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MOSQUITO STUDIES (Diptera, Culicidae)

VIII. A prodrome of the genus Orthopodomyia.

By Thomas J. Zavortink

CONTRIBUTIONS

of the

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VIII. A PRODROME OF THE GENUS ORTHOPODOMYIA[1]

By

Thomas J. Zavortink[2]

CONTENTS

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INTRODUCTION

The mosquito genus Orthopodomyia is one of the poorer known genera in the Culicinae (in the sense of Belkin, 1962). This is primarily because the adults, with very few exceptions, are not attracted to and do not bite man; consequently, the species are of no direct medical or economic importance and have not received study by culicidologists. Another factor contributing to our ignorance of the group is that all species breed in natural plant containers. These habitats are often overlooked by mosquito collectors; thus, the immature stages of Orthopodomyia are seldom encountered unless specifically sought and most species are poorly represented in museums.

In the past few years, however, a considerable number of specimens of some species of Orthopodomyia have been collected in connection with mosquito projects in Malaya, Thailand and Central America. As this additional material, particularly of the immature stages, has become available, it has become increasingly evident that the classification now existing for the group, based largely on features of adult ornamentation, does not properly reflect the

relationships among the species.

The purpose, then, of the present study is to revise this genus from the world standpoint on the basis of data from all known stages in the life cycle. To achieve this end, species have been delimited on the basis of morphological, ecological and distributional data and arranged into a classification which, it is hoped, is consistent with the evolution of the group. Descriptions and illustrations of all known stages of all species and descriptions of all higher taxa are provided, keys to these taxa are included, data on the distribution and bionomics of each taxon are summarized, and speculations on the affinities of the various taxa are made.

Material for this study was first sorted to geographical origin and larval habitat and then tentatively identified with existing keys or descriptions. I have been fortunate in having either paratypic or topotypic material of a large number of species available for examination. My general procedure for any particular species was to first study this paratypic or topotypic material in considerable detail. Then, when they existed and specimens were available, species sympatric with the one being studied at or near its type locality were examined. This process, essentially a reversion to that of the local naturalist dealing with nondimensional species, was necessary to obtain an appreciation of the fundamental morphological differences between undisputed, sympatric species. Only then were additional specimens, tentatively identified as being the species in question, compared with the paratypic or topotypic material and a decision made on the basis of morphological, ecological and geographical data as to whether or not these individuals came from conspecific populations. This entire process, when performed for each species, becomes somewhat self-correcting and leads to a general refinement of one's concepts of the species involved.

After species were delimited and diagnosed, they were grouped into higher taxa of various levels on the basis of morphological similarity. Many of the groupings are tentative only; until all the stages in the life cycle are known for most species it will not be possible to construct a classification accurately reflecting the various affinities within the group.

I have examined specimens representing all previously described nominal species except geberti, mcgregori and nkolbissonensis. Material contained in the following institutions or private collections was studied: Bernice P. Bishop Museum; British Museum (Natural History); California Academy of Sciences; Canadian National Collection; Centre Scientifique et Technique, Bondy, France; Cornell University; Fred Harmston; Instituto Oswaldo Cruz; Instituto de Salubridad y Enfermedadas Tropicales, Mexico City, Mexico; Liverpool School of Tropical Medicine; Antonio Martinez; Museo Firenze; South East Asian Mosquito Project, Washington, D.C.; United States National Museum; Universidad de São Paulo; University of California at Davis; University of California at Los Angeles; University of Utah.

Six of these collections deserve special mention because they have been particularly vital to this study. The collections of the British Museum (Natural History) and United States National Museum have been most important because of their broad representation of species and accumulation of lectotypes and holotypes. The excellent collection of William W. Macdonald has been instrumental in the treatment of the Oriental species because of its high quality and great number of adults with associated larval and pupal skins. Important also in the study of the Oriental species was the collection amassed by the South East Asian Mosquito Project; this is the largest collection from that area. The collection at UCLA has been invaluable, particularly in the study of the Neo-

tropical species. The bulk of this material has been collected for the project on the Mosquitoes of Middle America. This collection is outstanding in its representation of topotypic material, large series of specimens and number of individually reared adults. The last collection to be mentioned is my own. This collection was important not because of its representation of species but because I acquired an appreciation of the extent of intra- and inter-population variation from it.

I wish to thank Dr. John N. Belkin for directing this study. Special thanks are extended to Drs. P.F. Mattingly and J.A. Reid at the British Museum (Natural History) and A. Stone and B. de Meillon at the United States National Museum for the courtesies extended to me when I visited those institutions. I am also grateful to the individuals and institutions which loaned material. I am indebted to Sylvia Barr, Sally Dieckmann and Joyce Roberts for preparation of the final plates and to Sheila Bernstein for typing the copy for reproduction.

HISTORY

The history of the classification of the genus Orthopodomyia is both short and simple. The first species of Orthopodomyia was described as Culex pulchripalpis by Rondani in 1872 from material collected in Italy. In 1896 a second species, the North American signifera, was described in the genus Culex by Coquillett and in 1903 a third species, from India, was named Mansonia anopheloides by Giles. During the next year 2 species were described and genera based on them, Theobald (1904:236-237) creating the genus Orthopodomyia for Leicester's Malayan species albipes and Lutz (1904) naming Bancroftia albicosta from Brazil. Between 1905 and 1911, 9 additional species or varieties of Orthopodomyia were described in the genera Orthopodomyia, Culex, Mansonia and Kerteszia and 3 additional generic names were published, Dyar (1905: 46) naming Pneumaculex for signifera, Theobald (1909:297) proposing Newsteadina for the Mauritian arboricollis, and Newstead and Carter (1911:553-554) creating Thomasina for the South American longipalpis.

The classification of the family Culicidae was in a chaotic state during the early twentieth century. Species and genera were being described at such a rapid rate by workers throughout the world that many taxa were inevitably given more than one name. Additional confusion occurred because descriptions were often so inadequate that many misidentifications and incorrect usages of both specific and generic names took place. The greatest source of confusion, however, was that many workers, particularly Theobald, created and diagnosed numerous genera primarily on the basis of adult palpal length and scale morphology. As a consequence of all these factors, even closely related species were often not recognized as such and were placed in different genera. As an example, in Theobald's (1910) A Monograph of the Culicidae, which summarized the classification of the family, the 10 included nominal species of Orthopodomyia were placed in the following genera: Orthopodomyia, Bancroftia, Pneumaculex, Newsteadina, Mansonia, and Grabhamia.

Even before the initial period of proliferation of generic names was over, a great reorganization and clarification of the classification of the Culicidae started taking place. Genera were based on more fundamental morphological features of adults in conjunction with characteristics of the larvae and male genitalia. Fewer, but more natural, genera resulted.

In the case of Orthopodomyia, 4 of the 5 generic names proposed were reduced to synonymy and those species incorrectly placed in other genera were

properly realigned. The initial steps toward this clarification were taken by Dyar and Knab; first (1906:184) they reduced Pneumaculex to synonymy with Mansonia and later (1910:264) they removed the orthopodomyias from Mansonia and placed them in Bancroftia. The next step was taken by Edwards (1913:239) when he concluded that the New World Bancroftia was congeneric with the Oriental Orthopodomyia. Howard, Dyar and Knab (1917:878) accepted Edwards' concept of Orthopodomyia and in addition established that longipalpis was a synonym of fascipes, thus reducing Thomasina to synonymy. Finally, Newsteadina was synonymized with Orthopodomyia by Edwards (1920:135) when he examined the type specimens of arboricollis.

Since 1911, 19 additional species or varieties of Orthopodomyia have been described. All but two of these were described by people concerned only with the mosquitoes of a restricted region (i.e., nondimensional species).

Although the species of Orthopodomyia have never before been the subject of a thorough revision from the world standpoint, many species have been studied at one time or another in connection with regional faunal works. The most important of these faunal works, which have included several species, are those of Howard, Dyar and Knab (1917), treating the Central and North American area; Dyar (1928), covering the entire New World; Barraud (1934), on the fauna of India; Lane (1953), treating the Neotropics; and Carpenter and LaCasse (1955), for America north of Mexico.

While these faunal works and many other studies dealing with 1 or 2 species of Orthopodomyia have added to the knowledge of the species involved, they have not materially contributed to an understanding of the relationships between the species. There have been, however, three studies which have contributed to the classification of the genus.

The first study is Edwards' classic treatise on the entire family Culicidae (1932) in which one finds a brief treatment of Orthopodomyia from the entire world. Solely on the basis of adult ornamentation he arranged the species into 2 groups, Group A (Orthopodomyia) and Group B (Bancroftia), and cataloged the species in each. Except for the shifting of one species, phyllozoa, from Group A to Group B (Knight and Mattingly, 1950), this classification of Edwards has been accepted to the present time. The second study, by Edwards (1939), slightly revised Group B (Bancroftia) and provided, by means of a key to the adults of the included species, a classification of the group. The third study, by Knight and Mattingly (1950), was of the anopheloides subgroup. This subgroup, created by the authors on the basis of adult ornamentation, was a division of Edwards' Group A (Orthopodomyia) which contained the Southeast Asian species. Other subgroups proposed but not revised were the arboricollis and fascipes. This study resulted in a better understanding of the relationships within Edwards' Group A and among the species in the anopheloides subgroup.

A varying number of the nominal species proposed in Orthopodomyia have been reduced to synonymy when the species have been studied in connection with the larger faunal works. The synonymies established or expressed in Knight and Mattingly (1950) and Lane (1953) are currently accepted in Stone, Knight and Starcke's world catalog (1959).

In summary, the situation at the start of the present study is that 33 specific names are available in Orthopodomyia and 26 of these are considered to represent valid species or subspecies. On the basis of adult ornamentation the species are arranged into 2 groups, Group A (Orthopodomyia) and Group B (Bancroftia), and the species in the Orthopodomyia group are placed in 3 subgroups.

MORPHOLOGY

This section is not an exhaustive description of a representative species of Orthopodomyia, but is instead a discussion of some characteristics within the genus Orthopodomyia which have been found particularly useful or too variable for taxonomic purposes. In this discussion, and in the descriptions of the groups and species, the terminology and abbreviations used are those employed by Belkin (1962:547-563).

The adults of Orthopodomyia are all very similar in structural details. The head morphology, except for small differences in the palpal length of each sex and the number of palpal segments of the female, is similar in all species except those in the Thomasina section. Even in the Thomasina section the differences, restricted to males, are not extensive; the torus is reduced in size, the flagellum has fewer and shorter bristles and the proboscis is stout and strongly sclerotized. The palpus of the female is 4-segmented in all species except for some in the Albipes and Signifera groups which have a 5-segmented palpus. The external anatomy of the thorax is nearly the same in all species. Group characters are found in the number of pra and stp bristles. Species in the Albipes group are the only ones without a single strong upper stp bristle and the species in the Signifera group have an increased number of pra bristles. The species in the Signifera group are the only Orthopodomyia to have the first hindtarsal segment shorter than the hindtibia.

Except for the morphological differences just discussed, adults of the species and groups of Orthopodomyia differ only in ornamentation. Particularly valuable group characters are found on the thorax and wing. While the differences between the groups are, of course, constant, it is often difficult to find reliable specific differences. Ornamentation of the proboscis, palpus, legs, wing and abdomen is extremely variable. Part of this variation, at least in the Signifera group, is correlated with larval nutrition and some appears to be environmentally induced.

The male genitalia of all Orthopodomyia are also very similar. Specific and group differences are largely restricted to the shape, sclerotization and dentition of the aedeagus. Only the male genitalia of the Thomasina section are "conspicuously" different; in this group the basal mesal lobe has 2 or 3 stout, short, blunt and flattened bristles and the eighth tergite does not have a lobe on the posterior margin. The Nkolbissonensis group may differ in development of the bristles on the ninth tergite. Other group characters are found in the spiniform of the clasper; the Thomasina section and the Vernoni and Signifera groups have a lobed spiniform and the Albicosta group has 2 simple spiniforms. The shape of the lobe on the eighth tergite is quite variable and cannot be used extensively as a taxonomic character. The number of bristles on the basal mesal lobe and the ninth tergite is not characteristic of species or, except as noted above, groups.

The pupae and larvae of Orthopodomyia each conform to one morphological plan. There are no differences in the pattern of chaetotaxy between species or groups. For the most part, the taxonomic characters are restricted to the length and number of branches of the hairs. It is difficult or impossible to find specific differences in some cases because of the variability of both these features. This is best illustrated by the Signifera group, in which the majority of the populations of each allopatric species has a characteristic development of certain hairs in the continuum from weakly developed to strongly developed, but in which there are enough individuals and populations within each species

with these hairs more or less strongly developed than normal to prohibit diagnosis of the species on the basis of chaetotaxy. Many species of Orthopodomyia have "hairy" forms in which the development of many or most body hairs is strikingly changed. Normally short single hairs may become extremely long and multiple and short multiple hairs may become long and fewer branched. In at least 1 species, arboricollis, such changes in the chaetotaxy of the larva are accompanied by changes in the length and curvature of the antenna.

Except for differences in chaetotaxy, the pupa has few characters of taxonomic importance. The development of hairs 1-7-C and 9-VII, VIII, and the position of hairs 2-VI, VII have been found to be group characters. Pupae of the species in the Albipes group may differ in paddle and trumpet shape; while these differences are not striking, they do appear to be constant.

The evolution of the head morphology of Orthopodomyia larvae has been conservative. Only phyllozoa has a unique head capsule shape and only the species alba, arboricollis and flavithorax have conspicuous differences in the length and number of branches of some head hairs. By contrast, specific and group characters can usually be found on the terminal segments of the larva. The size, shape, number and arrangement of the comb scales are good group characters and the shape of the comb scales is a specific character in the Albipes group. The number of comb scales is too variable to be useful at the specific level; in several instances, both extremes for the range in the number of comb scales in a particular species have been encountered in 1 individual. The siphon and anal segment often provide both group and specific characters. Particularly important are the length of the siphon, the development of hair 1-S, the number of hairs in the ventral brush and the length of the anal gills. Additional group and specific differences are found in the chaetotaxy of the thorax and abdomen. Important group characters are the development of thoracic hairs 1, 4-M and 1-T, and the position of abdominal hairs 2-VI, VII.

Several features of the larva are variable enough to deserve mention. First is the development of the sclerotized plates on segments VI, VII and VIII of the fourth instar larva. It has been shown by Tate (1932:115), Reeves (1941: 70-71) and Chapman (1965:436) that these plates are added during the growth of the last instar larva. This fact was also known by Howard, Dyar and Knab (1917:893). As a consequence, the plates can be expected to vary in specimens which may have been killed at different ages. Specimens at the same physiological age (pupation) also vary in plate development. Chapman found 62 % of the larval skins he examined with plates on segments VII and VIII and 38 % with plates on segments VI, VII and VIII. Examination of skins from larvae collected at 2 different times in the same treehole has shown that winter-collected diapausing larvae usually have a more extensive development of plates than summer-collected non-diapausing larvae. The variability of the extent of these sclerotized plates is strikingly shown by occasional specimens which have large plates on the thorax. Two other areas of sclerotization are involved in age variation. The first is the presence and size of the ring basad of the anal saddle and the second is the presence or absence of an acus. Young fourth instar larvae do not have a ring basad of the saddle, but as the larvae grow a sclerotized band forms on each side and those from opposite sides may sometimes join to form an incomplete ring. Young fourth instar larvae often have a detached acus which, as the sclerotization of the base of the siphon increases with age, first becomes attached and is finally completely incorporated into the base of the siphon. The pigmentation of the larva is also quite variable. Some species have strongly developed red or purple epidermal pigments. These pigments

mask the color of the fat body and the larvae do not conspicuously change color with age or diet. Other species either do not have or have only weakly developed epidermal pigmentation, and in these the color of the fat body becomes conspicuous. These larvae are usually pink when young but become bluish as the time of pupation approaches. They may also become yellowish on laboratory diets. In addition to these biological variations, some mounting media remove or change the color of the epidermal pigment.

BIOLOGY AND ECOLOGY

The following discussion is based on observations made in the field in Arizona, southern California, New Mexico, Ohio, England and Guatemala, and those made in the laboratory. The species studied were alba, kummi, pulchripalpis, signifera and waverleyi.

Orthopodomyias are usually sought and collected as larvae, which, in the areas studied, are found in treeholes. Individuals of all instars may be found in any month of the year. During the winter, first, second, third and small fourth instar larvae become quiescent, but mature fourth instar larvae go into diapause. The larvae are not found in all treeholes (see below), but they may be present in large numbers in the proper type of hole.

The type of hole in which the immature stages are found depends upon the local climate. In cismontane southern California, females are active from May until October or early November. Since this flight period coincides with the dry season, only very few treeholes, the ones with permanent water, are available for oviposition. The permanent treeholes are of two types. Some are just particularly deep holes with small openings in oak (Quercus) trees; these holes are filled during the rainy season and although the water level drops considerably during the dry season they never quite dry out. The other type of permanent treehole is found in some species of cottonwood (Populus) and willow (Salix) trees. These holes are filled by fluids from the tree and the water level is independent of precipitation. Temporary treeholes, filled only during and for a short time after the rainy season, contain water at a time when there are no ovipositing females and as a consequence never contain Orthopodomyia larvae. The situation is somewhat different in the mountains in southeastern Arizona because there are 2 rainy seasons, a lesser one from December to February, and a greater one in July and August. As a consequence of being filled twice a year, a greater proportion of the oak treeholes contain water permanently and Orthopodomyia larvae can be found in them at any time. In addition, since the rainy season in July and August falls within the period of adult activity, many temporary treeholes will contain Orthopodomyia larvae at that time. The immature stages are, of course, also found in the permanent cottonwood and willow treeholes.

Various comments in the literature lead me to believe that most, if not all, species of treehole breeding Orthopodomyia are found more frequently in permanent than temporary treeholes. Particularly important as Orthopodomyia breeding sites may be those tree species in which the water in the hole is supplied by the tree and is independent of precipitation. In addition to the cottonwoods and willows mentioned above, this phenomenon is also found in horsechestnut (Aesculus hippocastanum), elm (Ulmus), and beefwood (Casuarina) trees. The fluid in these holes kept filled by the tree is usually lighter in color (sometimes straw-colored or even colorless) and more alkaline than that of

other treeholes. Permanent treeholes seem also to be the preferred breeding places of treehole Toxorhynchites and Anopheles, and as a consequence these genera are frequently found with Orthopodomyia.

Orthopodomyia larvae are apparently filter feeders, ingesting microorganisms and small particles which they have strained from the water with their mouthbrushes or plumose body hairs. They are rarely seen gnawing at large objects, browsing over the surface of submerged objects, or feeding from the surface film.

Larvae can easily be reared in the laboratory in diluted treehole water to which yeast is added if the medium is kept alkaline (as is the water in treeholes) by addition of sodium hydroxide. Despite being crude, this method is very successful, with the larvae growing rapidly and producing large, robust adults.

The pupal stage of Orthopodomyia lasts from 5 to 8 days.

Very little is known about the adults of Orthopodomyia. All specimens encountered in the field were resting above the water level on the inside of treeholes. They were quite wary and often flew away at the approach of an observer. While most usually settled on the bark near the treehole, others flew across sunlit areas to nearby trees. All specimens caught were freshly emerged.

Laboratory observations indicate that the adults are active only after darkness. Males seldom live more than 2 weeks and females fed on sugars live 4 to 6 weeks. Females of alba, signifera and kummi readily took blood meals from a canary (Serinus canaria), brown towhee (Pipilo fuscus), and a house sparrow (Passer domesticus), but would not feed on a pigeon (Columba livia). None could be induced to feed on a human arm. Gravid females oviposited during darkness on moist filter paper lining containers partially filled with filtered treehole water. Eggs were laid singly or in small groups; those of signifera and kummi were deposited within 3 or 4 mm of the water meniscus, but those of alba extended to 3 or 4 cm above the meniscus.

Of several thousand eggs obtained, only about 60 (of signifera) hatched. All others checked showed no development and were apparently never fertilized. Those which hatched did so immediately after embryonic development and did not go into diapause.

DISEASE RELATIONSHIPS AND ECONOMIC IMPORTANCE

Only 2 species of Orthopodomyia, the Oriental albipes and andamanensis, are known to take human blood. Since neither has been implicated as a vector of human disease or bites man frequently enough to be considered a pest, they, and all other species of Orthopodomyia, are usually dismissed as not having medical or economic importance. However, Orthopodomyia may be of considerable indirect medical importance. Three species, the Nearctic alba, kummi and signifera, are known to attack birds and are possibly important in the maintenance of arboviruses in sylvan environments or in the transmission of them to domestic fowl. Vargas (1960:339, 340) reported isolating the virus of Eastern Equine Encephalitis from signifera in Mexico. Chamberlain, Sikes, Nelsen and Sudia (1954:283) gave signifera "good" and "excellent" vector potential ratings for Eastern and Western Equine Encephalitides respectively. An appreciation of the role played by Orthopodomyia as vectors of arboviruses cannot be acquired until the biology of a greater number of species is investigated.

DISTRIBUTION

Fig. 1

Orthopodomyia has been only sparsely collected and the geographical distributions of the species are very poorly known. The data which are available are summarized here.

The genus is worldwide in distribution, but is largely restricted to tropical and warm temperate areas. In addition, each of the 8 species groups in the genus is entirely or largely restricted to one faunal region.

A large number of species, belonging to one diverse group, is concentrated in the Oriental region. Some species of this group have spread as far as Japan, New Guinea and northeastern Australia (Marks, 1962, in litt.).

While the Neotropical region has fewer species than the Oriental, it has the greatest representation of distinct groups, with 4 being present. One of the groups has spread northward into the Nearctic and Palearctic regions; this represents the only known large scale invasion of colder areas by Orthopodomyia species.

Very little is known about the Orthopodomyia fauna of the Ethiopian region. Muspratt (1955:156) was the first to indicate the presence of a species of Orthopodomyia in Africa, having found specimens in Kruger National Park, South Africa. This species has not yet been described. In early 1967 a species was described from Cameroon; it appears to represent a distinct group. How many species or groups actually occur in Africa is entirely problematical. According to Grjebine (1966:29, 30, 32), the island of Madagascar has 7 species, only 3 of which have been described, belonging to one group and the island of Mayote has one undescribed endemic species of the same group. The island of Mauritius, in the Indian Ocean east of Madagascar, has one endemic species of Orthopodomyia. This species represents a distinct group.

The breeding sites of Orthopodomyia could theoretically limit their geographical distribution. This does not appear to be the case, however, since angiosperm trees, bamboos, bromeliads and heliconias have more extensive distributions than those species breeding in them.

Although the majority of species breed in treeholes, the genus is not restricted to mesic, extensively forested areas. One species is often encountered in holes in cottonwood (Populus) and willow (Salix) trees along the watercourses in the Mojave, Colorado and Sonoran Deserts in the western United States.

SYSTEMATICS

Data from morphology, ecology and geography have been used in the interpretation of the systematics within the genus. Primary emphasis has been placed on the comparative morphology of the adults, male genitalia, pupae and larvae. The most important criterion has been that each species be characterized by several correlated morphological characters. Except for the species in the Signifera group, these correlated characters are found in all 3 stages and the male genitalia; within the Signifera group they are largely restricted to the adult stage.

The basic ecological criterion which I have used is that the immature stages of not more than one species in each complex will be found occupying the same habitat in any given area. This criterion has been extremely important because

the chaetotaxy of the immature stages of Orthopodomyia is often modified into "hairy forms," in which several correlated morphological characters are expressed in larvae, pupae, or both.

There are, however, 4 apparently bona fide instances in which the larvae of species in the same complex do occupy the same habitat in the same area. In 2 of the cases the larva of one of a pair of closely related sympatric species, both of which breed in treeholes, is very extensively modified. The species pairs involved are alba and signifera in North America and flavicosta and flavithorax in India. I believe that these 2 cases, rather than being exceptions to the ecological tenet, offer striking evidence of its validity; only in those cases where extensive secondary modification of the larva (the feeding stage) of one species has taken place are 2 species in the same complex enabled to coexist indefinitely over a broad area. In the third case, the larvae of the species occurring together are very similar. But, the species involved, kummi and signifera, are basically allopatric and are known to occupy the same treeholes in only one area. It is possible that it is the similarity of their larvae which has prevented either of these species from penetrating the range of the other. In the fourth case the species involved, anopheloides and andamanensis, have very similar larvae and yet are apparently sympatric over a broad area. Possible explanations are that andamanensis is not a distinct species, but is only a genetic segregate of anopheloides, or that the environment is diverse enough in time or space that neither species has eliminated the other.

Data from distribution, that is, allopatry or sympatry, have been used, but no rigid rules have been followed in deciding what rank to give morphologically distinct allopatric or sympatric populations. In general, if allopatric populations are characterized by the same amount of morphological difference as the populations of sympatric species, then these allopatric populations have been considered to represent distinct species. If, however, the differences are of lesser magnitude, the populations are usually considered to be conspecific. I have not recognized any subspecies because in most instances so few specimens are available that one does not know whether the differences observed are truly characteristic of populations of an area or are individual or environmentally induced variation. Sympatry of entities morphologically distinct by several correlated characters has been interpreted as indicating specific rank for the taxa involved.

The classification of Orthopodomyia which follows is based on features of adults, male genitalia, pupae and larvae. A classification based on any one of these stages would differ from that based on any other; I do not necessarily mean to indicate that these classifications would be conflicting, only that they would be different.

There are, however, several instances in Orthopodomyia in which the classification based on adult ornamentation is at variance with that based on the immature stages. Depending upon the situation, I have in some cases decided that the relationships shown by the immature stages were the true ones but in other cases have given precedence to adult characters.

In general, I have found the pupal stage to be the most reliable both for showing specific differences and affinities. It is superior to the larva for 2 reasons. First, the pupal chaetotaxy is less often and less extensively modified into hairy forms than is that of the larva (except in the Anopheloides subgroup); and second, since the pupa is not a feeding stage, it is not subject to selection pressures reducing competition for food, and consequently does not show the extensive modifications of morphology that some larvae do (e.g., alba and flavithorax).

In this study 24 species in 8 distinct groups are recognized in the genus Orthopodomyia. The groups, with their distribution and included species, are as follows: (1) the Oriental Albipes group with the 9 species flavicosta, flavithorax, madrensis, siamensis, wilsoni, albipes, papuensis, andamanensis and anopheloides; (2) the Holarctic Signifera group with the 6 species waverleyi, signifera, alba, pulchripalpis, species 5 and kummi; (3) the Neotropical Thomasina section with the 2 species fascipes and sampaioi; (4) the Madagascan Vernoni group with the 2 species vernoni and milloti; (5) the African Nkolbissonensis group with the 2 species nkolbissonensis and species 14; (6) the monotypic South American Albicosta group; (7) the monotypic Mauritian Arboricollis group; and (8) the Middle American Folicolae section with the single species phyllozoa.

At the present time the affinities of these 8 groups are not obvious; they may become evident, however, when the immature stages, which are at least partially unknown for half the groups, are described. The groups have been placed provisionally into 4 sections, as follows: (1) the Orthopodomyia section made up of the Albipes, Vernoni, Nkolbissonensis and Arboricollis groups; (2) the Bancroftia section containing the Signifera and Albicosta groups; (3) the Thomasina section; and (4) the Folicolae section.

The primary mechanism of speciation in Orthopodomyia appears to be geographical isolation. The species in the Signifera group, the Flavicosta subgroup and the Thomasina section are entirely or largely allopatric. The species in the Vernoni and Nkolbissonensis groups may also be allopatric. There is no evidence of sympatric ecological speciation in Orthopodomyia; closely related species are either allopatric or sympatric in the same habitat. In those cases where 2 closely related species are sympatric in the same habitat, I have assumed that the species were originally geographically isolated. With the possible exception of the Albipes group, complete hybridization does not appear to have been a mode of speciation in Orthopodomyia. The Anopheloides subgroup of the Albipes group may have arisen through hybridization between species in the Flavicosta and Albipes subgroups. Such an interpretation would not only explain some aspects of the morphology of the immature stages of the Anopheloides subgroup, but would also explain a portion of the discordance between adult and larval classifications in the Albipes group.

Although complete hybridization does not appear to have been an important mode of speciation, introgressive hybridization has evidently played a major role in the evolution of the genus. One of the most remarkable phenomena to be discovered in this study is that a species which contacts or almost contacts another often has characteristics, particularly in the adult, of the latter species. It appears that at least a portion of the cases where characters are distributed in this way can be explained only by introgressive hybridization, and that phenomenon must accordingly be considered very important in the evolution of Orthopodomyia. Introgression can apparently take place between species in the same group or between those of separate groups; it has possibly occurred between the following species: (1) kummi and signifera, (2) kummi and albicosta, (3) kummi and fascipes, (4) fascipes and phyllozoa, (5) pulchripalpis and some species in the Anopheloides subgroup, (6) flavicosta and flavithorax, and (7) between various species in the Albipes group.

There is one particular instance in which the evidence for introgression is especially strong and I think it is worthwhile to elaborate this case here. The South American Albicosta, Oriental Albipes and Holarctic Signifera groups are involved. The Signifera group has several apomorph characters not found in

the other 2 groups and since it has widespread allopatric species while the other 2 groups each have a species or subgroup with a relict distribution, it appears to be more recent than the Albipes and Albicosta groups on the basis of distribution. It is important to stress these factors because the argument for introgression is based on the fact that neither the Albicosta nor Albipes group could have been derived from the Signifera group. The Signifera group is centered in North America but has one species in Europe (pulchripalpis) and one in Central America (kummi). Pulchripalpis has several features which are unique for the group but which are found in the Oriental Albipes group and kummi has several traits which are found elsewhere only in the South American Albicosta group. While one could postulate the derivation of the Signifera group from either the Albipes or the Albicosta group, the similarities between the Signifera group and the remaining group may be due to introgression since the latter group cannot be derived from the former. I have considered the similarities between kummi and the Albicosta group to be due to relationship and those between pulchripalpis and the Albipes group to be due to introgression. It is possible, however, that the similarities between kummi and the Albicosta group are also due to introgression.

Hybridization between species must, of course, occur before introgression can take place. Evidence of hybridization between 3 different pairs of species has been seen during this study; the pairs involved are kummi and signifera, flavicosta and flavithorax, and albipes and anopheloides.

I do not believe that the evidence for hybridization or introgression in any way militates against considering the taxa involved as distinct species. Despite gene exchange, these taxa appear to be separate lineages with their own roles and tendencies and are accordingly given specific rank.

TAXONOMIC TREATMENT

The species have been aggregated into numerous groups at various levels to indicate their affinities, and both species and groups (but not the species within each group) have been arranged so that the most generalized or primitive are placed centrally and the most derived are placed at the ends.

Descriptions are extensive because the genus is poorly known and many undescribed species or forms probably exist. Species descriptions are composite, that is, based on many individuals. Group characters are not repeated in the descriptions of included taxa.

Complete synonymy is provided for all species group and generic group taxa. An extensive list of literature citations is provided for each species. Those taxa for which the type specimen has been seen are marked by an asterisk.

The systematics section of each species or group contains restatements or explanations of diagnostic characters, explanation of the treatment, discussion of geographic or other variations, mention of hybrids, and speculations on evolution and relationships.

The abbreviations used in the lists of specimens examined are those of Belkin (1962:563-564) or Stone, Knight and Starcke (1959:327-329) except for the following: Fred Harmston [HARM]; Antonio Martinez [MART]; University of California at Davis [UCD].

Genus ORTHOPODOMYIA Theobald

1904. Orthopodomyia Theobald, 1904:236-237. TYPE SPECIES: *Orthopodomyia albipes Leicester, 1904, Malaya; monobasic.
1904. Bancroftia Lutz, 1904:6, 1. TYPE SPECIES: Bancroftia albicosta Lutz, 1904, Brazil; monobasic.
1905. Pneumaculex Dyar, 1905:46. TYPE SPECIES: *Culex signifer Coquillett, 1896, United States; original designation.
1909. Newsteadina Theobald, 1909:297. TYPE SPECIES: *Culex arboricollis Charmoy, 1908, Mauritius; original designation.
1911. Thomasina Newstead and Carter, 1911:553-554. TYPE SPECIES: *Mansonia longipalpis Newstead and Thomas, 1910, Brazil; original designation.

FEMALES. Small, medium-sized or large mosquitoes, varied in appearance, ornamented conspicuously with narrow lines of white scales or broader lines of silver and golden scales on a dark integument (Bancroftia and Folicolae sections respectively), or less conspicuously with a general mottling of pale and dark scales (Orthopodomyia and Thomasina sections), readily distinguished from all other mosquito genera by the unusual proportions of the tarsal segments on the fore- and midlegs, segment 1 longer than the remaining 4 combined and segment 4 shorter than segment 5. Head: eyes narrowly separated above antennae, partially contiguous (Signifera group, in part), or entirely contiguous (albicosta); frontal tuft absent; frontal bristles 1 pair, strongly developed; orbital bristles rather few, lateral ones moderately developed, directed cephalad, mesal ones strongly developed, directed over the bases of the frontal bristles; vertex and occiput with few to numerous decumbent scales, all narrow and curved or with some broad and flat (albicosta), and numerous to very numerous erect scales; dorsolateral, lateral and ventral surfaces with broad flat decumbent scales; suborbital bristles numerous, weakly developed; ornamentation varied; clypeus small, an elongate angular lobe or triangular (albicosta, Kummi subgroup), normally without bristles or scales; labium quite broad, slightly to considerably swollen apically, with several subbasal bristles, shaft bristles absent or weakly developed, ornamentation varied; labella scaleless; palpus 0.33 to 0.58 of proboscis, bare of scales ventrally, 4- or 5-segmented, segment 4 moderately long to very short, segment 5 short or minute, segments 2 and 3 with well developed bristles, ornamentation varied; antennae longer than proboscis, scape scaleless, torus enlarged, flagellum 13-segmented, all segments subequal or first and last slightly longer, first sometimes somewhat swollen (albicosta, phyllozoa), flagellar whorls consisting of relatively few bristles arising from near base of each segment. Thorax: mesonotum moderately arched; scutellum trilobed; postnotum bare; paratergite narrow to broad, rarely with scales (flavicosta, flavithorax); apn lobes medium-sized, widely separated; pra not separated by a definite suture from stp; meron large, its upper edge well above base of hindcoxa; acrostichal, dorsocentral and lateral prescutellar bristles numerous, very strongly developed, acrostichals in a more or less double row from anterior promontory to cephalad of prescutellar space, dorsocentrals and lateral prescutellars forming a continuous line from anterior promontory to near scutellum, lateral prescutellars and sometimes posterior dorsocentrals in a more or less double row; humeral, lateral prescutal and posterior fossal bristles present, all strongly developed or some weakly developed, sometimes numerous enough to enclose fossa or with pos-

terior fossal bristles absent (albicosta); fossal bristles present or absent; supraalar bristles numerous, strongly developed, in 2 more or less distinct rows mesad of paratergite, in a single broad row over wing base; parascutellar bristles normally 1; prescutellar space bare except for fine bristles in center; lateral scutellar lobes with bristles numerous, some strongly developed, midlobe with bristles few, more or less divided into 2 groups, some strongly developed; mesonotum with narrow curved decumbent scales, ornamentation varied; scutellum with large and sometimes small decumbent scales; apn with numerous weakly to strongly developed upper anterior bristles and usually with weakly to strongly developed lower bristles; ppn usually with 2 or 3 strongly developed posterior bristles and sometimes with 1 or 2 additional weakly developed ones, normally without upper bristles; ppl bristles numerous, weakly to strongly developed; sp and psp bristles absent; pra bristles 0, 1, or 2-10 (Signifera group), moderately to strongly developed; upper stp bristles 0, 1 or 2, moderately to strongly developed, posterior stp bristles 0, 1, 2, or several, weakly to strongly developed, lower stp bristles 0 or several, weakly to strongly developed, stp always with at least posterior or lower bristles developed; mep with upper posterior bristles few to numerous, moderately developed, anterior bristles rarely present (pulchripalpis); pleuron with narrow curved and broad flat decumbent scales, ornamentation varied. Legs: fore- and midfemora of greater diameter than hindfemur; femora with inconspicuous to conspicuous erect scales ventrally at apex; fore- and midtarsal segment 1 longer than the remaining 4 segments combined, segment 4 markedly shortened, shorter than segment 5; hindtarsal segment 1 longer or shorter than hindtibia; claws of all legs medium-sized, subequal, simple, or hindclaws smaller; pulvilli not developed; forecoxa with numerous strongly developed bristles along outer anterior edge, midcoxa with nearly vertical row of strongly developed bristles on outer margin, hindcoxa with strongly developed bristles along lower outer posterior edge, all coxae with additional bristles associated with coxa-trochanter joint; trochanters without bristles; femora and tibiae with well developed bristles; ornamentation varied. Wing: wing membrane with distinct microtrichia; scales symmetrical or asymmetrical, broad or narrow, lying close against the veins or spreading; ornamentation varied; vein Sc ending between level of base of vein R_{4+5} and level of furcation in vein R_{2+3}, base without bristles ventrally; remigial bristles on base of vein R dorsally present or absent; veins R_s and R_{4+5} without basal spurs; cell R_2 varied in length but usually longer than vein R_{2+3}; crossvein r-m far distad of crossvein m-cu; cell M_2 varied in length but usually longer than vein M measured from crossvein m-cu to its furcation; plical vein strongly developed, with or without scales at base ventrally; vein 1A smoothly curved or slightly sinuate except at apex where it turns sharply towards posterior margin, apex far distad of furcation in vein Cu; costa concave between ends of veins Cu_1 and Cu_2; fringe without light spots; alula with a few narrow to medium-wide marginal scales; upper calypter with continuous marginal row of bristles or scalelike bristles, lower calypter bare. Haltere: short, stubby, knob and anterior edge of stem with small flat scales. Abdomen: bristles present on tergites I-VIII and sternites II-VII; tergite I with middorsal scales and with or without scattered scales; laterotergite with or without scales; tergites II-VIII completely and densely scaled; sternite I membranous, bare; sternites II-VIII not densely scaled. Buccopharyngeal Armature: not developed.

FEMALE GENITALIA. Segment VIII not retractile, sternite longer than tergite, with straight posterior margin; tergite IX distinct, narrow, extending far ventrad, with or without dorsolateral setae; tergite X not developed as a

distinct entity; cercus large, extending beyond postgenital plate, strongly compressed, scaleless, with apical setae; postgenital plate slightly longer than broad, deeply notched apically, resulting lobes with strong setae; cowl strongly sclerotized, fused to cephalic portion of postgenital plate; sigma weakly sclerotized; insula weakly sclerotized, connected to sigma, bare or with a pair of minute setae; spermathecae 3, more or less spherical, strongly sclerotized, 1 slightly larger than other 2.

MALES. Essentially as in females. Labium: not more strongly swollen than in females or of much greater diameter throughout length than in females and strongly sclerotized (Thomasina section). Palpus: 0.75 to 1.02 of proboscis, 5-segmented, segments 2 and 3 more or less ankylosed and forming about 0.67-0.75 of palpus, segment 5 short to very short, segments 4, 5 and sometimes 3 with a few well developed bristles. Antenna: subequal to or longer than proboscis, torus moderately (Thomasina section) to greatly enlarged, flagellum with segment 1 slightly elongated, segments 12 and 13 greatly elongated, moderately (Thomasina section) to strongly plumose, bristles on segments 1-12 very dense, arising from or distad of middle of segment on segments 1-11, but near base on segment 12, those on segment 13 sparse, arising near base of segment. Legs: anterior fore- and midclaws large, biserrate, basal tooth large (Thomasina section) or too small to be seen on pinned specimens, posterior fore- and midclaws medium-sized, simple or uniserrate with tooth too small to be seen on pinned specimens (Bancroftia section), hindclaws small, subequal, simple. Abdomen: bristles slightly stronger and more numerous, particularly on sternites, than in females; sternite VIII densely scaled.

MALE GENITALIA. Segment VIII: long and wide; tergite bearing a distinct median lobe on posterior margin or posterior margin only slightly rounded (Thomasina section); sternite unspecialized. Segment IX: medium-sized; tergite poorly sclerotized, without lobes, with or without setae dorsolaterally; sternite normally without bristles. Sidepiece: well developed, usually more or less long conical or cylindrical; basal mesal lobe small, more or less distinct, bearing specialized apical bristles, some of which may be shortened and flattened (Thomasina section); no other lobes developed; mesal surface completely sclerotized or partially membranous; mesal and/or tergomesal surfaces sometimes bearing specialized bristles distad of basal mesal lobe. Claspette: represented by basal mesal lobe of sidepiece. Clasper: simple, slender, arising subapically on sidepiece; very fine setae present, more numerous distally. Spiniform: usually 1, rarely 2 (albicosta), subapical on clasper, simple or with apex flattened, broadened, partially rolled, and divided into regular or irregular lobes. Phallosome: simple; aedeagus large, strongly or weakly sclerotized, varied in form, with or without apical, basal, tergal or sternal teeth, spines or processes; ventral paramere strongly developed, articulating with basal piece and aedeagus; dorsal paramere not developed; basal piece strongly developed, not joined to sidepiece, but articulating with it, with ventral paramere and with basolateral sclerotization of proctiger. Proctiger: strongly developed; basolateral sclerotization prominent, articulating with tergite IX and basal piece; paraproct sclerotization prominent, with 1 to several apical teeth; tergal surface not sclerotized; cercal sclerites absent, cercal setae few, very fine, distinct.

PUPAE. Cephalothorax: middorsal ridge strong; all hairs present, variously developed; hair 6-C always smaller than 7-C; 6, 7-C close together, hair 6 usually cephalad of hair 7, rarely caudad of it (flavicosta, flavithorax); 8, 9-C relatively close together and always far caudad of trumpet. Trumpet: not placed

on distinct tubercle; widely spaced, much nearer wing base than middorsal line; moderate in length; tracheoid absent, entirely reticulate; distal portion gradually widened from base in most species; meatus without slit; pinna small to large. Metanotum: fourth pair of hairs rarely developed (flavithorax). Abdomen: all normal hairs except 10, 11-I present; hair 1-I strongly developed and strongly dendritic; 9-II-VI small, lateral, dorsolateral, or ventrolateral in position, removed cephalad a considerable distance from caudolateral angle; 9-VII moderately to strongly developed, dorsal in position, removed cephalad a considerable distance from caudolateral angle of tergite; 9-VIII strongly developed, ventral in position, removed cephalad a considerable distance from caudolateral angle of sternite. Terminal Segments: hairs 1-IX, X absent; median caudal lobe about half as long as broad; cercal lobe of female projecting only short distance caudad of genital lobe, rounded apically; male genital lobe projecting slightly to far beyond median caudal lobe. Paddle: variously developed, usually longer than broad, sometimes somewhat angular, sometimes emarginate, never very narrow; external buttress more or less distinct and with short, minute nearly invisible marginal spicules or almost smooth; midrib moderately developed; outer part of paddle larger than inner part; outer margin distad of external buttress and inner margin usually smooth, without spicules; hair 1-P present, single or branched, usually removed cephalad from margin of paddle, often poorly developed and difficult to see; hair 2-P absent.

LARVAE. Head: varying from distinctly broader than long (phyllozoa) to as long as broad; labrum short to moderately long (phyllozoa) and poorly differentiated dorsally; mouthbrushes very numerous and filamentous; collar well developed and narrow; ventral part of head capsule long; posterior tentorial pit a considerable distance from caudal border; maxillary suture often not complete anteriorly, straight or slightly concave mesally or laterally, and not extending caudolaterad of tentorial pit; cephalic border of labial plate truncate or concave anteriorly; aulaeum with long filiform spicules; mental plate well developed and usually with 7-13 teeth on each side of large median tooth; chaetotaxy quite uniform, complete except that hair 2-C is usually absent and hairs 16, 17-C are always absent, hairs 4-7-C ordinarily multiple, 4 shortest, 5 usually longest and arising most caudad, and 7 with greatest number of branches or hairs 4-7-C all strongly developed and subequal (flavithorax). Antenna: usually short to moderate in length; bare or with minute spicules (phyllozoa, fascipes); chaetotaxy uniform, hair 1-A located in basal 0.3-0.45, moderately developed, and usually 4-9b and hairs 2-6-A all terminal. Thorax: epidermal pigment varying from absent to deep red or purple; integument usually not conspicuously spiculose; spiracular sensilla distinct; notched organ not developed; 1 pair of conspicuous tracheal dilations present; all hairs except 13-P present; hairs 9-12-P, M, T on common tubercles; 8-M, 7-T and sometimes 7-P with basal tubercle; 1-3-P arising together, not close to midline; 4-7-P strongly developed, 4 and 7 multiple, 5 and 6 usually single; 9-P multiple, 10, 12-P single, 12 usually somewhat longer; 14-P weakly developed; 1, 3-M moderately to strongly developed; 2-M weakly developed; 4-M usually moderately developed; 5-7-M strongly developed, usually single; 8, 9-M strongly developed, multiple; 10, 12-M strongly developed, single; 13, 14-M usually short and dendritic; 1-T weakly to strongly developed; 2, 3-T usually moderately developed; 4-T multiple, usually weakly to moderately developed; 5-T weakly developed; 6-T strongly developed, single; 7, 9-T strongly developed, multiple; 8-T usually dendritic; 10, 12-T single; 13-T multiple, moderately to strongly developed. Abdomen: pigmentation and spiculation as for thorax; spiracular sensilla distinct;

dorsal or more extensive sclerotized plate usually present on segment VII and a smaller plate sometimes present on segment VI; hair 1 never palmate; 6-I, II strongly developed and multiple, 6-III, V, VI long and single, and 6-IV shorter, single or double or only 6-I multiple and 6-II-VI double (arboricollis); 7-I moderately to strongly developed, long, and single or multiple; 13-II, VI dendritic or not (flavithorax); hairs 0, 8, 14-I and 14-II absent, otherwise all hairs present. Segment VIII: mature larva with or without (alba) dorsal or more extensive sclerotized plate; comb scales usually in 2 rows, rarely in 1 row (albicosta) or in 3 rows (anomalies); comb scales in posterior row usually larger than those in anterior row; no comb scales ever attached to sclerotized plate. Siphon: moderately long to long; base of siphon often very irregularly sclerotized; pecten absent; hair 1-S near middle or near base (alba, arboricollis), no accessory hairs 1a-S; 2-S small, simple, always on siphon, no accessory hairs 2a-S; valves small; spiracular apodeme distinct; trachea well developed. Anal Segment: saddle usually complete; acus absent but sclerotized lateral band or incomplete ring usually present basad of saddle; saddle margin without spicules; hair 1-X on or caudad of saddle; 2-X very strongly developed, multiple; 3-X long, single; ventral brush well developed, usually with 6 (alba, arboricollis, milloti), 7 (most species) or 8 (fascipes) pairs of hairs; grid well developed; no accessory saddle hairs; gills varied, dorsal usually longer than ventral.

EGGS. Known only in Signifera group.

KARYOTYPE. Known only in Signifera group.

BIONOMICS. The immature stages of Orthopodomyia are found in plant container habitats. While the majority of species breed in treeholes, others breed in bamboo stumps and internodes, bromeliad leaf axils, and heliconia flower spathes. In addition to the natural breeding sites, most species are occasionally found in artificial containers. The larvae, which may live several months, are filter feeders and apparently are not cannibalistic even when large numbers occur in a small breeding site.

The adults of all species are strictly sylvan and are rarely collected. Two species, albipes and andamanensis, are known to bite man and 3 species, alba, kummi and signifera, are known to take avian blood. The feeding habits of the remaining species are unknown and the other activities of all species are unknown.

SYSTEMATICS. Orthopodomyia is a small genus which is quite distinct from all other mosquito genera in the adult and larval stages. Belkin (1962: 117) considered the genus to be distinctive enough to be worthy of recognition as a separate tribe. The affinities of the genus are not evident, but similarities with the genera Mansonia, Ficalbia and Culiseta have been noted. Edwards (1932:106) felt that the genus was most closely related to Culiseta (as Theobaldia) and that the African treehole-breeding Culiseta (Theomyia) fraseri was intermediate between the 2 genera.

The place of origin of the genus is difficult to determine. The Southeast Asian group of species is the largest, most diverse, and apparently one of the oldest groups, but the Middle American area contains 4 distinct, although smaller and more homogeneous, groups of species.

Within the genus 8 distinct groups occur; these groups, with the number of included species, are: Albipes, 9; Signifera, 6; Nkolbissonensis, 2; Thomasina, 2; Vernoni, 2; Albicosta, 1; Arboricollis, 1; and Folicolae, 1. Each group is largely or entirely restricted to one zoogeographic region. For the present I am arranging the groups into 4 sections; when the immature stages of some of

the groups become better known it may be necessary to recognize additional sections and it may be desirable to give the sections subgeneric status.

DISTRIBUTION. Orthopodomyia is largely confined to tropical and warm temperate regions. The majority of species occur in Middle America and Southeast Asia.

KEYS TO GROUPS

Adults

(species 14 not included)

1. Tarsal segments 1 with yellow scales in distinct broad basal, central and apical rings . . . . . ORTHOPODOMYIA SECTION, in part . . . . . NKOLBISSONENSIS GROUP
   Tarsal segments 1 without yellow scales in distinct broad basal, central and apical rings 2

2(1). Mesonotum ornamented with 2-4 pairs of very narrow longitudinal lines of pure white scales and broader bands of brown scales; wing without light costal patches or broad asymmetrical scales . . . . . .BANCROFTIA SECTION 3
   Mesonotum mottled with broad areas of light and dark scales or ornamented with 2 pairs of broad lines of silvery-white scales and bands of brown scales; wing with conspicuous light costal patches or broad asymmetrical scales 4

3(2). Mesonotum with 3 or 4 pairs of very narrow longitudinal lines of white scales; hindtarsal segment 1 shorter than hindtibia; pra bristles 2-12. . . . . SIGNIFERA GROUP
   Mesonotum with 2 pairs of very narrow longitudinal lines of white scales; hindtarsal segment 1 longer than hindtibia; pra bristles absent . . . . . .ALBICOSTA GROUP

4(2). Parascutellar and pcx scale patches present; costal vein never with more than inconspicuous basal, humeral and subcostal light patches . . . . . .THOMASINA SECTION
   Parascutellar and pcx scales normally absent; costal vein with more numerous and more conspicuous light patches 5

5(4). Acrostichal scales almost entirely brown; pst with only a few scales near ppl; ssp scales absent . . . . . .FOLICOLAE SECTION
   Acrostichal scales largely light-colored; pst entirely covered with scales; ssp scales present. . ORTHOPODOMYIA SECTION, in part 6

6(5). Costal vein lacking light patch opposite base of vein Rs (accessory sectoral patch); laterotergite with patch of light scales; acrostichal and dorsocentral scales separated by longitudinal bare area. . . . . . ALBIPES GROUP
   Costal vein with accessory sectoral light patch; laterotergite bare; acrostichal and dorsocentral scales not separated by bare area . . 7

7(6). Lowermost mep scale patch small, rectangular and located close to

upper patch; wing without broad asymmetrical scales; portion of costal vein along posterior edge of wing entirely dark-scaled. . . . . VERNONI GROUP

Lowermost mep scale patch large, triangular and located in lower portion of sclerite; wing with some broad asymmetrical scales; portion of costal vein along posterior edge of wing with scattered light scales. . . . . ARBORICOLLIS GROUP

Male Genitalia

(species 5 and 14 unknown)

1. Paraproct sclerotization with a single apical tooth; IX-T setae strong; aedeagus acorn-shaped . . . . . NKOLBISSONENSIS GROUP

Paraproct sclerotization normally with at least 2 apical teeth; IX-T setae fine or absent; aedeagus not acorn-shaped 2

2(1). Basal mesal lobe with 2 or 3 short, blunt and flattened stout bristles at apex; VIII-T without a lobe on posterior margin . . . . . THOMASINA SECTION

Basal mesal lobe with 3-8 long, pointed and terete stout bristles at apex; VIII-T with a distinct lobe on posterior margin. 3

3(2). Aedeagus more or less pyriform and spiniform broadened, flattened, partially rolled and divided into numerous finger-like lobes . . . . . SIGNIFERA GROUP

Without both these characteristics; aedeagus not pyriform or, if so, then spiniform simple; spiniform not lobed or, if so, then lobes are few and irregular and aedeagus is not pyriform 4

4(3). Aedeagus with at least 15 small processes or teeth in a group or multiple rows on each side of apex and sternal surface of aedeagus with 1 pair of strong processes or spines; spiniform with 2-4 irregular lobes . . . . . VERNONI GROUP

Aedeagus without processes or teeth at apex or, if so, then at most 9 in 1 row and sternal surface of aedeagus without strong processes or spines; spiniform simple 5

5(4). Apex of aedeagus broadly truncate and with 5-8 crenate teeth on each side and mesal surface of sidepiece with strong specialized bristles; clasper with 2 spiniforms . . . . . ALBICOSTA GROUP

Apex of aedeagus not broadly truncate and without teeth or, if narrowly truncate and/or with pointed teeth, then mesal surface of sidepiece without specialized bristles; clasper normally with 1 spiniform . . 6

6(5). Apex of aedeagus with 2-7 large pointed teeth on each side; aedeagus without a pair of strong teeth or spines on sternal surface. . . . . FOLICOLAE SECTION

Apex of aedeagus without teeth; aedeagus often with a pair of strong teeth or spines on sternal surface 7

7(6). Aedeagus broadest in central portion and tapering towards both ends and with a pair of sternal teeth near apex . . . . ARBORICOLLIS GROUP

Aedeagus more or less pyriform or nearly as broad near apex as in central portion or, if broadest in central portion, then sternal teeth not near apex . . . . . ALBIPES GROUP

Pupae

(9. sampaioi, 11. vernoni, 12. milloti, 13. nkolbissonensis, species 5 and species 14 unknown; 15. arboricollis not included)

1. Hairs 1-7-C all shorter than or subequal in length to trumpet and 6-C cephalad of 7-C; 1-VI usually mesad of 2-VI. 2
At least hairs 5-C and/or 7-C not less than 1.5 times length of trumpet or 6-C caudad of 7-C; 1-VI laterad of 2-VI 4

2(1). Hair 3-C subequal in length and number of branches to 1-C; surface of paddle smooth or with minute spicules only in posterior portion of inner part near inner margin . . . . . SIGNIFERA GROUP
Hair 3-C much shorter and usually with more numerous branches than 1-C; entire surface of paddle with minute spicules 3

3(2). Hair 1-II 3-5b; external buttress of paddle extending only slightly distad of level of apex of median caudal lobe. . . . . .ALBICOSTA GROUP
Hair 1-II usually 10-13b (6-16); external buttress of paddle extending far distad of level of apex of median caudal lobe. .THOMASINA SECTION

4(1). Hair 3-C weakly developed, not as strong as 2-C; 5-C most strongly developed hair on cephalothorax; 9-VII moderately developed, usually 3-6b and not more than 0.33 length of 9-VIII. .FOLICOLAE SECTION
Hair 3-C weakly to strongly developed, always at least as strong as 2-C; 7-C usually most strongly developed hair on cephalothorax; 9-VII strongly developed, 8-12b (7-13) and about 0.5-0.75 length of 9-VIII . . . . . ALBIPES GROUP

Larvae

(13. nkolbissonensis and species 14 unknown; 9. sampaioi and 11. vernoni not included)

1. Comb scales normally in 1 row . . . . . .ALBICOSTA GROUP
Comb scales normally in 2 rows 2

2(1). Hair 6-II-VI similarly developed, double; 2-III-VII stellate; basal portion of siphon and anal saddle with spinules . ARBORICOLLIS GROUP
Hair 6-II developed like 6-I and usually more than double, 6-III-VI normally single or only 6-IV double; 2-III-VII usually small and single, never stellate; siphon and anal saddle without spinules 3

3(2). Hairs 4-10-C all more or less equally developed, long, strong and multiple; 0, 1, 3-7-P all more or less equally developed, long, strong and multiple . . . . . ALBIPES GROUP, in part . . . . . 17. flavithorax
Hairs 4-10-C not all equally developed, in particular 8, 10-C only 1-3b; 0, 1, 3-7-P not all equally developed. 4

4(3). Hairs 12, 13-I and 1, 5-VIII stellate; ventral brush with 6 pairs of hairs .

. . . . . .VERNONI GROUP
Hairs 12, 13-I and 1, 5-VIII not stellate; ventral brush usually with 7 or 8 pairs of hairs 5

5(4). Hair 4-M double or multiple; 2-VI, VII mesad of hair 1 of corresponding segment 6
Hair 4-M single; 2-VI, VII laterad of hair 1 of corresponding segment. 7

6(5). Comb scales in posterior row usually 2-4 (1-6); hair 13-I more strongly developed than 10-I; 2-I, II mesad of hair 1 of corresponding segment . . . . . .FOLICOLAE SECTION
Comb scales in posterior row usually 7-12 (5-14); hair 13-I less strongly developed than 10-I; 2-I, II laterad of hair 1 of corresponding segment . . . . . ALBIPES GROUP, in part

7(5). Ventral brush with 8 pairs of hairs, the strongest hairs with about 16-23 branches; hair 5-IV-VI usually longer than hair 3 of corresponding segment; head capsule and antenna with minute spicules . . . . . .THOMASINA SECTION
Ventral brush usually with 6 or 7 pairs of hairs, the strongest hairs with about 4-12 branches; hair 5-IV-VI usually shorter than hair 3 of corresponding segment; head capsule and antenna without spicules . . . . . SIGNIFERA GROUP

BANCROFTIA SECTION

FEMALES. Head: eyes partially or completely separated above antennae, or entirely contiguous (albicosta); frontal and orbital bristles dark; ocular border present, white, consisting of narrow curved decumbent scales passing caudad of lateral orbital bristles and cephalad of mesal ones; vertex and occiput with few to numerous decumbent scales, all narrow and curved or with some broad and flat (albicosta), and numerous erect scales, cephalad ones longer and with fewer forks; clypeus an elongate angular lobe or triangular (albicosta, Kummi subgroup), usually bare; labium considerably swollen apically, weakly developed shaft bristles present near apex; palpus straight, 0.33 to 0.48 of proboscis, 4- or 5- (pulchripalpis) segmented; torus with scales; first flagellar segment not or slightly (albicosta) swollen; no (albicosta), 1 (pulchripalpis) or several proximal flagellar segments with scales. Thorax: paratergite narrow to moderately broad, bare; posterior dorsocentral bristles sometimes in a double row; posterior fossal bristles rarely absent (albicosta); fossal bristles present or absent; all mesonotal and scutellar bristles dark; mesonotal ornamentation consisting of 4-6 pairs of lines of small white scales arranged into pattern of 2-4 longitudinal lines and broader areas or lines with brown scales; parascutellum normally bare; lateral lobes of scutellum with or without scales; pleural bristles, except as noted below, dark; upper anterior apn bristles 1-8 strongly developed, 0-4 weakly to moderately developed, lower apn bristles 0-2 strongly developed, 0-4 weakly to moderately developed, at least 1 bristle always present, sometimes light in color; ppl bristles 4-8 strongly developed, 0-9 weakly to moderately developed; pra bristles absent (albicosta) or 2-12; upper stp bristles 1 or 2, moderately to strongly developed, posterior stp bristles 2-10, weakly to strongly developed, lower stp bristles 0-10, weakly

to moderately developed; upper posterior mep bristles 4-15, sometimes light in color; anterior mep bristles rarely present (pulchripalpis); pleural scaling consisting of 3 more or less distinct horizontal lines and 1 nearly vertical line of white scales. Legs: coxal bristles light or dark; hindtarsal segment 1 shorter or longer (albicosta) than hindtibia; hindclaws smaller than fore- and midclaws. Wing: remigial bristles present, weakly developed; cell R_2 varied in length, vein R_2 1.75-3.50 of vein R_{2+3}; cell M_2 varied in length, vein M_{1+2} 1.20-2.50 of vein M distad of crossvein m-cu; plical area with a few light scales at base ventrally; alula scales narrow; upper calypter with bristles; scales symmetrical, or nearly so, varying in shape and degree of spreading; ornamentation varied, but without costal spots or yellow or golden scales. Abdomen: tergite I with middorsal fan of scales and sometimes with scattered white scales, laterotergite bare.

FEMALE GENITALIA. Tergite IX with or without dorsolateral setae.

MALES. Essentially as in females. Labium: not more strongly swollen than in females. Palpus: 0.77-1.02 of proboscis, segment 3 with or without well developed apical bristles. Antenna: torus greatly enlarged; flagellum strongly plumose; segments 12 and 13 subequal in length; segment 1 with or without (albicosta) scales. Legs: anterior fore- and midclaws with basal tooth too small to be seen on pinned specimens, posterior fore- and midclaws uniserrate with tooth too small to be seen on pinned specimens. Abdomen: sidepiece with light and dark scales.

MALE GENITALIA, PUPAE, LARVAE. Varied. See descriptions for Signifera group and albicosta.

BIONOMICS. The immature stages are found in bamboo internodes, treeholes and artificial containers. Females are not known to bite man.

SYSTEMATICS. The Bancroftia section is made up of the Albicosta and Signifera groups. The former group contains only the South American albicosta while the latter, centered in North America, contains 6 species. I am combining these groups because the adults of both share a highly derived ornamentation. However, the male genitalia, pupa and larva of albicosta are no more similar to the Signifera group than to any other group.

This section appears to have arisen in the American tropics and to have split into the South American albicosta and the North American centered Signifera group early in its history. The southern-most species in the Signifera group, kummi, is somewhat intermediate in adult ornamentation between albicosta and the other members of the Signifera group.

The affinities of this section are not obvious. The male genitalia of albicosta, particularly in the shape and dentition of the aedeagus, are reminiscent of the Madagascan Vernoni group. The male genitalia of the Signifera group resemble the Vernoni group and the Thomasina section in the shape of the spiniform and are like some species in the Oriental Albipes group in gross aedeagus shape. Among the groups for which the pupa is known, the pupa of both the Albicosta and Signifera groups is most similar to that of the Thomasina section. In fact, the pupa of albicosta is somewhat intermediate between that of the Signifera group and the Thomasina section. The larva of albicosta shares characteristics with the middle American phyllozoa and with the Signifera group. The larvae in the Signifera group bear a close resemblance to some species in the Albipes group (especially the Anopheloides subgroup) and the Thomasina section.

DISTRIBUTION. North America to southern Europe, south to South America and North Africa.

KEYS TO GROUPS

See keys on p. 19-22.

SIGNIFERA GROUP

FEMALES. Head: eyes partially to completely separated above antennae by white decumbent scales, which may be accompanied by weakly developed dark bristles; orbital bristles usually 3, 4 lateral pairs and 4, 5 mesal pairs; vertex and occiput with few to numerous white curved decumbent scales arranged into a more or less anteriorly directed "V"-shaped pattern, and brown or black erect scales; dorsolateral broad scales all white (Signifera subgroup) or white and dark (pulchripalpis and Kummi subgroup); lateral and ventral scales white; suborbital bristles dark; clypeus an elongate angular lobe or triangular (Kummi subgroup), usually bare; palpus 0.33 to 0.48 of probiscis, 4- or 5- (pulchripalpis) segmented, segments 4 and 5 entirely white-scaled dorsally; torus with dorsomesal small white flat scales; flagellum with segment 1 not swollen, segment 1 with brown scales dorsomesally (pulchripalpis) or segments 1-3, 4, 5, 6, or 7 with dorsomesal line of white scales; dorsal flagellar bristles 2.0-2.5 times length of their segment on proximal segments, ventral bristles usually much reduced or absent on segment 1, usually somewhat reduced on 1 to several succeeding segments. Thorax: paratergite narrow to moderately broad; humeral, lateral prescutal and posterior fossal bristles usually numerous enough to completely enclose fossa; mesonotal ornamentation consisting of 4-6 pairs of narrow lines of small white scales, arranged into a pattern of 3 or 4 pairs of longitudinal lines, and broader areas or bands with very small brown scales; white scales arranged as follows: (1) lateral prescutal scales always present, in line from anterior promontory to scutal suture laterad of humeral and lateral prescutal bristles, (2) supraalar scales present in line from scutal suture to parascutellum mesad of supraalar bristles or absent (signifera, in part), (3) inner dorsocentral scales always present, in line from anterior promontory to prescutellar space laterad of acrostichal bristles, (4) lateral prescutellar scales always present, larger than other mesonotal scales, in line from anterior edge of prescutellar space to scutellum mesad of lateral prescutellar bristles, rarely connected anteriorly to inner dorsocentral scale line (waverleyi), (5) posterior fossal scales rarely present (waverleyi), scattered in posterior fossal area and connected to outer dorsocentral scale line, (6) outer dorsocentral scales always present, in line from scutal suture to about level of cephalic end of lateral prescutellar scale line or extending to scutellum (pulchripalpis), laterad of posterior dorsocentral bristles; brown scales arranged as follows: (1) in band accompanying but extending further caudad than acrostichal bristles, (2) in band accompanying dorsocentral bristles, (3) as sparse covering in all or part of fossal area; lateral lobes of scutellum with or without scales, midlobe with 1 pair of narrow white scale lines which extend 1 to 2 times length of scutellum from its caudal margin; upper anterior apn bristles 2-8 strongly developed, 0-4 weakly to moderately developed, lower apn bristles 0-2 strongly developed, 0-4 weakly to moderately developed; ppl bristles 3-8 strongly developed, 0-9 weakly to moderately developed; pra bristles 2-12; upper stp bristles 1 or 2, moderately to strongly developed, posterior stp bristles 3-10, weakly to strongly developed, lower stp bristles 0-10, weakly to moderately developed; upper posterior mep bristles 4-15, not always dark in color, anterior mep bristles rarely present (pulchri-

palpis); pleural scaling with individual lines narrow (Kummi subgroup) or broader; apn with diagonal row of narrow curved decumbent scales between two groups of bristles and occasionally with 1, 2 similar white scales above upper anterior bristles; ppn with narrow horizontal row of flat scales extending from line on apn to its caudal border ventrad of posterior ppn bristles or with scales reduced or absent (signifera, in part); psp bare or with scales in dorsal posterior patch; pra usually with few to many curved decumbent scales; ppl with diagonal row of broad flat scales below ppl bristles, sometimes with a few similar scales above bristles; pst bare, with broad flat scales near ppl (pulchripalpis), or in horizontal line across entire prosternum (Kummi subgroup); pcx, ssp and hypostigial scales absent; stp scaling variable, with 3 more or less distinct lines of scales, as follows, broad flat scales in 2 horizontal lines, 1 above and 1 below upper stp bristle, and broad flat and sometimes semierect scales in nearly vertical line extending ventrad from level of lower margin of mep along posterior stp margin, both horizontal lines sometimes joined before or behind upper stp bristle or vertical line broad and extending dorsad over both horizontal lines; mep with upper diagonal patch or line of broad semierect scales, some elongated, and lower anterior patch or line of broad flat scales, lower patch sometimes joining upper or rarely absent or much reduced (signifera, in part); a few additional large brownish or transparent scales may be scattered over pleuron, especially meron and stp, of freshly eclosed, robust adults. Legs: coxal bristles usually very dark; broad flat scales present along outer edge of anterior surface on all coxae and above and behind uppermost bristles on forecoxa; trochanters with flat scales on anterior, inner and posterior surfaces; femora usually with small white knee spots; tibiae with apical white patch if tarsal segment 1 is white at base; hindtarsal segment 1 shorter than hindtibia; hindtarsal segment 1 with medium-sized posteriorly incomplete white ring basally and complete or ventrally incomplete white ring apically, segments 2-4 usually with conspicuous dorsal white patches at both ends, those on proximal segments sometimes forming complete rings, segment 5 entirely white-scaled dorsally or all or partially dark (waverleyi and part of signifera); patch or ring at joint between segments 1-2 largest, that over each succeeding joint smaller. Haltere: scales whitish. Abdomen: tergite I fan white-scaled; sternite VIII largely bare, a few scales usually present laterally.

FEMALE GENITALIA. Tergite IX with dorsolateral setae.

MALES. Essentially as in females. Palpus: 0.93-1.02 of proboscis, segment 5 small, segment 3 with or without strong apical bristles; white scales in patch at base of segment 4 and covering all of segment 5. Antenna: integument of flagellum dark except for lighter bands basad of whorls on shorter segments; segment 1 with dark or dark and white scales dorsomesally; bristles of flagellar whorls about 0.4-0.5 length of entire flagellum on proximal segments, about 0.5-0.8 length of segment 13 on that segment. Wing: plical scales often absent.

MALE GENITALIA. Segment VIII: tergite with distinct lobe on posterior margin. Segment IX: tergite with 0-6 fine bristles on each side. Sidepiece: medium to long conical; basal mesal lobe with 3-7 terete apical bristles, tergal 2-6 quite stout, sternal 1-3 finer; mesal surface membranous for short distance distad of basal mesal lobe; mesal surface without specialized setae distad of basal mesal lobe; tergomesal surface with 1 or 2 very large, and usually 1 or 2 smaller, curved, specialized bristles distad of or near basal mesal lobe. Spiniform: 1, apex flattened, broadened, partially rolled and divided into numerous more or less regular finger-like lobes. Aedeagus: strongly sclerotized, more or less pyriform, with 1 pair of triangular spines sternally and 1-7 small irregular processes on an apical ridge tergally. Proctiger: paraproct sclerotization with 2-5 apical teeth; cercal setae 2-6.

PUPAE. Cephalothorax: lightly to moderately pigmented, with upper and posterior portions of wing case and portion of mesonotum caudad of trumpet darker; integumentary sculpturing absent to very weak, reticulate; smaller hairs concolorous with integument, larger hairs darker; hairs 1-3-C all more or less equally developed, weak to moderate; 4, 5, 7-C moderately and more or less equally developed; 6-C cephalad of 7; 8, 9-C sometimes strongly developed. Trumpet: deeply pigmented except at extreme base and apex and much darker than darkest part of cephalothorax or more or less uniformly moderately pigmented and not darker than darkest part of cephalothorax (pulchripalpis); distal portion gradually widened from base; pinna medium-sized. Metanotum: lightly to moderately pigmented, with haltere cases lighter; integumentary sculpturing absent or very weak, reticulate; never more than 3 pairs of hairs developed. Abdomen: lightly to moderately pigmented; when moderately pigmented posterior portion of anterior segments and posterior segments in general are lighter; segments II-VIII usually with weakly to moderately developed reticulate to imbricate or somewhat spiculate integumentary sculpturing; smaller hairs and branches concolorous with integument, larger hairs darker; hair 1-II not dendritic and usually 2, 3b (1-5) or dendritic and usually 4-6b (4-16) (signifera, in part); 2-II at level of or caudad of 3-II; 1-VI, VII mesad of hair 2 of corresponding segment; 1-VI usually moderately long and 2, 3b; 9-VII moderately developed, usually 3-7b, longest branch shorter than or only slightly longer than 0.5 distance between alveoli of hairs 9-VII and 9-VIII; 9-VIII strongly developed, usually 7-10b (6-11), longest branch seldom extending much beyond end of external buttress of paddle. Terminal Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: lightly to moderately pigmented, midrib darker; longer than broad, shape varied; external buttress long, more or less straight in middle portion, nearly smooth; midrib usually convex mesally; surface of paddle smooth or with a band of spicules near inner margin (kummi).

LARVAE. Head: slightly broader than long to as long as broad; integument without ornamentation; labrum short; hair 2-C sometimes present. Antenna: short; integument smooth. Thorax: hair 4-M always single. Abdomen: segment VI often with a sclerotized dorsal plate and segment VII usually with a very large sclerotized plate (both plates always absent in alba); hairs 2-I, II laterad of hair 1 of corresponding segment; 6-I, II usually multiple (sometimes only double in alba), 6-III-VII single; 13-I shorter than 10-I; 5-IV-VI shorter than hair 3 of corresponding segment; 2-VI, VII laterad of hair 1 of corresponding segment. Segment VIII: large sclerotized plate present or absent (alba); comb scales in 2 rows; posterior row usually with 5-8 (5-12) comb scales; posterior comb scales with 1 long apical spine and basal fringe. Siphon: integumentary sculpturing absent or weakly developed, imbricate. Anal Segment: saddle usually complete, sometimes ventrally incomplete in alba; sclerotized band or incomplete ring present basad of saddle; integumentary sculpturing as for siphon; ventral brush usually with 6 pairs of hairs in alba, usually with 7 pairs of hairs in other species, the more caudal hairs usually with 4-8 branches in alba and 8-12 branches in other species.

EGGS. Length: about 0.61 mm. Maximum Width: about 0.14 mm. Laid singly or in small groups above the water meniscus on sides of breeding site; not resistant; brown to black in color; cephalic end larger and rounded, caudal end narrower and tapering; morphologically ventral surface uppermost in laid egg and with a veined gelatinous veil; hatching suture oblique, inclined about 45° from longitudinal axis of egg.

KARYOTYPE. Breland (1961:367-368) reported that a pair of satellites was associated with 1 of the larger pairs of chromosomes during prophase in

the prepupal brain of both alba and signifera. The members of the pair of satellites were sometimes unequal in size and it was postulated that they may represent sex chromosomes.

BIONOMICS. With the exception of kummi, the species in this group are restricted to breeding in treeholes and artificial containers. Kummi not only occupies these habitats, but also is found in bamboo stumps. Females of some species are known to take avian blood; no species is known to bite man.

SYSTEMATICS. This is the most recent and highly derived group in the genus Orthopodomyia. It contains 6 very closely related species: alba, kummi, pulchripalpis, signifera, waverleyi, and species 5. With the exception of alba and signifera, which are sympatric over much of the eastern United States, the species are allopatric and form a superspecies. The species in this group are the most poorly marked of any in the genus. The male genitalia are almost identical in all species; barring alba and possibly species 5, the larvae cannot be adequately separated (see below) and separation of the pupae, while somewhat better, is still rather poor. The adults of all species except alba and signifera are easily separated on the basis of ornamentation. I am considering the allopatric forms in this group to be species rather than subspecies because 2 of them, signifera and kummi, meet in southeastern Arizona without extensive hybridization and the differences between most of the other forms are of the same magnitude as those between kummi and signifera.

Larval features have historically been used for the recognition and separation of the forms (especially alba, californica and signifera) of this group which occur in the United States (see Bohart, 1950:399); Carpenter and LaCasse, 1955:98; Chapman, 1965:438). However, I have largely rejected the hypothesis that larval characters are important for separating species in this group. This decision is based on considerable study of the adults and the complete larval and pupal chaetotaxy of all the forms in the Signifera group. Indeed, if one were to base North American species on larval characters alone, several additional species would have to be recognized. More specifically, at least 4 more larval species with signifera-like adults and 1 with a kummi-like adult would be described. Moreover, the 2 larval species with kummi-like adults would scarcely be separable from 2 of the larval species with signifera-like adults. In addition, if one considers pupal characters to be as important as larval, then 3 additional species, 2 with signifera-like adults and 1 with a kummi-like adult, would be recognized. Many of the resulting 12 "species" with either signifera-like or kummi-like adults would have disjunct distributions and some areas would have several species occurring sympatrically. One would repeatedly need to postulate hybridization as an explanation for the mixture of immature and adult characters in the different larval or adult lines. In short, if species are based on larval and pupal chaetotaxy, then species are obtained which have biologically unsound distributions and any attempt to explain the evolution of the group must be highly speculative.

On the other hand, in a classification based largely on adult ornamentation, only 6 species are recognizable in the entire Signifera group. Such an approach is suggested when one considers that the three forms in the Signifera group which differ most in adult ornamentation, and which are most likely to be specifically distinct on the basis of geography (the Central American kummi, the North American signifera and the European pulchripalpis), have nearly identical larvae. The 6 species delimited under such a system have continuous distributions and all of the species except alba and signifera are allopatric. Explanation of the evolution of the group need not be highly speculative, since all species could have arisen in geographical isolation. In summary, if species

are based largely on adult ornamentation, then the resulting species have biologically sound distributions and the explanation of the evolution of the group is simple. This approach seems more reasonable than the one previously outlined and it is the one followed here. Under this system 2 of the 6 species, signifera and kummi, have various non-hairy, semi-hairy and hairy larval and pupal forms and only 1 of the 6 species, alba, is definitely known to have a diagnostic larva.

The Signifera group can be divided into 3 subgroups on the basis of adult ornamentation; the Kummi subgroup contains kummi and species 5, pulchripalpis forms a monotypic subgroup, and alba, signifera and waverleyi form the Signifera subgroup.

I believe the ancestral species in this group arose in the Middle American area and was derived from the same stock as albicosta. Since the adult wing and pleural ornamentation of kummi are similar to albicosta and kummi is the most southern species in the group, I am considering kummi to be the most primitive species.

Although I am including keys to the male genitalia, pupae and larvae of the species in this group, as indicated above, positive identification of most species can be made only on the basis of adult ornamentation.

DISTRIBUTION. United States to southern Europe, south to Panama, the Greater Antilles, and North Africa.

KEYS TO SPECIES

Adults

1. Outer dorsocentral scale line extending to scutellum; scales on vein 1A very narrow and lying parallel with vein; line of white scales at base of vein R about twice length of remigium . . . . . (PULCHRIPALPIS SUBGROUP) 4. pulchripalpis
   Outer dorsocentral scale line not extending to scutellum; scales on vein 1A narrow to broad, spreading; line of white scales at base of vein R restricted to remigium or extending to separation of vein R_S . . . 2

2(1). Pst with a complete horizontal line of white scales; scale lines of pleuron very narrow; base of vein 1A dark-scaled . . . . . (KUMMI SUBGROUP) 3
   Pst without scales; scale lines on pleuron broader; base of vein 1A white-scaled . . . . . .(SIGNIFERA SUBGROUP) 4

3(2). Line of white scales at base of vein R restricted to remigium .Species 5
   Line of white scales at base of vein R extending to separation of vein R_S . . . . . 6. kummi

4(2). Lateral prescutellar scale line connected to inner dorsocentral scale line; posterior fossal white scales present and connected to sparsely scaled outer dorsocentral scale line . . . . . 1. waverleyi
   Lateral prescutellar scale line not connected to inner dorsocentral scale line; posterior fossal white scales absent and outer dorsocentral scale line densely scaled 5

5(4). Lower stp bristles usually 4-10 in number and present throughout length

of lower stp scales; base of vein R_{4+5} with patch of white scales, or if not, then entire white spot over crossveins is much reduced. . . . . 2. signifera

Lower stp bristles usually 0-2 in number and present only in uppermost portion of lower stp scales; base of vein R_{4+5} usually dark-scaled and white spot over crossveins large . . . . . .3. alba

Male Genitalia

(Species 5 unknown)

1. Clasper not constricted distad of insertion of apodeme, but tapering smoothly from base to apex; strong setae of basal mesal lobe usually all straight. . . . . .4. pulchripalpis

Clasper usually constricted distad of insertion of apodeme, so that middle portion is narrower than apical portion; strong setae of basal mesal lobe usually curved mesally at apex. . . . . .1. waverleyi; 2. signifera; 3. alba; 6. kummi

Pupae

(Species 5 unknown)

1. Paddle with few to many minute spicules in posterior portion of inner part near inner margin; hair 5-IV, V almost always extending to caudal margin of following segment; 6, 7-I strongly developed, long. . . . . 6. kummi

Paddle without minute spicules; hair 5-IV, V usually not extending to caudal margin of following segment; 6, 7-I weakly to strongly developed, short to long 2

2(1). Hair 2-II-VI 0.4-0.6 length of hair 1 of corresponding segment; 5-III similar in development to and as, or nearly as, strongly developed as 3-III and 5-IV-VI; 5-IV, V not extending beyond 0.6 of following segment; 6, 7-I weakly developed, short. . . . . .3. alba

Hair 2-II-VI less than 0.3 length of hair 1 of corresponding segment; 5-III not as strongly developed as 3-III and 5-IV-VI; 5-IV, V variable in length; 6, 7-I weakly to strongly developed, short to long 3

3(2). Trumpet amber to tan colored and concolorous with or lighter than darkest portion of cephalothoracic integument; hair 5-IV, V not extending beyond 0.8 of following segment; 6, 7-I weakly to moderately developed, short to moderate in length. . . . . .4. pulchripalpis

Trumpet deep tan to brown and darker than darkest portion of cephalothoracic integument; hair 5-IV, V variable in length; 6, 7-I weakly to strongly developed, short to long. 4

4(3). Hair 6-I, II not as strongly developed or as long as hair 3 of corresponding segment and paddle index 1.45-1.65; 5-IV, V not extending beyond 0.6 of following segment. . . . . .1. waverleyi; 2. some signifera

Hair 6-I, II at least as strongly developed and as long as hair 3 of corresponding segment or, if not, then paddle index 1.15-1.45; 5-IV, V variable in length, sometimes extending to caudal margin of following segment . . . . . .2. signifera

Larvae

1. Hair 1-S weakly to moderately developed, usually 3, 4b (2-6), arising near base of siphon, and with branches usually not extending much beyond middle of siphon; 3-VIII weakly to moderately developed, usually 2, 3b (1-5), and usually shorter than the longest comb scales; 13-C strongly developed, usually 7, 8b (5-12) . . . . . 3. alba
Hair 1-S strongly developed, usually with 6 or more branches, arising near middle of siphon, and with branches extending nearly to or beyond apex of siphon; 3-VIII strongly developed, usually with 5 or more branches, and at least 1.5 times length of longest comb scales; 13-C moderately developed, usually 2, 3b (1-4). 2

2(1). Hair 13-T very strongly developed, 6-11b, and as long as 6-II; 6-II 10-14b . . . . . Species 5
Hair 13-T moderately to strongly developed, usually 2-4b (1-5), and usually not nearly as long as 6-II; 6-II usually 5-7b (2-8) 3

3(2). Hair 1-T longer than 2-T; 1-II often at least 1.5 times length of 3-II . . . 2. semi-hairy and hairy forms of signifera; 6. hairy forms of kummi
Hair 1-T shorter than 2-T; 1-II usually subequal to or shorter than 3-II 4

4(3). Siphon index usually greater than 4.0; diameter of base of anal saddle not or only slightly smaller than diameter at most distal point along ventral surface, so that dorsal and ventral surfaces of saddle appear parallel when viewed from the side; hair 13-VII usually 5, 6b (5-8). . . . . 4. pulchripalpis
Siphon index usually less than 3.6; diameter of base of anal saddle usually smaller than diameter at most distal point along ventral surface, so that dorsal and ventral surfaces diverge distally when viewed from the side; hair 13-VII often only 3, 4b (2-6). 5

5(4). Branches of hair 1-S extending beyond apex of siphon and dorsal anal gills 1.1-2.1 length of anal saddle . . 2. signifera, in part; 6. kummi
Branches of hair 1-S not extending beyond apex of siphon, or, if so, then dorsal anal gills only 0.45-0.80 length of anal saddle. . . . . 1. waverleyi; 2. signifera, in part

SIGNIFERA SUBGROUP

FEMALES. Head: vertex and occiput with white decumbent scales numerous, evenly distributed; dorsolateral broad scales all white; clypeus an elongate angular lobe, usually bare; labium dark-scaled with numerous white scales in distinct line or line of speckles from base to or near apex on each side of labial groove; palpus 0.33 to 0.35 of proboscis, 4-segmented, segment 4 very short, segments 1, 2 and 3 dark-scaled with white scales in line or line of speckles along dorsal surface; flagellar segments 1-3, 4, 5, 6 or 7 with white scales. Thorax: paratergite moderately broad; outer dorsocentral scale line not extending to scutellum; lateral lobes of scutellum with or without scales; anterior mep bristles absent; psp scales present or absent; pst without scales.

Legs: coxae with white scales or some lower ones on forecoxa brown or black; trochanters with white or white and dark scales; forefemur with anterior surface usually streaked with white scales in basal 0.05-0.6 dorsally, remainder dark-scaled with white speckles, ventral margin speckled or lined with white scales from base to apex, posterior surface usually with narrow ventral dark streak from base to apex, area dorsad of streak largely white-scaled basally and white-scaled with dark speckles apically; midfemur with anterior surface largely dark-scaled with white speckles, base varied, posterior surface pale- or white-scaled in basal 0.05-0.5 and to or near apex in progressively narrowing streak near ventral margin, remainder dark-scaled with white speckles; hindfemur with anterior surface usually pale- or white-scaled in basal 0.05-0.4, and somewhat further distally along ventral margin, remainder dark-scaled with white speckles, posterior surface like that of midfemur except that greater proportion of base is usually light-scaled and light scales do not extend to apex; tibiae largely dark-scaled; foretibial anterior surface with white scales in line or line of speckles from base to or near apex, posterior surface usually with similar but often shorter and/or less well defined line; midtibial anterior surface with white scales usually in poorly defined line or line of speckles from base to or near apex, posterior surface with well defined white line, ventral surface with white speckles basally; hindtibia varied; tarsi largely dark-scaled, varied. Wing: speckled and spotted with many white scales, vein R with remigium white-scaled, base of vein 1A white-scaled to about level of base of vein R_S, area of crossveins usually with more or less conspicuous white spot made up of white patches on veins R_S, M, and Cu, base of veins R_S and M often white-scaled, remainder of veins mentioned and all other veins usually dark-scaled with numerous white speckles; veins behind vein R_1 with broad scales; scales on vein 1A wide-spreading. Haltere: scales broad.

MALES. Essentially as in females. Palpus: 0.93 to 1.02 of proboscis, segment 3 with or without well developed apical bristles; segments 1, 2 and 3 with white scales in line or line of speckles on dorsal surface. Antenna: flagellar segment 1 with white and dark scales dorsomesally. Thorax: upper posterior mep bristles reduced in number. Wing: white-scaling generally reduced; scales at base of vein 1A not wide-spreading.

MALE GENITALIA. Segment IX: sternite without small projection in middle of cephalic edge. Clasper: usually strongly constricted distad of origin of apodeme so that middle portion is narrower than distal portion. Aedeagus: basal portion usually rounded, sometimes slightly angular.

SYSTEMATICS. This is the most highly derived subgroup in the Signifera group. It contains 3 species, alba, signifera and waverleyi. Signifera, the widespread, dominant species, is found throughout most of the United States, in northern Mexico and on all the Greater Antilles except Jamaica; waverleyi is restricted to Jamaica; alba is found throughout the eastern United States and in northeastern Mexico. Alba is apparently the most primitive of the 3 species.

DISTRIBUTION. United States, south to northern Mexico and the Greater Antilles.

