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CONTRIBUTION TO A GENERIC REVISION
OF THE NEOTROPICAL MILESINAE (DIPTERA: SYRPHIDAE)

A Dissertation Presented

By

F. Christian Thompson

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CONTRIBUTION TO A GENERIC REVISION
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INTRODUCTION

The family Syrphidae, commonly called "Flower or Hover flies," is a large group (over 5000) species of rather conspicuous flies. Their size ranges from 4 mm. to 25 mm. and their color from bright yellows and oranges to dull drab blacks and grays. Most syrphid adults are Batesian mimics of stinging Hymenoptera and are highly beneficial as pollinators. The economic importance of the larvae extends from the highly beneficial aphidophagous type of the subfamily Syrphinae to a few injurious pests of Narcissus bulbs (Eumerus spp. and Merodon equestris Linne). The vast majority are neither useful nor detrimental to man in the larva stage. Their medical importance is almost nil; a few cases of accidental intestinal myiasis have been caused by the drinking of putrid water containing the saprophytic larvae of Eristalis (see James, 1957, and Zumpt, 1965, for a general review).

Syrphid flies are world wide in distribution, with their greatest diversity of forms in the New World tropics. Despite this interesting diversity and the critical zoogeographic importance of the Neotropical area, the South American forms are probably the most neglected of all syrphids taxonomically. Most of the research on the

South American syrphids has been restricted to the simple description of new taxa with the majority of this having been done by Curran and Hull in the 1930's and 40's.

Very little has been done to organize and synthesize all such descriptive studies. In the last seventy years only two keys to the Neotropical genera of the Syrphidae have been published. Both of these were written by Shannon in the later 1920's and early 1930's and thus do not include the more recent works of Curran and Hull. Hull (1949) has published a revision of the world genera, but his keys are difficult to use and his descriptions are incomplete and misleading. Considering the outdated nature of Shannon's work and the inadequacy of Hull's, a synopsis of the South American genera of Syrphidae is needed. This thesis is intended as a contribution toward the filling of this void.

The approach I have used in this revision is three-fold. First, I will discuss and review the characters used for the groups of syrphid flies. Then from this base, the taxonomic interrelationships indicated by these characters will be discussed. Finally, the history of the syrphid distributions in South America will be deduced from an integration of syrphid phylogeny with the geological history of South America.

The methods of preparation and study of the specimens were the traditional ones: Flies were obtained and prepared for study by the standard techniques as described in various textbooks (Oldroyd, 1958; Ferris, 1928; and others); genitalic structures were prepared in the usual manner as discussed by Metcalf (1921), and were stored in microvials attached to the insect pin as described by Gurney et al (1964); drawings were made with the aid of an ocular grid and graph paper (see Oldroyd, 1958).

The scope of this revision is restricted to the tribes and genera of the subfamily Milesinae that are found in the Neotropical region. This region is here considered as all of South America and all of Middle America south of the isthmus of Tehuantepec. The isthmus of Tehuantepec is the traditional boundary used for the Neotropical region by the zoogeographers. However, for practical reasons, the two catalogues covering the Nearctic and Neotropical Diptera have used the boundary between Mexico and the United States for the division of their coverage. Thus to make this revision correspond to the catalogue coverage, I have included the genera found in Mexico north of the isthmus of Tehuantepec in my keys, but I have not described them.

Although this revision is restricted to the Neotropical region I have studied ^{all} available milesine taxa (about

80% of the genera) of the world for the purpose of improving my taxonomic perspective on the Neotropical fauna. For this reason I have included in my character tables and discussions all of the non-neotropical milesine genera that were available to me. With this information it was possible to work out preliminary schemes of generic phylogeny within various milesine tribes and, to a lesser extent, of tribal phylogeny of the Milesinae. It should be clearly realized that these phylogeny representations are only tentative being based in many places on incomplete information about some of the non-neotropical taxa.

With over 3000 species and some 150 genera of known milesine syrphids in the world, of which over 500 species and about 50 genera and undoubtedly many more unknown forms are Neotropical, it is obviously not possible to study all the taxa, all the stages and all structures in one lifetime. Thus a sampling-type of approach to each genus must usually be used. A knowledge of the nature of the sample used for the basis of the study is necessary for the reader's proper evaluation of my conclusions. The sample has been limited, of course, to the Milesinae and to the Neotropical region, as indicated by the title.

The nature of the taxonomic sample¹ is precisely indicated for each genus in a list of the species studied along with the approximate numbers of known world and Neotropical species. Being confined to external structures of the adult I may have missed some sources of possible characters of phylogenetic importance in the syrphids, such as immature stages and internal anatomy. However, it is not possible to investigate these other sources at present because too little material suitable for study is available. In the immature stages, less than 10% of the Neotropical genera and less than 1% of Neotropical species have been described in the literature. Thus it has not been possible to include any meaningful data on the immature stages in this revision. Likewise, for the internal anatomy of these flies, there has been neither properly prepared material available for study nor any information available in the literature. Museum material has been available for the study of the male genitalia which I have used in this revision to help decipher the phylogeny of the milesine

¹The format for these sample statements is as follows: Material examined: number of world species (number of Neotropical species); list of species examined. The asterisk indicates a Neotropical species and the (HT) or (PT) indicates that either the holotype or paratypes were examined.

taxa and to assess the value of the external characters I have used. That is, I have checked to see that the male genitalia are consistent with interpretations based on external characters. I have figured the male genitalia of the type-species where possible and "typical" examples otherwise. The study of the full range of genitalic variation is beyond the scope of this revision as presently defined since it would involve many non-neotropical genera and species. Thus it is not possible now to indicate what characters of the male genitalia are of tribal, generic, etc. importance.

The reasons given above for restricting myself to external adult characters are really only symptoms of a taxonomically confusing situation. The basic reason why immature stages have not been described, why internal anatomy has not been studied^d and why the range of variation in male genitalia has¹ not been evaluated is that at the present time it is almost impossible to identify even the adults of the Neotropical species of syrphids. The first step toward the solution of the Neotropical species problem was made by Fluke whose catalogue (1956-57, being revised by Sedman, in litt.) provides an index to all the literature on the known Neotropical species and genera. This present revision provides the second step: a preliminary framework in which to place all the presently

described species (and hopefully, new ones too!). In short, it is hoped that this contribution will provide a useful higher classification of the Neotropical milesines which will aid the study of the Neotropical fauna and the search for the answers to many of the unsolved questions it has revealed. Prerequisite to establishing such a framework is a concise working definition of a genus.

The definition of a genus generally accepted by taxonomists is: "a taxonomic category containing a single species or a monophyletic group of species, which is separated from other genera by a decided gap" (Mayr, 1969:92). Much generic synonymy is due to the fact that taxonomists do not always agree on the same interpretation of the words, "decided gap." Although Mayr has qualified the interpretation of "decided gap" by recommending "for practical reasons that the size of the gap be in inverse ratio to the size of the taxon," there still can be much latitude in interpretations as to what is a sufficient gap for the separation of two genera. Because of the latitude of opinions on the proper extent of the gap, the working standard used for genera in this revision is defined here. For practical purposes a genus is here defined as a group of similar species in which: 1) a group of species is distinctly separable from all other related groups in all

life stages, if known; and 2) all and only the species descendent from a unique common ancestor are included in a genus, so that all member species will be more closely related to one another than to species outside the genus concerned. The first qualification discourages the construction of genera on the basis of characters found only in one sex and encourages generic revision when the immature stages become known. Also by requiring genera to be distinctive in all stages, the genus will correspond more precisely with the ecological niches involved. The second qualification eliminates the use of paraphyletic groups (Hennig, 1965 and 1966).

The operational definition places the emphasis on finding similarities, not differences between taxa. When the emphasis is placed on differences, the usual attitude of taxonomists, the tendency is to split groups, not to combine them. The result is a trend towards a hodge podge of smaller, and more numerous taxa with less and less distinctness. In some cases however, monotypic taxa are necessary since, for lack of sufficient evidence of similarities, certain species can not be placed in genera with other species.

TAXONOMY OF NEOTROPICAL GENERA OF THE MILESINAE

TAXONOMIC CHARACTERS OF GENERIC IMPORTANCE IN THE MILESINAE

Most of the characters used in this study are the well-known traditional ones (see Williston 1886: 272-278; Lundbeck 1916: 18-28; Shannon 1922: 117-120; Curran 1924: 14-16; Shannon 1926: 6-7; and Hull 1949: 259-268). However, a few new characters and new interpretations of old characters have been used in this revision and an explanation of these with discussion of their distribution among the milesine syrphids has been included.

Facial Shape

Although the shape of the face is one of the traditional group characters in the syrphids, it is only recently (Hull 1945 and 1949) that the phylogenetic development of the various types of faces has been studied. In the conclusion of Hull's revision of fossil syrphids (1945) he discusses and diagrams the probable evolution of the facial region. He hypothesized that all the types of faces evolved from a straight type and diverged from this in four different lines--concave epistomal thrust type; convex type; tubercle type; and frontal thrust type

(Hull 1945: Fig. 2). Later, Hull (1949) reversed himself on the starting point of the character phylogeny and stated that the convex type of face was the most primitive. This seems reasonable since the convex face is the type found in the primitive related Microdontidae (and also in the related primitive Pipunculidae). One correction should be made of Hull's arrangement of facial types. My studies indicate that the tuberculate face is not a "dead-end" development but leads from the simple type of face to all the other facial types (Fig. 1).

In the Pipizini, the most primitive tribe of the Milesinae, on the basis of wing venation, pilosity, etc., one can see the transition from the simple type of face to the tuberculate type. The pipizines have a simple face except for some species of Trichopsomyia which show traces of the development of a tubercle. Trichopsomyia is the most highly specialized member of the Pipizini (see text discussion, p. 43). In all the groups with frontal thrust types of faces there are still traces of the tubercle. The same is true of those groups with a downward thrust type of face and most of those groups with an epistomal thrust type. The concave type of face is a direct development from the tuberculate type. If the tubercle were removed from a face, the result would

be a slightly concaved face. Some of the genera of the Chrysogasterini and Milesini, where the males have tuberculate faces, do in fact have the non-tuberculate female with a slightly concave face.

Metasternal Development

The extent of sclerotization and shape of the metasterna varies within the Syrphidae. The different forms of the metasterna have been arranged into a linear morphocline (Fig. 2). At one extreme of the cline the metasternal sclerites are just a thin sclerotic band stretching from one coxal articulation to the other; at the other end of the cline the metasternal sclerites are strongly produced ventrally and their medial areas are sclerotized. I have designated the former as undeveloped, the other extreme as well developed. The pipizines display the typical undeveloped metasterna, whereas Milesia shows a good example of the well developed condition. The undeveloped condition of the metasterna is found in pipunculids and microdontids and is therefore considered primitive.

First Abdominal Spiracle

The first abdominal spiracle is usually embedded in the metathoracic epimeron (Fig. 3). However, in two groups, Pipizine and Eumerini, the spiracle lies free of the epimeral plate in the membrane between the abdominal tergites and sternites (Fig. 4, 5).

In the pipizines the "free" spiracle is probably a primitive condition since: 1) this is the condition of the spiracle in related primitive families (Microdontidae and Pipunculidae), and 2) many other characters show the pipizines to be primitive. This condition in the eumerines is probably a secondary specialization because 1) all the intermediate ancestral groups between the pipizines and the eumerines have the spiracle embedded in the epimeron; and 2) the first abdominal sternite has been reduced and modified to fit around the spiracle in eumerines whereas the pipizines have a normal first sternite as in other groups of the Milesinae.

Thoracic Pile Patterns

The use for taxonomy of arrangement of pile on the thorax is a rather new development in syrphids and has

not yet gained wide acceptance. Shannon was perhaps the first to recognize the great importance of pile patterns for generic characters. In a series of generic revisions (1921, 1922, 1926 and 1927) Shannon pointed out where the presence or absence of pile on particular parts of the thorax could be used to separate some groups. Although Shannon's work was accepted by most other syrphid workers, no other investigations for new thoracic pile characters were conducted until recently. Only Collins (1952a, b), Vockeroth (1969 and in litt.) and Thompson (1969) have extended this work. These men have found pleural thoracic pile patterns of great value for working out difficult groups like the Microdontidae (Thompson), the Pipizini (Collins) and the Syrphini (Vockeroth). Perhaps the use thoracic pile patterns in combination with the more traditional characters will help to remove the enigma long associated with the syrphids which was characterized by Williston's famous quote, "While, as a general rule, the Syrphidae present excellent specific characters, there is a remarkable dearth of generic or group characters." (1886: xiii).

The following discussion of thoracic pile patterns is restricted to the subfamily Milesinae. Vockeroth (1964 and 1969) has studied the pile patterns of the Syrphini and other syrphine groups.

Four conditions relating to hairs are usually recognized in the study of syrphids: 1) Bare--without pile but sometimes with either pubescence or pollinosity; 2) Pollinosity--opaque material which looks like fine powder or dust; 3) Pubescence--very short fine hairs, closely set together, much like velvet; 4) Pilosity--long scattered hairs, in some genera broadly flattened into scales (i.e., Lepidomyia, etc.), in other genera (i.e., Meromacrus, etc.) very thick and opaque and called tomentum; frequently in those genera and species which are wasp-mimics there is a tendency for the thoracic pile to be composed of relatively small and appressed hairs. In the species of Ceroides, Spheginobaccha, Neplas, and other wasp mimics the normally long hairs of those sclerites which are pilose are very short and appressed to the exoskeleton.

Of the three types of modified hairs, the pilose condition is now considered to be primitive (Collin, 1952a; Chilcott, 1961:19). Hull (1949) wrongly considered the pilose condition to be derivative. He stated that there is a tendency toward the acquisition of pile on the metasterna, eyes and face. However, it is logical to assume that primitive syrphids also displayed the pilose condition since the pilose state is the usual condition found in Brachycerous and lower Cyclorhaphous groups of Diptera (also in some higher Cyclorhaphous groups).

Prothoracic Pile Patterns:

Pronotum, anepisternum, katespisternum, anepimeron and basisternum are the only distinct sclerotic areas of the prothorax, due to its reduction in size in the Diptera.

Pronotum or humerus: Shannon (1921-22) noted that the presence or absence of pile on the humerus could be used to distinguish most of the aphidophagous forms from other syrphids. This character correlates with the reduction of the pregenital segments in the males. All syrphids with five pregenital segments have the humerus bare and those with four pregenital segments have it pilose. Either one of these two characters will separate the subfamilies of Syrphidae. The subfamily placement of the Pipizini is somewhat in doubt. Even though they have a pilose humerus and four pregenital segments in the male, like the milesine flies, they are aphidophagous like the syrphines. Hopefully a study of the larvae will eventually elucidate their relationships. In Alipumilio the humeral hairs are greatly reduced in size and number, perhaps due to chafing against the close fitting head, but close examination will reveal a few hairs always to be present.

The anepisternum is usually strongly pilose.

Ceriogaster, all the Pipizini except Pipiza, and some species of Cerioides have the anepisternum bare. In

Spheginobaccha the anepisternum is enlarged and swollen and has a vertical row of long stiff hairs in contrast to the normal short soft scattered hairs.

The katepisternum is always bare on the posterior portion and frequently is completely bare. Most eristaline genera, and some species of the genera Cheilosia and Copestylum have the anterior portion (usually not visible with the head attached) pilose.

The anepimeron has the pilosity ranging from completely absent through short and scattered to densely pilose. The majority of the Milesinae have the anepimera strongly pilose. A few short and scattered hairs can be found on this sclerite in Valdivia, Chamaesphegina, Portevinia, Lepidomyia, Cerogaster, Neplas and some species of Crepidomyia. It is bare in Hammerschmidtia, Neoascia, Spheginobaccha and Alipumilio. The whole spectrum of pilosity can be found in the genera Cerioides and Brachyopa.

The basisternum is usually pilose but the pile is generally represented by only a few hairs. In a few species the basisternum is bare but there appears to be no generic significance to this loss of pile. The pilosity of this sclerite is either present or absent in each of the following genera: Graptomyia, Trichopsomyia, Neocnemodon, Sphegina and Hemixylota. In Neoascia it is always bare.

Mesothoracic Pile Patterns:

Of the three principal areas of the mesothorax, only the pleuron was found to display pile patterns of generic importance. The notum, except for the ventral portion of the scutellum, is always pilose and the sternal areas have been completely obliterated by the extension of the pleuron in Diptera. The sclerites of the pleuron that were examined for pile characters are: anepisternum; katepisternum; anepimeron; and meropleuron.

The anepisternum, frequently referred to as the mesopleuron, should, for the convenience of studying the pile, be considered as composed of two separate areas, a flat anterior portion and a convex raised posterior portion. Only in Alipumilio and Nausigaster is this distinction between the two portions lost and in these genera one finds a uniformly raised pilose anepisternum. The condition of the pile on the anterior part being variable amongst species, is of value for generic taxonomy. The posterior portion of the anepisternum is always pilose. The presence of some long hairs on the anterior anepisternal area was used by Collins (1952b) to separate his Parapenium from all other British Pipizini. Collins (1952a) also noted this character for a number of species in the genus Syrphus. His work appears to have been the first recognition of the

importance of the pile of this particular sclerite. Very few of the milesine syrphids have the anterior anepisternum pilose and those that do are mainly limited to two principle taxa, Eumerini and Volucellina. These have the anterior anepisterna strongly pilose. Spilomyia, Odyneromyia and a few species of Temnostoma also have the anterior part of the sclerite pilose. Cerioides has the upper half of the anterior anepisternum pilose. There are also traces of anterior anepisternal pile in a few other groups. In Lepidomyia, Orthonevra and some species of Myolepta there are a few hairs on the upper posterior corner of the anterior anepisternal area and Valdivia has a patch of a few hairs in the middle of the posterior edge of this area.

Katepisterum: Malloch (in Shannon 1922) pointed out that Sphegina could be separated from Neoascia by its completely bare sternopleuron (katepisternum). Except for this particular case, the presence or absence of katepisternal pile was found of little generic taxonomical use in the Milesinae. In the majority of the species examined there were two patches of pile on the katepisternum: a dorsal patch on the upper portion of the sclerite and a ventral patch between the pro- and mesocoxae, usually separated by a broad bare area. In a few scattered species one or the other of these patches was absent and in some

other species these patches were broadly connected.

Although the katepisternal pile patches appear to have no value as generic characters, they may be useful as species or species group characters. It should be noted that, whereas in the milesines no generic value for the pilosity of the katepisternum is apparent, Vockeroth (1969) has found the character very helpful with syrphine genera.

The anepimeron, frequently referred to as the pteropleuron, should, for convenience of studying the pile, be divided by an imaginary line from the large cleft on its dorsal edge to the ventral edge into an anterior and posterior portion. The anterior portion is always pilose. The posterior portion is commonly bare but in a few groups this part of the anepimeron is pilose. In Spilomyia, Korinchia, Ornidia, Pseudovolucella, Pyritis, Arctophila and many eristaline genera there is some pile on the posterior portion.

The meropleuron is always bare except for two restricted areas along the barrette and in front of the metathoracic spiracle.

The barrette, the upper edge (usually convex) of the meropleuron, is bare in most milesine syrphids. It is pilose in all Pipizini except Pipizia. Chromocheilosia bicolor and Myolepta luteola are the only chrysogasterines I have seen with pilose barrettes. In the volucellines

all species of Volucella and Ornidia and a large group of Copestylum have the barrette pilose. In the milesines only Merapioidus, Deineches, and some species of Criorhina have the barrette pilose. Criorhina can be divided into two species groups based on the presence or absence of pile on the barrette (Vockeroth, in litt.). In the Eristalini, Mesembrius, Megaspis, Eristalodes, Eristalis, Palpada, Lycastriirhyncha, Simioides, and Dolichomerus have the barrette pilose.

The presence of a metathoracic spiracular pile patch, a patch of long hairs in front of the metathoracic spiracle, is a primitive trait found in only a few groups of syrphids. Among the non-syrphine groups I have found this character state in only the volucellines, some eristalines, Psilota, Notiocheilosia, Lepidomyia, most species of Myolepta, and some species of Rhingia. In Rhingia some species (nascia, campestris) have a distinct patch, others like harrisi have a few hairs only, and still others (rostrata) are completely bare in some individuals and have a few hairs in others. In the eristaline genera which have the spiracular pile patch, the patch is reduced to a narrow row of hairs. Only Megaspis, Simioides, Meromarcus, Eristalodes, Palpada, and Lycastriirhyncha among the eristaline genera have the spiracular hair patch.

The scutellar fringe frequently is present on the ventral apical portion of the scutellum. This fringe was first noted by Lundbeck (1916) and its condition was described by him for all the Danish syrphid genera. Shannon (1922) discussed this character in relationship to the various cheilosine groups. He noted: 1) that all the Cheilosini had an "abundant fringe"; 2) Chrysogaster and Apicomylia (Cynorrhinella) had a fringe reduced to a single row of hairs; and 3) all the rest of the groups of Cheilosinae lacked the fringe altogether. Goffe (1952), in his reclassification of the syrphids, used this character to define his third key dichotomy. I have noted a distinct subscutellar fringe in the following tribes and genera: Pipizini; Cheilosini; most Milesini except Spilomyia, Chrysosomidia, Merapioidus, and some species of Criorhina, and Temnostoma; Notiocheilosia; Chromocheilosia; Psilota; Azpeytia; and some Copestylum.

Metathoracic Pile Patterns:

Like the prothorax, the metathorax in Diptera is greatly reduced and only three distinct areas are identifiable on the metathorax: episternum, epimeron and basisternum. The episternum is pilose only in Spilomyia, Syritta, Senogaster, and Mesembrius. The epimeron is bare

in all groups of milesine syrphids except Nausigaster. In Nausigaster this small sclerite is sparsely punctate and pilose.

The pair of sclerites between the meso- and metacoxae have been called by various terms such as, antecoxal piece, metasternum, and basisternum. Shannon in 1921-22 first used the presence or absence of pile on the antecoxal piece as a taxonomic character to separate some of the genera of his subfamily Xylotinae. Later Shannon (1922) discussed the value and distribution of the various states of this character in the Cheilosinae. He made the un- defended statement that the character is only of "specific importance" in the Cheilosinae as is the case in the Xylotinae. Then in his revision of the xylotine flies (1926) he uses the character for the main division of his key and also describes two new genera based on metasternal pile. In his two keys to the South American genera (1927 and 1933) he continues to follow his 1926 use of the character in the xylotine groups. Hull (1949) in his revision of the world genera also places strong emphasis on metasternal pile, describing it for all the genera.

I have found the metasterna bare in the following taxa: Pipizini, Cheilosini (Pelecocerina), all Chyrsogasterini except some species of Myolepta, Cerioidini, and some

Milesini (Xylota group except Xylotomina and Chalcosyrphus, Blera group). The following taxa have the metasterna pilose: Cheilosini (Cheilosina), Eristalini, all Eumerini except Nausigaster, and some Milesini (Milesia group except Korinchia and Hemixylota, Tropidia group and Criorhina group). The metasternal pile character is intragenerically variable in only two genera, Myolepta and Temnostoma. However, it should be noted that this may be only an artifact of the present classification, and thus a more thorough investigation of these two genera from a world-wide basis might show the state of the character to be constant in each genus.

CLASSIFICATION OF NEOTROPICAL GENERA OF THE MILESINAE

Characterization of the family Syrphidae

The syrphids can be easily separated from most dipterous groups by the following wing venational characters: 1) presence of long basal and anal cells; 2) apical and discal cells present and closed; 3) presence of a spurious vein between the radial and medial veins; and 4) radial sector only two-branched. The only family with which the Syrphidae may be confused is the Microdontidae, which was until recently included in the Syrphidae (Thompson, in press). However, the following key will separate the two families and summarize the main differences.

1. Hind femora, and usually tibiae, with pronounced scars or cicatricies; postmetacoxal bridge always complete; face always convex in profile, uniformly pilose, with oral margin not notched; antennae usually long, longer than face, with first segment usually much longer than broad. Male genitalia with: ejaculatory duct strongly sclerotized on posterior part, with a swollen and spherical portion partially enclosed by base of aedeagus, with apical portion elongate and completely

ensheathed by aedeagus; aedeagus elongate, swollen basally, unsegmented, tubular, never with lateral or dorsal processes although frequently divided apically into two parallel tubes; aedeagal apodeme double or absent; posterior dorsal surface of ninth sternite infolded..... Microdontidae

Hind femora and tibiae never with scars or cicatrices; postmetacoxal bridge usually incomplete and if complete, then face is either distinctly concave or tuberculate; face usually either straight, concave, or tuberculate, rarely convex, either pilose or bare, almost always with a distinct notch in the oral margin; antennae usually short, shorter than face, with first segment rarely longer than broad. Male genitalia radically different from the Microdontidae: ejaculatory duct membranous, never swollen or spherical, always a simple unmodified duct; aedeagus rarely elongate, frequently two-segmented, usually with lateral or dorsal processes; aedeagal apodeme always present and single; posterior dorsal surface of ninth sternite not infolded..... Syrphidae

The subfamilies of the family Syrphidae can be separated by the following key:

1. Pronotum bare..... Syrphinae
 Pronotum pilose..... Milesinae

Characterization of the subfamily Milesinae

Unlike the Syrphinae, the subfamily Milesinae is a very diverse group in both adult and larval forms, and at present is easily defined by two characters: 1) pronotum pilose; and 2) male with only four pregenital segments. The possession of only four pregenital segments in the males is the result of many complex peculiarities including such things as: reduction of fifth tergite and sternite, asymmetric modification of the fifth sternite, and 90° rotation of the sixth segment. This character complex is a derived condition found only in one other group of the Aschiza in the family Microdontidae. All other related families have five pregenital segments in the male (Platypezidae, Phoridae, Ironomyidae, Pipunculidae, Conopidae, and many groups of the Schizophora).

A major unsolved problem with the present subfamily groupings is the placement of the tribe Pipizini. The pipizines have a pilose pronotum and four pregenital segments in the male, like the rest of the Milesinae, but their larvae are aphidophagous, which is unique among the

milesines. Various workers (such as Hartley, 1961, and Wirth et al, 1965) have used the carnivorous type of larvae as the evidence for placing pipizines in with all the rest of the aphidophagous syrphids in the subfamily Syrphinae, but as pointed out by Thompson (1969), this placement in the Syrphinae creates more problems than it solves. Also, it should be noted that our knowledge of the aphidophagous habits of the pipizines rests mainly on field work, and thus, until someone does a detailed morphological study of the mouthparts of the larva pipizines to show whether the carnivorous habit is convergent with the Syrphinae or not, the pipizines are best left in the Milesinae on the basis of adult structures. Another unsolved question which could affect the placement of the Pipizini is whether the aphidophagous types of larvae are derived from the supposed primitive saprophytic types or vice versa. The present evidence (Hartley, 1961 and 1963) is not conclusive for either option. Pending new evidence to the contrary, the Pipizini are placed in the Milesinae where most workers have placed them (Shannon, 1921-22; Curran, 1924; Sack, 1928-30, 1930; Shiraki, 1949 and 1968; Seguy, 1965; Hull, 1949; Coe, 1954; Fluke, 1957-58; and Thompson, 1969).

The history of the suprageneric classification of the family Syrphidae is in a large part also the history of

the classification of the Milesinae since the Syrphinae have remained the same since it was first recognized and almost all the major changes in the classification of the Syrphidae have occurred in what is here considered the Milesinae. Since Rondani (1856-1857) first divided the Syrphidae into supergeneric groups, there have been two separate trends in classifying the higher groups of the family. The earliest of these trends was to elevate gradually each distinctive group of genera to subfamily status. Starting with Rondani's five subfamilies, various workers have increased the number of subfamilies to a high of 21. Goffe (1952) has reviewed, except for Shiraki's work (1949 and 1968), the historical development of the increase in syrphid subfamilies. Goffe (1952) was first to reverse the trend of increasing the number of subfamilies and suggested the use of two main groups only. Since Goffe's two subfamilies represent the two major phylogenetic lineages in the family, it is unfortunate that his oversimplified system of dividing the subfamilies results in obviously polyphyletic supergeneric groups and does not represent syrphid phylogeny. Whereas Goffe reduced the number of subfamilies to two, he increased the number of supergeneric groups to a new high of 32. Wirth et al (1965) have slightly modified Goffe's two subfamily groups and

have greatly improved the arrangement within each subfamily by reducing and incorporating Hull's 1949 classification into Goffe's two main groups. I have also followed Goffe's usage of two subfamilies except for considering one of his subtribes, the Microdontina, as a separate and distinct family (Thompson, in press). My arrangement of tribes within the subfamily Milesinae (Sphixinae Goffe) is quite different from that of Goffe or Wirth.

In my revision 10 tribes are recognized in the Milesinae. Hull (1949) recognized 12 subfamilies and 25 tribes (Table I) among the group of flies equivalent to my usage of Milesinae. More recently Wirth et al (1965) have reduced the status of many of Hull's tribes and subfamilies to incorporate them into a two subfamily arrangement (Table II). My arrangement of tribes and genera in the subfamily Milesinae follows that of Wirth et al except for four major changes along with a number of minor changes in the placement of genera into the tribes. The first change, the placement of the Pipizini into the subfamily Milesinae, has been discussed above. The second change is in recognition of the fact that the Microdontini are not true syrphids but represent a separate family as outlined above under the family discussion. This will also be

Table I

The arrangement of suprageneric taxa used by Hull
(1949) for the World milesine Syrphids.

Subfamily Microdontinae	Subfamily Volucellinae
Tribe Ceratophyini	Tribe Graptomyzini
Microdontini	Volucellini
Subfamily Eumerinae	Subfamily Sericomyiinae
Subfamily Nausigasterinae	Subfamily Xylotinae
Subfamily Cheilosinae	Tribe Xylotini
Tribe Rhingini	Temnostomini
Pipizini	Milesinae
Chrysogasterini	Criorhinini
Sphegini	Pocotini
Myioleptini	Tropidini
Cheilosini	Subfamily Psarinae
Subfamily Calliceratinae	Subfamily Cerioidinae
Subfamily Pelecoceratinae	Subfamily Eristalinae
	Tribe Helophilini
	Eristalini

Table II

The arrangement of suprageneric taxa used by Wirth et al (1965) for the milesine syrphids found in America north of Mexico.

Subfamily Syrphinae

Tribe Pipizini

Subfamily Milesinae

Tribe Cheilosini

Myoleptini

Chrysogasterini

Callicerini

Pelecocerini

Nausigasterini

Eumerini

Microdontini

Volucellini

Sericomyini

Milesini

Ceriodini

Merodontini

Eristalini

covered in more detail in a separate paper. The third major change is the combination of three small aberrant tribes (two are monotypic) into one. I have "lumped" the Eumerini, Nausigasterini, Merodontini, along with Psilota and Alipumilio of Chrysogasterini into one tribe, Eumerini. The previous recognition of these tribes as separate taxa has been due to the fact that taxonomists have emphasized the unique characters of each taxa and did not look for similarities. For example, Wirth et al separated Merodon from the Eristalini to form a separate tribe because Merodon has a phytophagous larva whereas the rest of the eristalines have saprophytic larvae. It is surprising to me that they did not compare Merodon with the only other phytophagous milesine syrphid group, the eumerines. As a matter of fact, both Merodon and Eumerus have the same common English generic name, Narcissus Bulb Flies. The detailed reasons for combining these tribes and genera together has been discussed under the tribe Eumerini in the text.

Finally, I have reduced the Pelecoceratini to a sub-tribe in Cheilosini. The traditional reason for considering the pelecoceratines as a separate tribe or subfamily has been their unusual arista. However, I do not feel that the unusual arista alone is sufficient ground for

tribal recognition. Sedman (1955) has shown that the pelecoceratines have the typical and unique two-segmented aedeagus of the cheilosines. The nature of the aedeagus, along with the presence of non-dimorphic tuberculate faces and thoracic bristles, indicates that the pelecoceratines are nothing more than cheilosines with atypical aristae. Thus I have reduced the tribe to subtribal status.

Presently it is not possible to draw a detailed phylogenetic arrangement for the milesine tribes because too little is known about the primitive or derived nature of various character states. However, it is possible to present a general picture of the phylogenetic position of the tribes from the information provided by a few well-known morphoclines.

The best known morphocline among the syrphids is the change in the shape and position of the anterior crossvein relative to the discal cell. The anterior crossvein ranges from being straight and located almost at the base of the discal cell to being strongly oblique and almost at the outer extreme of the discal cell, with almost every intermediate stage represented by some living species. Schiner (1862) was, I believe, the first to recognize the taxonomic importance of the anterior crossvein and since then it has been almost universally accepted by syrphid workers that

the basal position represents the primitive end of the cline. The primitive nature of the basal position is supported by the fact that this is the condition found in the most closely related primitive families (Microdontidae and Pipunculidae) in addition to the reasons given by Hull for example (1949:274). The second morphocline of importance relates to the facial shape, evolving from a pilose convex condition to a bare concave position. The facial morphocline has been illustrated and discussed in the character section. It should be noted that the extremes of the anterior crossvein cline and the facial cline correlate nicely with each other. The change in development of the metasterna from the very underdeveloped condition to the greatly enlarged condition (see character section) forms another morphocline which also corresponds in evolutionary direction with the facial and anterior crossvein clines.

Another major trend in the syrphids is the loss of pile on various parts of the body. This has not occurred in a uniform fashion, but generally the metathoracic sclerites, meropleurae, and anterior meso-anepisterna have appeared to be the first areas to lose their pile. The loss of pile appears to be irreversible. The arrangement of thoracic pile has been discussed in the character section as well as the reasons for considering the bare condition as

being derivative. Other tendencies of value in determining the phylogeny of the syrphids are: 1) bases of femora acquire basal setal patches; 2) hind femora acquire ventral spines; 3) third vein acquires a loop or kink. All of these trends have been discussed in detail by Hull (1949: 262-268, 273-274).

With the above morphoclines the phylogenetic positions of the milesine tribes can be characterized as follows:

Pipizines are clearly the most primitive of the milesine syrphids because they have: 1) strongly basal and straight anterior crossvein; 2) pilose convex faces; 3) underdeveloped metasterna; 4) no hind femoral spines; 5) no basal setal patches on any femora; 6) anterior crossvein basal in position and straight; 7) third vein always straight; and 8) subscutellar fringe. In short, the pipizines display the primitive extremes of all the morphoclines studied.

Calliceratini, Volucellini, and Cheilosini represent a group of primitive flies characterized by possession of the following common features: 1) pilose and non-sexual-dimorphic tuberculate faces; 2) pilose and underdeveloped metasterna; 3) anterior crossvein basal in position and straight; 4) thoracic bristles and subscutellar fringe usually present; and 5) absence of hind femoral spines.

Cheilosini, with their highly specialized two-segmented aedeagi, are perhaps more recently derived than either Calliceratini or Volucellini, which both have unsegmented aedeagi.

The chrysogasterines are intermediate between the more primitive milesine tribes mentioned above and the more advanced ones mentioned below. The intermediate conditions found in the chrysogasterines are: 1) anterior crossvein usually at the middle of the discal cell or slightly before it; 2) faces concave in both sexes or concave in females and tuberculate in males and usually bare; 3) metasterna bare but underdeveloped; 4) subscutellar fringe usually absent but scutellar or thoracic bristles frequently present.

The position of the Sericomyini is certainly phylogenetically intermediate and may be closely related to the Volucellini. The intermediate and specialized conditions found in the sericomyines are: 1) faces usually bare; 2) anterior crossvein at or beyond the middle of the discal cell; and 3) thoracic bristles absent. The primitive conditions of the sericomyines are: 1) faces non-dimorphic tuberculate; 2) femoral spines absent; and 3) metasterna pilose and underdeveloped. The tuberculate faces, position of anterior crossvein, lack of femoral spines, and particularly the plumose aristae suggest a close relationship to the volucellines.

The eumerines are intermediate like the chryso-gasterines. The possession of concave but pilose faces is a curious intermediate condition apparently restricted to the eumerines and Milesia. The ventral femoral spines and usually developed metasterna are derived conditions in the Eumerini, whereas the pilose anterior meso-anepisterna is a primitive trait. The anterior crossvein is in the middle area of the discal cell.

The eristalines are a recently derived milesine tribe since they are the only tribe with basal setal patches on all femora and always have a looped third vein. They also have hind femoral spines, an advanced feature. However, the pilose and tuberculate faces, pilose metasterna, and anterior crossvein at or only slightly beyond the middle of discal cell indicate that the eristalines are not as highly advanced as either the Milesini or Cerioidini.

The cerioidines and milesines are apparently the most highly advanced of the milesine tribes since they are generally essentially bare flies with the anterior crossvein located well beyond the middle of discal cell. Whether the cerioidines are more recently derived than the milesines is difficult to determine because both tribes are evolving along different lines. The cerioidines have retained the primitive tuberculate face and terminal style on the

antennae, but they have greatly developed metasterna. On the other hand, while Milesini includes, undoubtedly, the most recently derived genera (such as Milesia which has a strongly concaved face, greatly reduced pile, well-developed metasterna, and highly specialized wing venation), some of the milesine genera are much more primitive (such as Hemixylota which has a basal anterior crossvein). In short, Cerioidini are a small homogeneous taxon with many derived traits but a few very primitive ones, and the Milesini are a large heterogeneous tribe with many highly derived genera but with a few intermediate genera.

In general, on the basis of facial development, position of anterior crossvein, and presence or absence of hind femoral spines, the milesine tribes can be grouped as primitive, intermediate, or advanced. The primitive tribes have basal anterior crossveins, convex or tuberculate faces in both sexes, and lack hind femoral spines, whereas advanced tribes have apical crossveins, hind femoral spines, and usually have concave faces. The intermediate tribes have a mixture of primitive and derived character states, but usually have the recently derived hind femoral spines.

Key to the tribes of the subfamily Milesinae²

1. Hind femur with well-developed anterior, basal patch of setulae; anterior meso-anepisterna bare
 Eristalini
- Hind femora without basal patches of setulae; if with basal patch of setulae, then anterior meso-anepisterna pilose..... 2
2. Anterior crossvein (r-m) usually perpendicular, usually before the middle of the discal cell, never greatly slanted nor extending to the outer third or more of discal cell; if located at the middle area of the discal cell, then either with bristles on the thorax or with ventral spines on anterior four femora, or with basal patch of setulae on hind femora; and usually with underdeveloped metasterna
 3
- Anterior crossvein always slanted, usually beyond the middle of the discal cell, frequently greatly slanted and extending to the outer third or more of the discal cell; if located at the middle area of the discal cell, then with neither bristles on the

²Psarus Latreille is not included in this key.

- thorax nor ventral spines on anterior four femora
nor basal patches of setulae on hind femora; and
usually with developed metasterna..... 9
3. Oral margin evenly rounded, not notch apically; eyes
and face pilose; subscutellar fringe present;
facial grooves reduced to pits; hind femora unarmed
..... Pipizini
- Oral margin notched anteriorly; never with all the
above characters together in combination..... 4
4. Pro-anepisternum greatly swollen and produced dorso-
ventrally, with a vertical row of long stiff hairs
..... Spheginobacchini
- Pro-anepisternum not greatly swollen nor produced, with-
out a row of hair..... 5
5. Apical crossvein (upper turned portion of R4+5) either
strongly recessive or straight; arista plumose or if
bare, abdomen with bristles; with a distinct patch
of hairs in front of metathoracic spiracle
..... Volucellini
- Apical crossvein usually not recessive or straight; if
recessive or straight, then without the metathoracic
spiracular hair patch..... 6
6. Anterior meso-anepisternum pilose; frequently with a
notal wing shield; scutellum with apical rim
..... Eumerini

- Anterior meso-anepisterna bare; never with notal wing shield; scutellum without apical rim..... 7
7. Subscutellar fringe usually absent; if present, then hind tarsi with ventral longitudinal combs; hind femora always armed with ventral spines
..... Chrysogasterini
- Subscutellar fringe usually present; hind femora rarely with ventral spines (only some Cheilosia); hind tarsi without ventral longitudinal combs..... 8
8. Without thoracic bristles; usually with a distinct patch of hairs in front of metathoracic spiracle; eyes and face strongly pilose; face with a tubercle
..... Calliceratini..... 9
- With thoracic bristles; if without thoracic bristles, then eyes and/or face bare; usually without a metathoracic spiracular hair patch; if patch present, then face with a snout, not a tubercle.... Cheilosini
9. Antenna with a terminal style..... Cerioidini
- Antenna with an arista..... 10
10. Arista distinctly pilose..... Sericomyni
- Arista bare..... Milesini

Tribe Pipizini

Head: face pilose, usually without a tubercle except for Trichopsomyia which has a small tubercle in some species; oral margin not notched, even; facial grooves reduced to large elongate pits at the bases of the eyes; facial stripes not differentiated; ocellar triangle small, distinctly before the posterior margins of the eyes; eyes pilose, holoptic in the male.

Thorax: without bristles; pro-anepimera pilose; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; metathoracic pleurae bare; metasterna bare; plumulae elongate; scutellum with ventral pile fringe. Legs without ventral femoral spines. Wings: anterior crossvein always clearly located before the middle of the discal cell, usually at about basal fourth of discal cell; without radial sector bristles.

Abdomen: elongate, never constricted.

Discussion: The tribe Pipizini is quite distinct from all other milesine tribes because of the predominance of primitive adult characters it displays. Of these primitive characters, the lack of an apical notch in the oral margin is found elsewhere only in the Nearctic species of Chamaesyrrhus and the simple faces are unique among milesine

syrphids. Despite the primitive nature of adult pipizines, the larvae are predatory, a feature not possessed by other larval milesine syrphids. However, as discussed above, the habit of the pipizines suggest that the tribe may belong in the other subfamily, the Syrphinae.

The tribe Pipizini includes only two Neotropical genera, Pipiza Fallen and Trichopsomyia Williston. Pipiza is undoubtedly the most primitive member of the tribe since it is the only genus in the tribe in which the males lack a postanal hood, a specialization found only in the Tribe Pipizini. Trichopsomyia, on the other hand, is one of the most highly derived genera of Pipizini in that it has: 1) the ninth sternite of the male usually elongate; 2) the antennal pits separated; and 3) traces of a facial tubercle. The last two specializations are unique among the pipizine genera. A tentative phylogeny for the World pipizines has been diagrammed (Diag. 1).

Key to the Neotropical genera of Pipizini

1. Barrette pilose; anterior meso-anepisternum with some long hairs; antennal pits separate.....
..... Trichopsomyia Williston
- Barrette bare; anterior meso-anepisternum without any long hairs; antennal pits confluent.... Pipiza Fallen

Genus Pipiza Fallen

(Fig. 7, 34)

Pipiza Fallen, 1810, Spec. ent. novam

Dipt. disp. meth. exhibens., p. 11. Type-species,
Musca noctiluca Linne, 1758 (subsequent designation;
 Curtis 1837, Brit. Ent. 13: pl. 669)

Head: two-thirds higher than long; face straight with a slightly projecting epistoma, with pubescences; frontal prominence distinct, conically produced forward, at middle of head; front of the male long, usually twice as long as eye contiguity, flattened, not puffed-out; front of the female broad, almost as broad at antennae as long, longer than face, with convergent sides above. Antennae short; third segment roughly quadratic, slightly deeper than long; arista shorter than antenna, thick.

Thorax: roughly about as long as broad; proanepisterna strongly pilose; meso-anepisterna with anterior portion without long pile, barrettes bare. Legs: hind femora slightly swollen. Wings: apical cell acute; subcosta ending usually beyond the level of the anterior cross-vein, except before it in aurantipes Bigot.

Abdomen: elongate and emarginate.

Material examined: 34(3) albipilosa Williston,
austriaca Meigen, aurantipes (Bigot),* claripennis Shannon

and Aubertin (PTs),* femoralis Loew and triste (Philippi).*

Discussion: Pipiza can be separated easily from all other pipizines by: 1) the bare barrette and 2) the produced frons in the male. Pipiza is represented in the Neotropical Region by only three species which are restricted to the Andes of Chile and Argentina. The two species of Pipiza described by Enderlein from Brazil belong to the genus Trichopsomyia. The aedeagus of the Neotropical species of Pipiza examined is quite different from that of some of the Nearctic species and indicates that the South American species should be considered as forming a species group separate from their northern relatives. The aedeagus of the Neotropical species is elongate and tubular in shape, not orbicular, and is without dorsal or ventral prolongations. Shannon and Aubertin (1933) provide a key to all the Neotropical species of Pipiza. Philippi's flavipes should be considered a nomen nudum since Philippi himself clearly states it was not described [nicht beschreiben].

Genus Trichopsomyia Williston

(Fig. 6, 35)

Trichopsomyia Williston, 1888, Trans. Amer. Ent. Soc.

15:259. Type-species, Trichopsomyia polita

Williston, 1888 (subsequent designation; Hull 1949, Trans. Zool. Soc. London 26:330).

Head: higher than long; face with a distinct median tubercle, shiny, with pubescence restricted to a narrow band along eye margin; epistoma not produced; frontal prominence not differentiated, at middle of head; antennal pits separated; front of the male long, twice as long as or longer than eye contiguity, flattened below and swollen above where it meets eye contiguity; front of female broad, about as broad at antennae as long, as long as face, with sides slightly convergent above; occiput produced slightly posteriorly on upper third. Antennae long; third segment elongate, longer than first two segments together, more than twice as long as broad; arista not thick, shorter than antenna.

Thorax: about as long as broad; proanepisterna bare; meso-anepisterna with anterior portion with some long pile, barrettes pilose. Legs: hind femora swollen apically.

Wings: apical cell acute, with subcosta (sc) ending beyond level of anterior crossvein.

Abdomen: elongate, not distinctly emarginate.

Material examined: 11(11); catharinensis (Enderlein);* currani Fluke* and a number of undetermined species.

Discussion: The species of Trichopsomyia form a rather distinctive genus of pipizines with their: 1) separate antennal pits; 2) swollen hind femora; 3) patchy eye pile; and 4) facial tubercle. The genus includes 11 described species and is restricted to the Neotropical Region. Nine species of Trichopsomyia have been described from Brazil, one from Peru and one from Bolivia. Fluke (1937) provides the most recent key to the species of the genus. However, since Fluke only includes 7 of the eleven species and some of the characters he uses in his key appear to be variable, a revision based at least on genitalic characters is needed.

Tribe Cheilosini

Head: face never strongly sexually dimorphic, usually with a tubercle except Portevinia and Rhingia with none; oral margin notched anteriorly; facial grooves elongate; males with holoptic eyes; antennae short, never elongate; arista long, usually longer than antennae.

Thorax: proanepimera pilose, proanepisterna pilose; meso-anepisterna with anterior portion bare; meso-anepimera with posterior portion bare; barrettes bare; metasterna underdeveloped, usually pilose except bare in Chamaesyrrhus; scutellum without emarginate rim, with ventral pile fringe; legs simple except for some species of Cheilosia with ventral bristles or spines on hind femora; wings with apical cell acute, with long petiole, with anterior cross-vein usually before middle of discal cell except at middle in Ferdinanda.

Abdomen: oval to suboval, never constricted.

Discussion: The two-segmented aedeagus is a specialization that precisely defines the tribe Cheilosini. The only other milesine groups which has a two-segmented aedeagus are the Criorhina and Tropidia groups of Milesini. The two-segmented aedeagus of these groups is clearly of a different basic type. The presence of thoracic bristles and the lack of hind femoral spines in the Cheilosini will also distinctly separate the cheilosines from the Milesini. Characters 4-8 (see appendix I) indicate the primitive nature of cheilosines and when these characters are used in combination they will distinguish the tribe from all other syrphids. The tribe Cheilosini can be divided into two subtribes based on the position of the arista, pilosity

of metasterna, and size of the alula. The Pelecoceratina has the arista inserted apically on the third antennal segment, metasterna bare and the alula reduced. The subtribe Cheilosina has the arista inserted basad, metasterna pilose and the alula not reduced.

The tribe Cheilosini is predominantly northern in distribution. Only the genus Rhingia is found extensively outside of the Holarctic region. The phylogenetic position of Rhingia, the only Neotropical cheilosine genus, has been characterized by Hull (1949) as highly specialized (Phylogeront). However, I would consider Rhingia as the most primitive member of the subtribe Cheilosina. The presence of a metathoracic spiracular hair patch and the long costa support my contentions. I would suggest the following phylogenetic relationships between the world genera (Diag. 2).

Key to the Neotropical Genera of Cheilosini

1. Face drawn out into a long, porrect snout (Fig. 19);
 costa and third vein (r4+5) ending well behind the
 apex of the wing (Fig. 22).....
 Rhingia Scopoli
- Face without a snout; costa and third vein ending at or
 before the apex..... Cheilosia Meigen

Genus Rhingia Scopoli

(Fig. 19, 22, 36)

Rhingia Scopoli 1763, Ent. Carniol. p. 358.Type species, Conops rostrata Linne, 1758 (monotypy).

Head: greatly longer than high; face with lower part greatly drawn out in a porrect snout, bare; facial grooves short, extending to level of epistoma; facial stripes distinct, narrow; antennal pits confluent; frontal prominence distinct, low, clearly above middle of head; front of male small, one-half or shorter than eye contiguity; front of female with parallel sides, ranging from one-half to three-fourths as broad at antennae as long (as measured perpendicularly from oral margin to frontal prominence); ocellar triangle small, distinctly before posterior margins of eyes. Eyes bare. Antennae short; third segment suboval, slightly pointed apically, as long as or longer than first two segments; arista bare or with very fine pubescences, longer than antennae.

Thorax: longer than broad, with bristles, with or without metathoracic spiracular hair patches, with separate dorsal and ventral sternopleural pile patches. Wings with costa extending beyond the apex.

Abdomen: oval and emarginate.

Material examined: 46(2) campestris Meigen, nasica Say, nigra Macquart,* and rostrata (Linne).

