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A GENERIC CLASSIFICATION  
OF THE NEARCTIC SAWFLIES  
(HYMENOPTERA, SYMPHYTA)

WITH SEVENTEEN PLATES

BY

HERBERT H. ROSS

Contribution No. 188 from the Entomological Laboratories of the  
University of Illinois, in Cooperation with the  
Illinois State Natural History Survey



## CONTENTS

Introduction . . . . .	7
Methods . . . . .	7
Materials . . . . .	8
Morphology . . . . .	9
Head and Appendages . . . . .	9
Thorax and Appendages . . . . .	22
Abdomen and Appendages . . . . .	29
Phylogeny . . . . .	33
The Superfamilies of Sawflies . . . . .	33
Family Groupings . . . . .	34
Hypothesis of Genealogy . . . . .	35
Larval Characters . . . . .	45
Biology . . . . .	46
Summary of Phylogeny . . . . .	48
Taxonomy . . . . .	50
Superfamily Tenthredinoidea . . . . .	51
Superfamily Megalodontoidea . . . . .	106
Superfamily Siricoidea . . . . .	110
Superfamily Cephoidea . . . . .	114
Bibliography . . . . .	117
Plates . . . . .	127
Index . . . . .	162

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## INTRODUCTION

Few problems in the Hymenoptera have been so disputed as the general classification of the sawfly groups. Practically no two authors have agreed either on the subject of major groupings or the basic reasons for their divisions. The present study is an attempt to find fundamental morphological evidence which will separate the sawflies into groups and show the paths of evolution followed in their development. While such a study is almost necessarily incomplete without a lifetime of work, nevertheless structures have been found which show definitely some of the relationships and groupings of these insects. It is, I believe, the first time such a study has been based on the comparative morphology of the body and its appendages, rather than on only those characters which may be seen without dissection. It seems worth while to present these findings now in an endeavor to put the classification of the sawflies on a more stable basis.

Another grave difficulty confronting the North American sawfly worker has been the almost total lack of illustrated keys to the genera. Little effort has been made in the past to correlate the generic names used in various parts of the world, so that in many cases a considerable re-shuffling has been imperative. The solution of these problems has been linked very closely with the classification of the higher categories.

In the unravelling of these problems, palæontology has given us no clues, since the earliest known hymenopterous fossils belong to specialized groups which occur at the present day. These include such families as the Cephidae, Orussidae, and Siricidae. Fossils showing the nature of the earliest and most primitive Hymenoptera are still unknown. The utilization of embryological evidence has been impossible because of lack of material except in very few instances; and it is doubtful if a great deal could be learned from this source. This has left open only one avenue of approach, comparative morphology. The problem has therefore resolved itself into piecing together evidence drawn only from the differences and similarities found in the parts of those sawflies existing at the present day.

### METHODS

A large number of the drawings were made from pinned specimens. This is especially true of the characters used in generic keys, such as antennae, tarsi, sheaths, etc. The remainder were made from cleared specimens. The specimens were soaked in 25 per cent caustic potash (KOH) for three to twenty-four hours, depending on their darkness, hardness, etc. The male genitalia were preserved in glycerine in small vials; the saws, wings, and legs were mounted in either balsam or euparal on slides; and the larger structures were preserved in 80 per cent ethyl alcohol.

## MATERIALS

The taxonomic portion of this study is based on an examination of about 50,000 sawflies, including 90 per cent of the types of nearctic species. This material has been accumulated through the courtesy of the officers of the following institutions: Academy of Natural Sciences of Philadelphia; Brigham Young University; California Academy of Sciences; Canadian National Museum; Colorado Agricultural College; Cornell University; Deutsches Entomologische Institut; Entomological Branch, Canadian Department of Agriculture; Field Museum of Chicago; Illinois State Natural History Survey; Iowa State College; Iowa Wesleyan College; Kansas State Agricultural College; MacDonald College; McGill University; Montana State Agricultural College; New York State Museum; Ohio State University; Oregon Agricultural College; Purdue University; South Dakota Agricultural College; Texas Agricultural College; United States National Museum; University of Alberta; University of British Columbia; University of Colorado; University of Idaho; University of Illinois; University of Kansas; University of Michigan; University of Nebraska; University of Oklahoma; University of Wisconsin; Washington Agricultural College.

## MORPHOLOGY

The first work to be published dealing with the comparative morphology of sawflies was Hartig's "Die Familien der Blattwespen und Holzwespen" in 1837. This contains descriptions and many illustrations of the mouthparts, antennae, and other miscellaneous characters. It is, in fact, a veritable classic of sawfly morphology.

Since that time several workers have greatly increased our knowledge of sawfly morphology. Cameron in various papers (1882, etc.) gave descriptions and illustrations of many parts in other species. Van Dine (1906) described and illustrated the mouthparts of *Pamphilius*; MacGillivray (1906) made an exhaustive study of the wings of sawflies; Snodgrass (1911) illustrated the thoracic structure of many forms; Crampton (1919) described and illustrated almost all types of male genitalia found in the group; Boulonge (1924) made a remarkably fine study of the male genitalia, with special reference to the muscles and their attachment; Bird (1926) made a detailed morphological study of *Hoplocampa halcyon* (Norton); and Taylor (1931) has made a complete histological and internal anatomical study of the head of a few species of Tenthredinidae. Marlatt (1896), Smulyan (1923), Middleton and Rohwer (in several papers) have made some morphological studies, mostly in connection with taxonomic work. Aside from these, references to sawfly morphology are scattered in general texts and papers on insect anatomy and phylogeny.

In the following discussion no attempt is made to offer a complete treatise on sawfly morphology. Only those characters have been discussed which, on close study, appeared to offer differences indicating relationships of groups, or to possess differences which might be used in such a capacity at a later date. The following parts have been studied and illustrated in greatest detail: the head, its endoskeleton and appendages; the external anatomy of the thorax and first two abdominal segments; the wing venation and the male genitalia. In addition to these major parts some other characters, such as tibial spurs, have been of considerable help in corroborating the phylogenetic arrangements presented herein.

### HEAD AND APPENDAGES

#### *Head Capsule*

The head is always hypognathous, having the mouthparts directed downwards in repose. They may be directed forward when in use, but this is caused by a swinging forward of the entire head in a pendulum motion, the hinge being partly at the odontoidea and partly at the dorsal margin. This latter point of articulation is due to the moving of the head and "atlas" together (see p. 23).

Many sutures and sclerites found in the heads of primitive insects are obsolescent or entirely absent in the heads of sawflies. See Plate I, figs. 1, 2. Not only this, but no other parts have been added. The epicranial suture (ep) is present in only a few forms (e.g., Pergidae, Megalodontidae), and in these it is only a crease ending at a point between the lateral ocelli. The clypealiae and mandibulariae are entirely absent. The clypeus (cl) is not divided transversely into a pre- and postclypeus. It is separated from the front (f) by a furrow instead of a well-marked suture, and separated from the genae (g) by a suture or furrow. The lateral arms of the epicranial sutures are lacking, so that the definition of the vertex and front is practically impossible. The anterior aspect of the head, however, is provided with several furrows, ridges, and areas which bear a fixed relation to the ocelli, eyes, base of antennae, and tentorinae. These have been given a terminology by Marlatt, Rohwer, and MacGillivray; and although the names bear no relation to the hypothetical areas of the head, they are of great use in taxonomic description.

The antennal sclerites are usually fused with the surrounding head capsule, but sometimes separated from it by a suture which is more or less visible when the head is cleared in potash. The antennae, fig. 1, articulate with a distinct antacoila, which is peg-shaped and located on the ventral or meso-ventral margin of the antennal socket. The oculata or eye sclerite, fig. 17 (oc), is not visible externally, but consists of an internal, converging, sclerotized shelf upon which the eye rests. The compound eyes (e) themselves are always large, composed of a very large number of facets. Three ocelli (o) are always present, situated between the dorsal portions of the compound eyes.

In the Siricoidea, Plate II, fig. 18, a groove (gr) is present, running ventrad or caudad of the antennal sockets, which receives the basal segments of the antennae in repose.

On the posterior margin of the head of all sawflies the occipital and occipitopostgenal sutures are both absent. A distinct crassa (cr) is frequently present, originating at the postcoila of the mandible (ptc), extending dorsad and sometimes completely encircling the occipital region, fig. 2. It is always represented by a rounded, elevated portion if it is not present as a distinct ridge. The maxillariae (mx) are always present, defined by distinct furrows or sutures, and each is provided with an odontoidea (od), which articulates with the cervicum. The ventral end of the maxillariae bears the paracoila, upon which the maxillae articulate. In those forms possessing a genapont the maxillariae are confined to the margins of the occipital foramen and the paracoilae are not in evidence, fig. 19.

Sawfly heads vary considerably in shape, size, and sturdiness, in the relative positions of eyes and antennae, width of malar space, and many other points. These, however, are more useful in a study of taxonomy



than in morphology and will not be discussed further here. The most important matter is a consideration of the structure and origin of the types of head, which have a significant bearing on the relationships of the various groups of sawflies.

**HEAD TYPES.**—Four types of head are found, figs. 2, 5, 8, 19, characterized by the manner in which the genae or other parts are formed around the oral cavity or maxacava, and the occipital foramen. These types are termed *open*, fig. 2, *maxapontal*, fig. 8, *genapontal*, fig. 19, and *closed*, fig. 5, on a descriptive basis.