1. Orthopodomyia waverleyi (Grabham)

Figs. 2, 3, 4

1907. Mansonia waverleyi Grabham, 1907:25. *TYPE: Lectotype ♂ with genitalia slide 650626-14, specimen bearing the handwritten label "signifer,

Jamaica, Dr. Grabham, 1.9.06," Waverley Estate, Constant Spring, [St. Andrew, Surrey], Jamaica, reared from a larva found in a mango treehole, 1 Sept 1906, M. Grabham; PRESENT SELECTION [USNM]. Reduced to synonymy with signifera by Dyar (1928:397); resurrected from synonymy with signifera by Edwards (1939:121, 123); reduced again to synonymy with signifera by all subsequent workers; resurrected from synonymy with signifera in present study.

Orthopodomyia waverleyi of Howard, Dyar and Knab (1917:891-893); Johnson (1919:424); Bonne and Bonne-Wepster (1925:488); Gowdey (1926:74); Root (1927:463, 465, questionable identification); Edwards (1939:121, 123).

Pneumaculex waverleyi of Theobald (1910b:469, 619-620).

Orthopodomyia signifera of Dyar (1928:397, in part); Edwards (1932:108, in part); Lane (1939:97, in part); Hill and Hill (1945:3); Thompson (1947:79); Hill and Hill (1948:51); Lane (1953:628-629, in part); Stone, Knight and Starcke (1959:124, in part); Stone, Sabrosky, Wirth, Foote and Coulson (1965:109, in part).

FEMALE (fig. 2). Wing: 3.78 mm. Proboscis: 2.52 mm. Forefemur: 2.54 mm. Abdomen: about 2.9 mm. Head: integument of head capsule, clypeus, torus and flagellum brown to black; erect scales brown to black; clypeus sometimes with a few white scales; palpus about 0.33 of proboscis; flagellar segments 1-6 or 7 with scales. Thorax: integument of mesonotum and scutellum evenly brown to black or with supraalar area somewhat lighter, postnotum always lighter, evenly brown to beige, pleuron brown to black anteriorly, lighter posteriorly; supraalar scale line present; lateral prescutellar and inner dorsocentral scale lines connected; white posterior fossal scales present although very few in number, and connected to outer dorsocentral scale line; outer dorsocentral scale line with scales rather sparse; lower stp bristles 0, 1 strongly developed, 4-7 weakly to moderately developed, present throughout length of lower stp scales; part or all of mep bristles sometimes whitish in color; pleural scaling without well defined lines; ppn scales present; psp scales present; stp with lower vertical line of scales much broadened and extending dorsad to upper horizontal scale row, so that entire posterior portion of stp has sparse covering of white scales, some of which, in lower portion, may be semierect; lower anterior mep scale patch narrow to broad, apparently never joining upper. Legs: integument of forecoxa brown to blackish-brown, midcoxa not or somewhat lighter, hindcoxa slightly to considerably lighter; legs with dark scales brown to black; forefemur with anterior surface streaked in basal 0.3-0.4, posterior surface with area dorsad of dark streak sometimes largely dark-scaled with white speckles; midfemur with anterior surface entirely dark-scaled with white speckles, posterior surface light-scaled in basal 0.2-0.4; hindfemur with anterior surface usually light-scaled in basal 0.05-0.4; foretibial anterior surface usually with line of white speckles; hindtibial ventral, anterior, and dorsal surfaces speckled with white scales, posterior surface with white line in basal portion; foretarsal segment 1 usually with small dorsal white patch at ends and white speckles basally, segment 2 sometimes with very small dorsal white patch at ends; midtarsal segment 1 with complete narrow basal ring and ventrally incomplete narrow apical ring, and usually with white speckles basally, segment 2 with small dorsal white patch at each end; hindtarsal segment 1 usually with complete apical ring, segment 5 white-scaled only at ends or rarely only at base, patches over joints generally smaller than in other species. Wing: light spot in area of crossveins usually poorly developed

and not conspicuous to unaided eye, white patches on veins R_{2+3}, R_{4+5}, M and Cu_1 very small or 1 or more absent. Haltere: integument of stem beige to tan, knob brown. Abdomen: integument of tergite I beige to brown, sternites II-VII beige to brown, sternite VIII dark brown; abdominal segments with dark scales brown to black; tergite II entirely white-scaled or with some dark scales apically; tergites III-VIII with basolateral white patch and sometimes, especially on more proximal and distal segments, with a few white scales near base middorsally or with poorly developed basal band; sternite II entirely white-scaled; sternites III-VII with dark apicolateral patches or dark apical band, dark-scaling usually becoming more prevalent on distal segments; sternite VIII bare.

MALE. Essentially as in female. Labium: as in female or with white scales forming lateral patch or complete ring just distad of level of distal end of palpal segment 2. Palpus: about 0.93 of proboscis, segment 4 sometimes with scattered white scales. Abdomen: as in female or with more proximal and distal tergites with poorly developed basal bands; tergite VIII with mixed black and white scales, sternite VIII with white apical and basal bands.

MALE GENITALIA (fig. 3). Segment VIII: tergite lobe very small, broader than long, or larger, longer than broad, becoming narrower apically, apex usually rounded, sometimes truncate with slight central emargination. Segment IX: tergite with 1-4 bristles on each side. Sidepiece: basal mesal lobe with 3-5 stout bristles which are usually curved mesally near apex and with 1 or 2 finer bristles. Aedeagus: broader than in other species in Signifera group; ventral triangular spines usually near middle; preapical ridge with 3 or 4 processes. Proctiger: paraproct sclerotization usually with 2, 3 apical teeth; cercal setae usually 3 or 4.

PUPA (fig. 3). Abdomen: 3.3 mm. Trumpet: 0.5 mm. Paddle: 0.7 mm. Cephalothorax: hairs 8, 9-C not as long as trumpet. Trumpet: deep tan to brown except for extreme base and apex and largely darker than darkest part of cephalothoracic integument. Metanotum: hair 12-C usually moderately developed. Abdomen: hairs 6, 7-I medium long; 1-II moderately developed, usually 2, 3b (1-4); 2-II-VI less than 0.3 length of hair 1 of same segment; 6-II short and fine, similar to 7-II; 5-III usually 2-4b (1-5) and more weakly developed than 5-IV-VI or 3-III; 10-III-VII usually not extending beyond 0.8 of following segment; 5-IV, V not extending beyond 0.5 of following segment. Paddle: usually narrowly to broadly oval to oboval in outline; apex rounded, truncate or emarginate; inner part without minute spicules near inner margin.

LARVA (fig. 4). Head: 0.96 mm. Siphon: 0.91 mm. Anal Saddle: 0.46 mm. Not all branched hairs with conspicuous barbs. Head: largely brown colored, lighter cephalad and around imaginal eye, collar darker; mental plate brown, usually with 9, 10 (9-11) teeth on each side; hair 2-C apparently absent; 9-C single, fine; 11-C weakly developed, usually 3-5b; 13-C moderately developed, usually 2, 3b (2-4). Antenna: uniformly straw colored. Thorax: epidermal pigment moderately to strongly developed, purple in color; spicules not conspicuous; hairs strongly pigmented; hair 0-P usually 4, 5b (3-7); 6-P single; 1-M moderately developed, single; 1-T weakly to moderately developed, usually single; 13-T moderately developed, usually 3b (2-4). Abdomen: segment VII usually with a large sclerotized plate and segment VI often with a smaller dorsal plate; hairs strongly pigmented; hair 1-I weakly developed, usually 2-4b; 4-I shorter than 3-I; 6-I usually 5, 6b; 7-I single or double; 1-II weakly developed, usually single; 4-II moderately developed; 5-II-VI weakly developed, usually single or double (1-3b); 6-II usually 5, 6b (5-8); 7-II moderately developed; 1-III moderately to strongly developed, usually single; 13-III-V usually single or double and either shorter or longer than hair 10 of cor-

responding segment; 1-VI weakly developed, usually 1-3b; 1-VII moderately to strongly developed, single or double; 13-VII usually 3, 4b (3-6). Segment VIII: large sclerotized plate present; anterior comb scales usually 17-21 (14-23), posterior comb scales usually 6-8 (6-9); posterior row of comb scales about 0.46-0.56 length of anterior row; hair 3-VIII strongly developed, usually 8-10b (7-11). Siphon: index about 2.9-3.9, usually less than 3.5; largely brown in color, with extreme base darker and apex sometimes lighter; integumentary sculpturing weakly developed, imbricate; hair 1-S located 0.46-0.55 from base of siphon, usually 7-10b (7-13), strongly developed and with longest branches extending to or slightly beyond apex of siphon. Anal Segment: saddle complete; saddle uniformly brown or somewhat darker near apex dorsally; integumentary sculpturing absent to weakly developed, imbricate; diameter of saddle at most proximal point usually considerably smaller than diameter at most distal point along the ventral margin, so that dorsal and ventral surfaces diverge when viewed from the side and diameter of saddle at most proximal point usually less than diameter of base of siphon; hair 1-X single and fine; ventral brush usually with 7 pairs of hairs; more strongly developed hairs in ventral brush usually with 11-14 branches (10-17); gills short to moderately long, dorsal pair about 1.5-2.0 as long as ventral pair and 0.45-0.80 length of anal saddle.

BIONOMICS. Larvae of this species have been reported only from tree-holes. Nothing is known of the habits of the adults.

SYSTEMATICS. On the basis of adult ornamentation waverleyi is the most derived species of the Signifera group. It appears to be a recent derivative of signifera which arose in geographical isolation on Jamaica. It is possible that it should be considered as a subspecies of signifera.

The adults are best distinguished from those of alba and signifera on the basis of mesonotal ornamentation; in waverleyi the lateral prescutellar scale line curves and joins the inner dorsocentral scale line and the posterior fossal area has white scales which join with the outer dorsocentral scale line. The adults of signifera from the Greater Antilles agree with waverleyi in having the fifth hindtarsal segment white only at the ends and the white spot over the cross-veins of the wing reduced, and tend towards waverleyi in ornamentation of stp. None show the mesonotal ornamentation or other features of waverleyi. Some signifera from Arizona and southern California also have the fifth hindtarsal segment white only at the ends and have the wing spot reduced.

Only non-hairy forms of the larva and pupa are known. The larva is indistinguishable from signifera from the eastern United States and the Greater Antilles and is very similar to kummi and pulchripalpis. The pupa cannot be separated from signifera from the Greater Antilles and is very similar to signifera from California and pulchripalpis.

The mesonotum of the adult does not always show its complete ornamentation because the white posterior fossal scales and the outer dorsocentral scales are sparse and easily rubbed off.

This species appears to be more uniform than others in the Signifera group. This is expected as the species is endemic to one rather small island and this island is extensively forested so that the demes are not likely to be semi-isolated.

Preliminary investigation has failed to verify the past existence of a Waverley Estate at Constant Spring, Jamaica, but has revealed that a Maverley Estate did exist nearby. Depending upon the results of continuing research, the name of this species may be emended to maverleyi.

DISTRIBUTION. Endemic to the island of Jamaica. Material Examined: 459 specimens; 47 ♂, 44 ♀, 103 P, 265 L; 72 individual rearings (30 larval,

38 pupal, 4 incomplete).

JAMAICA. St. Andrew: Constant Spring, Waterworks gate, 7 Sept 1965, J. N. Belkin (JA 327), 1 L [UCLA]. Constant Spring, Waverley Estate, 1 Sept 1906, M. Grabham, ♂ lectotype, 1 ♂, 2 L [USNM]. Constant Spring, 16 Nov 1966, O. G. W. Berlin and D. C. Watson (JA 697), 2 lp♂ (697-10, 12), 1 lp♀ (697-13), 1 ♂, 1 P, 1 L [UCLA]; same data (JA 698), 5 lp♂ (698-10, 12, 13, 19, 20), 6 lp♀ (698-11, 14, 16-18, 21), 2 p♂ (698-100, 102), 2 p♀ (698-101, 103), 2 ♀, 12 P, 7 L [UCLA]. Hermitage, 20 Aug 1964, H. L. Tucker (JA 110), 1 L [UCLA]; 21 Sept 1966, D. C. Watson (JA 625), 12 L [UCLA]. Hermitage Dam Road, 22 Aug 1965, W. A. Page (JA 280), 2 p♀ (280-100, 101) [UCLA]; 29 Oct 1965, W. A. Page (JA 394), 1 lp♂ (394-10 [UCLA].

St. Mary: Annotto Bay, 16 Sept 1966, D. C. Watson (JA 622), 1 lp♂ (622-10), 1 lp♀ (622-11), 2 p♂ (622-100, 102), 1 p♀ (622-101), 1 lp (622-12), 9 L [UCLA]. Road from Annotto Bay to Broadgate, 28 Nov 1965, W. A. Page (JA 407), 5 p♂ (407-100, 102, 104, 112, 114), 9 p♀ (407-73, 74, 105-110, 113), 7 ♂, 2 ♀, 6 P [UCLA]. Broadgate, Junction Road, 25 Aug 1965, W. A. Page (JA 256), 1 lp♂ (256-15), 1 p♂ (256-100), 1 p♀ (256-101), 1 lp (256-31), 114 L [UCLA]. Broadgate, 12 Nov 1965, W. A. Page (JA 401), 2 lp♂ (401-11, 13), 5 lp♀ (401-14, 15, 20, 22, 23), 6 p♂ (401-100-103, 106, 108), 4 p♀ (401-104, 105, 107, 112), 1 lp (401-21), 1 l♀ (401-12), 4 ♂, 3 ♀, 1 P, 73 L [UCLA]; 27 Oct 1966, O. G. W. Berlin and D. C. Watson (JA 642), 3 lp♂ (642-11-13), 2 lp♀ (642-10, 14), 2 p♂ (642-100, 101), 1 p♀ (642-102), 2 P, 10 L [UCLA].

St. Thomas: Leith Hall, 13 Nov 1966, O. G. W. Berlin and D. C. Watson (JA 690), 10 P, 1 L [UCLA].

No locality or date: R. B. Hill, 1 ♀ [USNM].

Additional records from the literature. HAITI. Nord: Plaisance, Roche Platte, 7-11 Oct 1925, Hoffman (Root, 1927:463, 465). Since no specimens from Hispaniola have been available for study, the identity of the species present on the island is unknown. It is possible that the species is signifera rather than waverleyi.

2. Orthopodomyia signifera (Coquillett)

Figs. 2, 5, 6

1896. Culex signifer Coquillett, 1896:43. *TYPE: holotype ♀, Washington, District of Columbia, United States, June, D. W. Coquillett [USNM, 3654].

1950. Orthopodomyia californica Bohart, 1950:399-400. *TYPE: holotype ♀ with associated larval and pupal skins (48. 4. 21a), Elkhorn Ferry, near Sacramento, Yolo County, California, United States, larva found in a cottonwood treehole, 12 Apr 1948, R. M. Bohart [USNM]. NEW SYNONYMY.

Orthopodomyia signifera of Howard, Dyar and Knab (1917:887-891); MacGregor (1919:454); Edwards (1921:290); Seguy (1921b:114); Dyar (1922:67; 1923b:96-97); Seguy (1923:155); Viosca (1923:37); Seguy (1924:201); Dyar (1928:397-398, in part); Matheson (1929:203-204; 1930:294); Edwards (1932: 108, in part); Bishopp, Cory and Stone (1933:6); Marshall and Staley (1933: 435); Cory, Langford, Crosthwait and Graham (1934:21, 22, 29); Baker (1935:149, 151, 152, 153); MacCreary and Stearns (1935:118); Baker (1936: 1, 2, 4, 5, 7); Cairns (1936:371); Clarke (1936:103); Horsfall (1936:678); Banks (1937:146); Horsfall (1937:747); Quinby (1937:83); Shields and Miles (1937:237); Berger (1938:834); Penn (1938:5); Pennebaker (1938:4); Shields (1938:429); Edwards (1939:121, 123); Glick (1939:51); King, Bradley and

McNeel (1939:55-56); Lane (1939:97, in part); Senevet and Abonnenc (1939: 588); Tulloch (1939:128, 130); Carpenter (1941:58); Quinby (1941:20); Reeves (1941:69-72); King, Bradley and McNeel (1942:61); Reeves (1942:2); Rowe (1942:501); Rozeboom (1942:43); Freeborn and Brookman (1943:22); Gurney (1943:929, 932, 935); King, Roth, Toffaleti and Middlekauff (1943:574); Knutson (1943:317); McGregor and Eads (1943:939); Christensen and Harmston (1944:111); Dorer, Bickley and Nicholson (1944:49); Dorsey (1944:379, 380, 381, 382, 383, 385); Hart (1944:415); King, Bradley and McNeel (1944:61); Matheson (1944:248-249); Middlekauff and Carpenter (1944:89); Olson and Keegan (1944a:781, 782; 1944b:848); Pritchard and Pratt (1944:233); Quinby, Serfling and Neel (1944:548-549); Randolph and O'Neill (1944:84); Schoof and Ashton (1944:6, 7, 8, 9); Tate and Gates (1944:24); Weathersbee (1944:643); Good (1945:175); Headlee (1945:184-190); Kitzmiller (1945:409); Matheson (1945:27); Peterson and Smith (1945:381); Stabler (1945:95); Carpenter and Chamberlain (1946:82, 83, 84, 85, 86, 87, 88); Carpenter, Middlekauff and Chamberlain (1946:116-119); Jenkins and Carpenter (1946:40-41); Shlaifer and Harding (1946:254); Wilson, Barnes and Fellton (1946:84); Brandenburg and Murrill (1947:5, 6); Breland (1947a:185, 186; 1947b:81, 84, 85; 1947c:77); Michener (1947:361); Ross (1947:36-37); Weathersbee and Arnold (1947:225); Wirth (1947:742, 743); Brown (1948:231); Roth (1948:168); Snow (1948:87, 88); Barnes, Fellton and Wilson (1950:82); Bohart (1950:403, 404); Fellton, Barnes and Wilson (1950:91); Frost (1950:66); Darsie (1951:40-41); Darsie, MacCreary and Stearns (1951:144); Freeborn and Bohart (1951:50); Wilkins and Breland (1951:225, 227, 229, 233, 234); Yamaguti and LaCasse (1951:17-19); Carpenter (1952:52); Yamaguti (1952:16, 17); Hedeen (1953:3, 6); Lake (1953: 154, 155); Lane (1953:628-629, in part); Masters (1953:160, 161); Sudia and Gogel (1953:130); Venard and Mead (1953:331); Chamberlain, Sikes, Nelsen and Sudia (1954:283); Ferguson and McNeel (1954:31); Carpenter and La Casse (1955:101-103); Breeland (1956:101); Perez Vigueras (1956:472-474); Pratt (1956:8); Vargas (1956:31); Breland (1957:305); Barr (1958:53-54); Breland (1958:219, 221); Burbutis (1958:212); Chamberlain, Sudia, Burbutis and Bogue (1958:306); Price and Abrahamsen (1958:92); Rapp (1958:28); Rutschky, Mooney and Vanderberg (1958:16); Breland (1959:137-141); Rapp (1959:130); Stone, Knight and Starcke (1959:124, in part); King, Bradley, Smith and McDuffie (1960:136-137); Vargas (1960:339, 340); Breeland, Snow and Pickard (1961:306-307); Breland (1961:360, 372, 374); Johnson (1961:55); Love and Goodwin (1961:214); Porter, Evans and Hughs (1961:235); Edman (1962:431); Tinker and Stojanovich (1962:582); Dodge (1963:798, 804, 808); Warren and Breland (1963:621, 622); Ross (1964:107, 115); Breeland and Pickard (1965:20); Chapman (1965:435, 436, 438); Ross and Horsfall (1965: 14, 24, 43, 44); Stone, Sabrosky, Wirth, Foote and Coulson (1965:109, in part); Wiseman (1965:58); Dodge (1966:378); Flemings and Walsh (1966:426); Gerhardt (1966:38); Montchadsky and Garcia-Avila (1966:36).

Bancroftia signifer of Thibault (1910:20); Seguy (1920:253).

Pneumaculex signifer of Felt (1904:490); Dyar (1905a:46; 1905b:108); Coquillett (1906:26); Dyar (1906:3); Mitchell (1907:189-191); Theobald (1907:14, 524-527; 1910b:469, 620).

Culex (Pneumaculex) signifer of Viereck (1908:470-471).

Mansonia signifer of Dyar and Knab (1906:185); Grabham (1907:25); Knab (1907: 153, 154).

Stegomyia signifera of Howard (1901:236); Theobald (1901a:322); Giles (1902: 379); Smith (1902:299); Theobald (1903:238); Aldrich (1905:126); Blanchard

(1905:258-259); Theobald (1905:19).
Aedes signifer of Grossbeck (1910:719).
Culex signifer of Howard (1896:23); Coquillett (1900:6, 7); Giles (1900:195, 268); Howard (1900:31); Dyar (1903:26-27); Smith (1904:38; 1905:255-259); Ludlow (1906:97).
Orthopodomyia californica of Freeborn and Bohart (1951:50); Yamaguti and La Casse (1951:12-17); Yamaguti (1952:16, 17); Sudia and Gogel (1953:129); Grant (1954:73); Carpenter and LaCasse (1955:100-101); Loomis, Bohart and Belkin (1956:42); Pratt (1956:8); Stone, Knight and Starcke (1957:123); Loomis (1963:24); Ross (1964:107); Chapman (1965:432-439); Stone, Sabrosky, Wirth, Foote and Coulson (1965:108); Womeldorf and Gillies (1967:55, 56, 62).

FEMALE (fig. 2). Wing: 3.89 mm. Proboscis: 2.53 mm. Forefemur: 2.51 mm. Abdomen: about 3.2 mm. Head: integument of head capsule, clypeus, torus and flagellum light brown to black; erect scales dark brown to black; palpus about 0.33 of proboscis, segments 1, 2 and 3 rarely with white scales few and scattered (some western individuals); flagellar segments 1-4 or 5 with scales. Thorax: integument of mesonotum evenly orangish-brown, reddish-brown or light to dark brown or fossal and/or supraalar area lighter, scutellum evenly reddish-brown to dark brown, postnotum usually lighter, evenly beige to dark brown or with darker median longitudinal streak, pleuron reddish-brown to dark brown anteriorly, lighter posteriorly; supraalar scale line present or rarely completely absent (some western individuals); lateral prescutellar and inner dorsocentral scale lines not connected; white posterior fossal scales absent; outer dorsocentral scale line with numerous scales, rarely curving slightly laterad at anterior end; lower stp bristles 4-10, weakly to moderately developed, present throughout length of lower stp scales; mep bristles rarely light in color; pleural scaling with broad but usually well defined lines; ppn scales present, or rarely reduced or absent (some western individuals); psp scales present or absent; stp horizontal scale lines usually distinct, lower sometimes broadened posteriorly, upper and lower sometimes joined before and/or behind upper stp bristles, stp vertical scale line sometimes extending slightly dorsad of level of lower edge of mep, sometimes broadened dorsally, some upper and lower scales usually semierect; lower anterior mep scale patch broad, sometimes continuous with upper or rarely reduced or absent (some western individuals). Legs: integument of forecoxa light brown to brown, midcoxa lighter, hindcoxa lightest, beige to amber; legs with dark-scaling brown to black; forefemur with anterior surface usually streaked in basal 0.05-0.60, posterior surface with area dorsad of dark streak sometimes entirely white-scaled with dark speckles; midfemur with anterior surface usually white-scaled basally or dorsobasally, but sometimes without white scales at base, sometimes with light scales in ventral streak from base to near middle, posterior surface light-scaled in basal 0.05-0.33; hindfemur with anterior surface light-scaled in basal 0.05-0.4; foretibial posterior surface rarely with white-scaling reduced to a few speckles; midtibial dorsal surface rarely speckled with white scales (some western individuals); hindtibial anterior, dorsal and posterior surfaces speckled with white scales, those on posterior surface sometimes forming a line basally; foretarsus entirely dark-scaled or with small dorsal white patch at base of segment 1 or segments 1-2, 3 or 4 and at apex of segment 1, or segments 1-2 or 3; midtarsal segment 1 with ventrally incomplete basal white ring or dorsal patch and usually with dorsal apical white patch, segment 2 sometimes with small basal and apical dorsal white patch, segment

3 less frequently with small dorsobasal white patch, segments 4 and 5 sometimes with beige scales (some western individuals); hindtarsus with apex of segment 1 and base of segment 2 with complete ring, apex of segment 2 and base of segment 3 with complete or ventrally incomplete ring, segment 5 all white dorsally or segment 5 and sometimes 4 with white-scaling much reduced, sometimes almost absent (some western individuals and island populations). Wing: white spot in area of crossveins well developed, conspicuous to unaided eye, white patches on veins M, Cu_1, base of R_{4+5} and R_{2+3} large or spot somewhat reduced or absent (especially in some western individuals and island populations). Haltere: integument of stem white to tan, knob tan to brown. Abdomen: integument of tergite I beige to blackish, sternites II-VII whitish to brown, distal segments usually darker, sternite VIII light to dark brown; abdominal segments with dark scales brown to black; tergite II with large basolateral white patch and narrow to broad basal white band which may extend to apex of segment middorsally; tergites III-VIII with basolateral white or dingy patch, those on opposite sides sometimes connected by irregular dingy or distinct white basal band; sternite II entirely white-scaled; more proximal of sternites III-VII varying from entirely white-scaled to having a small to large apicolateral dark patch or broad apical dark band, more distal varying from mostly white-scaled with narrow dark apical band to mostly dark-scaled with only basolateral white patches; sternite VIII with light and dark scales laterally.

MALE. Essentially as in female. Labium: as in female or with lateral or ventral patch or narrow to broad incomplete or complete ring of white or dingy scales just distad of level of distal end of palpal segment 2 and sometimes with line or speckling of white scales at edge of labial groove much reduced or present only basally or apically. Palpus: about 1.02 of proboscis. Abdomen: tergites as in female, but frequency of basal banding greater, sternites generally darker than in female, sometimes nearly all dark-scaled; tergite VIII dark-scaled, with mixed white and dark scales, or with white apical band, sternite VIII with white basal and sometimes apical band.

MALE GENITALIA (fig. 5). Segment VIII: tergite lobe broader than long to longer than broad, parallel sided or narrowing or widening distally, apex usually emarginate, sometimes rounded, truncate, or irregular. Segment IX: tergite with 0-5 bristles on each side. Sidepiece: basal mesal lobe with 3 or 4 (2-5) stout bristles which are straight or only very slightly bent mesally towards apex, and with 1-3 finer bristles. Aedeagus: ventral spines variable in position; preapical ridge with 1-7 processes. Proctiger: paraproct sclerotization with 2-5 apical teeth; cercal setae 2-5.

PUPA (fig. 5). Abdomen: 3.5 mm. Trumpet: 0.4 mm. Paddle: 0.6 mm. Cephalothorax: hairs 8, 9-C often as long as trumpet except in western populations. Trumpet: deep tan to brown except for extreme base and apex and largely darker than darkest part of cephalothoracic integument. Metanotum: hair 12-C often strongly developed. Abdomen: hairs 6, 7-I usually strongly developed and long in all but most Californian and some Puerto Rican individuals; 1-II usually moderately developed and 4, 5b (4-16) in eastern populations, often strongly developed, long and 2, 3b (1-5) in western populations; 2-II-VI not more than 0.3 length of hair 1 of corresponding segment; 6-II moderately to strongly developed and stronger than 7-II in all but most Californian and some Puerto Rican individuals; 5-III usually 2, 3b (1-5) and not as strongly developed as 5-IV-VI or 3-III; 10-III, VI sometimes extending to apex of following segment, 10-IV, V, VII usually not extending beyond 0.8 of following segment; 5-IV, V extending to about 0.4 to 0.6 of following segment in eastern populations but extending to 0.7-1.0 of following segment in western populations. Paddle: usu-

ally narrowly elliptic, oval or oboval in outline in eastern populations, usually broadly oboval in outline in western populations; apex rounded, truncate or emarginate; inner part without band of minute spicules near inner margin.

LARVA (fig. 6). Head: 0.95 mm. Siphon: 0.75 mm. Anal Saddle: 0.47 mm. Not all branched hairs with conspicuous barbs. Head: largely light brown to brown, lighter cephalad and around imaginal eye, collar darker; mental plate brown, usually with 8-10 teeth on each side; hair 2-C apparently absent; 9-C usually single (1-3b), fine; 11-C weakly developed, usually with 3, 4b (2-6); 13-C moderately developed, usually 2, 3b (1-4). Antenna: uniformly light tan colored or lighter towards apex or base. Thorax: epidermal pigment usually strongly developed, purple, in eastern populations, but absent or weakly developed, pink or reddish, in western populations; spicules not conspicuous except in hairy forms; hairs strongly pigmented; hair 0-P usually 3-5b (2-6); 6-P single; 1-M usually moderately developed and single in eastern populations, usually strongly developed and single or double (1-4b) in western populations; 1-T usually very weakly developed and single or double in eastern populations, moderately to strongly developed and usually single or double (1-4b) in western populations; 13-T usually moderately developed and 2, 3b (2-4) in eastern populations, strongly developed and usually 2, 3b (2-5) in western populations. Abdomen: segment VII usually and segment VI often with sclerotized plate; hairs strongly pigmented; hair 1-I usually very weakly developed and 2, 3b (2-4) in eastern populations, usually moderately to strongly developed and 2-4b (2-6) in western populations; 4-I shorter than 3-I; 6-I usually 4-7b (4-8); 7-I usually single or double in eastern populations, usually double or 3b (1-5) in western populations; 1-II usually very weakly developed and single or double (1-3b) in eastern populations, usually moderately to strongly developed, single or double (1-3b) in western populations; 4-II usually moderately developed, but strongly developed in hairy forms; 5-II-VI usually weakly developed and single or double in eastern populations, usually moderately to strongly developed and 1-3b (1-4) in western populations; 6-II usually 5, 6b (2-8); 7-II moderately developed; 1-III usually moderately developed and single (single, double) in eastern populations, usually moderately to strongly developed and single or double (1-3b) in western populations; 13-III-V usually single or double (1-3b) and shorter than hair 10 of corresponding segment in eastern populations, usually 1-3b (1-5) and longer or shorter than hair 10 of corresponding segment in western populations; 1-VI usually weakly developed and 2, 3b (2-4) in eastern populations, usually moderately to strongly developed and 2, 3b (1-4) in western populations; 1-VII moderately to strongly developed, usually 2, 3b (1-4); 13-VII usually 2-4b (2-6). Segment VIII: large sclerotized plate usually present; anterior comb scales usually 17-21 (11-24), posterior comb scales usually 6-8 (5-11); posterior row of comb scales about 0.40-0.75 length of anterior row; hair 3-VIII strongly developed, usually 5-7b (3-8). Siphon: index about 2.3-3.8, usually 2.7-3.5; largely brown in color, extreme base somewhat darker, sometimes area basad of hair 1-S slightly lighter, apex not or somewhat lighter; integumentary sculpturing absent or weakly developed, imbricate; hair 1-S strongly developed, located 0.36-0.48 from base of siphon, usually 8, 9b (6-10) and with longest branches extending almost to apex of siphon in eastern populations, usually 6, 7b (5-10) and with longest branches extending far beyond apex of siphon in western populations, and 9-13b and with longest branches extending far beyond apex of siphon in Cuban specimens. Anal Segment: saddle complete; saddle brown, somewhat darker dorsoapically; integumentary sculpturing weakly developed, imbricate; diameter of saddle at most proximal point slightly to considerably smaller than diameter at the most distal point along the ventral margin, so that

dorsal and ventral surfaces diverge when viewed from the side and diameter of saddle at most proximal point equal to or less than diameter of base of siphon; hair 1-X usually single (1-3b), fine; ventral brush usually with 7 pairs of hairs; more strongly developed hairs in ventral brush usually with 8-12 branches (6-13); gills usually moderately long, dorsal pair about 1.5-2.4 as long as ventral pair and 0.6-1.2 (0.6-1.5) length of anal saddle.

BIONOMICS. Larvae of this species have been found in rot holes in trees and stumps, in artificial containers, particularly wooden ones or those containing twigs and leaves, and in flooded cesspools and manure pits. They are frequently found in association with larvae of alba where the ranges of the two species overlap and can be found in the same treeholes as kummi in southeastern Arizona.

Adults have been caught in light and malaise traps and have been collected as they rested inside rot holes or on the bark of trees. Glick (1939:51) reported catching 1 adult at 500 feet altitude in a trap on the wing of an airplane.

Thibault (1910:20) reported that females entered dwellings and bit frequently in Arkansas. This observation has never been verified by others. Females are known to take avian blood. Vargas (1960:339, 340) found adults from Tamaulipas, Mexico, infected with the virus of Eastern Equine Encephalitis.

For additional information on the biology and ecology of western populations of this species see Chapman (1965:432-439) and the Biology and Ecology section of this paper.

SYSTEMATICS. This is the most widespread and variable species in the Signifera group. The treatment given here differs from that of other authors in that I am considering californica Bohart to be a synonym of signifera and waverleyi Grabham to be a distinct species.

Adults of signifera are quite easily told from those of waverleyi by their mesonotal ornamentation. They are likely to be confused only with those of alba, but can be told from them by the presence of 4-10 bristles among the lower stp scales. In addition, in the eastern United States, where this species is sympatric with alba, vein R_{4+5} is usually white-scaled at the base whereas it is normally dark-scaled in alba.

Non-hairy, semi-hairy (=californica), and hairy forms of the larva exist. Non-hairy larvae are impossible to separate from waverleyi and are difficult to separate from kummi and pulchripalpis. Semi-hairy individuals are easily separated from the larvae of all other species in the Signifera group but the hairy form is similar to that of kummi. Both hairy and non-hairy forms of the pupa are known, the former very similar to the normal pupa of kummi and the latter very similar to those of waverleyi and pulchripalpis.

The range of signifera can be divided into 4 major areas, each of which is characterized by a more or less unique combination of larval and pupal forms and has a different pattern of adult variation. Throughout the eastern United States and as far west as Texas and northeastern Mexico adults, pupae and larvae are fairly uniform, with a large proportion of the total variation for this broad geographical area being found within any one deme. Larvae from this area are almost always deeply pigmented and non-hairy, whereas pupae are nearly always hairy and have narrow paddles. Adults are characterized by having the white rings over the joints between hindtarsal segments 1-2 and 2-3 covering a greater portion of the apex of the proximal segment than of the base of the distal segment.

The second area lies to the west and includes New Mexico, Arizona, Utah and the portion of California along the Colorado River. Populations in this arid area are often quite isolated, with the result that they differ considerably from

each other. The larvae throughout this area are not or only slightly pigmented and are usually semi-hairy, although both hairy and non-hairy larvae do occur. Pupae are usually hairy, as in the eastern United States, but have some hairs, especially 1-II and 5-IV, V, often nearly as strongly developed as in kummi. The pupal paddles are wider distally and more emarginate apically than in signifera from the eastern United States. The most numerous and striking adult variations of the species are found in this area. Banding of hindtarsal segments 1-2 and 2-3 may be as in eastern signifera, or as in Californian signifera (see below) or intermediate. Hindtarsal segment 5 may be white only at the ends or at the base and segment 4 often has its white-scaling reduced. The white spot over the crossveins of the wing is more frequently reduced or absent than in the other areas. The most conspicuous variation involves the supraalar, ppn and lower mep scales, which may be completely absent in some individuals from central and southeastern Arizona.

The third area is California west of the Colorado River drainage and possibly Oregon. Here, as in the eastern United States, all stages are quite uniform, probably indicating that populations are not isolated. The larvae from this area are not or only lightly pigmented and are semi-hairy; they are very similar to those from the New Mexico-Arizona area. The pupae are normally non-hairy, unlike those of either the first or second area, but have the paddles broadened distally as in those from the New Mexico-Arizona area. Normal adults are identical to signifera from the eastern United States except that the rings over hindtarsal joints 1-2 and 2-3 often cover equal portions of each segment involved. Some specimens from San Diego County, California, have the last hindtarsal segment white-scaled only at the ends, but this is probably due to the depauperate nature of the individuals. The Californian signifera is what Bohart described and named as californica in 1950 on the basis of larval characters.

The fourth area to be considered is the Greater Antilles. Signifera is apparently present on all the larger islands except Jamaica, which is inhabited by waverleyi. Although very few specimens from this area are available for study, it is evident that the populations on the different islands very considerably from each other. However, the larvae from all islands agree in being highly pigmented and non-hairy, as in the larvae from the eastern United States. The pupae are non-hairy to slightly hairy and have narrow paddles; they resemble the Californian population in chaetotaxy but resemble eastern signifera in paddle shape. Larvae from Cuba have shortened siphons, more strongly developed hair 1-S, and longer gills; in the latter 2 characters they resemble kummi. Adults throughout the area seem to always have the last hindtarsal segment white only at the ends, often have the spot over the crossveins of the wing reduced or absent and have the scales on stp more scattered. In all of these respects they resemble waverleyi, but none show the mesonotal ornamentation or other characteristics of that species.

As discussed in the systematics section for the Signifera group, I am not considering the various larval and pupal forms from the 4 different geographical areas to be distinct species. Most of the larval and pupal differences are restricted to chaetotaxy and the differences are of the same type as those found between hairy and non-hairy forms of several other species of Orthopodomyia. The pattern differs in signifera, however, in that the hairy pupal and semi-hairy larval forms are apparently genetically fixed over a portion of the range and are largely allopatric from the non-hairy ones. All of the adults except those from the Greater Antilles and the form lacking supraalar scales from Arizona are very similar and even these variants are more similar to typical signifera than are the adults of any other species in the Signifera group except alba.

The general pattern of variation in larval and pupal chaetotaxy can be explained if one assumes that at the time of its spread throughout the United States and the Greater Antilles signifera had only non-hairy larvae and pupae. Later a semi-hairy larval form became fixed in the western United States and a hairy pupal form arose in the eastern United States or was obtained by introgression with kummi. The semi-hairy larval form has not spread farther eastward than New Mexico and the hairy pupal form has not reached the populations in California or the Greater Antilles.

Ornamentation of adults from California and Arizona, and presumably from the rest of the range, varies with larval nutrition. Poorly fed larvae give rise to depauperate adults which have the white-scaling on all parts of the body reduced and abundantly fed larvae produce adults with superabundant white scales.

As mentioned above the most conspicuous adult variation is found in central and southeastern Arizona where individuals lacking the supraalar, ppn and lower mep scales may be found. In all cases this form has been found in the same treehole as normal signifera. A few individuals lacking supraalar scales have the ppn and the lower mep scale patches reduced rather than completely absent and some adults with supraalar scales have the patch on ppn reduced. The larva of the form lacking scales is identical to that of sympatric typical signifera and shows the same pattern of geographical variation in chaetotaxy as does the latter. The pupa usually has hairs 5-IV, V slightly longer than in typical signifera from the same treehole. The greatest number of specimens of this form have been reared from larvae collected at 2 different times (March and September, 1966) from one treehole in Cochise County, Arizona. Five out of 54 (9 %) of the mass reared pinned adults from the first collection and 22 out of 223 (10 %) of those from the second collection lacked the scales in question. I am considering this form to be a variant of typical signifera rather than a distinct species.

Hybrids between signifera and kummi have been found in Arizona and are discussed more fully under kummi. While the geographical variation of wing scaling in kummi can be interpreted as indicating introgression of signifera characters, I have seen no evidence of introgression of kummi characters into signifera. However, the type of development of pupal hairs 1-II and 5-IV, V in signifera from the Arizona, New Mexico, southeastern California and Utah area and possibly even the typical hairy pupal form of signifera may have been obtained from kummi during past introgression.

DISTRIBUTION. Oregon, Utah, New Mexico, North Dakota and Massachusetts, south to California, Tamaulipas, Cuba and the Virgin Islands. Material Examined: 7508 specimens; 1203 ♂, 987 ♀, 1 A, 1 gynandromorph, 6 isolated ♂ genitalia, 1968 P, 3392 L; 560 individual rearings (438 larval, 36 pupal, 86 incomplete).

CUBA. La Habana: Marianao, 1936, H. P. Carr, 1 ♂, 1 ♀, 1 gynandromorph, 4 L [USNM].

No locality: 21 June 1939, H. P. Capp, 1 ♂, 1 ♀ [USNM].

MEXICO. Coahuila: Allende, 2 Sept 1960, M. Yebra, 2 L [ISET].

PUERTO RICO. Humacao: El Yunque, 24 Aug 1942, G. E. Bohart, 6 ♂, 3 ♀ [CAS]; 30 Aug 1942, G. E. Bohart and T. H. G. Aitken, 1 P, 2 L [UCLA]; 8 Sept 1942, 2 L [UCD], 1 L [CAS]; 21 Oct 1945, H. D. Pratt, 1 L [USNM]; 12 Jan 1946, J. Rozas, 1 P [USNM], 1 L [CU].

UNITED STATES. Alabama: Cave Springs, Wheeler Lake, 10 June 1942, J. N. Belkin, 1 lp♂ (164), 2 lp♀ (97, 99), 1 p♂ (141), 1 l♂ (139), 1 lp (165), 1 ♂ [UCLA]; 8 July 1942, J. N. Belkin, 1 p♀ (173), 1 ♂, 1 ♀, 1 P [UCLA]. Ozark, 2 Apr 1943, 2 L [UCLA], 2 L [USNM]. Ozark, Camp Rucker, 26 Feb-

Apr 1943, J.G. Franclemont, 16 ♂, 7 ♀ [CU]. Point Clear, 9 May 1953, W.L. Seal, 3 L [USNM]. Sheffield, 18 Aug 1942, J.N. Belkin, 3 p♀ (355, 356, 357), 2 ♂ [UCLA]; 27 Aug 1942, J.N. Belkin, 3 ♂ [UCLA]. Wilson Dam, 14 Apr 1937, 6 ♂ [CU]; Aug 1953, R.X. Schick, 2 L [UCLA]; 21 Aug 1954, R.X. Schick, 1 ♂, 2 ♀ [UCLA].

Arizona: Camp Verde, 1 Sept 1966, T.J. Zavortink (UCLA 316), 2 lp♂ (316-10, 11), 4 lp♀ (316-12-15) [UCLA]; same data (UCLA 317), 2 lp♂ (317-11, 13), 4 lp♀ (317-12, 14-16), 2 p♂ (317-102, 104), 3 p♀ (317-100, 101, 103), 1 lp (317-10), 2 P [UCLA]. Chiricahua National Monument, 24 Dec 1966, L.T. Nielsen (N-36-66), 1 ♂ [UTAH]; same data (N-37-66), 3 ♂, 2♀, 1 A, 6 L [UTAH]; same data (N-38-66), 30 ♂, 11 ♀, 2 P, 14 L [UTAH]. Globe, 22 Mar 1966, L.T. Nielsen (N-9-66), 3 ♂, 13 L [UTAH]. Globe, Jones Water Campground, 2 Sept 1966, T.J. Zavortink (UCLA 331), 3 lp♂ (331-10, 14, 15), 12 lp♀ (331-11-13, 16-24), 41 ♂, 23 ♀, 70 P, 92 L [UCLA]. Mammoth, Aravaipa Canyon, 21 Dec 1966, L.T. Nielsen (N-35-66), 3 ♂, 4 P, 3 L [UTAH]. Pearce, Cochise Stronghold Campground, 26 Aug 1964, J. Burger (UCLA 255), 7 p♂ (255-102, 104, 107-111), 4 p♀ (255-100, 101, 105, 106), 7 ♂, 2 ♀ [UCLA]; 22 Mar 1966, T.J. Zavortink (UCLA 302), 1 p♂ (302-17), 1 ♂, 2 ♀, 3 P, 3 L [UCLA]; 4 Sept 1966, T.J. Zavortink (UCLA 326), 2 lp♂ (326-38, 39), 1 L [UCLA]; same data (UCLA 328), 2 lp♂ (328-29, 30), 13 lp♀ (328-11-14, 16, 18-20, 23, 24, 26-28), 5 lp (328-10, 15, 17, 21, 25), 3 ♂, 1 ♀, 18 P, 2 L [UCLA]; same data (UCLA 329), 6 lp♀ (329-14-19), 7 ♂, 1 ♀ [UCLA]; 6 Sept 1966, T.J. Zavortink (UCLA 342), 2 lp♂ (342-24, 28), 4 lp♀ (342-17, 22, 23, 25), 1 ♂, 1 P, 1 L [UCLA]. Phoenix, Verde River-Salt River Recreation Area, 1 Sept 1966, T.J. Zavortink (UCLA 318), 3 lp♀ (318-10-12) [UCLA]; same data (UCLA 319), 1 lp♂ (319-11), 1 lp (319-10), 1 P [UCLA]. Portal, SW Research Station, 5-25 Sept 1965, C.W. Sabrosky, 1 ♂ [USNM]. Portal, 6 Sept 1966, T.J. Zavortink (UCLA 343), 1 lp♂ (343-25), 19 lp♀ (343-11, 18, 20-24, 26-28, 50, 52-59), 3 lp (343-10, 29, 51), 42 ♂, 24 ♀, 73 P, 90 L [UCLA]; same data (UCLA 344), 5 lp♂ (344-11, 12, 15, 16, 21), 6 lp♀ (344-13, 14, 17-20), 5 ♂, 5 P, 8 L [UCLA]. Prescott, 1 Sept 1966, T.J. Zavortink (UCLA 315), 6 lp♂ (315-17, 19-21, 23, 24), 3 lp♀ (315-12-14), 1 p♀ (315-100), 5 lp (315-10, 11, 15, 22, 25), 2 ♂, 3 ♀, 9 P, 9 L [UCLA]. Rimrock, 20 Mar 1966, L.T. Nielsen (N-6-66), 3 ♂, 1 ♀, 2 P, 7 L [UTAH]. Rimrock, Beaver Creek Campground, 20 Mar 1966, L.T. Nielsen (N-7-66), 2 ♂, 2 ♀, 10 L [UTAH]. Sedona, 19 Mar 1966, L.T. Nielsen (N-3-66), 2 ♂, 3 ♀, 9 L [UTAH]. Sedona, Chavez Crossing Campground, 20 Mar 1966, L.T. Nielsen (N-4-66), 2 ♂, 2 L [UTAH]. Show Low, 14 Aug 1966, L.T. Nielsen (N-32-66), 1 ♀ [UTAH]. Sierra Vista, San Pedro River, 22 Mar 1966, T.J. Zavortink (UCLA 301), 27 lp♂ (301-10, 22, 25, 26, 36, 41, 45, 50, 51, 53-55, 57, 60, 61, 63-65, 68, 71-75, 77, 79, 83), 33 lp♀ (301-11, 13, 16-21, 27, 30, 37-40, 43, 44, 46, 47, 49, 56, 58, 59, 67, 69, 70, 76, 78, 81, 82, 84-87), 18 lp (301-12, 14, 15, 23, 24, 28, 29, 31-35, 42, 48, 52, 62, 66, 80), 54 ♂, 32 ♀, 136 P, 136 L [UCLA]; 5 Sept 1966, T.J. Zavortink (UCLA 336), 2 lp♂ (336-35, 39), 21 lp♀ (336-12-16, 19, 21-29, 32-34, 36-38), 7 lp (336-10, 11, 17, 18, 20, 30, 31), 108 ♂, 69 ♀, 210 P, 156 L [UCLA]; same data (UCLA 337), 1 lp♂ (337-11), 5 lp♀ (337-12-16), 7 ♂, 6 ♀, 19 P, 21 L [UCLA]. Wickenburg, 29 Dec 1965, L.T. Nielsen (N-36-65), 11 ♂, 8 ♀, 6 P, 8 L [UTAH]; 18 Mar 1966, L.T. Nielsen (N-1-66), 2 ♂, 4 ♀, 13 L [UTAH]; 19 Dec 1966, L.T. Nielsen (N-34-66), 3 ♂ [UTAH].

Arkansas: Fort Smith, Camp Chaffee, 21 Sept 1943, B. Crafchick, 1 ♂ [CU]. Little Rock, Boyle Park, 28 Mar 1943, J.N. Belkin, 1 P [UCLA]. Little Rock, Little Fourche Bayou, 29 Mar 1943, J.N. Belkin, 2 P [UCLA]. Pine Bluff, 26 Mar 1925, C.W. Fant, 2 ♀ [USNM], 1 ♀ [BMNH]. Scott, 24 Aug 1909, J.K. Thibault, 3 ♂, 1 ♀ [USNM].

California: Bakersfield, 17 May 1948, E. Hill, 6 L [UCD]; 2 May 1954, W. A. McDonald (UCLA 104), 4 1p♂ (104-113, 119, 302, 305), 14 1p♀ (104-102, 104-108, 111, 112, 116-118, 120, 301, 303), 3 1p (104-103, 109, 306), 18 ♂, 15 ♀, 64 P, 41 L [UCLA], 1 1p♂ (104-110), 2 1p♀ (104-114, 115) [USNM]; 21 Oct 1954, W. A. McDonald and J. Chao (UCLA 148), 11 ♂, 5 ♀, 30 P, 75 L [UCLA]. Benecia, C. Ludlow, 1 ♂ [BMNH]. Calabasas, Tapia Park, 19 Oct 1963, T. J. Zavortink (UCLA 417), 2 1p♂ (417-20, 22), 4 1p♀ (417-23-26), 1 1p (417-21), 3 ♂, 3 P, 5 L [UCLA]. Elkhorn Ferry, Yolo Co., 16 Feb 1948, R. M. Bohart, 12 L [UCD], 2 L [USNM]; 12 Apr 1948, R. M. Bohart, 12 1p♂ (48. 4. 26a, b, c, e, g, h, 48. 4. 27a, c, d, 48. 5. 6a, c, f), 3 1p♀ (48. 4. 27b, 48. 5. 6d, e), 2 1p (48. 4. 26d, f), 4 ♂, 1 L [UCD], 1p♀ holotype of californica (48. 4. 21a), 1 1p♂, 2 1p♀ (48. 4. 21c, d, 48. 4. 22b), 1 ♂, 3 L [USNM]; Apr 1948, R. M. Bohart, 4 ♀ [USNM], 1 ♂, 1 ♀ [BMNH]; 12 May 1948, R. M. Bohart, 2 L [BMNH]; 5 Aug 1948, R. M. Bohart, 1 ♂ [UCD]; 25-26 Aug 1948, R. M. Bohart, 1 ♂, 6 ♀ [UCD], 2 ♂, 2 ♀, 2 L [USNM], 1 ♂, 1 ♀ [BMNH]; 3 Nov 1949, R. M. Bohart, 3 L [UCD], 3 L [USNM]; 3 Nov 1950, R. M. Bohart, 10 ♂, 4 ♀ [UCD]; 4 June 1965, T. J. Zavortink (UCLA 421), 1 1p♀ (421-10), 1 p♀ (421-100), 2 P, 6 L [UCLA]; same data (UCLA 422), 3 ♀ [UCLA]. Helendale, 8 Jan 1966, T. J. Zavortink (UCLA 425), 10 1p♂ (425-10, 11, 18-20, 22, 23, 26-28), 8 1p♀ (425-14-17, 21, 24, 25, 29), 2 1p (425-12, 13), 18 ♂, 9 ♀, 35 P, 91 L [UCLA]. Kern Co., 12 Apr 1949, D. Marquez, 2 L [HARM]. Needles, 19 Feb 1966, T. J. Zavortink (UCLA 294), 9 1p♂ (294-10-13, 16, 17, 20, 21, 26), 7 1p♀ (294-18, 19, 22-25, 28), 3 1p (294-14, 15, 27), 9 ♂, 10 ♀, 19 P, 30 L [UCLA]; same data (UCLA 295), 2 1p♂ (295-12, 13), 2 1p (295-10, 11), 1 L [UCLA]; 26 Mar 1966, T. J. Zavortink (UCLA 307), 2 1p♂ (307-11, 12), 3 1p♀ (307-10, 13, 14), 1 ♂, 1 P, 2 L [UCLA]; same data (UCLA 308), 1 p♂ (308-100), 3 1p (308-10-12), 3 L [UCLA]; 29 Dec 1966, T. J. Zavortink (UCLA 414), 5 1p♂ (414-12-14, 17, 18), 4 1p♀ (414-10, 11, 15, 19), 1 1p (414-16), 11 ♂, 2 ♀, 14 P, 76 L [UCLA]. Nice, Lake Co., 22 Feb 1942, A. W. Lindquist, 2 ♂ [USNM]. Olancha, 13 Apr 1966, T. J. Zavortink (UCLA 309), 1 1p (309-10), 1 L [UCLA]. Pacheco, Contra Costa Co., 16 June 1954, J. Mallars, 1 L [HARM]. Pala, 3 Feb 1966, T. J. Zavortink (UCLA 293), 12 1p♂ (293-20-27, 29, 50, 52, 55), 1 1p♀ (293-54), 3 1p (293-28, 51, 53), 1 ♂, 3 P, 19 L [UCLA]. Pearblossom, 8 Jan 1966, T. J. Zavortink (UCLA 424), 1 ♂, 10 ♀, 14 P, 7 L [UCLA]. Piedra, Fresno Co., 7 Mar 1962, H. C. Chapman, 6 ♂, 6 ♀ [UTAH]. Pine Flat Dam, Fresno Co., 15 Aug 1966, Kleiwer and Clark (569), 1 ♀ [UTAH]. Piru, Lake Piru, 9 Feb 1964, T. J. Zavortink (UCLA 418), 11 ♂, 3 ♀, 55 L [UCLA]; 17 Oct 1964, T. J. Zavortink (UCLA 419), 6 1p♂ (419-11, 13, 14, 16-18), 4 1p♀ (419-10, 12, 15, 20), 1 1p (419-19), 1 ♂, 4 ♀, 8 P, 234 L [UCLA]; 21 May 1965, T. J. Zavortink (UCLA 420), 3 1p♂ (420-10, 11, 13), 5 1p♀ (420-12, 15-17, 19), 2 1p (420-14, 18) [UCLA]. Ravenna, Soledad Campground, 11 Dec 1965, T. J. Zavortink (UCLA 423), 6 1p♂ (423-10-12, 14, 15, 17), 5 1p♀ (423-13, 16, 18-20), 14 ♂, 2 ♀, 17 P, 13 L [UCLA]; 23 July 1966, T. J. Zavortink (UCLA 314), 1 1p♂ (314-10), 23 ♂, 11 ♀, 51 P [UCLA]. Redlands, 18 July 1940, 1 ♀ [CU]. Riverside, 2 Mar 1940, W. C. Reeves, 1 ♂ [UTAH]; 3 Apr 1940, W. C. Reeves, 1 ♀ [UTAH]; 13-21 June 1940, W. C. Reeves, 1 ♂, 1 ♀ [BMNH], 1 ♂, 1 ♀ [CAS], 1 ♂, 1 ♀ [USNM], 1 ♂ [CU]; 10 July 1940, W. C. Reeves, 1 ♀ [CAS]; 1 Sept 1944, W. C. Reeves, 2 ♂, 2 ♀ [UTAH]; 17 May 1948, W. C. Reeves, 2 L [UCD]; W. C. Reeves, 5 ♂ [USNM]. Riverview Park, Fresno Co., B. Rosay, 2 L [USNM].

Delaware: Bombay Hook, 4 Sept 1963, R. W. Lake, 2 ♂, 3 ♀ [UTAH]. Delaware City, 22 June 1933, D. MacCreary, 1 ♂ [USNM]; 5 Sept 1934, D. Mac Creary, 1 ♂ [USNM]. Lewes, 1 Aug 1935, 1 ♂ [USNM]. Millsboro, 31 Aug 1935, D. MacCreary, 1 ♀ [USNM].

District of Columbia: 12-20 Oct 1903, T. Pergande, 4 ♂, 2 ♀ [USNM];

June-July 1904, H.G. Dyar, 1 P, 2 L [USNM]; 26 Sept 1942, 1 ♂ [USNM]; 22 Oct-7 Nov 1942, 1 ♂ [USNM]; 27 May 1943, L.T. Gallinger, 1 ♂ [USNM]; 3 Aug 1943, 1 ♀ [USNM]; 16 Oct 1943, J. Kenilworth, 1 ♀ [USNM]; 25 May, H.S. Barber, 1 ♀ [USNM]; June, D. Coquillett, ♀ holotype of signifera [USNM]; 26 Aug, H.S. Barber, 1 ♂ [USNM]; Sept, W.V. Warner, 2 ♂, 2 ♀ [USNM].

Florida: Benson, 8 Apr 1943, S.F. Bailey, 1 ♂ genitalia [UCD]. Orange Co., 1 May 1937 (1862), 1 ♂, 1 ♀ [USNM]. Pensacola, 8 Apr 1943, Bronson, 2 L [UCD]. Rock Springs, Orange Co., 28 June 1937 (1883), 1 l♀ (1883-1), 1 ♂, 2 ♀, 3 L [USNM]. No locality, 1 Nov 1935, 2 l♀ (1708, 1709-1) [USNM]. No locality or date (1664), 1 ♀ [USNM].

Georgia: Atlanta, 9 July 1943, J.B. Duncan, 2 ♂ [UTAH]; 30 Jan 1944, 1 ♂, 2 ♀ [USNM]; 23 May 1944, 1 L [USNM]; May 1944, 1 ♂, 1 ♀ [USNM]; Sept 1946, 1 L [UCLA]; 14 Jan 1947, 1 ♀ [CNC]; 13 Aug 1947, W.D. Sudia, 1 L [UTAH]; Oct 1947, H.D. Pratt, 2 ♂, 1 ♀ [CNC]; 13 Aug 1949, H.D. Pratt, 4 L [UTAH]; W.B. Summerall, 1 ♂, 1 ♀ [USNM]. Atlanta, Fort McPherson, 23 Mar-8 Apr 1944, 4 ♂, 6 ♀ [USNM]; 30 Apr 1944, 2 L [USNM]; May 1944, 1 L [USNM]. Columbus, Fort Benning, 1 ♀ [USNM]. Newton, Mar 1949, 3 ♂, 3 ♀ [UCLA]. Savannah, 8 Feb 1932, 2 L [USNM]; 20 Feb 1933 (40), 1 ♂ [USNM]; 7 Mar 1933, 1 ♂ [USNM]; 16-30 Oct 1933, 1 ♂, 5 ♀ [USNM]; 15-20 Oct, V.H. Bassett, 1 ♀ [USNM]. Spring Creek, Decatur Co., 16-29 July 1912, 1 ♂ [CU]. No locality, 1956, A.R. Barr (244), 2 L [USNM]. No locality or date, 5 L [HARM].

Illinois: Glencoe, July 1925, C.W. Edwards, 6 ♂ [USNM].

Indiana: No locality, July 1942, 2 ♂, 2 ♀ [CU]. No locality or date, 2 L [HARM], 1 ♂ genitalia [UTAH].

Iowa: Ames, 28 Aug 1919, E.W. Laake, 1 ♀ [USNM]; 1 Aug 1947, J. Laffoon, 3 lp (1115.3, 1115.4, 1115.5) [UCD].

Kansas: Oberlin, 19 Sept 1963, F.C. Harmston, 5 ♂, 6 ♀ [UTAH]; 9 L [HARM].

Louisiana: Alexandria, 26 Oct 1942, J. Zukel, 1 ♂ [USNM]. Baton Rouge, 5 Apr-12 May 1903 (94), 2 ♀ [USNM]; 15 Aug 1941, W.W. Wirth, 4 L [USNM]. Buras, 12-13 Mar, W.V. King, 1 ♀ [USNM]. Kilbourne, 15 May 1944, W.W. Wirth, 1 ♂, 3 ♀ [USNM]. Lake Charles, 15 June 1943, W.W. Wirth, 2 ♂, 1 ♀ [USNM]. Leesville, Camp Polk, May 1945, K.L. Maehler, 2 ♂, 3 ♀ [CAS]. Mound, 26 Aug-2 Nov 1914, Hunter (4340), 1 ♂, 5 ♀ [USNM]; Sept 1929, 1 ♀ [USNM]; (9676), 1 ♀ [USNM]; (9682), 2 ♂ [USNM]; (10180A5), 1 ♀ [USNM]. New Orleans, 2 Jan 1913, W.V. King (142), 1 ♂ [USNM]. New Orleans, Camp Plauche, Apr 1944, 3 ♀ [USNM]. Norco, 15 Oct 1944, F.N. Young (208-9), 12 L, 2 P [UCLA], 2 L [CAS]. Pineville, 2 Nov 1942, T.S. Ford, 1 ♂ [USNM]. Simms, Camp Livingston, 1 Aug 1942, W.W. Fassig, 2 L [CAS].

Maryland: Annapolis, 15 Aug 1932, 1 ♀ [USNM]; 27 July 1933, F.C. Bishopp, 1 ♀ [USNM]. Baltimore, Patapsco State Park, 17 Oct 1965, W.A. Mc Donald (UCLA 286), 9 lp♂ (286-53, 55, 62, 64, 65, 70, 72, 81, 82), 13 lp♀ (286-52, 54, 57-59, 61, 63, 68, 69, 74, 78, 84, 85), 4 p♂ (286-66, 71, 73, 76), 3 p♀ (286-56, 67, 75), 6 lp (286-50, 51, 60, 77, 80, 83), 17 ♂, 35 ♀, 73 P, 91 L [UCLA]. Bethesda, 29 July 1944, G.B. Vogt, 4 ♂, 5 ♀ [USNM]; 22 Aug 1944, G.B. Vogt, 1 ♂ [USNM]. Cabin John, 5-15 Sept 1908, F. Knab, 5 ♂ [USNM]; Oct 1903, F. Knab, 2 ♂, 1 ♀ [USNM]; 7-13 Sept, F. Knab, 2 ♂ [USNM]. College Park, 17 July 1932, F.C. Bishopp, 1 ♀ [USNM]. Plummers Island, 7 June 1906, D.H. Clemons, 1 ♀ [USNM]. Riverview, Aug 1905, T. Pergande (9910), 7 ♂ [USNM].

Massachusetts: Boston, Fort Strong, 5 Oct 1924, 7 ♀ [USNM].

Mississippi: Bay Saint Louis, 8 June 1913, W.V. King (142), 4 ♂, 2 ♀ [USNM]. Electric Mills, J.A. LePrince, 3 ♀ [USNM]. Hattiesburg, Camp Shelby, 27 Mar 1944, C.D. Michener, 3 L [USNM]. Perkinston, 14 Sept 1933, 1 ♀ [USNM].

Missouri: Eagle Rock, Roaring River State Park, 5 July 1942, A. B. Gurney, 3 L [USNM]. Neosho, Camp Crowder, 3 July-30 Aug 1942, A. B. Gurney, 4 ♂ [USNM]. St. Louis, Aug-Oct 1904, A. Busck, 15 ♂, 10 ♀ [USNM].

Nebraska: Niobrara, 1 L [HARM].

New Jersey: Chester, 8-10 Sept, 2 ♀ [CU]; 10-13 Nov, J. M. Aldrich, 3 ♀ [USNM]. New Brunswick, J. B. Smith, 1 ♂, 1 ♀ [USNM].

New Mexico: Bernalillo, 19 Mar 1967, L. T. Nielsen and J. H. Linam (N-2-67), 3 ♂, 2 P, 3 L [UTAH]. Glenwood, Catwalk Campground, 21 Mar 1967, L. T. Nielsen and J. H. Linam (N-5-67), 4 ♂, 5 ♀, 10 P, 7 L [UTAH]. Los Lunas, 20 Mar 1967, L. T. Nielsen and J. H. Linam (N-3-67), 4 ♂, 1 ♀, 6 P, 4 L [UTAH]. Reserve, 21 Mar 1967, L. T. Nielsen and J. H. Linam (N-4b-67), 4 ♂, 3 ♀, 8 P, 8 L [UTAH]. Socorro, Escondida Recreation Area, 2 Sept 1966, T. J. Zavortink (UCLA 320), 6 1p♂ (320-10-12, 15, 17, 18), 4 1p♀ (320-13, 14, 16, 19), 41 ♂, 16 ♀, 61 P, 156 L [UCLA]; same data (UCLA 321), 7 1p♂ (321-10, 11, 14-16, 18, 19), 3 1p♀ (321-12, 13, 17), 42 ♂, 23 ♀, 69 P, 157 L [UCLA]; same data (UCLA 322), 7 1p♂ (322-16, 19, 22, 24, 25, 31, 33), 18 1p♀ (322-11, 12, 15, 18, 20, 21, 23, 26-28, 30, 32, 34-39), 2 p♀ (322-100, 101), 5 1p (322-10, 13, 14, 17, 29), 104 ♂, 68 ♀, 232 P, 488 L [UCLA]; same data (UCLA 323), 7 1p♂ (323-11, 14, 15, 21, 22, 24, 26), 12 1p♀ (323-10, 12, 13, 16-20, 23, 25, 27, 29), 1 p♀ (323-100), 1 1p (323-28), 64 ♂, 31 ♀, 112 P, 436 L [UCLA].

New York: Buffalo, 5 Sept 1909, M. C. Van Duzee, 1 ♂ [CAS]. Ithaca, 21 Aug-24 Oct 1932, F. C. Baker, 9 ♂, 9 ♀, 1 P, 20 L [CU], 3 L [USNM], 1 L [BMNH]; 3 Apr 1934, F. C. Baker, 1 L [CU]; 31 Aug-1 Oct 1934, F. C. Baker, 1 1p♂ (28), 1 1p♀ (15), 1 p♀ (20), 3 ♂ genitalia, 3 P [CU]; 15 Aug-3 Nov 1935, F. C. Baker, 2 1p♂ (17, 18), 2 1p♀ (24, 26), 1 1♀ (14), 1 1p (22), 3 ♂, 29 ♀, 1 P [CU], 1 1p♂ (23), 1 1p♀ (15) [BMNH], 1 1p♂ (20), 1 1p♀ (21) [USNM].

North Carolina: Charlotte, 8 July-3 Aug 1915, H. P. Barrett, 1 ♂, 1 ♀ [USNM]. Fayetteville, Fort Bragg, 29 Oct 1943, 3 L [USNM], 1 L [HARM]. Franklin, 8 June 1957, W. R. M. Mason, 1 ♂ [CNC]. Maxton, Nov-Dec 1943, A. B. Klots, 3 ♂, 6 ♀ [USNM]; June 1944, K. Snyder, 7 ♂, 5 ♀ [UCLA]; 31 Oct 1944, 1 ♀ [UTAH]; 6 Aug 1945, 1 L [UCLA], 1 L [UTAH].

Ohio: Canton, 22 Dec 1967, T. J. Zavortink (UCLA 436), 1 L [UCLA]; same data (UCLA 437), 7 1p♂ (437-10, 13-17, 19), 3 1p♀ (437-11, 12, 18), 1 ♂, 3 ♀, 7 P, 8 L [UCLA]. Columbus, 17-24 Aug 1942, H. W. Smith, 2 ♂ [UCLA]. Toledo, 3 Aug 1915, D. W. Iford, 1 L [USNM].

Oklahoma: Fort Sill, 2 ♀ [USNM].

Oregon: Corvallis, 27 June 1967, L. F. Lewis, 4 L [UCLA].

Pennsylvania: Roxborough, 15 Aug 1915, G. M. Greene, 1 ♂ [USNM].

South Carolina: Clemson, 20 May 1941, D. Dunavan, 1 ♀ [USNM]; 4 June 1945, O. L. Cartwright, 3 L [USNM]. Columbia, 1 Aug 1906, 3 ♀ [USNM]; 14 Oct 1944, 1 ♂ [USNM]. Myrtle Beach, 10 July 1943, 2 L [USNM]. Sumter Co., 8 Aug 1944, S. C. Sabrosky, 1 ♂ [USNM].

Tennessee: Memphis, 2 June 1934, J. A. Le Prince (46), 2 ♂ [USNM]. Tiptonville, 4 Sept 1928, W. D. Kiser (150), 1 ♂ [USNM]. Walnut Log, Obion Co., 3 Sept 1935, H. A. Johnson, 1 ♂ [USNM].

Texas: Austin, 10 Mar 1947, O. P. Breland, 1 ♀ [CNC]; 5 May 1949, O. P. Breland (10. 5), 4 ♂, 2 ♀ [CNC]; 2 Aug 1957, K. Riemann, 1 L [USNM]. College Station, Sept 1905, C. E. Sanborn, 1 ♀ [USNM]. Dallas, 17 Apr 1906, F. C. Pratt, 1 ♂ [USNM]. Houston, 24 May 1966, R. D. Walsh (TEX 35), 8 L [UCLA]; 23 Feb 1967, R. D. Walsh (TEX 45), 16 L [UCLA]; 5 L [HARM]. Luling, Palmetto State Park, 13 Sept 1942, H. R. Roberts and E. S. Ross, 1 L [CAS]; 25 Oct 1942, E. S. Ross, 1 L [CAS]. San Antonio, 14-18 June 1942, E. S. Ross, 3 ♂, 2 ♀, 3 L [CAS]; 2-3 July 1942, E. S. Ross, 2 ♂, 1 ♀ [CAS]. Texarkana, Aug

1942, E.S. Ross, 1 L [CAS]. No locality, 26 Apr 1943, A.C. Chandler, 2 L [CU].

Utah: Bluff, 13 May 1967, J.H. Arnell and L.T. Nielsen (HA-2-67), 4 ♂, 4 ♀, 3 P, 7 L [UTAH]; same data (HA-7-67), 2 ♂, 2 ♀, 2 P, 4 L [UTAH]. Canyonlands National Park, Salt Creek, 12 May 1967, J.H. Arnell and L.T. Nielsen (HA-5-67), 4 ♂, 2 ♀, 3 P, 6 L [UTAH].

Virginia: Bluemont, 27 July 1904, 1 ♂ [USNM]; 10 Mar 1905, 1 ♂ [USNM]. Falls Church, 17 Sept-8 Oct 1961, W.W. Wirth, 1 ♂, 1 ♀ [USNM]. Great Falls, 5 Oct 1906, T. Pergande, 1 ♂ [USNM]. Mt. Lake, 16 Aug 1943, O.A. Johannsen (2621), 1 L [CU]. Quantico, July 1926, R.L. Turner, 1 ♀ [USNM]; 1927, S.S. Cook, 1 ♂ [USNM]. Rosslyn, 2-3 Oct 1903, T. Pergande, 1 ♂, 1 ♀ [USNM]. St. Elmo, 4 June, F.C. Pratt, 1 ♀ [USNM]. Virginia Beach, 5 May 1928, L.L. Williams, Jr., 1 ♀ [USNM]. Williamsburg, Camp Peary, 3 July 1943, G.E. Bohart, 2 ♂, 3 ♀ [CAS]; 3 July 1943, R.M. Bohart, 1 L [USNM]; Nov 1943, 6 L [UCD]. Woodstock, 4-16 Aug 1904, F.C. Pratt, 4 ♂, 1 ♀, 4 L [USNM].

NO DATA. (233), 3 ♀ [USNM]; 6 ♀ (R-15, 39-1, 72, 125, 149, 188) [USNM]; 1 L (180-14) [CAS]; 1 ♂, 1 ♀, 1 ♂ genitalia, 2 L [USNM], 1 ♀ [UCLA], 1 ♀ [CAS].

Additional records from the literature. CUBA. La Habana: Isla de Pinos, Nueva Gerona (Montchadsky and Garcia, 1966:36).

Oriente: Baracoa (Montchadsky and Garcia, 1966:36).

HAITI. vide waverleyi.

MEXICO. Tamaulipas: Vargas, 1956:31).

UNITED STATES. Connecticut: New Canaan, 24 Aug 1929, R.F. Hart (Matheson, 1945:27).

Kentucky: Christian, Fayette, Graves, Hardin, McCracken, Meade and Union Counties (Quinby, Serfling and Neel, 1944:548-549).

Minnesota: Scott and Dakota Counties, 17, 22 Sept 1957, L.R. Abrahamsen, P, L (Price and Abrahamsen, 1958:92).

North Dakota. vide Carpenter and LaCasse, 1955:101-103.

Rhode Island: Westerly, Great Swamp, 1942 (Knutson, 1943:317).

South Dakota: Bon Homme and Yankton Counties, A (Edman, 1962:431).

VIRGIN ISLANDS. vide Flemings and Walsh, 1966:426.

3. Orthopodomyia alba Baker

Figs. 2, 7, 8

1936. Orthopodomyia alba Baker, 1936:1-4. *TYPE: holotype ♂ with associated larval and pupal skins (7), Ithaca, [Tompkins Co.], New York, United States, larva found in an elm or maple treehole, 12 Nov 1935 (date of eclosion), F. Baker [USNM, 51387].

Orthopodomyia alba of Shields and Miles (1937:237); Penn (1938:5); Pennebaker (1938:4); Shields (1938:429); Edwards (1939:123); King, Bradley and McNeel (1939:56); Reeves (1941:69, 70, 71, 72); King, Bradley and McNeel (1941:61); Day (1943:30, 31, 32, 37, 39, 40, 42); Gurney (1943:931, 932, 935); King, Roth, Toffaleti and Middlekauff (1943:574); Bradley, Fritz and Perry (1944:109); Dorsey (1944:379, 381, 382, 383, 385); King, Bradley and McNeel (1944:61); Matheson (1944:249); Middlekauff and Carpenter (1944:92); Olson and Keegan (1944a:781, 782; 1944b:848); Randolph and O'Neill (1944:83); Schoof and Ashton (1944:6-8); Carpenter, Chamberlain and Wanamaker (1945:402); Good (1945:175); Harden (1945:131); Kitzmiller (1945:409); Peterson and Smith (1945:381); Carpenter, Middlekauff and Chamberlain (1946:114-116); Jenkens and Carpenter (1946:33, 41-43); Miles and Rings (1946:390, 391); Bre-

land (1947a:185-187; 1947b:81-86); Michener (1947:361); Ross (1947:37); Weathersbee and Arnold (1947:225); Barnes, Fellton and Wilson (1950:82); Bohart (1950:403, 404); Darsie (1951:41); Darsie, MacCreary and Stearns (1951:144); Wilkins and Breland (1951:225-240); Yamaguti and LaCasse (1951:8-12); Breland (1952:254); Carpenter (1952:252); Yamaguti (1952:16, 17); Hedeen (1953:3, 6); Lake (1953:154, 155); Sudia and Gogel (1953:129-130); Carpenter and LaCasse (1955:98-100); Breeland (1956:101); Pratt (1956:8); Bickley (1957:24); Breland (1957:305, 307; 1958:219, 221); Burbutis (1958:210, 212); Breland (1959:137-141); Stone, Knight and Starcke (1959: 122); King, Bradley, Smith and McDuffie (1960:135-136); Breeland, Snow and Pickard (1961:306); Breland (1961:360, 372, 374); Johnson (1961:55-56); Porter, Evans and Hughes (1961:235); Miller (1962:309-310); Tinker and Stojanovich (1962:582); Dodge (1963:804, 808); Warren and Breland (1963:622); Ross (1964:107); Chapman (1965:435, 438); Ross and Horsfall (1965:14, 24, 43, 44); Stone, Sabrosky, Wirth, Foote and Coulson (1965:108); Wiseman (1965:58); Dodge (1966:378).

FEMALE (fig. 2). Wing: 3.35 mm. Proboscis: 2.00 mm. Forefemur: 1.89 mm. Abdomen: about 2.5 mm. Head: integument of head capsule, clypeus, torus and flagellum brown to black; erect scales dark brown or black; palpus about 0.35 of proboscis; flagellar segments 1-3, 4 or 5 with scales. Thorax: integument of mesonotum and scutellum evenly reddish-brown to brown or black, postnotum usually lighter, light to dark brown, pleuron reddish-brown to brown or black anteriorly, lighter along most sutures and often posteriorly; supraalar scale line present; lateral prescutellar and inner dorsocentral scale lines not connected; white posterior fossal scales absent; outer dorsocentral scale line with numerous scales, never curved laterad anteriorly; lateral lobes of scutellum usually without white scales; lower stp bristles usually 0-2, weakly to moderately developed, present among uppermost lower stp scales only; mep bristles all dark; pleural scaling with broad but well defined lines; ppn scales present; psp scales usually present; stp horizontal scale lines usually distinct, sometimes joined behind upper stp bristle, stp vertical scale line not extending dorsad of level of lower edge of mep, some lower and upper scales usually semierect; lower anterior mep scale patch broad, not connected to upper. Legs: integument of forecoxa brown to black, midcoxa lighter, hindcoxa beige to brown; legs with dark-scaling brown or black; forefemur with anterior surface streaked in basal 0.05-0.33; midfemur with anterior surface white-scaled in basal 0.05-0.25, posterior surface light-scaled in basal 0.05-0.5; hindfemur with anterior surface light-scaled in basal 0.05-0.3; hindtibial anterior, dorsal and posterior surfaces speckled with white scales; foretarsus entirely dark-scaled; midtarsal segment 1 with complete or ventrally incomplete basal white ring and usually with dorsal apical white patch, segment 2 sometimes with small dorsal white patch at base and rarely with one at apex; hindtarsus with apex of segment 1 and base and apex of segments 2 and sometimes 3 with complete white ring, segment 5 all white dorsally. Wing: light spot in area of crossveins usually well developed and conspicuous to unaided eye, white patches on veins M and Cu_1 usually large, but vein R_{4+5} usually dark-scaled at base and white patch on vein R_{2+3} reduced or absent. Haltere: integument of stem whitish to beige, knob beige to brown. Abdomen: integument of tergite I whitish to brown, sternites II-VII whitish to brown, distal segments darker, sternite VIII tan to brown; abdominal segments with dark scales brown or black; tergite II largely white-scaled, dark scales usually present in apicolateral patch, sometimes in narrow apical band; tergites III-VIII with basolater-

al white patch and sometimes with irregular, narrow, beige basal band; sternite II entirely white-scaled or with some apical scales dark; sternites III-VII white basally, dark scales in apicolateral patch or in apical band, distal segments with dark-scaling more extensive; sternite VIII with dark scales laterally.

MALE. Essentially as in female. Labium: as in female or with white scale lines broadened just distad of level of distal end of palpal segment 2. Palpus: about 1.01 of proboscis. Wing: white scales on veins behind vein R_1 sometimes dingy and difficult to distinguish from dark scales. Abdomen: as in female or with tergites III-VII with rather distinct white basal band; sternites II-VII usually darker than in female, sometimes all dark-scaled; tergite VIII scales all dark or mixed dark and white, sternite VIII with white apical and basal bands.

MALE GENITALIA (fig. 7). Segment VIII: tergite lobe longer than broad, narrowing distally, apex emarginate or very irregular. Segment IX: tergite with 2 or 3 bristles on each side. Sidepiece: basal mesal lobe with 3 or 4 stout bristles which are straight or only very slightly bent mesally near apex and with 2 or 3 finer bristles. Aedeagus: ventral spines variable in position; preapical ridge with 2-5 processes. Proctiger: paraproct sclerotization with 2-4 apical teeth; cercal setae 2-4.

PUPA (fig. 7). Abdomen: 3.5 mm. Trumpet: 0.5 mm. Paddle: 0.8 mm. Cephalothorax: hairs 8, 9-C never as long as trumpet. Trumpet: deep tan to brown except at extreme base and apex and largely darker than darkest part of cephalothoracic integument. Metanotum: hair 12-C usually moderately developed. Abdomen: hairs 6, 7-I short; 1-II moderately developed, usually 3b (1-6); 2-II-V usually 0.3-0.4 length of hair 1 of corresponding segment, 2-VI at least 0.5 length of 1-VI; 6-II short and fine, similar to 7-II; 5-III usually double (single, double), developed similarly to 5-IV-VI, and usually more strongly developed and longer than 3-III; 10-III-VII not extending more than 0.5 way to apex of following segment; 5-IV, V extending to about 0.5 of following segment. Paddle: usually more or less oboval in outline; extreme apex truncate or emarginate; inner part without minute spicules near inner margin.

LARVA (fig. 8). Head: 0.82 mm. Siphon: 0.63 mm. Anal Saddle: 0.38 mm. Most branched hairs with conspicuous barbs. Head: largely light straw colored, cephalic edges darker, collar brown; mental plate tan, usually with 7-9 (7-11) teeth on each side; hair 2-C absent; 9-C usually 3-5b (2-7), branches strong; 11-C moderately developed, usually 7, 8b (4-16); 13-C strongly developed, usually 7, 8b (5-12). Antenna: largely tan colored, apex lighter. Thorax: epidermal pigment absent; spicules not conspicuous; hairs strongly pigmented; hair 0-P usually 3, 4b (2-5); 6-P sometimes multiple; 1-M strongly developed, usually double (1-3b); 1-T strongly developed, usually single (1-3b); 13-T strongly developed, usually 5-8b (2-8). Abdomen: segments VI and VII never with sclerotized plates; hairs strongly pigmented; hair 1-I strongly developed, long, usually single or double (1-3b); 4-I longer than 3-I; 6-I usually 3b (2-5); 7-I usually 3, 4b (3-6); 1-II strongly developed, long, usually single or double (1-3b); 4-II well developed; 5-II-VI well developed, usually 3b (2-4); 6-II usually 2, 3b; 7-II strongly developed; 1-III long, usually single (single, double); 13-III-V usually 2, 3b (2-6), and usually longer than hair 10 of corresponding segment; 1-VI, VII moderately developed; 13-VII usually 3, 4b (2-4). Segment VIII: sclerotized plate never present; anterior comb scales usually 12-14 (10-17), posterior comb scales usually 8-11 (5-11); posterior row of comb scales about 0.84-1.07 length of anterior row; hair 3-VIII weakly to moderately developed, usually 2, 3b (1-5). Siphon: index about 2.6-3.4; base light brown in color, darker brown or blackish towards apex; integumentary sculpturing ab-

sent or very weak, imbricate; hair 1-S located near base of siphon, usually 3, 4b (2-6), weakly to moderately developed and with longest branch usually not extending much beyond middle of siphon. Anal Segment: saddle complete or incomplete; saddle largely tan, dorsal and apical portion darker, brown; integumentary sculpturing inconspicuous, imbricate; diameter of saddle or anal segment at most proximal point considerably smaller than diameter just basad of ventral brush, so that dorsal and ventral surfaces diverge distally when viewed from the side and diameter of saddle or anal segment at most proximal point usually equal to or greater than diameter of base of siphon; hair 1-X usually 2, 3b (1-3), branches coarse; ventral brush usually with 6 pairs of hairs; more strongly developed hairs of ventral brush usually with 4-8 branches; gills very short, rounded apically, dorsal pair only slightly longer than ventral pair and 0.5-1.0 length of anal saddle.

BIONOMICS. Larvae have been collected in treeholes and artificial containers. They have usually, but not always, been found in association with signifera. Breland (1947:185) found live larvae and pupae in the moist debris of a treehole with no free water.

Adults have been caught in light traps and found resting in treeholes and barns. Sudia and Gogel (1953:130) state that a female fed at night on a chick. Additional information on the bionomics of alba is given in the Biology and Ecology section.

SYSTEMATICS. Alba is one of the 2 sympatric species known in the Signifera group. It occurs with signifera throughout the eastern United States, in northeastern Mexico and as far west as New Mexico.

Adults of alba and signifera are very similar. While some authors (see Baker, 1936:7; Carpenter and LaCasse, 1955:98-99) have provided a few characters for separating the adults of these species, the characters have not been found reliable enough to permit separation of individual specimens and as a consequence most workers have considered the adults to be indistinguishable. Probably the best character was Baker's observation that the cuticle of the first abdominal tergite of signifera was purplish-brown whereas that of alba was yellowish. The purple epidermal pigment of the signifera larva is also present in the pupa and adult. While it is normally obscured by the dark integument in these stages, it is quite obvious in teneral individuals and is sometimes visible through the largely unscaled first abdominal tergite of pinned specimens of signifera. Two very reliable characters for separating the adults of alba and signifera have been found in this study. The better one is the number of lower stp bristles. In alba there are seldom more than 2 bristles on stp below the level of the lower edge of mep and these bristles are usually present only among the uppermost lower stp scales. In signifera 4 to 10 bristles are present and they are found throughout the length of the lower stp scales. The white spot over the crossveins of the wing is usually conspicuous in both alba and eastern signifera, but in alba the base of vein R_{4+5} is normally dark-scaled whereas in signifera it usually has a patch of white scales.

Alba is the only species in the Signifera group which has very distinctive immature stages. The pupa differs from that of all other species in the development of hairs 5-III and 2-II-VI. There are numerous additional characters (see Darsie, 1951:40-41) for separating the non-hairy pupa of alba from the hairy pupal form of signifera which occurs in all areas where the 2 species are sympatric. The fourth instar larva of alba is very different from that of any other species. The differences are largely the result of 2 phenomena; first, the larva is neotenic, that is, it retains many features in the fourth instar that are found in the third instar larvae of other species, and second, numerous

elements of the chaetotaxy are genetically fixed at a high level of hairiness. Neotenic features which distinguish alba are the development of hairs 6-I, II, 3-VIII, 1-S and 4-X and the complete lack of abdominal plates on segments VI-VIII. Particularly diagnostic setae which are fixed at a high level of hairiness are 11 and 13-C. Other diagnostic features of the alba larva, such as its complete lack of epidermal pigment and the anterior row of comb scales being short, are not the result of either neoteny or hairiness.

Except for the reduced pale-scaling in depauperate specimens, especially males, the species appears to be quite uniform in all stages throughout its range.

Largely on the basis of the few lower stp bristles, I am considering alba to be more primitive than either signifera or waverleyi. In general, evolution in the Signifera group seems to be in the direction of increasing numbers of thoracic bristles and extent of white thoracic and wing scaling. In particular, while the more primitive Kummi and Pulchripalpis subgroups have no lower stp bristles at all, signifera and waverleyi have a large number of them. Alba would appear, then, to be a species representing a stage in the evolution of the more advanced signifera and waverleyi. However, because of its apomorph larva, alba cannot possibly be ancestral to the signifera-waverleyi stock; the unique alba larva clearly had to have arisen after the isolation of alba from the line culminating in signifera and waverleyi. I believe that the original separation of the alba and signifera-waverleyi stocks was geographical, possibly in different glacial refuges, and that not only isolating mechanisms but also at least a portion of the alba larval differences evolved before the subsequent recontact of the lines. While it is true that the larva of alba is very different from those of the other species, since most of its morphological differences are the result of neoteny and genetically fixed hairiness, it could have arisen extremely rapidly. If there had been no larval differentiation between the stocks when they initially reestablished contact, one would have probably eliminated the other by competition. But, as natural selection would tend to preserve any additional differences reducing competition between sympatric species, some of the features of the alba larva could have arisen after sympatry with the signifera-waverleyi line. At any rate, I feel that the manifold differences of the alba larva, which must enable it to occupy a different niche in the treehole habitat, are what permit the coexistence of alba and signifera over a broad geographical area today.