Discussion: Rhingia is the only syrphid genus which has the costa extended beyond the apex of the wing. Rhingia is also one of the few genera of the Milesinae with a snout-like face. The only other genera of the Milesinae with snout-like faces are Lycastris Walker, Lycastrirhynchus Bigot and an undescribed genus from New Guinea. Rhingia can be separated from Lycastris by its lack of costal crossveins, from Lycastrirhynchus by its open marginal cell and straight R 4-5 vein, and from the undescribed New Guinean genus by its simple unswollen hind femora and non-rimmed scutellum.

Rhingia is obviously a relatively old genus: (1) known from both Miocene and Oligocene fossil remains, (2) almost world-wide in distribution, (3) morphologically primitive. Rhingia is absent only from the Australian fauna and has its greatest species abundance in the Oriental region. Only three Neotropical species of Rhingia have been described, two from Brazil and one from Ecuador. However, two of these species are probably synonyms. Rhingia harrisi Curran appears to be only a color variant of nigra Macquart. R. nigra is frequently cited as the type-species of Lycastrirhynchus Bigot. The type-species of Lycastrirhynchus is nitens Bigot by monotypy and Kertész (1910) synonymy

of nitens under nigra is wrong (see discussion under Lycastriirhynchus). There is no key to the Neotropical species of Rhingia. However, the comparative notes in Fluke's description of longirostris (1943) will serve to separate the two valid neotropical species.

Tribe Volucellini

Head: Face pilose, with a tubercle; oral margin notched anteriorly; facial grooves elongate, long, almost extending to antennal bases; facial stripes differentiated; antennal pits confluent; ocellar triangle small, distinctly before the posterior margin of eyes; eyes pilose, usually holoptic in male except dichoptic in Copestylum nasica group. Antennae short, shorter than face; third segment longer than broad except in Tachinosyrphus; arista plumose except bare in Tachinosyrphus.

Thorax: usually with distinct bristles except in some Copestylum, pro-anepisterna pilose; pro-anepimera pilose; metasterna pilose and underdeveloped; meropleurae with a metathoracic spiracular pile patch. Legs: simple, without spines on hind femora. Wings: with anterior crossvein always clearly located before the middle of the discal cell, with radial sector bristles, with apical crossvein either straight or recessive never directed outward.

Abdomen: short, oval or suboval, never elongate, emarginate, nor constricted.

Discussion: The volucellines are a rather homogeneous group of flies, easily recognized by their straight or recessive apical crossvein and plumose arista. Only Tachinosyrphus does not have a plumose arista but Tachinosyrphus is unique among the Syrphidae in that it has distinct bristles on the abdomen. The presence of bristles, the underdeveloped metasterna, basal anterior crossvein and the lack of hind femoral spines indicate that the volucellines are one of the more primitive milesine tribes. All the New World volucellines except the Holarctic species bomblyans, have the anterior part of the mesoanepisterna bare whereas the rest of the world volucellines have this area pilose. Thus the Neotropical volucellines and the Nearctic species derived from the Neotropical region (see discussion on transition between Neotropical and Nearctic milesine faunas) are clearly distinct from the other volucellines and are placed in a separate subtribe, Ornidina. Two possible phylogenetic arrangements are suggested for the tribe. It is not possible to say which of these two plans represents the actual phylogeny to the tribe without knowing more about the Old World genus Graptomyza. The answers to such

questions as the larval feeding habits of Graptomyza, whether saprophytic or scavenging in nests of Hymenoptera, are needed to indicate whether the Old World forms are monophyletic (Diag. 3a) or diphyletic (Diag. 3b).

Key to the Neotropical genera of the Volucellini

1. Arista bare; abdomen with bristles.....
 Tachinosyrphus Hull
- Arista pilose; abdomen without bristles.....2
2. Posterior portion of meso-anepimeron pilose.....
 Ornidia Lepeletier and Serville
- Posterior portion of meso-anepimeron bare.....
 Copestylum Macquart

Genus Ornidia Lepeletier and Serville

(Figs. 16, 27, 44)

Ornidia Lepeletier and Serville, 1828, Encyclopedie methodique 10:786. Type-species, Syrphus obesus Fabricius, 1775 (original designation).

Head: face concave beneath antennae, straight below median tubercle, with distinct median tubercle and two small lateral tubercles on either side of median tubercle; frontal prominence distinct, low above middle of head; front of male short, one-half as long as eye contiguity,

slightly puffed out; front of female narrow, about twice as long as wide at antennae bases, as long as face, with convergent sides above, puffed out, with a transverse depression about one-third of frontal length above antennae, with two short longitudinal depressions extending about one-third the length of front above transverse depression. Eyes pilose, holoptic in male. Antennae short, shorter than face; third segment elongate, twice as long as broad at base; arista plumose, as long as antenna.

Thorax: about as long as broad; notopleurae enlarged, swollen and elongate posteriorly on lateral one-half; meso-anepisterna with anterior portion bare; meso-katepisterna with posterior half completely pilose; meso-anepimera with posterior portion pilose; meropleurae with barrettes pilose; scutellum with a pre-apical depression and without ventral pile fringe. Wings: without microtrichia; marginal cell closed, petiolate, with apical portion angulate on posterior part; apical crossvein recessive.

Abdomen: suboval, convex, without bristles.

Material examined: 4(4); obesa Fab.* and major Curran.*

Discussion: Ornidia can be readily recognized by its three facial tubercles and pilose posterior meso-anepimera. Both of these characters are unique in the Volucellini.

Ornidia is endemic to the Neotropical Region but O. obesa has been widely distributed throughout the Old World tropics by Man (Hull 1929:196). Curran (1930) provides a key to the four known species.

Genus Tachinosyrphus Hull

Tachinosyrphus Hull, 1936, Proc. Ent. Soc. Wash. 38:167.

Type-species, Tachinosyrphus pseudotachina Hull, 1936 (original designation).

Head: Face bloated, in profile evenly convex from antennae to slightly above oral margin where it forms an acute cone; cheeks large, about one-half as wide as eye height; frontal prominence low, at middle of head; front of male swollen, slightly longer than eye contiguity. Eyes strongly pilose, holoptic in male. Antennae short; third segment subglobose; arista bare, about twice as long as antennae.

Thorax: about as long as broad; meso-katepisterna with separate dorsal and ventral pile patches; posterior meso-enepimera bare; barrettes bare; scutellum without preapical depression and subscutellar fringe. Wings: with microtrichia; marginal cell closed; apical crossvein recessive; spurious vein absent.

Abdomen: oval, flattened slightly with very dense long bristles.

Material examined: 1(1); none, above description prepared from original description and notes provided by Dr. Knudsen, who examined the holotype of the type-species, pseudotachina Hull.

Discussion: Tachinosyrphus is the only known syrphid with distinct bristles on the abdomen. Its swollen and puffed-out face and bare arista are found nowhere else in the Volucellini. The genus contains only one known species, which was described from Peru.

Genus Copestylum Macquart

(Fig. 43)

Copestylum Macquart, 1846, Mem. Soc. Roy. Sci. Agr.

Arts Lille (1845) 1844:252. Type-species, Copestylum flaviventris Macquart, 1846 (monotypy) = Volucella marginata Say, 1829.

Apophysophora Williston, 1888, Trans. Amer. Ent. Soc.

15:276. Type-species, Apophysophora scutellata Williston, 1888 (subsequent designation; Curran 1930, Amer. Mus. Novit. 413:5). New synonymy

Megametopon Giglio-Tos, 1891, Boll. Mus. Zool. Anat.

Comp., Torino 6(108):5. Type-species, Ophromyia nasica Williston 1891 (subsequent designation; Williston 1892, Biol. Centr. Amer., Dipt. 3:79; also Giglio-Tos, 1892, Ditteri del Messico, Pt. Pt. 1:44. New synonymy

Viereckomyia Curran, 1925, Ann. Mag. Nat. Hist. (9) 16:243. Type-species, Volucella gibbera Schiner, 1868 (original designation). New synonymy

Lepidopsis Curran, 1925, Ann. Mag. Nat. Hist. (9) 16:247. Type-species, Lepidopsis compactus Curran, 1925 (monotypy). New synonymy

Volosyrpha Shannon, 1929, An. Mus. Nac. Hist. Nat. Buenos Aires 34:575, (as a subgenus of Volucella). Type-species, Volucella (Volosyrpha) tibialis Shannon, 1929 (original designation). New synonymy

Volucellosia Curran, 1930, Amer. Mus. Novit. 413:5. Type-species, Volucella fornax Townsend, 1895 (original designation). New synonymy

Head: face usually concave beneath antennae, usually straight below medial tubercle, in some species straight from antennae to oral margin, in a few other with a snout, always with a median tubercle, without lateral tubercles; frontal prominence distinct, low, usually above middle of head except below the middle in Nasica group; front of

male short except long in Nasica group, ranging from one-half as long as to as long as eye contiguity, in Nasica group as long as face, and slightly puffed-out; front of female variable in size, ranging from four times as long as to shorter than wide at antennal bases, usually as long as face, with sides convergent above, usually with two lateral crescent shaped depressions. Eyes pilose, holoptic in male except dichoptic in Nascia group. Antennae short, shorter than face; third segment elongate, ranging from twice to about five times as long as broad at base; arista very variable but always with some sort of long hairs present.

Thorax: as long as or longer than broad and with or without bristles; meso-anepisterna with anterior portion bare; meso-katepisterna with either separate dorsal ventral pile patches or continuously pilose; meso-anepimera always bare; meropleurae with barrettes either pilose or bare; scutellum with or without a preapical depression or ventral pile frings. Legs: usually simple although hind tibiae greatly swollen in Hirtipes group. Wings: with or without microtrichia; marginal cell open or closed and petiolate; apical crossvein always recessive.

Abdomen: suboval to oval, convex and without bristles.

Material examined: 300+(275); nigra Greene, fornax Townsend, isabellina Williston, circe Curran,* marginata

Say, haagi Jaennicke, eugenia Williston, unipunctata Curran, pusilla Macquart, horvathi Szilady, compactus Curran,* smithae Thompson,* fuscipennis Macquart,* meretricias Williston,* impressa Hull,* belinda Hull,* tripunctata Hull,* tympanitis Fabricius,* selecta Curran,* pallens Wiedemann,* picta Wiedemann,* fasciata Macquart, vesicularia Curran, dracaena Curran, zephyra Curran,* obscurior Curran,* scutellata Macquart,* scutellata Williston,* azurea Philippi,* sapphirina Bigot,* vulta Fluke,* spinithorax Arribalzaga,* spinigera Wiedemann,* violacea Curran,* hirtipes Macquart,* and about two dozen new species. (all new combinations)

Discussion: Copestylum is a very large (over 300 species) and diverse genus but it is clearly separated from all other volucellines by its: 1) bare anterior meso-anepisternum; 2) bare posterior meso-anepimerum; and 3) pilose arista. Many generic names have been proposed for the species of this genus but since these names are based either on: 1) single or small groups of species with a few unique specializations (Volosyrpha Shannon, Viereckomyia Curran, Apophysophora Williston, Volucellosia Curran and Copestylum s. s.), or 2) larger groups with characters which since have been shown to be variable (Phalacromyia Rondani), they have not here been recognized

as representing valid genera. Clearly the names based on variable characters cannot be accepted representing good genera but the names for the small specialized species groups may be said to represent valid genera. However, splitting these specialized species groups off as separate genera will leave the remaining genus a poly- and paraphyletic mess, since all the species groups are clearly derived from one common ancestral species with the three above mentioned characters. Thus I have synonymized all these genera. Since many of these generic names have been used in the syrphid literature, I have included a key to them. Curran provides a series of keys to the Neotropical species of Copestylum (1930 Volucella* and Copestylum s. s.; 1939 Volucella*; 1947 Vesicular group; and 1953 Abdominalis and Esuriens groups). Also Fluke (1953) has revised the Scutellata Macquart group.

Key to the formerly separate Neotropical genera
of Copestylum, s. l. (Based on Curran 1930)

1. Arista bushy plumose, appearing more or less strap-like..... 2
- Arista loosely plumose..... 3
2. Hairs of arista all of about the same length and extending to the tip..... Copestylum s. s. Macquart

- Arista with dorsal and ventral row of longer, isolated hairs and with the apex broadly bare.....
Volosyrpha Shannon
3. Arista pectinate, with long hairs above and extremely short hairs below.....Volucellosia Curran
- Arista plumose, the ventral hairs never imperceptible...
4
4. Scutellum basally either with a very strong acute tubercle or with three weak tubercular swellings.....5
- Scutellum without tubercles basally.....6
5. Scutellum with three rather weak tubercular swellings which bear dense black pile; vertex of female strongly produced upward..... Apophysophora Williston
- Scutellum with a median, strongly produced, acute tubercle.....Viereckomyia Curran
6. Eyes of male widely separated; front much longer than the face.....Megametopon Giglio-Tos
- Eyes of male contiguous; front shorter than the face or at most slightly longer.....7
7. Pile of eyes dense and with scale-like hairs intermixedLepidopsis Curran
- No scale-like hairs on the eyes.....Volucella Geoffroy*

*New World species, except Holarctic bombylans a true Volucella, are now included in Copestylum.

Tribe Calliceratini

Notiocheilosia,³ new genus

(Fig. 37)

Head: about one-third higher than long; face very broad, occupying more than one-half of head width, strongly pilose, broadly pollinose on sides, straight with a small low median tubercle slightly nearer to oral margin than to antennae; oral margin with an anterior notch and epistoma distinctly produced at tip of notch; cheeks broad, about two-thirds as broad as long, pilose, pollinose; facial grooves elongate, short, extending only to level of tubercle; facial stripes very narrow, pilose, pollinose; frontal prominence not differentiated from surrounding area, at upper third of head; frontal triangle of male puffed-out slightly, pilose, as long as eye contiguity, about twice as broad as long, with a medial impressed groove; vertical triangle of male small, equilateral and less than one-half as long as eye contiguity, about twice as broad as long, with a medial impressed groove; vertical triangle of male small, equilateral and less than one-half as long as eye

³From the Greek, Notios, southern and Cheilosia referring to the syrphid genus.

contiguity; front of female broad, about one-fourth longer than broad at antennae, with a medial impressed groove on lower part of front like male, about one-third shorter than face, shiny, pilose; ocellar triangle small, equilateral, at posterior margin of eyes. Eyes strongly pilose and holoptic in male, thinly pilose and dichoptic in female, facets of uniform size. Antennae: short, about one-fourth as long as face; first two segments about as long as broad; third segment roughly orbicular; arista basal, slightly less than twice as long as antenna, bare.

Thorax: with mesonotum about as long as broad excluding scutellum, with pile long in male and short in female, without bristles; pro-anepisterna pilose; pro-anepimera pilose; meso-anepisterna with anterior portion with only very short pubescences; meso-katepisterna broadly and continuous pilose from ventral margin to dorsal margin; meso-anepimera with posterior portion with only very short pubescences; meropleurae bare except for a large patch of long pile in front of metathoracic spiracle; metathoracic pleurae bare; metasterna pilose, underdeveloped; plumulae elongate, almost as long as lower squamal lobe; squamae without long pile on disk; scutellum without an apical emarginate rim, with a sparse ventral pile fringe. Legs: simple, hind femora without ventral spines. Wings:

marginal cell open; apical cell closed, acute, petiolate, with petiole about as long as anterior crossvein; anterior crossvein straight, basal, before the basal fourth of discal cell; radial sector bristles present but weak in female; alulae normal not narrowed. Abdomen: short, oval, non-emarginate, with 1st abdominal spiracle embedded in metathoracic epimeron.

Type-species: Cheilosia nitescens Shannon and Aubertin.

Material examined: Holotype and allotype of type-species plus addition specimens of type-species.

Discussion: The position of Notiocheilosia in the phylogeny and classification of the Milesinae is problematic. It clearly does not belong to any tribe as presently characterized but I do not feel this exclusion from the other tribes is a sufficient reason for erecting a new tribe for its inclusion presently. The strongly basal anterior crossvein, underdeveloped and pilose metasterna, lack of femoral spines and the strongly pilose nature of Notiocheilosia places the genus among the more primitive tribes of the Milesinae. Notiocheilosia definitely does not belong with the Cheilosini because of its lack of a segmented aedeagus as Sedman (1955) has pointed out. The lack of thoracic bristles also excludes

Notiocheilosia from the cheilosines. The presence of 1) tuberculate faces in both sexes, 2) subscutellar fringe, 3) pilose metasterna, 4) pilose eyes, and 5) lack of femoral spines, all exclude Notiocheilosia from the Chrysogasterini. The acute apical cell, lack of thoracic bristles, bare arista; all eliminate Notiocheilosia from the Volucellini. The tuberculate faces in both sexes, notched oral margin and pilose metasterna exclude the genus from the Pipizini. Only the presence of a basal arista separates Notiocheilosia from the Calliceratini. However, the terminal styles may be of only minor importance in the recognition of Callicera as a separate tribe, thus Notiocheilosia may belong to the Calliceratini.

I consider antennal differences of only minor significance in deciding whether a taxon should have tribal status or not, unless they are correlated with other characters. Since the peculiar arista of the pelecoceratines is not correlated with any other major difference and the pelecoceratines do have the characteristic two-segmented aedeagus of Cheilosini, I have considered the pelecoceratines as only a subtribe under Cheilosini.

I have considered the terminal style of Callicera of tribal value in the adult fly because it correlates with the very unusual larval form. Since the larvae of Notiocheilosia

are not known, it is not possible to securely assign Notiocheilosia to the Calliceratini. However, because Notiocheilosia shares more characteristics with Callicera than any other milesine genera I am placing Notiocheilosia in the Calliceratini. The characteristics Notiocheilosia shares with Callicera are: 1) pilose face; 2) pilose eyes; 3) pilose metasterna; 4) scutellum with ventral pile fringe; 5) low facial tubercle in both sexes; 6) meso-katepisterna almost completely pilose; 7) scutellum without apical emarginate rim; 8) meropleuron with a patch of pile in front of metathoracic spiracle (only in some species of Callicera); 9) short facial grooves; 10) undifferentiated or very narrow facial stripes; and 11) similar wing venation. In short, although Notiocheilosia has been tentatively placed in Calliceratini, the genus is phylogenetically isolated from all other syrphid genera and likewise abundantly distinct.

Only one species of Notiocheilosia is known, nitescens. Nitescens is restricted to the Chilean Subregion of South America and is clearly described by Shannon and Aubertin (1933).

Tribe Chrysogasterini

Head: oral margin notched anteriorly; face bare except for a few scattered scales in Lepidomyia Loew; antennal pits confluent except narrowly separated in Chamaesphegina. Eyes usually bare, pilose in Chromocheilosia, holoptic in male except dichoptic in Neoascia, Sphegina and Lejogaster. Antennae usually short, shorter than face, longer than face in Lepidomyia; arista bare, except for short pile in Brachyopa, usually longer than antenna, thin.

Thorax: pro-anepisterna pilose; pro-anepimera pilose except bare in some species of Brachyopa; meso-anepisterna with anterior portion usually bare except for upper posterior corner pilose in Orthoneura, Myolepta and Lepidomyia; meso-anepimera with posterior portion bare; metathoracic pleurae bare; metathoracic spiracle small; metasterna usually bare, underdeveloped; plumulae elongate except absent in Sphegina and Neoascia; scutellum without ventral pile fringe except with in Chromocheilosia. Legs: hind femora with ventral spines. Wings: anterior crossvein usually before middle of discal cell.

Abdomen: variable, either oval, elongate or constricted.

Discussion: The chrysogasterines form a rather homogeneous tribe characterized by: 1) anterior crossvein before the middle of discal cell; 2) bare eyes; 3) bare metasterna; 4) absence of subscutellar fringe; and 5) absence of facial tubercle in female. However, there is at least one genus which is an exception to each of the above characters: a species of Myolepta from Chile has the anterior crossvein beyond the middle of discal cell; some Myolepta species have a pilose metasterna; Chromocheliosia has a distinct subscutellar fringe; and Lepidomyia has a facial tubercle in the female. Despite all these exceptions, a consensus of the five above characters will clearly delimit the tribe.

The tribe Chrysogasterini can be divided into two subtribes, Chrysogasterina and Spheginina. The Spheginina includes those genera with: 1) concave faces in both sexes; 2) narrow alulae; 3) pair of scutellar bristles; and 4) parallel-sided or constricted abdomens. Spheginina includes three genera, Sphegina, Neoascia and Chamaesphegina. The Chrysogasterina have: 1) usually tuberculate faces in the male; 2) normal broad alulae; 3) usually no scutellar bristles; and 4) usually oval abdomen. The Spheginina is a very distinctive group, first recognized by Williston

(1886) as a tribe. Since that time the spheginines have been almost universally recognized as either a tribe or subfamily. However, the lack of subscutellar fringe, bare metasterna and femoral spines clearly places the Spheginina in with the chrysogasterines. The spheginines form a natural group when restricted to Sphegina and Neoascia (and now Chamaesphegina) as almost every worker has done except Hull (1949). Hull enlarged the spheginines to include Takaomyia, Odyneromyia and Valdivia. These three genera belong to the tribe Milesini with the Temnostoma group because of the presence of a subscutellar fringe, bright pollinose markings, and tuberculate faces in males, and the absence of thoracic bristles. Chamaesphegina was first placed in with the spheginines when Enderlein described his Desmetrum (a synonym) and this action was repeated independently by Hull (1949), who did not know that Desmetrum was a synonym of Chamaesphegina.

The Spheginina is a predominantly Holarctic group with only the monotypic genus Chamaesphegina found greatly beyond the bounds of the northern temperate zone. Chamaesphegina is restricted to the Chilean Subregion of South America. The Chrysogasterina are world-wide in distribution, although the Ethiopian chrysogasterines appear to be

appear to be limited to the genus Orthonevra. Four genera of the Chrysogasterina are found in the Neotropical Region: one genus and another subgenus, Lepidomyia and Myolepta (Protolapidostola), are wide-spread in the tropical areas; whereas the rest of the chrysogasterine genera are restricted to the temperate Andes. The phylogenetic relationships of these Neotropical genera are tentatively suggested (Diag. 4).

Key to the Neotropical Genera of Chrysogasterini

1. Apical crossvein recessive or vertical, forming either a right or an obtuse angle with third vein (r4+5) (Fig. 32)..... Orthonevra Macquart
- Apical crossvein directed outward, forming an acute angle with third vein (Fig. 23)..... 2
2. Anterior four femora armed with ventral spines..... 3
- Anterior four femora unarmed, without ventral spines....
..... 4
3. Antennae elongate, longer than or as long as face; third antennal segment elongate, more than twice as long as wide..... Lepidomyia Loew
- Antennae short, never as long as face; third antennal segment short and oval..... Myolepta Newman

4. Hind basal three tarsal segments with ventral longitudinal combs (Fig. 42); eyes usually pilose.....
Chromocheilosia Hull and Fluke
 Hind tarsi without ventral longitudinal combs; eyes
 bare.....Chamaesphegina Shannon and Aubertin

Genus Lepidomyia Loew

(Fig. 8, 40)

Lepidomyia Loew, 1864, Berlin. Ent. Zeitschr. 8:69.

Type-species, Lepidomyia calopus Loew, 1864

(monotypy).

Head: short, higher than long; face tuberculate in both sexes, frequently with two median tubercle, produced slightly downward, with scattered scales or hairs; facial grooves short, extending to level of tubercle; facial stripes wide; frontal prominence not differentiated, slightly above middle of head; front of male long, longer than eye contiguity; front of female broad, about a third broader at antennae than long, about as long as face, with convergent sides above; ocellar triangle small, before posterior margin of the eyes, usually protuberant; occiput reduced laterally, just a mere line along upper third of head, flattened. Eyes flattened with metallic patterns in life, holoptic in male. Antennae long, longer than face; third segment more than twice as long as broad.

Thorax: as long as broad, with very short pile and scales; meso-anepisterna with anterior portion with upper posterior corner pilose; meso-katepisterna with separate dorsal and ventral pile patches; meropleurae bare except for a patch of pile in front of metathoracic spiracle; scutellum frequently triangular, and produced into dorsal thorn-like protuberance.

Legs: all femora swollen and with two ventral lateral rows of short spines; hind tibiae with a basal ventral short spines. Wings: apical cell acute; anterior crossvein at basal third of discal cell; sometimes with spurs on apical crossvein.

Abdomen: oval to elongate, indistinctly emarginate.

Species examined: 16(15) calopus Loew,* perpolita Johnson (HT),* similis Williston,* ortalina van der Wulp,* pulchra Williston*, nigra Thompson (HT)*; dionysiana D'Andretta and Carrera (HT).*

Discussion: Myolepta and Lepidomyia are distinguishable from all other syrphids by the presence of strong ventral spines on all femora. Lepidomyia can be separated from Myolepta by its: long antennae which are longer than the face, and presence of facial tubercle in the female. Lepidomyia is wide-spread throughout the Neotropical Region and extends into the southern Nearctic Region.

Genus Myolepta Newman

(Fig. 39)

Myolepta Newman, 1838, Ent. Mag. 5:373.Type-species, Musca luteola Gmelin, 1790 (monotypy).

Head: Face usually dark, with distinct tubercle in male, straight to slightly concave, with strongly projecting epistoma in female, bare; facial grooves short, extending along lower third of eyes; facial stripes distinct, pilose; frontal prominence distinct, slightly above middle of head; front of male short, one-half as long to as long as eye contiguity; front of female broad to narrow, as long to one and a half times as long as face, with sides convergent above; ocellar triangle slightly before posterior margin of eyes, vertical triangle ranging from as long as to twice as long as eye contiguity; occiput usually normal except reduced in Protolepidostola. Eyes holoptic or narrowly dichoptic in male. Antennae short, shorter than face; third segment large, not elongate.

Thorax: usually longer than broad, with short pile; meso-anepisterna with anterior portion with upper posterior corner pilose; meso-katepisterna with separate dorsal and ventral pile patches; meropleurae usually bare except in

luteola with a patch of pile in front of metathoracic spiracle and barrettes pilose; metasterna usually pilose, bare in strigilata; scutellum usually with distinct apical emarginate rim. Legs: all femora swollen and with two ventral lateral rows of short spines. Wings: apical cell closed at wing margin; anterior crossvein at middle of cell.

Abdomen: oval to elongate, not emarginate.

Discussion: Myolepta with its ventral spines on all femora can hardly be confused with any other syrphid genus except its sister-group Lepidomyia. Myolepta is distinguished from Lepidomyia by its: short antennae which are shorter than the face, and concave face in the female. Thompson (1968) has provided a key for the separation of Myolepta and its related genera and has discussed the subgeneric division of the genus. Fluke and Weems (1956) have provided a key to all the New World species of Myolepta. Thompson has described two more species (both of subgenus Protolepidostola) since that revision and provided a new key to the species of the subgenus Protolepidostola. The species of Myolepta are found throughout most of the world but are completely absent from Ethiopian and Australian Regions. The Neotropical myoleptas of the typic subgenus are restricted to the temperate Andes

of South America. However, the type species of Protolepidostola and one other species of this subgenus were described from Brazil, which suggests that Protolepidostola not only differs structurally from Myolepta, s. s., but differs in its adaptation to the tropical climate.

Key to the subgenera of Myolepta Newman

1. Head short, occiput reduced laterally; small compact flies.....Protolepidostola Hull
- Head normal, not short; occiput not reduced laterally; not compact flies.....Myolepta Newman

Myolepta (Myolepta) Newman

Head: not short, about as high as long; face broad, straight with a strongly projecting epistoma in the female, tuberculate in male; frontal prominence at upper two-thirds of the head; front of female broad, usually as broad at antennae as long; front of male short; occiput normal, not reduced as in Protolepidostola or Lepidostola. Eyes holoptic or narrowly dichoptic in male.

Thorax: as long as or longer than broad; with pile ranging from normal hair type to flattened scales.

Abdomen: oval to elongate.

Species examined: 21(9) luteola (Gmelin), nigra Loew, haemorrhoidalis (Philippi),* nascia (Hull),* strigilata Loew.

Discussion: Shannon in 1922 described the genus Eumyiolepta for those members of Myolepta with scales on the thorax and abdomen. He designated M. strigilata Loew as the type of the group. In 1941 Hull erected Sarolepta for a new species, dolorosa, which had an intermediate form of pile on the thorax. However, a few years (1949) later he synonymized his genus under Myolepta. Thus, it is clear that the type of pile on the thorax and abdomen of myoleptine flies ranges all the way from normal hairs to short and flattened opaque scales. For this reason I feel myoleptine groups should not be recognized solely on the basis of pile types. Sarolepta and Eumyiolepta do not differ structurely from Myolepta. Therefore I do not consider these valid groups.

Subgenus Protolepidostola Hull

Protolepidostola Hull, 1949, Trans. Zool. Soc. London
26:333 (as a subgenus of Lepidostola). Type-
species, Lepidostola scintillans Hull, 1946
(original designation).

Small compact flies with scale-like pile on some parts
of the body.

Head: very short, compressed longitudinally, twice
as high as long; face narrow, about as long as wide, deeply
concave in female, tuberculate in male; frontal prominence
at middle of head; front of female narrow, occupying less
than one-third of head width, about one and one-third as
long as face, with an impressed medial groove on upper
three-fourths, distinctly punctate on either side of this
groove, with sides only slightly convergent above; front
of male about twice as long as eye contiguity; ocellar
triangle of male long; occiput reduced laterally, just a
mere line along the upper one-half of eyes, flattened.
Eyes very large, occupying two-thirds or more of head
width. Antennae: third segment short, oval, about twice
as long as second segment.

Thorax: short and compact, with scales, with ventral
meso-katepisternal pile patch reduced to only a few hairs

in between medial suture, with scutellum without an apical emarginate rim. Wings: with the spurious vein absent.

Abdomen: short and compact.

Material studied: 3(3) scintillans Hull (HT),* problematica Thompson (HT),* and evansi Thompson (HT).*

Genus Orthonevra Macquart

(Fig. 32, 38)

Orthonevra Macquart, 1829, Mem. Soc. Roy. Sci. Agr.

Arts Lille 1827/1828:188. Type-species, Chryso-

gaster elegans Meigen, 1822 (monotypy).

Head: higher than long; face without a distinct tubercle in either sex, with scattered scales or hairs, frequently with strigae extending from eyes to middle of face; facial grooves extending to level of the produced epistoma, ending in a distinct pit; facial stripes indistinct; lower face and epistoma distinctly produced forward; frontal prominence not differentiated, above middle of head; front of male slightly swollen, usually with a distinct indentation above the antennal bases, usually about as long as eye contiguity; front of the female broad, as broad at antennae as long, about as long as face, with convergent sides above, strongly rugose, with a median

longitudinal groove or carina; ocellar triangle small, at posterior margin of eyes, not protuberant; occiput reduced on upper third of head. Eyes with metallic patterns in life, holoptic in male. Antennae vary from short to long, third segment variable, usually much longer than broad.

Thorax: longer than broad, with short pile; meso-anepisterna with anterior portion having upper posterior corner pilose; meso-katepisterna with separate dorsal and ventral pile patches; meropleurae bare; scutellum with distinct apical emarginate rim. Legs: all femora swollen hind femora with two ventral lateral rows of short spines; hind tibiae without ventral lateral rows of short spines; hind tibiae without ventral spines or knife-edge. Wings: frequently with brown patterns; apical cells obtuse; apical crossvein recessive on its upper portion; anterior crossvein always distinctly before middle of discal cell.

Abdomen: oval, flattened dorsoventrally, not emarginate, with the disc opaque and the sides shiny.

Material examined: ?(6) anniae Sedman, bellula Williston, chalybeata (Meigen), gewgew Hull (HT),* nigrovittata Loew (CTs), nitida (Wiedemann), parva (Shannon), pictipennis (Loew) (CTs), pulchella (Williston), robusta (Shannon), sonorensis (Sedman) and stigmata (Williston).

Discussion: Orthonevra is usually considered as a subgenus of Chrysogaster. Wirth et al (1965) have raised another subgenus of Chrysogaster, Chrysosyrphus, to full generic status and this action leaves the typic genus, Chrysogaster, a polyphyletic group. Sedman (1959), who has studied the male genitalia of Chrysogaster, s. l., states that 1) Orthonevra is derived from a Chrysogaster-like ancestor and 2) Chrysosyrphus is apparently intermediate between Chrysogaster and Orthonevra. Thus, if one is to consider the phylogenetic intermediates as a distinct genus, the extremes must also be considered separate genera. I feel on the basis of external characters and the male genitalia, all three of these subgenera are sufficiently distinct to be recognized as separate genera. The interrelationships and distinctions of these three genera are indicated by the following characterization:

Chrysogaster, s. s.: 1) aedeagus simple, without distinct ejaculatory hood or process; 2) 3rd antennal segment oval, 2nd without bristle-like hairs; 3) male frons puffed out; and 4) apical crossvein forming an acute angle with third vein.

Chrysosyrphus: 1) aedeagus intermediate, with distinct ejaculatory process but weakly developed

ejaculatory hood; 2) 3rd antennal segment oval, 2nd with long bristle-like hairs; 3) males frons only slightly puffed out; and 4) apical crossvein forming an acute angle with third vein.

Orthonevra: 1) aedaegus complex, with distinct ejaculatory hood and process; 2) 3rd antennal segment elongate, 2nd without bristle-like hairs; 3) male frons not puffed out but ruguose; and 4) apical crossvein forming a right or obtuse angle with third vein.

As for the other subgenera of Chrysogaster, s. l., it is probable that the two Palearctic subgenera, Lejogaster and Liochrysogaster, are also distinct and should be raised to generic status. I have seen two new species from New Caledonia which agree with the description of Plesia and Hemilampira (two Australian subgenera), respectively and these species definitely deserve full generic status; and Bezzi's Ethiopian Orthonevra with pilose eyes clearly do not belong to any of the described genera or subgenera related to Orthonevra. In short, I strongly suspect most subgenera and a few odd species now listed under Chrysogaster, s. l., probably represented distinct genera.

Eight species of Chrysogaster, s. l., have been described from the Neotropical Region. Of these eight species, five were described from the temperate Andes (labyrinthops Hull, neotropica Shannon, nitida Wiedemann, shannoni Curran and quadristriata Shannon and Aubertin) are Orthonevra, two of them (lugubris Jaennicke and annulifera Bigot) do not belong with the genera related to Chrysogaster, and one species (argentina Brethes) has not been available for study. There is no available keys to the Neotropical species of Orthonevra. However, Sedman (in litt.) is currently working on a revision of the Neotropical species.

Genus Chromocheilosia Hull and Fluke

(Fig. 10, 11, 41, 42)

Chromocheilosia Hull and Fluke, 1950, Bul. Amer. Mus.

Nat. Hist. 94:306 (as a subgenus of Cheilosia).

Type-species, Chilosia bicolor

Shannon and Aubertin, 1933 (original designation).

Head: about one-third higher than long; face yellowish orange, with distinct tubercle in male, straight and with strongly projecting epistoma in female, bare, as long as broad; facial grooves short, extending along

lower third of eyes; facial stripes distinct, pilose; frontal prominence low, slightly above middle of head; antennal pits confluent; front of male one-half as long as eye contiguity; vertical triangle about one-half as long eye congruity, longer than broad at occiput; front of female about as long as face, one-third longer than broad, with sides convergent above, one-third broader at antennae than at ocellar triangle; ocellar triangle before posterior margin of eyes. Eyes usually pilose (sparsely pilose in female of incerta), holoptic in male. Antennae short, almost two-thirds as long as face; third segment large, orbicular; arista bare, about twice as long as antenna.

Thorax: about as long as broad; with mesonotal bristles; meso-katepisterna with separate dorsal and ventral pile patches; meropleurae bare except for barrettes being pilose in bicolor; metasterna bare; scutellum with strong ventral pile fringe, without apical emarginate rim. Legs: hind femora swollen, with two lateral ventral rows of strong spines; hind tibiae with sharp ventral knife-edge on basal one-half; hind tarsi with ventral longitudinal combs on basal three segments; Wings: apical cell petiolate, with petiole about one-half as long as anterior crossvein; anterior crossvein at basal third of discal cell.

Abdomen: oval to elongate, not emarginate.

Material examined: 3(3); bicolor Shannon and Aubertin* (HT); incerta Shannon and Aubertin* (PTs); pubescens Shannon and Aubertin* (PTs).

Discussion: The species of Chromocheilosia were first described as cheilosine flies not chrysogasterines. Shannon and Aubertin (1933) in their study of the Syrphidae of Southern Chile and Patagonia described four species in the genus Chilosia Meigen. At that time they noted the close interrelationship among three of the species (Chromocheilosia) and the distinctiveness of the fourth (Notiocheilosia). They also indicated that they were uncertain as to the limits of Cheilosia and thereby the placement of their species. Since then no one has re-examined the species involved until now. Hull and Fluke merely made the distinctiveness of these flies official by naming a special subgenus for them. In their (Hull and Fluke 1950) review of the North American species of Cheilosia they erected the subgenus Chromocheilosia "for those truly aberrant antipodal Cheilosiae, of which there are several species, that are in large part bright, pale orange in color," and designated Chilosia bicolor as the genotype. It is surprising that the significance of the unusual characteristics of Chromocheilosia which are

the complete antithesis of those of Cheilosia were not recognized. The peculiar coloration and geographic distribution of Chromocheilosia, Hull and Fluke's characters, clearly indicate that Chromocheilosia is not a subgenus of Cheilosia but a valid genus. The characteristics of Chromocheilosia are not peculiar and the species of Chromocheilosia are not aberrant when one considers the genus as belonging to the tribe Chrysogasterini. In 1968 I (Thompson 1968) raised the group to generic level and placed it in the Myoleptini.

The presence of a scutellar fringe and thoracic bristles indicates that Chromocheilosia is the most primitive genus in the Chrysogasterina. The strongly sexually dimorphic face and the short petiolate apical cell suggests that Myolepta is the closest related group. The fact that Myolepta luteola (Gmelin) (European) and Chromocheilosia bicolor are the only two chrysogasterine flies that have pile on the barrette may be another indication of this relationship. The ventral longitudinal combs on the hind tarsal segments appears to be unique among the syrphids.

Genus Chamaesphegina Shannon and Aubertin

(Fig. 23)

Chamaesphegina Shannon and Aubertin, 1933, Dipt.

Patagonia S. Chile 6:145. Type-species,

Chamaesphegina argentifacies Shannon and Aubertin,
1933 (original designation).

Head: about one-fourth higher than long; face yellowish pollinose, bare, concave, with slightly projecting epistoma; facial grooves very short, not extending above level of oral margin; frontal prominence low, slightly above middle of head; antennal pits narrowly separated above; front of female about twice as long as broad, with slightly convergent sides above, as long as face; ocellar triangle slightly before posterior margin of eyes. Eyes bare, holoptic in males. Antennae short, about one-half as long as face; third antennal segment orbicular; arista bare, about one and one-half times as long as antenna.

Thorax: about twice as long as broad, with short pile; meso-katepisterna with separate dorsal and ventral pile patches; meropleurae bare; metasterna bare; scutellum with a pair of apical bristles, with distinct apical emarginate rim. Legs: simple except for minute ventral spines on hind femora. Wings: elongate, as long as whole

fly; apical cell petiolate; anterior crossvein strongly basal, at basal one-eighth of discal cell; alula narrow, narrower than second basal cell.

Abdomen: elongate, not emarginate, about twice as long as wide, parallel-sided.

Material examined: 2(2); argentifacies Shannon and Aubertin*(PTs).

Discussion: The non-constricted abdomen and the acute apical cell place Chamaesphegina as the primitive sister group to the rest of the Spheginina. Shannon and Aubertin in the original description stated that the group was probably allied to Hemixylota. Their statement confuses me since the group is clearly allied to Sphegina and this is what their name reflects also (chamae--from the Greek meaning dwarf and Sphegina). Hemixylota, with its scutellar fringe, lack of strong femoral spines and the developed metasterna, is far removed from Chamae-sphegina.

Desmetrum Enderlein has not been seen but it appears to be a synonym of Chamaesphegina. The original description agrees perfectly with Chamaesphegina. Fluke (1956) also considers this group a synonym, and Hull (1949) suggested the possibility of such a synonymy. The original description of Desmetrum Enderlein is based on the male

which I have not studied. The only important differences between the sexes is in the nature of the frontal region of the head, due to the fact that the male is holoptic and the female dichoptic.

Tribe Eumerini

Head: face pilose, usually concave except tuberculate in Nausigaster; oral margin notched; antennal pits usually confluent except separate in Nausigaster; ocellar triangle before posterior margin of eyes; eyes pilose, usually narrowly holoptic in male except in Nausigaster broadly holoptic. Antennae short, shorter than face; arista usually bare except with very short pubescences in Alipumilio.

Thorax: pro-epimera usually pilose except with pubescence in Alipumilio; pro-anepisternum pilose; meso-anepisterna with anterior portion pilose; meso-anepimera with posterior portion bare; meropleurae bare; metasterna pilose except bare in Nausigaster; metathoracic pleurae bare except epimera pilose in Nausigaster; scutellum with distinct flattened emarginate crenate rim, usually without ventral pile fringe except in Merodon, Azpeytia, and Psilota; Legs: hind femora with ventral spines except

in some Nausigaster. Wings: apical cell usually obtuse except in Nausigaster and Psilota; apical crossvein usually recessive except in Nausigaster and Psilota.

Abdomen: oval to suboval, not constricted, with first abdominal spiracle free, not embedded in meta-epimeron.

Discussion: The tribe Eumerini is easily distinguished from most milesine taxa by its pilose anterior meso-anepisterna. The only other milesine taxa with the anterior meso-anepisterna pilose are Volucellina, Trichopsomyia, Spilomyia, Milesia, and Temnostoma. The eumerines can be separated from both the volucellines and Trichopsomyia by their scutellum with its apical emarginate rim and hind femoral spines and from the three genera of Milesini by their recessive apical crossvein. The reduced and modified first abdominal sternite along with its free spiracle is a unique specialization found only in the eumerines.

The tribe Eumerini as considered here is a greatly enlarged concept from that previously recognized (Hull, 1949; Wirth et al, 1965). Merodon from the old Eristalinae, Psilota and Alipumilio from the old Cheilosinae, along with Nausigaster, formerly Nausigasterinae, have been combined with the old Eumerinae. All these taxa which are

now combined were formerly considered to be aberrant taxa not closely related to any other groups. By grouping all these taxa together with some previously overlooked characters one forms a rather homogeneous tribe. Not only are the adults very similar as indicated by the above character table but the larvae also appear to be very similar in habits and structure. The larvae of Eumerini are short-tailed maggots which breed in rotten bulbs or plant exudates. Hartley (1961 and 1965) has shown that the larvae of Eumerus and Merodon are very similar. Carrera et al (1947) described the larvae of Nausigaster. Miller (1921) has described a New Zealand species of Psilota in great detail. Hill (1921) has mentioned the presence of Psilota larvae in the putrid exudate of a Mastotermes darwinensis nest. I have received a series of a new species of Alipumilio from Brazil which is labelled as reared from the pitch of Araucaria australis.

The phylogenetic position of the Neotropical members of the tribe Eumerini is rather difficult to determine at the present time because so little is known about the character of some of the Oriental and Ethiopian taxa. However, the Neotropical members of the tribe share a couple of unique specializations which may suggest that

they form a separate group within the tribe. Alipumilio and Nausigaster are the only two syrphid taxa which do not have the meso-anepisterna differentiated into a flat anterior portion and convex posterior portion. Also Alipumilio and Nausigaster are the only milesine taxa that are strongly and distinctly punctate. However, both these Neotropical genera share another unique specialization with Eumerus, the notal wing shield. These unique characters may be combined to suggest the following phylogenetic arrangement for the tribe as a whole (Diag. 5).

Key to the Neotropical Genera of Eumerini

1. Apical crossvein recurrent (Fig. 33); face concave (Fig. 18); antennal pits confluent.....
Alipumilio Shannon
- Apical crossvein directed outwards (Fig. 29); face tuberculate; antennal pits separated.....
Nausigaster Williston

Genus Alipumilio Shannon

(Fig. 18, 33, 46, 47)

Alipumilio Shannon, 1927, Proc. U.S. Nat. Mus. 70(9):12.

Type-species, Alipumilio femoratus Shannon, 1927

(original designation).

Head: much higher than long, short; face short, concave, with a projecting epistoma; facial grooves short extending to slightly above level of epistoma; facial grooves short, extending to slightly above level of epistoma; facial stripes not differentiated; frontal prominence distinct, at middle of the head; antennal pits connected; front of male large, about one-third broader at antennae than long, as long as the face, about four times as long as the eye contiguity; vertical triangle of male long, about five times as long as eye contiguity; front of female narrow, more than twice as long as broad at antennae, long, about twice as long as face, with slightly convergent sides above, punctate, with a distinct medial line running from ocellar triangle to just above antennae; ocellar triangle small, not protuberant; occiput greatly reduced, not visible laterally. Eye pile very short, thick, dense. Antennae short; third segment suboval to oval, as long as or longer than first two segments; arista with very short fine pubescences.

Thorax: very short and broad, almost twice as broad as long; meso-katepisterna with small dorsal pile patches; scutellum without ventral pile fringe; plumulae long elongate. Legs: hind femora greatly swollen and armed ventrally with two lateral rows of short spines; hind

tibiae arcuate. Wings: apical cell obtuse; apical crossvein strongly recurrent; spurious vein absent; anterior crossvein always distinctly before middle of discal cell.

Abdomen: very short, broad, not emarginate, strongly curved down and forward at the third segment, sternites greatly reduced.

Material examined: 4(4); four new species.

Discussion: Alipumilio is readily separated from Nausigaster, the only other Neotropical eumerine, by its 1) concave face; 2) confluent antennal pits; 3) enlarged hind femora; and 4) recessive apical crossvein. Alipumilio can be separated from all other syrphid taxa by the unique characters it share with Nausigaster (see above discussion under the tribe) and its unusually enlarged swollen hind femora and concave face. Also, Alipumilio, Nausigaster, and Eumerus have a unique lateral project of the mesonotum which partly covers the base of the wing (called the notal wing shield).

Alipumilio appears destined to be a large genus although it is quite rare in collections. Shannon described the genus from a single female collected by Darwin on the Amazon. For some forty years, this was the only known specimen of the genus, but recently

Vockeroth (1964) uncovered three more specimens representing three new species. One of Vockeroth's species was from Mexico and the other two were from Peru. During the course of this revision, seven more specimens of the genus were discovered in various collections. These seven specimens, including one series of four specimens reared from pine pitch, represented four more new species. Sedman (in litt.) has told me he has another specimen representing still another new species. In all, only a dozen specimens of Alipumilio are presently known and these represent nine species, which range from Argentina in the south to Mexico in the north. Vockeroth (1964) has provided a new key to be included with the descriptions of the new species uncovered during this revision.

Genus Nausigaster Williston

(Fig. 29, 45)

Nausigaster Williston, 1883, Trans. Amer. Ent. Soc.

11:33. Type-species, Nausigaster punctulata

Williston, 1883 (monotypy).

Head: slightly higher than long; face with a distinct tubercle, deeply concave under antennae and above tubercle,

not produced greatly below tubercle, without a projecting epistoma; facial grooves short, extending to the level of epistoma; facial stripes not differentiated; frontal prominence distinct, at middle of head; antennal pits widely separated; front of male small, about as long as eye contiguity; vertical triangle long, varying from as long as eye contiguity to twice as long; front of female as long as face, about one-fourth longer than broad at antennae, with a median tubercle, with strongly convergent sides above; ocellar triangle small, usually protuberant; occiput slightly swollen laterally, punctate. Eye pile fine, short and widely scattered. Antennae short, about one-half as long as face; third segment round, swollen, longer than first two segments; arista thin, inserted dorsally at middle of third segment.

Thorax: about as broad as long with short thick pubescences, with only dorsal meso-katepisternal pile patches, without subscutellar fringe, with very short, broadly rounded plumulae. Legs: simple. Wings: usually with brown patterns; apical cells acute; apical crossvein strongly directed outward on apical portion; anterior crossvein at basal third of discal cell.

Abdomen: elongate, drooping, flexed at end of second segment where there is a strongly transverse crease;

sides and apical end greatly produced downward and somewhat inward, producing a large ventral cavity; lateral margins distinct, end in the form of small lobes on either side of apex; sternites not reduced.

Material examined: 14(7); bonariensis Arribalzaga*, clara Curran, curinervis Curran, geminata Townsend, punctulata Carrera, Lopes, and Lane*, and unimaculata Townsend.

Discussion: The strongly punctate exoskeleton of Nausigaster will clearly separate the genus from all other syrphid taxa. Although Alipumilio is also punctate, the punctures of Alipumilio are not as large or as numerous as those in Nausigaster. Nausigaster has the head punctate all over whereas in Alipumilio the head punctures are restricted to the front of the female only. The other characters of value in distinguishing Nausigaster from Alipumilio and other milesine taxa have been discussed under Alipumilio. About 14 species of Nausigaster have been described and Curran (1941) has provided a key to all but three of the more recently described species of the genus. The genus is distributed from Argentina in the south to the southern border of the United States in the north. The numbers of species are about equally divided between the Nearctic and Neotropical regions but

the Nearctic species are restricted to the tropical portion of the region. The restricted range of the Nearctic species along with the Nausigaster's extensive range in the Neotropical region strongly suggests that the genus had a Neotropical origin.

Tribe Cerioidini

Wasp-mimics with very short appressed hairs, each hair arising from a distinct but very small puncture.

Head: face with sparse short pile, broad, usually as broad as high, straight, with a low median tubercle near oral margin; cheeks broad, usually as broad as long or broader; oral margin notched anteriorly; facial grooves elongate, extending about half the length to frontal prominence; facial stripes indistinct; antennal pits confluent; frontal prominence at upper third or higher of head, ranging from undifferentiated condition to many times longer than broad; front of male excluding frontal prominence short, usually about as long as eye contiguity; front of female excluding frontal prominence short, usually less than one-half as long as face, broad, always broader at antennae than long, with convergent sides above; vertical triangle short, equilateral; ocellar triangle usually

before posterior margins of eyes; occiput thickened posteriorly behind ocellar triangle. Eyes bare, holoptic in male. Antennae long, at least as long as face; third segment tapering to a point, always with terminal style instead of arista.