*Open Head*, figs. 1 and 2.—This is the simplest type, from which all the other types are derived. Maxillariae long and slender, not united on the meson, the dorsal half bearing the odontoidea, the ventral margin bearing a small process, the paracoila. Postgenae neither produced mesally, nor over-lapping the maxillariae. This results in the occipital foramen being continuous with the maxacava, or oral cavity. The sides and anterior margin of the clypeus are free and the mandibles are never encircled at the base by the head capsule. This type occurs in the superfamily Tenthredinoidea and the families Xyelidae and Blasticotomidae. In the Tenthredinoid family Cimbicidae the maxillariae are very large, but are not fused together on the meson as they appear to be at first glance.

*Maxapontal Head*, figs. 7, 8.—Similar to the above type but with the ventral portion of the maxillariae fused on the meson, forming a bridge (maxaponta, mp) between the postgenae. The maxacava is therefore separated from the occipital foramen. This type is found in the family Cephidae.

Most of the Ichneumonoidea, figs. 10, 11, have a head similar in type to the Cephoid head, differing in having the fused maxillariae and the mesal margins of the postgenae produced at an angle into the interior of the head, forming a wide shelf upon which the maxillae and labium are folded in repose. The basin-like area thus formed has been called the "trophacava" by Salman (1929). It seems to me that this term is unnecessary and that MacGillivray's prior term "maxacava" can be applied equally well, irrespective of the type of head, to that region between the postgenae into which the maxillae and labium are folded in repose. The fusion of postgenae or maxillariae on the mesal line serves only to restrict this area without altering its position or function. If the different conditions of the maxacavae are to be named, it would seem better to apply adjectives to the name maxacava as they have been applied to antennae of different shapes.

*Closed Head*, figs. 4, 5.—This is a most curious head capsule. The ventral portion of the maxillariae (mx) are joined on the meson, forming a broad bridge between the postgenae, and separating the occipital for-

amen from the maxacava. The postgenae are produced meso-ventrally, the entire clypeus is folded back under the ventral side of the head, and the lateral areas of the clypeus are fused with the triangular, meso-ventral areas of the postgenae. The head, therefore, instead of being open on the ventral side, has only three small openings in its wall of armour through which the mouthparts protrude—two small, lateral holes through which the mandibles protrude, and a larger circular, median one which represents the maxacava and receives the maxillae and labium. The labrum is attached to the ventral margin of the maxacava (which is also the distal margin of the clypeus) and is directed posteriorly, covering the apex of the labium in repose. This type of head is restricted in the sawfly groups to the families Megalodontidae and Pamphiliidae. It must have evolved from the open type, but no intermediate steps have been observed.

*Genapontal Head*, figs. 18, 19.—The diagnostic character of the heads placed in this category is the presence of a true genaponta (gp). The postgenae have been produced mesad and have united on the meson, divided only by a postgenal suture, and form a bridge across the back of the head. This separates the occipital foramen from the maxacava. The maxillariae (mx) have apparently been squeezed dorsad and lie around the ventral and lateral margins of the occipital foramen. The odontoidea (od), as usual, are borne by them. This type of head is characteristic of the superfamily Siricoidea, including the family Orussidae. In *Syntexis*, fig. 20, and *Xiphydria* the genaponta is very narrow, representing an intermediate in its formation.

The heads of the Siricoidea present a very fine example of the migration of parts, culminating in the condition found in the Orussidae. The Orussid head has been considered by most authors as representing a type very distinct from all other sawfly heads, but a critical analysis shows it to be the final product in a rather well marked chain of modifications. These are concerned with the cephalic aspect of the head which develops (1) a distinct groove for the reception of the basal segments of the antennae in repose, fig. 18, gr, and (2) the migration of the clypeus, antennal sockets, and part of the frontal region to the ventral aspect of the head.

In *Syntexis* and *Xiphydria*, figs. 20, 21, 22, the more primitive genera in the superfamily, the antennae are inserted midway between the supratentorina and the pretentorina, and well up on the cephalic aspect; the antennal groove is very shallow, extending ventro-laterad of the antennal sockets, and not definitely marked at its lower extremity on the ventral margin of the head; and the clypeus is only slightly turned underneath. In the Siricidae, fig. 18, conditions are much different. The antennal sockets have migrated ventrad, and are adjacent to the pretentorina and distant from the supratentorina; the antennal grooves are much deeper

and well marked for their entire length; and almost half of the clypeus has turned under itself, so that it forms a shelf which almost completely hides the labrum. In *Orussus*, figs. 23, 24, this migration has gone much farther. The entire clypeus and the portion of the front bearing the antennae have become turned under and now form part of the ventral aspect of the head; the antennal grooves extend along the ventral aspect and some distance up the caudal aspect; but the eyes and ocelli have assumed a more dorsal position than in either the Xiphydriidae or Siricidae.

### *Tentorium*

The tentorium is readily identified, comprising the entire inner skeleton of the head, fig. 3. For its study it is an easy matter to pick the larger heads to pieces with a needle or to clear the smaller ones in caustic potash and cut off most of one side of the head with scissors.

The tentorium, fig. 3, is composed of the following parts: (1) the corpotentorium (cp), which is the more massive area from which the other parts apparently branch, comprising two lateral plates connected dorsally by a bridge; (2) the metatentorium (mt), which is the part of the corpotentorium adjacent to the metatentorial openings, and which is sometimes continued dorsally and ventro-laterally to form shelf-like metatentorial thickenings; (3) the supratentoria (st), represented by two arms issuing from the anterior or antero-dorsal margin of the corpotentorium and joining the head above or near the antennae; and (4) the pretentoria (pr), two arms extending ventrad or latero-ventrad from the antero-ventral margin of the corpotentorium, often appearing continuous with it, and always provided with mesal, shelf-like processes.

The caudo-cephalic width of the corpotentorial bridge seems to vary considerably within closely allied groups, and therefore may be of little phylogenetic significance. The position and direction of the supratentorial arms, on the other hand, seem to offer characters of some application.

TENTHREDINOIDEA.—*Tenthredo*, fig. 6.—Supratentoria arising at the dorso-anterior margin of corpotentorium and slanting in a dorsal angle to the head capsule. Pretentoria large, appearing confluent with the corpotentorium. Metatentorial thickenings fairly wide, running from the corpotentorium to the dorsal margin of the head. *Cimbex*, fig. 9.—Similar to above, but with the pretentoria very short and stout, undoubtedly an adaption to the extremely strong mandibles and head of the species.

MEGALODONTOIDEA.—*Macroxyela*, figs. 3, 29.—Very similar to Tenthredinoidea.

SIRICOIDEA.—*Xiphydria*, fig. 25.—Supratentoria slender, arising from the anterior part of the corpotentorium, considerably ventrad compared

with their connection in the Tenthredinoidea. Pretentoria more slender than in the Tenthredinoidea, and directed more nearly ventrad. *Tremex*, figs. 30, 31.—Similar to *Xiphydria*, differing in having a longer corpotentorium and a much wider bridge across it. *Orussus*, figs. 26, 27.—Markedly different from any other in the sawflies. Supratentoria short, not reaching the head capsule, their apices needle-like, apparently connected to the head only by a band of muscle. Pretentoria large and thick, directed almost exactly ventrad, their mesal processes large and almost joining on the meson. Corpotentorium short, the bridge very narrow; the supratentoria arising at the antero-dorsal margin.

CEPHOIDEA.—*Janus*, fig. 12.—Similar in many respects to *Xiphydria*. Supratentoria arising simultaneously with the pretentoria from the antero-ventral portion of the corpotentorium; relatively slender. Pretentoria directed almost ventrad, less robust than in the Tenthredinoidea and Megalodontoidea, similar in this respect to *Xiphydria*. Corpotentorium fairly large and long, the bridge wide, and bearing on its anterior margin a small but distinct corpotendon.

ICHNEUMONOIDEA.—Braconidae, *Aleiodes*, figs. 17, 28.—Unlike any of the sawfly tentoria. Supratentoria very long and slender, apparently arising from the pretentoria. Pretentoria long and robust with lateral processes as in the Cephidae; not differentiated from the corpotentorium. Corpotentorium with a narrow bridge from the centre of which arises a prominent corpotendon, furcate at the tip; laterally confluent with the pretentoria.

#### *The Braconid Head*

The type of head found in the primitive Braconidae, figs. 10, 11, seems at first glance to be very different from any of the sawfly heads. A study of the essential differences, however, shows that it may be derived from the Cephid head with only a few changes, although these are of quite a revolutionary nature. The evidence offered by other structures is fairly conclusive that the Braconidae originated from a Cephid-like stem, which would therefore demand that the Braconid head be a specialized product of the Cephid head.

The Braconid head differs from that of its progenitor in three important characteristics: (1) the maxillariae (mx) are apparently lengthened to form a gular-like sclerite; (2) the margins of the postgenae and the fused part of the maxillariae are bent back into the head cavity to form a broad shelf upon which the maxillae rest in repose; and (3) the tentorium has assumed the shape shown in fig. 28 with a long corpotendon, long supratentorial arms, and a small corpotentorium. Judging by the relative size and shape of the Braconid and Cephid heads, the former was formed

by a movement and readjustment of parts suggested by the following reconstruction. Starting with the Cephid head, fig. 8, the maxillariae continued to fuse dorsally on the meson, increasing the size of the fused portion and decreasing the size of the occipital foramen. Either subsequent to, or concurrent with, this fusion, the margin of the head around the maxacava (including both postgenae and maxillariae) began bending inward. This continued, increasing the width of the shelf around the maxacava and pushing the metatentorial openings dorsad. Such a series of events would culminate in a head similar in external appearance to that of the Braconidae.

The derivation of the tentorium is not so simple, for the Braconid tentorium is indeed different from the Cephid. The corpotentorium, however, has remained in the middle of the occipital foramen, so that it also must have moved dorsad. In doing so its lateral expanse could easily have been reduced, which would tend to reduce the angle made in the Cephid between the pretentorial arms and the corpotentorium. The large corpotendon is easily explained as an enlargement of the very small one found in the Cephid head. The remainder of the differences will have to be considered simply as readjustments to the new type of head which has evolved.

