Short title:-

NEARCTIC SPECIES OF PNIGALIO SCHRANK AND SYMPIESIS FORSTER

MILLER

THE NEARCTIC SPECIES OF PNIGALIO SCHRANK AND SYMPIESIS FORSTER (HYMENOPTERA : EULOPHIDAE)

by

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ABSTRACT

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THE NEARCTIC SPECIES OF PNIGALIO SCHRANK AND SYMPIESIS FORSTER

Material representing the North American species of the two chalcidoid genera Pnigalio Schrank and Sympiesis Forster was amassed, examined and is taxonomically reviewed. A historical review of the classification is presented and the materials and methods used are discussed. Salient morphological structures are copiously illustrated and the morphological and taxonomical terms used for them are given. The generic and species concepts of the author are provided and available information on the biology of the groups is presented. The distribution of the genera is given and a hypothesis on the phylogeny of the groups is discussed. A classification of the entities involved based on the biological species concept is offered.

The generic classification is unchanged but their limits are redescribed and keys to distinguish them and their species are provided. Synonomy of each species is given, the entity described and specific characteristics illustrated. Intraspecific variability is briefly described and when necessary lectotypes are selected and important information on them recorded. The distribution of each species is graphically shown. The provinces, states and localities are alphabetically tabulated and information on the sex of the specimens examined, the periodicity of their presence in nature, the hosts upon which they prey, the niche provided by the hosts and the plant upon which the hosts are nourished added. A typical niche attacked by each parasitoid is illustrated and available information on the biology of the parasitoid is recorded.

Unplaced species are listed and a brief discussion on each is provided. This is followed by a list of the references cited.

Only fifteen of the forty-three species and subspecies names available for the populations recognized by the author have retained a nomenclatorial status. They are Pnigalio proximus (Ashmead), Pnigalio metacomet (Crawford), Pnigalio uroplatae (Howard), Pnigalio maculipes (Crawford), Pnigalio flavipes (Ashmead), Sympiesis conica (Provancher), Sympiesis dolichogaster Ashmead, Sympiesis marylandensis Girault, Sympiesis bimaculatipennis (Girault), Sympiesis stigmata Girault, Sympiesis stigmatipennis Girault, Sympiesis ancylae Girault, Sympiesis argenticoxae Girault, Sympiesis marylandia Girault and Sympiesis viridula (Thomson).

Three new species have been described as Sympiesis enargiae new species, Sympiesis fragariae new species and Sympiesis acrobasidis new species.

The following species cannot be placed within the species concepts of the writer and are listed as unplaced species: Pnigalio coloni (Girault), Pnigalio kukakensis (Ashmead), Pnigalio minio (Walker), Pnigalio quercicola (Ashmead), Pnigalio pallipes Provancher, Sympiesis chenopodii Ashmead, Sympiesis gracillariae (Chambers), Sympiesis marylandica Girault and Sympiesis tricladus (Provancher).

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I. INTRODUCTION

A systematic review of the nearctic parasitoid insect species in the subfamily Eulophinae is past due, however, a complete revision of the subfamily is beyond the scope of this research and would defeat its purpose which is to publish urgently needed information on the more important entities involved. A review of the species which fall within the generic limits defined here for the genera Pnigalio Schrank and Sympiesis Forster is offered. This will form a basis for revisions of additional genera and ultimately the subfamily.

The only published classifications of the Nearctic species in these genera are in catalogue form (Peck 1951, 1963; Burks 1958, 1967) yet some of the species are important biological control agents partially or possibly wholly responsible for the homeostatic state of many agricultural and forest insect pests. The imperative need for a revision has stimulated this treatise which, 1) redefines the generic and specific concepts of these species bringing them into line with the concepts of modern taxonomy, 2) provides keys and illustrations to facilitate identification of genera and species, 3) gives adequate redescriptions of known species and valid descriptions of new species, 4) provides distribution records and maps of each species and 5) gives coherent information on niche and host preferences of each entity. The last bolsters the observation of Townes (1962) who states, "host specificity of the parasitic hymenoptera is not the rule, but rather the exception." It also confirms Askew's (1965) statement, "Host specificity is rare among chalcids as also is a broad host range. Most species have a host range definable in terms of the systematic proximity of the hosts or of the host environment." My observations inform me that the parasites treated in this work are truly niche specific and often transfer from insect pests in microenvironments in crops of economic importance to insect hosts in similar niches in the surrounding uncultivated vegetation, and vice-versa.

II. HISTORICAL REVIEW

The genus Pnigalio was erected by Schrank (1802) for the Palearctic species Pnigalio pectinicornis (Linnaeus) (= Ichneumon pectinicornis Linnaeus). The first North American record of the genus is attributable to Boyce (1939). He reared the species Pnigalio maculipes (Crawford) and Pnigalio felti (Crawford) as parasites of Agromyza melampyga Loew (= Liriomyza melampyga (Loew)) a dipterous leaf miner on Philadelphus sp. It was not recorded again until Nickels (1948) reported the species Pnigalio metacomet (Crawford) as a parasite of Cameraria caryaefoliella Clemens on Carya illinoensis (Wang.) K. Koch.

Peck (1951, 1963) after consultation with the late A. B. Gahan, United States National Museum, Washington, D.C., placed thirteen additional species in the genus, thereby broadening the generic concept to include sixteen nearctic species, eleven of which were originally described as species of Sympiesis.

The genus Sympiesis was erected by Forster (1856) for the Palearctic species Sympiesis sericeicornis (Nees). The genus was first recorded in North America by Brunn (1883), who published the nomen nudum Sympiezus lithocolletidis. Haseman (1916) stated, "Brunn(1) reared two species of Sympiesis from the mines of this insect. They were recorded under the manuscript names of S. minutus Howard and S. lithocolletidis Howard; but the descriptions by Howard were apparently never published, and Ashmead later redescribed the latter species as Sympiesis nigrifemora Ashmead."

Since Brunn, thirty-six nearctic species and one subspecies have been ascribed to Sympiesis. Currently according to Peck (1963) twenty-three species are attributable to the genus in North America. One of these, Sympiesis viridula (Thomson), is an introduced species; another, Sympiesis dolichogaster Ashmead, is considered Holarctic.

III. MATERIALS AND METHODS

Reared and randomly collected specimens of Pnigalio and Sympiesis in the Canadian National Collection, Ottawa, Canada, and the United States National Museum, Washington, D.C., were examined and assimilated. Select specimens of each species were dissected and structures with pertinent taxonomic characteristics were prepared on slides, using Richards (1964) technique, or exposed on cellucotton in 70% alcohol in small dissecting dishes for illustration purposes. Skins of last instar larvae when available were similarily treated.

Morphological and ecological data from the specimens were correlated with distributional and temporal information. These formed a basis for species recognition which allowed generic grouping. These terms of reference facilitated a better understanding of the various entities and helped define genera and species according to contemporary taxonomic practices.

Types of described species were relegated to their appropriate populations and synoptic conclusions were made where necessary. Lectotypes were designated when required and available names were applied. Redescriptions of genera and described species were written. New species were named, described and appropriate types designated. Intraspecific variation was analyzed and described. Keys and illustrations necessary for generic and specific identification were prepared. Distributions were recorded, mapped and compared. Niche and host preferences were observed, noted and when feasible the former illustrated.

IV. MORPHOLOGY AND TERMINOLOGY

Since comparative morphology is still the basic criterion for differentiating insect species it is necessary to present some morphology in taxonomic revisions to help those using them to locate and recognize salient morphological characters. A complete morphological study of each species would of course enhance this work, however, a thorough anatomical study of a single insect species is a tome in itself, therefore putting it beyond the scope of this treatise.

The following is a brief description of the important morphological characters of Pnigalio maculipes (Crawford). This and a description of a hypothetical fore wing and hind wing will aid the reader to orientate himself and facilitate usage of the keys.

The terminology used here is taken from Richards (1956) and Graham (1959).

A. THE HEAD

A coalesence of the sclerites of the head of P. maculipes has made their identification most difficult. Therefore, to follow discussion of this phragma one should continuously consult figure 1.

The three ocelli are placed in a triangle on the dorsum of the head or vertex. The area between the anterior margin of the anterior ocellus and the posterior margin of the antennal toruli is the frons. The region between the posterior margin of the antennal toruli and the clypeus is the face. The clypeus begins at the tentorial pits and ends at the anterior margin of the head. Posterior to the lateral area of the face is the gena which is below and posterior to the compound eye. The area between the compound eye and base of the mandible is referred to as the malar space.

The female antenna in figure 2 always consists of a scape with several erect hairs on its flexor surface, a pedicel, an anellus, a four-segmented funicle and two-segmented club. The terminal segment of the club bears a nipple-like process distally. Each funicular and club segment has many semi-erect hairs and numerous, elongate, cone-shaped surface and erect, knobbed sensillae, figure 3. The anellus is much shorter than the first funicular and bears a few erect setae. The pedicel is always longer than the anellus and bears a few erect setae as well.

The mandibles in figure 4 are typical for the two genera except for the teeth of the masticatory margin. These vary in number and shape among the species.

The labium and maxillae in figure 5 are typical for all the species. Specific variation, if any, occurs in the palps of these components.

The male antenna in all species except Sympiesis compressicornis (Provancher) is similar to figure 6. That of S. compressicornis is described elsewhere in this treatise.

B. THE THORAX

Snodgrass (1911) wrote "The gypsy moth and browntail moth have been for a number of years greatly infringing on human interests and pleasure in certain parts of New England. A most promising means of combatting them is in the importation and rearing of destructive hymenopteran parasites. Students of these parasites discover that the thorax presents valuable characters for the determination and classification of species." These words are as pertinent now as they were in 1911, for it is in the region of the thorax of species of both Pnigalio and Sympiesis that diagnostic characters of primordial order are detected. These are used both for generic and specific differentiation. Figures 7 and 8 illustrate the various areas and characters used in discussion of this phragma.

The thoracic dorsum consists of four major areas. The pronotum, mesonotum, metanotum and propodeum. The latter morphologically is the first tergite of the abdomen of the more generalized insect.

The pronotum is generally from the dorsal aspect a bell-shaped sclerite. Its sides extend latero-ventrally to a much reduced propleuron, partially covering it. The first pair of thoracic spiracles are located on the lateral posterior margin of the pronotum.

The mesonotum has an anterior region, the mesoscutum which is usually rectangular, wider than long but as long or longer than the pronotum. It is divided into a mid lobe and two side lobes by the notaulices which are always strongly developed anteriorly and complete in only a few species of Sympiesis. The posterior half of the mesonotum consists of a central raised area the scutellum, which is longer than wide and usually as long or longer than the pronotum, as well as two, narrow, elongate sclerites laterad of the scutellum, the axillae. These are well advanced into the mesoscutum.

The metanotum, a narrow but easily distinguishable area, is divided into a median lobe, the metascutellum and two lateral sclerites, the remnants of the metascutum.

The propodeum is the large rectangular segment comprising the entire posterior region of the thoracic dorsum. Diagnostic characters of primordial importance occur in this region. In what might be considered the primitive condition the propodeum is divided by longitudinal carinae. A central one, the median carina, one on either side of it, the plica, and a transverse one, the costula, running obliquely posteriorly from the median carina to each plica. The propodeum bears the second pair of thoracic spiracles, one in each anterior lateral angle.

The more highly evolved species described in this work show little or no trace of these carinae.

The thoracic pleuron consists of a small insignificant propleuron, a well developed mesopleuron and slightly smaller metapleuron.

The large mesopleuron is divided by sutures into an anterior, semi-triangular area, the prepectus, a middle, curved, elongate area, the mesepisternum and posterior area the mesepimeron.

The metapleuron is the area anterior to the metacoxal cavity and ventrad to the propodeum.

The hypothetical fore wing in figure 9 illustrates a well developed submarginal, marginal, postmarginal and stigmal vein. The latter is usually broadened slightly into a stigma with four sensillae present. The distal portion of the submarginal vein which curves anteriorily to the marginal vein is termed the parastigma. In addition, there are four veins present marked by lines of setae. These are the basal, median, cubital and subcubital veins or their remnants.

Three cells can be distinguished in the wing; they are the costal, basal and radial cells. The central portion of the wing is termed the disc. A row of posteriorily directed setae posterior to the marginal vein are referred to as admarginal setae and the setae at the edge of the wing make up the marginal fringe.

Except for shape the posterior wing has no characteristics which can be considered taxonomically significant. The leg as shown in figure 10 consists of coxa, trochanter, femur, tibia and a four-segmented tarsus. Each pro and meso tibia has a single tibial spur, whereas, each meta tibia has one large and one small tibial spur.

C. THE ABDOMEN

The female abdomen as shown in figure 11 is from the dorsal aspect oval in shape, strongly depressed, subpetiolate with eight visible

segments. The terga of these are designated as T-I, T-II, etc. As pointed out earlier, morphologically the propodeum is the true first abdominal tergite and the very short petiole is the second abdominal tergite, but for taxonomic facility I have termed the third tergite as T-I, the fourth as T-II and so on. The third pair of spiracles appear on the sixth tergite (true eight). Tergum seven (true nine) bears the cerci, the remnants of the primitive appendages of the eleventh abdominal segment of the more generalized insect.

The ovipositor runs the full length of the abdominal venter and extends beyond the terminal tergite.

The male abdomen, like the entire male, is considerably smaller than that of the female. It is from the dorsal aspect usually semi-rectangular in shape, somewhat narrowed anteriorly and strongly depressed. There are eight visible segments present.

The male genitalia as shown in figure 12 has an outer sheath the basiparamere which is membranous dorsally. A pair of movable toothed claspers attached to the ventro-posterior margin of the basiparamere are called the digiti. The long, central organ with the opening of the gonopore on its distal end and a pair of elongate apodemes on its basal end is the aedeagus.

V. GENERIC AND SPECIES CONCEPTS

As indicated earlier the classification of the Chalcidoidea as a whole in North America has developed more from the efforts of bibliographers than from those of revisors. Most of the species were described by systematists indoctrinated with the typeological concept. Therefore, many of the species names appearing in modern catalogues represent variants of one population.

Here I have applied the taxonomic concepts developed by Huxley (1940), Mayr (1942) and Mayr, Linsley and Usinger (1953). This has made it necessary to synonomize many of the species currently recognized in these genera because all of them do not represent modern biological species.

I have recognized these genera as taxonomic categories which include a number of species, presumably of common phylogenetic ancestory, which can be separated from each other and similar taxonomic units by a specific gap. I have also recognized species within these aggregate units as interbreeding natural populations which are reproductively isolated from other similar natural populations. Proof of reproductive isolation is difficult to obtain; therefore, I have, to the best of my ability, correlated morphological and colour characteristics of individuals with distributional and biological data on them. This has formed the terms of reference upon which my species concept has been developed.

VI. BIOLOGY

An examination of the literature quickly reveals that there is little or nothing recorded from North America on the life-histories or annual development of Pnigalio species. Indeed the only information gleaned from this source informs us that these insects are parasitoid in habit and attack insect hosts which spend all or part of their larval period mining leaves. The majority of hosts attacked appear to be micro-lepidopteran, however, some belong to the orders Coleoptera, Hymenoptera and Diptera.

Chittendon (1902), Cotton (1906) and Beique and Bouchard (1958) go so far as to inform us that the species Pnigalio uroplatae Howard and P. maculipes are ectoparasitic and that the former species forms a naked black pupa within the mine.

Little more information is published on the biology of most North American species of Sympiesis. The first recorded data of this nature was made by Webster (1909). He observed a larva of Sympiesis bimaculatipennis (Girault) emerging as a secondary parasitoid from the cocoon of an unknown parasitoid host. He described the larva as "cylindrical, white and measuring 1.4 by 4.3 mm." Schuh and Mote (1948), almost forty years later recorded the same species as an internal parasitoid of the larva of Choristoneura rosaceana (Harris). Lewis (1925) observed a specimen of Sympiesis ancylae Girault emerging from a species of Ancylis Hubner and pupating June 20. It emerged as an adult June 28. The adult died July 3. Musebeck and Dohanian (1927) noted that Sympiesis compressicornis Provancher (= Sympiesis massasoit Girault) was occasionally a parasitoid on Apanteles melanoscelus Ratzburg. They suggested this was "purely accidental" and that "species of Sympiesis are probably largely primary parasites of dipterous leaf miners."

Beckham, Hough and Hill (1950) report the species of Sympiesis marylandensis Girault (= Sympiesis lexingtonensis Girault) as a primary, external parasitoid of the fourth and fifth instars and pupa of Lithocolletis crataegella Clemens and that it hibernates as a pupa. They further inform us that S. compressicornis (= Sympiesis nigripes Ashmead) is a primary, external parasitoid on the fifth instar larva of that host, and occasionally secondarily a parasitoid of Apanteles ornigie (Weed). It too hibernates as a pupa. Schaffner (1959) obtained one, two or three specimens of Sympiesis stigmatipennis Girault (= Sympiesis guttatipennis Girault) from each Exotelia pinifoliella (Chamb.) he reared, and informs us that probably two or more generations of this parasitoid occur each year in Massachusetts, U.S.A. He further reports the species S. compressicornis (= Sympiesis nigrifemora Ashmead) as a parasitoid of Lithocolletis cincinnatiella (Chamb.) and tells us that each host when parasitized produces one parasitoid and that this species probably has two or more generations per year in that state. McLeod (1963) observed S. stigmatipennis as an ectoparasitoid of Recurvaria ducharmi (Freeman) (= Eucordylea ducharmi Freeman). He recorded that, "The adult of this species deposits its eggs on the body of the host larva, stunning or killing it. The parasite larva feeds externally on the host, eventually consuming the contents. The parasite pupates within the needle and the adults emerge about three to four weeks after the eggs are deposited."

It is paradoxical that though nothing is known about the biology of indigenous species of Pnigalio and Sympiesis much has been published in North America on Sympiesis viridula (Thomson), a Palearctic species introduced as a potential biological control agent against the European corn borer Ostrinia nubilalis Hubner. The most comprehensive research published on this parasitoid is that of Parker and Smith (1933). Additional important digests on its biology, distribution and economics have since been published by Baker, Bradley and Clark (1949) and Clausen (1956).

With the little information available on indigenous species we are able to conclude that here at least some species of Sympiesis are ectoparasitoids while others are endoparasitoids. The latter seem to be associated with microlepidopterous hosts having a leaf-rolling or leaf-tieing habit, whereas the former are associated with microlepidopterous, coleopterous and dipterous hosts which have a leaf-mining or stem-boring larva. In addition one species secondarily attacks an Apanteles sp. found in the niche occupied by the plant feeding host.

A sound knowledge of the biology of each entity in these genera will undoubtedly elucidate their true, natural position in the hierarchial arrangement. It is hoped this revision will stimulate research aimed at understanding the biologies of these insects, for it is my belief that one cannot truly understand the classification of any biological group without a thorough knowledge of the biology of the entities involved. This is especially true since the final criterion for species recognition is proof of reproductive isolation of similar populations in nature.

Unfortunately, in this treatise, as is the case in many taxonomic revisions of this kind, neither time nor facilities will allow me to make a comprehensive study of the biology of each entity treated here. Instead I have relied, as most systematists are forced to do in research of this nature, on an analysis of the data available at this time, however slim it may be. Hence, I have correlated morphological, distributional and available biological information to form terms of reference acceptable to contemporary standards for recognition of the species treated here. I am convinced some of the present chaos has been subsequently put in order and should develop incentive in others to initiate sound, meaningful biological studies on these entities.

Research of a biological nature should conclusively prove the hypothesis I propounded at the outset of this work which suggests that these parasitoids are truly niche specific and that host specificity among the parastica in general is indeed a rarity, if not a myth.

VII. DISTRIBUTION AND PHYLOGENY

A. DISTRIBUTION

It would appear from the literature that the genus Pnigalio is not as widely represented as Sympiesis. In fact it seems to be restricted to the Nearctic and Palearctic regions. Sympiesis on the other hand has representatives in Africa, Central Asia, Japan, Phillipines, Hawaii, Australia and South America as well as being well represented and certainly more prolific in species than Pnigalio in the Nearctic and Palearctic regions.

In North America the two genera are widely spread throughout the Boreal and Austral regions. However, the majority of the species of Pnigalio are restricted to the Hudsonian and Canadian zones where as most of those in Sympiesis are confined to the Transition and Upper Austral zones.

B. PHYLOGENY

Assuming that a highly evolved entity is revealed by a reduction of segmentation and wing venation one would have to consider the species of Pnigalio as more primitive than those of Sympiesis. The propodeum of the former group is strongly divided by sutures and carinae whereas that of the latter group is less and less so, as one examines the species from the lowest to the most highly evolved. This observation is further supported by the wing venation of both groups, those of Pnigalio tend to have more venation remnants than the highly specialized species of Sympiesis. The available biological evidence further supports this theory, since it seems that all of the known species of Pnigalio are ectoparasitoids, a condition obviously related to a primitive predatory type. Some of the species of Sympiesis on the other hand are true endoparasitoids, a more highly evolved habit.

VIII. SYSTEMATICS

It is well known that systematic categories above and below the species level are subjective and of an arbitrary nature. Hence, changes in them should only be made if they facilitate identification of species.

The material I have studied indicates that a change in the present status of Pnigalio and Sympiesis cannot be justified. It is true that a few small females and some males of some species of Pnigalio might be placed in the genus Sympiesis because they lack the characters which normally characterize the former genus. However, the incidence of occurrence of these specimens is rather low and when present in a series from a single brood the discrepancy is usually corrected on examination of the entire series.

The genus Pnigalio was first recorded in North America by Boyce (1939), nearly one and half centuries after its conception by Schrank (1802). To date fifteen Nearctic species and one subspecies have been relegated to it.

The genus Sympiesis was first recorded in the Nearctic region by Ashmead (1888) only thirty years after its description by Forster (1856). Currently twenty-three North American species are attributed to it.

I have recognized here five Nearctic species of Pnigalio, none of which I consider new. Seven species and two subspecies names have been placed in synonomy and four are not placeable within the terms of reference used.

Only thirteen North American species of Sympiesis fit my species concept and three of these are new. I have placed eleven species names in synonomy and four I cannot place within my concepts.

Hence, I submit below a taxonomic review of the Nearctic species of Pnigalio and Sympiesis genera in the family Eulophidae.

IX. KEY TO THE GENERA PNIGALIO SCHRANK AND SYMPIESIS FORSTER

1. Propodeal plica, median carina and costula usually well developed (rarely weakly developed or lacking in some small females and males) lateral sulci present; mid lobe of mesoscutum anteriorly with numerous irregularly placed, conspicuous bristles; face and genae usually smooth and shiny ..... Pnigalio Schrank
2. Propodeal plica, and costula never complete, usually lacking in some species; median carina lacking in some species; mid lobe of mesoscutum anteriorly with three to five pairs of setae in two longitudinal series; face and genae usually reticulate and duller ..... Sympiesis Forster

X. GENUS PNIGALIO SCHRANK

Pnigalio Schrank, 1802, Fauna Boica 2(2), p. 315. Type species: Ichneumon pectinicornis Linnaeus.

Notanisomorphomyia Girault, 1913, Mem. Queensland Mus. 2: 289. Type species: Notanisomorphomyia albicoxa Girault.

Schrank's (1802) concept of the genus Pnigalio as reflected by his published diagnosis of it leaves much to be desired. It translates as follows: club wasp; four mouth parts, front ones longer; no tongue; branched antenna with articulate funicle; variable abdomen and protruding ovipositor. These characteristics are common to most Chalcidoidea making the diagnosis useless.

The species of Pnigalio treated here have the following characteristics in common which I consider the generic limits.

Female.- length 1.30 mm. to 3.10 mm.; width of thorax in front of tegulae 0.26 mm. to 0.72 mm. Colour: bronzy green or green; blue or bluish to blue-black; black with or without violaceous reflections; light coloured markings (usually yellow but white or ivory in teneral or faded specimens) on scape, trophi, legs and/or some basal abdominal segments. Structure: head roundish, subtriangular or subrectangular, wider than high; compound eyes prominent with numerous short, erect white or yellowish setae evenly distributed on their surfaces; vertex, frons, face, clypeus and genae reticulate to smooth and shiny with appressed to erect setae variably distributed on their surfaces; antennal scrobes smooth and shiny, well impressed and coalesce dorsally; clypeus small and poorly defined; antenna laterally compressed, composed of scape, pedicel, one anellus, four funicular and two club segments; scape nearly as long or longer than pedicel, anellus and first funicular combined, with numerous appressed setae on dorsal margin and three to four erect setae on flexor surface; pedicel 1/3 to 1/2 as long as first funicular which is longer than the following funiculars each of which is usually shorter than the

preceeding one; anellus small 1/17 to 1/10 as long as first funicular; club segments subequal in length, the apical one with a strong, terminal, nipple-like seta; funicular and club segments with numerous, suberect setae, elongate, elliptical, transparent, surface sensillae and erect knobbed sensillae evenly distributed on their surfaces; anellus and pedicel with a few erect setae on their surfaces; mandibles subquadrate usually with two well developed, acute, superior teeth and two to four small, rounded teeth; maxilla with two-segmented palp, the distal segment with subterminal and/or terminal setae; labium with non-segmented palps with two small and two or three elongate subterminal setae; thorax from dorsal aspect subspindle to subquadrate in shape; usually as wide or wider than other body phragma; pronotum campanulate to subrectangular in shape, finely reticulate to strongly punctate with numerous, appressed, whitish to yellowish setae evenly distributed on its surface; mesoscutum reticulate to very heavily punctate with numerous appressed, whitish to yellowish setae evenly distributed on its surface; scutellum reticulate to strongly punctate with two to three pair of lateral, suberect, elongate, whitish to yellowish setae; axilla smooth and shiny to heavily but finely punctate with or without erect setae; metascutellum smooth to heavily sculptured; metascutum smooth and shiny; propodeum smooth and shiny to heavily reticulate and strongly wrinkled almost always with a well developed median carina, plicae and costula, these may be lacking or poorly developed in some small females; lateral sulcus well developed; propodeal spiracles small and round to large and oval, may or may not touch anterior border of propodeum; calli with numerous, elongate whitish setae evenly distributed on their surfaces; pleuron smooth and shiny to variably sculptured; wings hyaline, fore wing usually with well developed submarginal, marginal, post marginal and stigmal veins, as well as basal, cubital and subcubital veins partially or wholly defined by setal patterns,

four stigmal sensillae are always present: abdomen subpetiolate, from above oval in shape, acute at apex and strongly depressed dorso-ventrally; integument of abdomen smooth and shiny to finely reticulate; tergites one, two and three usually naked medially; abdomen with or without light markings.

Male.- length 0.81 mm. to 2.10 mm.; width of thorax in front of tegulae 0.20 mm. to 0.60 mm.; antennal scape broader than female slightly dilated medially; anellus very short; first three funiculars each with an elongate rami posteriorily on its dorsal margin, fourth funicular much longer than the preceeding ones: abdomen subpetiolate, from a dorsal aspect subtriangular to subrectangular in shape, strongly depressed, usually with light coloured markings on discs of tergites and sternites one to three; genitalia as illustrated for each species.

XI. KEY TO NEARCTIC SPECIES OF PNIGALIO SCHRANK

1. Sculpturing of mesoscutum and scutellum always weak; axillae smooth and polished in some more heavily sculptured specimens lightly reticulate; individuals as a rule smaller than the following species ..... Pnigalio proximus Provancher

   Sculpturing of mesoscutum and scutellum usually stronger (weak in small specimens); axillae always sculptured, usually strongly reticulate; individuals generally larger than previous species ... 2

2. Prepectus strongly sculptured over more than 3/4 of its surface, usually wholly reticulate to punctate...Pnigalio metacomet (Crawford)

   Prepectus lightly sculptured on the lower half or less, upper half usually smooth and shiny 3

3. Propodeum with the areas encompassed by the propodeal carinae heavily to lightly rugose and coriaceous, usually with more than one costula often two or three ..... Pnigalio uroplatae (Howard)

   Propodeum with the areas encompassed by the propodeal carinae smooth and usually bright and shiny, never more than one costula 4

4. Femora and usually tibiae dark brown to black, thorax black occasionally with some light bluish or purplish reflections, female abdomen never with light coloured markings .... Pnigalio maculipes (Crawford)

   Femora and tibiae usually testaceous to yellow, sometimes the profemora darkish, body always bright metallic blue, abdomen often with large yellowish markings ..... Pnigalio flavipes (Ashmead)

XII. PNIGALIO PROXIMUS (ASHMEAD)

Elachistus proximus Ashmead, 1894, Trans. Amer. Ent. Soc. 21: 340-341.
Eulophus guttiventris Girault, 1906, Ent. News 17: 305. New Synonomy.
Elachertus proximus Schmiedeknecht, 1909, Genera Insect. 97, p. 395.
Sympiesis felti Crawford, 1911, Proc. U.S. natn. Mus. 40: 448. New Synonomy.
Sympiesis agromyzae Gahan, 1913, Proc. U.S. natn. Mus. 46: 440-1. New Synonomy.
Sympiesis agromyzae var. pennsylvanicus Girault, 1917, Des. Stellarum Nov., p. 7. New Synonomy.
Sympiesis wordsworthi Girault, 1917, Des. Hym. Chalcidoid, Variorum cum Observ. 3, p. 10.
Sympiesis guttiventris Glick, 1939, Tech. Bull. U.S. Dep. Agr. 673: 47.
Pnigalii felti Boyce, 1939, Can. Ent. 71: 267.
Pnigalio felti Brown, 1940, Can. Ent. 72: 20. Emend. of Pnigalii in Boyce, 1939.
Pnigalio agromyzae agromyzae Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.
Pnigalio agromyzae pennsylvanicus Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.
Pnigalio guttiventris Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2:425.

Female.- (Figs. 13, 50, 68, 86, 122, 140-142) length 1.30 mm. to 2.00 mm.; width of thorax in front of tegulae 0.26 mm. to 0.33 mm. Colour: black, basal 2/3 of scape, trophi, legs and first and second abdominal sternites yellow. Structure: head oval in shape, wider than high; compound eyes with numerous short, erect, white setae; frons smooth and shiny with some widely scattered setaeceous punctures laterally, bearing suberect, whitish setae; face and genae smooth and shiny

with widely scattered setaeceous punctures with suberect and erect whitish setae; clypeus small, crescent-shaped broadly emarginate anteriorly; vertex gently reticulate; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 6 : 10; antennal scape longer than pedicel, anellus and first funicular combined with numerous appressed setae on dorsal margin and four erect, elongate setae on flexor surface; pedicel 1/3 as long as first funicular; anellus 1/12 as long as first funicular; first club segment twice as long as second; mandible with two, well developed, acute, superior teeth and two small, rounded, inferior teeth; apical segment of maxillary palp with five to six subterminal and one terminal, elongate setae; labial palp with two small and two elongate subterminal setae: thorax from dorsal aspect spindle shaped, as wide or slightly wider than other body phragma; mesonotum twice as long and 2/5 wider than either pronotum or propodeum; pronotum campanulate in shape, reticulate with numerous, appressed, whitish setae scattered on its surface; mesoscutum more strongly reticulate with numerous, appressed whitish setae scattered on its surface; scutellum, heavily reticulate to punctate with three pairs of lateral, suberect, elongate, whitish setae; axillae smooth and shiny; metascutellum medially smooth and shiny, laterally closely punctate; propodeum smooth, shiny with median carina, plicae and costula usually well developed (lacking in some small females); lateral sulci well developed; propodeal spiracle small and circular, 1/2 its diameter from anterior margin of propodeum; pleuron smooth and shiny throughout; fore wing, submarginal and marginal veins subequal, the latter 1 1/3 times as long as postmarginal which is three times as long stigmal; basal cubital and subcubital veins completely or partially defined by setal patterns; stigma with four sensillae; hind wing round at apex: abdomen subpetiolate from dorsal aspect oval; first tergite 1/3 abdominal length with numerous, appressed, elongate, whitish setae scattered on lateral regions, median region naked.

Male.- (Figs. 31, 104, 143-145) differs from female as follows: length 0.90 mm. to 1.90 mm.; width of thorax in front of tegulae 0.25 mm. to 0.50 mm.; antennal scape dilated medially; anellus very short; funiculars progressively longer from first to fourth, the last twice as long as first, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced and in some small specimens, abdomen lacks propodeal carinae; abdomen from dorsal aspect subtriangular with base narrower than apex, usually with a yellow or whitish blotch on discs of tergites and sternites one to three; genitalia as illustrated.

Variation.- this species is relatively stable over most of its range. Structural variability is confined to the costula of the propodeum. It may intersect the median carina at, above or below its median point. It may not be present on some small females and males.

The axillae in large females may at times be lightly reticulate but this never makes the surface opaque.

The front coxae and femora in some specimens may be dark brown in colour and the discs of some abdominal tergites and sternites may appear yellow.

Types.- lectotypes are selected as follows: Pnigalio agromyzae Gahan; female, type number 16359, U.S.N.M., Lakeland, Florida, Webster number 7599 AF, G.G. Ainslie: Pnigalio guttiventris Girault; female, type number 9640 U.S.N.M., Quaintance number 1663.

The holotype of Pnigalio proximus (Ashmead) bears the following data on its labels; W. Va., accession number 3152, A.D. Hopkins. Ashmead (1894) records the species from "Morgantown, West Virginia". His description was based on the "single specimen captured April 29, 1891 by A.D. Hopkins".

Distribution.- this species seems to be confined to the Austral region of eastern North America, map 1.

Material examined.- the data on the specimens examined of this species are recorded in table 1.

This species appears to prefer a host which forms a blotch-like mine, figures 248, 249, on the leaves of deciduous plants. It has been recorded on a wide range of hosts belonging to orders Lepidoptera, Diptera, Hymenoptera and Coleoptera.

Biology.- this species is ectoparasitoid in habit. It has been reared or captured in the field from May to September.

Map 1. Nearctic distribution of Pnigalio proximus (Ashmead)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			H
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Manitoba	Aweme	20	IV	1929	Protolithocollet
	1	New Brunswick	Fredericton	1	VII	1950	Argyresthia thui
	1	Nova Scotia	Port Williams	-	Spring	1946	Lithocolletis sp
1	2	Ontario	Belleville	6	VIII	1937	Ligriomyza sp.
3	4	"	Clayton Rideau	21-24	VI	1955	Caulocampus acar
	3	"	London	-	-	1925	-
1		"	Merivale	11	VII	1960	Chrysopora stipe
	3	"	Ottawa	12-22	VII	1936	-
	2	"	"	9-16	VIII	1947	-
	2	"	"	5	IX	1940	-
	1	"	"	19	VI	1939	Coptodisca sp.
	1	"	"	3	VII	1951	Liriomyza sp.
	1	"	"	19	VII	1962	Lithocolletis ce
2		"	Point Pelee	9-13	VII	1962	"
	2	"	Port Colborne	4	IX	1934	Phyllocnistis sp
1	1	"	Vineland	6	VII	1933	Lithocolletis cr
	3	"	"	-	V	1939	"
	1	Quebec	Hull	25	VIII	1960	Liriomyza sp.
1	2	"	"	11-17	VII	1962	Leucanthiza amph
1	3	"	"	3-7	VIII	1962	Phyllocnistis sp
	3	"	Lac Brulé	4-7	VIII	1945	-
	1	"	"	27	VII	1947	-
	1	"	Nomininge	4	VI	1941	-
	2	"	Messines	10	VII	1947	-
	1	"	St. Michel	25	VIII	1958	Phytagromyza pop
	1	"	"	2	IX	1958	P "
	5	"	"	12-16	IX	1958	"
	6	"	"	30	IX	1958	"
1	3	"	"	5-13	XI	1958	"
	1	"	"	9	XII	1958	"
	1	"	Trois Rivieres	30	IX	1958	"

Table 1. Recorded data on specimens of Pnigalis proximus (Ashmead) with information known about host niche.

? = Doub
B.L.M. = Blot

E / EAR	HOST	NICHE	HOST PLANT
29	Protolithocolletis lathyri	B. L. M.	-
50	Argyresthia thuiella	B. L. M.	Thuja occidentalis
46	Lithocolletis sp.	B. L. M.	Malus sp.
37	Ligriomyza sp.	-	Syringa sp.
55	Caulocampus acaricaulis ?	-	-
25	-	-	-
60	Chrysopora stipella	B. L. M.	Chenopodium album
36	-	-	-
47	-	-	-
40	-	-	-
39	Coptodisca sp.	B. L. M.	-
51	Liriomyza sp.	-	Philadalphus sp.
62	Lithocolletis celtisella	B. L. M.	Celtis occidentalis
62	"	B. L. M.	"
34	Phyllocnistis sp. ?	S. E. M.	-
33	Lithocolletis crataegella	B. L. M.	-
39	"	B. L. M.	-
60	Liriomyza sp.	B. L. M.	Eupatorium maculata
62	Leucanthiza amphicarpaefoliella	B. L. M.	Amphicarpa sp.
62	Phyllocnistis sp. ?	S. E. M.	Vitis sp.
45	-	-	-
47	-	-	-
41	-	-	-
47	-	-	-
58	Phytagromyza populicola	B. L. M.	Populus deltoides
58	P "	B. L. M.	"
58	"	B. L. M.	"
58	"	B. L. M.	"
58	"	B. L. M.	"
58	"	B. L. M.	"
58	"	B. L. M.	"

? = Doubtful record
B.L.M. = Blotch Leafmine
S. E. M. = Serpentine epidermis mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			HO
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		UNITED STATES					
	1	Alabama	Camden	24	III	1959	-
	1	"	Florence	-	-	-	Agromyza parvi
	3	Connecticut	North Haven	22	V	1918	Tischeria mali
1	1	"	Wallingford	11	X	1917	Hyposotar pito
	1	"	"	29	VIII	1918	Coptodisca spe
	1	District of Columbia	Washington	5	II	1911	Tischeria mali
1	1	"	"	4	XII	1964	Phytomyza sp.
	4	Florida	Lakeland	-	-	-	Agromyza parvi
	1	"	Gainesville	-	-	-	-
1	2	Iowa	Ames	13-29	VII	1927	-
	1	"	Sioux City	26	X	1926	-
	1	Kentucky	Henderson	-	-	-	Ceradontha dor
1	2	Louisiana	Baton Rouge	26-31	V	1921	Mantura florid
13	13	Maryland	College Park	2-24	VII	1913	Agromyza sp.
1	1	"	Smithsburg	-	III	1929	Coptodisca spe
	1	Maine	Augusta	-	IV	1944	Lithocolletis
	1	"	Bar Harbor	8	VI	1933	Brachys sp.
	2	"	"	5-6	VII	1936	Argyresthia th
	1	Massachusetts	Agawam	14	VIII	1915	-
1	1	"	Amherst	12	VIII	1947	Exema sp.
1	2	"	"	-	II	1957	Phytomyza ilic
	2	"	"	25	X	1961	Phytomyza ilic
	1	"	West Springfield	2-3	VIII	1915	-
	1	Michigan	Lawton	-	VIII	1924	Phylocnistis s
	1	Missouri	Columbia	12	IX	1958	-
	1	Nebraska	Halsey	14	VIII	1967	-
1	1	New Jersey	Brown Hill	-	-	-	Parornix kalmi
	1	"	Moorestown	2	VIII	1939	-
1		"	New Brunswick	12	V	1924	Coptodisca spe
	1	New York	Hudson Falls	27	V	1910	-
	1	North Dakota	Minot	-	-	1915	Agromyza sp.

Table 1. Recorded data on specimens of Pnigalis proximus (Ashmead) with information known about host niche.

? - Doubtf
B.L.M. - Blotch

HOST	NICHE	HOST PLANT
-	-	-
Agromyza parvicornis	B. L. M.	Zea mays
Tischeria malifoliella	B. L. M.	Malus sp.
Hyposotar pitosulus ?	-	-
Coptodisca spendoriferella	B. L. M.	-
Tischeria malifoliella	B. L. M.	Malus sp.
Phytomyza sp.	-	-
Agromyza parvicornis	B. L. M.	Zea mays
-	-	-
-	-	-
-	-	Fragrostis sp.
Ceradontha dorsalis	B. L. M.	Panicum dichotomiflorum
Mantura floridana	B. L. M.	Rumex hymenosepalus
Agromyza sp.	B. L. M.	Trifolium sp.
Coptodisca spendoriferella	B. L. M.	-
Lithocolletis sp.	B. L. M.	Populus sp.
Brachys sp.	B. L. M.	Salix sp.
Argyresthia thuiella	B. L. M.	Thuja occidentalis
-	-	-
Exema sp.	B. L. M.	-
Phytomyza ilicis	B. L. M.	Ilex aquifolium
Phytomyza ilicicola	-	-
-	-	-
Phylocnistis sp. ?	S. E. M.	Vitis sp.
-	-	-
-	-	-
Parornix kalmiella	B. L. M.	-
-	-	-
Coptodisca spendoriferella	B. L. M.	-
-	-	-
Agromyza sp.	-	-

? - Doubtful record S. E. M. - Serpentine epidermis Mine
B.L.M. - Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	2	Ohio	Kellup Island	14-16	VIII	1913	Coptodisca
	2	"	Milford Centre	4-7	VII	1929	Orchestas p
9	6	Pennsylvania	North East	25-26	V	1911	Nepticula s
	2	"	"	8	V	1915	Agromyza sp.
4	5	"	"	11-26	V	1916	Antispila s
17	6	"	"	15-26	V	1916	Nepticula s
	1	"	"	25	V	1916	Tischeria s
	2	"	"	16-24	V	1916	Ornix sp.
4	5	"	"	15-25	V	1916	Coptodisca
8	2	South Dakota	Elk Point	24-26	VIII	1915	Agromyza pa
	1	Tennessee	Nashville	-	-	-	
	3	Texas	Brownsville	15	V	1914	Agromyza pa
	1	Virginia	Richmond	-	-	1913	Phytomyza i
	1	"	Vienna	25	VI	1912	Gonotrachel

Table 1. Recorded data on specimens of Pnigalio proximus (Ashmead) with information known about host niche.

? - Doub
B.L.M. - Blot

ENCE IN YEAR	HOST	NICHE	HOST PLANT
1913	Coptodisca spendoriferella	B. L. M.	-
1929	Orchestas pallicornis	B. L. M.	-
1911	Nepticula sp.	B. L. M.	-
1915	Agromyza sp.	-	-
1916	Antispila sp.	B. L. M.	-
1916	Nepticula sp.	B. L. M.	-
1916	Tischeria sp.	B. L. M.	-
1916	Ornix sp.	B. L. M.	-
1916	Coptodisca sp.	B. L. M.	-
1915	Agromyza parvicornis	B. L. M.	Zea mays
-	-	-	-
1914	Agromyza parvicornis	B. L. M.	Zea mays
1913	Phytomyza ilicis	B. L. M.	Ilex aquifolium
1912	Conotrachelus nenuphar ?	-	-

? - Doubtful record
B.L.M. - Blotch Leaf Mine
S.E.M. - Serpentine epidermis Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	2	Ohio	Kellup Island	14-16	VIII	1913	Coptodisca
	2	"	Milford Centre	4-7	VII	1929	Orchestes
9	6	Pennsylvania	North East	25-26	V	1911	Nepticula
	2	"	"	8	V	1915	Agromyza sp
4	5	"	"	11-26	V	1916	Antispila
17	6	"	"	15-26	V	1916	Nepticula
	1	"	"	25	V	1916	Tischeria
	2	"	"	16-24	V	1916	Ornix sp.
4	5	"	"	15-25	V	1916	Coptodisca
8	2	South Dakota	Elk Point	24-26	VIII	1915	Agromyza pr
	1	Tennessee	Nashville	-	-	-	
	3	Texas	Brownsville	15	V	1914	Agromyza pr
	1	Virginia	Richmond	-	-	1913	Phytomyza i
	1	"	Vienna	25	VI	1912	Conotrachel

Table 1. Recorded data on specimens of Puligalia proximus (Ashmead) with information known about host niche.

? - Doubt
B.L.M. - Blot

NCE N YEAR	HOST	NICHE	HOST PLANT
1913	Contodinea spondoriferella	B. L. M.	-
1929	Orchestes pallicornis	B. L. M.	-
1911	Nepticula sp.	B. L. M.	-
1915	Agromyza sp.	-	-
1916	Antispila sp.	B. L. M.	-
1916	Nepticula sp.	B. L. M.	-
1916	Tischeria sp.	B. L. M.	-
1916	Ornix sp.	B. L. M.	-
1916	Contodinea sp.	B. L. M.	-
1913	Agromyza parvicornis	B. L. M.	Zea mays
-	-	-	-
1914	Agromyza parvicornis	B. L. M.	Zea mays
1913	Phytomyza ilicis	B. L. M.	Ilex aquifolium
1912	Conotrachelus nenuphar ?	-	-

? - Doubtful record S.E.M. - Serpentine epidermis Mine
B.L.M. - Blotch Leaf Mine

XIII. PNIGALIO METACOMET (CRAWFORD)

Sympiesis metacomet Crawford, 1913, Proc. U.S. natn. Mus. 45: 257.
Eulophus lineaticoxa Girault, 1916, Soc. Ent. 31: 37-38. New Synonomy.
Sympiesis lineaticoxa Britton, Bull. Conn. St. geol. nat. Hist. Surv. 60: 145.
Pnigalio metacomet Nickels, 1948, J. econ. Ent. 41: 114.
Pnigalio lineaticoxa Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.

Female.- (Figs. 14, 51, 69, 87, 123, 146-148) length 1.90 mm. to 3.10 mm., width of thorax in front of tegulae 0.55 mm. to 0.72 mm. Colour: metallic bluish green; trophi, tegulae, anterior dorsal region of mesepimeron, coxae and abdominal sterna yellow; legs white except last tarsal segments which are fuscous. Structure: head subquadrate, wider than high; compound eyes with numerous short, erect, whitish setae distributed over their surfaces; entire head heavily shagreened and dull with numerous, close, erect setae scattered on lateral areas of frons and widely scattered on vertex, clypeus and genae; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 5:10; antennal scape as long as pedicel, anellus and first funicular combined with numerous appressed setae on dorsal margin and four erect, elongate setae on flexor surface; pedicel 1/3 as long as first funicular; anellus 1/15 as long as first funicular; first club segment 1 1/3 times as long as second; mandible quadrate with two, well developed, acute, superior teeth and three or four rounded, inferior teeth; apical segment of maxillary palp with four or five elongate, subterminal and one terminal setae: thorax from dorsal aspect subquadrate shaped, wider than other body phragma; mesonotum four times as long as either pronotum or propodeum, 1 1/3 times wider than pronotum and 1 1/6 times wider than propodeum; pronotum subquadrate in shape, strongly punctate, punctures anteriorly smaller than those

posteriorly, with appressed, yellowish setae widely distributed on its surface; mesonotum punctate, those anteriorly and laterally smaller than those medially and posteriorly, with appressed to suberect, yellowish setae widely distributed on its surface; scutellum strongly punctate with punctures laterally and posteriorly wider than those medially, with two pairs of lateral, suberect, elongate, yellowish setae; axillae heavily punctate and opaque the punctures anteriorly minute and close together, with seven to eight suberect setae on their discs; metascutellum punctate; propodeum heavily sculptured with median carina complete and broad anteriorly, plica well developed posteriorly and anteriorly but difficult to define medially, costula consisting of three to four pair of heavy carinae; propodeal spiracle large, round and touching anterior margin of propodeum; calli strongly punctate; pleuron, prepectus entirely punctate; mesopleuron strongly reticulate to lightly punctate; upper half of mesepimeron smooth and shiny; lower posterior half of mesepimeron and metapleuron, strongly reticulate; fore wing, submarginal 1 1/3 times as long as marginal; the latter 1 1/2 times as long as postmarginal which is twice as long stigmal; basal, median, cubital and subcubital veins completely or partially defined by setal patterns; stigma with four sensillae; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect oval in shape, acute at apex; except for a few suberect setae on lateral areas, first and second tergites naked, the remaining tergites with appressed, whitish setae widely scattered on their surfaces, surface of tergites smooth and shiny.