Thorax: longer than broad, with very short appressed pile; meso-anepisterna with anterior portion with upper half pilose; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna developed, always with a few short distinct hairs; postmetacoxal bridge complete or incomplete; plumulae usually absent, present in a few Australian species; scutellum without a ventral pile fringe and without distinct apical emarginate rim. Legs: simple except with hind femora slightly swollen and with ventral spines. Wings: long, pointed, with anterior margin always broadly darkened; marginal cell broadly open; apical cell closed at wing margin; third vein usually looped into apical cell, frequently with an appendix; anterior crossvein always beyond middle of discal cell, usually at outer third of discal cell; stigmatic crossvein well-developed. Abdomen: elongate or constricted, never oval.

Discussion: As presently construed, the tribe Cerioidini consist of only the genus Cerioides. Cerioides, sensu lato contains a large number of highly varied wasp mimics which some workers, notably Shannon (1925 and 1927) and Hull (1949), have placed in a number of different genera. However, the characters used by Shannon and Hull, such as length of antennae and frontal prominence, abdominal shape and postmetacoxal bridge, are the type of attributes involved in forming the mimetic appearance of these flies. Thus convergence rather than common ancestry is a distinct possibility for Cerioides. Riek (1954), the only person who has done a detailed study of the genus using genitalic characters, has shown that the traditional characters of Shannon do not divide the Australian Cerioides into genera along phylogenetic lines. Riek has suggested that until the world species of Cerioides can be studied for genitalic characters, it is best to consider all the species as belonging to one genus, Cerioides. Since many of the world species of Cerioides are very rare in collections and unavailable for study, and the restricted Neotropical Cerioides fauna is an inappropriate basis for a revision, I have followed Riek's advice and leave all species of Cerioidini in one genus for the present.

Genus Cerioides Rondani

(Figs. 17, 28, 48)

Cerioides Rondani, 1850, Ann. Soc. Ent. France (2) 88:211. Type-species, Ceria subsessilis Illiger,

1807 (original designation).

Generic description--same as tribe.

Material examined: 176(46) abbreviata Loew, acra Curran,* ancoralis Coquillett, barbipes Loew,* bassleri Curran,* bigotii Williston,* brauerii Williston,* capitis Curran,* conosoides Linne, daphnaeus Walker,* facialis Kertesz,* nigripennis Williston* (HT), shannoni Lane & Carrera*(PTs), signifera Loew, superba Williston* (HT), tridens Loew, travassosi Lane & Carrera* (HT), wulpai Williston* and tricolor Loew.*

Discussion: Cerioides is separated readily from all other syrphids by having: 1) a terminal style on the antenna and 2) the anterior crossvein beyond the middle of the discal cell. Callicera and Macropelecocera are the only other syrphid genera with terminal styles on the antennae but both of these genera have the anterior crossvein before the middle of the discal cell. Besides the above characters, Cerioides can be distinguished by its general habitus. Cerioidines are wasp mimics except for a

few Australian species that mimic sawflies. The wasp appearance of having: 1) no body hairs, 2) constricted abdomens, 3) two pairs of wings, and 4) long antennae, is achieved in Cerioides by having: 1) body hairs greatly shortened and appressed, 2) abdomen constricted and/or with a pair of yellow lateral spots near the base of abdomen, 3) anterior margin of wing dark, and 4) either long antennae or frontal prominence greatly produced. Some of the cerioidines have also evolved a mechanism for folding their single pair of wings in such a way as to appear similar to the wasp's four folded wings (see Riek 1954 for details).

Curran (1941) has provided a key to the Neotropical Cerioides but it includes less than one-half of the described species. However, Cerioides because of their distinctive mimetic appearances are easily recognized from their original descriptions. Shannon (1927) states that for more than 120 described species there have been less than 10 synonyms!

Tribe Eristalini

Head: face usually with a tubercle except in Dissoptera and Keda, never strongly sexually dimorphic,

densely pilose on sides; oral margin notched anteriorly; facial grooves elongate; antennal pits confluent; ocellar triangle distinctly before posterior margin of eyes.

Antennae short, rarely elongate, usually shorter than face; third segment usually small, orbicular, rarely elongate; arista basal, usually bare, rarely sparsely pilose on basal half, usually longer than antenna.

Thorax: pro-anepimera pilose; pro-katepisterna pilose frequently with a few short spines; meso-anepisterna with anterior portion bare; metasterna pilose; postmetacoxal bridge incomplete; plumulae usually present and elongate except absent in Xenzoon; scutellum usually without apical emarginate rim except in Orthoprosopa, Solenaspis and Dolichomerus. Legs: hind femora with basal setal patches and usually ventral spines. Wings: anterior crossvein at or beyond middle of discal cell except before in Xenzoon; third vein usually forming a strong loop or kink in apical cell except in Xenzoon; apical and discal cells usually without external appendices on outer posterior corners; stigmatic crossvein usually present.

Abdomen: oval, rarely elongate and never constricted.

Discussion: The basal setal patch on the hind femur will readily distinguish the eristalines from all other syrphid taxa except Merodon. Merodon can be easily

distinguished by its pilose anterior meso-anepisterna. The strongly looped third vein also serves as a good characteristic for the eristalines. However, care must be used with this looped third vein character since a few milesine genera, such as Korinchia, also have a distinctly looped third vein. Eristalini is traditionally broken down into two subtribes based on whether the marginal cell is open or closed, Helophilina and Eristalina, respectively. Both of these subtribes are world-wide in distribution and are well distributed in the Neotropical Region.

Key to the Neotropical Genera of the Eristalini

1. Marginal cell (R1) open (Fig. 30).....Helophilina...7
 Marginal cell closed (Fig. 31).....Eristalina...2
2. Face drawn out into a long slender porrect snout.....
 Lycastrirhyncha Bigot
 Face without a long snout.....3
3. Fronto-antennal region greatly produced; occiput very
 tumid; abdomen elongate and rather slender.....
 Thalamopales Hull
 Fronto-antennal region not greatly produced; occiput not
 very tumid; usually short, compact flies.....4

- 4. Thorax with marking of opaque tomentum; eyes bare.....
Meromacrus Rondani
- Thorax without marking or tomentum; eyes pilose or bare.
5
- 5. Barrettes bare.....genus #1
- Barrettes pilose.....6
- 6. With pile in front of and beneath metathoracic spiracle.
Palpada Macquart
- Without any pile around the metathoracic spiracle.....
Eristalis Latreille
- 7. Eyes pilose.....8
- Eyes bare.....9
- 8. Third antennal segment deeper than long; anterior part
 of wing usually not dark.....Mallota Meigen
- Third antennal segment longer than deep, usually twice
 as long or longer than deep (except cestus Hull only
 1.5 as long as deep); anterior part of wing usually
 dark.....Quichuana Knab
- 9. Ocellar triangle extremely large; front very broad .
 (Figs. 13, 14).....10
- Ocellar triangle normal size; small.....11
- 10. Front greatly swollen below; ocellar triangle obtuse,
 anterior ocellus close to the base of the triangle
 (Fig. 13).....Dolichogyna Macquart

- Front not greatly swollen; ocellar triangle equi-
lateral (Fig. 14).....Asemosyrphus Bigot
11. Thorax densely pilose, without distinct pollinose
ground patterns.....Mallota Meigen
- Thorax with scattered pile, not dense pile, usually
with distinct pollinose stripes and bands.....12
12. Fronto-antennal region usually greatly produced forward,
subconical to conical (Fig. 21); anterior edge of
wing dark; males holoptic or narrowly dichoptic.....
.....Habromyia Williston
- Fronto-antennal region not greatly differentiated, not
subconical; wings hyaline, anterior edge not dark;
males broadly dichoptic.....Helophilus Meigen

Genus Dolichogyna Macquart

(Figs. 13, 49)

Dolichogyna Macquart, 1842, Mem. Soc. Roy. Sci. Agr.

Arts Lille 1841 (1):125. Type-species, Dolichogyna
fasciata Macquart, 1842 (monotypy).

Head: face yellow, broad, slightly broader than long,
occupying more than one-half head width, shallowly concave
beneath antennae, with a large very low medial tubercle,
pollinose and pilose on sides, shiny and bare medially;

cheeks narrow in profile, longer than broad; facial grooves short, extending along lower fourth of eyes; facial stripes indistinct; frontal prominence low, at upper third of head; front yellow, pollinose, puffed-out, with frontal lunule very large, in males more strongly narrowed posteriorly; vertex black, pollinose, rectangular, more than twice as long as wide; ocellar triangle very broad at base, more than three times as broad at base as long. Eyes bare, broadly dichoptic in male. Antennae very short, less than one-fourth as long as face; third segment quadrate; arista bare, more than twice as long as antenna.

Thorax: broader than long, long pilose, with longitudinal light pollinose stripes on mesonotum; meso-katepisterna continuously pilose from ventral margin to dorsal margin; meso-anepimera with posterior portion bare; mero-pleurae bare; metathoracic spiracle large, two to three times as large as third antennal segment; plumulae elongate and unbranched. Legs: Hind femora swollen; hind tibiae slightly arcuate, without apical spur. Wings: marginal cell open; apical cell with a short petiole, with petiole shorter than stigmatic crossvein; stigmatic crossvein present.

Abdomen: oval to suboval with paired lateral light colored spots on dorsum.

Material examined: 7(7); abrupta Hine* and chilensis (Guerin)*.

Discussion: The habitus of Dolichogyna with its 1) very broad face and front in both sexes, 2) vittate mesonotum and 3) spotted abdomen, readily distinguishes the genus from all other syrphid taxa. Aemosyrphus and Arctosyrphus are similar in that they both have very broad ocellar triangles and fronts in both sexes but they have quite different color markings. Also these two genera have small facial tubercles, longer antennae and dark faces, whereas Dolichogyna has a large facial tubercle, short antennae and a yellow face. Dolichogyna is confined to the Andes of South America. Seven species have been described. Fluke (1951) has revised the genus and provided a key with numerous figures illustrating the heads, abdominal patterns, and male genitalia.

Genus Quichuana Knab

(Figs. 30, 50)

Quichuana Knab, 1913, Ins. Insci. Mens. 1:13.

Type-species, Quichuana sylvicola Knab, 1913

(original designation).

Head: higher than broad; face pollinose and pilose broadly on sides, shiny and bare medially, concave beneath

antennae, with medial tubercle straight beneath tubercle; cheeks narrow, usually longer than broad; facial grooves short, extending to the level of tubercle; facial stripe indistinct; frontal prominence medium height, about one-half to three-fourths as high as broad at base as measured in profile, above the middle of head; front of male long, more than twice as long as vertical triangle; vertical triangle short, as broad as long; front of female long, slightly shorter than face, about one-half as broad at antennae as long, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes thinly pilose, narrowly holoptic in male. Antennae variable in length, from as long as to one-half as long as face; third segment elongate, usually more than twice as long as broad except only slightly longer than broad in cestus; arista bare, long, about as long as antenna.

Thorax: longer than broad, with short pile, without tomentum or pollinose markings; meso-katepisterna either with a narrowly connected or separated ventral and dorsal pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae usually bare; metasterna frequently greatly developed; metathoracic spiracle small, with diameter about equal to width of third antennal segment; plumulae short, unbranched. Legs: hind

femora swollen; hind tibiae arcuate, without apical spur.
Wings: marginal cell open; apical cell petiolate, with petiole longer than stigmatic crossvein; stigmatic crossvein present.

Abdomen: elongate.

Material examined: 25(25); auratus (Walker),*
bezzii Ceresa,* bormeieri Carrera & Lane (HT),* pogonosa
Fluke,* calathea Shannon.*

Discussion: Quichuana is readily recognized among the eristalines by its pilose eyes and long antennae. It is related to Mallota but Mallota has short antennae and is thickly pilose on thorax. Twenty-five species of Quichuana are known, 21 from the Neotropical Region and 4 from the southern part of the Nearctic Region (Mexico). Hull (1945) has revised Quichuana and provided keys and illustrations.

Genus Habromyia Williston

(Figs. 21, 51)

Habromyia Williston, 1888, Trans. Amer. Ent. Soc.

15:284. Type-species, Habromyia coeruleithorax
Williston, 1888 (monotypy).

Edwardsiella Hull, 1941, J. Wash. Acad. Sci. 31:437.

Type-species, Edwardsiella ochracea Hull, 1941
(original designation). NEW SYNONYMY

Lycopale Hull, 1944, J. Wash. Acad. Sci. 34:129.

Type-species, Meromacrus vittata Hull, 1937

(original designation). NEW SYNONYMY

Criorthrix Hull, 1949, Trans. Zool. Soc. London 26:391

Type-species, Habromyia rectilinea Hull, 1942

(original designation). NEW SYNONYMY

Head: higher than broad; face pollinose and pilose broadly on sides, shiny and bare medially, ranging from straight to deeply concave beneath antennae, with a median tubercle, straight beneath tubercle; cheeks broad or narrow, ranging from as broad as long to longer than broad; facial grooves short, extending to level of facial tubercle; facial stripes indistinct; frontal prominence ranging from very low to greatly produced, above middle of head; front of male long, always as long as vertical triangle, frequently longer than vertical triangle; vertical triangle long, more than twice as long as broad at occiput; front of female long, as long as or longer than face, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes bare, very narrowly dichoptic in male. Antennae short, ranging from one-half as long as to about as long as face; third segment either orbicular or elongate, never more than twice as long as broad; arista bare, long, slightly longer than antenna, thick.

Thorax: longer than broad, with short pile and usually tomentum, usually with longitudinal vittae and/or transverse bands; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare, meropleurae bare; metathoracic pleurae bare; metasterna greatly developed; metathoracic spiracle large, usually as large as third antennal segment; plumulae elongate, single or multibranched. Legs: hind femora swollen; hind tibiae slightly arcuate, with or without apical spur. Wings: marginal cell open; apical cell petiolate, with petiole as long as or longer than stigmatic crossvein; stigmatic crossvein present.

Abdomen: variable, ranging from short subtriangular and flattened to long and subcylindrical.

Material examined: 10(10); chrysotaenia (PTs) Fluke,* barbiellini Ceresa,* and rectilinea Hull.*

Discussion: Habromyia is easily recognized among the Helophilines by its bare eyes, short body pile and patterns of tomentum on the mesonotum. The genus is rather homogeneous except there is considerable variation in the shape of both the frontal prominence and abdomen. A couple of genera, Edwardsietta, Lycopale, and Criorthrix, have been described on the basis of slight differences in the shape of both the frontal prominence and abdomen. However,

the differences integrate into each other and I can not find any other significant differences that correlate with either abdomen or frontal prominence shape.

In the typic genus, Habromyia, the frontal prominence ranges from not differentiated (barbiellinii) to about one-half as high as broad at base as measured in profile. The abdominal shape ranges from short, subtriangular and flattened in barbiellinii to long, slightly tapered behind and subcylindrical in chrysotaenia males (slightly flattened in females). The other three genera were described by Hull for differences in the abdominal shape and frontal prominence which are within the range of variation mentioned above. Since I am unable to find any other significant differences between these genera and Habromyia, I have synonymized them.

Genus Mallota Meigen

(Fig. 52)

Mallota Meigen, 1822, Syst. Besch. 3:377.

Type-species, Syrphus fuciformis Fabricius, 1794

(subsequent designation; Rondani, 1844, Nuov. Ann.

Sci. Nat. Bologna (2) 2:452).

Head: higher than broad; face pollinose and pilose broadly on sides, shiny and bare medially, deeply concave beneath antennae, with a median tubercle, straight beneath tubercle; cheeks broad, broader than long; facial grooves short, extending above the level of the tubercle; facial stripes indistinct; frontal prominence low, slightly more than one-half as high as broad at base when measured in profile, above middle of head; front of male long, slightly longer than ocellar triangle; vertical triangle long, about a third longer than broad at occiput; front of female broad, about as broad at antennae as long, slightly shorter than face, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes thinly pilose or bare, dichoptic or holoptic in male. Antennae short, about one-half as long as face; third segment quadrate, usually slightly broader than long; arista bare, long, about twice as long as broad.

Thorax: about as broad as long, with mesonotal pile long and dense, without tomentum nor pollinose markings; meso-katepisterna and ventral continuously pilose from ventral margin to dorsal; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metathoracic spiracle large, as large or larger than third antennal segment; plumulae long unbranched. Legs: hind

femora greatly swollen, arcuate; hind tibiae flattened laterally, arcuate, without distinct apical spur. Wings: marginal cell open; apical cell petiolate, with petiole as long as or longer than stigmatic crossvein; stigmatic crossvein present.

Abdomen: suboval with long pile.

Material examined: 49(10); sackeni Williston, bautias (Walker) and posticata (Fabricius).

Discussion: Mallota species are typical bee mimics with dense long mesonotal pile. This bee-like appearance along with their massive hind femora will readily separate Mallota from the other Helophilina. Mallota is predominantly a northern temperate genus with about ten species found along the Andes in South America. Curran (1953) has indicated that the Ethiopian and perhaps Oriental mallotas do not belong in Mallota proper, but probably in other genera. Curran (1940) has provided a key to all the New World species.

Genus Eristalis Latreille

(Fig. 53)

Eristalis Latreille, 1804, Nouv. Dict. Hist. Nat. 24:194.

Type-species, Musca tenax Linne, 1758 (subsequent designation; Curtis 1832, Brit. Ent. 9: pl. 432).

Head: about twice as high as broad; face broadly pilose and pollinose on sides, shiny and bare medially, straight except for medial tubercle and slight outward production at antennal pits, with tubercle on lower third of its length, strongly produced downward, with about one-third of facial length below eyes; cheeks broad, broader than long; facial grooves short, extending along lower third of eyes; facial stripes indistinct; frontal prominence low, on the upper third of head; front of male long, about twice as long as eye contiguity, slightly longer than vertical triangle; vertical triangle small, as broad as long; front of female broad, broader than long, about two-thirds as long as face, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes pilose, with two denser longitudinal pile bands, holoptic in male. Antennae short, about one-fourth as long as face; third segment quadrate, slightly longer than broad; arista bare, long, about twice as long as antenna.

Thorax: slightly longer than broad, with long pile; meso-katepisterna continuously pilose from ventral to dorsal margin; meso-anepimera with posterior portion bare; mero-pleurae bare except for barrettes pilose; metathoracic pleurae bare; metathoracic spiracle large, larger than antenna; plumulae long and multibranched. Legs: simple.

Wings: without microtrichia; marginal cell petiolate; apical cell petiolate, with petiole as long as stigmatic crossvein; stigmatic crossvein present.

Abdomen: oval in males and suboval in females.

Material examined: 1? (1); tenax (Linne).

Discussion: Vockeroth (in litt.) is currently working on a generic revision of the genus Eristalis, sensu lato, and his preliminary findings indicate that Eristalis should be restricted to tenax and related species only. The rest of the species formally placed in Eristalis belong to a number of other genera but all the Neotropical species belong to either genus #1 or Palpada. These three genera can be easily distinguished by pile characters: Genus #1 has all of the posterior parts of thoracic pleurae bare, including the posterior meso-anepimera, meropleurae and barrette and metapleurae; Palpada and Eristalis both have the barrettes pilose; but Palpada also has a distinct patch of long hairs in front of and at base of the meta-thoracic spiracle. Genus #1 is apparently restricted to the temperate Andes, whereas Palpada is found throughout the Neotropical region. Eristalis is represented in the Neotropical Region by only its cosmopolitan type-species, tenax.

Genus #1

(Fig. 54)

Head: only about one-third higher than broad; face almost completely pilose and pollinose except for a narrow medial area bare and shiny, with a large broad low median tubercle, with tubercle on lower third of face, slightly concave beneath antennae, straight below tubercle, not produced greatly below eyes; cheeks narrow, as long as broad; facial grooves short, extending to level of tubercle; facial stripes indistinct; frontal prominence low, slightly above middle of head; front of male long, about twice as long as eye contiguity; vertical triangle short, about one-half as long as front of male, equilateral; front of female broad, slightly broader at antennae than long about three-fourths as long as face, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes pilose, holoptic in male. Antennae short, about one-fourth as long as face; third segment quadrate, as long as broad; arista usually sparsely pilose on basal one-half, long, about one and one-half times as long as antenna.

Thorax: about as broad as long, with long pile; meso-katepisterna continuously pilose from ventral to dorsal margin; meso-epimera with posterior portion bare;

meropleurae bare; metathoracic pleurae bare; metathoracic spiracle large, larger as third antennal segment; plumulae long, multibranched. Legs: simple. Wings: without microtrichia; marginal cell petiolate; apical cell petiolate, with petiole as long as stigmatic crossvein; stigmatic crossvein weak.

Abdomen: oval.

Material examined: 22? (?); arbustorum Linne, saxorum Wiedemann, brousii Williston, obscurus Loew, latifrons Loew, transversus Wiedemann, bogotensis Macquart,* intricarius Line, rupium Fabricius, nemorum Linne, pertinax Scolopi.

Discussion: Genus #1 is readily distinguished from Eristalis, Palpada and related genera by its almost completely bare posterior thoracic pleurae (posterior mesoanepimera, meropleurae, and metathoracic pleurae, all bare). Genus #1 includes most of the North American and European species formerly placed in Eristalis and is restricted to the temperate Andes in South America. The genus is apparently unnamed because of the confusion about the type-species of Eristalis. Most authors have accepted arbustorum Linne as the type-species of Eristalis and have used Rondani's Eristalomyia for the species related to tenax. Wirth et al (1965) indicate that tenax Linne is

the correct type for Eristalis, designated by Curtis (1832). Thus Eristalomyia with its type-species tenax becomes an objective synonym of Eristalis and the arbustorum group is without a name. However, since Vockeroth is currently working on this group I have not named the arbustorum genus. Curran (1930) has included the New World species of genus #1 in his Eristalis key and Bean (1949) has figured the peripheral system of the male genitalia for most Nearctic species (includes a few Neotropical ones).

Genus Palpada Macquart

(Fig. 31, 55)

Palpada Macquart, 1834, Hist. Nat. Ins. Dipt. 1:512.

Type-species, Palpada scutellata Macquart, 1834

(monotypy)= Milesia conica Fabricius, 1805.

Head: higher than broad; face broadly pilose and pollinose on sides, shiny and bare medially, concave beneath antennae, with a large median tubercle on lower third, straight beneath tubercle, may be produced greatly below eyes; cheeks usually broad, ranging from slightly longer than broad to much broader than long; facial grooves short, extending to the level of the tubercle; facial stripes indistinct; frontal prominence usually low, above

middle of head; front of male usually slightly puffed-out, long, usually twice as long as vertical triangle, always longer than eye contiguity; vertical triangle short, about two-thirds as broad at occiput as long; front of female long, usually as long as face and twice as long as broad at antennae, with slightly convergent sides above; ocellar triangle small, equilateral. Eyes bare or short pilose, holoptic in males. Antennae short, about one-fourth as long as face; third segment usually quadrate, as long as broad; arista bare, longer than antenna, at least one and one-half times as long as antenna.

Thorax: longer than broad, with either long or short pile, without tomentum; meso-katepisterna usually continuous pilose from ventral to dorsal margin, sometimes with narrowly divided dorsal and ventral pile patches; meso-epimera with posterior portion bare; meropleurae bare except for barrettes pilose and a few hairs in front of metathoracic spiracle; metathoracic pleurae bare except for a distinct patch of pile below spiracle; metathoracic spiracle large, larger than third antennal segment; plumulae long, multibranched. Legs: hind femora swollen, frequently strongly swollen; hind tibiae flatten laterally, arcuate, frequently ciliate. Wings: usually with extensive areas of microtrichia; marginal cell petiolate;

with petiole as long as stigmatic crossvein; stigmatic crossvein present.

Abdomen: oval to elongate.

Material examined: about 100_± (100_±); agrorum (Fabricius),* albifrons (Wiedemann),* aemulus (Williston),* testaceicornis (Macquart),* vinetorum (Fabricius),* fasciatus (Wiedemann),* precipuus (Williston)* and two dozen new or unidentified species.

Discussion: Palpada contains most of the Neotropical species formerly included under the name Eristalis. However, Eristalis is quite different from these Neotropical species (See discussion under Eristalis). Palpada appears to be the oldest available name for the Neotropical species. Curran (1930) has provided a key to the New World species of Eristalis including both genus #1 and Palpada, but the key is outdated and now includes less than half of the described species.

Genus Meromacrus Rondani

(Fig. 56)

Meromacrus Rondani, 1848, Studi Ent. (Turin) 1:70.

Type-species, Meromacrus ghilianii Rondani,
1848 (monotypy).

Head: higher than broad; face broadly pilose and pollinose on sides, bare and shiny medially, concave beneath antennae, with a low median tubercle on lower third, straight below tubercle, not greatly produced below eyes; cheeks narrow, longer than broad; facial grooves short, extending to level of tubercle; facial stripes indistinct; frontal prominence low, on upper third of head; front of male long, more than twice as long as eye contiguity, as long as or longer than vertical triangle; vertical triangle long, about twice as long as broad at occiput; front of female short, about one-third shorter than face, slightly longer than broad at antennae; ocellar triangle small, equilateral. Eyes bare, holoptic in male. Antennae short, about one-half as long as face; third segment pointed, slightly longer than broad; arista bare, about one-third longer antenna.

Thorax: about as broad as long, with very short pile, with distinct patterns of tomentum; meso-katepisterna with narrowly separated dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare except for a few hairs above coxal articulation; plumulae long, multibranched. Legs: hind femora swollen; hind tibiae slightly arcuate. Wings: with anterior margin dark, with microtrichia;

marginal cell petiolate; apical cell petiolate, with petiole as long as stigmatic crossvein; stigmatic crossvein present.

Abdomen: oval to suboval.

Material examined: 38(36); ghilianii Rondani,* brunneus Hull,* pratorum (Fabricius),* nigra Sack,* zonatus Loew,* and cingulatus Sack.*

Discussion: The petiolate marginal cell and presence of tomentum will distinguish Meromacrus from all the other syrphids except Thalamopales Hull. Thalamopales can be separated from Meromacrus by its greatly produced frontal prominence and absence of a facial tubercle. Meromacrus is a New World genus restricted to the Neotropical Region and southern part of the Nearctic Region. Hull (1942) has reviewed the genus and presented a key to most of the species.

Genus Lycastirhynchus Bigot

(Fig. 57)

Lycastirhynchus Bigot, 1859, Rev. Mag. Zool. (2) 9:307.

Type-species, Lycastirhynchus nitens Bigot, 1859

(monotypy).

Head: about one-third broader than high; face pilose and pollinose on sides, bare and shiny medially, snout-like, strongly concave beneath antennae, with snout produced straight forward, with snout above level of bottom of eyes; cheeks linear, much longer than broad; facial grooves short, extending along lower half of eyes; facial stripes indistinct; frontal prominence low, above middle of head; front of short, as broad as long, one-half as long as vertical triangle; vertical triangle rectangular, slightly longer than broad; front of female short, about two-thirds as long as face when face measured vertically from oral margin, about as broad as long, with sides only slightly convergent above; ocellar triangle small and equilateral. Eyes bare, broadly dichoptic in male. Antennae short, about one-third as long as face when face measured vertically from oral margin; third segment slightly elongate, little longer than broad, pointed; arista bare, long, about twice as long as antennae.

Thorax: longer than broad, with short pile and usually dark pollinose longitudinal vittae; meso-katepisterna with broadly separated dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare except for barrette pilose and a few hairs in front of metathoracic spiracle; metapleurae

bare except for a distinct patch of pile below the spiracle; metathoracic spiracle large, about as large as third antennal segment; plumulae short and unbranched. Legs: simple except hind femora slightly swollen. Wings: without microtrichia; marginal cell petiolate; apical cell petiolate, with petiole longer than stigmatic crossvein; stigmatic crossvein present.

Abdomen: oval.

Material examined: 5(3); mexicana Curran*?

Discussion: Lycastriirhynchus is one of the few syrphids with a snout-like face and it can be easily separated from all of the other snout-faced syrphids by its looped third vein and petiolate marginal cell (see Rhingia for notes on other snout-faced syrphids). Van Doesburg (1963) has presented a key to all the species of Lycastriirhynchus.

There is considerable confusion in the literature as to the type-species of Lycastriirhynchus. Most authors (Hull 1949, Fluke 1956) have cited Rhingia nigra Macquart as the type-species without explanation. Lycastriirhynchus was described by Bigot for a single new species, nitens. Thus nitens is the only possible type-species. The confusion in the literature probably stems from Kertész (1910) synonymy of nitens Bigot under Rhingia nigra Macquart.

Why Kertész made the synonymy is not explained in his catalogue citation. Macquart in his description clearly stated that nigra had normal venation which would immediately eliminate it from being the same as nitens (the looped third vein and petiolate marginal cell of nitens are not usual among most syrphids). Further, Macquart does not mention any body marking, only stated that the fly is black. This is in contrast to nitens which has distinct mesonotal vittae and a pair of light colored spots on the abdomen. I think there can be no doubt that Macquart described a true Rhingia and Bigot's nitens is distinct from it since there exists both, a common South American Rhingia which agrees perfectly with Macquart's description and a fly which agrees with Bigot's nitens and belongs to Lycastirrhynchus. Thus nitens Bigot is a valid species (NEW STATUS), not a synonym of nigra Macquart.

Genus Thalamopales Hull

Thalamopales Hull, 1949, Trans. Zool. Soc. London 26:401.

Type-species, Helophilus scitus Walker, 1857

(original designation).

"Fronto-antennal region greatly produced. Face retreating, without tubercle, the epistoma not produced. Head short but wider than the thorax. Eyes bare (male unknown). Occiput thick, with rectangular edge. Second and third antennal segments somewhat elongated. Abdomen as wide basally as thorax but quite elongate. Hind femora moderately thickened, the ventral apex with stiff setae; tibiae slender, arcuate, knife-edged at base. Marginal cell of wing closed and petiolate; loop of third vein moderately deep and rounded, V-shaped. Mesonotum with yellow tomentose pattern. This form is perhaps nearest Meromacrus, with elongate abdomen and produced front." Hull 1949:401.

Discussion: I have not seen the species on which this genus is based, which is represented by a unique type in the British Museum (Natural History). However, I suspect that Thalamopales may only be an aberrant Meromacrus species with a long frontal prominence and reduced facial tubercle. These are the only significant differences mentioned above in Hull's original description, and, unless additional characters are found to correlate with the facial shape, the genus should not deserve generic recognition. Thalamopales may also be a Palpada derivative. The answer to the question of whether Thalamopales is derived from Meromacrus or Palpada depends on the presence (Palpada) or absence (Meromacrus) of pile on the barrette and around the metathoracic spiracle. Vockeroth (in litt.) is currently studying the type and will hopefully settle the problem of the status and derivation of Thalamopales.

Tribe Milesini

Head: face usually bare except Macrometopia, Milesia and some Criorrhina, either concave or tuberculate or straight; oral margin notched anteriorly; facial grooves elongate; antennal pits usually confluent except in Cacoceria; ocellar triangle usually before posterior margin of eyes. Eyes bare except in Macrometopia, either holoptic or dichoptic in male. Antennae usually short, shorter than face except in Sphecomyia and Cacoceria; third segment orbicular or elongate; arista always bare.

Thorax: usually short pile; anterior meso-anepisterna usually bare, completely pilose in Spilomyia, some Temnostoma and Milesia, and with a small patch of pile in Odyneromyia and Valdivia; meso-katepisterna usually with separate dorsal and ventral pile patches except patches united in Temnostoma and Takaomyia; metasterna usually developed, either pilose or bare; scutellum with or without ventral pile fringe; plumulae present; Legs: hind femora frequently greatly swollen and/or armed with apical ventral spurs or plates, always with ventral spines. Wings: anterior crossvein usually at or beyond middle of discal cell except before middle in Valdivia and Hemixylota; marginal cell usually open except closed in Milesia;

third vein frequently with a shallow loop, rarely with a deep loop into apical cell.

Abdomen: variable in shape, from oval to elongate to constricted.

Discussion: The tribe Milesini a rather heterogenuous group as compared to the other tribes recognized here. The Milesini is best defined by exclusion: milesines are those flies 1) with anterior crossvein usually at or beyond middle of discal cell, 2) without a terminal style on antenna, 3) without thoracic bristles, 4) without basal setal patch on hind femur, 5) without ventral spines on anterior four femora, and 6) without plumose aristae. Milesine flies, in general, tend to be rather bare flies with bare faces and aristae, whereas most other syrphids tend to be pilose flies.

Hull (1949) has recognized six tribes within the Xylotinae, the equivalent of my tribe Milesini, which he characterized as follows:

"First, the Xylotini; these are short pilose, setaceous species with the face concave, the femora either slender or greatly swollen and the abdomen sometimes petiolate. Second, the Temnostomini; large, wasp-like, usually bright yellow pollinose, the femora simple, the anterior crossvein at or near the middle of the discal cell. Third, the Milesini; large flies with front more or less produced, the face concave, or plano-concave, the marginal cell closed, or open, the femora

slender and often toothed. Fourth, the Criorrhinini; large, shaggy, woolly, usually long pilose flies, the face generally tuberculate, the metasternum pilose; Lycastris possibly belongs here, or by itself. Fifth, the Pocotini, in which the metasternum is pubescent and the face concave, and which are also rather long pilose as a rule. Lastly the Tropidini, in which the face is distinctly tricarinate." Hull 1949:356.

Hull's subfamily groupings roughly correspond to the tribes recognized here. The limited work done on male genitalia in the course of this study tends to support Hull's groupings of genera, and perhaps, when the tribal groups are revised on a world-wide basis using genitalic characters, they will be found to be sufficiently distinctive to warrant formal recognition as subtribes. However, for the present I have not assigned a definite category rank to Hull's tribes but I have indicated the genera I place in these respective grouping in the tribal table. (see Appendix I).

Key to the Neotropical genera of Milesini

1. Eyes pilose.....Macrometopia Philippi
- Eyes bare.....2
2. Hind femur with apical ventral spur, tooth or plate....3
- Hind femur without any ventral projections.....8

3. Marginal cell (R1) closed and petiolate.....
Milesia Latreille
 Marginal cell open.....4
4. Anterior meso-anepisternum pilose; hind femur with a
 single small ventral spur.....Spilomyia Meigen
 Anterior meso-anepisternum bare; hind femur with a bifid
 spur or ventral plate.....5
5. Anterior crossvein (r-m) with a long spur (Fig. 25).....
Stilbosoma Philippi
 Anterior crossvein without a spur.....6
6. Metasternum bare.....Crioprora Osten-Sacken
 Metasternum pilose.....7
7. Hind femur greatly swollen, with a large ventral bifid
 spur near the apex; metasternum not divided by mem-
 braneous band.....Senogaster Macquart
 Hind femur without a bifid spur, not greatly swollen,
 with a prominent subapical lateral plate; metasternum
 divided into two parts by a basal membraneous band...
Tropidia Meigen
8. Anterior edge of mesonotum and posterior dorsal edge of
 occiput with a transverse row of short spines; post-
 metacoxal bridge complete.....Cerogaster Williston
 Mesonotum and occiput without a transverse row of spines;
 post-metacoxal bridge usually not complete.....9

- 9. Antennae elongate, longer than the face; first antennal segment more than three times as long as broad.....
Cacoceria Hull
- Antennae short, shorter than the face; first antennal segment never more than twice as long as broad.....10
- 10. Hind femur simple, not swollen and without ventral spines; metasternum bare or pubescent not pilose...11
- Hind femur usually with distinct ventral spines; if without distinct spines, then hind femur strongly swollen and arcuate or metasternum pilose.....12
- 11. Face subcarinate, more or less straight in profile, not concave; abdomen greatly constricted at the second segment.....Mutillimya Hull
- Face concave; abdomen not constricted.....
Hemixylota Shannon & Aubertin
- 12. Metasternum bare.....17
- Metasternum pilose.....13
- 13. Scutellum with a ventral pile; meta-episternum bare...14
- Scutellum without a ventral pile fringe; meta-episternum with a few long hairs.....
Syritta Saint Fargeau and Serville
- 14. Face concave, subcarinate; antennae elongate, about as long as face; third antennal segment elongate, usually twice as long as wide; hind femur short and

- greatly swollen; hind tibia strongly arched; with
 very short body pile.....Neplas Porter
- Face usually tuberculate (Fig. 12); antennae short, much
 shorter than the face; third antennal segment
 orbicular or kidney-shaped, never longer than wide;
 hind femur elongate and usually not greatly swollen;
 hind tibiae usually not arched; with at least long,
 thick mesonotal pile.....15
15. Anterior crossvein (r-m) at or before the middle of the
 discal cell (1st M2).....16
- Anterior crossvein at the distal fourth of discal cell..
Criorrhina Meigen
16. Apical cell petiolate, with petiole longer than humeral
 crossvein (Fig. 24)....Aneriophora Stuardo and Cortes
- Apical cell not petiolate, closed at wing margin.....
Flukea Etcheverry
17. Face straight, with distinct keels (Fig. 20).....
Sterphus Philippi
- Face either concave or tuberculate, never straight.....18
18. Third antennal segment deeper than long.....19
- Third antennal segment orbicular or elongate, never
 deeper than long.....20
19. Scutellum with apical emarginate rim.....
Philippimyia Shannon

- Scutellum without apical emarginate rim.....
Crioprora Osten-Sacken
20. Face bright yellow in ground color; metathoracic spiracle distinctly larger than third antennal segment.....Sterphus Philippi
- Face dark in ground color; metathoracic spiracle usually much smaller than third antennal segment.....21
21. Face usually with a tubercle; if without facial tubercle, then either with strongly constricted abdomen or wings bicolored, anterior edge dark and posterior part light.....22
- Face concave; abdomen not strongly constricted and wings never bicolored.....Xylota Meigen
22. Apical cell petiolate, with petiole as long as or longer than humeral crossvein.....Valdivia Shannon
- Apical cell not petiolate, closed at wing margin.....
Odyneromyia Shannon and Aubertin

Genus Cerogaster Williston

(Fig. 59)

Cerogaster Williston, 1888, Trans. Amer. Ent. Soc.

15:285. Type-species, Cerogaster foscithorax

Williston, 1888 (monotypy).

Head: higher than long; face bare, pollinose except keels shiny, carinate, with strong medial and lateral keels, with medial keel slightly concave below antennal pits and slightly rounded below the concavity into a low indistinct tubercle; cheeks narrow; facial grooves long, extending about two-thirds the distance to antennal pits; facial stripes indistinct; frontal prominence low, slightly above middle of head; front of male short, about two-thirds as long as vertical triangle; vertical triangle long, more than twice as long as broad at occiput; front of female broad, as broad at antennae as long; ocellar triangle always distinctly before posterior margin of eyes; occiput with a transverse row of short strong spines on upper half. Eyes bare, narrowly dichoptic in male, with an oblique transverse impressed groove at level of antennal pits. Antennae elongate, slightly shorter than face; third segment always elongate, two or more times as long as broad; arista long, longer than either antenna or face.

Thorax: longer than broad, with transverse row of short strong spines on anterior edge of mesonotum, with a pair of median interrupted transverse golden pollinose bands on anterior half, with one band on anterior edge and the other in front of transverse suture, with very short pile; meso-katepisterna with separate dorsal and

ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna bare, developed; postmetacoxal bridge always complete; metathoracic spiracle small; plumulae very short but distinct; scutellum without ventral pile fringe and without distinct apical emarginate rim. Legs: anterior tarsi flattened, always dark; hind femora swollen; hind tibiae with ventral basal knife edge. Wings: marginal cell open; apical cell petiolate; anterior crossvein at or slightly before middle of discal cell, straight.

Abdomen: slightly petiolate, with constriction on second segment, with third and fourth segments forming a short club.

Material examined: 9(9); aureopila Hull,* foscithorax Williston,* scutellata Curran,* spinosa (Shannon)* and about half dozen undetermined species.*

Discussion: Cerogaster is unique among the syrphids because of its collar of short spines on both the occiput and anterior edge of mesonotum. Also, the complete postmetacoxal bridge is another rather uncommon character in the syrphids: only Sphegina (all); some Neoascia, Valdivia, Ceriodes and Baccha have a complete postmetacoxal bridge. Hull (1943) has written a key to the nine species of the genus but it is impossible to use since

its couplets conflict with each other and the description of various species.

Genus Macrometopia Philippi

(Figs. 9, 61)

Macrometopia Philippi, 1865, Verh. Zool.-Bot. Ges. Wien 15:740. Type-species, Macrometopia atra Philippi, 1865 (monotypy).

Nosodepus Speiser, 1913, Jb. Nassau. Ver. Naturk.

Wiesbaden 66:131. Type-species, Nosodepus minotaurus Speiser, 1913 (monotypy). NEW SYNONYMY

Head: higher than long; face strongly pilose, broadly pollinose on sides, shiny medially, with a weak medial keel, almost straight, with a low medial tubercle, produced slightly downward below eyes; cheeks broad, broader than long; facial grooves short, extending along lower one-third of eye margins; facial stripes indistinct; frontal prominence low, on upper third of head; front of male long, about one-fourth longer than vertical triangle; vertical triangle long, twice as long as broad at occiput; front of female broad, only slightly longer than broad at antennae, slightly longer than face, with strongly convergent sides above, only one-half as broad at ocellar triangle as at

antennae; ocellar triangle clearly before posterior margin of eyes. Eyes strongly pilose, narrowly dichoptic in male. Antennae short, much shorter than face; third segment elongate ventrally, about twice as broad as long; arista long, longer than antenna.

Thorax: about as long as broad, with long pile, with mesonotum shiny and pleurae pollinose; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna bare and under developed; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae elongate; scutellum with ventral pile fringe, without apical emarginate rim. Legs: simple with hind femora not swollen and with very few small ventral spines. Wings: marginal cell open; apical cell closed at costa, without petiole; anterior crossvein slightly beyond middle of discal cell and slightly oblique.

Abdomen: oval in female, suboval in male.

Material examined: 3(3); atra Philippi.*

Discussion: Macrometopia is the only genus, except for Nosodepus, in the tribe Milesini that has pilose eyes. Macrometopia can be separated from Nosodepus, according to Hull (1949), by its: 1) pilose face; 2) bare meta-

sternum; and 3) non-petiolate apical cell. Of these differences, the pilose face and non-petiolate apical cell are usually of only species level importance in related genera such as Criorrhina, and Hull's statements about pilosity are unreliable since he frequently incorrectly described the condition of the pile of various structures (see Vockeroth 1969:16). Although I have not been able to study the species on which Speiser based his genus Nosodepus, I can find no significant differences between the original description of Nosodepus and specimens of Macrometopia. Until Hull's statement about the pilose metasternum can be verified or genitalic or other differences can be found to support the above mentioned minor external differences, Nosodepus should be synonymized under Macrometopia. It is interesting to note the fact that the only milesine flies with pilose eyes are restricted to the mountains of South America and this alone suggest that these flies may have had a common ancestor and perhaps represent only a single genus. Only three species of Macrometopia are known: Macrometopia atra Philippi is rather common in the Andes of Chile and Argentina; minotaurus (Nosodepus) was described from Peru; and Hull described montensis (Nosodepus) from the mountains of Venezuela. No keys are available to separate these species.

Genus Sterphus Philippi

(Figs. 20, 60)

Sterphus Philippi, 1865, Verh. Zool.-Bot. Ges. Wien15:737. Type-species, Sterphus antennalis Philippi,
1865 (original indication) = Xylota coerulea
Rondani, 1863.Crepidomyia Shannon, 1926, Proc. U.S. Nat. Mus. 69(9):47. Type-species, Crepidomyia tricrepis Shannon,
1926 (original designation). NEW SYNONYMYTatuomyia Shannon, 1926, Proc. U.S. Nat. Mus. 69(9):48. Type-species, Tatuomyia batesi Shannon,
1926 (original designation). NEW SYNONYMYSenoceria Hull, 1930, Trans. Amer. Ent. Soc. 56:144.Type-species, Senoceria spinifemorata Hull, 1930
(original designation) = Xylota coarctata Wiedemann,
1830. NEW SYNONYMY

Head: higher than long; face bare, either completely pollinose or pollinose only on sides, carinate, with medial and lateral keels, frequently with keel very strong and straight, rarely with medial keel slightly concave beneath antennal bases and swollen laterally near the oral margin; cheeks broad, as broad as or broader than long; facial grooves long, extending about two-thirds the way to the

antennal bases; facial stripes indistinct; frontal prominence low, above the middle of the head; front of male short, slightly longer than vertical triangle; front of female broad, as broad as or broader at antennal bases than long; vertical triangle of male long, about twice as long as broad; ocellar triangle always distinctly before posterior margin of eyes. Eyes bare, narrowly holoptic in male. Antennae usually elongate, slightly shorter than face, sometimes only half as long as face; third segment usually elongate, rarely slightly orbicular, usually two or more times as long as broad; arista long, longer than antenna.

Thorax: longer than broad, usually with short pile, rarely with long pile, may have a pair of medially interrupted transverse golden pollinose bands on the anterior part of notum; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metasterna bare and developed; post-metacoxal bridge always incomplete; metathoracic pleurae bare; metathoracic spiracle usually enlarged, in some species larger than third antennal segment; plumula ranging from absent to elongate; scutellum with a ventral pile fringe, with or without a distinct emarginate apical rim. Legs: hind trochanters frequently with spurs; hind

femora usually slightly swollen, straight ventrally, with two rows of ventral spines, frequently with ventral spines very strong; hind tibiae frequently with apical spurs. Wings: marginal cell open; apical cell closed and petiolate; anterior crossvein at or beyond the middle of the discal cell, always greatly oblique; anterior margin of wings may be dark.

Abdomen: usually elongate, rarely petiolate; batesi with a long petiole; coarctata with a short petiole; constriction always on second segment.

Material examined: 8(8); coeruleus Rondani,* ?batesi (Shannon),* coarctata(Wiedemann),* darlingtoni (Hull)*(HT), genuina (Williston),* plagiata (Wiedemann),* and tincta (Fluke)* (also about half dozen new species as mentioned below).

Discussion: Sterphus can be separated easily from most milesine syrphids by its carinate face. Only Tropidia, Nepenthosyrphus, and Ceriogaster have distinctly carinate faces and Senogaster, Syritta, Neplas, and Macrometopia have weakly subcarinate faces, but all of these genera except for Ceriogaster and Macrometopia have pilose metasterna. Sterphus can be distinguished from Ceriogaster and Macrometopia to which it is clearly closely related by its: 1) bare face, 2) bare eyes, 3) lack of spines on occiput and anterior edge of mesonotum and 4) incomplete post-metacoxal bridge. Sterphus,

Cerogaster, and Macrometopia all have the metasterna bare and are the only genera except Neplas (pilose metasterna) of the Xylota group with carinate faces or subcarinate faces. These similarities suggest that Sterphus, Cerogaster and Macrometopia had a single common ancestral species and these genera represent just one emigration into South America from the north.

Crepidomyia, Senoceria and Tatuomyia have all been synonymized because the characters on which they are based have been found to intergrade.

Crepidomyia was erected for the species with 1) strong straight facial keels, 2) black faces, 3) elongate third antennal segments, and 4) hind trochanters spurred in the males. Tatuomyia differs from Crepidomyia only in that it has 1) constricted abdomen, and 2) lacks spurs on the hind trochanter of the males. Tatuomyia coarctata was later split off from Tatuomyia as Senoceria because it has a short abdominal petiole instead of a long petiole. Sterphus was originally described for a Chilean species with: 1) elongate abdomen; 2) orange face with weak medial keel; 3) oval third antennal segment; and 4) hind trochanter of male spurred. During the course of this revision I have found a number of new species which are intermediate between all these groups. One new species

(in American Museum of Natural History) is like a typical Crepidomyia but has no spurs on the trochanters. Crepidomyia tincta Fluke has its antennae and face like a typical Crepidomyia but has a slightly constricted abdomen and no spurs on the trochanters. Thus there are species that display the complete transition of the characters of Crepidomyia, Senoceria and Tatuomyia: from elongate abdomen and spurred males (Crepidomyia) to elongate abdomen and non-spurred males (new species), to slightly constricted abdomen and non-spurred males (C. tincta), to constricted abdomen but short petiole (Senoceria), to constricted abdomen and long petiole (Tatuomyia). Two other new species (Dept. Zool., Sec. Agric., Brazil) bridge the gap between Crepidomyia and Sterphus. One is a typical Crepidomyia except that it has an oval third antennal segment and a slightly weaker medial facial keel and the other new species is very similar to the first but has a medial keel like Sterphus and black and orange face. The genitalic differences between the species are not of generic significance (Thompson, in preparation).

Genus Neplas Porter

(Fig. 58)

Planes Rondani, 1863, Arch. Zool. 3:9 (preoccupied,
Bowdich 1825; Saussure 1862). Type-species,
Xylota vagans Wiedemann, 1830 (original designation).

Neplas Porter, 1927, Rev. Chil. Hist. Nat. 31:96
(new name for Planes Rondani).

Head: slightly higher than broad; face bare, narrow, subcarinate, with a weak medial keel and two short lateral keels, slightly concave in profile, completely pollinose; cheeks linear; facial grooves short, extending along lower third of eyes; facial stripes indistinct; frontal prominence low, slightly above middle of head; front of male short, as long as or slightly longer than eye contiguity; vertical triangle long, more than three times as long as broad, more than twice as long as eye contiguity; front of female narrow, slightly less than twice as long as broad at antenna, with convergent sides above; ocellar triangle always distinctly before posterior margin of eyes. Eyes bare, narrowly holoptic in male. Antennae elongate, as long as face or slightly longer; third segment elliptical or elongate, always twice as long as broad or longer; arista bare, longer than antenna or face.