#### *Labrum*

In almost all sawflies the labrum (1) is at least as wide as long, sometimes retracted slightly under the clypeus so that only the anterior margin is visible, figs. 13, 14. The only exception to this is the long, narrow labrum present in the superfamily Siricoidea, figs. 15, 16.

#### *Mandibles*

As would naturally be expected with a group of such varied habits, the sawflies exhibit an array of mandibles which is variable in the extreme. From the standpoint of the entire group they are not of great significance in showing relationships. They will, however, undoubtedly prove interesting when more is known of the feeding habits of the adults. A glance at Plates II and III will reveal the diversity found in the group.

Almost all the mandibles have lost the brustiae, prostheca, acia, and a definite mola, and possess only the dentes, or teeth. It is likely that in forms with three or more teeth, figs. 34-36, both proxadentes (px) and distadentes (dx) are represented. In other forms having only two teeth present, figs. 39-41, it is impossible to say whether both or only one of these sets is present. In all cases except the Xyelidae, therefore, these will be referred to simply as teeth.

The lateral aspect of all sawfly mandibles is provided with abundant slender setae, but to date patches of them which correspond to the

brustiae found in more primitive groups have been discovered only in the mandibles of some larval Argidae, fig. 34.

The mandibles of the Xyelidae, fig. 35, are unique in that they possess a larger number of parts than any others in the sawflies. The left mandible has both proxadentes and distadentes differentiated, and a large incised area which has been identified as the mola (ma). The right mandible has the mola very greatly developed into a cusp-like projection which fits into the mola on the left mandible. The brustiae and prostheca are lacking.

The family Tenthredinidae presents a great variety of mandibles, all of which can be traced from a simple, two-toothed form, fig. 51. From this bidentate mandible some have evolved which have lost the inner tooth and become sickle-shaped, figs. 48-50, and others which have developed additional teeth, as shown in figs. 42-44. This is discussed more fully in the treatment of the phylogeny of the Tenthredinidae (see page 61).

The mandibles in some other families have undergone considerable modification. Conspicuous among these are the spatulate, toothless mandibles of the Orussidae, fig. 37, the long, sickle-shaped mandibles of the Pamphiliidae, fig. 4, and those of the Xyelidae, described above.

#### *Maxillae*

Except in the family Siricidae, the maxillae of the sawflies, Plate IV, follow essentially a uniform plan. The cardo (cd) is undivided and articulates with the maxillary sclerite. The stipes is sometimes divided longitudinally into the eustipes (eus) and parastipes (ps), in which case the parastipes is always only a narrow, inconspicuous sclerite. The lacinia (lc) is always membranous, sometimes adorned with setae. The galea (gl) is undivided in most forms, but in the Xyelidae, fig. 61, is divided into an ectogalea (ecg) and endogalea (eg). The palpi (p) have from one to six segments. The palpifer is referred to here simply as the first or basal segment of the palpus. The Siricidae, fig. 84, present a case of extreme fusion in which none of the above parts are differentiated except the cardo and palpi.

From the standpoint of phylogeny, the structure of the maxillae offers only incidental help. Two points, however, are of great interest, the similarity of this appendage in the Syntectidae, fig. 70, Xiphidriidae, fig. 69, and Orussidae, fig. 68, and the lack of specialization in the lower Braconids, fig. 67, over the sawfly type.

XYELIDAE.—The two divisions of the galea of the Xyelidae were termed the ectogalea and the endogalea by Crampton (1923). The progressive development of the endogalea, figs. 61, 62, 65, from a constricted

portion of the galea to a long digitate lobe, suggests that these two parts might be homologous to the proxagalea and distagalea found in other insects. The question, however, is entirely open to conjecture; and it seems safest to adopt Crampton's names at present.

*Macroxyela*, fig. 65.—Cardo short and trapezoidal. Stipes indistinctly divided into eustipes and parastipes, sclerotized on the ventral (ectal) side. Lacinia rounded, clothed with a patch of long setae; apparently continuous with the parastipes. Endogalea a distinct mesal lobe, set with peg-like setae on the mesal margin; ectogalea slightly hooked at the apex, with long setae on the margin. Palpi four-segmented, the last one with a submembranous apex.

*Pleroneura*, fig. 62.—Lacinia membranous, with an apical row of setae. Galea divided by a furrow into a proximo-lateral ectogalea and a meso-distal endogalea, the latter armed with stout setae.

*Xylecia*, fig. 61.—Lacinia longer, clavate. Endogalea digitate, long, with a few, scattered, peg-like setae; ectogalea long and relatively slender, with stout setae at the apex.

ARGIDAE.—*Arge*, fig. 63.—Cardo relatively long, folded under the rest of the maxilla in repose. Eustipes large, parastipes very narrow. Lacinia borne at the end of the parastipes, small and triangular, with fine setae on its mesal margin. Galea borne on the eustipes, large and submembranous, with tuft of setae on the ental side. Palpi six-segmented, relatively long and robust.

CIMBICIDAE.—*Trichiosoma*, fig. 64.—Cardo long, folded underneath the remainder of the maxilla in repose. Eustipes large and rectangular, parastipes very narrow. Lacinia almost as large as the galea, with fine setae along the margins. Galea with the basal portion semi-sclerotized, the apical portion forming a rounded, membranous cap bearing a few setae. Palpi scarcely longer than the parastipes, six-segmented, and moderately robust.

These last two maxillae are representative of the group of families contained in the Tenthredinoidea and the family Pamphiliidae. Differences are found in the relative portions of the various segments of the palpi, and the development of the lacinia and galea, but these do not change the fundamental aspect in relation to the other groups.

SYNTECTIDAE.—*Syntexis*, fig. 70.—Cardo small, somewhat trapezoidal. Stipes much as in other groups, the suture dividing it from the parastipes only barely indicated. Lacinia very large, membranous, with a few weak setae at apex; with a crease marking off a relatively wide area along the mesal margin. Galea broadly hook-shaped, submembranous on the latero-ventral side, provided with a brush of stout setae on the meso-dorsal

side. Palpi five-segmented, apparently with little or no articulation between the third and fourth segments; relatively long and moderately slender.

XIPHYDRIIDAE.—*Xiphydria*, fig. 69.—Cardo short, almost square. Stipes much as above, apparently not divided longitudinally into eustipes and parastipes. Lacinia a very weak, rounded, membranous lobe, with only one or two weak setae at apex. Galea much larger, submembranous, covered with fine setae. Palpi five-segmented, short and slender. Judging from the close relationship of this genus with *Syntexis*, the second palpal segment of *Xiphydria* represents the fused second and third of *Syntexis*.

ORUSSIDAE.—*Orussus*, fig. 68.—Cardo short, rectangular. Stipes normal, the parastipes very narrow and separated by a distinct suture from the eustipes. Lacinia a large trapezoidal lobe, entirely membranous and without setae, very much resembling that of *Syntexis*. Galea no larger than the lacinia, membranous on the ventral side, with a thick pad of strong setae on the dorsal side. Palpi about four times the length of stipes, five-segmented, the second segment short, the remainder long, the fifth and the apical portion of the fourth armed with truncate setae.

SIRICIDAE.—*Urocerus*, fig. 84.—Maxillae extremely reduced; the stipes of the two maxillae fused along the mesal line without a suture remaining, so that the two maxillae form a single lunate structure (st). Cardines (cd) also fused on the meson, appearing as two tubercles, each with a thread attached to the basal margin. These threads are attached within the head. Lacinia either atrophied or fused with the galea (gl). Galea continuous with the stipes, the entire appendage uniformly submembranous. Palpi (max. p.) reduced to a single bulbous segment.

CEPHIDAE.—*Cephus*, fig. 66.—Cardo short and trapezoidal. Stipes undivided, normal in general shape; slightly creased at apex to suggest the distal portion of the suture separating the eustipes and parastipes. Lacinia very small, submembranous. Galea large, also submembranous, with a proximo-lateral lobe or fold which appears to form a distinct sclerite. Palpi six-segmented, slightly longer than the stipes.

BRACONIDAE.—*Aleiodes*, fig. 67.—Similar in general plan to *Syntexis*, *Xiphydria*, and *Cephus*. Cardo almost as long as stipes. Stipes undivided, bearing at its distal end the membranous lacinia and the submembranous galea. Galea with a brush of stout setae on its ental side. Palpi six-segmented, four or five times the length of the stipes.

### *Labium*

The various types of labia, Plate V, found in the sawfly groups present a heterogeneous outlay. Most of the differences are due to the relative development of the alaglossa (alg), which is composed of the



fused pair of glossae, and the paraglossae (pgl). The submentum (sm) is usually present, of various sizes and shapes. The mentum is apparently absent. The stipulae (sti) are represented by a sclerotized area basad of or around the palpi and basad of the glossae and paraglossae. The palpi have two, three, or four segments. The paraglossae and the alaglossae are distinct except in the Siricidae, fig. 84, and some Tenthredinoidea (e.g., Loboceridae, fig. 76), in which they all have fused completely to form a totaglossa.

CIMBICIDAE.—*Trichiosoma*, fig. 71.—Submentum elongated, diamond-shaped, separated from the stipulae by a considerable area of membrane. Stipulae bi-emarginate distally forming a median triangle. Palpi four-segmented, the two apical segments provided with sensory areas. Paraglossae large, almost twice the width of the alaglossa, both finely setate on the apical third, the latarima extending to the membranous ligula. Typical of most of the families in the Tenthredinoidea and the family Megalodontidae. In the Blasticotomidae the paraglossae and alaglossa are much reduced but distinct.