Male.- (Figs. 32, 105, 149-151) differs from female as follows: length 1.50 mm. to 2.10 mm., width of thorax in front of tegulae 0.40 mm. to 0.60 mm.; antennal scape dilated medially, anellus very short; funiculars progressively longer from first to fourth, the last, three times as long as first, first three each with an elongate rami on the posterior dorsal margin: thorax sculpturing not so strong: abdomen from dorsal aspect subrectangular usually with yellow or whitish blotch on discs of tergites two to four; genitalia as illustrated.

Variation.- this species displays considerable variation in the rugae or carinae of the propodeum. There may be one to four costulae. Specimens may show melanistic characteristics in the form of partially black femora, tibiae and wholly black abdomens.

Types.- lectotypes are selected as follows: Pnigalio metacomet (Crawford); female, type number 15097, U.S.N.M., Auburndale, Massachusetts, 25.VII. 1911, ex. Lithocolletis hamadryella Clemens on swamp, white oak leaves.

Distribution.- this species prefers the Alleghanian and Transition zones of the Austral region but has been taken in the Canadian zone of the Boreal region as far west as British Columbia, map 2.

Material examined.- the data on the specimens examined of this species are recorded in table 2.

This species prefers a host which lives in a mined leaf or leaf petiole of deciduous plants. Most of the hosts form a blotch-like mine figure 250 some time during their early larval development. The hosts from which this parasitoid has been reared belong to the orders Lepidoptera and Hymenoptera.

Biology.- little is known on the life history and annual development of this species.

Map 2. Nearctic distribution of Pnigalio metacomet (Crawford)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
1	2	British Columbia	Delta Falls	9	II	1949	Tenth
	2	"	Summerland	13-17	VIII	1934	
	5	"	Surprise Falls	25	VI	1951	Lyone
	1	"	"	2	VII	1959	
1	3	Nova Scotia	Yarmouth	22-26	VIII	1960	Litho
1	4	"	"	1-3	IX	1960	
4	9	Ontario	Codrington	19	VII	1962	Litho
1		"	"	1	VIII	1962	
	1	"	Kemptville	2	VIII	1960	
	3	"	Ottawa	30	VI	1939	Nemat
2	3	"	"	10-17	VII	1951	Ponta
1	1	"	"	20	IX	1940	
2		"	"	2	X	1940	Tenth
	1	"	"	11	VII	1960	Fenus
	3	"	Port Burwell	20	VI	1950	
1		"	Toronto	5	V	1894	Nemat
		UNITED STATES					
	1	California	Marin County	16	VI	1958	Euura
19	13	Connecticut	East River	-	IX	1911	Antis
	1	"	Westport	7	IX	1937	
	1	Maine	Mt. Desert Island	28	VIII	1932	Camer
	2	Massachussetts	Auburndale	25	VII	1911	Litho
	1	Missouri	Scott County	24	IX	1936	
	1	"	Oregon County	-	-	1938	

Table 2. Recorded data on specimens of Paigalio metacomet (Crawford) with information known about host niche.

? B.L.

...GENCE ...TION		HOST	NICHE	HOST PLANT
	YEAR			
	1949	Tenthredinidae	-	-
	1934	-	-	-
	1951	Lyonetia saliciella	B. L. M.	-
	1959	-	-	-
	1960	Lithocolletis picturatella	B. L. M.	Myrica pensylvania
	1960	"	B. L. M.	"
	1962	Lithocolletis sp.	B. L. M.	-
	1962	"	B. L. M.	-
	1960	"	B. L. M.	-
	1939	Nematus sp.	B. L. M.	-
	1951	Pontania sp.	-	-
	1940	"	-	-
	1940	Tenthredinidae	-	-
	1960	Fenusa ulmi	B. L. M.	Ulmus sp.
	1950	-	-	-
	1894	Nematus desmodiodes	-	-
	1958	Euura resinicola ?	-	Salix sp.
	1911	Antispila nyssaefoliella	B. L. M.	-
	1937	-	-	Quercus sp.
	1932	Cameraria aceriella	-	-
	1911	Lithocolletis hamadryadella	B. L. M.	-
	1936	-	-	-
	1938	-	-	-

...et
...iche.

? = Doubtful record
B.L.M. = Blotch leafmine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	New York	Geneva	-	-	-	Lithocol
	1	Ohio	Blakeslea	13	VI	1934	Orcheste
	1	"	Columbus	-	-	-	Eulophus
2	6	"	Delaware	5-9	VI	1934	
3	6	"	Milford Center	18-25	VI	1930	Orcheste
	1	Texas	Brownswood	30	VII	1919	Camerari
2	1	"	Crystal City	-	VII	1939	Acrobasi
4	20	"	"	-	VII	1939	
	1	"	"	12	XI	1945	Camerari
2		Wisconsin	Door County	15	VI	1932	Coleopho
	1	"	"	18	V	1959	Coleopho
	1	"	"	2	VII	1959	

Table 2. Recorded data on specimens of Pnigalio metacomet (Crawford) with information known about host niche.

? =
B.L.M. =

ATE OF EMERGENCE OR COLLECTION			HOST	NICHE	HOST PLANT
	MONTH	YEAR			
-	-	-	Lithocolletis sp.	B. L. M.	-
3	VI	1934	Orchestes pallicornis	B. L. M.	-
-	-	-	Eulophus sp. ?	-	-
9	VI	1934	-	-	-
5	VI	1930	Orchestes pallicornis	B. L. M.	-
0	VII	1919	Cameraria caryaefoliella	B. L. M.	-
-	VII	1939	Acrobasis caryivorella ?	-	-
-	VII	1939	" ?	-	-
2	XI	1945	Cameraria caryaefoliella	B. L. M.	-
5	VI	1932	Coleophora pruniella	B. L. M.	-
8	V	1959	Coleophora sp.	B. L. M.	Malus sp.
2	VII	1959	-	-	-

o metacomet
ut host niche.

? = Doubtful record
B.L.M. = Blotch leaf mine

XIV. PNIGALIO UROPLATAE (HOWARD)

Sympiezus uroplatae Howard, 1885, Ent. Am. 1: 117.

Sympiesis unicarinatus Ashmead, 1894, Trans. Am. ent. Soc. 21: 343. New Synonomy.

Pnigalio uroplatae, Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Pnigalio unicarinatus Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Female.- (Figs. 15, 52, 70, 88, 124, 152-154) length 2.00 mm. to 3.10 mm.; width of thorax in front of tegulae 0.48 mm. to 0.72 mm. Colour: greenish black with bluish reflections especially on the propodeal and pleural areas; scape, trophi, legs, mid and hind coxae, discs of first to fourth abdominal tergites and sternites yellow to yellowish white. Structure: head subtriangular, wider than high; compound eyes with numerous, short, erect, whitish setae evenly distributed on their surfaces; vertex, frons, face and genae very smooth and shiny with appressed, suberect and erect setae widely scattered on their surfaces; clypeus small, finely wrinkled and very minutely punctate, anterior margin broadly emarginate; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 4:8; antennal scape as long as pedicel, anellus, first and half of second funicular combined, with numerous appressed setae on dorsal margin and four to five erect, elongate setae on flexor surface; pedicel less than 1/2 as long as first funicular; anellus 1/17 as long as first funicular, first club segment 1 1/3 as long as second; mandible subquadrate with one well developed, acute, superior, subterminal tooth and four to six inferior, decreasingly smaller teeth; apical segment of maxillary palp with four subterminal and one terminal, elongate setae; labial palp with two short and two elongate subterminal setae: thorax from dorsal aspect subspindle shaped, narrower than head, wider than abdomen; mesonotum twice as long

as either pronotum or propodeum, 1 1/2 times as wide as the pronotum but little or no wider than propodeum; pronotum campanulate in shape, anterior half with fine, lateral wrinkles and small appressed, whitish setae scattered on its surface, posterior half heavily punctate with longer appressed, whitish setae scattered on its surface; mesoscutum strongly punctate, punctures on median region two times as broad as those on lateral regions, suberect, whitish setae irregularly and broadly dispersed on its surface; scutellum strongly punctate, punctures on median area smaller than those laterally, with two pairs of lateral, suberect, elongate, whitish setae; axillae finely punctate and opaque; metascutellum with four to six strong punctures; propodeum coarsely rugose and bright with median carina, plicae and costula well developed, in most specimens more than one costula is present; propodeal spiracle small and round, its own diameter from anterior margin of propodeum; pleuron smooth and shiny; fore wing, submarginal and marginal veins subequal; the latter 1 1/3 times postmarginal which is twice as long as stigmal; basal, cubital and subcubital veins completely or partially defined by setal patterns; four stigmal sensillae present; hind wing round at apex: abdomen subpetiolate, from dorsal aspect oval in shape; first abdominal tergite 1/3 abdominal length, abdominal tergites one to three with suberect, whitish setae distributed on lateral margins only, discs naked, smooth and shiny.

Male.- (Figs. 33, 106, 155-157) differs from female as follows: length 1.40 mm. to 1.85 mm.; width 0.40 mm. to 0.55 mm.; scape dilated medially; anellus very short; funiculars progressively longer from first to fourth, the last three times as long as first, first three each with an elongate rami on the posterior dorsal margin: thoracic dorsum reticulate and shiny: abdomen from dorsal aspect oval, with a yellow blotch on discs of tergites and sternites two and three; genitalia as illustrated.

Variation.- structurally this species varies only in that the male may partially or completely lack a propodeal costula. The body colour may be either wholly blue or black and the legs, especially the femora, may display melanism by being partially black.

Types.- there appears to be some discrepancy concerning the type of Pnigalio uroplatae Howard since in the U.S.N.M. a male and female are included in the type series, yet Howard (1885) based the original description on a male specimen reared at Washington, D.C. from the host Anoplitis inaequalis (Weber) [= Odontota suturalis (Fabricius)]. Both type specimens bear a type number 1452 with a label below containing only the numbers 302502, 24/284. I designate the male as the lectotype.

Distribution.- records available indicate that this species is widely distributed throughout the eastern and western Austral region of North America map 3.

Material examined.- the data on the specimens examined of this species are recorded in table 3.

This species prefers leaf-mining hosts which form a blotch-like mine, figure 251, on deciduous plants. They include insects in the orders Lepidoptera and Coleoptera. Some species have been recorded as parasitoids on some lepidopterous species with leaf-rolling habits.

Biology.- this species has been recorded by Howard (1885) and others as an ectoparasitoid. It appears in nature from late April to mid November in the southern part of its range.

Map 3. Nearctic distribution of Pnigalio uroplatae (Howard)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	New Brunswick	York County	14	VII	1954	Coleophora
	1	Nova Scotia	Kingston	12	IX	1960	Lithocolle
	1	Ontario	Fitzroy Harbour	19	VIII	1960	
1	2	"	"	1-6	IX	1960	
	1	"	Kinburn	25	VIII	1960	Leucanthiz
1		"	Lake Huron	26	VII	1955	Lithocolle
1	1	"	Madoc	15	I	1961	Lithocolle
	1	"	Ottawa	17	I	1961	
	2	"	"	-	-	-	Willowgall
1	3	"	Point Pelee	29-31	VII	1963	Lithocolle
1	1	"	"	1-4	VII	1963	
	1	"	Simcoe	8	VIII	1960	Lithocolle
	1	Quebec	Hull	25	I	1961	
	1	"	Ste. Anne de Bellevue	-	-	-	Baliosus r
		UNITED STATES					
1	2	Arizona	Cochise County	13-16	XI	1960	Coleophora
1	1	California	Santa Clara Co.	8	IX	1952	
	1	Connecticut	East River	30	VI	1911	Lithocolle
	1	"	"	11	VII	1914	
1	1	"	"	19	VII	1914	Gracilaria
1		"	"	12	VIII	1914	Lithocolle
1	1	District of Columbia	Washington	24	VII	1884	Odontota s
	1	Florida	Gainesville	29	IV	1952	
	1	Indiana	Bedford	19	VIII	1932	

Table 3. Recorded data on specimens of Pnigalio uroplatae (Howard) with information known about host niche.

? = D
B.L.M. = B

AR	HOST	NICHE	HOST PLANT
954	Coleophora salmani	B. L. M.	-
960	Lithocolletis sp.	B. L. M.	-
960	"	B. L. M.	Hamamelis sp.
960	"	B. L. M.	"
960	Leucanthiza dircella	B. L. M.	Dirca sp.
955	Lithocolletis hamadryadella	B. L. M.	-
961	Lithocolletis sp.	B. L. M.	Quercus alba
961	"	B. L. M.	Tilia sp.
	Willowgalls ?	-	-
963	Lithocolletis celtisella	B. L. M.	Celtis occidentalis
963	"	B. L. M.	"
960	Lithocolletis sp.	B. L. M.	-
961	"	B. L. M.	Acer sp.
	Baliosus ruber	-	-
960	Coleophora sp.	B. L. M.	Ceanothus integrerrimus
952	-	-	Fragaria sp.
911	Lithocolletis sp.	B. L. M.	-
914	"	B. L. M.	-
914	Gracilaria strgifinitella	B. L. M.	-
914	Lithocolletis sp.	B. L. M.	-
984	Odontota suturalis	-	-
952	-	-	-
932	-	-	-

? = Doubtful record
B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	Maine	Katahdin	31	VIII	1923	
	1	Maryland	Bowie	29	V	1945	
	2	"	Plummers Island	1	X	1960	
	1	Michigan	Rochester	-	VIII	1937	Camerar
	1	New Hampshire	Mt. Washington	-	-	-	
		New Jersey	Moorestown	1	VIII	1939	
	2	New York	Huntington	-	VII	1932	Microri
	1	Ohio	Blakeslee	23	VI	1934	Orchest
	2	"	Delaware	12	VI	1934	
	1	"	Lucas County	11	VII	1935	
	1	Pennsylvania	North Glenside	15	V	1916	Antispi
1	5	"	"	9	VI	1930	
	1	"	"	22	VI	1930	
	1	"	"	23	XI	1930	
	1	South Carolina	Clemson	6	VII	1938	Tischer
	1	Texas	Crystal City	-	VII	1939	Acrobas
	1	Utah	Hyrum	21	VII	1938	Ancylis

Table 3. Recorded data on specimens of Pnigalio uroplatae (Howard) with information known about host niche.

B.L.M.
L.R.

GENCE TION	HOST	NICHE	HOST PLANT
YEAR			
1923	-	-	-
1945	-	-	-
1960	-	-	-
1937	Cameraria cincinnatiella	-	-
-	-	-	-
1939	-	-	-
1932	Microrhopala vittata	-	-
1934	Orchestes pallicornis	B. L. M.	-
1934	"	B. L. M.	-
1935	-	-	-
1916	Antispila sp.	B. L. M.	-
1930	-	-	-
1930	-	-	-
1930	-	-	-
1938	Tischeria malifoliella	B. L. M.	-
1939	Acrobasis caryivorella ?	-	Cayra illinoensis
1938	Ancylis comptana fragariae	L. R.	Fragaria sp.

B.L.M. = Blotch Leaf Mine
L.R. = Leaf Roller

XV. PNIGALIO MACULIPES (CRAWFORD)

Sympiesis maculipes Crawford, 1913, Proc. U.S. natn. Mus. 45: 258-9.
Sympiesis dandolini Girault, 1917, New Chalcid Flies, p. 1. New Synonomy.
Pnigalii maculipes Boyce, 1939, Can. Ent. 71: 267.
Pnigalio maculipes Brown, 1940, Can. Ent. 72: 20. Emend. of Pnigalii in Boyce, 1939.
Pnigalio dandolini Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.

Female.- (Figs. 16, 53, 71, 89, 125, 158-160) length 1.89 mm. to 2.70 mm.; width of thorax in front of tegulae 0.51 to 0.68 mm. Colour: black with bluish or purplish reflections from some areas of thorax and abdomen when rotated in incandescent light; scape, apices of femora and tibiae as well as basal three tarsal segments yellow to ivory. Structure: head roundish, wider than high; compound eyes with numerous short, erect, yellowish setae evenly distributed on their surfaces; frons finely reticulate and shining, two parallel rows of widely separated setae between inner orbits of compound eyes and antennal scrobes; face and genae coriaceous and bright with suberect setae widely scattered on their surfaces; clypeus small, crescent-shaped, smooth medially, anterior margin broadly emarginate; vertex finely reticulate punctate and dull with elongate, erect setae widely scattered on its surface and along its posterior margin; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 3:10; antennal scape longer than pedicel, anellus and first funicular combined with numerous appressed setae on dorsal margin and four erect, elongate setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/10 as long as first funicular; first club segment 1 1/4 times as long as second; mandible with two, well developed, acute, superior teeth and four small, rounded, inferior teeth; apical segment of maxillary palp with four to five

elongated, subterminal and one terminal setae; labial palp with two small and two elongate subterminal setae: thorax from dorsal aspect spindle shaped, as wide or wider than other body phragma; mesonotum twice as long and 2/5 wider than either pronotum or propodeum; pronotum campanulate in shape, anterior 2/3 finely wrinkled, the wrinkles becoming course and widely separated rugae on disc, posterior 1/3 finely coriaceous to smooth and shining, sculptured areas with widely scattered, subappressed, whitish setae; mesoscutum strongly punctate, punctures anteriorly broader and shallower than those on disc and posterior area, suberect, whitish setae irregularly and widely scattered on its lateral and anterior regions; scutellum strongly punctate, punctures broader on disc than on lateral areas, with two pairs of lateral, suberect, elongate, whitish setae; axillae longitudinally reticulate and opaque; metascutellum finely punctate laterally with a posterior depression on each side of a well defined median carina; propodeum smooth and usually shiny with median carina, plicae and costulae well defined; lateral sulci well developed; anteriorly but laterad of median carina sometimes rugose; propodeal spiracle small and round, 1/2 its diameter from anterior margin of propodeum; pleuron mostly smooth and shiny, mesepisternum very finely reticulate; fore wing, submarginal and marginal veins equally long; the latter two times as long as postmarginal which is twice as long as stigmal; basal, cubital and subcubital veins completely or partially defined by setal patterns; stigma with four sensillae; hind wing round at apex: abdomen subpetiolate, from dorsal aspect oval; first abdominal tergite 1/4 abdominal length, with numerous appressed, elongate, whitish setae scattered on its anterior 1/2 laterad of a median naked area.

Male.- (Figs. 34, 107, 161-163) differs from female as follows: length 0.81 mm. to 1.62 mm.; width 0.40 mm. to 0.50 mm.; antennal scape dilated medially; anellus very short; funiculars progressively longer from first to fourth, the last four times as long as first, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced ; abdomen from dorsal

aspect subtriangular with base narrower than apex, usually with a yellow or whitish blotch on discs of tergites and sternites one to three; genitalia as illustrated.

Variation.- this species is also relatively stable over most of its range. Structural variation occurs on the axillae which are in some specimens nearly smooth and shiny.

The scape though normally white may be dark brown or black, the black body colour may become metallic blue. The tibiae sometimes have black basis.

Types.- lectotypes are selected as follows: Pnigalio dandolini (Girault), female, type number 21136, U.S.N.M., Milford, Virginia, 11-15, VII, ex. Lithocolletis hamadryadella Clemens on Quercus bicolor Willd.: Pnigalio maculipes (Crawford); female, type number 15095, U.S.N.M., 25.VII.1911, ex. Lithocolletis hamadryadella Clemens on swamp white oak (Q. bicolor) leaves. The head and left fore legs of this specimen have been mashed on a slide, the remainder is in fair condition.

Distribution.- this species has been taken mostly in the Canadian and Hudsonian zones of the Boreal region. Some specimens have been collected in the Transition and Alleghian zones of the Austral region. Its range appears to be transcontinental with southern extensions in the Appalachian and Rocky Mountains, map 4.

Material examined.- the data on the specimens examined of this species are recorded in table 4.

This species prefers mostly leaf-mining hosts, figure 252, which attack broad-leaved plants in its range. It has been reared from hosts on coniferous plants. The hosts involved form a blotch- or tentiform-like mine. It has been reared from hosts belonging to the orders Lepidoptera, Diptera, Hymenoptera and Coleoptera. It appears that this species replaces P. proximus in similar niches beyond its range and vice-versa.

Biology.- this species has also been recorded as an ecto-parasitoid occurring in nature from late April to early September.

Map 4. Nearctic distribution of Pnigalio maculipes (Crawford)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Tofield	7	V	1946	
1		British Columbia	Babine Lake	15	VI	1958	Phyl
		"	Chilkot Pass	14	VII	1948	
1		"	Houston	-	VIII	-	Phyl
	1	"	Robson	27	V	1949	
	1	New Brunswick	Fredericton	1	V	1950	Argg
	1	"	"	5	V	1950	
	1	Northwest Territories	Millville	28	VI	1951	
	1	"	Norman Wells	5	VIII	1949	
	1	"	Saw Mill Bay	21	VI	1948	
	1	Nova Scotia	Aldershot	25	VIII	1950	Lith
	2	"	Berwick	-	Spring	1946	
2		"	"	9	VII	1946	
1		"	"	15	VII	1946	
2		"	"	17	VII	1946	
2		"	"	20	VII	1946	
1	1	"	Smiths Cove	3	VIII	1945	Lith
1		"	Watterville	25	VII	1936	Lith
	1	"	Aldershot	25	VIII	1950	
	1	"	"	4	VII	1952	
	1	"	N. Sawler	7	IX	1951	
2		"	Berwick	9	VII	1946	
2		"	"	20	VII	1946	
1		"	Grand Pre	15	VII	1946	

Table 4. Recorded data on specimens of Pnigalio maculipes (Crawford) with information known about host niche.

B.L.

R	HOST	NICHE	HOST PLANT
6	-	-	Salix sp.
8	Phyllocnistis populiella	B. L. M.	-
8	-	-	-
	Phyllocnistis populiella	B. L. M.	-
9	-	-	-
0	Argyresthia thuiella	B. L. M.	Thuja sp.
0	" "	"	"
1	" "	"	"
9	-	-	-
8	-	-	-
0	Lithocolletis sp.	B. L. M.	Malus sp.
6	"	"	"
6	"	"	"
6	"	"	"
6	"	"	"
6	"	"	"
5	Lithocolletis sp.	"	Fagus sp.
6	Lithocolletis crataegella	"	-
0	-	-	Malus sp.
2	-	-	"
1	-	-	"
6	-	B. L. M.	-
6	-	"	-
6	-	"	-

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
2		Nova Scotia	Grand Pre	17	VII	1946	
	1	"	Smiths Cove	3	VIII	1945	Li
1		"	"	3	VIII	1945	
1		"	Watterville	25	VII	1936	Li
1		"	Dearfield	21	VII	1959	Li
1	2	"	Kingston	22	I	1961	Li
	1	"	Ohio	11	VII	1959	Li
1		Ontario	Ackray	31	VII	1954	Li
9	4	"	Amberly	23	I	1961	Ne
	2	"	"	25	I	1961	
	3	"	Ameliasburg	-	VIII	1938	Hi
	1	"	Belleville	8	VII	1950	
	1	"	"	12	VIII	1951	
	1	"	"	6	VIII	1937	Ag
	1	"	Bobcaygeon	-	VII	1932	
1	2	"	Byron	16	VII	1952	Bu
	1	"	Codrington	24	IX	1959	Li
1		"	Carp	15	VI	1950	
1	1	"	Fitzroy Harbour	1	IX	1960	Li
5	1	"	"	25	VIII	1960	
3	1	"	"	3	IX	1960	
1		"	"	6	IX	1960	
2		"	"	7	IX	1960	
1	1	"	"	19	VIII	1960	
1		"	"	2	IX	1960	
1	1	"	"	1	IX	1960	

Table 4. Recorded data on specimens of Pnigalio maculipes (Crawford) with information known about host niche.

ENCE ON YEAR	HOST	NICHE	HOST PLANT
1946	-	B.L.M.	-
1945	Lithocolletis sp.	"	Fagus sp.
1945	"	"	"
1936	Lithocolletis crataegella	"	-
1959	Lithocolletis malimalifoliella	"	Malus sp.
1961	Lithocolletis sp.	"	Myrica Gale
1959	Lithocolletis malimalifoliella	"	Malus sp.
1954	Lithocolletis tremulodiella	"	-
1961	Nepticula sp.	"	-
1961	"	"	-
1938	Hickory leafminer	"	-
1950	-	-	-
1951	-	-	-
1937	Agromyza melampyga	B.L.M.	Syringa sp.
1932	-	-	-
1952	Bucculatrix ainsiella ?	-	-
1959	Lithocolletis hamadryadella	B.L.M.	-
1950	-	-	-
1960	Lithocolletis sp.	B.L.M.	Carpinus sp.
1960	"	"	"
1960	"	"	"
1960	"	"	"
1960	"	"	"
1960	"	"	Hamamelis sp.
1960	"	"	"
1960	"	"	"

3
che.

? = Doubtful Record
B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
1		Ontario	Fitzroy Harbour	6	IX	1960	Litho
	1	"	"	8	IX	1960	
	1	"	Hilton Beach	12	VII	1957	Argyr
1		"	Kinburn	25	VIII	1960	Leuca
1		"	"	3	IX	1960	
1		"	"	6	IX	1960	
1		"	"	8	IX	1960	
	1	"	"	13	IX	1960	
	2	"	"	21	IX	1960	
	1	"	Meadowvale	5	III	1963	Copto
1		"	Merivale	11	VII	1960	Chrys
2		"	"	19	VI	1960	Agrom
2		"	"	26	VI	1960	
1		"	"	27	VI	1960	
	1	"	"	9	VIII	1960	Litho
	1	"	Meldrum Bay	28	II	1963	Litho
1		"	Normandale	19	VI	1961	Litho
7	3	"	"	24	VI	1961	
1	1	"	"	25	VI	1961	
1		"	"	26	VI	1961	
2		"	"	27	VI	1961	
1		"	"	6	VIII	1961	
1	2	"	"	31	VII	1963	
	1	"	Ottawa	30	V	1940	
1		"	"	28	VI	1940	
2	1	"	"	13	VII	1945	Liric

Table 4. Recorded data on specimens of Pnigalio maculipes (Crawford) with information known about host niche.

B.L.I

CE YEAR	HOST	NICHE	HOST PLANT
1960	Lithocolletis sp.	B.L.M.	Hamamelis sp.
1960	"	"	"
1957	Argyresthia aureoargentella	"	-
1960	Leucanthiza dircella	"	Dirca sp.
1960	"	"	"
1960	"	"	"
1960	"	"	"
1960	"	"	"
1960	"	"	"
1963	Coptodisca splendoriferella	"	-
1960	Chrysopora stipella	"	Chenopodium album
1960	Agromya sp.	"	Ulmus rubra
1960	"	"	"
1960	"	"	"
1960	Lithocolletis sp.	"	Populous tremuloides
1963	Lithocolletis ostensackenella	"	-
1961	Lithocolletis sp.	"	Populous tremuloides
1961	"	"	"
1961	"	"	"
1961	"	"	"
1961	"	"	"
1961	"	"	"
1963	"	"	Caryaovata sp.
1940	-	-	-
1940	-	-	-
1945	Liriomyza melanopyga	B.L.M.	Philadelphus coronarius

ıe.

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	2	Ontario	Ottawa	9	VIII	1947	
1		"	"	-	VI	1949	
	1	"	"	21	VI	1951	
	6	"	"	3	VII	1951	
	1	"	"	15	VII	1951	Liriomyza
2		"	"	12	VIII	1952	Agromyza
1		"	"	15	VIII	1952	
2		"	"	18	VIII	1952	
	1	"	"	19	VIII	1952	
	1	"	"	18	VII	1960	Fenusa ul
3	1	"	"	29	VI	1961	
3		"	"	30	VI	1961	
18	1	"	"	3	VII	1961	
5	3	"	"	4	VII	1961	
4		"	"	5	VII	1961	
5	1	"	"	6	VII	1961	
5	1	"	"	7	VII	1961	
14	4	"	"	10	VII	1961	
9		"	"	11	VII	1961	
5	5	"	"	12	VII	1961	
9	8	"	"	13	VII	1961	
	1	"	"	14	VII	1961	
1		"	"	17	VII	1961	
4	1	"	"	21	IV	1958	
1		"	Orillia	4	VIII	1965	Nepticula
1		"	"	9	VIII	1965	

Table 4. Recorded data on specimens of Pnigalio maculipes (Crawford) with information known about host niche.

B.L.M. =

GENCE TION		HOST	NICHE	HOST PLANT
	YEAR			
	1947	-	-	-
	1949	-	-	-
	1951	-	-	-
	1951	-	-	-
	1951	*Liriomyza melanopyga*	-	-
	1952	*Agromyza* sp.	-	*Populous nigra*
	1952	"	-	"
	1952	"	-	"
	1952	"	-	"
	1960	*Fenusa ulmi*	B.L.M.	*Ulmus glabra*
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1961	"	"	"
	1958	-	-	-
	1965	*Nepticula* sp.	B.L.M.	-
	1965	"	"	-

oes
niche.

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
1	1	Ontario	Orillia	11	VIII	1965	Ne
1		"	"	13	VIII	1965	
2		"	"	16	VIII	1965	
1	4	"	Pembroke	3	VIII	1954	Lit
2	1	"	Point Peelee	26	VII	1963	Lit
	1	"	Port Colborne	14	VIII	1934	
	1	"	"	17	VIII	1934	
	2	"	"	18	VIII	1934	
	1	"	"	4	IX	1934	
	1	"	"	12	IX	1934	
1		"	Ralphton	11	VIII	1952	Lit
4	1	"	Rondeau	16	VIII	1958	Bu
1		"	St. Catharines	15	VII	1951	
1		"	Shelbourne	12	II	1962	Lit
1		"	South March	3	VIII	1962	
1		"	"	23	VIII	1962	
3	1	"	St. Williams	17	VII	1961	
	1	"	Therold	16	VII	1952	Bu
	1	"	Tweed	17	VII	1944	Lu
	1	"	Vineland	30	VI	1953	Li
1	1	"	"	5	VIII	1953	
	1	"	"	8	VIII	1953	
	1	Quebec	Aylmer	18	VII	1960	Ti
2		"	"	18	VII	1960	Ch
	1	"	"	25	VII	1960	Ti
1	2	"	Berthierville	7	VII	1948	Ag

Table 4. Recorded data on specimens of Paigalio maculipes (Crawford) with information known about host niche.

B.

NCE N YEAR	HOST	NICHE	HOST PLANT
1965	Nepticula sp.	B.L.M.	-
1965	"	"	-
1965	"	"	-
1954	Lithocolletis tremuloidiella	"	-
1963	Lithocolletis sp.	"	Rhus toxicodendron
1934	-	-	-
1934	-	-	-
1934	-	-	-
1934	-	-	-
1934	-	-	-
1952	Lithocolletis tremuloidiella	B.L.M.	-
1958	Bucculatrix ainsliella	"	-
1951	"	"	-
1962	Lithocolletis sp.	"	-
1962	"	"	Quercus alba
1962	"	"	"
1961	"	"	Populous tremuloides
1952	Buculatrix ainsliella	"	-
1944	Lucanthiza dircella	"	Dirca pilustris
1953	Lithocolletis crataegella	"	-
1953	"	"	-
1953	"	"	-
1960	Tischeria sp.	"	Malus sp.
1960	Chrysopora stipella	"	Chenopodium album
1960	Tischeria malifoliella	"	Malus sp.
1948	Agromyza aristata	"	-

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
1		Quebec	Deschenes	26	VI	1961	Agron
1		"	"	30	VI	1961	
1		"	"	30	VI	1961	
	1	"	"	3	VII	1961	
4	1	"	Great Whale River	15	VII	1949	Lithc
1		"	Hull	15	VIII	1960	
2		"	"	18	VIII	1960	
1		"	"	3	IX	1960	
1		"	"	29	VII	1960	
	1	"	"	4	VIII	1960	
1	1	"	"	29	IX	1961	Agron
	2	"	"	3	VII	1961	
1		"	"	2	VIII	1962	Lithc
1		"	"	22	VIII	1960	Dipt
1		"	"	31	VII	1960	Lithc
1		"	"	7	VII	1962	
	1	"	"	29	VII	1960	
	3	"	"	9	VIII	1961	
	1	"	Kirks Ferry	19	VI	1950	
	2	"	Lac Brule	16	VIII	1951	
2		"	Laniel	4	VII	1943	
	2	"	Montigny	9	VI	1941	
1	1	"	Nominingue	13	VI	1941	
2		"	Quebec	15	IX	1957	Phyt
	1	"	St. Michel	21	VIII	1958	Phyt
2	2	"	"	25	VIII	1958	

Table 4. Recorded data on specimens of Pnigalio maculipes (Crawford) with information known about host niche.

B.L.I

E EAR	HOST	NICHE	HOST PLANT
1961	Agromyza sp.	B.L.M.	Ulmus rubra
1961	"	"	"
1961	"	"	"
1961	"	"	"
1949	Lithocolletis sp.	"	Ledum sp.
1960	"	"	Amphicarpa bractiata
1960	"	"	"
1960	"	"	"
1960	"	"	Carpinus sp.
1960	"	"	"
1961	Agromyza sp.	"	Ulmus rubra
1961	"	"	"
1962	Lithocolletis ostryavirginiana	"	-
1960	Diptera	"	Eupatorium maculatum
1960	Lithocolletis sp.	"	Quercus alba
1962	"	"	"
1960	"	"	Tilia americana
1961	"	"	"
1950	-	-	-
1951	-	-	-
1943	-	-	-
1941	-	-	-
1941	-	-	-
1957	Phytagromyza sp.	-	-
1958	Phytagromyza populicola	B.L.M.	-
1958	"	"	-

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
2	4	Quebec	St. Michel	29	VIII	1958	Phyta
	4	"	"	2	IX	1958	
	3	"	"	21	IX	1958	
1	1	"	"	30	IX	1958	
	2	"	"	13	XI	1958	
		UNITED STATES					
	1	Alaska	Matanuska	10	VII	1944	
	1	"	Richardson Hwy.	8	VII	1951	
	1	Arizona	Catalina Mt.	-	-	1958	Lepid
	1	"	Sedona	20	VI	1938	
	1	California	San Jose	-	XI	1941	
1	1	"	Yosemite N.P.	-	-	1935	Casta
	1	District of Columbia	Washington	19	III	1889	Tisch
	2	Maine	Great Pond	-	IX	1931	Phyll
2	1	"	Bar Harbor	15	VII	1933	Lepid
	1	"	Mt. Desert	29	VIII	1931	Parac
	1	Massachusetts	Woburn	6	IX	1936	Kalio
8	4	"	Wakefield	6	IX	1936	
1	1	"	Cambridge	8	VIII	1944	Litho
	2	"	Springfield	9	VI	1941	Leafm
2	1	"	Auburndale	25	VII	1911	Litho
	1	Maryland	Riverview	-	-	-	Octot
	1	"	College Park	21	V	1914	
	1	Michigan	Lawton	-	VIII	1924	
	1	"	Rochester	-	VIII	1937	Camel
	3	Minnesota	Olmstead	24	IV	1905	

Table 4. Recorded data on specimens of Paigalio maculipes (Crawford) with information known about host niche.

B.L.
B.M.

E EAR	HOST	NICHE	HOST PLANT
.958	Phytagromyza populicola	B.L.M.	-
.958	"	"	-
.958	"	"	-
.958	"	"	-
.958	"	"	-
1944	-	-	-
1951	-	-	-
1958	Lepidoptera	-	Ceanothus sp.
1938	-	-	-
1941	-	-	-
1935	Castanopsis chrysbyella	B.L.M.	-
1889	Tischeria ambrosaella	"	-
1931	Phyllotoma nemorata	"	-
1933	Lepidoptera	"	Thuja sp.
1931	Paraclemensia acerifoliella	B.M.S.	Acer sp.
1936	Kaliofenusa ulmi	"	-
1936	"	"	-
1944	Lithocolletis blancardella	-	-
1941	Leafminer	-	-
1911	Lithocolletis hamadryella	-	-
-	Octotoma plicatula	-	-
1914	-	-	-
1924	-	-	-
1937	Cameraria cincinnatiella	-	-
1905	-	-	-

B.L.M. = Blotch Leaf Mine
B.M.S. = Blotch Mine Simulation

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION		
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR
	1	Minnesota	Ramsey County	11	IX	1952
	1	Missouri	Oregon County	-	III	1938
1		New York	Fredonia	-	-	-
10	7	"	Geneva	-	-	-
	1	"	Ithaca	28	V	1947
	1	"	Newark	18	V	1948
	1	"	Rochester	-	IX	1892
	1	Ohio	Painesville	30	VII	1958
1	2	Pennsylvania	Spring Br.	9	V	1945
9		Virginia	Milford	11	VIII	1915
	1	Wisconsin	Door County	20	VIII	1960
1		"	"	7	X	1960

Table 4. Recorded data on specimens of Paigalio maculipes (Crawford) with information known about host niche.

RGENCE CTION		HOST	NICHE	HOST PLANT
	YEAR			
	1952	-	-	-
	1938	-	-	-
	-	Metallus rubi	B.L.M.	-
	-	Lithocolletis sp.	"	-
	1947	-	-	-
	1948	-	-	-
	1892	-	-	-
	1958	-	-	-
	1945	-	-	-
	1915	-	-	-
	1960	-	-	-
	1960	-	-	-

ipes
niche.

B.L.M. = Blotch Leaf Mine

XVI. PNIGALIO FLAVIPES (ASHMEAD)

Sympiesis flavipes Ashmead, 1886, Trans. Am. ent. Soc. 13: 133.

Sympiesis tischeriae Ashmead, 1888, Bull. Kans. agric. Exp. Stn. 3: App. p. VI-VII. New Synonomy.

Sympiesis quercicola Ashmead, 1888, Bull. Kans. agric. Exp. Stn. 3: App. p. VII. New Synonomy.

Pnigalio flavipes Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.

Pnigalio quercicola Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Pnigalio tischeriae Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Female.- (Figs. 17, 54, 72, 90, 126, 164-166) length 1.80 mm. to 2.73 mm.; width of thorax in front of tegulae 0.40 mm. to 0.65 mm. Colour: black with bluish reflections emitted from most of propodeum and posterior part of scutellum when rotated in incandescent light; trophi, legs except front coxae, most of abdominal venter basally and lateral areas of tergites one to three yellow. Structure: head subtriangular, wider than high; compound eyes, with numerous short, erect, yellowish setae evenly distributed over their surfaces; integument of entire head smooth and shiny, vertex with some light reticulations, all surfaces with yellowish, suberect setae widely scattered on their surfaces; clypeus very small, and transversely impressed; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 6:10; antennal scape longer than pedicel, anellus and first funicular combined, with numerous appressed setae on dorsal margin and three erect, elongate setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/15 as long as first funicular; first club segment 1 1/3 as long as second; mandible subquadrate with two, well developed, acute, superior teeth, the dorsal one subterminal, the second terminal and three inferior small, rounded teeth; apical segment of maxillary palp with four elongated,

subterminal and one terminal setae; labial palp with two short and one elongate subterminal setae; thorax from dorsal aspect subquadrate, narrower than head, wider than abdomen; mesonotum 1 1/2 times as wide and five times as long as pronotum, 1 1/4 times as wide and three times as long as propodeum; pronotum quadrate in shape, strongly punctate, with appressed whitish setae widely scattered on its surface; mesoscutum strongly punctate, the punctures on the median posterior region wider and deeper than those on the anterior and lateral regions, the latter with appressed elongate, whitish setae widely scattered on their surfaces; scutellum, strongly punctate, with two pairs of lateral, suberect, elongate, whitish setae; axillae strongly reticulate dorsally, punctate laterally; metascutellum rugose punctate; propodeum smooth and shiny with median carina, plicae and costula well developed; propodeal spiracle small, round, 1/2 its diameter from anterior margin of propodeum; lateral areas of pronotum and prosternum reticulate; dorsal anterior area of prepectus deeply impressed, lower 1/3 with broad deep punctures, central area with shallow punctures, dorsal posterior area smooth and shiny; mesepisternum reticulate; mesepimeron smooth and shiny; lateral area of propodeum reticulate; fore wing, submarginal and marginal veins subequal; the latter 1 1/2 times as long as postmarginal which is three times as long as stigmal; basal, cubital and subcubital veins completely or partially defined by setal patterns; stigma with four sensillae; hind wing round at apex: abdomen subpetiolate, from dorsal aspect oval in shape, acuminate posteriorly; first tergite with numerous appressed, elongate setae on either side of a narrow, central naked region, posterior portion of tergite one and broad, central areas of tergites two and three without setae; tergites four to seven with two to three lateral rows of appressed setae.

Male.- (Figs. 35, 108, 167-168) differs from female as follows: length 1.30 mm. to 2.10 mm.; width of thorax in front of tegulae 0.40 mm. to 0.60 mm.; antennal scape dilated medially; anellus very short; funiculars progressively longer from first to fourth, the last four times as long as

first, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced: abdomen subtriangular with base narrower than apex, usually with yellow blotch on discs of tergites two and three; genitalia as illustrated.

Variation.- this species is the most stable nearctic species of Pnigalio, small specimen might be confused with the species P. proximus if care is not taken to examine cautiously the sculpturing of the axillae which are always noticeably reticulate to punctate and opaque in P. flavipes.

Types.- lectotypes are selected as follows: Pnigalio tischeriae (Ashmead); female, type number 27284, U.S.N.M., Riley Co., Kansas, 3.VIII. 1918, ex. leaf miner on button-bush, the type specimen on which P. flavipes was based is in very poor condition, it bears the type number 27284, U.S. N.M. and a locality label, Jacksonville, Florida.

Distribution.- this species is restricted to the Transition zone of the Nearctic Austral region. Some specimens have been collected in the Canadian zone of the Boreal region and the Lower Austral zone of the Austral region, these may be island or finger extensions of the species range, map 5.

Material examined.- the data on the specimens examined of this species are recorded in table 5.

This species prefers hosts which form a blotch- or tentiform-like mine, figure 253 on deciduous plants. The hosts belong to the orders Lepidoptera, Hymenoptera, Coleoptera and Diptera.

Biology.- this species has also been observed as an ectoparasitoid.

Map 5. Nearctic distribution of Pnigalio flavipes (Ashmead)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Edmonton	29	VI	1946	Phyllo
	1	"	Jasper	7	VII	1959	
	1	"	Lethbridge	11	VIII	1944	
	1	British Columbia	Creston	10	VI	1949	Coleop
	1	"	Cultus Lake	15	VII	1948	
	1	"	Evelyn Station	5	VII	1955	Lithoc
	1	"	Robson	30	VI	1949	
	1	"	"	5	VIII	1949	
	3	"	"	24	VIII	1949	
	1	"	"	23	IV	1949	
	1	"	"	20	VIII	1948	
	1	"	"	23	VIII	1948	
	1	"	Summerland	22	VIII	1934	
	1	"	"	1	X	1931	
	1	Nova Scotia	Bridgetown	17	VIII	1912	
	1	"	"	2	IX	1912	
	1	"	Dearfield	1	VIII	1959	Lithoc
	5	"	Grand Pré	15	VII	1946	Leafmi
1		"	Hebron	24	VII	1959	Lithoc
	5	"	Kentville	31	VIII	1951	
1		"	Ohio	28	VII	1959	Lithoc
1		"	Smiths Cove	7	VIII	1945	Gracil
	1	"	Tuskett	29	VII	1959	Lithoc
1		"	Yarmouth	20	VIII	1960	Lithoc

Table 5. Recorded data on specimens of Pnigalio flavipes (Ashmead) with information known about host niche.

?
B. L.

NCE N YEAR	HOST	NICHE	HOST PLANT
1946	Phyllocnistis populiella ?	S. M.	Populus sp.
1959	-	-	-
1944	-	-	-
1949	Coleophora pruniella	B. L. M.	-
1948	-	-	-
1955	Lithocolletis populiella	B. L. M.	-
1949	-	-	-
1949	-	-	-
1949	-	-	-
1949	-	-	-
1948	-	-	-
1948	-	-	-
1934	-	-	-
1931	-	-	-
1912	-	-	-
1912	-	-	-
1959	Lithocolletis malimalifoliella	B. L. M.	Malus sp.
1946	Leafminer	"	"
1959	Lithocolletis malimalifoliella	"	"
1951	-	-	"
1959	Lithocolletis sp.	B. L. M.	Fagus americana
1945	Gracilaria sp.	"	Rubus sp.
1959	Lithocolletis sp.	"	Alnus crispa
1960	Lithocolletis picturatella	"	Myrica pennsylvanica

? = Doubtful Record
B. L. M. = Blotch Leaf Mine
S. M. = Serpentine Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
			CANADA				
	2	Nova Scotia	Yarmouth	25	VIII	1960	Lit
1		"	"	29	VIII	1960	
1		New Brunswick	Plaster Rock	29	VII	1955	Lit
	1	"	Nipisiguit Lake	15	VIII	1955	
2		Ontario	Amberly	24	I	1964	Ner
	2	"	"	15	II	1964	
	1	"	Dunrobin	27	VIII	1924	
	1	"	Hilton Beach	2	VII	1957	Ar
	1	"	Merivale	31	VII	1961	Lit
	5	"	Ottawa	13	VIII	1894	
	1	"	"	-	VIII	1908	Le
	3	"	"	27	VI	1940	
2	1	"	Point Pelee	29	VII	1963	Lit
	1	"	Port Colborne	23	VIII	1934	
2	2	"	Sauble	23	II	1961	Ner
8	19	"	Vineland	11	VIII	1925	Met
	1	"	Vittoria	1	II	1961	Tis
1	3	Quebec	Gr. Whale River	15	VII	1949	Lit
	1	"	Hull	14	VIII	1894	
1		"	"	22	I	1960	Lit
1		"	"	25	I	1960	
	1	"	"	25	I	1960	Tis
2		"	"	26	VII	1960	Lit
1		"	"	25	VIII	1960	
	1	"	Lac Brulé	25	VII	1947	

Table 5. Recorded data on specimens of Pnigalio flavipes (Ashmead) with information known about host niche.

ENCE ON YEAR	HOST	NICHE	HOST PLANT
1960	Lithocolletis picturatella	B. L. M.	Myrica pennsylvanica
1960	" "	"	"
1955	Lithocolletis salicifoliella	"	-
1955	" "	"	-
1964	Nepticula sp.	-	-
1964	"	-	-
1924	-	-	-
1957	Argyresthia aureoargentella	B. M. S.	-
1961	Lithocolletis sp.	"	Populus tremuloides
1894	-	-	-
1908	Leafminer	-	Lonicera sp.
1940	-	-	-
1963	Lithocolletis celtisella	B. L. M.	Celtis occidentalis
1934	-	-	-
1961	Nepticula sp.	-	-
1925	Metallus bethunei	-	-
1961	Tischeria castaneaella	B. L. M.	-
1949	Lithocolletis sp.	"	Ledum sp.
1894	-	-	-
1960	Lithocolletis sp.	B. L. M.	Ostrya sp.
1960	"	"	Quercus alba
1960	Tischeria sp.	"	-
1960	Lithocolletis sp.	"	Tilia americana
1960	"	"	Amphicarpa
1947	-	-	-

he.

B. L. M. = Blotch Leaf Mine
B. M. S. = Blotch Mine Simulation

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Quebec	Lac Sagnay	9	VI	1941	
	2	"	Nominingue	12	VI	1941	
1	1	"	Ste Foy	20	VIII	1956	Cali
	1	"	Wakefield	9	VII	1946	
		UNITED STATES					
	1	Alabama	Elk Mt.	21	VII	1913	Grac
	1	Arkansas	Hot Springs N.P.	23	III	1962	
1	1	California	Yosemite N.P.	-	-	1935	
	1	Connecticut	Woodbridge	-	IX	1929	Fenn
4	6	Idaho	Targhee	16	VII	1953	
	1	Indiana	Bedford	19	VIII	1932	
1		Iowa	Ames	-	-	-	
	2	Maine	Bar Harbor	2	VII	1936	Argy
	1	"	"	5	VII	1935	Phyl
	1	"	"	8	VII	1929	
	1	Minnesota	Eaglesnest	3	IX	1958	
	1	"	"	25	VII	1952	Lith
	1	New Hampshire	Durham	3	VII	1962	Liri
	1	"	"	25	VIII	1959	
	1	New York	Fredonia	2	VIII	1927	
	2	Ohio	Columbus	4	VIII	1910	
	1	"	Milford Center	23	VI	1930	
	2	"	Delaware	13	VI	1934	
	2	Oregon	Waldport	6	VIII	1953	Lith

Table 5. Recorded data on specimens of Pnigalio flavipes (Ashmead) with information known about host niche.