Thorax: longer than broad, with very short pile; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna pilose and strongly developed; postmetacoxal bridge incomplete; pleurotergite with one or more distinct carinate ridges; plumula absent; metathoracic spiracle small; scutellum with ventral pile fringe and apical emarginate rim. Legs: hind femora short, greatly and evenly swollen, with some long ventral bristles as well as two rows of numerous short ventral spines; hind tibiae strongly arcuate, with ventral side forming a long knife edge, ending with short spur. Wings: marginal cell open; apical cell petiolate; anterior crossvein at middle of discal cell and oblique.

Abdomen: elongate and frequently constricted near base; sternites extremely long and narrow.

Material examined: 28(26); armatipes Curran,* frontalis Curran,* and more than a dozen undetermined species.*

Discussion: Neplas is distinguished from the other milesine syrphid genera by the following combination of characters: 1) pilose metasterna; 2) greatly swollen hind femora; 3) strongly arcuate hind tibiae; 4) carinate pleurotergites and 5) scutellum with ventral fringe.

Neplas is frequently considered a synonym of the Holarctic

genus Xylota, s. l., but Neplas is readily separated from Xylota by the following characters, in addition to characters 2, 3 and 4 above: 1) subcarinate faces; 2) very narrow and long sternites; 3) long and narrow vertical triangle in male. I have not seen any Neplas species from outside the Neotropical Region although two Nearctic species have been described from Sierra Madre just north of the Isthmus of Tehuantepec (willistoni Shannon and pauxilla Williston). Curran (1941) provides a key to 12 of the 28 species of Neplas.

Genus Odyneromyia Shannon and Aubertin

(Fig. 62)

Odyneromyia Shannon and Aubertin, 1933, Dipt. Patagonia S. Chile 6:156. Type-species, Doros odyneroides Philippi, 1865 (original designation).

Head: higher than long; face bare, completely pollinose, with a low medial tubercle about half way between oral margin and antennae, slightly concave above tubercle, straight below tubercle; cheeks linear, longer than broad; facial grooves short, extending along lower one-fourth of eye margins; facial stripes indistinct; frontal prominence low, slightly above middle of head;

front of male short, slightly longer than vertical triangle, about three times as long as eye contiguity; vertical triangle short, slightly longer than broad at occiput; front of female broad, slightly longer than broad at antennae, with sides convergent above, slightly longer than face; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, narrowly dichoptic in male. Antennae short, about one-half as long as face; third segment orbicular; arista about one and one-half times as long as antenna.

Thorax: about as long as broad, without distinct light colored pollinose markings on mesonotum, with short pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna underdeveloped and bare; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae very short but distinctly present; scutellum with ventral pile fringe, without apical emarginate rim. Legs: simple except hind femora slightly swollen apically. Wings: with anterior half orange and brown; marginal cell open; apical cell closed at costa, without a petiole; anterior crossvein at or slightly before middle of discal cell, oblique.

Abdomen: petiolate, constricted on base of second segment, narrowest at base of second segment, with petiole short and about one-half length of second segment.

Material examined: 2(2); odyneroides (Philippi).*

Discussion: Odyneromyia can be separated from Valdivia by the following characters: 1) apical cell non-petiolate; 2) anterior crossvein at or beyond middle of discal cell; 3) eyes holoptic in males; 4) frontal prominence near the middle of head not on upper fourth of head; 5) abdomen narrowest at base of second segment, not at middle of second segment; and 6) abdominal petiole short, only about half as long as segments three and four together, not as long as these segments together. Odyneromyia and Valdivia with their: 1) tuberculate faces, 2) simple legs, 3) bare and underdeveloped metasterna, 4) subscutellar fringes and lack of apical emarginate scutellar rims, and 5) constricted abdomens are definitely sister-groups and form a group distinctly different from all other milesine syrphids. The first four characters are shared by only the Holarctic genus Temnostoma which never has a constricted abdomen. Takaomyia, a Far East genus related to the Temnostoma group, has a strongly constricted abdomen but it has a concave face, pilose and developed metasterna.

Odyneromyia includes only two species, both known only from the Andes of Chile and Argentina. The descriptive notes provided by Shannon and Aubertin (1933) with their description of valdiviformis will aid in distinguishing the two species.

Genus Valdivia Shannon

(Fig. 50)

Valdivia Shannon, 1927, Proc. U.S. Nat. Mus. 70(9):31.

Type-species, Valdivia darwini Shannon. 1927

(original designation).

Head: higher than long; face bare, pollinose broadly on sides, with a low medial tubercle on lower third of face, with shallow concavity above tubercle, straight below tubercle; cheeks linear, much longer than broad; facial grooves short, extending along lower third of eyes; facial stripes not differentiated; frontal prominence low, on upper fourth of head; front of male short, shorter than vertical triangle; vertical triangle long, about twice as long as broad; front of female narrow, about twice as long as broad at antennae, less than two-thirds as long as face, with sides convergent above; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, narrowly

dichoptic in male. Antennae short, less than one-half as long as face; third segment orbicular; arista long, about one and one-half times as long as face.

Thorax: about twice as long as broad, with short pile, frequently with lateral borders of mesonotum broadly pollinose; meso-anepisterna with anterior part with a distinct patch of pile in the middle of posterior margin; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna bare and underdeveloped; metathoracic spiracle small; postmetacoxal bridge complete in darwini, incomplete in all other species; plumulae elongate; scutellum with ventral pile fringe, without apical emarginate rim. Legs: simple. Wings: marginal cell open; apical cell petiolate, with a distinct petiole about one-half as long as anterior crossvein; anterior crossvein distinctly before middle of discal cell, usually at basal third of discal cell, straight.

Abdomen: strongly constricted in males, in females of almost uniform width; petiole of male almost as long as third and fourth segments combined, as long as second segment, narrowest at middle of second segment.

Material examined: 6(6); darwini Shannon.*

Discussion: See discussion under Odyneromyia for distinctive characters of Valdivia. Only six species of

Valdivia have been described, all from Chile. Sedman (1965) has provided an up-to-date key to all known species along with figures of the male genitalia of darwini and camrasi. Sedman has pointed out that the aedeagi of darwini (type-species) and camrasi are quite different and these differences "may necessitate a sub-generic splitting of this interesting genus." Too little is still known about some of the species in the genus to do this but I should point out some other structural characters that may correlate with genitalic differences: 1) most species (edwardsi, ruficauda, nigra and camrasi) have incomplete postmetacoxal bridge, whereas darwini has a complete postmetacoxal bridge; and 2) darwini has a facial tubercle in both sexes, whereas edwardsi and ruficauda, the only other species of which the female is known, lack the tubercle in the female.

Genus Aneriophora Stuardo and Cortes

(Figs. 12, 24, 64)

Eriophora Philippi, 1865, Verh. Zool.-Bot. Ges. Wien

15:736 (preoccupied, Simon 1864). Type-species,

Eriophora aureorufa Philippi, 1865 (monotypy).

Aneriophora Stuardo and Cortes, 1952, Rev. Chil. Ent.

2:311 (new name for Eriophora Philippi).

Head: twice as high as long; face bare, lightly orange pollinose, long, produced downwards, one-half of face below bottom of eyes, slightly concave under antennae, with traces of small medial tubercle, straight below tubercle; cheeks shiny, elongate anteriorly, as long as broad; facial grooves short, extending along basal one-third of eyes; facial stripes indistinct; frontal prominence low, on upper third of head; front of male very short, as long as eye contiguity, only one-half as long as vertical triangle; vertical triangle long, more than twice as long as broad at occiput; front of female broad, about two-thirds as broad at antennae as long, slightly more than two-thirds as long as face; ocellar triangle always distinctly before posterior margin of eyes. Eyes bare, holoptic in male. Antennae very short, about one-third as long as face; third segment almost quadrate; arista long, about two and one-half times as long as antenna.

Thorax: as long as broad, mostly orange pollinose except pectus black, with long mesonotal pile; meso-katepisterna with broadly separated dorsal and ventral pile patches; meso-anepimera with posterior portion bare; mero-pleurae bare; metathoracic pleurae bare; metasterna pilose and intermediate in development; postmetacoxal bridge incomplete; metathoracic spiracle medium in size, as large as third antennal segment; plumulae elongate; scutellum

with ventral pile fringe and distinct apical emarginate rim. Legs: simple except for hind femora very slightly swollen before apex in males and with only a few ventral spines, hind tibiae with a short broad rounded projection at apex. Wings: with apical third orange brown; marginal cell open; apical cell closed at costa, without petiole; anterior crossvein at middle of discal cell strongly oblique.

Abdomen: oval; tergites orange with long orange pile; sternite shiny black with black pile. Material examined:

Material examined: 1(1); aureorufa Philippi.*

Discussion: Aneriophora has frequently been considered a synonym or a subgenus of the large almost world-wide genus Criorrhina. The usual reasons for this synonymy is that the only differences between Criorrhina and Aneriophora are insignificant. Aneriophora differs from Criorrhina, s. l., by the following characters: 1) apical cell with a long petiole; 2) apical and posterior crossvein disjunct, not jointing in a line; and 3) coloration, orange instead of usually black and yellow. Further, an examination of the male genitalia indicates that Aneriophora is quite distinctive and not very closely related to Criorrhina but to Temnostoma instead. The aedeagus of Aneriophora is one segmented and has fairly well

developed lateral and dorsal lobes, whereas the typical Criorrhina has a two-segmented aedeagus with very reduced lateral lobes. The very distinctive male genitalia of Aneriophora suggests that: 1) Criorrhina on a world-wide basis is probably paraphyletic or polyphyletic; 2) Criorrhina and related genera were probably derived from a Temnostoma-Aneriophora type of ancestor. In support of the first suggestion, Deinches, the only non-Holarctic "supposed" synonym of Criorrhina I have seen besides Aneriophora, has also been found to have radically different genitalia from the typical Criorrhina and is distinct (see discussion under Flukea). Aneriophora contains only one species, which is restricted to Chile.

Genus Flukea Etcheverry

(Figs. 65, 66)

Flukea Etcheverry, 1966, Publ. Centr. Estud. Ent. 8:1.

Type-species, Flukea vockerothi Etcheverry, 1966

(monotypy).

Head: higher than long; face bare, pollinose in male, shiny in female, concave in female, in male concave beneath antennae with a distinct medial tubercle and straight beneath tubercle, produced slightly downwards, with about

one-third of face below bottoms of eyes; Cheeks narrow, longer than broad; facial grooves short, extending around basal third of eyes; facial stripes distinct, pilose; frontal prominence high, about as high as face is deep, on upper third of head; front of male long, as long as vertical triangle long, about twice as long as broad at occiput; front of female broad, as broad as face, almost as broad at antennae as long, with only slightly convergent sides above, three-fourths as broad at ocellar triangle as at antennae; ocellar triangle small, always before posterior margin of eyes. Eyes bare, dichoptic in male, separated in males by one and one-half times width of ocellar triangle. Antennae short, one-half as long as face; third segment kidney-shaped, twice as broad as long; arista long, twice as long as antenna.

Thorax: longer than broad, with long mesonotal pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; mero-pleurae bare; metathoracic pleurae bare; metasterna pilose and developed; postmetacoxal bridge incomplete; metathoracic spiracle small; plumula elongate; scutellum with ventral pile fringe and without apical emarginate rim. Legs: hind femora swollen and slightly arcuate, without ventral spines; hind tibiae flattened laterally and arcuate.

Wings: with apical third dark and the rest orange; marginal cell open; apical cell closed at costa and without petiole; anterior crossvein slightly before middle of discal cell.

Abdomen: suboval, distinctly emarginate on segments two through four in males, with emargination indistinct in female.

Material examined: 1(1); vockerothi Etcheverry (PTs).*

Discussion: The two-segmented aedeagus, pilose metasterna, kidney-shaped third antennal segment, tuberculate face in male, etc. all indicate a close relationship between Flukea and Criorrhina and its related genera. Flukea and Aneriophora are different from all the genera related to Criorrhina in that the apical and posterior crossveins are not continuous with each other but are disjunctive (Fig. 24) (posterior crossvein ends in fourth vein (m1+2) well before base of apical crossvein and at the base of the apical crossvein there is a distinct m2 spur) whereas in Criorrhina, Sphecomyia, Merapioidus, Deineches and Lycastris (the other genera of the Criorrhina group) the posterior crossvein ends at the base of the apical crossvein and there is no spur at the base of apical crossvein (Fig. 26).

Flukea is easily separated from Aneriophora by its dark coloration as well as by the following characters:

1) dichoptic eyes in male; 2) strongly tuberculate face in male; 3) strongly concave face in female; 4) high frontal prominence; 5) kidney-shaped third antennal segment; 6) absence of emarginate scutellar rim; 7) swollen hind femora; and 8) arcuate hind tibiae.

The genitalia of Flukea are very similar to those of the Australian genus Deinches. The aedeagi of the two genera are virtually identical, but there are a few minor differences in the superior lobes and surstyli of the two genera. However, none of these genitalic differences appear of any more than species importance. Flukea does differ from Deinches in a number of characters besides the wing venation as mentioned above, Flukea has: 1) bare barrette; 2) no apical emarginate scutellar rim; 3) small metathoracic spiracle; 4) broadly dichoptic eyes in male; 5) bare front in male; and 6) anterior crossvein located before middle of discal cell. Deinches was considered by Ferguson (1926) in the most recent revision of the Australian milesine syrphids to be only a synonym of Criorrhina. Ferguson considered the Australian species of Criorrhina "to form a fairly homogeneous group," but Hardy (1921) earlier pointed out that Deinches had the apical and posterior crossveins continuous, whereas in "Criorrhina" they are disjunctive. Hardy goes on to say,

"It is doubtful if this character is sufficient to justify generic separation." As I mentioned above, only the two Chilean genera, Flukea and Aneriophora, have the disjunctive crossvein. Hardy's "Criorrhina" are apparently not the same as the Holarctic Criorrhina species and may belong to either Aneriophora or Flukea. Also, one Australian species, hackeni, is described as lacking the tubercle in the female, a character found among the criorrhine genera in only Flukea. Unfortunately, with the exception of the type-species of Deinches, I have been unable to study any of the other "Criorrhina." For this reason I am forced to leave the questions of inter-relationships between the Australian genera related to Criorrhina and the Chilean ones unsolved.

In summary, Flukea and Deinches are definitely sister-groups and represent the first known case of trans-antarctic relationships among the syrphids and higher Diptera in general. However, until more is known about the Australian components of this relationship, it is not possible to make any further evaluation.

Genus Philippimyia Shannon

(Fig. 67)

Philippimyia Shannon, 1926, Proc. U.S. Nat. Mus. 69(9):47. Type-species, ?Sterphus cyanocephala

Philippi, 1865 (original designation).

Head: metallic bluish, one-third higher than long; face bare, shiny, not pollinose, obliquely retreating below antennae to just above oral margin, straight just above oral margin; cheeks linear, longer than broad; facial grooves short, extending along lower third of eyes; facial stripes very narrow, pilose and pollinose; frontal prominence high, extending distinctly beyond oral margin, at middle of head; front of male long, about four times as long as eye contiguity, as long as vertical triangle; vertical triangle long, about twice as long as broad at occiput; front of female narrow, about twice as long as broad at antennae, about one-third longer than face, with slightly convergent sides above; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, narrowly holoptic in male. Antennae short, about two-third as long as face; third segment trapezoidal, ventral margin longer than dorsal, apical end oblique; arista long, about one-third longer than antenna.

Thorax: as broad as long, metallic bluish, with short pile, without pollinose markings; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna bare and intermediate in development; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae short; scutellum with ventral pile fringe and distinct broad emarginate apical rim. Legs: simple except hind femora slightly swollen. Wings: marginal cell open; apical cell closed just before costa, with a distinct but very short petiole; anterior crossvein slightly beyond middle of discal cell, oblique.

Abdomen: elongate, metallic bluish with short pile.

Material examined: 1(1); cianocephala (Philippi).*

Discussion: Philippimyia is readily separated from most milesine genera by its distinctive face with a strongly protruding frontal prominence. Only the faces of Stilbosoma and some species of Lejota, Xylota, Blera and Somula may be confused with Philippimyia's face. Philippimyia is easily distinguished from all the above genera by the following characters: 1) bare metasterna; 2) simple legs; 3) broadly emarginate scutellar rim; and 4) very short petiole of apical cell. The general habitus of Philippimyia is also very distinctive: completely metallic

bluish flies with elongate abdomen and smoky wings.

Stilbosoma cyanea is the only other South American syrphid with this appearance that I know of, and it may be separated by the characters given above. Philippimyia contain only one species, which is restricted to Chile.

Genus Senogaster Macquart

(Fig. 68)

Senogaster Macquart, 1834, Hist. Nat. Ins. Dipt.

1:519. Type-species, Senogaster coerulescens

Macquart, 1834 (monotypy).

Head: higher than long; face bare, pollinose, concave; cheeks linear, much longer than broad; facial grooves short, extending along lower third of eyes; facial stripes indistinct; frontal prominence low, slightly below middle of head; front of male short, about one-half as long as eye contiguity, less than one-fourth as long as vertical triangle very long, over four times as long as broad at occiput; front of female very narrow, more than four times as long as broad at antennae, one-third longer than face, with slightly convergent sides above; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, narrowly holoptic in male. Antennae short, about three-

fourths as long as face; third segment oval, with apex bluntly rounded, with a basal row of short black spines on inside near arista base; arista long, longer than face.

Thorax: one-fourth longer than broad, with very short pile and two pairs of pale pollinose longitudinal vittae on mesonotum; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepisterna with apical posterior edge raised into a small ridge; meso-anepimera with posterior portion pilose on ventral half; meropleurae bare except with anterior part of barrette pilose; metasterna greatly developed and pilose; metathoracic spiracle small; postmetacoxal bridge incomplete; meta-episterna with a distinct patch of pile behind and below spiracle; plumulae very short but distinct; pleurotergite with one large short transverse keel; scutellum without ventral pile fringe and emarginate apical rim. Legs: anterior four legs simple except for strongly developed basal setal patches on both coxae and base of femora; hind coxae with distinct small tubercle on inner sides; hind trochanter in male with tubercle on inner side larger than coxal tubercle, in female without tubercle but with slight swelling instead; hind femora short, greatly swollen, with ventral apical bifid spur on outer side; hind tibiae slightly arcuate, ending with short blunt spur on outside. Wings: marginal

cell narrowly open at costa; apical cell distinctly closed before meeting costa, with petiole very short and shorter than humeral crossvein; apical and posterior crossveins continuous, without spurs at their bases; anterior crossvein beyond middle of discal cell oblique.

Abdomen: Female abdomen elongate, strongly emarginate on segments three and four, with a pair of strong lateral tubercles and a single low medial swelling on segments three and four, with sternite four swollen medially; male abdomen constricted, with second segment narrowed posteriorly, with third segment cylindrical and forming the petiole, with rest of abdomen club-shaped.

Material examined: 1(1); dentipes (Fabricius).*

Discussion: Senogaster is unique among syrphids for a number of reasons: 1) the male abdomen with the petiole formed by the third segment not the second; 2) the female abdomen with two pairs of large dorsal tubercles (The only other syrphid with abdominal tubercles is "Sphaerophoria quadrituberculata Bezzi but in this species the tubercles are quite different and are restricted to the male) 3) hind femora with a bifid spur, (Stilbosoma, has a bifid hind femoral process but Stilbosoma's process is a large flattened plate-like structure, not a spur.). Also, Senogaster is one of the few syrphid genera with true hind coxal processes. The only other genera with true hind coxal

processes, to my knowledge, are Neocnemodon (males only) and Stilbosoma.

The similar head shape, lack of subscutellar fringe, presence of pile on meta-episterna, pilose and developed metasterna, swollen hind femora, carinate pleurotergite, etc. are some of the common characters shared by Syritta and Senogaster and strongly suggest a sister-group relationship despite all of Senogaster's unique characters. Senogaster is represented by a single wide-spread Neotropical species, whereas Syritta is a large Old World genus absent from the New World until introduced by Man.

Some authors have used Bigot's name Acrochordonodes because Senogaster is supposedly preoccupied. However, it is Williston's unjustified emendation, Stenogaster, that is preoccupied, not Macquart's original spelling, Senogaster. Thus Senogaster is the valid name of the genus.

Genus Syritta Lepeletier and Serville

(Fig. 69)

Syritta Lepeletier and Serville, 1828, Encyclopedie methodique 10:808 (as subgenus of Xylota).

Type-species, Musca pipiens Linne, 1758 as (as Xylota pipiens Meigen) (monotypy).

Head: about one-third higher than long; face bare except for some long hairs narrowly along sides, completely pollinose, subcarinate, with medial keel fairly distinct and slightly concave in profile, lateral keels indistinct; facial grooves very short, extending only half the length to level of tip of oral notch, extending along lower sixth of eyes; facial stripes distinct, pilose, restricted to cheeks only; cheeks very elongate, about eight times as long as broad; frontal prominence low, not clearly differentiated from surrounding area, at middle of head; front of male short, slightly shorter than eye contiguity, about one-third as long as vertical triangle; vertical triangle long, more than twice as long as broad at occiput; front of female fairly broad, slightly less than twice as long as broad at antennae, with sides only slightly convergent above, about two-thirds as broad at occiput as at antennae; ocellar triangle slightly in front of posterior margin of eyes. Eyes bare, narrowly holoptic in male. Antennae of medium length, ranging from two-thirds as long as to as long as face; third segment rectangular, ranging from as long as broad to twice as long as broad; arista short, about as long as antenna.

Thorax: about one-third longer than broad, with lateral mesonotal margin pollinose in front of suture, with

pleurae pollinose, with very short pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepisterna with apical posterior portion bare; meropleurae bare; metasterna pilose and greatly developed; metathoracic spiracle small; postmetacoxal bridge incomplete; meta-episterna with distinct patch of pile behind and below spiracle; plumulae short; scutellum without ventral pile fringe, with distinct apical emarginate rim. Legs: hind femora short, greatly swollen and with a low spinose ridge on outer apical ventral third; hind tibiae arcuate; various species with additional armature on hind legs. Wings: marginal cell broadly open; apical cell petiolate, with petiole long and about as long as anterior crossvein; anterior crossvein slightly before middle of discal cell, straight; spruious vein frequently absent.

Abdomen: elongate, narrowed slightly beyond base of second segment, with apical segment in male club-shaped, with a row of strong curved long hairs at base of second segment.

Material examined: 28(1); pipiens (Linne), flaviventris (Macquart),*

Discussion: The presence of pile on the meta-episterna is found only in three genera of the tribe Milesini, Syritta, Senogaster and Spilomyia. The differences and interrela-

tionships between Syritta and Senogaster have been discussed under the latter. Spilomyia can be distinguished from both Senogaster and Syritta by its slender elongate hind femora with a small apical ventral tooth. The spinose ridge on the hind femora of Syritta is found elsewhere in the syrphids only in the Oriental genus Nepenthosyrphus. Nepenthosyrphus, although closely related to Syritta, is easily separated from Syritta by its strongly carinate face with the median keel convex or straight in profile, not concave.

Syritta is not indigenous to the New World but has been introduced by Man. The larvae of Syritta breed in almost any kind of waste and pipiens has been frequently reported to breed in human feces. Syritta is found throughout the Old World and has its greatest species abundance in Africa. S. pipiens is almost world-wide in distribution being absent in South America. It is possible that S. flaviventris, which is found only in Africa and South America, has occupied the pipiens niche in South America.

Genus Tropidia Meigen

(Fig. 70)

Tropidia Meigen, 1822, Syst. Besch. 3:346.Type-species, Eristalis milesiformis Fallen, 1817

(subsequent designation; Curtis 1832; Brit. Ent.

9: pl. 401) = Musca scita Harris, 1782.

Head: higher than long; face bare, mostly pollinose, carinate, males with strong median keel convex in profile, females with medial keel weaker and frequently concave; cheeks linear, about twice as long as broad; facial grooves short, extending along lower third of eyes; facial stripes distinct, pilose; frontal prominence low, above middle of head; front of male short, slightly shorter than eye contiguity, about one-half as long as vertical triangle; vertical triangle long, twice as long as broad at occiput; front of female broad, about two-thirds as broad at antennae as long, about as long as face, with convergent sides above; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, holoptic in males. Antennae intermediate in length, ranging from about one-half as long as face to as long as face; third segment quadrate, about as long as broad; arista long, about one-fourth longer than antenna.

Thorax: slightly longer than broad, with pleurae and frequently sides of mesonotum pollinose, with short pile; meso-anepisterna with posterior apical edge frequently swollen and ridge-like; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna pilose, greatly developed, with a membranous stripe dividing base from developed ventral portion; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae elongate; scutellum with a broad emarginate apical rim, with or without ventral pile fringe. Legs: hind femora strongly swollen, with ventral triangular plate on apical third on outside; hind tibiae ending in a broad rounded spur. Wings: marginal cell open; apical cell closed distinctly before reaching costa, with petiole very short and shorter than humeral crossvein; anterior crossvein at or beyond middle of discal cell, frequently on outer third of discal cell; apical and posterior crossveins continuous, without spurs at their bases.

Abdomen: elongate, with sides converging slightly towards the apex.

Material examined: 20(6); quadrata (Say), calcarata Williston, scita (Harris).

Discussion: Tropidia is readily recognized by its triangular ventral plate on the hind femora and strongly

carinate faces. The divided metasternum of Tropidia is a unique character among the syrphids. Tropidia is a Holarctic genus with six species extending south along the temperate Andes into Chile. A single species, dicentra Speiser, has been described from outside the Holarctic and Neotropical Regions. However, the description of this African species suggests that it does not belong to Tropidia, the face and plate on hind femora being unlike those of a typical Tropidia. Shannon and Aubertin (1933) provided a key to four of the Neotropical species.

Genus Hemixylota Shannon and Aubertin

(Fig. 71)

Hemixylota Shannon and Aubertin, 1933, Dipt. Patagonia

S. Chile 6:146. Type-species, Hemixylota varipes

Shannon and Aubertin, 1933 (original designation).

Head: slightly higher than long; face bare, pollinose, concave; cheeks linear, about twice as long as broad; facial grooves very short, extending along lower sixth of eyes; facial stripes distinct and pilose; frontal prominence low, slightly above middle of head; front of male long, slightly longer than vertical triangle; vertical triangle rectangular, only slightly broader at occiput than at front,

about one-fourth longer than broad; front of female broad, slightly broader than long, as long as face, with sides slightly convergent above, about three-fourths as broad at ocellar triangle as at antennae; ocellar triangle distinct before posterior margin of eyes. Eyes bare, dichoptic in male, separated in male by about width of ocellar triangle. Antennae short, about three-fourths as long as face; third segment orbicular; arista long, about one-third longer than antenna.

Thorax: slightly longer than broad, with short pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; mero-pleurae bare; metathoracic pleurae bare; metasterna pilose and developed; postmetacoxal bridge incomplete; metathoracic spiracle small; pleurotergite not carinate; plumulae elongate; scutellum with a ventral pile fringe and distinct apical emarginate rim. Legs: simple; hind femora with only a few ventral spines. Wings: marginal cell open; apical cell petiolate, with long petiole; anterior crossvein distinctly before middle of discal cell.

Abdomen: elongate, with parallel sides.

Material examined: 3(3); varipes Shannon and Aubertin (PTs).*

Discussion: In appearance, Hemixylota look likes a typical Xylota but with dichoptic eyes in the male and anterior crossvein distinctly before middle of the discal cell.

Xylota is the only genus with which Hemixylota is likely to be confused, but besides the obvious differences mentioned above, Hemixylota differs from Xylota by its:

1) much smaller metathoracic spiracle, only about one-half as large as third antennal segment; 2) lack of trochanteral spurs in the male; and 3) lack of ventral spines on probasitarsi of male. Chamaesphegina might be confused with Hemixylota because of its concave face, orbicular third antennal segment and elongate abdomen but its lack of subscutellar fringe, scutellar bristles, and reduced alulae will clearly separate Chamaesphegina from Hemixylota.

Only three species of Hemixylota have been described. All species were described from the Chilean Subregion of South America by Shannon and Aubertin (1933) who have provided comparative notes for the identification of the various species.

Genus Stilbosoma Philippi

(Fig. 25, 72)

Stilbosoma Philippi, 1865, Verh. Zool.-Bot. Ges. Wien

15:736. Type species, Stilbosoma rubiceps Philippi,

1865 (subsequent designation; Shannon 1926, Proc. U.S. Nat. Mus. 69 (9):45).

Head: higher than long; face bare, thinly pollinose, concave; cheeks linear, more than twice as long as broad; facial grooves short, extending along lower fourth of eyes; facial stripes distinct, pilose; frontal prominence greatly produced forward, extending far beyond oral margin, above middle of head; front of male long, slightly longer than broad, as long as vertical triangle; vertical triangle slightly swollen, rectangular, broader than long, with sides straight; front of female broad, as broad as face, about as long as broad, about one-fourth longer than face, with parallel sides; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, broadly dichoptic in male. Antennae short, about two-thirds as long as face; third segment large, orbicular; arista short, only about a third longer than antenna.

Thorax: as broad as long, with short pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna greatly developed, pilose; postmetacoxal bridge incomplete; metathoracic spiracle large, but not as large as third antennal segment; plumulae elongate; scutellum with ventral

pile fringe and distinct apical emarginate rim. Legs: hind coxae with a blunt tubercle on inside; hind femora swollen, with apical ventral large notched plate on outside. Wings: marginal cell open; apical cell distinctly closed before reaching costa, but with very short petiole; anterior crossvein at outer fourth of discal cell, with anterior three-fourths strongly oblique and continuous with appendix, at junction of oblique and straight sections.

Abdomen: short and oval.

Material examined: 2(2); cyanea Philippi,* rubiceps Philippi.*

Discussion: Stilbosoma is unique among syrphids for its long spur on the anterior crossvein and large notched ventral plate on hind femora. The spur, which Curran (1923) has called r5, to my knowledge is not only unique among syrphids but all cyclorrhaphous Diptera. Only two species of Stilbosoma are known. Both are restricted to the Chilean Subregion of South America and can be easily separated by the color of their heads: cyanea has a shiny black face and front; whereas rubiceps has an orange face and front.

Genus Milesia Latreille

(Fig. 73)

Milesia Latreille, 1804, Nouv. Dict. Hist. Nat. 24:194.

Type-species, Musca semiluctifera Villers, 1789.

To preserve the long and almost universal usage of Milesia in the sense of Musca semiluctifera Villers as type-species, the International Commission on Zoological Nomenclature should be asked to suspend the rules and suppress Rondani's 1844, Nuov. Ann. Sci. Nat. Bologna (2) 2:455) designation of Musca diophthalma Linne (Type-species of Spilomyia Meigen) and to place Milesia Latreille on the Official List of Generic Names with Musca semiluctifera Villers as type-species.

Head: higher than long; face bare in middle, distinctly pilose on sides, extensively pollinose, concave; cheeks linear, more than twice as long as broad; facial grooves short, extending along lower third of eyes; facial stripes indistinct, pilose; frontal prominence low, slightly above middle of head; front of male short, more than three times as long as eye contiguity, two-thirds as long as vertical triangle; vertical triangle long, about as long as face, more than twice as long as broad at occiput; front of female

narrow, about three-fifths as broad at antennae as long, about one-fourth longer than face; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, narrowly holoptic in males. Antennae short, about half as long as face; third segment quadrate with apical end slightly rounded; arista long, more than one-half longer than antenna.

Thorax: usually longer than broad, with short pile, usually with bright color and pollinose markings; meso-katepisterna continuously pilose from ventral to dorsal margins; meso-anepisterna with anterior portion frequently with pile on upper half, with posterior apical edge swollen ridge-like; meso-anepimera with posterior portion bare; meropleurae bare; metathoracic pleurae bare; metasterna pilose, greatly developed; postmetacoxal bridge incomplete; metathoracic spiracle large, as large as third antennal segment; plumulae short, frequently very short; scutellum with ventral pile fringe and distinct apical emarginate rim. Legs: hind femora slightly swollen, with a small ventral spur near apex. Wings: marginal cell petiolate, with a long petiole; apical cell petiolate, with a long petiole; anterior crossvein at outer fourth of discal cell, greatly oblique; apical and posterior crossvein continuous, without spurs at their bases; anal cell with petiole meeting wing margin perpendicularly.

Abdomen: elongate and parallel-sided.

Material examined: 50(2); scutellata Hull;
virginiensis (Drury), brunetti Herve-Bazin.

Discussion: Milesia is readily recognized by its strongly concave face and petiolate marginal cell. The only other groups with petiolate marginal cells, the Eristalina and some volucellines, all have tuberculate faces. Milesia appears to be one of the most highly specialized syrphid genera as the following characteristics would seem to indicate: 1) petiolate marginal cell; 2) apical anterior crossvein, at outer fourth or more of discal cell; 3) greatly developed metasterna; and 4) concave face.

Milesia, which is a predominantly Oriental genus, is represented by only five New World species, of which two are found in the Neotropical Region. Both species are restricted to Central America. The comparative notes provided by Fluke (1939) in his description of nigra will separate this species from the rest of the New World species, to which Hull (1924) has provided a key.

Genus Spilomyia Meigen

(Fig. 74)

Spilomyia Meigen, 1803, Mag. Insektenkunde 2:273.

Type-species, Musca diophthalma Linne, 1758

(subsequent designation; as Syrphus diophthalmus Fabricius, Coquillett, 1910, Proc. U.S. Nat. Mus. 37:607).

Head: higher than long; face bare in middle, pilose on sides above, straight with a slightly produced epistoma, in some species with a low medial tubercle; cheeks linear, more than twice as long as broad; facial grooves short, extending along lower third of eyes; facial grooves short, extending along lower third of eyes; facial stripes indistinct, pilose; frontal prominence low, on upper third of head; front of male short, about twice as long as eye contiguity, about three-fourths as long as vertical triangle; vertical triangle long, half as long as face, more than twice as long as broad at occiput; front of female broad, ranging from two-thirds to three-fourths as broad at antennae as long, about one-third to one-fourth shorter than face, with slightly convergent sides above; ocellar triangle distinctly before posterior margin of eyes. Eyes bare, holoptic in males. Antennae short, ranging from

three-fourths to one-third as long as face; third segment suboval, slightly longer than broad; arista short, shorter than or equal to antenna.

Thorax: about as broad as long, with short pile; meso-katepisterna with separate dorsal and ventral pile patches; meso-anepisterna with anterior portion pilose; meso-anepimera with posterior portion pilose on anterior basal half; meropleurae bare; metasterna pilose, greatly developed; meta-episterna with a distinct pile patch below and behind spiracle; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae elongate; scutellum without a ventral pile fringe, usually with a distinct apical emarginate rim, without a rim in gratiosa. Legs: hind femora elongate, slightly swollen, with a ventral spur on outside near apex. Wings: marginal cell broadly open; apical cell distinctly closed before wing margin but with a very short petiole; anterior crossvein at outer fifth of discal cell, greatly oblique; anal cell with petiole greatly elongate and parallel to wing margin.

Abdomen: suboval, with apical half of second segment and all of third and fourth segments emarginate.

Material examined: 22(1); fusca Loew, hamifera Loew, longicornis Loew, quadrifasciata (Say), texana Johnson (HT), interrupta Williston, ephippium (Osten Sacken) (HT), gratiosa Wulp,* pleuralis Williston (HT).

Discussion: The presence of pile on both the anterior portion of the meso-anepisterna and meta-episterna as found in Spilomyia is a unique combination among the milesine syrphids. Other distinctive characteristics of Spilomyia are: 1) anterior crossvein strongly oblique and extending to outer fifth of discal cell; 2) hind femora with a small ventral spur near the apex; 3) scutellum with apical emarginate rim; and 4) eyes with metallic patterns. The very similar wing venation of Spilomyia and Milesia along with the common possession of character 2 and 3 above indicate a close relationship between the two genera. Only one species of Spilomyia has been described from the Neotropical Region. Spilomyia gratiosa Wulp was described from Argentina and I have figured the male genitalia of a specimen from the coastal mountains of Brazil. This species does not appear to have been recorded since it was originally described. Gratiosa has an extensively yellow pleuron and will key to pallipes Bigot in Curran's key to Nearctic species (1951). However, it should be readily recognized by its distinctive color pattern which was beautifully illustrated by Wulp (1888) in his original description.

Genus Cacoceria Hull

Cacomylia Hull, 1930, Trans. Amer. Ent. Soc. 56:147

(preoccupied, Coquillett 1906). Type-species,

Cacomylia cressoni Hull, 1930 (original designation).

Cacoceria Hull, 1936, Ent. News 47:277 (new name for Cacomylia Hull).

Head: twice as high as long; face bare, pollinose, straight with a low medial tubercle, produced downward; cheeks broad, as broad as long; facial grooves short, extending along lower third of eyes; facial stripes indistinct; frontal prominence low, as high as facial tubercle, at upper third of head; front of male long, about one-third longer than eye contiguity; vertical triangle small, one-half as long as eye contiguity, about twice as long as broad; front of female short, only three-fourths as long as face, narrow, longer than broad at antennae; ocellar triangle slightly protuberant and distinctly before posterior margin of eyes. Eyes bare, holoptic in male. Antennae very long, more than one and one-half times as long as face; first segment elongate, about four times as long as broad; second segment elongate, more than twice as long as broad; third segment elongate, in female more than twice as long as broad, in male with two long slender adjacent prongs of equal length; arista short, shorter than antenna.

Thorax: as long as broad, with short pile; meso-katepisterna with two widely separated dorsal and ventral pile patches; meso-anepimera with posterior portion bare; mero-pleurae bare; metathoracic pleurae bare; metasterna pilose, greatly developed; postmetacoxal bridge incomplete; metathoracic spiracle small; plumulae short; scutellum with a ventral pile fringe, without a distinct apical emarginate rim. Legs: hind femora greatly swollen medially, tapered at both ends, spindle shaped, with a row of distinct long ventral spines on apical third; hind tibiae strongly arcuate, ending in long ventral spur. Wings: marginal cell open; apical cell petiolate; anterior crossvein at or beyond middle of discal cell, straight.

Abdomen: constricted, with second segment forming petiole, with constriction only one-half of width of second segment.

Material examined: 2(2); one undetermined species.

Discussion: Cacoceria is a rather aberrant genus not closely related to any other milesine genus. The very long antennae, with deeply bifurcate third segment in the male, is unique among the syrphids. The pilose and well-developed metasterna, enlarged hind femora, tuberculate faces in both sexes and subscutellar fringe places the genus in the Milesini but neither the male genitalia nor any other

characteristic reveals any indication of the probable ancestral group. Thompson (1968) called Cacoceria a genus of Myoleptini but at that time was not clear about the limits of either the Myoleptini or Milesini. Only two species of Cacoceria are from Mexico and Peru.

ZOOGEOGRAPHY OF THE NEOTROPICAL MILESINAE

INTRODUCTION WITH A REVIEW OF CONTINENTAL DRIFT AND ITS
EFFECT ON THE NEOTROPICAL FAUNA

Ever since evolution replaced the biblical notion of creation as an explanation of organic diversity, biologists have been left with the question of when, from where, and how did animals distribute themselves. In fact, it was the observation of present and past distributions of animals, particularly those of South America, that led Darwin to doubt the idea of special creation and to suggest evolution instead. Thus, modern zoogeography began with Darwin's On the Origin of Species, 1859. Since then, there have developed two main schools of thought on animal and plant distribution.

One school has stressed the positions of and connections between the land masses as being of major importance in the dispersal of living things whereas the other stresses mainly climate and evolution. The former school at first contented itself with hypothesizing land bridges and connections wherever necessary to explain the various distribution patterns of living things. Characteristic of this early period of bridge building is Gadow (1913) (also Croziat, 1958). Later, Wegener presented a mechanism by which the dispersal of the continents, and thereby life, could be explained.

However, Wegenerians, as the landmovers are called, fell into disrepute until very recently, the geologists being unwilling to accept the Wegenerian idea of movement of the continents.

The other school feels that the movement of the continents and the presence of land bridges other than those present now are not necessary to explain the distribution patterns of life. They maintain that the forces of competition and climate working directly and through evolution are sufficient to account for the distribution patterns of animals and plants. Matthew's name is usually identified with this school because of his concise statement of it in his book, Climate and Evolution, but Darwin actually was first to suggest the interrelationship of climate and distribution (see chapters on Geographical Distribution in On the Origin of the Species). The renewed interest in evolution at the beginning of the present century, culminating in Huxley's Modern Synthesis of Evolution, has greatly strengthened the Matthewite point of view and thus enabled the Matthew followers to dominate the field. Recently geologists have substantiated the Wegenerian view of a dynamic earth with wandering continents, thus reviving the Wegenerian point of view.

As with all disputes, neither side is all right or all wrong, both have valid points. As Darlington, a Matthewite, has clearly stressed, favorable climate and large areas are

related to the evolution of dominance among animals and there is a trend for the more competitive organism to evolve and disperse from the tropics and to replace the less efficient elsewhere. But it is also true that the continents have not long been where they are (much modern literature in both geology and biology) and their migration has influenced the distribution of past and present organisms. To deny either one is to see only half of the true picture. Since Darlington (1957:chap.9; 1965:chaps.5&6) has done an excellent job in summarizing the interrelationships and effects of area, climate, and evolution on dispersal and distribution patterns, I will not delve into these here. However, the past history of land connections has been greatly neglected in the biological literature due to the dominance of the Mattheuite school of thought. Therefore, I will briefly review these connections and their biological implications for South America.

The following review of the geologic history of South America and the southern continents is mainly based on King's Morphology of the Earth (2nd Ed., revised 1967) but other sources such as Carey (1958) and Runcorn (1962) have been reviewed. It is restricted to describing the relative positions of the continents and the major geologic events that might have biological significance.

Fortunately, the history of the geographical relationships of South America to other land masses is fairly well

known since South America has been one of the key points of emphasis in proof of the Continental Displacement. When animals first came out on land, sometime in the Devonian Period or earlier, they probably found South America part of a large supercontinent called Gondwanaland. Gondwanaland consisted of all the southern continents: South America, Africa, Antarctic, India, Australia, and associated islands. It is not clear when this supercontinent was first formed since as one goes further back into time, the geological record becomes more fragmentary. There are some indications, such as strike direction in the basement rock of the southern continents (King 1967:84), that Gondwanaland has existed since Pre-Cambrian times. By the time of the arrival of the first insects in the Carboniferous the evidence is overwhelmingly in favor of the existence of Gondwanaland.

Although the southern continents were united in as a single unit throughout the Paleozoic Era, they were not stationary. They moved considerably as a unit before breaking up as the accompanying text maps illustrate. This displacement is a critical determinant of climate since it determines position relative to the poles and thus affects the angle of incidence of sun's rays. Gondwanaland was tropical for most of its existence.⁴ As Darlington (1957,1965)

⁴The tropics are by definition the areas of the earth where the sun's rays fall perpendicularly (Darlington,1957:4). Thus, the tropics are bounded by the tropic of Cancer and Capricorn (23°27' north and south of Equator).

has pointed out, the tropics are the workshop of evolution and the main trend in animal distribution is for dominant groups to arise in the tropics and to move outward. Thus, the paleoclimate of South America, as determined by the relative continental position, is a major factor in the determination of the size and diversity of the Neotropical fauna.

Besides the paleoclimate of South America, the history of accessibility of South America to the influx of animals from other continents is also a major factor affecting faunal composition. During the Paleozoic Era there were a number of cordilleras stretching across the various areas of Gondwanaland that later broke up into the present southern continents. These formerly continuous cordilleras provide an explanation for the present disjunctive distribution of various ancient cold-adapted groups of animals in the southern hemisphere, as has been shown by Brundin (1966) for the primitive austral chironomid midges. The question of whether there was a connection between the southern land mass, Gondwanaland, and its northern counterpart, Laurasia, during the late Paleozoic is still a moot point. Present geological evidence strongly suggests that if there was a connection between Laurasia and Gondwanaland, it was not through the South American area of Gondwanaland.

Towards the end of the Carboniferous Period and during the early part of the Permian Period Gondwanaland was extensively glaciated. It was then much further south than now and the land mass was moving through the South Pole area (Irving and Robertson, 1968). As Gondwanaland swung in an arc across the South Pole, the land mass was progressively glaciated slowly from west to east. The glaciation was followed by a cold-temperate climate period. Thus, for example, Australia was glaciated later than the other continents and remained cold throughout the Permian while the Congo and India were semi-tropical (King, 1967:55). The Permo-carboniferous glaciation was restricted to the southern continents, as one would expect if the phenomenon was due to the displacement of the continents and not a world-wide climate change.

The disruption of Gondwanaland in the Mesozoic Era into its various component continents was the result of two major breaks (see text maps). The first divided Gondwanaland into a western and an eastern component. The eastern component consisted of Australia, India, and possibly Antarctica, whereas the western part contained South America and Africa. The questionable position of Antarctica in either the western or eastern component is due mainly to the lack of paleomagnetic data from this continent. The time of this first break is also somewhat uncertain at present. Opinions on the

time of breakup of eastern Gondwanaland range from the beginning of the Mesozoic to the beginning of the Tertiary. Irving and Robertson (1968) have suggested that the fragmentation began between the Permian and Triassic Periods whereas King (1967) thinks it started in the middle of the Jurassic Period. These discrepancies need not worry the reader since the connections between South America and the continents of eastern Gondwanaland were always indirect, either through Africa or Antarctica. Thus, the important break is the second one, between South America and Africa (or the rest of Gondwanaland, if you please), and the time of occurrence of this break is well documented. In the mid-Cretaceous period the Atlantic basin began to open up in the south and gradually the two continents, Africa and South America, moved apart. The separation was complete by Upper Cretaceous times and South America drifted slowly westward to its present position, arriving there at the beginning of Tertiary times.

The rest of the geological story of South America is the same whether one be a Wegenerian or conventional geologist. As Darlington has defended and clearly stated, "the Tertiary isolation of South America is a fact" (Darlington, 1957:594). However, during the Tertiary the water gap between North America and South America fluctuated in size with changes in the geomorphism of Central America and

the Antilles. There were two island arcs, Lesser Antilles and present Panama area, over which some animals could have "leap-frogged" their way into or out of South America. The Lesser Antilles form such a connection from South America through Trinidad and Tobago to Greater Antilles, the latter being simply an extension of the North American cordilleran structures. The Panama island arc connected Columbia with the south borders of Nicaragua. Both island arcs appear to have been present and above water since the late Cretaceous Period. During the late Pliocene and early Pleistocene, the Panama island arc became a continuous land bridge.

In summary, there are three key geological time points in respect to the biogeography of South America. First, up to the mid-Cretaceous times South America was directly connected to Africa, and earlier still in the Paleozoic Era both of these continents were also attached to Antarctica, Australia, and India, forming a single land mass called Gondwanaland. Second, South America was an island from the time it separated from Africa until the time the present isthmus of Panama was formed, that is, from Upper Cretaceous to the end of Tertiary. Third, throughout the Tertiary there was a fluctuating water gap between South America and North America with islands in between them. Therefore, there should be three corresponding faunal and floral strata in South America, reflecting the geologic history: old residents

from Gondwanaland, island-hoppers crossing narrow water gaps from North America during the Tertiary, and recent arrivals coming by way of the isthmus of Panama during the Pleistocene.

GENERAL ANALYSIS OF THE ZOOGEOGRAPHY OF THE NEOTROPICAL
MILESINE FAUNA

Gross statistical analysis of the Neotropical milesine fauna in comparison to the other regional faunas.

The zoogeography of the Neotropical milesine syrphids will be examined from a general viewpoint; first, by comparison of the gross statistics (such as number of species and genera) of the Neotropical milesine fauna with the fauna of various other regions; and second, by plotting the distribution of the Neotropical genera on maps and studying the resulting patterns. The treatment of the individual genera has been included under the generic discussions.

Table III lists the number of milesine genera and their species endemic to each particular region, along with the total number of milesine genera and species for that region. The species counts are approximate for the number of species described as of 1965 exclusive of fossil species; and were compiled from the following sources: Wirth et al (1965) for the Nearctic region, exclusive of Mexico; Fluke (1956) for the Neotropical region and Mexico; Hull and Fluke (1950) for the genus Cheilosia, sensu lato; Hull (1949) for the rest of the world; and the Zoological Record (1945-65). During the course of this study on Neotropical milesine genera I have

critically reviewed about 80% of the world milesine genera. The total number of genera and the number of endemic genera listed for each particular region considerably reflect my opinions of what are good genera (see Appendix II).

The amount and nature of the taxonomic work on a particular region can greatly affect the number of taxa being recorded for the area. In the analysis of any quantitative zoogeographic data the taxonomic bias should be nearly the same from region to region. The only area of the world on which there has been significantly more systematic work done relative to the rest of the world is Europe. Thus the greater amount of taxonomic work on the Palearctic region may bias the figures. Whether taxonomists split or lump taxa in their work can also affect the number of taxa. Thus it is essential that degree of clustering of taxa be nearly the same for the faunal regions being compared. On the species level, the problem of the "splitters and lumpers" is not significant in syrphids since there has been very little use of the infraspecific categories, such as variety, form, subspecies, etc., and most workers have used the same operational definition of a species. On the generic level, when I critically reviewed the world milesine genera I tried to apply criteria (see Introduction, definition of genus) uniformly so that figures for the numbers of genera for each region would have a uniform base. Only in some of the eristaline groups do I feel that I may have had a tendency

to lump more than I did elsewhere. I have not recognized a number of subgroups in the Eristalini, such as the subgenera of Mallota, Mesembrius, and Eristalis. There undoubtedly has been a large eristaline radiation in the Old World tropics and some of the groups that I have not recognized are possibly valid; a thorough study is needed (fortunately Vockeroth has started such a study). When the eristaline radiation is worked out, it is doubtful that more than a dozen genera will be added to the syrphid faunas of the Old World tropics (Palearctic, Ethiopian, and Oriental). Such an eventuality would not upset my conclusions on zoogeographic relationships between the Neotropical fauna and the rest of the world. Thus the numbers in Table III should allow for reliable zoogeographical interpretations.