LOBOCERIDAE.—*Incalia*, fig. 76.—Differs markedly from the above in having the paraglossae and alaglossa entirely fused to form a totaglossa. This also occurs in *Decameria* (Perreyiidae).

ARGIDAE.—*Arge*, figs. 72, 73.—Submentum and stipulae differing in shape from the above. Stipulae produced mesad to near hypopharynx, somewhat stirrup fashion. Hypopharynx a large sclerotized area with abundant setae. Condition of hypopharynx and stipulae essentially typical of all sawflies with well developed labial parts.

XYELIDAE.—*Macroxyela*, fig. 77.—Submentum shield-shaped, adjacent to the stipulae. Palpi three-segmented, the apical half of the third segment with numerous stout setae. Paraglossae short, with several spine-like setae; alaglossa absent, represented by a membranous area connecting the bases of the paraglossae. In *Megaxyela* the palpi are four-segmented.

CEPHIDAE.—*Janus*, fig. 81.—Stipulae reduced to a narrow, sclerotized band. Palpi four-segmented. Paraglossae lobe-like, only half the width of the alaglossa; alaglossa similarly lobe-like; both of them stumpy and set with thick, small setae and united at the base. Below them is a trapezoidal sclerite (x) set in the apical membranous portion of the stipulae.

XIPHYDRIIDAE.—*Xiphydria*, fig. 82, 83.—Submentum represented by a triangular sclerotized area between the bases of the maxillae, gradually fusing into the membranous area basad of the stipulae. Stipulae with only a narrow, sclerotized basal area. Palpi large, three-segmented, the apical segment with an ovate sensory area. Paraglossae slender, small, and curved, alaglossa broader and more or less truncate at the apex; both

paraglossae and alaglossa very small; the latarima extending basad for the exposed length of the alaglossa.

ORUSSIDAE.—*Orussus*, fig. 80.—Stipulae large, encircling the base of the palpi. Palpi three-segmented, the third segment club-shaped and with curved, strong setae. Paraglossae small, separated from the glossa by sutures, but otherwise not free from it; alaglossa large, with a depressed, membranous, median area; all approaching the condition of a totaglossa.

SIRICIDAE.—*Urocerus*, figs. 84, 85.—Submentum represented by a small sclerotized area between the cardines of the fused maxillae. Stipulae large and shield-shaped, not produced anteriorly into a stirrup-like process. All parts of the glossae united into a totaglossa. Palpi three-segmented, the apical one with a round, membranous, sensory area. Hypopharynx (hy) reduced to a small area of setae, fig. 85.

SYNTECTIDAE.—*Syntexis*, figs. 78, 79.—Submentum ovate, situated in the membrane between the bases of the maxillae. Stipulae large, embracing the bases of the palpi. Palpi three-segmented, the third segment clavate and armed with stout, curved spines similar to those found in the Orussidae. Paraglossae thin and flap-like; alaglossa U-shaped, encircling the paraglossae at their base, these latter being situated within the circle of the alaglossa and covering most of it from view when seen from the posterior aspect. The alaglossa of this species might superficially be termed a "duplaglossa," which has previously been considered as restricted to the higher Hymenoptera. It is very similar to that found in the Braconidae (see *Aleiodes*, fig. 75), having similar rows of microtrichiae on the anterior face. It differs slightly from the true duplaglossae, however, in that the paraglossae are contained within the hollow semi-circle formed by the alaglossa instead of being situated beside it.

BRACONIDAE.—*Aleiodes*, figs. 74, 75.—Stipulae large, similar in type to that found in sawflies. Palpi four-segmented. Paraglossae small, reduced to flaps along the base of the duplaglossa. Duplaglossa large, somewhat V-shaped, bearing rows of microtrichiae on the anterior surface.

The trend of development in these labia has been one leading from a condition in which the paraglossae were large and the alaglossa subordinate to them, to one reversing this relation, having the alaglossa large and the paraglossae subordinate to it. This has led to the totaglossa of the Siricidae, Loboceridae, and Perreyiidae on the one hand and the duplaglossa of the Apocrita on the other.

#### *Antennae*

The antennae, figs. 86-107, vary greatly both in shape and the number of segments comprising them. They are frequently of use in the diagnosis

of genera or larger groups, and undoubtedly offer some of the best characters for keying out the families. They apparently afford few clues as to the phylogeny of the various sawfly groups. There is no gradual development towards a predominant type as, for example, the case of the aristate antennae of the cyclorrhaphous Diptera. They will be discussed, therefore, simply according to shape.

*Filiform and setaceous.*—This is the common type found in most of the sawflies. The number of segments may vary from six in the Acorduleceridae, fig. 95, to thirty or more in the Pamphiliidae, fig. 88. An interesting deviation from the setaceous type is found in the Argidae, Xyelidae, and Blasticotomidae. The third segment has become greatly lengthened and thickened, and the remaining apical segments are either absent (Argidae, fig. 97), reduced to a small stub (Blasticotomidae, fig. 96) or form a slender, segmented filament (Xyelidae, figs. 86, 87).

*Furcate.*—The males of some genera of the Argidae have undergone a further modification of the enlarged third segment, which is divided longitudinally for almost its entire length, forming two slender filaments which are usually somewhat curled and harp-shaped, fig. 98.

*Fusiform.*—Some species of *Macrophya*, fig. 103, and the females of *Orussus*, fig. 92, have the preapical segments enlarged, giving it a decided spindle shape.

*Serrate.*—In those families in which setaceous or filiform antennae are the rule, occasionally genera appear in which the antennae are more or less distinctly serrate. In some Diprionid genera, e.g., *Augomonotenus*, fig. 107, and *Monotenus*, the female antennae are markedly serrate. In some Tenthredinidae, e.g., *Ceratulus*, fig. 355, both sexes have serrate antennae.

*Pectinate.*—The males of Diprionidae, fig. 105, the genus *Pterygophorus* and the genus *Cladius* (Tenthredinidae), fig. 104, have antennae which are very conspicuously pectinate. The females associated with these may have the antennae either setaceous, serrate, or pectinate, but in the latter case, fig. 106, never to the same extent as the males.

*Flabellate.*—The males of *Megalodonta* have curious antennae, fig. 94. The segments of the flagellum are provided with distinct lamellae which are small and ovate, and may be folded back in repose so that the antenna appears filiform.

*Clavate.*—The Pergidae and some groups of the genus *Tenthredo*, figs. 101, 102, of the family Tenthredinidae have antennae with a well-formed, but not conspicuous club.

*Capitate.*—In the Cimbicidae the club is large and the "handle" (third segment) is very slender, fig. 100.

## THORAX AND APPENDAGES

Since the thorax of sawflies has been studied in comparison with that of the Apocrita and other orders by Snodgrass (1911), only those parts will be mentioned in this discussion which have shown differences of taxonomic or phylogenetic significance within the sawfly groups. These consist chiefly of the cervical sclerites, mesonotum, and mesopostnotum.

*Cervical Sclerites*

Crampton's interpretation of these sclerites is adopted here. This postulates, fig. 146, that the large, lateral sclerites (cv) lying antero-dorsad of the prosternum represent the enlarged cervical sclerites to which are fused the reduced propleurae (pl). In the Tenthredinoidea the propleurae are usually demarked by a suture, but even in some of these forms it is almost impossible to be sure of these sutures.

In most of the Tenthredinoidea the ventro-mesal portion of the cervical sclerites is V-shaped or U-shaped, not meeting on the meson, figs. 155, 156. In other members of the superfamily, the sclerites practically meet on the meson, and the ventro-mesal margin is truncate, figs. 157, 158, or subtruncate, fig. 154. This enlargement and strengthening appears to be purely adaptive and a modification very easily acquired. Thus, in the family Tenthredinidae these sclerites have become truncate and approximate on the meson in the subfamilies Tenthredinae, Dolerinae, and Allantinae. The primitive genera of the Tenthredinae and Allantinae have these sclerites unmodified, so that the development of these truncate sclerites has occurred independently in each of the three subfamilies mentioned.

In the Cimbicidae, fig. 159, an interesting modification occurs. The lateral angles of the prosternum unite with the mesal margin of the cervical sclerites to form a precoxal bridge. This, however, is not the primitive condition typical of the sawflies, but simply an aberrant offshoot.

In the Siricoidea, figs. 132, 133, and Cephoidea, fig. 131, the cervical sclerites are very large, with the ventro-mesal margins truncate and more approximate than in any of the Tenthredinoidea. This is the condition typical of the Apocrita.

*Propleurae*

The propleurae are either separated from the cervical sclerites by a distinct suture, or undifferentiated, in which case they form the posterior portion of the cervical sclerites. In the Xyelidae, fig. 148, they are extremely small and difficult to differentiate. In the Tenthredinoidea, fig. 146, and some Siricoidea, fig. 147, they are longer, and are almost entirely invaginated into the body, giving an apodeme-like appearance.

The study of this structure, however, is at present not extensive enough to be used as a basis for any conclusions.

According to Crampton (1926), the propleurae are divided by a distinct suture into the episternum and epimeron, but I have not yet been able to observe this suture. The line of origin of the propleurodeme is difficult to determine exactly, and may be the suture here considered to separate the cervical sclerites and the propleurae. When this and some other uncertain points are finally cleared up, our conception of the homologies of this region may have to be modified.

### *The "Atlas"*

The cervical sclerites, fig. 129, cv plus bs, (including the fused propleurae) and the probasisternum together form a single unit from the standpoint of function. The head articulates at the anterior end of the cervical sclerites, the prothoracic legs between the basisternum and procoxacondyle. The cervical sclerites and prosternum are firmly united by means of the strong endoskeleton, but are united to the remainder of the body only by membrane. Consequently, the head and front legs have not only their articulation where they join the cervicum and prothorax, but in addition the flexibility allowed by the membranous connection of these parts. For this combination of cervical sclerites and probasisternum the term "atlas" is proposed, since it is analogous to this structure in the vertebrate skeleton.