DISTRIBUTION. New Mexico, Missouri and New York, south to Coahuila, Texas and Georgia. Material Examined: 732 specimens; 86 ♂, 78 ♀, 179 P, 389 L; 42 individual rearings (39 larval, 3 incomplete).

MEXICO. Coahuila: Allende, 22 Aug 1961, J. Delgado, 2 L [ISET].

UNITED STATES. Alabama: Wilson Dam, 3 July 1936, S. E. Shields (4-248), 1 ♂ [USNM]; 16 July 1936, S. E. Shields (1-261), 1 ♀, 1 L [USNM].

Arkansas: Fort Smith, Camp Chaffee, 21 Sept 1943, B. Crafchick, 1 ♂ [CU]. Stuttgart, 28-29 Apr 1915, J. A. Le Prince, 1 ♀ [USNM].

District of Columbia: 20 July 1901, N. Banks, 1 ♂ [USNM]; 4 Sept 1942, 1 ♂ [USNM]; 26 June 1943, 1 ♀ [USNM]; 9 July 1943, 1 ♀ [USNM]; 20 Aug-25 Sept 1943, 1 ♂, 2 ♀ [USNM]; C. N. Ainslie, 1 ♀ [USNM]; W. V. Warner, 1 ♂ [USNM].

Georgia: Atlanta, 25 Mar 1953, W. D. Sudia and R. H. Gogel, 3 ♂, 3 ♀, 6 L [UCLA], 4 L [USNM].

Maryland: College Park, 1 ♀ [USNM].

Missouri: Neosho, Camp Crowder, 6 Oct 1942, A. B. Gurney (225), 3 ♂, 6 L [USNM]; 9 Oct 1942, A. B. Gurney (239), 1 ♂ [USNM]; Oct 1942, A. B. Gur-

ney, 1 P, 3 L [USNM], 1 P, 3 L [UCD].

New Jersey: Newport, 19 July 1937, J. A. Rowe, 1 ♀ [USNM].

New Mexico: Alcalde, 6 L [HARM].

New York: Ithaca, 7-16 Sept 1934, F. C. Baker, 2 lp♂ (1, 2), 1 l♀ (4), 2 P, 6 L [CU], 1 L [BMNH], 1 L [USNM]; 5 Feb 1935, F. C. Baker, 1 P [CU]; 17 Aug-12 Nov 1935, F. C. Baker, lp♂ holotype (7), 2 lp♂ (1, 2), 2 lp♀ (8, 9) [USNM], 1 lp♀ (5), 3♀, 1 P [CU], 1 lp♂ (4), 1 lp♀ (6) [BMNH]; 13-16 Aug 1936, F. C. Baker, 1 l♀ (18), 1 ♂ [CU].

Ohio: Canton, 22 Dec 1967, T. J. Zavortink (UCLA 436), 14 lp♂ (436-20-22, 24-30, 33, 34, 36, 39), 5 lp♀ (436-23, 31, 32, 35, 38), 1 lp (436-37), 39 P, 241 L [UCLA]; same data (UCLA 437), 8 lp♂ (437-20-26, 28), 2 lp♀ (437-27, 29), 1 ♂, 5 P, 60 L [UCLA]; same data, mixed collections (UCLA 436 and UCLA 437), 31 ♂, 37 ♀, 89 P [UCLA].

Oklahoma: Oklahoma City, 11 July 1934, 1 ♀ [USNM].

Texas: Austin, 16 June 1947, O. P. Breland, 3 ♂, 5 ♀ [USNM], 4 ♂, 2 ♀ [CNC]; 8 July 1947, O. P. Breland, 1 ♂, 2 ♀ [CNC]; 30 Nov 1949, O. P. Wilkins, 3 L [UCD]; 26 Aug 1957, K. Riemann, 1 L [USNM]. Brownsville, 20 Aug-24 Nov 1925, R. L. Turner, 3 ♂, 1 ♀ [USNM]. Kerrville, 1 Aug-4 Sept 1953, L. J. Bottimer, 1 ♂, 1 ♀ [USNM]. San Antonio, 1 L [HARM]. Sonora, May 1934, 1 ♀ [CU].

Virginia: Williamsburg, Camp Peary, Nov 1943, 2 L [UCD].

Additional larval records from the literature. UNITED STATES. Illinois: Onarga, L (Ross, 1947:37).

Kentucky: Fort Knox, 22, 24 Aug 1944, J. B. Kitzmiller and T. E. Potts, L (Kitzmiller, 1945:409).

Louisiana: New Orleans, 23 Nov 1937-May 1938, L (Pennebaker, 1938:4).

Mississippi: Hattiesburg, Camp Shelby, 10 Aug 1943, L (Michener, 1947: 361).

North Carolina: Manchester, 18 Sept 1942, S. C. Schell, L (Schoof and Ashton, 1944:6-8).

Tennessee: Knoxville, 11 July 1955, S. G. Breeland, L (Breeland, 1956: 101).

PULCHRIPALPIS SUBGROUP

4. Orthopodomyia pulchripalpis (Rondani)

Figs. 2, 9, 10

1872. Culex pulchripalpis Rondani, 1872:31. *TYPE: lectotype ♂ with genitalia slide 670327-1, Italy; PRESENT SELECTION [FM].

1919. Orthopodomyia albionensis MacGregor, 1919:451-454. *TYPE: lectotype ♂, Epping Forest, Essex, England, reared from a larva found in a beech treehole, July 1919 (date of eclosion), A. Macdonald; PRESENT SELECTION [BMNH]. Synonymy with pulchripalpis by Edwards (1921:290, 291).

Orthopodomyia pulchripalpis of Seguy (1920b:253); Edwards (1921:290-291); Seguy (1921a:182, 187; 1921b:110, 112-114); Dyar (1922:67); Martini (1922: 99); Dyar (1923b:96); Seguy (1923:64, 98, 130, 154-155); Keilin (1927a:370; 1927b:196); Stackelberg (1927:68-69); Beattie and Howland (1929:49, 50, 56); Bashkareva (1931:56, 58); Brighenti (1931:219); Kalandadze (1931:113); Velichkevich (1931:316, 320-321); Edwards (1932:107, 108); Keilin (1932:280, 281); Macan and Tutin (1932:283); Tate (1932:111-120); Marshall and Staley

1933:435); Edwards and James (1934:20); Marshall and Staley (1935:531); Pandazis (1935a:926; 1935b:3, 18); Montchadsky (1936:218-222); Stackelberg (1937:114-115); Callot (1938:152); Marshall (1938:258-264); Stephanides (1938:251); Edwards (1939:122); Edwards, Oldroyd and Smart (1939:1, 22-23); Macan (1939:266-267); Clastrier (1941:443-446); Cambournac (1943:71-77); Callot and Ty (1944:65); Cambournac (1944:256); Cañamares (1945:838, 842, 849); Classey (1946:113); Shillito (1948:25, 26, 27); Bohart (1950:403); Mattingly (1950:113, 117); Montchadsky (1951:143-146); Aitken (1954:465); Peus (1954:79-80); Senevet, Andarelli and Duzer (1954:274); Clastrier (1955: 274-275); Doby (1955:370); Doby and Doby-Dubois (1955:384); Mattingly (1955:32); Mihalyi (1955:14); Hedeen (1958:320); Mihalyi (1959:142-143); Parrish (1959:266); Rioux and Nicoli (1959:74); Senevet and Andarelli (1959: 301-309); Stone, Knight and Starcke (1959:123-124); Coluzzi (1962:14); Rioux, Juminer and Kchouk (1964:14, 18); Callot and Rioux (1965:243); Dubose and Curtin (1965:349, 352); Bailly-Choumara (1966:39-41); Bozhkov (1966:571, 572, 573); Dodge (1966:379).

Orthopodomyia (Bancroftia) pulchripalpis of Shannon and Hadjinicolaou (1937: 173, 174, 175, 176, 178); Rioux and Arnold (1955:278); Rioux (1958:257-260).

Orthopodomyia albionensis of Lang (1920:109-111); Seguy (1924:201; 1925:78); Martini (1930:194-196).

Culex pulchripalpis of Ficalbi (1896:256; 1899:220-222); Giles (1900:275-276; 1902:426); Husson (1908:86, may refer to Aedes).

FEMALE (fig. 2). Wing: 4.95 mm. Proboscis: 2.82 mm. Forefemur: 2.97 mm. Abdomen: about 3.5 mm. Head: integument of head capsule, clypeus, torus and flagellum dark brown or black; vertex and occiput with white decumbent scales usually more numerous laterally; erect scales dark brown or black; dorsolateral broad scales dark and white; clypeus an elongate, somewhat angular lobe, bare; labium largely dark-scaled, with white ring at about 0.67 distance from base; palpus about 0.44 of proboscis, 5-segmented, segment 5 minute, segment 4 short, segments 1, 2 and 3 largely dark-scaled, usually with dorsal white spot at base of segments 2 and 3 and sometimes at apex of segments 1 and 2; flagellar segment 1 with brown scales. Thorax: integument of mesonotum, scutellum, and postnotum evenly reddish-brown to black, pleuron reddish-brown to black anteriorly, usually lighter behind and below ppn, in posterior portion of stp and mep, and on metapleuron and metameron; paratergite narrow; supraalar scale line present; lateral prescutellar and inner dorsocentral scale lines not joined; posterior fossal white scales absent; outer dorsocentral scale line extending to scutellum; lateral lobes of scutellum without scales; lower stp bristles absent, so that there are no bristles among lower stp scales; upper posterior mep bristles dark in color, anterior mep bristles 0-3, weakly developed, dark in color; pleural scaling with lines rather broad; ppn scales present; psp scales absent; pst with scales present only near ppl; stp with horizontal scale lines usually not connected, although lower is quite broad; upper stp scale line sometimes more or less connected to scales on pra; vertical stp scale line not extending dorsad of level of lower edge of mep and without semierect scales; lower anterior mep scale patch broad, sometimes contiguous with upper. Legs: integument of forecoxa reddish-brown to dark brown, midcoxa somewhat lighter, hindcoxa much lighter; all coxal scales white or fore- and midcoxae with lower scales brown; trochanters with all scales white or with some brownish; remaining leg segments with dark scales brown or black; forefemur with anterior surface usually streaked with white or dingy-white scales in basal 0.10 to 0.67 dorsally, remainder dark-

scaled, ventral margin speckled with white scales from base to apex, posterior surface usually largely white-scaled, dark scales in longitudinal streak from base to near apex along or near ventral margin, usually along dorsal margin apically, and at apex; midfemur with anterior surface largely dark-scaled with white speckles, sometimes white speckles concentrated in more or less distinct median or ventral longitudinal streak basally, posterior surface usually pale- or white-scaled in at least basal 0.33 and to or near apex in a progressively narrowing streak, remainder dark-scaled with white speckles; hindfemur with anterior surface usually pale- or white-scaled at least dorsally in basal 0.10 to 0.67, remainder entirely dark-scaled or with white speckles which may be concentrated near dorsal margin, posterior surface usually pale- or white-scaled in basal 0.10 to 0.67, remainder entirely dark-scaled or with white speckles; tibiae largely dark-scaled; foretibial anterior surface with white scales in line or line of speckles from base to or near apex, posterior surface with irregular speckling or mottling of white scales basally; midtibial anterior and posterior surfaces usually and dorsal surface sometimes with irregular speckling or mottling of white scales basally or from base to near apex; hindtibial anterior and dorsal surfaces with speckled white scales in at least central portion of segment; tarsi largely dark-scaled; foretarsal segment 1 sometimes with small dorsal white patch at base and less often with smaller one at apex; midtarsal segment 1 with small dorsal white patch at base and sometimes with one at apex, segment 2 less often with very small dorsal white patch at base and rarely with one at apex; hindtarsal segment 1 with posteriorly incomplete basal white ring, segments 1 and 2 sometimes with complete apical ring, segment 5 entirely white-scaled dorsally. Wing: largely brown- or black-scaled, white scales in short line about twice length of remigium at base of vein R, usually speckled on vein Sc, and sometimes in very small patch at base of costa; veins behind vein R_1 with very narrow scales; scales on vein 1A lying parallel to vein. Haltere: integument of stem whitish to beige, knob whitish to tan, scales medium wide. Abdomen: integument of tergite I and sternites II-VII whitish to brown, apex of sternites often darker than base and more distal sternites often darker than proximal ones, integument of sternite VIII tan to brown; abdominal segments with dark scales brown to black; tergites II-VII with conspicuous broad, basal, white bands, apex dark-scaled; tergite VIII dark-scaled with white scales basally or basolaterally; sternite II entirely white-scaled; sternites III-VII white-scaled basally, dark-scaled apically or apicolaterally, dark-scaling becoming more extensive on distal segments; sternite VIII bare.

MALE. Essentially as in female. Labium: largely dark-scaled, usually with small ventral white spot or complete narrow white ring just distad of level of distal end of palpal segment 2. Palpus: about 0.99 of proboscis, segment 3 with well developed apical bristles; largely dark brown- or black-scaled, segments 1 and 2 white at apex dorsally, segments 2 and 3 white at base dorsally. Antenna: flagellar segment 1 with black or brown scales dorsomesally. Thorax: upper posterior mep bristles not reduced in number. Abdomen: segment VIII entirely white-scaled or with a few dark scales.

MALE GENITALIA (fig. 9). Segment VIII: tergite lobe large, sides more or less parallel or slightly diverging distally, apex usually truncate, with irregular edge, sometimes with small or large emargination. Segment IX: tergite with 2-4 bristles on each side, sternite often with small projection in middle of cephalic edge. Sidepiece: basal mesal lobe with 4-6 usually straight, stout, bristles and 1-3 finer bristles. Clasper: not strongly constricted distad of origin of apodeme, but tapering gradually from base to apex. Aedeagus:

more or less pyriform or sometimes with lateral margins from or near apex to broadest point of aedeagus nearly straight; ventral triangular spines usually distad of middle of aedeagus; preapical ridge with 1-4 processes. Proctiger: paraproct sclerotization with 3 or 4 apical teeth; cercal setae usually 3-6.

PUPA (fig. 9). Abdomen: 4.5 mm. Trumpet: 0.7 mm. Paddle: 0.9 mm. Cephalothorax: hairs 8, 9-C never as long as trumpet. Trumpet: uniformly pigmented or with extreme base somewhat lighter, largely bright amber to tan and normally concolorous with or lighter than darkest portion of cephalothorax. Metanotum: hair 12-C usually moderately developed. Abdomen: 6, 7-I usually medium-long; 1-II moderately developed, usually double (2-7b); 2-II-VI usually less than 0.3 length of hair 1 of corresponding segment; 6-II short and fine, similar to 7-II; 5-III usually double and not as strongly developed as 5-IV-VI or 3-III; 10-III, IV not extending beyond 0.4 of following segment, 10-V-VII not extending beyond 0.8 of following segment; 5-IV, V extending to about 0.75 of following segment. Paddle: usually more or less oval in outline; apex rounded to slightly truncate; inner part without spicules near inner margin.

LARVA (fig. 10). Head: 1.04 mm. Siphon: 0.97 mm. Anal Saddle: 0.46 mm. Not all branched hairs with conspicuous barbs. Head: largely light brown colored, lighter cephalad and around imaginal eye, collar darker; mental plate tan, usually with 8-10 teeth on each side; hair 2-C sometimes present; 9-C usually single or double (1-3b), fine; 11-C weakly developed, usually with 4-6b; 13-C moderately developed, usually 3b (2-4). Antenna: uniformly light straw-colored. Thorax: epidermal pigment weakly developed, pink, violet or reddish in color; spicules not conspicuous; hairs moderately pigmented; hair 0-P usually with 3-6b (3-8); 6-P single; 1-M moderately to strongly developed, single; 1-T weakly to moderately developed, usually single or double (1-3b); 13-T moderately developed, 3, 4b. Abdomen: segment VII usually with sclerotized plate and segment VI often with plate; hairs moderately pigmented; hair 1-I weakly developed, usually 2-4b (1-5); 4-I shorter than 3-I; 6-I usually 5, 6b; 7-I single; 1-II weakly developed, usually double (1-3b); 4-II moderately developed; 5-II-VI weakly to moderately developed, usually 2, 3b (1-3); 6-II usually 5, 6b; 7-II moderately developed; 1-III weakly to moderately developed, single; 13-III-V usually 2, 3b and shorter than hair 10 of corresponding segment; 1-VI weakly to moderately developed, usually 2, 3b (1-3); 1-VII moderately developed; 13-VII usually 5, 6b (5-8). Segment VIII: large sclerotized plate present; anterior comb scales usually 16-21 (15-23), posterior comb scales usually 6-8 (5-9); posterior row of comb scales about 0.47-0.67 length of anterior row; hair 3-VIII strongly developed, usually 5-8b. Siphon: index about 3.6-5.0, usually greater than 4.0; largely light brown to brown in color, extreme base darker, extreme apex lighter; integumentary sculpturing absent; hair 1-S located 0.4-0.5 from base of siphon, usually 9-13b, strongly developed and with longest branches extending to apex of siphon. Anal Segment: saddle complete, light brown; integumentary sculpturing very weakly developed, imbricate; diameter of saddle at most proximal point not or only slightly smaller than diameter at the most distal point along ventral surface, so that dorsal and ventral surfaces are parallel or diverge only slightly when viewed from the side and diameter of saddle at most proximal point usually equal to or greater than diameter of base of siphon; hair 1-X single, fine; ventral brush usually with 7 pairs of hairs; more strongly developed hairs in ventral brush with 9-11 branches; gills moderately long, dorsal pair about twice as long as ventral pair and 0.9-1.3 length of anal saddle.

BIONOMICS. Larvae have been found only in treeholes. Adults have apparently never been collected.

Tate (1932:111-120) found that reared females would not bite men, birds, toads, earthworms or slugs and Cambournac (1943:71-77) reported that they would not take blood from men, birds, rabbits or frogs.

SYSTEMATICS. This is the only Palearctic representative of the Signifera group. The adult is distinctive enough for the species to be placed in a monotypic subgroup. It differs most conspicuously in having the outer dorsocentral scale line extending to the scutellum, the scales on vein 1A very narrow, vein R white-scaled at base for a distance about twice the length of the remigium, the proboscis of the female white-ringed and in lacking white scales on the basal flagellar segments.

Only non-hairy forms of both the larva and pupa are known for this species. The larva is difficult to distinguish from signifera from the eastern United States and the Greater Antilles, and from kummi and waverleyi. In pulchripalpis the siphon is usually slightly longer, the dorsal and ventral surfaces of the anal segment are more frequently parallel, hair 13-VII is usually more strongly developed and the sclerotized parts are usually lighter colored than in these other species. The pupa is most similar to that of signifera from California and the Greater Antilles and waverleyi; it is usually told from these by its lighter trumpet color and in addition is separated from Californian signifera by the paddle being narrower. It differs from signifera from the eastern United States and from kummi in being less hairy.

The femoral ornamentation is quite variable in this species. Since all individuals in one collection usually have the same pattern and this pattern may differ from that of individuals from another collection in the same area, this variation must be environmentally induced. Clastrier (1941:443-445) indicated that pulchripalpis from Algeria lacked the white proboscis ring in the female and Bailly-Choumara (1966:39-41) reported the same for material from Morocco. The immature stages from England are slightly less hairy than others which I have seen.

This species bears a greater resemblance to kummi than to any other species in the Signifera group. It is apparently one of the older species in the group. Some of its peculiarities have evidently been obtained by introgression from the Oriental Albipes group. In particular, the ringed proboscis and 5-segmented palpus of the female and the strongly developed lateral prescutellar scale line are features of pulchripalpis which are found in the Albipes group but not in other species in the Signifera group. While pulchripalpis is not known to contact any species of the Albipes group at present, it may have been sympatric with some species of that group in southwestern Asia during more mesic times.

DISTRIBUTION. England, France, Hungary and Ukrainian, south to Morocco, Tunisia, Turkey and Georgian. Material Examined: 472 specimens; 90 ♂, 86 ♀, 141 P, 155 L; 40 individual rearings (30 larval, 10 incomplete).

ALBANIA. Mamuras, 13 June 1932, D.J. Lewis, 4 ♂, 4 ♀ [BMNH].

ENGLAND. Essex: Epping Forest, 20 July 1920, F.W. Edwards, 1 ♂ [BMNH]; July 1919, A. Macdonald, ♂ lectotype of albionensis, 1 ♀ [BMNH]; Aug 1919, F.W. Edwards, 1 ♀ [BMNH]; Aug 1919, H. Main, 3 L [BMNH]; Sept 1919, H. Main 1 L [BMNH]; 12 Sept 1919, 1 L [BMNH]; 4 P, 3 L [BMNH]. Loughton, Epping Forest, 12 June 1966, T.J. Zavortink (UCLA 312), 9 1p♂ (312-24-29, 32, 34, 38), 9 1p♀ (312-10-13, 15, 16, 20, 35, 36), 6 1p (312-14, 23, 30, 31, 33, 37), 31 ♂, 30 ♀, 83 P, 56 L [UCLA]. Wake Arms, Epping Forest, 18 Aug 1919, F.W. Edwards, 1 L [BMNH].

Hampshire: Hayling Island, 1♂, 2P, 5L [BMNH]. New Forest, Buskett's Wood, June 1939, F.W. Edwards, 11 ♂, 9 ♀, 11 L [BMNH], 1 ♂, 1 ♀ [UCLA].

London: Buckingham Palace Gardens, 30 Mar 1926, F. W. Edwards, 1 P, 1 L [BMNH]; June 1926, F. W. Edwards, 2♂, 3♀ [BMNH]. Kensington Gardens, 30 Mar 1926, F. W. Edwards, 5 P, 6 L [BMNH]; 10 June 1966, T. J. Zavortink (UCLA 311), 4 lp♂ (311-10, 13, 17, 21), 8 lp♀ (311-12, 14, 16, 18, 23-26), 4 lp (311-11, 15, 20, 22), 1 ♂, 4 P, 10 L [UCLA].

No locality or date: J. F. Marshall, 3 ♂, 2 ♀ [USNM], 1 ♂, 1 ♀ [CNC].

GREECE. Macedonia: Lahanas Hills, July-Oct 1935, R. C. Shannon and J. Hadjinicolaou, 1♂, 6 L [USNM]. Struma Valley, June-Oct 1934, R. C. Shannon, 11 ♂, 11 ♀, 3 L [USNM]; June 1934, R. C. Shannon and J. Hadjinicolaou, 1 ♂ [USNM]; Aug 1935, R. C. Shannon and J. Hadjinicolaou, 1 ♂, 4 ♀ [USNM].

ITALY. Latium: Esperia, 28 May 1960, 3 ♂, 1 ♀, 2 L [UCLA]. Pontecorvo, 28 May 1960, 1 P [UCLA]. Castnocielo, 29 Mar 1961, 1 P [UCLA].

Sardinia: Gadoni, 11 Mar 1948, 2 L [BMNH].

No locality or date: C. Rondani (3022), ♂ lectotype of pulchripalpis, 1 ♂ [FM].

PORTUGAL. Estremadura: Aguas de Moura, 1937, F. J. Cambournac, 1♂, 1 ♀ [BMNH].

YUGOSLAVIA. Croatia: Zagreb, Pavicic, 2 L [BMNH].

NO LOCALITY. June 1928, Medjid (5214), 2 L [BMNH] (possibly from Turkey, vide Mattingly, 1955:32).

Additional records from the literature. ALGERIA. Mouzaia Mountains, L, A (Clastrier, 1941:443-446).

BULGARIA. Black Sea coast (Bozhkov, 1966:571, 572, 573).

ENGLAND. Buckinghamshire: Burnham Beeches, 1928-1929, M.V.F. Beattie and L. J. Howland (Beattie and Howland, 1929:49, 50, 56).

Cambridgeshire and the Isle of Ely: Cambridge, L (Keilin, 1927a:370).

Surrey: Ripley, 1930, M. E. MacGregor (Marshall, 1938:258-264).

FRANCE. Aude: Sigean, L (Rioux, 1958:257-260).

Bouches-du-Rhone: Saintes-Maries-de-la-Mer, Mar 1955, J. A. Rioux and J. Callot, L (Rioux, 1958:257-260).

Charente Maritime: La Rochelle, Mar 1955, R. A. Hedeen, L (Hedeen, 1958: 320).

Corsica: Morosaglia and Porto Vecchio, 1, 5 Nov 1959, L (Rioux and Nicoli, 1959:74).

Gard: Alex, L (Rioux, 1958:257-260).

Herault: Montpellier (Rioux and Arnold, 1955:278).

Indre-et-Lorie: Richelieu, Mar, July 1937, L (Callot and Ty, 1944:65).

Pyrenees-Orientales: Massane, 20 Aug 1953, L (Doby, 1955:370).

Seine-et-Oise: St. Germain, Forêt de Marly, M.P. Lesne, L (Seguy, 1920b: 253).

GREECE. Ionian Islands: Corfu (Stephanides, 1938:251).

Thessalia: Tempi Valley, L (Pandazis, 1935a:926).

HUNGARY. Veszprem: Lake Balaton, Badeortes Heviz, 1938, 1939, F. Mihalyi, L (Mihalyi, 1959:142-143).

MOROCCO. Mamora, Mar 1965, L (Bailly-Choumara, 1966:39-41).

SPAIN. Cuenca: Alberca de Zancara, Apr, May 1945, L (Cañamares, 1945: 838, 842, 849).

Gerona: Gerona, L (Rioux, 1958:257-260).

TUNISIA. Kroumirie Mountains, 27, 28 Mar 1964, L (Rioux, Juminer and Kchouk, 1964:14, 18).

TURKEY. (Parrish, 1959:266).

UNION OF SOVIET SOCIALIST REPUBLICS. Adygey: Sochi, Bashkareva (Stackelberg, 1937:114-115).

Adzhar: Lindrop (Stackelberg, 1937:114-115).
Crimean Oblast: (Velichkevich, 1931:316, 320-321).
Georgian: Abkhaz (Kalandadze, 1931:113).

KUMMI SUBGROUP

FEMALES. Head: vertex and occiput with few white decumbent scales; dorsolateral broad scales dark and white; clypeus more or less triangular, bare; palpus 0.41 to 0.45 of proboscis, 4-segmented, segment 4 very short, entirely white-scaled; flagellar segments 1-4, 5 or 6 with white scales. Thorax: paratergite moderately broad; supraalar scale line present; lateral prescutellar and inner dorsocentral scale lines not joined; posterior fossal white scales absent; outer dorsocentral scale line not reaching scutellum; lateral lobes of scutellum without scales; lower stp bristles absent, so that there are no bristles among lower stp scales; upper mep bristles dark in color, anterior mep bristles absent; pleural scaling with all lines or patches very narrow; ppn scales present; psp scales absent; pra scales very few, sometimes absent; pst with a broken or complete narrow line of white scales; stp with horizontal scale lines widely separated; vertical stp scale line not extending dorsad of level of lower edge of mep, with or without some semierect scales at each end; lower anterior mep scale patch narrow, far separated from upper patch. Legs: fore- and midcoxae with upper scales white, lower usually brown, hindcoxa with all scales dingy-white or with some lower ones brownish; trochanters, particularly on fore- and midlegs, usually with mixed brown and white scales. Wing: largely brown- or black-scaled; veins behind vein R_1 with narrow to medium-wide scales; scales on vein 1A wide spreading. Haltere: scales broad.

SYSTEMATICS. I believe this is the most primitive subgroup of the Signifera group. It contains the widespread kummi and species 5.

DISTRIBUTION. Arizona, south to Panama.

5. Orthopodomyia sp. Mexican highlands form

Figs. 2, 11

FEMALE (fig. 2). Wing: 4.52 mm. Proboscis: 2.18 mm. Forefemur: 2.32 mm. Abdomen: about 2.9 mm. Head: integument of head capsule, clypeus, torus and flagellum dark brown; erect scales black; labium largely dark-scaled, white scales very few, scattered; palpus about 0.45 of proboscis, largely dark-scaled, segments 2 and 3 with only very few scattered white scales. Thorax: integument of mesonotum and scutellum dark chestnut-brown, postnotum lighter chestnut-brown, pleuron dark chestnut-brown anteriorly, lighter posteriorly. Legs: integument of forecoxa chestnut-brown, midcoxa somewhat lighter, hindcoxa much lighter; legs with dark-scaling dark brown; forefemur with anterior surface largely dark-scaled, white scales scattered along dorsal margin near base and entire ventral margin; posterior surface with medium-wide dark streak from base to apex, areas dorsad and ventrad of streak white-scaled with dark speckles; midfemur with anterior surface largely dark-scaled, white speckles apparently concentrated in median longitudinal streak, posterior surface pale-scaled basally and to or near apex in progressively narrowing streak along ventral margin, remainder dark-scaled; hindfemur with anterior surface white-scaled ventrally in basal portion, remainder dark-scaled with

white speckles, dorsal margin white-scaled to about middle, posterior surface pale-scaled basally and with white speckles ventrally near apex, remainder dark-scaled; tibiae largely dark-scaled; foretibia with line of white speckles on anterior surface and with at least some white speckles on posterior surface; midtibia with white speckles on anterior, dorsal and posterior surfaces; hindtibia with all surfaces speckled with white scales; tarsi largely dark-scaled; fore- and midtarsi with small dorsal white patch on at least base of segment 1; hindtarsal segment 1 with posteriorly incomplete basal ring and with complete apical ring, segment 5 all white-scaled dorsally. Wing: vein R with remigium white; costa and vein Sc apparently all dark; remainder of vein R and all other veins dark-scaled with at least a few white speckles. Haltere: integument of stem whitish to tan, knob reddish-brown. Abdomen: integument of tergite I and sternites II-VIII tan; abdomen with dark scales brown to blackish; tergites II-VIII with large basolateral white patch, and at least on tergites II and III, with middorsal white patch; sternite II entirely white-scaled; sternites III-VII white-scaled basally or basolaterally, remainder dark; sternite VIII with white and dark scales laterally.

MALE, PUPA. Unknown.

LARVA (fig. 11). Head: 1.03 mm. Siphon: 0.86 mm. Anal Saddle: 0.55 mm. Not all branched hairs with conspicuous barbs. Head: largely brown colored, lighter cephalad and around imaginal eye; mental plate tan, usually with 9, 10 (9-11) teeth on each side; hair 2-C sometimes present; 9-C normally single, fine; 11-C weakly developed, usually 2, 3b (2-4); 13-C moderately developed, usually 2, 3b. Antenna: uniformly straw-colored. Thorax: epidermal pigment absent or weakly developed and pink in color; spicules not conspicuous; hairs strongly pigmented; hair 0-P usually 8, 9b (7-11); 6-P single; 1-M very strongly developed, long, usually 3-5b (3-6); 1-T very long, usually single (single, double); 13-T very strongly developed, long, usually 8-10b (6-11). Abdomen: segment VII usually with sclerotized plate and segment VI often with plate; hairs strongly pigmented; hair 1-I moderately developed, usually 2, 3b; 4-I shorter than 3-I; 6-I usually 10, 11b (9-12); 7-I single; 1-II very long, single; 4-II well developed; 5-II-VI moderately developed, usually 3b (2-4); 6-II usually 12-14b (10-14); 7-II moderately developed; 1-III very long, single; 13-III-V usually single or double (1-3b) and shorter than or subequal to hair 10 of corresponding segment; 1-VI strongly developed, usually single or double (1-3b); 1-VII very strongly developed; 13-VII usually 3, 4b (3-5). Segment VIII: large sclerotized plate present; anterior comb scales usually 23-27 (19-32), posterior comb scales usually 6-9 (5-12); posterior row of comb scales about 0.43-0.53 length of anterior row; hair 3-VIII very strongly developed, usually 8-10b (7-10). Siphon: index about 2.6-3.3; uniformly brown in color; integumentary sculpturing absent; hair 1-S located 0.50-0.54 from base of siphon, 9-11b, very strongly developed and with longest branches extending far beyond apex of siphon. Anal Segment: saddle complete, light brown; integumentary sculpturing inconspicuous, imbricate; diameter of saddle at most proximal point not or only slightly smaller than diameter at the most distal point along ventral surface, so that dorsal and ventral surfaces are parallel or diverge only slightly when viewed from the side and diameter at most proximal point of saddle usually equal to or greater than diameter of base of siphon; hair 1-X single, fine; ventral brush with 7 pairs of hairs; more strongly developed hairs in ventral brush with 8-10 branches; gills long, dorsal pair about twice as long as ventral pair and 1.4-2.4 length of anal saddle.

BIONOMICS. Larvae have been collected in a large treehole at ground level. Nothing is known of the habits of the adult.

SYSTEMATICS. This species is known from a single badly rubbed female

collected at 9,000 feet elevation at El Salto, Mexico. It is quite similar to kummi in most details, but differs from it in having the line of white scales on vein R restricted to the remigium and fewer white speckles on the proboscis and palpus than all but the depauperate specimens of kummi.

I am tentatively associating larvae collected at about 8,400 feet elevation near Zitacuaro (about 450 miles south of El Salto) with this adult. These larvae are extremely hairy forms; they resemble, but are even more hairy than, the hairy forms of kummi from Guatemala and signifera from Arizona and California. In particular hairs 13-T and 6-II are more strongly developed in these larvae than in the hairy forms of kummi and signifera.

While I believe that the adult and larva are the stages of a distinct species from the Mexican highlands, I am not naming the adult because it is known from only one damaged specimen and am not naming the larva because of the possibility that it is only a hairy form of kummi.

DISTRIBUTION. Known only from the Mexican states of Durango and Mexico. Material Examined: 70 specimens; 1 ♀, 69 L.

MEXICO. Durango: El Salto (10 miles W), 10 July 1964, J. F. McAlpine, 1 ♀ [CNC].

Mexico: Zitacuaro (28 miles E), 3 Sept 1964, E. Fisher and D. Verity (MEX 167), 69 L [UCLA].

6. Orthopodomyia kummi Edwards

Figs. 2, 12, 13

1939. Orthopodomyia kummi Edwards, 1939:121-122. *TYPE: holotype ♀, Orosi [Cartago], Costa Rica, reared from a larva found in an abandoned tank or cesspool full of clear rainwater, 16 Dec 1937, H. W. Kumm [BMNH].

Orthopodomyia kummi of de Buen (de Biagi) (1952:243-252; 1953:189, 191); Lane (1953:626); Vargas (1956:31); Stone, Knight and Starcke (1959:123); McDonald and Belkin (1960:249-250); Stone (1961:36); Diaz Nájera (1963:191); Burger (1965:396); Chapman (1965:432, 435, 436, 438); Stone, Sabrosky, Wirth, Foote and Coulson (1965:108); Diaz Nájera (1966:63).

Orthopodomyia n. sp. of Kumm, Komp and Ruiz (1940:405, 417, 418).

Orthopodomyia signifera of Richards, Nielsen and Rees (1956:16); McDonald (1957a:505; 1957b:535).

Orthopodomyia californica of Rigby and Ayres (1961:56).

FEMALE (fig. 2). Wing: 4.65 mm. Proboscis: 2.82 mm. Forefemur: 2.82 mm. Abdomen: about 3.1 mm. Head: integument of head capsule, clypeus, torus and flagellum reddish-brown to black; erect scales brown to black; labium largely dark-scaled, white scales few to numerous, scattered, yet somewhat concentrated along dorsal surface; palpus about 0.41 of proboscis, largely dark-scaled, segments 1, 2 and 3 usually with some scattered white scales. Thorax: integument of mesonotum, scutellum, and postnotum evenly reddish-brown to black, pleuron more or less evenly reddish-brown to black anteriorly and dorsally, lighter on central posterior portion of stp, lower portion of mep and on metameron. Legs: integument of forecoxa reddish-brown to dark brown, midcoxa somewhat lighter, hindcoxa much lighter; legs with dark scales brown to black; forefemur with anterior surface usually streaked with white scales along dorsal margin basally, remainder dark-scaled with

white scales scattered along apical dorsal margin and entire ventral margin, posterior surface with narrow to broad, median or more ventral, dark streak from base to apex, areas dorsad and ventrad of streak entirely white-scaled or with dark speckles; midfemur with anterior surface usually largely dark-scaled with white speckles dorsally, posterior surface pale-scaled basally and to apex in progressively narrowing streak along ventral margin, remainder usually dark-scaled with white speckles, sometimes all dark-scaled; hindfemur with anterior surface usually white- or pale-scaled ventrally in basal portion, sometimes narrowly white-scaled across entire base, remainder largely dark-scaled with few to many white speckles, dorsal margin usually white-scaled to beyond middle, posterior surface more or less like that of midfemur, often with basal pale-scaling extending farther apically; tibiae largely dark-scaled; foretibial anterior surface usually with white scales in line or line of speckles from base to or near apex, posterior surface with similar but shorter line or with very sparse or irregular white speckling; midtibial anterior and posterior surfaces with more or less distinct white lines from base to or near apex, ventral and sometimes dorsal surfaces speckled with white; hindtibial anterior, posterior and usually dorsal surfaces speckled with few to numerous white scales, which, when numerous, may form more or less distinct lines basally on anterior and posterior surfaces; tarsi largely dark-scaled; foretarsal segment 1 usually with very small to small dorsal white patch at base; midtarsal segment 1 with medium-sized dorsal white patch at base and sometimes with smaller one at apex, segments 2, 2-3 or 2-4 sometimes with a few white scales at base; hindtarsal segment 1 with posteriorly incomplete basal white ring, and sometimes with apical white ring, segment 5 all white-scaled dorsally. Wing: vein R with line of white scales from base to separation of vein R_S; additional light-scaling variable within 1 population and also apparently varying clinally, southern populations having fewer white scales, northern populations more; at minimal development only a few scattered white scales occur on distal portion of vein Sc and middle and distal portions of vein R_1; at maximal development numerous scattered white scales occur on distal portion of vein Sc, middle and distal portions of vein R_1, distal portion of stem of vein Cu, basal portion of vein Cu_1 and distal portion of vein 1A and a few scattered white scales occur on the costa and basal portion of vein R_{4+5}; remaining portion of veins mentioned and all other veins entirely dark-scaled; scales narrow in southern populations, wider in northern ones. Haltere: integument of stem whitish to brown, knob tan to brown. Abdomen: integument of tergite I tan to brown, sternites II-VII whitish to brown, sternite VIII brown to dark brown; abdominal ornamentation quite variable; abdomen with dark scales brown to black; tergite II with white scales in large middorsal patch which may extend to apical margin and in small to large basolateral patch or narrow to broad basal band; more proximal of tergites III-VII with white scales in small to large basolateral patch, dorsal surface all dark, with only a few white scales basally, or with conspicuous basal white patch; more distal of tergites III-VII with white-scaling more extensive, basolateral white patch larger, dorsal surface more often with basal white patch and sometimes with complete basal white band; tergite VIII varying from largely dark-scaled to having complete narrow basal white band; sternite II entirely white-scaled or with some scales dark; sternites III-VII with white scales basally or basolaterally, remainder dark-scaled, more distal of these sternites more extensively dark-scaled than proximal ones, sternite VIII with dark or dark and white scales laterally.

MALE. Essentially as in female. Labium: largely dark-scaled, white scales in narrow ring just distad of level of distal end of palpal segment 2 and

scattered, especially dorsally and/or distally. Palpus: about 0.96 of proboscis, segment 3 without well developed bristles; white scales scattered on segments 1, 2 and 3, and sometimes concentrated near base of segment 3. Antenna: flagellar segment 1 with black and white scales dorsomesally. Thorax: upper mep bristles reduced in number. Wing: usually with fewer white speckles than in females from the same collection, and showing, but less conspicuously, the same clinal variation as females; more southern populations with only a few scattered white scales on distal portion of vein Sc and sometimes on middle and distal portions of vein R_1; more northern populations with numerous scattered white scales on distal portion of vein Sc and on middle and distal portions of vein R_1, and with vein 1A, middle portion of vein Cu, and base of vein R_{4+5} usually with at least 1 white scale. Abdomen: ornamentation variable, but with white-scaling generally more extensive than in females; tergites III-VII as in female or with narrow to broad basal white band which may be wider laterally and middorsally, more distal of these segments usually more extensively white-scaled than proximal ones; tergite VIII usually with white basal band; sternites III-VII with white basolateral patch or with narrow to broad basal white band which may be wider laterally, more proximal of these segments usually more extensively white-scaled than distal ones; sternite VIII varying from entirely dark-scaled to entirely white-scaled.

MALE GENITALIA (fig. 12). Segment VIII: tergite lobe broadly truncate or emarginate, sometimes with small serrations near apex, sides parallel or diverging apically. Segment IX: tergite with 2-6 bristles on each side; sternite rarely with small projection in middle of cephalic edge. Sidepiece: basal mesal lobe with 3-5 stout bristles which are bent mesally near apex and with 1-3 finer bristles. Clasper: usually constricted distad of origin of apodeme, so that middle portion is narrower than distal portion. Aedeagus: basal portion usually more angular than in other species; ventral triangular spines variable in position; preapical ridge with 2 or 3 processes. Proctiger: paraproct sclerotization usually with 2-5 apical teeth; cercal setae usually 2-5.

PUPA (fig. 12). Abdomen: 3.7 mm. Trumpet: 0.5 mm. Paddle: 0.7 mm. Cephalothorax: hairs 8, 9-C often as long as trumpet. Trumpet: deep tan to brown except at extreme base and apex and largely darker than darkest part of cephalothoracic integument. Metanotum: hair 12-C usually strongly developed. Abdomen: hairs 6, 7-I usually strongly developed, long; 1-II usually 2, 3b (1-4), very strongly developed, long; 2-II-VI not more than 0.1-0.3 length of hair 1 of corresponding segment; 6-II long and strong, considerably stronger than 7-II; 5-III usually 3-5b and not nearly as strongly developed as 5-IV-VI or 3-III; 10-III-VII usually reaching to or nearly to caudal margin of following segment; 5-IV, V usually extending to or nearly to caudal margin of following segment. Paddle: usually narrowly to broadly elliptic; apex rounded, truncate or emarginate; inner part usually with band of minute spicules near inner margin.

LARVA (fig. 13). Head: 0.91 mm. Siphon: 0.72 mm. Anal Saddle: 0.43 mm. Not all branched hairs with conspicuous barbs. Head: largely light brown to brown in color, lighter cephalad and around imaginal eye, collar darker; mental plate brown, usually with 9, 10 (8-11) teeth on each side; hair 2-C apparently absent; 9-C single or double, fine; 11-C weakly developed, usually with 3, 4b (3-5); 13-C moderately developed, usually 2, 3b (2-4). Antenna: uniformly light tan colored. Thorax: epidermal pigment weakly to strongly developed, pink to red or purple in color; spicules not conspicuous; hairs strongly pigmented; hair 0-P usually 5, 6b (4-8); 6-P single; 1-M usually moderately developed and single, strongly developed and 2, 3b in hairy form; 1-T usually weakly developed and single, strongly developed and 1-3b in hairy form; 13-T

usually 3-5b and moderately developed or, especially in hairy form, strongly developed. Abdomen: segment VII usually with sclerotized plate and segment VI often with plate; hairs strongly pigmented; hair 1-I usually weakly developed and 2, 3b (1-4), strongly developed and 1-3b in hairy form; 4-I shorter than 3-I; 6-I usually 7, 8b (6-9); 7-I single; 1-II usually weakly developed and single (single, double), strongly developed and single or double in hairy form; 4-II weakly to moderately developed; 5-II-VI usually weakly to moderately developed and 2, 3b (2-4), quite strongly developed in hairy form; 6-II usually 6-8b; 7-II usually moderately developed, strongly developed in hairy form; 1-III usually moderately developed and single (single, double), strongly developed and single or double in hairy form; 13-III-V usually single or double (1-3b) and shorter than hair 10 of corresponding segment; 1-VI usually weakly developed and double (1-3b), moderately developed and double (single, double) in hairy form; 1-VII usually moderately developed and double (single, double), strongly developed and 2, 3b in hairy form; 13-VII usually 4, 5b (4-6). Segment VIII: large sclerotized plate present; anterior comb scales usually 18-22 (17-26), posterior comb scales usually 5-7 (5-9); posterior row of comb scales about 0.33-0.58 length of anterior row; hair 3-VIII strongly developed, usually 7-9b (7-11). Siphon: index about 2.7-3.8, usually less than 3.5; largely light brown to brown in color, extreme base darker, apex sometimes lighter; integumentary sculpturing absent to weakly developed, imbricate; hair 1-S located 0.48-0.57 from base of siphon, usually 9-11b (8-12), strongly developed and with longest branches extending considerably beyond apex of siphon. Anal Segment: saddle complete; saddle uniformly light brown to brown or somewhat darker dorsoapically; integumentary sculpturing weakly developed, imbricate; diameter of saddle at most proximal point usually considerably smaller than diameter at the most distal point along the ventral margin, so that dorsal and ventral surfaces diverge when viewed from the side, and diameter of saddle at most proximal point usually less than diameter of base of siphon; hair 1-X usually single and fine, often enlarged and branched in hairy form; ventral brush usually with 7 pairs of hairs; more strongly developed hairs in ventral brush usually with 11-13 branches (9-17); gills usually long, dorsal pair about 1.4-1.7 as long as ventral pair and 1.1-2.1 length of anal saddle.

BIONOMICS. Larvae of kummi have been found in treeholes, open-ended bamboo internodes, artificial containers and in an abandoned cesspool. They are found in the same treeholes as signifera in southeastern Arizona. Nothing is known of the habits of adults except that they are active during darkness and will take avian blood (see Biology and Ecology section).

SYSTEMATICS. Kummi is similar to species 5 but is told from it and all other species in the Signifera group in the adult stage by having the line of white scales on the base of vein R extending to the separation of R_S.

Adults of this species are quite variable. Wing variation is clinal, with northern populations having broader and more white scales than southern populations. This cline is evidently due to introgression with signifera, which occurs with kummi in southeastern Arizona and is known to hybridize with it. The description of the wing of northern populations is based on individuals collected in areas of Arizona where signifera does not exist. In those areas where the 2 species occur together, there are some females which appear to be kummi on the basis of all larval, pupal and adult features except that they have a few additional white scales on any or all of the following veins: base of veins R_S, R_{2+3}, R_2, Cu and 1A and on vein M near the crossveins. I have considered these individuals to be kummi, but they may actually be backcrosses of kummi to the F_1 hybrids between kummi and signifera. The hybrids are discussed be-

low. Femoral ornamentation in collections from treeholes separated by only a few meters often differs considerably, leading me to believe that the differences are environmentally induced rather than having a genetic basis. Other variations in adult ornamentation are due to larval nutrition; depauperate adults have the white-scaling on the abdomen, palpus, proboscis, femora and tibiae much reduced.

While most larvae throughout the species range are non-hairy, extremely hairy individuals have been found in Guatemala and partially hairy larvae occur at Patagonia, Arizona. The non-hairy larvae are difficult or impossible to distinguish from signifera from the eastern United States and the Greater Antilles, and from pulchripalpis and waverleyi. The hairy larval form is similar to species 5 and the hairy form of signifera. Except for a single specimen collected in bamboo in El Salvador, the pupa of kummi is the hairy form and is similar to that of signifera from the eastern United States. It is generally told from the latter by the greater development of hairs 6, 7-I, 1, 6-II and 5-IV-VI and especially by the development of minute spicules near the inner margin of the posterior portion of the paddle. These spicules are present in all or most individuals of every collection of kummi, but are very rarely present in signifera and never occur in any other species of the Signifera group.

Kummi and signifera occur together at some localities in southeastern Arizona and, to date, specimens appearing to be hybrids between the species have been found at the following three locations in Cochise County: Huachuca Mountains, Coronado National Memorial; Dragoon Mountains, Cochise Stronghold Campground; and Chiricahua Mountains, Chiricahua National Monument. Supposed hybrid adults are similar to kummi except that the pleural scale lines are broader and the wings have numerous scattered white scales and may even have a weakly developed spot over the crossveins. The number of scattered white scales is generally greater than that indicated above for the possible backcrosses to kummi. Pupae of the hybrids are nearly indistinguishable from those of kummi, but do have some hairs, particularly 1-II and 4-V, less well developed than that species. Because of variation present in the parental species, hybrid larvae are difficult to distinguish. In southeastern Arizona, larvae of kummi generally differ from those of signifera by the following features: (1) hair 1-S with a greater number of branches and the branches more evenly spaced, (2) hair 1-T, II shorter and more weakly developed, (3) siphon more uniformly sclerotized and with straighter lines, (4) epidermal pigment more frequently present and darker in color when present, (5) abdominal plates larger and more numerous, (6) anal gills longer, and (7) sclerotized parts darker in color. Hybrid larvae usually resemble kummi in character 2 and sometimes in character 6, but, for the most part, tend toward signifera in the other characters. They normally differ from the larvae of either pure species by having a longer siphon. However, it cannot be overemphasized that the larval variations of each parental species is so great that they sometimes cannot be told from each other and, as a consequence, it is difficult to recognize the hybrids.

I am considering kummi to be the most primitive species in the Signifera group because the adult shares many features with albicosta, a South American species which I have placed in a separate group. The wing and pleural ornamentation of the 2 species are almost identical; in addition, kummi tends toward albicosta by having a more triangular clypeus, fewer scales between the eyes and fewer pra bristles than any other species in the Signifera group. It is of course possible that these similarities are due to introgression rather than relationship.

Kummi

DISTRIBUTION. Southeastern Arizona, south to northern Panama. Material Examined: 2925 specimens; 693 ♂, 585 ♀, 3 A, 801 P, 843 L; 286 individual rearings (213 larval, 47 pupal, 26 incomplete).

COSTA RICA. Orosi, 16 Dec 1937, H.W. Kumm, 26 ♂, 38 ♀, 10 L [USNM], holotype ♀, 4 ♂, 3 ♀ [BMNH], 1 ♂, 1 A [UCLA].

EL SALVADOR. Santa Tecla, 19 June 1958, O.L. Cartwright, 1 L [USNM]. Sonsonate, Canton El Castano, 1 Aug 1964 (SAL 2), 1 p♂ (2-100) [UCLA].

GUATEMALA. Solola, 30 June 1965, J.N. Belkin and T.J. Zavortink (GUA 25), 1 lp♂ (25-12), 3 p♂ (25-100-102), 4 lp (25-10, 11, 13, 14), 1 P, 54 L [UCLA]. No locality or date (GUA 151), 1 ♂, 2 ♀, 2 P [UCLA].

MEXICO. Baja California Sur: Todos Santos, 30 May 1965, W.A. McDonald (UCLA 237), 20 lp♂ (237-11-29, 31), 2 lp♀ (237-10, 30), 1 p♂ (237-102), 4 p♀ (237-101, 103-105), 13 ♂, 2 ♀, 16 P, 37 L [UCLA]; 1 June 1965, W.A. McDonald (UCLA 246), 3 lp♂ (246-11, 12, 14), 1 lp♀ (246-10), 5 p♂ (246-102-106), 2 p♀ (246-100, 101), 1 lp (246-13), 1 ♀, 1 P, 9 L [UCLA].

Chiapas: Mapastepec, El Pavat, 20-27 July 1959, B. Lievano, 1 ♂, 3 L [ISET].

Guerrero: Omilteme, 8 Sept 1965, D. Schroeder (MEX 361), 14 L [UCLA].

Oaxaca: Las Cruces, El Barrio, 16 Oct 1959, H. Calderon, 1 ♂, 2 ♀ [ISET].

San Luis Potosi: Tamazunchale, 20 July 1965, R.X. Schick and D. Schroeder (MEX 233), 1 lp♂ (233-20) [UCLA]. Tlapexhuncan, May 1942, 1 ♂, 1 ♀ [USNM].

Veracruz: Cordoba, 22 July 1964, E. Fisher and D. Verity (MEX 71), 1 lp♀ (71-10), 2 ♂, 4 ♀, 4 L [UCLA]; 4 Aug 1964, E. Fisher and D. Verity (MEX 93), 2 lp (93-11, 12), 1 L [UCLA].

PANAMA. Chiriqui: El Volcan Chiriqui, 6 Mar 1943, T.H.G. Aitken, 1 ♂ [UCLA]; 30 June 1943, T.H.G. Aitken, 1 ♀, 40 L [USNM], 2 ♀ [UCLA].

UNITED STATES. Arizona: Chiricahua National Monument, 24 Dec 1966, L.T. Nielsen (N-37-66), 6 ♂, 1 ♀, 1 A [UTAH]. Coronado National Memorial, 25 Dec 1966, L.T. Nielsen (N-41-66), 2 ♂, 2 ♀, 3 P, 4 L [UTAH]; same data (N-42-66), 14 ♂, 6 ♀, 4 P [UTAH]. Madera Canyon, 22 Aug 1954, W.A. Mc Donald (UCLA 135), 2 lp (135-101, 111), 3 L [UCLA]; 17-19 Aug 1955, W.A. McDonald (UCLA 171), 15 lp♂ (171-303, 304, 306, 307, 309-315, 325, 326, 328, 349), 26 lp♀ (171-316-320, 323, 324, 327, 329-332, 334-343, 345-348), 5 p♂ (171-301, 302, 322, 351, 352), 1 l♂ (171-321), 3 P, 24 L [UCLA], 2 lp♂ (171-305, 308) [USNM]; 26 Dec 1966, L.T. Nielsen (N-43-66), 21 ♂, 4 ♀, 1 A, 8 P, 6 L [UTAH]; Nogales, 21 Mar 1966, T.J. Zavortink (UCLA 298), 3 lp♂ (298-10, 17, 19), 7 lp♀ (298-11-16, 18), 24 ♂, 28 ♀, 52 P, 40 L [UCLA]; same data (UCLA 299), 6 lp♂ (299-10, 11, 13-16), 2 lp♀ (299-12, 17), 2 ♂, 2 P, 2 L [UCLA]. Patagonia, 24 Aug 1954, W.A. McDonald (UCLA 137), 7 L [UCLA]; 18 Aug 1964, J. Burger (UCLA 252), 3 p♂ (252-101, 102, 104), 1 p♀ (252-103), 91 ♂, 117 ♀, 1 P [UCLA]; same data (UCLA 253), 2 p♂ (253-104, 106), 4 p♀ (253-101-103, 107), 92 ♂, 99 ♀, 4 P [UCLA]; 13 Sept 1964, J. Burger (UCLA 259), 24 ♂, 16 ♀ [UCLA]; 24 Jan 1965, J. Burger (UCLA 273), 107 ♂, 38 ♀, 30 P, 71 L [UCLA]; 25 July 1965, J. Burger (UCLA 280), 3 L [UCLA]; 27 July 1965, J. Burger (UCLA 282), 26 L [UCLA]; 21 Mar 1966, T.J. Zavortink (UCLA 300), 10 lp♂ (300-10-14, 16, 19, 28, 31, 37), 11 lp♀ (300-15, 17, 18, 20-25, 27, 29), 1 lp (300-26), 26 ♂, 11 ♀, 39 P, 78 L [UCLA]; 5 Sept 1966, T.J. Zavortink (UCLA 333), 6 lp♀ (333-14-19), 5 ♂, 3 ♀, 9 P, 19 L [UCLA]; same data (UCLA 334), 4 lp♂ (334-11, 21-23), 7 lp♀ (334-10, 17-20, 24, 25), 18 ♂, 7 ♀, 28 P, 51 L [UCLA]; same data (UCLA 335), 2 lp♂ (335-11, 12), 3 lp♀ (335-10, 13, 14), 1 p♀ (335-100), 5 ♂, 6 ♀, 11 P, 7 L [UCLA]. Pearce, Cochise Stronghold Camp-

ground, 26 Aug 1964, J. Burger (UCLA 255), 6 p♂ (255-122, 127-131), 6 p♀ (255-120, 121, 123-126), 15 ♂, 3 ♀, 1 P [UCLA]; 22 Mar 1966, T.J. Zavortink (UCLA 302), 6 lp♂ (302-18-20, 22-24), 1 lp♀ (302-21), 9 ♂, 10 ♀, 20 P, 4 L [UCLA]; 4 Sept 1966, T.J. Zavortink (UCLA 325), 2 lp♀ (325-10, 11), 2 P [UCLA]; same data (UCLA 326), 21 lp♀ (326-11-17, 20, 22-25, 27-32, 34-36), 5 lp (326-10, 18, 21, 26, 33), 6 ♀, 9 P, 1 L [UCLA]; same data (UCLA 328), 4 lp♂ (328-31, 32, 35, 37), 1 ♂, 1 P, 1 L [UCLA]; same data (UCLA 329), 16 lp♀ (329-20, 21, 23, 25, 26, 28-30, 32-39), 4 lp (329-22, 24, 27, 31), 46 ♂, 22 ♀, 242 P, 67 L [UCLA]; 6 Sept 1966, T.J. Zavortink (UCLA 342), 3 lp♂ (342-12, 14, 27), 5 lp♀ (342-16, 18-21), 1 lp (342-11), 10 ♂, 12 P, 2 L [UCLA]. Sierra Vista, Carr Canyon, 5 Sept 1966, T.J. Zavortink (UCLA 338), 2 lp♂ (338-11, 12), 6 lp♀ (338-13-16, 18, 19), 1 lp (338-17), 2 ♂, 2 P, 6 L [UCLA]; same data (UCLA 340), 2 lp♀ (340-14, 15), 2 p♂ (340-102, 103), 4 lp (340-10-13), 2 ♂, 9 P [UCLA]; same data (UCLA 341), 3 lp♂ (341-10, 13, 14), 5 lp♀ (341-12, 15-18), 1 p♂ (341-100), 1 ♂, 2 P, 4 L [UCLA]. Sierra Vista, San Pedro River, 5 Sept 1966, T.J. Zavortink (UCLA 336), 2 ♀ [UCLA]; same data (UCLA 337), 1 lp♂ (337-17), 3 lp♀ (337-10, 18, 19), 3 ♂, 2 ♀, 5 P, 8 L [UCLA].

Additional records from the literature. MEXICO. Puebla: El Agengibre, 31 May-19 July 1952, D. Garza, F. Biagi and A.M. de Buen, L, P (de Buen (de Biagi), 1952:243-252).

Hybrids

DISTRIBUTION. Known from only Cochise County, Arizona. Material Examined: 69 specimens; 4 ♂, 14 ♀, 9 P, 42 L; 9 larval individual rearings.

UNITED STATES. Arizona: Chiricahua National Monument, 24 Dec 1966, L.T. Nielsen (N-37-66), 2 ♀ [UTAH]. Coronado National Memorial, 25 Dec 1966, L.T. Nielsen (N-42-66), 5 ♀, 6 L [UTAH]. Pearce, Cochise Stronghold Campground, 22 Mar 1966, T.J. Zavortink (UCLA 302), 2 lp♂ (302-10, 11), 4 lp♀ (302-12-15), 2 ♀, 7 L [UCLA]; 4 Sept 1966, T.J. Zavortink (UCLA 326), 1 lp♂ (326-37), 1 L [UCLA]; 6 Sept 1966, T.J. Zavortink (UCLA 342), 1 lp♂ (342-26), 1 lp♀ (342-29), 19 L [UCLA].

Additional records from the literature. None.

ALBICOSTA GROUP

7. Orthopodomyia albicosta (Lutz)

Figs. 2, 14, 15

1904. Bancroftia albicosta Lutz, 1904:6, 1. TYPE: A, [Serra da Cantareira, São Paulo], Brazil [Location unknown]. Neither of the specimens in the BMNH marked as types by J. Lane can be part of the type series because of different locality (Cochocirinha) or date (1905) later than that of the original description.

Orthopodomyia albicosta of Dyar (1928:398); Edwards (1932:108); Prado (1935: 1510); Edwards (1939:121, 122); Lane (1939:96); Anduze (1941:11); Davis (1944:230); Lane (1953:624-625); Stone (1957:334); Stone, Knight and Starcke (1959:122); Cova-Garcia, Sutil and Rausseo (1966a:53; 1966b:51, 117, 370-371).

Orthopodomyia (Bancroftia) albicosta of Lima (1935:175-176).

Bancroftia albicosta of Blanchard (1905:632); Lutz (1905:67-69); Theobald (1907: 521-523); Peryassu (1908:21, 70, 247-249, 354); Theobald (1910b:469); Peryas-

su (1929:281).

FEMALE (fig. 2). Wing: 4.15 mm. Proboscis: 2.32 mm. Forefemur: 2.38 mm. Abdomen: about 2.7 mm. Head: integument of head capsule and flagellum brown, clypeus tan, torus dark brown mesally, beige to tan laterally; eyes contiguous above antennae; orbital bristles usually 1 lateral pair, 2 mesal pairs; vertex and occiput with numerous decumbent scales, those on vertex black, broad and flat, those on occiput white, broad and flat laterally, narrow and curved mesally, erect scales brown to black; dorsolateral scales all white or some black; lateral and ventral scales white; suborbital bristles tan or brown; clypeus triangular, bare; labium largely dark-scaled, white scales scattered over entire surface or more or less concentrated dorsally, and in short mid-dorsal longitudinal streak in apical half; palpus about 0.46 of proboscis, 4-segmented, segment 4 very small and entirely silvery-white-scaled, segments 1-3 largely dark-scaled, with scattered white scales on segments 2 and 3; torus with mesal line of small silvery-white flat scales; flagellum with segment 1 slightly swollen, no segments with scales; dorsal flagellar bristles about 3.0 times length of their segment on proximal segments; ventral bristles absent on segment 1 and reduced in length on segments 2-4. Thorax: integument of mesonotum deep reddish-brown to brownish-black at margins, along dorsocentral bristles and in posterior quarter, remainder lighter, either yellowish-tan, light brown or sometimes reddish-brown, scutellum brown to blackish-brown, postnotum reddish- to blackish-brown, usually with darker median longitudinal streak, pleuron brown except for lighter areas near sutures and posterior portion of mep; paratergite moderately broad; humeral and lateral prescutal bristles few, posterior fossal bristles absent; mesonotal ornamentation consisting of 4 pairs of lines of small white scales arranged into a pattern of 2 pairs of longitudinal lines, and broader bands of small brown scales; white scales arranged as follows: (1) lateral prescutal scales in line from anterior promontory to scutal suture laterad of humeral and lateral prescutal bristles, (2) supraalar scales in line from scutal suture to parascutellum mesad of supraalar bristles, (3) outer dorsocentral scales in line from caudad of humeral bristles to lateral prescutellar scale line laterad of dorsocentral bristles, mesad of fossal bristles, (4) lateral prescutellar scales much larger and longer than other mesonotal scales, in line from anterior edge of prescutellar space to scutellum mesad of lateral prescutellar bristles, connected anteriorly to outer dorsocentral scale line; brown scales arranged as follows: (1) in band accompanying, but extending further caudad than, acrostichal bristles, (2) in band accompanying dorsocentral bristles; lateral lobes of scutellum with or without a few long, thin, white scales, midlobe with 1 pair of narrow white scale lines which extend 3 to 4 times length of scutellum from its caudal margin; upper anterior apn bristles 1-4 strongly developed, 1-4 weakly developed, lower anterior apn bristles 1 or 2, moderately to weakly developed, tan; ppl bristles 4-6 strongly developed, 2-5 weakly developed; pra bristles absent; upper stp bristles 1, strongly developed, posterior stp bristles 2 strongly developed, 0 or 1 weakly developed, lower stp bristles 1 or 2, weakly to moderately developed, amber in color; upper posterior mep bristles 4-7, amber, anterior mep bristles absent; pleural scaling with individual lines narrow; apn with diagonal row or curved decumbent scales between upper and lower bristles; ppn with horizontal line of curved decumbent scales extending from line on apn to its caudal border ventrad of posterior ppn bristles; psp bare; pra with many curved decumbent scales; ppl with row of curved, decumbent scales below ppl bristles; pst with curved decumbent scales near ppl; pcx, ssp and hypostigial scales ab-

sent; stp with 3 distinct lines of scales, as follows, decumbent scales in 2 horizontal rows, 1 above and 1 below upper stp bristle, and broad decumbent and semierect scales in nearly vertical line extending ventrad from level of lower margin of mep along posterior stp margin; mep with upper horizontal line of decumbent and long semierect scales and lower horizontal line of decumbent scales; additional large brownish scales may be scattered on pleuron. Legs: integument of forecoxa tan in upper portion, remainder beige, midcoxa brown in upper outer portion, remainder beige, hindcoxa beige; fore- and hindcoxal bristles beige to tan, midcoxal bristles brown; broad to rather narrow, flat scales present along outer edge of anterior surface on all coxae and above and behind uppermost bristles on forecoxa, coxae largely white-scaled, light brown scales usually above bristles and along anterior surface of forecoxa and on lower portion of hindcoxa; trochanters with narrow, appressed scales, those on anterior and mesal surfaces light brown, those on posterior surface white; remaining leg segments with dark scales brown to black; femora without knee spots; forefemur with anterior surface white-scaled at base, remainder dark-scaled with white speckles, the latter often more common apically, posterior surface irregularly but almost completely white-scaled ventrally, dark-scaled with white speckles dorsally; midfemur with anterior surface largely dark-scaled, white scales in median longitudinal line from near base to apex, and scattered, especially dorsally, posterior surface white-scaled basally and to or near apex in progressively narrowing longitudinal streak at or near ventral margin, remainder dark-scaled with white speckles; hindfemur with anterior surface white-scaled in ventral longitudinal streak which narrows and continues to apex as median line, white scales scattered along dorsal margin, remainder dark-scaled, posterior surface largely white-scaled, dark scales present dorsally in distal portion and along ventral margin near apex; tibial largely dark-scaled, without apical white patches; foretibial anterior surface with white scales in poorly defined line in basal portion or in well defined line to near apex, posterior surface with irregular light mottles or speckles in poorly defined line in basal portion or in well defined line to near apex; midtibial anterior and posterior surfaces with well defined white line from base to or near apex; hindtibial anterior surface with well defined white line from base to apex, posterior surface with similar line in basal 0.33 and streak of tannish scales from there to near apex; tarsi largely dark-scaled; foretarsus entirely dark-scaled or with a few dorsal white scales at base of segment 1 and over joint between segments 1 and 2; midtarsus with dorsal white patch at base of segments 1-3 or 4 and apex of segments 1-2, 3 or 4, basal patch usually larger than apical; hindtarsal segment 1 longer than hindtibia; hindtarsus with dorsal light patch at base of segments 1-4 or 5 and apex of segments 1-3 or 4, patch at base of segment 1 small, patch over joint between segments 1 and 2 large, usually forming narrow ring ventrally, patch at apex of segment 4 or base of segment 5 very small when present. Wing: all veins entirely dark brown-scaled except for vein R, which is white-scaled from base to separation of vein R_S; veins posterior to vein R_1 with narrow scales; scales on vein 1A only slightly spreading. Haltere: integument of stem whitish to beige, knob brown; scales on stem white and brown, those on knob all brown. Abdomen: integument of tergite I beige to tan, sternites II-VII whitish to brown, apex of sternites often darker than base and more distal sternites darker than proximal, sternite VIII brown; tergite I fan brown- or brown- and white-scaled; remaining abdominal segments with light scales white or creamish, dark scales brownish-black; tergite II with large middorsal basal light patch and basolateral light patch, remainder dark-scaled; tergites III-VII with basolateral light patch, remainder dark-scaled;

tergite VIII like preceding or with additional light scales basally; sternite II and sometimes III entirely light-scaled; sternites III-VII usually white-scaled basally, dark-scaled apically or dorsoapically, dark-scaling more prevalent on distal segments; sternite VIII mostly bare midventrally, dark and light scales present laterally.

FEMALE GENITALIA. Tergite IX without setae.

MALE. Essentially as in female. Labium: largely dark brown- to black-scaled, white scales forming short longitudinal streak on dorsal surface near apex, ventral patch distad of level of distal end of palpal segment 2 and speckled over surface, especially distally. Palpus: about 0.77 of proboscis, segment 5 very short, segment 3 without well developed apical bristles; white scales scattered on segments 2 and 3, in patch at base of segment 4 and on entire surface of segment 5. Antenna: integument of flagellar segments 1-11 whitish, that of segments 12 and 13 dark brown; segment 1 of flagellum without scales; bristles of flagellar whorls about 0.45 length of entire flagellum on proximal segments, about 0.6 to 0.9 length of segment 13 on that segment. Abdomen: tergite VIII mostly light-scaled, sternite VIII dark-scaled with light basolateral patch.

MALE GENITALIA (fig. 14). Segment VIII: tergite lobe distinct, rather small, narrowing apically, apex rounded. Segment IX: tergite without bristles. Sidepiece: medium-long conical; basal mesal lobe with 4 or 5 strong terete bristles and 1 or 2 finer sternally; mesal surface membranous for short distance distad of basal mesal lobe; mesal surface with specialized bristles in large area distad of basal mesal lobe, individual bristles directed tergomesally, with ends fine and curved sternally; specialized tergomesal bristles absent. Spiniforms: 2, simple. Aedeagus: strongly sclerotized; apex broadly truncate, with row of 6-8 crenations on each side, without ventral spines or processes, but with small basal projection extending cephalad between ventral parameres. Proctiger: paraproct sclerotization with 2 or 3 apical teeth; cercal setae 3-5.

PUPA (fig. 14). Abdomen: 3.0 mm. Trumpet: 0.4 mm. Paddle: 0.6 mm. Cephalothorax: lightly to moderately pigmented, with dorsal portion of wing case and portion of mesonotum caudad of trumpet usually darker; integumentary sculpturing absent; hairs concolorous with to slightly darker than integument; all hairs shorter than trumpet; hairs 1, 2-C subequal, moderately developed, usually single or double (1-3b); 3-C weakly developed, much shorter than 1 or 2-C; 4, 5-C subequal, moderately developed, usually 3, 4b (2-5); 6-C cephalad of 7-C; 7-9-C usually subequal in length, 7-C 2, 3b, 8, 9-C normally single. Trumpet: brown except for lighter extremes; distal portion gradually widened from base; pinna medium-sized. Metanotum: lightly to moderately pigmented, with haltere cases lighter; integumentary sculpturing absent; never more than 3 pairs of hairs developed. Abdomen: lightly to moderately pigmented, with posterior portion of anterior segments and posterior segments lighter; segments II-VIII with weakly to moderately developed reticulate to imbricate integumentary sculpturing; smaller hairs concolorous with integument, larger hairs darker; hair 5-I apparently single; 6, 7-I moderately developed, usually single (single, double); 1-II not dendritic, moderately developed, 3-5b; 2-II cephalad of 3-II; 5-IV, V extending at least 0.75 distance to alveolus of hair 5 of following segment; 10-III-VII generally extending 0.5-0.7 distance to apex of following segment; 10-III single or double; 10-IV usually 2, 3b (1-3); 1-VI usually mesad of hair 2, short and 4-7b; 1-VII mesad or laterad of hair 2; 9-VII moderately developed, usually 6-8b (5-8), with longest branch extending 0.6-0.8 distance to alveolus of 9-VIII; 9-VIII strongly developed, usually 9-11b, with longest branch extending 0.6-0.8 distance to apex of paddle. Terminal

Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: lightly pigmented, straw-colored, with midrib darker; longer than broad, more or less oval in shape, distal portion of outer margin nearly straight; external buttress short, convex laterally, with minute spicules; midrib slightly convex mesally; entire surface of paddle with small spicules.

LARVA (fig. 15). Head: 0.95 mm. Siphon: 0.92 mm. Anal Saddle: 0.41 mm. Head: slightly broader than long; integument without ornamentation; labrum short; largely light tan colored, lighter around imaginal eye, collar darker; mental plate tan or brown, with 8-11 teeth on each side; hair 2-C apparently absent; 8-10-C usually 2, 3b (1-4), fine. Antenna: short; integument smooth; uniformly light tan colored. Thorax: epidermal pigment strongly developed, red in color; spicules absent; hairs strongly pigmented; hair 0-P 14-24b; 4-P 8-12b; 1-M moderately developed, 3-6b; 4-M double; 13-M 9-21b; 1-T moderately developed, usually single (1-3b); 3-T 5-8b. Abdomen: segments VI and VII with large sclerotized plates; hairs strongly pigmented; hair 1-I weakly developed, 2-5b; 2-I, II laterad of hair 1 of corresponding segment; 6-I, II multiple; 10, 11-I usually double (2, 3b); 13-I shorter than 10-I; 1-II moderately developed, 1-3b; 3-II, IV usually double (1-3b); 7-II 5-8b; 10-II 1-5b; 13-II 7-14b; 1-III moderately developed, usually single (1-4b); 6-III-VI single; 7-III-V 7-15b; 1-VI weakly developed, 4-8b; 2-VI laterad of hair 1; 4-VI 2-4b; 7-VI, VII usually 2, 3b (1-4); 13-VI 15-23b; 2-VII usually mesad of hair 1; 6, 8-VII 7-12b. Segment VIII: sclerotized plate large, sometimes ringing segment; comb scales normally in 1 row, 18-31 in number; individual comb scales fringed only, without a long apical spine; hair 3-VIII strongly developed, 9-12b. Siphon: integumentary sculpturing moderately developed basally, imbricate; index about 3.5-4.2; extreme base dark brown, basal 0.6 light brown, fading to light tan in apical 0.4; hair 1-S located about 0.53-0.61 from base of siphon, 10-13b, strongly developed and with longest branches extending to apex of siphon. Anal Segment: saddle complete; sclerotized incomplete ring present basad of saddle; integumentary sculpturing weakly developed, imbricate; saddle usually dark brown at extreme base and sometimes at apex, remainder uniformly light brown; hair 1-X usually 2, 3b (1-5), fine; ventral brush with 7 pairs of hairs; more strongly developed hairs in ventral brush with 11-16 branches; gills moderately long, dorsal pair 1.2-2.1 as long as ventral pair and 1.1-1.9 length of anal saddle.

BIONOMICS. According to Davis (1944:230), larvae are usually found in living or dead bamboo internodes with either small or large openings and are rarely found in bromeliad leaf axils. There is no information available on habits of the adults.

SYSTEMATICS. This species is very distinct from all other Orthopodomyia. Adults are told from those of the Signifera group by having 4 narrow longitudinal white lines on the mesonotum, broad flat decumbent scales on the vertex, hindtarsal segment 1 longer than the hindtibia and no pra bristles. The male genitalia differ from the Signifera group in aedeagus shape and dentition, by having 2 simple spiniforms and by having specialized mesal setae instead of specialized tergomesal setae on the sidepiece. The larva of this species is the only Orthopodomyia normally having a single row of comb scales.

The description of the adult of this species is based on specimens from the state of São Paulo, Brazil; specimens from Venezuela agree in almost all details but differ by sometimes having the mesonotal integument more evenly reddish-brown, coxae and trochanters usually without tannish or brownish scales, hindtarsal segment 1 sometimes white speckled and the fan of scales on tergite 1 sometimes all white. In addition, the markings on the proboscis are appar-

ently somewhat different in the Venezuelan material, the female having a long continuous or broken dorsal streak of white scales while the male lacks even a short streak in the same position. The descriptions of the larva and pupa are based on material from Venezuela. I have seen 1 larva, possibly from Brazil, which appears to agree with the Venezuelan specimens (it is in very poor condition) except for having 13 or 16 teeth, instead of 8-10, on each side of the mental plate.

This is apparently a relict species restricted to a few localities in South America. Specimens have been collected only near Caracas, Venezuela and Rio de Janeiro and São Paulo, Brazil. It is evidently at least distantly related to the Signifera group since the adult ornamentation, especially on the thorax, is similar and apomorph in both groups. However, the male genitalia are not at all similar to the Signifera group; the aedeagus is remotely similar to the Madagascan Vernoni group, whereas similarly developed specialized setae on the mesal surface of the sidepiece are found only in albipes and madrensis, members of the Oriental Albipes group. Two spiniforms, the rule in albicosta, are found as anomalies in both the Vernoni and Albipes groups. The pupa is similar to both the Signifera group and the Thomasina section; the development of hairs 3-C, 10-IV and 1-VI and the presence of spicules over the entire paddle surface are notable similarities to fascipes, while hairs 10-12-C and 1-II, III are like those of the Signifera group. The larva is similar to the Signifera group in head shape, in lacking ornamentation on the antenna, in development of hairs 8-P, 1-I-V, VII, and 13-I, in position of hair 2-I, II-VI and in siphon shape and ornamentation, but is similar to phyllozoa in the development of hairs 1, 4-M and 3-T.

DISTRIBUTION. Discontinuous, found only in north-central Venezuela and southeastern Brazil. Material Examined: 75 specimens; 26 ♂, 21 ♀, 13 P, 15 L; 13 individual rearings (7 larval, 5 pupal, 1 incomplete).

BRAZIL. Guanabara: Rio de Janeiro, Muda da Tijuca, 29 June 1953, H. Ferreira, 1 ♀ [IOC].

São Paulo: Boraceia, Feb 1961-Aug 1962, O. P. Forattini, 3 ♂, 4 ♀ [FH]. Cantareira, 16 Apr 1905, 1 ♀ [BMNH]. Cochocirinha, 22 Nov 1904, 1 ♂ [BMNH].

No locality or date: 2 ♀ [BMNH].

VENEZUELA. Aragua: Maracay, 1 Dec 1967, R. I. C. Hansell and J. J. Vera (VZ 83), 3 lp ♂ (83-10, 14, 70), 4 lp ♀ (83-11, 12, 15, 16), 2 p ♂ (83-100, 103), 3 p ♀ (83-17, 107, 108), 1 lp (83-20), 4 L [UCLA]. Ocumare de la Costa, 14 July-18 Aug 1927, M. Nunez Tovar, 14 ♂, 5 ♀, 1 L [USNM], 1 ♂ [BMNH]. Villagos, 9 Aug 1927, M. Nunez Tovar, 1 ♂ [USNM].

No locality: March 1939, P. J. Anduze (51), 1 L [USNM].

NO DATA. 1 ♂, 1 ♀ [USNM]; 1 L [BMNH].

Additional records from the literature. BRAZIL. Rio de Janeiro: Teresopolis, May 1942-Sept 1943, L (Davis, 1944:230).

THOMASINA SECTION

FEMALES. Head: integument of head capsule, clypeus, torus and flagellum brown to dark brown; eyes separated above antennae by a row of white to cream-colored decumbent scales; frontal bristles amber to dark brown; orbital bristles amber to dark brown, usually 2 lateral pairs and 2 or 3 mesal pairs; ocular border absent; vertex and occiput with very numerous narrow curved decumbent scales and very numerous erect scales, decumbent scales broader and denser in front of dorsolateral scales and mesally; dorsolateral scales

brown anteriorly; suborbital bristles pale; clypeus an elongate angular lobe, bare; labium slightly swollen distally, shaft bristles absent, largely brown- or black-scaled with white scales forming a small to moderate-sized dorsal patch 0.7-0.8 distance from the base and a small dorsoapical patch, and with numerous scattered yellow and sometimes white scales; palpus straight, 0.36-0.38 of proboscis, 4-segmented, segment 4 short, segments 2 and 3 largely brown- or black-scaled with numerous scattered yellow and sometimes white scales or largely mixed dark- and light-scaled, apex of segment 3 and segment 4 with silvery-white scales; inner half of torus with small scales except for bare spot mesally and dorsal portion of inner half with short, fine hairs; flagellar segment 1 not noticeably swollen and with a few small scales; dorsal flagellar bristles about 1.5-2.0 length of their segment on proximal segments, ventral bristles absent on segments 1-6 or 7. Thorax: paratergite narrow to moderately broad, bare; posterior dorsocentral bristles usually not in a double row; humeral, lateral prescutal and posterior fossal bristles not numerous enough to completely enclose fossa; fossal bristles absent; mesonotal bristles dark brown, parascutellar and scutellar bristles lighter; mesonotal ornamentation consisting of light and dark scales of various sizes and densities almost completely covering the scutum, as follows: (1) acrostichal scales in a broad band accompanying the acrostichal bristles, not separated by a narrow bare longitudinal area from the dorsocentral scales, (2) anterior prescutellar scales in a more or less crescent-shaped or triangular area anterior to prescutellar space, small and large, yellow or golden or with a few brown posteriorly, (3) dorsocentral scales in a broad band accompanying the dorsocentral bristles, (4) lateral prescutellar scales accompanying the lateral prescutellar bristles and extending caudad to margin of scutellum, large, brown anteriorly, (5) lateral prescutal scales extending from anterior promontory to scutal angle along edge of mesonotum, small, (6) posterior fossal scales extending from scutal angle to dorsocentral scales anterior of scutal suture, small, usually silvery-white and yellow or golden, sometimes brownish, (7) fossal scales in the area enclosed by the dorsocentral, lateral prescutal and posterior fossal scales, small, (8) supraalar scales extending from scutal suture to parascutellum among and mesad of supraalar bristles and with middle extension ventrad to margin of paratergite, scales mostly small mesally and large laterally; parascutellum usually with patch of white to silvery-white scales; lateral and midscutellar lobes each with an extensive patch of large scales which extend over the caudal margin of the scutellum; larger apn, ppn and pra bristles brown, remaining pleural bristles lighter; upper anterior apn bristles 2-5 strongly developed, 2 or 3 weakly to moderately developed, lower apn bristles usually absent; ppl bristles 3-5 strongly developed, 3-6 weakly to moderately developed; pra usually with 1 bristle (0-2); upper stp bristles 1, strongly developed, posterior stp bristles 4-11, moderately to strongly developed, lower stp bristles 2-6, weakly to moderately developed; upper posterior mep bristles 4-10, moderately developed, anterior mep bristles absent; pleural scaling consisting of extensive areas and patches of scales; apn with narrow decumbent scales in an upper anterior patch and narrow and broader decumbent scales in a ventral diagonal row; ppn scaled in posterior-ventral half, scales above narrow and curved, those below broad and flat; psp scales absent; pra with scales on anterior edge and below knob; ppl with broad flat and semierect scales in a dense patch around the bristles; entire pst with a dense covering of broad flat scales; pcx, ssp and hypostigial scales present, broad; upper half of stp completely covered with broad flat scales except for a small bare area below the ssp scales and around the upper stp bristle, lower half with a posterior ventral row

of broad flat and semierect scales; mep with elongate semierect scales anterior to the upper posterior bristles and with broad flat scales in an upper anterior patch continuous with the patch of semierect scales; a few additional large brownish or transparent scales may be found scattered on stp, mep and the meron. Legs: integument of coxae same color as pleuron or upper portion, especially on forecoxa, lighter; forecoxal bristles amber, midcoxal bristles usually brown and hindcoxal bristles usually brownish-amber; forecoxa with broad flat scales on anterior surface and among and behind bristles and in a small patch on lower posterior surface, midcoxa with broad flat scales among and anterior to bristles, hindcoxa with broad flat scales on anterior surface; trochanters with brown, white and sometimes yellowish flat scales on anterior, inner and posterior surfaces; femora with small white or yellowish knee spots; hindtarsal segment 1 longer than hindtibia; hindclaws slightly smaller than fore- and midclaws. Wing: remigial bristles absent; vein R_2 1.85-2.17 length of vein R_{2+3}; vein M_{1+2} 1.58-2.11 length of vein M distad of crossvein m-cu; plical area with light scales; alula scales moderately broad; upper calypter with bristles; scales symmetrical and asymmetrical, moderately to very broad, mostly spreading, some large and cordate; wing largely brown- or black-scaled, with light scales forming small patches and scattered, as follows: (1) costal vein with small basal and humeral light patches, sometimes with small subcostal light patch and with few to numerous scattered light scales, (2) vein Sc with few to numerous scattered light scales and sometimes with small sectoral and subcostal light patches, (3) vein R with normally small basal, humeral and sectoral light patches and sometimes with scattered light scales, (4) vein R_1 with accessory sectoral light patch and few to numerous scattered light scales, (5) veins R_s, R_{4+5}, Cu and 1A usually with basal light patch and vein M sometimes with basal light patch, (6) vein R_{2+3} with light patch opposite base of vein R_{4+5}, (7) vein Cu usually with light patch over furcation, (8) veins M and Cu usually with light patches distad of crossveins, (9) veins R_2 and R_3 usually with an apical light patch, (10) veins R_s, M, Cu and 1A with few to numerous scattered scales. Abdomen: integument of tergites and distal sternites light to dark brown, proximal sternites evenly light to dark brown or with much lighter, even white, areas beneath light scales; laterotergite with numerous silvery-white scales; tergite 1 with entirely or largely dark brown- or black-scaled fan and with numerous scattered light and dark scales; remaining segments with dark scales brown or black, light scales largely white, but some yellowish; tergites largely dark-scaled, tergites II-VII with long straight or curved diagonal light patch starting basolaterally, tergite VIII with basolateral light patch; some or most tergites with few to numerous yellowish scales basally and/or apically; sternite VIII bare mesally, dark-scaled laterally.

FEMALE GENITALIA. Tergite IX with 1 pair of dorsolateral setae.

MALES. Similar to females. Labium: strongly sclerotized and much greater in diameter throughout length than in female; upper portion bare of scales, ventral portion largely dark brown- to black-scaled, white scales in a small dorsoapical patch, yellow or golden scales scattered. Palpus: 0.90-0.93 of proboscis, segment 5 moderately long, segment 3 with moderately developed apical bristles; largely yellowish- and white-scaled with a few brown scales or largely mixed brown- and light-scaled, white or silvery-white scales usually near base of segment 1 and at joints between segments 2-3, 3-4 and 4-5, segment 4 often with fewer light scales than segments 2 and 3, segment 5 silvery-white- and brown-scaled or entirely silvery-white-scaled. Antenna: integument of flagellum brown to dark brown except for lighter areas basad of bristles on shorter segments; segment 13 about 1.5 length of segment 12; torus not as en-

larged as in males of other groups; flagellar segment 1 with small tuft of moderate-sized scales; flagellar bristles not as strongly developed as in males of other groups, bristles about 0.2-0.3 length of entire flagellum on proximal segments and 0.3-0.5 length of segment 13 on that segment. Legs: anterior fore- and midclaws with basal tooth large, visible in pinner specimens, posterior fore- and midclaws simple. Abdomen: tergites often with narrow basal and apical yellow or golden bands; sternites with more extensive light-scaling; sternite VIII dark-scaled with basolateral light patch; sidepiece with light and dark scales.

MALE GENITALIA. Segment VIII: posterior margin of tergite without lobe, straight or slightly rounded mesally. Segment IX: tergite somewhat reduced, without fine setae dorsolaterally. Sidepiece: shape varied, basal mesal lobe with 2 or 3 very strong, short, blunt and flattened (at least distally) apical bristles tergally and with 1-8 long fine bristles sternally; mesal surface membranous for a considerable distance distad of basal mesal lobe; mesal and tergomesal surfaces with or without specialized bristles. Spiniform: 1, with apex flattened, broadened, partially rolled and divided into numerous more or less finger-like lobes. Aedeagus: weakly to moderately sclerotized, varied in form. Proctiger: basolateral sclerotization very strongly developed; paraproct sclerotization with 2-4 apical teeth; cercal setae 2-5.