The regional milesine faunas are either quite large or small; none are intermediate in size. Interestingly, the range of variation in the number of species amongst the small faunas is the same as for the large faunas, about 150 (except for the intensively worked Palearctic fauna). Even the minimum gap between the numbers of species in the large and small faunas is more than twice the above figure, over 300. The Neotropical region, along with the Palearctic, Nearctic, and Oriental regions, has a relatively large, rich milesine fauna, whereas Australian and Ethiopian regions have rather depauperate faunas.

TABLE III Number of genera and species, total and endemic, for each faunal region.

Region	# endemic genera- species	# genera	#species
Palaearctic	16 -- 32	70	805
Nearctic	15 -- 35	66	738
Holarctic	17 -- 513	91	1523
North-Temperate	48 -- 579		
Ethiopian	5 -- 19	22	267
Neotropical	26 -- 137	42	570
Oriental	9 -- 20	45	652
Australian (includes Oceania)	13 -- 19	26	150

TABLE IV Land area for each faunal region, from Lane (1949).

Region	Area of region in square miles	Rank
Palaearctic	17,421,000	1
Nearctic	7,335,000	4
Holarctic	24,756,000	-
Ethiopian	10,762,000	2
Oriental	4,120,000	5
Neotropical	7,721,000	3
Australian	3,610,000	6

The various faunal regions are not of uniform land size (Table IV) and because large areas tend to have larger numbers of taxa than smaller areas, dividing the number of taxa by a unit of area produces more meaningful comparative figures. The effects of area on number of taxa are not arithmetic but geometric. However, within the range of values for the areas used in the present analysis, an arithmetic interpretation is sufficient to compensate for the area factor and thus to help evaluate the other influences affecting faunal size (see Williams, 1964, for details on the mathematical interpretation of species and area problems).

The numerical relationships between land area and number of taxa is not the same for all categories: as area becomes smaller, there is a greater effect on the lower categories like species than on higher categories like genus. Thus, a very small area may have many genera but only one species per genus, whereas a large area may have a few more genera but many more species per genus. For example, the milesine fauna of the Juan Fernandez Islands consist of two tribes representing two broad ecological niches, the terrestrial short-tailed maggots and the aquatic long-tailed maggots, but only one genus and species for each of the two broad niches as opposed to Chile with five tribes, twenty-three genera, and about fifty species representing the same two broad niches.

The relationships indicated for the different milesine faunas based on the diversity per unit area (Table V) are quite different from those based on the unadjusted numbers of taxa (Table III) per faunal area. Although Africa, even based on diversity per unit area, has a depauperate milesine fauna, the small Australian fauna is as rich in species per unit area as is the Palearctic fauna and about twice as rich in genera. The Neotropical and Nearctic milesine faunas are intermediate in terms of diversity per unit area and the Oriental region has significantly more milesines than all others.

The differences between the figures of diversity per unit area for the various milesine faunas reflect mainly variation in climate and to some extent the history of accessibility of each faunal region to animals from other regions. Tropical climates produce much larger faunas than temperate climates when the land areas and other factors are equal. Islands and isolated continents generally have smaller faunas than connected areas when climate, area, etc. are equal¹ (see Darlington 1957&1965, and also MacArthur and

¹ The above are general statements applying to taxonomic units occupying a wide variety of habitats and niches (sensu Elton). The milesine syrphids are such a large, diverse group that these general statements do have applicability to them. However, it would be absurd to apply, for example, the statement about tropical climate to a group like the Capniidae, a strictly cold adapted group of stoneflies.

Wilson 1966, for detailed discussion of the area, accessibility, and climate factors). Unfortunately, there is no numerical method or index for working with the climate or accessibility factors of a faunal region for the study of the taxonomic diversity of that region as there is for the area factor. Thus the best way to study the effects of the climate and accessibility variables is to designate a "standard" faunal region and compare the others with it. The Oriental region has the optimal conditions of both climate and accessibility and therefore provides a good reference point or "standard" for comparison.

As Darlington (1957) has pointed out, the tropics are the workshop of evolution and for the workshop to be most efficient in producing species variety, it must be readily accessible for the inflow of new types. The Oriental region is almost completely within the tropical belt of the world with mostly tropical rain forest type of habitat, and has been readily accessible to the Palearctic and other faunal regions throughout the Cenozoic Era. As would be expected of a region with such ideal conditions, the Oriental region has a significantly greater milesine generic and species diversity per unit area than all other faunal regions. The Neotropical region and Australian region to a lesser extent also have extensive tropical areas, but both of these regions have been isolated from the rest of the world for long periods

TABLE V Milesine diversity per unit area (100,000 sq.miles) for each faunal region.

Region	Generic	Specific
Palaearctic	.42	4.6
Nearctic	.90	10.0
Holarctic	.37	6.1
Ethiopian	.20	2.5
Neotropical	.55	7.4
Oriental	1.09	16.0
Australian	.72	4.2

TABLE VI Endemic levels for each milesine syrphid fauna.

Region	Per cent of Endemic Genera	Endemic Quotient
Palaearctic	04	22
Nearctic	04	22
Holarctic	38	52
Ethiopian	07	23
Neotropical	24	62
Oriental	03	20
Australian	13	50

of time and this isolation probably accounts for their smaller milesine syrphid unit-area faunas relative to the Oriental region.

If isolation has indeed been a major factor in determining the diversity of a fauna, then one would expect a high percentage of endemic genera and a high endemic quotient (EQ). Endemic quotient is defined as the percentage of the total number of species represented by the species in the endemic genera. The endemic quotient and percentage of endemic genera are about the same for all the faunal regions except for the Australian and Neotropical⁵ regions (see Table VI). The high endemic levels (EQ and percentage of endemic genera) for the Neotropical and Australian milesine syrphid faunas confirm the geological evidence that these faunas have long been isolated. The difference in endemic levels between Neotropical and Australian milesine syrphid faunas are probably due mainly to differences in accessibility and secondarily to differences in sizes of the regions. Table VI can be modified to show, by dividing by units of

⁵The endemic quotient of the Neotropical region is rather conservative because of the arbitrary boundary of the Neotropical region which excludes the consideration of Copestylum and Palpada as endemic Neotropical genera. These two large genera account for about 70% of the total South American milesine fauna but about 10% of species of Copestylum and Palpada have extended their ranges across the Neotropical-Nearctic boundary into Mexico and southern United States (see below under Transition between Neotropical and Nearctic fauna). If these two Neotropical radiations were scored as endemic, since they certainly had a recent origin in South America, the endemic quotient would be about 98% instead of 62%.

area (million square miles, 8 and 4, for example), that the endemic diversity per unit area is slightly higher for the Australian fauna than the Neotropical. Thus it can be safely stated that the slightly higher endemic levels per unit area for the Australian region are due to its slightly longer period of isolation than that of South America.

The Holarctic or North Temperate region has been physically joined to the Ethiopian and Oriental regions throughout the Cenozoic Era (also intermittently connected to South America). Therefore, the only plausible isolating mechanism to explain the high endemism of the Holarctic faunal fauna is climate. The southern limits of the Holarctic region are, by definition, the tropics. Thus any northern group of animals that is strictly cold adapted will be limited to the Holarctic region.

The Nearctic faunal syrphid fauna is numerically significantly larger than the Neotropical one. Since the areas of both regions are roughly the same, the difference is probably due to the greater accessibility of the Nearctic region. This greater accessibility in comparison to the Neotropical region is due to North America's intermediate position between the Old World and South America. Thus the Nearctic region can receive taxa from both the Old World and the Neotropical region, whereas the Neotropical region can receive taxa from the Nearctic region only. The Neotropical

milesine contribution (8 genera and 157 species) to the Nearctic fauna alone is sufficient to compensate for the difference between the two regions. And considering that the Nearctic fauna also receives a large number of taxa from the Old World too, it is clear how the Nearctic region with a less extensive tropical area can have a larger milesine fauna than South America with its extensive tropical areas.

The reasons for the apparently depauperate milesine fauna of the Ethiopian region are not clear. The relatively small African tropical rain forest area, in conjunction with the Sahara Desert acting as a barrier, could help account for the reduced faunal variety of Africa. However, the low percentage of endemic genera and low endemic quotient for the Ethiopian region tend to suggest that geographic isolation has not been a significant factor. Similarly the reasons for the significant differences between the Nearctic and Palearctic milesine faunas when adjusted for area factor are not apparent unless one assumes an upper limit for the area factor beyond which it does not affect faunal size. Both regions have a similar climate and history of accessibility.

In summary, from a gross analysis of numbers of endemic genera and their species, along with total numbers of genera and species of the milesine syrphids of the major world faunal regions, several conclusions have been reached about

the Neotropical milesine fauna: 1) Neotropical milesine fauna is relatively large in terms of absolute numbers of species and genera; 2) Neotropical fauna in diversity per unit area is only intermediate; 3) South America's relatively low milesine diversity for such a large area with extensive tropical climate is probably related to long isolation from the rest of the world; and 4) South America's unusually large number of endemic genera and high endemic quotient strongly supports the idea of a long isolated South American milesine fauna.

Patterns of distribution of the Neotropical milesine genera.

When the geographic distributions of the Neotropical milesine syrphid genera are plotted on maps of the world the results can be grouped into four distinct patterns (see text maps 7 - 10). The first pattern represents the Holarctic endemic genera extending into the transitional zone between the Neotropical and Nearctic regions and marking the southern limits of the Nearctic fauna (see section below on transition between Nearctic and Neotropical faunas).

The second pattern also represents predominantly northern groups, but these extend into the Neotropical region along the Andean cordillera. The genera of the second pattern, like the above ones, are restricted to the temperate

climate except for two genera, Rhingia and Spilomyia, extending across South America from the Andes to the semi-tropical coastal mountains of Brazil. I have called the genera of the second pattern, "recent invaders," due to the fact that these genera have not yet: 1) evolved new generic distinctions, nor 2) adapted to the true tropical climate. The older resident groups, Pattern III, have evolved generic distinctiveness in South America and can be divided into two groups depending on whether or not some of their species have had time to adapt to tropical climates. The two groups of endemic milesine genera are reflected by their different distributional patterns; Pattern IIIa representing endemic genera which have become adapted to the tropics, whereas Pattern IIIb represents endemic genera restricted to the temperate Chilean subregion.

It is quite apparent where the non-endemic Neotropical milesine genera (Pattern II) came from since their restricted distribution in South America along the Andean cordillera but widespread distribution in the northern hemisphere strongly suggests that these genera have recently moved into South America by way of the Panama isthmus from the north. However, the question of where the endemic Neotropical genera came from is not quite as obvious. Some Neotropical endemic genera could possibly have come also from more distant places, like Australia or Africa. To decide which was or were the

source or sources of the endemic Neotropical genera, two types of approaches will be used: one, by working out the phylogenetic relationships of the endemic genera and relating this to geographic origins; and two, by working out the history of the land connection of South America to see which routes of introduction were most plausible.

The history of the land connections between the Neotropical region and the rest of the world has already been discussed, so it will be sufficient just to point out where the milesine syrphids fit into the time table of that history. The first fossil syrphids known are from the Eocene period and they are representative of both present day subfamilies. Thus, the origin of the family and divergence into two subfamilies must have been before Eocene times. The two subfamilies probably arose in the Paleocene and the family itself probably in the late Cretaceous Period (Hull, 1945; also see Hennig, 1954). The relatively young age of the family Syrphidae and the subfamily Milesinae places their origin at a period in time when South America was an island. Thus either 1) the family arose in the Neotropical region and spread out to the rest of the world, or 2) the first syrphids must have crossed a water gap to South America. The presence of a large number of fossil syrphids (35 genera, 75 species) in Eocene, Oligocene, and Miocene deposits from the northern continents strongly suggests that the family

did not arise in the Neotropical region, since this would have required rather rapid and frequent dispersal from South America across a large water gap in the very early part of the Tertiary. Also, as will be shown below, through phylogenetic evidence, all endemic Neotropical milesine genera are recently derived obviously from more primitive genera in other parts of the world.

In studying zoogeographical relationships of the endemic Neotropical genera, two questions are of interest: first, what is the location of the non-endemic group most closely related to the taxon in question (its sister-group); and second, if there is a non-endemic sister-group, in which direction did the past dispersal take place. If no non-endemic sister-group is found, then the group in question probably arose in the area where it is found. However, if a non-endemic sister-group is found, then there must have been some past dispersal. This dispersal could be of two types: 1) the ancestor of one of the sister-groups disperses to a new area, or 2) the ancestors of both sister-groups disperse to new areas. In the first case, only two different areas are involved and in the second case, three. Almost all endemic Neotropical milesine genera have a strictly northern group as their nearest relative (see Table VII, VIII), strongly indicating that only two areas are involved as possible sources of the Neotropical endemic genera, South

TABLE VII Sister-group relationships of the Chilean endemic milesine genera.

<u>Chilean Genus</u>	<u>Sister-group</u>	<u>Location of Sister-group</u>	<u>Status of Sister-group in</u>	
			<u>Ethiopian</u>	<u>Australian</u>
<u>Chamesp hegina</u>	<u>Neoascia</u> <u>Sphegina</u>	Holarctic	absent	absent
<u>Chromocheilosia</u>	<u>Myolepta</u>	mainly Holarctic	absent	absent
<u>Notiocheilosia</u>	<u>Callicera</u>	mainly Holarctic	absent	absent
<u>Valdivia</u> and <u>Odyneromyia</u> *	<u>Temnostoma</u>	Holarctic	absent	absent
<u>Eriophora</u>	<u>Criorhina</u>	Holarctic Oriental	absent	???
<u>Macrometopia</u>	<u>Xylota</u> group	Holarctic Oriental	absent	? absent
<u>Philippimyia</u>	<u>Blera</u>	Holarctic	absent	absent
<u>Hemixylota</u> and <u>Stilbosoma</u> *	<u>Milesia</u>	Holarctic Oriental	absent	absent
<u>Flukea</u>	<u>Deinches</u>	Australian	absent	absent

*The two genera listed have the same extralimital sister-group.

TABLE VIII Sister-group relationships of the Neotropical milesine radiations.

<u>Radiation</u>	<u>Sister-group</u>	<u>Location of Sister-group</u>	<u>Status of Sister-group in Ethiopian Australian Regions</u>
<u>Trichopsomyia</u>	<u>Neocnemodon</u>	Holarctic	absent
<u>Ornidina</u>	<u>Volucella</u>	mainly Holarctic	absent a few spp.
<u>Nausigaster and Alipumilio</u>	<u>Eumerus</u>	Megagea	radiation present
<u>Lepidomyia</u>	<u>Myolepta</u>	mainly Holarctic	absent
<u>Quichuana</u>	<u>Mallota?</u>	mainly Holarctic	absent
<u>Habromyia</u>	<u>Mallota</u>	mainly Holarctic	absent
<u>Palpada and Lycastirhynchus*</u>	genus #1 <u>Eristalis</u>	mainly Holarctic	1 sp. (tenax)**
<u>Meromacrus</u>	genus #1 <u>Eristalis</u>	mainly Holarctic	1 sp. (tenax)**
<u>Cerioides</u>	???	???	???
<u>Sterphus and Ceriogaster*</u>	<u>Chrysosomidia Habromyia</u>	Nearctic	absent
<u>Neplas</u>	<u>Chalcosyrphus</u>	Nearctic	absent

*As in Table VII. **Eristalis tenax is now cosmopolitan and was probably introduced into the Australian and Ethiopian regions by man.

TABLE IX Sister-group relationships of miscellaneous endemic Neotropical milesine genera.

<u>Genus</u>	<u>Sister-group</u>	<u>Location of Sister-group</u>	<u>Status of Sister-group in Ethiopian Australian Regions</u>
<u>Cacoceria</u>	? <u>Temnostoma</u>	Holarctic	absent
<u>Senogaster</u>	<u>Syritta</u>	Megagea	radiation
			absent

America itself and North America. The few remaining endemic Neotropical milesine genera, except for Senogaster and Flukea, are closely related to genera found throughout most of the world including the Nearctic region. Thus these few endemic genera could possibly have had their origins on almost any continent, but the probabilities, based on the majority of the cases being of New World origin, strongly favor that these are also of Nearctic or Neotropical origin.

Only two particular cases suggest a non-New World origin of an endemic Neotropical milesine group. The monotypic genus Senogaster is most closely related to Syritta, which is absent from the Nearctic region but is abundant in the Ethiopian region. Flukea is the sister-group of Deinches, an Australian endemic genus. Since Senogaster and Flukea are monotypic, I would suggest, in these special cases, either wind dispersal or rafting across the oceans to explain these two exceptions to the general pattern of endemic Neotropical milesine genera (as well as all higher Diptera - see Vockeroth 1969)- having a northern sister group.

Although most endemic Neotropical milesine genera have a northern sister-group, the location of the sister-group does not indicate the direction of past dispersal unless we know which sister-group is primitive or have other information about the geographical location of the ancestral group to both sister-groups, i.e. fossils. The fact that the

sister-groups of the Neotropical endemic milesine genera are almost always found in the Nearctic region mutually supports the geological evidence that there are only two probable sources for these genera, Nearctic or Neotropical regions. The dispersal of the ancestor of either sister-group probably took place during the Tertiary Period, as indicated previously, thus allowing both sufficient time and isolation for the evolution of generic distinctiveness. The Tertiary isolation of South America, which greatly restricted faunal interchanges, would tend to cause the retention of primitive forms in the area where they arose and insure the dispersal of the derived forms across the barrier. The hypothesized nature of the selective or filtering mechanism affecting the fauna of South America, the isolating Tertiary water gap, is based on the following evolutionary observation. The fossil record indicates that higher taxa also have a definite life cycle, as species have: a new taxon comes into existence, quickly grows abundant and diverse, spreading over many niches and much land area, and then leveling off at a peak point. From this peak point in the life cycle of the taxon, three different things may happen: 1) the taxon may give rise to new taxa, 2) it may be replaced by another taxon and quickly go to extinction, or 3) it may persist in low numbers and in specialized niches or isolated areas. Thus it would appear that the derived groups of animals, being

more numerous and widespread, have a greater probability of crossing a barrier than primitive groups which tend to be rare and restricted in range. The Tertiary ocean between South and North America was a constant barrier to syrphids: no syrphid has ever become adapted to survive in salt water. In summary, if syrphids arose in South America, then the oldest syrphids should still be there. However, if syrphids arose elsewhere, these primitive groups probably would not have been able to cross the barrier into South America and therefore they should be absent from the Neotropical region.

Knowing whether the endemic South American genera are either derived or primitive is essential for indicating the direction of past dispersal. In the determination of the phylogenetic relationship between the northern and Neotropical genera, the sister-groups must be dealt with individually. For our general purpose it is only necessary to study a few of the sister-group relationships since we are mainly concerned with the place of origin of the milesines. The answer to the question of whether the milesines arose in South America or not depends only on whether the oldest extant milesine genera are restricted to the Neotropical region or not. The oldest genera will naturally be found only in the most primitive milesine tribes - Pipizini, Cheilosini, Volucellini, and Calliceratini.

Of these tribes only two,⁶ Pipizini and Volucellini, have endemic Neotropical milesine genera and in both of these two tribes the endemic Neotropical milesine genera are the most recently derived genera in their respective tribes as indicated in the main text. Thus absence of primitive endemic genera of the primitive milesine tribes indicates that the family did not arise in South America and that almost all endemic milesine syrphids must have crossed the Tertiary water gap from the north.

Transition between the Nearctic and Neotropical milesine faunas

Faunal regions provide a means for categorizing the main features of distribution of existing animals. Since Sclater (1857) first proposed faunal regions to explain the distribution of birds, there has been considerable controversy about the reality and practicality of these faunal regions. The controversy stems from the lack of appreciation of two fundamental facts about faunal regions: 1) the limits of faunas do not correspond exactly to certain geographical boundaries, but they tend to merge into each other in complex zones of transition; and 2) faunal regions are only pragma-

⁶ If Notiocheilosia is a Calliceratini, which is likely, then it is the derived sister-group of Callicera (see above).

tical devices, representing the average patterns of animal distribution and thus serving as a "standard" for comparison purposes only.

An appreciation of the above two fundamental facts concerning faunal regions leads to questions as to the nature of the transition between the Neotropical and Nearctic milesine syrphid faunas - 1) what taxa are involved in the overlap; 2) how large or small a part of the main fauna are involved in the overlap; 3) what is the relative contribution of each faunal region to the overlap; and 4) how well are the distribution patterns of the milesine syrphids categorized by the faunal regions. Faunas and the transitions between them include three types of taxa: shared taxa, transitional taxa and exclusive taxa. The shared taxa are those taxa equally distributed in both regions. The transitional taxa which are those taxa that are predominantly distributed in one region but with a few representatives in the other region are the only type of taxa actually involved in the overlap between faunal regions. The exclusive taxa (including the endemic taxa) which are those taxa distributed in one of the regions but not the other, are not involved in the overlap but the limits of their distribution defines the faunal boundaries. The boundary between two faunal regions can be defined operationally as the geographical boundary that divides two faunas in such a way as to maximize the number of exclusive taxa and minimize the number of trans-

itional taxa. The transitional taxa and the shared taxa have all been marked in the list of genera in Appendix II. Diagram 6 is a modification of Darlington's diagram of faunal transition (1957:453, fig. 53), illustrating the transition between the Nearctic and Neotropical milesine faunas. The vertical axis represents the percentage, based on number of species, of each type of taxa present in the respective fauna excluding the transitional genera from the other fauna and the longitudinal axis represents the geographical relationship of the various types of taxa. From the above mentioned diagram, it can be clearly seen that the transition between the Nearctic and Neotropical milesine fauna appears to be made up of predominantly southern groups which have moved northward in direction. Only the genus Milesia extends slightly south of the isthmus of Tehuantepec, whereas a number of genera of Neotropical origin have extended northward across the isthmus of Tehuantepec and into Mexico and the southern United States. The transition between the Nearctic and Neotropical milesine faunas can be also illustrated by plotting the distribution of the involved genera and their species with isometric lines (see maps 11,12). In short, the isthmus of Tehuantepec is the southern limit for almost all northern taxa and thus the isthmus precisely

defines the southern boundary of the Nearctic fauna. On the other hand, the isthmus is not as useful as a boundary for categorizing the Neotropical milesine syrphid fauna as for Nearctic milesines, since many predominantly South American taxa extend their range beyond the isthmus.

GLOSSARY

Williston (1886) and Shannon (1922 and 1926) have provided brief glossaries to some of the special terms and characters used for syrphids. However, most of the terms used in syrphid systematics can be found also in Torre Bueno (1937). Where my usage of a term differs from that in those papers, or where it may not be clear in which sense I have used a term, or where I have used a term not include in these papers, I have then listed the term below with its definition. Also, the section on characters in the front part of this revision should be consulted.

Apical cell: Apical cell is the same as cell R4+5, also called the first posterior cell (Williston).

Apical crossvein: Apical crossvein is the up-turned portion of vein ml+2, which seals off the apical cell (R4+5).

Character: A character is anything that differs among a collection of objects. Each difference is a state of the character. Thus character is a collective term, denoting a set of differences of a homologous nature. For example: color is a character; red, white and blue are states of the character color.

Derived: Derived refers to the character state that has changed the most in a dichotomy. It is the new difference that has evolved to separate one taxon from another. Hennig's term apomorphic (apo-) is synonymous.

Dichotomy: A dichotomy is the graphic representation of the divergence between any two taxon. Over a period of time, two taxa, sister-groups, diverge from a single ancestral taxon. This phenomena can be drawn on paper as a dichotomy with one axis, ordinate, as time and the other, abscissa, as divergence.

Facial stripes: The facial stripes is the area between the facial grooves and the eye margin.

Primitive: Primitive refers to the character state that has remained the same or changed the least in a dichotomy. It is the condition or state closest to that of the ancestral taxon. Hennig's term pleisomorphic (pleiso-) is synonymous.

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APPENDIX I

Character survey of the milesine tribes.

Genera	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
Tribe Pipizini																							
<u>Pipiza</u>	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	+	+
<u>Trichopsomyia</u>	-	-	-	+	-	-	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+
<u>Neocnemodon</u>	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	+	+
<u>Pipizella</u>	-	-	-	+	-	-	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	+	+
<u>Heryngia</u>	-	-	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	-	-	-	-	+	+
Tribe Cheilosini																							
Subtribe Cheilosina																							
<u>Cheilosia</u>	+	v	v	-	-	-	-	+	-	-	+	-	-	-	-	+	-	-	-	-	-	+	+
<u>Hiatomyia</u>	+	+	+	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-	-	+	+
<u>Portevinia</u>	+	+	+	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-	-	+	+
<u>Ferdinandea</u>	+	-	+	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-	-	+	+
<u>Rhingia</u>	+	+	+	-	-	+	+	+	-	-	v	-	-	-	-	+	-	-	-	-	-	+	+
Subtribe Pelecoceratina																							
<u>Chamaesyphus</u>	v	+	v	+	v	-	+	+	-	-	+	-	-	-	-	+	-	-	v	-	-	+	+
<u>Pelecocera</u>	+	+	+	+	+	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-	-	+	+
Tribe Volucellini																							
Subtribe Volucellina																							
<u>Volucella</u>	+	-	-	-	+	-	+	+	-	-	+	-	-	+	-	+	-	-	+	-	-	-	+
<u>Graptomyza</u>	+	-	-	-	+	v	+	+	-	-	+	-	-	+	-	+	-	-	-	-	-	-	+
Subtribe Ornidina																							
<u>Tachinosyrphus</u>	+	-	-	-	+	-	+	+	-	-	+	-	-	+	-	+	-	-	+	-	-	+	+
<u>Ornidia</u>	+	-	-	-	+	-	+	+	-	-	+	-	-	+	-	+	-	-	+	-	-	+	+
<u>Copestylum</u>	+	-	-	-	v	-	+	+	-	-	+	-	-	+	-	+	-	-	v	-	-	+	+

Genera	Character states																						
	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
Tribe Eristalini																							
Subtribe Helophilina																							
<u>Quichuana</u>	+	+	+	+	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Polydontomyia</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Aemosyrphus</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Arctosyrphus</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Mallota</u>	+	v	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Helophilus</u>	+	+	-	-	-	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Lunomyia</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Parohelophilus</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Anasimyia</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Eurmyia</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Dolichogyna</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Habromyia</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Orthoprosopa</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Myiatropa</u>	+	-	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Mesembrius</u>	+	+	-	-	+	-	+	+	+	-	v	+	+	+	+	+	-	+	-	+	+	+	+
Subtribe Eristalina																							
<u>Megaspis</u>	+	+	-	-	v	-	+	+	+	v	-	+	+	+	+	+	-	v	+	+	+	+	+
<u>Solenaspis</u>	+	+	-	-	-	-	+	+	+	-	+	+	+	+	+	+	-	+	+	+	+	+	+
<u>Simioides</u>	+	+	-	-	v	-	+	+	+	+	-	+	+	+	+	+	-	+	-	+	+	+	+
<u>Keda</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Xenzoon</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Meromacrus</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Eristalis</u>	+	-	-	-	v	-	+	+	+	+	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Genus #1</u>	+	-	-	-	v	-	+	+	+	v	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Eristalinus</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Eristalodes</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Lathyrrophthalmus</u>	+	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Palpada</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+
<u>Lycastirrhychus</u>	+	+	-	-	v	-	+	+	+	-	+	+	+	+	+	+	-	+	-	+	+	+	+

Genera	Character states																						
	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
Tribe Milesini																							
<u>Criorrhina Group</u>																							
<u>Criorrhina</u>	+	+	v	-	v	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Flukea</u>	+	+	+	-	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Aneriophora</u>	+	+	+	-	-	-	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Merapioidus</u>	+	+	+	-	+	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Deineches</u>	+	+	+	-	-	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Sphecomyia</u>	+	+	+	-	-	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Calliprobola</u>	+	+	+	+	+	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Paratropidia</u>	+	+	+	-	-	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Blera Group</u>																							
<u>Blera</u>	+	+	+	+	v	v	v	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Somula</u>	+	+	+	+	-	-	-	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Lejota</u>	+	+	+	+	v	v	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Philippimya</u>	+	+	+	+	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Milesia Group</u>																							
<u>Milesia</u>	+	+	v	-	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Hemixylota</u>	+	+	+	+	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	v	+
<u>Korchinia</u>	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-	-	+	+
<u>Spilomyia</u>	+	+	+	+	+	v	+	+	+	+	+	+	+	-	+	+	-	v	-	-	-	+	+
<u>Stilbosoma</u>	+	+	+	-	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Temnostoma Group</u>																							
<u>Temnostoma</u>	+	+	+	v	-	-	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	v	+
<u>Takaomyia</u>	+	+	+	-	-	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Valdivia</u>	+	+	+	+	-	-	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Odyneromyia</u>	+	+	+	+	-	-	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Tuechnemis</u>	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	+	+
<u>Pterallastes</u>	+	+	+	-	-	-	+	+	+	+	+	+	+	v	+	+	-	+	-	-	-	+	+

Genera	Character states																						
	1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13	14	15a	15b	16	17	18	19	20
<u>Tropidia Group</u>																							
<u>Tropidia</u>	+	+	+	-	v	-	v	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Senogaster</u>	+	+	+	-	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Syritta</u>	+	+	+	-	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Nepenthosyrphus</u>	+	+	v	-	+	-	-	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Xylota Group</u>																							
<u>Xylota</u>	+	+	+	-	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Xylotomimia</u>	+	+	+	-	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Chalcosyrphus</u>	+	+	+	-	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Crioprora</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Brachypalpus</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Chrysosomidia</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Nepilas</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Sterphus</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Ceriogaster</u>	+	+	+	+	+	-	-	+	+	+	+	+	-	-	+	+	-	v	v	-	-	+	+
<u>Macrometopia</u>	+	+	v	+	-	-	-	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Hadromyia</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+
<u>Pocota</u>	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	+	+	-	-	+	+

1. Oral margin medially notched (+), not notched, evenly rounded (-).
2. Eyes bare (+), pilose (-).
3. Face bare (+), pilose at least on sides (-).
4. Metasterna bare (+), pilose (-).
5. Subscutellar fringe absent (+), present (-).
- 6a. Face concave (+), otherwise (-).
- b. Face concave in female at least (+), otherwise (-).
- c. Face tuberculate in both sexes or concave (+), otherwise (-).
7. Thoracic bristles absent (+), present (-).
8. Hind femur with ventral spines (+), without (-).
9. Arista plumose (+), bare (-).
10. Metathoracic spiracular pile patch absent (+), present (-).
11. Anterior crossvein distinctly at or beyond middle of discal cell (+), before middle of discal cell (-).
12. Apical crossvein peripendicular or recessive (+), directed outward (-).
13. Third vein strongly looped into apical cell (+), straight (-).
14. Antenna with arista (+), with terminal style (-).
15. a. 1st abdominal spiracle free and 1st abdominal sternite reduced (+), otherwise (-).
- b. 1st abdominal spiracle embedded in meta-epimeron or 1st abdominal sternite reduced (+), 1st abdominal spiracle free and 1st abdominal sternite unmodified (-).
16. Scutellum with distinct apical emarginate rim (+), without such a rim (-).
17. Marginal cell petiolate (+), open at wing margin (-).

18. Hind femu with a basal setal patch (+), without such a patch (-).
19. Anterior portion of meso-anepisternum bare (+), pilose (-).
20. Male with four pergenital segments (+), with five pregenital segments (-).

Note: v means variable or intermediate.

APPENDIX II

Neotropical milesine genera

- Pipizini
Pipiza (s)
 *Trichopsomyia
- Cheilosini
 Cheilosina
Rhingia (s)
- Calliceratini
 *Notiocheilosia
- Volucellini
 Ornidina
Copestylum (t)
 *Ornidia
 *Tachinosyrphus
- Chrysogasterini
 Spheginina
 *Chamaesphegina
 Chrysogasterina
Orthonevra (s)
Myolepta (s)
Lepidomyia (t)
 *Chromocheilosia
- Eumerini
Nausigaster (t)
 *Alipumilio
- Cerioidini
Cerioides (s)
- Eristalini
 Helophilina
 *Dolichogyna
 *Quichuana
 *Habromyia
Mallota
 Eristalina
Eristalis (introduced)
Genus #1 (s)
Palpada (t)
Meromacrus (t)
 *Thalamopales
 *Lycastriirhynchus
- Milesini
 *Neplas
 *Cerogaster
 *Sterphus
 *Macrometopia
 *Cacoceria
 *Valdivia
 *Odyneromyia
 *Aneriophora
 *Flukea
 *Philippimyia
 *Senogaster
Syritta (introduced)
Tropidia
 *Hemixylota
 *Stilbosoma
Milesia (t)
Spilomyia (s)

Nearctic milesine genera

- Pipizini
Pipiza (s)
Heryngia
Parapenium
Neocnemodon
- Cheilosini
 Cheilosina
Cheilosia
Cartosyrphus
Hiatomyia
Rhingia (s)
Ferdinandea

Cheilosini
 Pelecoceratina
Pelecocera
Chamaesyrrhus

Calliceratini
Callicera

Volucellini
 Volucellina
Volucella
 Ornidina
Copestylum (t)

Chrysogasterini
 Spheginina
Sphegina
Neoascia
 Chrysogasterina
Chrysogaster
 *Chrysosyrphus
Orthonevra (s)
Myolepta (s)
Lepidomyia (t)
Brachyopa

Sericomyini
Sericomyia
Arctophila
 *Pyritis
 *Tapetomyia

Eumerini
Nausigaster (t)
Eumerus (introduced)
Merodon (introduced)
Psilota

Cerioidini
Cerioides (s)

Eristalini
 Helophilina
Helophilus
Anasimyia
Parohelophilus
Eurimyia
 *Lunomyia
 *Aemosyrphus
 *Polydomyia
Mallota (s)
 Eristalina
Meromacrus (t)
Genus #1 (s)
Eristalis
Palpada (t)

Milesini
Xylota
Xylotominia
Brachypalpus
 *Chrysosomidia
 *Teuchocnemis
Syritta (introduced)
Tropidia
 *Pterallastes
 *Hadromyia
 *Crioprora
Pocota
Elera
 *Somula
Criorhina
 *Merapioidus
Sphecomyia
Spilomyia (s)
Temnostoma
 *Mutillimyia
Milesia (t)
 *Cynorhinella
 *Chalcosyrphus
Lejota

Palaearctic milesine genera

Pipizini
Pipiza
Heryngia
Parapenium
Triglyphus
Neocnemodon
Pipizella

Cheilosini
 Cheilosina
Cheilosia
Cartosyrphus
Hiatomyia
Rhingia

Cheilosini

Cheilosina

Ferdinandea*Psarocheilosia*Portevinia

Pelecoceratina

PelecoceraChamaesyrrhus*Ischyroptera*Macropelecocera

Calliceratini

Callicera

Volucellini

Volucellina

VolucellaGraptomyza

Chrysogasterini

Spheginina

SpheginaNeoascia

Chrysogasterina

*HelleniolaMyoleptaOrthonevraChrysogaster*LejogasterBrachyopa

Sericomomyini

SericomyiaArctophilaPararctophilaPseudovolucella

Eumerini

*PlatynochaetusMerodonEumerusPsilota

?????

*Psarus

Cerioidini

Cerioides

Eristalini

Helophilina

HelophilusAnasimyiaParohelophilus*LejopsEurimyiaMesembrius*MyiatropaArctosyrphusMallota

Eristalina

Eristalis

Genus #1

Simioides*Palumbia*Pleaskeola

Milesini

XylotaXylotominaBrachypalpus*MacrozelimaSyrittaTropidia*RhinotropidiaPocotaBlera*Matsumyia*CalliprobolaCriorhinaSphecomyiaSpilomyiaKorinchiaMilesiaTemnostomaTakaomyiaLejota

Oriental milesine genera

Pipizini	Eumerini
<u>Pipiza</u>	<u>Eumerus</u>
<u>Pipizella</u>	<u>Merodon</u>
Cheilosini	<u>Psilota</u>
Cheilosina	* <u>Azpeytia</u>
<u>Cheilosia</u>	Cerioidini
<u>Ferdinanda</u>	<u>Cerioides</u>
<u>Rhingia</u>	Eristalini
Pelecoceratina	Helophilina
<u>Chamaesyphus</u>	<u>Helophilus</u>
Calliceratini	<u>Eurimyia</u>
<u>Callicera</u>	<u>Mesembrius</u>
Volucellini	<u>Mallota</u>
Volucellina	* <u>Klossia</u>
<u>Volucella</u>	* <u>Catacores</u>
<u>Graptomyza</u>	Eristalina
Chrysogasterini	* <u>Solenaspis</u>
Spheginina	* <u>Digulia</u>
<u>Sphegina</u>	* <u>Keda</u>
Chrysogasterina	<u>Eristalis</u>
<u>Myolepta</u>	<u>Megaspis</u>
<u>Chrysogaster</u>	<u>Disoptera</u>
Spheginobacchini	<u>Axona</u>
<u>Spheginobaccha</u>	Milesini
Sericomyini	<u>Xylota</u>
<u>Sericomyia</u>	<u>Brachypalpus</u>
<u>Pararctophila</u>	<u>Syritta</u>
<u>Pseudovolucella</u>	<u>Blera</u>
	<u>Milesia</u>
	<u>Temnostoma</u>
	<u>Takaomyia</u>
	<u>Korinchia</u>
	* <u>Nepenthosyrphus</u>
	* <u>Lycastris</u>
	* <u>Cheiroxylota</u>

Ethiopian milesine genera

Cheilosini	Chrysogasterini
Cheilosina	Chrysogasterina
<u>Rhingia</u>	<u>Orthonevra</u>
Volucellini	<u>Chrysogaster</u>
Volucellina	Spheginobacchini
<u>Graptomyza</u>	<u>Spheginobaccha</u>

Eumerini
Eumerus
Merodon

Cerioidini
Cerioides

Eristalini
 Helophilina
Eurmyia
Mallota
Mesembrius
 *Chasmomma

Eristalini
 Eristalina
Eristalis
Megaspis
Simioides
 *Senaspis
 *Meromacroides

Milesini
Xylota?
Syritta
Tropidia?
 *Syrittosyrphus
 *Pogonosyrphus

Australian milesine genera

Pipizini
 *Emmyia
 Triglyphus?

Volucellini
 Volucellina
Graptomyza

Chrysogasterini
 Chrysogasterina
 *Cyphipelta
 *Cocheilosia
 *Coeloprosopa
 *Plesia
 *Hemilampra

Eumerini
Psilota
Eumerus

Cerioidini
Cerioides

Eristalini
 Helophilina
Helophilus?
 *Pilinascia
Mesembrius
 *Orthoprosopa
 Eristalina
Eristalis
Dissoptera
Axona
 *Xenzoon

Milesini
Syritta
Xylota?
Criorhina?
 *Deinches
 *Paratropidia
 *Malometaternum
 *Hardimyia

Symbols used in Appendix II:

- (s) = shared genera
 (t) = transitional genera
 * = endemic genera

EXPLANATION OF MAPS, DIAGRAMS AND FIGURES

Maps

- Map 1. Gondwanaland during the late Carboniferous Period.
- Map 2. Gondwanaland during the early Permian Period.
- Map 3. Gondwanaland during the late Triassic Period.
- Map 4. Separation of Eastern Gondwanaland during late Jurassic-early Cretaceous Period.
- Map 5. Beginning of the separation of South America and Africa during the mid to upper Cretaceous Period.
- Map 6. South America and Africa during the beginning of the Tertiary Period.
- Map 7. Pattern I, Northern Groups.
- Map 8. Pattern II, Recent Invaders.
- Map 9. Pattern IIIa, Endemic Groups, Radiations.
- Map 10. Pattern IIIb, Endemic Groups, Chilean.
- Map 11. Geographic distribution of the Neotropical-Nearctic transitional genera plotted with approximate isometric lines.
- Map 12. Geographic distribution of the transitional species of the Neotropical-Nearctic transitional genera plotted with approximate isometric lines.

Diagrams

- Diag. 1. Phylogeny of the Pipizini.
- Diag. 2. Phylogeny of the Cheilosini.
- Diag. 3a-b. Phylogenies of the Volucellini.
- Diag. 4. Phylogeny of the Neotropical Chrysogasterini.
- Diag. 5. Phylogeny of the Eumerini.

- Diag. 6. Transition between Nearctic and Neotropical milesine faunas. The area with the with the horizontal lines represents the shared genera; with the diagonal lines, Neotropical transitional genera; with solid black, Nearctic transitional genera; with vertical lines, Nearctic exclusive genera; without lines, Neotropical exclusive genera.

Figures

- Fig. 1. Interrelationships between various milesine facial types. A, convex type; B, tuberculate type without notched oral margin; C, tuberculate types, C, normal tuberculate type, C₁, downward thrust type, C₂, epistomal thrust type, C₃, frontal thrust type; D, sexually dimorphic type; E, concave type, E₁, concave epistomal thrust type, E₂, concave frontal-epistomal thrust type.
- Fig. 2. Metasternal development. a, lateral view; b, ventral view.
- Figs. 3-5. First abdominal spiracle, ventral view.
- Fig. 3. Pipizine type.
- Fig. 4. Eumerine type.
- Fig. 5. Normal type.
- Figs. 6-21. Heads, lateral view except figs. 13-14, dorsal.
- Fig. 6. Trichopsomyia lasiotibialis Fluke, male.
- Fig. 7. Pipiza claripennis Shannon & Aubertin, male (PT).
- Fig. 8. Lepidomyia nigra Thompson, female (HT).
- Fig. 9. Macrometopia atra Philippi, male.
- Fig. 10. Chromocheilosia bicolor (Shannon & Aubertin), male (PT).

- Fig. 11. Chromocheilosia bicolor (Shannon & Aubertin), female.
- Fig. 12. Aneriophora aureorufa (Philippi), female.
- Fig. 13. Dolichogyna abrupta Hine, male.
- Fig. 14. Aemosyrphus polygrammus Loew, male.
- Fig. 15. Tropidia quadrata (Say), male.
- Fig. 16. Ornidia obesa (Fabricius), male.
- Fig. 17. Cerioides travassosi Lane & Carrera, male (HT).
- Fig. 18. Alipumilio atesphatus Thompson, male (HT).
- Fig. 19. Rhingia nigra Macquart, female.
- Fig. 20. Sterphus Nova Teutonia species, male.
- Fig. 21. Habromyia rectilinea Hull, female.

Figs. 22-33. Wings, dorsal view.

- Fig. 22. Rhingia nascia Say.
- Fig. 23. Chamaesphegina argentifacies Shannon & Aubertin.
- Fig. 24. Aneriophora aureorufa (Philippi).
- Fig. 25. Stilbosoma ruficeps Philippi.
- Fig. 26. Criorhina caudata Curran.
- Fig. 27. Ornidia obesa (Fabricius).
- Fig. 28. Cerioides acra Curran.
- Fig. 29. Nausigaster flukei Curran.
- Fig. 30. Quichuana pogonosa Fluke.
- Fig. 31. Palpada precipuus (Williston).

Fig. 32. Orthonevra pulchella Williston.

Fig. 33. Alipumilio atesphatus Thompson (HT).

Figs. 34-41, 43-74. Male genitalia; a, aedaegus and apodeme; e, ejaculatory apodeme; s, sternite 9; t, tergite 9; all lateral view unless with a subscript letter indicating a different view, a-anterior, d-dorsal, pd-posterio-dorsal, v-ventral.

Fig. 34. Pipiza claripennis Shannon & Aubertin (PT).

Fig. 35. Trichopsomyia lasiotibialis Fluke.

Fig. 36. Rhingia nigra Macquart.

Fig. 37. Notiocheilosia nitescens Shannon & Aubertin (HT).

Fig. 38. Orthonevra anniae Sedman.

Fig. 39. Myolepta luteola Gmelin.

Fig. 40. Lepidomyia similis Williston.

Fig. 41. Chromocheilosia bicolor (Shannon & Aubertin) (PT).

Fig. 43. Copestylum spinithorax (Arribalzaga).

Fig. 44. Ornidia obesa (Fabricius).

Fig. 45. Nausigaster tuberculata Carrera, Lopes and Lane.

Fig. 46-47. Alipumilio atesphatus Thompson (HT).

Fig. 48. Cerioides travassosi Lane & Carrera (HT).

Fig. 49. Dolichogyna abrupta Hine.

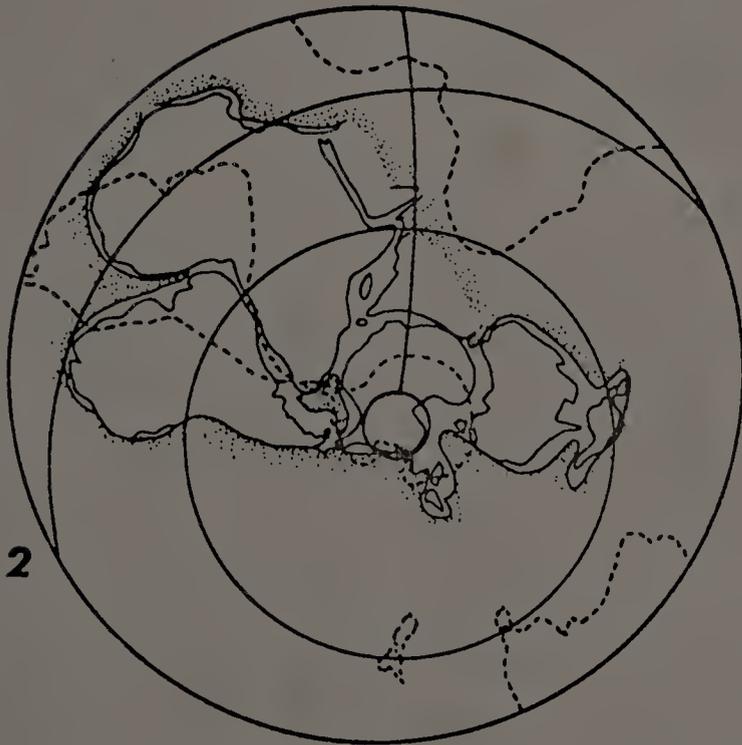
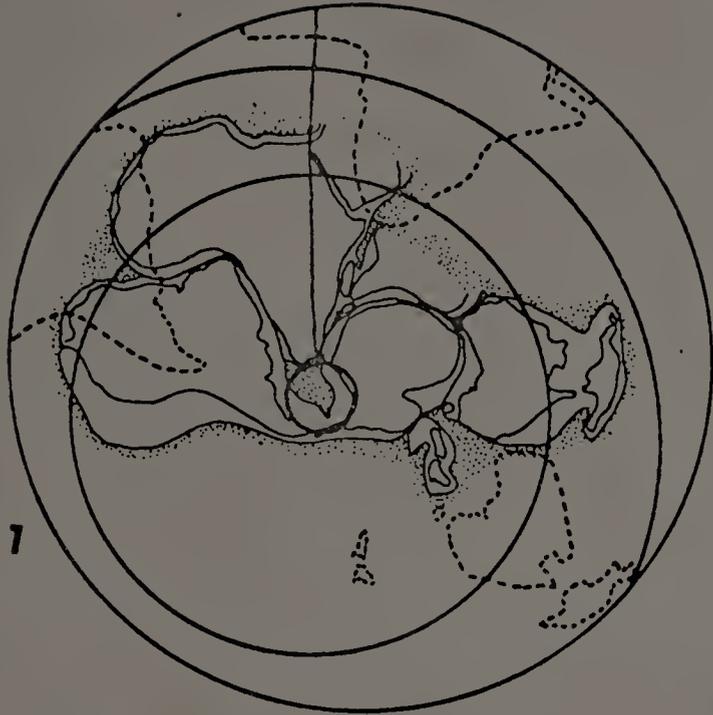
Fig. 50. Quichuana pogonosa Fluke.

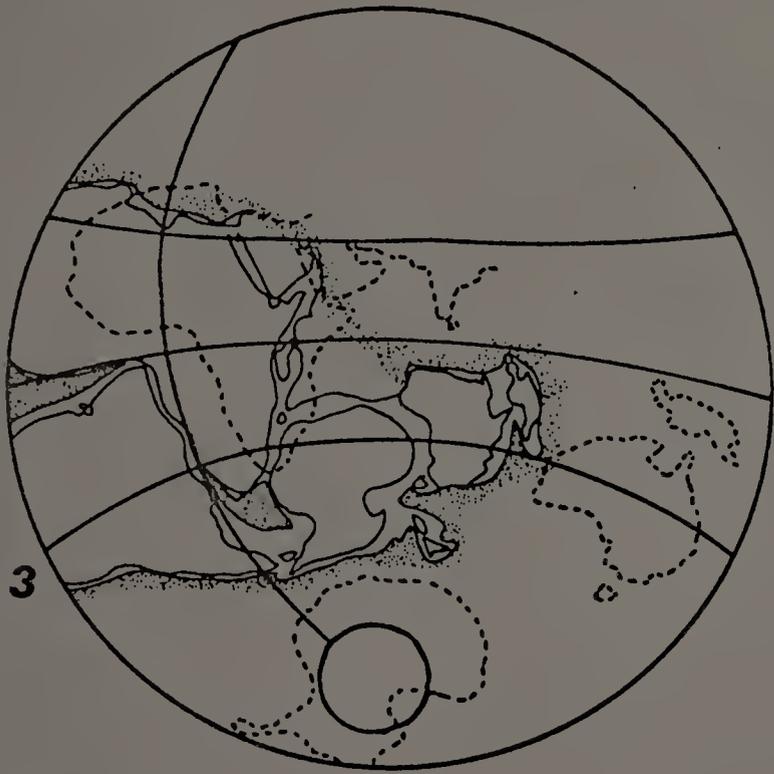
Fig. 51. Habromyia chrysotaenia Fluke.