### *Prosternum*

The prosternum is primitively represented by two widely separated sclerites, fig. 129, the basisternum (bs) and the spinisternum (ss). The basisternum is between and sometimes partly under the mesal portion of the cervical sclerites, and between the front legs. It is variable in shape, being diamond-shaped, ovate, T-shaped, or I-shaped; internally it bears the large, fused furca.

*An unrecorded sclerite, the spinisternum.*—The spinisternum (ss), if differentiated as a distinct sclerite, is situated on the meson just anterior to the mesosternum or mesopleurae. It is a small sclerite and usually bears internally a small furcella or plate, fig. 153 (fl). In the Megalodontoidea, some of the families of the Tenthredinoidea (e.g., Argidae, fig. 134) and the Siricidae, fig. 138, it is distinct, but in this last family lacks the furcella. In the Syntectidae, Xiphydriidae, and Cephidae the spinisternum is represented by a very small, indistinct thickening of the membrane only. In the higher Tenthredinoidea, fig. 136, it is apparently fused with the mesosternum and forms the small triangular area between the anterior fork of the mesofurcina.

*Mesosternum*

In many sawflies this area is distinct, separated from the mesepisterna by well-marked sterno-pleural sutures. In others it may be entirely fused with them, or at the most separated by obsolescent sutures. There is a deep suture along the meson which marks the emargination of the fused and lengthened furca, fig. 153, (fc).

XYELIDAE AND PAMPHILIIDAE, fig. 129.—Sternum (ms) forming a triangular area, divided from the episterna by a distinct or at least a well-marked suture; episterna (eps) produced mesally and fused anterior to the sternum to form a wide presternal bridge (psb).

CEPHOIDEA, fig. 131.—Sternum triangular, longer than in the above, the sterno-pleural sutures converging and meeting near the anterior margin of the segment. Presternal bridge very narrow, not distinctly differentiated from the antecostal ridge of the sclerites.

SIRICOIDEA.—Syntectidae, fig. 130.—Sternum more or less short and triangular, set off from the episterna by distinct sutures terminating anteriorly on the meson in deep pits. Episterna bilobed anteriorly, the three incisions between the lobes membranous. Furcal suture extending to the anterior margin of the segment, apparently representing a narrow tongue of the sternum separating the two episterna. The condition is peculiar, apparently most resembling the Pamphiliid type, fig. 129.

XIPHYRIIDAE, fig. 132, AND SIRICIDAE, figs. 137, 138.—Sternum fused with episterna with no evident suture. In these two families, however, the furca does not quite reach the anterior margin of the segment, indicating the presence of a narrow presternal bridge. Furthermore, there is a triangular area, fig. 138, (ms), separated from the lateral areas by a convexity, by slight differences in texture and by a lack of large punctures. This area may be regarded with certainty as the true sternal region.

ORUSSIDAE, fig. 133.—In this family also the sternum is fused with the episterna with no distinct suture between them. There are, however, faint remnants of the sterno-pleural sutures in the form of impressions on the external surface of the sclerites. When traced out these delineate a triangular sternum, the tip of which just reaches the anterior margin of the segment.

TENTHREDINOIDEA AND MEGALODONTIDAE, fig. 134.—Sternum trapezoidal, episterna well separated anteriorly, not forming a presternal bridge. This condition is present in the Pergidae, Pterygophoridae, Loboceidae, Perreyiidae, and some genera of the Argidae, fig. 134. In other Argidae and the Cimbicidae the sterno-pleural suture is weak or entirely absent, as is the case with all the remaining Tenthredinoidea, figs. 135, 136. In these latter, however, it is a simple matter to demonstrate that they

are a derivative of the trapezoidal type of sternum, since the path of the sterno-pleural suture is indicated as in fig. 134 by lines of punctures, color differences, depressions in the surface of the sclerite, and a distinct internal line of muscle attachment.

#### *Pronotum*

This sclerite is quite varied in shape. In the Xyelidae, fig. 120, (pn), Cephidae, fig. 121, and Syntectidae, fig. 122, it is somewhat rectangular, and slightly narrowed on the meson; in the Xiphydriidae, figs. 123, 141, Siricidae, fig. 127, and Orussidae, figs. 128, 142, it is of approximately the same dimensions but tilted forward into a vertical position. In the Tenthredinoidea, figs. 124, 139, it is greatly reduced on the meson, forming only a narrow collar at this point.

#### *Mesonotum*

The sawfly mesonotum, fig. 120 (II), is primitively divided into four major parts—praescutum (prs) subdivided on the meson into two lateral halves, scutum (scut), scutellum (scl), and postnotum (ptn), most of which is invaginated underneath the metanotum. The postero-lateral areas of the scutum are usually markedly declivous, forming the parascutellar areas (is). Some groups have an apparent posterior lobe of the scutellum, the post-tergite (pt). All the sclerites are subject to variation, which may be discussed to best advantage according to taxonomic units.

MEGALODONTOIDEA, fig. 120.—Praescutum diamond-shaped; scutum large, not divided transversely; scutellum V-shaped anteriorly; the posterior margin of the scutellum produced into a narrow post-tergite (pt); postnotum forming the lateral post-alar bridge, and forming a phragma underneath the metanotum. The phragma, fig. 149, is about two-thirds concealed, the concealed portion consisting of two small lateral lobes and two large median lobes.

TENTHREDINOIDEA, figs. 124, 126.—Similar to the Megalodontoidea. Post-tergite absent in all but the Diprionidae, in which it is only a narrow cord, and the Tenthredinidae, in which it is usually well-developed and triangular, figs. 124, 125. The Acorduleceridae, fig. 126, are unique among the Tenthredinoidea in having the lateral and mesal sutures of the praescutum distinct only for the anterior two-thirds of their length, so that the praescutum is not separated from the scutum which therefore appears much longer than normally; and in having the scutellum transversely sinuate on its anterior margin. Throughout the Tenthredinoidea the postnotum is similar to that of the Megalodontoidea.

CEPHOIDEA, fig. 121.—Similar to the Megalodontoidea, except as follows: post-tergite very small, scarcely present; postnotum, fig. 152, very

long, much narrower, with the two small, lateral lobes considerably reduced; parascutellar areas not distinctly set off from the scutum.

SIRICOIDEA.—The Syntectidae, fig. 122, are similar to the Cephidae, fig. 121, (condition of the postnotum unknown). The remainder of the Siricoid families differ considerably from this primitive type.

Xiphydriidae, fig. 123.—Scutum divided by a transverse suture near its middle into anterior and posterior halves. Praescutal sutures extending meso-caudad to this trans-scutal suture, so that the praescutum is much longer than normally. Parascutellar areas relatively distinct. Scutellum differentiated anteriorly and laterally by broad, trench-like sutures. Postnotum as in the Megalodontoidea, fig. 149.

Orussidae, fig. 128.—Scutum divided transversely. Praescutal sutures extending almost longitudinally from the pronotum to the trans-scutal suture; the median praescutal suture absent, so that the praescutum is an undivided, rectangular sclerite. Scutellum distinctly set off by sutures; the scutum apparently solidly united to the postnotum so that the scutellum appears to be surrounded by the scutum. Postnotum longer than in the Xiphydriidae, fig. 150.

Siricidae, fig. 127.—Scutum divided by diagonal, wide, trench-like sutures into an anterior sclerite and two postero-lateral sclerites (*y*). Praescutal sutures present only as faint traces, the praescutum therefore appearing fused with the anterior sclerite of the scutum. Postnotum considerably lengthened, fig. 151.

#### *Metanotum*

In the Megalodontoidea, fig. 120 (III), Tenthredinoidea, and the family Syntectidae of the Siricoidea, fig. 122, the metanotum is separated from the mesonotum by a deep furrow marking the invagination of the postnotum. In these the scutum and scutellum may be fairly readily identified, figs. 120, 122. In addition to these areas, a pair of hard, opaque, rough areas are present on the scutum, known taxonomically as the cenchri (*cn*). The praescutum is either absent or undifferentiated. The two chief differences from this condition may be briefly summarized as follows: (1) in the Cephidae, fig. 121, Xiphydriidae, fig. 123, Siricidae and Orussidae, fig. 128, the metanotum is closely appressed to the posterior margin of the mesonotum, and part of the metascutum is hidden from view; in the last three families named, the cenchri appear as small pads protruding from the suture formed by this consolidation; (2) in the Cephidae the cenchri are entirely wanting. The scutellum also is more or less undifferentiated in the families mentioned above.

#### *Mesopleurae*

A hypothetical sawfly mesopleuron would be as follows: prepectus



present as a distinct sclerite, fig. 129, (pp); pleural suture present, dividing the pleuron into the mesoepisternum and mesoepimeron; epimeron divided by a short epimeral suture into the anepimeron (aem) and katepimeron (cem). Unlike the epimeron, the episternum is never divided. The deviations from this type are primarily due to the atrophy of one or more of the sutures.

TENTHREDINOIDEA, fig. 139.—Prepectus either present or absent, sometimes the two conditions being found in closely related genera. In some cases the prepectal suture is modified into a furrow and the prepectus is present as a shoulder-like ridge. Pleural suture present. Epimeron divided; anepimeron markedly convex, katepimeron usually flat, the epimeral suture dividing them sometimes obsolete but the two parts distinct due to their great difference in convexity.

MEGALODONTOIDEA.—Similar to above, differing in having the epimeron undivided.