B. L

:E YEAR	HOST	NICHE	HOST PLANT
1941	-	-	-
1941	-	-	-
1956	Caliroa cerasi	-	-
1946	-	-	-
1913	Gracillaridae	B. L. M.	Fagus sp.
1962	-	-	-
1935	-	-	Populus tremuloides
1929	Fenusa pusilla	-	Betula sp.
1953	-	-	Populus sp.
1932	-	-	-
-	-	-	-
1936	Argyresthia thuiella	B. L. M.	-
1935	Phyllotoma nemorata	-	-
1929	-	-	-
1958	-	-	-
1952	Lithocolletis sp.	B. L. M.	-
1962	Liriomyza	-	Lonicera sp.
1959	-	-	Rumex sp.
1927	-	-	-
1910	-	-	-
1930	-	-	-
1934	-	-	-
1953	Lithocolletis gaultheiella	B. L. M.	Salal sp.

B. L. M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION		
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR
		UNITED STATES				
	1	Oregon	Saddleback Mt.	9	VIII	1959
1		"	"	25	VIII	1959
	1	Pennsylvania	North East	30	VIII	1915
	2	"	"	6	IX	1915
	1	"	"	4	IX	-
	3	"	"	21	VII	1917
	1	"	Glenside	23	IX	1930
2	1	Texas	Houston	2	XI	1929
	1	Washington	Seattle	26	XII	1942
	1	Wisconsin	Door County	23	VII	1960

Table 5. Recorded data on specimens of Pnigalio flavipes (Ashmead) with information known about host niche.

E / EAR	HOST	NICHE	HOST PLANT
1959	-	-	-
1959	-	-	-
1915	Antispila isobella	B. L. M.	-
1915	" "	"	-
-	" "	"	-
1917	Cimbex americana	-	-
1930	-	-	Azalea
1929	-	-	Quercus Phellos
1942	Agromyza sp.	-	-
1960	-	-	Malus sp.

B. L. M. = Blotch Leaf Mine

XVII. GENUS SYMPIESIS FORSTER

Sympiesis Forster, 1856, Hym. Stud. 2: 74, 76. Type species: Eulophus sericeicornis Nees.

Teleogmus Forster, 1856, Hym. Stud. 2: 72, 74. Type species: Teleogmus orbitalis Forster.

Sympiezus Thomson, 1878, Hym. Scand. 5: 208. [Erroneous subsequent spelling.]

Pseudophiliminus Girault, 1913, Mem. Queensland Mus. 2: 286. Type species: Pseudophiliminus longiventris Girault.

Notanisomorphella Girault, 1913, Mem. Queensland Mus. 2: 287. Type species: Notanisomorphella australiensis Girault.

Moroceras Erdos, 1954, Ann. Hist. nat. Mus. Natl. Hung. (s. n.), 5: 323. Type species: Moroceras biroi Erdos.

Like Shrank's description of Pnigalio Forster's (1856) definition of Sympiesis leaves much to be desired. Unfortunately he based his concept of the genus on the male of Sympiesis sericeicornis (Nees) which, as demonstrated by Boucek (1959) and Erdos (1966), is not typical for the genus. Indeed the funicular rami, normally present in the male antenna of the other species in the genus, are not or only poorly developed in males of the type species.

The species of Sympiesis treated here have the following characteristics in common which I consider the generic limits.

Female.- length 1.80 mm. to 5.00 mm.; width of thorax in front of tegulae 0.40 mm. to 0.80 mm. Colour: metallic blue or black with bluish to violaceous or greenish reflections on the head, scutellum, propodeum or pleuron, or black; light coloured markings (yellow or white) on scape, trophi, dorsal area of mesepisternum, tegulae, legs and some abdominal segments. Structure: head, oval, roundish, subtriangular or subquadrate, wider than high; compound eyes prominent with numerous very short to short whitish setae evenly distributed on their surfaces; vertex, frons, face, clypeus and genae coriaceous, reticulate or strongly punctate, never

smooth and shiny, with suberect to erect whitish setae variably distributed on their surfaces, antennal scrobes smooth and shiny, well impressed and coalesce dorsally; clypeus small and poorly defined; antenna very strongly compressed laterally, composed of scape, pedicel, one anellus, four funiculars and two club segments; scape nearly as long or longer than pedicel, anellus and first funicular combined, with numerous appressed setae on dorsal margin and three to ten erect, delicate, elongate setae on the basal lateral and/or flexor surfaces; pedicel 1/3 to 1/2 as long as first funicular which is longer than the following three funiculars of which the third and fourth are often equal, more often the three are progressively shorter from second to fourth; anellus 1/7 to 1/20 as long as first funicular; second club segment subequal to or sometimes as much as 1/3 as long as first, often with a strong terminal nipple-like seta; funiculars and club segments with numerous suberect setae, elongate, elliptical, transparent, surface sensillae and erect, knobbed sensillae evenly distributed on their surfaces; anellus and pedicel with some erect setae on their surfaces; mandibles usually subquadrate with one or two strong, acute superior teeth and two to eight, progressively smaller, rounded inferior teeth; maxilla with two-segmented palp, the distal segment with subterminal and/or terminal elongate or short setae; labium with non-segmented palps with three to four elongate or short, subterminal and terminal setae; thorax from dorsal aspect subspindle to subrectangular; usually narrower than head but wider than abdomen; pronotum most often campanulate in shape, reticulate to strongly punctate with numerous, appressed, usually white, but sometimes dark setae evenly distributed on its surface, five to six elongate, erect setae are evenly distributed on its posterior margin; mesoscutum reticulate to very strongly punctate, usually with a lateral row of four to five elongate white setae on mid lobe, and numerous appressed to suberect setae widely distributed on side lobes; scutellum reticulate to strongly punctate with a pair of lateral, erect, white setae; axillae reticulate to strongly punctate; metascutellum reticulate to strongly punctate;

metascutum smooth and shiny; propodeum lightly reticulate and shiny to strongly punctate and opaque, median carina complete or incomplete or lacking; plica never complete often lacking; costula nor its remnants never present; lateral sulcus well developed or poorly defined; propodeal spiracles large and oval to small and round sometimes nearly touching anterior margin of propodeum, usually a measurable distance from it; calli with numerous, elongate, whitish setae evenly distributed on their surfaces; pleuron smooth and shiny to punctate; wings hyaline, with or without fuscous markings; fore wing with well-developed submarginal, marginal, post marginal and stigmal veins, as well as basal, cubital, subcubital and sometimes median veins partially or wholly defined by setal patterns; four stigmal sensillae always present: abdomen subpetiolate, from above short to long lanceolate in shape, acute at apex and strongly depressed dorsoventrally; integument usually lightly and finely reticulate; tergites one to three usually naked medially, abdomen with or without yellowish markings.

Male.- length 1.20mm. to 2.50 mm.; width of thorax in front of tegulae 0.30 mm. to 0.65 mm.; antennal scape broader than female slightly dilated medially; anellus very short; first three funiculars barely to strongly aciculate or each with an elongate rami posteriorly on its dorsal margin; fourth funicular always longer than preceding ones: abdomen subpetiolate, from dorsal aspect subrectangular in shape, strongly depressed, often with light-coloured markings on discs of tergites one to three; genitalia as illustrated for each species.

XVIII. KEY TO NEARCTIC SPECIES OF SYMPIESIS FORSTER

1. Propodeum smooth and shiny or partially to wholly, lightly reticulate, vermiculate and/or finely granular 2
   Propodeum usually heavily punctate or sometimes strongly reticulate 5
2. Abdomen ovate or lanceolate seldom longer than head and thorax combined; lateral sulci deep and well developed; robust species.. 3
   Abdomen long and narrow, usually much longer than head and thorax combined; lateral sulci when present shallow and poorly developed, more delicate species 4
3. Parapsidal grooves incomplete; meta scutellum strongly punctate; all femora mostly black, never totally white; species prefer hosts of the orders Lepidoptera, Diptera, Coleoptera and Hymenoptera which form blotch- or tentiform-like mines on deciduous plants ..... Sympiesis conica (Provancher)
   Parapsidal grooves complete; meta scutellum very lightly reticulate to smooth and shiny; legs except coxae usually entirely white, occasionally fore and mid femora with black markings; species prefers hosts of the order Lepidoptera known to be predacious and nocturnal in their feeding habits, hiding in foliage during the day ..... Sympiesis enargiae new species
4. Propodeum finely reticulate never vermiculate or granulose; abdomen very long and narrow without white or yellowish markings; species large and delicate; Holarctic; Nearctic population prefers hosts of the order Lepidoptera which have leaf-rolling habits ..... Sympiesis dolichogaster Ashmead
   Propodeum finely reticulate, granulose and/or vermiculate; abdomen long lanceolate usually with white or yellow markings on tergites and sternites two to five; species small and delicate; Nearctic only; prefers hosts of the order Lepidoptera which make blotch- or tentiform-like mines on deciduous plants .... Sympiesis marylandensis Girault

5. Fore wings with at least a faint fuscous marking near stigmal vein, usually fuscous markings of fore wings easily visible 6
   Fore wings without fuscous markings 11
6. Fore wings with fuscous markings at basis of marginal veins as well as around stigmal veins ..... Sympiesis bimaculatipennis (Girault)
   Fore wings without fuscous markings at basis of marginal veins, fuscous markings confined to stigmal veins 7
7. Parapsidal grooves not visible posteriorly, incomplete; abdomen long and narrow, much longer than head and thorax combined; western species ..... Sympiesis stigmata Girault
   Parapsidal grooves usually visible posteriorly, complete; abdomen usually ovate or long lanceolate, not much longer, if any, than head and thorax combined, usually shorter 8
8. Usually all femora mostly black; abdomen rarely marked with yellow; small species which prefer hosts in the order Lepidoptera which mine the needle-like leaves of coniferous plants .... Sympiesis stigmatipennis Girault
   Usually hind femora yellow or all legs white; abdomen usually with yellow markings; more robust species which prefers hosts in the order Lepidoptera which either roll or mine leaves of deciduous plants 9
9. Median carina of propodeum usually barely indicated anteriorly, incomplete, if complete hind coxae totally black .... Sympiesis ancylae Girault
   Median carina of propodeum usually well defined and complete, if incomplete hind coxae partially white 10
10. Scutellar punctures small and round .... Sympiesis argenticoxae Girault
    Scutellar punctures large and elongate ... Sympiesis marylandia Girault
11. Lateral sulcus of propodeum very strongly developed and elongate, forming a trough which reaches the spiracle; propodeal carina not well defined; species a beautiful, deep, metallic blue .... Sympiesis fragariae new species

Lateral sulcus not elongate, trough-like; propodeal carina well defined and usually complete 12

12. Propodeum heavily punctate, all legs yellowish; abdomen largely marked with yellow; species prefers hosts of the order Lepidoptera with stem-boring habits especially Pyrausta nubilalis (Hubner) ..... Sympiesis viridula (Thomson)

Propodeum reticulate to lightly punctate; all femora and coxae black; abdomen without yellowish markings; species restricted to lepidopterous hosts which feed in the open during the day but retire at night to a frass tube .....
..... Sympiesis acrobasidis new species

XIX. SYMPIESIS CONICA (PROVANCHER)

Metacolus conicus Provancher, 1887, Add. Corr. Faune Ent. Canada, Hym., pp. 200-201.

Coccophagus compressicornis Provancher, 1887, Add. Corr. Faune Ent. Canada, Hym., p. 206. New Synonomy.

Sympiezus lithocolletidis Brunn, 1883, Brunn, Rep. N.Y. (Cornell) Agric. Expt. Sta. Dep. Ent. 2: 150. [Nomen nudum]

Sympiesis nigrifemora Ashmead, 1888, Bull. Kans. Agric. Expt. Sta. 3: App. p. VII.

Sympiesis nigripes Ashmead, 1888, Bull. Kans. Agric. Expt. Sta. 3: App. p. VII. New Synonomy.

Segnipiesis [!] nigrifemora Webster, 1895, Can. Ent. 27: 68.

Sympiesis nigrifemorata Schulz, 1906, Spoila Hym., p. 142 [Invalid] emend.

Sympiesis massosoit Crawford, 1913, Proc. U.S. natn. Mus. 45: 258. New Synonomy.

Sympiesis compressicornis Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Sympiesis conicus Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

Female.- (Figs. 18, 55, 73, 91, 127, 170-172) length 2.50 mm. to 3.30 mm.; width of thorax in front of tegulae 0.45 mm. to 0.75 mm. Colour: metallic blue, blue black to black; trophi, trochanters, apices of femora, tibiae and all but last segment of tarsus white. Structure: head oval in shape, wider than high; compound eyes with very short, erect setae evenly distributed on their surfaces; vertex, frons and genae lightly to heavily reticulate; face and clypeus finely punctate; all surfaces with erect, elongate setae evenly but widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli 5:13; antennal scape as long as pedicel, anellus; first funicular and 1/2 of second funicular combined with

three short, fine and eight or nine, elongate stout, suberect setae on dorsal margin and eight fine, elongate, erect setae on flexor surface; pedicel 1/2 as long as first flagellar; anellus 1/10 as long as first flagellar; first club segment 1 1/3 times as long as second; mandible subquadrate with two well-developed, acute, superior teeth, the dorsal one subterminal the second terminal and five to six rounded very small inferior teeth; apical segment of maxillary palp with four elongate and one short stout subterminal setae and one elongate terminal seta; labial palp with two short and two elongate subterminal setae: thorax from dorsal aspect subquadrate in shape, narrower than head, wider than abdomen; mesonotum ten times as long and 1 1/2 times as wide as pronotum, 3 1/2 times as long and only slightly wider than propodeum; pronotum campanulate in shape, strongly reticulate to punctate with suberect, yellowish setae widely distributed on its surface and four to five of these are elongate and evenly distributed on the posterior margin; mesoscutum punctate with elongate, suberect yellowish setae widely but evenly distributed on its surface; scutellum punctate, puncture on median anterior region small and close together, those on lateral and posterior regions larger, with two pair of elongate, lateral, suberect, yellowish setae; axillae closely punctate; metascutellum punctate; smooth to gently reticulate and shiny; median carina and posterior half of plicae well developed; lateral sulcus strongly impressed and large; propodeal spiracle oval and almost touching anterior margin of propodeum; propleuron reticulate; prepectus strongly reticulate; mesepisternum and ventral region of mesepimeron reticulate, dorsal region of mesepimeron and lateral extensions of propodeum smooth and shiny with very fine reticulations; fore wing, submarginal and marginal veins subequal, the latter more than two times as long as postmarginal which is twice as long as stigmal; stigma with four sensillae; basal, cubital and subcubital veins completely or partially defined by setal patterns; hind wing rounded at apex; abdomen subpetiolate from dorsal aspect lanceolate in shape, as long or longer than head and thorax

combined; first and second tergites naked dorsally, third to sixth tergite with delicate, appressed, elongate setae widely scattered over their dorsal surfaces, seventh tergite with numerous appressed, delicate, elongate setae closely distributed on its surface.

Male.- (Figs. 36, 37, 109, 173-175) differs from female as follows: length 1.50 mm. to 1.80 mm.; width of thorax in front of tegulae 0.30 mm. to 0.45 mm.; antennal scape broader, as long as pedicel, anellus and first two flagellars combined; first three falgellars with anterior dorsal angle aciculated; club segments equally long; funiculars and club segments yellow ventrally; thorax more weakly sculptured: abdomen subrectangular narrower anteriorly, without light coloured markings; genitalia as illustrated.

Variation.- the female of this species is structurally stable throughout its range but the coloration of the species is extremely varaible. It ranges from a brilliant metallic blue with tibiae and most of the femora yellow through blue black with greenish tinges to pure black with legs almost entirely black.

The male is relatively stable in colour but like the European species Sympiesis sericeicornis (Nees) the dorsal anterior angles of the first three funicualrs may be extremely elongated producing a rami affect or more commonly barely to slightly aciculate, figures 36, 37.

Types.- lectotypes are selected as follows: Sympiesis nigrifemora Ashmead; female, type number 27283, U.S.N.M., Riley Co., Kansas, VIII.1887, ex. apple Tischeria, Marlatt 728; Sympiesis massasoit Crawford; female, type number 15016, U.S.N.M., Auburndale, Mass. VII.1925, ex. Lithocolletis hamadreyella Clemens on swamp white oak leaves.

Distribution.- this species is very widely spread throughout the transitional zone of the Austral region and the Canadian zone of the Boreal region. Some specimens have been taken or reared in localities well within the Hudsonian zone of the Boreal region. These are few in number and possibly represent part of a fauna which occur in island refuges typical of the Canadian zone, map 6.

Material examined.- the data on the specimens examined of this species are recorded in table 6.

This species prefers hosts which make a tentiform- or blotch-like mine, figure 254, in leaves of deciduous plants. Some specimens have been recorded from hosts which mine leaves in their early stages but leave the mine and roll the edge or tip of the leaf in latter stages. The majority of hosts belong to the order Lepidoptera.

Biology.- this species is an ectoparasitoid in habit and was observed in S.W. Quebec by Dr. R. P. Pottinger (unpublished notes) Lincoln College, Canterbury, New Zealand, feeding on the fifth instar larva of Lithocolletis malimalifoliella Braun. He also observed it feeding on fifth instar larvae of the same species already parasitized by the parasitoid Apanteles ornigis Weed which died as a result of the feeding activities of S. conica.

Map 6. Nearctic distribution of Sympiesis conica (Provancher)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
			C A N A D A				
	2	Alberta	Aspen Beach	23-25	VIII	1944	-
	1	"	Edmonton	8	VI	1946	-
	1	British Columbia	Robson	1	V	1948	-
	2	"	"	17-23	VIII	1949	-
	1	"	Cassiar District				Lithocolleti
	1	"	Cranbrook	12	V	1932	-
1	3	"	Lavington	13-16	VI	1958	-
2	2	"	Summerland	14-23	VIII	1934	-
1	1	"	Victoria	14	IX	1961	-
	1	Manitoba	Duck Mountain	15	VII	1946	Archips conf.
	1	"	Red Rock Lake	19	VIII	1946	Lithocolleti
	1	New Brunswick	Fredericton	5	III	1956	Phyllocnisti
1	2	"	Northumberland County	9-21	III	1956	Lithocolleti
	1	"	Restigouche County	13	IV	1951	-
	1	"	Siegas	27	VI	1960	Sciaphila sp.
1	2	"	Sunbury County	9-15	III	1956	Lithocolleti
	1	"	York County	15	VIII	1955	"
	2	Northwest Territories	Yellowknife	19	VIII	1949	-
2		Nova Scotia	Aldershot	-	IV	1946	-
	3	"	"	18-25	VIII	1950	-
2		"	Berwick	-	IV	1946	Tentiform le
2		"	"	9-20	VII	1946	"
	1	"	"	-	X	1945	-
	4	"	Bridgetown	2	IX	1912	-

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche.

B.L.M. = Blot
S.M. = Serpen
L.R. = Leaf

HOST	NICHE	HOST PLANT
-	-	-
-	-	Prunus sp.
-	-	-
-	-	-
Lithocolletis tremuloidiella	B. L. M.	-
-	-	-
-	-	-
-	-	-
-	-	-
Archips conflictana	L. R.	Populus sp.
Lithocolletis sp.	-	-
Phyllocnistis sp.	S. M.	-
Lithocolletis salicifoliella	B. L. M.	-
-	-	-
Sciaphila sp.	L. R.	Populus sp.
Lithocolletis salicifoliella	B. L. M.	-
"	-	-
-	-	-
-	-	-
-	-	Malus sp.
Tentiform leafminer	-	-
"	-	-
-	-	-
-	-	-

B.L.M. = Blotch Leaf Mine
S.M. = Serpentine Mine
L.R. = Leaf Roller

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
2		Nova Scotia	Kentville	-	IV	1946	Tentii
2	1	"	Kings County	-	IV	1946	
4		"	Nictaux	-	IV	1946	
	2	"	North Sawler	-	VI	1951	
		"	"	7	VII	1951	
	1	"	"	31	VIII	1951	
	5	"	"	21	IX	1951	
	4	"	"	4-14	VI	1952	
	1	"	"	9	VII	1952	
	1	"	"	8	VIII	1952	
	1	"	Parrsboro	16	VII	1914	Gracil
	2	"	"	25	VIII	1913	Lithoc
	1	"	Smiths Cove	29	VII	1945	
2	4	"	"	3	VIII	1945	Lithoc
4	1	"	South Waterville	28	IX	1945	Tentii
	1	"	Star's Point	12	VI	1955	
	3	"	Waterville	25	VII	1936	Lithoc
1	1	"	"	-	Spring	1946	Tentii
	1	"	Welsford	2	VIII	1946	
	1	"	Queen's County	17	VIII	1935	Lithoc
1	1	Ontario	Ameliasburg	-	VIII	1938	Leafmi
	2	"	Bells Corners	1	III	1957	Gracil
		"	Bobcaygeon	3- 8	VIII	1932	
1	7	"	Chapleau	31	VII	1962	Lithoc
	1	"	Connaught	-	-	1962	Lithoc
	5	"	Golden Lake	28-31	III	1945	Leafmi

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche.

B.L.M.

E EAR	HOST	NICHE	HOST PLANT
.946	Tentiform leafminer	-	-
.946	-	-	-
.946	-	-	-
.951	-	-	Malus sp.
.951	-	-	"
.951	-	-	"
.951	-	-	"
.952	-	-	"
.952	-	-	"
.952	-	-	"
.914	Gracillaria alnifoliella	B. L. M.	Alnus sp.
.913	Lithocolletis sp.	"	Betula sp.
.945	-	-	-
.945	Lithocolletis sp.	B. L. M.	Malus sp.
.945	Tentiform leafminer	-	"
.955	-	-	-
.936	Lithocolletis crataegella	B. L. M.	-
.946	Tentiform leafminer	-	-
.946	"	-	-
.935	Lithocolletis sp.	B. L. M.	Alnus sp.
.938	Leafminer	-	Carya sp.
.957	Gracillaria sp.	B. L. M.	Hypericum sp.
.932	-	-	-
.962	Lithocolletis salicifoliella	B. L. M.	-
.962	Lithocolletis sp.	"	-
.945	Leafminer	-	Rhus toxicodendron

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	2	Ontario	Golden Lake	2	IV	1945	Leafminer
	1	"	"	13	IX	1943	Lithocollet
1	1	"	Homer	10-16	VII	1936	-
1	1	"	"	12-18	VIII	1936	-
	1	"	Longlac	19	II	1963	Lithocollet
1	4	"	Macintosh	3	VIII	1962	Lithocollet
	1	"	Madoc	31	VII	1961	Lithocollet
	1	"	Merivale	22	VIII	1932	-
1		"	Nicholson	30	VII	1962	Lithocollet
8	1	"	Normandale	21-31	VII	1961	Lithocollet
2		"	"	1- 9	VIII	1961	"
1		"	Ottawa		II	1902	Leafminer
1	3	"	"		VIII	1908	"
	1	"	"	5	VII	1938	-
	1	"	"	15	IX	1942	-
1		"	"	11	VII	1955	Lithocollet
	1	"	"	13	VII	1958	-
	2	"	Port Arthur	14	III	1951	Lithocollet
	1	"	Port Colborne	25	VIII	1934	-
	1	"	"	14	IX	1934	Lithocollet
	1	"	Quarries	14	V	1946	-
	1	"	Renfrew	13	VIII	1962	Lithocollet
	1	"	St. Davids	22	VI	1931	Epinotia la
	1	"	St. Williams	24	VII	1961	Lithocollet
	1	"	"	8	VIII	1961	"
	1	"	Simcoe	26	VI	1939	-

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche.

B. L. M. =

HOST	NICHE	HOST PLANT
Leafminer	-	Rhus toxicodendron
Lithocolletis salicifoliella	B. L. M.	Populus sp.
-	-	-
-	-	-
Lithocolletis alnicolella	B. L. M.	-
Lithocolletis sp.	"	-
Lithocolletis sp.	"	Populus tremuloides
-	-	-
Lithocolletis salicifoliella	B. L. M.	-
Lithocolletis sp.	"	Populus tremuloides
"	"	"
Leafminer	-	Lonicera sp.
"	-	"
-	-	-
-	-	-
Lithocolletis sp.	B. L. M.	-
-	-	Ulmus alba
Lithocolletis salicifoliella	B. L. M.	-
-	-	-
Lithocolletis lucetiella	B. L. M.	-
-	-	-
Lithocolletis sp.	B. L. M.	Quercus alba
Epinotia laracana	-	-
Lithocolletis sp.	B. L. M.	Populus tremuloides
"	"	"
-	-	-

B. L. M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
1		Ontario	Simcoe	3	V	1945	-
	1	"	"	9	IX	1957	Lithocoll
6		"	"	19-25	VII	1961	Lithocoll
1		"	South March	3	V	1945	-
	1	"	Timagami	19	VIII	1947	-
1		"	Vermilion Bay	14	VII	1955	Lithocoll
	1	"	Vineland	3	VII	1933	Lithocoll
1		"	"	-	V	1939	"
1	2	"	Winona	-	-	-	Tischeria
	1	Quebec	Farnham	-	VI	1956	Lithocoll
	3	"	Forestville	9	VIII	1950	-
3	11	"	Great Whale River	15	VII	1949	Lithocoll
	1	"	Hull	18	VII	1955	"
1		"	"	31	VII	1961	"
	1	"	"	10	VIII	1961	"
1	2	"	Lac Brulé	25	VIII	1946	Leafminer
	2	"	Lacoste	7	VII	1941	-
	2	"	Nominigue	13	VI	1941	-
	1	"	Wakefield	9	VII	1946	-
	1	Saskatchewan	Attons Lake	10	VI	1940	-
1	3	"	Indian Head	9-17	VIII	1937	Gracillar
1		"	"	2	VIII	1938	"
	2	"	Otosquen	4	VIII	1955	"
	1	"	White Fox	10	VII	1944	-
	1	Yukon Territory	Dawson	4	VII	1949	-

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche.

B.L.M. = 1

HOST	NICHE	HOST PLANT
-	-	-
Lithocolletis tremuloidiella	B. L. M.	Populus grandidentata
Lithocolletis sp.	"	"
-	-	-
-	-	-
Lithocolletis salicifoliella	B. L. M.	-
Lithocolletis crataegella	"	-
"	"	-
Tischeria malifoliella	"	-
Lithocolletis propinquinella	"	-
-	-	-
Lithocolletis sp.	B. L. M.	Ledum sp.
"	"	-
"	"	Populus
"	-	Prunus pennsylvanicus
Leafminer	-	Fraxinus sp.
-	-	-
-	-	-
-	-	-
-	-	-
Gracillaria negundella	B. L. M.	-
"	"	-
"	"	Acer sp.
-	-	-
-	-	-

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	Yukon Territory	Swift River	14-16	VIII	1948	-
	1	"	Marsh Lake	9	VIII	1948	-
	1	U N I T E	D S T A T E S				
	1	California	Banning	18	V	1938	-
1	2	"	Coalinga	-	VIII	1939	Bucculatr
1		"	Lake Tenaya	17	VI	1949	Recurvari
1	1	"	National Forest	3	IX	1958	-
	1	Connecticut	North Haven	22	V	1918	Tischeria
	1	Florida	Dixie County	20	IV	1955	-
	1	"	Fort Ogden	9	IV	1952	-
1		Idaho	Idaho County	-	VII	1951	Gracillar
1	1	"	Lucille	13	VI	1951	-
	2	"	Riggins	26	IV	1950	-
1		"	Spalding	27	VIII	1956	-
	1	"	"	-	IX	1956	-
	3	Illinois	Champaign	1	II	1887	Tischeria
1	1	Indiana	Bedford	26-27	VIII	1932	-
	3	Iowa	Ames	-	-	-	Tischeria
	1	Kansas	Onaga	-	-	-	-
	3	"	Riley County	-	VIII	1887	Tischeria
	1	"	Wathena	20	VIII	1938	-
	1	Maine	Albion	-	XI	1946	Lithocoll
	1	"	Bar Harbor	26	VIII	1926	"
	1	"	Mt. Desert Island	8	VIII	1932	-
	1	Maryland	Cumberland	24	X	1955	-
2	1	Massachusetts	Auburndale	25	VII	1911	Apanteles

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche

L.M. = Le
N.M. = Ne

	HOST	NICHE	HOST PLANT
48	-	-	-
48	-	-	-
58	-	-	Prunus sp.
59	Bucculatrix sp.	L. M.	Populus sp.
49	Recurvaria milleri	N. M.	Pinus sp.
58	-	-	-
.8	Tischeria malifoliella	B. L. M.	Malus sp.
55	-	-	-
52	-	-	-
51	Gracillaria rhoifoliella	B. L. M.	Rhus
51	-	-	-
50	-	-	Rhus
56	-	-	-
56	-	-	-
57	Tischeria malifoliella	B. L. M.	Pyrus malus
52	-	-	"
	Tischeria malifoliella	B. L. M.	Malus
	-	-	-
57	Tischeria	B. L. M.	Malus
58	-	-	-
46	Lithocolletis sp.	B. L. M.	-
26	"	"	Salix
52	-	"	Amelanchier sp.
55	-	-	-
.1	Apanteles sp.	-	-

L.M. = Leaf Mine
N.M. = Needle Miner B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	Massachusetts	Boston	9	VIII	1944	Lithocollet
5	3	Michigan	East Lansing	22	IX	1936	Ornix gemir
1		Minnesota	Eaglesnest	25	VII	1936	Lithocollet
	1	New Hampshire	Rye	9	VII	1923	Apanteles m
2	3	New York	Long Island	1	IX	1934	-
	1	"	Rochester	2	IX	1933	-
	1	Ohio	Columbus	17	IX	1920	-
	1	"	North	-	VIII	1893	-
	1	Oregon	Boyer	24	VI	1938	-
	1	"	Waldport	6	VIII	1953	-
	1	Pennsylvania	North East	5	V	1915	Tischeria m
2	5	"	"	3-23	V	1915	Ogeninatell
1	1	"	"	23-25	V	1916	Lithocollet
3	3	"	"	24-26	V	1916	Nepticula s
	1	"	Philadelphia	15	IV	1920	Gracillaria
	1	South Carolina	Florence	29	III	1951	-
1		Tennessee	East Ridge	6	V	1952	-
	1	Texas	Houston	20	XI	1929	-
2	11	Virginia	Timberville	10	IV	1942	Lithocollet
	1	"	Winchester	-	-	-	Callisto ge
		West Virginia	Kearneysville	-	VII	1955	"
	2	Washington	Seattle	7	VIII	1942	Gracillaria
2		Wisconsin	Door County	-	-	1932	Coleophora

Table 6. Recorded data on specimens of Sympiesis conica (Provancher) with information known about host niche

B. L. M. = P

ICE	YEAR	HOST	NICHE	HOST PLANT
	1944	Lithocolletis blancardella	B. L. M.	Pyrus sp.
	1936	Ornix geminatella	"	-
	1936	Lithocolletis tremuloidiella	"	-
	1923	Apanteles melanoscelus	-	-
	1934	-	-	-
	1933	-	-	-
	1920	-	--	-
	1893	-	-	-
	1938	-	-	-
	1953	-	-	-
	1915	Tischeria malifoliella	B. L. M.	-
	1915	Ogeninatella sp.	-	-
	1916	Lithocolletis sp.	B. L. M.	-
	1916	Nepticula sp.	-	-
	1920	Gracillaria azaleaella	-	-
	1951	-	-	-
	1952	-	-	-
	1929	-	-	Quercus virginiana
	1942	Lithocolletis crataegella	B. L. M.	Malus sp.
	-	Callisto geminatella	"	-
	1955	"	"	-
	1942	Gracillaria sp.	"	-
	1932	Coleophora pruniella	"	-

B. L. M. = Blotch Leaf Mine

XX. SYMPIESIS ENARGIAE NEW SPECIES

Female.- (Figs. 19, 56, 74, 92, 128, 176-178) length 1.80 mm. to 2.50 mm.; width of thorax in front of tegulae 0.45 mm. to 0.70 mm. Colour: metallic blue or black, basal 3/4 of scape, femora, tibiae and tarsi white; trophi yellowish. Structure: head circular in shape, slightly wider than high; compound eyes with numerous erect, short, whitish setae evenly distributed on their surfaces; vertex and areas of frons laterad to antennal scrobes strongly reticulate with erect whitish setae widely distributed on their surfaces; antennal scrobes smooth and shiny; clypeus, face and genae more finely reticulate with erect, whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 6:16; antennal scape as long as pedicel, anellus, first funicular and half the second funicular combined, with numerous appressed, setae on dorsal margin and five elongate, delicate erect setae on flexor surface; pedicel 1/2 as long as first flagellar; anellus 1/7 as long as first flagellar; first club segment 1 1/4 times as long as second; mandibles long rectangular with two well-developed, acute, terminal, superior teeth and two to four rounded, smaller inferior teeth; apical segment of maxillary palp with five elongate and one short subterminal setae and one elongate, terminal seta; labial palp with one elongate and one short subterminal setae and one elongate terminal seta: thorax from dorsal aspect subquadrate, as wide as head and abdomen; mesonotum four times as long as pronotum and propodeum, 1 1/2 times wider than pronotum and only slightly wider than propodeum; pronotum campanulate in shape, coarsely punctate laterally finely punctate medially, with suberect setae evenly and widely scattered on its surface, four to five of these are elongate and evenly distributed on the posterior margin; mesoscutum coarsely punctate posteriorly and finely anteriorly and laterally; notaulices complete; median lobe with four pair of elongate, suberect, whitish setae near the lateral margins; lateral

lobes with numerous suberect setae widely scattered on their surfaces; scutellum reticulate, reticulation anteriorly less coarse than those posteriorly, with two pair of elongate, lateral, suberect whitish setae; axillae finely reticulate; metascutellum delicately reticulate and shiny; propodeum delicately reticulate and shiny with a fine median carina; lateral sulcus well developed; propodeal spiracle large and round about 1/4 its diameter from anterior border of propodeum; propleuron reticulate; prepectus strongly reticulate; mesepisternum finely reticulate; mesepimeron delicately reticulate dorsally more strongly reticulate ventrally; fore wing, submarginal and marginal veins subequal, the latter twice as long as postmarginal which is 2 1/2 times as long as stigmal; stigma with four sensillae; basal, cubital, subcubital and median veins completely or partially defined by setal patterns, the last faintly indicated; hind wing rounded at apex; abdomen subpetiolate, from dorsal aspect broadly ovate, acute at apex, as long as head and thorax combined, very strongly depressed dorsal ventrally; tergites one to four with suberect, whitish setae on their lateral areas; tergites five to seven with suberect whitish setae distributed over their entire surfaces.

Male.- (Figs. 38, 110, 179-181) differs from female as follows: length 1.50 mm. to 2.00 mm., width of thorax in front of tegulae 0.45 mm. to 0.60 mm.; antennal scape very broad with five elongate setae on flexor surface; anellus very short, funiculars progressively longer from first to fourth, first three each with a stout elongate, club-like rami on the posterior dorsal margin; each funicular, rami and club segment bear numerous, elongate sensillae resembling stout setae widely distributed on their surfaces, interspersed with these are a number of smaller erect setae: thoracic sculpturing less pronounced, median carina of propodeum is lacking, propodeum is smooth and shiny: abdomen from dorsal aspect subrectangular; tergites and sternites two and three with whitish markings; genitalia as illustrated.

Variation.- this species appears to be relatively stable over its entire range. The hind and mid femora of some male specimens from eastern Canada were partially black.

Types.- holotype, female, C.N.C. No. 9515, Cedar Lake, Ontario 16.VII.1961, ex. Enargia decolour Grote; paratypes 15 females, 3 males same data as holotype; 2 females, 2 males, same locality and host as holotype, 11.VII.1961; 6 females, 1 male, same locality and host as holotype, 6.VI.1961.

Distribution.- this species is transcontinental in the Canadian and Hudsonian zones of the Nearctic Boreal region, map 7.

Material examined.- the data on the specimens examined of this species are recorded in table 7.

This parasitoid prefers lepidopterous hosts which are nocturnal and predacious in feeding habits; during the day they are known to hide between leaves tied with silk or in rolled or curled leaves. They are probably attacked during the resting, hiding period.

Biology.- nothing is known on the biology of this species.

Map 7. Nearctic distribution of Sympiesis enargiae (Miller)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
			C A N A D A				
1	4	British Columbia	Waldo	28	IV	1958	Hesperidae
1	1	New Brunswick	York County	14	VII	1965	-
	1	Northwest Territories	Yellowknife	29	VI	1949	-
	1	Ontario	Bells Corners	20	V	1941	-
1	5	"	Cedar Lake	6	VI	1961	Enargia de
5	19	"	"	11-16	VII	1961	-
	5	"	Hearts Desire	2	VI	1941	Nematine s
	1	Quebec	Knob Lake	8	VII	1948	-

Table 7. Recorded data on specimens of Sympiesis enargiae Miller with information known about host niche.

CE YEAR	HOST	NICHE	HOST PLANT
1958	Hesperidae sp.	-	-
1965	-	-	Corylus sp.
1949	-	-	-
1941	-	-	-
1961	Enargia decolor	-	-
1961	-	-	-
1941	Nematine sp.	-	-
1948	-	-	-

XXI. SYMPIESIS DOLICHOGASTER ASHMEAD

Sympiesis dolichogaster Ashmead, 1888, Bull. Kans. agric. Expt. Stn. 3: App. p. VII.

Sympiesis nowickii Szelenyi, 1941, Fragm. Faun. Hung. 4: 27.

Female.- (Figs. 20, 57, 75, 93, 129, 182-184) length 3.40 mm. to 5.00 mm.; width of thorax in front of tegulae 0.65 mm. to 0.80 mm. Colour: dark metallic green to black with copperish and purplish reflections; distal half to two-thirds of hind coxae, mid and front coxae, rest of legs and base of scape white; last tarsal segments, trophi, and wing veins light to dark green; apices of femora and posterior part of abdomen dark green; tegulae transparent. Structure: head subtriangular, wider than high; compound eyes with numerous very short, erect, whitish setae evenly distributed on their surfaces; entire head closely punctate with suberect to erect setae widely distributed over its surface; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 5:11; antennal scape longer than pedicel, anellus and first flagellar combined with numerous appressed setae on dorsal margin and six to seven elongate, erect setae on flexor surface; pedicel 1/3 as long as first flagellar; anellus 1/19 as long as first flagellar; club segments subequal in length; mandible subquadrate, with two well-developed, acute, superior teeth, the dorsal one subterminal the second terminal; and four well-defined but smaller, rounded, inferior teeth; apical segment of maxillary palp with four elongate and one short subterminal and one elongate terminal setae; labial palp with two short and three elongate subterminal setae: thorax from dorsal aspect subquadrate in in shape, as wide as head but wider than abdomen; mesonotum eight times as long and 1 1/3 times as wide as pronotum, four times as long but barely wider than propodeum; pronotum campanulate in shape, strongly reticulate with numerous appressed, short,

whitish setae scattered on its surface and four to five suberect, elongate, whitish setae evenly distributed on its posterior margin; mesoscutum strongly punctate, punctures on disc and posterior regions much larger than those on anterior and lateral regions, with some elongate, appressed, yellowish setae widely distributed on its surface; scutellum strongly punctate, punctures laterally much larger than those medially and anteriorly, with two pair of elongate, suberect, lateral, whitish setae; axillae finely punctate and opaque without setae; metascutellum punctate; propodeum smooth, very finely reticulate with a fine median carina, posterior laterally with two elongate impressions the second of which coalesce with a poorly developed lateral sulcus; propodeal spiracle long oval and large, 1/2 its shortest diameter from anterior margin of propodeum; propleuron and prepectus strongly reticulate; ventral regions of mesosternum, mesepimeron and lateral region of propodeum reticulate; dorsal region of mesosternum punctate, of mesepimeron smooth and shiny or very finely reticulate; fore wing, submarginal and marginal veins equally long; marginal vein 2 1/2 times long as postmarginal which is 3 times as long as stigmal; stigma with four sensillae; basal, cubital subcubital and median veins completely or partially defined by setal patterns; hind wing rounded at apex; abdomen subpetiolate, from dorsal aspect lanceolate in shape twice as long as head and thorax combined; first tergite smooth and shiny without setae dorsally but numerous suberect, whitish setae scattered on its lateral region; tergites two to nine finely reticulate; tergites two to four with appressed, widely scattered setae; tergites five and six with numerous suberect setae; tergite seven twice as long as wide with numerous suberect, closely placed setae.

Male.- (Figs. 39, 111, 185-187) differs from female as follows: length 1.65 mm. to 2.50 mm.; width of thorax in front of tegulae 0.40 mm. to 0.65 mm.; antennal scape dilated medially with three elongate, erect setae on flexor surface; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin; thoracic sculpturing less pronounced, apical

1/2 of hind femora and apex of hind tibia black: abdomen from dorsal aspect subrectangular, longer than wide with yellowish or whitish blotches on tergites and sternites one to three; genitalia as illustrated.

Variation.- structurally this species is relatively stable over its entire range.

Types.- the holotype for this species is in excellent condition in the U.S.N.M. It is a female, type number 27285, U.S.N.M., Riley Co., Kansas, 26.VI., ex. leafroller on balsam, Marlott 765. According to the original description the holotype was reared from a lepidopterous leaf roller on balsam poplar.

Distribution.- this species is confined to the Transitional zone of the Nearctic Austral region, map 8. It has been recorded by Boucek (1959) from Czechoslovakia, Austria, Hungary, Western Ukraine (U.S.S.R.), Italy and Rhodes.

Material examined.- the data on the specimens examined of this species are recorded in table 8.

This species prefers a lepidopteran host which mines deciduous leaves early in its larval development but rolls the edge or tip of the leaf and feeds within the roll during the latter part of its larval development, figure 255. Boucek (ibid) records this species as a parasitoid on "Tischeria complanella Hb. mining the leaves of Quercus, and Lithocolletis populifoliella Tr. on Populus. Another host is Gracillaria fidella Rtti. mining Colutea leaves. It parasitizes most probably also further lepidopterous leaf-miners on Fagus, Salix, Carpinus, Tibia, perhaps also on other trees."

Biology.- Nothing is known about the biology of this species.

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	British Columbia	Summerland	27	VIII	1936	
	1	"	Sugar Lake	2	VIII	1957	Hy
	1	Ontario	Bobcageon	20	VII	1932	Gr
1	1	"	Chapleau				Gr
	1	"	Kaministikwia	1	VIII	1964	Gr
	1	"	Merivale	23	VIII	1932	
	1	"	Ottawa	25	VIII	1890	
	2	"	Orono	14	IX	1963	Gr
	1	"	Point Pelee	20	VII	1927	
	1	"	Simcoe	19	VI	1939	
	5	"	Tillsonburg	24	VIII	1960	Gr
	1	"	Vineland	29	VIII	1935	Ep
	3	Saskatchewan	Indian Head	15	VIII	1936	Gr
4	6	"	"	2	VIII	1938	
		UNITED STATES					
	1	Connecticut	East River	10	VII	1913	Gr
1	3	Florida	Miami		VII	1920	Gr
	1	"	"	22	VIII	1892	Gr
	12	"	"	1	V	1918	
	2	"	Orlando	28	V	1937	
	2	Idaho	Lucife	13	VI	1951	
	2	Illinois	Decatur	12	VI	1911	Gr
1		Kansas	Riley County	15	VII	-	
	1	Maine	Bar Harbor	13	VIII	1936	Gr
	1	Michigan	Leelanau	22	VI	1937	
	1	Missouri	Columbia	27	V	1912	
	1	North Dakota	Verona		VII	1954	
	1	South Dakota	Elk Point		VIII	1915	
	1	New Jersey	Moorestown	22	VIII	1930	
	1	Ohio	Ottawa County	23	IX	1943	
	1	Pennsylvania	York	9	VIII	1960	

Table 8. Recorded data on specimens of Sympiesis dolichogaster Ashmead with information known about host niche.

RGENCE TION	HOST	NICHE	HOST PLANT
YEAR			
1936	-	-	Acer sp.
1957	Hydriomena renunciata	L. R.	-
1932	Gracilaria sp.	"	Rhus sp.
	Gracilaria fraxinella	"	-
1964	Gracilaria cuculipennella	"	-
1932	-	-	-
1890	-	-	-
1963	Gracilaria cuculipennella	L. R.	-
1927	-	-	-
1939	-	-	-
1960	Gracilaria fraxinella	L. R.	-
1935	Episimus argutamus	"	-
1936	Gracilaria negundella	"	-
1938	"	"	-
1913	Gracilaria sassafrassella	"	-
1920	Gracilaria perseae	"	Persea sp.
1892	Gracilaria belfragilla	"	-
1918	-	"	Persea sp.
1937	-	"	"
1951	-	"	Rhus sp.
1911	Gracilaria sp.	"	Acer negundo
-	-	-	-
1936	Gracilaria fraxinella	L. R.	-
1937			
1912	-	-	-
1954	-	-	-
1915	-	L. R.	Acer Negundo
1930	-	"	Sassafras sp.
1943	-	"	"
1960	-	-	-

nogaster

L. R. - Leaf Roller

Map 8. Nearctic distribution of Sympiesis dolichogaster Ashmead

XXII. SYMPIESIS MARYLANDENSIS GIRAULT

Sympiesis marylandensis Girault, February, 1917, Entomologist 50: 37.
Sympiesis rex Girault, March 30, 1917, New Chalcid Flies, pp. 2-3. New Synonomy.
Sympiesis miltoni Girault, May 3, 1917, Des. Hym. Chalcidoid. Variorum cum Observ. 3, p. 7. New Synonomy.
Sympiesis lexingtonensis, August 8, 1917, Des. Hym. Chalcidoid. Variorum cum Observ. 5, p. 6. New Synonomy.

Female.- (Figs. 21, 112, 191-193) length 1.80 mm. to 2.90 mm.; width of thorax in front of tegulae 0.40 mm. to 0.50 mm. Colour: blue, bluish black to black, trophi, legs, dorsal tip of mesepisternum, tegulae and discs of tergites and sternites two to five yellow. Structure: head oval, wider than high; compound eyes with numerous very short, erect, whitish setae evenly distributed on their surfaces; vertex, lateral areas of frons, face and clypeus reticulate - punctate; central area of frons smooth and shiny; genae gently reticulate; vertex, lateral area of frons, anterior margin of clypeus and genae with erect, whitish setae widely scattered on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 4:16; antennal scape longer than pedicel, anellus and first funicular combined with numerous appressed setae on dorsal margin and eight, elongate, erect setae on flexor surface; pedicel 1/3 as long as first funicular; anellus 1/15 as long as first funicular; first club segment 1 2/3 times as long as second; mandible subquadrate with two well-developed, acute, superior teeth, the dorsal one subterminal, the second terminal, and five to six rounded, very small, inferior teeth; apical segment of maxillary palp with five to seven elongate and/or short subterminal and one elongate terminal setae; labial palp with two elongate subterminal and one short terminal setae: thorax from dorsal aspect subquadrate, narrower than head but much wider than abdomen; mesonotum eight times as long and 1 1/2 times as wide as pronotum, four times as long

and 1 1/3 times as wide as propodeum; pronotum campanulate in shape, reticulate with suberect setae scattered on its surface, four to five of these are elongate, and evenly distributed on the posterior margin; mesoscutum punctate, punctures anteriorly and laterally finer than those medially and posteriorly, with some suberect, elongate setae, evenly but widely distributed over its surface; scutellum punctate, punctures laterally and posteriorly more elongate than those medially and anteriorly, with two pair of elongate, lateral, suberect, whitish setae; axillae longitudinally and closely reticulate; metascutellum punctate; propodeum finely punctate; median carinae and short posterior remnants of plicae present, lateral sulcus poorly developed; propodeal spiracle large, round and nearly touching anterior border of propodeum; propleuron reticulate; prepectus broadly punctate; ventral area of mesepisternum reticulate dorsal area punctate; ventral portion of mesepimeron reticulate, dorsal region very lightly reticulate and shiny; fore wing, submarginal and marginal veins subequal, the latter twice as long as postmarginal which is twice as long as stigmal; stigma with four sensillae; basal, cubital, subcubital and median veins completely or partially defined by setal patterns, the last very faintly indicated; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect long and narrow 1 1/4 times as long as head and thorax combined, base narrower than the widest fifth tergite, acuminate at apex; first tergite nearly naked; second to fifth with appressed, elongate whitish setae evenly but widely scattered over their surface; fifth to seventh tergites with numerous suberect setae evenly but closely distributed on their surfaces; tergites two to five and sternites one to five with yellow markings.