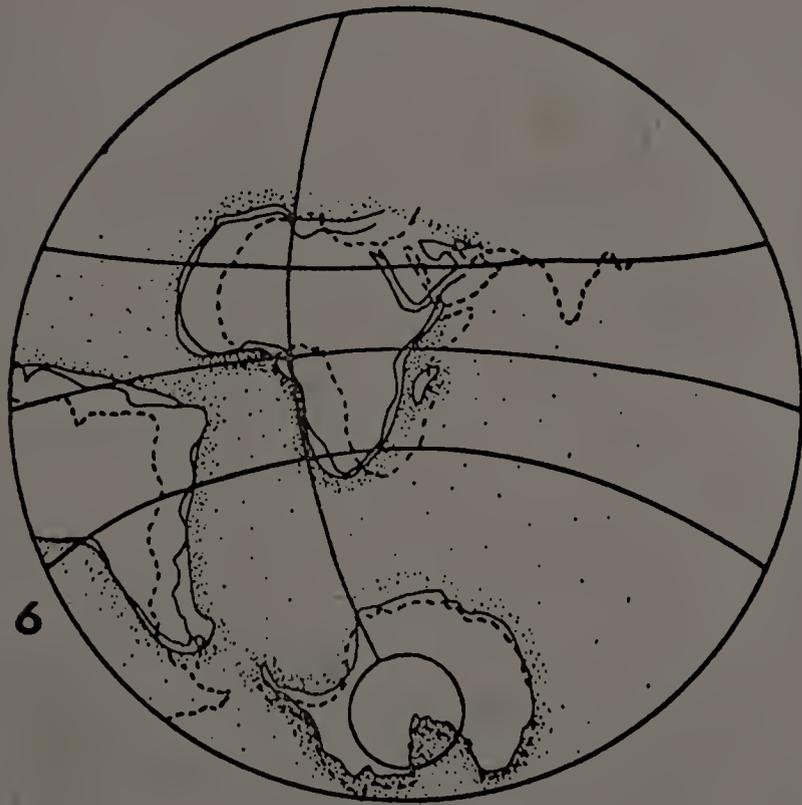
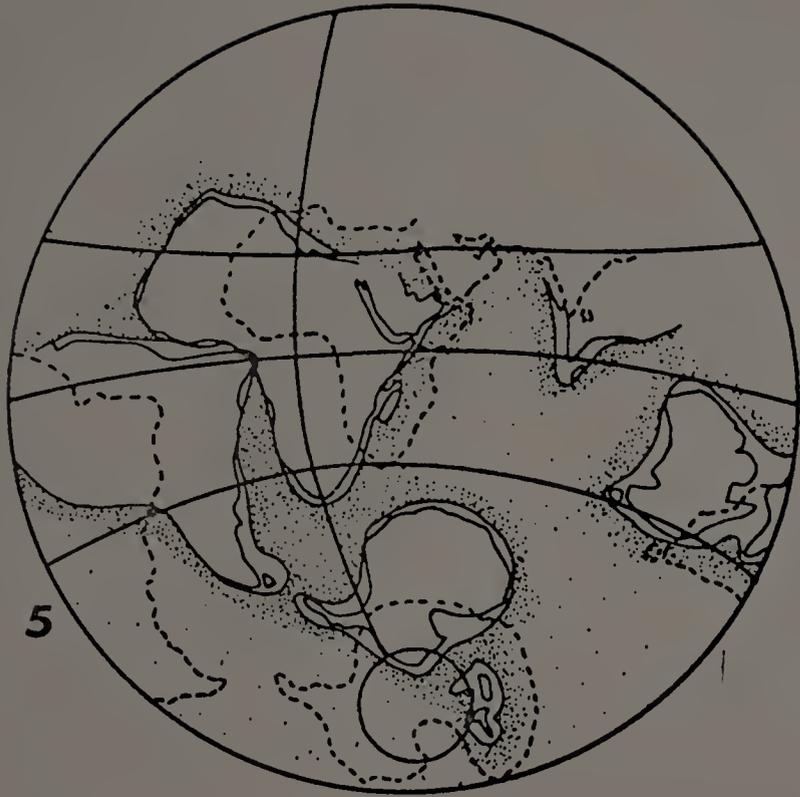
Fig. 52. Mallota sackeni Williston.

Fig. 53. Eristalis tenax (Linne).

- Fig. 54. Genus #1, arbustorum Linne.
- Fig. 55. Palpada papaveroi Thompson (HT).
- Fig. 56. Meromacrus cingulatus Sack.
- Fig. 57. Lycastriirhynchus ?mexicana Curran.
- Fig. 58. Neplas armatipes Curran.
- Fig. 59. Ceriogaster sp.
- Fig. 60. Sterphus coerulea (Rondani).
- Fig. 61. Macrometopia atra Philippi.
- Fig. 62. Odyneromyia odyneroides (Philippi).
- Fig. 63. Valdivia darwini Shannon.
- Fig. 64. Aneriophora aureorufa (Philippi).
- Fig. 65-66. Flukea vockerothi Etcheverry (PT).
- Fig. 67. Philippimyia cyanocephala (Philippi).
- Fig. 68. Senogaster dentipes (Fabricius).
- Fig. 69. Syritta flaviventris Macquart
(Austrosyritta cortesi Marnef (PT)).
- Fig. 70. Tropidia quadrata (Say).
- Fig. 71. Hemixylota varipes Shannon & Aubertin (PT).
- Fig. 72. Stilbosoma ruficeps Philippi
- Fig. 73. Milesia virginensis (Drury).
- Fig. 74. Spilomyia gratiosa Wulp.
- Fig. 42. Hind tarsus, ventral view. Chromocheilosia bicolor (Shannon & Aubertin) (PT).





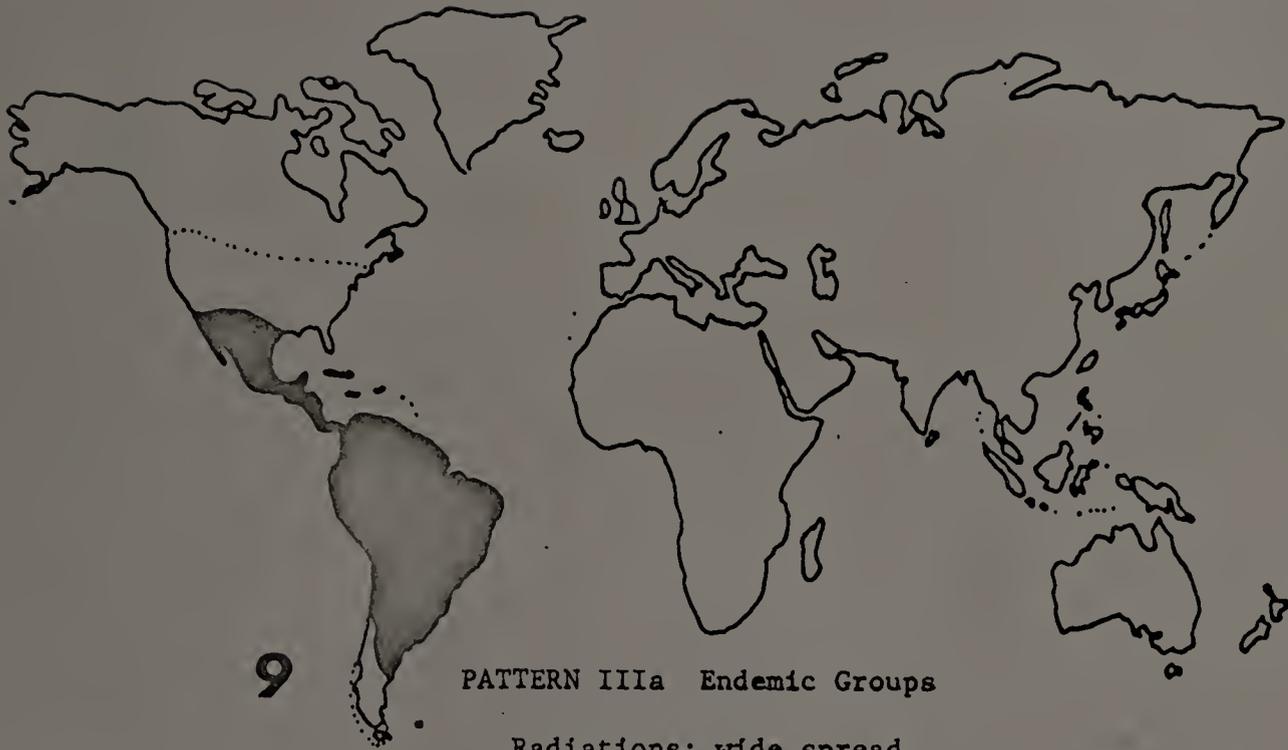




7 PATTERN I Northern Groups
transitional zone only

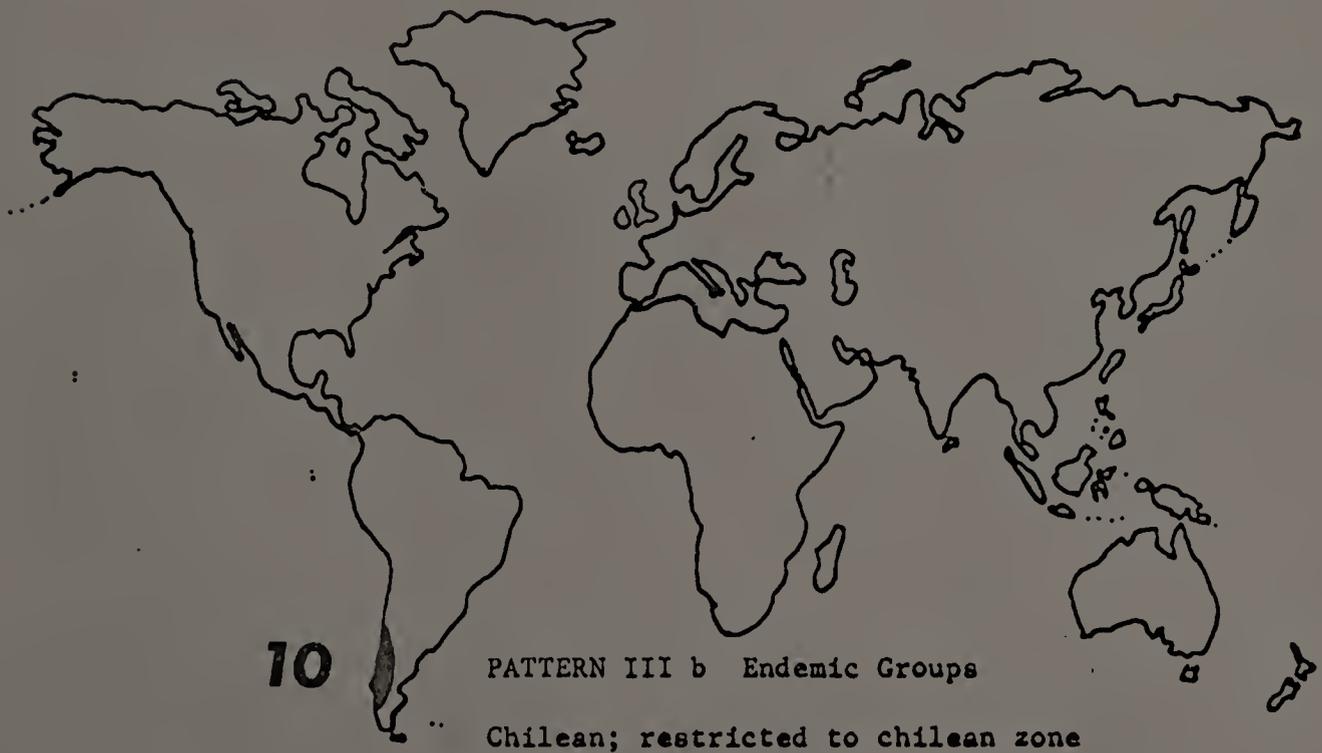


8 PATTERN II Recent Invaders
cordillera zone only



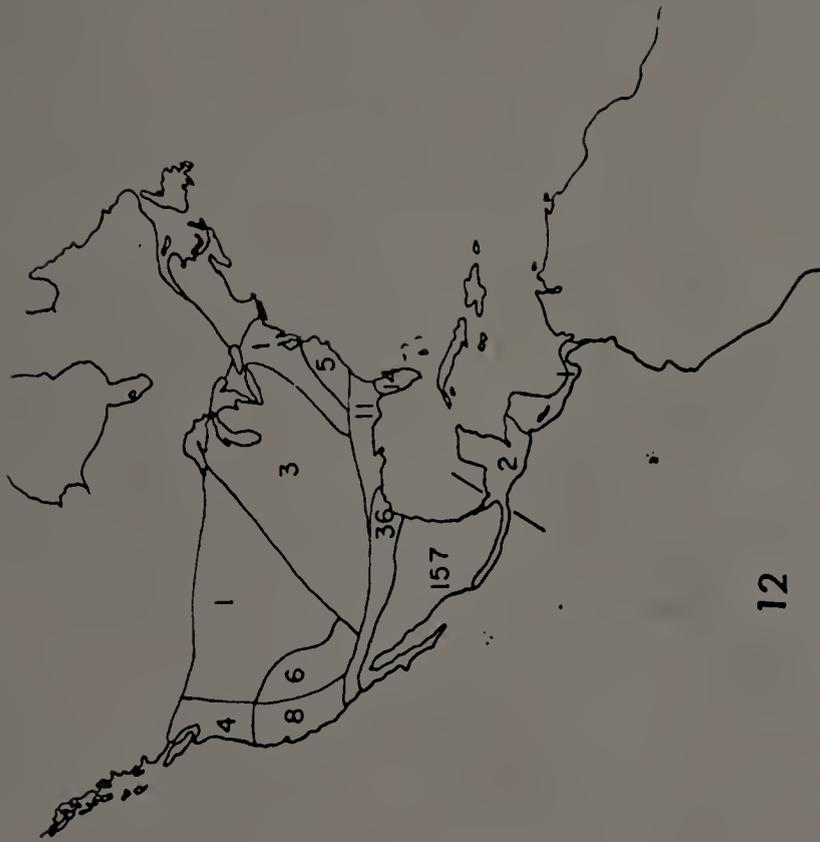
PATTERN IIIa Endemic Groups

Radiations; wide spread



PATTERN III b Endemic Groups

Chilean; restricted to chilean zone



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DIAGRAM I Phylogeny of the Pipzini

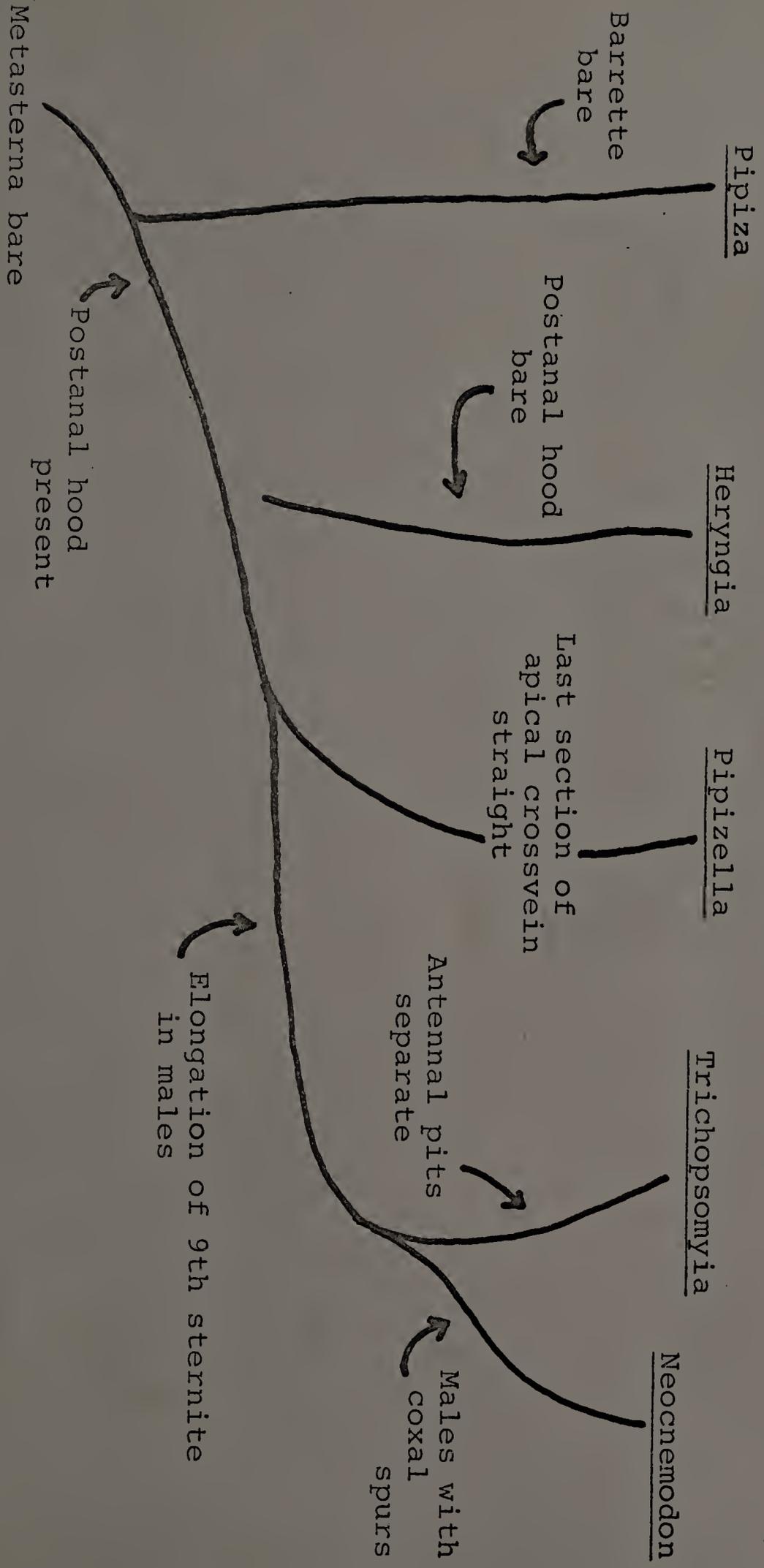


DIAGRAM II Phylogeny of the Cheilosini

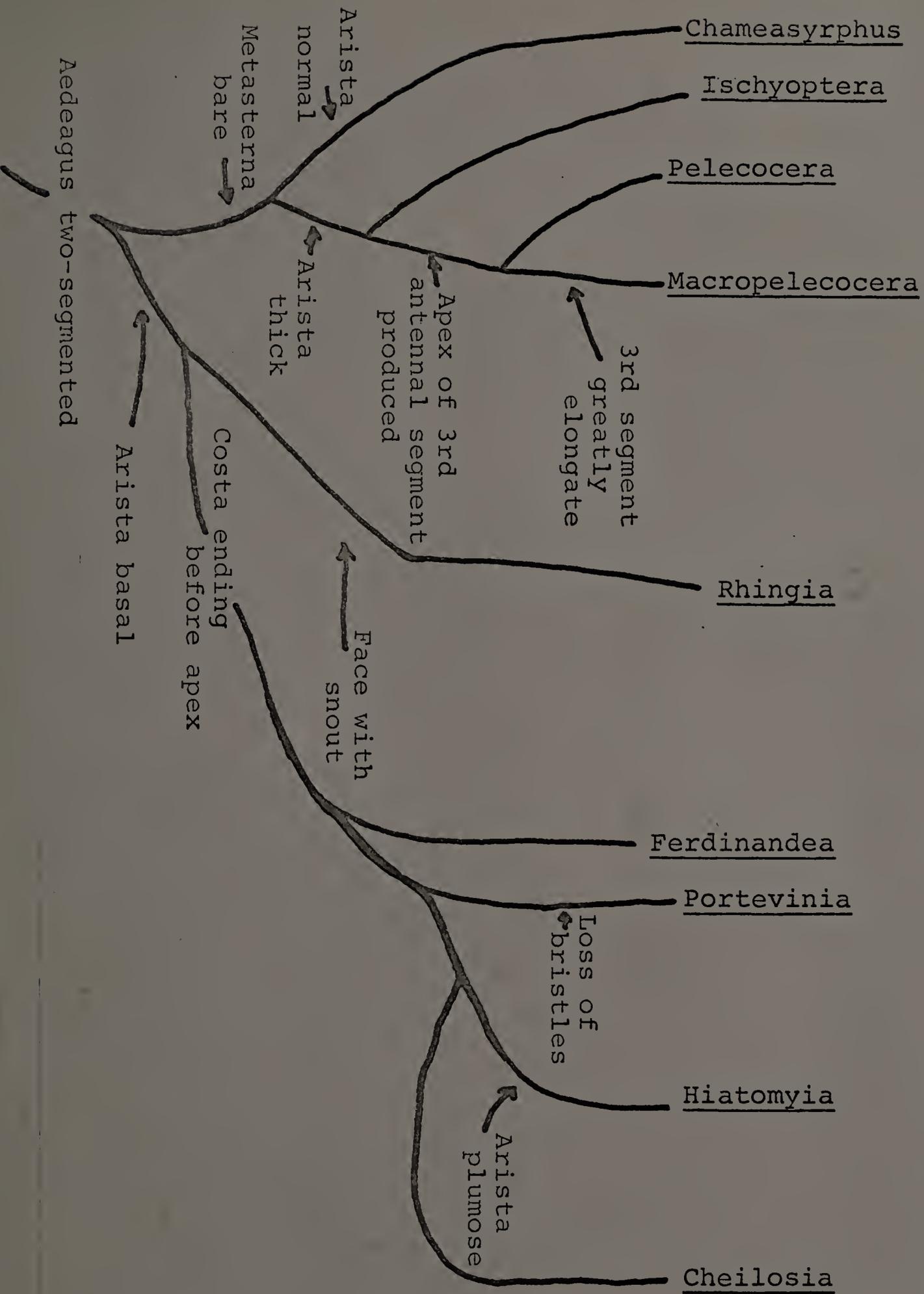


DIAGRAM IIIa Phylogeny of the Volucellini

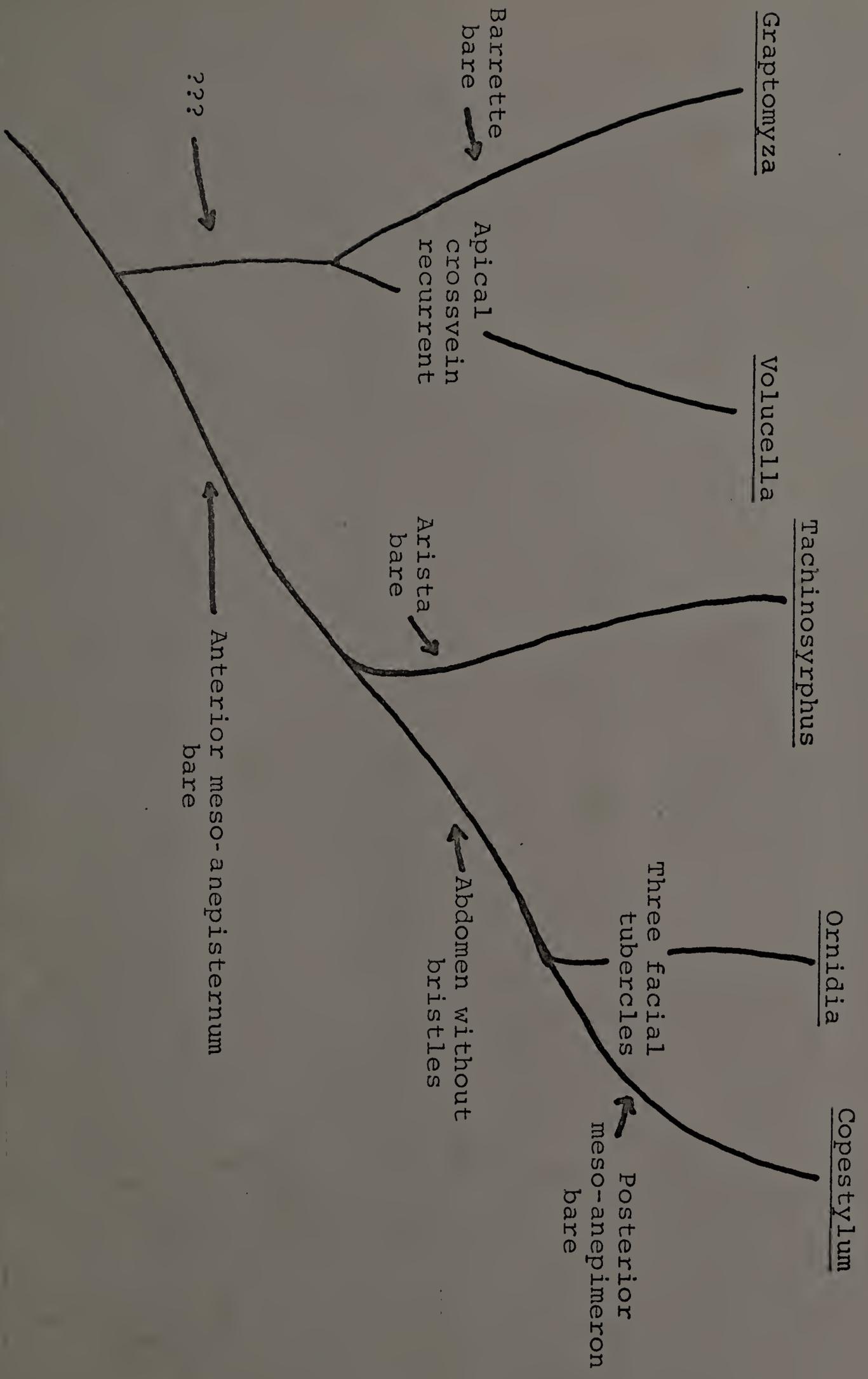


DIAGRAM IIIb Phylogeny of the Volucellini

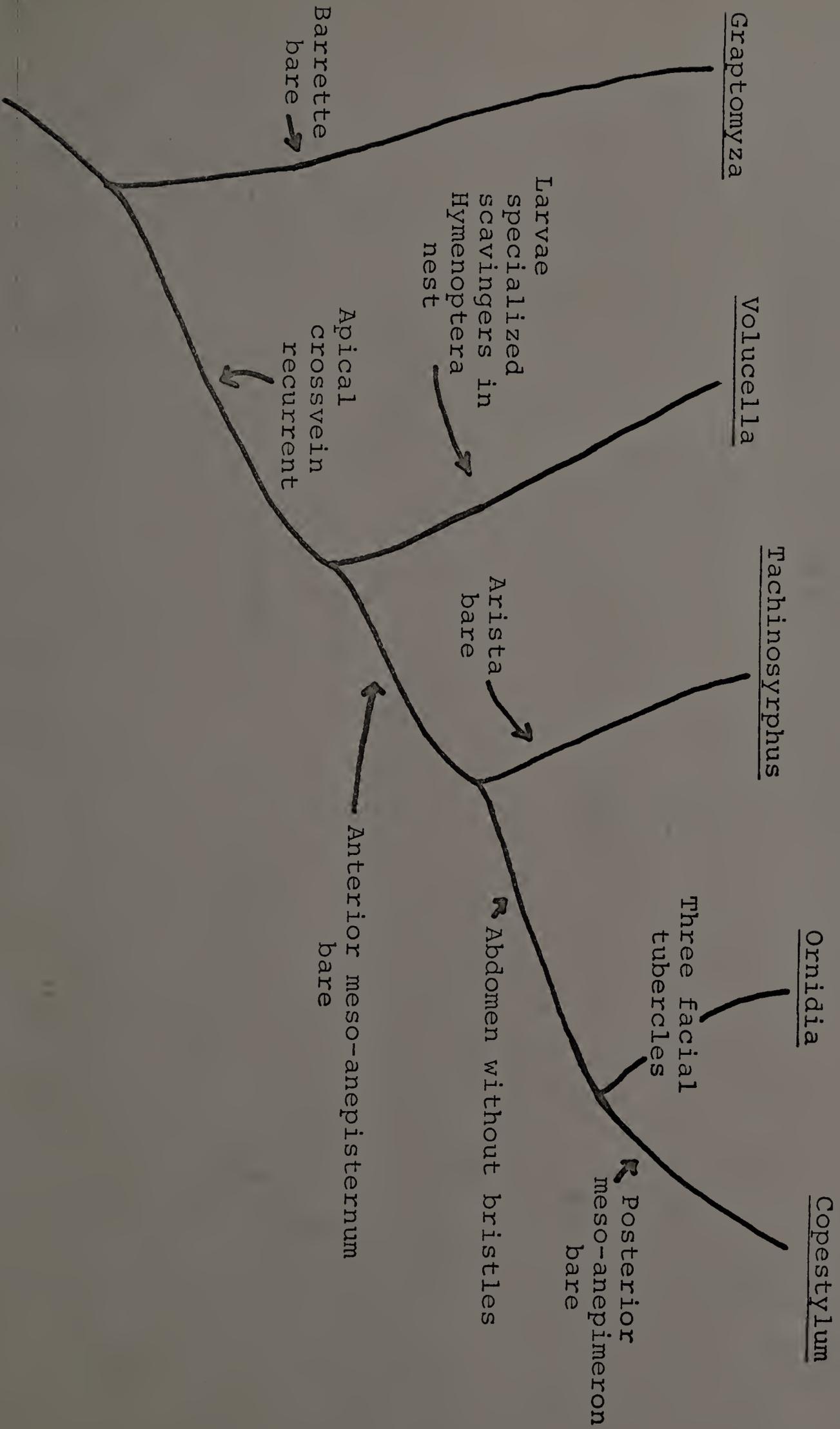


DIAGRAM IV Phylogeny of the Neotropical Chrysogasterini

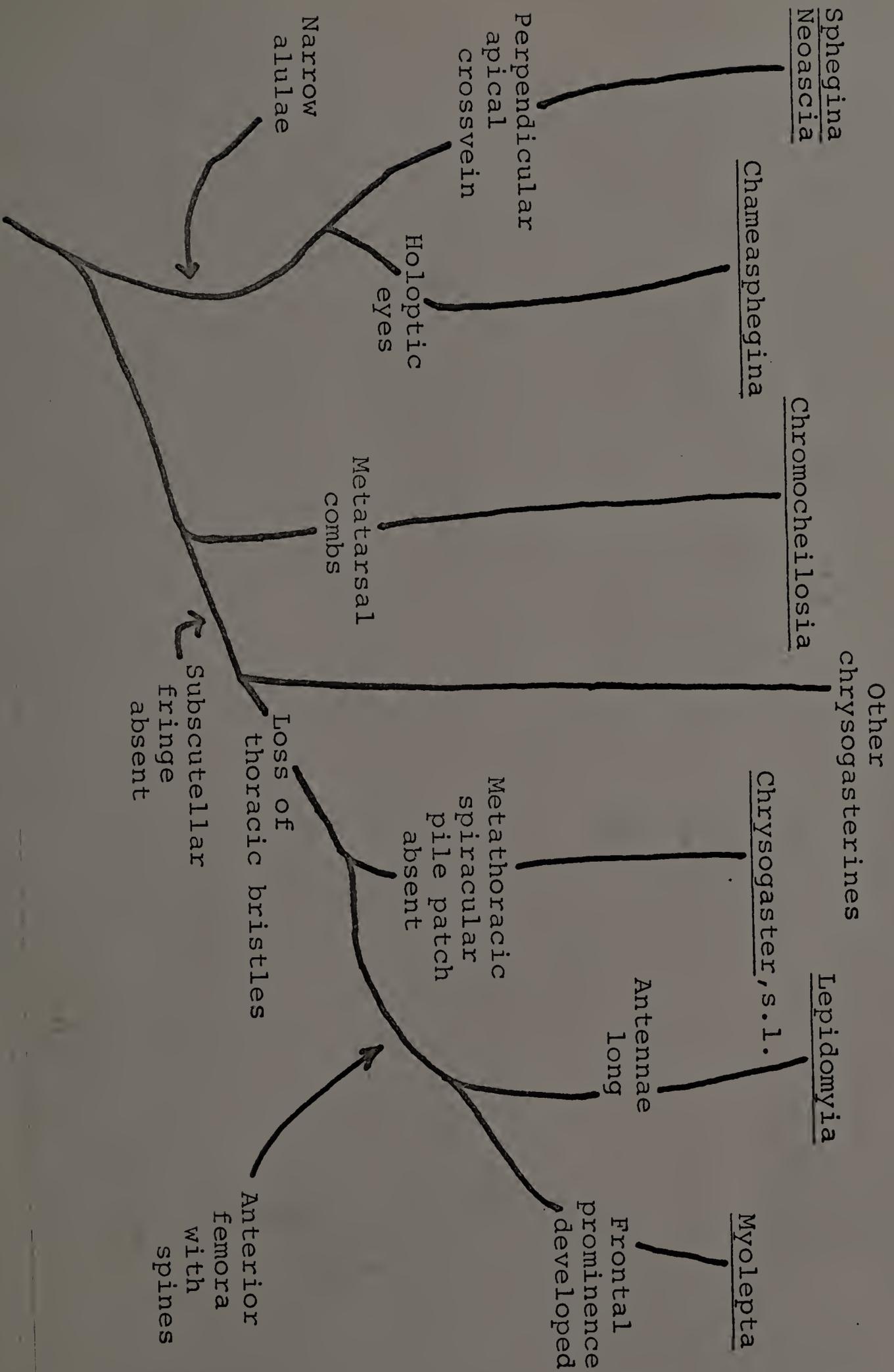
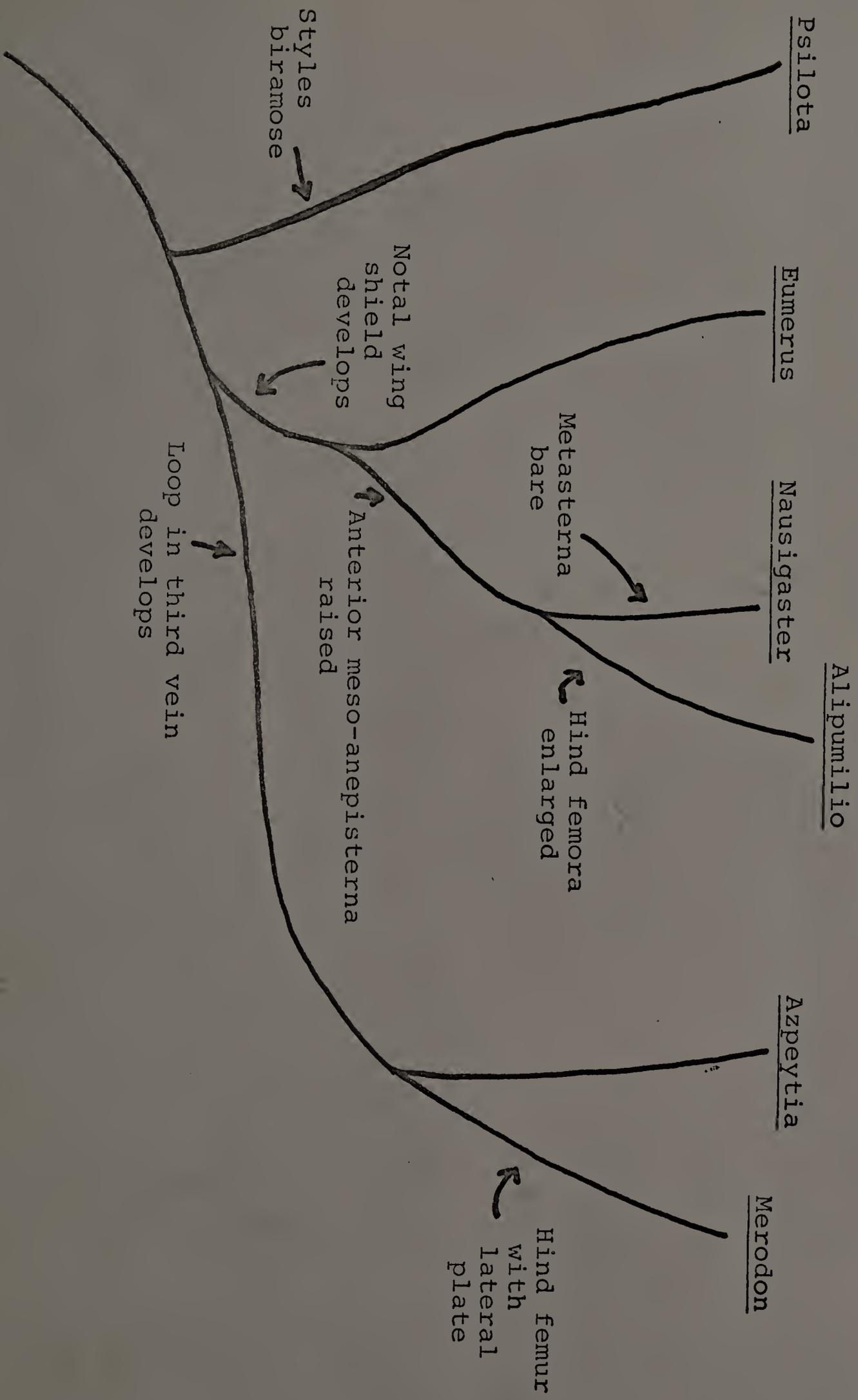
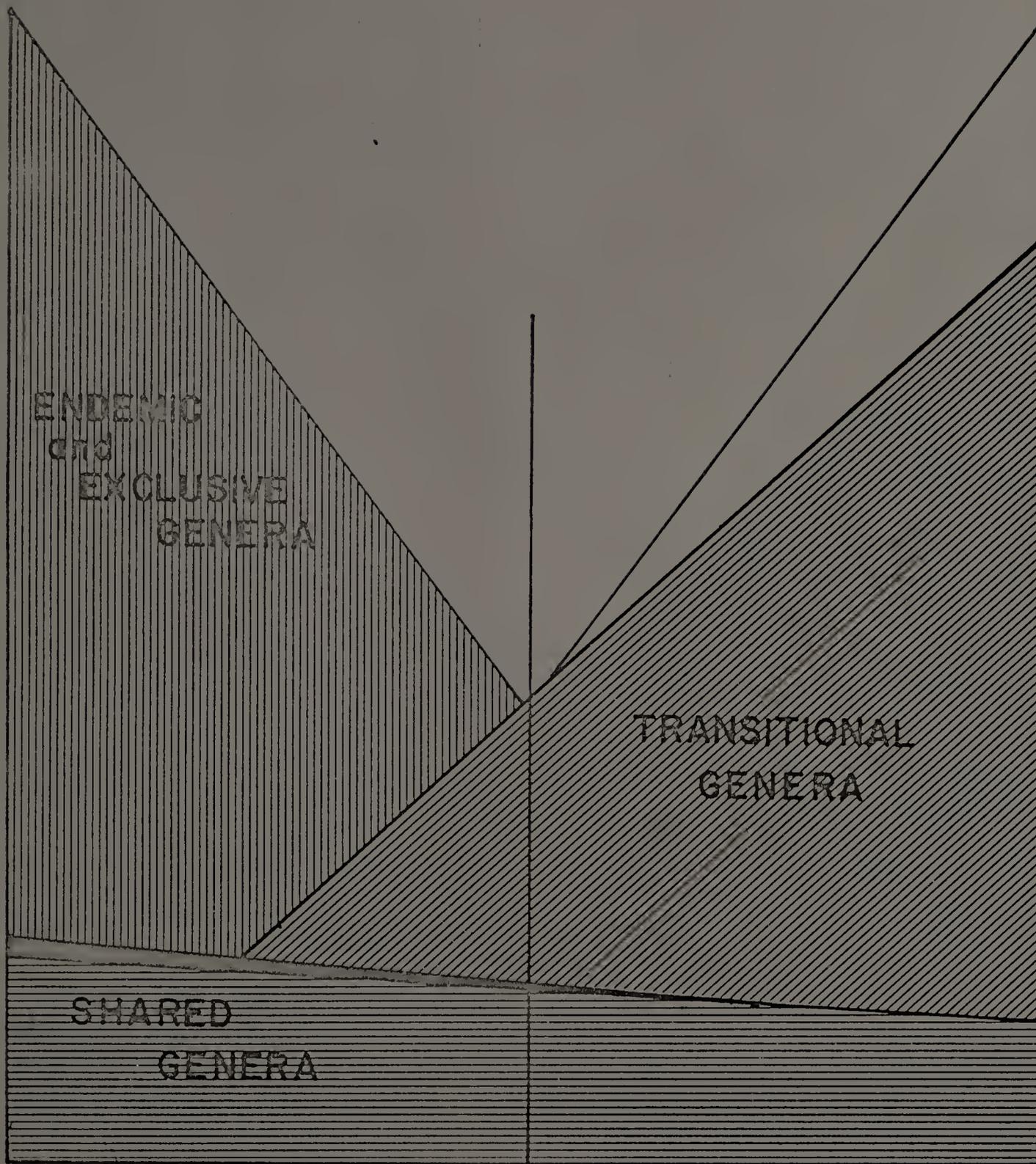


DIAGRAM V Phylogeny of the Eumerini

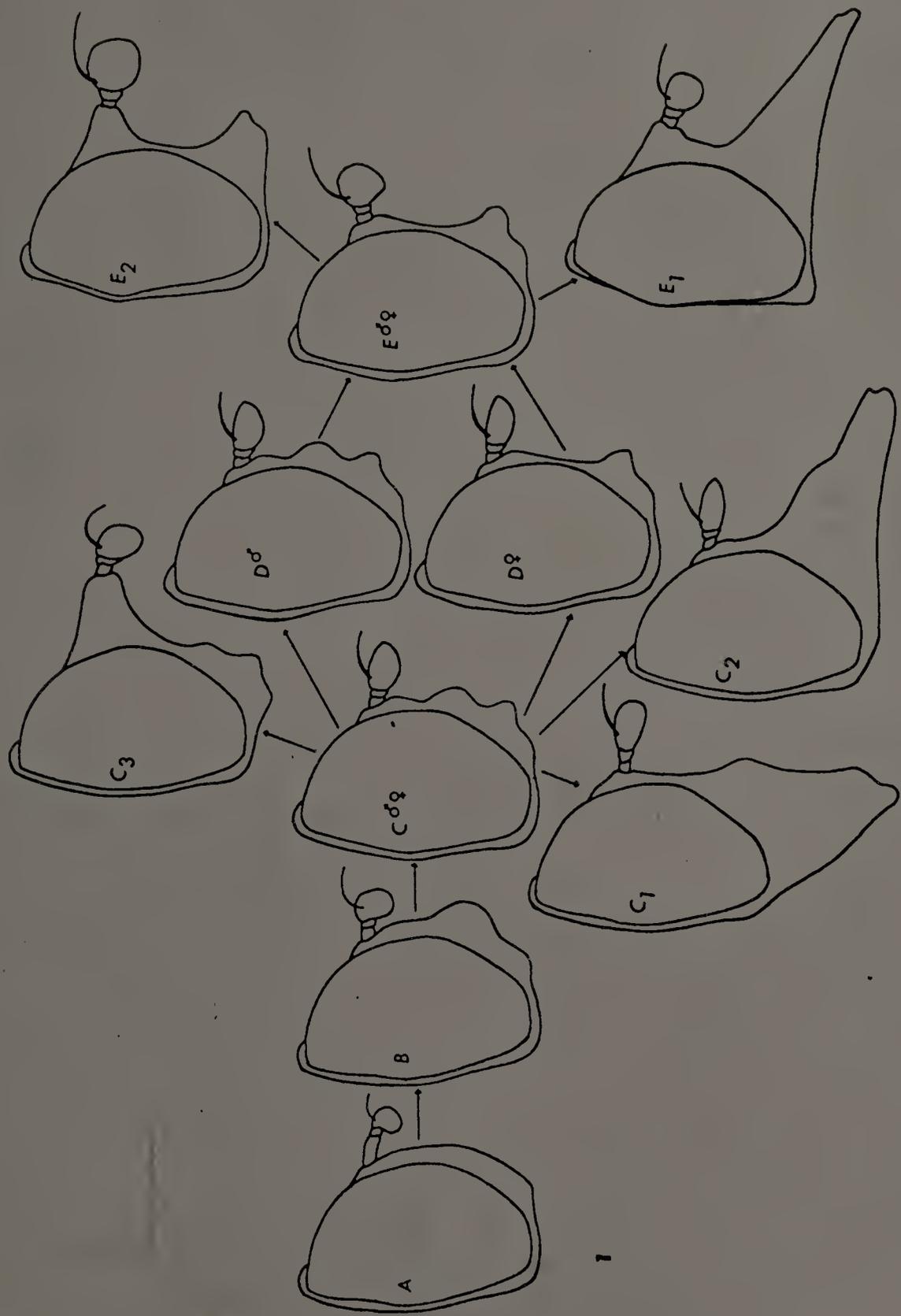


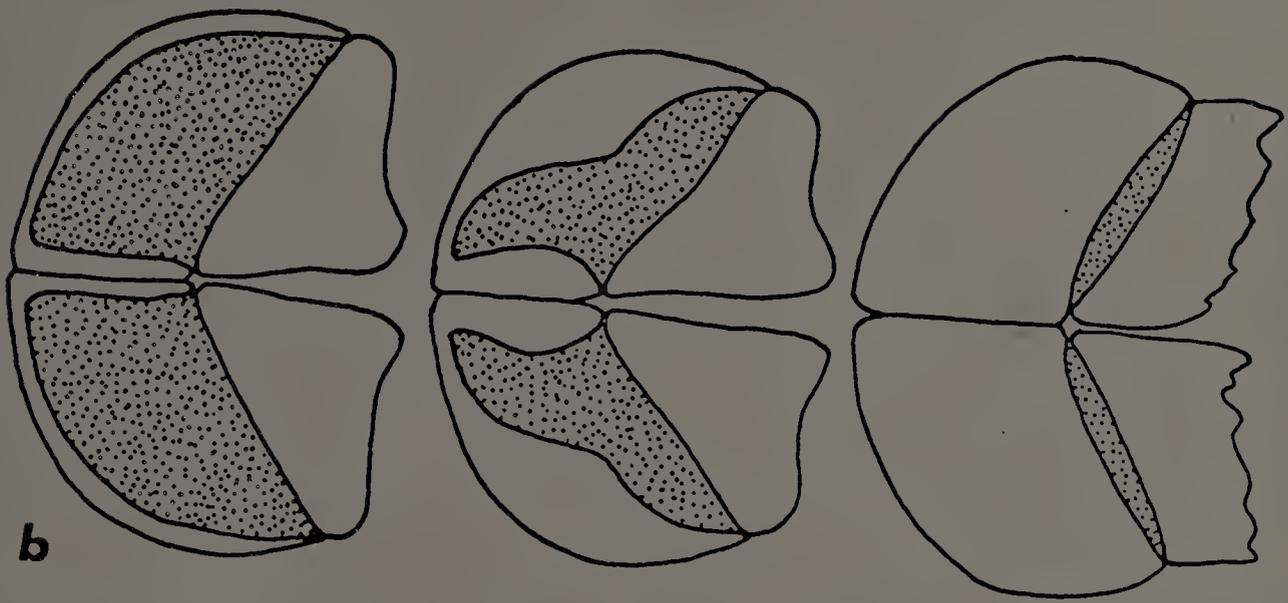
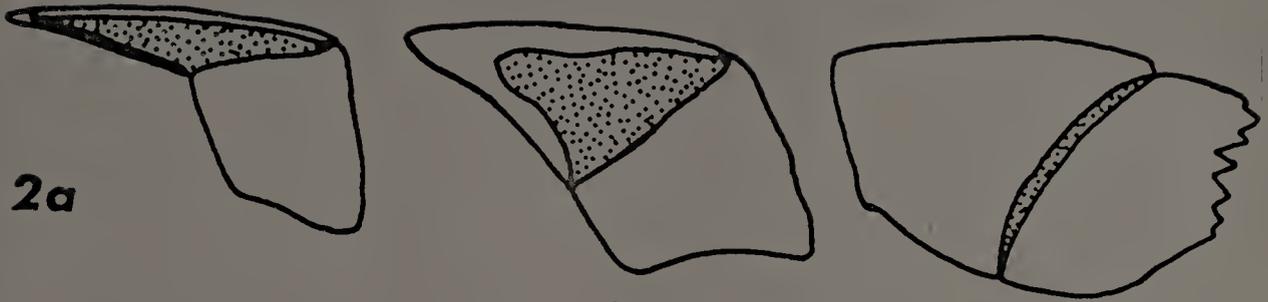


NORTH

MIDDLE
AMERICA

SOUTH

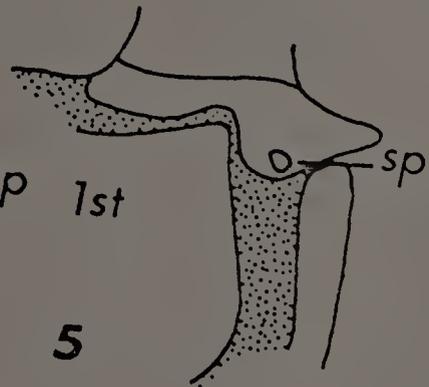
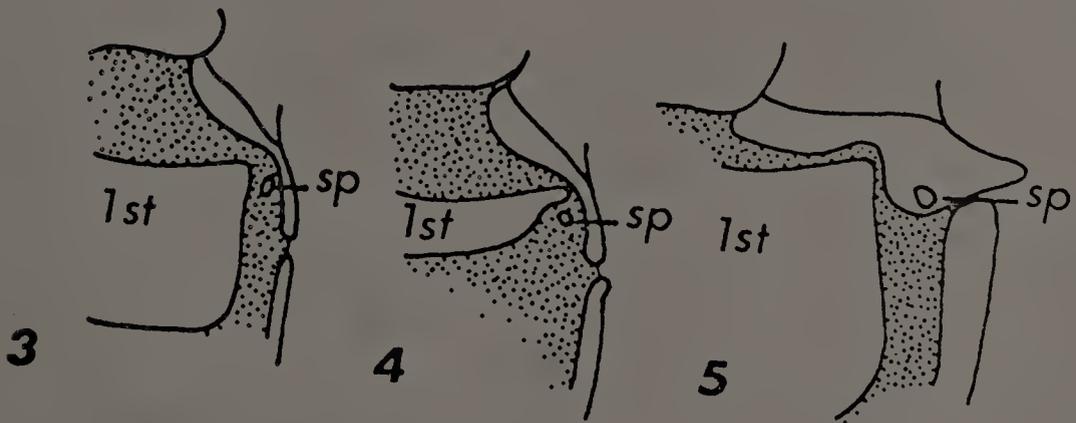