SIRICOIDEA AND CEPHOIDEA, figs. 140-143.—In these two super-families the epimeron is undivided as in the Megalodontoidea. The pleural suture is either lost or indistinct in most of these families, frequently discernible only at one end.

#### *Metapleurae*

Similar in general features to the mesopleurae, differing, however, in lacking a prepectus and having the sutures disappear in this segment before they do in the mesopleurae. An interesting modification occurs in the Pergidae and Philomastiginae. The metaepimeron is not only undivided but solidly fused with the lateral margin of the first abdominal tergite. Intermediates between this and the free condition are found in the Perreyiinae and to some extent in other members of the Tenthredinoidea.

#### *Legs*

The three pairs of legs are built essentially along the same plan, consisting of the following parts, fig. 110—coxa (cx), two-segmented trochanter (tr), femur (fm), tibia (tb), five-segmented tarsus (ta), and tarsal claws (tc). The only known exception to this is the front leg of the female of *Orussus*, fig. 108, which has the apical portion of the tibia constricted to form an additional tibial segment and has only four segments to the tarsus, the first segment hidden in the distal end of the tibia so that the tarsus appears three-segmented.

The tibial spurs present several characters worthy of note. Pre-apical spurs, fig. 110, (psp), numbering from one to four, are present on the middle and hind legs of the Pergidae, Acorduleceridae, the genus *Arge* in the family Argidae, and the families Xyelidae, Megalodontidae,

and Cephidae. The front tibia of the genus *Acantholyda* (Pamphiliidae) also has a pre-apical spur. Occasionally one is found on the middle or hind tibiae of the Loboceridae, and may likely appear haphazardly in other groups.

All the tibiae are provided with one or two apical spurs, fig. 110, (asp). On the middle and hind tibiae they are quite uniform, but on the front tibiae offer some valuable differences as follows. In the Pergidae, Acorduleceridae, Argidae, Pterygophoridae, Cimbicidae, Diprionidae, Perreyiidae, and Loboceridae two are present, both of the same shape, although one may be slightly smaller than the other, fig. 113, (asp). Usually they are pointed but in some genera may be truncate or even slightly swollen at the apex. In the Tenthredinidae, Blasticotomidae, Xyelidae, Megalodontidae, and Orussidae, two apical spurs are present, but one is broadened and branched or incised at its tip, fig. 114. In the Orussidae the unbranched spur is very small, fig. 115. In the remainder of the sawflies, the Cephidae, Syntectidae, Xiphydriidae, and Siricidae, the unbranched spur has been lost entirely, and the modified spur has developed into several different forms. That of *Xiphydria*, fig. 117, is long and slender, similar to that of *Orussus*. In the Siricidae, fig. 116, the spur has widened, and the inner side is sub-membranous. In *Syntexis*, fig. 118, the inner margin has become transversely incised to form a pectinate fringe running almost the entire length of the spur, and the outer tooth of the apical incision is small and slender. In the Cephidae, fig. 119, this outer tooth is very large, the inner one being small.

In some genera of the Siricidae, the middle and hind tibiae have only one apical spur.

### *Wings*

The multitude of differences found in the venation of sawfly wings has been the basis for several methods of classifying the groups themselves. When, however, the wings are studied after the other parts of the insect, two facts are apparent: (1) the characters of the venation give assistance in tracing evolution in only a few cases, and (2) parallel evolution has occurred in many instances.

The systems of nomenclature for the Hymenopterous wing are many. These have been discussed in a previous paper (Ross, 1936a) and the system there propounded is used here. The simple evolution of the Hymenopterous venation from the Panorpoid types is the basis for the terminology, which is given in figs. 170 and 211.

The most primitive characters in the sawfly wings are: (1) a free subcosta in the Xyelidae and Pamphiliidae, fig. 172; (2) the unfused condition of media and radial sector, which are therefore separated by the first radio-medial cross-vein, in *Pleroneura*, fig. 172; (3) the presence

of the base of all the anal veins in some Siricidae, fig. 173; and (4) the presence of the base of cubitus in the hind wings of some Xyelidae, much as in fig. 170.

The most marked differences between the superfamilies include: (1) the unique tendency in the Tenthredinoidea for continued basal fusion of media along radial sector, this fusion frequently going back down the stem of radius, fig. 185; (2) the partial loss of the first radial cross-vein in some Cephidae and its total atrophy in the Orussidae; and (3) the more or less straight course of the veins in the Siricoidea and Cephoidea.

Parallel development has taken place most frequently in the anal veins. There seems to be a tendency in all sawflies for 2A & 3A to fuse with the first anal vein. It has occurred in the Argidae, Diprionidae, and Cimbicidae and is very well illustrated in the Tenthredinidae, figs. 197-210 (see p. 61).

There seems to be little uniformity in the atrophy of veins or cross-veins. In many cases the atrophy of a portion of the venation may be simply individual variation, and in other cases it may typify species or genera. The only family in which the venation shows consecutive steps in variation is the Tenthredinidae, under which heading it is discussed fully.

#### ABDOMEN AND APPENDAGES

As with the thorax, the general features of the sawfly abdomen have been studied by Snodgrass (1931). Only those parts will be discussed here, therefore, which have some bearing on the question of relationships.

##### *First Abdominal Tergum, or Propodeum*

The first segment is represented only by the tergum, the sternum being either membranous or atrophied. This first tergum is an integral part of the metathorax, since it is fused quite solidly with it in all sawflies. If the body is broken, the break occurs between the mesothorax and metathorax, not between the thorax and abdomen. The first tergite, fig. 120, (1), is typically divided or incised on the meson, to produce two lateral plates. These are referred to in taxonomic literature as the "basal plates" or "propodeum." In some genera or families (e.g., Orussidae, Cimbicidae, and some Tenthredinidae), they have become reunited, fig. 128.

In most sawflies the dorsal contour line of the metathorax and the first two abdominal terga, when viewed laterally, is almost continuous, without marked constrictions between the segments, figs. 139, 140, 142. There are only two distinct exceptions to this: (1) the Xiphydriidae, fig. 141, have a distinct constriction between the metanotum and first tergite; and

(2) the Cephidae, fig. 143, have a very well marked constriction between the first and second tergites. In the Apocrita, fig. 144, the first tergite is entirely fused with the metanotum, and the second and following segments articulate with the first by a ball-and-socket joint. While no such joint as this exists in the Cephidae, the articulation of the rest of the abdomen does occur at this point, and there is a suggestion of a joint at the postero-lateral angle of the first tergite.

### *Male Genitalia*

The terminology advocated by Crampton (1919) has been used for the parts of the male genital capsule, for the reason that it is the only one taking into account the prior use of names for some other part of an insect. For instance, the terms "cardo," "stipes," and "manubria," used by some authors for parts of the genitalia, are in current usage for sclerites of mouthparts or other appendages, and these Crampton has changed or discarded. His argument is quite sound that this is the only way to arrive eventually at a uniform and nonconfusing terminology of homologous parts of different insects.

The male genitalia, as would be expected, present a multitude of differences, especially in the Tenthredinoidea. As far as can be ascertained at present, a great deal of this variation is of use only in grouping related genera. Only a few of the differences show relationships between larger groups, and these are the differences discussed here.

The genitalia present two different orientations. In one group the adult genital capsule remains in the same orientation as in the pupa. In the other the capsule revolves through a 180° angle around its linear axis. This was first pointed out by Crampton (1919), and was later shown by Boulonge (1924) to occur just prior to eclosion. Crampton proposed the terms "Orthandria" for those sawflies with normal genitalia and "Strophandria" for those in which the genitalia turned. The latter includes only the Tenthredinoidea, while the former includes the Megalodontoidea, Siricoidea, and Cephioidea.

The genital capsule, fig. 160, is composed of the following sclerites: (1) gonocardo, or basal ring (ca); (2) a pair of gonostipites, (go), comprising the lateral foundation; (3) harpes (h), or appendages of the gonostipites; (4) sagittae (sa) and volsellae (ol); two pairs of sclerotized plates, primitively ventral, but dorsal in the Strophandria or Tenthredinoidea; (5) a pair of penis valves (py), enclosing the true penis; and other structures of a sporadic nature, including the gonamaculae (gm) or apical muscular disc of the harpes of the Megalodontoidea and others, the parapenes (gg) of some Tenthredinoidea, and the median sclerotized style of the Siricidae and Cephidae.

TENTHREDINOIDEA.—*Arge*, fig. 160, *Trichiosoma*, fig. 163, and *Acordulecera*, fig. 164.—Genitalia are turned so that the volsellae and sagittae are on the dorsal surface. Gonocardo usually present, sometimes partially atrophied. Gonostipites present, varying in form; in the Cimbicidae and Tenthredinidae incised on the ventral surface to form a pair of median lobes or processes, the parapenes. Harpes always present, articulating with the gonostipites; never with gonomaculae. Volsellae and sagittae always approximately the same shape; sagittae with a mesal hook-like process and an apical point or process. Penis valves of many different shapes. They are characters which are extremely valuable in specific diagnosis of many genera.

MEGALODONTOIDEA.—*Macroxyela*, fig. 167.—Capsule not turned, the sagittae and volsellae on the ventral surface. Gonocardo present as a broad band. Gonostipes large, resembling in shape that found in *Arge*, fig. 160. Harpes articulating with the gonostipes, with an apical gonomacula (gm). Volsellae and sagittae similar to those of Tenthredinoidea, but much reduced. The genitalia of the Megalodontidae are similar in all essentials to those of the Xyelidae with the exception of the gonocardo, which is very narrow, and the volsellae and sagittae which are even further reduced.

SIRICOIDEA.—The genitalia of the families of this group differ greatly, so they are described separately.