PUPAE. Known only for fascipes.

LARVAE. Known completely only for fascipes.

BIONOMICS. The immature stages are found in treeholes, bamboo internodes and artificial containers. Females are not known to bite man.

SYSTEMATICS. This section contains the 2 species fascipes and sampaioi. It is well marked in the adult stage and the male genitalia. The immature stages are adequately known only for fascipes.

The affinities of the Thomasina section are no more obvious than those of the other sections and groups of Orthopodomyia. Edwards (1932:108) placed fascipes in his Group A (Orthopodomyia) on the basis of adult ornamentation. However, characteristics of the male genitalia, larva and pupa indicate that fascipes is not closely related to the other species Edwards placed in that group. The male genitalia of the Thomasina section have several unique features, but the spiniform is like that of the Holarctic Signifera and the Madagascan Vernoni groups. The pupa of fascipes resembles the Signifera group while the larva shares characteristics with both the Signifera group and the Central American Folicolae section. Since it is possible that some of the larval and pupal features of fascipes have been acquired by hybridization, caution should be exercised in judging the affinities of the Thomasina section on characteristics of the immature stages until those stages are known for sampaioi.

Males of fascipes and sampaioi have fewer and shorter flagellar bristles and smaller tori than males of other Orthopodomyia. These differences indicate that the auditory function of the antennae is less well developed in these species and imply a difference in mating behavior. The proboscis of the males of these species is also unusual in structure. It is very stout, nearly equal to the forefemur in diameter, and strongly sclerotized. The function of this specialized organ is unknown.

Although fascipes and sampaioi are basically allopatric, their ranges apparently meet or overlap in the Brazilian state of Goias. Larvae which I have seen from the highlands separating the Paraná and Tocantins drainage systems are indistinguishable from fascipes, yet the few adults available from the same area are sampaioi. It is possible that the 2 species meet along the entire arc of highlands which separate the Paraná River system from the north- and eastward draining rivers of South America.

DISTRIBUTION. Central and South America.

KEYS TO SPECIES

Adults

1. Femora, tibiae and tarsal segments 1 with distinct light patches or irregular rings; acrostichal scale band usually with large cream-colored or yellowish scales at anterior promontory and in tufts throughout length of scale band . . . . . 8. fascipes
   Femora, tibiae and tarsal segments 1 without distinct light patches or irregular rings; acrostichal scale band with large white or cream-colored scales in more or less complete row from anterior promontory to caudal end of scale band . . . . . 9. sampaioi

Male Genitalia

1. Sidepiece long conical, not strongly constricted distally; basal mesal lobe with only 1 or 2 long fine bristles sternad of strong blunt bristles; aedeagus with 1 long, strong process on each half sternally . . . 8. fascipes
   Sidepiece broad basally, strongly constricted distally; basal mesal lobe with 6-8 long fine bristles sternad of strong blunt bristles; aedeagus without strong sternal processes, but with a sclerotized tooth along mesal edge of each half sternally . . . . . 9. sampaioi

8. Orthopodomyia fascipes (Coquillett)

Figs. 16, 17

1905. Mansonia fascipes Coquillett, 1905:182-183. *TYPE: lectotype ♀ (338b), pathway to Las Loras, Rio Aranjuez, near Puntarenas, [Puntarenas], Costa Rica, adult found in the crevice of a tree trunk, 13 Sept 1905, F. Knab; selection of Stone and Knight (1957:198) [USNM, 8296].
1910. Mansonia longipalpis Newstead and Thomas, 1910:145-147. *TYPE: lectotype ♀, specimen labeled "Type ♀," Bach's outside house, Manaos, Amazonas, Brazil, adult captured from 4 to 6 PM, 23 Aug 1906; PRESENT SELECTION [BMNH]. Synonymy with fascipes by Howard, Dyar and Knab (1917:882-883).
1935. Orthopodomyia (Orthopodomyia) townsendi Lima, 1935:178. *TYPE: holotype ♀, Rio Tapajos, Boa Vista, Pará, Brazil, 11 Oct 1932, C. H. T. Townsend [IOC, vial 582]. Synonymy with fascipes by Lane (1951:335).
1958. Orthopodomyia bacigalupoi Martinez and Prosen, 1958:17-22. TYPE: holotype ♂, Buenavista (Tacú), Ichilo, Santa Cruz, Bolivia, reared from a larva found in a treehole, Apr 1955, A. Martinez and A. F. Prosen [MEPRA]. NEW SYNONYMY.

Orthopodomyia fascipes of Howard, Dyar and Knab (1917:882-886); Bonne-Wepster and Bonne (1923:127); Dyar (1923a:183); Dyar and Shannon (1924:484); Bonne and Bonne-Wepster (1925:490-494); Dyar (1925:179; 1928:396-397); Lima (1930:255); Shannon (1931:9); Edwards (1932:108; 1934:632); Townsend (1934:497); Komp (1936:66); Antunes (1937:79); Chagas, Castro and Ferreira (1937:385); Kumm and Novis (1938:511); Lane (1939:96-97); Senevet and Abonnenc (1939:588-590); Kumm, Komp and Ruiz (1940:405, 417, 418);

Anduze (1941:12); Floch and Abonnenc (1942:5); Senevet (1946:326); Anduze (1947:359-360); Floch and Abonnenc (1947:7); Roth (1948:168-169); Arnett 1949:235-236); Bates (1949:23); Arnett (1950:107, 109, 111); Bohart (1950: 403, 404); Knight and Mattingly (1950:2); Galindo, Carpenter and Trapido (1951:127); Lane (1951:335); Carpenter and Peyton (1952:676); Leví-Castillo (1952:555); Lane (1953:620-622); Leví-Castillo (1953:37); Galindo, Carpenter and Trapido (1955:159, 161); Trapido, Galindo and Carpenter (1955:535); Stone, Knight and Starcke (1959:123); Aitken (1960:4); Cerqueira (1961:143); Fauran (1961:25); Maciel (1962:489); Cova-Garcia, Sutil and Rausseo (1966a: 53; 1966b:51-52, 117, 143, 371).

Orthopodomyia (Orthopodomyia) fascipes of Lima (1935:176, 177, 178).

Bancroftia fascipes of Dyar and Knab (1910:264).

Mansonia fascipes of Coquillett (1906:25); Dyar and Knab (1906:185); Knab (1907: 153); Aiken (1909:13-14); Theobald (1910b:447, 451); Stone and Knight (1957: 198).

Orthopodomyia bacigalupoi of Stone, Knight and Starcke (1959:123); Prosen, Carcavallo and Martinez (1964:90).

Orthopodomyia townsendi of Lane (1939:97); Knight and Mattingly (1950:2).

Orthopodomyia aff. fascipes of Townsend (1934:497).

Thomasina longipalpis of Newstead and Carter (1911:553-556).

FEMALE. Wing: 4.00 mm. Proboscis: 2.52 mm. Forefemur: 2.37 mm. Abdomen: about 2.7 mm. Head: decumbent scales yellow or yellow and white mesally, yellow, white and brown laterally, erect scales usually yellow mesally, largely brown laterally; posterior dorsolateral, lateral and ventral scales white or yellow-tinged; palpus 0.38 of proboscis; torus and flagellar scales dingy. Thorax: integument of mesonotum reddish brown to dark brown laterally, anterior mesal portion usually lighter and posterior mesal portion usually darker, scutellum lighter than lateral portion of mesonotum, postnotum darker except for lighter lateral edge, pleuron reddish-brown to dark brown dorsoanteriorly, usually lighter ventrally and posteriorly; acrostichal scale band with large cream-colored or yellowish scales at anterior promontory and in tufts throughout length of scale band or rarely in a more or less complete row throughout length of band, brown scales at caudal end, remaining scales large and small, yellow or golden; dorsocentral scale band with small white and golden or brown scales at anterior promontory, large cream-colored or rarely golden scales in a tuft at caudal end or rarely in a row throughout the posterior portion of the scale band, remaining scales large and small, mostly yellow or golden; lateral prescutellar scales silvery-white to yellowish posteriorly; lateral prescutal scales silvery-white anteriorly and sometimes posteriorly, usually yellow or golden posteriorly; fossal scales usually mostly yellow or golden, sometimes brownish; supraalar scales silvery-white anteriorly and in ventral extension, silvery-white or silvery-white and brown among bristles, remainder yellowish; scutellar scales white to silvery-white or yellowish; pleural scales creamy-white to yellow-tinged or dingy. Legs: forecoxal scales white or yellow-tinged, mid- and hindcoxal scales white or yellowish above, brown or brown and yellowish below; forefemur largely brown- or black-scaled except for white and/or yellow scales in a small patch distad of every bristle, in an irregular more or less complete ring about 0.7-0.8 distance from base, and sometimes scattered; midfemur like forefemur except that base of posterior surface has short to long pale streak; hindfemur entirely white- or yellowish-scaled in ventral portion of anterior surface and basal 0.4-0.6 of posterior surface and largely white- or yellowish-scaled in distal portion of anterior

surface, remainder brown-scaled with white and/or yellowish scales in small patches and scattered; tibiae largely brown- to black-scaled, with white, dingy or yellowish scales in numerous irregular patches and rings, at apex, scattered, in streak on ventral and anterior surface of hindtibia and sometimes in streak on posterior surface of foretibia; tarsi largely brown- or black-scaled, segment 1 with white to yellowish scales forming small dorsobasal patch or narrow ring on foretarsus, narrow basal ring on midtarsus, small dorsobasal patch on hindtarsus and irregular patches or speckles on midtarsus and sometimes fore- and hindtarsi; foretarsal segments 1-3 or 4 usually with a few white scales at apex, segment 2 sometimes with small light patches, segment 3 sometimes white- or cream-scaled at base or over entire dorsal surface; midtarsus usually with white to cream-colored scales covering apex of segment 1, ends of segment 2, ends or entire surface of segment 3, entire dorsal surface of segments 4 and 5, sometimes in speckles or small patches on segment 2 and sometimes streaked on ventral surface of segment 1; hindtarsal segment 1 with or without a few light scales at apex, segment 2 with white scales forming narrow to very broad apical ring and sometimes small patches or speckles, segments 3-5 entirely white-scaled or more commonly segment 3 with dark-scaled basal and/or preapical ventral patch or complete ring, segment 4 dark-scaled except at ends and segment 5 dark-scaled ventrally. Wing: light scales in small patches usually white, sometimes dingy yellow, scattered light scales mostly dingy yellow, some white; veins R_{2+3} and M usually with distinct light patch over furcation; vein R_{4+5} rarely with apical light patch. Haltere: integument beige to brown; scales transparent to whitish and/or brownish. Abdomen: sternites II and III with large basolateral light-scaled patches, mesal and apical portions of segments dark-scaled, sternites IV-VII largely dark-scaled, with light scales in basolateral patch or weakly developed basal band.

MALE. Similar to female. Palpus: 0.90 of proboscis. Antenna: flagellar scales dingy.

MALE GENITALIA (fig. 16). Segment VIII: posterior margin of tergite straight or slightly rounded mesally. Sidepiece: cylindrical to long conical; basal mesal lobe with 1 or 2 long fine bristles separated by a gap from more tergal strong blunt bristles; mesal surface without specialized bristles; tergomesal surface usually with 1-7 short, strong, flat and curved bristles distad of basal mesal lobe. Aedeagus: more or less parallel sided; sternal surface with 2 long, strong processes; base with irregular projection between or below ventral parameres. Proctiger: paraproct sclerotization with 2-4 apical teeth; cercal setae 2-4.

PUPA (fig. 16). Abdomen: 4.38 mm. Trumpet: 0.70 mm. Paddle: 0.93 mm. Cephalothorax: moderately pigmented, straw-colored to tan, with upper and posterior portions of wing case, portion of mesonotum caudad of trumpet, and sometimes middorsal ridge darker; integumentary sculpturing strong, reticulate; hairs largely concolorous with integument; all hairs shorter than trumpet; hairs 1, 7-C moderately developed, usually subequal, usually double (1-3b); 2-C short, single or double; 3-C very weakly developed, usually 3, 4b (2-5); 4-C slightly shorter than 1-C, usually double (1-3b); 5-C short, usually 3-5b (2-6); 6-C cephalad of 7-C; 8, 9-C short, usually single or 8-C 2, 3b. Trumpet: brown except for extreme base and apex; distal portion gradually widened from base; pinna large. Metanotum: uniformly moderately pigmented, tan; integumentary sculpturing strong, reticulate; never more than 3 pairs of developed; hair 10-C moderately developed, usually 3-5b (2-6). Abdomen: anterior segments moderately pigmented, tan, posterior segments lightly pigmented, straw-colored; anterior segments darker cephalad and along posterior

edge; anterior segments with strongly developed imbricate integumentary sculpturing, posterior segments with weaker sculpturing; smaller hairs concolorous with integument, larger hairs darker; hair 1-II usually not dendritic, usually 10-13b; 2-II cephalad of 3-II; 5-IV, V reaching to or nearly to alveolus of hair 5 of following segment and normally single; 10-III-VII short, not extending beyond 0.5 distance to apex of following segment; 10-III, IV usually 2, 3b (1-4); 1-VI, VII mesad of hair 2 of corresponding segment; 1-VI short, usually 6, 7b (5-10); 9-VII moderately developed, usually 4-6b, longest branch about 0.3-0.5 distance between alveoli of hairs 9-VII and 9-VIII; 9-VIII strongly developed, usually 7-9b, longest branch not extending beyond end of external buttress of paddle. Terminal Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: lightly pigmented, straw-colored, with midrib darker; longer than broad, usually somewhat angular apically, with distal portions of inner and outer margins straight; external buttress long, slightly convex laterally, with minute spicules; midrib slightly convex mesally; entire surface of paddle covered with small spicules.

LARVA (fig. 17). Head: 1.13 mm. Siphon: 1.38 mm. Anal Saddle: 0.43 mm. Head: slightly broader than long; integument spiculose; largely straw-colored, lighter around imaginal eye, darker posteriorly, collar brown; labrum short; mental plate tan, usually with 10-12 teeth on each side; hair 2-C absent. Antenna: short; integument with small spicules; uniformly straw-colored; hair 1-A moderately developed, 6-8b (4-9). Thorax: epidermal pigment moderately to strongly developed, red to purple in color; spicules not conspicuous; hairs strongly pigmented; hair 9-P strongly developed, long, usually 7-9b; 1-M moderately developed and usually 3-5b in non-hairy form, strongly developed and up to 20b in hairy form; 4-M always single; 1-T long and single in non-hairy form, long and up to 20b in hairy form; 13-T strongly developed, long, usually 5-10b. Abdomen: segment VI with or without dorsal sclerotized plate, segment VII usually with large, often quadrangular, sclerotized plate; hairs strongly pigmented; hair 1-I usually 3-5b and weakly developed in non-hairy form, up to 15b and strongly developed in hairy form; 2-I, II laterad of hair 1 of corresponding segment; 6-I, II multiple, 6-III-VI single or up to 5b in hairy form; 13-I shorter than 10-I; 1-III-V long, single or double in non-hairy form, up to 18b in hairy form; 13-III, IV long, usually single or double in non-hairy form, up to 18b in hairy form; 5-IV, V single and longer than hair 3 of corresponding segment in non-hairy form, up to 10b and longer than or subequal to hair 3 in hairy form; 13-V long, usually 2-4b in non-hairy form, up to 11b in hairy form; 1-VI weakly developed in non-hairy form, strongly developed in hairy form; 2-VI, VII laterad of hair 1 of corresponding segment; 5-VI longer than 3-VI except in some hairy individuals. Segment VIII: large sclerotized plate present; comb scales in 2 rows; anterior comb scales usually 19-26, posterior comb scales usually 9-14; larger anterior comb scales shaped like posterior comb scales, with 1 long apical spine and inconspicuous fringe in basal portion. Siphon: index about 3.5-6.0; uniformly light brown to dark brown except for darker base and lighter apex or with portion distad of alveolus of hair 1-S somewhat darker; integumentary sculpturing strongly developed, imbricate; hair 1-S located about 0.3-0.4 from base of siphon, longest branches extending about 0.6-0.9 distance from alveolus to apex of siphon. Anal Segment: saddle complete, largely light brown to dark brown, base and dorsal surface usually darker; integumentary sculpturing strongly developed, imbricate; sclerotized band or incomplete ring present at base of saddle; hair 2-X usually with 20-28b; ventral brush usually with 8 pairs of hairs, the more strongly developed hairs with about 16-23 branches; gills moderately long, dorsal pair about 1.2-1.6 as long

as ventral pair and 1.0-2.6 length of anal saddle.

BIONOMICS. The immature stages have been collected in treeholes, bamboo stumps, open and closed-top bamboo traps, cement containers and cesspools. Adults have been captured in light traps, flying, and resting on tree-trunks and buildings.

SYSTEMATICS. Fascipes is the dominant, widespread species of Orthopodomyia in tropical America. It has 3 synonyms, longipalpis, townsendi, and bacigalupoi. Newstead and Thomas were apparently unacquainted with Coquillett's 1905 description of fascipes when they described longipalpis in 1910. Howard, Dyar and Knab (1917:882) first synonymized longipalpis with fascipes and their treatment has been accepted by all subsequent authors.

Townsend (1934:497) reported collecting a large series of fascipes and 1 male and 1 female of "Orthopodomyia aff. fascipes (?)" at Boa Vista, Pará, Brazil. The latter differed from fascipes by the following features: (1) the structure of the male genitalia, (2) tergites II-VI of the female pale yellowish, and (3) the fourth hindtarsal segment only slightly longer than the fifth and entirely white-scaled in both sexes. The male was sent to the United Stated National Museum and identified as fascipes by Dr. Alan Stone. I have examined the specimen (labeled "Orthopodomyia n. sp." by Townsend) and agree with Stone. The differences between the male genitalia of fascipes and "Orthopodomyia aff. fascipes (?)" observed by Townsend are artifacts caused by flattening of the slide mounted preparations. The female of "Orthopodomyia aff. fascipes (?)" was sent to Cesar Pinto. It was examined, considered to be distinct from fascipes on the basis of the hindtarsus, and described as townsendi by Lima in 1935. Lane (1951:335) reduced townsendi to synonymy with fascipes and I concur with that interpretation. The hindtarsus of the holotype of townsendi is not unique in ornamentation or structure. Measurement of segments 4 and 5 has shown that their relative lengths are no different than in fascipes. As pointed out by Howard, Dyar and Knab (1917:886), the tarsal ornamentation of fascipes is quite variable and the last 3 segments may be entirely white-scaled on all legs. Since all tergites of the holotype are denuded of scales, it is impossible to verify whether II-VI were pale yellowish as stated by Townsend.

Martinez and Prosen described bacigalupoi in 1958 from material collected in Bolivia. Since the original description of the species does not compare bacigalupoi with any other species of Orthopodomyia, it is not clear why these authors considered their material to represent an undescribed species. I have examined 2 male paratypes and have found that they agree with fascipes in ornamentation and male genitalia and as a consequence I am synonymizing bacigalupoi with fascipes.

Adults of fascipes are easily distinguished from sampaioi by the following: (1) distinct light patches or irregular rings on all femora, tibiae and first tarsal segments, (2) fewer (usually, see below) large outstanding white or cream-colored scales in the acrostichal scale band and the posterior portion of the dorsocentral scale band, and (3) yellower or dingier color of many of the light scales on all parts of the body. In addition to the characters given in the key, the male genitalia of fascipes and sampaioi differ in shape of the aedeagus. The larvae of fascipes and sampaioi differ by at least the features indicated in the description of sampaioi.

The wing and tarsal ornamentation of fascipes are quite variable. While some light patches of the wing are always present and distinct, others may be present and distinct, present but obscured by scattered light scales, or absent. The scattered light scales vary in number and color. As indicated above, the last 3 tarsal segments may be entirely white-scaled on all legs, but more com-

monly at least some of the segments involved have dark scales (see description). The acrostichal scale band of fascipes usually has tufts of large white or cream-colored scales throughout its length, but in a few individuals there is an almost complete row of these scales. In this respect these individuals resemble sampaioi. The same type of variation is found in the posterior portion of the dorsocentral scale band; most individuals have only a single tuft of large light scales directly in front of the brown lateral prescutellar scales, but a few have a long row of large outstanding light scales.

Both non-hairy and hairy forms of the larva are known. Extremely hairy individuals may have hairs which are single in the non-hairy form with as many as 20 branches, and even hairs 6-III-VI may be 3-5 branched. All pupae, including those from extremely hairy larvae, are non-hairy.

Fascipes is sympatric with phyllozoa in the northern portion of its range and some of its characteristics may have been obtained from that species. The spotted legs and yellower coloration of the adult and the multiple hair 1-M and spiculate head capsule and antenna of the larva are characteristics of fascipes found in phyllozoa but not in sampaioi.

Fascipes is apparently sympatric with albicosta in Venezuela and in contact with sampaioi in Brazil. It may be sympatric with kummi in Central America. The pupa of fascipes is near that of both albicosta and kummi and possibly this similarity is due to hybridization with one of these species.

DISTRIBUTION. Nicaragua, south to Bolivia and the Brazilian states of Goias and Minas Gerais. Material Examined: 1163 specimens; 199 ♂, 271 ♀, 1 gynandromorph, 7 isolated ♂ genitalia, 169 P, 516 L; 118 individual rearings (97 larval, 14 pupal, 7 incomplete).

BOLIVIA. Santa Cruz: Ichilo, Buenavista, Tacu, A. Martinez (955), 2 ♂ [MART].

BRAZIL. Amazonas: Manaus, 23 Aug 1906, ♀ lectotype of longipalpis [BMNH]; 4 Nov 1910, H. W. Thomas, 1 ♂ [BMNH]. No locality or date, 2 ♂, 2 ♀ [BMNH].

Bahia: Piraja, 8 Oct 1929, R. C. Shannon, 1 ♂ genitalia, 2 P, 7 L [USNM]; 1 L [USNM]. Rio Coruripe, 13 Jan-June 1931, 2 ♂, 2 ♀ [BMNH]. No locality, June 1931, 3 ♀ [BMNH]. No locality or date, 1 ♂ [BMNH].

Goias: Bomfim, 1 L [USNM]. Inhumas, 2 L [USNM].

Para: Belem, 11 Apr 1941, W. H. W. Komp, 1 ♀ [UCLA]. Curralinho, Rio Pagão (K1184), 4 ♂, 2 ♀, 8 L [USNM], 3 L [BMNH]. Curralinho (K1436), 2 ♂, 1 ♀ [BMNH], 2 ♂ [USNM]. Boa Vista, Rio Tapajos, 11 Oct 1932, C. H. T. Townsend, ♀ holotype of townsendi [IOC]; C. H. T. Townsend, 15 ♂, 8 ♀ [USNM].

Piaui: Teresina, July 1934-Mar 1935, 1 ♂, 1 ♀ [CU]; 7 L [USNM].

COLOMBIA. Boyaca: Muzo, 18 July 1936, E. Osorno, 1 ♀ [CU].

Meta: Restrepo, July-Aug 1935, W. H. W. Komp, 1 ♂, 3 ♀, 1 ♂ genitalia, 3 L [USNM]. Villavicencio, Retiro, Aug 1935 (KO3-6), 3 ♂, 2 ♀ [UCLA].

Valle del Cauca: Buenaventura, 3 Sept 1964, V. H. Lee (COL 3), 3 1p♂ (3-10, 11, 14), 1 1p♀ (3-12), 1 1p (3-17), 1 L [UCLA].

No locality or date: E. Osorno, 1 ♂ [UCLA].

COSTA RICA. Bananito, 1 ♂ [USNM]. Golfito, Punta Rieles, 17 Mar 1943, T. H. G. Aitken, 1 ♀ [USNM]. Osa Peninsula, Rincon, 29 June 1963, C. L. Hogue (CR 130), 1 1p♂ (130-502), 1 1p♀ (130-501), 1 L [UCLA]; same data (CR 131), 5 1p♂ (131-301-303, 306, 307), 2 1p♀ (131-304, 305), 4 L [UCLA]. Puntarenas, Rio Aranjuez, F. Knab (338), ♀ lectotype of fascipes, 6 ♂, 3 ♀ [USNM].

ECUADOR. Napo: Coca, Coca and Napo Rivers, 23 Apr-12 May 1965, L. E. Peña (ECU 8), 1 ♀ [UCLA]. Pompeya Island (Napo River), 19-26 May

1965, L. E. Peña (ECU 19), 1 ♀ [UCLA].

FRENCH GUIANA. Cayenne: Montagne de Mahury, Rorota, 23 Sept 1945, 1 ♂ genitalia [UCLA].

Inini: Saül, 3 Mar 1944, 1 P, 2 L [UCLA].

GUYANA. Essequibo: Essequibo River, Moraballi Creek, 30 Oct 1929, 1 ♀ [BMNH]. Omai, K. S. Wise, 1 ♂, 1 ♀ [USNM]. Rio Mazaruni, 25 June 1936, 1 ♂ [UCLA].

NICARAGUA. Potosi, 22 July 1943, 2 L [UCD], 1 L [USNM].

PANAMA. Bocas del Toro: Almirante, 4 May 1963 (PA 315), 13 L [UCLA].

Canal Zone: Alhajuelo, 4 Mar-27 May 1912, A. Busck, 7 ♂, 1 ♀ [USNM], 1 ♂ [UCLA]. Arraijan, 18 Aug 1950, 5 L [UCLA]. Barro Colorado Island, 23 Dec 1928, C. H. Curran, 1 ♂ genitalia [CU]; Feb 1937, 1 ♂, 1 ♀ [UCLA]. Corozal, 1944, 1 ♂ [UCLA]. Corozal Dam, 28 June 1943 (KO 3-1), 4 ♀ [UCLA]; 22 July 1943, 2 L [USNM]; 12 Jan 1944 (KO 3-4), 1 ♂, 1 ♀ [UCLA], 1 L [USNM]; same data (KO 3-5), 1 ♀ [UCLA]. Empire, 10 June 1922, J. B. Shropshire, 2 ♀ [USNM]. Fort Randolph, 15 Sept 1920, 4 ♂, 12 ♀ [USNM]; 15 Sept 1924, 4 ♂, 2 ♀ [USNM]; 12 Sept, 4 ♀ [USNM]. Fort Sherman, 1918, L.H. Dunn, 2 ♀ [USNM]. France Field, 10 Oct, 3 ♂, 5 ♀ [USNM]. Gamboa, 11-20 Aug 1923, H. G. Dyar and R. C. Shannon (P 43), 4 ♀, 1 P, 1 L [USNM]; 4 Aug 1923, H. G. Dyar and R. C. Shannon (P 44), 1 ♀ [USNM]; 10 July 1945, K. E. Frick (242-1), 9 ♂, 10 ♀, 1 P, 10 L [CAS], 16 L [UCD]; 11 July 1945, Van Doren, 44 ♂, 41 ♀, 80 L [UCLA], 8 L [USNM]. Gatun, 4 June 1934, 2 L [USNM]; 24 Sept 1964 (PA 711), 2 L [UCLA]; same data (PA 712), 3 lp♂ (712-41, 42, 48), 2 lp♀ (712-43, 44), 3 p♀ (712-106-108), 3 ♂, 8 ♀, 11 P, 124 L [UCLA]; 2 L [USNM]. Gatun Lake, Cano Saddle, May 1923, R. C. Shannon, 3 ♂, 1 ♀ [USNM]; 5 Aug 1923, H. G. Dyar and R. C. Shannon, 1 ♂, 1 ♀ [USNM], 1 ♀ [UCLA]. Majagual, 26 Nov 1921, J. B. Shropshire, 7 ♂, 8 ♀ [USNM]; 8 July 1922, J. B. Shropshire, 1 ♀ [USNM]; 20 Jan 1923, J. B. Shropshire, 2 ♂, 1 ♀ [USNM]. Margarita, 20 Jan 1923, J. B. Shropshire, 2 ♀ [USNM]. Mindi, 12 July 1922, J. B. Shropshire, 1 ♀ [USNM]; 7 Aug 1923, H.G. Dyar and R. C. Shannon (P 40), 1 ♀ [USNM]. Mt. Hope, 9 Aug 1923, H. G. Dyar and R. C. Shannon (P 49), 1 ♂ [USNM]. Rio Trinidad, 5 May 1911, A. Busck (648), 1 ♀ [USNM]. Summit, 30 Aug 1941, W. H. W. Komp, 2 P, 1 L [USNM]. Summit Road, 30 Aug 1941 (KO 3-2), 1 ♂, 2 ♀ [UCLA]; 17 Aug 1941, 1 ♀ [UCLA]. Tabernilla, 14 Aug 1908, A. H. Jennings, 1 gynandromorph [USNM]. Toro Point, 11-28 Feb 1922, J. B. Shropshire, 1 ♂, 1 ♀ [USNM]. No locality, 31 Dec 1921, J. B. Shropshire, 1 ♂ [USNM]. No locality or date, H.H. Crowell, 1 ♀ [UCLA]; 1 ♂, 3 ♀ [UCLA]; 1 ♂ genitalia [USNM].

Colon: Portobelo, 5 Dec 1963 (PA 588), 1 lp♀ (588-101), 9 L [UCLA]; 1 ♂ [USNM].

Darien: Jaque, 3-4 July 1945, 2 ♂, 2 ♀ [UCLA]; 18 Dec 1963 (PA 610), 1 lp♂ (610-108), 3 lp♀ (610-102, 105, 107), 1 L [UCLA]. Jaque River, 3 July 1945, W. H. W. Komp, 1 lp (37) [USNM]; 19 Dec 1963 (PA 612), 1 lp♀ (612-120), 10 L [UCLA]. La Palma, 29 Nov 1966, O. G. W. Berlin (PA 960), 1 lp♀ (960-30) [UCLA]; 10 Dec 1966, O. G. W. Berlin and M. Mena (PA 997), 1 lp (997-10) [UCLA]. Tuira River, 1 Apr 1958 (GG 50), 1 ♂, 1 ♀ [UCLA].

Panama: Pacora, 15 Dec 1949, S. J. Carpenter, 1 ♂, 4 ♀ [CAS]. Pacora, La Lumbadora (Cerro Azul), 9 Feb 1963 (PA 79), 2 lp♂ (79-112, 114), 3 lp♀ (79-104, 110, 113), 4 p♂ (79-101, 108, 109, 111), 5 p♀ (79-102, 103, 105-107), 1 P, 5 L [UCLA]; 13 Feb 1963 (PA 88), 2 L [UCLA]; 18 Feb 1963 (PA 109), 2 lp♂ (109-105, 106), 4 lp♀ (109-101, 110-112), 1 p♂ (109-107), 1 p♀ (109-109), 4 lp (109-102-104, 113), 1 ♂, 11 L [UCLA].

No locality or date: S.J. Carpenter, 1 ♀ [UCLA]; A.H. Jennings, 2 L [USNM]; A. H. Jennings (390), 1 lp♂ (390-16), 3 lp♀ (390-1, 9, 14), 2 ♀, 1 L [USNM]; A. H. Jennings (420), 2 ♂, 1 ♀, 1 L [USNM].

PERU. Loreto: Iquitos, Mar-Apr 1931, R.C. Shannon, 1 ♂, 1 ♀ [USNM].

TRINIDAD. Arima, 6-10 Sept 1964, A. Guerra (TR 677), 3 L [UCLA]. Mayaro, 5-16 Dec 1963 (TR 1), 4 1p♂ (1-101-104) [UCLA]; 6-16 Dec 1963 (TR 2), 4 1p♂ (2-102, 104, 110, 111), 2 1p♀ (2-103, 105) [UCLA]; 3-23 Dec 1963 (TR 6), 4 1p♂ (6-101, 103-105), 1 1p♀ (6-102), 6 ♂, 5 ♀, 11 P, 11 L [UCLA]; 3-30 Dec 1963 (TR 8), 7 1p♂ (8-105, 108-110, 113, 114, 117), 11 1p♀ (8-101, 104, 106, 107, 111, 112, 115, 116, 118-120) [UCLA]; 4-30 Dec 1963 (TR 9), 4 1p♂ (9-104, 105, 109, 129), 4 1p♀ (9-106-108, 128), 7 ♂, 11 ♀, 18 P, 17 L [UCLA]; 5-30 Dec 1963 (TR 10), 2 ♂, 1 ♀, 3 P, 2 L [UCLA]; 7-30 Dec 1963 (TR 11), 3 1p♂ (11-110, 112, 117), 5 1p♀ (11-111, 113-116), 9 L [UCLA]; 4-13 Jan 1964 (TR 17), 1 1p♂ (17-119), 2 1p♀ (17-109, 110) [UCLA]; 1-13 Jan 1964 (TR 41), 1 1p♀ (41-114) [UCLA]; 6-9 Dec 1963 (TR 62), 1 1p♂ (62-126), 2 1p♀ (62-127, 128) [UCLA]; same data (TR 663), 4 ♂, 4 ♀ [UCLA]. Saint Anns, 6-7 June 1938, E. Deverteuil, 2 ♂, 2 ♀ [BMNH]. Sangre Grande, 10 Sept-1 Oct 1964, A. Guerra (TR 745), 1 ♂ [UCLA]; 17 Dec 1964, F. Powdhar (TR 882), 6 L [UCLA]. Sangre Grande, Tamana Mt., 2-19 June 1964, A. Guerra (TR 500), 1 1p♀ (500-131) [UCLA]. Tabaquite, 1914, J.R. Dickson, 1 ♂, 1 ♀, 1 L [BMNH]. No locality or date, F.W. Urich, 4 ♂, 2 ♀, 2 L [USNM].

VENEZUELA. Aragua: Turiamo, 12 Sept 1944, 1 ♂ [UCLA].

_____: Guaruries, Sept 1943, P.J. Anduze, 1 ♂ [USNM].

NO LOCALITY. 17 May 1943, T.H.G. Aitken, 1 ♂, 1 ♀ [USNM]; 18 Jan 1935, 1 L [USNM]; 18 Mar 1935, 3 ♂, 3 ♀ [UCLA].

NO DATA. (39C), 6 L [USNM]; (575), 2 ♂ [UCLA]; (182-4), 1 L [CAS]; (745), 1 ♂ genitalia [UCLA]; 2 ♂ (11464, 12690), 2 ♀ (7587, 12593) [UCLA]; 5 ♀ [UCLA]; 1 ♂ genitalia [USNM].

Additional records from the literature. BRAZIL. Maranhao: São Luis (Cerqueira, 1961:143).

Minas Gerais: Belo Horizonte, Coronel Fabriciano, Januaria and Monte Carmelo (Maciel, 1962:489). The material from some of these localities may possibly be sampaioi.

ECUADOR. Guayas: (Leví-Castillo, 1953:37).

Los Rios: (Leví-Castillo, 1953:37).

PANAMA. Chiriqui: L (Galindo, Carpenter and Trapido, 1955:159, 161).

Cocle: Tucue, A (Trapido, Galindo and Carpenter, 1955:535).

SURINAM. Brokopondo: Kabel Station, L (Bonne and Bonne-Wepster, 1925: 490-494).

Marowijne: Moengo, L (Bonne and Bonne-Wepster, 1925:490-494).

VENEZUELA. Merida: Tovar (Anduze, 1947:359-360).

Miranda: (Cova-Garcia, Sutil and Rausseo, 1966b:51-52, 117, 143, 371).

Tachira: Ayacucho and Uribante (Anduze, 1947:359-360).

9. Orthopodomyia sampaioi Lima

Fig. 18

1935. Orthopodomyia (Orthopodomyia) sampaio Lima, 1935:176-178. *TYPE: lectotype ♂ (1861) with genitalia in capillary tube, Tijuca, Rio de Janeiro, Brazil, adult (?) found in a treehole, June 1934, P.C. Sampaio; PRESENT SELECTION [IOC, vial 941]. Stated to be probably only a subspecies of fascipes by Lane (1953:623).

Orthopodomyia sampaioi of Lane (1939:97); Knight and Mattingly (1950:2); Lane (1953:623); Stone, Knight and Starcke (1959:124).

Orthopodomyia fascipes of Pinto (1932:295-296); Lane (1936:131; 1937:128).

FEMALE. Wing: 4.63 mm. Proboscis: 3.11 mm. Forefemur: 3.03 mm. Abdomen: about 3.1 mm. Head: decumbent scales white and yellowish mesally, mostly white and yellowish laterally, erect scales yellowish mesally, largely light to dark brown laterally; posterior dorsolateral, lateral and ventral scales white; palpus 0.36 of proboscis; torus and flagellar scales white. Thorax: integument of mesonotum reddish-brown to chestnut-brown with prescutal and lower supraalar areas and prescutellar space darker, scutellum lighter than mesonotum, postnotum reddish-brown to dark brown except for lighter lateral edge, pleuron reddish-brown to dark brown dorsoanteriorly, lighter ventrally and posteriorly; acrostichal scale band with large white or cream-colored scales in more or less complete row throughout length of band, large brown scales at caudal end, remaining scales large and small, yellow; dorsocentral scale band with small white and brown scales at anterior promontory, large white or cream-colored scales in a more or less complete row from level of posterior fossal area to caudal end, remaining scales large and small, mostly yellow; lateral prescutellar scales silvery-white posteriorly; lateral prescutal scales brownish and/or whitish anteriorly and posteriorly or yellowish posteriorly; fossal scales silvery-white and brownish, sometimes some yellowish; supraalar scales silvery-white anteriorly, in ventral projection and among bristles, remainder white and yellowish or brownish; scutellar scales white to silvery-white; pleural scales creamy-white. Legs: forecoxal scales all white or a few brown, midcoxal scales white above, brown and white below, hindcoxal scales white above, brown or brown and white below; forefemur largely brown-scaled with white and yellowish scales in an irregular more or less complete ring about 0.7-0.8 distance from base and scattered, the scattered light scales sparse basally, more numerous basad of ring; midfemur like forefemur except that posterior surface has pale basal streak; hindfemur with anterior surface largely white- to cream-scaled, brown scales in basal streak, irregular dorsal patches and scattered, posterior surface entirely white- to cream-scaled in basal 0.5-0.6, remainder largely light brown-scaled with scattered cream or yellowish scales; tibiae largely brown-scaled, cream scales at apex, scattered, and concentrated on posterior surface of fore- and midtibiae and ventral and anterior surfaces of hindtibia; tarsi largely brown- or black-scaled, segment 1 with white to cream-colored scales forming narrow basal ring on fore- and midtarsi, small dorsal basal patch on hindtarsus and usually scattered; foretarsal segment 1 dark-scaled at apex and segments 2-5 entirely dark-scaled or white scales present at apex of segments 1-4 and base of segment 3; midtarsus with white to cream-colored scales covering apex of segment 1, ends of segment 2, ends or entire surface of segment 3 and all of segments 4 and 5; hindtarsal segment 1 with or without a very few white scales at apex, segment 2 with narrow to moderately broad white-scaled apical ring, segment 3 entirely white-scaled, segment 4 with white scales in dorsal patch or narrow ring at ends, segment 5 white-scaled dorsally. Wing: light scales almost entirely white, rarely some scattered ones dingy; veins R_{2+3} and M without distinct patch over furcation; vein R_{4+5} with an apical light patch. Haltere: integument of stem whitish, knob beige; scales on stem white, those on knob transparent to brown. Abdomen: sternites II-VII dark-scaled with large basolateral light-scaled patch and sometimes poorly developed light basal band, light patch on distal segments apparently larger than in fascipes.

MALE. Similar to female. Palpus: 0.93 of proboscis. Antenna: flagellar scales white.

MALE GENITALIA (fig. 18). Segment VIII: posterior margin of tergite slightly rounded mesally. Sidepiece: very broad basally, sharply constricted distad of basal mesal lobe; basal mesal lobe with 6-8 long fine bristles which are not separated from strong blunt bristles by a gap; mesal and tergal surfaces near apex of sidepiece with patch of specialized bristles, individual bristles directed tergally or tergomesally and curved mesally at apex; tergomesal surface distad of basal mesal lobe with poorly differentiated short, flat curved bristles. Aedeagus: broader distad of middle; each half of sternal surface with sclerotized tooth along mesal edge; without projection between or below ventral parameres. Proctiger: paraproct sclerotization with 2 apical teeth; cercal setae 2-5.

PUPA. Unknown.

LARVA. Lima (1935:178) states that the larva resembles fascipes. I have examined 2 fourth instar larvae from Tijuca, Rio de Janeiro, Brazil, which are presumably this species. Although both these larvae are in very poor condition and cannot be critically studied, it has been noted that they differ from fascipes as follows: (1) head capsule and antenna without spicules, (2) hair 1-A weakly developed and only 2-4b, (3) hair 1-M single, (4) 1 branch of hair 2-X much elongated, and (5) ventral brush with only 7 pairs of hairs.

BIONOMICS. Larvae have been collected in treeholes. Nothing is known of the habits of the adults.

SYSTEMATICS. Sampaioi is evidently a relict species restricted to southern Brazil. The characteristics by which the adults and male genitalia differ from fascipes are indicated in the keys and discussed in the systematics section of fascipes.

The larva of sampaioi is so incompletely known that it has not been included in the keys. The specimens examined differ from fascipes by the features indicated in the description. The affinities of the Thomasina section may become more obvious when the immature stages of sampaioi are completely known.

DISTRIBUTION. Goias, south to Paraná and Guanabara. Material Examined: 13 specimens; 5 ♂, 5 ♀, 3 L.

BRAZIL. Goias: Anapolis, Mar 1936, 1 ♂ [USNM].

Guanabara: Rio de Janeiro, Tijuca, June 1934, P.C. Sampaio, ♂ lectotype [IOC]; 3 L [USNM].

Paraná: Londrina, 2 ♂ [USNM], 1 ♀ [BMNH].

São Paulo: Avare, 1 ♂ [CU]. Serra do Cubatão, Dec 1929, O. Castro, 1 ♀ [IOC].

NO DATA. (12226), 2 ♀ [UCLA]; 1 ♀ (12690) [UCLA].

Additional records from the literature. BRAZIL: Minas Gerais: vide fascipes.

FOLICOLAE SECTION

10. Orthopodomyia phyllozoa (Dyar and Knab)

Figs. 2, 19, 20

1907. Mansonia phyllozoa Dyar and Knab, 1907:199. *TYPE: holotype ♂ (177.2), native village near Tabernilla, Canal Zone, Panama, reared from a larva found in a bromeliad leaf axil, 25 June 1907, A. Busck [USNM, 10864].

Orthopodomyia phyllozoa of Howard, Dyar and Knab (1917:879-882); Dyar (1923a: 183); Bonne and Bonne-Wepster (1925:489); Dyar (1925:179; 1928:395-396);

Edwards (1932:107, 108; 1939:121); Lane (1939:97); Kumm, Komp and Ruiz (1940:405, 417, 418); Anduze (1941:12; 1947:360); Knight and Mattingly (1950: 1); Lane (1953:626-628); Stone, Knight and Starcke (1959:123); Cova-Garcia, Sutil and Rausseo (1966a:53; 1966b:52, 143, 371).
Bancroftia phyllozoa of Picado (1913:353).
Mansonia phyllozoa of Busck (1908:60); Theobald (1910b:446, 619).

FEMALE (fig. 2). Wing: 2.59 mm. Proboscis: 1.32 mm. Forefemur: 1.62 mm. Abdomen: about 2.0 mm. Head: integument of head capsule, clypeus and flagellum light to dark brown, torus brown to dark brown dorsally, lighter brown or yellowish ventrally; eyes separated above antennae by a row of silvery-white decumbent scales; frontal bristles amber to brown; orbital bristles amber to brown, 1 or 2 lateral pairs and 1 or 2 mesal pairs; ocular border absent; vertex and occiput with numerous narrow curved decumbent scales and numerous erect scales, decumbent scales broader and denser along edge of eye, yellow laterally, silvery-white mesally, remaining decumbent scales mostly bright yellow or yellow and silvery-white, sometimes a few brown or cream, erect scales mostly yellow, but usually a few tan or brown; dorsolateral scales brown anteriorly, yellow posteriorly; suborbital bristles pale; lateral and ventral scales mostly yellow; clypeus more or less triangular, bare; labium considerably swollen apically, shaft bristles absent, mostly brown-scaled, usually with white and/or yellow scales forming dorsal patch 0.67-0.75 distance from base and dorsal preapical patch and with few to very numerous scattered yellow scales; palpus usually coiled in dried specimens, 0.54 of proboscis, 4-segmented, segment 4 short, largely brown-scaled, yellow scales usually in patch over joint between segments 2-3 and scattered throughout entire length, silvery-white scales covering segment 4; torus with mesal patch of silvery flat or hair-like scales; flagellar segment 1 swollen and with tuft of brown scales; dorsal flagellar bristles about 2.5-3.0 length of their segment on proximal segments, ventral bristles absent on segment 1 and usually on segments 2-3 or 4. Thorax: integument of mesonotum and pleuron light rusty brown to dark brown except for lighter area on mesonotum near prescutal scales, scutellum lighter, postnotum usually darker; paratergite narrow, bare; posterior dorsocentral bristles usually not in double row; humeral, lateral prescutal and posterior fossal bristles not numerous enough to completely enclose fossa; fossal bristles absent; mesonotal bristles dark brown, parascutellar and scutellar bristles amber; mesonotal ornamentation consisting of mostly brown and silvery-white scales in longitudinal bands; brown scales arranged as follows: (1) in band accompanying the acrostichal bristles, and (2) in band accompanying the dorsocentral bristles; larger silvery-white or rarely yellow-tinged scales arranged as follows: (1) acrostichal scales in small patch on anterior promontory, (2) lateral prescutal scales extending from anterior promontory to scutal angle along edge of mesonotum, (3) posterior fossal scales extending from scutal angle to dorsocentral scales anterior of scutal angle, (4) lateral prescutellar scales larger than other mesonotal scales, accompanying lateral prescutellar bristles and extending caudad to margin of scutellum, and (5) supraalar scales extending from caudad of scutal suture to cephalad of parascutellum mesad of supraalar bristles; additional silvery-white scales sometimes laterad of posterior dorsocentral brown scales; golden supraalar scales present mesad of paratergite; parascutellum normally without scales; lateral and midscutellar lobes each with an extensive patch of large silvery-white scales which extend over the caudal margin of the scutellum; ppn bristles brown, remaining pleural bristles amber; upper anterior apn bristles 3-6 strongly developed,

2-5 weakly to moderately developed, lower apn bristles 1 or 2, weakly to strongly developed; ppl bristles 3 or 4 strongly developed, 1-3 weakly to moderately developed; pra usually with 1 bristle (0-2); upper stp bristles 1, strongly developed, posterior stp bristles 2-4, moderately to strongly developed, lower stp bristles 3 or 4, weakly to strongly developed; upper posterior mep bristles 1-4, moderately developed, anterior mep bristles absent; pleural scaling consisting of patches and lines of curved and flat silvery-white, yellowish and yellow scales; apn with yellowish scales in a diagonal row between upper and lower bristles; ppn with silvery-white to yellowish scales along posterior margin below bristles; psp and pra without scales; ppl with yellowish to yellow scales in patch around bristles; pst with yellowish scales only near ppl; pcx, ssp and hypostigial scales absent; stp with 2 horizontal rows of scales, 1 above and 1 below upper stp bristle, upper row with silvery-white to yellowish scales, lower row with yellowish to yellow scales, the 2 rows joined anterior to bristle by vertical row of yellowish to yellow scales, and upper row with vertical extension of silvery-white to yellow scales to pra, lower portion of stp with semierect and flat scales in vertical area along posterior margin; mep with semierect silvery-white scales in an upper patch anterior to mep bristles and semierect and flat silvery-white to yellowish scales in a small patch near anterior edge opposite lower stp horizontal scale row; a few additional large brownish or transparent scales may be scattered over the pleuron. Legs: integument of coxae same color as pleuron; coxal bristles amber and/or brown; forecoxa with broad flat yellowish scales above and behind uppermost bristles and with smaller brown or brown and yellow scales on anterior surface and among bristles, mid- and hindcoxae with broad flat scales on anterior surface, those on midcoxa yellow above, brown below, those on hindcoxa brown; trochanters with brown or brown and yellowish flat scales on anterior, inner and posterior surfaces; femora with mixed brown and yellow scales except for small white knee spots, largely brown-scaled preapical ring on fore- and midfemora and yellowish-scaling in basal 0.3-0.6 of posterior surface of mid- and hindfemora, the scattered yellow scales concentrated in basal portion of anterior surface of forefemur and in basal and apical portions of anterior surface of hindfemur; tibiae brown- or black-scaled with numerous irregular yellowish-scaled rings or patches and white- or yellowish-scaling at apex; hindtarsal segment 1 longer than hindtibia; tarsi largely brown- or black-scaled, segment 1 with cream-colored or yellowish scales forming narrow basal ring on fore- and midtarsi, dorsal basal patch on hindtarsus and sometimes poorly developed irregular rings or patches on all tarsi; foretarsal segment 1 dark-scaled at apex, segments 2-5 entirely dark-scaled or with white or cream-colored scales in dorsal patch at base of segment 2; midtarsus with white or cream-colored scales forming complete or incomplete narrow ring or small dorsal patch at apex of segment 1, complete narrow ring at base of segment 2, small dorsal patch or incomplete ring at base of segment 3, and sometimes dorsal patch over segments 4 and 5; hindtarsus with white or cream-colored scales forming broad ring at apex of segment 1 and base of segments 2 and 3, narrower complete or incomplete ring or dorsal patch at apex of segment 2, narrow incomplete ring or dorsal patch at apex of segment 3, dorsal basal patch on segment 4 and basal or more extensive dorsal patch on segment 5; hindclaws smaller than fore- and midclaws. Wing: remigial bristles absent; vein R_2 1.36 length of vein R_{2+3}; vein M_{1+2} 1.18 length of vein M distad of crossvein m-cu; plical area with or without a few dark scales; alula scales moderately broad; upper calypter with scale-like bristles; scales symmetrical, moderately broad, mostly spreading; wing largely brown- or black-scaled with white to yellowish scales in quite variable

patches, lines and speckles, as follows: (1) costal vein with basal, accessory sectoral, subcostal and apical light patches and usually with presectoral and accessory subcostal light patches, (2) vein Sc with accessory sectoral and subcostal light patches and usually with presectoral light patch, (3) vein R light-scaled from base to or beyond level of distal end of presectoral costal patch, (4) vein R_1 with accessory sectoral, subcostal and apical light patches and usually with accessory subcostal light patch, (5) veins R_S and R_{4+5} with light patch at base, (6) vein R_{2+3} with light patch opposite base of vein R_{4+5}, (7) veins R_{2+3}, M and sometimes Cu with light patch over furcation, (8) veins M and Cu with light patches distad of crossveins, (9) some or all of veins R_2, R_3, R_{4+5}, M_{1+2}, M_{3+4}, Cu_2 and 1A with small apical light patch, (10) veins M and Cu usually with scattered light scales in basal portion, sometimes with distinct basal light patch, (11) vein 1A usually with scattered light scales, sometimes with distinct central light patch, and (12) vein Cu_2 sometimes with scattered light scales or central or more extensive light patch. Haltere: integument beige, scales whitish to yellowish. Abdomen: integument of tergites and distal sternites brown to dark brown, proximal sternites lighter, even transparent; laterotergite bare; tergite 1 with dark brown or dark brown and yellow scales in fan and sometimes with a few other scattered scales; remaining segments with dark scales brown or black, light scales whitish to yellowish; tergites largely dark-scaled, segments II-VI or VII with light scales in a more or less diagonal patch starting basolaterally, segment VIII or segments VII and VIII with light scales in smaller basolateral patch; proximal tergites sometimes with a few dorsobasal or other light scales; sternites largely dark-scaled, segments II and III with large basolateral or lateral light patch, segments IV-VIII with light scales in smaller basolateral patch or poorly developed basal band.

FEMALE GENITALIA. Tergite IX without dorsolateral setae.

MALE. Similar to female. Labium: not more strongly swollen than in females, yellow to white scales usually in narrow ring distad of level of distal end of palpal segment 2, in dorsal preapical patch and scattered. Palpus: 0.88 of proboscis, segment 5 very short, segment 3 normally without strong apical bristles; largely brown-scaled, yellow scales at joint between segments 1-2 and 2-3 and scattered on segments 2 and 3, silvery-white scales at joint between segments 3-4 and covering all of segment 5. Antenna: integument of flagellum dark brown except for lighter rings basad of bristles on shorter segments; torus greatly enlarged; flagellum strongly plumose; segment 13 about 1.5 length of segment 12; flagellar segment 1 with tuft of brown scales; bristles of flagellar whorls about 0.4-0.6 length of entire flagellum on proximal segments, about 0.4-0.8 length of segment 13 on that segment. Legs: anterior fore- and midclaws with basal tooth too small to be seen on pinned specimens, posterior fore- and midclaws simple. Abdomen: light scaling on tergites sometimes more extensive than in female; sidepiece with light and dark scales.

MALE GENITALIA (fig. 19). Segment VIII: posterior margin of tergite with distinct lobe; lobe as long as broad to distinctly longer than broad, sides parallel, diverging or converging apically, apex truncate or more often emarginate. Segment IX: tergite usually without setae dorsolaterally, sometimes with 1 fine seta on each side. Sidepiece: long conical; basal mesal lobe with 3-5 strong terete apical bristles which are slightly bent mesally at apex and usually with 1 or 2 finer apical bristles; mesal surface membranous distad of basal mesal lobe; without specialized mesal bristles but usually with 1-3 specialized, curved tergomesal bristles distad of basal mesal lobe. Spiniform: 1, apex slightly flattened. Aedeagus: moderately sclerotized; apex with 2-7 large teeth on each side; base with short projection between ventral parameres and with 2 strongly

sclerotized, tergally-directed processes; sternal surface strongly sclerotized along mesal edge, without teeth. Proctiger: paraproct sclerotization with 1-3 apical teeth; cercal setae 1-3.

PUPA (fig. 19). Abdomen: 3.11 mm. Trumpet: 0.46 mm. Paddle: 0.59 mm. Cephalothorax: uniformly very lightly pigmented or with upper posterior portion of wing case and portion of mesonotum caudad of trumpet slightly darker; integumentary sculpturing weak, reticulate; smaller hairs concolorous with integument, larger hairs darker; hairs 1, 2, 4, 7-C moderately and more or less equally developed, usually 2-4b (2-5); 3-C weakly developed, 2-4b, and much smaller than 1 or 2-C; 5-C usually 3, 4b (2-5), very strongly developed, at least 2 times length of 4-C; 8, 9-C moderately developed, usually single; 6-C cephalad of 7-C. Trumpet: uniformly lightly pigmented and only slightly darker than darkest portion of cephalothorax; distal portion gradually widened from base, rather narrow; pinna small. Metanotum: lightly pigmented with haltere cases lighter; integumentary sculpturing weak to moderate, reticulate; never more than 3 pairs of hairs developed. Abdomen: very lightly pigmented, with distal segments lighter; anterior portion of proximal segments darker; anterior segments with moderately developed imbricate integumentary sculpturing, posterior segments with weaker sculpturing; smaller hairs concolorous with integument, larger ones darker; hair 1-II dendritic, usually with about 15-30 (9-41) ultimate branches; 2-II cephalad of 3-II; 5-IV-VI usually 3b (2-4) and with 1 branch very long, reaching nearly to or extending beyond alveolus of hair 4 of second following segment; 1-VI, VII laterad of hair 2 of corresponding segment; 9-VII weakly to moderately developed, usually 3-6b, longest branch extending about 0.4-0.7 distance between alveoli of hairs 9-VII and 9-VIII; 9-VIII strongly developed, usually 9-13b, longest branches reaching nearly to or beyond apex of paddle. Terminal Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: very lightly pigmented, with midrib somewhat darker; longer than broad, more or less elliptical in outline, never angulate; external buttress strongly convex laterally, with minute marginal spicules; midrib usually almost straight; entire surface of paddle covered with minute spicules.

LARVA (fig. 20). Head: 0.79 mm. Siphon: 1.06 mm. Anal Saddle: 0.30 mm. Head: distinctly broader than long; integument with minute spicules in posterior dorsal portion; largely straw-colored, slightly lighter around imaginal eye, darker caudally, collar brown; labium moderately long; mental plate brown, usually with 8, 9 (7-10) teeth on each side; hair 2-C absent. Antenna: moderately long; integument with small spicules; uniformly straw-colored. Thorax: epidermal pigment present, weakly to moderately developed, purple in color; spicules not conspicuous; hairs moderately pigmented; hair 8-P weakly developed; 1-M, T moderately developed, multiple; 4-M always double or multiple. Abdomen: segment VI without sclerotized plate, segment VII with large quadrangular sclerotized plate; hairs moderately pigmented; hairs 1-I-IV moderately developed, multiple; 2-I, II mesad of hair 1 of corresponding segment; 6-I, II multiple, 6-III-VI single; 13-I longer than 10-I; 5-II-VI moderately developed, usually 3b; 13-III-V moderately developed, multiple; 2-VI, VII mesad of hair 1 of corresponding segment. Segment VIII: large sclerotized plate present; comb scales in 2 rows; anterior comb scales usually 16-24 (12-26), posterior comb scales usually 2-4 (1-6); anterior and posterior comb scales of the same size and shape, with a medium-sized apical spine flanked on either side by 1-3 smaller spines which merge basally with fringe. Siphon: base brown, remainder uniformly straw-colored or apical portion slightly darker; index 4.5-9.0; hair 1-S located 0.35-0.50 from base of siphon, longest

branches extending 0.55-0.90 distance from alveolus to apex of siphon; moderately to strongly developed imbricate integumentary sculpturing present basally. Anal Segment: saddle complete, base and apical portion usually tan, remainder uniformly light straw-colored or with darker areas dorsally; sclerotized band or incomplete ring present at base of saddle; integumentary sculpturing weaker than on siphon; ventral brush usually with 7 pairs of hairs, the more caudal hairs usually with about 10-12 branches; gills moderately to very long, dorsal pair about 0.95-1.5 as long as ventral pair, 1.5-5.5 length of anal saddle and 0.4-2.1 length of siphon.

BIONOMICS. The immature stages are found in the leaf axils of bromeliads and the spathes of heliconias. Nothing is known of the habits of the adults.

SYSTEMATICS. Phyllozoa is so distinct from other Orthopodomyia in all stages that it is worthy of recognition as a separate section. The most distinctive features are the ornamentation of the adult thorax, the shape and dentition of the aedeagus, the development of pupal hairs 1-7-C and 9-VII, VIII and shape of the larval head and comb scales.

Larvae of phyllozoa collected in heliconias differ quite strikingly from those collected in bromeliads by their shorter siphons and longer anal gills. In the heliconia form the siphon index varies from 4.5-5.5 and the gills are usually 1.3 to 2.1 times the length of the siphon; in the bromeliad form the siphon index varies from 6.0 to 9.0 and the gills are 0.4-0.6 the length of the siphon. The only apparent difference in the chaetotaxy of the 2 forms is that hair 8-P usually has a greater number of branches in the larvae from heliconias. Pupae from the 2 habitats are very similar, but those from heliconias differ by slightly longer paddles and fewer branches in hair 5-C. Adults bred from the 2 larval forms are apparently indistinguishable and there are no differences in the male genitalia. For the present I am considering the heliconia and bromeliad forms to be conspecific. It is possible, however, that study of living material may show that 2 distinct species are involved.

Although extremely hairy forms of pupae and larvae are unknown, pupae with hairs 1, 3, 7, 10-12-C, 6, 7-I and 6-II longer and stronger than customary and larvae with the branches of the moderately developed multiple hairs of the thorax and abdomen stouter and more numerous than usual have been seen in collections from both heliconias and bromeliads.

Adults of phyllozoa exhibit considerable variation, particularly in ornamentation of the torus, proboscis, wing and first tarsal segments. The torus may have a conspicuous patch of silvery-white broad scales or an inconspicuous patch of silvery-white hair-like scales. The proboscis usually has 2 dorsal light patches and scattered light scales, but either or both patches may be absent or the scattered light scales may be so numerous as to obscure them. The wing may or may not have presectoral and accessory subcostal light patches and the light-scaling on veins M, Cu and 1A is quite variable in extent. The first tarsal segments vary from being nearly entirely dark-scaled to having conspicuous light patches or rings.

Phyllozoa appears to be an ancient species which has escaped being replaced by more recent ones by occupying different habitats. It combines characteristics found in other groups of Orthopodomyia and cannot be definitely allied with any. Edwards (1932:107; 1939:121) placed phyllozoa in Group A (Orthopodomyia) because of its wing and leg ornamentation but Knight and Mattingly (1950:1) moved it to Group B (Bancroftia) on the basis of the male genitalia and mesonotal ornamentation. Consideration of the immature stages does indicate a distant kinship with the Oriental Albipes group; in particular, the larval chaetotaxy of wilsoni and phyllozoa is similar.

Phyllozoa is sympatric with 3 other species of Orthopodomyia: albicosta, fascipes and kummi. As discussed more fully in the systematics section of fascipes, some of the characteristics of that species may have been acquired from phyllozoa by introgression.

DISTRIBUTION. Nicaragua and north-central Venezuela, south to central Colombia. Material Examined: 944 specimens; 89 ♂, 130 ♀, 1 isolated ♂ genitalia, 187 P, 537 L; 181 individual rearings (103 larval, 53 pupal, 25 incomplete).

COLOMBIA. Meta: Restrepo, 1935, E. Osorno, 1 ♀ [CU].

Valle del Cauca: Buenaventura, Rio Raposo, 20 Oct 1964, V. H. Lee (COL 11), 1 lp♂ (11-20), 1 lp♀ (11-29), 1 ♀, 1 P, 3 L [UCLA]; 8 Dec 1964, V. H. Lee (COL 33), 3 lp♂ (33-10, 14, 15), 1 p♂ (33-103), 1 p♀ (33-100), 1 ♂, 2 ♀, 19 L [UCLA]; 8 Feb 1965, V. H. Lee (COL 50), 2 lp♂ (50-20, 23), 7 lp♀ (50-21, 22, 25-29), 1 p♀ (50-24), 22 L [UCLA]; 10 Feb 1965, V. H. Lee (COL 55), 1 p♂ (55-100) [UCLA]; 23 Feb 1965, V.H. Lee (COL 57), 2 lp♂ (57-13, 19), 1p♂ (57-107), 2 p♀ (57-100, 106), 1 lp (57-12), 3 ♂, 1 ♀, 3 P, 6 L [UCLA]; 2 Mar 1965, V. H. Lee (COL 58), 2 lp♂ (58-37, 38), 1 lp♀ (58-32), 1 p♂ (58-110), 1 l♂ (58-31), 1 lp (58-30), 10 L [UCLA].

No locality or date: E. Osorno, 1 ♀ [USNM].

COSTA RICA. Cervantes, 9 Nov 1962, J. N. Belkin, C. L. Hogue and W. A. Powder (CR 13), 2 lp♀ (13-205, 206) [UCLA]. Orosi, 7 Dec 1962, C. L. Hogue and W. A. Powder (CR 83), 4 lp♂ (83-201, 203, 207, 209), 5 lp♀ (83-202, 205, 206, 212, 213), 1 lp (83-211), 35 L [UCLA]; 4 Jan 1937, 1♀ [USNM]; 6 Jan 1938, 1 ♀ [BMNH]; Nov, C. Picado, 2 ♂, 3 ♀ [USNM]; 6 ♀ [BMNH].

NICARAGUA. Zelaya, Recreo, 26 June 1954, K. Neiland (NI 4), 3 L [UCLA]; 27 June 1954, K. Neiland (NI 5), 2 L [UCLA].

PANAMA. Bocas del Toro: Almirante, 2 May 1963 (PA 297), 1 p♂ (297-102), 1 p♀ (297-103), 7 L [UCLA]. Almirante, Nigua Creek, 27 Apr 1963 (PA 258), 1 p♀ (258-101) [UCLA]; 28 Apr 1963 (PA 276), 1 L [UCLA]; 29 Apr 1963 (PA 279), 1 L [UCLA]; 6 May 1963 (PA 325), 4 L [UCLA]. Big Creek, 10 Apr 1964 (PA 655), 7 L [UCLA]. Chiriquisito, El Guabo, 16 Apr 1963 (PA 209), 3 L [UCLA]; same data (PA 212), 1 L [UCLA]. Chiriquisito, Kaysan, 16 Apr 1963 (PA 215), 1 L [UCLA]; 18 Apr 1963 (PA 229), 3 L [UCLA].

Canal Zone: Gatun, 24 Sept 1964 (PA 711), 1 lp♂ (711-20), 7 lp♀ (711-21-24, 27, 29, 30), 3 p♂ (711-105, 112, 114), 5 p♀ (711-26, 100, 103, 106, 108), 3 lp (711-25, 28, 33), 76 L [UCLA]; 4 June 1934, 1 ♂, 1 ♀ [UCLA], 2 L [USNM]; 2 L [USNM]. Gatun Lake, Cano Saddle, 7 Aug-25 Oct 1923, H. G. Dyar and R. C. Shannon (P 67), 2 ♂, 3 ♀ [USNM]. Madden Road Forest Preserve, Cruces Trail, 17 Sept 1964 (PA 709), 1 lp♀ (709-19) [UCLA]. Tabernilla, A. Busck (177. 2), ♂ holotype [USNM]. No locality or date, A. H. Jennings (416), 1 ♂ [USNM]; 1 ♂, 1 ♀ [UCLA].

Cocle: El Valle, 19 Apr 1942, G. B. Fairchild, 1 ♂ [UCLA], 1 L [USNM].

Colon: Buena Vista, 24 Sept 1964 (PA 710), 5 lp♀ (710-23, 24, 26-28), 3 L [UCLA]. Portobelo, 8-20 Aug 1923, H. G. Dyar and R. C. Shannon (P 79), 1 ♂, 10 ♀ [USNM], 1 ♂ [BMNH]; 10 Feb 1909, A. H. Jennings (480), 1 ♂ [USNM]; 16 Feb 1909, A. H. Jennings (497), 1 ♀ [USNM]; 4 Dec 1963 (PA 579), 4 lp♀ (579-125, 127, 132, 136), 55 L [UCLA]; 9 Dec 1963 (PA 599), 2 p♂ (599-106, 110), 1 P, 51 L [UCLA]. Portobelo, Caldera Island, 24 Jan 1908, A. H. Jennings, 1 lp♀ (194. 1) [USNM]. Santa Rosa, Juan Mina, 17 Jan 1963 (PA 3), 2 lp♂ (3-145, 160), 5 lp♀ (3-147, 148, 156, 157, 161), 2 p♂ (3-112, 126), 4 L [UCLA]; 22 Jan 1963 (PA 33), 1 p♀ (33-103), 1 lp (33-108), 1 L [UCLA]; 29 Jan 1963 (PA 49), 2 lp♂ (49-108, 112), 2 lp♀ (49-104, 118), 2 p♀ (49-116, 132), 1 lp (49-137), 4 L [UCLA]; 30 Jan 1963 (PA 52), 2 lp♂ (52-103, 127), 4 lp♀ (52-106, 116, 121, 126), 3 p♂

(52-107, 111, 125), 1 p♀ (52-123), 4 L [UCLA]. Santa Rosa, Rio Chilibre, 21 Jan 1963 (PA 28), 1 lp (28-106), 1 L [UCLA]; same data (PA 29), 1 lp (29-109), 1 L [UCLA].

Darien: Jaque, 6 July 1945, 1 ♀ [USNM]. Jaque, Rio Jaque, 19 Dec 1963 (PA 613), 1 lp♀ (613-109) [UCLA]. La Palma, 28 Nov 1966, O.G.W. Berlin (PA 955), 1 lp♀ (955-21) [UCLA]; 1 Dec 1966, O.G.W. Berlin and R. Hinds (PA 962), 1 lp♂ (962-12), 1 p♀ (962-111) [UCLA]; same data (PA 963), 1 lp♂ (963-20) [UCLA]; same data (PA 964), 2 L [UCLA]; same data (PA 966), 1 lp♂ (966-13) [UCLA]; 3 Dec 1966, O.G.W. Berlin and R. Hinds (PA 974), 1 lp♂ (974-11), 1 lp♀ (974-10), 1 P, 1 L [UCLA]; 7 Dec 1966, O.G.W. Berlin and R. Hinds (PA 984), 1 lp♂ (984-50), 4 lp♀ (984-10, 11, 13, 15), 1 p♂ (984-104), 3 p♀ (984-108, 109, 111), 2 L [UCLA]; same data (PA 985), 1 lp♂ (985-10) [UCLA]; same data (PA 986), 1 p♂ (986-105) [UCLA]; same data (PA 987), 1 lp♀ (987-10) [UCLA]. Pucro, Tacarcuna River, 14 June 1963 (PA 386), 3 lp♂ (386-109, 110, 115), 8 lp♀ (386-104, 107, 108, 111, 117, 119, 120, 122), 4 p♂ (386-101, 102, 106, 113), 1 p♀ (386-112), 1 lp (386-123), 15 L [UCLA]; 22 June 1963 (PA 414), 1 lp♂ (414-101), 1 lp♀ (414-121), 1 p♂ (414-116), 2 lp (414-118, 120) [UCLA]; 27 June 1963 (PA 430), 1 lp♂ (430-101), 1 lp (430-103) [UCLA]; 5 July 1963 (PA 435), 1 p♀ (435-103), 1 P [UCLA]. Tuira River, 8 Mar 1958 (GG 89), 1 ♀ [UCLA].

Panama: Chica, Cerro Campana, 3 Aug 1963 (PA 461), 1 lp♀ (461-101), 5 L [UCLA]; same data (PA 462), 1 p♂ (462-104), 1 lp (462-10), 1♀, 1 P [UCLA]; 5 Aug 1963 (PA 473), 3 lp♂ (473-115, 117, 122), 3 lp♀ (473-107, 113, 114), 4 p♂ (473-102, 110, 123, 124), 3 p♀ (473-104, 105, 119), 1 l♀ (473-106), 8 lp (473-112, 116, 118, 120, 121, 125-127), 2 ♂, 32 L [UCLA]; 12 Aug 1963 (PA 496), 1 lp♂ (496-105), 1 p♂ (496-103), 1 p♀ (496-102), 1 ♂, 12 L [UCLA]; 31 Aug 1963 (PA 545), 1 lp♂ (545-103), 7 L [UCLA]. Coscajal River, 18 Feb 1909, A. H. Jennings (503), 1 ♂ [USNM].

NO LOCALITY OR DATE. A. H. Jennings (157), 3 ♂, 2 ♀ [USNM].

NO DATA. 1 ♂ genitalia [USNM].

Additional records from the literature. VENEZUELA. Aragua (Cova-Garcia, Sutil and Rausseo, 1966b:52, 143, 371).

Tachira: Uribante (Anduze, 1947:360).

ORTHOPODOMYIA SECTION

FEMALES. Head: eyes separated above antennae by a row of decumbent scales which are sometimes accompanied by weakly developed pale or dark bristles; frontal bristles usually dark; orbital bristles dark, usually 1-3 lateral pairs and 2-4 mesal pairs; ocular border absent; vertex and occiput with numerous narrow curved decumbent scales which are usually broader and denser at base of frontal bristles and in front of dorsolateral broad scales and very numerous erect scales; suborbital bristles pale; clypeus an elongate angular lobe, usually bare; labium slightly to considerably swollen apically, shaft bristles absent; palpus straight, 0.37-0.58 of proboscis, 4- or 5-segmented; inner half of torus with small scales except for a bare spot mesally and dorsal portion of inner half with short, fine hairs; flagellar segment 1 not swollen; flagellar segment 1 with scales; dorsal flagellar bristles about 2.0-3.0 length of their segment of proximal segments, ventral bristles absent on segment 1 and often reduced or absent on segments 2-4. Thorax: paratergite moderately broad, with (flavicosta, flavithorax) or without scales; posterior dorsocentral bristles sometimes in a double row; humeral, lateral prescutal and posterior fossal

bristles not numerous enough to completely enclose fossa; fossal bristles absent; mesonotal ornamentation consisting of light and dark scales of various sizes and densities almost completely but sparsely covering the scutum, as follows: (1) acrostichal scales in a broad band accompanying the acrostichal bristles, (2) anterior prescutellar scales in a more or less triangular area anterior to prescutellar space, (3) dorsocentral scales in a broad band accompanying the dorsocentral bristles, (4) lateral prescutellar scales accompanying the lateral prescutellar bristles and extending caudad to margin of scutellum, (5) lateral prescutal scales extending from anterior promontory near dorsocentral scale line to scutal angle along edge of mesonotum, small, (6) posterior fossal scales extending from the scutal angle to the dorsocentral scales anterior of the scutal suture, small, (7) fossal scales in the area enclosed by the dorsocentral, lateral prescutal and posterior fossal scales, small, (8) supraalar scales extending from caudad of scutal suture to cephalad of parascutellum among and mesad of supraalar bristles and with anterior and middle extensions ventrad to near margin of paratergite; parascutellum normally without scales; lateral and midscutellar lobes each with an extensive patch of large white to silvery-white scales which extend over the caudal margin of the scutellum; pleural bristles dark and light; upper anterior apn bristles brownish-amber to brown, 2-6 strongly developed, 0-7 weakly to moderately developed, lower apn bristles amber, 2-6, weakly to moderately developed; ppn bristles brown; ppl bristles amber, 2-5 strongly developed, 0-4 weakly to moderately developed; anterior mep bristles absent; pleural scaling consisting of extensive areas of broad flat, narrow curved and broad semierect scales; apn with narrow curved scales in an upper anterior patch and narrow curved or broader and/or flatter scales in a ventral diagonal row; psp scales normally absent; pra with a few flat or curved scales on anterior edge and/or below knob; ppl with broad flat and semierect scales in a dense patch around the bristles; entire pst with a dense covering of broad flat scales; pcx scales absent; ssp scales broad and flat; hypostigial scales present (madrensis) or absent; upper half of stp completely covered with broad flat scales except for 1-3 small bare areas, lower half with a vertical row of broad flat and semierect scales; mep with elongate semierect white scales in an upper patch anterior to the upper posterior bristles; a few additional large brownish or transparent scales may be found scattered over the pleuron, especially the meron and lower stp. Legs: trochanters with white to silvery-white or slightly yellowish flat scales on anterior, inner and posterior surfaces; femora with small white to dingy knee spots; tibiae white- or cream-scaled apically; hindtarsal segment 1 longer than hindtibia; hindclaws slightly to considerably smaller than fore- and midclaws. Wing: remigial bristles absent; plical area usually without scales, sometimes with a few light or dark scales; alula scales moderately broad; upper calypter with bristles.

FEMALE GENITALIA. Tergite IX with dorsolateral setae.

MALES. Similar to females. Labium: not more strongly swollen than in females. Palpus: 0.75-1.00 of proboscis, segment 5 short. Antenna: integument of flagellum moderate or dark except (usually) for lighter bands basal of bristles on shorter segments; torus greatly enlarged; flagellum strongly plumose; segments 12 and 13 subequal in length; flagellar segment 1 (flavicosta, flavithorax) or segment 1-4 or 5 with tufts of scales; bristles of flagellar whorls about 0.4-0.6 length of entire flagellum on proximal segments, about 0.6-1.0 length of segment 13 on that segment. Legs: anterior fore- and midclaws with basal tooth too small to be seen on pinned specimens, posterior fore- and midclaws simple.

MALE GENITALIA. Varied, see description for each included group.

PUPAE. Known only for Albipes group.

LARVAE. Varied, consult description for included groups.

BIONOMICS. So far as is known, the immature stages are normally found in treeholes, bamboo internodes and artificial containers. Females of 2 species, albipes and andamanensis, are known to bite man.

SYSTEMATICS. The Orthopodomyia section contains all the Old World species except pulchripalpis. These species fall into 1 Oriental and 3 Ethiopian groups. The Ethiopian species are very poorly known and it is possible that at least some of them should be placed in the Thomasina section rather than in the Orthopodomyia section. These possibilities are discussed more fully later (see especially arboricollis).

It is unfortunate that the isolated species and small groups of Orthopodomyia, which may represent relictual or primitive forms, the study of which is paramount to understanding the relationships within the genus, are the most poorly known of all Orthopodomyia. Until the immature stages of the 3 Ethiopian groups and the South American sampaioi are better known, any classification of the genus is provisional.

DISTRIBUTION. Cameroon, India, and southern Japan, south to South Africa and northeastern Australia.

KEYS TO GROUPS

See keys on p. 19-22.

VERNONI GROUP

FEMALES. Head: integument of head capsule, clypeus, torus and flagellum dark brown; eyes separated above antennae by silvery-white to white decumbent scales; frontal bristles brown; orbital bristles brown, usually 2 lateral pairs and 3 mesal pairs; lateral and ventral scales white or dingy white; labium considerably swollen apically. Thorax: integument of mesonotum and postnotum dark brown, scutellum lighter, pleuron evenly dark brown or with lighter areas; paratergite bare; posterior dorsocentral bristles apparently not in double row; anterior mesonotal bristles dark brown, supraalar, parascutellar and scutellar bristles lighter; acrostichal scales not separated laterally from dorsocentral scales by a narrow longitudinal area; pra bristles 1, brown; upper stp bristles 1, strongly developed, brown, posterior stp bristles 2-4, amber, weakly to strongly developed, lower stp bristles 5-8, amber, weakly to strongly developed; upper mep bristles 7-17, whitish; ppn with extensive area of narrow curved scales; hypostigial scales absent; upper portion of stp with bare areas at base of bristles, lower stp scales apparently not joined to those in upper portion; mep with more or less quadrangular patch of flat scales near margin of stp in upper portion of mep. Legs: integument of forecoxa light, mid- and hindcoxae brown; forecoxal bristles yellowish-amber, midcoxal bristles brown, hindcoxal bristles brownish-amber; forecoxa with broad flat white scales on anterior surface and above bristles and with semierect white scales among bristles, mid- and hindcoxae with broad flat scales in an upper outer patch and along outer anterior surface; hindtarsal segment 5 entirely dark-scaled. Wing: scales symmetrical, moderately broad, spreading and clasping

veins; wing largely brown- or black-scaled with white scales forming patches and scattered, as follows: (1) costal vein with prehumeral, humeral, accessory sectoral, subcostal and apical light patches and with few to numerous scattered light scales distally, (2) vein Sc with accessory sectoral and subcostal light patches, (3) vein R with humeral light patch, sometimes with prehumeral light patch, and with scattered light scales, (4) vein R_1 with accessory sectoral and apical light patches and with numerous scattered light scales, (5) veins R_S, R_{4+5}, Cu and 1A with basal light patch, (6) vein R_{2+3} with light patch opposite base of vein R_{4+5}, (7) veins M and Cu with light patches distad of crossveins, (8) veins R_{2+3} and M with light patch at furcation, (9) all veins behind vein R_1 with apical light patch, (10) stem of vein M and veins Cu and 1A with light scales scattered or in small patches, the light scales concentrated in central portion of stem of M, basad of furcation in Cu, central portion of Cu_1 and central portion of 1A. Haltere: integument white to beige, scales transparent to whitish. Abdomen: integument of tergites and sternites light brown to brown except for lighter areas beneath light scales; laterotergite bare; tergite I with largely dark brown- or black-scaled fan and with a few scattered light scales.

MALES. Similar to females. Palpus: 0.96-1.00 (?) of proboscis; segment 3 usually with a few strong apical bristles, largely dark brown- to black-scaled, white scales present at joints between segments 1-2, 2-3 and 3-4 and covering all of segment 5. Antenna: flagellar segments 1-4 with tufts of extremely long white or silvery scales.

MALE GENITALIA. Segment VIII: tergite lobe distinct, longer than broad, apex emarginate and with irregular teeth. Segment IX: tergite with 2 or 3 fine bristles on each side. Sidepiece: long conical; basal mesal lobe with 4 or 5 stout terete apical bristles which are slightly curved mesally at apex and 1 or 2 finer terete apical bristles sternad of stout ones; mesal surface completely sclerotized; mesal surface without specialized bristles; tergomesal surface with strong specialized bristles. Spiniform: normally 1, apex with 3 or 4 irregular lobes. Aedeagus: strongly sclerotized; shape varied; apex with numerous small teeth; each half of sternal surface with large, strong, sharp, curved spine on distal portion of mesal margin. Proctiger: paraproct sclerotization with 2-5 apical teeth; cercal setae 1-3.

PUPAE. Unknown.

LARVAE. The one specimen available for study has been provisionally identified as milloti and is described under that species. See below also.

BIONOMICS. Larvae have been collected in treeholes and bamboo internodes. Nothing is known of the habits of the adults.

SYSTEMATICS. The Vernoni group contains all the Madagascan species. To date 3 names, vernoni, milloti and geberti, have been proposed. According to Grjebine (1966:29, 30, 32), 7 species of this group occur on Madagascar and 1 additional species is endemic to Mayote.

The taxonomy of the group is confused. Two species, vernoni and milloti, were described as adults and the third species, geberti, was described as a larva. Van Someren (1949:6-7) described a larva tentatively associated with vernoni; during this study it was possible to make only a cursory examination of this larva. I have provisionally associated the only larva available for critical study with milloti. Since the description of geberti and the description and my notes of the larva associated with vernoni are quite incomplete, it is not possible to state with any certainty whether the larvae represent distinct species or if they differ from the one larva I have studied. It may be that geberti is conspecific with the larva associated with vernoni and that the larva illustra-

ted as vernoni by Doucet (1950:57) is conspecific with the one I am associating with milloti. If this is the case and the tentative associations are correct, then the larvae of milloti and vernoni might differ on the basis of the length and curvature of the antennae and the length of hair 5-C. However, since both these features are known to be extremely variable in the Mauritian species arboricollis, they may be poor taxonomic characters in this apparently related group. I have examined adults of vernoni and milloti and find them to be distinct species. It appears that the most reasonable procedure to follow here is to recognize these 2 species and to consider geberti as a nomen dubium. The total number of species involved and the identity of the larvae cannot be ascertained until adults with associated skins are available for study.

Arboricollis appears to be related to this group. Adults of arboricollis and the Vernoni group agree in wing ornamentation and in the absence of laterotergite scales and a bare area between the acrostichal and dorsocentral scales. Larvae of arboricollis and milloti have 6 pairs of hairs in the ventral brush and stellate body hairs. It is possible, however, that the latter characteristic is due to parallelism. The other affinities of the Vernoni group are obscure. The spiniform of the male genitalia is like that of the Neotropical Thomasina section and the Holarctic Signifera group and the dentition of the aedeagus is reminiscent of the Neotropical albicosta. As discussed more fully under arboricollis, certain features of both arboricollis and the Vernoni group are also found in the Thomasina section, but it is uncertain whether these similarities indicate relationship or are only retentions of primitive characteristics in separate phylads. Until the immature stages, particularly the pupa, are better known for arboricollis, the species in the Vernoni group, and the African Orthopodomyia, it will not be possible to accurately classify the Ethiopian species, and until this information is available all the Ethiopian groups are tentatively being associated with the Albipes group in the Orthopodomyia section.

DISTRIBUTION. Madagascar.

KEYS TO SPECIES

Adults

1. Hindtarsal segment 2 dark-scaled at apex, segment 3 white-scaled in basal 0.5; acrostichal scales mixed brown, white and yellow; dorsocentral scales largely yellow . . . . . 11. vernoni
   Hindtarsal segment 2 with white-scaled apical ring, segment 3 entirely white-scaled; acrostichal and dorsocentral scales largely white or cream-colored . . . . . 12. milloti

Male Genitalia

1. Apex of aedeagus with broad, more or less truncate, lobe on each half; apical lobe of aedeagus with blunt teeth in more or less distinct rows; broadest portion of aedeagus parallel sided . . . . . 11. vernoni
   Apex of aedeagus with acute, more or less triangular, lobe on each half; apical lobe of aedeagus with acute, curved teeth not arranged into distinct rows; aedeagus not parallel sided . . . . . 12. milloti

11. Orthopodomyia vernoni van Someren

Fig. 18

1949. Orthopodomyia vernoni van Someren, 1949:5-7. *TYPE: holotype ♂ with genitalia slide 660610-3, Sakaramy, near Diego-Suarez, Madagascar, 1 Apr 1944 [BMNH].

Orthopodomyia vernoni of Knight and Mattingly (1950:2); Hopkins (1952:83-84); Stone, Knight and Starcke (1959:124); Rickenbach and Hamon (1967:1117).

FEMALE. Unknown.

MALE. Head: decumbent scales silvery anteriorly, yellow posteriorly; erect scales brown; dorsolateral scales brown anteriorly, white posteriorly; labium largely brown-scaled, white scales in narrow ring just distad of distal end of palpal segment 2, in narrow ventrally incomplete apical ring and in line from base to middle ring along edge of groove; palpus equal to length of proboscis, segment 3 with scattered white scales. Thorax: acrostichal scales large, yellow and white at anterior promontory, small and brown at caudal end, remainder small, mixed yellow, white and brown; anterior prescutellar scales small, golden yellow; dorsocentral scales large and white at anterior promontory and at caudal end, remainder small, largely yellow; lateral prescutellar scales large, brown anteriorly, white posteriorly and laterally; lateral prescutal scales yellow and white; posterior fossal scales largely white; fossal scales brown; supraalar scales small mesally, larger laterally, yellow and white anteriorly, brown posteriorly, silvery-white in middle extension; scutellar scales white; upper apn scales yellowish; lower apn scales white; ppn scales yellow above, white below; pra, ppl, pst, ssp, stp and mep scales all white. Legs: mid- and hindcoxal scales white above, white and brown below; remaining leg segments with dark scales dark brown or black; femora with dark-scaled preapical ring; forefemur largely dark-scaled, white scales in basal ring and scattered; midfemur anterior surface with largely white-scaled patch basad of dark-scaled preapical ring, white scales at base ventrally, remainder dark-scaled basally and ventrally, dark-scaled with white speckles dorsally, posterior surface white-scaled basally, dark-scaled ventrally, dark-scaled with white speckles dorsally, remainder largely white-scaled; hindfemur anterior surface white-scaled at base ventrally, remainder largely dark-scaled ventrally, dark-scaled with white speckles dorsally, posterior surface largely white-scaled in basal portion, largely dark-scaled apically; tibiae with irregular dark-scaled preapical ring; foretibia with dark-scaled basal ring, anterior, dorsal and ventral surfaces dark-scaled with white speckles, posterior surface largely light-scaled; midtibia with basal white scales and subbasal dark-scaled ring, anterior, dorsal and ventral surfaces dark-scaled with white speckles, posterior surface largely white-scaled; hindtibia with narrow white-scaled basal ring and dark-scaled subbasal ring, dorsal surface dark-scaled with white speckles, anterior and ventral surfaces light-scaled with dark speckles, posterior surface white-scaled in basal portion, remainder dark-scaled; tarsi largely dark-scaled; foretarsus with white scales in narrow basal ring on segment 1; midtarsus with white scales in narrow ring at base of segments 1-3; hindtarsus with white scales in narrow ring at base of segment 1, in moderately broad ring at base of segment 2, in basal 0.5 of segment 3 and in basal 0.6 of segment 4. Wing: vein R_2 longer than vein R_{2+3}; vein M_{1+2} longer than M distad of crossvein m-cu; vein Sc with scattered light scales; vein R_{4+5} with light patch in central

portion. Abdomen: tergites II-VII largely dark brown- to black-scaled, white scales in small basolateral patch and in median dorsal or subdorsal patch on segments II, III, V and VI; tergite VIII with white scales in basal band and apicolateral patch, remainder dark-scaled; sternite II largely bare, white scales present laterally; sternite III with very large basolateral white patch, remainder dark-scaled; sternites IV, V largely dark-scaled, white scales in basolateral patch; sternites VI, VII apparently entirely dark-scaled; sternite VIII largely dark-scaled, white scales present basally; sidepiece with light and dark scales.