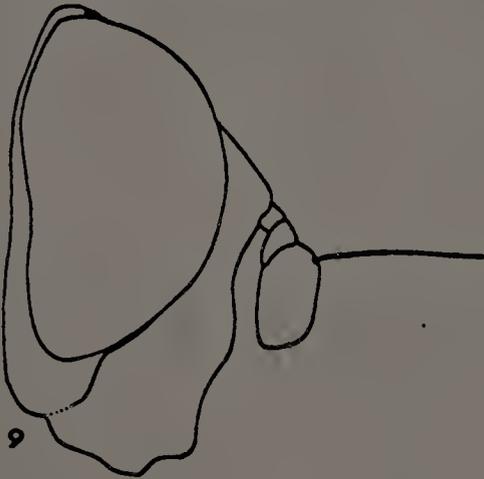
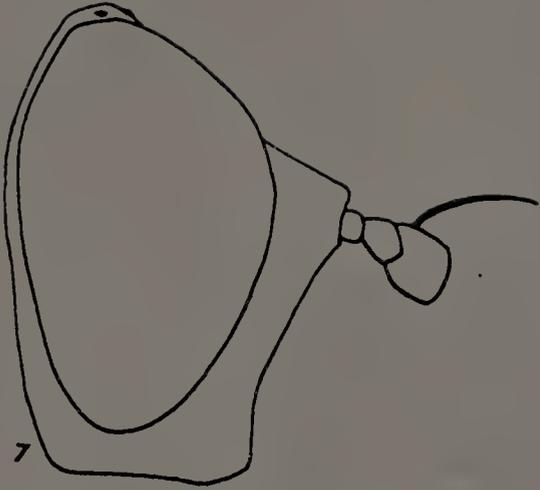


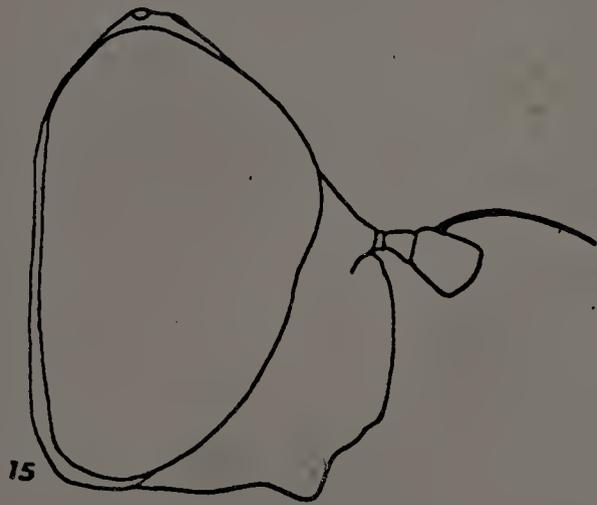
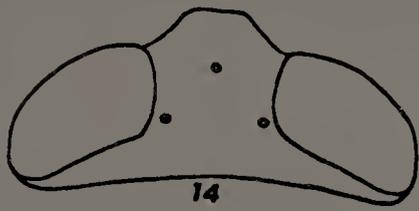
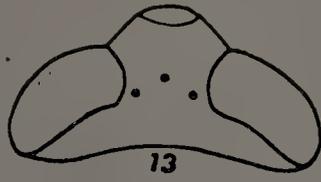
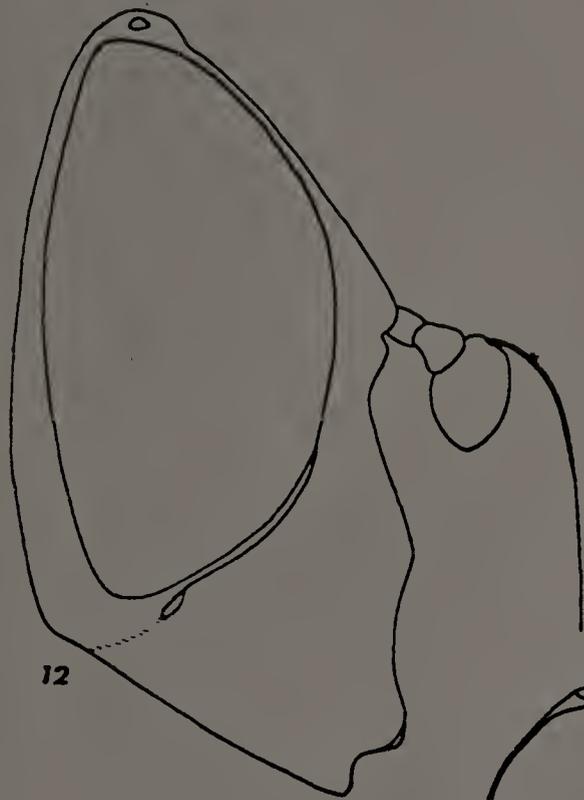
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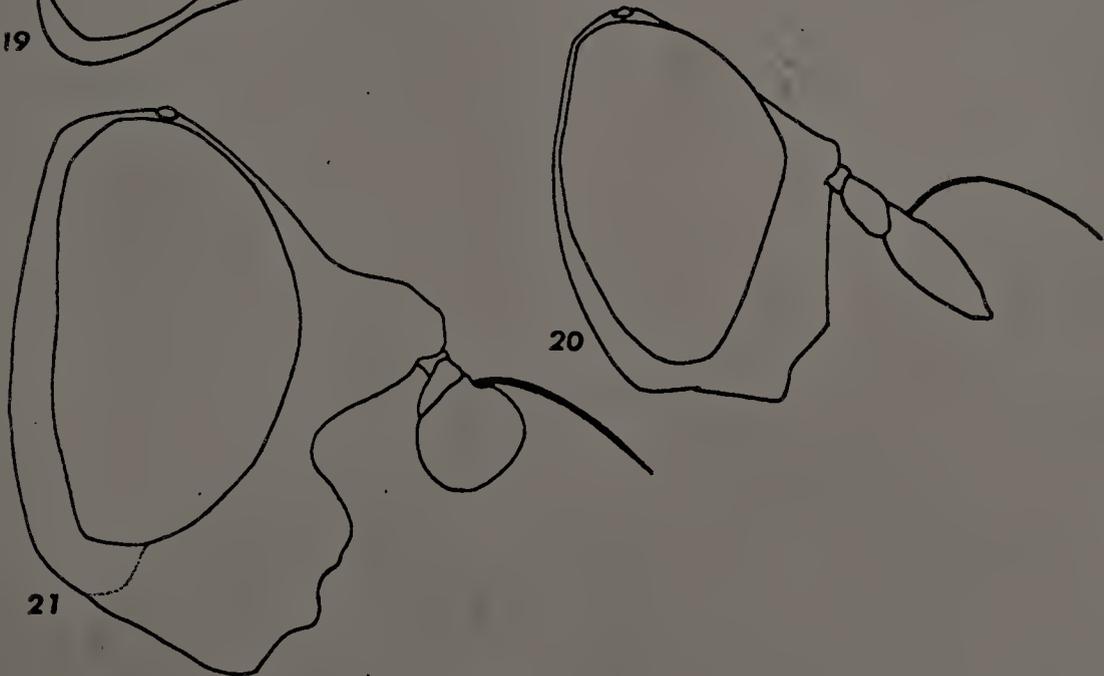
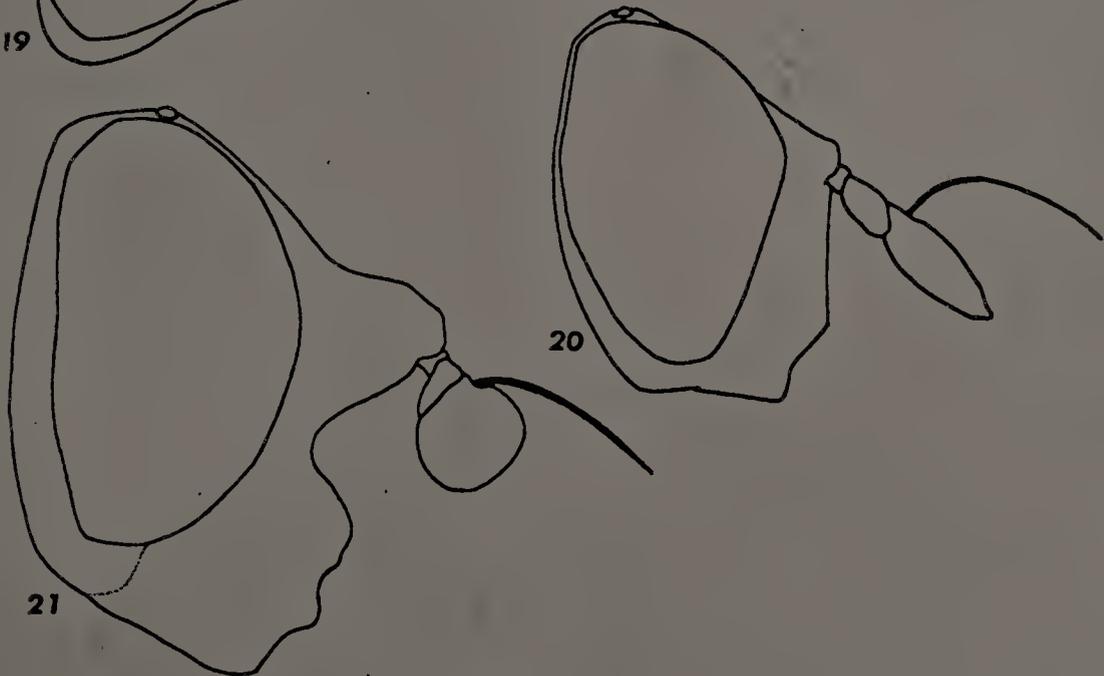
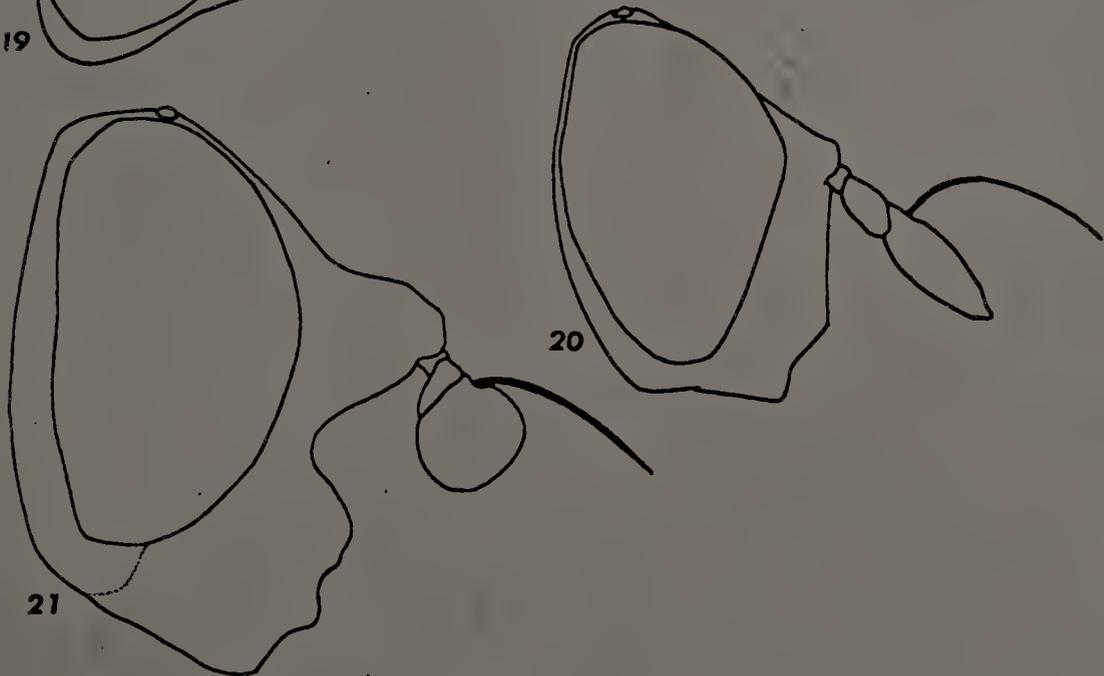
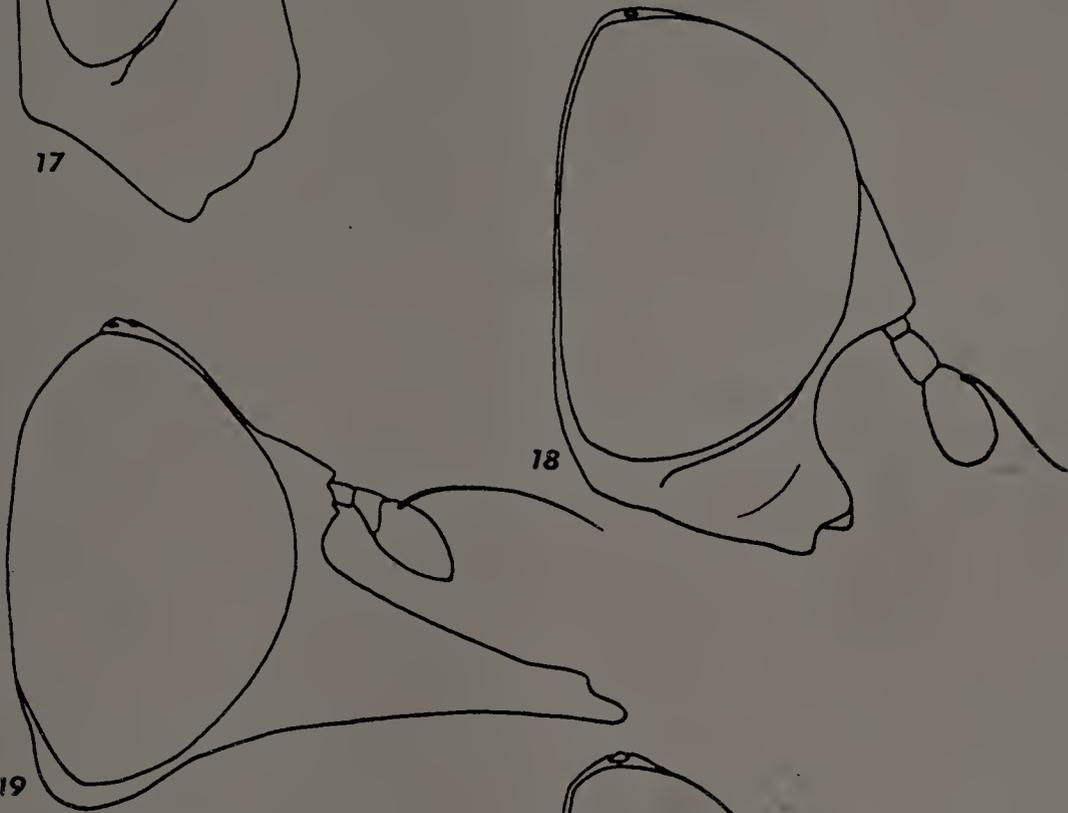
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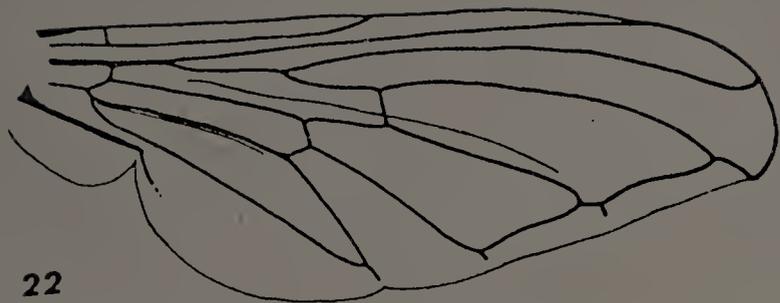
Well developed











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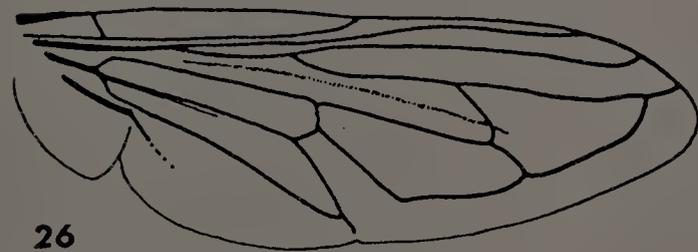
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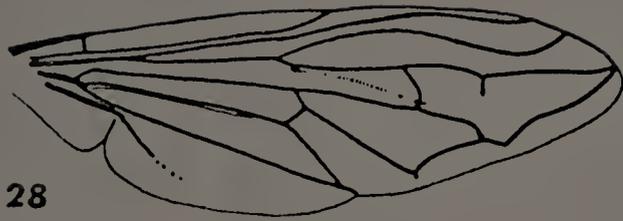
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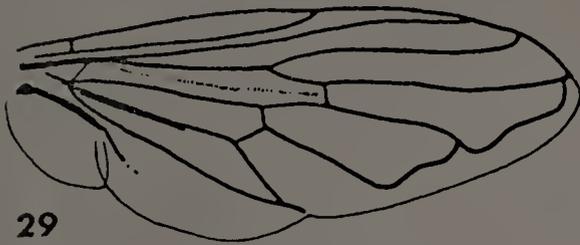
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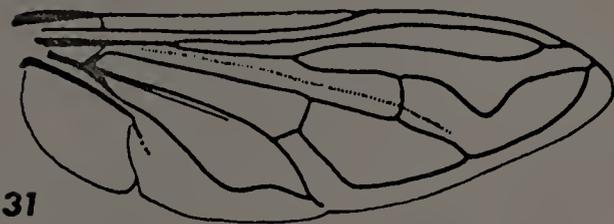
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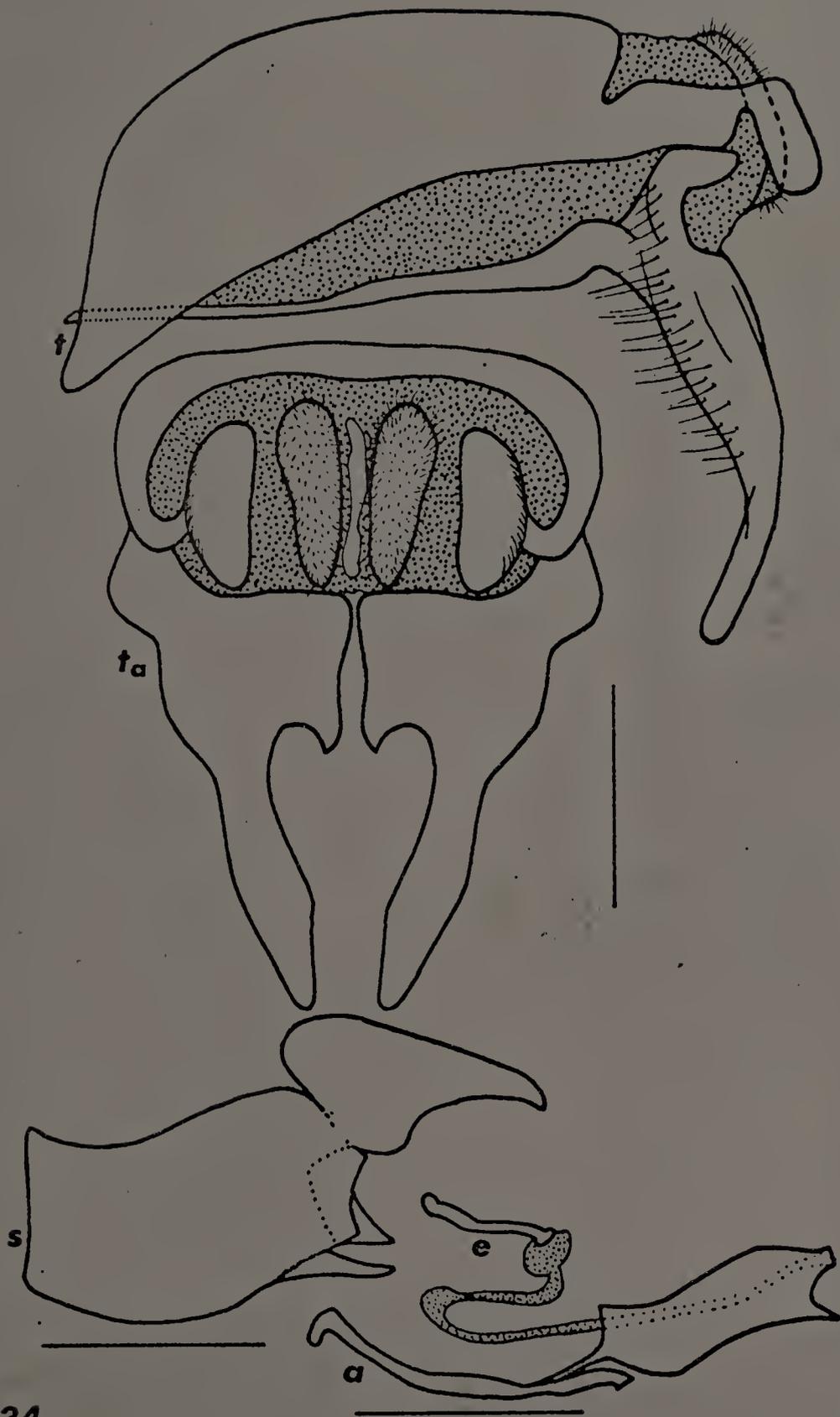
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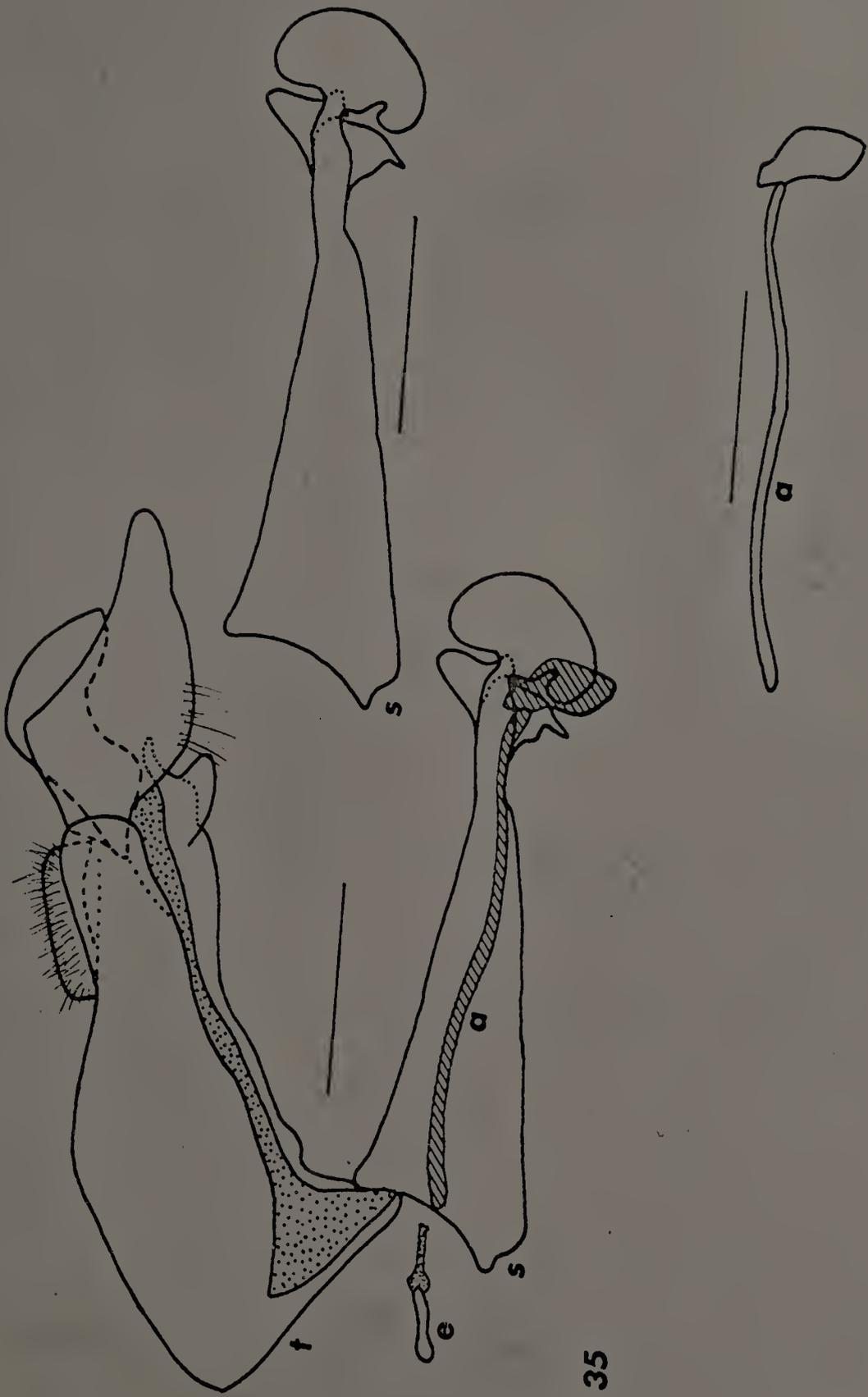


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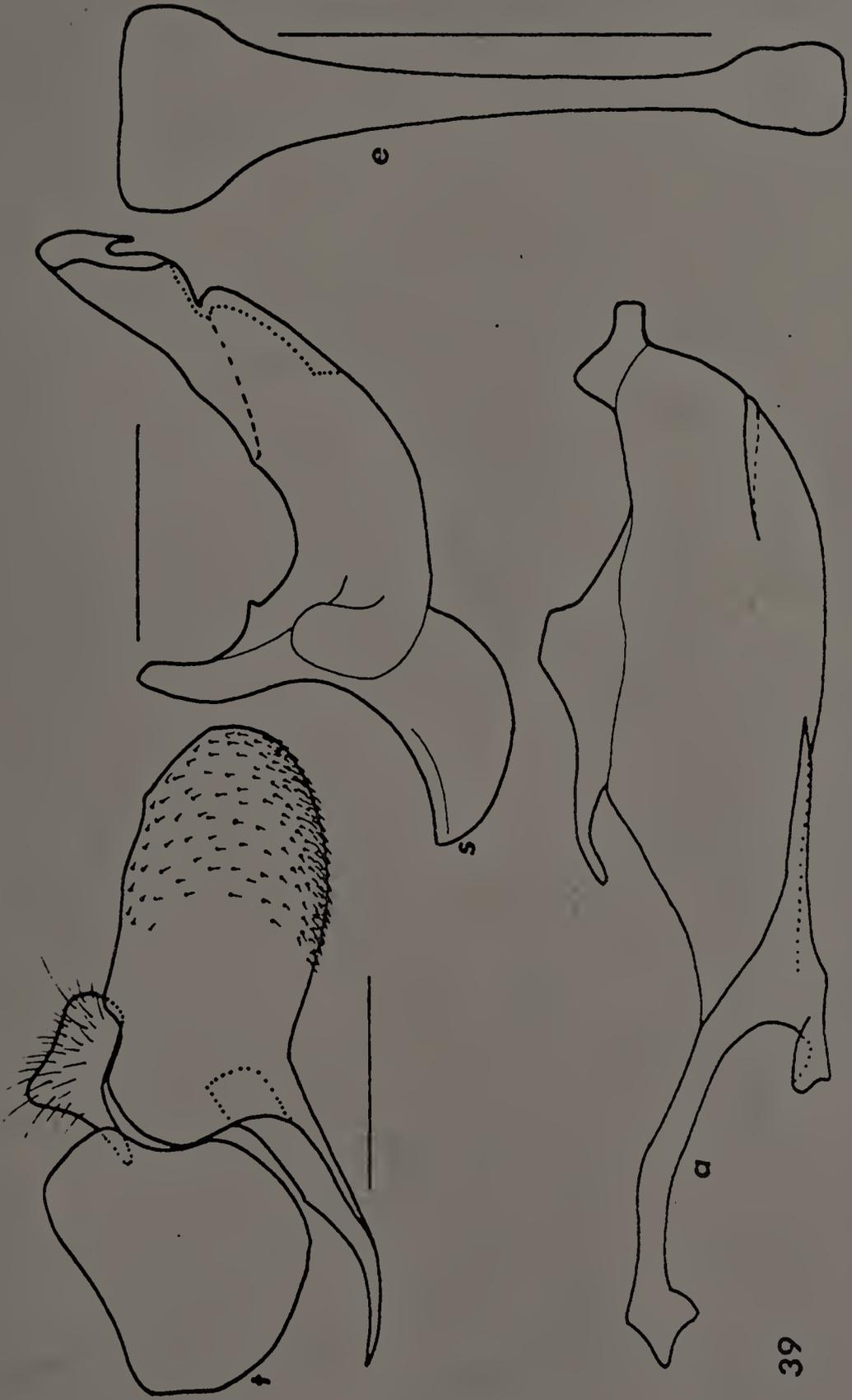


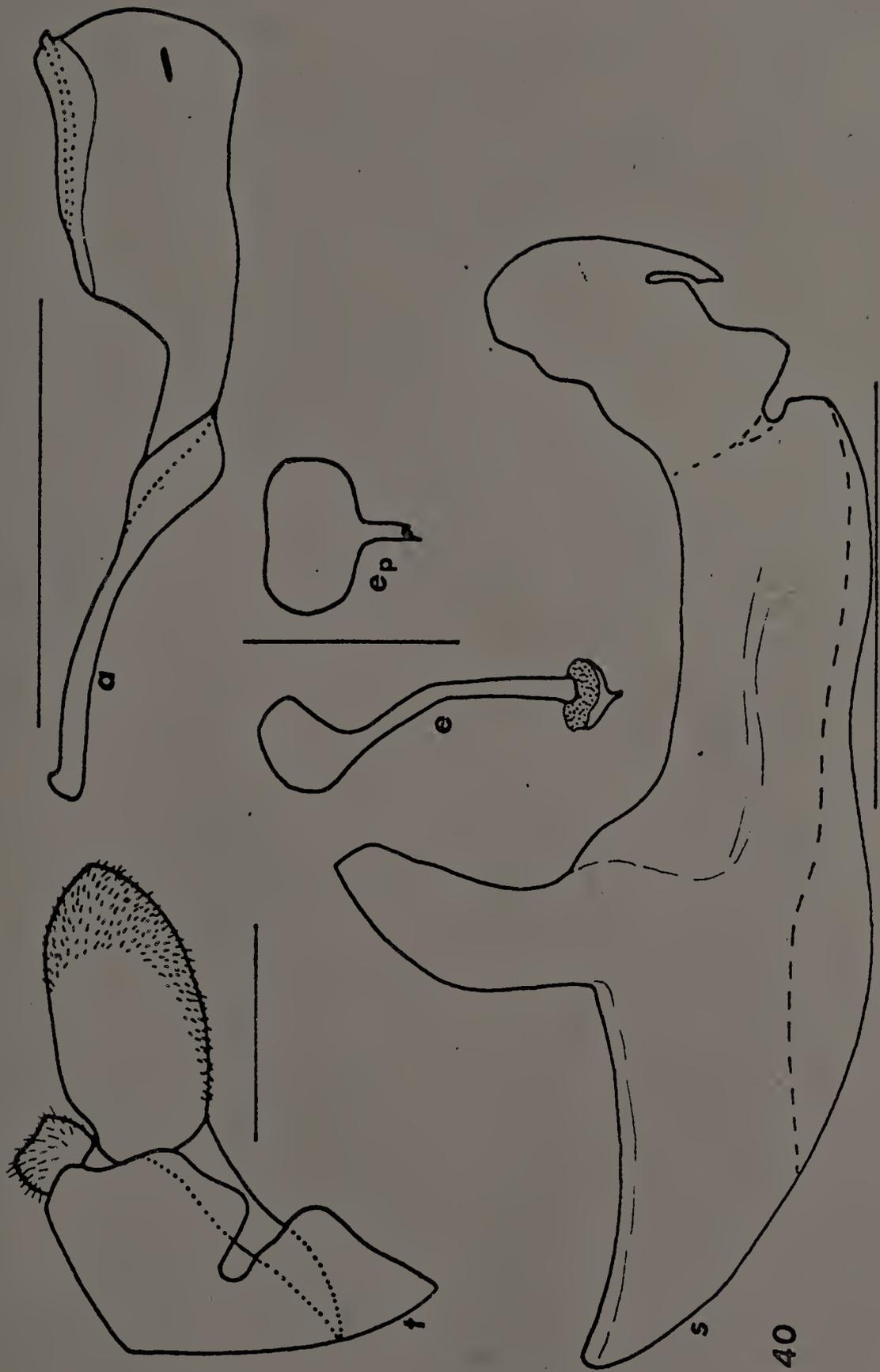
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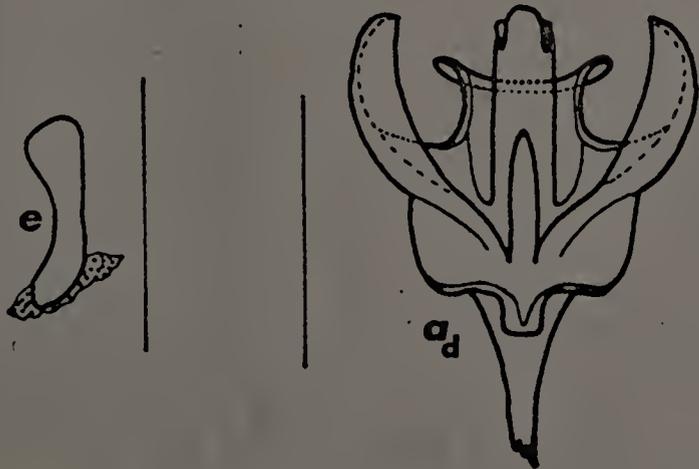
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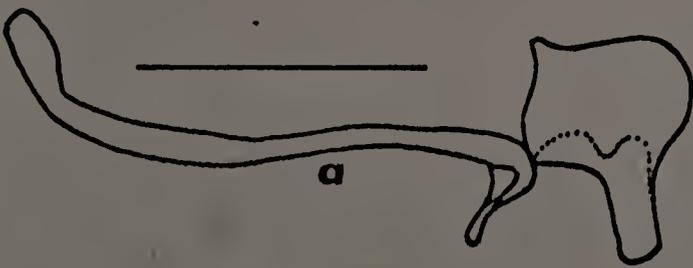




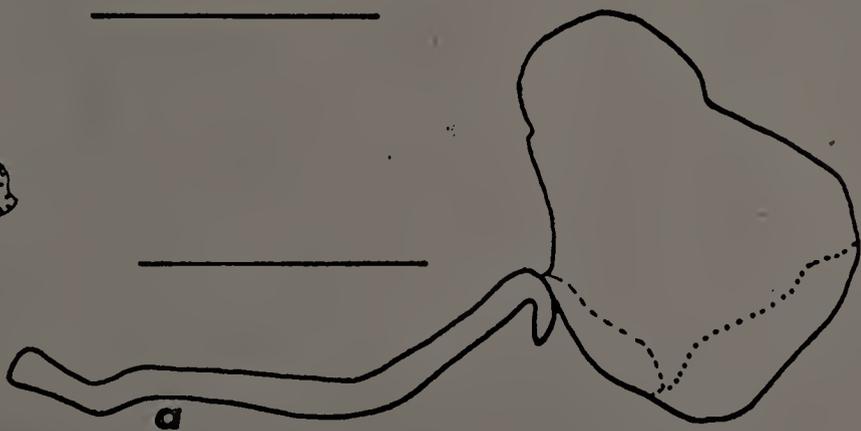
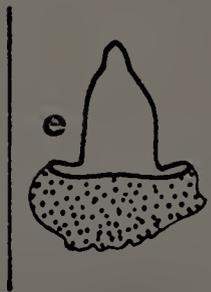
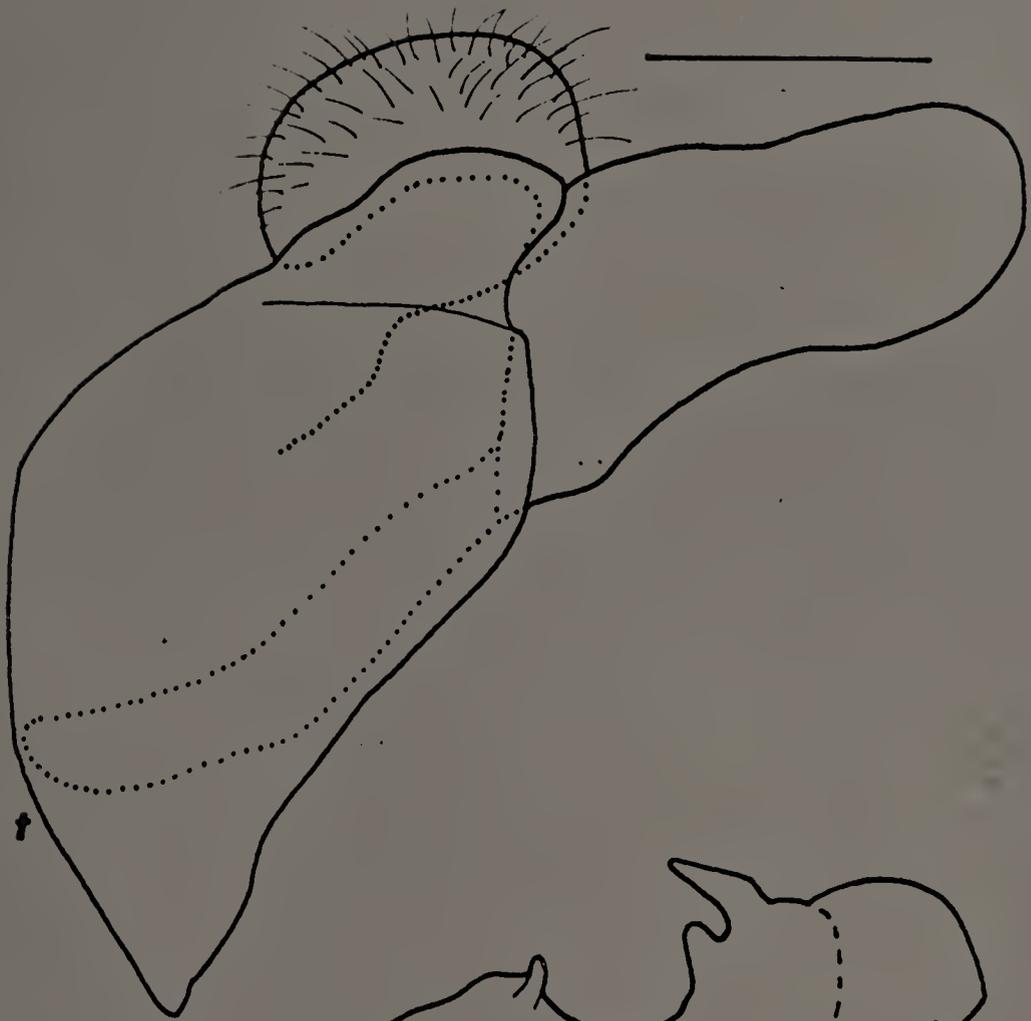


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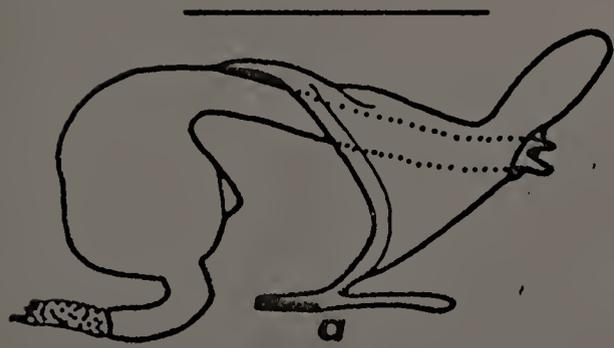
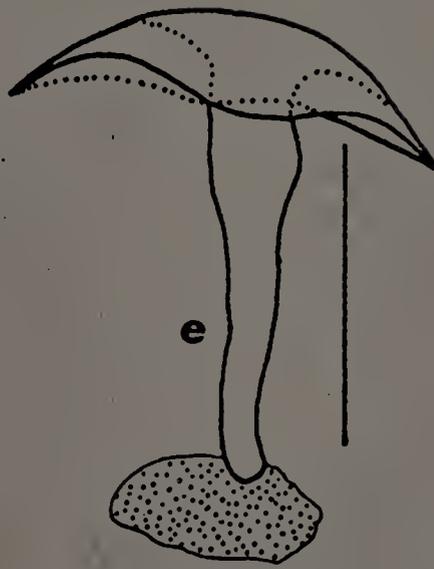
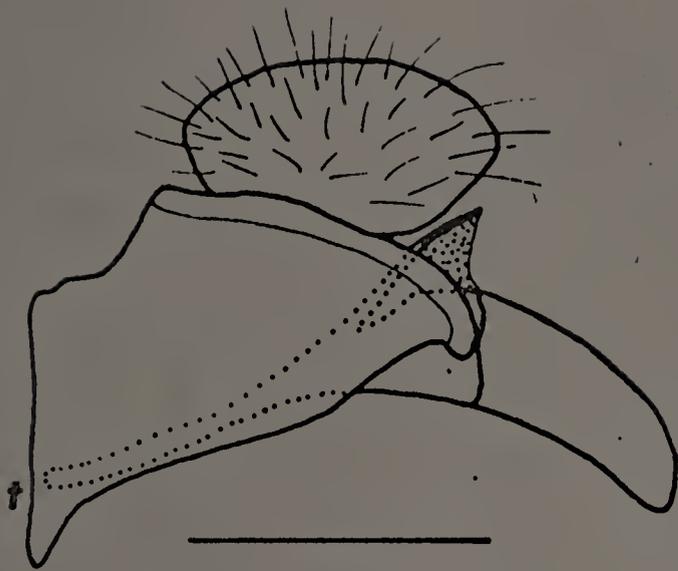


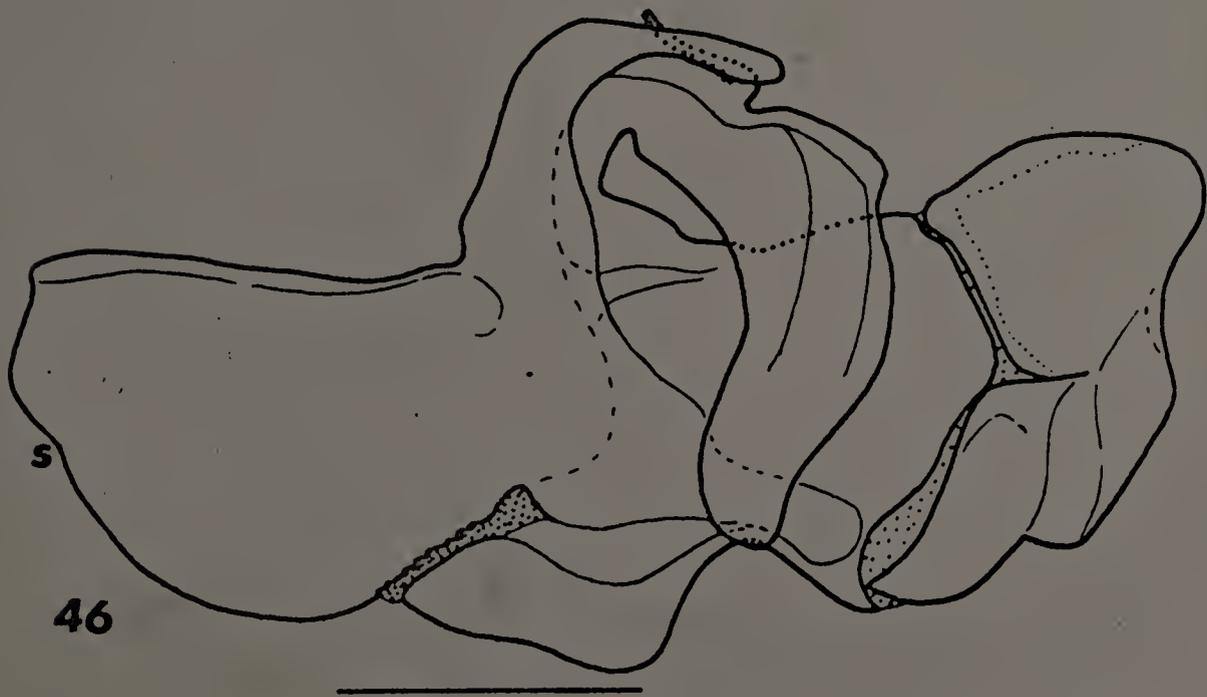


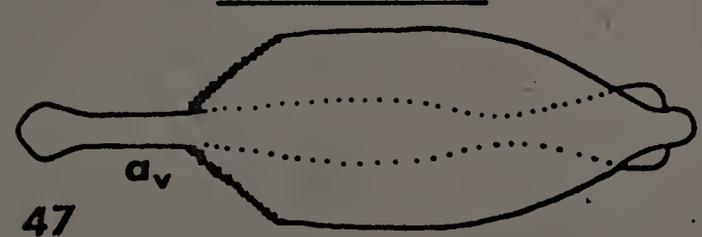
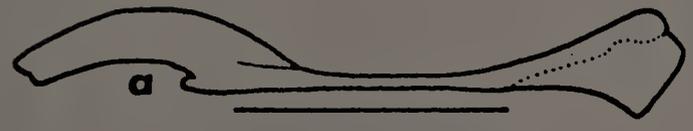
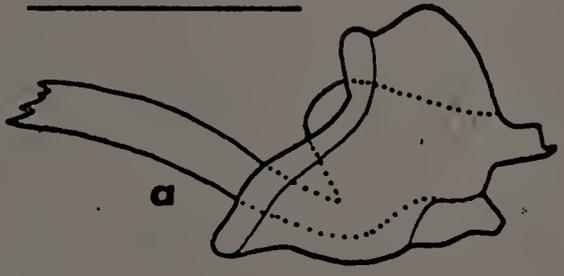
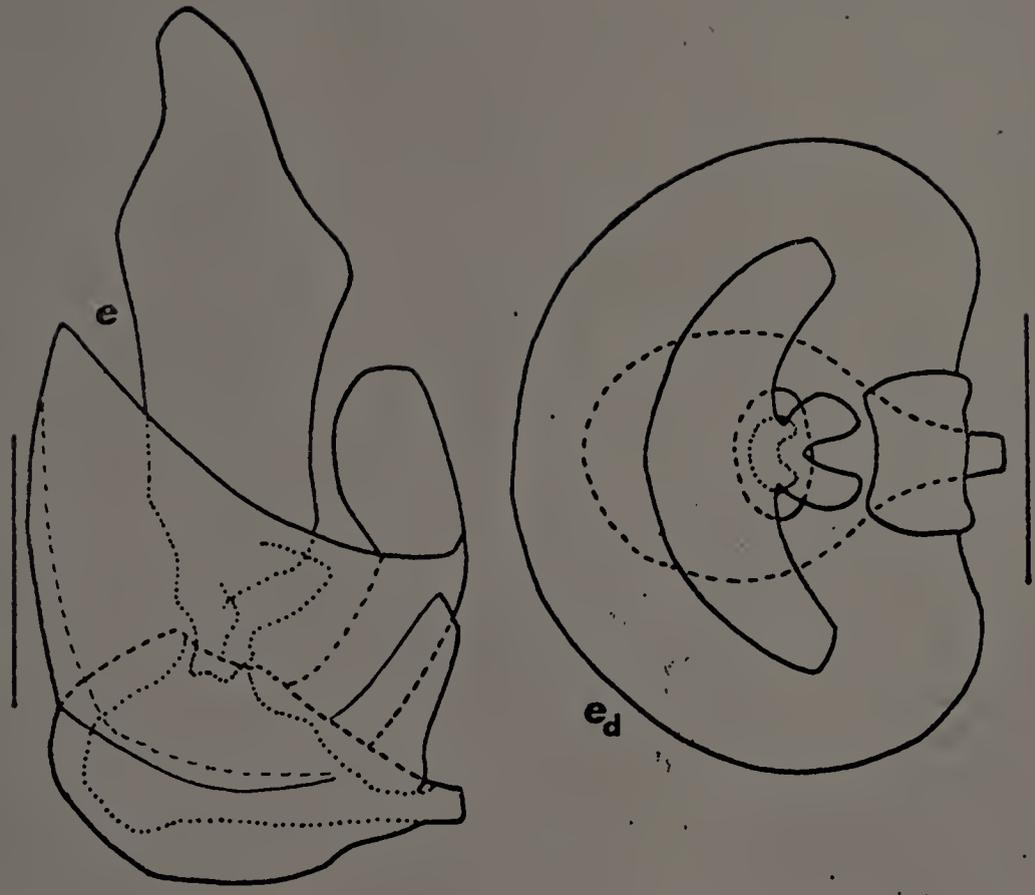
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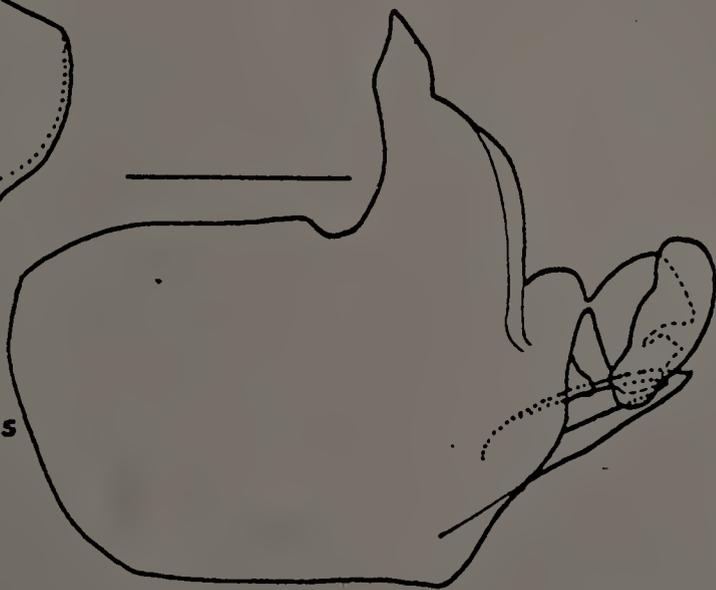
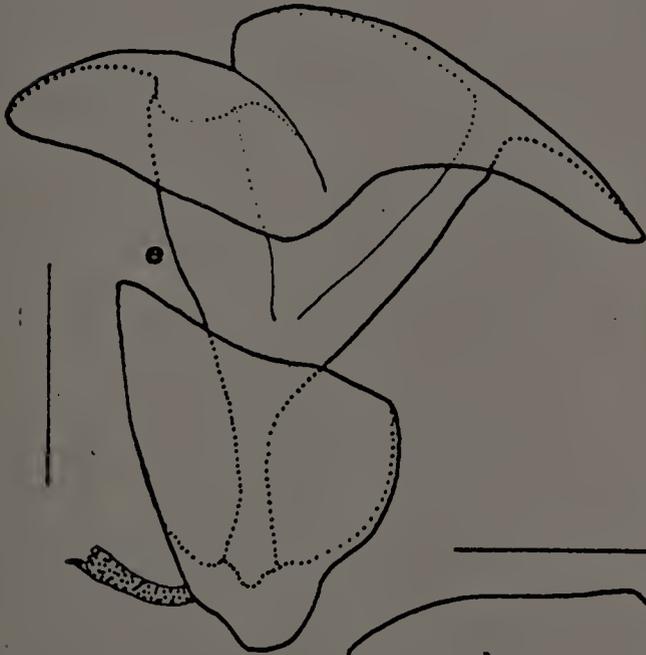
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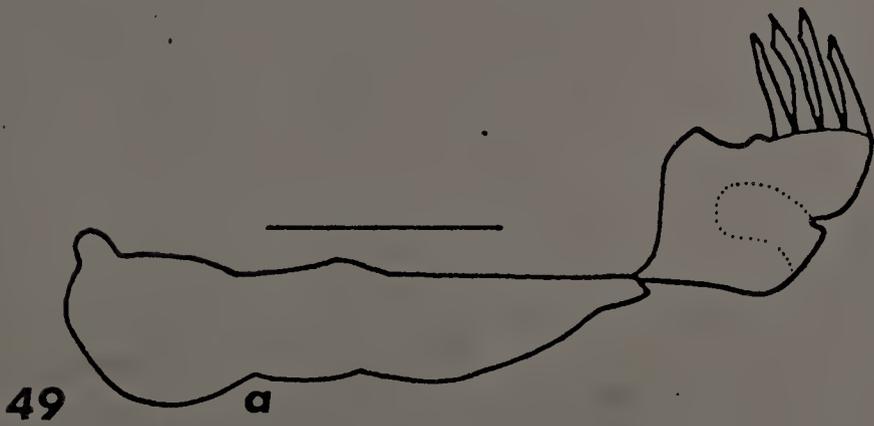
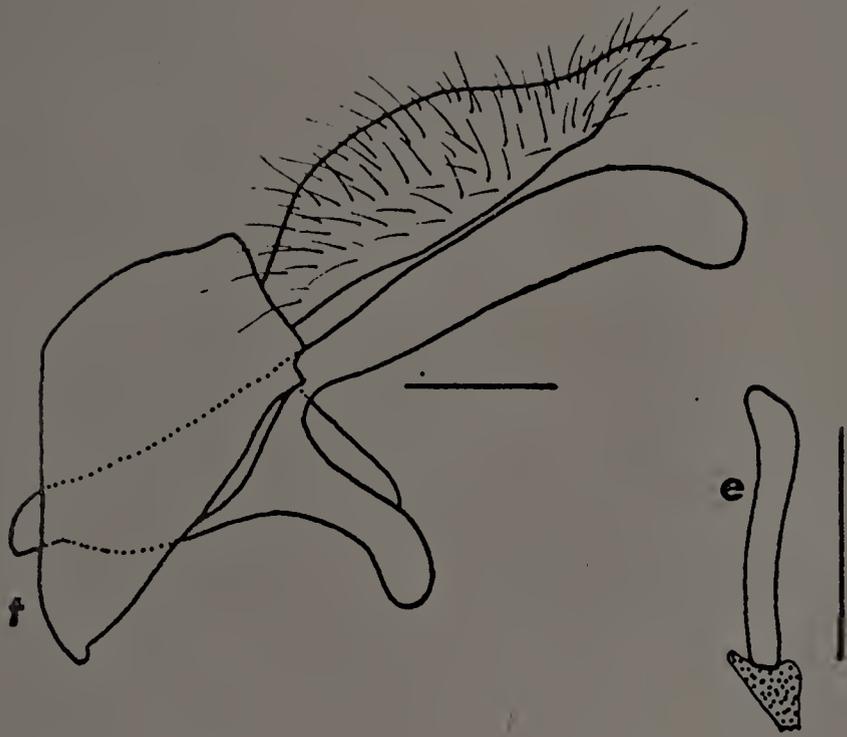