Male.- (Figs. 40, 58, 76, 94, 130, 188-190) differs from female as follows: length 1.20 mm. to 1.60 mm.; width of thorax in front of tegulae 0.30 mm. to 0.40 mm.; antennal scape broader with three elongate setae on flexor surface; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced, apical 1/2 of hind femora and apex of hind tibia black: abdomen from dorsal aspect subrectangular, longer than wide with yellow or whitish blotch on tergites and sternites one to three; genitalia as illustrated.

Variation.- structurally this species is very stable, however, the colour is quite variable in that the blue is not as vivid in some specimens as in others, sometimes being replaced by black. Other specimens are melanistic and the yellow or white colour of the abdomen and coxae is sometimes replaced with blue or black.

Types.- a lectotype is selected as follows: Sympiesis miltoni Girault; female, type number 21399, U.S.N.M., Northeast, Pennsylvania, 22. V.1916, ex. Lithocolletis sp.

Distribution.- this sepcies is widely distributed throughout the Transition zone of the Nearctic Austral region with some specimens being found in island refuges in the Boreal zone. It is transcontinental in nature with southern extensions in the Rocky Mountains, map 9.

Material examined.- the data on the specimens examined of this species are recorded in table 9.

This species prefers lepidopterous hosts of the genus Lithocolletis which are known to make blotch-like mines in leaves of deciduous plants, figure 256. Specimens have been recorded from a few other genera which produce similar mines.

Biology.- I have observed this species as an ectoparasitoid on Lithocolletis malimalifoliella Braun and my observations have been confirmed by the unpublished notes of Dr. R. P. Pottinger. These observations corroberate those of Beckham, Hough and Hill (1950).

Map 9. Nearctic distribution of Sympiesis marylandensis Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Aspen Beach	23	VIII	1944	
	1	British Columbia	Robson	10	VI	1950	
	2	"	Summerland	17	IX	1953	
	1	Manitoba	Churchill	4	VIII	1949	
	1	New Brunswick	Allandale	26	VII	1961	Phy
	1	"	Bakerbrook	30	VI	1950	Lit
1		Nova Scotia	Aldershot	-	Spring	1946	
	3	"	"	18-28	VIII	1950	
3	4	"	Berwick	9-20	VII	1946	
1	1	"	Carleton	24	VII	1959	
	1	"	"	-	VIII	1959	
	2	"	Dearfield	28	VII	1959	Lit
3	2	"	"	1-27	VIII	1959	
1	8	"	Ohio	17-27	VII	1959	
5	7	"	"	12-29	VII	1959	Lit
4	4	"	Port Williams	-	Spring	1946	
1	1	"	Smiths Cove	3	VIII	1945	
3	2	"	South Waterville	-	Spring	1946	
	1	"	Tusket	23	VII	1959	Lit
1	1	"	Woodville	-	Spring	1946	Lit
	4	"	Yarmouth	29	VIII	1960	
	1	Ontario	Bells Corners	7	V	1945	
	2	"	Bobcaygeon	5	VIII	1932	Lea
	3	"	Caledonia	25	VII	1961	Lit
	1	"	Golden Lake	10	IX	1943	Lit

Table 9. Recorded data on specimens of Sympiesis marylandensis (Girault) with information known about host niche.

ENCE ON YEAR	HOST	NICHE	HOST PLANT
1944	-	-	-
1950	-	-	-
1953	-	-	Malus sp.
1949	-	-	-
1961	Phyllocnistis populiella	B. L. M.	-
1950	Lithocolletis sp.	"	-
1946	"	"	Malus sp.
1950	"	"	"
1946	"	"	"
1959	"	"	Prunus pennsylvanica
1959	"	"	"
1959	Lithocolletis malimalifoliella	"	Malus sp.
1959	"	"	"
1959	"	"	"
1959	Lithocolletis sp.	"	Fagus americana
1946	"	"	Malus sp.
1945	"	"	Fagus sp.
1946	"	"	Malus sp.
1959	Lithocolletis malimalifoliella	"	"
1946	Lithocolletis sp.	"	"
1960	"	"	Alnus sp.
1945	-	-	-
1932	Leafminer	B. L. M.	Robinia sp.
1961	Lithocolletis lucidicastella	"	-
1943	Lithocolletis salicifoliella	"	Populus sp.
ensis	B.L.M. = Blotch Leaf Mine		

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	Ontario	Jarvis	9	VIII	1961	Lithocoll
	1	"	Nicholson	30	VII	1962	Lithocoll
1	1	"	Normandale	19-31	VII	1961	Lithocoll
	1	"	Ottawa	-	II	1906	-
	1	"	"	28	II	1939	Lithocoll
	1	"	"	21	VI	1950	-
	1	"	"	28	XI	1958	Lithocoll
1		"	"	29	I	1960	Lithocoll
1		"	Point Pelee	29	VII	1963	Lithocoll
	2	"	"	7	VII	1963	"
2		"	P. E. County	16	III	1947	Lithocoll
4	4	"	St. Williams	17-19	VII	1961	"
	1	"	Simcoe	8	VIII	1960	"
2	4	"	"	17-20	VII	1961	"
4	6	"	Stittsville	7-15	VII	1960	"
	1	"	Vineland	27	VI	1933	Lithocoll
2	4	"	"	3-12	VII	1933	"
	1	"	"	-	V	1939	"
	1	"	Wellington	5	VII	1947	Lithocoll
1	1	Quebec	Berthierville	17	VIII	1931	Gracilla
	2	"	Farnham	-	VI	1956	Lithocoll
1	3	"	"	7-15	VIII	1956	"
30	28	"	Hull	7-31	VII	1960	Lithocoll
1	1	"	"	8	VIII	1960	"
1	1	"	"	25-31	VII	1960	Lithocoll
1	1	"	"	11	VII	1955	"

Table 9. Recorded data on specimens of Sympiesis marylandensis (Girault) with information known about host niche.

B.L.M. =

	HOST	NICHE	HOST PLANT
61	Lithocolletis sp.	B. L. M.	Acer saccharum
62	Lithocolletis salicifoliella	"	-
61	Lithocolletis sp.	"	Populus tremuloides
06	-	-	Lonicera sp.
39	Lithocolletis sp.	B. L. M.	Betula sp.
50	-	-	-
58	Lithocolletis baslstrigella	B. L. M.	Quercus alba
60	Lithocolletis sp.	"	Quercus sp.
63	Lithocolletis celtisella	"	Celtis occidentalis
63	"	"	"
47	Lithocolletis sp.	"	-
61	"	"	Populus tremuloides
60	"	"	-
61	"	"	Populus tremuloides
60	"	"	Malus sp.
33	Lithocolletis crataegella	"	-
33	"	"	-
39	"	"	-
47	Lithocolletis propinquinella	"	-
31	Gracillaria elongella	"	Betula sp.
56	Lithocolletis propinquella	"	-
56	"	"	-
60	Lithocolletis malimalifoliella	"	Malus sp.
60	"	"	"
60	Lithocolletis sp.	"	Tilia americana
55	"	"	-

B.L.M. = Blotch Leaf Mine

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
	1	Quebec	Hull	14	V	1924	
2	2	"	"	2-8	VIII	1960	Lit
1		"	"	2	VIII	1960	
	1	"	"	1	IX	1960	
2		"	"	5	II	1960	
	3	"	"	4	II	1960	
	1	"	"	2	II	1960	
2	2	"	"	5	II	1960	Lit
	1	"	Lac Brule	7	VIII	1945	
	1	"	Montigny	11	VI	1941	
		UNITED STATES					
5	5	California	Los Angeles	-	X	1943	Lit
	1	"	Yosemite N. P.	-	-	1935	
	2	Connecticut	Cheshire	11	VIII	1944	Gal
	2	Maine	Bar Harbor	17-24	VI	1935	Phy
	2	"	"	16	IX	1933	
	2	"	Mt. Desert Island	22	VII	1932	Rec
	1	Maryland	Hancock	22-27	VIII	1900	Lit
1	1	"	Plummers Island	4-5	IX	1959	
	1	New York	Cranberry Lake	11	VIII	1925	Per
	2	Oregon	Corvallis	29	VIII	1956	Lit
1	1	Pennsylvania	Adams County	5	V	1947	
2	1	"	North East	24	V	1916	
	1	Virginia	Roslyn	20	IV	1934	
2	2	"	Timberville	10-24	IV	1946	Lit
	1	Washington	Seattle	23	VII	1942	Gra
	1	West Virginia	Monongalia County	-	V	1962	Lit
	3	Wisconsin	Door County	20	VIII	1960	Lit
	1	"	Florence County	2	IX	1959	

Table 9. Recorded data on specimens of Sympiesis marylandensis (Girault) with information known about host niche.

ICE	YEAR	HOST	NICHE	HOST PLANT
	1924	-	"	-
	1960	Lithocolletis sp.	B. L. M.	Tilia americana
	1960	"	"	Fagus sp.
	1960	"	"	Amphicarpa sp.
	1960	"	"	Acer sp.
	1960	"	"	Quercus sp.
	1960	"	"	Lonicera sp.
	1960	Lithocolletis sp.	"	Prunus sp.
	1945	-	-	-
	1941	-	-	-
	1943	Lithocolletis fellinella	B. L. M.	-
	1935	-	-	Populus tremuloides
	1944	Gallisto geminatella	B. L. M.	-
	1935	Phyllotoma nemorata	"	-
	1933	-	-	Salix sp.
	1932	Recurvaria thujaella	B. L. M.	-
	1900	Lithocolletis blancardella	"	-
	1959	-	-	-
	1925	Peronea chalybeana	L. R.	-
	1956	Lithocolletis sp.	B. L. M.	Malus sp.
	1947	"	"	"
	1916	-	-	-
	1934	-	-	-
	1946	Lithocolletis crataegella	B. L. M.	Malus sp.
	1942	Gracilaria sp.	"	-
	1962	Lithocolletis robiniella	B. L. M.	-
	1960	Lithocolletis sp.	"	Malus sp.
	1959	-	-	-
iensis		B. L. M. - Blotch Leaf Mine		

XXIII. SYMPIESIS BIMACULATIPENNIS (GIRAULT)

Astichus bimaculati pennis Webster, 1909, Bul. Iowa Agr. Expt. Sta. 102: 210. [Nomen nudum]
Astichus bimaculatipennis Girault, 1912, Can. Ent. 33: 815.
Sympiesis bimaculata Crawford, 1913, Proc. U.S. natn. Mus. 45: 259.
Sympiesis bimaculatus Girault, 1916, Soc. Ent. 31: 37. [Nomen nudum]
Sympiesis meteori Girault, 1916, Soc. Ent. 31: 37. New Synonomy.
Sympiesis bimaculatipennis Girault, 1917, Proc. U.S. natn. Mus. 53: 449.

Female.- (Figs. 22, 59, 77, 95, 131, 194-196) length 2.10 mm. to 3.60 mm.; width of thorax in front of tegulae 0.50 mm. to 0.85 mm. Colour: dark blue to black; trophi yellow; apices of femora, most of tibiae and tarsi white. Structure: head subtriangular, wider than high, compound eyes with numerous very short, erect, blackish setae evenly distributed on their surfaces; vertex and frons strongly and closely reticulate; face, clypeus and genae finely and closely punctate, short erect yellowish setae widely but evenly distributed over entire head; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli 1:2; antennal scape as long as pedicel, anellus, first funicular and half the second funicular, with numerous appressed setae on dorsal margin and four elongate, erect, delicate setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/20 as long as first funicular; first club segment 1 1/4 times as long as second; mandibles subquadrate with two well-developed, acute superior teeth, the dorsal one subterminal, the second terminal, and two to three blunt, very small inferior teeth; apical segment of maxillary palp with four to five, elongate setae distributed over its length and one terminal, elongate seta; labial palp with four elongate, setae distributed over the apical half and one elongate terminal seta: thorax from dorsal aspect oval in shape, narrower than head but wider than abdomen; mesonotum three times as long and 1 1/6 times as wide as pronotum, five times as long and 1 1/6 times as wide as propodeum; pronotum campanulate, dorsally punctate, laterally reticulate, with suberect, blackish

setae widely distributed on the dorsal area and four to five elongate suberect setae evenly distributed on its posterior margin; mesonotum strongly and closely punctate with numerous suberect, blackish setae widely but evenly distributed on its surface; scutellum heavily reticulate, reticulation anteriorly long and narrow, those laterally and posteriorly quadrate and broader, with two pair of elongate, lateral, suberect, blackish setae; axillae punctate; metascutellum punctate; propodeum closely punctate vermiculate, smooth and shiny laterad of spiracles and near posterior margin; median carina well developed; remnants of plicae barely visible posteriorly; lateral sulcus well defined; propodeal spiracle oval, its narrowest diameter from anterior margin of propodeum; propleuron reticulate; prepectus punctate; ventral region of mesepisternum lightly reticulate dorsal area punctate; anterior half of mesepimeron smooth and shiny, posterior half reticulate; calli and lateral region of propodeum reticulate punctate; fore wing always with fuscous marking at the base of the marginal vein and around stigmal vein, submarginal vein 1 1/3 times as long as marginal, the latter 1 1/3 times as long as postmarginal which is twice as long as stigmal; stigma with four sensillae; basal, cubital, subcubital and median veins completely or wholly defined by setal patterns, the last faintly indicated; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect lanceolate in shape 1 1/2 times as long as head and thorax combined, first tergite smooth and shiny and naked dorsally, laterally with numerous, elongate, suberect whitish setae distributed on the surface; tergites two to seven progressively more reticulate and with progressively more appressed setae evenly scattered over their surfaces.

Male.- (Figs. 41, 113, 197-199) differs from female as follows: length 1.50 mm. width of thorax in front 0.40 mm. (only one male was available for measurement); antennal anellus very short, funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced, especially on the propodeum which is nearly smooth and shiny; fore wing without fuscous markings: abdomen from dorsal aspect subtriangular the base much narrower than apex; tergites and sternites two to four with whitish blotch on their discs.

Variation.- structurally this species is exceptionally stable in colour, varying from a bright deep blue to pure black. The antennal scape may be almost totally black or ivory.

Types.- the type of this species is in the University of Illinois Natural History Survey Collection of Insects. Dr. B. D. Burks compared it with the type of S. bimaculata and informed me that in his opinion they are conspecific. The type of S. bimaculata is a female bearing the following data: type number 15094, U.S.N.M., Franconia, New Hampshire.

Distribution.- this species is transcontinental and appears to be restricted to the Canadian zone of the Boreal region and Transitional and Carolinian zones of the Austral region.

Material examined.- the data on the specimens examined of this species are recorded in table 10.

This species prefers hosts of the order Lepidoptera which make a blotch mine in or skeletonize the lower surface of deciduous plants, figure 257. Some specimens have been recorded as parasitoids of lepidopterous leaf rollers.

Biology.- according to Sadava and Miller (1967) this parasitoid was collected on June 1, 1966, and observed as being ectoparasitic on the larva of Spilonota ocellana (D. & S.) in a late bud of Malus sp. The host was slightly shrivelled and appeared dead. The parasitoid larva was large, about 2/3 the size of the host and reddish brown. By June 8, 1966, the host was devoured and its head capsule remained. A black, naked pupa about 2.5 mm. long, appeared. The adult appeared on June 15, 1966.

Map 10. Nearctic distribution of Sympiesis bimaculatipennis (Girault)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Edmonton	24	V	1946	
	1	British Columbia	Robson	10	VII	1947	
	1	"	"	10	IX	1948	
	1	"	"	28	VII	1949	
	1	"	Saanich District	10	VIII	1927	
	3	Nova Scotia	Bridgetown	21	X	1912	
	1	"	South Waterville	28	IX	1945	
	1	Ontario	Algonquin Park	10	VIII	1960	
	1	"	Fenwick	27	VI	1955	
	1	"	"	1	VII	1955	
	1	"	Ottawa	13	VI	1966	Spil
	1	"	St. Davids	23	VI	1937	Epir
1		"	Simcoe	28	II	1963	
	1	Quebec	Kazabazua	10	VII	1947	
	3	"	Hull	18-29	VII	1960	
1		"	"	9	VI	1966	Spil
	1	"	Laniel	7	VI	1943	
	1	"	Ste. Anne de Bellevue	-	-	1962	Lith
	1	Yukon Territories	Dawson	12	VII	1949	
		UNITED STATES					
		Alaska	Birch Lake	7	VII	1951	
		"	Summit Lake	9	VII	1951	
	1	California	Capistrano	2	X	1963	
	1	Indiana	Vincennes	16	VIII	1957	
	1	Iowa	Ames	-	-	-	Tisc
	3	Kansas	Manhattan	26	VI	1933	Orni
	1	"	Wichita	8	VII	1911	
	1	Maine	Mt. Desert	21	VIII	-	
	1	"	Salsbury Cove	15	VII	1923	

Table 10. Recorded data on specimens of Sympiesis bimaculatipennis (Girault) with information known about host niche.

T. B.
L. M.

EAR	HOST	NICHE	HOST PLANT
1946	-	-	-
1947	-	-	-
1948	-	-	-
1949	-	-	-
1927	-	-	-
1912	-	-	-
1945	-	-	Malus sp.
1960	-	-	"
1955	-	-	Malus sp.
1955	-	-	"
1966	Spilonota ocellana	T. B.	"
1937	Epinotia laracana	-	-
1963	-	-	-
1947	-	-	-
1960	-	-	-
1966	Spilonota ocellana	T. B.	Malus sp.
1943	-	-	-
1962	Lithocolletis sp.	L. M.	Malus sp.
1949	-	-	-
1951	-	-	-
1951	-	-	-
1963	-	-	-
1957	-	-	-
	Tischeria malifoliella	L. M.	-
1933	Ornix sp.	L. M.	-
1911	-	-	-
	-	-	-
1923	-	-	-

T. B. - Twig Borer
L. M. - Leaf Miner

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION		
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR
	1	Michigan	Bangor	1	VII	1946
	1	"	Leelanau County	-	-	-
	1	Minnesota	Eaglesnest	12	VIII	1958
	1	New York	Brant	-	-	-
	1	Oregon	Corvallis	29	VIII	1956
	3	"	McMinnville	21	VII	1923
	1	Pennsylvania	Fayetteville	-	-	1932
	1	"	North East	25	V	1916
	1	West Virginia	Kearneysville	-	VII	1952
	1	Wisconsin	Door County	28	VII	1932
	1	"	"	23	VII	1960

Table 10. Recorded data on specimens of Sympiesis bimaculatipennis (Girault) with information known about host niche.

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R	HOST	NICHE	HOST PLANT
46	-	-	-
	-	-	-
58	-	-	-
	Ancylis comptana	L. R.	-
56	-	-	Malus sp.
23	Agonopteryx posticella	-	-
32	Ancylis comptana	L. R.	-
16	Ornix sp.	L. M.	-
52	-	-	-
32	Lithocolletis blancardella	L. M.	-
60	-	-	-

L. M. - Leaf Miner
L. R. - Leaf Roller

XXIV. SYMPIESIS STIGMATA GIRAULT

Sympiesis stigmatus Girault, May, 1917, Desc. Stellarum Nov., pp. 15-16.

Sympiesis substigmatus Girault, August, 1917, Proc. U.S. natn. Mus. 53: 447-8. New Synonomy.

Sympiesis stigmata Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427.

Sympiesis substigmata Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427.

Female.- (Figs. 23, 60, 78, 96, 132, 200-202) length 2.00 mm. to 3.70 mm.; width of thorax in front of tegulae 0.40 mm. to 0.70 mm. Colour: black; mandibles, most of front femora, the mid and hind femora, front tibiae, basal half of mid and hind tibiae, tegulae, dorsal tip of mesepisternum and lateral margins of the first to fourth abdominal tergites yellow; first to third tarsal segments white. Structure: head subtriangular, wider than high; compound eyes large and prominent with numerous very short, erect setae evenly distributed over their surfaces; vertex, face and clypeus closely and finely reticulate; frons and genae coriaceous and dull; dark, erect setae widely distributed on all their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 10:16; antennal scape as long as pedicel, anellus, first funicular and 1/3 second funicular combined with numerous appressed setae on dorsal margin and seventeen, delicate elongate setae on the flexor and basal lateral surfaces; pedicel 1/3 as long as first funicular, anellus 1/17 as long as first funicular; first club segment 1 1/3 times as long as second; mandibles subquadrate with two well-developed, acute superior teeth, both terminal and four smaller, rounded, inferior teeth; apical segment of maxillary palp with five elongate and one short subterminal setae and one elongate terminal seta; labial palp with three elongate subterminal setae: thorax from dorsal aspect subrectangular, narrower than head, as wide as abdomen; mesonotum six times as long as either pronotum

or propodeum, twice as wide as pronotum, 1/3 wider than propodeum; pronotum campanulate, closely punctate with numerous dark suberect setae scattered on its surface, four to five of these are elongate, and evenly distributed on the posterior margin; punctures on mid lobe coarser than on mesoscutum closely punctate with a row of four, suberect dark setae on the lateral margin of its mid lobe and a number of appressed setæwidely distributed on its lateral lobes; scutellum strongly and closely punctate, with two pair of dark elongate, lateral suberect setae; axillae closely punctate without setae; metascutellum closely punctate; propodeum punctate, punctures medially coarser than those laterally; median carina complete and well developed; lateral sulci moderately developed; propodeal spiracle round-oval and large, 1/2 its greatest diameter from anterior margin of propodeum; propleuron reticulate; prepectus strongly reticulate-punctate; mesepisternum reticulate ventrally, closely punctate medially and coarsely punctate dorsally; mesepimeron reticulate ventrally, smooth and shiny dorsally; lateral portion of propodeum punctate; fore wing, submarginal and marginal veins subequal, the latter twice as long as postmarginal which is twice as long as stigmal; stigma with four sensillae and a large fuscous marking; basal cubital, subcubital and median veins partially or wholly defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate from dorsal aspect long lanceolate, 1 1/6 times as long as head and thorax combined; first tergite with white suberect setae distributed on lateral areas; tergites two and three with white appressed setae on their lateral margins; tergites four to seven with appressed to suberect, dark setae widely distributed on their surfaces; tergites one to four with lateral yellow markings.

Male.- (Figs. 42, 114, 203-205) differs from female as follows: length 1.50 mm. to 2.00 mm.; width of thorax in front of tegulae 0.40 mm. to 0.50 mm.; antennal scape wider with five elongate setae on flexor surface; anellus very short, funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced, all femora mostly black:

abdomen from dorsal aspect rectangular, twice as long as broad, without pale markings; genitalia as illustrated.

Variation.- this species is very stable in both structure and colour. Xanthism and melanism does occur in some specimens. In these the yellow markings of the abdomen are more or less.

Types.- a lectotype is selected as follows: Sympiesis stigmata Girault; female, type number 19792, U.S.N.M., Alameda, California.

Distribution.- this species is widely distributed throughout the western half of the Transition zone of the Nearctic Austral region, map 11.

Material examined.- the data on the specimens examined of this species are recorded in table 11.

This species prefers lepidopterous hosts which are known to mine leaves of deciduous plants early in their larval development, figure 258, or throughout it. Some hosts are known as case bearers, and skeletonize deciduous leaves as they feed.

Biology.- nothing is known about the development of this species.

Map 11. Nearctic distribution of Sympiesis stigmata Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	2	Alberta	-	-	-	-	
3	2	British Columbia	Creston	24, 26, 27	VI	1949	Coleo
10	20	"	"	9-27	VII	1949	
	1	"	Robson	1-5	VIII	1949	
	2	Saskatchewan	Indian Head	2-9	VIII	1937	Graci
		UNITED STATES					
	2	Arizona	Snowflake	6	X	1932	
1	1	California	Sentinel Meadow	30	VIII	1957	
	4	"	Sacramento	13	VIII	1932	Tische
	1	"	Yosemite N. P.	25	VII	1959	
	1	"	Watsonville	8	IX	1946	Carpoc
	1	"	Santa Clara	8	VIII	1952	
	1	"	Los Angeles	-	X	1939	Lithoc
	1	"	"	-	X	1943	
1		"	"	-	X	1937	
	1	Idaho	Hollister	9	V	1930	
	1	"	"	13	VIII	1929	
	1	Nevada	Owyhee	28	VII	1926	
	1	Oregon	Corvallis	29	VIII	1956	
	1	"	Crater Lake	8	VIII	1930	
	1	"	"	1	IX	1930	
	1	Wyoming	Laramie	21	VIII	1956	
	1	"	Yellowstone N. P.	-	VIII	1944	

Table 11. Recorded data on specimens of Sympiesis stigmata Girault with information known about host niche.

? C. B.

	HOST	NICHE	HOST PLANT
	-	-	-
49	Coleophora pruniella	C. B.	-
49	"	"	-
49	-	-	-
37	Gracilaria negundella	L. M.	-
32	-	-	Oxytropis sp.
57	-	-	Populus tremuloides
32	Tischeria omissa	L. M.	-
59	-	-	Pinus contorta
46	Carpocapsa pomonella ?	-	-
52	-	-	Fragaria sp.
39	Lithocelletis fellinella	L. M.	-
43	"	"	-
37	"	"	-
30	-	-	-
29	-	-	-
26	-	-	-
56	-	-	Malus
30	-	-	-
30	-	-	-
56	-	-	-
44			

? - Doubtful record
C. B. - Case Bearer
L. M. - Leaf Miner

XXV. SYMPIESIS STIGMATIPENNIS GIRAULT

Sympiesis stigmatipennis Girault, 1917, Des. Stellarum Nov., pp. 14-15.
Sympiesis guttatipennis Girault, 1917, Des. Stellarum Nov., p. 15. New Synonomy.

Female.- (Figs. 24, 61, 79, 97, 133, 206-208) length 1.80 mm. to 2.60 mm.; width of thorax in front of tegulae 0.40 mm. to 0.65 mm. Colour: deep metallic blue; occasionally scutellum, abdomen, pleurae, coxae, femora, apical tarsal segments and antennal flagella greenish black; antennal scape, trophi, tibiae and first three tarsal segments whitish. Structure: head oval in shape, slightly wider than high; compound eyes with short, numerous, erect whitish setae evenly distributed on their surfaces; vertex, frons, face, clypeus and genae closely punctate to reticulate with erect whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli 6:14; antennal scape as long as pedicel, anellus, first funicular and 1/3 second funicular combined, with numerous appressed setae on dorsal margin and four elongate erect setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/14 as long as first funicular; first and second club segments subequal; mandible subquadrate, with one well-developed, acute, superior tooth and four to five progressively smaller, rounded inferior teeth, the superior tooth is slightly subterminal; apical segment of maxillary palp with two elongate and two shorter subterminal setae and one elongate terminal seta; labial palp with one elongate and two shorter subterminal setae and one elongate terminal seta; thorax from dorsal aspect subspindle shaped, slightly narrower than head but wider than abdomen; mesonotum five times as long and 1 1/3 times as wide as pronotum, five times as long and 1 1/6 times as wide as propodeum; pronotum campanulate; closely reticulate with suberect, whitish setae scattered on its surface, four to five of these are elongate, and evenly distributed on the posterior margin; mesoscutum punctate, punctures anteriorly, smaller than those

posteriorly, with two rows of five or six elongate white setae, one on each side of the median lobe and numerous shorter, whitish setae widely scattered on the side lobes; parapsidal grooves complete; scutellum punctate with two pair of suberect, elongate, lateral, whitish setae; axillae reticulate; metascutellum punctate; remnants of median carina and plicae present anteriorly; propodeal spiracle small and round, 1/2 its diameter from anterior margin of propodeum; propleuron reticulate; prepectus strongly but broadly reticulate; mesepisternum closely but finely punctate; mesepimeron ventrally reticulate, dorsally coriaceous and shiny; fore wing, submarginal and marginal veins subequal, the latter nearly twice as long as postmarginal which is twice as long as stigmal; stigma with four sensillae and conspicuous fuscous mark; basal, cubital and subcubital veins completely or partially defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate, as long as head and thorax combined; tergites one to three naked medially with elongate suberect to appressed whitish setae evenly distributed on their lateral margins; tergites four to seven with appressed to elongate setae widely spread on their surfaces.

Male.- (Figs. 43, 115, 209-211) differs from the female as follows: length 1.40 mm. to 1.60 mm. width of thorax in front of tegulae 0.30 mm. to 0.45 mm.; antennal scape broader with suberect setae of variable lengths distributed on lateral and dorsal surfaces as well as three erect setae on the basal half of flexor surface; anellus very short, funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin, these flagellars and rami bear elongate sensory setae which occur also on the fourth flagellar and club segments interspersed with normal and pedicellate, sensory setae; thoracic sculpturing less pronounced; fore wing without fuscous mark; abdomen from dorsal aspect subrectangular with or without pale markings; genitalia as illustrated.

Variation.- structurally this species is relatively stable but does vary in colouration in that the normal deep blue colour of the scutellum, abdomen and pleurae is often black. The fuscous marking of the female fore wing is sometimes indistinguishable and the male abdomen may or may not have pale markings on the discs of tergites two and three.

Types.- a lectotype is selected as follows: Sympiesis stigmatipennis Girault; female, type number 19789, U.S.N.M., Pasadena, California, VI.1915.

Distribution.- this species is transcontinental in the Canadian zone of the Boreal region. Specimens have been taken in the Transition zone of the Austral region but their presence there may be associated with accidental introductions on ornamental plants infested with the hosts of the species, see map 12.

Material examined.- the data on the specimens examined of this species are recorded in table 12.

This species prefers lepidopterous hosts which are known to mine the needle-like leaves of some coniferous plants, figure 259. It has been recorded from some lepidopterous species known to mine leaves of some deciduous plants as well. These are probably alternate hosts used to carry a second generation of the parasite through the period when the coniferous feeder is in the adult or reproductive period.

Biology.- S. stigmatipennis has been recorded by McLeod (1963) as an ectoparasitoid whose "adult - deposits - eggs on the body of the host larva, stunning or killing it. The parasite larva feeds externally on the host, eventually consuming the contents. The parasite pupates within the needle and the adults emerge about three to four weeks after the eggs are deposited".

Map 12. Nearctic distribution of Sympiesis stigmatipennis Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	2	Alberta	Banff N. P.	10	VI	1949	Recurv
5	6	"	"	-	Summer	1944	
100-	100-	"	"	22-25	VII	1949	
1	1	"	"	1-18	VII	1950	
	1	"	"	20	VIII	1952	
	1	"	"	22	VII	1953	
	2	"	"	27-30	VI	1958	
1	4	"	"	17-21	VII	1958	
1	1	"	"	-	VII	1964	
8	4	"	"	-	III	1965	Recurv
3	12	Nova Scotia	Kentville	-	-	-	
	1	"	Waterville	9	VIII	1945	Sympie
	1	Ontario	Angus	13	VII	1951	Grapho
2	1	"	Bells Corners	8-9	VII	1954	Recurv
2	1	"	"	6-8	VI	1960	
1	2	"	"	6-14	VI	1960	
		"	Capreol	13	VIII	1960	Rhyaci
1	1	"	Fallowfield	26-27	VI	1961	Argyre
	1	"	Haileybury	4	VII	1956	Acnero
	1	"	Merivale	11	VII	1960	Chryso
	1	"	Ottawa	3	VIII	1951	Rhyaci
	1	"	Prescott	31	V	1961	Recurv
7	5	"	South March	9-16	VI	1961	Recurv
	1	"	Vermillion Bay	10	VI	-	Recurv
	1	"	Vernon	15	VI	1955	Exotel
	1	"	Vineland	30	VI	1938	Haplop
1		"	"	1	VII	1938	
	5	Quebec	Aylmer	1-7	VI	1960	Recurv
	1	"	"	15	VII	1960	Chryso
	2	"	Hull	6	VI	1960	Argyre
	1	"	"	30	VI	1961	Recurv

Table 12. Recorded data on specimens of Sympiesis stigmatipennis Girault with information known about host niche.

? -
T. B. -
N. M. -

HOST	NICHE	HOST PLANT
Recurvaria milleri	N. M.	-
"	"	-
"	"	-
"	"	-
"	"	-
"	"	-
"	"	-
"	"	-
Recurvaria starki	"	-
-	-	-
Sympiesis sp. ?	-	-
Grapholitha sp. ?	-	-
Recurvaria sp.	N. M.	-
"	-	Picea glauca
"	-	Juniperus sp.
Rhyacionia frustrana	T. B.	-
Argyresthia thuiella	N. M.	Thuga occidentalis
Acnerostoma piniariella	N. M.	-
Chrysopora stipella	-	Chenopodium album
Rhyacionia buoliana	T. B.	-
Recurvaria sp.	N. M.	Tsuga canadensis
Recurvaria apicitripunctiella	N. M.	-
Recurvaria gibsonella	N. M.	-
Exoteleia dodecella	N. M.	-
Haploptilia eleagnisella	L. T.	-
-	-	-
Recurvaria sp.	N. M.	-
Chrysopora stipella	-	Chenopodium album
Argyresthia sp.	N. M.	Juniperus sp.
Recurvaria sp.	-	"

? - Doubtful record
T. B. - Twig Borer
N. M. - Needle Miner

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
5	1	Quebec	Hull	20-28	VI	1961	Rec
	1	"	Kazabazua	-	-	1960	Rec
	1	"	Lac Brule	15	VIII	1946	
	1	"	Montigny	11	VI	1941	
2		"	New Carlisle	18-20	V	1959	Rec
2	1	"	St. Norbert	25	IV	1958	
	2	"	Ste. Philomene	17-18	IV	1957	
		UNITED STATES					
	1	Arkansas	Washington County	15	VII	1938	
	1	"	"	13	VII	1942	
1	1	California	Alhambra	-	-	1926	Pht
	1	"	Berkeley	16	V	1961	Eva
1	1	"	Escondido	2	VII	1964	Kei
	1	"	Inyo	30	VIII	1957	
	5	"	Irvine	10	I	1938	
1	3	"	Long Beach	-	I	1938	Kei
3		"	Lake Tenaga	27	VII	1949	Rec
	1	"	"	28	XII	1949	
	3	"	"	12	I	1950	
	1	"	"	10	II	1950	
1	1	"	"	7	I	1953	
	1	"	Los Angeles	9	XII	1927	
3	4	"	Pasadena	-	X	1914	
5	5	"	"	-	VIII	1915	Pht
	1	"	Saticoy	10	IX	1927	
	1	"	Stanton	30	X	1936	Gnc
	1	"	Visalia	15	IX	1937	
	1	"	Yosemite N. P.	6	V	1937	Gra
1		"	"	15	VII	1954	
5	9	"	"	1-6	VIII	1954	
12	8	"	"	1-2	VI	1955	

Table 12. Recorded data on specimens of Sympiesis stigmatipennis Girault with information known about host niche.

? N. M. L. M. T. W.

HOST	NICHE	HOST PLANT
Recurvaria apicitripunctiella	"	Tsuga canadensis
Recurvaria sp.	"	Picea sp.
-	-	-
-	-	-
Recurvaria sp.	N. M.	-
"	"	Picea glauca
"	"	"
-	-	-
-	-	-
Phthorimaea operculella	L. M.	-
Evagora sp.	N. M.	Pinus radiata
Keiferia lycopersicella	L. M.	-
-	-	Populus tremuloides
-	-	Lycopersicon sp.
Keiferia lycopersicella	L. M.	-
Recurvaria milleri	N. M.	-
"	"	"
"	"	-
"	"	-
"	N. M.	Pinus contorta
-	-	-
-	-	-
Phthorimaea operculella	L. M.	-
-	-	-
Gnorimoschema lycopersicella	L. M.	-
-	-	Lycopersicon sp.
Graphalium sp.	-	-
-	-	Pinus controta
-	-	"
-	-	"

? - Doubtful record
N. M. - Needle Miner
L. M. - Leaf Miner
T. W. - Twig Borer

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
1		California	Yosemite N. P.	1	VIII	1958	-
2	1	"	"	18	VII	1959	-
		Idaho	Hollister	13	VI	1931	-
7	26	"	Idaho	20	VI	1950	Recurvaria mi
6	3	"	"	18-29	VII	1950	"
6	7	"	"	24	VIII	1950	"
5	16	"	"	6-26	VI	1952	"
8	21	"	"	3-16	VII	1952	"
	1	"	Warm River	6	VIII	1959	-
	1	Louisiana	Alexandria	-	IV	1962	Exotelia sp.
	1	Maryland	Oakland	-	-	1961	Rhyocionia bu
	1	Massachusetts	Belchertown	13	VI	1931	Exoteleia pin
2		"	Plymouth	6	II	1931	"
1	1	"	Sudbury	16	VI	1930	"
	1	Nebraska	Halsey	29	VII	1957	-
	1	Oklahoma	Stillwater	14	VI	1964	-
1	1	Oregon	Corvallis	-	-	-	Argyrotaenia
1	2	South Carolina	Columbia	-	-	-	-
	1	Texas	Rusk County	-	IX	1957	-
2	2	Virginia	Onley	-	IX	1927	-
	1	Wyoming	Laramie	21	VIII	1956	-
	1	"	Mammoth Hot Springs	-	-	-	-

Table 12. Recorded data on specimens of Sympiesis stigmatipennis Girault with information known about host niche.

L. R. - Lea

AR	HOST	NICHE	HOST PLANT
58	-	-	Pinus contorta
59	-	-	Pinus murreyana
31	-	-	Artemisia tridentata
50	Recurvaria milleri	N. M.	-
50	"	"	-
50	"	"	-
52	"	"	-
52	"	-	-
59	-	-	-
52	Exotelia sp.	N. M.	Pinus sp.
51	Rhyocionia buoliana	T. W.	-
31	Exoteleia pinifolella	N. M.	-
31	"	"	-
30	"	"	-
57	-	-	-
54	-	-	-
	Argyrotaenia citrana	L. R.	-
	-	-	-
57	-	-	-
27	-	-	-
56	-	-	-
	-	-	-

L. R. - Leaf Roller

XXVI. SYMPIESIS ANCYLAE GIRAULT

Sympiesis ancylae Girault, 1917, Proc. U.S. natn. Mus. 53: 448-9.

Female.- (Figs. 25, 62, 80, 98, 134, 212-214) length 2.10 mm. to 2.90 mm.; width of thorax in front of tegulae 0.55 mm. to 0.70 mm. Colour: black; vertex and metanotum blue; propodeum greenish black; most of antennal scape, the trophi, tibiae, posterior femora and lateral portions of some abdominal tergites yellow; wing with a relatively large fuscous stigmal mark: Structure: oval in shape wider than high; compound eyes with numerous short, erect, whitish setae evenly distributed on their surfaces; vertex, frons, face, clypeus and genae closely reticulate with numerous elongate, erect, whitish setae distributed over their surfaces; ratio of distance between lateral ocellus and compound eye, and distance between lateral ocelli, 5:8; antennal scape longer than pedicel, anellus, first funicular and 3/4 of second funicular combined, with numerous appressed setae on the dorsal margin and nine to ten elongate, erect setae on the flexor and lateral, basal surfaces; pedicel 1/2 as long as first funicular; anellus 1/10 as lon g as first funicular; first and second club-segments subequal; mandibles subquadrate with one acute superior subterminal tooth and five progressively smaller, rounded, terminal, inferior teeth; apical segment of maxillary palp with two elongate and four shorter, subterminal setae and one elongate, terminal seta; labial palp with two short and two elongate, subterminal setae: thorax from dorsal aspect subquadrate, narrower than head but wider than abdomen; mesonotum five times as long, 1 1/3 times as wide as pronotum, five times as long and only slightly wider than propodeum; pronotum campanulate, closely punctate the puncture medially larger than those laterally, numerous appressed setae evenly distributed on its surface and five or six elongate, suberect setae evenly distributed on posterior margin; mesoscutum punctate, the punctures on median lobe larger than those on side lobes, the former with a row of four elongate, suberect, whitish setae on each lateral margin, the latter with numerous suberect whitish setae evenly distributed on their surfaces; mesoscutellum

strongly punctate the punctures medially closer, and more elongate than those laterally, with two elongate, suberect whitish setae on each lateral margin; axillae strongly punctate; metascutellum strongly punctate; propodeum strongly punctate mediaily, reticulate laterally; lateral sulci well developed; remnants of median carina and plica present anteriorly; propodeal spiracle small and round nearly touching anterior margin of propodeum; propleuron reticulate; prepectus punctate; ventral half of mesepisternum reticulate, dorsal half punctate; ventral half of mesepimeron punctate, dorsal half finely and closely reticulate; fore wing, submarginal vein slightly shorter than marginal, the latter is twice as long as postmarginal which is slightly more than twice as long as stigmal; stigma with four sensillae and large fuscous marking; basal, cubital and subcubital veins partially or wholly defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect lanceolate in shape, as long or slightly longer than head and thorax combined; first to third tergites naked medially with numerous suberect, whitish setae evenly distributed on their lateral margins; tergites with appressed to suberect setae widely distributed on their surfaces; lateral margins of tergites one to four and sternites one to three with variable yellow markings.

Male.- (Figs. 44, 116, 215-217) differs from female as follows: length 1.40 mm. to 1.70 mm.; width of thorax in front of tegulae 0.40 mm. to 0.50 mm.; antennal scape broader medially with three elongate setae on flexor surface; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing much less pronounced; fore wing without stigmal marking; legs nearly all whitish: abdomen from dorsal aspect subrectangular, longer than wide with yellowish or whitish markings on tergites and sternites two and three; genitalia as illustrated.

Variation.- structurally this species is stable over most of its range. The light-coloured markings of the legs and abdomen vary in amounts with melanistic and xanthic specimens being dark in the former and larger and brighter in the latter.

Types.- a lectotype is selected as follows: Sympiesis ancylae Girault; female, type number 20746, Whitebog, New Jersy, Coll. 20.VII.1916, Em. 15.VIII.1916.

Distribution.- this species is restricted to the Transition zone of the Austral region, map 13.

Material examined.- the data on the specimens examined of this species are recorded in table 13.

This species prefers lepidopterous hosts which are known to roll the edge or tip of leaves of deciduous plants, figure 260.

Biology.- Lewis (1925) observed this species emerging from the pest insect Ancylis sp. possibly indicating that this species is an endo-parasitoid, otherwise nothing is known about the habits of this insect.

Map 13. Nearctic distribution of Sympiesis ancylae Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Aspen Beach	22	VIII	1944	
	1	"	Edmonton	26	V	1946	
	1	Nova Scotia	Bridgetown	4	VIII	1912	
	3	Ontario	Algonquin Park	16	VIII	1955	
	1	Quebec	Laniel	21	VI	1944	
	1	"	"	8	VII	1944	
		UNITED STATES					
	1	Arkansas	Washington County	22	VII	1938	
1		"	"	11	VIII	1938	
	1	California	Irving	6	XII	1937	
	1	"	"	10	II	1938	
1		Kansas	Blair	24	VI	1937	
	1	"	Wathena	16	VI	1939	Ancylis
1	1	Maryland	Salisbury	29	VI	1931	
	2	"	"	10	VII	1931	Ancylis
	2	New Jersey	Moorestown	28	VI	1929	
	4	"	"	-	-	1932	
	1	"	New Lisbon	12	VII	1934	Gelechi
	1	"	Pemberton	22	IX	1936	Spargan
	1	"	Riverton		V	1920	Ancylis
2		"	"		VI	1920	
3	4	"	"		VII	1920	
	1	"	Whitesbog	15	VIII	1916	
	1	New York	Hunter	24	V	1947	
	1	"	"	24	V	1947	
	1	Ohio	Montgomery	5-8	VI	1943	
	2	"	"	6	VII	1943	
	1	South Carolina	Columbia	-	-	-	

Table 13. Recorded data on specimens of Sympiesis ancylae Girault with information known about host niche.

L. R.

RB 399

E EAR	HOST	NICHE	HOST PLANT
944	-	-	-
946	-	-	-
912	-	-	-
955	-	-	-
944	-	-	-
944	-	-	-
938	-	-	Fragaria sp.
938	-	-	"
937	-	-	-
938	-	-	-
937	-	-	-
939	Ancylis comptana	-	Fragaria sp.
931	-	-	-
931	Ancylis comptana	L. R.	-
929	-	-	-
932	-	-	-
934	Gelechia enalamaculella	L. R.	-
936	Sparganothis sulfureana	"	-
920	Ancylis comptana	"	-
920	"	"	-
920	"	"	-
916	-	-	-
947			
947	-	-	-
943	-	-	-
943	-	-	-
	-	-	-

L. R. - Leaf Roller

XXVII. SYMPIESIS ARGENTICOXAE GIRAULT

Sympiesis argenticoxae Girault, 1916, [1917], Insecutor Inscitiae Menstruus 4: 120.

Female.- (Figs. 26, 63, 81, 99, 135, 218-220) length 2.30 mm. to 3.40 mm.; width of thorax in front of tegulae 0.50 mm. to 0.65 mm. Colour: greenish black to black; scape, trophi, legs except basis of coxae and the tarsal claws whitish; abdominal tergites two and four with or without yellow markings. Structure: subrectangular in shape, wider than high; compound eyes with numerous very short, erect, whitish setae evenly distributed on their surfaces; vertex and frons closely punctate with suberect to erect whitish setae widely distributed on their surfaces; face, clypeus and genae reticulate with suberect to erect, whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 4:10; antennal scape as long as pedicel, anellus, first funicular and 1/3 second funicular combined with numerous appressed, setae on dorsal margin and four to seven delicate, elongate, erect setae on flexor surface; pedicel 1/3 as long as first funicular; anellus 1/12 as long as first funicular; club segments subequal; mandible subquadrate with two large, acute superior teeth and five small to very small round inferior teeth; apical segment of maxillary palp with five subterminal and one terminal elongate setae; labial palp with one short and two elongate subterminal setae: thorax from dorsal aspect subrectangular, narrower than head, wider than abdomen; mesonotum six times as long as, pronotum and propodeum, 1 1/3 times as wide as pronotum, little wider than propodeum; pronotum campanulate; closely punctate with numerous suberect, whitish setae widely distributed on its surface, four to five elongate setae evenly distributed on its posterior margin; mesoscutum very strongly punctate with a row of four suberect, elongate, white setae on lateral margins of median lobe and numerous suberect, white setae evenly distributed on lateral lobes; parapsidal grooves complete; scutellum strongly punctured, punctures elongate and in rows, with two pair of elongate, lateral, suberect, white setae; axillae closely punctate anteriorly and reticulate posteriorly; metascutellum very closely punctate; propodeum

finely wrinkled and closely punctate with well-developed median carina; remnants of plicae posteriorly; lateral sulcus well developed; propodeal spiracle round and almost its diameter from anterior border of propodeum; propleuron reticulate; prepectus punctate; mesepisternum lightly to strongly reticulate; mesepimeron ventrally punctate, dorsally reticulate; fore wing, submarginal and marginal veins subequal, the latter twice as long as postmarginal which is three times as long as stigmal; stigma with four sensillae and fuscous marking; basal, cubital, subcubital and median veins completely or partially defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect long lanceolate, as long or slightly longer than head and thorax combined; first to fourth tergites naked medially, with suberect to appressed, whitish setae distributed on their lateral margins; tergites four to seven with appressed and suberect setae distributed widely over their entire surfaces; tergites two to four with or without yellowish markings.