MALE GENITALIA (fig. 18). Sidepiece: tergomesal surface with 3 large stout bristles near basal mesal lobe. Aedeagus: broad, parallel-sided in distal portion, base narrowed, apex with lateral shoulder, the mesal apical portion with numerous small blunt teeth arranged into 3 more or less distinct rows.

LARVA. Head: hairs 4-7-C large and with many plumose branches; 13-C 13b, long. Antenna: about 0.5 length of head, straight, swollen in basal 0.5; hair 1-A 3-5b. Thorax: stellate setae present; hair 1-P double; 1-M 8b, long; 1-T 5b. Abdomen: stellate setae present; hairs 1, 5, 7, 13-II-VI with fewer branches than in milloti. Siphon: index about 5; hair 1-S at about middle, 10b. Anal Segment: hair 1-X double, long; anal gills short.

BIONOMICS. The larva provisionally associated with vernoni was found in a treehole.

SYSTEMATICS. Some details of the sternopleuron and mesepimeron of the type of vernoni have been obscured by the minuten pin. One clasper of the male genitalia from this specimen has 2 spiniforms whereas the other has only 1; I assume that each clasper normally has only 1 spiniform.

The larval description has been taken from van Someren (1949:6-7) and from notes made at the British Museum of Natural History.

A more complete discussion of the systematics of this species can be found under the Vernoni group.

DISTRIBUTION. Known definitely only from the type locality in extreme northern Madagascar. Material Examined: 3 specimens; 1 ♂, 2 L.

MADAGASCAR. Diego-Suarez: Sakaramy, near Diego-Suarez, 1 Apr 1944, ♂ holotype [BMNH]; Dec 1944, 2 L [BMNH].

Additional records from the literature. None; see systematics sections for the Vernoni group and geberti.

12. Orthopodomyia milloti Doucet

Figs. 18, 21

1951. Orthopodomyia milloti Doucet, 1951:66-68. TYPE: holotype ♂, Périnet, Tananarive, Madagascar, adult found in a bamboo internode lying on damp leaves, 1-8 Mar 1950 [IRSM, T. A. 3].

Orthopodomyia milloti of Stone, Knight and Starcke (1959:123); Rickenbach and Hamon (1967:1117).

Orthopodomyia vernoni of Doucet (1950:57, 62; 1951:64, 65).

FEMALE. Wing: 4.10 mm. Proboscis: 2.51 mm. Forefemur: 2.31 mm. Abdomen: about 3.0 mm. Head: decumbent scales entirely white or white mesally and yellow-tinged laterally; erect scales brown laterally and posteriorly, dingy tan near eyes, the remainder dingy cream-colored and yellow; dorsolateral scales brown anteriorly and white with a tinge of tan posteriorly; labial-scaling not completely known, dark brown scales

present along dorsal surface in basal 0.4, white scales present dorsally beyond middle and at apex; palpus straight, about 0.37 of proboscis, 4-segmented, segment 4 minute, scaling incompletely known, apparently largely dark brown, with white scales at least at base of segment 3 and with silvery-white scales covering segment 4; torus scales cream-colored; flagellar scales medium-sized, cream-colored. Thorax: acrostichal scales large and white or cream-colored at anterior promontory, small and brown at caudal end, remainder small, white or cream-colored; anterior prescutellar scales small, white to cream-colored or yellowish; dorsocentral scales large and white or cream-colored at anterior promontory, large and silvery-white at caudal end, remainder small, white to cream-colored; lateral prescutellar scales large, brown anteriorly, silvery-white posteriorly; lateral prescutal and posterior fossal scales white to cream-colored; fossal scales brown or brown and yellow; supraalar scales small mesally, larger laterally, white and cream-colored anteriorly, brown posteriorly, silvery-white in middle extension; scutellar scales silvery-white; apn, ppn, ppl, pst, ssp, stp and mep scales white to cream-colored; pra scales white to dingy white. Legs: mid- and hindcoxal scales white or brown and white; remaining leg segments with dark scales dark brown to black; femora with dark-scaled preapical ring; forefemur largely dark-scaled, white or cream-colored scales in basal ring, on distal portion of posterior surface and scattered; midfemur anterior surface with cream-colored patch basad of preapical dark-scaled ring, white scales at base ventrally, remainder dark-scaled basally and ventrally, dark-scaled with cream speckles dorsally and apically, posterior surface white-scaled basally, dark-scaled dorsally and in basal ventral portion, remainder largely pale-scaled; hindfemur anterior surface white-scaled at base ventrally, remainder dark-scaled ventrally, dark-scaled with cream speckles dorsally, posterior surface white-scaled at base, dark-scaled ventrally and apically, dark-scaled with cream speckles dorsally, remainder largely pale-scaled; foretibia anterior and dorsal surfaces dark-scaled with cream-colored speckles, posterior and ventral surfaces largely pale-scaled; midtibia with mostly cream-colored scales basally except for dark-scaled subbasal ring, remainder dark-scaled with cream-colored speckles becoming entirely dark-scaled preapically; hindtibia with mostly cream-colored scales basally except for irregular dark-scaled ventrally incomplete subbasal ring, dark-scaled preapically, remainder largely dark-scaled with cream-colored speckles on anterior and dorsal surfaces, largely light-scaled on posterior and ventral surfaces; tarsi largely dark-scaled; foretarsus with white scales in small dorsal patch or complete ring at base of segment 1, in small dorsobasal patch on segment 2 and sometimes on segment 3; midtarsus with white scales at base of segments 1-4, those on segments 1, 2 and sometimes 3 forming a complete ring, those on segment 4 in dorsal patch; hindtarsus with white scales in small dorsobasal patch on segment 1, in narrow basal and broader apical ring on segment 2, covering all of segment 3 and in basal 0.67 of segment 4. Wing: vein R_2 1.67 length of vein R_{2+3}; vein M_{1+2} 1.14 length of M distad of crossvein m-cu; vein Sc apparently without scattered light scales; vein R_{4+5} apparently without light patch in central portion. Abdomen: tergites II-VIII largely dark brown-scaled with white scales in basolateral patch and possibly in dorsobasal or median subdorsal patch; sternite II largely white-scaled, brown scales present apically and mesally; sternites III-VII largely brown-scaled, with white scales in basolateral patch; sternite VIII largely bare, white scales present basolaterally.

MALE. Essentially as in female. Proboscis: largely dark brown- or

black-scaled, white scales in narrow ring just distad of distal end of palpal segment 2, cream-colored scales at apex laterally. Palpus: about 0.96 of proboscis, apparently without scattered light scales on segment 3. Antenna: integument of torus lighter laterally. Abdomen: light-scaling possibly more extensive than in female; tergite VIII with narrow basal light band; sternite VIII dark-scaled with basolateral and apicolateral light patches; sidepiece with light and dark scales.

MALE GENITALIA (fig. 18). Sidepiece: tergomesal surface with 1 stout and 2 finer specialized bristles near basal mesal lobe. Aedeagus: middle portion broad, with sides diverging distally, base narrow, apex without lateral shoulder, but with each half narrowing to acute tooth-bearing lobe, teeth numerous, curved and sharp-pointed, not arranged into rows.

LARVA (fig. 21). Head: 1.25 mm. Siphon: 1.81 mm. Anal Saddle: 0.54 mm. Head: broader than long; integument not spiculose; largely tan colored, lighter around imaginal eye, darker posteriorly, collar brown; labrum short; mental plate brown, with 10, 11 teeth on each side; hair 2-C apparently absent; 4-C long, extending beyond apex of antenna; 13-C 6, 7b, long; 14-C moderately developed, 2, 3b; maxillary sclerite hair strongly developed, 3, 4b. Antenna: moderately-long, narrow, curved mesally; integument not spiculose; uniformly brown colored; hair 1-A 7, 8b. Thorax: epidermal pigment strongly developed, purple in color; spicules not conspicuous; hairs strongly pigmented; hairs 0-P, 1, 14-M and 1, 3, 4-T stellate; 1-P multiple; 1-M, T 12-14b; 4-M single. Abdomen: segments VI, VII without sclerotized plates; hairs strongly pigmented; hair 1-I, II stellate; 2-I, II laterad of hair 1 of corresponding segment; 6-I, II multiple, 6-III-VI single; 12, 13-I stellate, branches of 13-I shorter than 10-I; 13-II stellate; 1-III, IV, VI, VII moderately long, multiple; 5-III-VI moderately long, multiple; 13-III, IV, VI, VII moderately long, multiple; 1-V very long, 3b; 13-V long, multiple; 2-VI, VII laterad of hair 1 of corresponding segment; 8-VII stellate. Segment VIII: sclerotized plate present; comb scales in 2 rows; anterior comb scales about 26, posterior comb scales about 15; larger anterior comb scales shaped like posterior comb scales, with 1 long apical spine and basal fringe; hairs 1, 5-VIII strongly developed, stellate. Siphon: index about 4.8; brown, with extreme base darker, apex lighter, portion distad of alveolus of hair 1-S slightly darker than portion basad of 1-S; integumentary sculpturing moderately developed basally, imbricate; hair 1-S located about 0.44 from base of siphon, 11b, longest branches reaching about 0.4 distance from alveolus to apex of siphon. Anal Segment: saddle complete; sclerotized incomplete ring present basad of saddle; integumentary sculpturing weakly developed, imbricate; brown, extreme base darker, dorsal portion slightly darker than ventral portion; hair 1-X 2, 3b, long; ventral brush apparently with 6 pairs of hairs; gills short, dorsal pair 1.5 times length of ventral pair and 0.85 length of anal saddle.

BIONOMICS. Adults of the type series were collected in bamboo internodes lying on the ground. Larvae have also been collected in bamboo internodes.

SYSTEMATICS. Milloti is distinct from vernoni on the basis of the adult and male genitalic characters given in the keys.

The small sample of adults available for examination is quite uniform, with only some variation in the sizes of the light patches and the number of scattered light scales on the wing. The lateral prescutal, posterior fossal and anterior prescutellar scales are cream-colored to yellowish and apparently not as strongly yellow-pigmented as in the type series.

The larva described here was collected at the type locality of milloti and I

am provisionally associating it with this species. It agrees well with the larva identified as vernoni and figured by Doucet (1950:57). It differs from the larva described by geberti and figured by Grjebine (1953:465-467) by having longer, curved antennae and longer hair 5-C.

DISTRIBUTION. Known definitely only from east-central Madagascar. Material Examined: 6 specimens; 4 ♂, 1 ♀, 1 L.

MADAGASCAR. Tamatave: Fenerive, 24 Dec 1955, Sakondroely, 4 ♂, 1 ♀ [IERT].

Tananarive: Périnet, 1 L [USNM].

Additional records from the literature. MADAGASCAR. Diego-Suarez: Montagne d'Ambre, R. Paulian (Doucet, 1950:57, 62). Larvae collected at this locality were reported as vernoni, but may be milloti; see systematics discussion of milloti.

NOMEN DUBIUM

12a. Orthopodomyia geberti Grjebine

1953. Orthopodomyia geberti Grjebine, 1953:465-467. TYPE: holotype larva, forest station at Ampijoroa, Ambato-Boeni District, [Majunga], Madagascar, larva found in a treehole, 10 Dec 1951 [IRSM].

Orthopodomyia geberti of Stone, Knight and Starcke (1959:123); Rickenbach and Hamon (1967:1117).

SYSTEMATICS. Grjebine described geberti on the basis of the larva alone. He apparently believed it differed from the larva described and tentatively associated with vernoni by van Someren (1949:6-7) because it did not have stellate hairs on the thorax and body. This difference may well be a matter of semantics, since geberti was stated to have "tufts of strong plumose hairs." Comparison of the descriptions of Grjebine and van Someren fails to show any means of distinguishing the larvae and raises the possibility that geberti is a synonym of vernoni. However, since the larva described by van Someren was only provisionally considered to be vernoni, and since both descriptions are rather incomplete, I think it better to consider geberti as a nomen dubium than a synonym.

DISTRIBUTION. Type from Ampijoroa, Majunga, Madagascar. Specimens Examined: none.

NKOLBISSONENSIS GROUP

13. Orthopodomyia nkolbissonensis Rickenbach and Hamon

1967. Orthopodomyia nkolbissonensis Rickenbach and Hamon, 1967:1112-1117. TYPE: holotype ♀, Center for Agricultural Research of Nkolbisson, 8 km from Yaoundé, south Cameroon, adult found in lower vegetation of forest, 18 Jan 1965 [IERT].

FEMALE. Head: integument of torus yellow; decumbent scales white to pure yellow; erect scales pale mesally, darker laterally; labium largely black-scaled, pale yellow scales in a broad ring distad of middle and at apex (?);

palpus almost 0.5 of proboscis, largely black-scaled, with pale yellow scales in median ring and narrow zone at distal end; torus and flagellar scales pale. Thorax: mesonotum deep brown, almost black, pleuron dark; paratergite bare; acrostichal scales separated from dorsocentral scales by a longitudinal bare area; scales bright yellow to middle of scutum where dense black scales (anterior lateral prescutellar scales, ?) form a pair of large triangular patches laterad of dorsocentral bristles; scutellar scales bright yellow; apn and ppn scales yellow; ppl, stp and mep scales cream-colored; mep with middle patch of scales. Legs: coxae with patch of cream-colored scales on upper part; femora with yellow scales at apex; forefemur with black scales at base, in preapical ring, and scattered in basal 0.67 of anterior surface, remainder yellow-scaled; midfemur with black scales at base, in preapical ring, in streak in middle portion of dorsal surface and densely scattered in middle portion of anterior surface, remainder yellow-scaled; hindfemur with black scales at base and in preapical ring, remainder yellow-scaled; tibiae yellow-scaled with black scales in broad subbasal, median and preapical rings and sometimes on ventral surface basally; tarsi largely black-scaled; tarsal segment 1 with yellow scales in basal, median and apical rings, the median ring broad on the mid- and hindlegs; tarsal segment 2 with yellow scales in basal and apical rings; tarsal segment 3 with yellow scales in narrow basal and apical rings, either or both rings sometimes reduced to patches or absent on foreleg; tarsal segments 4 and 5 usually entirely black-scaled, yellow scales sometimes present in basal zone on segment 4 or over entire surface of segment 5. Wing: costal vein, veins Sc and R and bases of veins M, Cu and 1A with large scales, otherwise scales long and narrow; scales black and cream-colored; costal vein black-scaled in basal 0.67; basal 0.33 of wing with mixed cream-colored and black scales, with either color predominating, middle 0.33 black-scaled, apical 0.33 with cream-colored scales only or with some black scales. Haltere: yellow. Abdomen: tergites II-VII largely black-scaled, cream-colored scales in basolateral oblique patch, yellow scales connecting patches of opposite sides, forming a basal band convex towards the base on tergite II and a preapical band convex towards the apex on tergites V-VII, tergite VII sometimes with light streak from base to preapical band middorsally; tergite VIII with pale scales basally; sternites largely dark-scaled, yellow scales forming basal band.

MALE. Similar to female. Proboscis: largely black-scaled, yellow scales in complete median ring, sometimes in ventrally incomplete ring nearer apex, and streaked along dorsal surface from distal ring to apex or from median ring to near apex. Palpus: about as long as proboscis, ornamentation apparently as follows: segment 1 and possibly base of segment 2 black-scaled with yellow speckles, segment 2 yellow-scaled, segments 3 and 4 black-scaled except for yellow scales over joint between them, segment 5 pale yellow-scaled.

MALE GENITALIA. Segment IX: tergite with 4-6 bristles on each side, these apparently quite strong. Sidepiece: long conical; basal mesal lobe with 4 or 5 stout terete apical bristles which are curved mesally at apex and apparently with some long finer bristles sternad of stout ones; mesal surface possibly with moderately developed specialized bristles; tergomesal surface with strong specialized bristles near basal mesal lobe. Spiniform: 1, simple. Aedeagus: strongly sclerotized, acorn-shaped, apparently without sternal teeth. Proctiger: paraproct sclerotization with only 1 apical tooth; cercal setae 4.

PUPA, LARVA. Unknown.

BIONOMICS. Adults were captured in the lower vegetation of a forest.

SYSTEMATICS. Nkolbissonensis was the first species to be described

from the continental portion of the Ethiopian Region. It appears to be very distinct from all other Orthopodomyia on the basis of the male genitalia and adult ornamentation. The immature stages are unknown.

I have not examined any specimens of nkolbissonensis and the description provided above has been taken from Rickenbach and Hamon (1967:1112-1117).

This species has been given group rank and placed in the Orthopodomyia section. The latter action is taken on the basis of geography only.

DISTRIBUTION. Type series from Yaoundé, south Cameroon. Specimens Examined: none.

14. Orthopodomyia sp. South African form

Orthopodomyia species of Mattingly and Brown (1955:104); Muspratt (1955:156, 194).

SYSTEMATICS. Muspratt reported finding 1 damaged adult and some larvae of an undescribed species of Orthopodomyia in a treehole at Satara Camp, Kruger National Park, South Africa. All that is known about this species is the following statement taken from the key presented by Muspratt: "medium-sized blackish species, proboscis with some pale scales, but unbanded, femora and tibiae speckled and with white bands on the tarsi, some of which embrace the joints."

This species cannot be described until the original specimens are located or additional material is collected. Its relationships are, of course, unknown; it is tentatively being associated with nkolbissonensis, the only species described from mainland Africa.

DISTRIBUTION. Known only from Satara Camp, Kruger National Park, South Africa. Specimens Examined: none.

ARBORICOLLIS GROUP

15. Orthopodomyia arboricollis (Charmoy)

Figs. 18, 22

1908. Culex arboricollis Charmoy, 1908:257-258. *TYPE: lectotype ♂ (148), specimen labeled as "Type ♂," Vacoas, Mauritius, reared from a larva found in a treehole, 1908, R. Ross; PRESENT SELECTION [LIVER in BMNH].

Orthopodomyia arboricollis of Edwards (1920:135); MacGregor and Gebert (1923:449-452); MacGregor (1927:142-147); Edwards (1932:107, 108); Hopkins (1936:62-63); Edwards (1941:72-73, 374); van Someren (1949:5, 6); Knight and Mattingly (1950:2); Hopkins (1952:82-83); Halcrow (1954:239); Mattingly and Brown (1955:104); Stone, Knight and Starcke (1959:122); Rickenbach and Hamon (1967:1117).

Newsteadina arboricollis of Theobald (1909:297; 1910b:475-477).

FEMALE. Wing: 3.64 mm. Proboscis: 2.05 mm. Forefemur: 2.12 mm. Abdomen: about 2.5 mm. Head: integument of head capsule, clypeus, torus

and flagellum brown to dark brown; eyes separated above antennae by yellowish to yellow scales; frontal bristles brown; orbital bristles brown, usually 3 lateral pairs and 2 mesal pairs; decumbent scales silvery-white to cream-colored or yellowish; erect scales behind eyes narrow, brown, those on occiput broader, brown posteriorly and laterally, remainder yellowish; dorsolateral scales brown anteriorly, cream-colored to yellowish posteriorly; lateral and ventral scales cream-colored to yellowish; labium considerably swollen apically, largely dark brown- to black-scaled, white or slightly yellow-tinged scales in narrow ring about 0.6-0.7 from base and scattered; palpus 0.45 of proboscis, 4-segmented, segment 4 short, largely dark brown- to black-scaled, white scales at joints between segments 1-2 and 2-3, covering all of segment 4 and scattered; torus scales white or dingy; flagellar scales small and medium-sized, whitish. Thorax: integument of mesonotum, postnotum and pleuron uniformly brown to dark brown or posterior portion of mesonotum, postnotum and posterior portion of pleuron lighter, scutellum always lighter; paratergite bare; posterior dorsocentral bristles apparently not in double row; anterior mesonotal bristles dark brown, supraalar, parascutellar and scutellar bristles brownish-amber; acrostichal scales not separated laterally from dorsocentral scales by a narrow longitudinal area, large white or cream-colored scales at anterior promontory and sometimes in interrupted or more or less continuous row throughout length of scale band, large or small brown scales at posterior end, remaining scales small, white and yellowish or all yellow; anterior prescutellar scales small, golden; dorsocentral scales large, white or cream-colored at anterior promontory, large, silvery-white and yellowish at posterior end, remainder small, silvery-white anteriorly, remainder yellow or yellow and brownish; lateral prescutellar scales large, brown anteriorly, silvery-white posteriorly; lateral prescutal scales silvery-white anteriorly, remainder largely dingy-yellow, often with brown or pink reflection; posterior fossal scales dingy-white and dingy-yellow, often with pink reflection; fossal scales brown and dingy-yellow, sometimes with pink reflection; supraalar scales small mesally, larger laterally, posterior scales brown, remainder whitish, silvery-white and dingy-yellow, often with pink reflection; scutellar scales silvery-white; pra usually with 1 brown bristle (0-2); upper stp bristles 1, strongly developed, brown, posterior stp bristles amber, 2 or 3 strongly developed, 1 or 2 moderately developed, lower stp bristles 3-7, amber, weakly to strongly developed; upper mep bristles 7-14, white or rarely yellowish; upper apn scales dingy yellow; lower apn scales cream-colored with yellow reflection; ppn with almost complete covering of dingy white and dingy yellow narrow curved scales, scales sometimes with pink reflection; pra, ppl, pst and ssp scales cream-colored with yellow reflection; hypostigial scales absent; upper half of stp with bare areas below pra and at bases of bristles, lower posterior stp scales joined to those in upper half, all stp scales cream-colored with yellow reflection; mep with flat scales in a lower anterior triangular patch which may be connected to upper mep scale patch, scales cream-colored with yellow reflection. Legs: integument of mid- and hindcoxae same color as pleuron, forecoxa lighter; forecoxal bristles yellowish-amber, midcoxal bristles brown, hindcoxal bristles brownish amber; coxal scales largely broad, flat, the light ones cream-colored with yellowish reflection; forecoxa with light scales on anterior surface, above and among bristles and in small patch on lower posterior surface, some of those among bristles semierect, midcoxa with patch of light scales above bristles and with light and brown scales on anterior surface, hindcoxa with scales on anterior surface, those above light, those below brown or brown and light; remaining

leg segments with dark scales brown or black, light scales white to cream-colored with yellowish tinge; femora with dark-scaled preapical ring; forefemur with light-scaled streak at base of dorsal surface, remainder dark-scaled with scattered light scales; midfemoral anterior surface dark-scaled at base and ventrally in basal 0.2-0.5, remainder dark-scaled with scattered light scales which become more numerous apically, posterior surface dark-scaled ventrally to beyond middle, usually with pale basal streak, remainder dark-scaled with scattered light scales; hindfemur like midfemur except that ventral streak of dark scales on both anterior and posterior surfaces extends further apically; tibiae with dark-scaled irregular preapical ring; foretibia with dark-scaled basal ring, anterior and dorsal surfaces dark-scaled with scattered light scales, posterior surface with light-scaled streak, ventral surface entirely dark-scaled; midtibia with a few light scales at base followed distally by dark-scaled ring, dorsal, anterior and ventral surfaces dark-scaled with scattered light scales, posterior surface with light-scaled streak; hindtibia with narrow irregular basal light-scaled ring followed distally by irregular dark-scaled subbasal ring, dorsal and anterior surfaces dark-scaled with scattered light scales, ventral surface largely light-scaled, posterior surface largely dark-scaled or with light speckles; tarsi largely dark-scaled, segment 1 with incomplete to complete narrow basal light-scaled ring; foretarsal segment 1 dark-scaled at apex, segments 2-5 all dark-scaled; midtarsal segment 1 with a few light scales at apex, segments 2-3 or 4 with a few light scales at base; hindtarsal segment 1 with moderately broad apical light-scaled ring, segments 2 and 3 with moderately broad basal and narrow apical light-scaled rings, segment 4 with light-scaled ring in basal 0.5, segment 5 entirely dark-scaled or with a few light scales at apex. Wing: vein R_2 3.55 length of vein R_{2+3}; vein M_{1+2} 1.86 length of vein M distad of crossvein m-cu; scales mostly asymmetrical, moderately to quite broad, spreading on most veins; wing largely dark brown- to black-scaled, with light, usually white, scales in definite but variable-sized patches and scattered, as follows: (1) costal vein with basal, prehumeral, humeral, accessory sectoral, subcostal and apical light patches and with few to numerous scattered light scales, (2) vein Sc with accessory sectoral and subcostal light patches and with few to numerous scattered light scales, (3) vein R with humeral and sometimes prehumeral light patches, and with few to numerous scattered light scales, (4) vein R_1 with accessory sectoral and apical light patches and with few to numerous scattered light scales, (5) veins R_S, R_{4+5}, Cu, 1A and sometimes M with basal light patch, (6) vein R_{2+3} with light patch opposite base of vein R_{4+5}, (7) veins M and Cu with light patches distad of crossveins, (8) all veins behind vein R_1 with apical light patch, (9) veins R_2, R_3, R_{4+5}, M, Cu and 1A with few to numerous light scales in small patches or scattered, (10) portion of costa along posterior edge of wing with light scales in patches at ends of veins and scattered. Haltere: integument white to beige, scales transparent to whitish or yellowish. Abdomen: integument of tergites and sternites light brown to brown except for lighter areas beneath light scales; laterotergite bare; tergite I with brown or brown and light scales in fan, with lateral patch of light scales and with scattered light and dark scales; remaining segments with dark scales brown to dark brown or black; tergites II-VII with white scales in large basolateral patch and usually in narrow irregular basal band, patch on segments II and III sometimes extending to apex of segment near lateral edge of tergite, patch on each succeeding segment smaller, basal band of segment II sometimes broadened middorsally; tergite VIII with white scales in basal band; sternite II largely bare, with a few white scales; sternite III largely white-scaled, brown scales mesally

and in narrow apical band; sternites IV-VII with white scales in basolateral patch and sometimes in irregular narrow basal band, patch smaller on each succeeding segment; sternite VIII bare mesally, brown-scaled laterally.

MALE. Essentially as in female. Head: mesal posterior erect scales yellowish. Proboscis: largely dark brown- or black-scaled, white or yellow-tinged scales in narrow to broad ring just distad of distal end of palpal segment 2 and scattered. Palpus: about 0.92 of proboscis, segment 3 with a few strong apical bristles; largely dark brown- or black-scaled, white scales at joints between segments 1-2, 2-3 and 3-4 and scattered on segments 2 and 3, white or silvery-white scales sometimes at apex of segment 4 and always covering all of segment 5. Antenna: integument of torus lighter laterally; flagellar segments 1-4 with tufts of extremely long silvery-white scales. Abdomen: basal light bands of tergites better developed than in female; sternite VIII white-scaled apically and laterally, remainder dark-scaled; sidepiece with light and dark scales.

MALE GENITALIA (fig. 18). Segment VIII: tergite lobe distinct, slightly longer than broad, apex truncate or shallowly emarginate, apical portion (not just margin) with small teeth. Segment IX: tergite with 2 or 3 fine bristles on each side. Sidepiece: long conical; basal mesal lobe with 4 stout terete apical bristles which are curved mesally at apex and 2 finer terete apical bristles sternad of stout ones; mesal surface more or less completely sclerotized; mesal surface with moderately developed specialized bristles, bristles long, curving sternally and basally at apex; tergomesal surface sometimes with 1 or 2 poorly developed specialized bristles distad of basal mesal lobe. Spiniform: 1, simple. Aedeagus: moderately sclerotized; central portion broadest, tapering to both a narrow base and apex; apex slightly flared, the edge of the flare wrinkled; sternal surface with tooth on each half along mesal edge near apex. Proctiger: paraproct sclerotization with 3 or 4 apical teeth; cercal setae 2-4.

PUPA. Not available for study. According to MacGregor and Gebert (1923:452) hair 9-VIII is a "dense plume" and is considerably longer than hair 9-VII.

LARVA (fig. 22). Head: 1.04 mm. Siphon: 0.93 mm. Anal Saddle: 0.38 mm. Head: broader than long, integument not spiculose; light tan to tan in color, lighter around imaginal eye, darker posteriorly, collar brown; labrum short; mental plate tan, with 8-10 teeth on each side; hair 2-C apparently absent; 4-7-C apparently extremely variable in size and number of branches; 13-C strongly developed, 15-24b in specimens available for study. Antenna: apparently short and straight in individuals with hairs 4-7-C reduced, moderately-long and curved in individuals with hairs 4-7-C strongly developed; integument without spicules; uniformly light tan to tan. Thorax: epidermal pigment absent in specimens examined; spicules not conspicuous; hairs strongly pigmented and strongly plumose; chaetotaxy extremely variable; hairs 0-P, 1, 14-M and 1, 3, 4-T stellate; hairs 1, 3, 4, 8-P, 13-M and 8-T somewhat stellate; 5-P and 6-M single or multiple; 4-M always single. Abdomen: segments VI, VII with or without sclerotized plates; hairs strongly pigmented and strongly plumose; chaetotaxy extremely variable; hairs 1, 5, 13-I-VII, 7-II-VI, 8-VI, VII, 9-III-VI and 12-I stellate; 2-I, II not stellate, laterad of hair 1 of corresponding segment; 6-I multiple, 6-II-VI double; branches of 13-I shorter than 10-I; 2-III-VII laterad of hair 1 of corresponding segment, moved cephalad and stellate. Segment VIII: sclerotized plate present; comb scales in 2 rows; anterior comb scales 26-31, posterior comb scales 9-14; larger anterior comb scales shaped like posterior comb scales, with 1 long apical spine and basal fringe; hairs

1, 5-VIII stellate; hair 3-VIII only moderately developed, 3-7b. Siphon: index 2.9-3.2; largely tan or brown with darker base and lighter apex; integument ornamented with spinules which are more conspicuous basally; hair 1-S located about 0.33-0.38 distance from base, only moderately developed, 3-5b, longest branches not reaching apex of siphon. Anal Segment: saddle complete; sclerotized incomplete ring at base of saddle present or absent; integument with spinules; tan to brown, darker dorsally and at base; hair 1-X strongly developed, multiple; ventral brush with 6 pairs of hairs, the more caudal hairs with 8-12 branches; gills very short, rounded, dorsal pair about 1.2 times length of ventral pair and about 0.45 length of anal saddle.

BIONOMICS. The immature stages are found in treeholes. MacGregor and Gebert (1923:450) report that the larvae are very common. Nothing is known of the habits of the adults. MacGregor (1927:142) states that except for specimens which have just emerged from the pupa, adults have never been encountered in nature.

SYSTEMATICS. This is the most beautifully ornamented species of Orthopodomyia and it is one of the most interesting from the viewpoints of evolution and zoogeography.

The adults of arboricollis are distinctive on the basis of mesonotal, wing and hindtarsal ornamentation. They are rather uniform, with conspicuous variations involving only the mesonotal and wing ornamentation. On the mesonotum the acrostichal scales range in color from white to deep yellow and the proportions of the different colors of scales making up the lateral prescutal, fossal, posterior fossal and supraalar scale areas differ. The wing exhibits variation in the size of the light patches and in the number of scattered light scales.

The larva of arboricollis is one of the most characteristic in the genus. The form of hairs 6-II-VI and the possession of spinules on the siphon and anal saddle are unique. The remainder of the larval chaetotaxy is also quite distinct. Some of the hairs, such as the relatively poorly developed 3-VIII and 1-S, are apparently neotenic retentions while others are strongly developed and stellate. In spite of the limited distribution of this species and the uniformity of the adults, the larva of arboricollis is evidently the most variable in the genus. In the limited number of specimens available for study it appears that larvae from any one collection are quite uniform in chaetotaxy but may differ considerably from those of another collection. A particular hair, for example 6-M, may be single in individuals in one collection, 3-5 branched in those from another treehole and 9-11 branched in yet another series of larvae. The number of branches in the stellate hairs varies widely and again individuals from any particular collection display only a limited portion of the variation. These observations indicate that hairy forms are environmental modifications.

I have not seen larvae with either as hairy or non-hairy head capsules as those studied by MacGregor and Gebert (1923:451). These authors illustrate a specimen with short, straight antennae and hairs 4-7-C weakly developed and another with long, curved antennae and hairs 4-7-C strongly developed. These authors indicate that both the hairy and non-hairy larvae they illustrated came from a single treehole and that intermediates between the 2 extremes existed in the same collection. This would imply that there is a genetic component involved in determining the hairiness of an individual or that the treehole environment may be heterogeneous in time and conditions existing during some interval stimulate hairiness in only those individuals that pass through a particular stage in their development during that interval.

Although many other species of Orthopodomyia have non-hairy and hairy

larval forms, arboricollis is the only one in which even the head hairs are involved. The "non-hairiest" larva available for study still had most body hairs stellate; it is not known if this would be the case in a larva with reduced head hairs.

Edwards (1932:108) placed arboricollis in Group A (Orthopodomyia) along with the Oriental species, the Central American phyllozoa and the Neotropical fascipes. When Knight and Mattingly (1950:1-2) subdivided Edward's Group A, they erected the arboricollis subgroup for arboricollis, the Madagascan vernoni and the Indian species flavicosta and flavithorax on the basis of the long male palpi and the absence of an accessory subcostal light patch on the wing. A more detailed study of the arboricollis subgroup of these authors has shown that it is an unnatural assemblage. Even on adult characters flavicosta and flavithorax are more similar to the species in the anopheloides subgroup of Knight and Mattingly than to arboricollis or vernoni and a study of the immature stages has shown that at least one of them, flavicosta, is definitely allied with the anopheloides subgroup of these authors.

An appraisal of the affinities of arboricollis is difficult because of the meager information available on the immature stages of it and the Ethiopian species. Adults of arboricollis have the mesonotum nearly completely covered with scales and in this respect they are similar to adults in the Neotropical Thomasina section, the Madagascan Vernoni and Oriental Albipes groups, and the African nkolbissonensis. A closer relationship between arboricollis and the species in the Thomasina section and the Vernoni group is suggested by the fact that all of these species do not have a longitudinal bare area separating the acrostichal and dorsocentral scale bands and all have a single upper stp bristle. In addition, arboricollis and the species in the Thomasina section are the only species of Orthopodomyia with very broad asymmetrical wing scales, and arboricollis and the species in the Vernoni group are the only ones among those species with an extensively scaled mesonotum lacking scales on the laterotergite and possessing an accessory sectoral light patch on the costa.

The male genitalia of arboricollis are very similar to some species in the Albipes group. They are dissimilar to both the Vernoni group and the Thomasina section.

As indicated before, the pupa is the most reliable stage for showing affinities in Orthopodomyia, and until it is adequately described for this species all hypotheses on the relationships of arboricollis must be provisional.

The larva of arboricollis is superficially similar to vernoni in possessing numerous stellate body hairs. While this may indicate true relationship, since this type of chaetotaxy has been evolved separately in larvae of many different genera of mosquitoes, one must consider that these similarities may only be due to parallelism. Two characteristics of the chaetotaxy of Orthopodomyia larvae have been found to be of particular value in hypothesizing group relationships. The first of these is the form of hair 4-M. This hair is always single in species in the Holarctic Signifera group and the Thomasina section and it is normally always double or multiple in the Albipes group and the Central American phyllozoa. The second characteristic is the position of hairs 2-VI, VII. In the Signifera group and in at least fascipes of the Thomasina section these hairs are laterad of hair 1 of the corresponding segment, whereas in the Albipes group and phyllozoa they are mesad of hair 1. In arboricollis and milloti hair 4-M is single; this again suggests a closer relationship to the Thomasina section than to the Albipes group. The position of hairs 2-VI, VII cannot be used to indicate affinities in arboricollis because in association with their stellate de-

velopment these hairs have moved far cephalad and laterad of hair 1 on all of abdominal segments III-VII. In milloti hair 2 is laterad of hair 1.

Arboricollis appears to be distinctive enough to be placed in a monotypic group. I believe its closest affinities are with the Vernoni group, and for the time being I am placing arboricollis, the Vernoni group and nkolbissonensis in the Orthopodomyia section largely on the basis of geography. This arrangement is provisional only and is subject to change when the pupae of arboricollis and the Vernoni group and the immature stages of the continental African species are described.

As indicated above, some features of both arboricollis and the Vernoni group are found in the Neotropical Thomasina section. It is possible that these similarities are not indicative of relationship but are retentions of primitive characteristics by distinct groups. There is some evidence that at least 1 of the characteristics shared by the 3 groups, the presence of an upper stp bristle, is primitive and consequently its presence cannot be used to unite these groups.

DISTRIBUTION. Endemic to Mauritius. Material Examined: 33 specimens; 7 ♂, 11 ♀, 15 L.

MAURITIUS. Réduit, M. E. MacGregor, 4 July 1922, 1 L [BMNH]. Vacaos, 1908, R. Ross, ♂ lectotype (148), 2 ♀ [LIVER in BMNH]. No locality, 15 Sept 1922, M. E. MacGregor, 2 ♂ [BMNH]; Sept-Nov 1922, M. E. MacGregor, 1 ♂, 1 ♀ [BMNH]; Mar-June 1952, 1 ♂, 5 ♀, 5 L [IERT]; Jan 1953, 4 L [IERT]; 27 Sept, M. E. MacGregor, 2 L [BMNH]; 1952, 2 ♂, 1 ♀ [UCLA]. No locality or date, M. E. MacGregor, 2 ♀, 3 L [BMNH].

Additional records from the literature. None.

ALBIPES GROUP

FEMALES. Head: eyes separated above antennae by white to cream-colored scales; orbital bristles usually 1 or 2 lateral pairs and 2-4 mesal pairs; labium slightly swollen apically; palpus 0.42-0.58 of proboscis, 4- or 5-segmented; flagellar scales large and small. Thorax: paratergite with (flavicosta, flavithorax) or without scales; posterior dorsocentral bristles sometimes in a double row; anterior mesonotal bristles brownish-amber to dark brown, supraalar, parascutellar and scutellar bristles lighter, yellowish-amber to tan; acrostichal scales separated from dorsocentral scales by a longitudinal bare area, large and white or cream-colored at anterior promontory, remainder small; anterior prescutellar scales usually small, sometimes a few large and elongate, all golden or yellow or with a few brown posteriorly; dorsocentral scales large and white or cream-colored at anterior promontory, large at caudal end, remainder small; lateral prescutellar scales large, brown anteriorly; lateral prescutal scales white or rarely a few yellowish; supraalar scales usually small in anterior mesal area, remainder larger; scutellar scales white to silvery-white; pra bristles absent or 1, brown; upper stp bristles absent, posterior stp bristles 1-3, amber, moderately to strongly developed, lower stp bristles 0-7, amber, weakly to moderately developed; upper posterior mep bristles 3-10, yellowish-amber (flavicosta, flavithorax) or white, moderately developed, when white they may be somewhat flattened and difficult to distinguish from scales; upper apn scales yellowish, lower white; ppn with an extensive area of scales; hypostigial scales present (madrensis) or absent; mep with flat and semierect scales in a lower anterior angular patch. Legs: forecoxal

bristles yellowish-amber, mid- and sometimes hindcoxal bristles darker; forecoxa with broad flat scales on anterior surface and above bristles and with semierect scales among bristles, mid- and hindcoxae with broad flat scales in an upper outer patch, along outer anterior surface and on midcoxal lower anterior surface; tarsal segment 1 usually with white scales at base in a small patch or narrow incomplete or rarely complete ring; hindtarsal segment 5 all white. Wing: vein R_2 0.91-1.25 length of vein R_{2+3}; vein M_{1+2} 0.82-1.18 length of vein M distad of crossvein m-cu; scales symmetrical, moderately broad, spreading and clasping veins; wing dark, ornamented with light patches (white to cream or rarely yellowish on basal portion of costa) on costa and other veins, the number and size of light patches, especially at base of costa, quite variable within each species, the maximum development as follows: (1) costal vein with subcostal, apical and usually basal, prehumeral, humeral, presectoral, sectoral and accessory subcostal light patches, (2) vein Sc with sectoral, subcostal and sometimes presectoral light patches, (3) vein R with humeral, sectoral, and sometimes basal light patches, (4) vein R_1 with accessory sectoral, subcostal, apical and usually accessory subcostal light patches, (5) veins R_s, R_{4+5}, Cu and sometimes 1A with light patch at base, (6) vein R_{2+3} with light patch opposite base of vein R_{4+5}, (7) veins R_{2+3} and M with light patch over furcation, (8) veins M and Cu with light patches distad of crossveins, (9) vein Cu sometimes with light patch basad of its furcation, (10) veins behind R_1 sometimes with apical light patch. Abdomen: integument of tergites I-VIII and sternites II-VIII usually brown, sometimes lighter under areas with light scales; laterotergite white-scaled; sternite VIII scaled basally, bare apically.

MALES. Similar to females. Palpus: 0.75-0.98 of proboscis, segment 3 normally without strong apical bristles, usually brown-scaled with light scales over joints between segments 1-2, 2-3, 3-4 and 4-5 and usually with remainder of segment 5 light-scaled, light scales white, sometimes yellowish in basal 1 or 2 patches. Antenna: flagellar segment 1 (flavicosta, flavithorax) or segments 1-4 or 5 with tufts of scales. Wing: apical light patches on all or some veins behind vein R_1 sometimes less conspicuous than in female or absent; light patch over furcation of vein M sometimes reduced.

MALE GENITALIA. Segment VIII: tergite with distinct lobe on posterior margin. Segment IX: tergite with 0-5 fine bristles on each side. Sidepiece: long conical; basal mesal lobe usually with 6-8 terete apical bristles, tergal 3-6 quite stout and usually slightly curved mesally at apex, sternal 1-4 usually more strongly curved mesally at apex and distinctly finer (except in madrensis); mesal surface completely sclerotized, weakly sclerotized or membranous distad of basal mesal lobe; mesal surface with patch of specialized curved or sinuous bristles distad of basal mesal lobe (albipes, madrensis) or tergomesal surface with 1 or 2 specialized curved bristles near basal mesal lobe. Spiniform: normally 1, simple. Aedeagus: weakly to strongly sclerotized, varied in form and dentition. Proctiger: paraproct sclerotization with 2-5 apical teeth; cercal setae 1-6.

PUPAE. Cephalothorax: pigmentation varied; integumentary sculpturing present or absent; hairs largely darker than integument; hairs variously developed; hair 6-C cephalad of hair 7 and at least hair 7-C strongly developed and long or hair 6-C caudad of hair 7 (flavicosta, flavithorax); 1 or more of hairs 1-5, 8, 9-C usually strongly developed. Trumpet: largely moderately to strongly pigmented and darker than darkest part of cephalothorax; shape varied; pinna varied. Metanotum: pigmentation varied; integumentary sculpturing present or absent; rarely with fourth pair of hairs developed (flavithorax). Abdomen:

pigmentation varied; segments I or II-VII or VIII with reticulate integumentary sculpturing which is moderately to strongly developed on anterior segments but becomes weaker on posterior segments; smaller hairs concolorous with integument, larger hairs darker; hair 1-II somewhat dendritic (albipes, wilsoni) or not, usually 8-28b (4-37); 2-II cephalad of 3-II; 1-VI, VII laterad of hair 2 of corresponding segment; 9-VII moderately to strongly developed, 7-13b and with longest branch extending about 0.6-1.1 distance to alveolus of 9-VIII; 9-VIII strongly developed, usually 11-16b (9-19), and with longest branch reaching 0.4-0.9 distance to apex of paddle. Terminal Segments: male genital lobe varied. Paddle: lightly pigmented, midrib darker; longer than broad to nearly as broad as long, shape varied; external buttress nearly straight to convex laterally and smooth or with small marginal spicules; midrib nearly straight or convex mesally; entire surface of paddle smooth.

LARVAE. Head: slightly to distinctly broader than long; integument with or without ornamentation; labrum short; hair 2-C absent. Antenna: short to moderately long, integument without ornamentation. Thorax: hair 4-M double or multiple. Abdomen: segment VI without or with (siamensis) a sclerotized plate, segment VII with or without (flavicosta, flavithorax) a sclerotized plate; hairs 2-I, II laterad of hair 1 of corresponding segment; 6-I, II multiple, 6-III, V, VI single, 6-IV often double; 13-I shorter than 10-I; 2-VI, VII mesad of hair 1 of corresponding segment. Segment VIII: sclerotized plate present; comb scales in 2 rows; posterior row usually with 7-12 (5-14) comb scales; posterior comb scales variously shaped. Siphon: integumentary sculpturing absent or present. Anal Segment: saddle complete; sclerotized band or incomplete ring usually present basad of saddle; integumentary sculpturing present or absent; ventral brush usually with 7 pairs of hairs, the stronger hairs usually with 10-18 branches.

BIONOMICS. The immature stages are usually found in treeholes, bamboo internodes or artificial containers. Females of albipes and andamanensis are known to bite man.

SYSTEMATICS. This is the largest and most diverse group in Orthopodomyia, containing 4 subgroups and 9 species, albipes, andamanensis, anopheloides, flavicosta, flavithorax, madrensis, papuensis, siamensis and wilsoni. The following changes have been made in the taxonomy of this group: maculata and maculipes, considered to be distinct taxa by Knight and Mattingly (1950:9, 10), and lemmonae, described by Thurman (1959:58-59), are here considered as synonyms of anopheloides; mcgregori, a name applied to a Philippine specimen by Knight and Chamberlain (1948:10) and Knight and Mattingly (1950:13-15), is treated as a nomen dubium; and papuensis and siamensis are described as new species.

Knight and Mattingly (1950:2) placed flavicosta and flavithorax with the Mauritian arboricollis and the Madagascan vernoni on adult features. After a consideration of the immature stages I cannot agree and believe that flavicosta and flavithorax should be allied with the species which these authors placed in the anopheloides subgroup. The Albipes group of this paper is then equivalent to the anopheloides subgroup of Knight and Mattingly plus flavicosta and flavithorax. As indicated below, the Anopheloides subgroup is here restricted to the 3 species anopheloides, andamanensis and papuensis.

The greatest discordance among classifications based on immature stages, male genitalia and adults is found in this group. Based on adult characters, flavicosta and flavithorax would form one group while the other 7 species would form a second; of the latter 7 species, albipes, andamanensis, anopheloides,

papuensis and siamensis are very similar while madrensis and wilsoni each differ slightly. Similarities in male genitalia would group andamanensis and anopheloides, place albipes, flavicosta, flavithorax and wilsoni together, aggregate papuensis and siamensis, and put madrensis into a separate category. Groups based on pupae would be (1) flavicosta, flavithorax, madrensis and siamensis, (2) wilsoni, (3) albipes, and (4) papuensis, andamanensis and anopheloides. The larval classification agrees with the pupal except that flavithorax would form a fifth group. The classification used here is the one shown by the pupae and the group is accordingly divided into the Flavicosta, Wilsoni, Albipes and Anopheloides subgroups.

Hybridization may explain at least part of the discordance between the stages. The Anopheloides subgroup may be of hybrid origin, with putative ancestors in the Albipes and Flavicosta subgroups.

In light of the great variety of larval and pupal types, the Albipes group is probably one of the oldest in the genus. Its relationships have not been determined. The larval chaetotaxy of wilsoni is very similar to the Central American phyllozoa whereas the larval chaetotaxy of the Anopheloides subgroup is similar to the Holarctic Signifera group. Adult mesonotal ornamentation is like the Mauritian arboricollis, the Madagascan Vernoni group, and the South American Thomasina section, while the ornamentation of the wing is like phyllozoa. The male genitalia of several species have a more or less pyriform aedeagus which is somewhat similar to the Signifera group and arboricollis.

Adults of most species in this group are rather variable, particularly in ornamentation of the proboscis, wing, abdomen and hindtarsus. The larval chaetotaxy of albipes, anopheloides and wilsoni is rather variable and hairy forms are known for the larva and pupa of anopheloides and the pupae of andamanensis and papuensis. These hairy forms resemble the normal larva and pupa of albipes in many ways.

Identification of male genitalia is difficult because many species differ only subtly in the shape of the aedeagus. It is necessary to have the genitalia removed from the eighth segment in order to see the often weakly sclerotized aedeagus, and in addition the genitalia must be mounted perfectly horizontally and with the parts in the normal resting position.

The group differs from the others in the genus in that every species except papuensis is sympatric with at least 1 other species over all or part of its range. Anopheloides occurs with every species in the group except papuensis and in some areas 3, 4 (Malaya) or possibly even 5 (Thailand) species may be sympatric.

DISTRIBUTION. India, southern China and southern Japan, south to Ceylon, the Malay Archipelago and northern Queensland.

KEYS TO SPECIES

Adults

1. Femora, tibiae and tarsal segments 1 with light scales aggregated into distinct light patches; costal vein and vein R_1 lacking a white patch opposite furcation of vein R_{2+3} into veins R_2 and R_3 (accessory subcostal patch); paratergite with a small patch of light scales 2

   Femora, tibiae and tarsal segments 1 with light scales largely scattered; costal vein and vein R_1 normally with an accessory subcostal light patch; paratergite bare 3

2(1). Mesonotal-scaling largely bright yellow or golden; costal vein with presectoral light patch (at least ventrally) and at most with only a few light speckles in basal 0.5; light-scaling on ventral surface of proboscis of female distad of light patch on dorsal surface; vein Cu with or without a light patch basad of its furcation in female 17. flavithorax
Mesonotal-scaling appearing largely brownish; costal vein without presectoral light patch and with numerous light speckles in basal 0.5; light-scaling on ventral surface of proboscis of female basad of light patch on dorsal surface; vein Cu always with a light patch basad of its furcation in female . . . . . .16. flavicosta

3(1). Pra with 1 bristle; hypostigial scales present . . . . . 18. madrensis
Pra normally without a bristle; hypostigial scales absent 4

4(3). Hindtarsal segments 2 and 3 with a moderate-sized subequal white ring at each end; tergites II and sometimes III of female with a large middorsal basal light (usually yellowish) patch . . . . . 20. wilsoni
Hindtarsal segments 2 and 3 not as above, segment 2 entirely or largely dark-scaled at either base or apex, segment 3 all white or with dark scales in proximal or distal portion; tergites II and III of female without a large middorsal basal light patch 5

5(4). Hindtarsal segment 2 usually with more extensive white-scaling at base than at apex; palpus of female with three white patches beyond the base; abdominal sternites II or III to V or VI with a midventral apical light patch . . . . . .21. albipes
Hindtarsal segment 2 always with more extensive white-scaling at apex than at base; palpus of female with two white patches beyond the base; abdominal sternites II-VI without a midventral apical light patch. . 6

6(5). Hindtarsal segment 4 with a dark spot or ring distad of middle . . . . . .24. in part, anopheloides
Hindtarsal segment 4 entirely white-scaled. 7

7(6). Hindtarsal segment 3 entirely white-scaled. . . .19. in part, siamensis; 22. papuensis; 23. in part, andamanensis; 24. in part, anopheloides
Hindtarsal segment 3 with some dark scales 8

8(7). Hindtarsal segment 3 with dark-scaling in basal 0.5. . . . . 23. in part, andamanensis
Hindtarsal segment 3 with dark-scaling in apical 0.5 . . . . . 19. in part, siamensis; 24. in part, anopheloides

Male Genitalia

1. Aedeagus without any sclerotized teeth on the sternal surface but with a projection from the base which extends between or below the ventral parameres 2
Aedeagus with one sclerotized tooth on each half of sternal surface and without a projection extending between or below the ventral parameres 3

2(1). Basal projection of aedeagus usually extending conspicuously between the

ventral parameres . . . . . 24. anopheloides
Basal projection of aedeagus usually directed more sternally so that it does not extend conspicuously between the ventral parameres . . . . . 23. andamanensis

3(1). Basal mesal lobe without apical bristles sharply divided into strong and fine ones, but with 7 or 8 more or less equally developed, strong bristles; mesal surface of sidepiece with a large patch of strong, sinuous, specialized bristles distad of basal mesal lobe . .18. madrensis
Basal mesal lobe with 3-6 strong apical bristles and 1-4 finer ones; mesal surface of sidepiece with or without a patch of strong sinuous or curved specialized bristles distad of basal mesal lobe 4

4(3). Aedeagus not distinctly pyriform, broadest in apical half or at or distad of level of sternal teeth 5
Aedeagus more or less pyriform, distinctly broadest in basal half and basad of level of sternal teeth 6

5(4). Sternal aedeagal teeth 0.50-0.55 distance from base and usually basad of broadest portion of aedeagus. . . . . .19. siamensis
Sternal aedeagal teeth 0.65-0.75 distance from base and usually slightly distad of broadest portion of aedeagus. . . . . .22. papuensis

6(4). Sclerotized teeth on sternal surface of aedeagus separated by a distance nearly equal to the width of one of them; tergite VIII lobe with numerous distinct serrations at apex 7
Sclerotized teeth on sternal surface of aedeagus contiguous or nearly so; tergite VIII lobe without serrations at apex or with only a few irregular teeth. 8

7(6). Mesal surface of sidepiece with a large patch of strong, sinuous or curved, specialized bristles distad of basal mesal lobe . . 21. albipes
Mesal surface of sidepiece without specialized bristles . . . 20. wilsoni

8(6). Clasper strongly curved in the distal 0.25; each strong bristle of basal mesal lobe conspicuously longer than the one dorsad of it . . . . . 16. flavicosta
Clasper only slightly curved in distal 0.25; each strong bristle of basal mesal lobe only slightly longer than the one dorsad of it 17. flavithorax

Pupae

1. Trumpet cylindrical and largely dark brown; hairs 1-6, 8, 9-C moderately developed, shorter than the trumpet, and usually 1-3b (1-4). . . . . .(WILSONI SUBGROUP) 20. wilsoni
Trumpet not both cylindrical and dark brown; normally one, some, or most of hairs 1-6, 8, 9-C strongly to very strongly developed, longer than the trumpet, and/or with more than 4b 2

2(1). Trumpet attaining maximum or nearly maximum width in basal 0.33, the remainder broad and almost or actually parallel sided . . . . . (ALBIPES SUBGROUP) 21. albipes
Trumpet broadening gradually from base to apex, or if attaining nearly

maximum width in basal 0.5, trumpet is rather narrow 3

3(2). Hair 5-VI long, extending to or beyond alveolus of hair 4-VIII, and single, or if 2, 3b, then 6-C is caudad of 7-C and 5-II is short and multiple . . . . . .(FLAVICOSTA SUBGROUP) 4
Hair 5-VI short, extending nearly to or slightly beyond alveolus of 4-VII, or long, usually 3-7b; 6-C cephalad of 7-C and 5-II long and single . . . . . (ANOPHELOIDES SUBGROUP) 7

4(3). Hair 5-VI 2, 3b; 5-II short, 3b; metanotum with 4 pairs of hairs . . . . . 17. flavithorax
Hair 5-VI single; 5-II long, single; metanotum with 3 pairs of hairs . 5

5(4). Hairs 1, 2-C strongly developed and usually 6, 7b (5-8); 2-II laterad of 5-II, 2-IV thickened. . . . . .19. siamensis
Hairs 1, 2-C moderately developed and usually 1-3b (1-4); 2-II mesad of 5-II; 2-IV fine 6

6(5). Hair 6-C caudad of 7-C; 5-III 4-6b; 5-IV single . . . . . 16. flavicosta
Hair 6-C cephalad of 7-C; 5-III 2, 3b; 5-IV usually 3b (2-4) . . . . . .18. madrensis

7(3). Hairs 5-V, VI long, extending to or nearly to alveolus of hair 4 of second following segment; usually some or all of hairs 2-4-C and 6-III, V, VI very strongly developed and long . . . . . (hairy forms) 22. papuensis; 23. andamanensis; 24. anopheloides
Hairs 5-V, VI short, extending nearly to or slightly beyond alveolus of hair 4 of first following segment; usually none of hairs 2-4-C or 6-III, V, VI more than moderately developed . . . . (non-hairy forms) 8

8(7). Hair 1-III usually 12-14b (10-17); 9-C usually 2, 3b (2-5) . . . . . 22. papuensis; 23. andamanensis
Hair 1-III usually 5-7b (3-11); 9-C usually single (single, double) . . . . . .24. anopheloides

Larvae

1. Hairs 4-10-C all more or less equally developed, long, strong and multiple; 0, 1, 3-7-P all more or less equally developed, long, strong and multiple . . . . . (FLAVICOSTA SUBGROUP, in part) 17. flavithorax
Hairs 4-10-C not all equally developed, in particular 8-10-C only 1-3b; 0, 1, 3-7-P not all equally developed, in particular 1, 5, 6-P normally single 2

2(1). Hair 1-M shorter than or only slightly longer than 3-M; 1-T shorter than or only slightly longer than 2-T; posterior comb scales with 5-7 large apical spines; 6-I, II with individual branches usually stouter than 6-III . . . . . (FLAVICOSTA SUBGROUP, in part) 3
Not with above combination of characters; if 1, 3-M and/or 1, 2-T are subequal in length, then posterior comb scales have only a single terminal spine, or if posterior comb scales have more than 1 terminal spine, then 1-M is much longer than 3-M and 1-T is much longer than 2-T; 6-I, II with individual branches usually finer than 6-III 5

3(2). Hairs 1-M, T multiple; 1-III-V shorter than or subequal to hair 3 of corresponding segment; head capsule papillose . . . . . .16. flavicosta
Hairs 1-M, T single; 1-III-V longer than hair 3 of corresponding segment; head capsule smooth 4

4(3). Hairs 6-I, II with branches coarse nearly to apex and barbed only in basal portion; 13-C usually 3-5b; 1-V usually single . . 18. madrensis
Hairs 6-I, II with branches tapering to a fine apex and barbed from near base to near apex; 13-C usually 8, 9b (7-11); 1-V usually double . . . . . .19. siamensis

5(2). Longest spine of posterior comb scales not longer than 1.5 times the distance from its base to the attachment of the comb scale . . . . . (ALBIPES SUBGROUP) 21. albipes
Longest spine of posterior comb scales longer than 2.0 times the distance from its base to the attachment of the comb scale. 6

6(5). Posterior comb scales with only 1 large apical spine . . . . . (WILSONI SUBGROUP) 20. wilsoni
Posterior comb scales with 3-5 large apical spines . . . . . (ANOPHELOIDES SUBGROUP) 7

7(6). Most or all of hairs 1-M, T, III, V multiple; 1-VI often longer than 4-VI . . . . . (hairy forms) 24. anopheloides
All of hairs 1-M, T, III, V usually single; hair 1-VI usually shorter than 4-VI. . . . . (non-hairy forms) 8

8(7). Hair 6-I usually 9, 10b (7-10); hair 6-II usually 9-11b (7-12) . . . . . 23. andamanensis
Hair 6-I usually 5-8b; hair 6-II usually 4-8b . . . . . .22. papuensis; 24. anopheloides

FLAVICOSTA SUBGROUP

PUPAE. Abdomen: hair 1-II strongly developed and long and with mostly simple branches, some much finer than others, arising from the base; 5-V, VI long, extending nearly to or beyond alveolus of hair 4 of second following segment; 5-VI usually single or double (1-3b). Terminal Segments: male genital lobe projecting far beyond median caudal lobe. Paddle: asymmetrically obovate in outline.

LARVAE. (Description does not pertain to the highly modified flavithorax). Head: distinctly broader than long; hairs 4-10-C not all equally developed. Thorax: hairs 0, 1, 3-7-P not all equally developed; 1-M, T short; 13-T weakly developed, usually 3-5b. Abdomen: hairs 6-I, II with individual branches stouter than 6-III. Segment VIII: posterior comb scales with 5-7 large apical spines.

BIONOMICS. Larvae have usually been found in treeholes. Habits of the adults are unknown.

SYSTEMATICS. This subgroup contains the 4 species flavicosta, flavithorax, madrensis and siamensis. The 3 allopatric species flavicosta, madrensis and siamensis are well marked from each other as adults, male genitalia, pu-

pae and larvae, yet clearly belong to 1 group on larval and pupal characters. The fourth species, flavithorax, is sympatric with flavicosta; its larva is very different from that of the other 3 species and shows no evidence of belonging to the same subgroup, but its pupa, while showing several unique features, is similar to the other species and the adult and male genitalia resemble flavicosta. There appear to be no characters in the adults or male genitalia to unite these 4 species into 1 subgroup, although 3 of them, flavicosta, flavithorax and madrensis, are the only members of the Albipes group to have a bristle on pra.

Since 3 of the 4 species are well marked in all stages, and all 4 species have very restricted, relictual distributions, this must be one of the oldest subgroups in the Albipes group.

DISTRIBUTION. Discontinuous, with species found in southwestern India and Ceylon, peninsular Thailand and the Philippines.

16. Orthopodomyia flavicosta Barraud

Figs. 23, 24

1927. Orthopodomyia flavicosta Barraud, 1927:531-532. *TYPE: lectotype ♂ (875) with genitalia slide 660610-4, specimen labeled "TYPE ♂," Karwar, [Mysore], India, reared from a larva found in a treehole, Sept 1921, P. J. Barraud; PRESENT SELECTION [BMNH].

Orthopodomyia flavicosta of Barraud and Covell (1928:676); Barraud (1932:1016); Edwards (1932:108); Barraud (1934:104-105); Knight and Mattingly (1950:2); Stone, Knight and Starcke (1959:123).

FEMALE. Wing: 3.40 mm. Proboscis: 2.02 mm. Forefemur: 2.24 mm. Abdomen: about 2.5 mm. Head: integument of head capsule, clypeus, torus and ends of most flagellar segments dark brown, middle portion of most flagellar segments lighter; frontal and orbital bristles amber to brown; decumbent scales silvery-white to cream-colored; erect scales short, broad and dingy yellowish-brown to brown posteriorly and somewhat longer, narrower and lighter anteriorly, a few erect scales, especially laterally, white or yellow; dorsolateral scales brown anteriorly, white posteriorly; lateral and ventral scales white; labium mostly brown-scaled, white scales scattered ventrally near base and in dorsal patch about 0.67-0.75 distance from base, white and/or yellow scales in ventral patch basad of dorsal white patch, and near apex dorsally; palpus 0.51 of proboscis, 4-segmented, segment 4 short, mostly brown-scaled, white scales over joint between segments 2 and 3 and covering all of segment 4 and sometimes in a patch near base of segment 2; torus scales white; flagellar scales white and brown. Thorax: integument of mesonotum, postnotum and pleuron uniformly brown to dark brown, scutellum lighter; paratergite with a few dingy to white scales; acrostichal scales brown at caudal end, remainder brown and golden or mostly golden; dorsocentral scales white or golden at caudal end, remainder brown and golden; lateral prescutellar scales golden or brown and golden, with white scales laterally and caudally; posterior fossal scales mostly golden or yellow; fossal scales usually largely brown anteriorly and golden or yellow posteriorly; supraalar scales white mesally and in anterior projection, remainder golden or yellow; pra with 1 bristle; mep bristles yellowish amber; ppn with white and yellow decumbent scales along upper margin, yellow decumbent scales along posterior margin and flat white scales along

ventral margin; pra, ppl and pst scales white or yellow-tinged; ssp scales in a long row, white anteriorly, yellow-tinged posteriorly; hypostigial scales absent; upper half of stp with bare areas near lower end of ssp scales and opposite upper end and middle of lower mep scale patch, upper and anterior scales white, remainder yellow-tinged; lower stp scales yellow-tinged above, white below; lower mep scales white. Legs: integument of mid- and hindcoxae same color as pleuron, forecoxa sometimes lighter; coxal scales white except for a few yellowish ones ventrally on forecoxa and some brown ones along outer anterior edge of mid- and hindcoxae; femora brown-scaled with irregular white to beige patches on anterior surface and on posterior surface of forefemur, posterior surface of mid- and hindfemora with pale speckles and usually with a pale-scaled streak or patch at least near apex; tibiae brown-scaled with many irregular white patches on all surfaces (each patch is distad of a bristle); tarsi largely brown-scaled, segment 1 with small patches of white scales; foretarsal segment 2 and sometimes segment 3 with dorsobasal light patch; midtarsal segment 1 with a few light scales at apex, segments 2, 3 and sometimes 4 with dorsobasal light patch; hindtarsus with white rings over joints between segments 1-2, 2-3 and 3-4 and with white scales at apex of segment 4. Wing: costal vein without presectoral, sectoral or accessory subcostal patches, with or without a single irregular patch in prehumeral to humeral area, and with numerous yellow to white scales speckled from the basal to the subcostal patch and usually at position of accessory subcostal spot; vein Sc with sectoral patch sometimes very small, presectoral patch absent; vein R with basal patch; vein R_1 without accessory subcostal patch but usually with light speckles in that area; vein 1A dark at base; vein Cu with light patch basad of its furcation; usually all veins behind R_1, except sometimes Cu_2, with apical light patch. Haltere: integument beige to brown; scales transparent to brownish. Abdomen: tergite I with brown-scaled fan and scattered brown and white scales laterally; tergites II-VII largely brown-scaled, with basolateral white patch and smaller apicolateral white to yellowish patch which becomes even smaller or disappears on distal segments; tergites III-VII with subdorsal median yellowish or white and yellowish patch; tergite VIII brown-scaled with basal white band which is broader laterally; sternites II-VII with basolateral white patches which are large and cover most of sternites II and III but become smaller on distal segments, remainder brown-scaled; all or only more distal of sternites II-VI sometimes with ventral median light patch; sternite VIII scales dark.

MALE. Similar to female. Proboscis: white scales in narrow incomplete to complete ring just distad of level of distal end of palpal segment 2 and usually speckled or streaked for a short distance distad of this ring on ventral surface, yellow scales in dorsal preapical patch and scattered, especially in apical portion. Palpus: about 0.94 of proboscis; segment 3 with yellow speckles. Antenna: flagellar segment 1 with tuft of large and small brown and white scales. Abdomen: sternite VIII dark-scaled with light scales apically; sidepiece with light and dark scales.

MALE GENITALIA (fig. 23). Segment VIII: tergite lobe much longer than broad, wider apically than basally, apex truncate, without teeth. Segment IX: tergite with 2-5 bristles on each side. Sidepiece: basal mesal lobe with 3 or 4 stout bristles and 2-4 finer; each stout bristle considerably longer than the one dorsad of it; mesal surface membranous distad of basal mesal lobe; specialized mesal bristles absent, 1 or 2 specialized tergomesal bristles present. Clasper: strongly curved in distal 0.25. Aedeagus: moderately sclerotized; more or less pyriform, with 1 pair of contiguous or nearly contiguous sternal

teeth about 0.65 from base; without basal projection between parameres. Proctiger: paraproct sclerotization usually with 3 or 4 apical teeth; cercal setae 2 or 3.

PUPA (fig. 23). Abdomen: 3.22 mm. Trumpet: 0.40 mm. Paddle: 0.73 mm. Cephalothorax: mostly light greyish-tan colored, posterior portion of mesonotum and upper part of wing case darker, tan; integumentary sculpturing conspicuous, reticulate; hairs 1, 2-C moderately developed, usually double (2, 3b); 3-C moderately developed, 3-6b; 4-C moderately developed, 2-4b; 5-C with 1 branch very strongly developed, others moderately developed, 2-4b; 6-C caudad of 7-C; 7-C very strongly developed, double; 8-C moderately developed, single; 9-C moderately developed, double. Trumpet: light brown in color except for pinna which is lighter; widening gradually from base; pinna large. Metanotum: light brown mesally, light greyish-tan laterally and on haltere case; reticulate integumentary sculpturing well developed; hair 10-C moderately developed, 5-9b; 11-C moderately developed, usually with 2, 3b arising below middle; 12-C moderately developed, 3, 4b; fourth pair of hairs never developed. Abdomen: anterior segments light tan, posterior very light greyish-tan; posterior edges of anterior segments darker; integumentary sculpturing strongly developed on anterior segments; hair 1-II usually 21-27b; 2-II slightly thickened and mesad of 5-II; 5-II long and single; 2-III slightly thickened, 2-IV fine; 5-IV-VI single; 9-VII 9-12b and with longest branch extending to alveolus of 9-VIII; 9-VIII 9-14b and with longest branch reaching about 0.6-0.7 distance to apex of paddle. Paddle: very light straw-colored; quite angular in outline, with greatest width nearly equal to length; external buttress slightly convex laterally in distal portion and with small marginal spicules; midrib nearly straight to slightly convex mesally.

LARVA (fig. 24). Head: 1.08 mm. Siphon: 1.23 mm. Anal Segment: 0.31 mm. Head: integumentary sculpturing conspicuous, papillose; largely straw-colored, becoming darker, tan or brown, posteriorly, collar dark brown; mental plate straw to tan, usually with 9, 10 teeth on each side; 13-C weakly developed, usually 2, 3b. Antenna: moderately long, tan to light brown basally, becoming straw-colored apically. Thorax: epidermal pigment absent; spicules absent; 8-P usually 2, 3b; 1-M usually 2-4b; 1-T usually 3-6b. Abdomen: segment VII without a plate; hairs 1-I-IV short, usually 3, 4b (3-5); 6-I, II with individual branches tapering to a fine apex and barbed from near base to near apex; 1-V and 13-III-V short, 2, 3b. Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 21-24 (20-25), posterior comb scales usually 7-10 (7-11); anterior comb scales fringed only; posterior comb scales usually with 5 large spines and 2 smaller ones; posterior row of comb scales about 0.65-0.84 length of anterior row; hair 3-VIII usually 6, 7b. Siphon: index about 4.5-5.7; base of siphon brown to dark brown, portion between base and alveolus of hair 1-S tan to brown, portion between 1-S and apex darker, dark tan to dark brown, apex straw-colored; strongly developed imbricate integumentary sculpturing present; hair 1-S located 0.40-0.44 from base of siphon, usually 5-8b (4-10). Anal Segment: base and dorsal surface brown, remainder tan to light brown; moderately developed imbricate integumentary sculpturing present; dorsal anal gills about 1.5-1.6 length of ventral pair and about 0.7-0.8 length of anal saddle.

BIONOMICS. The immature stages have been found only in treeholes and may occur in the same breeding site with flavithorax and anopheloides.

SYSTEMATICS. Adults of this species and the following, flavithorax, are most conspicuously differentiated from all other members of the Albipes group

by the following features: (1) definite patches rather than scattered light scales on the femora, tibiae and first tarsal segments, (2) absence of the accessory subcostal light patch on the costal vein and vein R_1, (3) a light patch basad of the fork of vein Cu (at least in the male), (4) a broad white ring over the joint between hindtarsal segments 1 and 2, (5) a small patch of scales on the paratergite, (6) scales on only the first flagellar segment in the male, and (7) the male palpus about as long as the proboscis. The adults of flavicosta and flavithorax are distinguished from each other by the characters given in the key.

The ornamentation of the basal portion of the costal vein is quite variable in flavicosta. There may or may not be a small to large light patch in the prehumeral to humeral area, but there is never a presectoral patch. There are numerous yellow, or rarely white, scales scattered along the basal half of the costa. According to Barraud (1927:532) these scales may be so numerous as to form a long streak.

The male genitalia of flavicosta and flavithorax are quite distinct from those of the other 2 species in the Flavicosta subgroup, but resemble those of albipes and wilsoni. The pupal chaetotaxy of flavicosta is more similar to madrensis than any other species in this subgroup, but it shares with flavithorax the placement of hair 6-C caudad of 7-C. The larva of flavicosta is not as similar to either madrensis or siamensis as those two species are to each other.

One of Barraud's specimens from Karwar, India, cannot be assigned to either flavicosta or flavithorax and is apparently a hybrid between the 2 species. The larval skin is in such poor condition that few hairs can be checked, but the skin is definitely not the extremely hairy flavithorax and agrees with flavicosta in comb scales and those hairs which can be identified. The pupa, adult, and male genitalia show mixed flavicosta and flavithorax characters.

Flavicosta

DISTRIBUTION. Coastal southwestern India. Material Examined: 36 specimens; 7 ♂, 9 ♀, 3 P, 17 L; 3 larval individual rearings.

INDIA. Mysore: Karwar, Aug-Sept 1921, P. J. Barraud, ♂ lectotype (875), 2 1p♂ (876, 886), 1 1p♀ (873), 2 ♂, 6 ♀, 14 L [BMNH], 2 ♂, 2 ♀ [USNM].

Additional records from the literature. None.

Hybrids

DISTRIBUTION. Karwar, India. Material Examined: 3 specimens; 1 ♂, 1 P, 1 L; 1 larval individual rearing.

INDIA. Mysore: Karwar, Aug 1921, P. J. Barraud, 1 1p♂ (882).

Additional records from the literature. None.

17. Orthopodomyia flavithorax Barraud

Figs. 25, 26

1927. Orthopodomyia flavithorax Barraud, 1927:529-531. *TYPE: lectotype ♂ (871) with genitalia slide 660610-2, specimen labeled "Type ♂," Karwar, [Mysore], India, reared from a larva found in a treehole, Sept 1921, P. J. Barraud; PRESENT SELECTION [BMNH].

Orthopodomyia flavithorax of Barraud and Covell (1928:676); Barraud (1932: 1015-1016); Edwards (1932:107, 108); Barraud (1934:103-104); Knight and

Mattingly (1950:2); Stone, Knight and Starcke (1959:123).

FEMALE. Wing: 3.63 mm. Proboscis: 1.98 mm. Forefemur: 2.05 mm. Abdomen: about 2.5 mm. Very similar to flavicosta, differing in the following details. Head: decumbent scales yellow except for white ones at base of frontal bristles and in front of dorsolateral scales; many erect scales, especially laterally, yellow; labium with dorsal white patch about 0.67-0.75 distance from base and with white and/or yellow scales in ventral patch distad of dorsal white patch and sometimes also scattered near base ventrally and apex dorsally or ventrally. Thorax: acrostichal scales brown at caudal end, remainder bright yellow; dorsocentral scales bright yellow; lateral prescutellar scales brown and bright yellow; posterior fossal scales bright yellow; fossal scales yellowish-brown in center of fossa, remainder bright yellow; supraalar scales white in anterior projection, remainder bright yellow; all ppn scales curved, decumbent, yellow along upper and posterior margins, white along ventral margin; pra scales yellowish; ssp scales mostly yellow-tinged; stp scales white anteriorly, remainder yellow-tinged. Legs: forecoxal scales all white; posterior surface of mid- and hindfemora with more extensive pale-scaling, sometimes largely yellowish; midtarsal segment 1 without white scales at apex. Wing: costal vein with presectoral patch present at least on ventral surface (usually present on dorsal surface also), always with a single patch in prehumeral to humeral area, and with or without a few yellow scales speckled from the presectoral to the subcostal patch; vein Cu with or without light patch basad of its furcation. Abdomen: all or only more distal of tergites II-VII with subdorsal median white and/or yellowish patch; basolateral light patches on distal sternites yellowish and sometimes connected to form basal bands; sternite VIII all dark-scaled basally or with basolateral light patch.

MALE. Similar to female; differs from flavicosta as follows. Proboscis: with or without small patch or narrow ring distad of level of distal end of palpal segment 2, without distinct yellow preapical patch, with many yellow and white scales speckled or arranged into small spots throughout length but especially numerous apically. Palpus: about 0.98 of proboscis. Wing: vein Cu always with light patch basad of its furcation (always so in flavicosta ♂ and ♀ but not always so in flavithorax ♀). Abdomen: sternite VIII light-scaled basally, laterally and apically.

MALE GENITALIA (fig. 25). Segment VIII: tergite lobe not or considerably longer than broad, sides parallel or diverging apically, apex truncate or emarginate, without distinct serrations. Segment IX: tergite with 0-3 bristles on each side. Sidepiece: basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer; each stout bristle only slightly longer than the 1 dorsad of it; mesal surface membranous distad of basal mesal lobe; specialized mesal bristles absent, 1 or 2 specialized tergomesal bristles present. Clasper: not strongly curved in distal 0.25. Aedeagus: moderately sclerotized; more or less pyriform, with 1 pair of contiguous or nearly contiguous sternal teeth about 0.5-0.7 from base; without basal projection between parameres. Proctiger: paraproct sclerotization usually with 3 or 4 apical teeth; cercal setae 1-3.

PUPA (fig. 25). Abdomen: 3.36 mm. Trumpet: 0.46 mm. Paddle: 0.70 mm. Cephalothorax: ventral portion light greyish-tan, dorsal portion tan, posterior part of mesonotum and upper part of wing case light brown; integumentary sculpturing absent; hair 1-C strongly developed, usually double (2, 3b); hair 2-C strongly developed, 6-12b; hair 3-C strongly developed, 5-9b; hair 4-C moderately developed, 4, 5b; 5-C strongly developed, 5-7b; 6-C caudad of

7-C; 7-C strongly developed, 4, 5b; 8-C strongly developed, 3b; 9-C strongly developed, 7, 8b. Trumpet: mostly brown in color, extreme base and apex lighter; broadened gradually from base; pinna large. Metanotum: evenly light brown; integumentary sculpturing absent; hair 10-C moderately developed, 14-21b; 11-C moderately developed and with 4-6b from near base; 12-C strongly developed, 9-11b; fourth pair of hairs developed, moderate, 3, 4b. Abdomen: anterior segments evenly light brown, posterior segments straw-colored; integumentary sculpturing strongly developed on anterior segments; hair 1-II 16-21b; 2-II slightly thickened and mesad of 5-II; 5-II short, 3b; 2-III, IV thickened; 5-IV, V 3b; 5-VI usually double (2, 3b); 9-VII 8b and with longest branch extending beyond alveolus of 9-VIII; 9-VIII 11, 12b and with longest branch reaching 0.6-0.7 distance to apex of paddle. Paddle: light straw-colored; similar to flavicosta, but not as angular; external buttress convex laterally and smooth; midrib slightly convex mesally.

LARVA (fig. 26). Head: 1.12 mm. Siphon: 1.50 mm. Anal Segment: 0.39 mm. Head: distinctly broader than long; integumentary sculpturing absent; largely straw-colored to light tan, lighter around imaginal eye, darker posteriorly, collar brown; mental plate straw-colored to tan, usually with 7, 8 (7-9) teeth on each side; hairs 4-10-C all more or less equally developed, strong, long and usually 12-18b (8-22); 13-C strongly developed, 8-12b. Antenna: moderately long, base brown, becoming straw-colored apically. Thorax: epidermal pigment absent; spicules present; hairs 0, 1, 3-7-P all more or less equally developed, strong, long and usually 8-24b (6-27); 8-P usually (?) 14-18b; 1-M long, usually 26-30b; 1-T long, usually 15-23b; 13-T strongly developed, usually 5, 6b. Abdomen: segment VII without plate; hair 1-I moderately long, 7-9b; 1-II-IV moderately long, usually 4-6b; 6-I, II with individual branches finer than 6-III, tapering to a fine apex, and barbed from near base to near apex; 13-III-V moderately long, 6-9b; 1-V long, 3-5b. Segment VIII: sclerotized plate present, but reduced and irregular in all specimens available for study; anterior comb scales usually 19-22 (17-26), posterior comb scales usually 10-12; anterior comb scales fringed; posterior comb scales with 1 very long, strong apical spine and 3 or 4 smaller spines on each side of base of large spine; posterior row of comb scales 0.89-1.02 length of anterior row; hair 3-VIII usually 5, 6b. Siphon: index about 5.3-6.3; colored as in flavicosta; integumentary sculpturing imbricate, moderately developed basally; hair 1-S located 0.39-0.42 from base of siphon and usually 6-9b. Anal Segment: coloration and sculpturing as in flavicosta; dorsal anal gills about 1.3-1.7 times length of ventral pair and about 0.3-0.6 length of anal saddle.

BIONOMICS. Larvae have been collected only in treeholes, where they may be associated with those of flavicosta and anopheloides.

SYSTEMATICS. The adult of this species is very similar to flavicosta and differs from the remaining species in the Albipes group in the same features.

The scaling at the base of the costal vein is less variable in this species than in flavicosta. There are always 2 light patches, one in the prehumeral to humeral area, and one in the presectoral area. The latter patch is represented on the upper surface of the wing in all specimens except one and in that specimen it is present on the ventral surface. The ornamentation of vein Cu is more variable in the female of this species than in flavicosta, since a light patch may be present or absent basad of the furcation of the vein.

The pupa of flavithorax is more similar to siamensis than to any other species, but it has in common with flavicosta the position of hair 6-C caudad of 7-C. The development of the fourth pair of hairs on the metanotum of this species

is unique in the genus. Only 2 specimens of the pupa have been available for study, but since the hair is present and well developed on both sides of each individual I think that it must be a normal component of the chaetotaxy rather than an anomaly.

The flavithorax larva is completely unlike that of any other in the Flavicosta subgroup and is, in fact, the most distinctive larva in the entire genus. It is remarkable in the elongation and branching of many hairs on the head and thorax. Even the comb scales are of a type not found elsewhere in the Albipes group. The extremely different larva of this species poses problems in erecting a classification. The species could actually belong to a separate subgroup and have obtained adult and male genitalic features similar to those of flavicosta via introgression with that species, or the species could truly be related to flavicosta and the peculiar larva have been evolved in response to competition with it. The second alternative has been chosen here.

Barraud (1932:1013) stated that no definite saddle occurred on segment VIII of the larva, but that there was some indefinite sclerotization on that segment. I find, however, that a definite plate is present on the larval skin.

Flavithorax is probably the most recent derivative in the Flavicosta subgroup, having arisen from flavicosta or its ancestor. It seems most likely that the species arose in geographical isolation.

A specimen which is possibly a hybrid between flavicosta and flavithorax is discussed in the systematics section of flavicosta.

DISTRIBUTION. Coastal southwestern India and Ceylon. Material Examined: 31 specimens; 6 ♂, 6 ♀, 2 P, 17 L; 2 individual rearings (1 larval, 1 incomplete).

INDIA. Mysore: Karwar, Aug-Sept 1921, P. J. Barraud, ♂ lectotype (871), 1 lp♀ (881), 1 lp (872), 4 ♂, 5 ♀, 15 L [BMNH].

No locality or date: 1 ♂ [USNM].

Additional records from the literature. CEYLON. Madola, near Opanayaka, Feb 1933, Henry (Barraud, 1934:103-104).

18. Orthopodomyia madrensis Baisas

Figs. 27, 28

1946. Orthopodomyia madrensis Baisas, 1946:41-45. TYPE: holotype ♂ with associated larval and pupal skins (THIB-4), Llavac, Laguna, Luzon, Philippine Islands, larva found in a moderately large treehole, Sept 1940, P. Sunico [Location unknown].

Orthopodomyia madrensis of Knight and Mattingly (1950:2, 17-20); Stone, Knight and Starcke (1959:123); Delfinado, Viado and Coronel (1962:438); Delfinado (1966:68-70).

FEMALE. Wing: 3.44 mm. Proboscis: 2.17 mm. Forefemur: 2.41 mm. Abdomen: about 3.4 mm. Head: integument of head capsule, clypeus and ends of most flagellar segments brown to dark brown, torus, basal flagellar segments and central portion of most remaining flagellar segments lighter; frontal and orbital bristles brown; decumbent scales white except for yellowish ones in front of dorsolateral broad scales; erect scales not longer and narrower anteriorly, posterior ones all brown, anterior ones white-tipped; dorsolateral scales all yellow; lateral and ventral scales yellow or white tinged with yellow;

labium brown-scaled with cream-colored to yellow scales in narrow to broad ring near middle, dorsal patch or complete ring near apex, ventral streak usually extending from or basad of middle ring to or near apex and sometimes in streak on dorsal surface extending basad of middle ring; palpus 0.42 of proboscis, 5-segmented, segment 4 short, segment 5 minute, largely brown-scaled with cream-colored or yellow scales over joint between segments 2-3 and sometimes near base of segment 2, and with white scales at apex of segment 3 and covering all of segment 4 and 5; torus scales white or yellow-tinged; flagellar scales white. Thorax: mesonotum brown, greyish-brown or reddish-brown, scutellum usually lighter and greyer, postnotum dark mesally, lighter laterally, pleuron uniformly brown, greyish-brown or reddish-brown, or with lighter areas; paratergite bare; acrostichal scales brown or white at caudal end, remainder mostly white but with some brown and yellow; dorsocentral scales white at caudal end, remainder mostly brown but with some yellow; lateral prescutellar scales all brown except for white near scutellum; posterior fossal and supraalar scales white; fossal scales mostly brown but with some yellow; pra with 1 bristle; mep bristles white; ppn scales all or mostly broad and flat, upper ones yellowish, remainder white; pra, ppl and stp scales white; pst scales white or cream-colored; ssp scales in a long row, white; hypostigial scales broad, flat and white and connected to ssp scale row; upper half of stp with 1 large conspicuous bare area opposite upper end of lower mep scale patch; lower mep scales white. Legs: integument of mid- and hindcoxae same color as pleuron or lighter in upper portion, forecoxa much lighter; coxal scales white except for some brown ones on lower portion of hindcoxa; forefemur with an irregular mostly brown-scaled ventrally incomplete preapical ring, anterior surface white- to yellowish-scaled at base, remainder largely brown-scaled with white to yellowish speckles, posterior surface similar but with more light scales and with light-scaled patch basad of incomplete preapical ring; mid- and hindfemora with an irregular largely brown-scaled ventrally incomplete preapical ring preceded basally by an irregular ring of mostly white or cream-colored scales, anterior surface brown-scaled at base, remainder brown-scaled with white to yellowish speckles, posterior surface usually mostly brown-scaled basally, ventrally and dorsally basad of light ring, remainder largely pale-scaled or sometimes posterior surface entirely pale-scaled except for some brown scales dorsally; tibiae largely brown-scaled with cream-colored speckles and usually with an irregular narrow subbasal brown-scaled ring, posterior surface of foretibia, posterior and sometimes part of dorsal surface of midtibia and basal portion of posterior surface of hindtibia with largely cream-colored scales, and apical portion of posterior surface of hindtibia brown-scaled; tarsi largely brown-scaled, segment 1 with a few white speckles and sometimes with ventral and/or posterior surface largely pale-scaled; foretarsal segment 3 and sometimes segment 2 white- to beige-scaled at ends and segments 4 and 5 all white- to beige-scaled; midtarsal segment 1 white- to beige-scaled at apex, segments 2 and 3 white- to beige-scaled at ends and segments 4 and 5 all white- to beige-scaled; hindtarsal segment 2 broadly white-ringe at apex and segments 3 and 4 entirely white-scaled or more commonly with a small to large brown dorsal patch or complete ring distad of middle of segment 3. Wing: costal vein with sectoral and accessory subcostal light patches, and usually with small distinct basal, prehumeral, humeral and presectoral light patches, or prehumeral, humeral and/or presectoral patches absent, or basal and prehumeral or basal, prehumeral and humeral patches large and confluent; vein Sc without presectoral light patch; vein R with or without basal light patch; vein R_1 usually

with accessory subcostal light patch and rarely without subcostal light patch; base of vein 1A dark; vein Cu without light patch basad of furcation; some or all of veins R_2, R_3, R_{4+5}, M_{1+2}, M_{3+4} and Cu_1 with white scales at apex. Haltere: integument white to brown; scales transparent to whitish. Abdomen: tergite I with brown-scaled fan and scattered white scales laterally; remaining segments with dark scales brown or black, light scales white or rarely yellowish; tergites II-VII dark-scaled with basolateral and apicolateral light patches which become smaller on distal segments, basolateral patches of same segment sometimes connected by weak narrow light-scaled basal band, basal and apical patches of same segment sometimes broadly connected along lateral edge on proximal segments and narrowly connected on distal segments by light scales; all or only more distal of tergites IV-VII with very small to moderately large subdorsal median light patch; some tergites sometimes with middorsal basal light patch; tergite VIII dark-scaled with narrow basal light band; sternites II or II and III light-scaled; sternites III-V or IV and V light-scaled with median lateral dark-scaled patch; sternites VI-VIII dark-scaled with light scales in basolateral patch and sometimes in median streak.