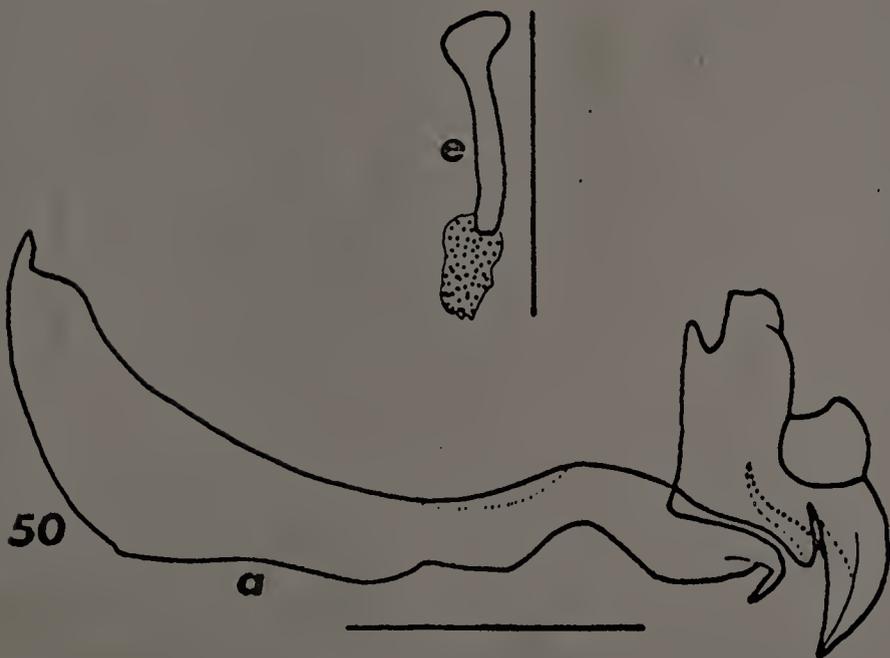
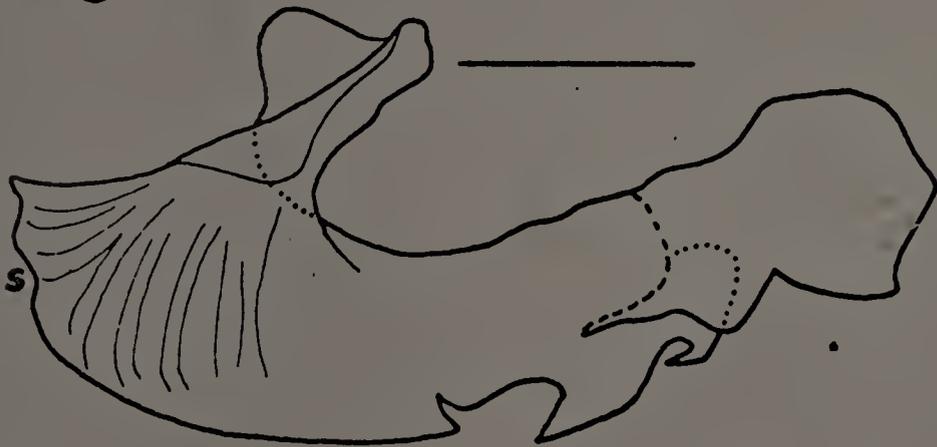
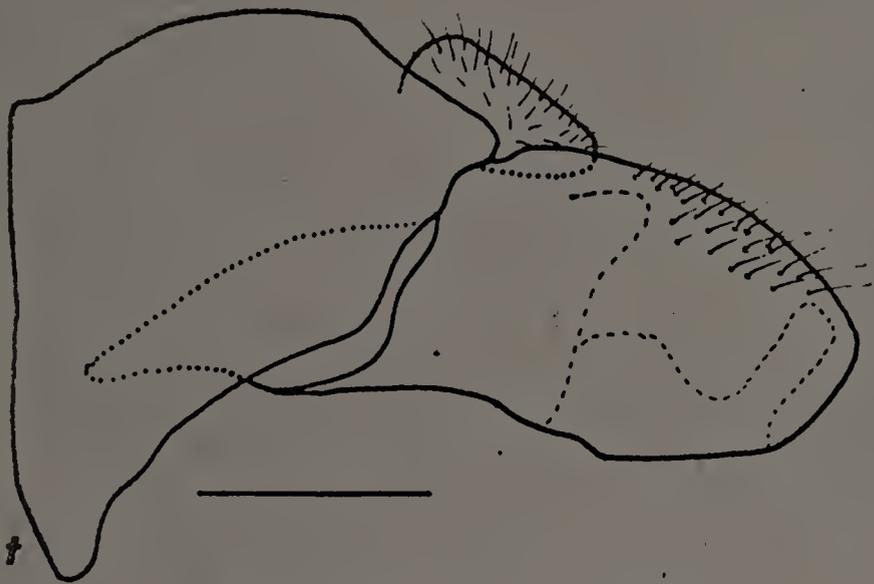
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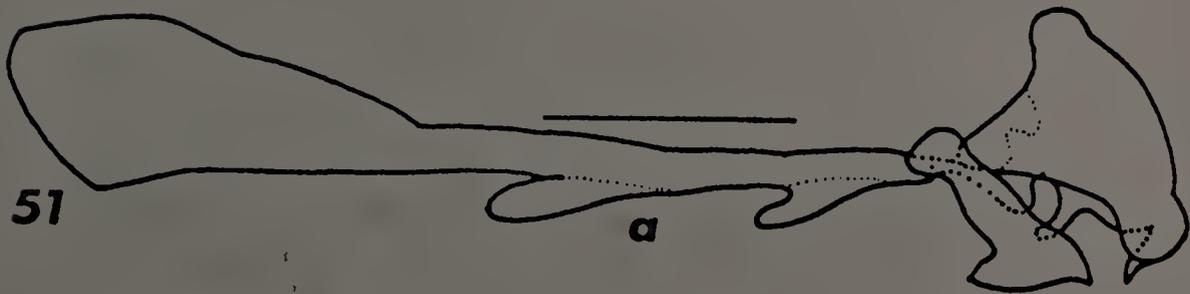
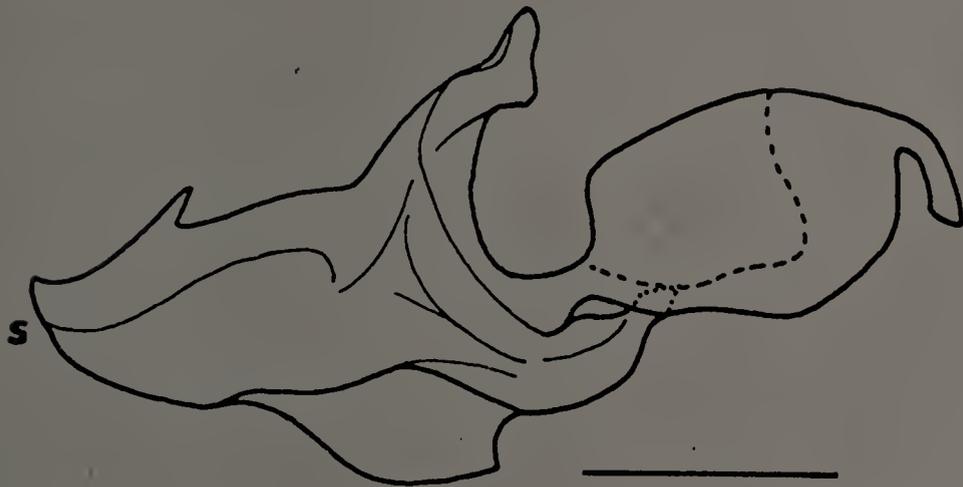
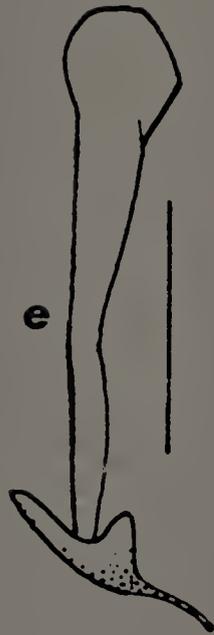


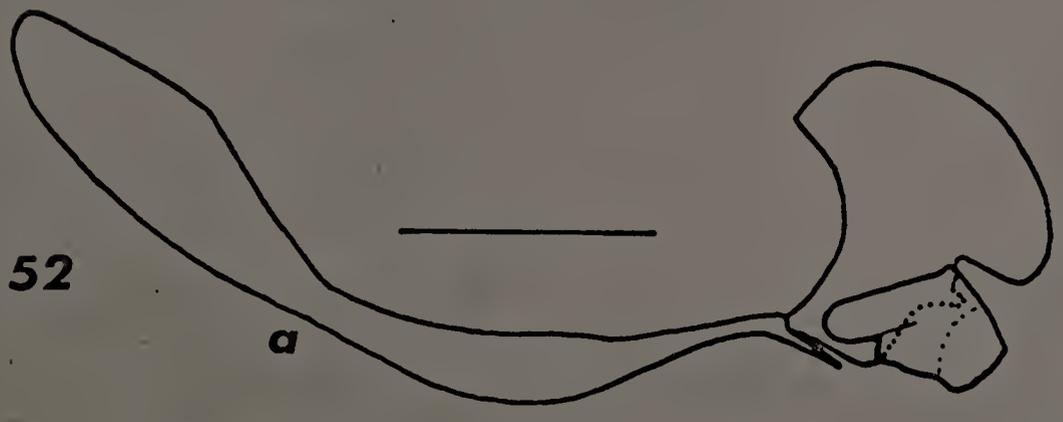
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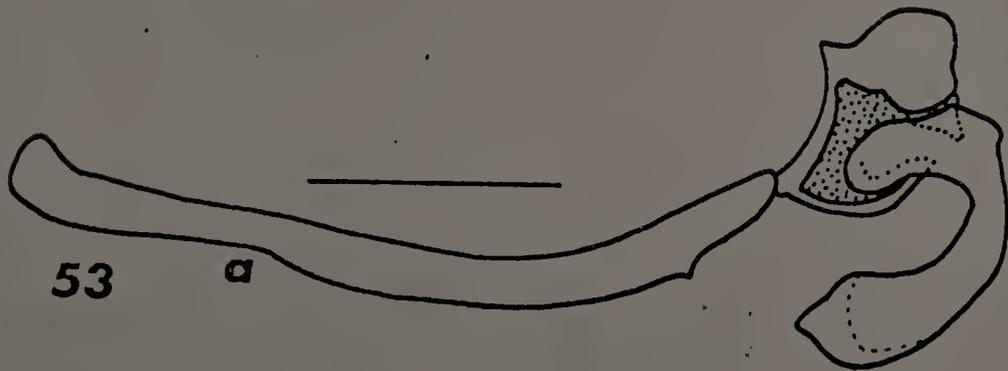
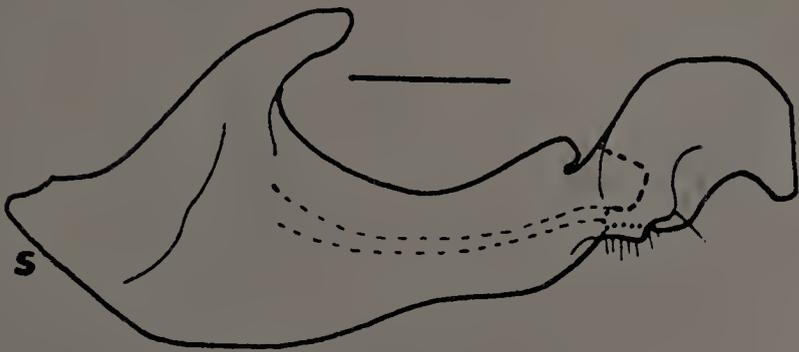
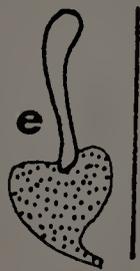
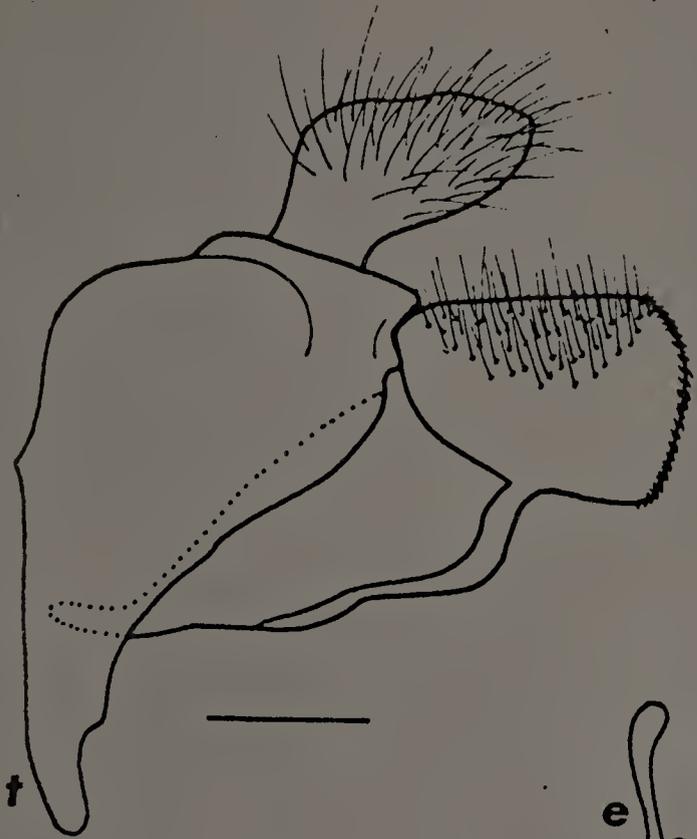


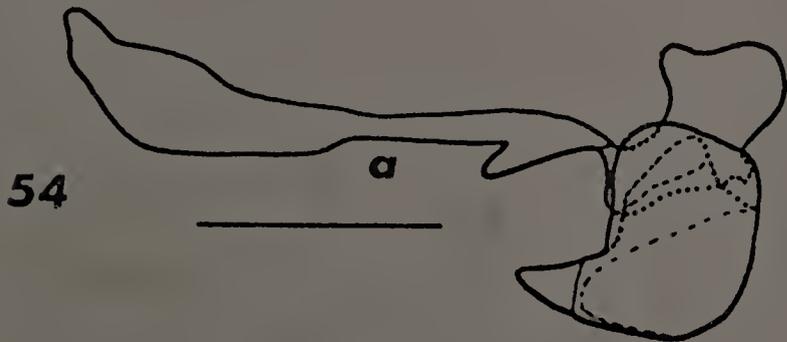
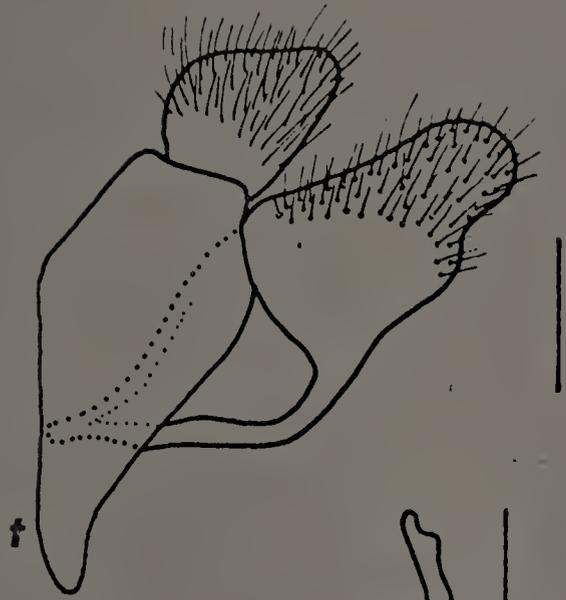


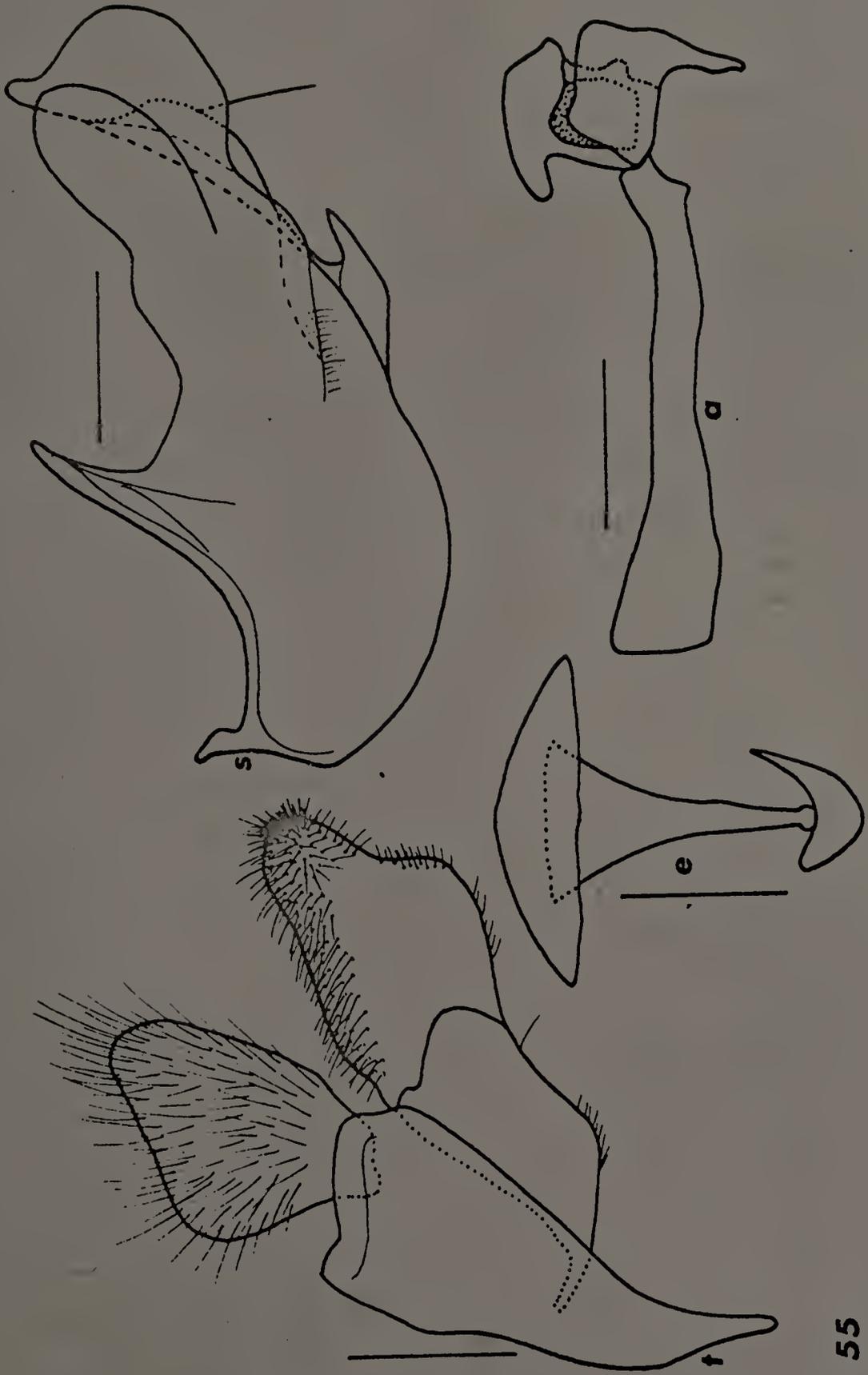


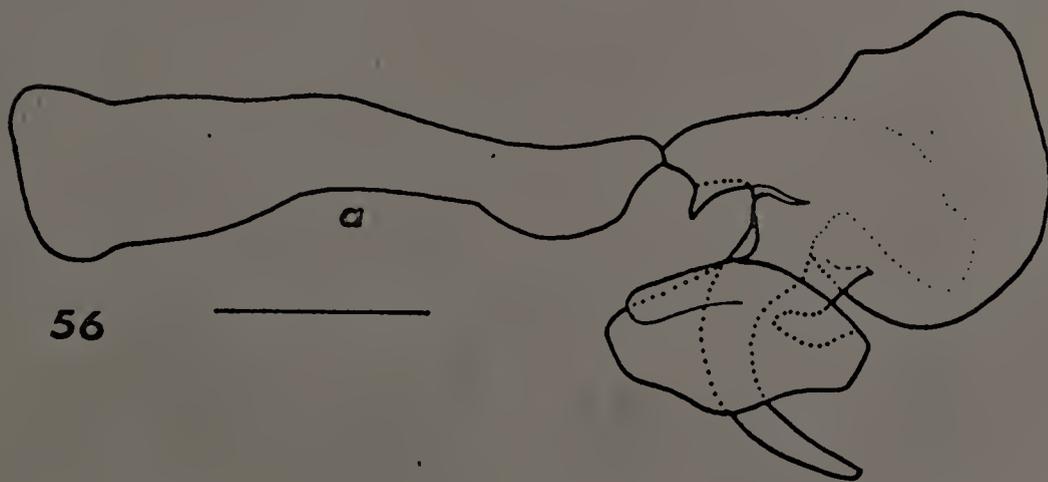


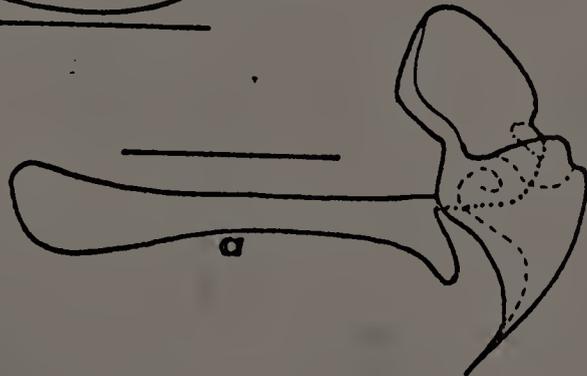
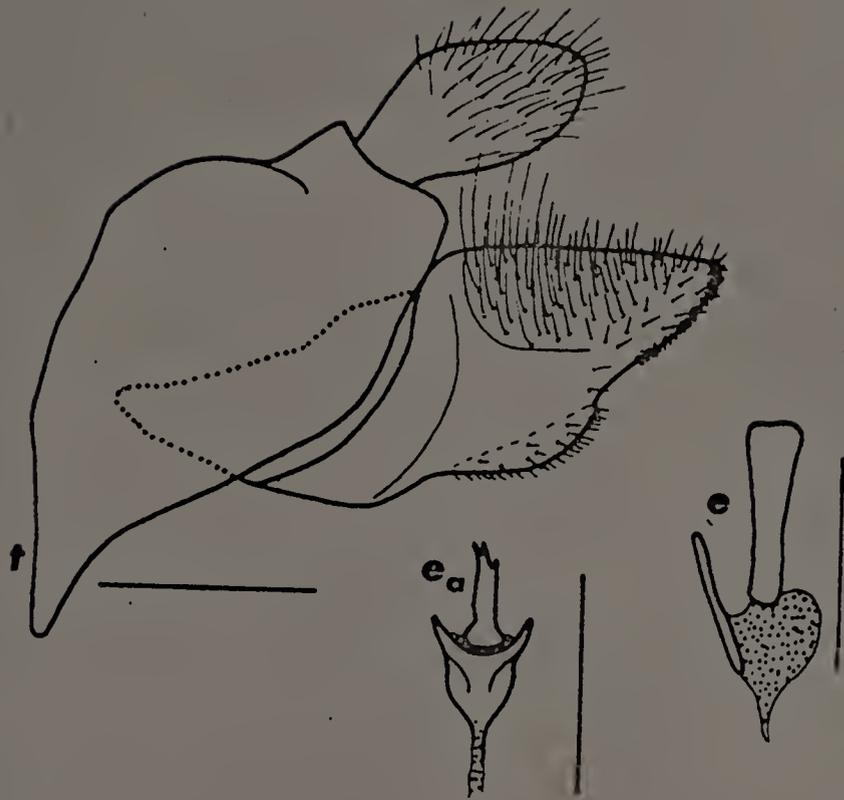
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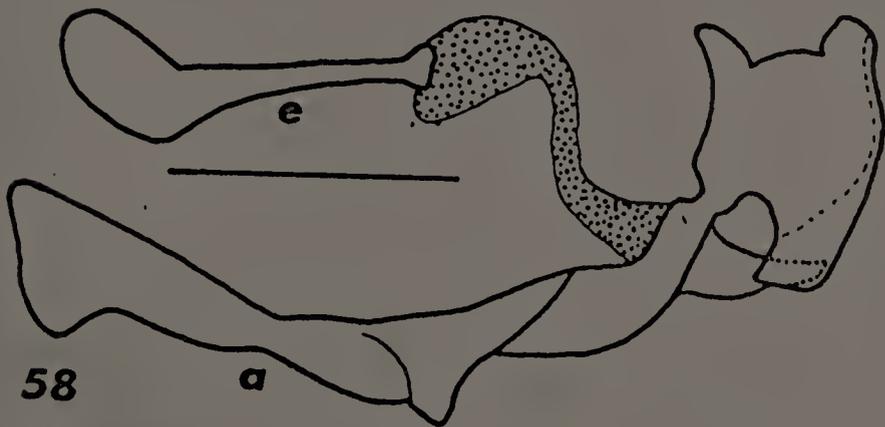


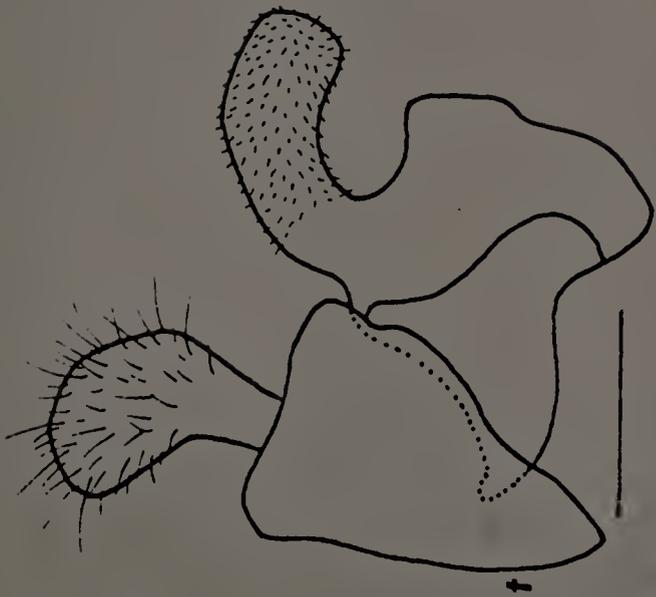
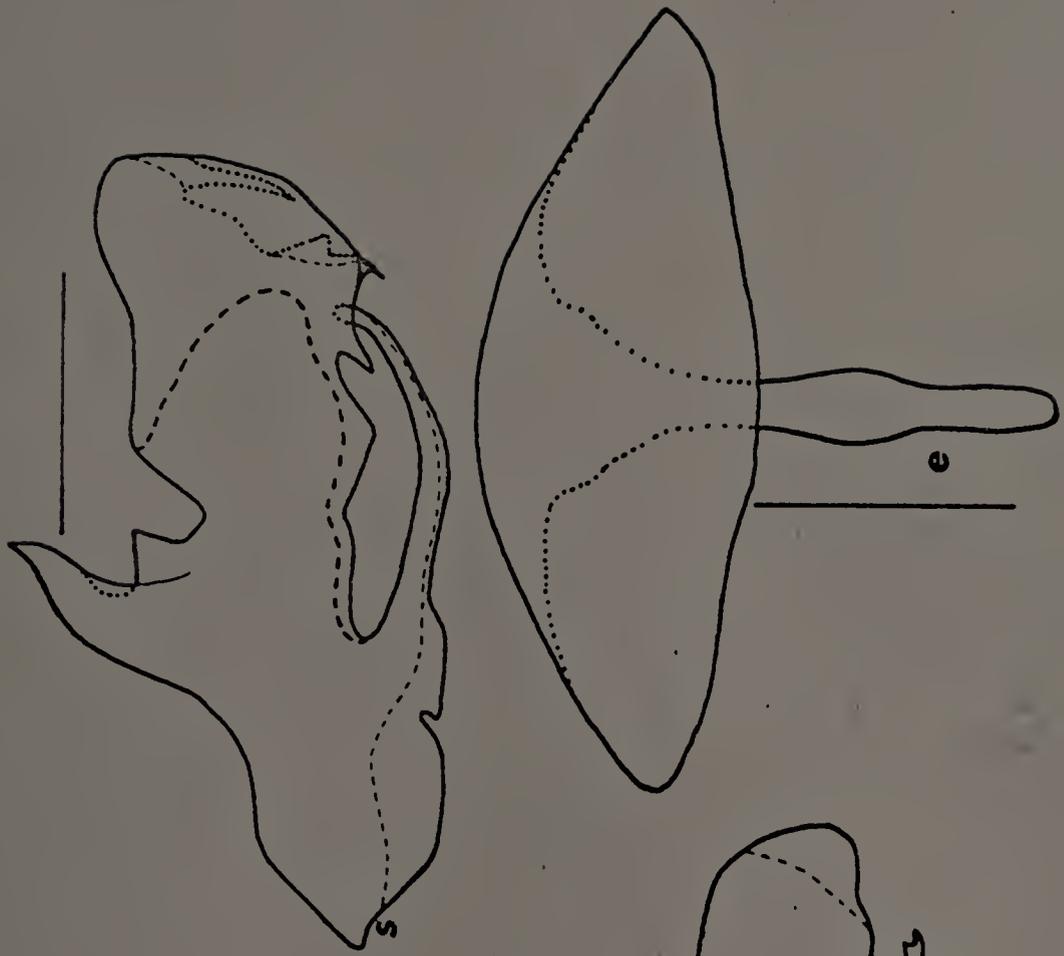


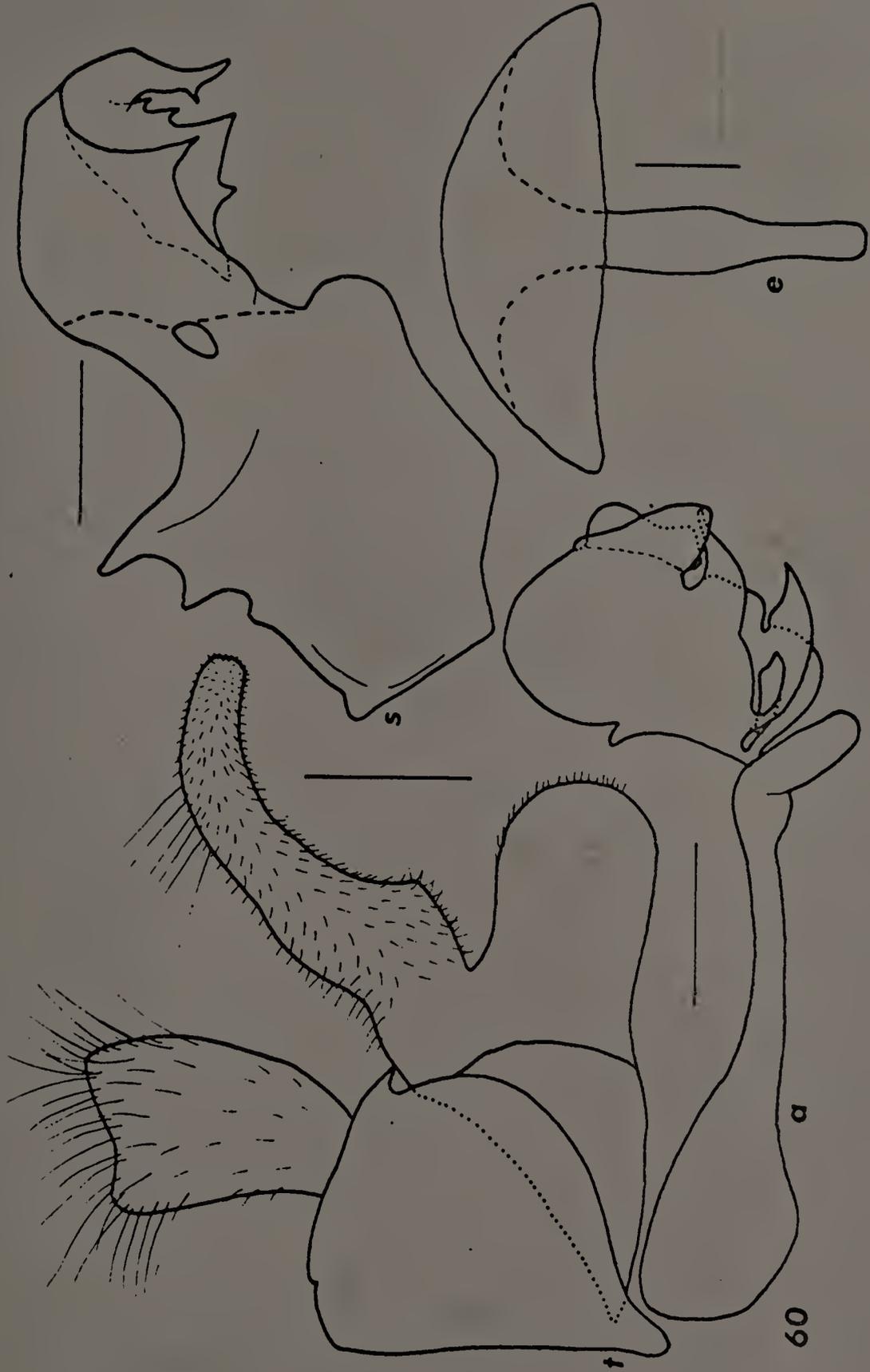


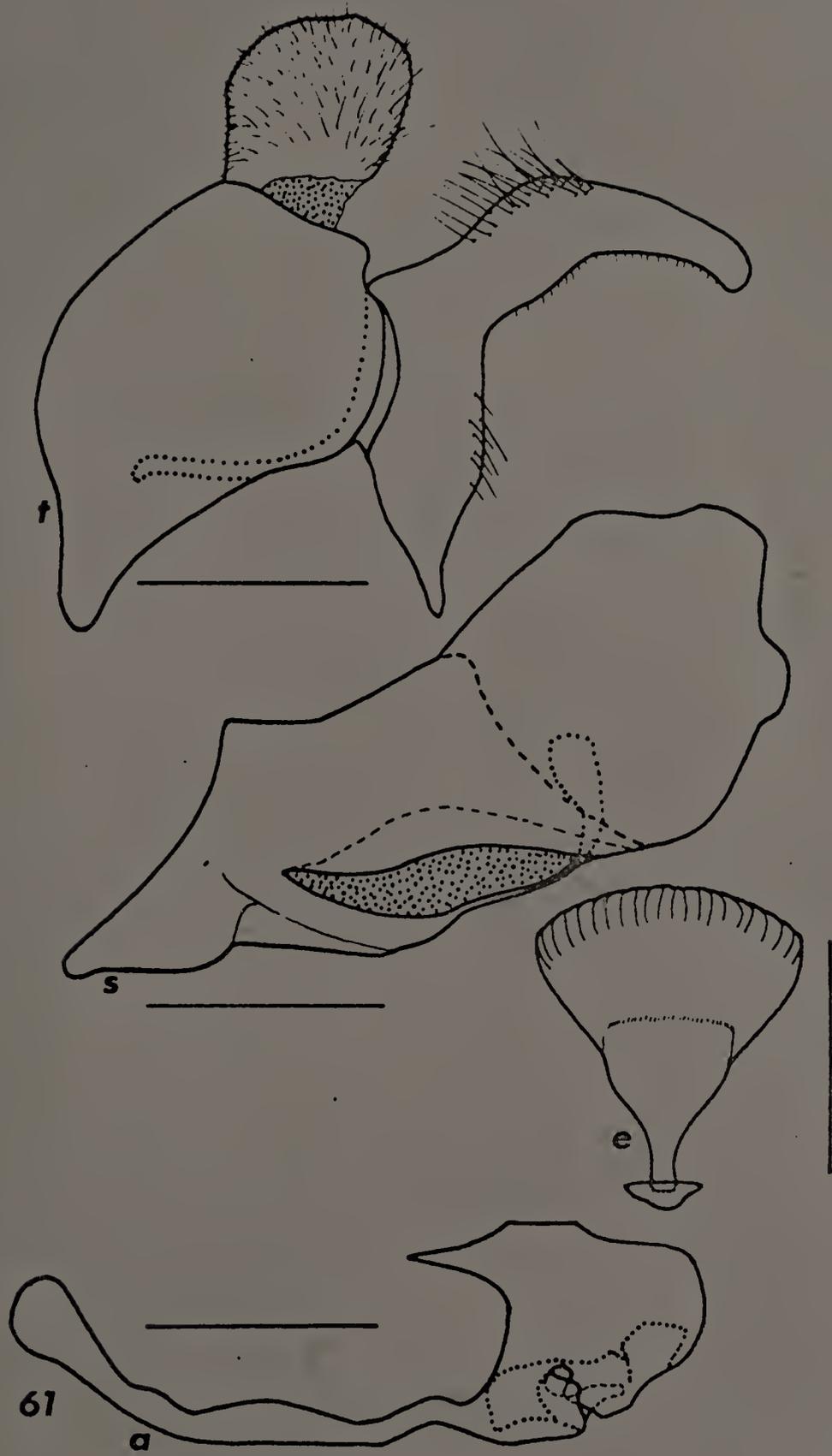


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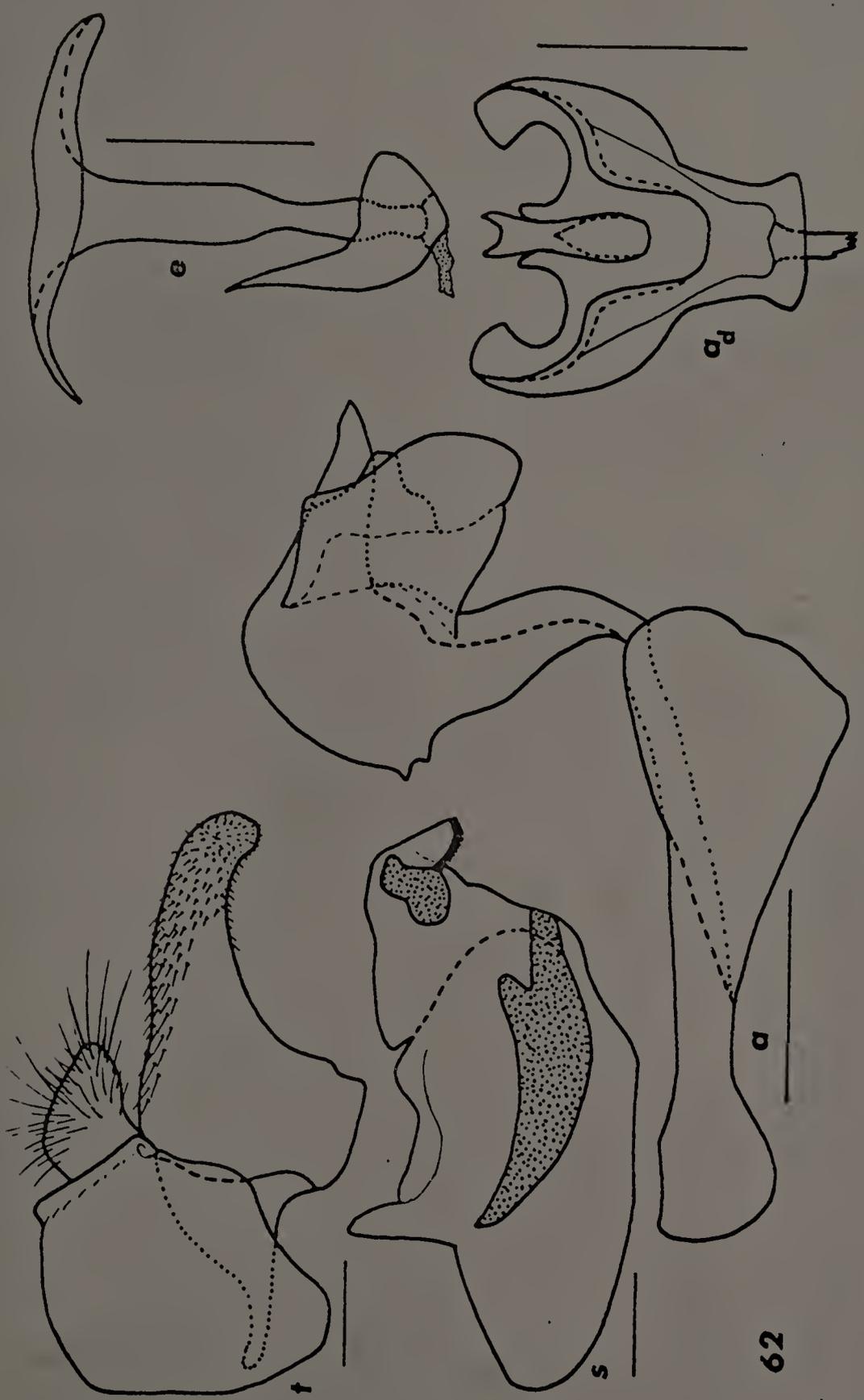


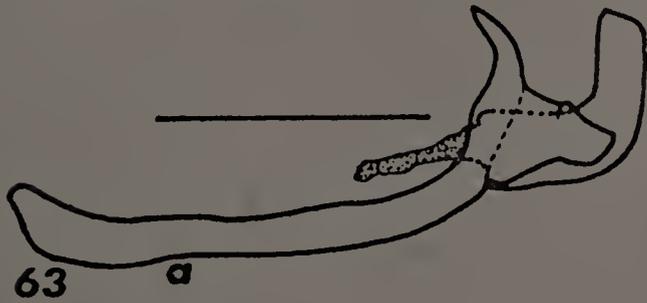
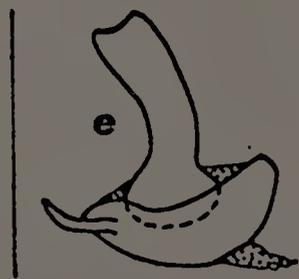


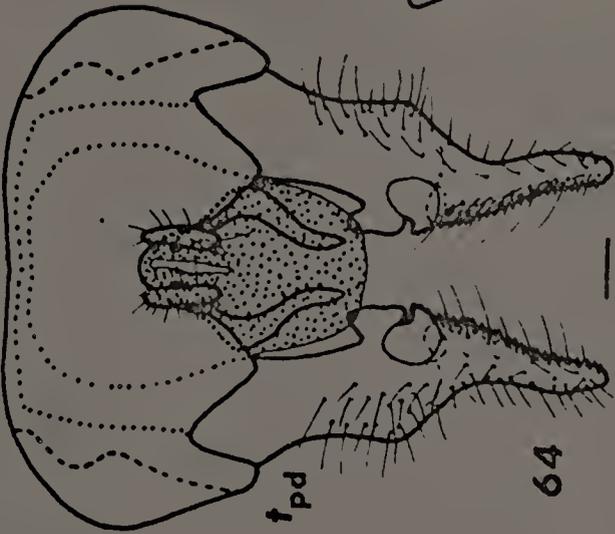
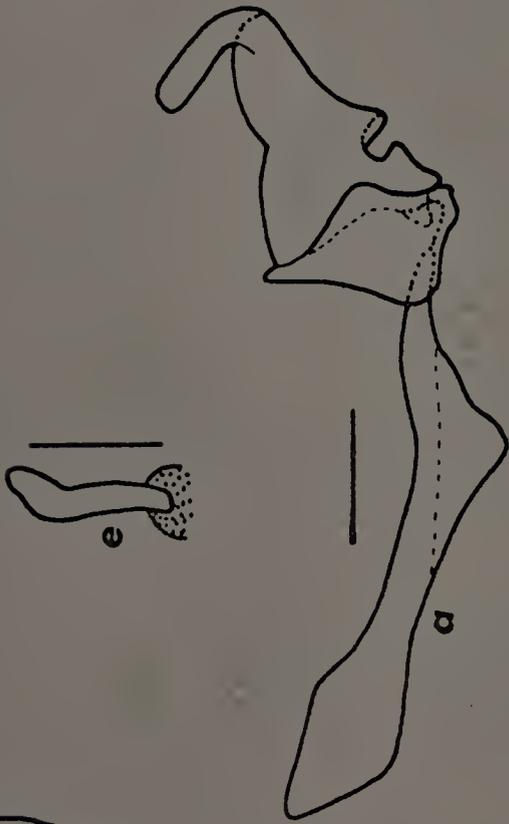




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