Male.- (Figs. 45, 117, 221-223) differs from female as follows: length 1.90 mm. to 2.10 mm.; width of thorax in front of tegulae 0.50 mm. to 0.60 mm.; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing slightly less pronounced; fore wing without a fuscous stigmal marking: abdomen from dorsal aspect long oval in shape with whitish markings on tergites and sternites two and three; genitalia as illustrated.

Variation.- structurally this species appears to be relatively stable over its entire range. Some specimens without yellow abdominal markings indicate melanism is not uncommon in the species.

Types.- the single female specimens representing the type in the U.S.N.M. bears the type number 20609, but has no further information. The head has been removed and the specimen is poorly preserved.

Distribution.- this species is sporadically distributed throughout the eastern part of the Transition zone of the Nearctic Austral region, map 14.

Material examined.- the data on the specimens examined of this species are recorded in table 14.

This species seems to prefer a lepidopterous host which rolls sides of leaves or tips of leaves or ties two leaves together so that it can feed within their protection. Some specimens have been reared from a case bearing species which mines leaves in its early development.

Biology.- nothing is known about the life history or annual development of this species.

Map 14. Nearctic distribution of Sympiesis argenticoxae Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Manitoba	Aweme	14	VI	1924	-
	1	Ontario	Ottawa	16	VIII	1949	-
	2	Quebec	Hull	7-19	VIII	1961	-
		UNITED STATES					
	1	Illinois	Urbana	8	VI	1922	Ancylis divis
	1	Maryland	College Park	7	VIII	1934	Psilocorcis g
	1	"	"	3	VIII	1934	-
	10	Missouri	Webster Grove	14-28	IX	1932	-
	1	Tennessee	Nashville	30	VII	1932	-
	1	West Virginia	Kearneysville	-	VI	1939	Coleophora ma

Table 14. Recorded data on specimens of Sympiesis argenticoxae Girault with information known about host niche.

L. R. - Leaf
L. T. - Leaf

HOST	NICHE	HOST PLANT
-	-	-
-	-	-
-	-	-
Ancylis divisona	L. R.	-
Psilocorcis quercicella	L. T.	-
-	-	-
-	-	*Helianthus tuberosa*
-	-	-
Coleophora malivorella	C. B. & M.	-

L. R. - Leaf Roller
L. T. - Leaf Tyer
C. B. & M. - Case Bearer and Leaf Miner

XXVIII. SYMPIESIS MARYLANDIA GIRAULT

Sympiesis marilandia Girault, 1917, Chalcidoidea Nova Marilandensis [1], p. 1.

Sympiesis marylandia Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427 [Valid] emend.

Female.- (Figs. 27, 64, 82, 100, 136, 224-226) length 2.10 mm. to 3.30 mm.; width of thorax in front of tegulae 0.55 mm. to 0.70 mm. Colour: greenish black to black; scape, trophi, tibiae, tarsus and sometimes femora and apices of tibia, tegulae and sometimes abdominal tergites white or yellowish. Structure: head subquadrate in shape, wider than high; compound eyes with numerous short, erect, whitish setae evenly distributed on their surfaces; vertex and frons strongly reticulate with numerous appressed to suberect whitish setae distributed on their surfaces; face, clypeus and genae lightly reticulate with suberect whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 7:12; antennal scape as long as pedicel, anellus, first funicular and 2/3 second funicular combined with numerous appressed setae on dorsal margin and six elongate, erect setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/11 as long as first funicular; club segments subequal; mandible subquadrate with one well developed, acute, subterminal, superior tooth and seven progressively smaller, rounded terminal teeth; apical segment of maxillary palp with three elongate and two shorter erect subterminal setae and one elongate, erect terminal seta; labial palp with two elongate and two short subterminal setae: thorax from dorsal aspect subrectangular in shape, mesonotum six times as long as pronotum, four times as long as prododeum, 1 1/3 times as wide as pronotum only slightly wider than propodeum; pronotum subquadrate in shape, punctate, with suberect, whitish setae widely distributed on its surface, four to five of these are elongate and evenly distributed along its posterior margin; mesoscutum strongly punctate with two rows of three elongate, whitish setae on each lateral

margin of mid lobe, numerous suberect, whitish setae evenly distributed on side lobes; parapsidal grooves complete; mesoscutellum strongly punctate, punctures elongate, with two pair of elongate, lateral, suberect, whitish setae; axillae punctate; metascutellum closely punctate; propodeum wrinkled and punctate; median carina well defined, posterior half of plicae present; lateral sulcus well developed; propodeal spiracle small, round, 1/2 its diameter from anterior margin of propodeum; propleuron and prepectus reticulate; ventral half of mesepisternum punctate dorsal part reticulate; ventral half of mesepimeron punctate, dorsal half smooth and opaque; fore wing, submarginal and marginal veins subequal the latter twice as long as the postmarginal which is twice as long as stigmal; stigma with four sensillae and fuscous marking; basal, cubital, subcubital and median veins completely or partially defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect oval in shape, usually shorter than head and thorax combined; first three tergites naked medially with some appressed and suberect setae on their lateral margins; tergites four to seven with appressed and suberect setae evenly but widely distributed on their surfaces; tergites two to four with or without yellow markings.

Male.- (Figs. 46, 118, 227-229) differs from female as follows: single male available length 2.90 mm.; width of thorax in front of tegulae 0.50 mm.; anellus very short; antennal funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thorax not as strongly sculptured; femora mostly black; fore wing without fuscous marking about stigmal vein: abdomen subpetiolate and from dorsal aspect subrectangular; tergites and sternites one to three with yellow markings; genitalia as illustrated.

Variation.- structurally this species is relatively stable, specimens from the northeastern part of its range display melanism in that the legs become marked with black and the abdomen is without yellow markings. In addition the fuscous marking of the wing is very distinct in these specimens.

Types.- the single female specimen which is type of this species in the U.S.N.M. bears the type number 21408 and a Girault determination label with the species name Sympiesis marylandia Grlt., female type, College Park, Maryland. The head of the specimen is removed and placed on a slide.

Distribution.- this species is sporadically distributed in the northeastern part of the Transition zone of the Austral region, map 15.

Material examined.- the data on the specimens examined of this species are recorded in table 15.

This species has been reared from foliage of Quercus velutina Lam. in Durham, New Hampshire. I suspect its host is a lepidopterous leaf miner or leaf roller.

Biology.- little is known about the habits of this species.

Map 15. Nearctic distribution of Sympiesis marylandia Girault

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION		
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR
		CANADA				
	1	Ontario	Port Colborne	29	IV	1935
	1	Quebec	Nominique	13	VII	1941
		UNITED STATES				
	1	Maryland	College Park	29	VI	1961
	1	Minnesota	Eaglesnest	22	VIII	1957
2	3	New Hampshire	Durham	17-19	VI	1958

Table 15. Recorded data on specimens of Sympiesis marylandia Girault with information known about host niche.

HOST	NICHE	HOST PLANT
-	-	-
-	-	-
-	-	-
-	-	-
-	-	Quercus velutina

XXIX. SYMPIESIS FRAGARIAE NEW SPECIES

Female.- (Figs. 28, 65, 83, 101, 137, 230-232) length 1.60 mm. to 2.50 mm.; width of thorax in front of tegulae 0.40 mm. to 0.70 mm. Colour: metallic blue; face, clypeus, genae, pleura and apical half of abdomen metallic green to black; antennal scape, trophi, tegulae and legs except coxae and tarsal claws yellowish to yellowish white. Structure: head subtriangular in shape; vertex, frons, face, clypeus and genae closely reticulate with white suberect to erect setae distributed on their surfaces; compound eyes with numerous erect, whitish setae evenly distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 9:14; antennal scape longer than pedicel, anellus and first funicular combined with numerous, appressed setae on dorsal margin and four to five elongate, erect setae on flexor surface; pedicel nearly 1/2 as long as first funicular; anellus 1/10 as long as first funicular; first club segment 1 1/4 times as long as second; mandible subquadrate with two well-developed, acute, superior teeth and six progressively smaller, rounded, inferior teeth; apical segment of maxillary palp with one short and three elongate, subterminal setae and one terminal elongate seta; labial palp with two short and two elongate, subterminal setae: thorax from dorsal aspect oval shaped; mesonotum six times as long, 1 1/2 times as wide as pronotum, five times as long and only slightly wider than propodeum; pronotum closely reticulate medially and anteriorly, strongly reticulate punctate latero posteriorly with suberect, white setae widely distributed on its surface, four to five of these are elongate and evenly distributed on its posterior margin; mesonotum punctate with a row of five elongate, white, suberect setae on each lateral margin of mid lobe and numerous suberect, white setae evenly distributed on the side lobes; parapsidal grooves well developed and complete; mesoscutellum punctate, the punctures medially small and close together, those laterally large, with two pair of elongate, suberect, white, lateral setae; axillae punctate; metascutellum punctate; propodeum strongly punctate

a pair of median carinae anteriorly; lateral sulcus well developed and trough-like, extending to spiracles which are large and oval, their shortest diameter from anterior margin of propodeum; propleuron reticulate; prepectus and mesoepisternum lightly but closely punctate; mesepimeron reticulate ventrally, coriaceous and shiny dorsally; fore wing, submarginal and marginal veins subequal; the latter nearly three times as long as the postmarginal which is twice as long as stigmal; stigma with four sensillae; basal, cubital, subcubital and median veins partially or wholly defined by setal patterns; hind wing rounded at apex: abdomen from dorsal aspect broadly lanceolate in shape, shorter than head and thorax combined; first four tergites naked medially with numerous suberect, white setae distributed on lateral surfaces; tergites five to seven with suberect, white setae distributed over their entire surfaces.

Male.- (Figs. 47, 119, 233-234) differs from female as follows: length 1.40 mm. to 2.00 mm.; width of thorax in front of tegulae 0.45 mm. to 0.55 mm.; antennal scape slightly dilated; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thorax less strongly sculptured; hind femora and tibiae partially black: abdomen subpetiolate, from dorsal aspect subtriangular in shape, narrower at base than near apex; tergites and sternites two and three with yellowish markings; genitalia as illustrated.

Variation.- this species is stable in structure and colour over its entire range.

Types.- holotype: female, Fisherville, Virginia, VIII.1947. D. W. Clancy, Lab. # 2254 Id. Lot No. 47-14367, type number 69632 U.S.N.M.

Paratypes.- 1 female, same data as holotype; 1 female, Wallingford, Connecticut, 31.VII.1921, ex. Hemerophila pariana B. A. Porter. 1 female, Experiment, Georgia, 10.VI.1929, ex. Lepidoptera in Pecan (Stigma), T. L. Bissell. 1 female, Glenburnie, Maryland, 6.VII.1931.

ex. Ancylis comptana, H. S. McConnel. 1 female, 1 male, Arendtsville, Pennsylvania, 1940, ex. Coleophora malivorella, J. N. Beacher. 1 female, Blair, Kansas, 23.VI.1937, ex. A. comptana, P. G. Lamerson. 1 female, Wamago, Kansas, 19.VI.1929, ex. A. comptana, S. A. Summerand. 1 female, Wathena, Kansas, 19.VI.1938, ex. A. comptana, P. G. Lamerson. 1 male, Winchester, Virginia, 1931, ex. C. malivorella, W. S. Hough. 1 female, 1 male, Charlottesville, Virginia, VI.1947, ex. A. comptana, D. W. Clancy. 1 female, 3 males, Kearnyville, West Virginia, VI.1939, ex. C. malivorella, E. Gould. 1 female, Morgantown, West Virginia, 1931, ex. C. malivorella, E. Gould. 1 female, Door Co., Wisconsin, 19.VI.1931, M. H. Doner. 1 female, Sauk Co., Wisconsin, 22.VII.1957, ex. Tetralopha rousella Wallesz.

Distribution.- this species appears to be restricted to eastern part of the Nearctic Transitional zone of the Austral region, map 16.

Material examined.- the data on the specimens examined of this species are recorded in table 16.

This species prefers a lepidopterous host whose larva either rolls the deciduous host leaf on which it feeds, feeding within the roll, or bears a case during its development.

Biology.- little is known about the habits of this species.

Map 16. Nearctic distribution of Sympiesis fragariae Miller

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		UNITED	STATES				
	1	Connecticut	Wallingford	31	VII	1921	Hemerophia p
	1	Georgia	Experiment	-	-	-	
	1	Kansas	Blair	23	VI	1937	
	1	"	Wamego	11	VI	1929	Acleris comp
	1	"	Wathena	19	VI	1938	
	1	Maryland	Glenburnie	6	VII	1931	Ancylis comp
	1	"	Salisbury	8	VII	1931	"
	1	Ohio	Lake County	12	VIII	1942	
1	1	Pennsylvania	Arendisville	-	-	1940	Coleophora m
1	1	Virginia	Charlottesville	-	VI	1947	
	2	"	Fisherville	-	VIII	1947	Argyrotaenia
1		"	Winchester	-	-	1931	Coleophora m
2	2	West Virginia	Kearneysville	-	VI	1939	"
	1	"	Morgantown	-	-	1931	"
	1	Wisconsin	Door County	19	VI	-	
	1	"	Saulk County	22	VII	1957	Tetralopha s

Table 16. Recorded data on specimens of Sympiesis fragariae Miller with information known about host niche.

L. R. =
C. B. & M. =

RGENCE CTION		HOST	NICHE	HOST PLANT
	YEAR			
	1921	Hemerophia pariana	-	-
	-	-	-	-
	1937	-	-	-
	1929	Acleris comptana	L. R.	-
	1938	-	-	Fragaria sp.
	1931	Ancylis comptana	L. R.	-
	1931	"	"	-
	1942	-	-	Rhus sp.
	1940	Coleophora malivorella	C. B. & M.	-
	1947	-	-	-
	1947	Argyrotaenia velutinana	L. R.	-
	1931	Coleophora malivorella	C. B. & M.	-
	1939	" "	"	-
	1931	" "	"	-
	-	-	-	-
	1957	Tetralopha sp.	L. R.	-

ariae
ae.

L. R. = Leaf Roller
C. B. & M. = Case Bearer and Miner

XXX. SYMPIESIS VIRIDULA (THOMSON)

Eulophus viridulus Thomson, 1878, Hym. Scand. 5, p. 233.
Sympiesis viridula Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427.

Female.- (Figs. 29, 66, 84, 138, 236-238) length 1.70 mm. to 3.00 mm.; width of thorax in front of tegulae 0.45 mm. to 0.75 mm. Colour: green to greenish black; scape, area of face below antennal torulus, trophi, legs, tegulae, sternites and dorsal lateral areas of most of tergites of abdomen yellowish to white. Structure: head subtriangular in shape, wider than high; compound eyes with numerous very short, erect, whitish setae evenly distributed on their surfaces; vertex, face, clypeus and genae lightly reticulate, frons strongly reticulate to punctate; suberect, whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli, 10:16; antennal scape as long as pedicel, anellus, first funicular and 1/5 second funicular combined with numerous appressed setae on dorsal margin and six to eight elongate, erect setae on flexor surface; pedicel 1/2 as long as first funicular; anellus 1/10 as long as first funicular; first club segment 1 1/3 times as long as second; mandible subquadrate with two well-developed, acute, superior teeth, one subterminal the other terminal and four progressively smaller, rounded inferior teeth the last being very small and almost indistinguishable; apical segment of maxillary palp with two elongate and two short subterminal setae and one elongate terminal seta; labial palp with one basal seta; two short and one elongate subterminal setae and one elongate terminal seta: thorax from dorsal aspect subrectangular, mesonotum three times as long and 1 1/3 times as wide as pronotum, five times as long as and only slightly wider than propodeum; pronotum campanulate in shape, lightly reticulate medially, heavily reticulate laterally with suberect whitish setae, widely distributed on its surface and four to five suberect, elongate, whitish setae evenly

distributed on its posterior margin; mesonotum punctate with a row of four, suberect, elongate, whitish setae on each lateral margin of mid lobe and numerous suberect, whitish setae ev enly but widely distributed on side lobes; parapsidal grooves complete, often almost indistinguishable posteriorly; mesoscutellum punctate to very strongly reticulate, with two pair of elongate lateral, suberect whitish setae; axillae with elongate punctures; metascutellum punctate; propodeum very heavily reticulate; median carina, plicae posteriorly and anteriorly and lateral sulcus well developed; propodeal spiracle large and round its diameter from the anterior margin of propodeum; entire pleuron, except dorsal part of mesepimeron which is coriaceous to smooth and shiny, reticulate; fore wing, submarginal and marginal veins equally long; the latter twice as long as postmarginal which is twice as long as stigmal; stigma with four sensillae; basal, cubital, subcubital and median veins completely or partially defined by setal patterns; hind wing rounded at apex: abdomen subpetiolate, from dorsal aspect ovate in shape, acute apically; tergites one to four naked medially with suberect or appressed whitish setae on their lateral margins; tergites four to seven with appressed and suberect setae evenly but widely distributed on their surfaces; sternites and tergites one to six with yellow lateral markings.

Male.- (Figs. 48, 120, 239-241) differs from female as follows: length 1.50 mm. to 1.90 mm.; width of thorax in front of tegulae 0.45 mm. to 0.50 mm.; antennal scape dilated medially with six elongate setae on flexor surface; funiculars progressively longer from first to fourth; first three each with an elongate rami on the posterior dorsal margin: thorax not as strongly sculptured: abdomen subpetiolate and from dorsal aspect subrectangular; tergites and sternites two and three with yellowish white markings; genitalia as illustrated.

Variation.- this species is very stable throughout its range. Some Italian specimens in the C.N.C. display melanism in reduction of light coloured markings and a darkening of hind femora. This melanistic attribute is possibly associated with environmental conditions and probably occurs in the North American population.

Types.- the type of this well known species has not been examined as it is in the Zoological University Museum, Lund, Sweden.

Distribution.- this European species was introduced into North America in the early 1930s as a potential regulative factor in the control of the European corn borer, Pyrausta nubilalis (Hubner). It has become well established on this host and appears to be confined to the corn growing regions of our continent, map 17. It is widespread in Europe according to Erdos (1959).

Material examined.- the data on the specimens examined of this species are recorded in table 15.

This species appears to be restricted in North America to the host against which it was released, figure 261. However, in Europe, Erdos (Ibid) reports it as a parasitoid of P. nubilalis, Sesamia cretica Led. and Tachyptilia populella Clerck. In addition he reared it from "inflorescences of Lappa (ex ? Phalonia posterana Zell.)." All of these hosts bore in the stems of plants.

Biology.- as I indicated earlier it is rather paradoxical that so much is written on the habits of this parasite which was introduced to this continent whereas virtually nothing is known about the habits of indigenous species.

The best expose of the habits of P. viridula is that of Parker and Smith (1933). In brief, they inform us that the species in Europe is an ectoparasitoid which paralyzes its host, usually a third, fourth or fifth instar larva and lays a number of white oblong, ovate smooth eggs on it. The eggs produce larvae which feed externally and moult three times, becoming a pupa on the third moult within a five to six day period. The pupa passes through a period of diapause during hibernation and the adults emerge in late April or early May.

This parasite produces two generations per season in the Sequanian zone of Europe. Its life cycle from egg to adult takes approximately 14 days.

Map 17. Nearctic distribution of Sympiesis viridula (Thomson)

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		CANADA					
	1	Alberta	Lethbridge	-	-	1924-26	
1	1	Nova Scotia	Bridgetown	4	VIII	1912	
1	1	Ontario	Belleville	-	-	1947	Pyraust
2		"	"	2	VII	1931	"
	1	"	Leamington-	6	IX	1960	"
1	1	"	Windsor	22	VIII	1940	"
		UNITED STATES					
	1	Indiana	Tippacanoe	28	VII	1946	"
1	3	Iowa	Albion	-	VII	1949	"
1		"	Kossuth	20	VII	1952	
1	2	"	Marshaltown	17-	VI	1949	
2	1	Minnesota	Ramsey County	31	VIII	1953	Pyraust
5	3	New York	Cattaraugus Indian Reserve	10-24	X	1947	"
	5	Ohio	Adams, Lucus Co.	19	IV	1948	"
2	3	"	"	25	VIII	1938	"
1	7	"	Danbury	11	IV	1938	
	5	"	Jerusalem	11	IV	1938	
3	3	"	"	18	VIII	1938	Pyraust
		"	Perkins	30	VIII	1947	"
1	4	Pennsylvania	Elizabethtown	6	IV	1962	"
	6	Wyoming	Torsington	13	VIII	1953	

Table 17. Recorded data on specimens of Sympiesis viridula (Thomson) with information known about host niche.

C. B. =

NCE N YEAR	HOST	NICHE	HOST PLANT
1924-26	-	-	-
1912	-	-	-
1947	Pyrausta nubilalis	C. B.	Zea sp.
1931	" "	"	"
1960	" "	"	"
1940	" "	"	"
1946	" "	"	"
1949	" "	"	"
1952	-	-	Papai pema
1949	-	-	-
1953	Pyrausta nubilalis	C. B.	Zea sp.
1947	" "	"	"
1948	" "	"	"
1938	" "	"	"
1938	-	-	-
1938	-	-	-
1938	Pyrausta nubilalis	C. B.	-
1947	" "	"	Zea sp.
1962	" "	"	"
1953	-	-	-

C. B. = Corn Borer

XXXI. SYMPIESIS ACROBASIDIS NEW SPECIES

Female.- (Figs. 30, 67, 85, 103, 139, 242-244) length 1.80 mm. to 2.30 mm.; width of thorax in front of tegulae 0.45 mm. to 0.60 mm. Colour: dark brown to black with violaceous reflections emitted from the lateral areas of the mesonotum, the propodeum, lateral areas of abdomen and vertex of head; scape, tibiae and first three segments of tarsi white. Structure: oval in shape, wider than high; compound eyes with numerous short, erect setae evenly distributed on their surfaces; vertex, frons, face, clypeus and genae reticulate, with some suberect to erect whitish setae widely distributed on their surfaces; ratio of distance between compound eye and lateral ocellus, and distance between lateral ocelli 8:15; antennal scape as long as pedicel, anellus, first funicular and 1/2 second funicular combined, with seven to eight strong appressed setae on dorsal margin and six delicate, erect, elongate setae on flexor surface; pedicel 2/3 as long as first funicular; anellus 1/4 as long as first funicular; first club segment 1 1/5 times as long as second; mandible subquadrate with one well-developed acute superior tooth and four progressively smaller rounded inferior teeth; apical segment of maxillary palp with one elongate and one short subterminal setae and one elongate terminal seta; labial palp with two short and two elongate subterminal setae: thorax from dorsal aspect subrectangular in shape narrower than head as wide as abdomen; mesonotum nearly four times as long and about 1 1/3 times as wide as pronotum, almost seven times as long and little wider than propodeum; pronotum campanulate and closely reticulate with numerous suberect, yellowish setae widely distributed on its surface and four to five elongate yellowish setae evenly distributed on its posterior margin; mesoscutum closely punctate anteriorly and laterally, widely and strongly reticulate medially, with four elongate, suberect, yellowish setae on each lateral margin of midlobe and numerous, suberect, yellowish setae evenly distributed on side lobes; mesoscutellum closely punctate anteriorly, heavily reticulate laterally and posteriorly; axillae punctate dorsally, reticulate laterally;

propodeum closely punctate medially reticulate laterally; median carina well developed on anterior half; lateral sulci poorly developed; propodeal spiracle small and round nearly its own diameter from anterior margin of propodeum; propleuron reticulate; prepectus punctate; mesepisternum punctate medially, reticulate dorsally and ventrally; mesepimeron reticulate ventrally and coriaceous dorsally; fore wing, submarginal and marginal veins subequal, the latter twice as long as postmarginal which is twice as long as stigmal; basal, cubital and subcubital veins partially or wholly defined by setal patterns; stigma with four sensillae; hind wing rounded at apex; abdomen broadly lanceolate from dorsal aspect; tergites one to three naked medially, with some suberect and appressed, whitish setae on lateral margins; tergite four to seven with appressed and suberect, whitish setae widely distributed on their surfaces.

Male.- (Figs. 49, 121, 245-247) differs from female as follows: length 1.40 mm. to 1.60 mm.; width of thorax in front of tegulae 0.45 mm. to 0.50 mm.; antennal scape dilated medially with three erect, elongate delicate setae on flexor surface; anellus very short; funiculars progressively longer from first to fourth, first three each with an elongate rami on the posterior dorsal margin: thoracic sculpturing less pronounced: abdomen from dorsal aspect subrectangular with base narrower than apex; tergites and sternites two and three with whitish markings; genitalia as illustrated.

Variation.- the specimens available for study of this species come from three reared series from rather widely separated areas. They indicate very little variability but this may not necessarily be the case. Additional series might show some variability at least in colour.

Types.- holotype, female, U.S.N.M. No 69633, Gustin, Texas, 25.V.1939. W. C. Pierce, ex. Acrobasis caryivorella Ragonot on Pecan, Lot 39-13709 Quaintance No. 31143; paratypes; 41 females, 5 males, same data as holotype; 6 females, Wiggins, Mississippi, 11.VI.1929, J. P. Kislanka, ex. Acrobasis juglandis Le Baron; 3 females, Monticello, Florida,

13.VI.1919. A. I. Fabis, ex. Acrobasis sp., Quaintance No. 16986; 3 females, 1 male, Vienna, Virginia, 19.IV.1912, R. A. Cushman ex. Mineola indigenella Zeller, Quaintance No. 7810.

Distribution.- this species is restricted to the Upper and Lower Austral zones of the Nearctic Austral region, map 18.

Material examined.- the data on the specimens examined of this species are recorded in table 18.

This parasitoid prefers lepidopterous hosts which form a frass tube during their larval development, retiring to it to rest after feeding.

Biology.- little known of the life history and habits of this species.

Map 18. Nearctic distribution of Sympiesis acrobasidis Miller

NUMBER AND SEX		DISTRIBUTION		DATE OF EMERGENCE OR COLLECTION			
♂	♀	PROVINCE OR STATE	LOCALITY	DAY	MONTH	YEAR	
		UNITED STATES					
	3	Florida	Monticello	8	V	1919	Acrobasis
	7	Missouri	Wiggins	1	VI	1929	Acrobosis
6	40	Texas	Gustine	25-26	V	1939	Acrobasis
1	3	Virginia	Vienna	19	IV	1912	Mineola ir

Table 18. Recorded data on specimens of Sympiesis acrobasidis Miller with information known about host niche.

F. C. = Fr

	HOST	NICHE	HOST PLANT
19	Acrobasis sp.	F. C.	-
29	Acrobosis juglandis	F. C.	-
39	Acrobasis caryivorella	F. C.	Apocarya sp.
12	Mineola indigenella	F. C.	-

F. C. = Frass Case

XXXII. UNPLACED SPECIES

A. Pnigalio coloni Girault

Sympiesis coloni Girault, 1917, Des. Hym. Chalcidoid Variorum cum Observ. 3, pp. 2-3.

Pnigalio coloni Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427.

I am unable to relate this entity to a population which represents the modern biological species concept as defined in this work.

Specimens of the type series from Walnut Creek, California, U.S.A. in the U.S.N.M. which represent this species look like small specimens of P. proximus, except the integument of the thoracic dorsum is smoother. Most specimens are in poor condition and difficult to assess. A placement of the name into synonomy with P. proximus would have to be done on pure speculation, especially since P. proximus appears to be limited to the northeastern part of the Transitional zone of the Nearctic Austral region.

Until additional material of P. coloni can be found from the type locality or surrounding areas it seems best to leave the name alone.

B. Pnigalio kukakensis (Ashmead)

Eulophus kukakensis Ashmead, 1902, Proc. Wash. Acad. Sci. 4: 147-8.

Pnigalio kukakensis Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 425.

The description of this species was based on a single male specimen from Kukak Bay, Alaska. I believe it to be a male P. maculipes; however, I hesitate to combine the two on the slim evidence available, especially since the name P. maculipes a junior synonym has appeared much more often in the literature.

C. Pnigalio minio (Walker)

Eulophus minio Walker, 1847, Ann. Mag. Nat. Hist. (1) 20: 26.

Pnigalio minio Peck, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

The type of this species is in the British Museum, London, England and therefore unavailable for examination. Hence, I have been unable to relate it to any of the populations treated here.

D. Pnigalio quercicola (Ashmead)

Sympiesis quercicola Ashmead, 1888, Bul. Kans. Agric. Expt. Sta. 3: App. p. VII.

Pnigalio quercicola Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 426.

The type of this species has been lost and an assessment of Ashmead's description is hopeless.

E. Pnigalio pallipes Provancher

Coccophagus pallipes Provancher, 1887, Add. Corr. Faune Ent. Canada, Hym., p. 206.

Sympiezus pallipes Howard, 1895, Tech. Ser. U.S. Dep. Agric., Div. Ent., 1:6.

Cratotechus smerinthi Ashmead, 1898, Proc. Ent. Soc. Wash. 4: 158.

Coccophagus pallidipes Dalle Torre, 1898. Cat. Hym. 5, p. 226.

Comedo smerinthi Crawford, 1912, Proc. U.S. natn. Mus. 43: 186.

Eulophus pallipes Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 430.

Pnigalio pallipes Burks, 1963, Can. Ent. 95: 1257.

I have not had the opportunity to examine the lectotype of this species and confirm Dr. Burks's (1963) observations. Therefore, I have not treated it fully in this thesis. Hence, for the purposes of this work, I quote Dr. Burks's published notes on this entity. "Coccophagus pallipes

(11, p. 206, 1887). Lectotype in Quebec; labeled Provancher no. 1389; Lectotype no. 278, 1944. Specimen on a pin. This is now placed (7) as a species of Eulophus, and as a senior synonym of smerinthi Ashmead, 1898. This placement is incorrect; pallipes is a valid, but apparently rare, species of Pnigalio. New combination. The species in Eulophus must again take the name smerinthi."

F. Sympiesis chenopodii Ashmead

Sympiesis chenopodii Ashmead, 1888, Bul. Kans. Agric. Expt. Sta. 3: App. p. VII.

The type of this species is also lost and an assessment of Ashmead's description is impossible. I think it too is synonymous with P. proximus.

G. Sympiesis gracillariae (Chambers)

Eulophus gracillariae Chambers, 1872, Can. Ent. 4: 28.

Sympiesis gracillariae Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 427.

The type on which the description of this species was described is also lost. The fact that it was a male and the inadequate description make its assessment impossible.

H. Sympiesis marylandica Girault

Sympiesis marilandica Girault, 1916 [1917], Insecutor Inscitiae Menstruus 4: 119.

Sympiesis marylandica Peck, 1951, in Muesebeck et al., Agric. Monogr. U.S. Dep. Agric. 2: 247.

I have been unable to place the type, a single female specimen, into any population. On the verbal advice of Dr. Burks, U.S.N.M., Washington, D.C., I have treated the entity as an unplaced species.

I. *Sympiesis tricladus* (Provancher)

Eulophus tricladus Provancher, 1887, Add. Corr. Faune Ent. Canada, Hym., p. 208.

Sympiesis tricladus Burks, 1963, Can. Ent. 95: 1258.

I have examined the lectotype of this species and agree with Dr. Burks (1963) that it is a species of *Sympiesis*. However, I have been unable to relate it to any of the populations treated here.

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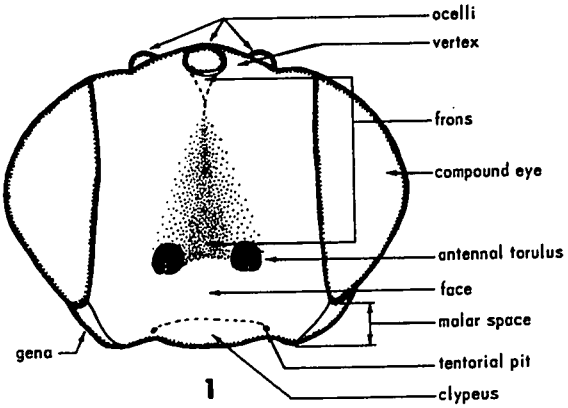
Figs. 1-6, Pnigalio maculipes (Crawford). 1. Anterior aspect of head. 2. Lateral aspect of female antenna. 3. Lateral aspect of first funicular segment of female antenna highly magnified. 4. Anterior aspect of female mandible. 5. Ventral aspect of female maxillae and labium. 6. Lateral aspect of male antenna.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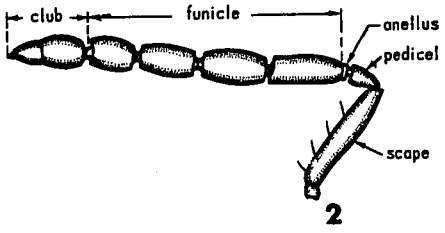
vertex
frons
compound eye
antennal torulus
face
malar space
gena
tentorial pit
clypeus

1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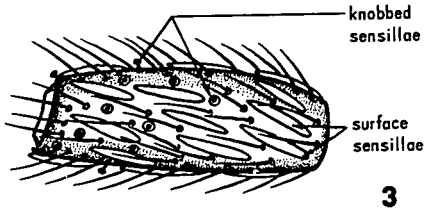
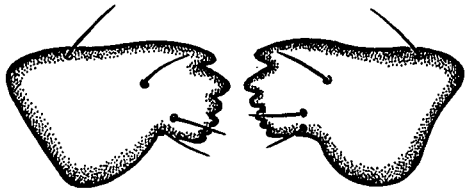
funicle
anellus
pedicel
scape

2


knobbed sensillae
surface sensillae

3



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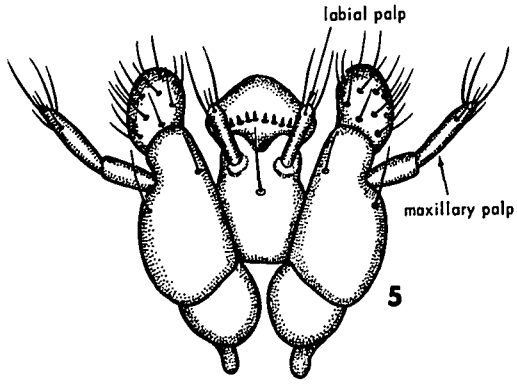
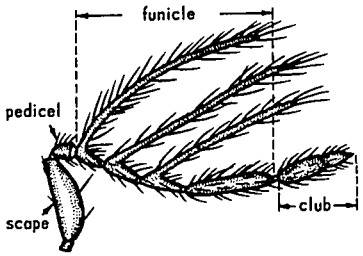
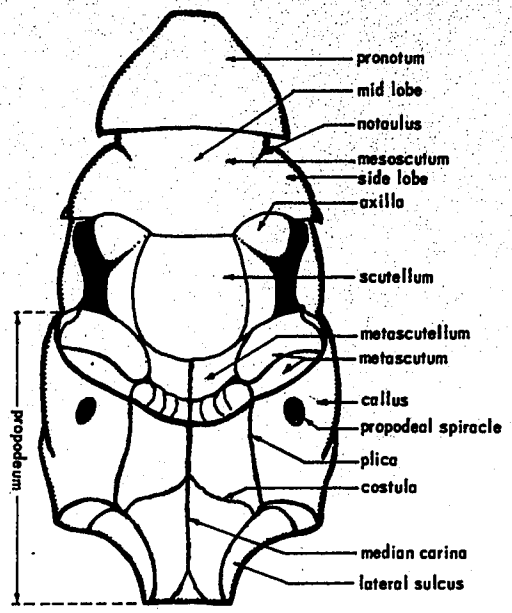

labial palp
maxillary palp

5


funicle
pedicel
scape
club

6

Figs. 7-8, Pnigalio maculipes (Crawford). 7. Dorsal aspect of female thorax. 8. Lateral aspect of female thorax.


pronotum
mid lobe
notaulus
mesoscutum
side lobe
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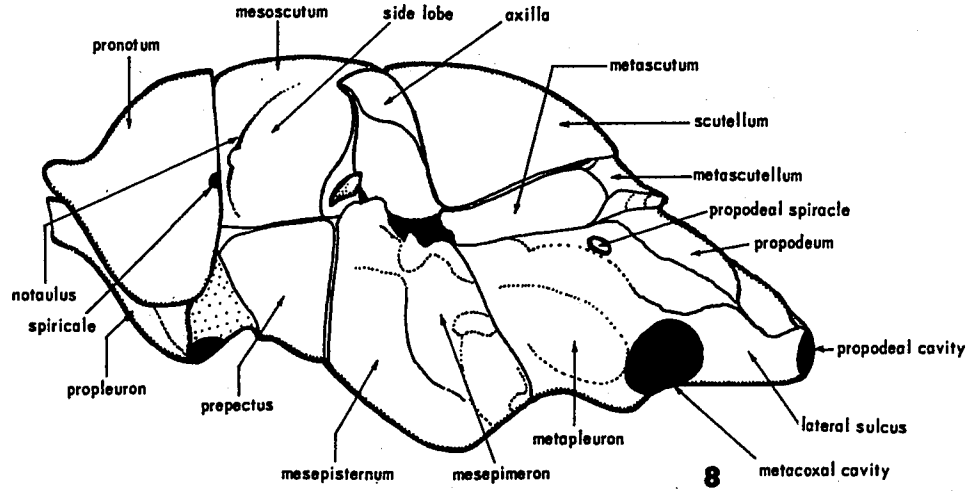
callus
propodeal spiracle
plica
costula
propodeum
median carina
lateral sulcus

7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axilla
pronotum
metascutum
scutellum
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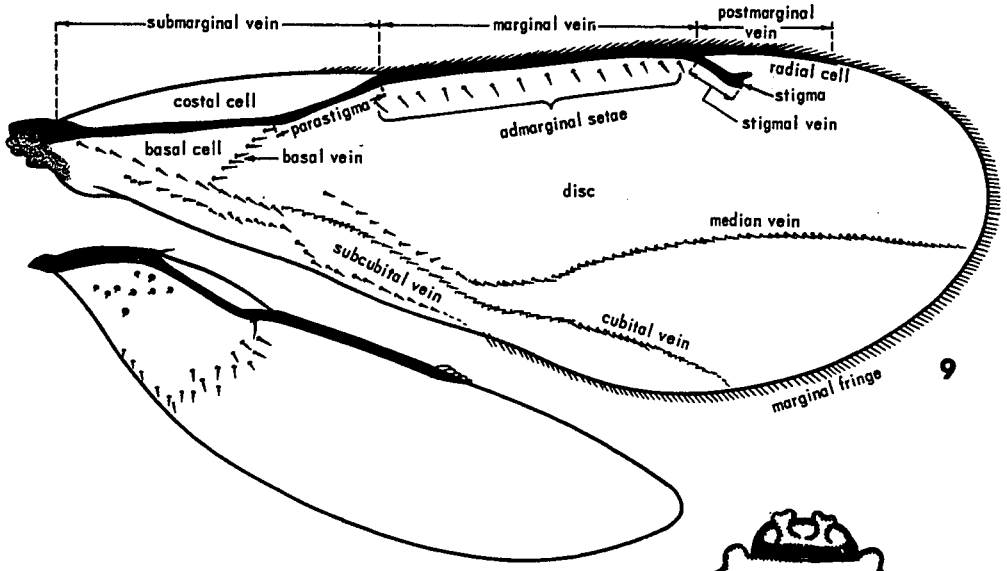
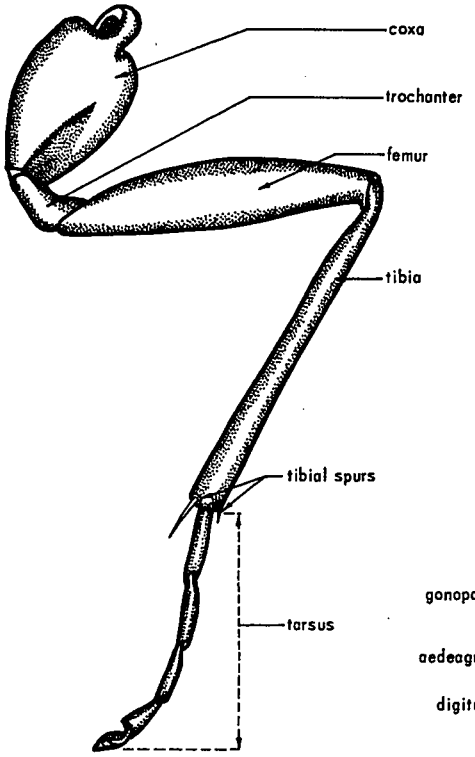
propodeal spiracle
propodeum
notaulus
spiricale
propodeal cavity
propleuron
prepectus
lateral sulcus
metapleuron
mesepisternum
mesepimeron
metacoxal cavity

8

Fig. 9. Hypothetical fore and hind wing illustrating components contained by wings of species of Pnigalio and Sympiesis.
Figs. 10-12, Pnigalio maculipes (Crawford). 10. Lateral aspect of female metathoracic leg. 11. Dorsal aspect of female abdomen. 12. Ventral aspect of male genitalia.


submarginal vein
marginal vein
postmarginal vein
radial cell
stigma
stigmal vein
costal cell
parastigma
admarginal setae
basal cell
basal vein
disc
median vein
subcubital vein
cubital vein
marginal fringe

9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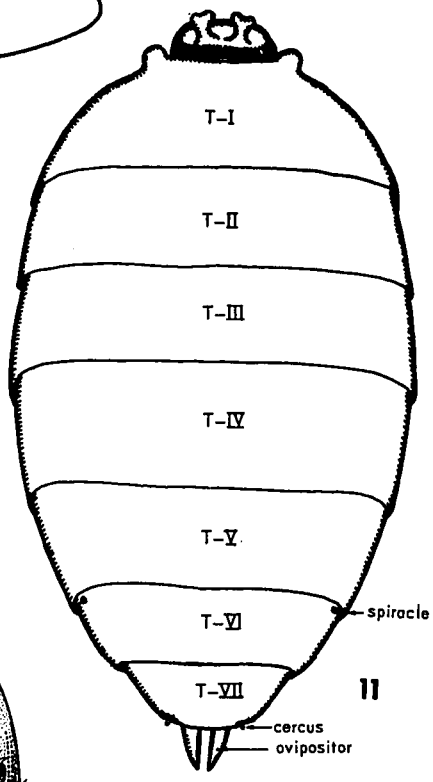
trochanter
femur
tibia
tibial spurs
tarsus

10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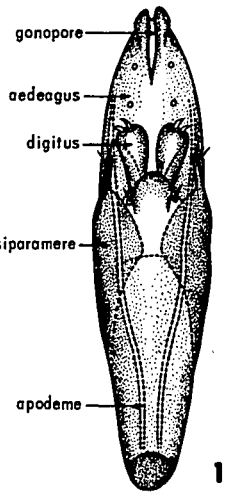
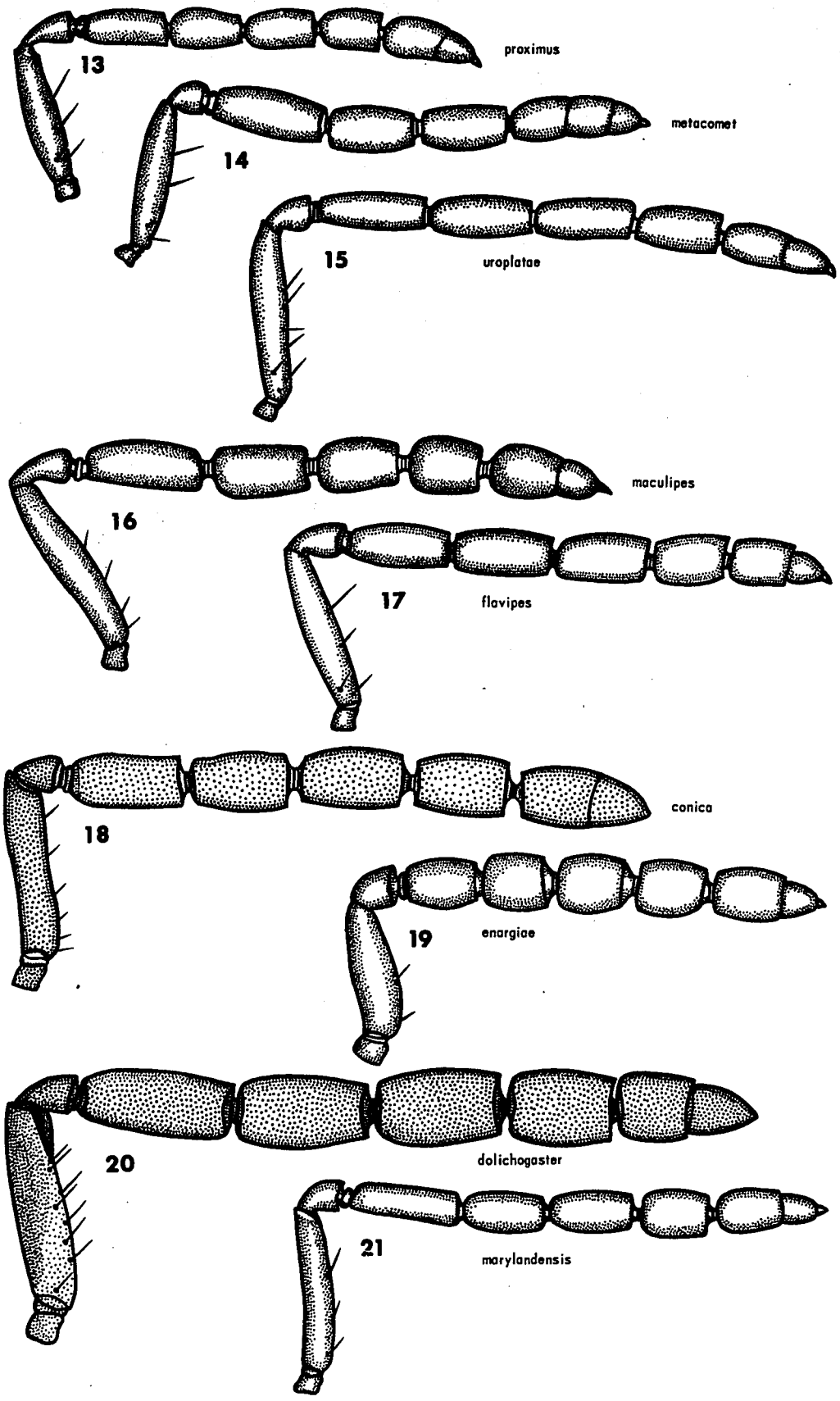
T–II
T–III
T–IV
T–V
T–VI
T–VII
spiracle
cercus
ovipositor

11

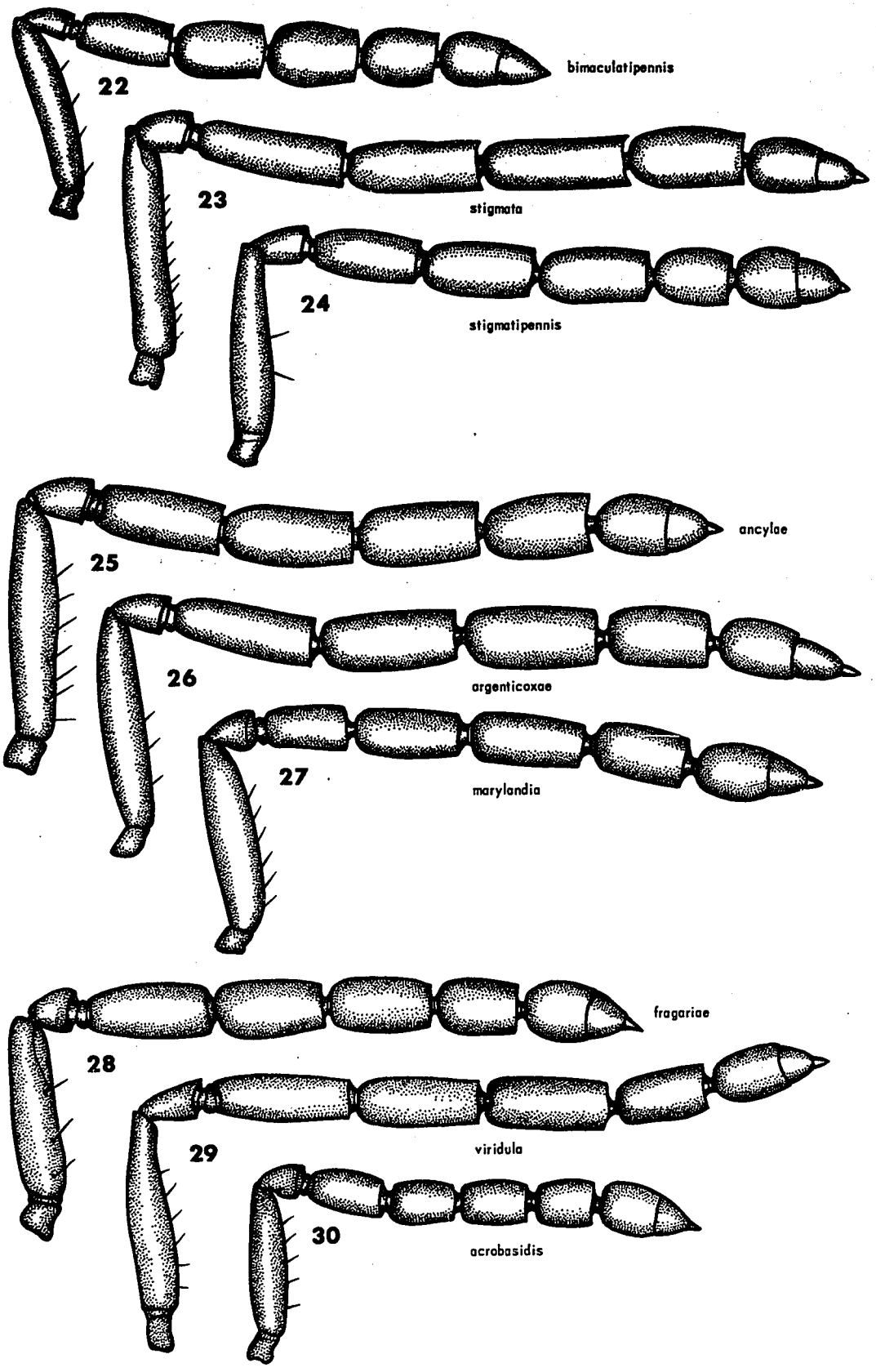

gonopore
aedeagus
digitus
basiparamere
apodeme

12

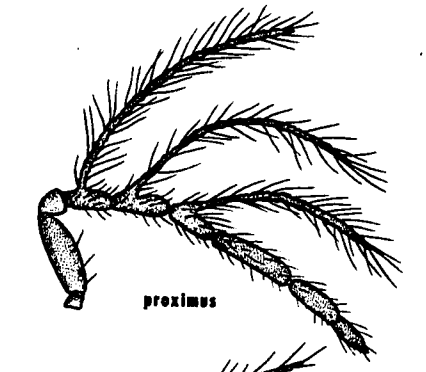
Figs. 13-21. Lateral aspect of female antennae of *Pnigalio* spp. and *Sympiesis* spp. 13. *P. proximus*. 14. *P. metacomet*. 15. *P. uroplatae*. 16. *P. maculipes*. 17. *P. flavipes*. 18. *S. conica*. 19. *S. enargiae*. 20. *S. dolichogaster*. 21. *S. marylandensis*.