MALE. Similar to female. Proboscis: with narrow ring of white to cream-colored scales distad of level of distal end of palpal segment 2, with broad preapical ring of cream-colored scales, both rings usually joined by ventral light streak, and with or without light speckles on dorsal surface. Palpus: about 0.77 of proboscis; segment 3 without light speckles. Antenna: integument of torus lighter laterally; flagellar segments 1-4 with tufts of long white scales. Abdomen: sternite VIII white-scaled basally, laterally and sometimes apically; sidepiece with light and dark scales.

MALE GENITALIA (fig. 27). Segment VIII: tergite lobe longer than broad, sides diverging apically, apex emarginate and with irregular small teeth. Segment IX: tergite with 0 or 1 bristle on each side. Sidepiece: basal mesal lobe with 7 or 8 bristles which are not sharply divided into stout and fine ones; each bristle not or only slightly longer than the 1 dorsad of it; mesal surface membranous distad of basal mesal lobe; patch of strong sinuous specialized mesal bristles present, specialized tergomesal bristles absent. Clasper: not strongly curved in distal 0.25. Aedeagus: weakly sclerotized; somewhat "angular-ovate" in outline, sternal surface flared laterally on each side near apex; with pair of nearly contiguous to widely separated teeth along edges of sternal surface about 0.55-0.67 from base; without basal projection between parameres. Proctiger: paraproct sclerotization with 3-5 apical teeth; cercal setae 3 or 4.

PUPA (fig. 27). Abdomen: 3.23 mm. Trumpet: 0.50 mm. Paddle: 0.66 mm. Cephalothorax: mostly straw-colored, posterior portion of mesonotum and upper part of wing case darker, tan; integumentary sculpturing weakly developed, reticulate; hair 1-C moderately developed, usually single or double; 2-C moderately developed, usually 2, 3b (2-4); 3-C strongly to very strongly developed, usually 4-6b (3-8); 4, 5-C very strongly developed, usually 3, 4b (2-4); 6-C cephalad of 7-C; 7-C very strongly developed, usually double (1-3b); 8-C moderately to strongly developed, single; 9-C moderately to strongly developed, usually double or single (1-3b). Trumpet: dark brown except at extreme base and apex; widened gradually from base; pinna large. Metanotum: evenly light brown in color or with lateral part of haltere case lighter; integumentary sculpturing weakly developed, reticulate; hair 10-C moderately to strongly developed, usually 4-6b (3-7); 11-C moderately developed, usually single, sometimes with fine branches near apex; 12-C strongly developed, usually 4, 5b (2-5); fourth pair of hairs never developed. Abdomen: anterior seg-

ments light brown, posterior segments tan; anterior portion and posterior edge of anterior segments darker; integumentary sculpturing moderately developed on anterior segments; hair 1-II usually 9-13b; 2-II slightly thickened and mesad of 5-II; 5-II long and single; 2-III, IV fine; 5-IV usually 3b (2, 3b); 5-V usually double (single or double); 5-VI single; 9-VII 10-12b and with longest branch extending to or nearly to alveolus of 9-VIII; 9-VIII usually 16-18b (12-19) and with longest branch reaching 0.6-0.7 distance to apex of paddle. Paddle: very light straw-colored; longer than broad, external portion somewhat angular; external buttress straight in middle portion and with small marginal spicules; midrib convex mesally or straight.

LARVA (fig. 28). Head: 1.03 mm. Siphon: 1.16 mm. Anal Segment: 0.36 mm. Head: integumentary sculpturing absent; dark, tan to brown, posteriorly, lighter, straw-colored to tan, anteriorly and around imaginal eye, collar brown; mental plate tan to brown, usually with 8-10 teeth on each side; 13-C moderately developed, usually 3-5b. Antenna: short, largely light brown to brown, lighter at apex. Thorax: epidermal pigment strongly developed, purple; spicules absent; 8-P usually 4-6b; 1-M, T single. Abdomen: segment VII with large plate; hair 1-I short, usually double (2, 3b); 1-II short, usually single (single, double); 6-I, II with individual branches coarse to near apex and barbed only in basal portion; 1-III moderately long, single; 1-IV and 13-III-V moderately long, double, 1 branch longer than other; 1-V long, single. Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 23-27 (20-28), posterior comb scales usually 8-10 (8-13); anterior comb scales fringed only or with several apical members of fringe lengthened and spine-like; posterior comb scales with 5-7 large apical spines bordered on each side by numerous lesser spines which become smaller and fringe-like proximally; posterior row of comb scales 0.78-0.97 length of anterior row; hair 3-VIII usually 8-11b (7-11). Siphon: index usually 3.8-6.6; base of siphon brown to black, apex straw-colored, remainder evenly brown to dark brown or lighter basad of alveolus of hair 1-S; imbricate integumentary sculpturing weakly to moderately developed basally; hair 1-S located 0.44-0.53 from base of siphon, usually 8-11b (6-13). Anal Segment: largely light to dark brown in color with base and dorsal surface darker; weakly to moderately developed imbricate integumentary sculpturing present; dorsal anal gills about 1.8-2.3 times length of ventral and 0.8-1.1 length of anal saddle.

BIONOMICS. The immature stages have been collected in treeholes and in a hole in the stump of a treefern. The immature stages of anopheloides may occur with those of this species.

SYSTEMATICS. Adults of this species and the 6 following differ from flavicosta and flavithorax by the following features: (1) light scales on the femora, tibiae and first tarsal segments scattered rather than in distinct patches, (2) presence of accessory subcostal light patch on the costal vein and vein R_1, (3) absence of a light patch basad of the fork on vein Cu in either sex, (4) absence (usually) of a broad white ring over the joint between hindtarsal segments 1 and 2, (5) absence of scales on the paratergite, (6) scales on first 4 or 5 flagellar segments in the male, and (7) the male palpus definitely shorter than the proboscis.

The adults of madrensis are unique in the Albipes group in the presence of a patch of hypostigial scales and share a bristle on pra with only flavicosta and flavithorax. The white-scaling on the thorax of madrensis is usually a more pure white than in the other species. Madrensis is not distinct from the other members of the Albipes group in ornamentation of the proboscis and base of the

costa as stated by Baisas (1946:41) and Knight and Mattingly (1950:6, 19). The light-scaling of the proboscis is more frequently white than yellow and is subject to the same variation in extent as in the other species; the light ornamentation of the base of the costa is actually more variable in this species than in any other, ranging from only a small basal patch to small and distinct basal, prehumeral, humeral and presectoral patches or to large and confluent basal, prehumeral and humeral patches. Only sternites II and sometimes III are entirely white-scaled and in this respect madrensis differs only slightly from other species. As is the case in albipes, andamanensis, anopheloides and siamensis, the number of all white hindtarsal segments varies. In madrensis segments 3, 4 and 5 may be all white or segment 3 may have a small dark patch or a complete dark ring distad of the middle.

The male genitalia of this species are unique in the shape of the aedeagus and in having all the bristles on the basal mesal lobe strong. They resemble albipes in the development of a large patch of specialized mesal bristles.

The abdominal chaetotaxy of the pupa of madrensis is similar to flavicosta, but the cephalothoracic chaetotaxy is similar to the Anopheloides subgroup. The larva is more similar to siamensis than any other species. It can be told from all other species of Orthopodomyia by the development of hairs 6-I, II on the abdomen.

DISTRIBUTION. Endemic to Luzon. Material Examined: 56 specimens; 9 ♂, 10 ♀, 8 P, 29 L; 2 individual rearings (1 larval, 1 incomplete).

REPUBLIC OF THE PHILIPPINES. Camarines Sur: Mt. Isarog, 20 Sept 1964, M. Delfinado, 1 ♂, 3 ♀, 6 P, 20 L [USNM], 6 ♂, 6 ♀ [BISHOP].

Laguna: Llavac, Sept 1940, P. Sunico (THIB), 1 ♀ [BISHOP]. Mt. Makiling, 8 June 1964 (IH 35), 3 L [UCLA]; 27 Aug 1966, 1 lp♂ (252-9) [UCLA].

Mountain: Baguio, 6 Sept 1945 (455), 1 L [USNM].

Quezon: Mt. Banahao, 14 Feb 1945 (P 624), 1 ♂, 2 L [USNM].

NO DATA. 1 lp (P 599-1) [USNM]; (P 605), 1 L [USNM].

Additional records from the literature. None.

19. Orthopodomyia siamensis, n. sp.

Figs. 29, 30

TYPES: Holotype: ♂ with associated larval and pupal skins (TG 102-30), Muang, Trang, Thailand, larva found in a roothole, 1964 [USNM]. Allotype: ♀ with associated larval and pupal skins (TG 111-31), Muang, Trang, Thailand, larva found in a treehole, 1964 [USNM]. Paratypes: 2 p♂ (TG 111-101, 102), 3 p♀ (TG 111-100, 103, 104), 1 ♂ (TG 111), 1 L (TG 111), same data as allotype.

FEMALE. Wing: 3.50 mm. Proboscis: 2.03 mm. Forefemur: 2.14 mm. Abdomen: about 2.5 mm. Head: integument of head capsule, clypeus and ends of most flagellar segments brown to dark brown, torus lighter, middle portion of most flagellar segments much lighter; frontal and orbital bristles brown; decumbent scales all white or white anteriorly and yellow posteriorly and laterally; erect scales not longer and narrower anteriorly, brown posteriorly, white or cream-colored or tipped anteriorly; dorsolateral scales brown anteriorly, white or yellow posteriorly; lateral and ventral scales white tinged with yellow; labium mostly brown-scaled, cream-colored scales in ring distad of middle, in ventral streak from or basad of ring to near apex, and in dorsal patch near apex; palpus 0.42 of proboscis, 4-segmented, segment 4 short, mostly brown-

scaled, white scales over joint between segments 2-3, at apex of segment 3 and covering all of segment 4; torus scales white to yellow-tinged; flagellar scales white. Thorax: integument of mesonotum and postnotum light brown to brown or greyish- or reddish-brown, scutellum often lighter and greyer, pleuron darker; paratergite bare; acrostichal scales brown at caudal end, remainder brown and yellow; dorsocentral scales yellow or yellow and white at caudal end, remainder yellow and brown; lateral prescutellar scales brown except for white laterally and near scutellum; posterior fossal scales white and yellow; fossal scales mostly brown anteriorly, yellow posteriorly; supraalar scales white mesally and golden laterally; pra bristles absent; mep bristles white; ppn with upper scales narrow and curved, at least a few lower ones broad, yellow or yellow and white; pra with cream-colored scales; ppl, pst, ssp and stp scales white to cream-colored or yellow-tinged; ssp scales in a short to moderately long row; hypostigial scales absent; upper half of stp with bare areas opposite upper and middle portions of lower mep scale patch; lower mep scales white. Legs: integument of mid- and hindcoxae same color as pleuron, forecoxa lighter; forecoxal scales white or some yellow-tinged, mid- and hindcoxal scales white above, brown below; forefemur with an irregular largely brown-scaled preapical ring, anterior surface with cream-colored to yellow scales at base, remainder brown-scaled with cream-colored to yellow speckles, posterior surface brown-scaled at base and with cream-colored to yellow scales in a patch basad of preapical ring, remainder brown-scaled with cream-colored to yellow speckles; midfemur with an irregular largely brown-scaled complete or incomplete preapical ring usually preceded basally by an irregular dorsally incomplete ring of mostly white to cream-colored scales, anterior surface brown-scaled at base and ventrally to beyond middle, remainder brown-scaled with cream-colored to yellow speckles, posterior surface brown-scaled basally and ventrally to beyond middle, brown-scaled with cream-colored to yellowish speckles dorsally, remainder largely pale yellowish-scaled; hindfemur with brown and cream-colored rings similar to those of midfemur, anterior surface largely brown-scaled, having only a few cream-colored to yellowish speckles, posterior surface like that of midfemur or nearly entirely brown-scaled; tibiae largely brown-scaled with cream-colored to yellow speckles, white to cream-colored scales at base, brown scales in a narrow subbasal ring, posterior surface of fore- and midtibiae and basal portion of posterior surface of hindtibia with mostly cream-colored scales, apical portion of posterior surface of hindtibia largely brown-scaled, and anterior surface of hindtibia cream-colored with brown speckles; tarsi largely brown- to black-scaled, segment 1 with a few cream-colored to yellow speckles and sometimes with ventral and/or posterior surface largely pale-scaled; fore- and midtarsal segments 2 and 3 white- to beige-scaled at ends and segments 4 and 5 entirely white- to beige-scaled; mid- and hindtarsal segment 1 white-scaled at apex; hindtarsal segment 2 broadly white-ringed at apex and segments 3 and 4 entirely white-scaled or less commonly with dark-scaled ring distad of middle of segment 3. Wing: costal vein with sectoral and accessory subcostal light patches, and usually with small distinct basal, prehumeral, humeral and presectoral light patches, or basal and/or presectoral patches absent, or basal, prehumeral and humeral patches large and confluent; vein Sc without presectoral light patch; vein R with or without basal light patch; vein R_1 with accessory subcostal light patch; vein 1A dark at base; vein Cu without light patch basad of furcation; some or all of veins R_2, R_3, R_{4+5}, M_{1+2}, M_{3+4}, and Cu_1 with white scales at apex. Haltere: integument of stem whitish to tan, knob beige to brown; scales transparent to whitish

and brownish. Abdomen: tergite I with brown-scaled fan and with scattered white scales; remaining segments with dark scales brown to black, light scales white or white and yellow; tergites II-VII largely dark-scaled with basolateral and apicolateral light-scaled patches, lateral patches of same segment connected along lateral edge on proximal segments, basal patches of same segment sometimes connected by basal light band on distal segments, and with median subdorsal light-scaled patch on all or more distal tergites; tergite VIII with light-scaled basal band; sternites II-VIII dark-scaled with basolateral light-scaled patch which becomes smaller on distal segments.

MALE. Similar to female. Proboscis: white scales in complete narrow ring distad of distal end of palpal segment 2 and in dorsal preapical patch connected laterally to 1 or 2 preapical ventral patches, or with broad yellowish preapical ring which extends further basally on ventral surface than on dorsal surface. Palpus: about 0.82 of proboscis; segment 3 not light-speckled. Antenna: integument of torus lighter laterally than in female; flagellar segments 1-4 with tufts of long white scales. Abdomen: sternite VIII light-scaled basally and apically; sidepiece with light and dark scales.

MALE GENITALIA (fig. 29). Segment VIII: tergite lobe about as long as broad to longer than broad, usually parallel sided, apex rounded or emarginate, with or without irregular teeth. Segment IX: tergite with 0 or 1 bristle on each side. Sidepiece: basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer; each stout bristle only slightly longer than the one dorsad of it; mesal surface sclerotized distad of basal mesal lobe; specialized mesal bristles absent, 1 or 2 specialized tergomesal bristles present. Clasper: not strongly curved in distal 0.25. Aedeagus: strongly sclerotized; broadest about 0.55-0.60 from base, tapering to obtuse apex, sides sometimes almost parallel to near base, basal portion truncate; 1 pair of very strongly sclerotized, nearly contiguous sternal teeth about 0.50-0.55 distance from base; without basal projection between parameres. Proctiger: paraproct sclerotization with 3 or 4 apical teeth; cercal setae 3 or 4.

PUPA (fig. 29). Abdomen: 2.99 mm. Trumpet: 0.46 mm. Paddle: 0.62 mm. Cephalothorax: mostly light straw-colored, posterior portion of mesonotum and posterior portion of wing case darker, tan; integumentary sculpturing absent; hairs 1, 2-C strongly developed, usually 6, 7b (5-8); 3-C strongly developed, usually 7-9b (4-10); 4, 5-C strongly developed, usually 5, 6b (3-8); 6-C cephalad of 7-C; 7-C strongly developed, double; 8-C strongly developed, usually 6, 7b (3-8); 9-C strongly developed, 3-5b. Trumpet: light brown in color with apex and base lighter; quite similar to wilsoni in shape, narrower than in most other species, parallel sided or widening slightly towards apex, pinna small. Metanotum: evenly tan; integumentary sculpturing absent; hair 10-C moderately developed, usually 7-10b (7-13); 11-C moderately developed, usually single; 12-C strongly developed, 6-9b; fourth pair of hairs never developed. Abdomen: anterior segments tan, posterior segments straw-colored; anterior portion and posterior edge of anterior segments darker; integumentary sculpturing moderately developed on anterior segments; hair 1-II 11-19b; 2-II quite thickened and laterad of 5-II; 5-II long and single; 2-III, IV thickened; 5-IV double; 5-V, VI single; 9-VII 9-12b and with longest branch extending to alveolus of 9-VIII; 9-VIII 13-16b and with longest branch reaching 0.8-0.9 distance to apex of paddle. Paddle: very light straw-colored; longer than broad, external portion sometimes somewhat angular; external buttress nearly straight in middle portion and with marginal spicules; midrib straight to slightly convex mesally.

LARVA (fig. 30). Head: 0.97 mm. Siphon: 1.27 mm. Anal Segment: 0.37 mm. Head: integumentary sculpturing absent; largely tan to light brown in color, darker posteriorly, lighter around imaginal eye, collar dark brown to black; mental plate tan to light brown, usually with 8-10 teeth on each side; 13-C moderately strong, usually with 8, 9b (8-11). Antenna: moderately long, brown basally, lighter apically. Thorax: epidermal pigment strongly developed, purple; spicules absent; 8-P usually 2, 3b; 1-M, T single. Abdomen: segment VI with dorsal sclerotized plate and segment VII with large sclerotized plate; hairs 1-I, II moderately long, single; 6-I, II with individual branches tapering to fine apex and barbed from near base to near apex; 1-III long, single; 13-III-V moderately long, usually double (double, single), and with 1 branch longer than other; 1-IV long, double; 1-V very long, double. Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 20-27, posterior comb scales usually 8-10 (7-11); larger anterior comb scales shaped like posterior comb scales, with 5 or 6 large apical spines bordered on each side by numerous lesser spines which become smaller and fringe-like proximally; posterior row of comb scales about 0.80-0.94 length of anterior row; hair 3-VIII usually 8-10b. Siphon: index usually 6.4-7.8 (6.4-10.1); base of siphon brown to dark brown, apex straw-colored, remainder uniformly light to deep brown; weakly developed imbricate integumentary sculpturing present basally; hair 1-S located 0.41-0.49 from base of siphon, usually 6-8b (5-8). Anal Segment: saddle brown to dark brown with base and dorsal surface darker; weakly to moderately developed imbricate integumentary sculpturing present; dorsal anal gills 1.2-2.0 length of ventral and about 1.0-1.6 times length of anal saddle.

BIONOMICS. The immature stages have been collected in rot holes in trees, stumps and roots. So far as is known, they have not been collected in association with any other species of the Albipes group, although the treehole-breeding andamanensis and anopheloides occur in the same area.

SYSTEMATICS. On larval and pupal characters this species definitely belongs to the Flavicosta subgroup, but the adults cannot be adequately separated from those of the Anopheloides subgroup and the male genitalia are very similar to those of papuensis.

Adults of this species show the same hindtarsal markings as madrensis, and the range in costal ornamentation is almost as great as in that species. In published keys to species of this group (Knight and Mattingly, 1950:6), adults of siamensis would run to either andamanensis or maculipes.

The larva resembles madrensis and the pupa flavithorax. The larva of siamensis is apparently the only one in the Albipes group to develop a sclerotized plate on abdominal segment VI.

DISTRIBUTION. Peninsular Thailand. Material Examined: 62 specimens; 11 ♂, 6 ♀, 15 P, 30 L; 16 individual rearings (7 larval, 8 pupal, 1 incomplete).

THAILAND. Narathiwat: Khau Lau (00430), 1 p♂ (00430-100), 1 L [USNM].

Trang: Muang (TG 20), 1 lp♀ (20-52), 1 p♀ (20-100) [USNM]; same locality (TG 98), 1 l♂ (98-47) [USNM]; same locality (TG 102), 1 p♂ holotype (102-30) [USNM]; same locality (TG 111), 1 p♀ allotype (111-31), 2 p♂ (111-101, 102), 3 p♀ (111-100, 103, 104), 1 ♂, 1 L [USNM].

No locality or date: (00476), 7 L [USNM]; (00477), 3 L [USNM]; (00481), 4 L [USNM]; (NV 12), 1 lp♂ (12-13), 1 L [USNM]; (NV 13), 1 lp♂ (13-10), 4 L [USNM]; (NV 21), 1 lp♂ (21-11), 1 p♂ (21-112) [USNM]; (RN 49), 1 lp♂ (49-1-10) [USNM]; (TG 121), 1 L [USNM].

Additional records from the literature. None.

WILSONI SUBGROUP

20. Orthopodomyia wilsoni Macdonald

Figs. 31, 32

1958. Orthopodomyia wilsoni Macdonald, 1958:121-124. *TYPE: holotype ♂ with associated larval and pupal skins (0348/4), 15 to 16 miles north of Kuala Lumpur in the Ulu Gombak Forest Reserve, Selangor, Malaya, larva found in a bamboo internode, 8 Oct 1957 [BMNH].

Orthopodomyia wilsoni of Stone, Knight and Starcke (1959:124); Macdonald and Traub (1960:94).

FEMALE. Wing: 2.84 mm. Proboscis: 1.65 mm. Forefemur: 1.68 mm. Abdomen: about 2.1 mm. Head: integument of head capsule, clypeus, torus and ends of most flagellar segments brown to dark brown, middle portion of most flagellar segments lighter; frontal and orbital bristles brown; decumbent scales white to cream-colored anteriorly, yellowish posteriorly; erect scales not longer and narrower anteriorly, brown posteriorly, white anteriorly; dorsolateral scales brown anteriorly, yellowish posteriorly; lateral and ventral scales yellowish; labium largely brown-scaled with cream-colored scales in ring at about 0.75 distance from base, in ventral streak extending slightly basad and distad of ring and in dorsal patch between ring and apex; palpus 0.42 of proboscis, 4-segmented, segment 4 short, largely brown-scaled with white scales over joint between segments 2-3 and covering segment 4; torus scales white to yellow-tinged; flagellar scales white. Thorax: integument of mesonotum and pleuron brown, scutellum and sometimes postnotum lighter; paratergite bare; acrostichal scales brown at caudal end, remainder mostly yellow but with some brown and sometimes white; dorsocentral scales white and yellow at caudal end, remainder brown and yellow; lateral prescutellar scales brown or brown and yellow except for white scales laterally and posteriorly; posterior fossal scales yellowish to yellow; fossal scales brown and yellow; supraalar scales white mesally, golden laterally; pra bristles absent; mep bristles white; ppn with yellowish to golden scales, some lower ones broad, flat; pra, ppl, pst, ssp, stp and lower mep scales cream-colored to yellow; ssp scale row usually short, sometimes moderately long; hypostigial scales absent; upper half of stp with bare areas opposite upper and middle portions of lower mep scale patch. Legs: integument of mid- and hindcoxae same color as pleuron or slightly lighter, forecoxa always lighter; forecoxal scales white to yellowish, midcoxal scales white to yellowish above and brown below, hindcoxal scales white above and golden or brown below; femora similar to those of siamensis, but midfemur sometimes not brown-scaled to beyond middle on ventral anterior surface, hindfemur often with numerous light speckles on anterior surface and sometimes not brown-scaled at base of posterior surface; tibiae similar to those of siamensis, but mid- and hindtibiae with a more or less conspicuous ring of white to cream-colored scales distad of subbasal brown-scaled ring and hindtibial posterior surface sometimes all light-scaled; tarsi largely brown- to black-scaled, segment 1 with cream-colored speckles at least on hindleg and sometimes on all three legs and at least hindtarsal segment 1 sometimes with ventral surface largely pale-scaled; foretarsal segments 2-5 all dark-scaled, or segments 2 and 3 white-scaled at base and segments 4 and 5 with brown scales lighter than more proximal segments; midtarsal segments 2 and 3 white-scaled basally and

dark- or beige-scaled apically, segments 4 and 5 white- to beige-scaled; hindtarsal segment 1 usually dark-scaled at apex but sometimes with narrow white-scaled ring, segments 2 and 3 with narrow to broad white-scaled ring at each end, segment 4 entirely white-scaled. Wing: costal vein usually with sectoral and accessory subcostal light patches, and usually with small distinct basal, prehumeral, humeral and presectoral light patches, or humeral and presectoral patches large and confluent; vein Sc without presectoral light patch; vein R without basal light patch and rarely without sectoral light patch; vein R_1 with accessory subcostal light patch; vein 1A dark at base; vein Cu without light patch basad of furcation; some or all of veins R_2, R_3, R_{4+5}, M_{1+2}, M_{3+4} and Cu_1 with white scales at apex. Haltere: integument of stem whitish, knob beige to tan; scales transparent to whitish. Abdomen: tergite I with brown-scaled fan and without or with only a few scattered light or dark scales laterally; remaining segments with dark scales brown to blackish, light scales white, yellow or golden, more frequently yellow or golden than in most other species; tergites II-VII dark-scaled with basolateral and apicolateral light-scaled patches, apicolateral light patch usually quite yellow or golden, lateral patches of segment II or segments II and III broadly joined; tergite II or II and III with large to very large basal middorsal light (usually yellowish) patch which may be connected to basolateral patches by weak light-scaled basal band; tergites IV-VII with scattered light scales basally or with basal light band which is more strongly developed on distal segments; tergites III-VII with subdorsal median light patch (usually yellow or golden); tergite VIII dark-scaled with light basal band; sternites II-VII dark-scaled with basolateral light patch, patch large on segment II, smaller on distal segments; sternite VIII scales dark.

MALE. Similar to female. Proboscis: with narrow incomplete to complete white- and yellow-scaled ring just distad of distal end of palpal segment 2, with dorsal preapical yellow-scaled patch, and sometimes with yellow-scaled preapical patch on ventral surface basad of dorsal patch, the 2 patches connected laterally when ventral is present. Palpus: about 0.84 of proboscis; segment 3 not speckled. Antenna: integument of torus lighter laterally; flagellar segments 1-4 with tufts of long white scales. Abdomen: tergites more frequently and more broadly banded and subdorsal median light-scaled patches larger; sternite VIII with light scales apically and basally; sidepiece with light and dark scales.

MALE GENITALIA (fig. 31). Segment VIII: tergite lobe longer than broad, parallel sided or broader apically, apex truncate or emarginate and with small teeth. Segment IX: tergite with 0 or 1 bristle on each side. Sidepiece: basal mesal lobe with 4 stout bristles and 1 finer; each stout bristle considerably longer than the 1 dorsad of it; mesal surface weakly sclerotized distad of basal mesal lobe; specialized mesal bristles absent; sometimes 1 or 2 specialized tergomesal bristles present. Clasper: not strongly curved in distal 0.25. Aedeagus: moderately sclerotized; pyriform, with 1 pair of strong, sternal teeth near apex, teeth always separated; without basal projection between parameres. Proctiger: paraproct sclerotization with 3 or 4 apical teeth; cercal setae 2-4.

PUPA (fig. 31). Abdomen: 3.19 mm. Trumpet: 0.56 mm. Paddle: 0.64 mm. Cephalothorax: evenly yellowish-tan colored; integumentary sculpturing absent; hairs 1-3-C moderately developed, usually double (1-3b); 4-C moderately developed, usually single (1-4b); 5-C moderately developed, usually single or double (1-3b); 6-C cephalad of 7-C; 7-C only hair longer than trumpet, very strongly developed, usually double (2, 3b); 8, 9-C moderately developed, usually single (single, double). Trumpet: dark brown in color, base and apex lighter; narrow and parallel sided throughout most of its length; pinna small.

Metanotum: evenly yellowish-tan colored or with central portion slightly darker and haltere case slightly lighter; integumentary sculpturing absent; hair 10-C moderately developed, usually 5, 6b (5-9); 11-C moderately developed, usually 3, 4f (1-5); 12-C moderately developed, usually single, sometimes with a couple of fine branches beyond middle; fourth pair of hairs never developed. Abdomen: all segments yellowish-tan colored; anterior portion and posterior edge of segments II and IV sometimes slightly darker; integumentary sculpturing weakly developed on anterior segments; hair 1-II moderately developed, dendritic or with 1 or more stalks from which 18-34 fine ultimate branches arise; 2-II fine and mesad of 5-II; 5-II long, single; 2-III, IV fine; 5-IV usually 3, 4b; 5-V usually 2, 3b and extending to or almost to alveolus of 4-VII; 5-VI usually double (1-3b) and extending to alveolus of 4-VIII; 9-VII usually 8-10b and with longest branches extending to or nearly to alveolus of 9-VIII; 9-VIII 11-14b and with longest branch reaching about 0.75 distance to apex of paddle. Terminal Segments: male genital lobe projecting only slightly beyond median caudal lobe. Paddle: light straw-colored; longer than broad, narrowly elliptical or oval in outline; external buttress nearly straight to slightly convex laterally in distal portion and with small marginal spicules; midrib slightly convex mesally.

LARVA (fig. 32). Head: 0.97 mm. Siphon: 1.81 mm. Anal Segment: 0.33 mm. Head: distinctly broader than long; integumentary sculpturing absent; largely straw-colored to tan, lighter around imaginal eye, darker posteriorly, collar dark brown; mental plate tan, usually with 8, 9 teeth on each side; hairs 4-10-C not all equally developed; 13-C moderately strong, usually with 6, 7b (5-8). Antenna: moderately long, evenly brown to dark brown or lighter apically. Thorax: epidermal pigmentation unknown; spicules absent; hairs 0, 1, 3-7-P not all equally developed; 8-P usually 5-7b (5-9); 1-M moderately long, usually 3, 4b (1-5); 1-T moderately long, usually 2, 3b (1-5); 13-T moderately strong, usually 5, 6b (4-7). Abdomen: segment VII with large sclerotized plate; hair 1-I, II moderately long, usually 3, 4b (1-4); 6-I, II with individual branches finer than 6-III, tapering to fine apex and barbed from near base to near apex; 1-III moderately long, usually 2, 3b (1-3); 13-III moderately long, usually 3, 4b (2-4); 1-IV moderately long, usually 3, 4b (1-5); 13-IV, V moderately long, usually 5, 6b (2-7); 1-V very long, single. Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 21-24 (20-26), posterior comb scales usually 10-12 (7-14); larger anterior comb scales shaped like posterior comb scales, with 1 long apical spine and a fringe, the distal elements of the fringe enlarged, about 0.20-0.50 as long as terminal spine; posterior row of comb scales about 0.71-0.99 length of anterior row; hair 3-VIII usually 8-10b (6-11). Siphon: index usually 7.2-11.5; base of siphon dark brown to black, portion between base and alveolus of hair 1-S light brown to tan, portion between 1-S and apex darker, brown to dark brown, extreme apex not or slightly lighter; weakly developed imbricate integumentary sculpturing present basally; hair 1-S located 0.30-0.37 from base of siphon, usually 8-10b (6-10). Anal Segment: largely light brown to brown in color, dorsal surface and base sometimes darker; integumentary sculpturing absent or very weakly developed and imbricate; dorsal anal gills 1.4-2.2 times length of ventral and usually 1.1-1.6 (1.1-3.0) length of anal saddle.

BIONOMICS. Larvae have been collected in bamboo internodes with moderate to large holes or cracks, but have not been collected in bamboo stumps. Although wilsoni occurs in the same habitat as albipes in Malaya, the two species have never been found in the same collection. Larvae were once collected in the fungus Polystictus xanthopus. Nothing is known of the habits of the adults.

SYSTEMATICS. Adults are distinct in hindtarsal banding and in the presence of a large, usually yellowish, middorsal basal patch on abdominal tergite II and sometimes III. The males of other species may approach wilsoni in the latter character, but the patch is usually smaller and not yellow. The abdominal light-scaling is generally more yellow or golden on all segments in wilsoni than in any other species, and the ssp scale line is sometimes reduced to only 3 or 4 scales.

The male genitalia are similar to albipes but are distinct in lacking specialized mesal bristles. The genital lobe of the male pupa is very small and diagnostic in wilsoni.

The pupa is differentiated from others in the Albipes group by short and weakly developed cephalothoracic setae (except for hair 7-C) and a cylindrical darkly-pigmented trumpet. Its abdominal chaetotaxy is similar to albipes. The most distinctive feature of the larva is the shape of the comb scales. The siphon is longer and thinner than in any other species except for occasional specimens of siamensis and papuensis. The modal condition of the larval chaetotaxy is rather distinctive, but some individuals have the number of branches in hairs 1-M, T, I-IV and 13-T, II-V reduced, and hair 1 may even be single. The modal chaetotaxy is rather similar to that of the Central American phyllozoa.

This appears to be a relictual species; it has no close relatives, but its affinities probably lie with albipes. I believe this species is distinctive enough to be placed in a separate subgroup.

DISTRIBUTION. Malay Peninsula. Material Examined: 45 specimens; 9 ♂, 6 ♀, 13 P, 17 L; 13 larval individual rearings.

FEDERATION OF MALAYSIA. Selangor: Tembler Park, 25 June 1958 (0672), 1 lp♂ (0672-1) [LIVER]. Ulu Gombak, 21 Aug 1956, J. A. Reid (054B), 1 ♀ [LIVER]; 8 Oct 1957, W.W. Macdonald (0348), lp♂ holotype (0348-4), 2 lp♂ (0348-8, 14), 3 lp♀ (0348-1, 5, 6) [BMNH], 2 lp♂ (0348-9, 15), 2 lp♀ (0348-11, 12) [USNM]; 15 Jan 1958 (0459), 2 lp♂ (0459-1, 3) [LIVER].

THAILAND. No locality or date: (RN 7), 1 L [USNM]; (RN 8), 3 L [USNM]; (RN 36), 1 ♂ [USNM].

Additional records from the literature. None.

ALBIPES SUBGROUP

21. Orthopodomyia albipes Leicester

Figs. 33, 34

1904. Orthopodomyia albipes Leicester, 1904:237-239. *TYPE: lectotype ♂ with genitalia slide, specimen labeled "Orthopodomyia albipes (type) Leicester," Pahang Road, 5 3/4 miles from Kuala Lumpur, [Selangor], Malaya, reared from a larva collected in a bamboo internode, 8 Apr 1903 (date of eclosion), PRESENT SELECTION [BMNH]. Stated to be probably only a variety of anopheloides by Edwards (1913:239); given specific rank by Edwards (1926:117, 118); considered as a form of anopheloides by Barraud (1927:527, 528, 529); resurrected by Edwards (1928:53).

Orthopodomyia albipes of Theobald (1907:527-530); Daniels (1908:4); Leicester (1908:176-177, in part); Theobald (1910a:30; 1910b:470); Edwards (1913:239; 1922:458, 470; 1926:117, 118; 1928:53, 57; 1932:108); Barraud (1934:102);

Baisas (1946:34, 35, 45); Brug and Bonne-Wepster (1947:183); Knight and Mattingly (1950:16-17); Macdonald (1957:14; 1958:123, 124, 125); Stone, Knight and Starcke (1959:122); Macdonald and Traub (1960:94); Delfinado, Viado and Coronel (1962:438); Delfinado (1966:68); Stone, Scanlon, Bailey, Definado and Bram (1966:82).

Orthopodomyia anopheloides form albipes of Barraud (1927:527, 528, 529); Borel (1930a:298-302; 1930b:167).

Finlaya albipes of Giles (1904:366).

FEMALE. Wing: 3.24 mm. Proboscis: 2.05 mm. Forefemur: 2.22 mm. Abdomen: about 2.5 mm. Differs from siamensis as follows. Head: decumbent scales all white; posterior dorsolateral, lateral and ventral scales white; labial markings as in siamensis, but pale scales white and ring at about middle of proboscis; palpus 0.58 of proboscis, 5-segmented, segment 4 moderately long, segment 5 short, largely brown-scaled with white scales over joints between segments 2-3, 3-4 and 4-5, covering all of segment 5 and sometimes near joint between segments 1-2; torus scales white. Thorax: acrostichal scales usually brown, sometimes yellow, at caudal end, remainder largely yellow and brown, but usually with some white; dorsocentral scales white or white and yellow at caudal end, remainder yellow and/or cream-colored and brown; lateral prescutellar scales sometimes yellow mesally; posterior fossal scales white or white and yellow; supraalar scales white mesally and sometimes at ends of anterior and middle projections, remainder yellowish, yellow or golden; ppn with upper scales narrow and curved, lower ones narrow and curved or broad and flat, upper yellow-tinged, lower white; pra, ppl, pst, ssp, stp and mep scales white or sometimes cream-colored; ssp scales in a moderately long line; stp with bare areas opposite upper and middle portions of lower mep scale patch and usually also below ssp scales. Legs: forecoxal scales entirely white to cream-colored; forefemur sometimes with small light-scaled patch basad of preapical brown-scaled ring on anterior surface and sometimes with brown-scaling at base of posterior surface reduced; midfemur anterior surface not always brown-scaled ventrally to beyond middle and posterior surface with pale-scaling yellowish or cream-colored; mid- and hindtibiae sometimes with more or less conspicuous largely white- to yellowish-scaled ring distad of subbasal brown-scaled ring, foretibia usually with an anterior light-scaled patch in same position, anterior surface of hindtibia with either light or dark scales predominating; tarsal segment 1 dark-scaled at apex; fore- and midtarsal segments 2 and 3 and sometimes 4 and 5 white-scaled at base, segments 4 and 5, especially on midtarsus, sometimes light brown-scaled; hindtarsal segment 2 with small white-scaled dorsal patch or complete ring at base, apex brown-scaled, with a few white scales or with complete narrow white ring, segments 3 and 4 entirely white-scaled, or rarely segment 3 with dorsal dark patch basad of middle. Wing: costal vein usually with accessory subcostal light patch, and usually with small distinct basal, prehumeral, humeral and presectoral light patches, rarely with prehumeral and humeral light patches absent; vein Sc often with presectoral light patch; vein R_1 usually with accessory subcostal light patch; vein 1A white-scaled at base. Haltere: scales transparent to whitish. Abdomen: tergite I fan sometimes with white scales; light scales usually white, only infrequently some yellow; tergites II-V sometimes with a few light scales basally; sternite II mostly light-scaled, sternites III-VII often with narrow basal light band, sternites II-VI or III-V with ventral apical light patch.

MALE. Similar to female; differs from siamensis as follows. Proboscis:

always with complete broad white or rarely yellowish preapical ring which extends further basally along ventral surface than along dorsal surface. Palpus: about 0.75 of proboscis. Abdomen: sternite VIII light-scaled basally, laterally and apically; sidepiece with all dark scales.

MALE GENITALIA (fig. 33). Segment VIII: tergite lobe always much longer than broad and wider apically than basally, apex rounded or truncate and with small serrations. Segment IX: tergite with 0-2 bristles on each side. Sidepiece: basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer; each stout bristle slightly to considerably longer than the 1 dorsad of it; mesal surface with or without long membranous area distad of basal mesal lobe; mesal surface with patch of moderately to strongly developed sinuous or curved specialized bristles; specialized tergomesal bristles absent. Clasper: not strongly curved in distal 0.25. Aedeagus: moderately sclerotized; pyriform, with 1 pair of strong sternal teeth near apex, teeth always separated; without basal projection between parameres. Proctiger: paraproct sclerotization with 3-5 apical teeth; cercal setae 2-4.

PUPA (fig. 33). Abdomen: 3.38 mm. Trumpet: 0.46 mm. Paddle: 0.62 mm. Cephalothorax: mostly light straw-colored, posterior portion of mesonotum and upper part of wing case slightly darker; integumentary sculpturing absent; hair 1-C moderately developed, usually 2-4b (2-5); 2-C strongly developed, usually 2, 3b (1-3); 3-C very strongly developed, usually 4-6b (4-9); 4-C strongly developed, usually 3, 4b (2-4); 5-C very strongly developed, usually 4, 5b (3-6); 6-C cephalad of 7-C; 7-C very strongly developed, usually 3, 4b (3-5); 8-C moderately developed, single or double; 9-C moderately developed, usually single. Trumpet: largely brown to dark brown in color, base and apex lighter; broadening rapidly from the base and attaining its maximum or nearly maximum width in the basal 0.33, middle 0.34 almost or actually parallel sided; pinna large, making up the distal 0.33. Metanotum: mostly light tan to tan in color, haltere case lighter; integumentary sculpturing absent; hair 10-C moderately developed, usually 2, 3b (2-5); 11-C moderately developed, usually 3, 4f (2-5); 12-C moderately developed, usually 2, 3b (1-3); fourth pair of hairs never developed. Abdomen: anterior segments straw-colored to tannish-brown, posterior segments lighter, light straw-colored to yellowish-tan; anterior and mesal portions and posterior edges of anterior segments darker, tan to light brown; integumentary sculpturing moderately developed on anterior segments; hair 1-II short, not extending to 0-III and usually with a central stalk from which 19-35 very fine dendritic or forked branches arise; 2-II fine and mesad of 5-II; 5-II long, single; 2-III, IV fine; 5-IV usually 3-5b; 5-V usually 3b (2-4) and extending to alveolus of 4-VII; 5-VI usually 2b (2-5) and extending to alveolus of 4-VIII; 9-VII usually 9-11b (8-13) and with longest branches reaching alveolus of 9-VIII; 9-VIII usually 12-14b (11-16) and with longest branch reaching about 0.75 distance to apex of paddle. Terminal Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: very light straw-colored; longer than broad, narrowly elliptical to obovate in outline; external buttress nearly straight in distal portion and almost smooth; midrib slightly convex mesally.

LARVA (fig. 34). Head: 1.15 mm. Siphon: 1.74 mm. Anal Segment: 0.43 mm. Head: distinctly broader than long; integumentary sculpturing absent; largely straw-colored, lighter around imaginal eye, darker posteriorly, collar brown; mental plate tan, usually with 11, 12 (11-13) teeth on each side; hairs 4-10-C not all equally developed; 13-C moderately developed, usually 4-6b. Antenna: moderately long, light brown in color. Thorax: epidermal pigment

strongly developed, purple; spicules absent; hairs 0, 1, 3-7-P not all equally developed; 8-P usually 8-13b; 1-M long, usually 1-3b (1-4); 1-T long, usually 1-3b; 13-T strongly developed, usually 7-9b (5-10). Abdomen: segment VII with large sclerotized plate; hairs 1-I, II moderately long, usually 2, 3b; 6-I, II with individual branches finer than 6-III, tapering to fine apex and barbed from near base to near apex; 1-III long, usually 2, 3b (1-4); 13-III-V moderately long, usually 4, 5b (3-5); 1-IV long, usually 4, 5b (3-5); 1-V very long, usually single (single, double). Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 19-21 (18-27), posterior comb scales usually 7-10 (5-12); larger anterior comb scales shaped like posterior comb scales, with 1 strong but short apical spine and a fringe, the distal members of the fringe enlarged, about half as long as terminal spine; posterior row of comb scales about 0.46-0.77 length of anterior row; hair 3-VIII usually 10-12b (9-14). Siphon: index usually 4.0-6.0 (3.6-6.7); base of siphon dark brown to black, portion between base and alveolus of hair 1-S tan to brown, portion between 1-S and apex darker, dark tan to dark brown, apex straw-colored to yellowish-tan; weakly to moderately developed imbricate integumentary sculpturing present in basal portion; hair 1-S located 0.32-0.40 from base of siphon, usually 9-11b (6-14). Anal Segment: base and dorsoapical portions usually brown, remainder usually tan in color; integumentary sculpturing absent or very weakly developed, imbricate; dorsal anal gills about 1.3-1.9 times length of ventral pair and 1.1-2.5 times length of anal saddle.

BIONOMICS. The immature stages of albipes are usually found in bamboo internodes with moderate to large holes or cracks. According to Macdonald (1958:124, 125), this is the most common species of Orthopodomyia at Ulu Gombak, Malaya, where it is the only one biting man (7 separate records).

SYSTEMATICS. The most distinctive adult feature of this species is the palpus of the female. It is 5-segmented, with segment 4 moderately long and segment 5 short. Females of other species in the Albipes group have either a 4-segmented palpus or a 5-segmented one with segment 4 short and 5 just a minute apical projection. The added length of segment 4 in albipes effectively separates the light scales at the base and apex of the segment into 2 patches, so that the palpus has 3 white patches beyond the base. In other species it has only 2. Both sexes are distinct in the ornamentation of hindtarsal segment 2, which has a broader area of white scales at the base than at the apex. Wing vein 1A is white-scaled at the base in albipes and this serves to separate the species from all others except for some specimens of the Anopheloides subgroup.

The male genitalia of albipes are similar to wilsoni, but are easily told from it by a patch of specialized mesal bristles. These specialized bristles are also found in madrensis, but that species is distinct from albipes in the number of strong bristles on the basal mesal lobe and the shape of the aedeagus.

Besides the feature given in the key, the pupa is distinctive in hairs 3, 7-C both being long and multiple. The size and type of branching of hair 1-II is also diagnostic. The larval chaetotaxy is quite variable, hairs 1-M, T, III, IV and 13-T, II-V often being developed as in the Anopheloides subgroup.

This species is known to hybridize with anopheloides. The hybrids, 4 males from northern Thailand, resemble albipes in the adult stage except that they have a patch of scales on each side of the clypeus. Larvae and pupae are also like albipes, but show some less conspicuous features of anopheloides. The male genitalia of these 4 specimens are very distinct, however, the aedeagus being unlike that of any species in the group; it is somewhat intermediate in shape between albipes and anopheloides.

Although it is probably distantly related to wilsoni, albipes is distinct enough on larval and pupal features to be placed in a separate subgroup.

Albipes

DISTRIBUTION. Eastern India to South Vietnam, south to the Malay Peninsula and northern Borneo. Material Examined: 226 specimens; 25 ♂, 26 ♀, 28 P, 147 L; 27 individual rearings (22 larval, 4 pupal, 1 incomplete).

FEDERATION OF MALAYSIA. Perak: Batang Padang, 8 Mar 1925, H. M. Pendlebury, 1 ♂ [BMNH].

Sabah: Keningau, 11 Aug 1956 (US 56), 2 ♀ [BMNH]. Tambunan, 1949, D. H. Colless, 1 ♀ [BMNH].

Sarawak: Kuching, 2 ♂ [BMNH].

Selangor: Kuala Lumpur, 8 Apr 1903, ♂ lectotype [BMNH]; 10 Dec 1903, 1 ♀ [BMNH]; 1 ♀ [BMNH]. Ulu Gombak, Feb 1956 (04), 3 lp♂ (04-7, 12, 16), 2 lp♀ (04-8, 14) [LIVER]; 8 Oct 1957 (0352), 1 lp♀ (0352-5) [LIVER]; same data (0353), 2 lp♂ (0353-3, 8), 4 lp♀ (0353-2, 4, 5, 7) [LIVER]; 28 May 1958 (0631), 1 lp♂ (0631-3), 1 lp♀ (0631-4), 1 ♀ [USNM]. Ulu Klang jungle, 21 Mar-18 Sept 1903, 7 ♂ [BMNH]. Ulu Langat, 6 May 1958 (0600), 1 lp♂ (0600-2), 1 lp♀ (0600-4), 1 lp (0600-3) [USNM]; 10 June 1958 (0646), 1 ♀ [USNM].

_____: Ginting Simpab, A.T. Stanton, 1 ♂, 1 P, 1 L [BMNH].

No locality or date: H. P. Hacker, 4 ♀ [BMNH].

INDIA. Bihar: Sukna, Aug 1928, Sobha Ram, 1 ♂, 1 ♀ [BMNH].

THAILAND. Kanchanaburi: Khao Salak Phra, 1965 (00383), 1 lp♀ (00383-10) [USNM]; same data (00387), 1 lp♂ (00387-1), 1 p♂ (00387-100) [USNM]; same data (00389), 1 lp♂ (00389-1), 1 lp♀ (00389-2), 1 p♀ (00389-101), 6 L [USNM]; same data (00392), 1 p♂ (00392-100), 2 L [USNM].

Ranong: Kra Buri, 1964 (RN 72), 2 lp♀ (72-40, 42) [USNM].

No locality or date: (00383), 2 L [USNM]; (00123), 4 L [USNM]; (00254), 9 L [USNM]; (00256), 4 L [USNM]; (00259), 5 L [USNM]; (00260?), 1 L [USNM]; (00262), 9 L [USNM]; (00267), 22 L [USNM]; (00287), 8 L [USNM]; (00307), 1 L [USNM]; (00310), 6 L [USNM]; (00313), 2 L [USNM]; (00378), 1 L [USNM]; (00381), 6 L [USNM]; (00382), 1 L [USNM]; (00384), 2 L [USNM]; (00394), 1 L [USNM]; (00395), 11 L [USNM]; (00399), 3 L [USNM]; (00400), 1 L [USNM]; (00401), 5 L [USNM]; (T 1794), 2 L [USNM]; (NV 19), 1 L [USNM]; (RN 27), 1 p♂ (27-8-113) [USNM]; (RN 69), 8 L [USNM].

Additional records from the literature. SOUTH VIETNAM. Cochin China, L, A (Borel, 1930a:298-302).

Hybrids

DISTRIBUTION. Northern Thailand. Material Examined: 12 specimens; 4 ♂, 4 P, 4 L; 4 larval individual rearings.

THAILAND. Chiang Rai: Doi Sam Sao, 1965 (00332), 4 lp♂ (00332-1-4) [USNM].

Additional records from the literature. None.

ANOPHELOIDES SUBGROUP

PUPAE. Cephalothorax: straw-colored to light tan ventrally, tan to light brown dorsally; integumentary sculpturing absent; 6-C cephalad of 7-C. Trumpet: largely brown to dark brown in color with base and apex lighter; broadening

gradually from base; pinna large. Metanotum: uniformly tan to light brown or with haltere case and sometimes mesal portion lighter; integumentary sculpturing absent; fourth pair of hairs never developed. Abdomen: anterior segments tan to light brown in color, posterior segments yellowish-tan to tan; anterior portion and posterior edge of anterior segments darker; integumentary sculpturing moderately developed on anterior segments; hair 1-II moderately to strongly developed and with mostly simple branches, some much finer than others, arising from the base; hair 2-II fine and mesad of 5-II; 5-II long and single; 2-III, IV fine; 5-V, VI short, extending nearly to or slightly beyond alveolus of hair 4 of first following segment in non-hairy forms, but long and extending nearly to or to alveolus of hair 4 of second following segment in hairy forms; 5-VI usually 3-7b (2-8); 9-VII 7-11b and with longest branch reaching 0.6-0.9 distance to alveolus of 9-VIII. Terminal Segments: male genital lobe projecting considerably beyond median caudal lobe. Paddle: light straw-colored; longer than broad; external buttress nearly straight in middle portion and with marginal spicules; midrib convex mesally.

LARVAE. Head: slightly broader than long; integumentary sculpturing absent; largely tan to dark brown colored, lighter cephalad and around imaginal eye, collar very dark brown; mental plate tan to brown, usually with 8-10 teeth on each side; hairs 4-10-C not all equally developed; 13-C moderately developed, 4-6b (4-7). Antenna: short, largely brown to dark brown in color, usually lighter towards apex. Thorax: epidermal pigment strongly developed, red to purple; spicules absent; hairs 0, 1, 3-7-P not all equally developed. Abdomen: segment VII with large sclerotized plate; hairs 6-I, II with individual branches finer than 6-III, tapering to fine apex and barbed from near base to near apex. Segment VIII: anterior comb scales fringed only, or with distal elements of fringe lengthened and spine-like; larger posterior comb scales with 3-5 large apical spines, the central one of which may be much longer and stronger than the others, bordered on each side by numerous lesser spines which become smaller and fringe-like proximally. Siphon: base of siphon dark brown to black, portion between base and alveolus of hair 1-S tan to brown, portion between 1-S and apex almost always darker, dark tan to dark brown, apex straw-colored to tan; integumentary sculpturing absent to very weakly developed, imbricate. Anal Segment: saddle largely brown in color, dorsal surface and sometimes base darker; integumentary sculpturing weakly developed, imbricate.

BIONOMICS. Larvae and pupae have been collected in treeholes, bamboo stumps and artificial containers. Two species included in this subgroup, anopheloides and andamanensis, are often found together.

SYSTEMATICS. This subgroup contains the 2 widespread species andamanensis and anopheloides and the geographically restricted papuensis. It is well defined on larval and pupal characters, but adults of the included species are similar to albipes and cannot always be separated from siamensis.

This is the most recent, widespread and dominant subgroup in the Albipes group. It may well have had a hybrid origin, with putative ancestors in the Albipes and Flavicosta subgroups. Such an interpretation is suggested by the following features of the immature stages: (1) the form of the larval comb scales, (2) resemblance of the hairy larval and pupal forms of this subgroup to albipes, and (3) the occurrence of immature stages commonly in both treeholes and bamboo. If one of the ancestral species was similar in adult ornamentation to the extant species albipes or siamensis, then the discordance between classifications based on adults and immature stages might be partially explained.

Some aspects of the larval morphology, such as the shape of the head and

antennae, color of the sclerotized parts, and the modal condition of the chaetotaxy, are very similar to the Signifera group. The European member of that group, pulchripalpis, has several features in the adult which may have been obtained by introgression with the Albipes group. Possibly, then, some features of the larva of the Anopheloides subgroup have been obtained from the Signifera group by introgression.

Difficulty may be encountered with the key couplet separating the hairy and non-hairy forms of larvae and pupae of this subgroup because various intermediates occur. Semihairy pupae may often be identified to species by the same characters as non-hairy ones, but identification of the hairiest individuals is not possible.

DISTRIBUTION. Same as for the Albipes group.

22. Orthopodomyia papuensis, n. sp.

Figs. 35, 36

TYPES: Holotype: ♂ with associated larval and pupal skins (384-3), Finschhafen, Territory of New Guinea, larva found in a treehole, 28 Nov 1944, C. S. Lauby [USNM]. Allotype: ♀ with associated larval and pupal skins (384-1), same data as holotype [USNM]. Paratypes: 1 1p♂ (384-2), 5 L, same data as holotype.

Orthopodomyia andamanensis (in part) of Knight and Mattingly (1950:15-16); Bonne-Wepster (1954:28-30); Stone, Knight and Starcke (1959:122).

Orthopodomyia anopheloides var. andamanensis of Brug (1934:518-519); Knight, Bohart and Bohart (1944:14, 66, in part); Lee (1944:36); Brug and Bonne-Wepster (1947:183, in part).

FEMALE. Wing: 3.87 mm. Proboscis: 2.48 mm. Forefemur: 2.60 mm. Abdomen: about 2.8 mm. Differs from siamensis as follows. Head: torus as dark as or lighter than head capsule or clypeus; decumbent scales all white or sometimes yellow laterally; light scales on labium cream-colored or white, in broad ring near middle and large preapical dorsal patch, or sometimes with preapical patch continued ventrally to form a ring and extending to middle ring along ventral surface; palpus 0.37 of proboscis, 5-segmented, segment 4 short, segment 5 minute, white scales on segment 4 also covering segment 5; torus scales white or dingy. Thorax: postnotum sometimes lighter laterally; acrostichal scales white or brown at caudal end, remainder mostly white but with some brown and/or yellow; dorsocentral scales mostly white at caudal end, remainder yellow, white and brown; lateral prescutellar scales sometimes golden in middle portion of row; posterior fossal scales all white or white and yellow; fossal scales mixed yellow and brown; supraalar scales all white or yellow laterally; ppn scales all narrow; pra, ppl, pst, ssp, stp and mep scales white to cream-colored; ssp scales in a moderately long row; stp sometimes with additional bare area below ssp scales. Legs: forecoxal scales white; preapical brown and light femoral rings not always distinct, especially on anterior surface; posterior surface of forefemur light-scaled at base; midfemur with posterior surface sometimes largely brown-scaled; ventral surface of fore- and hindtibiae largely cream-scaled; tarsal segment 1 usually white-scaled at apex; fore- and midtarsal segments 2 and 3 sometimes light-scaled at base only, segments 4 and 5 dark-scaled, light-scaled, or light-scaled only at ends; hindtarsal segment 2 with moderately broad white-scaled apical ring and with poste-

rior and ventral surfaces largely pale-scaled, segments 3 and 4 all white-scaled. Wing: costal vein probably as in siamensis, but basal patch absent in the few specimens available, and prehumeral and humeral light patches either absent or confluent with presectoral; vein R_1 sometimes without subcostal light patch; vein 1A sometimes with white scales at base.

MALE. Similar to female; differs from siamensis as follows. Proboscis: preapical light-scaling either a broad dorsal patch or a very broad ring. Palpus: about 0.72 of proboscis. Antenna: integument of torus not always lighter laterally.

MALE GENITALIA (fig. 35). Segment VIII: tergite lobe about as broad as long, apex emarginate and with small teeth. Segment IX: tergite with 0-3 bristles on each side. Sidepiece: basal mesal lobe with 4 or 5 stout bristles and 1 or 2 finer; each stout bristle only slightly longer than the 1 dorsad of it; mesal surface weakly sclerotized distad of basal mesal lobe; specialized mesal bristles absent, 1 or 2 specialized tergomesal bristles sometimes present. Clasper: not strongly curved in distal 0.25. Aedeagus: weakly to moderately sclerotized; central portion with sides nearly parallel or slightly diverging apically, base rounded, apex pointed; 1 pair of sternal teeth present about 0.65-0.75 distance from base; without projection between or below ventral parameres. Proctiger: paraproct sclerotization with 2-4 apical teeth; cercal setae 2-4.

PUPA (fig. 35). Abdomen: 3.22 mm. Trumpet: 0.55 mm. Paddle: 0.64 mm. Cephalothorax: hair 1-C moderately developed and usually double (2-4b); 2, 3-C strongly to very strongly developed, usually 3, 4b, but up to 14b; 4-C strongly to very strongly developed, usually 2-4b, but up to 8b; 5-C strongly to very strongly developed, usually 2, 3b (2-4); 7-C very strongly developed, usually double, but up to 5b; 8, 9-C moderately to very strongly developed, usually 2, 3b, but up to 5b. Metanotum: hair 10-C moderately developed, usually 6-10b (6-16); 11-C moderately developed, usually 2-4f; 12-C strongly to very strongly developed, usually 3-5b (3-6). Abdomen: hair 1-II moderately developed, usually 10-20b (7-25); 1-III usually 10-16b (8-20); 5-IV 4-7b; 5-V, VI 3-6b, extending at least 1.5 distance to alveolus of hair 4 of second following segment; 9-VIII 9-13b and with longest branch reaching about 0.72 distance to apex of paddle. Paddle: asymmetrically obovate in outline, external portion sometimes somewhat angular.

LARVA (fig. 36). Head: 1.20 mm. Siphon: 1.31 mm. Anal Segment: 0.44 mm. Thorax: 8-P 5-7b; 1-M very long, single; 1-T long, single; 13-T moderately to strongly developed, 4-7b. Abdomen: hair 1-I, II moderately to very long, usually single (single, double); 6-I, II usually 5-8b; 1-III-V long to very long, single; 13-III, IV long, single or double, when double 1 branch much longer than other; 13-V moderately long to long, usually 2, 3b. Segment VIII: sclerotized plate large, sometimes ringing segment; anterior comb scales usually 24-26 (23-27), posterior comb scales usually 9-12 (7-12); posterior row of comb scales about 0.64-0.90 length of anterior row; hair 3-VIII usually 9-14b. Siphon: index 5.6-9.5; hair 1-S located 0.33-0.39 from base of siphon, usually 9-13b. Anal Segment: dorsal anal gills 1.5-1.8 times length of ventral pair and about 1.0-1.1 length of anal saddle.

BIONOMICS. Larvae have been collected in holes in buttress roots, logs and trees.

SYSTEMATICS. Each stage of papuensis is very similar to at least 1 other species in the Albipes group. The adults cannot be completely separated from andamanensis, anopheloides or siamensis and the male genitalia are like siamensis. The pupa is apparently indistinguishable from andamanensis and the

larva from anopheloides. Papuensis is being described as new because the male genitalia are unlike those of the other 2 species, andamanensis and anopheloides, in the Anopheloides subgroup. Knight and Mattingly (1950:15-16) did not distinguish papuensis from andamanensis.

The adults have some characteristics which may prove to be diagnostic when additional specimens are available. Some segments of the legs, particularly the ventral surface of the fore- and midtibiae and the posterior and ventral surfaces of hindtarsal segments 1 and 2, seem to have lighter scales than andamanensis or anopheloides. The mesonotal scales may prove to be consistently whiter in papuensis than these other species also.

Most of the pupae available for study are hairy forms. The hairs are usually more highly branched but shorter than they are in the hairy forms of andamanensis and anopheloides. Some of the larvae display a tendency towards hairiness as well.

Papuensis, restricted, as far as is definitely known, to Ceram and New Guinea, is the only allopatric species in the Albipes group. I believe that it is a relict predating the evolution of andamanensis and anopheloides which has persisted only on these outlying islands.

DISTRIBUTION. Ceram and New Guinea; possibly also in northern Queensland. Material Examined: 41 specimens; 4 ♂, 9 ♀, 9 P, 19 L; 9 larval individual rearings.

INDONESIA. Ceram. Karloetoe Kara, 30 Dec 1931, S. L. Brug and H. de Rook, 1 lp♂ (6639), 2 lp♀ (2898, 6642), 4 ♀, 3 L [UCLA], 1 lp♂ (2896), 1 lp♀ (2897), 1 L [BMNH].

West Irian: Sukarnapura, Pegunungan Cycloop, 21 Feb 1945, Schultz, L. E. Rozeboom and J. L. Laffoon (270), 1 lp♀ (270.8), 1 L [USNM].

TERRITORY OF NEW GUINEA. Finschhafen, 28 Nov 1944, C. S. Lauby (384), lp♂ holotype (384-3), 1 lp♂ (384-2), 1 lp♀ (384-1), 5 L [USNM].

Additional records from the literature. AUSTRALIA. Queensland: northern portion, 1 L (Marks, 1962, in litt.). The specimen reported as andamanensis may be papuensis.

23. Orthopodomyia andamanensis Barraud

Figs. 37, 38

1934. Orthopodomyia anopheloides var. andamanensis Barraud, 1934:102. *TYPE: lectotype ♂ with genitalia slide, specimen labeled "Type ♂," Andaman Islands, Aug 1926, G. Covell; PRESENT SELECTION [BMNH]. Elevated to specific rank by Knight and Mattingly (1950:15-16); reduced to variety of anopheloides by Thurman (1963:55); resurrected by Delfinado (1966:68).

Orthopodomyia andamanensis of Knight and Mattingly (1950:15-16, in part); Bonne-Wepster (1954:28-30, in part); Macdonald (1957:14; 1958:123, 125, in part); Stone, Knight and Starcke (1959:122, in part); Macdonald and Traub (1960:94, in part); Stone (1961:36); Delfinado, Viado and Coronel (1962:438); Delfinado (1966:68); Stone, Scanlon, Bailey, Delfinado and Bram (1966:82).

Orthopodomyia (Orthopodomyia) andamensis of Thurman (1959:58).

Orthopodomyia anopheloides var. andamanensis of Knight, Bohart and Bohart (1944:14, 66, in part); Baisas (1946:33, 35, 39, 41, 45); Brug and Bonne-Wepster (1947:183, in part); LaCasse and Yamaguti (1948:270); Thurman (1963: 55).

Orthopodomyia albipes of Leicester (1908:176-177, in part).

FEMALE. Wing: 5.35 mm. Proboscis: 2.86 mm. Forefemur: 3.13 mm. Abdomen: about 4.2 mm. Differs from papuensis as follows. Head: decumbent scales all white; posterior dorsolateral, lateral and ventral scales white; labium with light scales usually white, with ring either at or distad of middle or absent, with dorsal preapical patch sometimes either absent or continued ventrally to form a ring, and sometimes with additional light scales scattered near base; palpus 0.43 of proboscis, sometimes with white scales at joint between segments 1-2; torus scales white. Thorax: acrostichal scales usually brown, sometimes yellow, at caudal end, remainder sometimes largely yellow and white but with some brown; dorsocentral scales white or white and yellow at caudal end, remainder yellow and/or cream-colored and brown; lateral prescutellar scales rarely golden laterally; supraalar scales entirely white or white mesally, and sometimes at ends of anterior and middle projections, the remainder yellowish, yellow or golden; ppn with all scales narrow and curved or lower ones broad and flat, lowermost and usually uppermost scales white, remainder yellow. Legs: forecoxal scales white to cream-colored; preapical femoral rings usually distinct; forefemur sometimes with a small light-scaled patch basad of preapical brown-scaled ring on anterior surface, and with basal scaling of posterior surface dark or light; midfemur not always brown-scaled to beyond middle on anterior surface and posterior surface with light-scaling yellowish or cream-colored; mid- and hindtibiae sometimes with a more or less conspicuous largely white- to yellowish-scaled ring distad of subbasal brown-scaled ring and foretibia usually with an anterior light patch in same position, anterior surface of mid- and hindtibiae with either light or dark scales predominating; ventral surface of fore- and hindtibiae brown-scaled with light speckles; foretarsus entirely dark-scaled or segments 2 and 3 white-scaled at base and sometimes at apex and segments 4 and 5 with a few white scales at base; midtarsal segment 2 and usually 3 white-scaled at both ends, segments 4 and 5 white- to light brown-scaled; hindtarsal segment 2 with narrow to moderately broad apical white ring and with posterior and ventral surfaces largely dark-scaled, segments 3 and 4 entirely white-scaled or rarely with moderately to very broad subbasal dark-scaled ring on segment 3. Wing: costal vein usually with accessory subcostal light patch and usually with distinct basal, prehumeral, humeral and presectoral patches, or 1 or more of basal, prehumeral, humeral and presectoral patches absent, or humeral and presectoral patches large and confluent; vein R_1 rarely lacking accessory subcostal patch. Haltere: scales usually transparent to whitish, sometimes some brownish. Abdomen: tergite I fan sometimes with white scales; light scales usually white or cream-colored, rarely yellowish; tergites II-V sometimes with light scales basally.

MALE. Similar to female; differs from papuensis as follows. Proboscis: always with white or rarely yellowish scales in a moderately broad to broad preapical ring which extends further basally along ventral surface. Palpus: about 0.80 of proboscis. Abdomen: tergites and sternites sometimes with light-scaled basal bands; sternite VIII light-scaled basally, laterally and apically.

MALE GENITALIA (fig. 37). Segment VIII: tergite lobe slightly to considerably longer than broad, apex usually emarginate, sometimes truncate, and with small teeth. Segment IX: tergite with 0-2 bristles on each side. Sidepiece: basal mesal lobe with 4 or 5 stout bristles and 1-3 finer; each stout bristle only slightly longer than the 1 dorsad of it; mesal surface usually weakly sclerotized distad of basal mesal lobe; specialized mesal bristles absent, 1 or 2 specialized

tergomesal bristles present. Clasper: not strongly curved in distal 0.25. Aedeagus: weakly sclerotized; broadest distally, tapering to obtuse apex, sides almost parallel basad of broadest point but with constriction near middle; without sternal teeth but with basal projection that extends between and below ventral parameres, apical portion of projection usually with pair of small teeth; major direction of basal projection is below ventral parameres. Proctiger: paraproct sclerotization with 3 or 4 apical teeth; cercal setae 3 or 4.

PUPA (fig. 37). Abdomen: 3.72 mm. Trumpet: 0.56 mm. Paddle: 0.86 mm. Cephalothorax: hair 1-C moderately developed and usually double (2, 3b) in non-hairy form, strongly developed and up to 4, 5b in hairy form; 2, 3-C moderately developed and usually 3-5b (2-6) in non-hairy form, strongly to very strongly developed and up to 9, 10b in hairy form; 4-C moderately to strongly developed and 2-4b in non-hairy form, very strongly developed and up to 7, 8b in hairy form; 5-C strongly to very strongly developed and 2, 3b in non-hairy form, very strongly developed and up to 6b in hairy form; 7-C very strongly developed, 2, 3b in non-hairy form, 5, 6b in hairy form; 8, 9-C moderately to strongly developed and usually 2, 3b (2-5) in non-hairy form, very strongly developed and up to 7, 8b in hairy form. Metanotum: hair 10-C moderately developed, usually 10-13b (10-17); 11-C moderately developed, usually 2-4f; 12-C strongly developed, usually 5, 6b (5-9). Abdomen: hair 1-II moderately developed and with 16-25 branches in non-hairy form, strongly developed and with up to 35 branches in hairy form; 1-III usually 12-14b (10-17); 5-IV 5, 6b in non-hairy form, up to 8b in hairy form; 5-V usually 4, 5b (4-6) in non-hairy form, up to 6, 7b in hairy form; 5-VI usually 6, 7b (4-8); 9-VIII 12-16b and with longest branch reaching 0.6-0.7 distance to apex of paddle. Paddle: asymmetrically and narrowly to broadly obovate in outline, external portion somewhat angular.

LARVA (fig. 38). Head: 1.24 mm. Siphon: 1.57 mm. Anal Segment: 0.52 mm. Thorax: 8-P usually 9-11b (8-12); 1-M very long, single; 1-T long, single; 13-T moderately to strongly developed, usually 5-9b. Abdomen: hairs 1-I, II moderately long, usually single (single, double); 6-I usually 9, 10b (7-10), 6-II usually 9-11b (7-12); 1-III, V very long, single; 13-III, IV long, usually double (1-3b), one branch much longer than other; 1-IV long, usually single (single, double); 13-V moderately long, usually 3, 4b (2-5). Segment VIII: sclerotized plate large, sometimes ringing segment; anterior comb scales usually 24-28 (22-30), posterior comb scales usually 10-12 (8-14); posterior row of comb scales about 0.69-0.85 length of anterior row; hair 3-VIII usually 10-14b. Siphon: index usually 4.0-5.6; hair 1-S located 0.37-0.50 from base of siphon, usually 11, 12b (10-14). Anal Segment: dorsal anal gills 1.5-2.0 times length of ventral pair and 1.2-2.2 length of anal saddle.

BIONOMICS. Knight and Mattingly (1950:16) report the capture of a female from Celebes biting in the daytime. Nothing else is known of the habits of the adults. The entire range of breeding sites of the Anopheloides subgroup is utilized by andamanensis.

SYSTEMATICS. The decision to consider andamanensis as a species distinct from anopheloides is a very tenuous one. The 2 forms are extremely similar morphologically in all stages, appear to have the same ecology and are sympatric over a broad geographical area. It is possible that andamanensis is only a form of anopheloides in which certain slight adult, larval and pupal variations are correlated. Analysis of the 2 forms has been hampered by the paucity of large series of individuals and associated larval and pupal skins. A final decision on the status of andamanensis cannot be reached without further collec-

tions, ecological studies and progeny rearings. Although doing so creates problems, I favor the hypothesis that the 2 forms are distinct species and am treating them as such here.

Andamanensis and anopheloides can be separated more reliably in the adult stage than in any other. Andamanensis has a very narrow to moderately broad white ring at the apex of hindtarsal segment 2 and usually has hindtarsal segments 3 and 4 entirely white-scaled, whereas anopheloides has a narrow to very broad white ring at the apex of hindtarsal segment 2 and usually has a dark ring or patch distad of the middle of tarsal segment 3 or segments 3 and 4. The apical white ring of hindtarsal segment 2 is usually less than 2 times, but up to 3 times, as long as the diameter of that tarsal segment in andamanensis; in anopheloides the ring is never narrower than 2 diameters and is usually greater than 3. There are 3 male specimens from Thailand which have dark scales in a ring in the basal portion of hindtarsal segment 3. I am referring these to andamanensis on the basis of the male genitalia and the very narrow white ring on the apex of hindtarsal segment 2. These 3 adults can be separated from those of anopheloides which have the dark scales restricted to hindtarsal segment 3 because the dark-scaling is distad of the middle of the segment in that species. They could possibly represent a new species, but in the absence of immature stages it seems better to consider them as andamanensis. Rare individuals of anopheloides have hindtarsal segments 3 and 4 entirely white-scaled. These specimens are the most difficult to separate from andamanensis, but can sometimes be distinguished by a broader white ring at the apex of hindtarsal segment 2. Judging by the broad apical ring on hindtarsal segment 2, the leg of "andamanensis" illustrated by Macdonald (1958:122) is most likely that of a specimen of anopheloides with the last 3 hindtarsal segments entirely white.

Separation of the male genitalia of andamanensis and anopheloides is difficult. The only way to differentiate between them is by the direction of the projection from the base of the aedeagus. In andamanensis the projection is usually directed more sternad than cephalad (towards segment VIII), while the reverse is usually true in anopheloides. However, there are specimens which appear to be one species on the basis of leg banding which have the aedeagus of the other species. In addition, the angle of the aedeagus, and hence of the projection, varies from specimen to specimen due to the varying degree to which the aedeagus may be swung forward by the ventral parameres, and, as a consequence, the apparent major direction of the projection may not be its direction in the resting position.

Separation of the immature stages of the 2 species is also difficult. In the collection of W. W. Macdonald there are several individual rearings of andamanensis and many of anopheloides. The larvae and pupae of these specimens, all collected near Kuala Lumpur, Malaya, can be separated without much difficulty. Larvae of andamanensis differ from anopheloides by a longer and darker siphon, hair 1-S nearer the base of the siphon, fewer branches in hair 0-P, a greater number of branches in hairs 6-I, II and a greater number of posterior comb scales. Pupae of andamanensis differ by a broader outer part of the paddle and a greater number of branches in hairs 9, 10-C and 1, 6-III. Examination of associated skins from other localities where the 2 species have been collected in the same treehole or in the same immediate area shows that only a part of these same differences are present. On the average, the andamanensis larva seems to have always a longer siphon and a greater number of branches in hairs 6-I, II and the pupa seems to have always a greater number of branches in hairs 9, 10-C and 1-III. However, the length of the siphon (and the siphon

index) and the number of branches in the hairs involved for both the larva and pupa vary to such a degree that it is not possible to achieve reliable separation of the species by a key. Specimens of the immature stages from an area from which no associated skins are available for comparison often cannot be identified. The most dependable hair branchings for separation of the associated skins available are given in the key.

One collection from Kuala Lumpur has non-hairy larval and hairy pupal skins associated with both anopheloides and andamanensis adults. This can be interpreted in 1 or 2 ways. It is either good evidence that hairy forms are environmentally induced variations or that andamanensis is indeed only a form of anopheloides. On the basis of observations made on other species (see arboricollis) the first alternate is favored. Hairy larval forms have not been seen for andamanensis, but they are to be expected.

DISTRIBUTION. Eastern India to South Vietnam and Palawan, south to the Andaman Islands, Sumatra, Java and Celebes. Material Examined: 145 specimens; 56 ♂, 44 ♀, 1 A, 1 isolated ♂ genitalia, 20 P, 23 L; 16 individual rearings (12 larval, 2 pupal, 2 incomplete).

FEDERATION OF MALAYSIA. Perak: Pulau Pangkor Laut, 19-23 Oct 1903, C. W. Daniels, 2 ♀ [BMNH].

Selangor: Ulu Gombak, 25 Oct 1956, J.A. Reid (084), 1 lp♂ (084-29) [LIVER]; 13 Nov 1956 (096), 1 lp♀ (096-38) [LIVER]; 10 Jan 1957, J.A. Reid (0129), 1 lp♂ (0129-27), 3 lp♀ (0129-22, 30, 41) [LIVER], 1 lp (0129-24) [USNM]; 15 Jan 1957, J. A. Reid (0133), 1 ♂, 1 ♀ [USNM]; 14 Feb 1957 (0175), 1 ♂ [LIVER].

INDIA. Andaman and Nicobar Islands: Andaman Islands, Aug 1926, G. Covell, ♂ lectotype, 1 ♀ [BMNH].

INDONESIA. Java: Bogor, 1930, R. W. Paine, 1 P [BMNH]. Garut, Djajasana, 1 ♀ [UCLA].

Kalimantan: Samarinda, 1 lp♂ (9711), 1♀ [UCLA]. Tarakan, 12 June 1945, A. G. Humes (30), 1 ♂ [USNM].

Sumatra: Danau Ranau, 5 ♂, 6 ♀, 1 P, 1 L [UCLA]. Tjoeroek, 1♀ [UCLA].

REPUBLIC OF THE PHILIPPINES. Palawan: Irahuan River area, 2 June 1945, J. L. Laffoon (854), 1 lp♂ (854.25), 1 lp♀ (854.30) [USNM].

SINGAPORE. D. H. C. Given, 2 ♂, 1 ♀, 1 P, 1 L [BMNH].

SOUTH VIETNAM. Long Khanh, 1964 (LK 2746), 1 ♀ [USNM]. Long Khanh, Xuan Loc, 1965 (LK 2781), 1 ♂ [USNM].

THAILAND. Chiang Mai: Chang Puek, 1962 (T 1041), 1 ♂ [USNM]. Doi Suthep, 1962 (T 215 E), 1 ♀ [USNM]; same data (T 1095-1), 1 ♀ [USNM]; same data (T 1147), 1 ♂ [USNM]; same data (T 1161), 1 ♂ [USNM]; same data (T 1185), 3 ♂ [USNM]; same data (T 1224), 2 ♂ [USNM]; same data (T 1384), 1 ♂ [USNM]; same data (T 1659), 2 ♂, 1 ♀ [USNM]; same data (T 1926), 1 ♂, 1 ♀ [USNM]; 1963 (T 1934), 3 ♂ [USNM]; same data (T 1936), 1 ♂, 1 ♀ [USNM]; same data (T 1989), 1 ♂ [USNM]. Huay Mae Sanan, 1962 (T 1157), 5 ♂, 4 ♀ [USNM].

Chiang Kai: Doi Sam Sao, 1965 (00277), 2 p♂ (00277-100, 101) [USNM].

Khon Kaen: Pa Dong Larn, 1962 (T 1861), 1 ♀ [USNM].

Lampang: Kuhn Tal, 10 June 1952, D. C. Thurman (M 208), 1 ♂ genitalia [USNM].

Nakhon Nayok: Khao Kheo, 17 Sept 1963 (NY 43), 1 lp♀ (43-20) [USNM]. Khao Yai, 23 May 1964 (NY 151), 4 L [USNM]. Sariga Village, 22 May 1964 (NY 140), 1 lp♀ (140-41), 1 l♀ (140-43) [USNM].

Nakhon Ratchasima: Khao Yai, 1962 (T 1863), 1 ♂ [USNM].

No locality or date: (00303), 1 P [USNM]; (CM 169), 1 L [USNM]; (CM 381),

1 lp♂ (381-40) [USNM]; (RN 29), 1 P [USNM]; (RN 36), 2 ♂ [USNM]; (TG 55), 1 L [USNM]; (TG 59), 1 L [USNM]; (T 1225), 3 ♂, 2 ♀ [USNM]; (T 1226), 1 ♂ [USNM]; (T 1862), 1 ♂ [USNM]; (T 2094), 1 ♂ [USNM].

NO DATA. 6 ♂, 9 ♀, 1 A [UCLA].

Additional records from the literature. INDIA. Bihar: Sukna, Aug 1928, Sobha Ram, A (Barraud, 1934:102).

Uttar Pradesh: Dehra Dun, L (Wattal, Bhatia and Kalra, 1958:226-228). I strongly suspect that these larvae are anopheloides rather than andamanensis.

INDONESIA. Celebes: Mamudju, A (Knight and Mattingly, 1950:15-16).

24. Orthopodomyia anopheloides (Giles)

Figs. 39, 40, 41

1903. Mansonia anopheloides Giles, 1903:315. *TYPE: lectotype ♂ with genitalia slide, specimen labeled "Mansonia anopheloides ♂ type," Himalayan foothills, Dehra Dun, [Uttar Pradesh], India, reared from a larva collected in a garden tank; PRESENT SELECTION [BMNH].

1908. Orthopodomyia albipes var. nigritarsis Leicester, 1908:177. *TYPE: lectotype ♀ (76), specimen labeled "cotype," "The Dinding," on the island Pangkor Laut, [Perak], Malaya, reared from a larva found in a treehole, 20 Oct 1903, Daniels; PRESENT SELECTION [BMNH]. Synonymy with anopheloides by Edwards (1913:239); synonymy with albipes by Edwards (1932:108); synonymy with anopheloides by Barraud (1934:98).

1910. Orthopodomyia maculata Theobald, 1910a:29-30. TYPE: holotype ♂, Maddathorai, west base of Western Ghats, Travancore, India, adult found resting on a tree trunk in the jungle, 17 Nov 1908, Annandale [IM]. Synonymy with anopheloides by Edwards (1913:239); considered as a form of anopheloides by Barraud (1927:527, 529); considered as a synonym of anopheloides by Edwards (1932:108); considered as a variety of anopheloides by Barraud (1934:101); given subspecific rank by Knight and Mattingly (1950:9-10); elevated to specific rank by Thurman (1959:59); reduced to variety of anopheloides by Thurman (1963:55).

1910. Orthopodomyia maculipes Theobald, 1910b:470-473. *TYPE: lectotype ♀, specimen labeled as "type ♀" by Theobald, Andaman Islands, 22 July 1908, Lowis and R. White; PRESENT SELECTION [BMNH]. Reduction to varietal status of anopheloides suggested by Edwards (1913:239); considered as a form of anopheloides by Barraud (1927:527, 528, 529); resurrected by Edwards (1928:53); reduced to a variety of anopheloides by Barraud (1934:101); resurrected by Knight and Mattingly (1950:10-13). NEW SYNONYMY.

1946. Orthopodomyia manganus Baisas, 1946:35-39. TYPE: holotype ♂ with associated larval and pupal skins (TH 111-5), Llavac, Laguna, Luzon, Philippine Islands, larva found in a treehole, 14 Sept 1940, P. Sunico [Location unknown]. Synonymy with anopheloides by Knight and Mattingly (1950:7).

1948. Orthopodomyia (Orthopodomyia) nipponica LaCasse and Yamaguti, 1948: 264-269. *TYPE: lectotype ♀ with associated pupal skin, heavily wooded cemetery in the foothills of the mountainous terrain surrounding the city of Kyoto, Honshu, Japan, reared from a larva found in a cut bamboo flower holder or a stone bowl, 17 Nov 1948; selection of Stone and Knight (1957:198-199) [USNM]. Synonymy with anopheloides by Knight and Mattingly (1950:7).

1959. Orthopodomyia (Orthopodomyia) lemmonae Thurman, 1959:58-59. *TYPE: holotype larva (M398-1), Doi Chom Cheng of Doi Sutep Range, Chiang Mai Province, Thailand, larva hatched from debris collected in a treehole, 30 Dec 1952, D.C. Thurman [USNM, 64290]. NEW SYNONYMY.

Orthopodomyia anopheloides of Edwards (1913:239); Senior-White (1920:317); Edwards (1922:458, 470); Barraud (1927:527-529, in part); Barraud and Covell (1928:676); Edwards (1928:53); Barraud (1932:1014-1015); Edwards (1932:108); Barraud (1934:98-102); Brug (1934:519); Wu (1936:46, 51); Feng (1938:287; 1939:1581); Edwards (1941:72, 73); Baisas (1946:33, 35, 36, 39); Bohart (1946:5); LaCasse and Yamaguti (1948:269, 270); Chow (1949:128; 1950:282); Knight and Mattingly (1950:7-9); LaCasse and Yamaguti (1950: 65); Kimizu (1952:25-28); Asanuma and Nakagawa (1954:373); Chen and Lien (1956:204); Chang (1957a:214, 220, 221, 222; 1957b:503-505, 508-509, 510); Gentry (1957:82); Hara (1957b:16); Macdonald (1957:14); Ramachandra Rao and Rajagopalan (1957:13, 33); Macdonald (1958:125); Bohart (1959:196); Stone, Knight and Starcke (1959:122); Macdonald and Traub (1960:94); Delfinado, Viado and Coronel (1962:438); Lien (1962:621-622); Thurman (1963: 55); Kalra and Wattal (1965:316); Delfinado (1966:66-67); Stone, Scanlon, Bailey, Delfinado and Bram (1966:82).

Orthopodomyia (Orthopodomyia) anopheloides of Thurman (1959:56-57).