Xiphydriidae (*Xiphydria*, figs. 161, 162).—Very similar to *Macroxyela*, differing only slightly in the relative size of the parts. Volsellae and sagittae essentially like those of *Macroxyela*, fig. 167, small, and concealed on the mesal face in repose. Harpes with gonomaculae.

Siricidae (*Urocerus*, fig. 166).—Dorsal expanse of gonostipites larger, ventral expanse smaller than in *Xiphydria*. Harpes stout, with gonomaculae. Volsellae represented by a flat, sclerotized plate. Sagittae more erect in position, the apical portion rounded and bearing tooth-like projections. Penis valves stouter. Ventral surface with a long, slender, sclerotized style extending from the base up the meson of the gonostipes to the base of the sagittae.

Orussidae (*Orussus*, fig. 169).—Very unlike the capsule of any other sawfly. Gonocardo large, wide on the dorsum. Gonostipes with a large dorsal expanse, fused on the center with the volsellae, the two separated by a suture. Sagittae greatly elongated, with a long basal portion and an apical, clasper-like portion which extends slightly beyond the harpes. Harpes separated from the gonostipes by a wide area of membrane, triangular, and more or less inconspicuous due to the larger apex of the sagitta; gonomaculae not present.

CEPHOIDEA.—The genitalia of the only family in the superfamily show some interesting deviations from other sawfly capsules. *Janus*, fig. 165.—Gonocardo enlarged laterally to form a very thin sheath covering the basal portion of the gonostipes. Gonostipes and harpes separated either by an indistinct suture or not at all, with no articulation between the two sclerites. Volsellae and sagittae with their apices knob-like and provided with minute peg-like elevations.

ICHNEUMONOIDEA.—Braconidae (*Aleiodes*, fig. 168).—Considerably different in aspect to any of the sawfly genitalia except those of the Cephidae, fig. 164. Gonocardo ring-like, as in the sawflies. Gonostipes and harpes completely fused with no trace of a dividing suture. Sagittae similar in shape and position to those of *Janus* and *Urocerus*. Volsellae large, the apical portion triangular. Both volsellae and sagittae provided with small knobs or teeth at apex. The genitalia of several other Ichneumonoids have been examined and found to be of the same type as *Aleiodes*, the sagittae and volsellae occupying approximately the same position, and the harpes always completely fused with the gonostipes.

A restudy of the male genitalia has substantiated practically all the conclusions pointed out by Crampton. They show that the Megalodontoidea and Xiphydriidae are closely related, and that the former are similar in many respects to the Tenthredinoidea. One point is especially noteworthy. The almost complete fusion of the harpes with the gonostipes in the Cephidae is a distinct step towards the condition found in the Ichneumonoidea, which rebuts as much as anything else the assertion of Rohwer and Cushman that the Orussidae are the true intermediates between the Symphyta and the Apocrita. It is quite evident from the male genitalia that the Cephidae are the true intermediates between these two suborders.

## PHYLOGENY

In a review of the morphology, three sets of characters stand out as offering a basis for primary groupings of the sawflies. These are:

(1) Head capsule, with its four types:—open, fig. 2; maxapontal, fig. 8; genapontal, fig. 19; and closed, fig. 5.

(2) Mesosternum, with its three types:—trapezoidal, fig. 134, and its derivatives through atrophy; triangular, without a wide presternal bridge, fig. 131; and triangular, with a wide presternal bridge in front of it, fig. 129.

(3) Male genitalia, with two types:—normal, with the sagittae and volsellae ventral in position; and turned so that the sagittae and volsellae are dorsal.

### THE SUPERFAMILIES OF SAWFLIES

Trial and error grouping on the basis of the above characters shows that any one set does not give satisfactory division. For instance, if we group together all those with the open type of head, we find forms with the trapezoidal sternum and inverted genitalia included among those with the widest presternal bridge and normal genitalia. There are so few discrepancies of this nature, however, that continued experimental groupings bring out the existence of four major divisions of the sawflies, which are considered superfamilies, as follows:

*Tenthredinoidea*.—This group is unique in having the male genitalia inverted, the pronotum narrow and reduced to a thin strap on the meson, and in combining an open type head with a trapezoidal mesosternum, whether determined by sutures or internal muscle attachments. These two latter characters are not confined to this superfamily but are found together in no other.

*Siricoidea*.—Set off from all other sawflies by the genapontal head, fig. 19, and spatulate labrum, fig. 15. As nearly as can be determined the sternum is triangular, with definite evidence of a narrow presternal bridge in some forms. This is undoubtedly the most heterogeneous group of the sawflies.

*Cephoidea*.—This small superfamily is characterized by the maxapontal head, fig. 8, and a large number of other characters not possessed by other sawflies. These include such significant items as: (1) possession of a corpotendon on the tentorium, fig. 12, as well as the apical origin of the supratentorial arms; (2) lack of well differentiated claspers in the male genitalia, fig. 165; and (3) lack of cenchri, fig. 121.

*Megalodontoidea*.—Three families, Xyelidae, Pamphiliidae, and Megalodontidae, have been placed together in this superfamily. They combine

an odd assortment of extremely diverse characters. The Xyelidae have an open type head, fig. 2, and a wide presternal bridge, fig. 129. The Pamphiliidae have the extreme closed head, fig. 5, but in almost all other respects are similar to the Xyelidae, including the wide presternal bridge. The Megalodontidae also have the closed head and in most characters are similar to the Pamphiliidae but lack all trace of a presternal bridge, in fact have a trapezoidal mesosternum as have the Tenthredinoidea.

## FAMILY GROUPINGS

### *Tenthredinoidea*

The members of this superfamily have extremely diverse antennae and wings. The antennae include such extreme types as bifurcate, fig. 98, pectinate, fig. 105, serrate, fig. 106, clavate, fig. 101, capitate, fig. 100, and various proportions of simple types, figs. 93, 97. The wings vary in the position of almost any vein or cross-vein, and the shape of almost any cell.

Grouping characters of a more fundamental nature include the presence or absence of (1) preapical spurs on the tibiae, (2) sterno-pleural sutures, and (3) parapenes on the male genitalia, fig. 163. Intergrading forms occur between the extremes of the latter two.

By using characters distinctive to a single group it is possible to break up the nearctic representatives into five families, as follows:

*Argidae*.—Antennae three-segmented, the third segment long, either simple, fig. 97, or furcate, fig. 98.

*Acorduleceridae*.—Praescutal sutures atrophied posteriorly, and anterior margin of mesoscutellum sinuate, fig. 126. Antennae six-segmented, small, fig. 95.

*Tenthredinidae*.—Inner spur of front tibiae cleft at apex, fig. 114. Antennae have eight to ten segments, ranging from filiform to clavate; sometimes with one or two pectinations, fig. 104. Sterno-pleural sutures and preapical spurs absent.

*Diprionidae*.—Antennae serrate, fig. 107, or pectinate, fig. 105, having at least twelve segments. Sterno-pleural sutures and preapical spurs absent.

*Cimbicidae*.—Lateral margins of abdomen sharply angled. Antennae capitate, fig. 100. Sterno-pleural sutures and preapical spurs absent.

The Australian and South American faunae contain a large number of forms which are divided by Rohwer and Benson into three or four families, the Pergidae, Loboceridae, Perreyiidae, and Pterygophoridae. These are apparently close relatives of the Argidae and Acorduleceridae, having either preapical spines on the tibiae, sterno-pleural sutures, or the simple



type of male genitalia without parapenes. A detailed study of this fauna, especially from the neotropical regions, is necessary before the segregation of these groups can be stabilized.

### *Megalodontoidea*

The head capsules at once divide the nearctic members of this superfamily into two groups, those with an open head, fig. 2, and those with the closed head, fig. 5. Within these two groups there are a few striking differences, so they are considered two families, viz.:

*Xyelidae*.—Head capsule open, fig. 2. Antennae with third segment greatly lengthened or enlarged, figs. 86, 87. Labium with alaglossa absent, fig. 77.

*Pamphiliidae*.—Head capsule closed, fig. 5. Antennae filiform, fig. 88. Labium with alaglossa present, as in fig. 71.

### *Siricoidea*

Of the four superfamilies, the Siricoidea is divisible into the best marked families. The diverse types of mesonotum, mesosternum, mouthparts, etc., indicate the existence of four families, as follows:

*Syntectidae*.—Mesosternum triangular, fig. 130, with the mesopleurae produced to form two long, rounded processes in front of it. Mesonotum without a transverse suture, but normally divided, fig. 122; head without a groove for the reception of the antennae in repose, fig. 21.

*Xiphydriidae*.—Mesosternum with sterno-pleural sutures almost atrophied; mesonotum divided by a transverse suture, otherwise normally divided, fig. 123; head with a shallow groove for reception of antennae, fig. 22.

*Siricidae*.—Mesosternum set off from pleurae as a depressed area, fig. 138, with a narrow presternal bridge, fig. 137; mesonotum with praescutal sutures faint, and with two lateral grooves setting off parascutal lobes, fig. 127 (y); head with narrow, reniform eyes and a well marked antennal groove, fig. 18.

*Orussidae*.—A very striking group set off by the head, in which the portion bearing the antennal sockets, pretentorinae, clypeus, and labrum has shifted on to the ventral aspect, figs. 23 and 24, with a curiously modified tentorium, figs. 26 and 27.