13
proximus
14
metacomet
15
uroplatae
16
maculipes
17
flavipes
18
conica
19
enargiae
20
dolichogaster
21
marylandensis

Figs. 22-30. Lateral aspect of female antennae of Sympiesis spp. 22. S. bimaculatipennis. 23. S. stigmata. 24. S. stigmatipennis. 25. S. ancylae. 26. S. argenticoxae. 27. S. marylandia. 28. S. fragariae. 29. S. viridula. 30. S. acrobasidis.

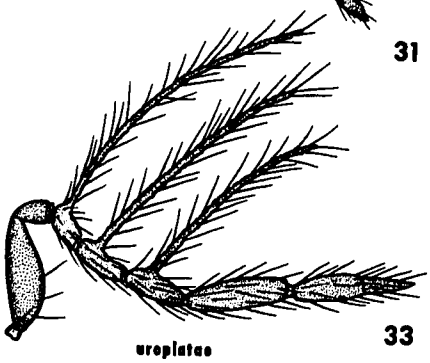

22
bimaculatipennis
23
stigmata
24
stigmatipennis
25
ancylae
26
argenticoxae
27
marylandia
28
fragariae
29
viridula
30
acrobasidis

Figs. 31-40. Lateral aspect of male antennae of *Pnigalio* spp. and *Sympiesis* spp. 31. *P. proximus*. 32. *P. metacomet*. 33. *P. uroplatae*. 34. *P. maculipes*. 35. *P. flavipes*. 36, 37. *S. conica*. 38. *S. enargiae*. 39. *S. dolichogaster*. 40. *S. marylandensis*.



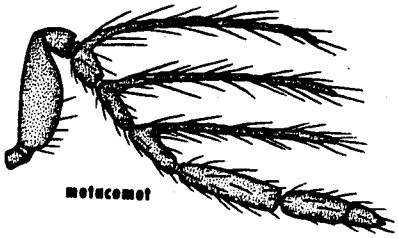
proximus

31



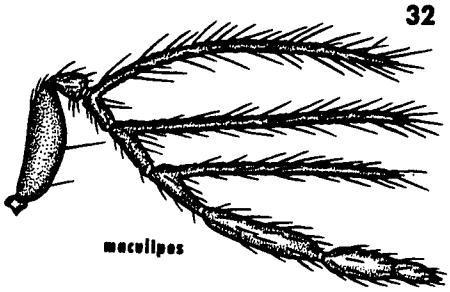
uropictus

33



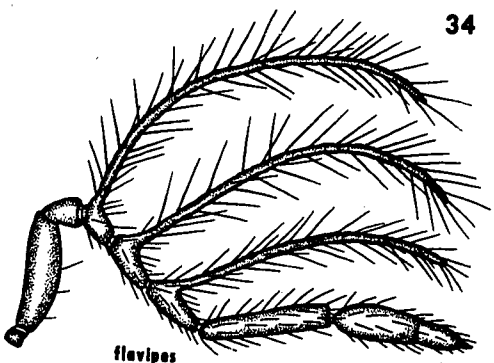
metacomet

32



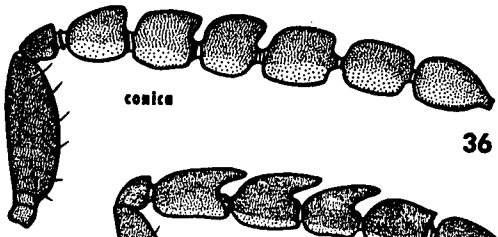
maculipes

34



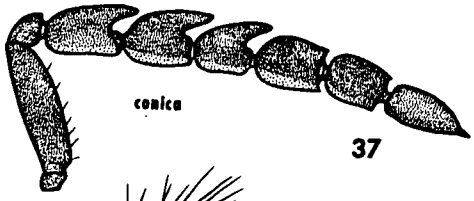
flavipes

35



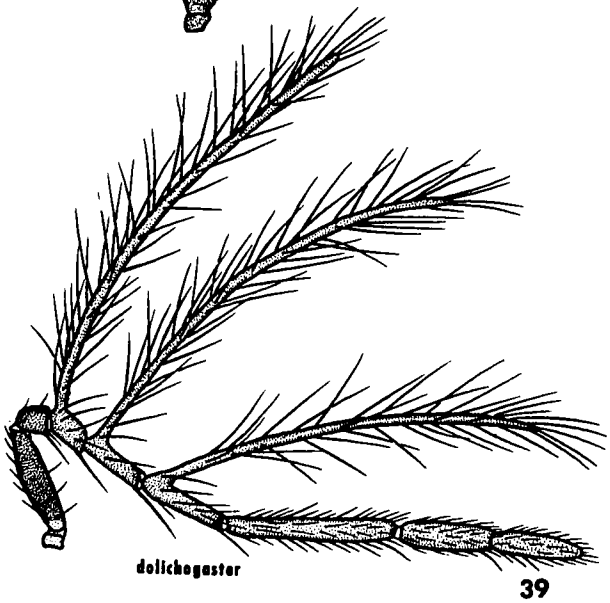
conica

36



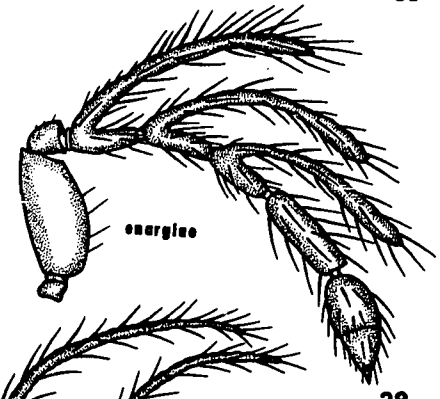
conica

37



dolichogaster

39



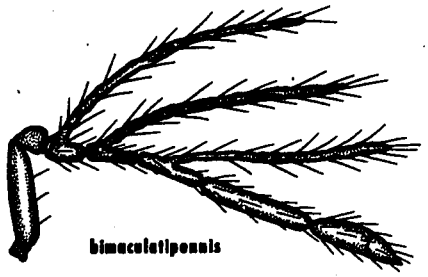
energica

38

marylandensis

40

Figs. 41-49. Lateral aspect of male antennae of *Sympiesis* spp. 41. *S. bimaculatipennis*. 42. *S. stigmata*. 43. *S. stigmatipennis*. 44. *S. ancylae*. 45. *S. argenticoxae*. 46. *S. marylandia*. 47. *S. fragariae*. 48. *S. viridula*. 49. *S. acrobasidis*.



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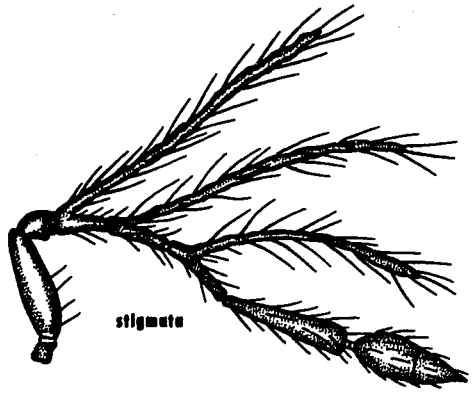

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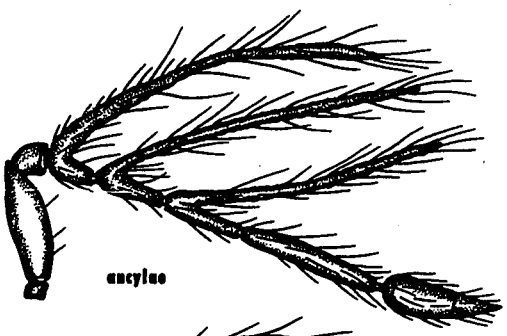

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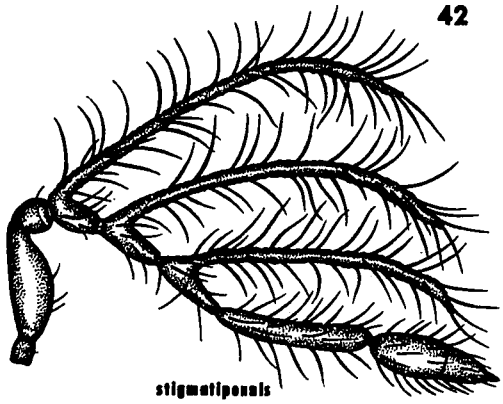

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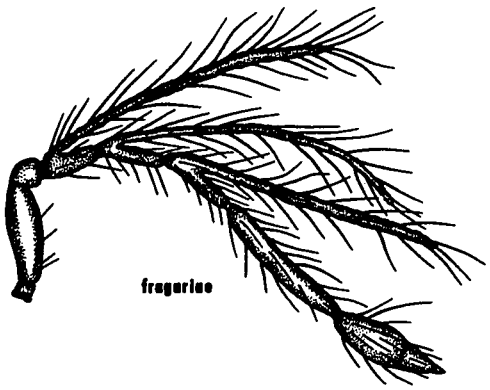
45

46



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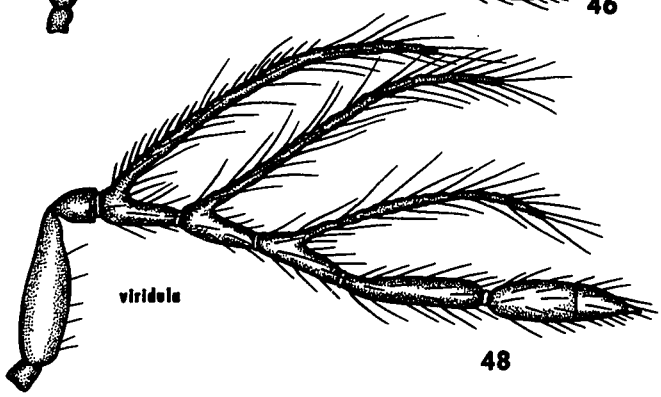
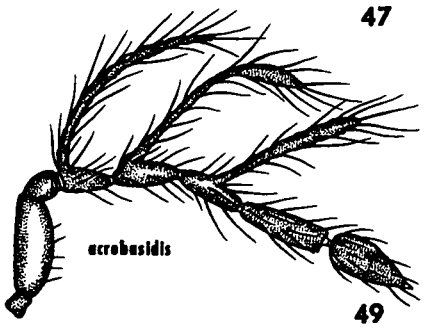
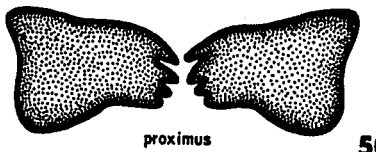


48



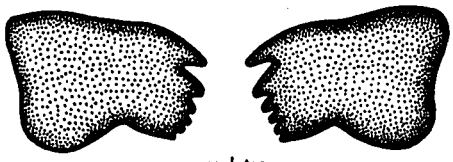
49

Figs. 50-63. Anterior aspect of female mandibles of Pnigalio spp. and Sympiesis spp. 50. P. proximus. 51. P. metacomet. 52. P. uroplatae. 53. P. maculipes. 54. P. flavipes. 55. S. conica. 56. S. enargiae. 57. S. dolichogaster. 58. S. marylandensis. 59. S. bimaculatipennis. 60. S. stigmata. 61. S. stigmatipennis. 62. S. ancylae. 63. S. argenticoxae.

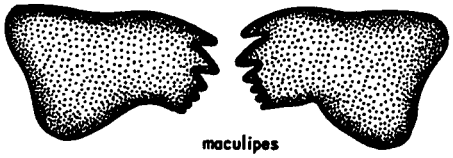


proximus 50

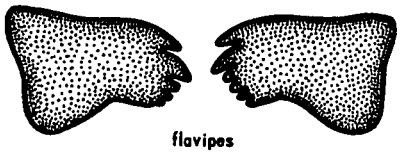
metacomet 51



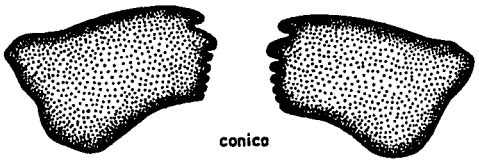
uroplatae 52



maculipes 53



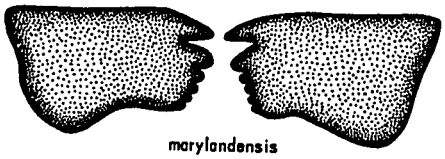
flavipes 54



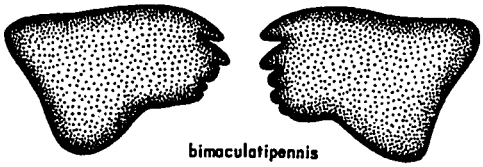
conica 55

enargiae 56

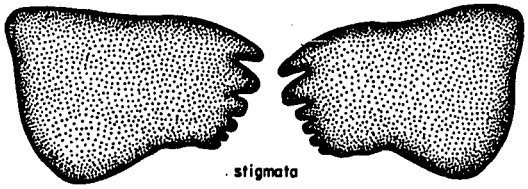
dolichogaster 57



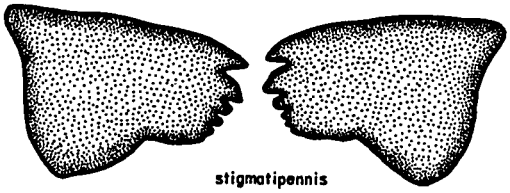
marylandensis 58



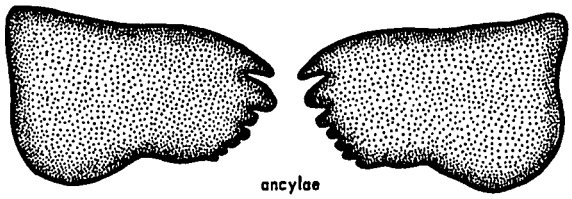
bimaculatipennis 59



stigmata 60



stigmatipennis 61

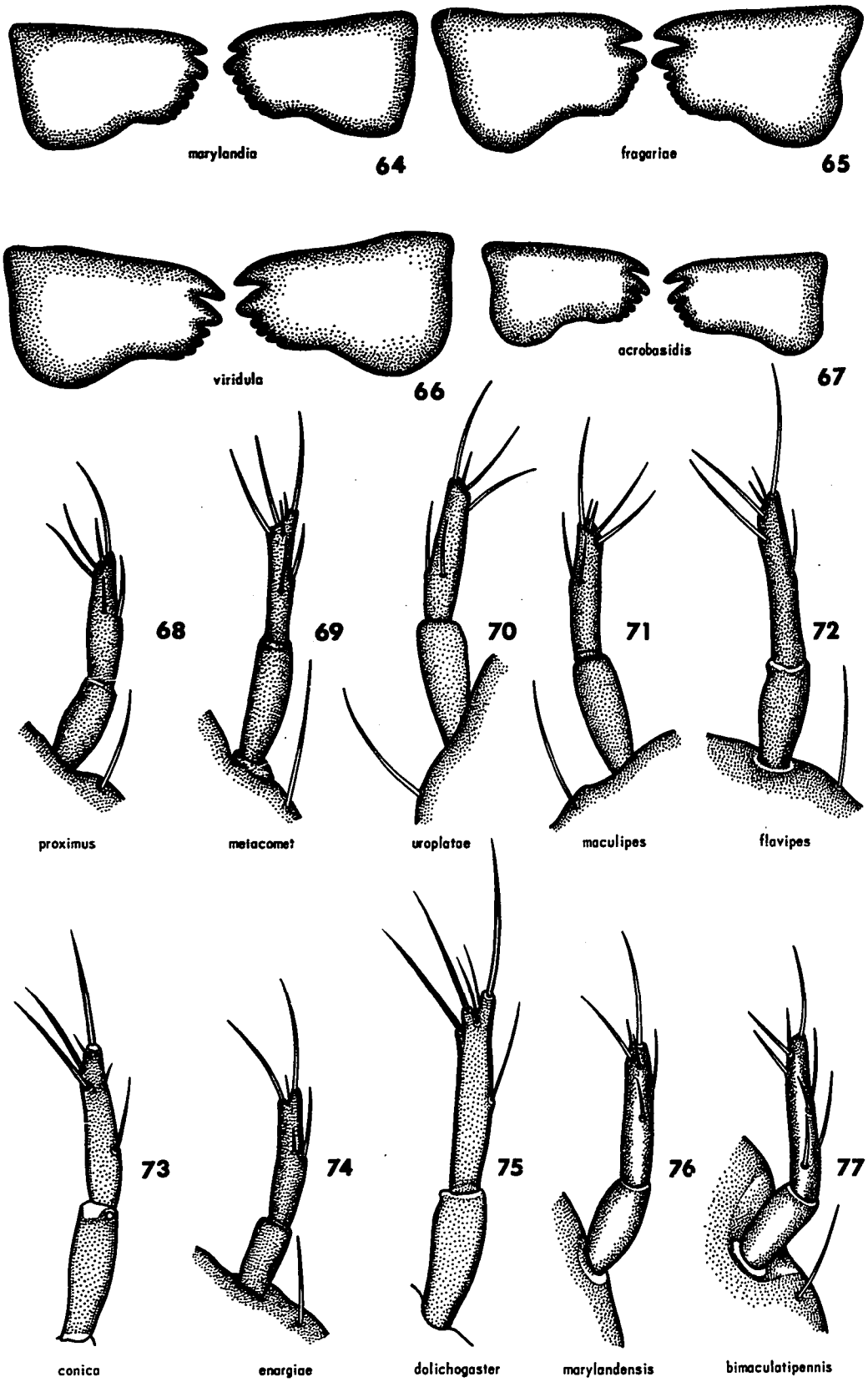


ancylae 62

argenticoxae 63

Figs. 64-67. Anterior aspect of female mandibles of Sympiesis spp. 64. S. marylandia. 65. S. fragariae. 66. S. viridula. 67. S. acrobasidis.

Figs. 68-77. Maxillary palps of Pnigalio spp. and Sympiesis spp. 68. P. proximus. 69. P. metacomet. 70. P. uroplatae. 71. P. maculipes. 72. P. flavipes. 73. S. conica. 74. S. enargiae. 75. S. dolichogaster. 76. S. marylandensis. 77. S. bimaculatipennis.


marylandia
64
fragariae
65
viridula
66
acrobasidis
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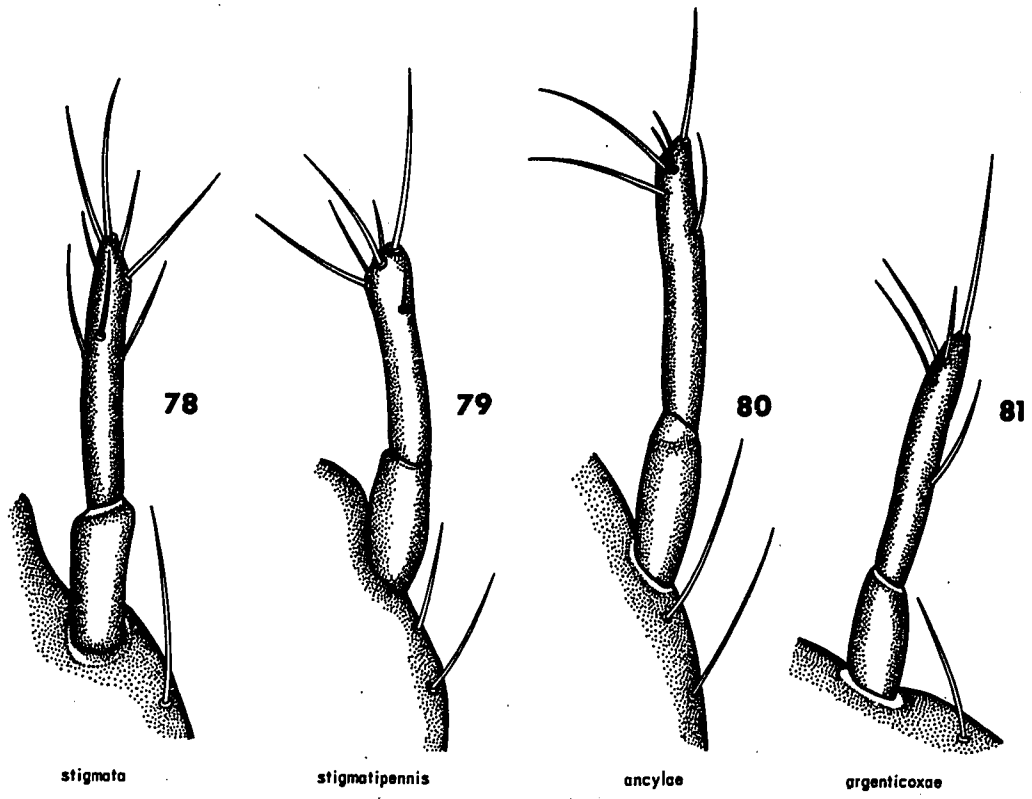
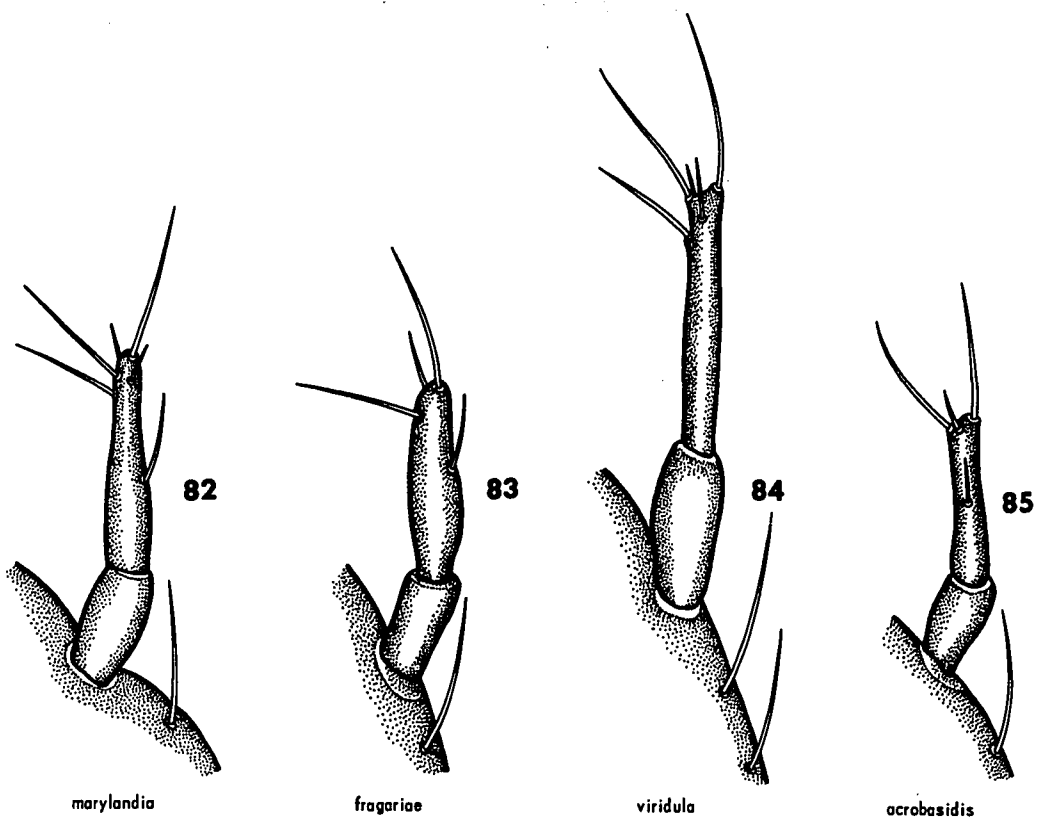
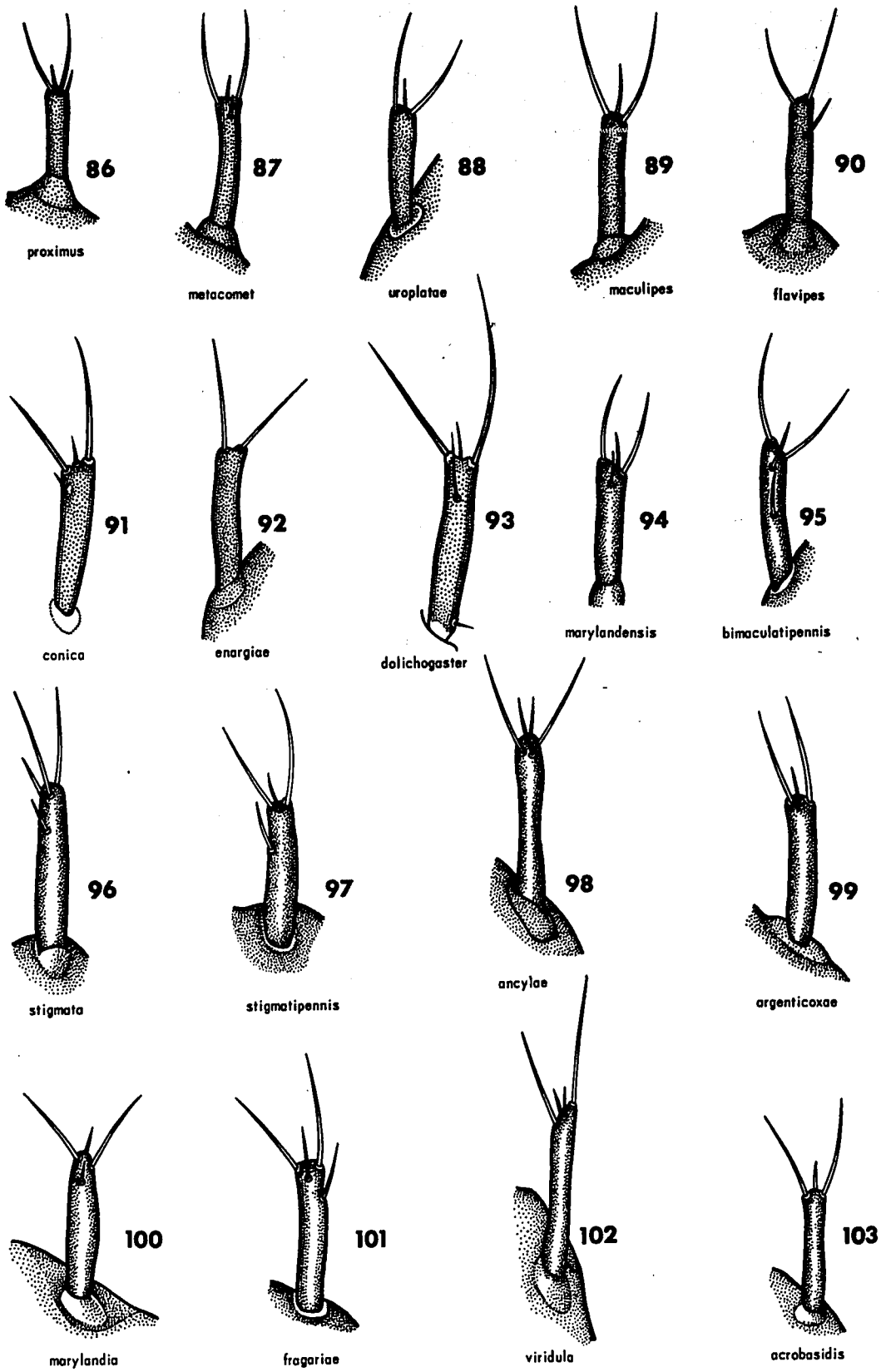
68
69
70
71
72
proximus
metacomet
uroplatae
maculipes
flavipes
73
74
75
76
77
conica
enargiae
dolichogaster
marylandensis
bimaculatipennis

Figs. 78-85. Maxillary palps of *Sympiesis* spp. 78. *S. stigmata*. 79. *S. stigmatapennis*. 80. *S. ancylae*. 81. *S. argenticoxae*. 82. *S. marylandia*. 83. *S. fragariae*. 84. *S. viridula*. 85. *S. acrobasidis*.


78
79
80
81
stigmata
stigmatipennis
ancylae
argenticoxae


82
83
84
85
marylandia
fragariae
viridula
acrobasidis

Figs. 86-103. Labial palps of Pnigalio spp. and Sympiesis spp. 86. P. proximus. 87. P. metacomet. 88. P. uroplatae. 89. P. maculipes. 90. P. flavipes. 91. S. conica. 92. S. enargiae. 93. S. dolichogaster. 94. S. marylandensis. 95. S. bimaculatipennis. 96. S. stigmata. 97. S. stigmatipennis. 98. S. ancylae. 99. S. argenticoxae. 100. S. marylandia. 101. S. fragariae. 102. S. viridula. 103. S. acrobasidis.


86
proximus
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metacomet
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uroplatae
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maculipes
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flavipes
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conica
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enargiae
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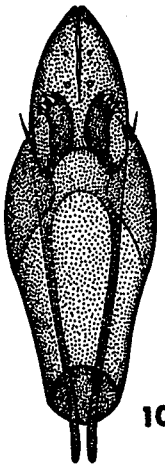
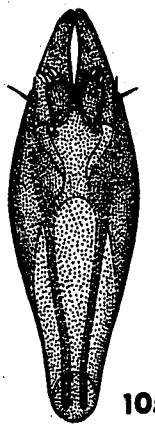
dolichogaster
94
marylandensis
95
bimaculatipennis
96
stigmata
97
stigmatipennis
98
ancylae
99
argenticoxae
100
marylandia
101
fragariae
102
viridula
103
acrobasidis

Figs. 104-112. Ventral aspect of male genitalia of Pnigalio spp. and Sympiesis spp. 104. P. proximus. 105. P. metacomet. 106. P. uroplatae. 107. P. maculipes. 108. P. flavipes. 109. S. conica. 110. S. enargiae. 111. S. dolichogaster. 112. S. marylandensis.



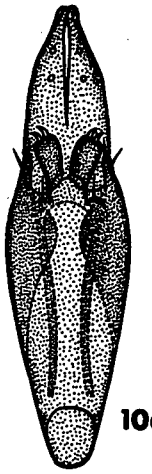
104

proximus



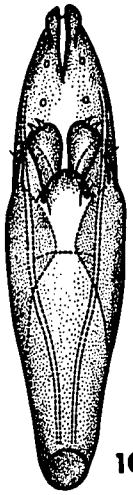
105

metacomet



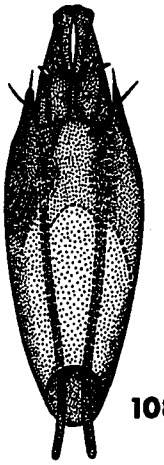
106

uroplatae



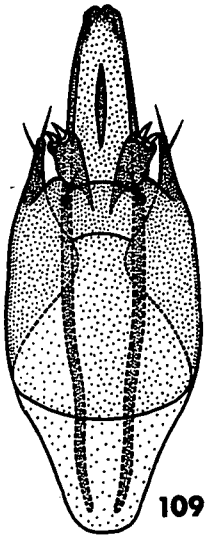
107

maculipes



108

flavipes

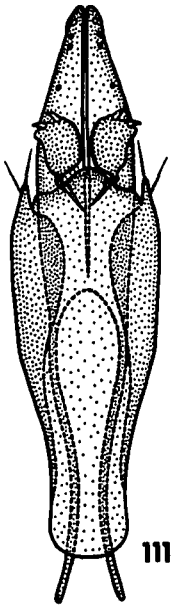


109

conica

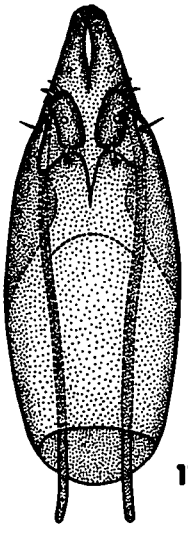
110

enargiae



111

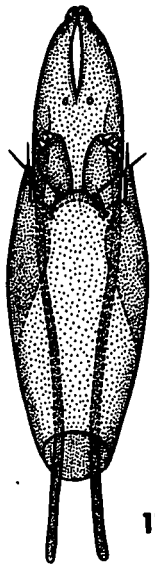
dolichogaster



112

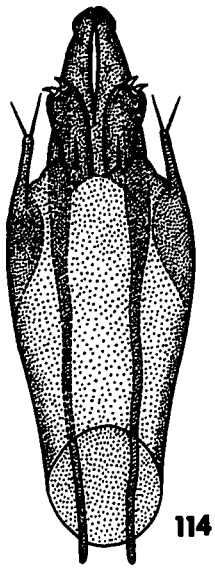
marylandensis

Figs. 113-121. Ventral aspect of male genitalia of *Sympiesis* spp. 113. *S. bimaculatipennis*. 114. *S. stigmata*. 115. *S. stigmatipennis*. 116. *S. ancylae*. 117. *S. marylandia*. 118. *S. argenticoxae*. 119. *S. fragariae*. 120. *S. viridula*. 121. *S. acrobasidis*.



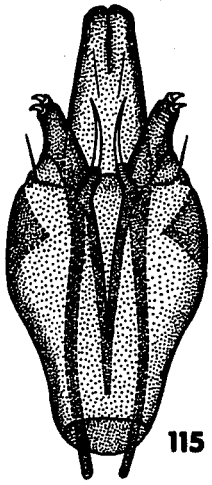
113

bimaculatipennis



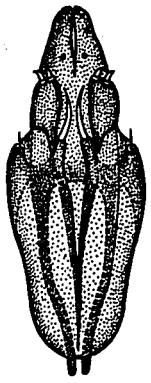
114

stigmata



115

stigmatipennis

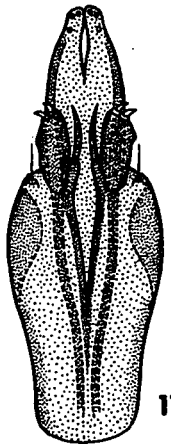


116

ancylae

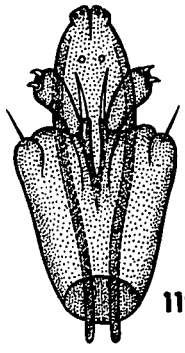
117

marylandia



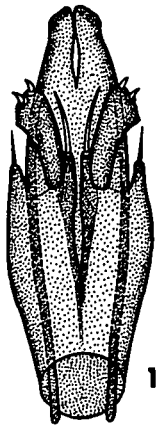
118

argenticoxae



119

fragariae



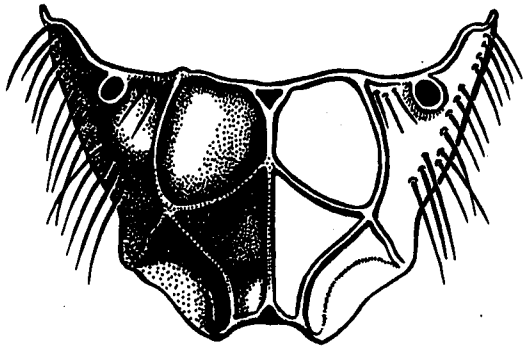
120

viridula

121

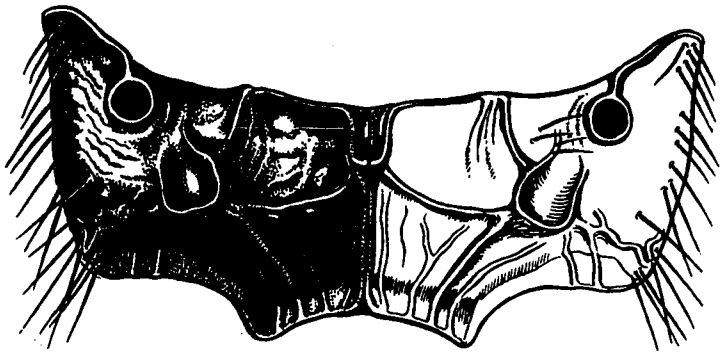
acrobasidis

Figs. 122-125. Dorsal aspect of propodia of Pnigalio spp. 122. P. proximus. 123. P. metacomet. 124. P. uroplatae. 125. P. maculipes.



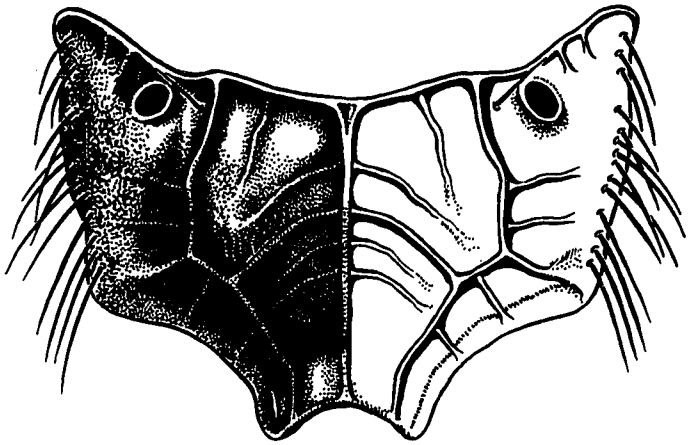
122

proximus



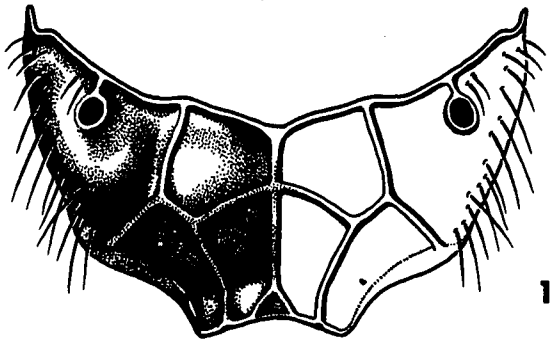
123

metacomet



124

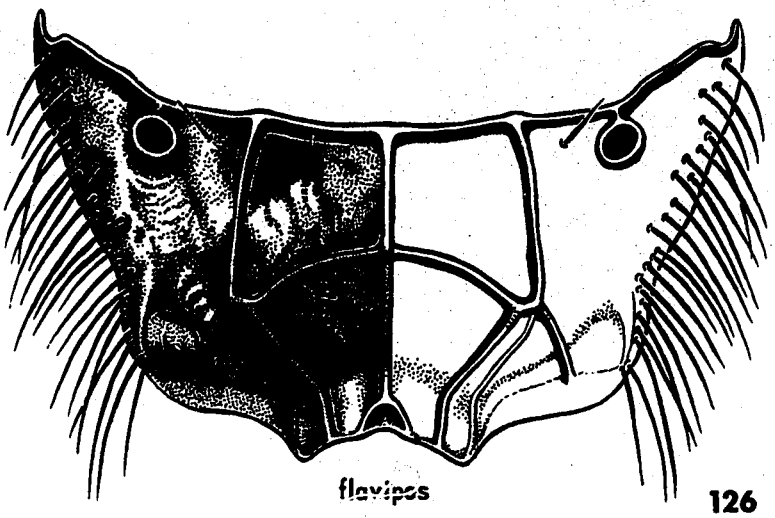
uroplatae



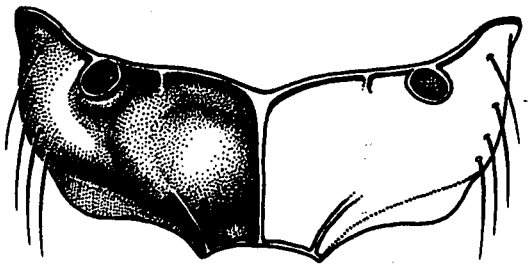
125

maculipes

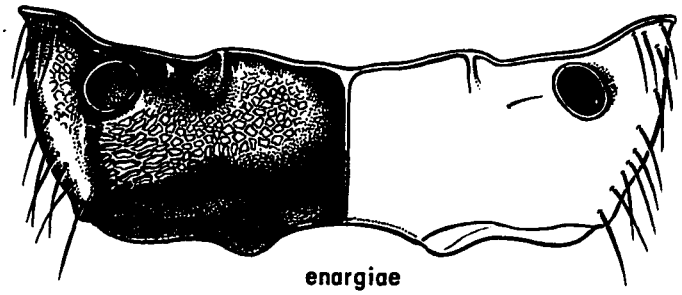
Figs. 126-129. Dorsal aspect of propodia of Pnigalio sp. and Sympiesis spp. 126. P. flavipes. 127. S. conica. 128. S. enargiae. 129. S. dolichogaster.



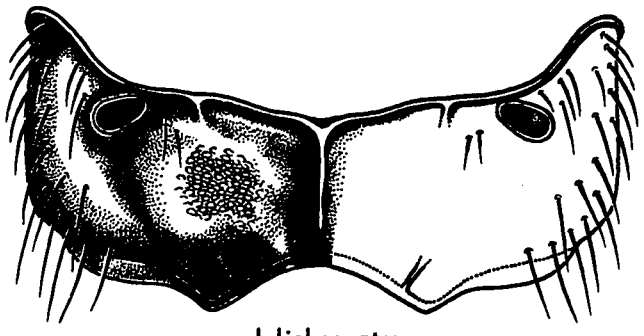
flavipes 126



conica 127

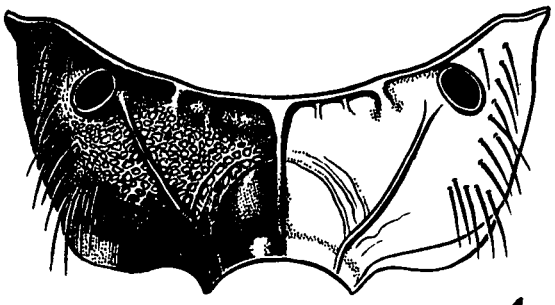


enargiae 128



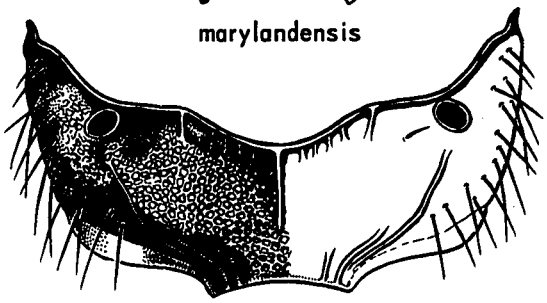
dolichogaster 129

Figs. 130-134. Dorsal aspect of propodia of *Sympiesis* spp.
130. *S. marylandensis*. 131. *S. bimaculatipennis*. 132. *S. stigmata*.
133. *S. stigmatipennis*. 134. *S. ancylae*.



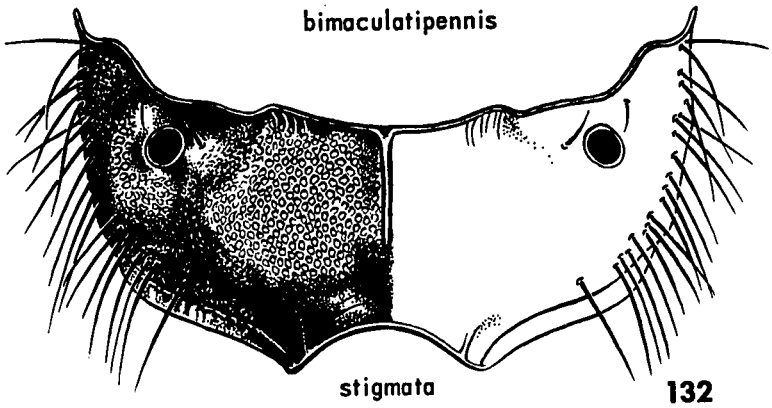
130

marylandensis



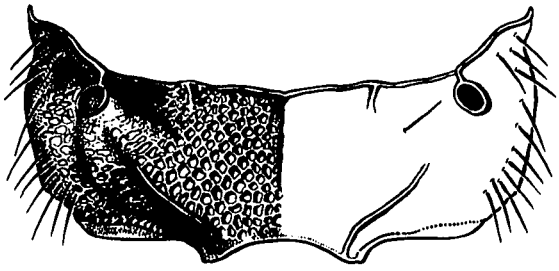
131

bimaculatipennis



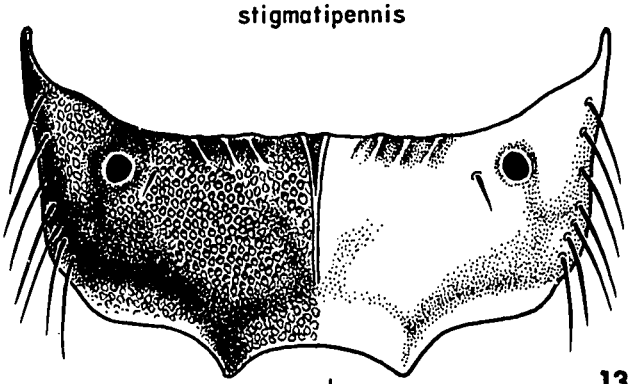
stigmata

132



133

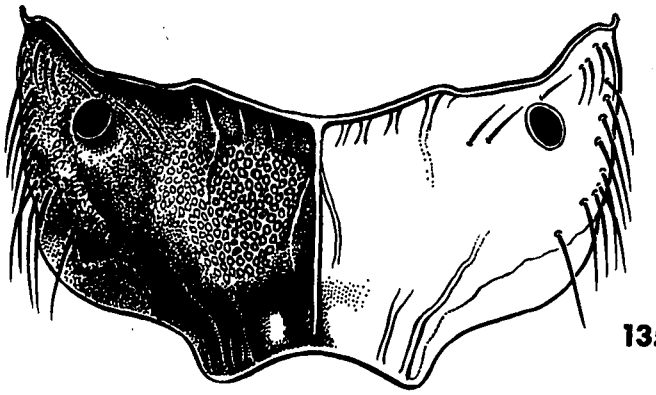
stigmatipennis



ancylae

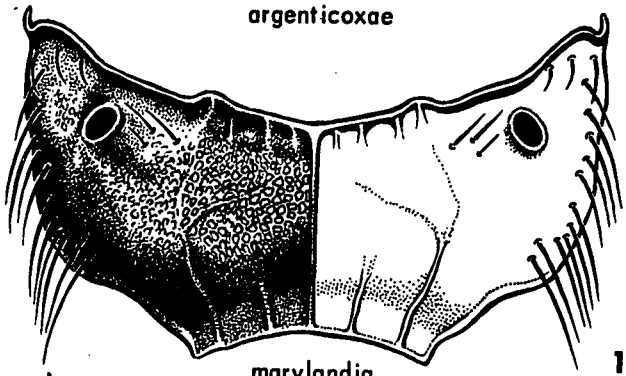
134

Figs. 135-139. Dorsal aspect of propodia of *Sympiesis* spp.
135. *S. marylandia*. 136. *S. argenticoxae*. 137. *S. fragariae*.
138. *S. viridula*. 139. *S. acrobasidis*.