Orthopodomyia (anopheloides) anopheloides of Hara (1957a:50).

Mansonia anopheloides of Giles (1903b:329).

Finlaya anopheloides of Giles (1904:365, 366); Blanchard (1905:631); Theobald (1905:33).

Orthopodomyia maculipes of Edwards (1913:239; 1922:459, 470); Haga (1924: 831); Edwards (1926:117-118; 1928:53, 57); Brug and Edwards (1931:259); Edwards (1932:108); Brug and Bonne-Wepster (1947:183); Knight and Mattingly (1950:10-13); Macdonald (1957:15; 1958:123, 125, 126); Stone, Knight and Starcke (1959:123); Macdonald and Traub (1960:94); Delfinado, Viado and Coronel (1962:438); Thurman (1963:54); Delfinado (1966:70).

Orthopodomyia (Orthopodomyia) maculipes of Thurman (1959:59-60).

Orthopodomyia anopheloides var. maculipes of Barraud (1934:101); Baisas (1946:33, 35, 39, 41).

Orthopodomyia anopheloides form maculipes of Barraud (1927:527, 528, 529).

Orthopodomyia maculata of Theobald (1910b:473-474).

Orthopodomyia (Orthopodomyia) maculata of Thurman (1959:59).

Orthopodomyia anopheloides maculata of Knight and Mattingly (1950:9-10); Stone, Knight and Starcke (1959:122).

Orthopodomyia anopheloides var. maculata of Barraud (1934:101); Baisas (1946: 33, 35, 36); Chu (1957:149, 163; 1958:110, 111); Thurman (1963:55).

Orthopodomyia anopheloides form maculata of Barraud (1927:527, 529).

Orthopodomyia lemmonae of Stone (1961:36).

Orthopodomyia (O.) nipponica of Stone and Knight (1957:198-199).

Orthopodomyia anopheloides nipponica of LaCasse and Yamaguti (1950:58-65, app. I:2); Kimiza (1952:25-26).

Orthopodomyia andamanensis of Macdonald (1958:123, 125, in part); Wattal, Bhatia and Kalra (1958:226-228); Macdonald and Traub (1960:94, in part).

Orthopodomyia albipes of Bohart (1950:403, 404).

Orthopodomyia mcgregori of Knight and Chamberlain (1948:10); Knight and Mattingly (1950:13-15); Stone, Knight and Starcke (1959:123); Delfinado, Viado and Coronel (1962:438); Delfinado (1966:68).

FEMALE (fig. 39). Wing: 3.83 mm. Proboscis: 2.29 mm. Forefemur: 2.51 mm. Abdomen: about 3.4 mm. Differs from andamanensis as follows. Head: decumbent scales sometimes yellow; palpus 0.48 of proboscis. Thorax: lateral prescutellar scales brown and white only, sometimes with considerably more white scales than in andamanensis; ppn sometimes with all scales white; rarely with remaining pleural scales yellow-tinged. Legs: midfemoral posterior surface sometimes largely dark-scaled; hindtarsal segment 1 sometimes with broad apical white ring; hindtarsal segment 2 dark-scaled at base or with a few white scales and with a moderately to very broad white apical ring, segments 3 and 4 entirely white-scaled, or more commonly segment 3 with brown scales in small dorsal patch to broad ring distad of middle, or even more commonly segment 3 with broad brown ring distad of middle and segment 4 with brown scales in small dorsal patch to moderately broad ring distad of middle. Wing: costal vein sometimes with basal, prehumeral and humeral patches large and confluent; sectoral patch of costal vein sometimes absent; vein R rarely with sectoral and accessory sectoral patches large and confluent; vein R_1 rarely with subcostal patch absent. Abdomen: tergite I fan infrequently with white scales; subdorsal median patches usually developed only on distal segments; tergites and sternites sometimes with white basal bands.

MALE (fig. 39). Similar to female; differs from andamanensis as follows. Proboscis: preapical ring sometimes reduced to dorsal patch. Palpus: about 0.78 of proboscis. Antenna: fifth flagellar segment rarely with tuft of scales. Abdomen: tergites and sternites more frequently and extensively banded than in female; sternite VIII light basally and laterally.

MALE GENITALIA (fig. 40). Segment VIII: tergite lobe longer than broad, sides parallel or diverging apically, apex emarginate or truncate and usually with small teeth. Segment IX: tergite with 1-4 bristles on each side. Sidepiece: basal mesal lobe with 4-6 stout bristles and 1-3 finer; each stout bristle only slightly longer than the 1 dorsad of it; mesal surface membranous or weakly sclerotized distad of basal mesal lobe; mesal surface without any specialized bristles or with weakly developed curved or sinuous specialized bristles distad of basal mesal lobe; 1, 2 specialized tergomesal bristles present. Clasper: not strongly curved in distal 0.25. Aedeagus: weakly to moderately sclerotized; as in andamanensis except that major direction of basal projection is between rather than below ventral parameres. Proctiger: paraproct sclerotization with 2-4 apical teeth; cercal setae 3-6.

PUPA (fig. 40). Abdomen: 3.44 mm. Trumpet: 0.55 mm. Paddle: 0.92 mm. Cephalothorax: hair 1-C moderately developed and 2, 3b in non-hairy form, moderately to strongly developed and up to 3, 4b in hairy form; 2-C moderately developed and 1-3b in non-hairy form, very strongly developed and up to 6, 7b in hairy form; 3-C moderately developed and 3-5b in non-hairy form, very strongly developed and up to 9, 10b in hairy form; 4-C moderately to very strongly developed and 2, 3b in non-hairy form, very strongly developed and up to 5, 6b in hairy form; 5-C very strongly developed, 2, 3b in non-hairy form, up to 5, 6b in hairy form; 7-C very strongly developed, double in non-hairy form, up to 5, 6b in hairy form; 8, 9-C moderately to strongly developed and usually single (sometimes double) in non-hairy form, strongly to very strongly developed and 1-3b in hairy form. Metanotum: hair 10-C moderately developed, usually 3-6b (2-8); 11-C moderately developed, usually 3, 4f (2-5); 12-C usually 2, 3b (2-4) and moderately or, especially in hairy form, strongly developed. Abdomen: hair 1-II moderately developed and usually with 12-19 (8-23) branches in non-hairy form, strongly developed and up to 34-branched in hairy form;

1-III usually 5-7b (3-11); 5-IV 3, 4b in non-hairy form, up to 7, 8b in hairy form; 5-V usually 3, 4b (2-4) in non-hairy form, up to 6, 7b in hairy form; 5-VI usually 3-5b (2-6); 9-VIII 9-14b and with longest branch reaching 0.4-0.9 distance to apex of paddle. Paddle: usually narrowly and asymmetrically elliptical or obovate in outline.

LARVA (fig. 41). Head: 1.05 mm. Siphon: 1.15 mm. Anal Segment: 0.50 mm. Thorax: 8-P usually 8-12b (5-14); 1-M very long and single in non-hairy form, long and up to 4b in hairy form; 1-T long and single in non-hairy form, long and up to 4b in hairy form; 13-T moderately to strongly developed, or, especially in hairy form, very strongly developed, usually 4-7b. Abdomen: hairs 1-I, II moderately long and single or double in non-hairy form, long and up to 5b in hairy form; 6-I usually 5-8b, 6-II usually 4-8b; 1-III, V very long and single in non-hairy form, long and double in hairy form; 13-III, IV moderately long and usually double (1-3b), with 1 branch longer than other in non-hairy form, long and up to 5b in hairy form; 1-IV long and usually double (1-3b) in non-hairy form, long and up to 5b in hairy form; 13-V moderately long and usually 3b (2-4) in non-hairy form, long and up to 5b in hairy form. Segment VIII: sclerotized plate large but not ringing segment; anterior comb scales usually 21-28 (17-32), posterior comb scales usually 7-10 (6-12); posterior row of comb scales about 0.55-0.74 length of anterior row; hair 3-VIII usually 9-13b. Siphon: index usually 3.5-4.8 (3.2-6.4); hair 1-S located 0.36-0.50 from base of siphon, usually 10-12b (9-13). Anal Segment: dorsal anal gills 1.6-2.5 times length of ventral gills and 0.71-2.5 length of anal saddle.

BIONOMICS. The immature stages may be found in treeholes, bamboo stumps and artificial containers in association with those of flavicosta, flavithorax and madrensis in addition to those of andamanensis. Adults have been collected resting on tree trunks.

SYSTEMATICS. This is the most widespread species in the Albipes group, occupying the entire range of the group except for the islands east of Borneo and south of the Philippines. Because of its broad distribution and variability, particularly in ornamentation of the proboscis and hindtarsus, the species has numerous synonyms.

In addition to anopheloides, 4 names (nigritarsis, maculata, manganus and nipponica) have been given to adults with dark rings on hindtarsal segments 3 and 4. Leicester apparently did not know of Giles' 1903 description of anopheloides when he described nigritarsis in 1908. Although Leicester was the author of the species albipes, the "albipes" he described in the 1908 "Culicidae of Malaya" was actually andamanensis. The type of nigritarsis differs in no way from anopheloides and this nominal species has been considered as a synonym of the latter by virtually all authors.

According to Giles (1904:365), Theobald had placed anopheloides with an allied species (albipes) in the genus Orthopodomyia in the collection at the British Museum. Theobald apparently overlooked or forgot the name anopheloides later, for it is not mentioned in the 1910 description of maculata or the 1910 volume of A Monograph of the Culicidae. It cannot be determined, then, whether he described maculata because he was ignorant of anopheloides or because he felt that it was distinct from anopheloides. At any rate, the names are applied to individuals which agree in all details except that maculata has a broader white ring at the apex of hindtarsal segment 2. It has been considered to be anything from a synonym, form, variety or subspecies of anopheloides to being a distinct species. Knight and Mattingly (1950:9-10) considered it to be a subspecies of anopheloides. I am treating it as a synonym of anopheloides,

considering the differences in hindtarsal banding to be within the limit of variation of that species. Specimens of anopheloides with a broad white ring at the apex of hindtarsal segment 2 have been seen in collections from Borneo, Ceylon, Java, the Philippines, Taiwan and Thailand.

Manganus and nipponica were considered to be distinct from anopheloides by their authors largely on the basis of ornamentation of the proboscis, but Knight and Mattingly (1950:9) found both to fall within the range of variation of anopheloides and reduced them to synonymy. I agree with their interpretation.

The name maculipes was given to a form identical to anopheloides except that hindtarsal segment 4 was entirely white-scaled. This nominal species has been considered to be a form or variety of anopheloides, or a distinct species. Knight and Mattingly (1950:10-13) treated it as a distinct species. I am reducing maculipes to synonymy with anopheloides on the basis of specimens from Malaya in the collection of W. W. Macdonald. As pointed out by Macdonald (1958:125, 126), the dark band on hindtarsal segment 4 of 1 of his specimens of anopheloides was incomplete and represented by only a few dark scales. However, of even more value than this specimen with intermediate tarsal banding is the large series of adults with associated skins. Comparison of the larval and pupal chaetotaxy has failed to show any differences between the Malayan maculipes and anopheloides and has failed to show any differences between the Malayan anopheloides and anopheloides from near the type locality in India. As a consequence, it appears that maculipes is just a natural variant of anopheloides and should be considered as a synonym of it. Specimens of anopheloides with hindtarsal segment 4 entirely white-scaled have been seen in collections from Malaya, Singapore and Sumatra as well as from the Andaman Islands.

Thurman described 2 fourth instar larvae as lemmonae in 1959, considering them to be distinct from all other Orthopodomyia species in Thailand because they lacked the sclerotized basal ring on segment X and the sclerotized plate on segment VII, had only a small sclerotized plate on segment VIII, and had the longest branch in hair 2-X bifid, twice the length of other branches and only 0.33 the length of hair 3-X, whereas all the other species had a sclerotized ring on segment X, had large sclerotized plates on segments VII and VIII and had the longest branch of hair 2-X single, 3 times the length of the shorter branches and 0.75 the length of hair 3-X. Tate (1932:115) and Reeves (1941: 70-71) had reported that the plates on the terminal segments of Orthopodomyia larvae were added without moulting by the fourth instar larva and that the number and size were dependent upon the age of the larva. Since both of Thurman's larvae died early in the fourth instar, they lack the full complement of plates simply because they were young. No significance can be attached to hair 2-X, for it may have 1 or 2 branches elongated and the length of these elongated branches is variable. It is common for the elongated branch to be shorter when double or bifid than when single. Despite the fact that lemmonae is not different on the basis of the characters pointed out by Thurman, its chaetotaxy is quite different from any species in the Albipes group. Hairs 1-M, T, I-VII and 13-T, III-V are well developed and multiple. In this respect the larvae resemble albipes, but the morphology of the head, antenna, comb scales and siphon agree with anopheloides. Another of Thurman's collections contains larvae identical to the 2 specimens she called lemmonae except that they have only 1 long branch in hair 2-X and segments VII and VIII have sclerotized plates; these larvae were identified as anopheloides. This was correct, for these larvae, and the 2 she called lemmonae, are only hairy forms of anopheloides. Similar hairy forms have been seen in collections from Borneo, Japan, the

Philippines and Taiwan in addition to Thurman's and others from Thailand. Numerous specimens in collections from Borneo and Thailand show various degrees of intermediacy between the normal and hairy extremes and on this basis lemmonae is reduced to synonymy with anopheloides.

The majority of adults of anopheloides have hindtarsal segments 3 and 4 with a dark ring and relatively few have a dark ring on segment 3 only. In addition, rare specimens have the last 3 hindtarsal segments all white-scaled. A specimen from Palawan with this pattern was called mcgregori by Knight and Chamberlain (1948:10) and Knight and Mattingly (1950:13-15), but is definitely anopheloides (see mcgregori). Others have been seen from Malaya and possibly the Philippines (Negros) and Sumatra. Means by which these and other specimens of anopheloides can be told from andamanensis are discussed under that species.

Larvae of anopheloides from Japan have longer siphons than those from other areas. Larvae from the Philippines often have hair 1-T double in otherwise non-hairy individuals. In addition to hairy larvae, hairy pupae are known. Normal larvae may give rise to normal or hairy pupae; it is not known if hairy larvae give rise to hairy pupae, but that is suspected since partially hairy larvae from Borneo give rise to partially hairy pupae.

Hybridization in the past with a member of the Signifera group (pulchripalpis or its ancestor) may be the means by which anopheloides acquired its most common type of hindtarsal banding. As pointed out in the systematics section of the Anopheloides subgroup, some larval features may also have been acquired from the Signifera group. Hybridization currently takes place between anopheloides and albipes and is discussed under that species.

DISTRIBUTION. India, southern China, and southern Japan, south to Ceylon, Sumatra, Java, Borneo and the Philippine Islands. Material Examined: 636 specimens; 145 ♂, 138 ♀, 1 isolated ♂ genitalia, 71 P, 281 L; 69 individual rearings (51 larval, 9 pupal, 9 incomplete).

CEYLON. Aluwilake, 14-26 Nov 1919, R. Senior-White, 1 ♂, 1 ♀ [BMNH]. Peradeniya, May-July 1909, 1 ♂, 3 ♀ [BMNH]; K. M. McGahey, 1 ♀ [BMNH]. Suduganga Estate, 26 Nov-4 Dec 1919, R. Senior-White, 2 ♂, 1 ♀ [BMNH]; 19 May 1923, R. Senior-White, 2 ♀ [BMNH].

CHINA. Chekiang: Hangchow, 12 Sept 1935, Shih-Cheng Wu, 1 ♂, 1 ♀ [BMNH].

FEDERATION OF MALAYSIA. Perak: Pulau Pangkor Laut, 20 Oct 1903, C. W. Daniels, ♀ lectotype of nigritarsis (76) [BMNH].

Sabah: Jesselton, 25 July 1956 (US 7), 7 1p♂ (7-1, 20-23, 25, 28), 5 1p♀ (7-2, 3, 24, 26, 27), 1 p♂ (7-29), 1 1♂ (7-30) [BMNH]. Keningau, 11 Aug 1956 (US 55), 3 ♀ [BMNH].

Selangor: Ulu Gombak, 13 Nov 1956 (096), 1 1p♀ (096-39) [LIVER]; same data (0103), 1 1p♂ (0103-29) [LIVER]; 10 Jan 1957, J. A. Reid (0129), 5 1p♂ (0129-6, 11, 13-15), 2 1p♀ (0129-19, 46), 1 ♀ [LIVER], 2 1p♂ (0129-44, 45), 2 1p♀ (0129-25, 42), 1 1p (0129-44) [USNM]; 15 Jan 1957, J. A. Reid (0133), 2 1p♂ (0133-2, 9), 2 1p♀ (0133-1, 3) [LIVER], 1 ♂ [USNM]; 14 Feb 1957 (0175), 1 ♀ [LIVER]; 13 May 1957 (0197), 1 1p♂ (0197-2) [LIVER].

No locality: 18-19 Jan 1922, 1 ♀ [BMNH].

INDIA. Andaman and Nicobar Islands: Andaman Islands, 22 July 1908, Lowis and R. White, ♀ lectotype of maculipes, 3 ♀ [BMNH].

Assam: Doom Dooma, Sookerating, 11 May 1943, D. E. Hardy (S 31), 3 L [USNM]; 9 July 1943, G. F. Johnstone (S 31), 1 L [USNM]. Golaghat, 16 May 1925, P. J. Barraud, 1 1p♀ (1938) [BMNH]. Nongpoh, July 1922, P. J. Bar-

raud, 1 L [BMNH].

Himachal Pradesh: Simla, 28 Sept 1930, P. J. Barraud, 2 1p♂ (2541, 2543), 1 1p♀ (2546), 1 1♂ (2542) [BMNH]; S. R. Christophers, 1 ♂, 1 ♀ [BMNH]. Solon, Krol Mountain, Aug 1923, P. J. Barraud, 2 1♀ (1602, 1603) [BMNH]; 4 July 1930, P. J. Barraud, 2 L [BMNH].

Mysore: Yellapur, 1 Oct 1921, P. J. Barraud, 1 1p♀ (916), 4 L [BMNH].

Uttar Pradesh: Dehra Dun, G. M. Giles, ♂ lectotype of anopheloides, 1 ♀ [BMNH].

INDONESIA. Java: Bogor, 1930, R.W. Paine, 1 ♂, 1 ♀, 2 P, 5 L [BMNH].

Sumatra: Danau Ranau, 2 P [UCLA]. Tjoeroek, 4 ♂, 1 ♀ [UCLA].

JAPAN. Honshu: Kyoto, 1947-1950, p♀ lectotype of nipponica, 1 p♂, 6 ♂, 2 ♀, 14 L [USNM], 1 ♂, 1 ♀, 3 L [UCLA], 2 ♂, 1 L [BMNH], 2 L [UCD]. Tokyo, 13 July-22 Aug 1949, 1 ♂, 1 ♀ [CU]. No locality, 6 Oct 1948, 2 L [USNM].

NEPAL. Hetaura, June 1955, S. C. Desson, 1 L [BMNH].

PAKISTAN. East Pakistan: Rangamatti, Sept 1922, P. J. Barraud, 1 L [BMNH].

REPUBLIC OF THE PHILIPPINES. Laguna: Llavac, 14 Sept 1940, P. Sunico (TH 111), 1 ♂ [BISHOP]. Mt. Makiling, 8 June 1964 (IH 35), 2 L [UCLA]; 1 Aug 1964, (IH 77), 1 L [UCLA].

Leyte: Tacloban, 3 Sept 1945, R. E. Gossington, 2 L [USNM].

Mountain: Baguio, 25 Aug 1945, S. E. Shields (443), 2 1♀ (443-1, 3) [USNM].

Negros Occidental: Fabrica, Feb 1931, W. V. King (139a), 7 ♂, 2 ♀, 5 L [USNM].

Negros Oriental: Cuemos de Negros, 14-16 July 1964, M. Delfinado, 1 ♂, 1 ♀ [USNM].

Nueva Ecija: Munoz, 11 Aug 1945, MacMillan, 2 L [USNM].

Occidental Mindoro: San Jose, Jan-May 1945, E. S. Ross, 1 1p♂ (C-870), 1 1p♀ (C-55), 6 ♂, 4 ♀, 16 L [USNM], 1 ♂, 1 ♀, 1 L [BISHOP].

Palawan: Irahuan River area, 2 June 1945, D. R. Johnson and J. L. Laffoon (851), 1 1p♂ (851.4) [USNM]; 4 June 1945, J. L. Laffoon (860), 1 1p♂ (860.4), 1 1p♀ (860.1) [USNM]; 11 June 1945, J. L. Laffoon and Fitzgerald (875A), 1 L [USNM]. Puerto Princesa, 16 Sept 1945 (P 291), 2 1p♂ (291-1, 2), 1 1p, 2 L [USNM]. Tarumpitao, 7 Jan 1960, L. Quate, 1 L [USNM].

Quezon: Casiguran, 5 June 1957, 4 ♂, 1 ♀ [UCLA].

Zambales: Subic Naval Base, 18 July 1966 (175), 2 1p♂ (175-1, 2) [UCLA].

RYUKYU ISLANDS. Iriomote Island: Shirahama, 17 Nov 1951, R. M. Bohart, 2 ♂, 3 ♀ [UCD].

Ishigaki Island: Mt. Maeshi, Oct 1951, R. M. Bohart, 1 ♀ [UCD]. Teri River, 17 Oct 1951, R. M. Bohart, 3 L [UCD]. Yarabu Peninsula, Oct-Nov 1951, R. M. Bohart, 8 ♂, 14 ♀, 9 L [UCD], 1 ♂, 2 ♀, 3 L [USNM], 1 ♂, 1 ♀, 3 L [CAS], 2 ♂, 2 ♀ [BISHOP].

Okinawa: ADA Village, 20 Apr 1955, Nakata, 2 L [USNM]. AHA Village, 6 Oct 1955, I. Zaldua, 1 L [USNM].

SINGAPORE. D. H. C. Given, 3 ♂, 2 ♀, 1 P, 7 L [BMNH].

TAIWAN. Chu Kod Fan Iu, Chid-I Hsien, 11 Mar 1954, H. H. Chen, 1 ♂ [USNM]. Chukou, Fanlu, Chiai, 14 Mar 1954, J. C. Lien (78065), 1 ♀ [BMNH]. Chung Shan Park, Chiai Chiai, 6 July 1953, J. C. Lien (78020), 1 ♀ [BMNH]. Chy-Lia, Cu-Ku, Nan-Tou Hsien, 2 Oct 1954, C. L. Chung and J. Y. Li (80662), 1 L [BMNH]. Ho-Ping, Tai-Chung, 23 June 1959, J. F. Chiu and W. L. Chen (00389), 5 L [USNM], 4 L [BISHOP]. Kechuang, Fanlui, Chiai, 14 June 1955, J.C. Lien (78008), 1 ♀ [BMNH]. Ku Lou, Lai I, Fing-Tung, 29 Sept 1958, C. J. Kuo and C. C. Kang (00047), 2 ♀ [USNM]. Mei-Shan, Chia-I, 11 Mar 1954, H. H.

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Khon Kaen: Tham Pui Tiyan, 1962 (T 1823), 3 ♂, 1 ♀ [USNM]; same data (T 1824), 1 ♀ [USNM].

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Nakhon Ratchasima: Khao Yai, 1962 (T 1862), 2 ♂, 1 ♀ [USNM]; same data (T 1863), 1 ♂ [USNM].

Trang: Kantang, 1964 (TG 133), 1 lp♂ (133-50) [USNM]. Muang, 1964 (TG 59), 1 lp♂ (59-41) [USNM].

No locality or date: (00097), 1 L [USNM]; (00159), 2 L [USNM]; (00303), 11 L [USNM]; (00352), 1 L [USNM]; (00663), 1 L [USNM]; (06671), 2 L [USNM]; (T 1045), 1 ♂ [USNM]; (T 1092), 1 ♂ [USNM]; (T 1157), 1 ♂ [USNM]; (T 1251), 6 L [USNM]; (T 1303), 1 ♂, 1 ♀, 1 L [USNM]; (T 1967), 1 ♀ [USNM]; (T 1984), 1 ♀ [USNM]; (T 2084), 1 ♂, 1 ♀ [USNM]; (T 2087), 1 ♀ [USNM]; (T 2573), 1 L [USNM]; (T 2781), 2 L [USNM]; (CM 33), 1 L [USNM]; (CM 36), 5 L [USNM]; (CM 46), 1 lp♀ (46-1-25), 3 L [USNM]; (CM 49), 4 L [USNM]; (CM 114), 2 L [USNM]; (CM 117), 1 ♂ [USNM]; (CM 129), 2 L [USNM]; (CM 169), 1 lp♂ (169-2-18), 3 L [USNM]; (CM 171), 1 L [USNM]; (CM 204), 4 L [USNM]; (CM 215), 1 lp♂ (215-1-32), 4 L [USNM]; (CM 220), 1 lp♂ (220-45) [USNM]; (CM 223), 9 L [USNM]; (CM 228), 1 L [USNM]; (CM 229), 1 L [USNM]; (NR 423), 1 L [USNM]; (PR 167), 1 L [USNM]; (RN 36), 1 ♂ [USNM].

NO LOCALITY. 17 July 1964 (P-37), 2 L [USNM].

NO DATA. 5 ♂, 4 ♀ [USNM].

Additional records from the literature. CHINA. Hunan: Changsha, Jan-Mar 1956, L (Chang, 1957a:214, 220, 221, 222).

Kwangtung: Hainan (Chu, 1957:149, 163).

Yunnan: Chefang, Apr 1940-Mar 1942, L (Chow, 1949:128).

INDIA. Bihar: Sukna, Sept 1922, P.J. Barraud (Barraud, 1927:527-529).

Kerala: Maddathorai, 17 Nov 1908, Annandale, A (Theobald, 1910a:29-30).

Maharashtra: Bhorghat Pass, Apr 1953-Mar 1955, A (Ramachandra Rao and Rajagopalan, 1957:13, 33).

Punjab: Koti, near Kasauli, Aug 1923, P.J. Barraud (Barraud, 1927:527-529).

REPUBLIC OF THE PHILIPPINES. Bulacan: San Jose, Tungkong Manga, Dec 1929, F. E. Baisas, L, A (Baisas, 1946:35-39).

THAILAND. Nakhon Si Thammarat: Khao Ram, 23 Feb 1922, Pendlebury, A (Edwards, 1928:53, 57).

NOMEN DUBIUM

24a. Orthopodomyia mcgregori (Banks)

1909. Kerteszia mcgregori Banks, 1909:548-550. TYPE: holotype ♂, Basilan Island, [Zamboanga del Sur], Philippine Islands, 28 Dec 1906, R. C. Mc Gregor. Holotype was #6666 in the Entomological Collection, Bureau of Science, Manila, P. I., but according to Baisas (1946:34) it was destroyed during the liberation of Manila in World War II. Reduced to synonymy with albipes by Edwards (1932:108); judged to probably be distinct from albipes by Baisas (1946:34, 35); resurrected from synonymy with albipes by Knight and Chamberlain (1948:10); reduced to status of nomen dubium here.

Orthopodomyia mcgregori of Baisas (1946:34, 35).
Orthopodomyia albipes of Edwards (1932:108, in part); Barraud (1934:102, in part); Bohart (1945:37).

SYSTEMATICS. Kerteszia mcgregori was described by Banks in 1909 from 2 males collected on Basilan Island. The type and presumably the other male were destroyed during the Second World War. Edwards (1932:108) and Barraud (1934:102) considered mcgregori to be a synonym of albipes on the basis of hindtarsal segments 3-5 being white-scaled. Baisas (1946:34, 35) felt that mcgregori was probably distinct from albipes and was distinct from the 2 species, manganus (=anopheloides) and madrensis, which he described from Luzon. He suggested leaving the taxonomic status of mcgregori uncertain until additional material was collected from the type locality. Knight and Chamberlain (1948: 10) and Knight and Mattingly (1950:13-15) applied the name to a single male from Palawan which had the last 3 hindtarsal segments all white. This specimen, however, is anopheloides.

On the basis of hindtarsal segments 3-5 being entirely white-scaled, mcgregori could be albipes, andamanensis, anopheloides, madrensis, papuensis, siamensis or a distinct species. The original description indicates that hindtarsal segment 2 is white at the apex, implying that it is dark at the base. Also, white spots are mentioned to occur on the bases of wing veins I (R) and V (Cu), but none is mentioned for the anal vein. Since albipes has white scaling at the base of hindtarsal segment 2 and always has white scales at the base of vein 1A, these specimens were not that species. On geographical grounds it is unlikely that they were siamensis.

Since it is impossible to tell whether mcgregori is a distinct species or not, I think the suggestion of Baisas to leave its taxonomic status uncertain until topotypic material is available is the best procedure and the name is accordingly considered here to be a nomen dubium.

DISTRIBUTION. Type from Basilan Island, Zamboanga del Sur, Republic of the Philippines. Specimens Examined: none.

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FIGURES

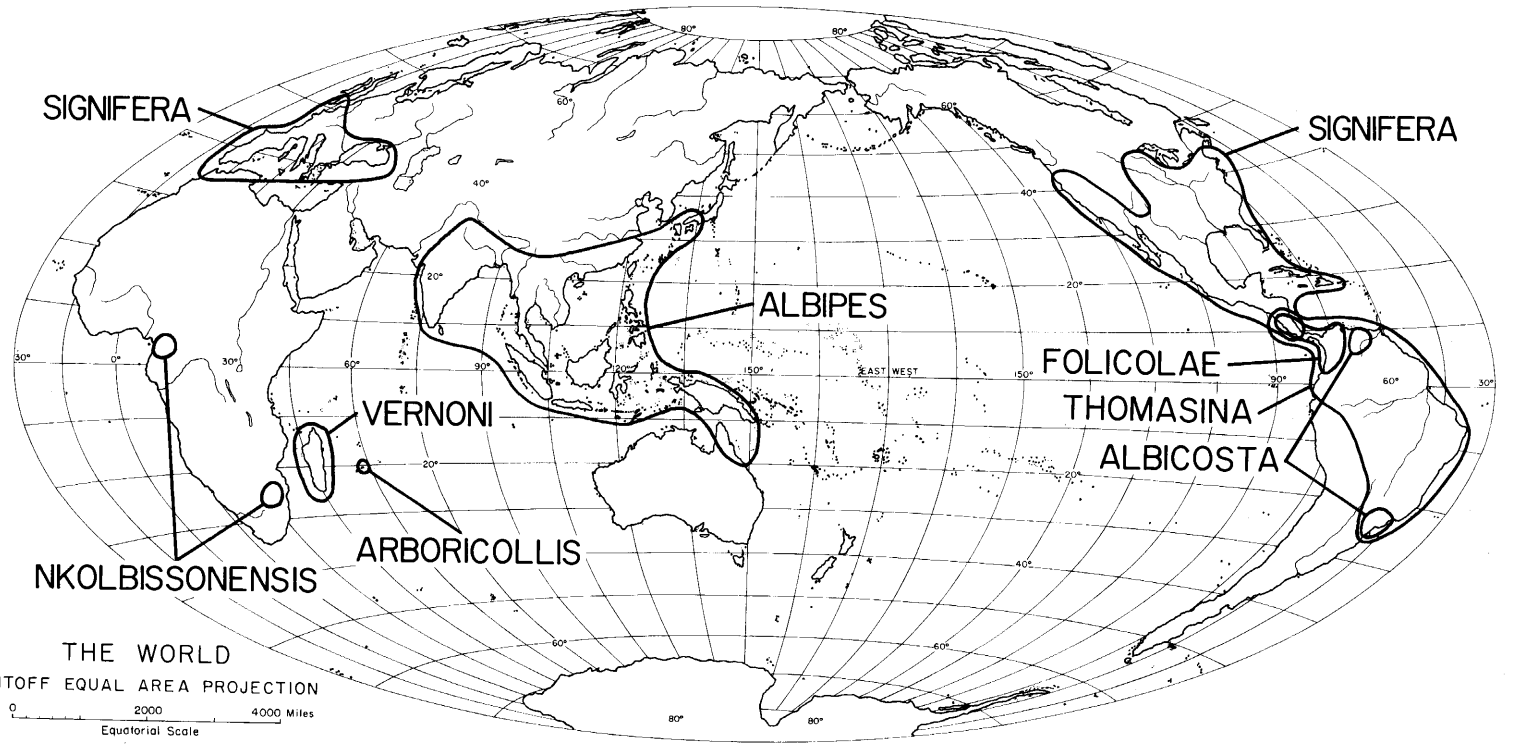

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Fig. 1

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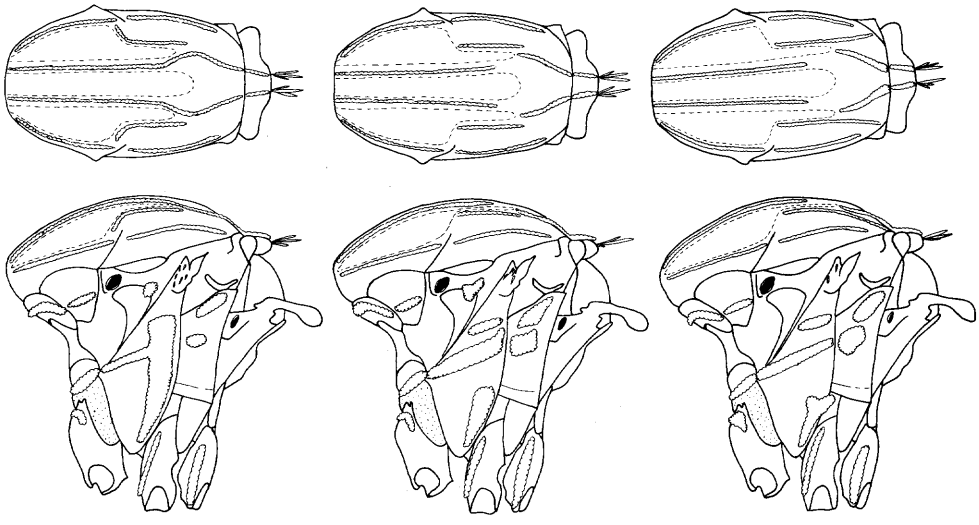
Fig. 2



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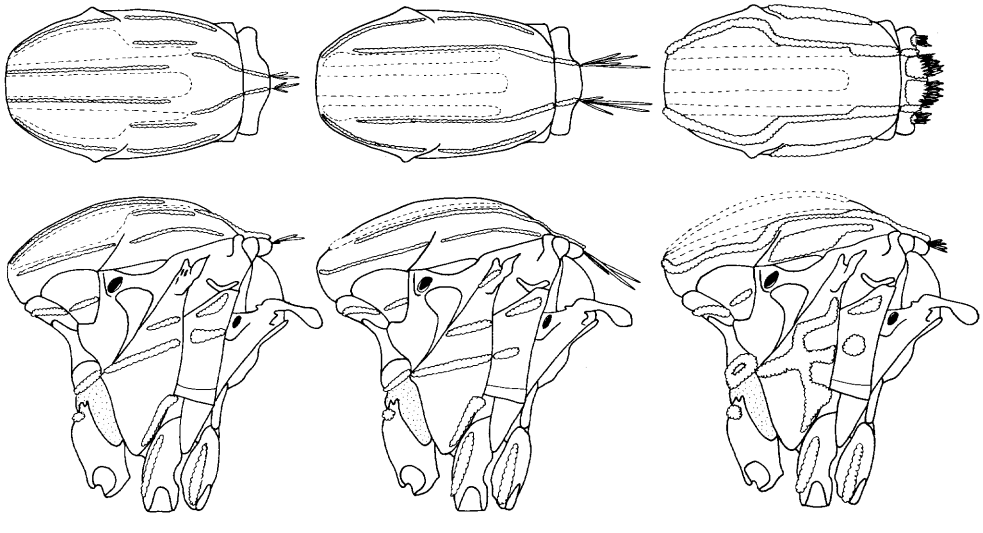

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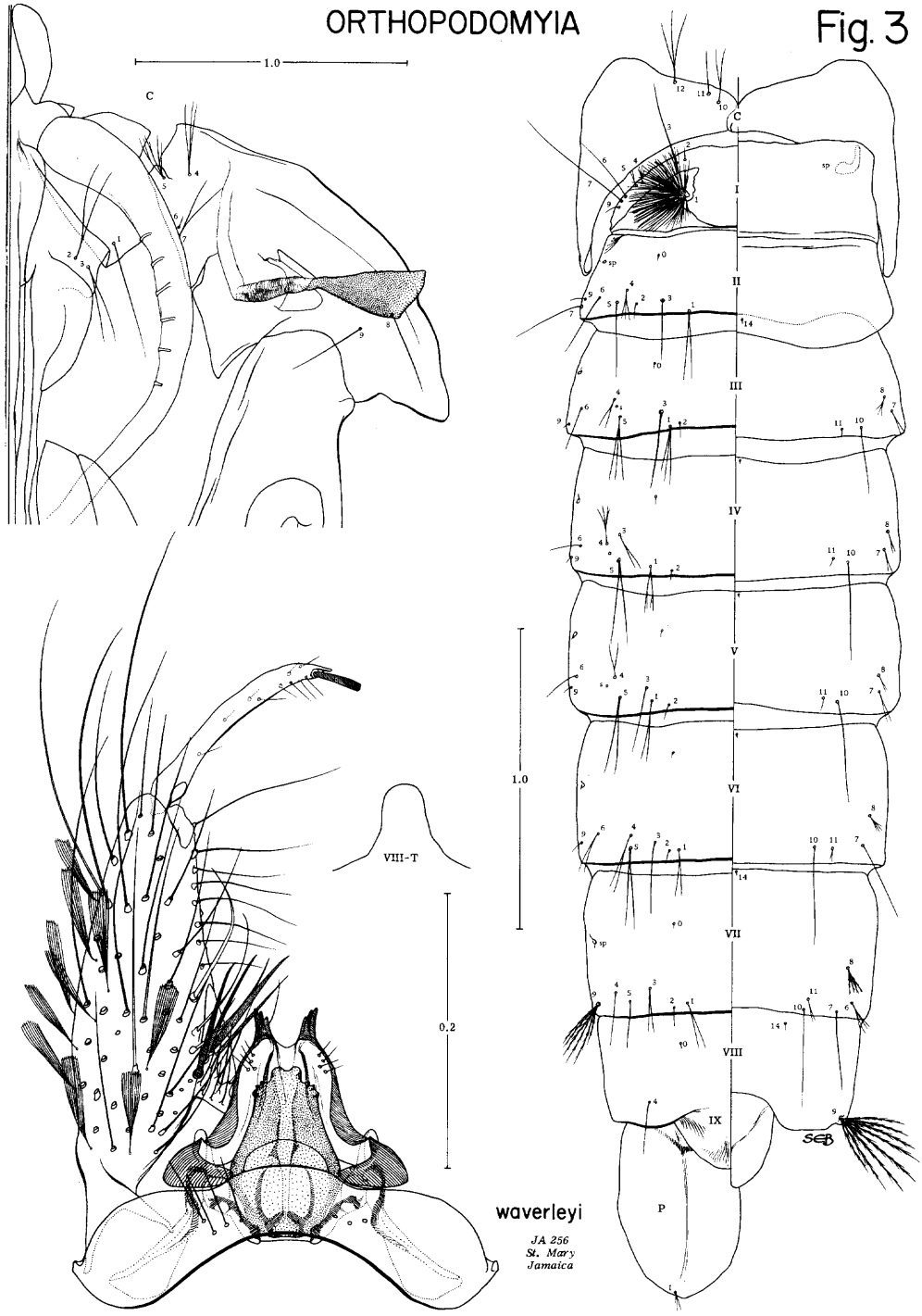
Fig. 3



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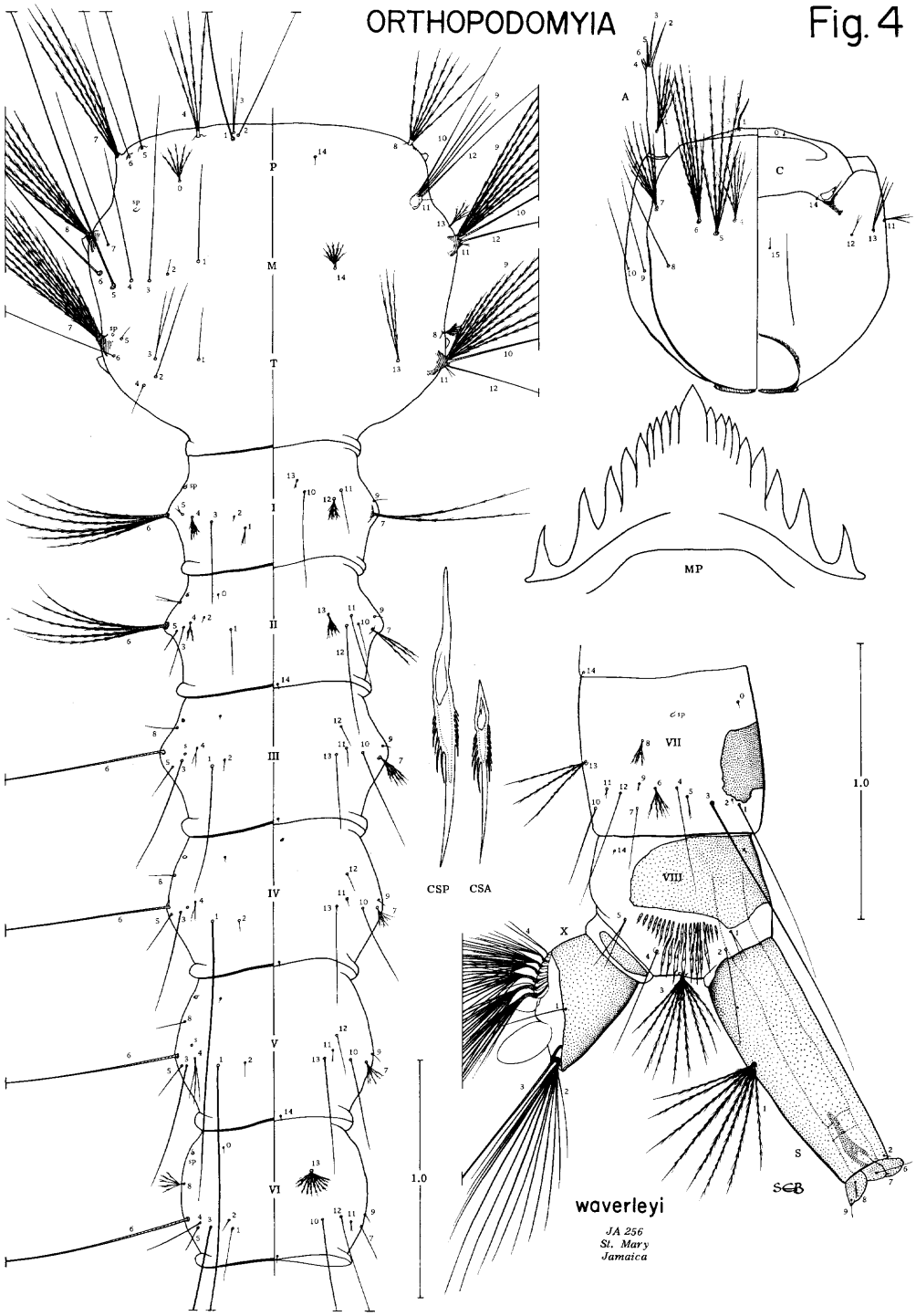
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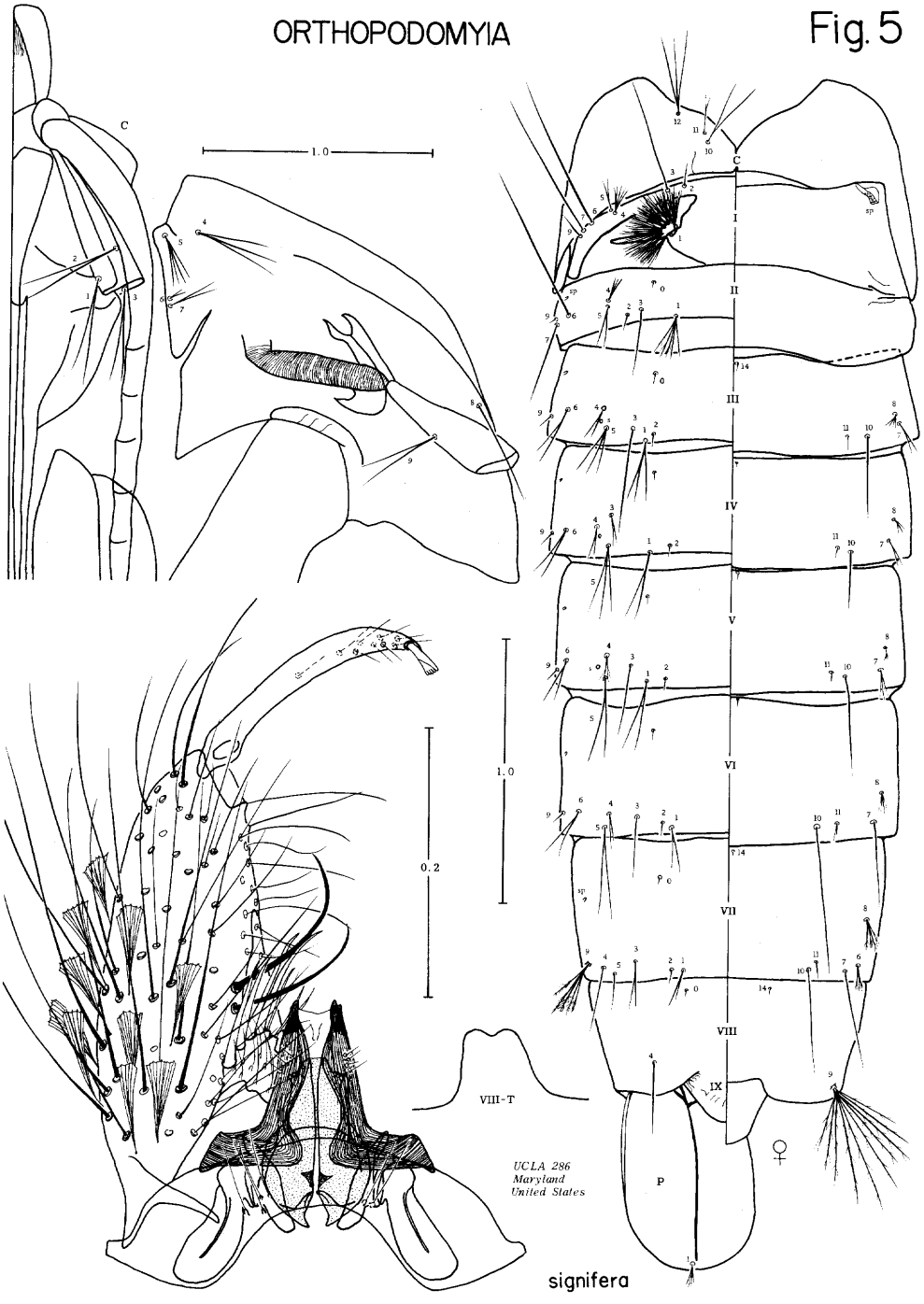
Fig. 5



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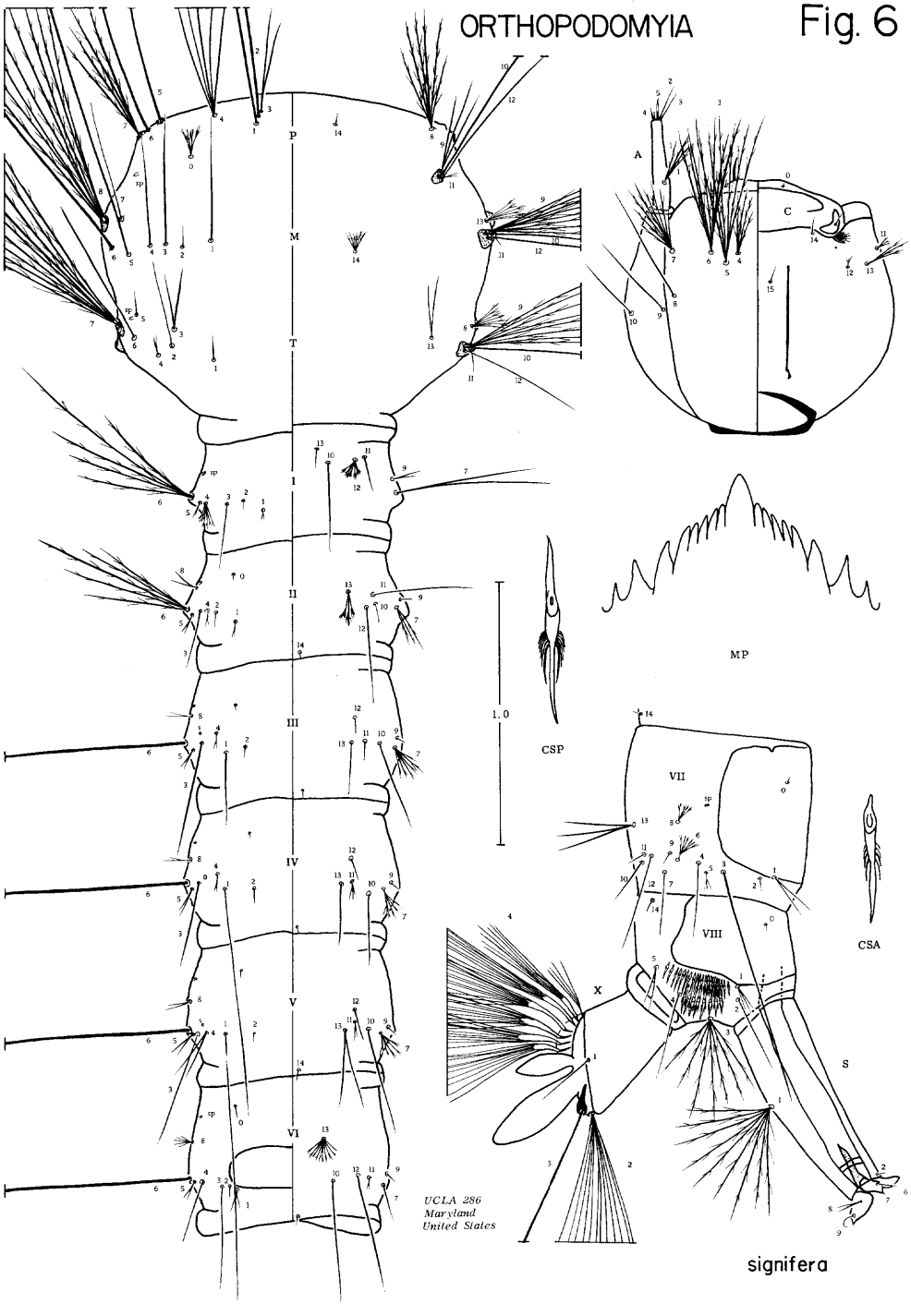
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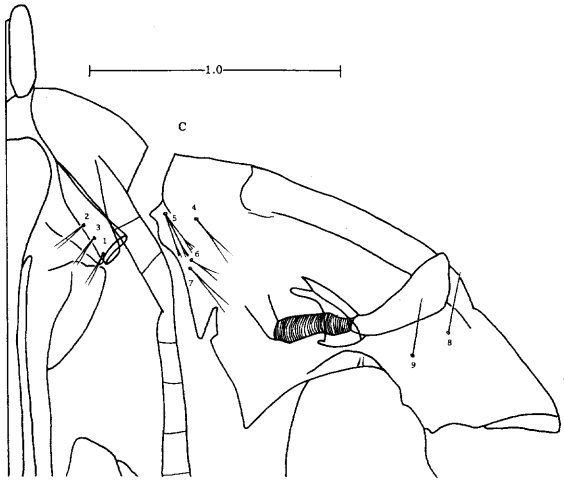
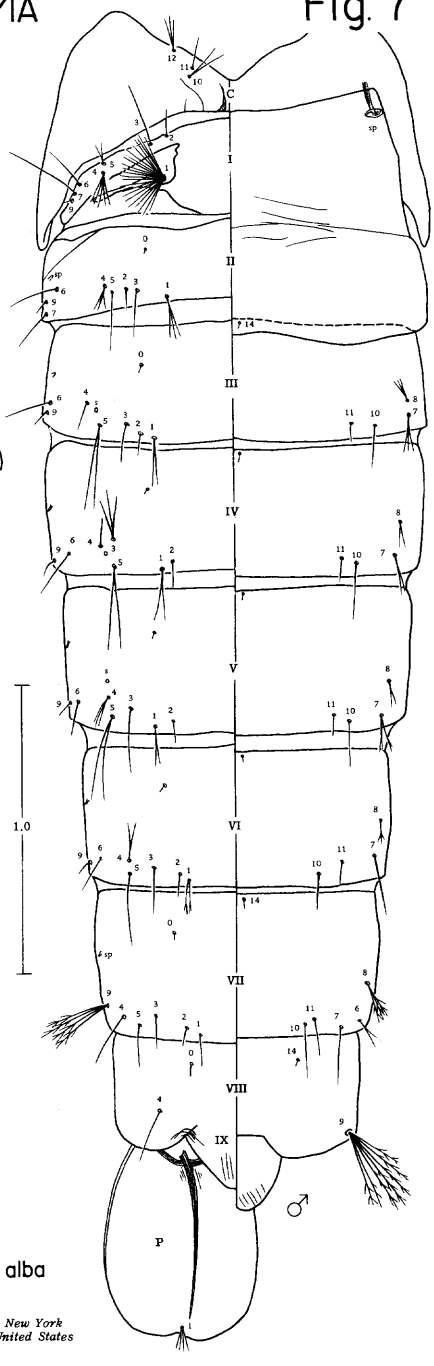
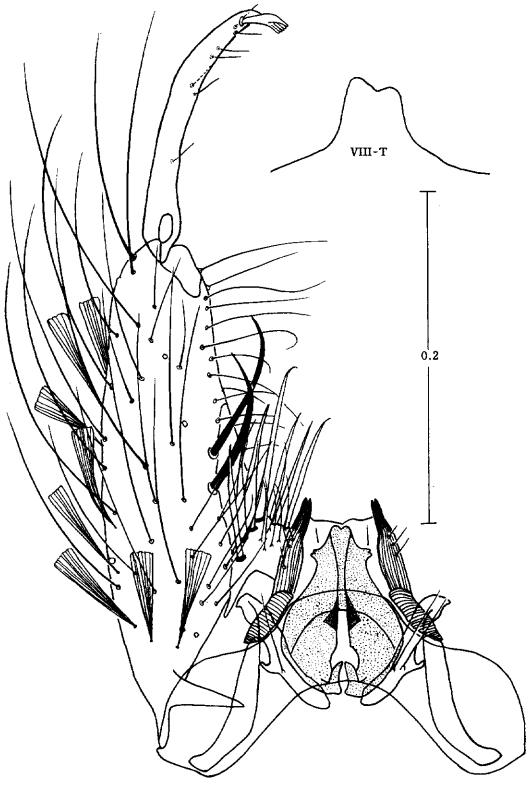
Fig. 7







alba

New York
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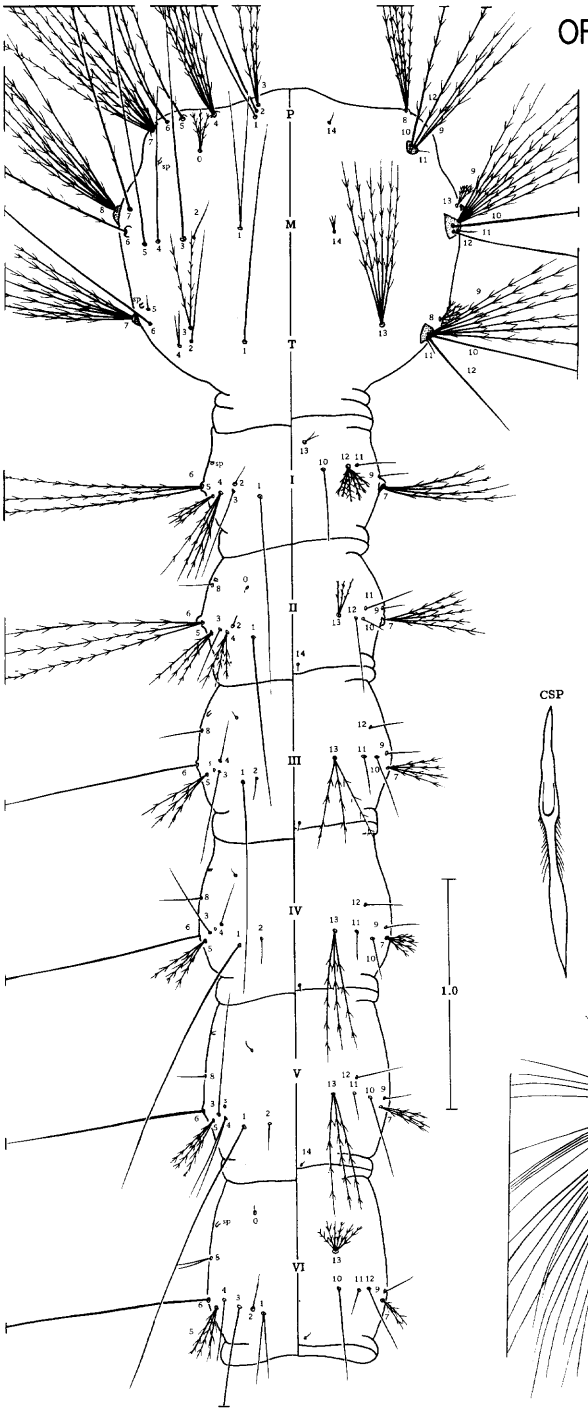
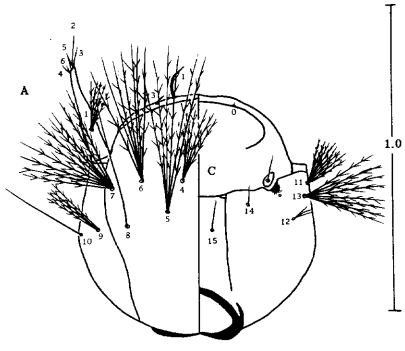
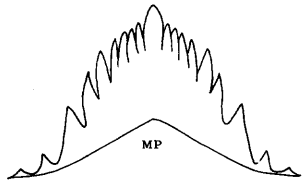
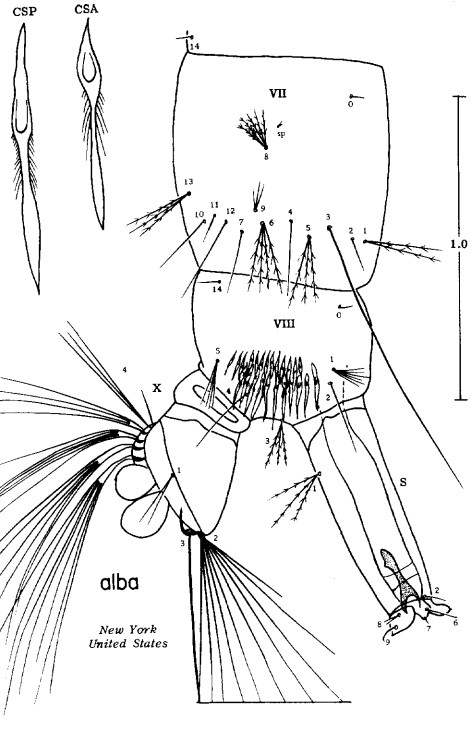
ORTHOPODOMYIA Fig. 8



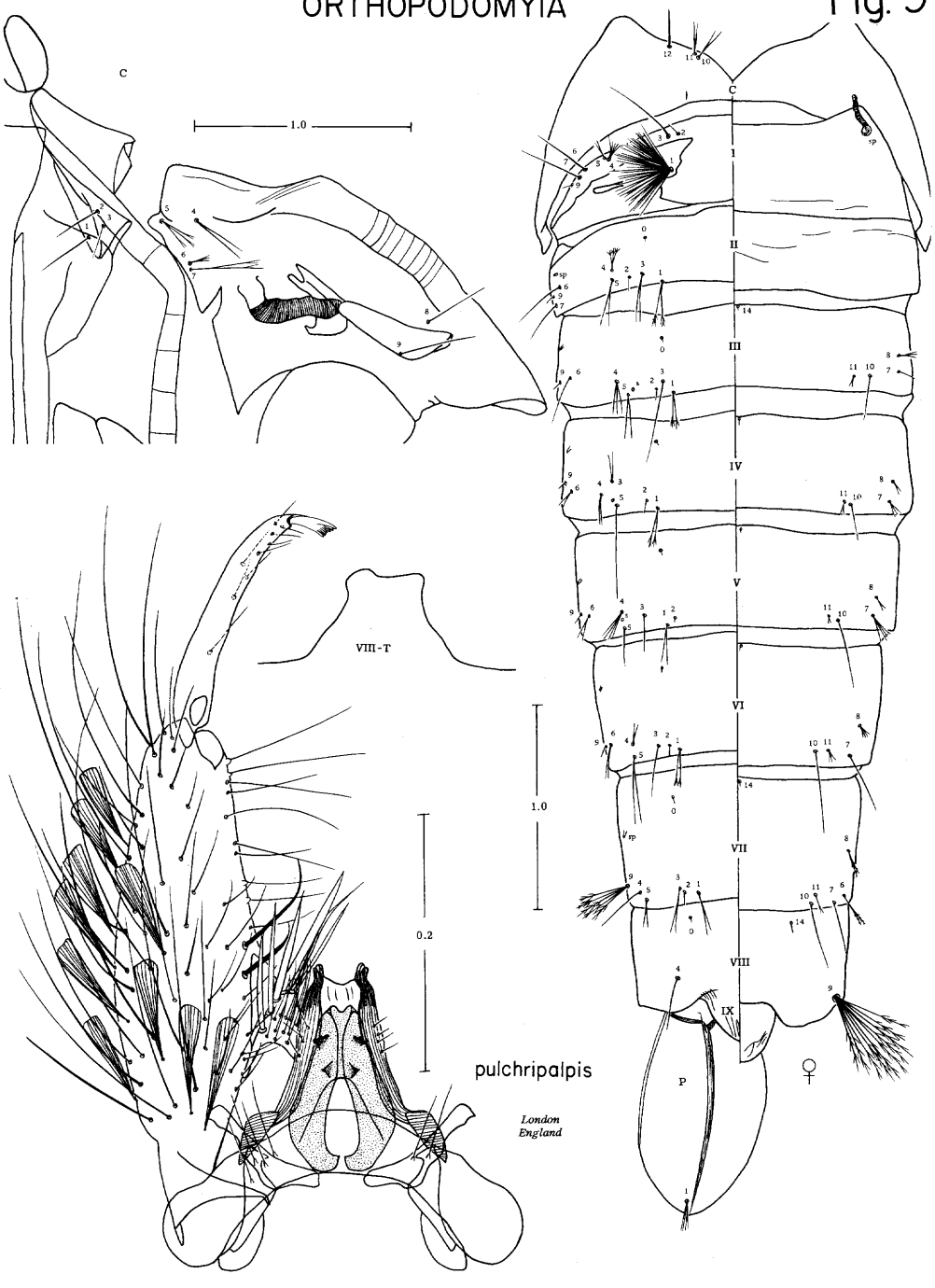




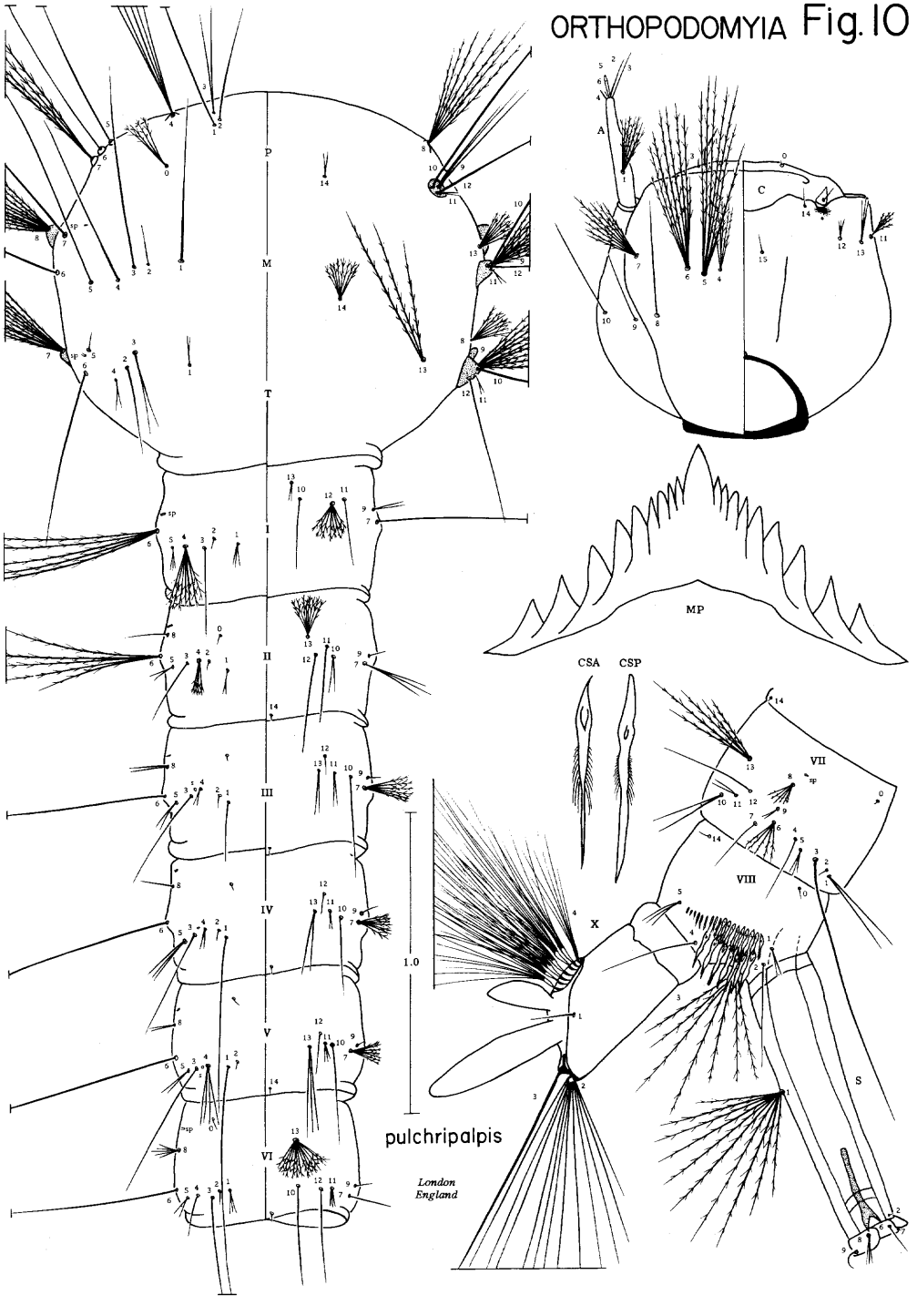


ORTHOPODOMYIA

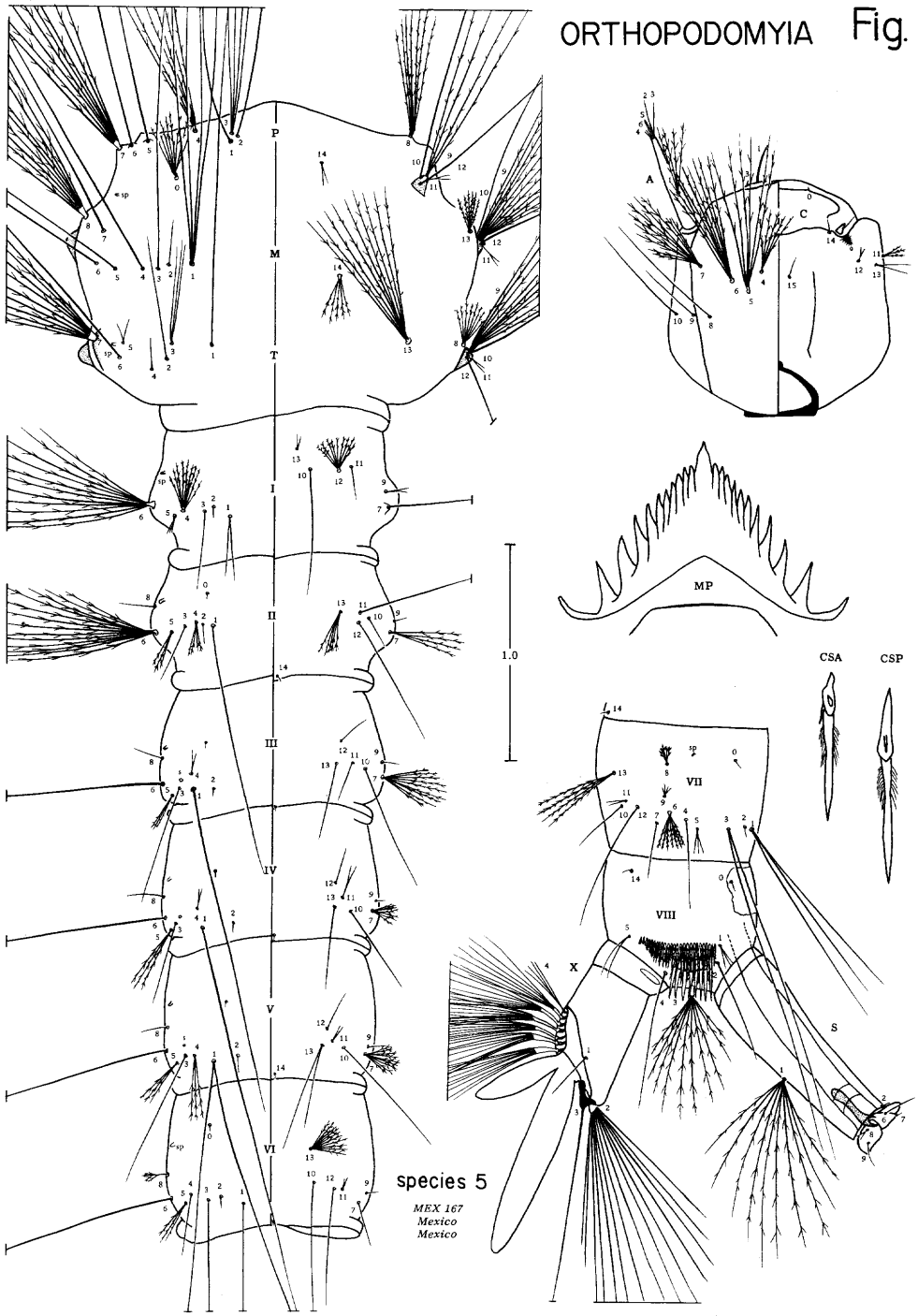
Fig. 9



ORTHOPODOMYIA Fig. 10

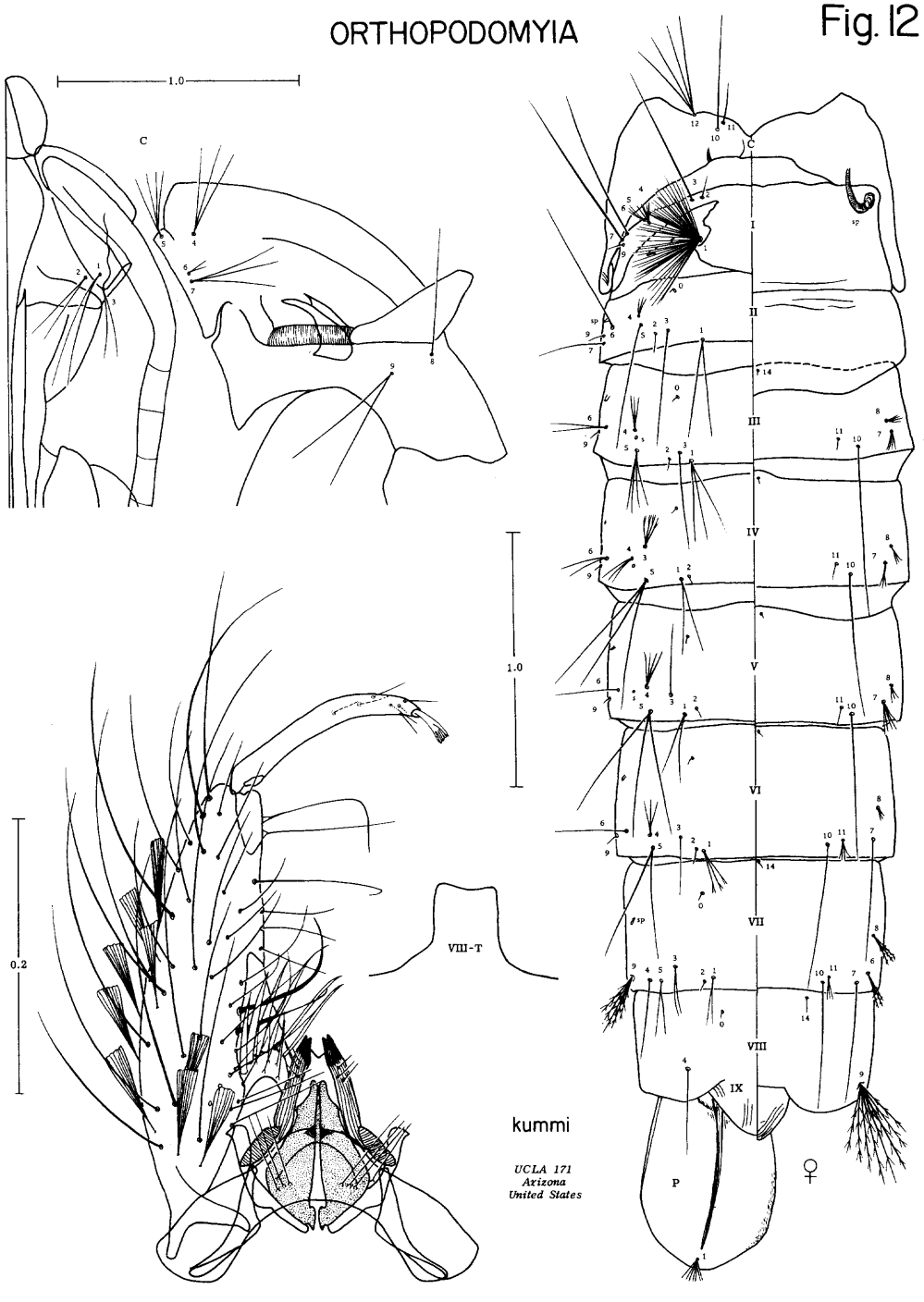


ORTHOPODOMYIA Fig. 11

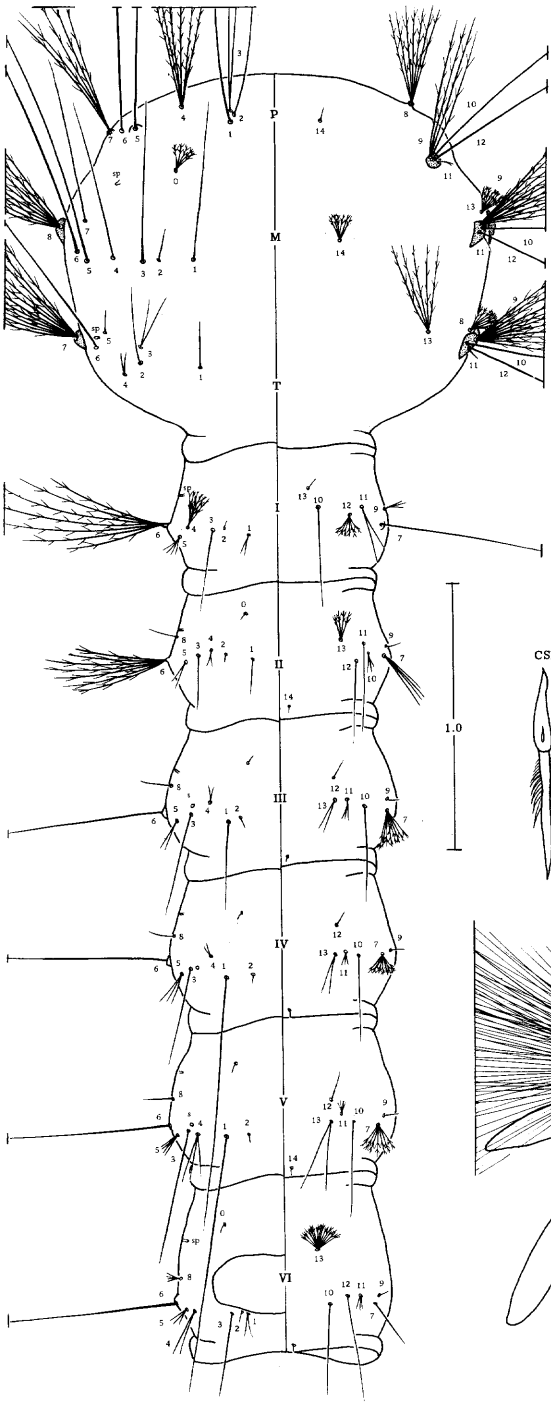


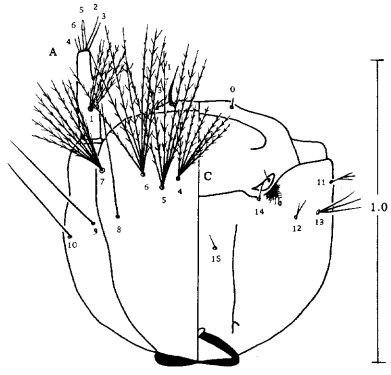
ORTHOPODOMYIA

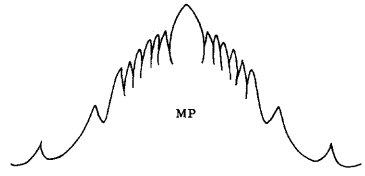
Fig. 12

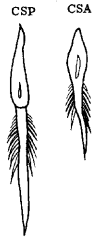


ORTHOPODOMYIA Fig. 13









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ORTHOPODOMYIA
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IV
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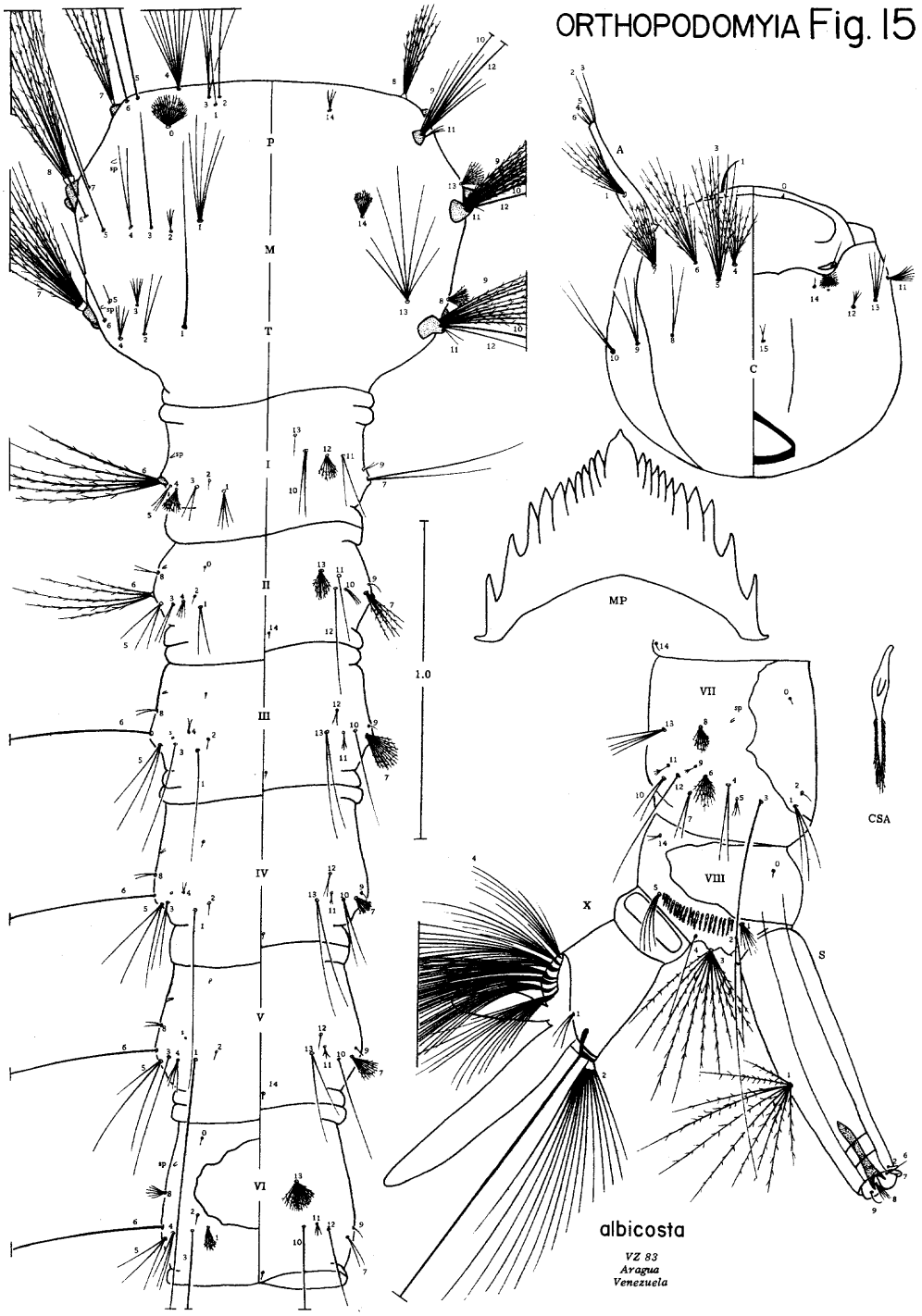
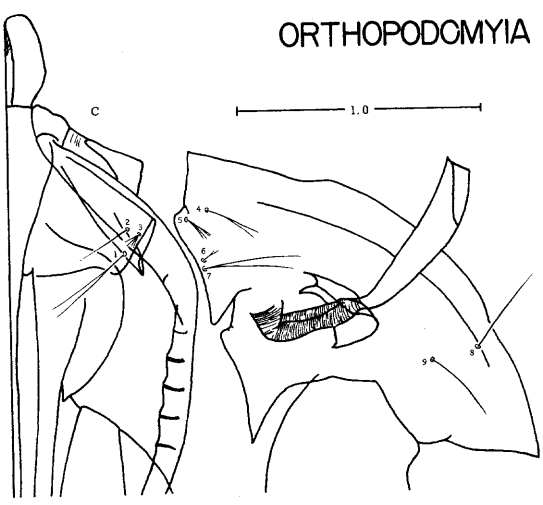
VI
VII
VIII
IX
VIII-T
albicosta
VZ 83
Aragua
Venezuela
Sao Paulo
Brazil
P
♂