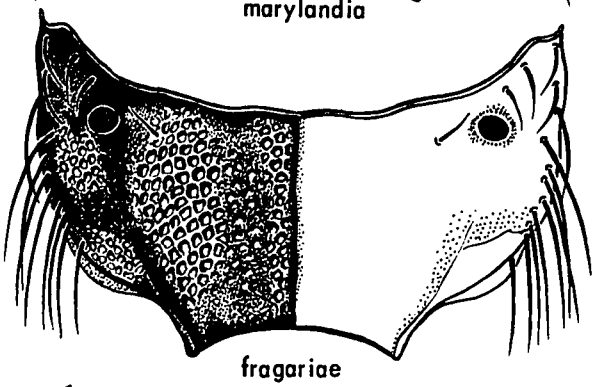
argenticoxae

135



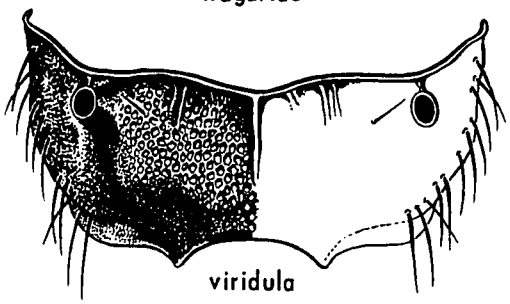
marylandia

136



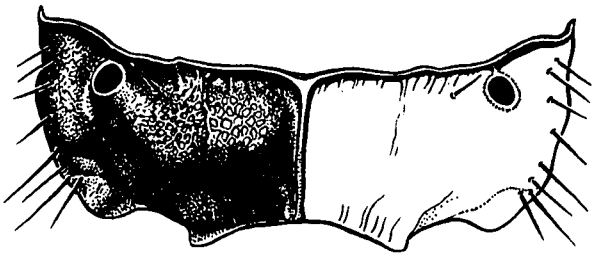
fragariae

137



viridula

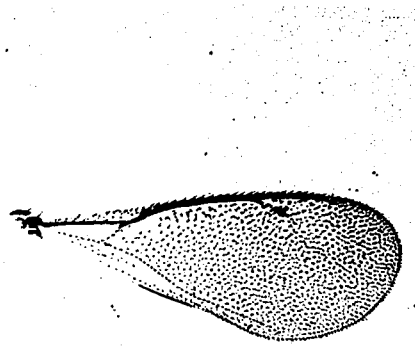
138



acrobasidis

139

Figs. 140-145. Fore wing, hind wing and stigmal sensillae of fore wing of Pnigalio proximus (Ashmead). 140-142. Female. 143-145. Male.



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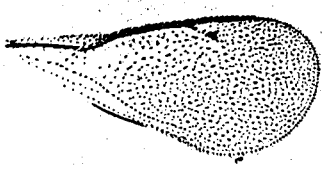
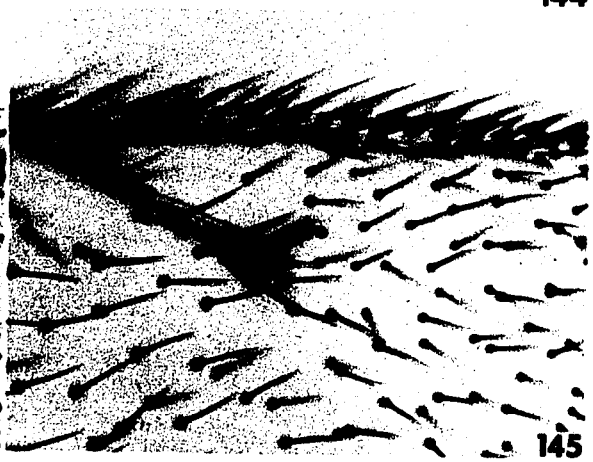


143

141

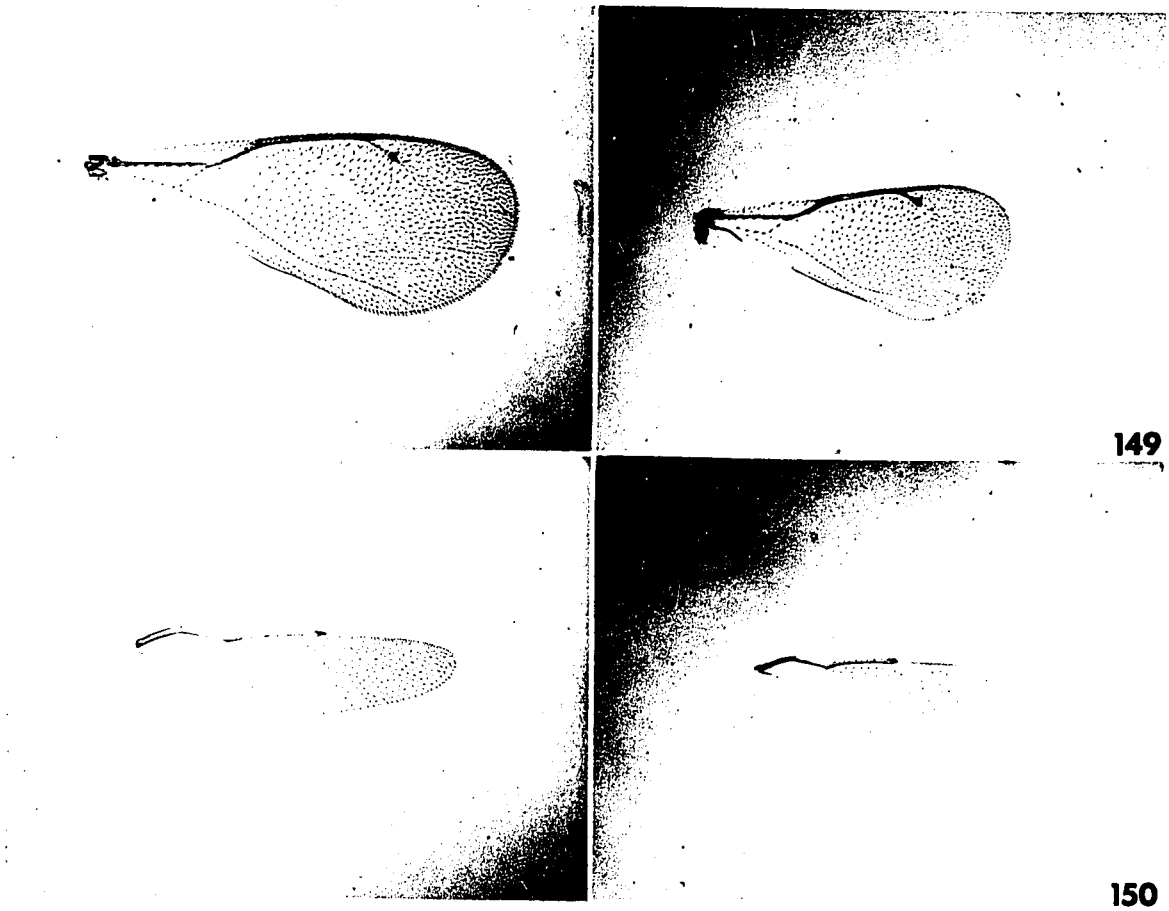
144

142



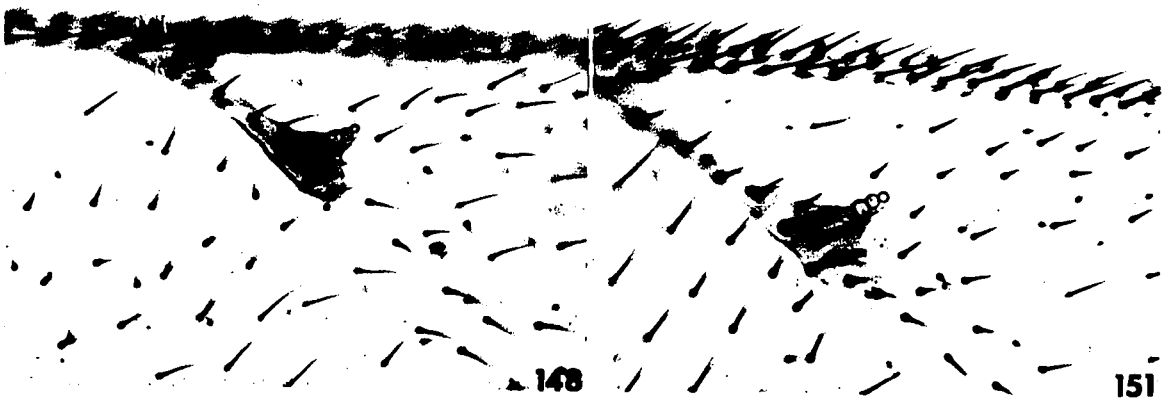
145

Figs. 146-151. Fore wing, hind wing and stigmal sensillae of fore wing of Paimalio melanogaster (Crawford). 146-148. Female. 149-151. Male.



149

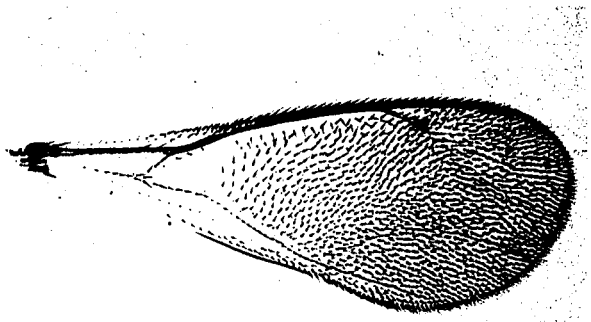
150



148

151

Figs. 152-157. Fore wing, hind wing and stigmal sensillae of fore wing of Pnigalio uroplatae (Howard). 152-154. Female. 155-157. Male.



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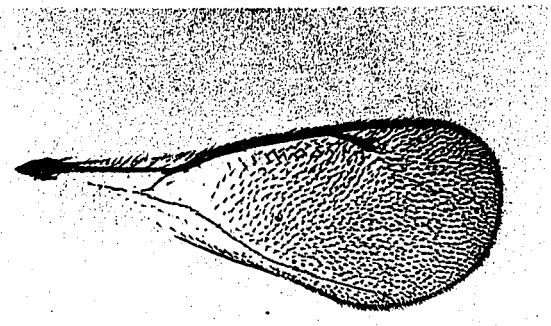

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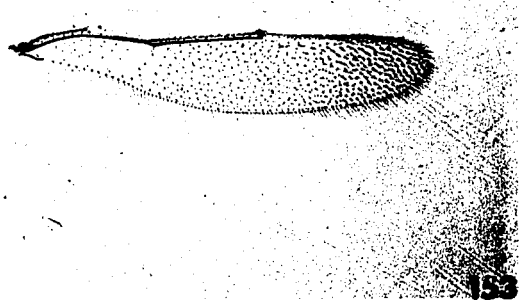

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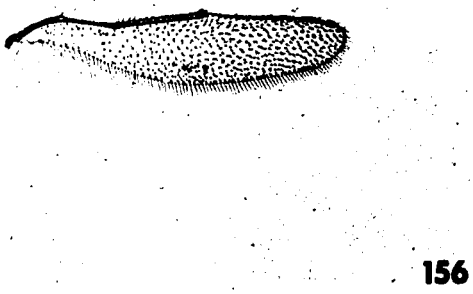

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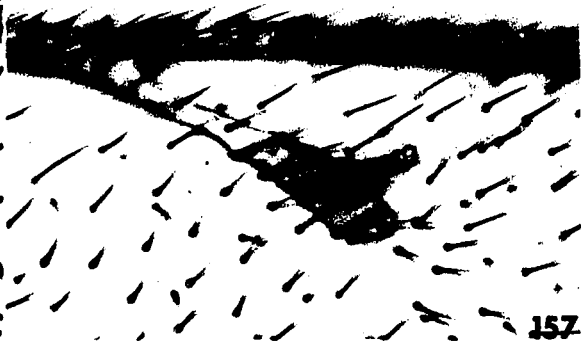
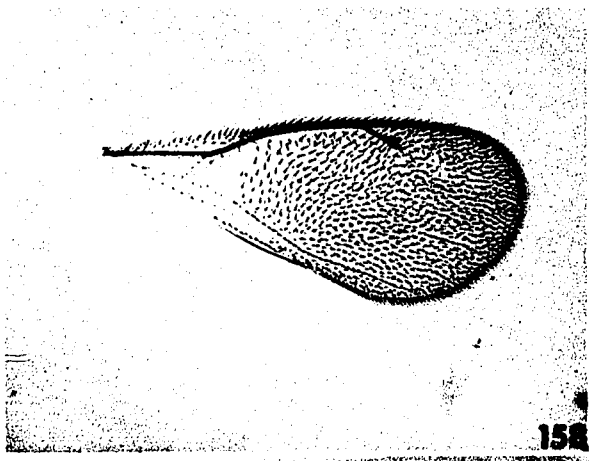
154



157

Figs. 158-163. Fore wing, hind wing and stigmal sensillae of fore wing of Pnigalio maculipes (Crawford). 158-160. Female. 161-163. Male.



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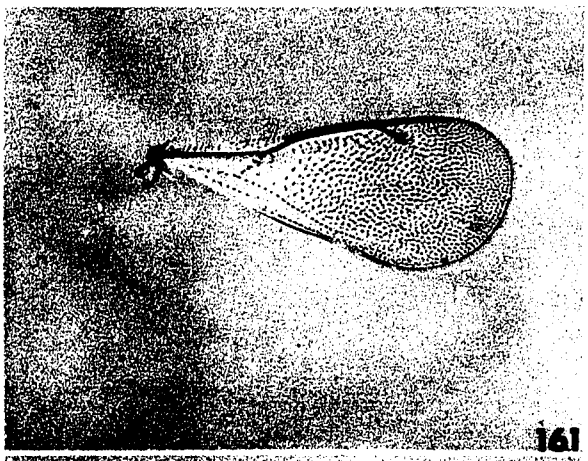

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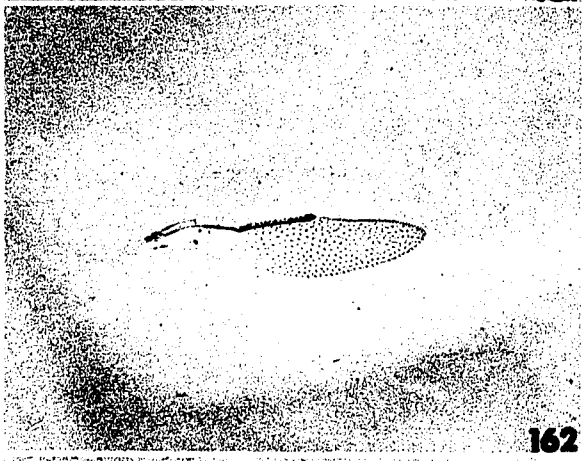

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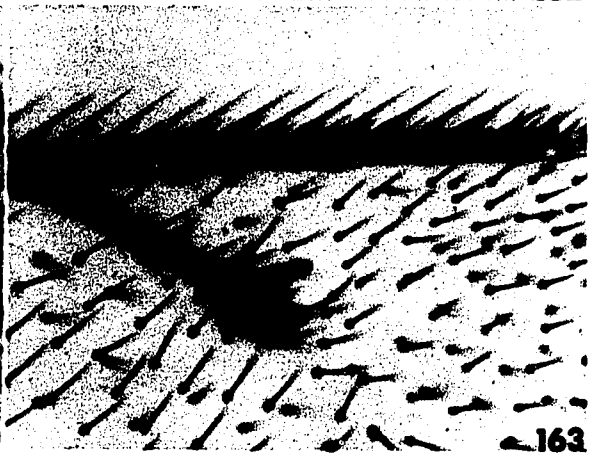

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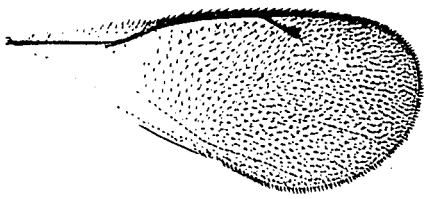

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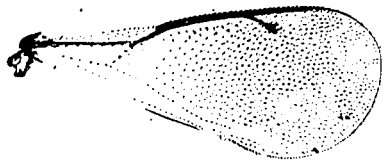

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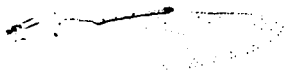
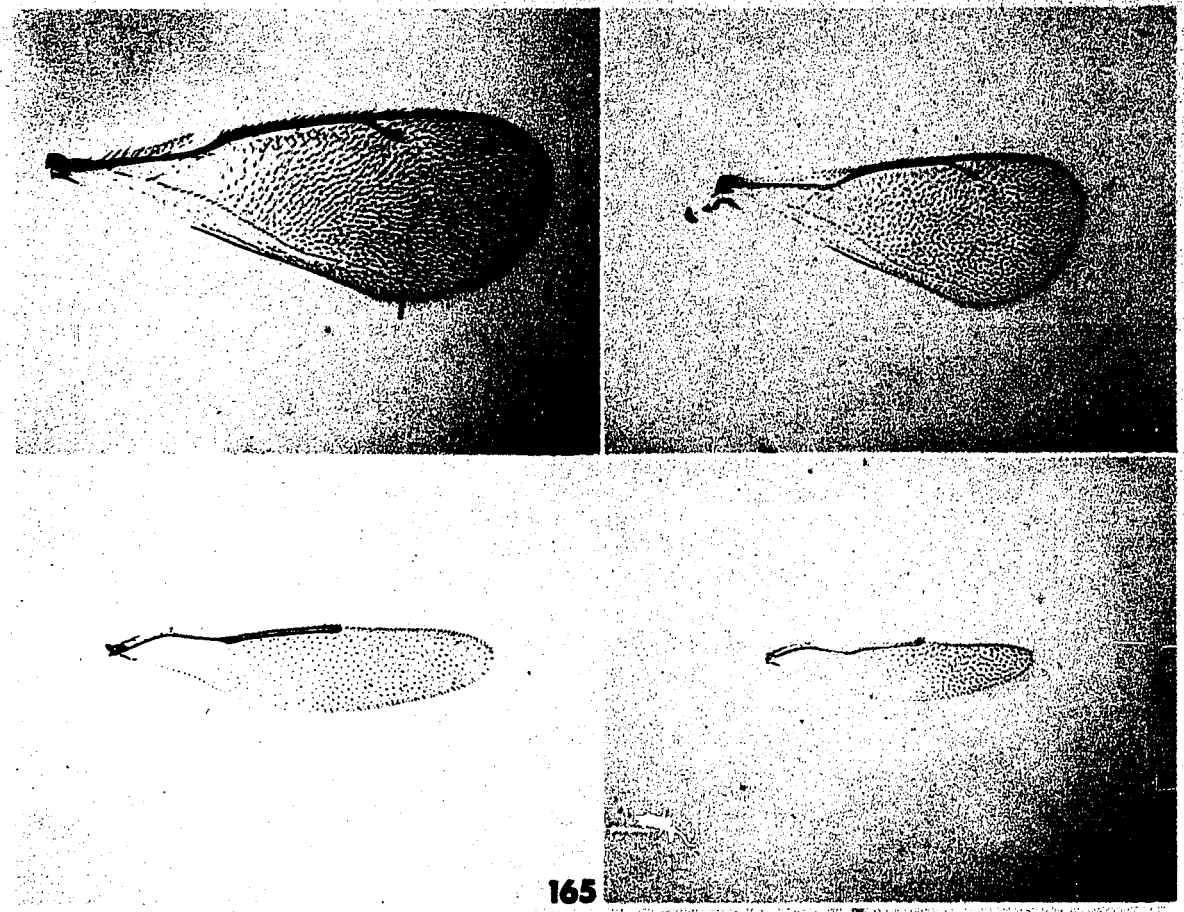


162

160

163

Figs. 164-169. Fore wing, hind wing and stigmal sensillae of fore wing of Pnigalio flavipes (Ashmead). 164-166. Female. 167-169. Male.



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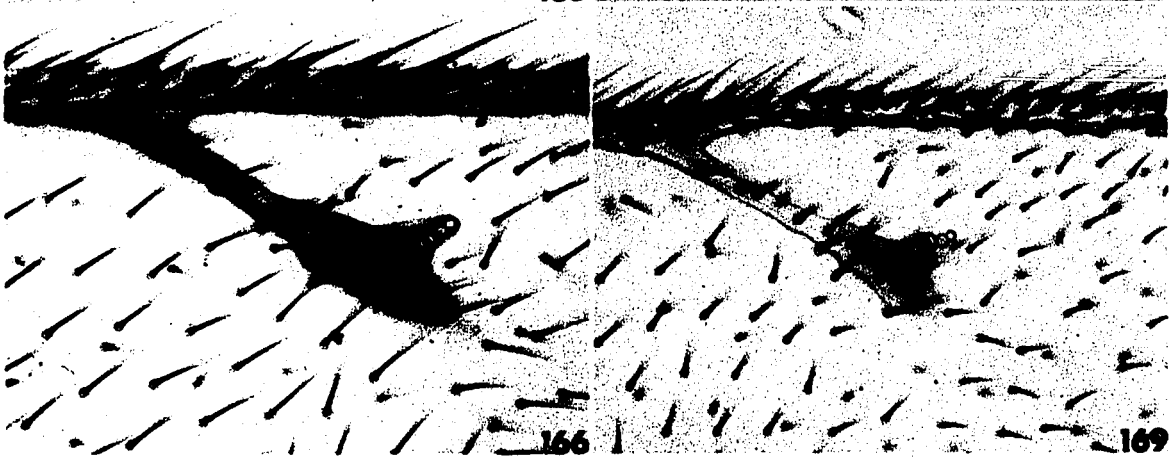
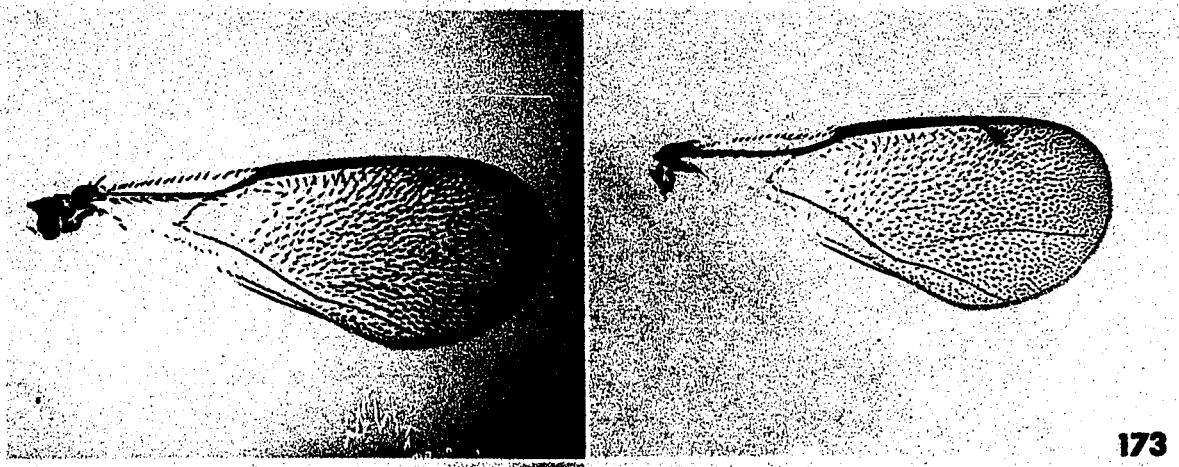


166

169

Figs. 170-175. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis conica (Provancher). 170-172. Female. 173-175. Male.



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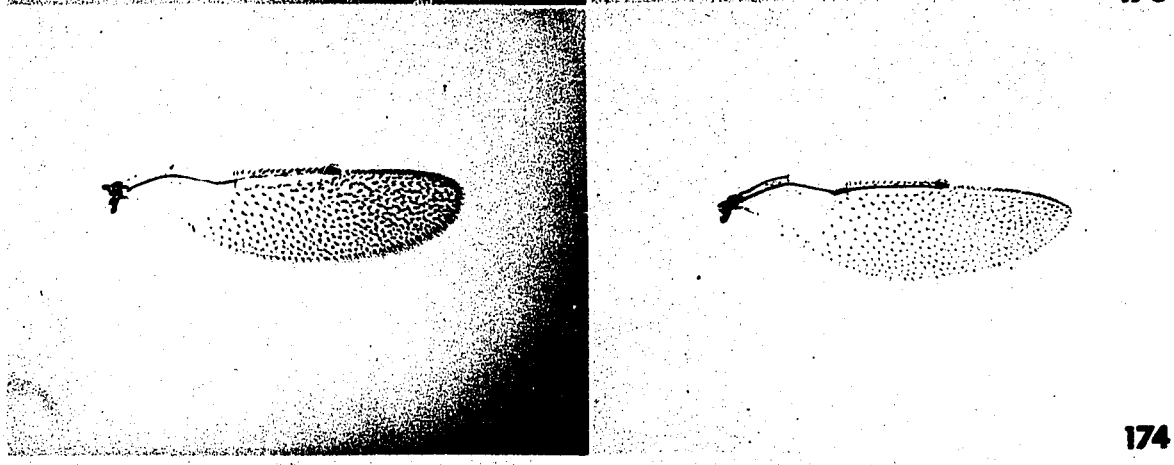

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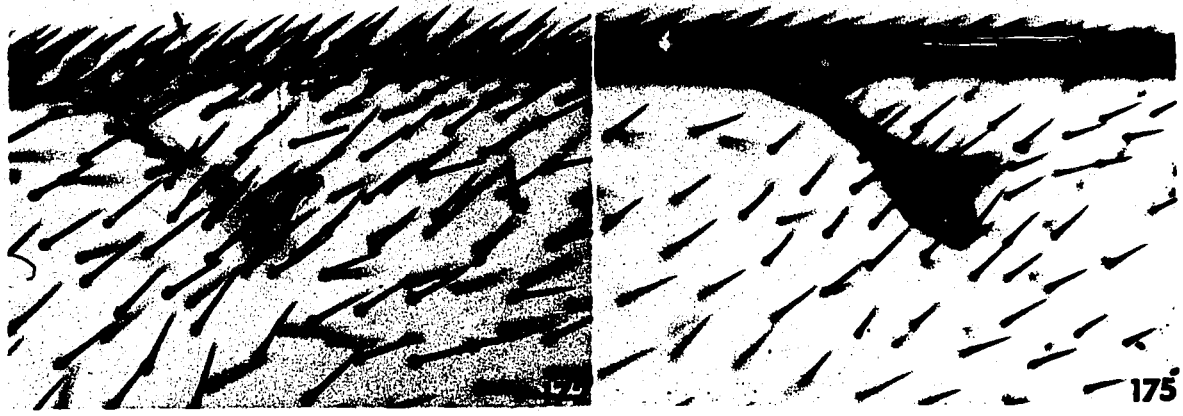

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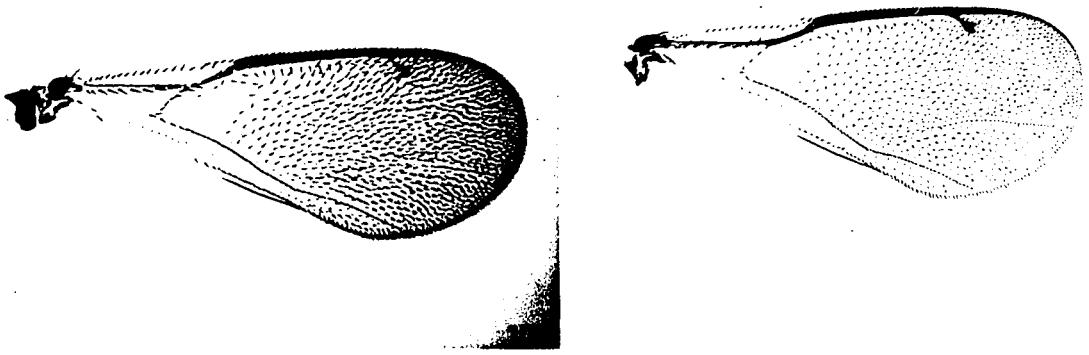

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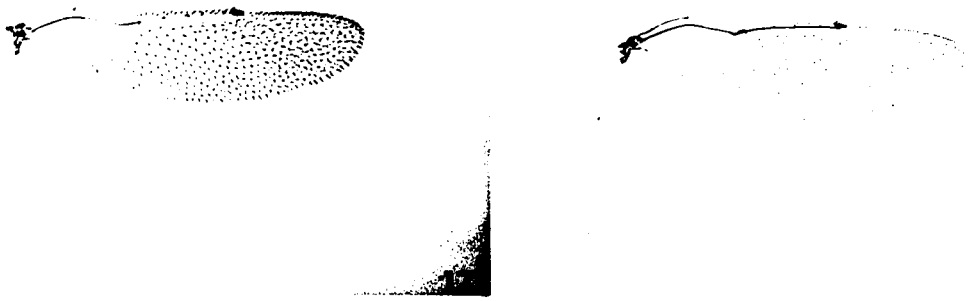

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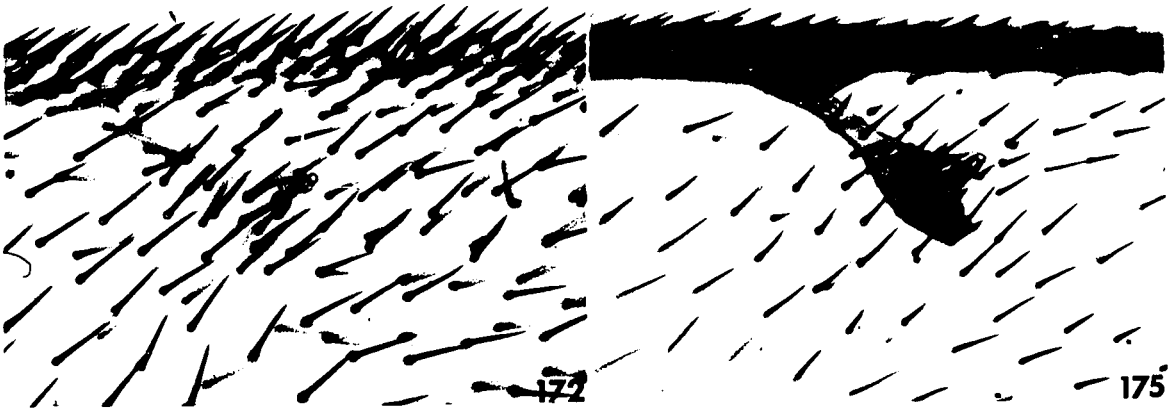
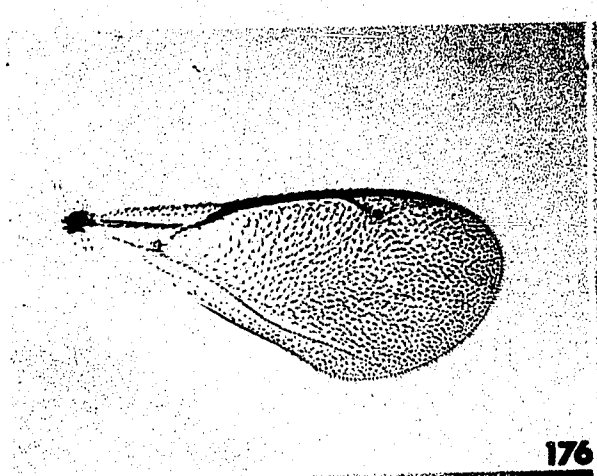


172

175

Figs. 176-181. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis enargiae Miller. 176-178. Female. 179-181. Male.



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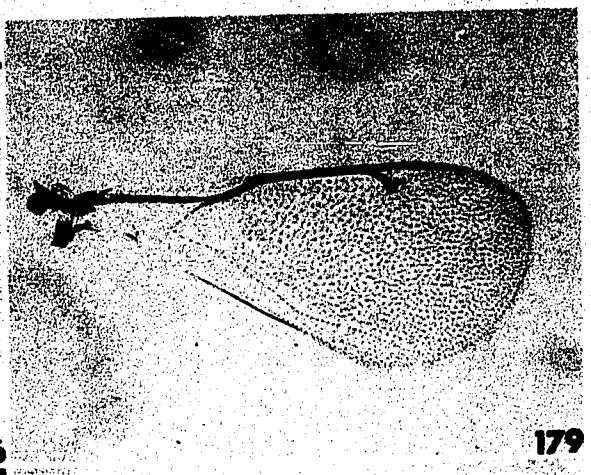

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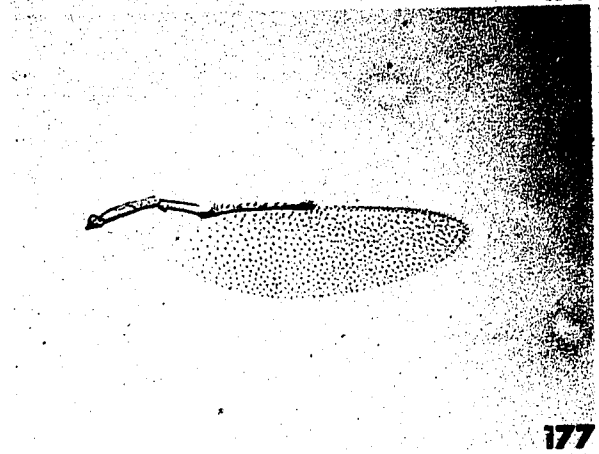

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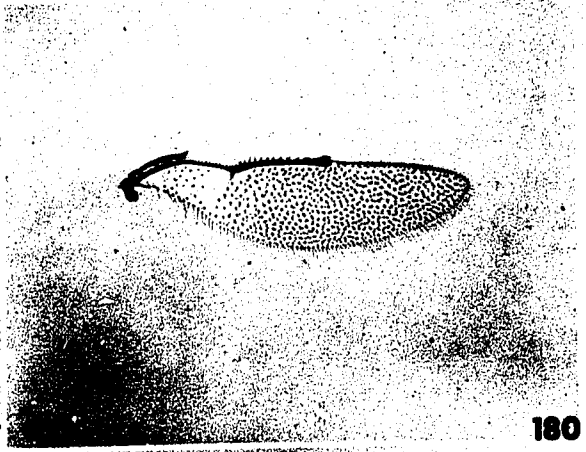

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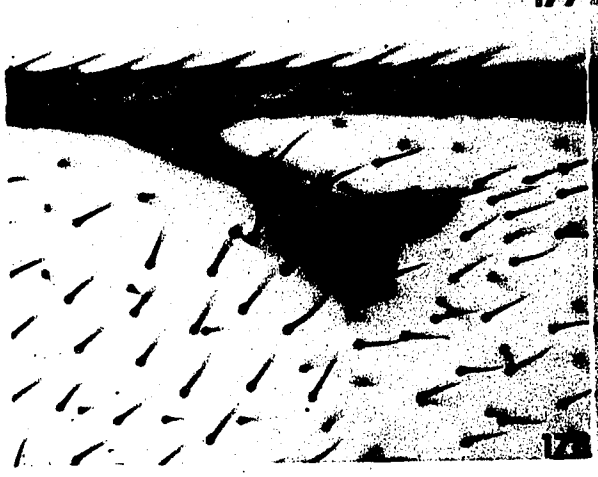

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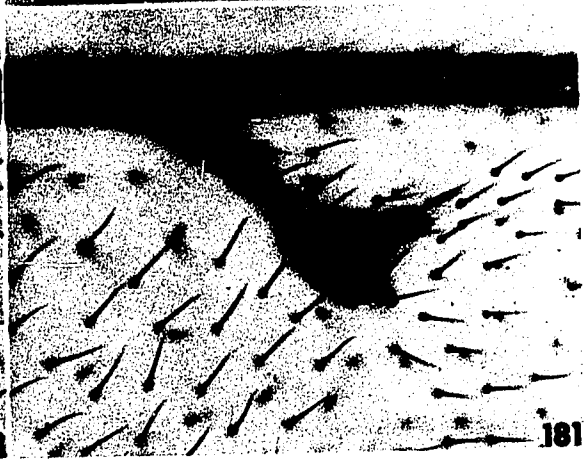

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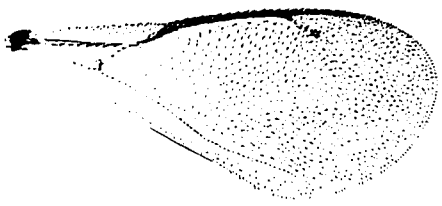

176

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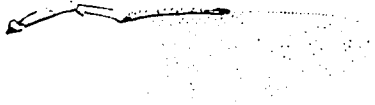

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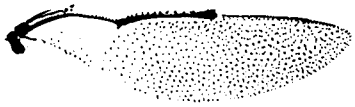

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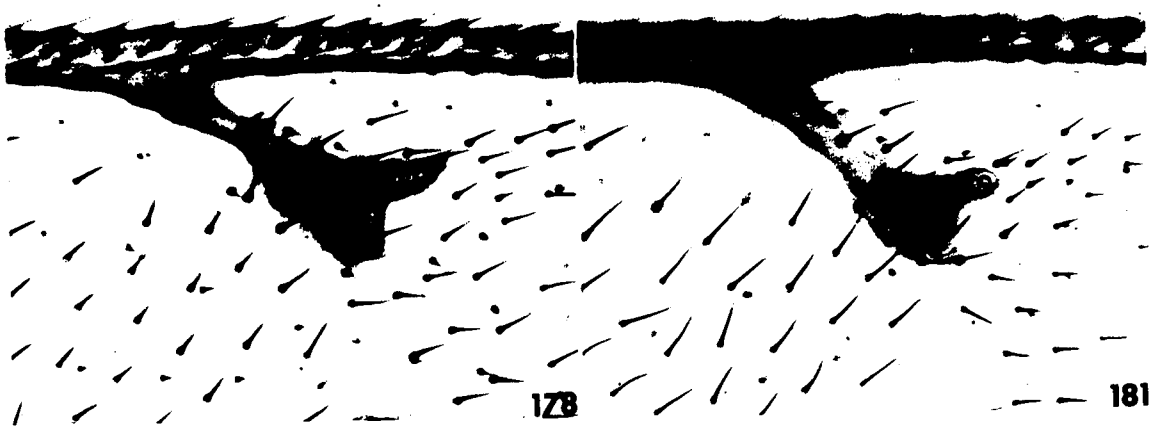
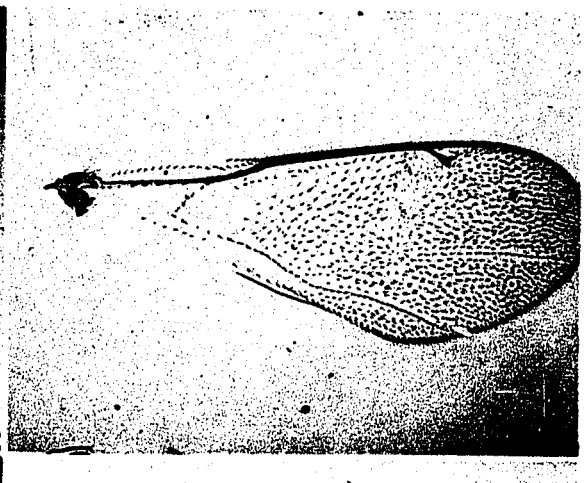


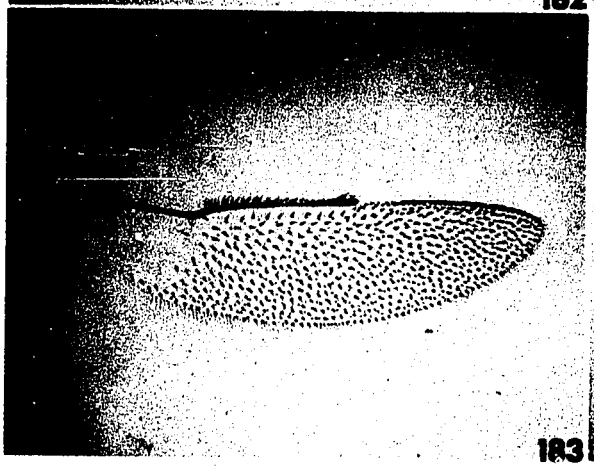
178

181

Figs. 182-187. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis dolichogaster Ashmead. 182-184. Female. 185-187. Male.

182





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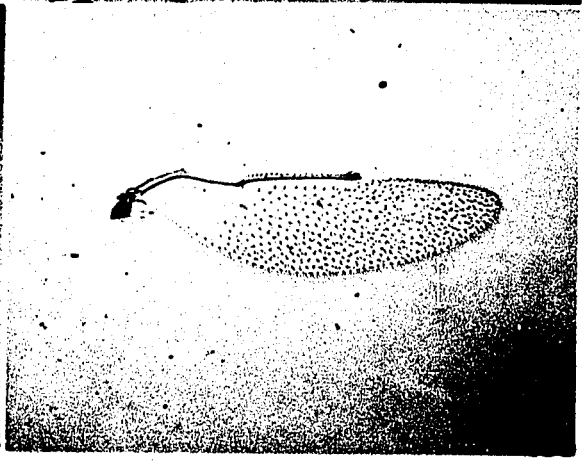

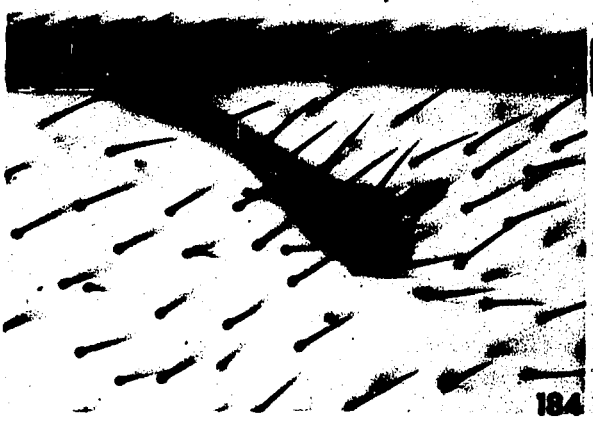

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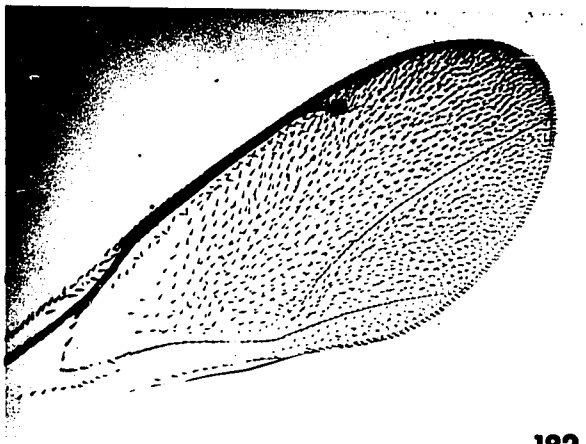

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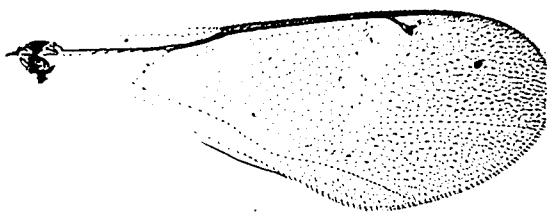

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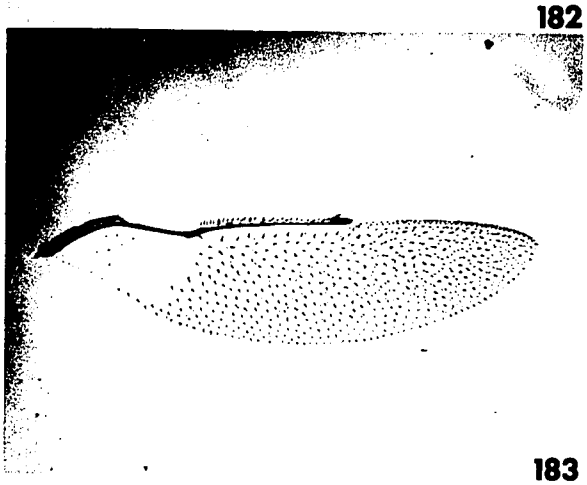

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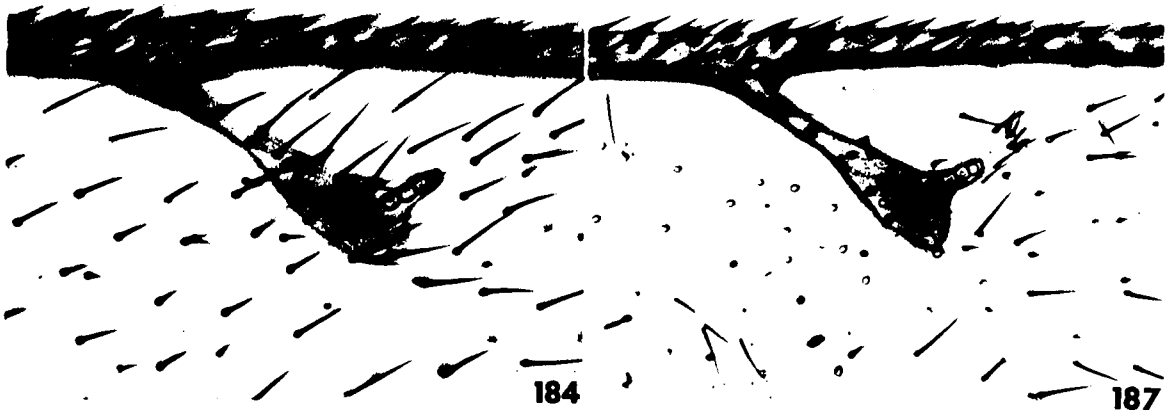

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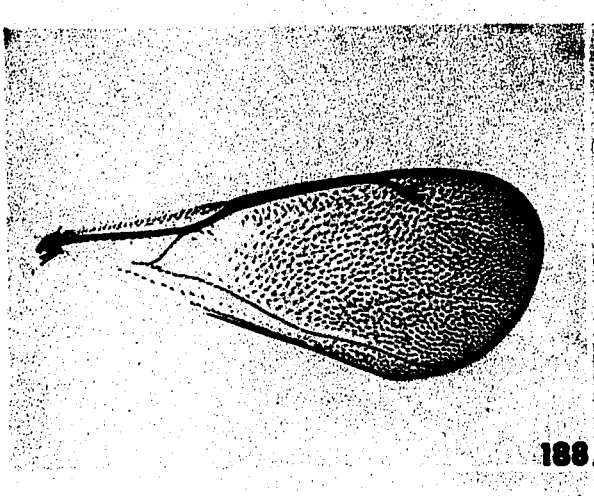
Figs. 188-193. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis marylandensis Girault. 188-190. Female. 191-193. Male.



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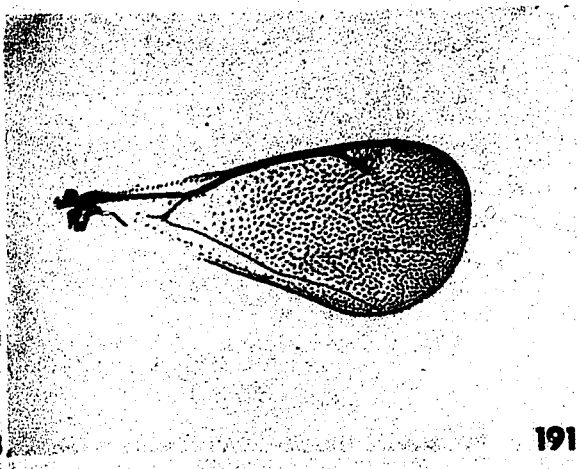

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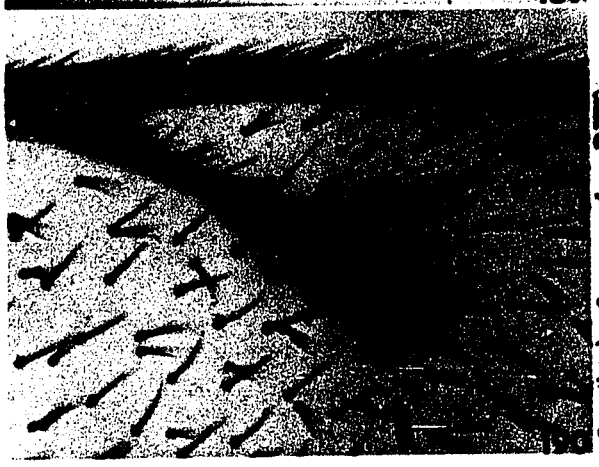

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Figs. 194-199. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis bimaculatipennis (Girault). 194-196. Female. 197-199. Male.

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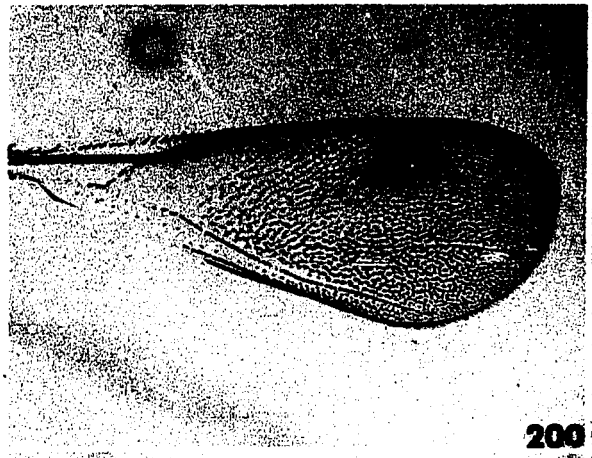
Figs. 200-205. Fore wing, hind wing and stigmal sensillae of hind wing of Sympiesis stigmata Girault. 200-202. Female. 203-205. Male.



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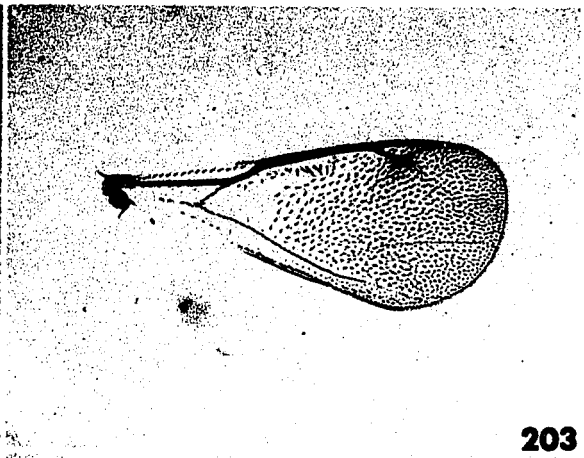

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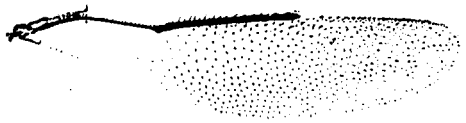

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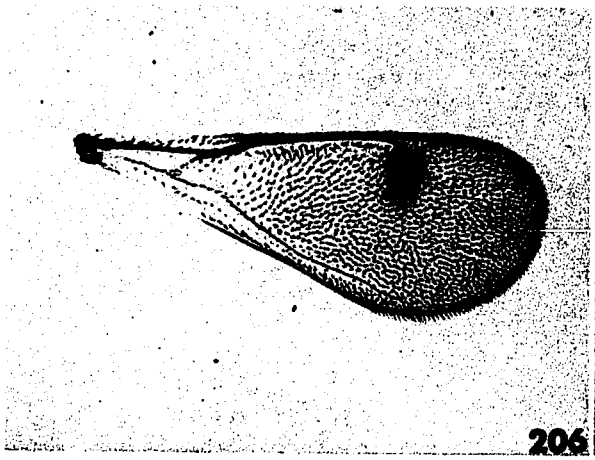
Figs. 206-211. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis stigmatipennis Girault. 206-208. Female. 209-211. Male.



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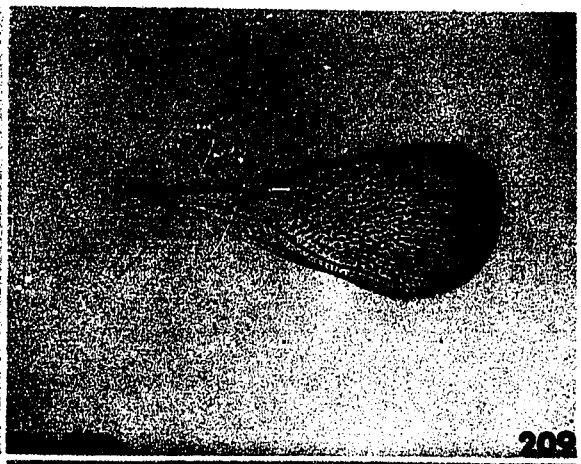

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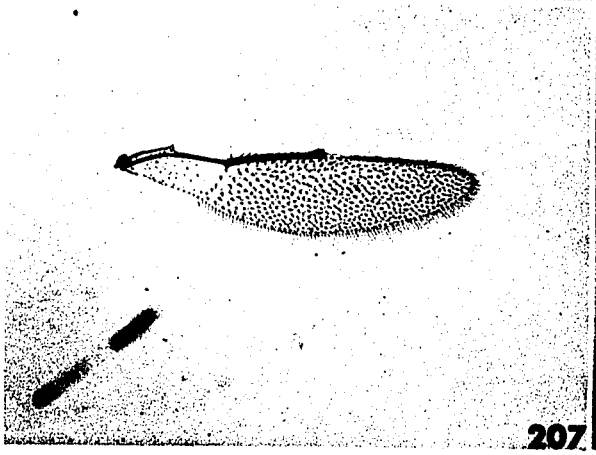

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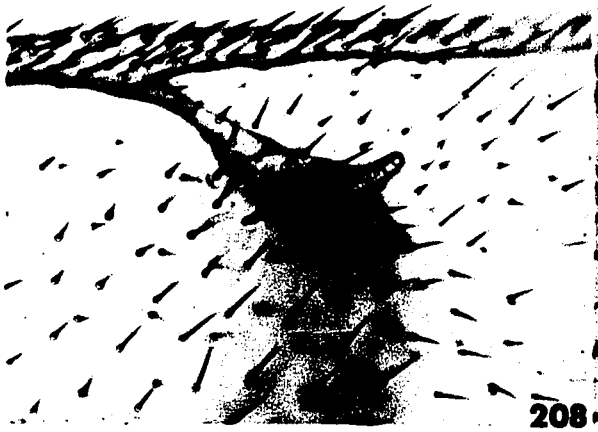

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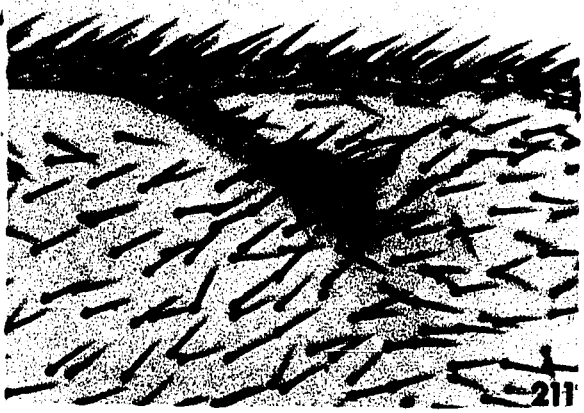

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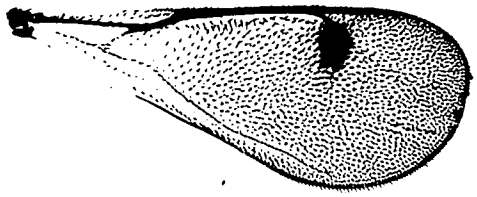

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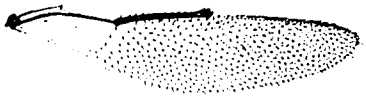

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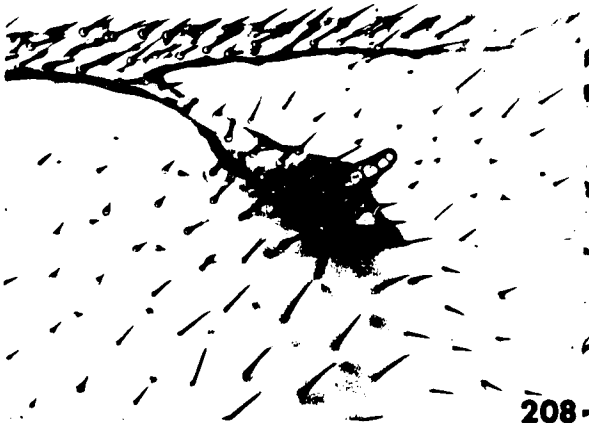

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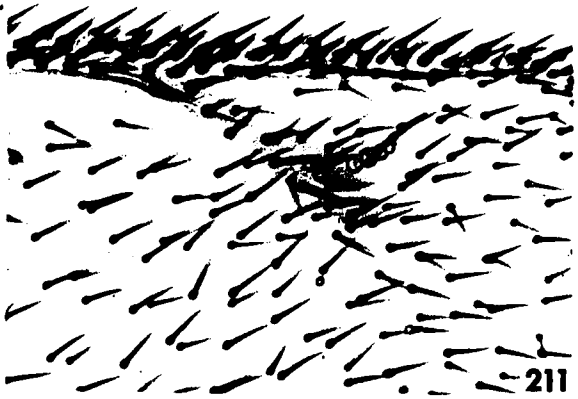

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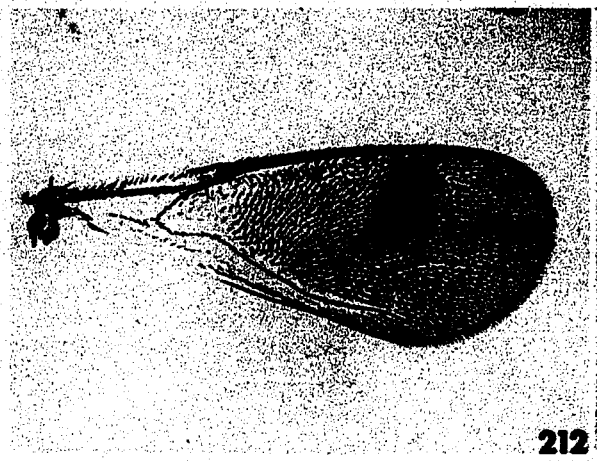
Figs. 212-217. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis ancylae Girault. 212-214. Female. 215-217. Male.



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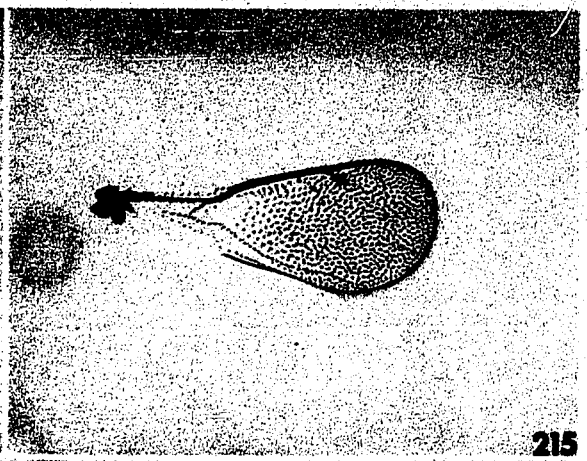

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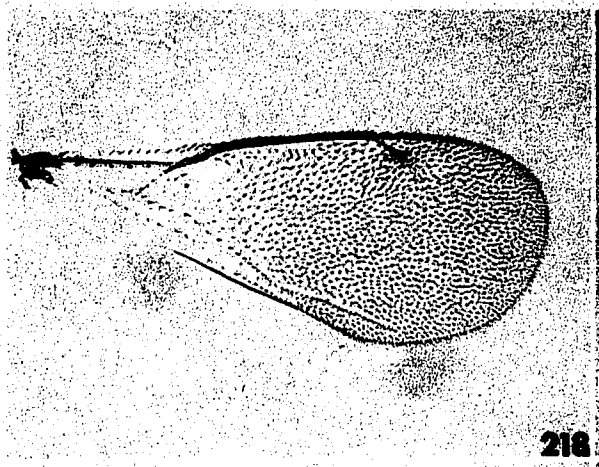
Figs. 218-223. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis argenticoxae Girault. 218-220. Female. 221-223. Male.



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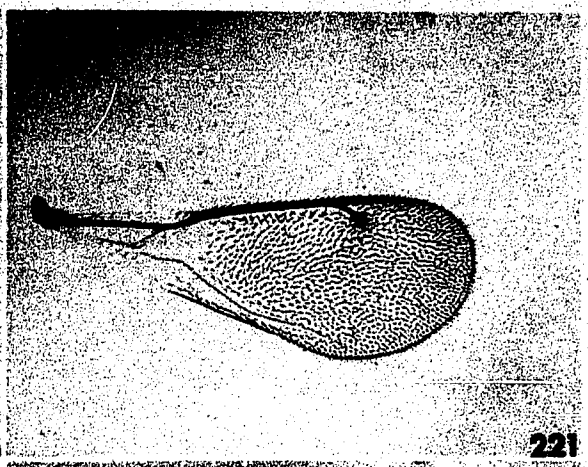

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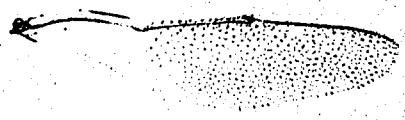

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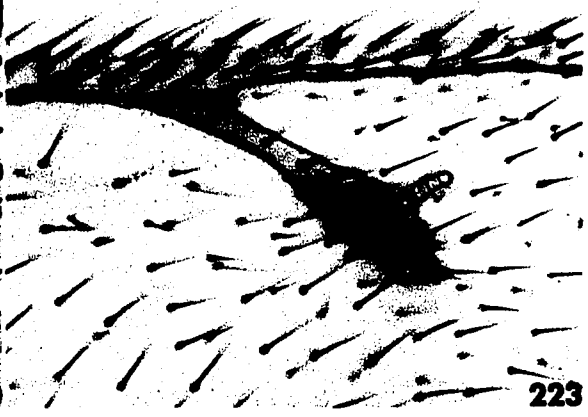

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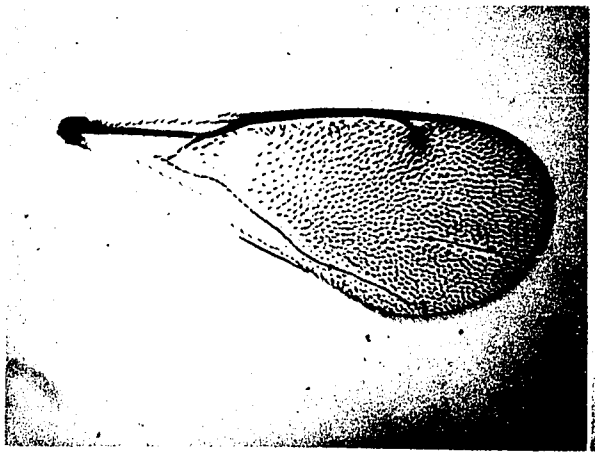
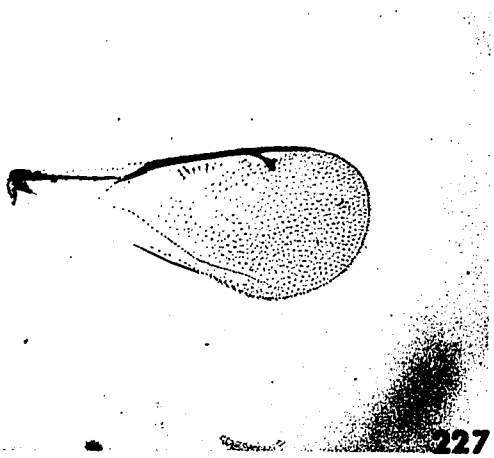
Figs. 224-229. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis marylandia Girault. 224-226. Female. 227-229. Male.





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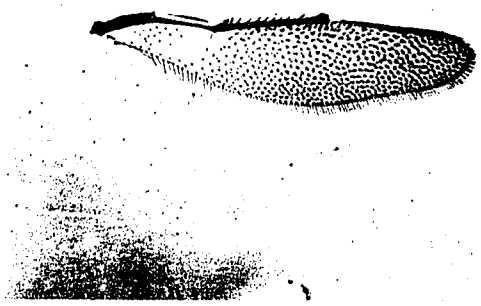

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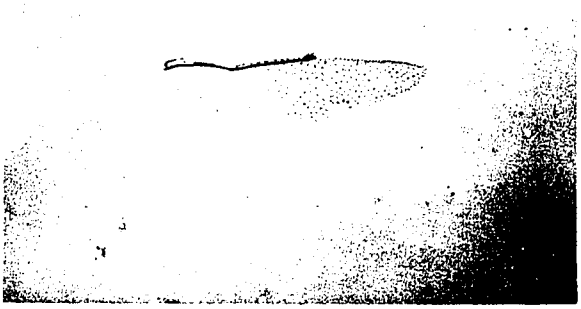

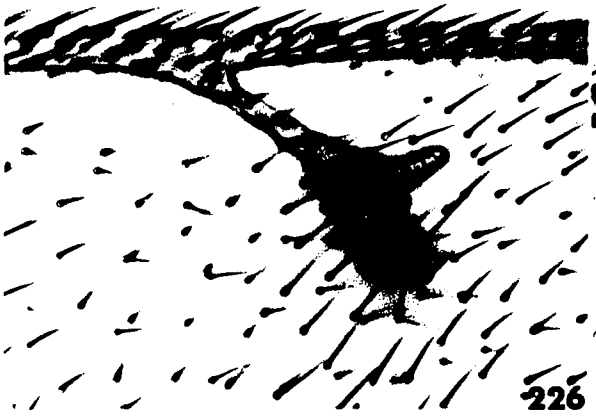

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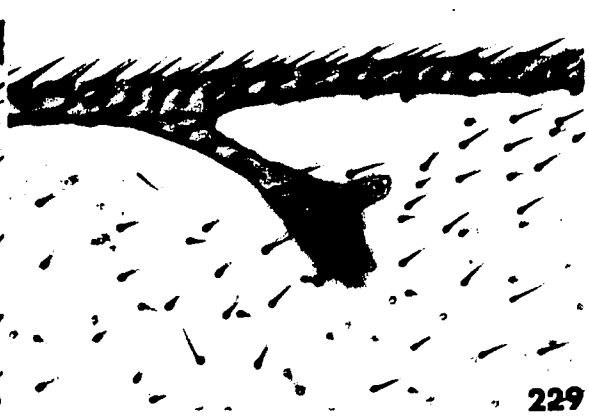

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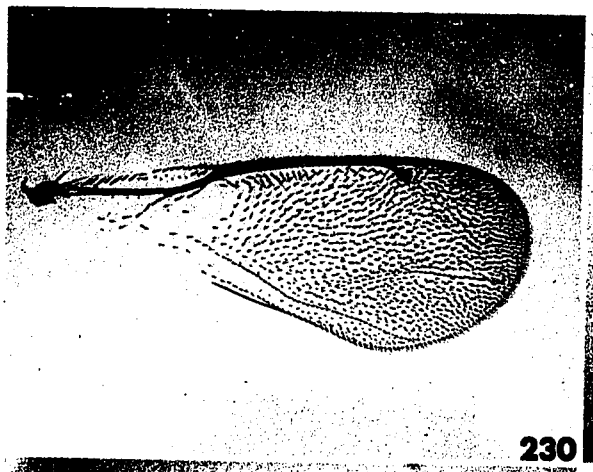
Figs. 230-235. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis fragariae Miller. 230-232. Female. 233-235. Male.



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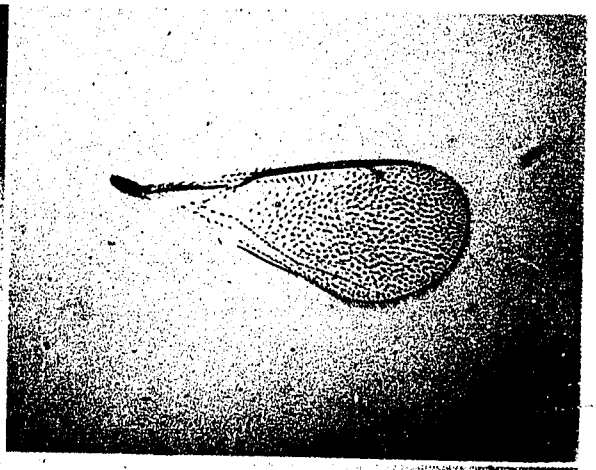

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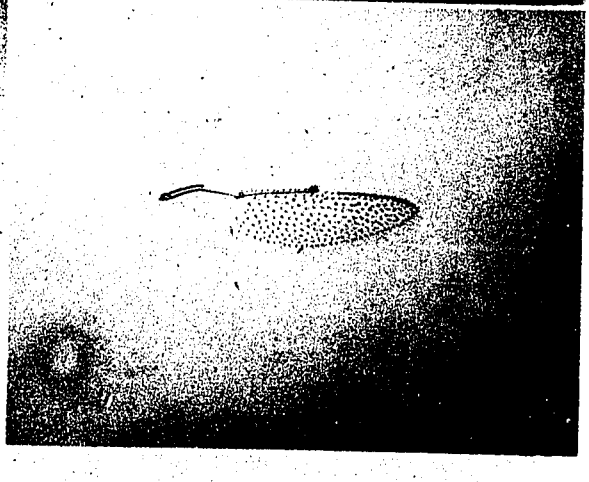

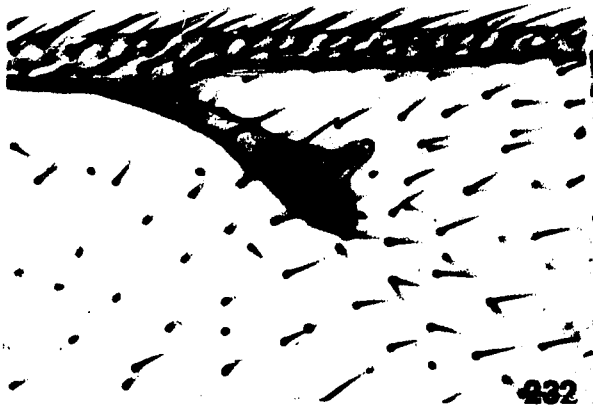

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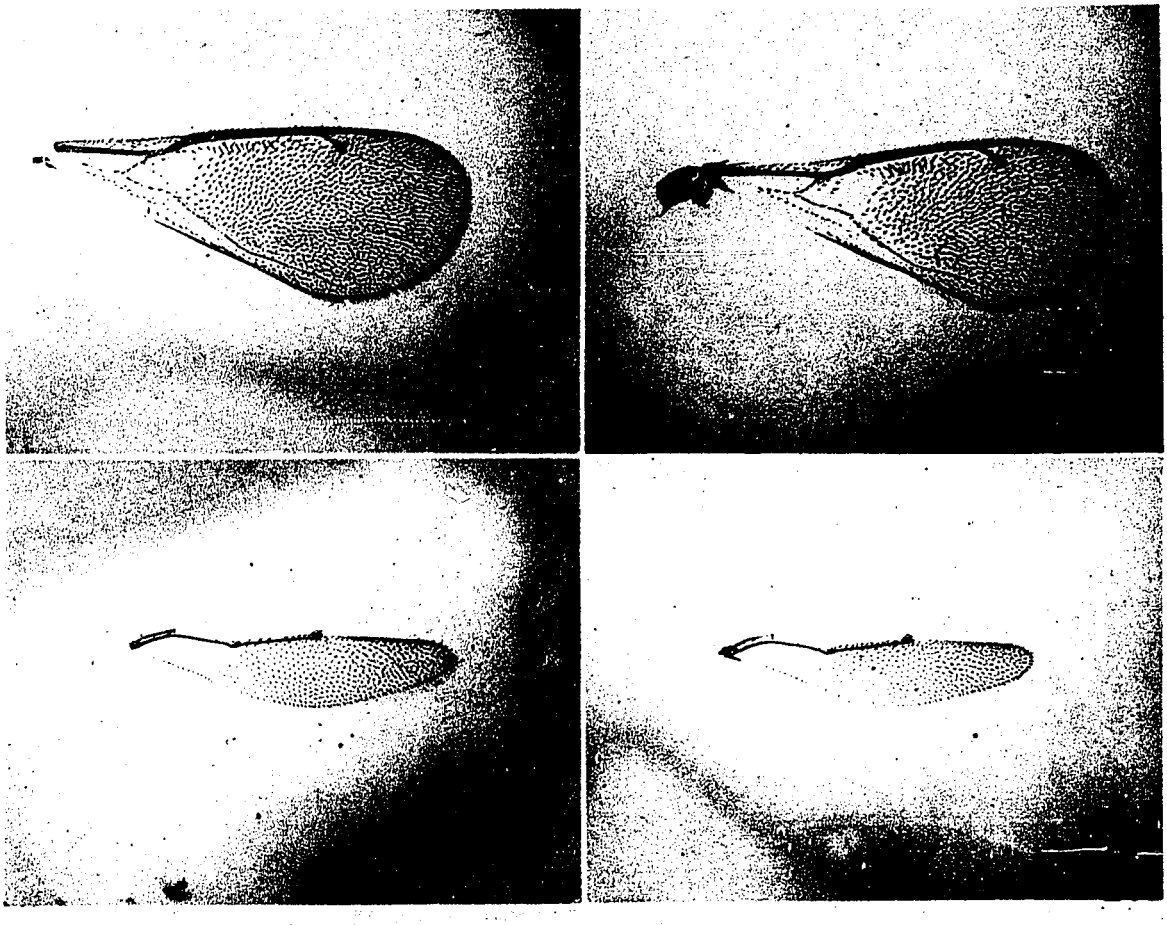
Figs. 236-241. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis viridula (Thomson). 236-238. Female. 239-241. Male.

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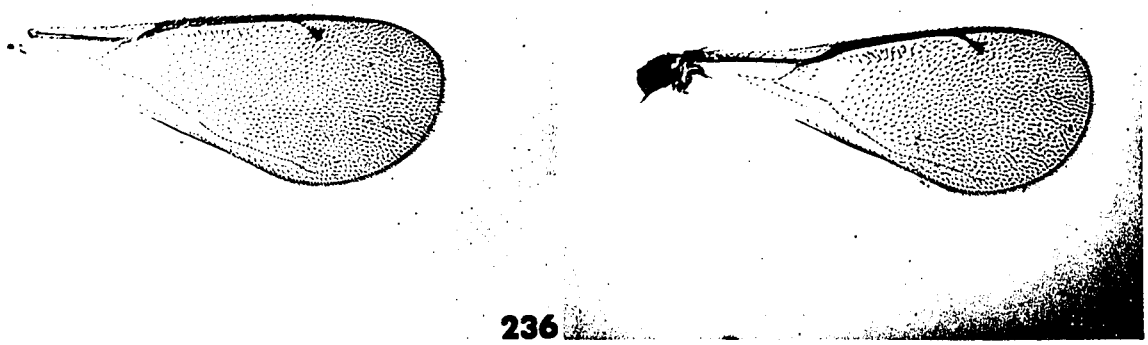

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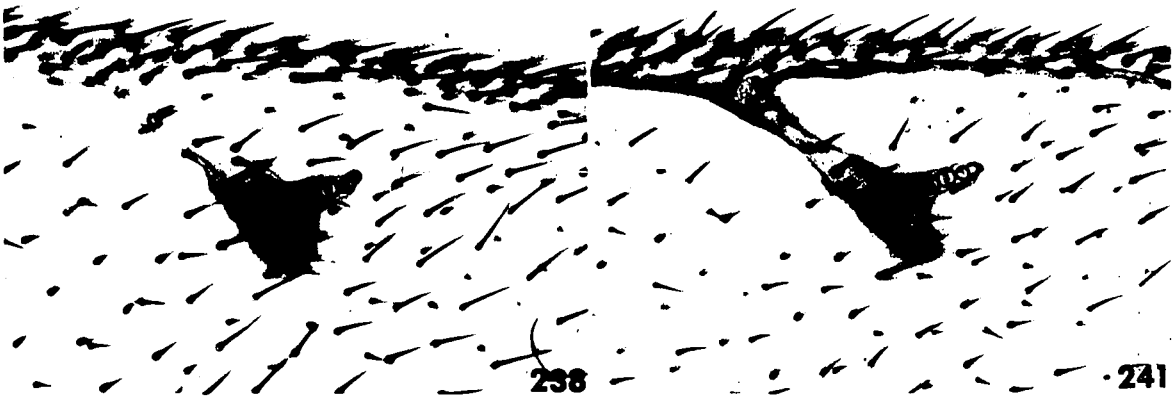

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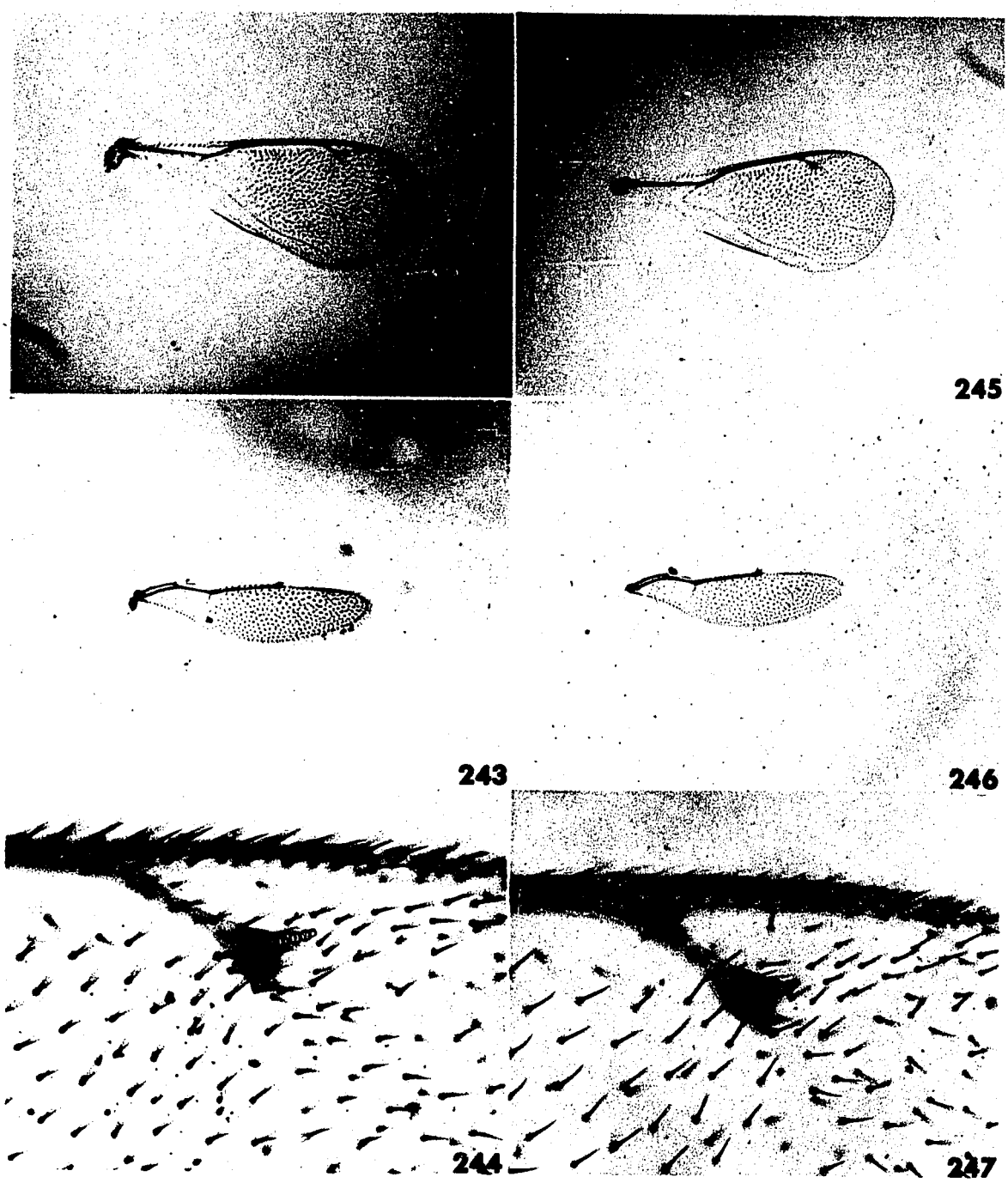
Figs. 242-247. Fore wing, hind wing and stigmal sensillae of fore wing of Sympiesis acrobasidis Miller. 242-244. Female. 245-247. Male.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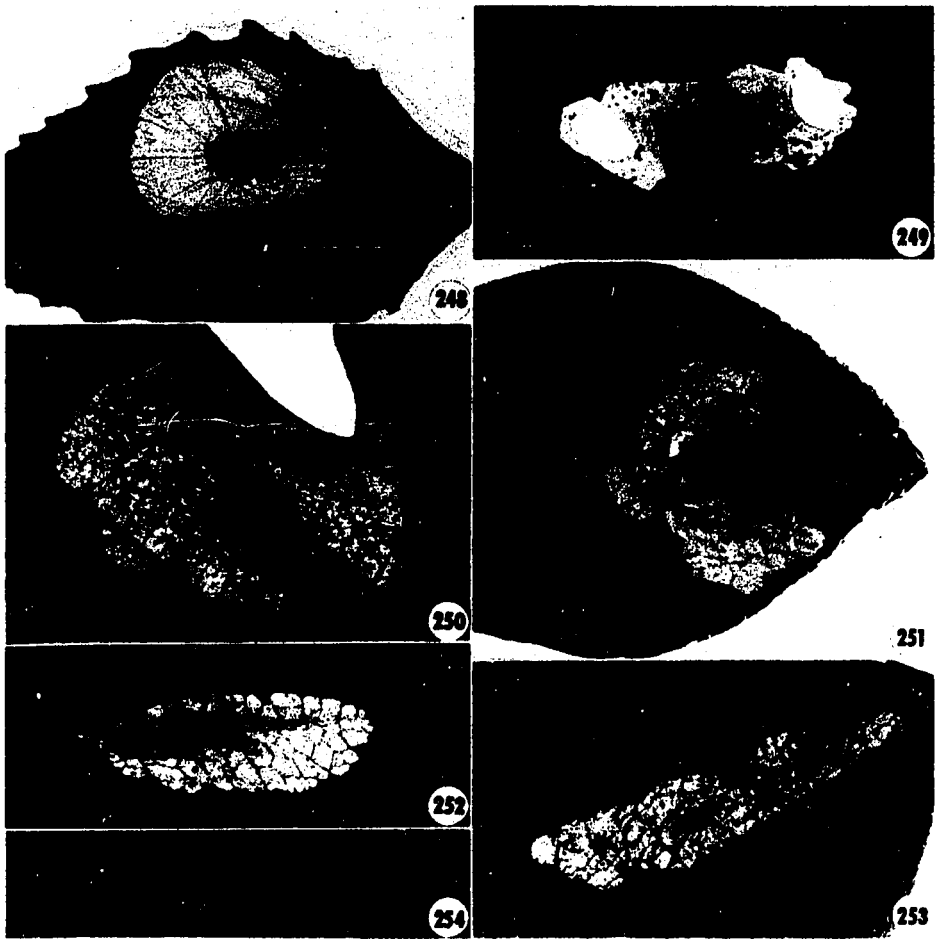
Figs. 248-254. Blotch-like mines made by microlepidopterous insect species in leaves of deciduous plants. 248. Blotch-mine of Chrysopora stipella Dup. on Chenopodium album L. 249. Blotch-mine of Coptodisca sp. on Prunus sp. 250. Blotch-mine of Lithocolletis hamandreyella Clemens on Quercus sp. 251. Blotch-mine of Leucanthiza dircella Braun on Dirca palustris L. 252. Blotch-mine of Lithocolletis malimalifoliella Braun on Malus sp. 253. Blotch-mine of Lithocolletis celtisella Chamb. on Celtis occidentalis L. 254. Blotch-mine of Lithocolletis salicifoliella Clem. on Populus tremuloides Michx.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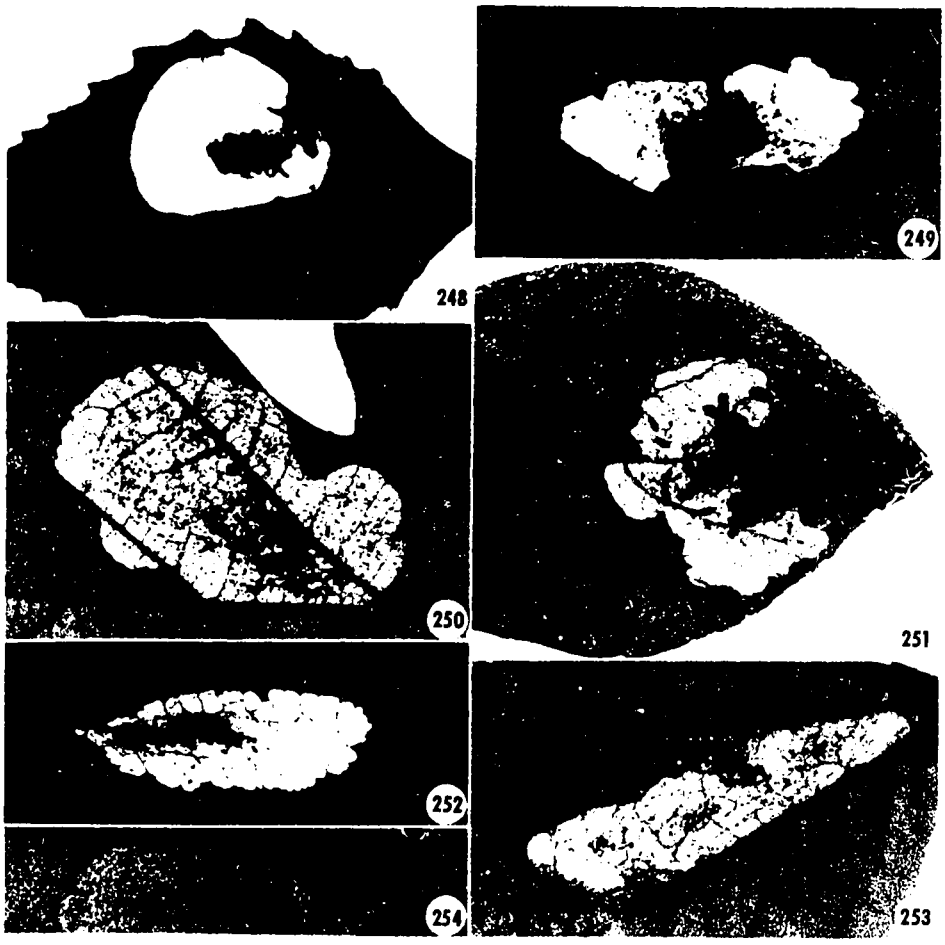
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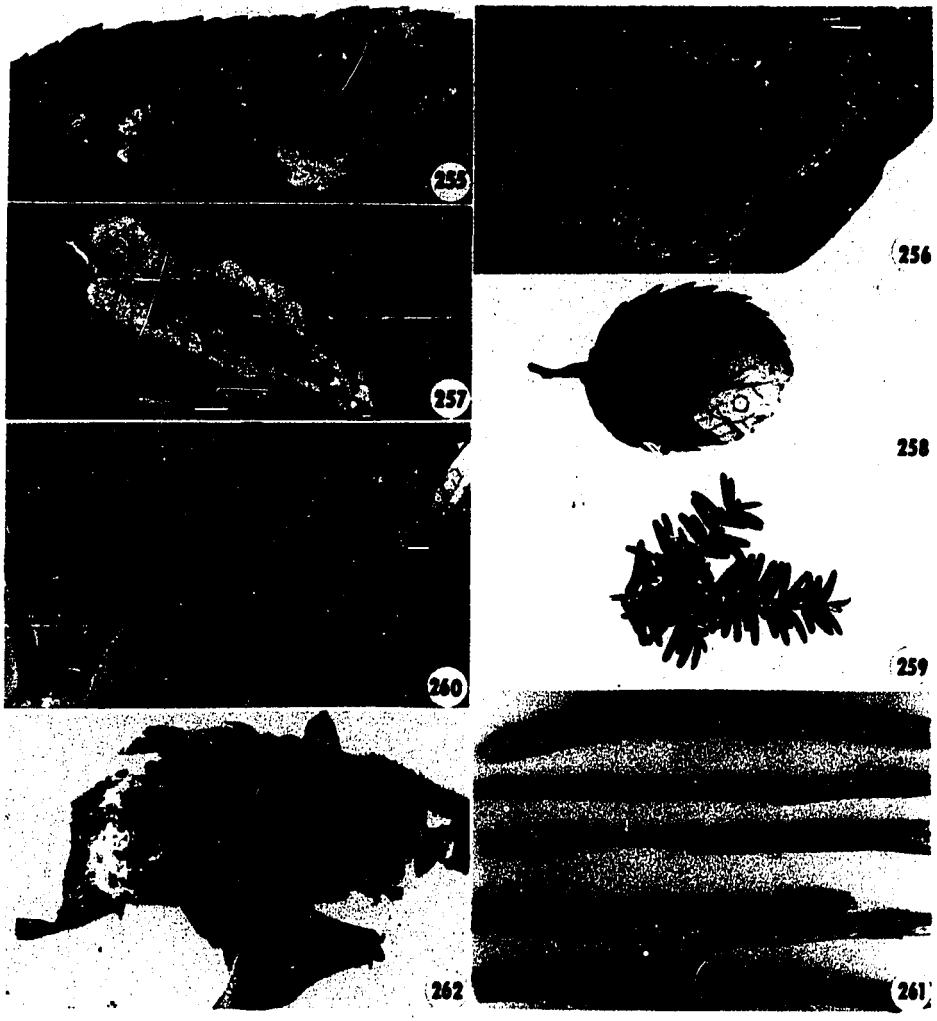
Figs. 255-258. Blotch-like mines made by microlepidopterous insect species in leaves of deciduous plants. 255. Blotch-mine of Gracilaria syringella (Fab.) on Syringa vulgaris L. 256. Blotch-mine of Lithocolletis robiniella Clem. on Robinia pseudo-acacia L. 257. Blotch-mine of Spilonota ocellana (D. & S.) on Malus sp. 258. Blotch-mine of Coleophora pruniella Clem. on Prunus serotina Ehrh.

Fig. 259. Needle-like leaves of Tsuga canadensis (L.) Carr. mined by the microlepidopterous species Recurvaria apicitripunctella Clem.

Fig. 260. A leaf of Fragaria sp. rolled in typical fashion by the lepidopterous species Ancylis comptana Froelich.

Fig. 261. Split Zea sp. stalks showing damage caused by Pyrausta nubilalis (Hubner).

Fig. 262. A typical frass nest made by the lepidopterous species Acrobasis juglandis Le Baron in leaves of Juglans sp.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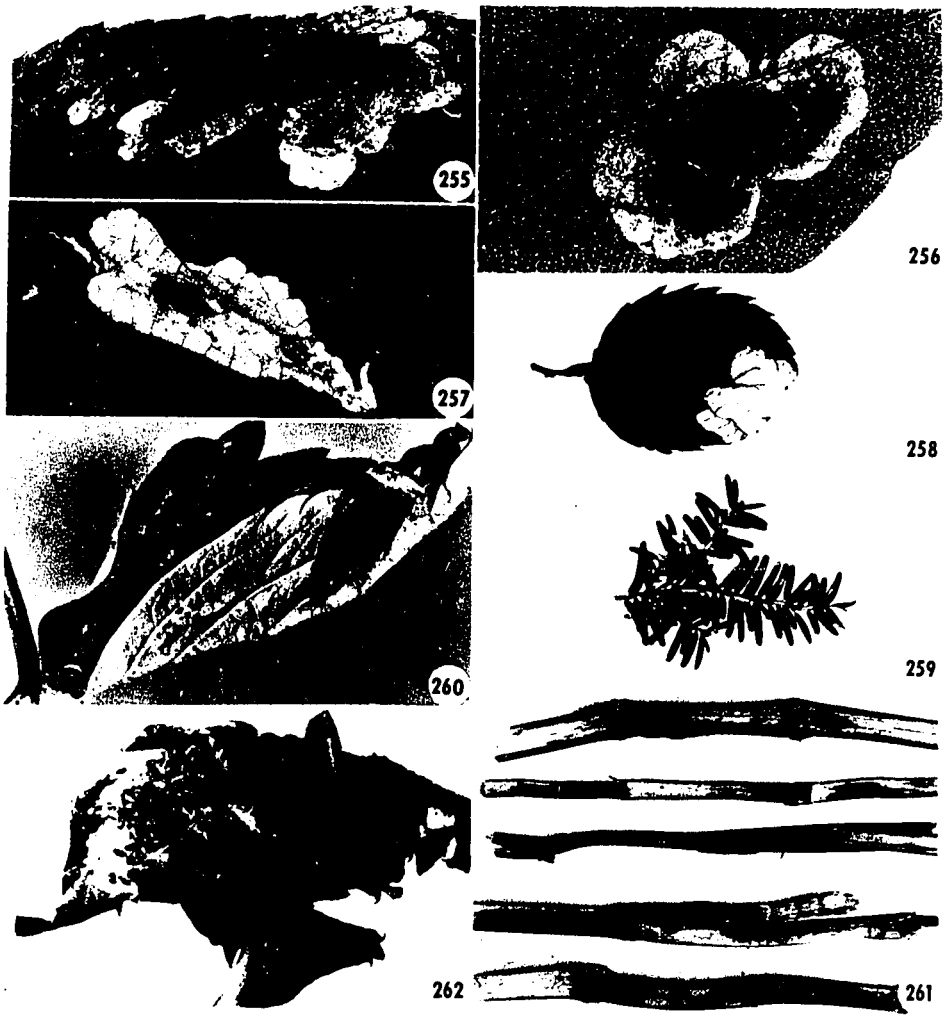
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