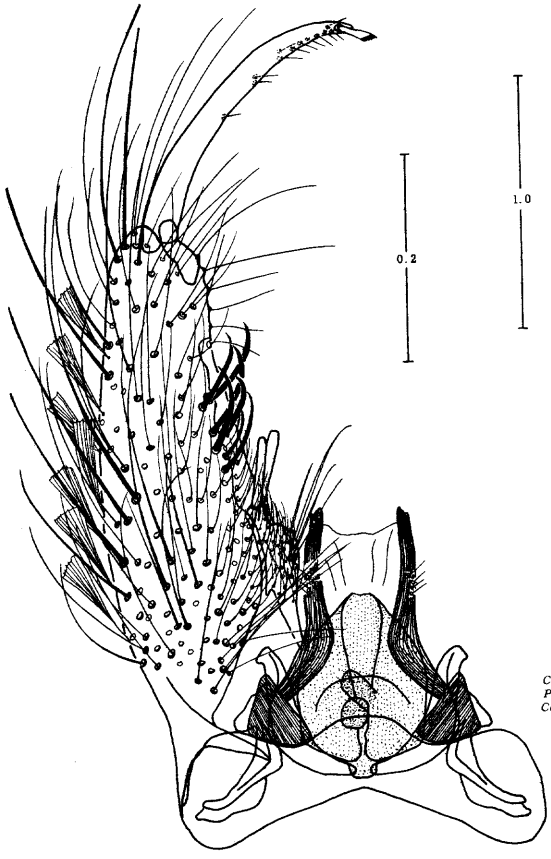
ORTHOPODOMYIA Fig. 15

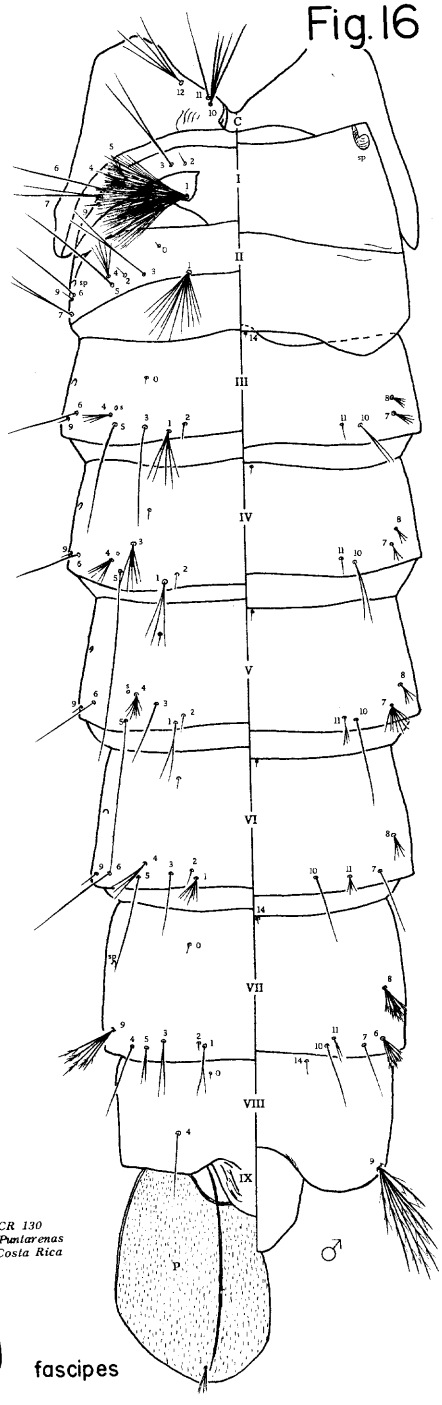


ORTHOPODOMYIA

Fig. 16

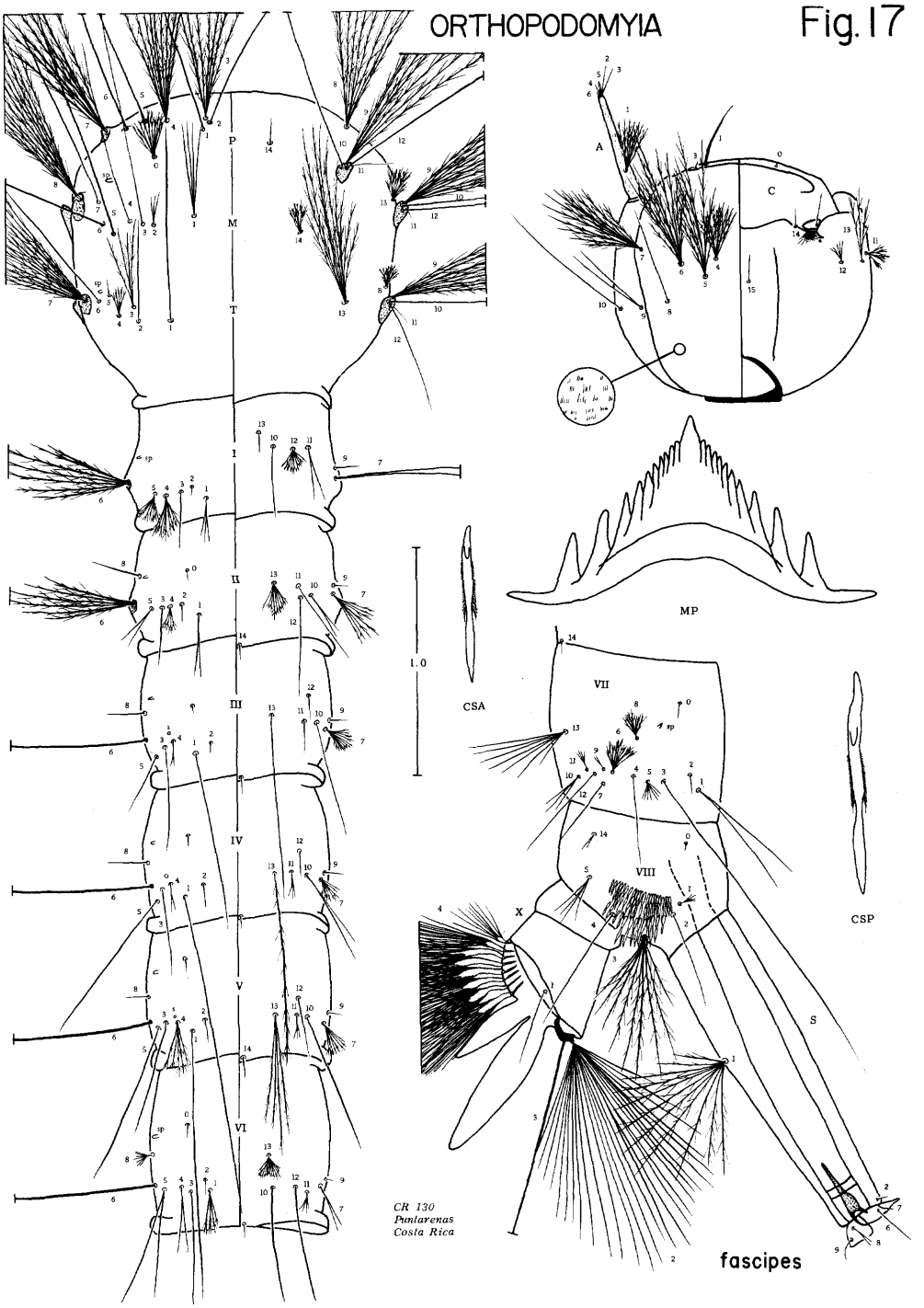


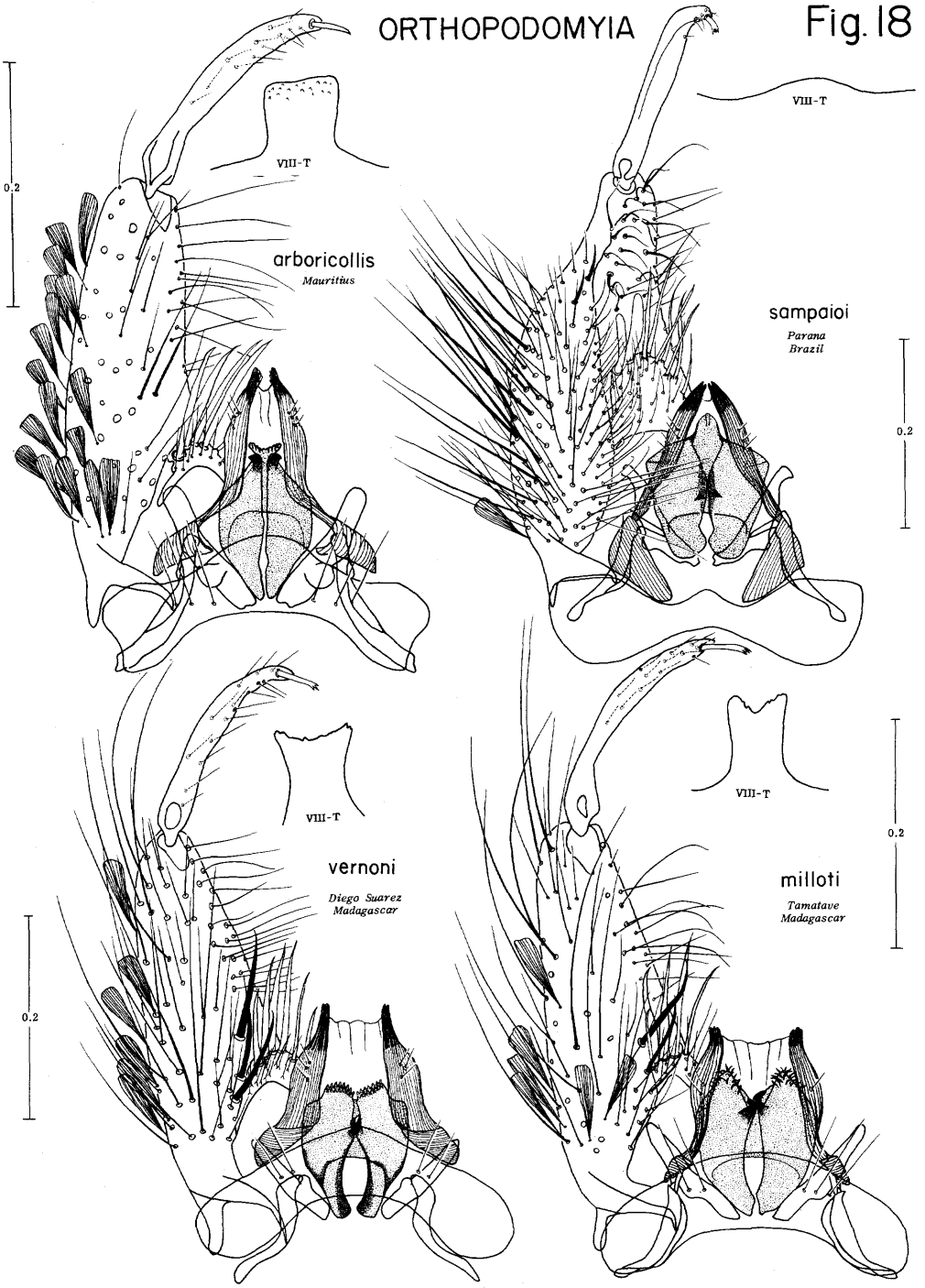




CR 130
Puntarenas
Costa Rica

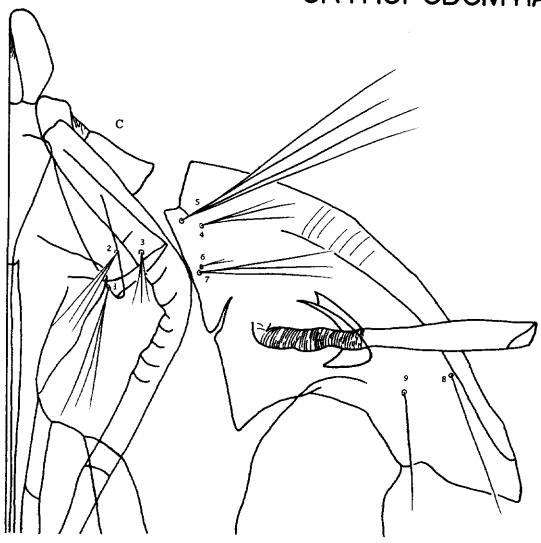
fascipes

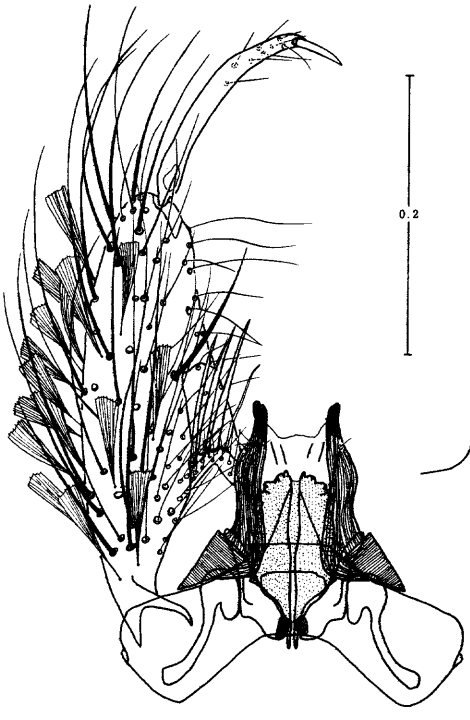

ORTHOPODOMYIA
Fig. 17
P
M
T
I
II
III
IV
V
VI
VII
VIII
X
A
C
MP
CSA
CSP
1.0
S
CR 130
Pinilarenas
Costa Rica
fascipes

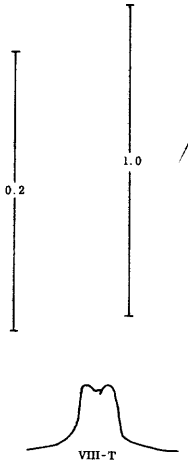

ORTHOPODOMYIA
Fig. 18
VIII-T
arboricollis
Mauritius
0.2
VIII-T
sampaioi
Parana
Brazil
0.2
VIII-T
vernoni
Diego Suarez
Madagascar
0.2
VIII-T
milloti
Tamatave
Madagascar
0.2

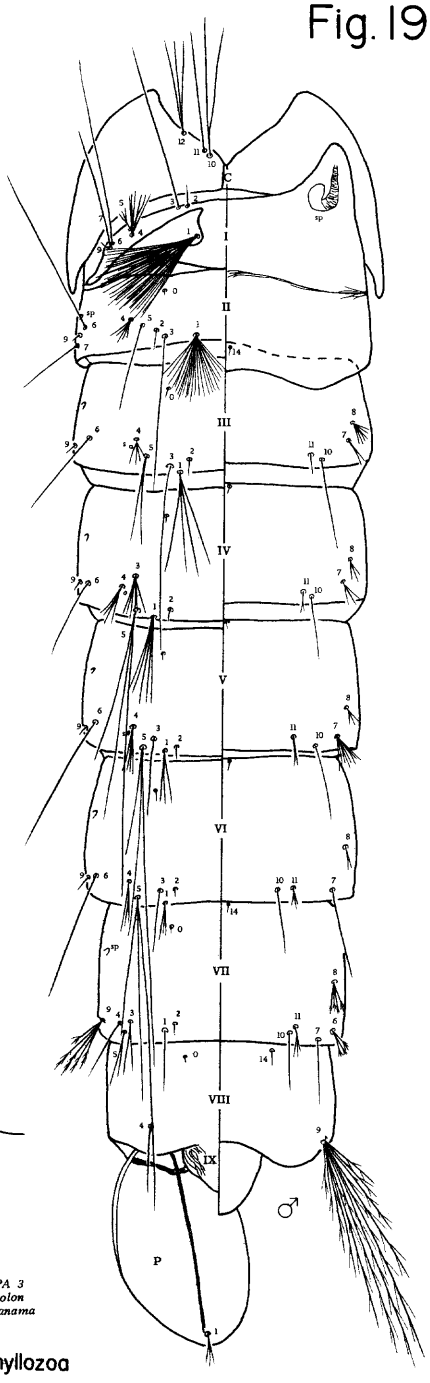
ORTHOPODOMYIA

Fig. 19







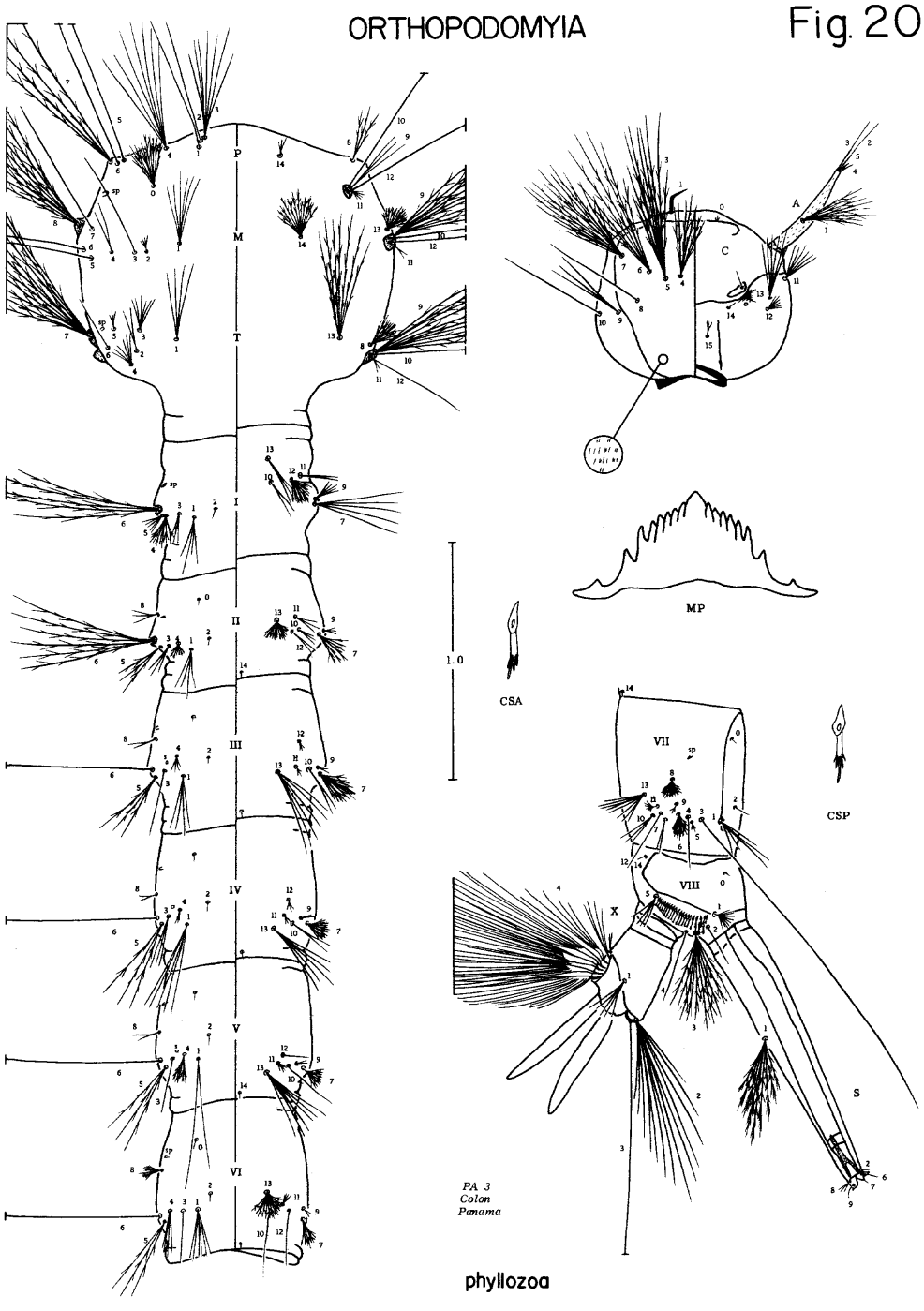


PA 3
Colon
Panama

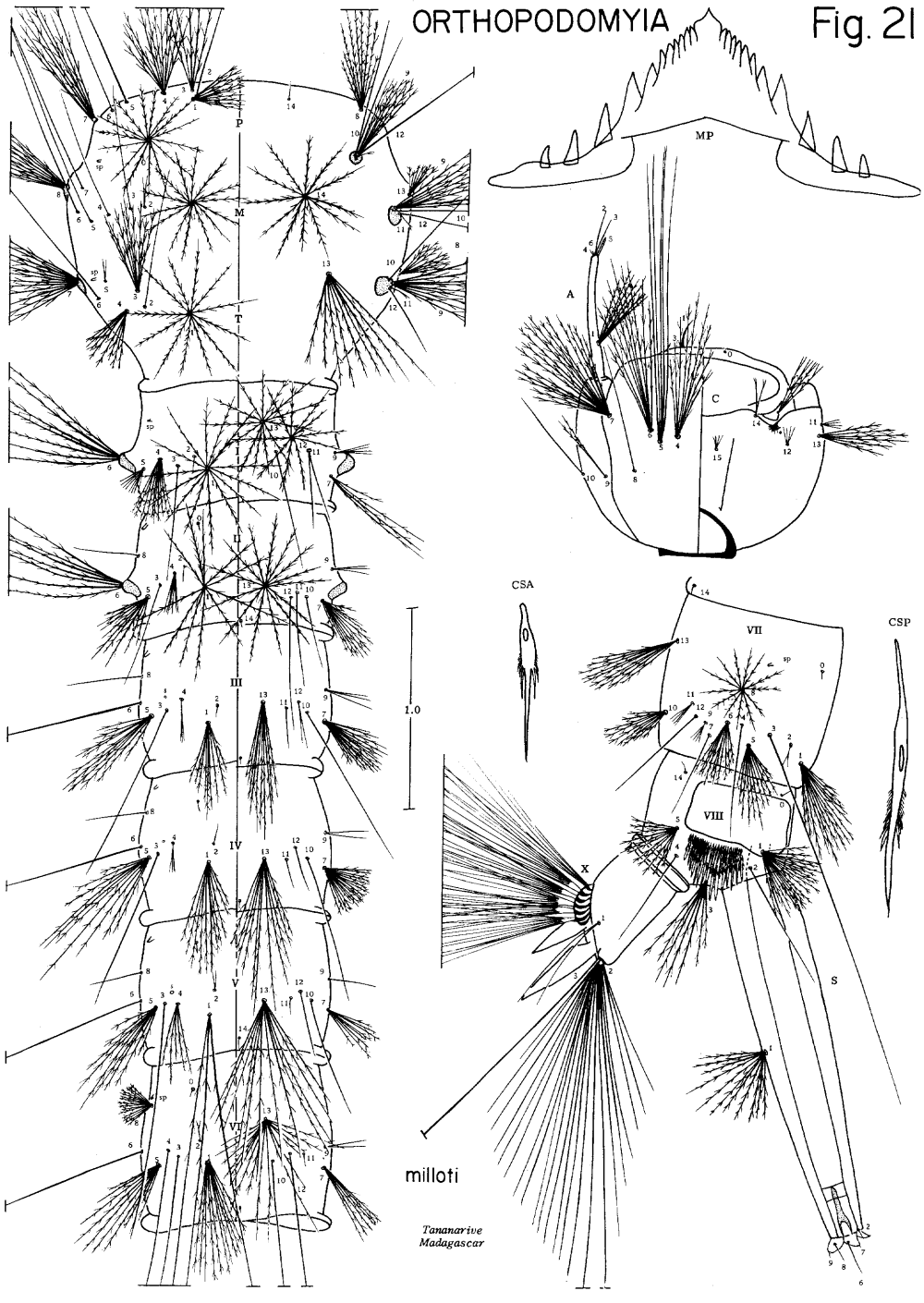
phyllozoa

ORTHOPODOMYIA

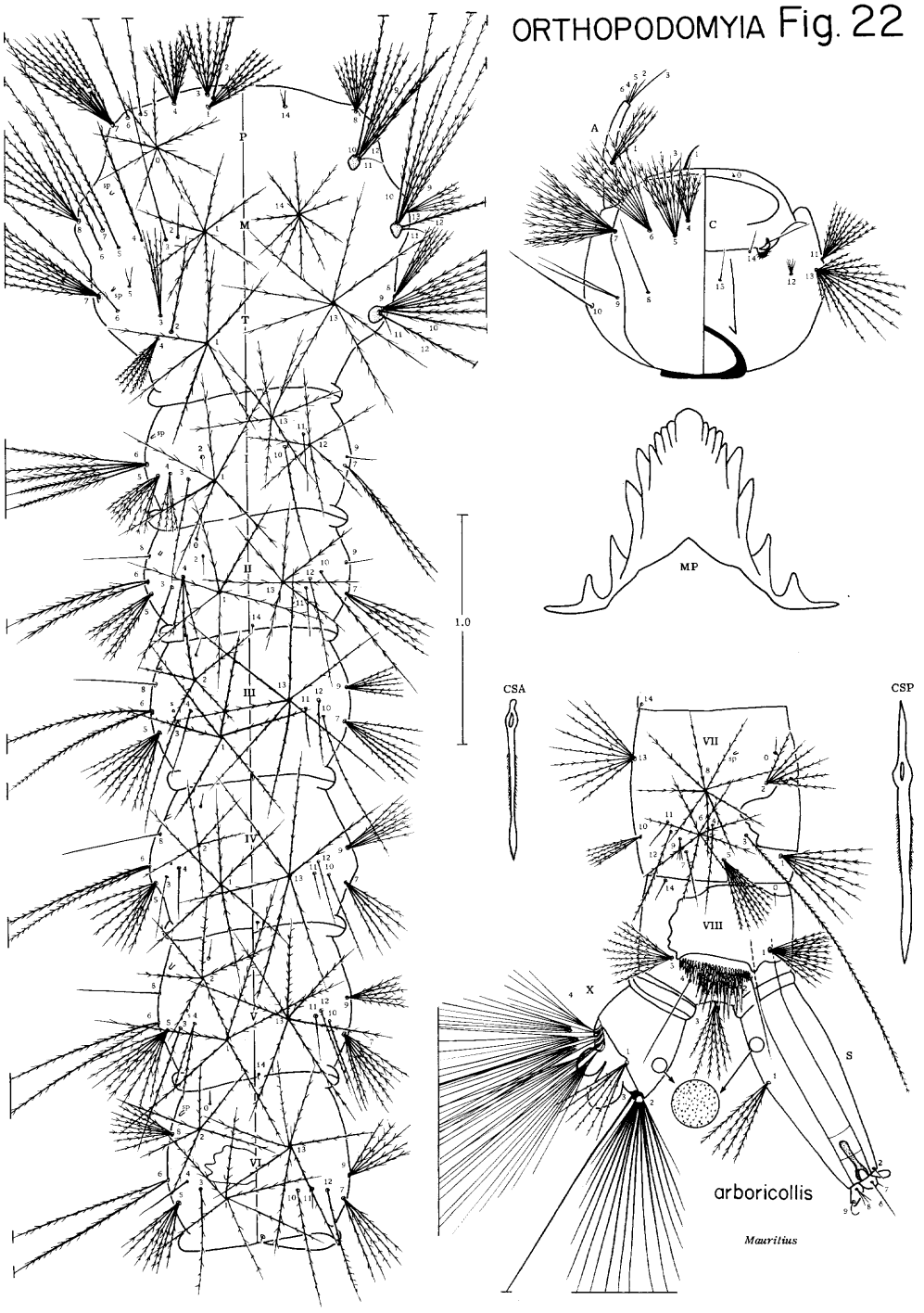
Fig. 20



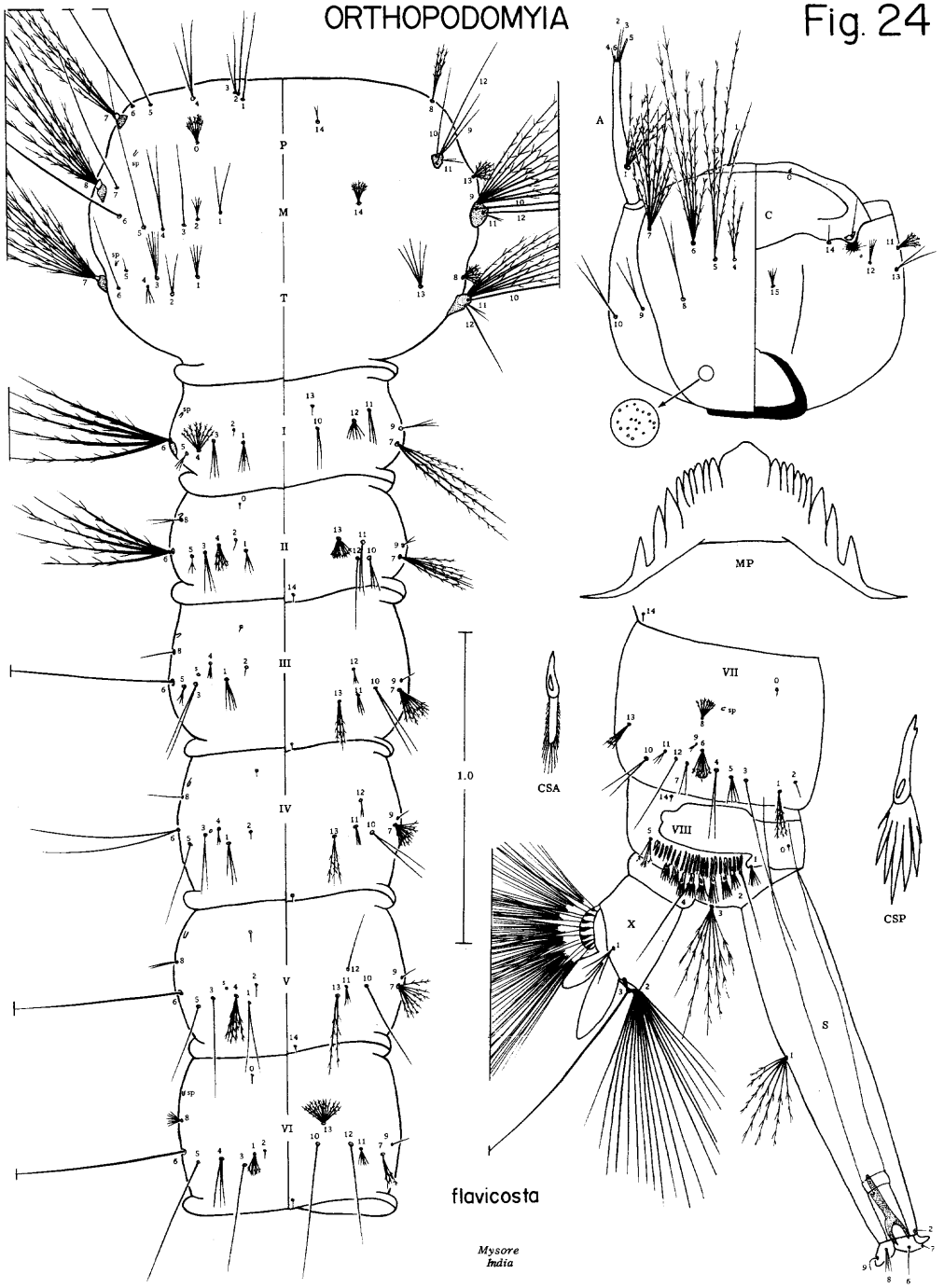
phyllozoa

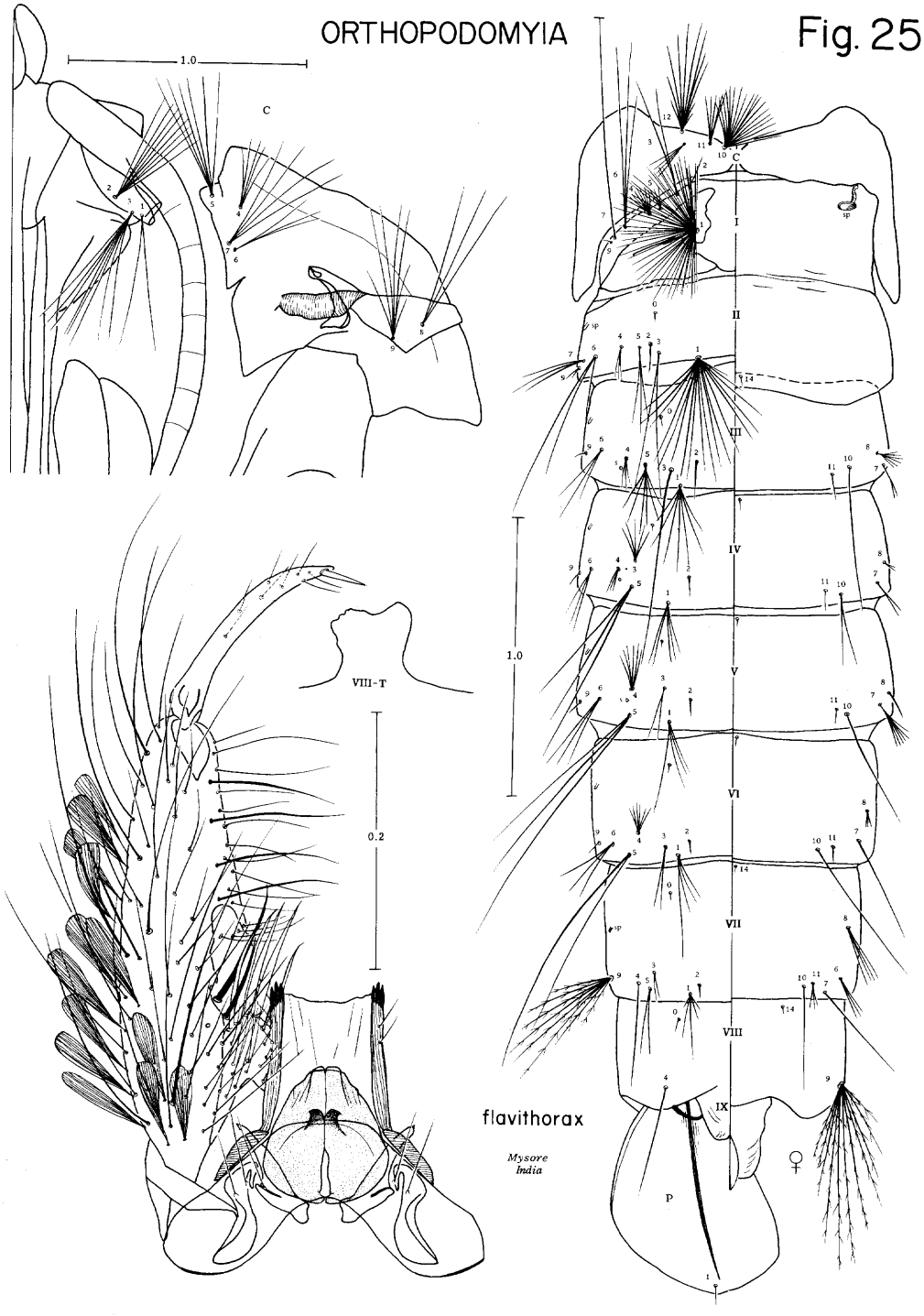

ORTHOPODOMYIA
Fig. 21
P
M
T
I
II
III
IV
V
VI
VII
MP
A
C
CSA
CSP
VII
VIII
X
S
1.0
milloti
Tananarive
Madagascar

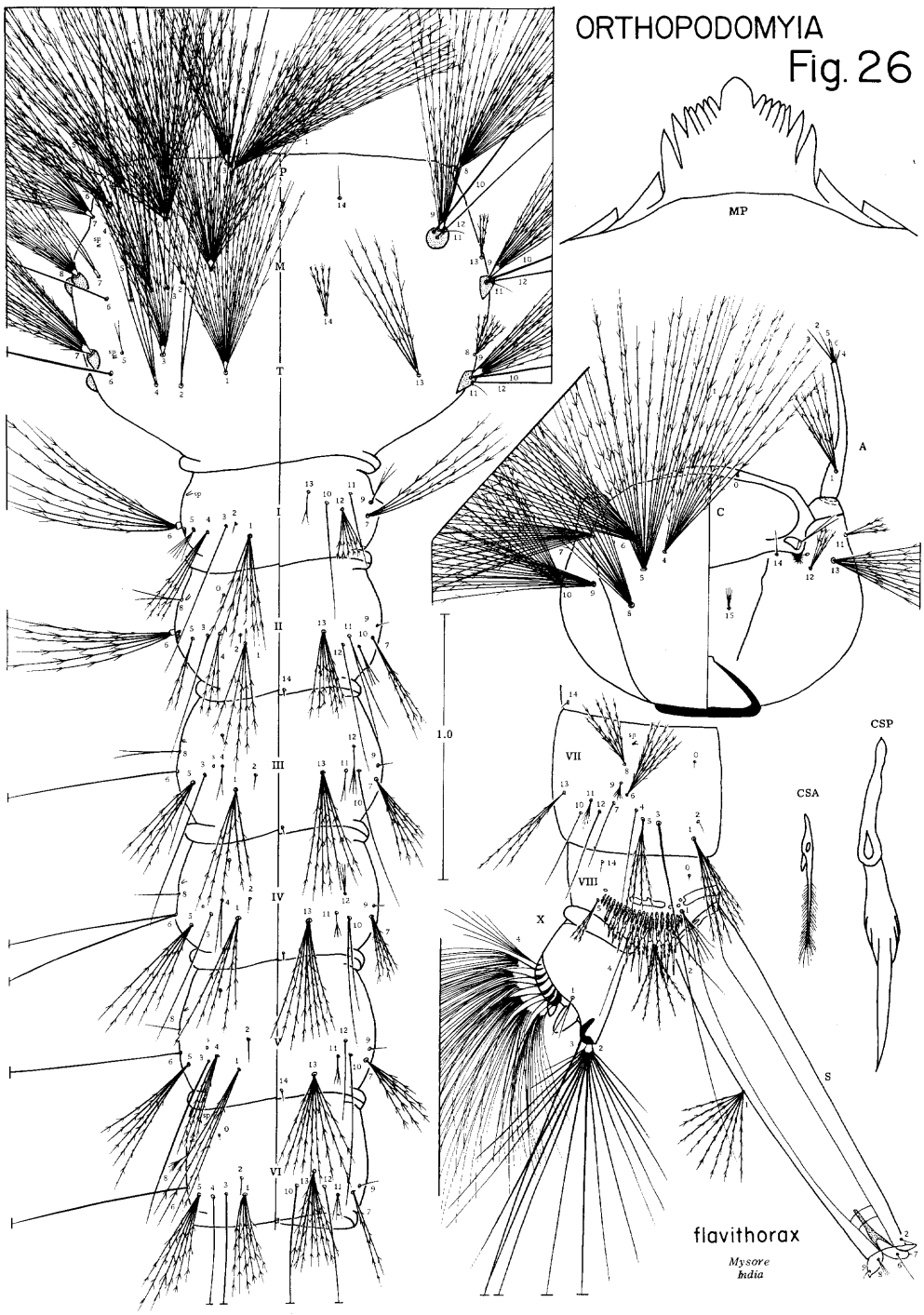
ORTHOPODOMYIA Fig. 22




ORTHOPODOMYIA
Fig. 23
1.0
C
1.0
0.2
VIII-T
flavicosta
Mysore
India

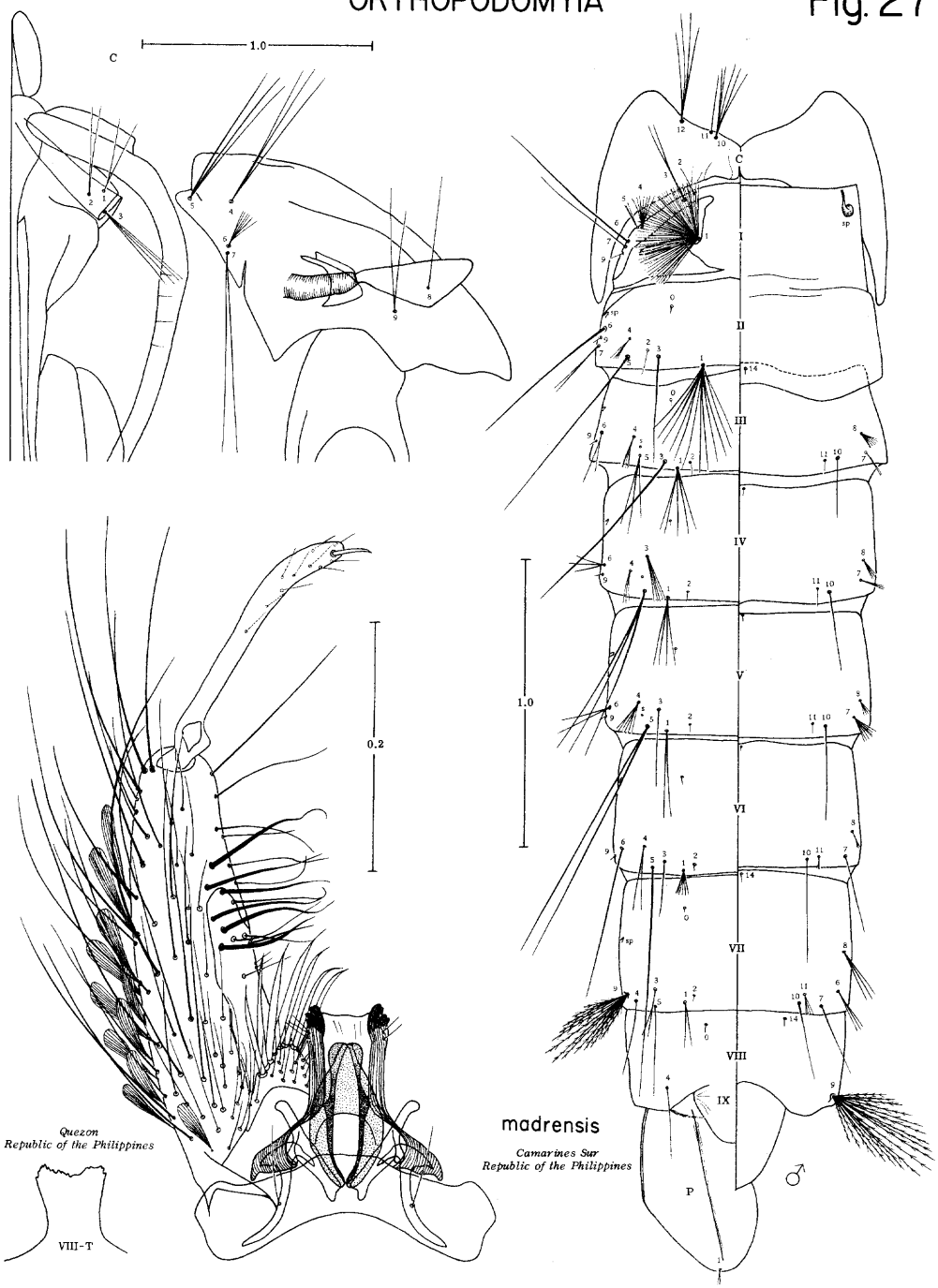

ORTHOPODOMYIA
Fig. 24
P
M
T
I
II
III
IV
V
VI
VII
VIII
A
C
MP
CSA
CSP
X
S
1.0
flavicosta
Mysore
India


ORTHOPODOMYIA
Fig. 25
1.0
C
VIII-T
0.2
I
II
III
IV
V
VI
VII
VIII
IX
P
flavithorax
Mysore
India


ORTHOPODOMYIA
Fig. 26
MP
P
M
T
I
II
III
IV
V
VI
VII
VIII
X
A
C
S
CSP
CSA
1.0
flavithorax
Mysore
India

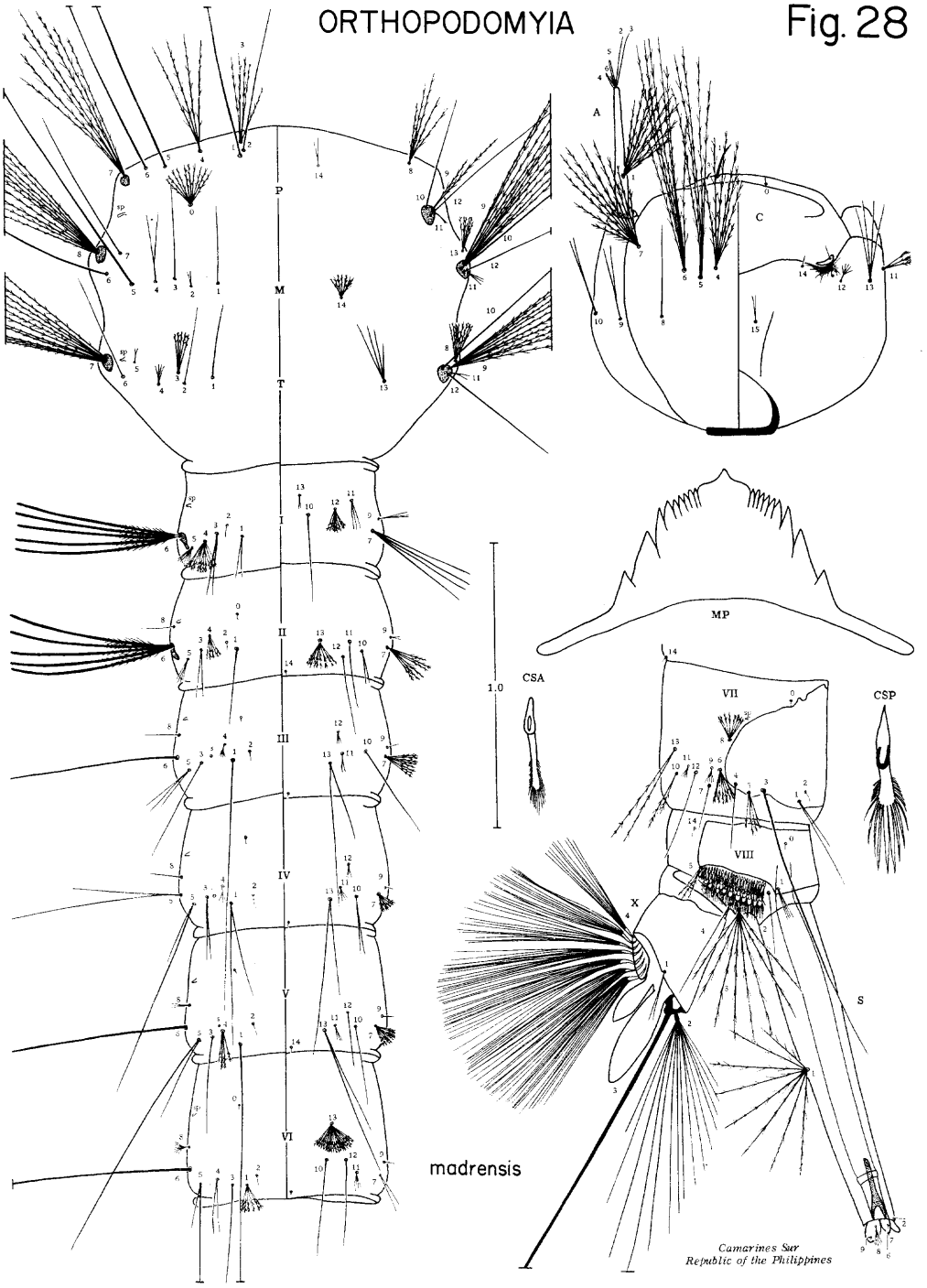
ORTHOPODOMYIA

Fig. 27



ORTHOPODOMYIA

Fig. 28

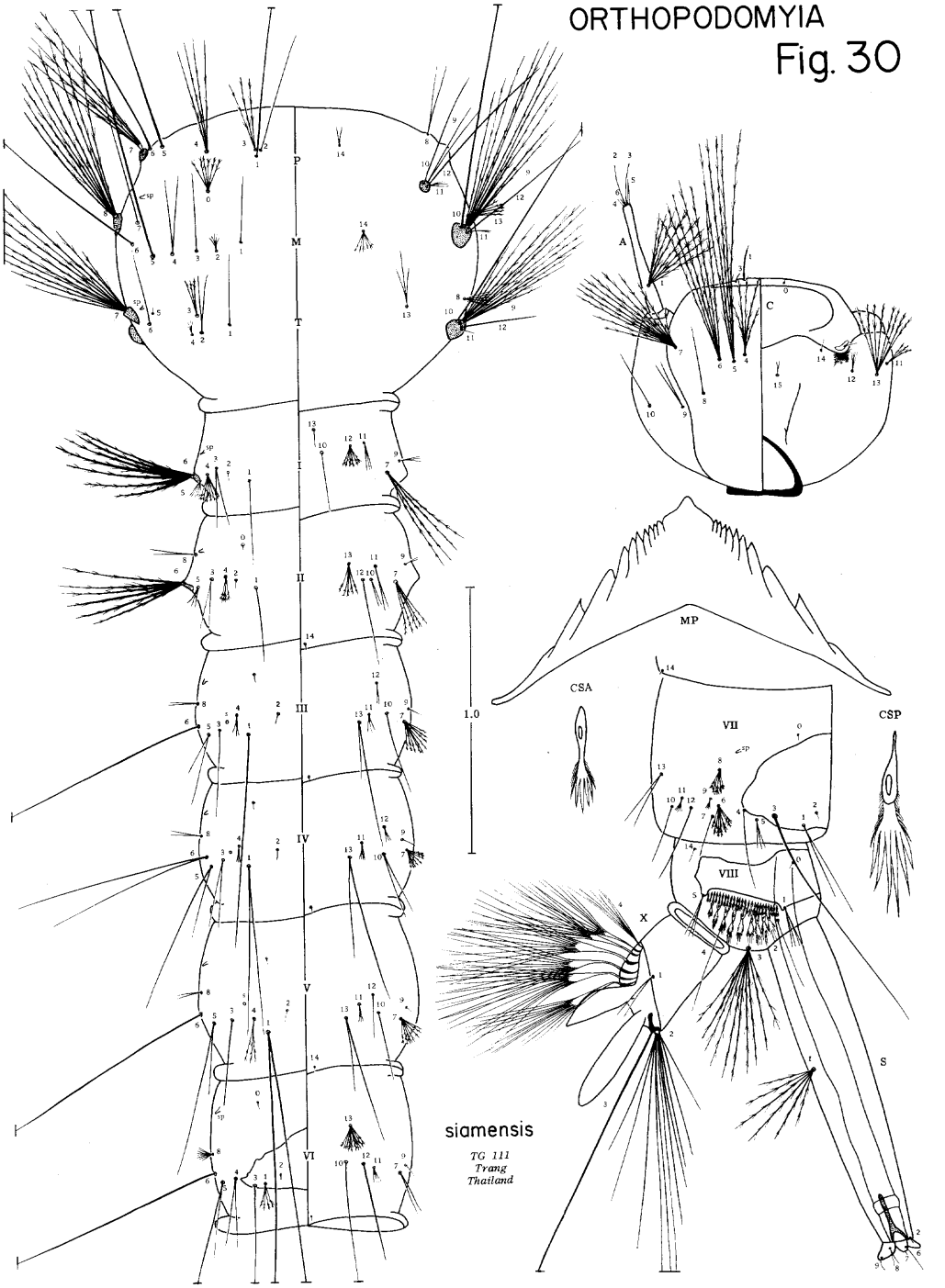


ORTHOPODOMYIA

Fig. 29

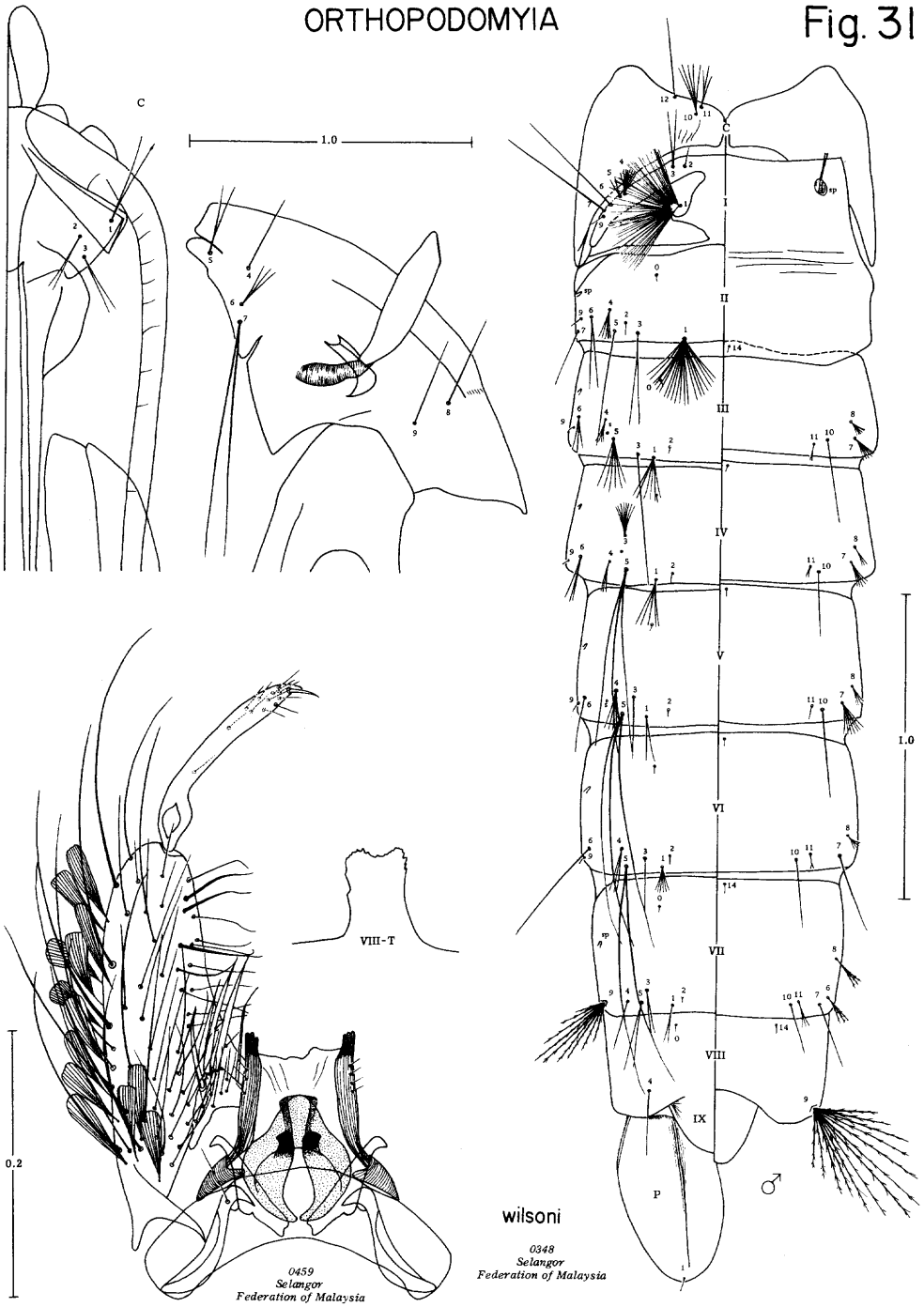
ORTHOPODOMYIA

Fig. 30



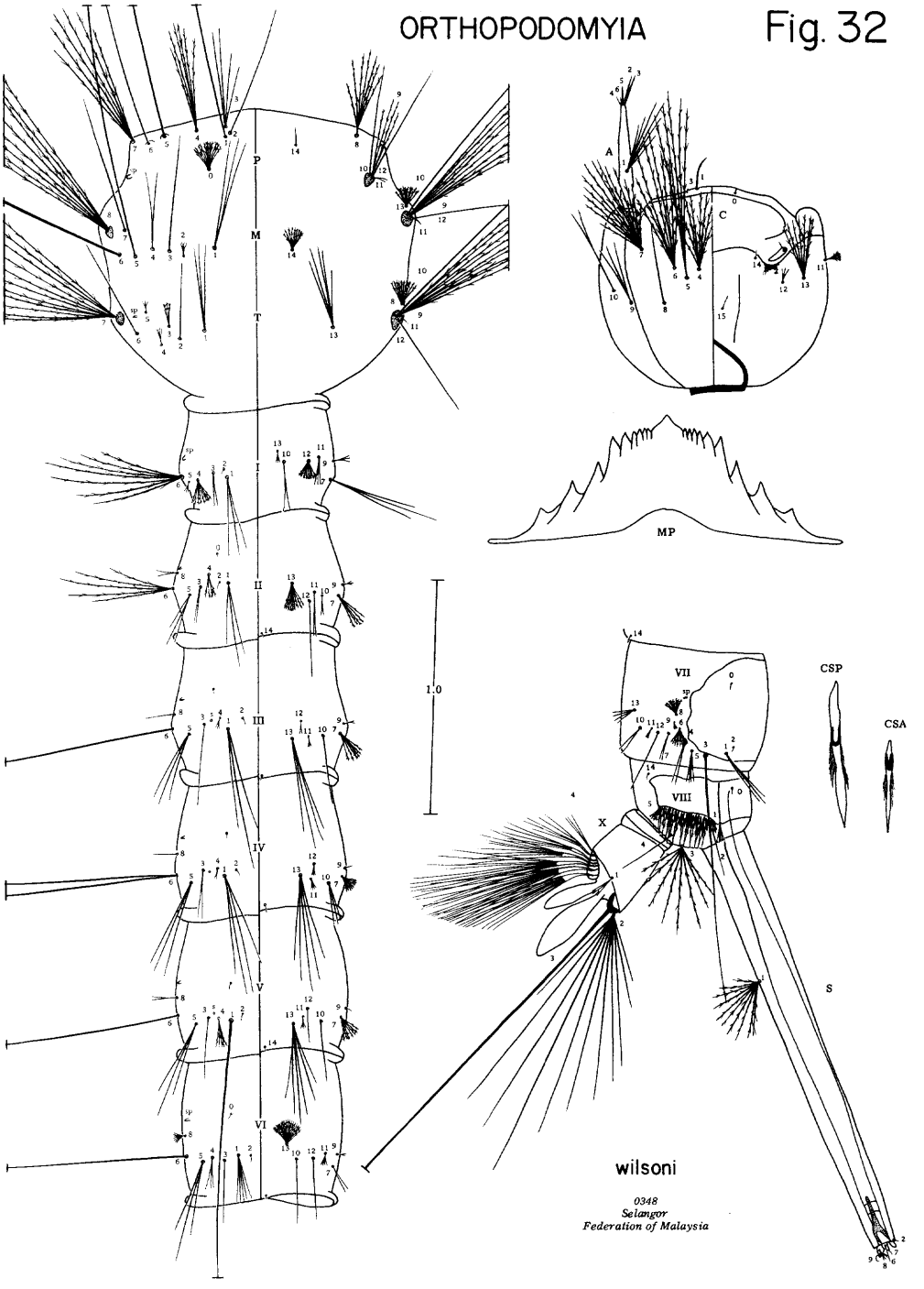
ORTHOPODOMYIA

Fig. 31



ORTHOPODOMYIA

Fig. 32

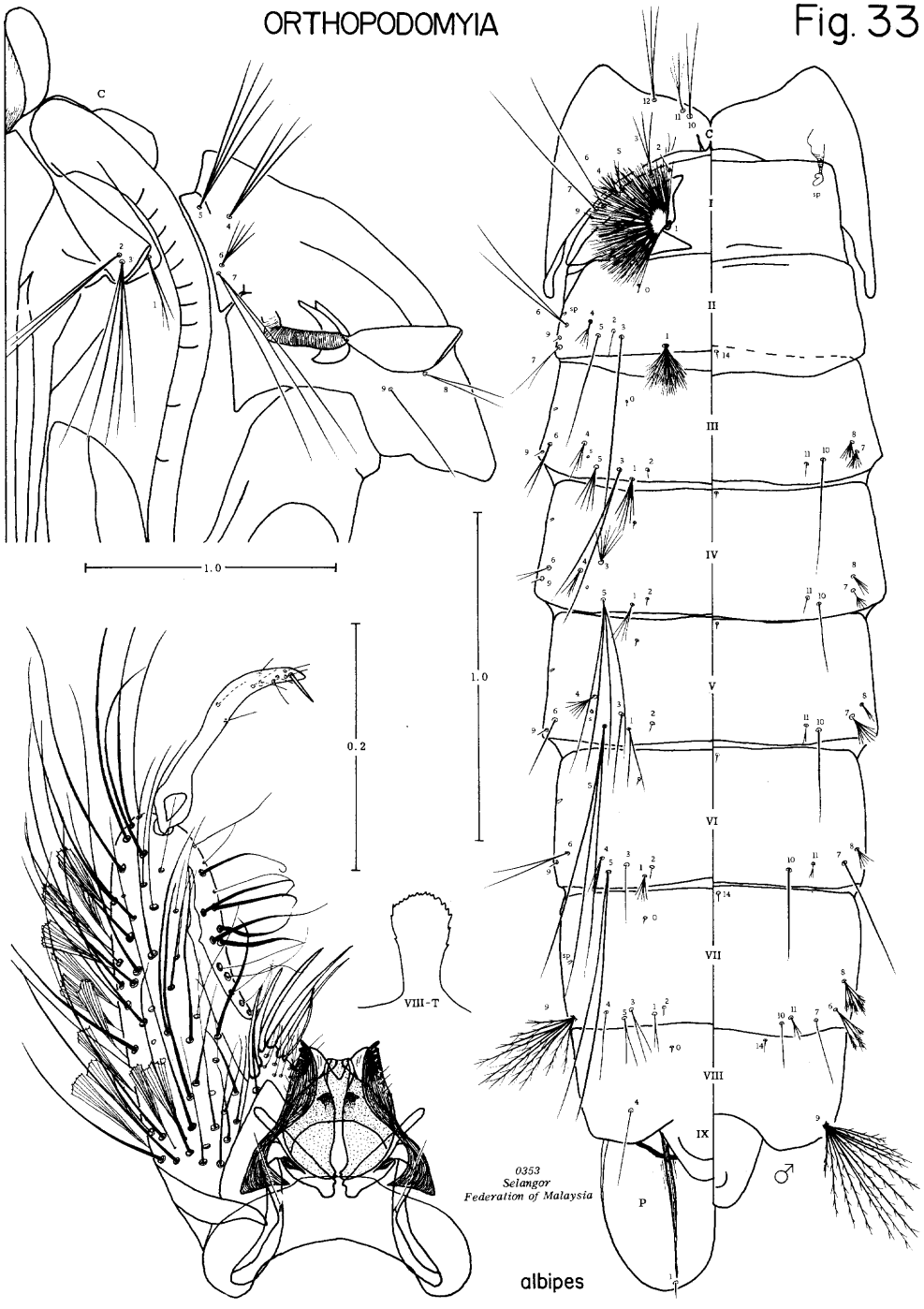


wilsoni

0348
Selangor
Federation of Malaysia

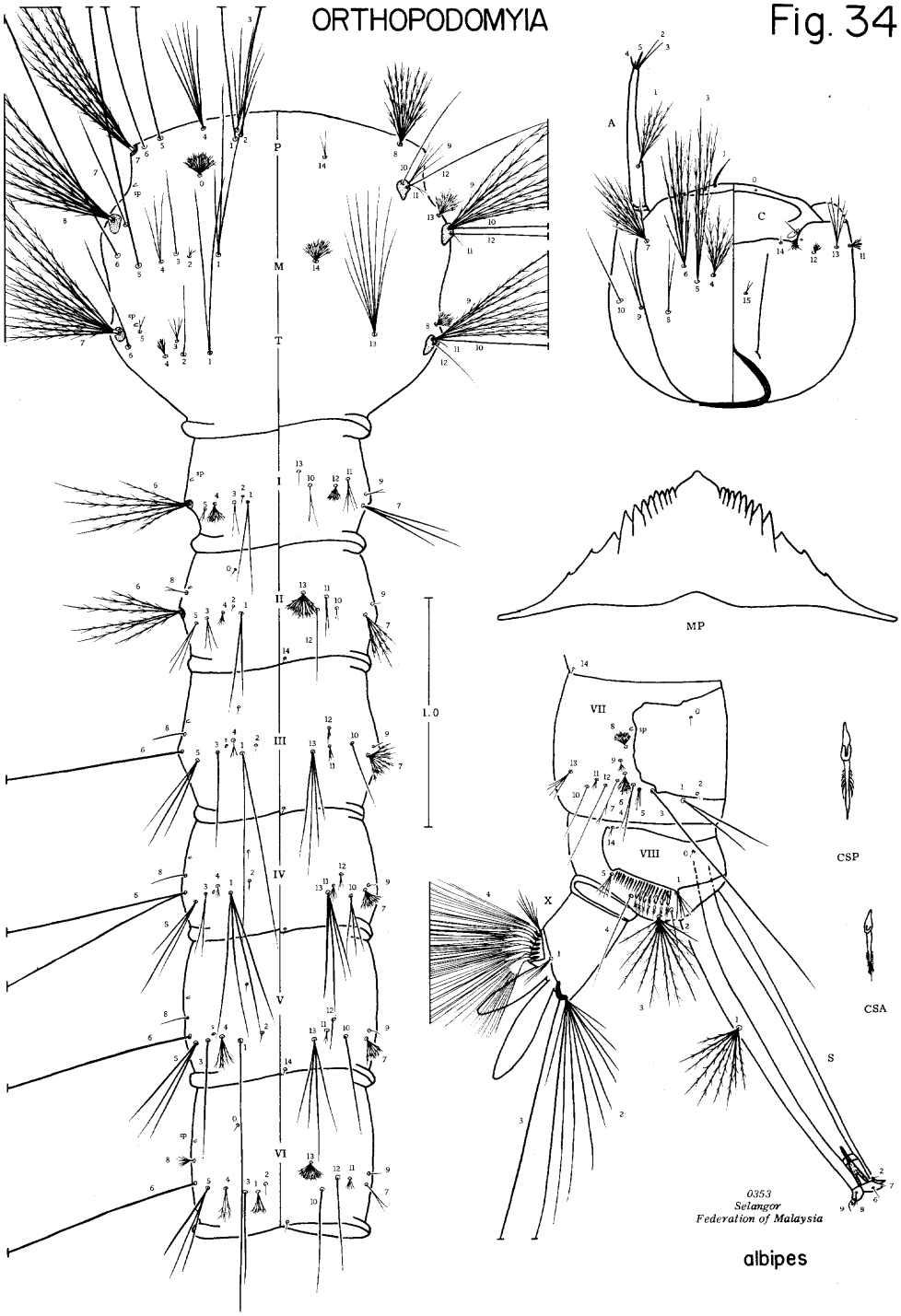
ORTHOPODOMYIA

Fig. 33



ORTHOPODOMYIA

Fig. 34



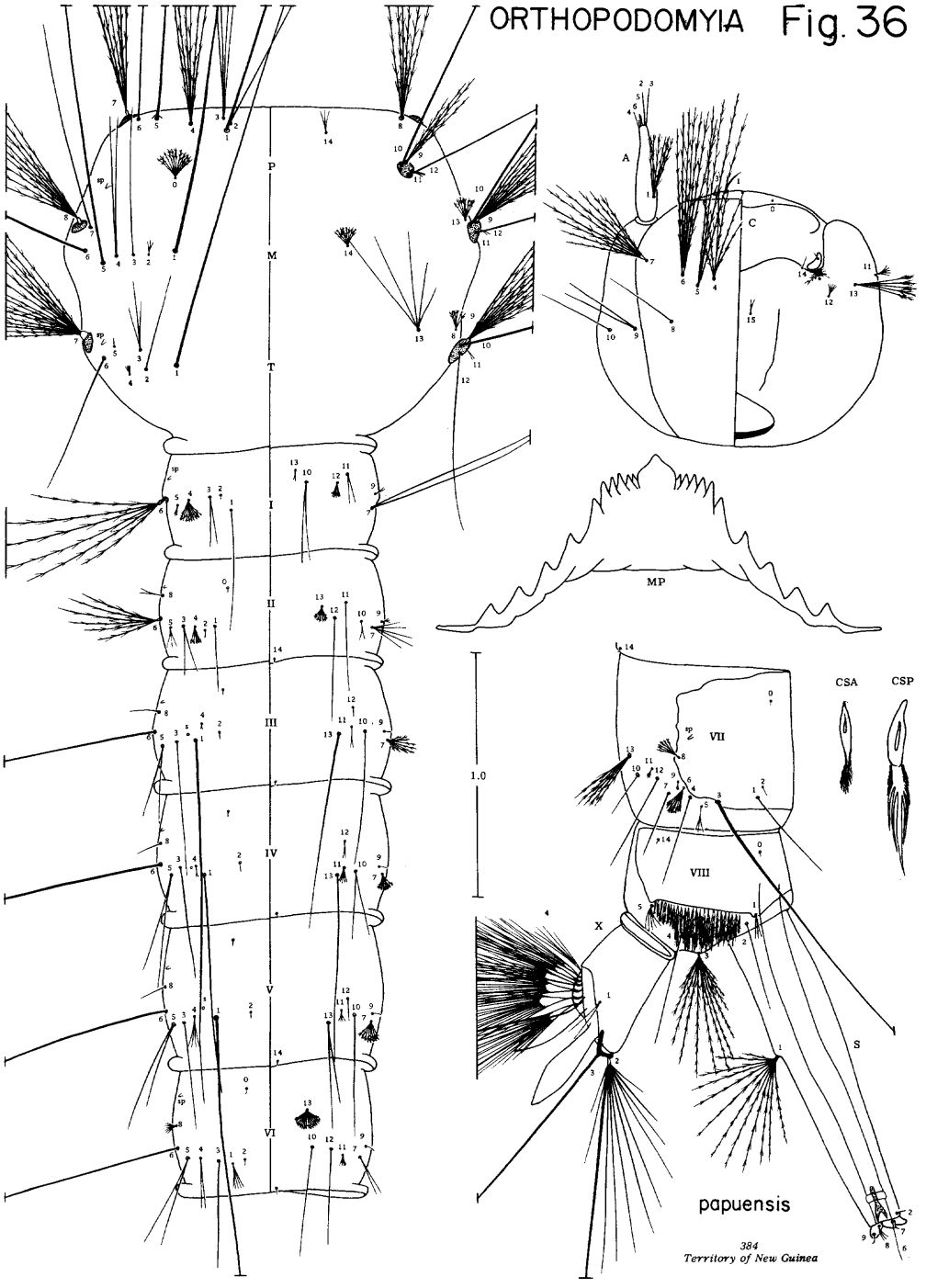
albipes

ORTHOPODOMYIA

Fig. 35

papuensis

384
Territory of New Guinea


ORTHOPODOMYIA Fig. 36
P
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I
II
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IV
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VI
A
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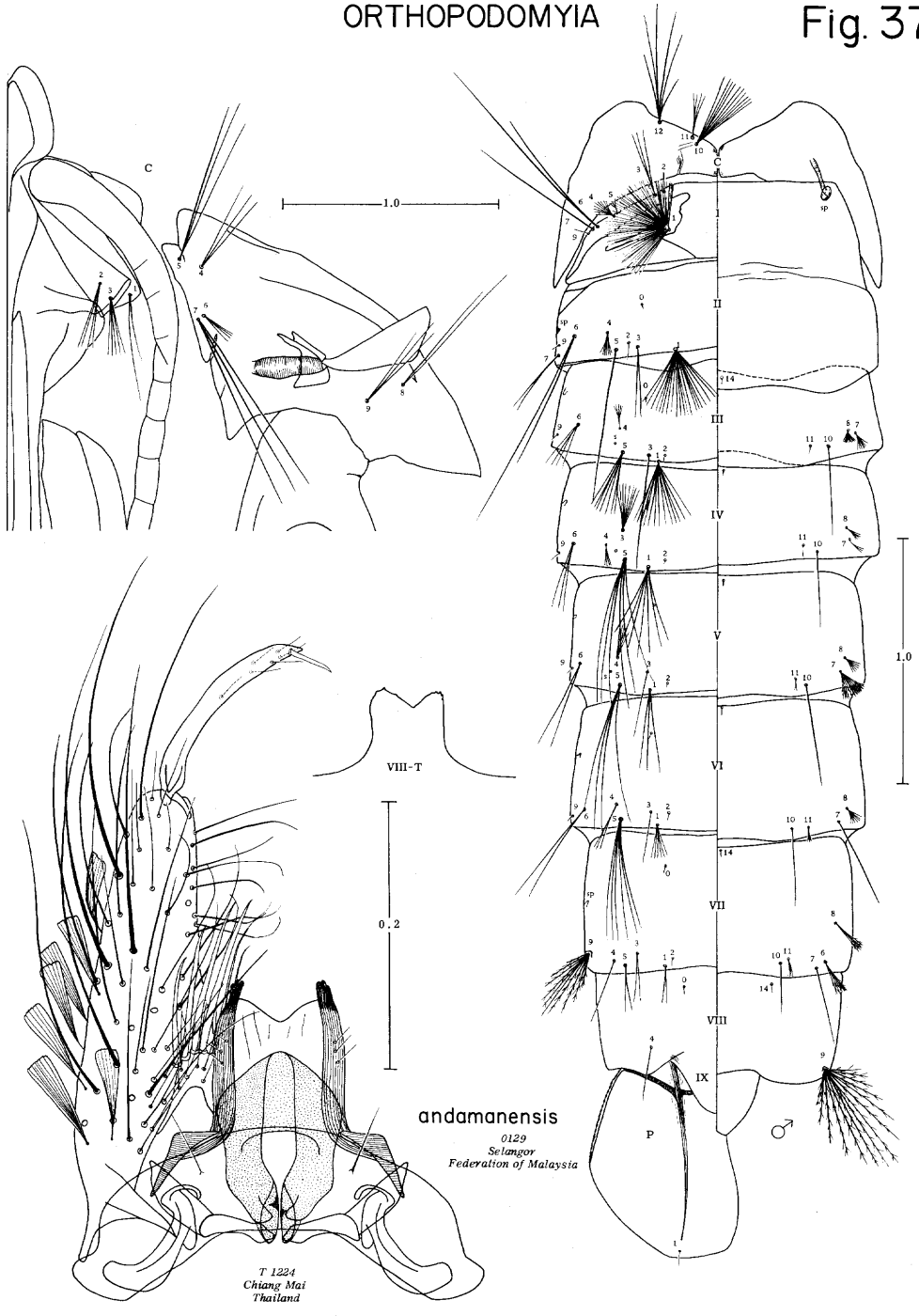
MP
1.0
CSA
CSP
VII
VIII
X
S
papuensis
384
Territory of New Guinea

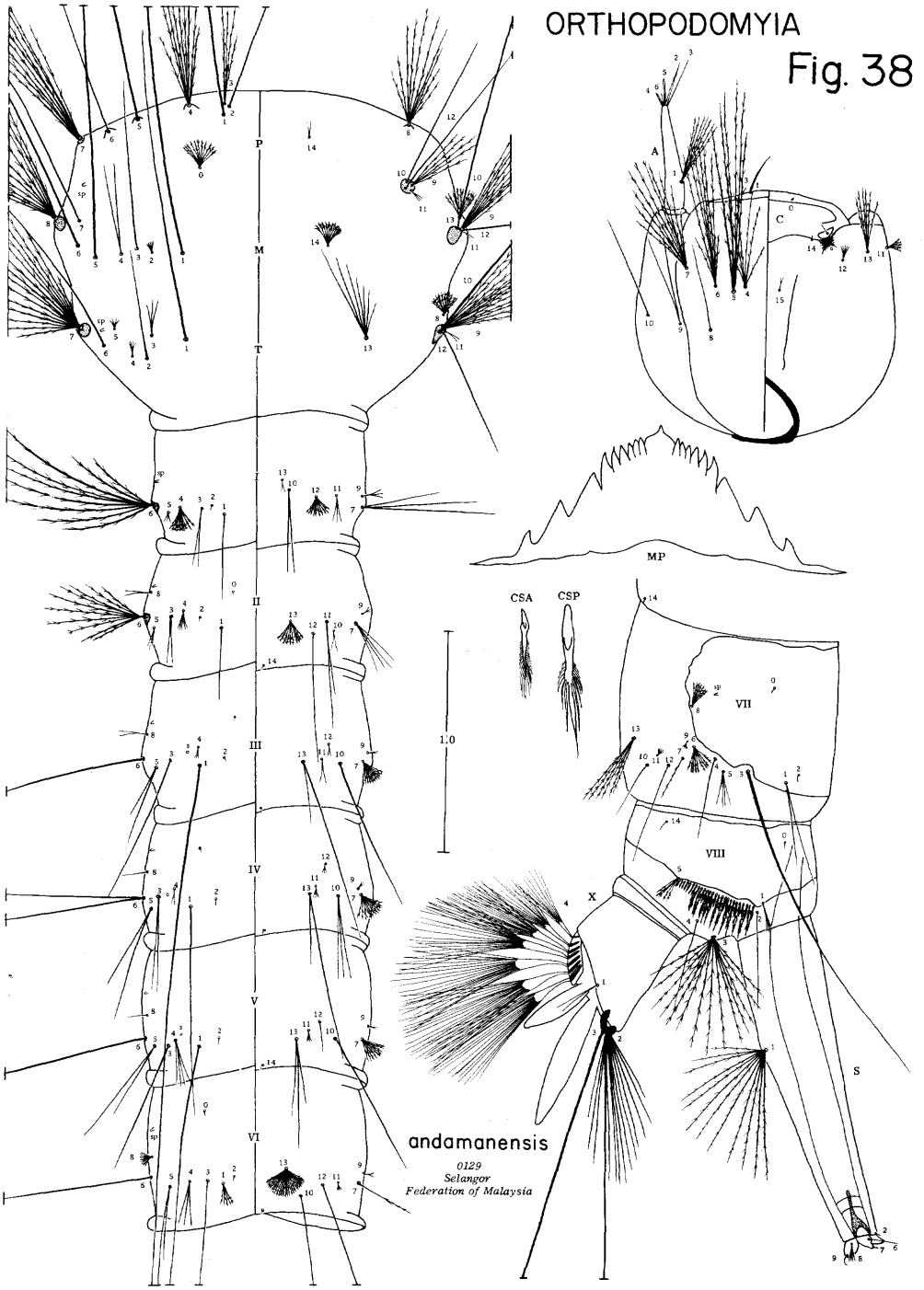
ORTHOPODOMYIA

Fig. 37



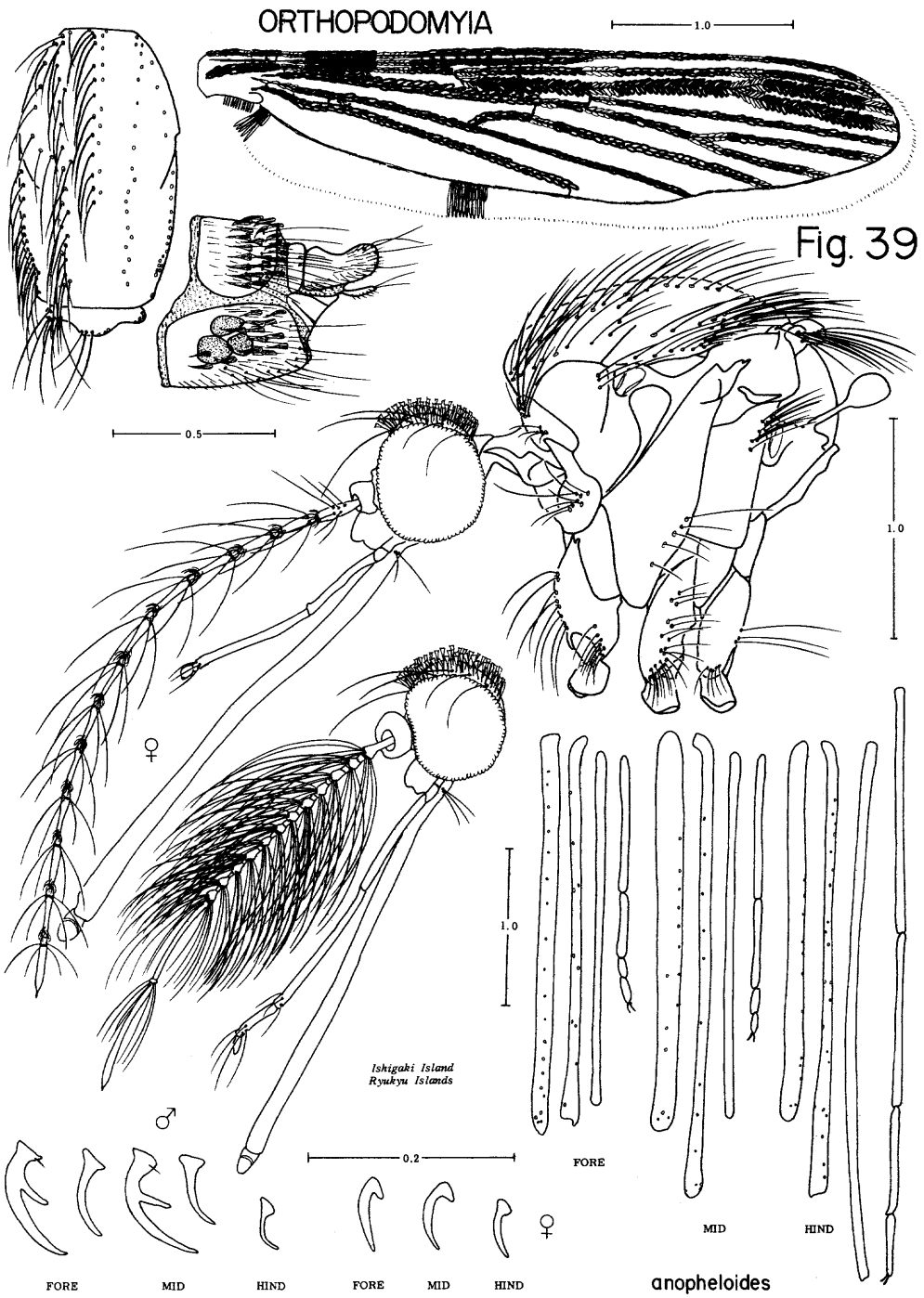
ORTHOPODOMYIA

Fig. 38



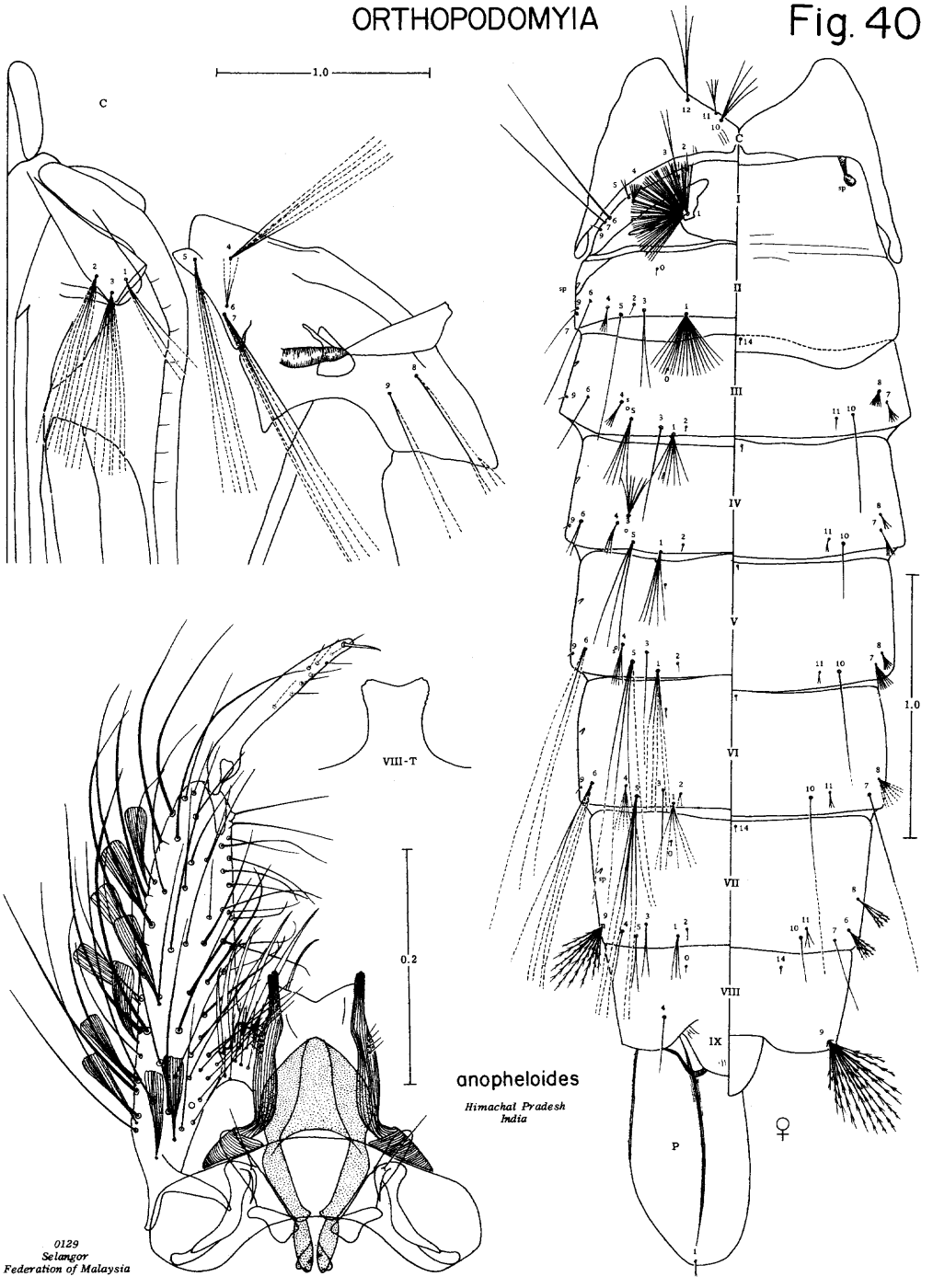
andamanensis

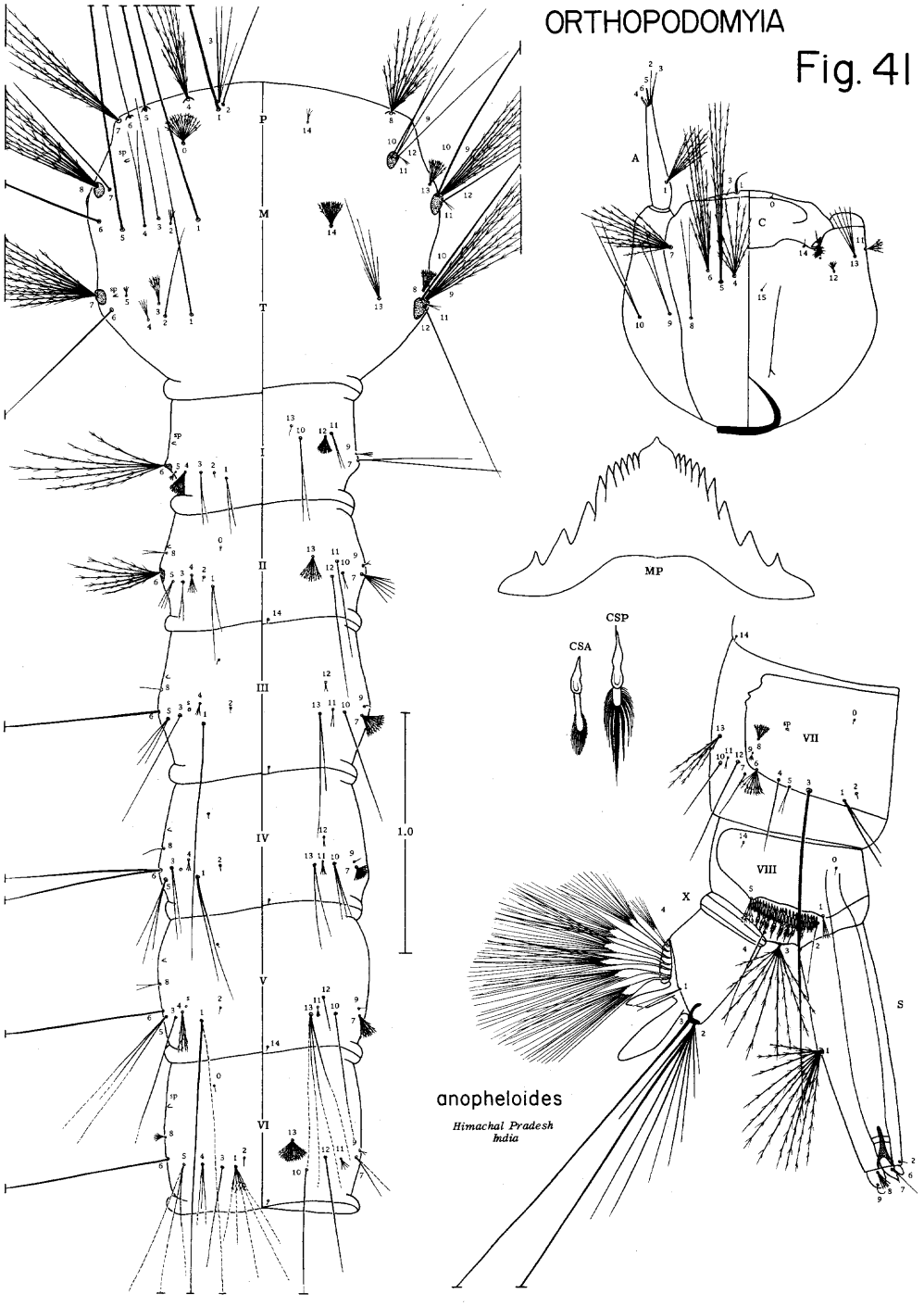
0129
Selangor
Federation of Malaysia


ORTHOPODOMYIA
1.0
Fig. 39
0.5
1.0
♀
1.0
Ishigaki Island
Ryukyu Islands
♂
0.2
FORE
MID
HIND
♀
FORE
MID
HIND
FORE
MID
HIND
anopheloides

ORTHOPODOMYIA

Fig. 40




ORTHOPODOMYIA
Fig. 41
P
M
T
I
II
III
IV
V
VI
1.0
A
C
MP
CSP
CSA
VII
VIII
X
S
anopheloides
Himachal Pradesh
India

INDEX TO SCIENTIFIC NAMES