### HYPOTHESIS OF GENEALOGY

The evolutionary tendency of the sawfly groups (and Hymenoptera) has been chiefly in the direction of fusion or simplification of parts. The

wing venation and the thoracic sclerites, for instance, have been greatly reduced in number of parts in comparison with the Neuropterous types, from one of which they undoubtedly arose (Ross, 1936a). This, however, is not a uniform rule for modifications within the order. Evolution may be expressed equally well by the addition of parts as well as their subtraction. A good example of this is seen in the case of the mandibles in the family Tenthredinidae (Plate III). The four-toothed mandible of *Tenthredo*, fig. 42, and the one-toothed mandible of *Eriocampa*, fig. 48, both have developed from the bidentate type represented by *Lycaota* and *Strongylogaster*, figs. 46, 51, the former by the addition, the latter by the reduction, of parts. The same is shown by the antennae, the simple, nine-segmented antenna of the Tenthredinidae, fig. 103, having arisen from the same stock as the multi-segmented pectinate antenna of the Diprionidae, fig. 105. The condition of the antenna of the Tenthredinidae has resulted from a reduction in the number of segments and the lengthening of each segment; that of the Diprionidae from the addition of lateral outgrowths to a more or less primitive multi-segmented antenna.

The entire sawfly group is relatively closely knit from a structural basis, when one considers the resemblance of primitive forms of each superfamily. A conclusion based on the extremes in structure between distantly related forms would be very different, but such a conclusion is one-sided and erroneous. In fact, so small is the jump between any two related families that it seems very advisable to consider the group as a single suborder, the Symphyta.

The Symphyta are divisible into two major series, the Strophandria (Tenthredinoidea) and Orthandria (Megalodontoidea, Siricoidea, and Cephoidea). The Strophandria are characterized as follows: male genitalia turned 180° on the median axis before eclosion; and second radial cross-vein (if present) joins  $R_s$  distad of the second radio-medial cross-vein. In the Orthandria the male genitalia are not turned and the front wings have second radial cross-vein joined to  $R_s$  proximad of the second radio-medial cross-vein. The Strophandria comprise a compact group, and the Orthandria contain a series of superfamilies which are closely linked by their respective primitive families, the Xyelidae, Syntectidae, and Cephidae.

The Strophandria have undergone considerable modification of antennae, tibial spurs, wing venation, and mouthparts, and have lost certain sutures in some families, for instance the sterno-pleural and prepectal sutures. In spite of these numerous differences, it seems impossible to divide the group into two or three major groups. It seems probable, on the other hand, that the group might best be expressed as a single, large, pectinate branch, Chart 1. Therefore, the Strophandria are considered as comprising a single superfamily, the Tenthredinoidea.

The Orthandria present a different condition, Chart 1. They are composed of three distinct groups which may be easily set apart on the basis of head capsule and mesosternum. The Xyelidae and Pamphiliidae are at once segregated from the other Orthandria on the basis of the large presternal bridge, fig. 129 (psb), formed by the fusion of the mesoepisterna anterior to the mesosternum. The two families themselves are remarkably different in respect to the head and mouthparts, but are just as remarkably similar in thoracic structure, legs, and the basic plan

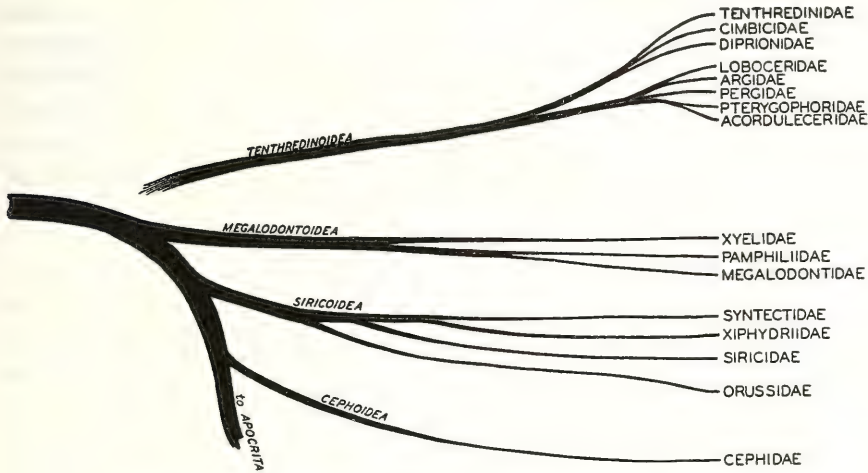


CHART 1.—GENEALOGICAL ARRANGEMENT OF SAWFLY FAMILIES

of the wings. They are therefore considered collectively as the superfamily Megalodontoidea.

The remaining families of the Orthandria are divided into two superfamilies on the basis of the head capsule: (1) the Cephoidea (including Cephidae only) have the occipital foramen separated from the maxacava by a maxapont, fig. 8, and (2) the Siricoidea (including Syntectidae, Xiphydriidae, Siricidae, and Orussidae) have the occipital foramen separated from the maxacava by a genapont, fig. 19.

These two superfamilies are closely related. This is shown by the similarity in the wing venation of the Cephidae and the Syntectidae and Xiphydriidae, the loss or reduction in each of one of the apical tibial spurs of the prothoracic legs and the similar ventral tilting of the tentorium. The Cephidae, however, represent an offshoot of the Siricid stem before the others had developed the genapont. The two lines resulting from this branching have become modified in entirely different characters. The

Cephoidea followed the line leading to a petiolate abdomen and a head capsule with a more open maxacava, whereas the Siricoidea followed the line leading to extreme consolidation of the thorax and abdomen, resulting in the loss of all flexibility between the two, and the development of a stronger head with a more enclosed maxacava.

The selection of the characters mentioned above as being indicative of relationships has been fraught with many difficulties. In the first place, so many instances have been discovered of true parallel evolution that it has been problematic to decide when similarities were significant of relationship or merely another case of parallel evolution. These instances will doubtless have been noticed in a perusal of the foregoing discussion of the morphology. There has frequently occurred, also, the combination of very primitive and very specialized characters in the same form, where it has been necessary to decide which ones were the more significant. In order to harmonize these observations it seems advisable to present a hypothetical reconstruction of the origin and development suggested for the different groups segregated in this treatise.

Members of the early sawfly stem had a simple head capsule, fig. 2, distinct sterno-pleural sutures, figs. 129, 134, slender and multi-segmented antennae, fig. 88, and tibiae with two unmodified apical spurs and at least one to four preapical spurs, fig. 110. This is simply an assemblage of the generalized characters found in existing forms of the group.

The Tenthredinoidea branched off before this collective pattern had changed greatly. After their separation from the main stem, these sawflies developed the strophandrous or turned male genitalia. Very likely the mesosternum resolved itself into its present trapezoidal shape at this time also. The group was exclusively a leaf-feeding one and probably evolved its large number of genera and species concurrently with the increasing diversity and evolution of the surrounding flora. It split up into a number of well-marked groups which correspond to the families recognized in this paper.

The earliest families to emerge from the group were the Pergidae, Argidae, Loboceridae, Perreyiidae, and the Pterygophoridae-Acorduleceridae complex. All these have retained the preapical spurs and the sterno-pleural sutures in at least their primitive genera. They have developed many differences of an apparently adaptive nature—the Pergidae have reduced, clavate antennae; the Argidae have antennae still further reduced, the flagellum composed of only a single, thick segment, fig. 97, which is furcate in some of the males, fig. 98; the Perreyiidae and Pterygophoridae have antennae modified in the opposite direction, with a multi-segmented flagellum, serrate in the female and pectinate in the male (similar to figs. 106 and 105, respectively). There is a series of characters of somewhat the same nature in the wings. Media and first

medio-cubital cross-vein may be parallel or divergent, many of the cross-veins may be present or absent, and the anal veins may assume various patterns. These characters appear in random combination throughout the Tenthredinoidea.

The behavior of the sterno-pleural sutures and the preapical spurs in some of these families is indicative of the condition we find in the more specialized Tenthredinoidea. For instance, in the Argidae the sterno-pleural sutures are present in some members, weak in others, and apparently absent in the remainder; and the preapical spurs of the tibiae are present in the genus *Arge* but not in *Atomacera*, *Sterictiphora*, *Sericocera*, and others. Again, the Acorduleceridae and Pterygophoridae are apparently very closely related and evolved from a common parent, but in the former the sterno-pleural sutures are entirely absent and the preapical spurs present, whereas in the latter the preapical spurs are absent and the sterno-pleural sutures are distinctly present.

The more recently differentiated Tenthredinoidea have lost both sterno-pleural sutures and preapical spurs. They comprise three families, the Diprionidae, Cimbicidae, and Tenthredinidae. These have developed peculiar characteristics which set them off from each other distinctly. The Cimbicidae have conspicuous capitate antennae, fig. 100, and also have the abdominal terga angulate on the lateral margin, so that their ventral portions appear to be pleurites. The Diprionidae are characterized by the antennae, which have thirteen or more segments, serrate in the female, fig. 106, and pectinate in the male, fig. 105. The Tenthredinidae have setaceous, fig. 103, rarely clavate, fig. 101, antennae and a peculiar modification of the caudal margin of the mesoscutellum, fig. 124 (pt), known as the post-tergite.

Most of the Tenthredinidae have another interesting difference from the remainder of the Tenthredinoidea. Instead of both apical spurs of the front tibiae being simple and alike, one of them is furcate at the tip, fig. 114. It is interesting to note that this or some variation of it is the condition found throughout the Orthandria. Not all the Tenthredinidae possess this character. *Athalia* has both spurs unmodified, similar in this respect to the other Tenthredinoidea; in the small species of the leaf-mining Phyllotominae and a few Nematinae the apical incision in the modified spur is absent; but in all the other members of the family which I have seen this furcation is pronounced.

Except for lacking the sterno-pleural sutures and the preapical spurs, the Tenthredinidae are probably the most unmodified family in the entire superfamily. Its primitive genera have an almost hypothetical wing venation, antennae unmodified except by reduction in the number of segments, and a distinct prepectus. In addition, the family is represented at the present time by more genera and species than any other sawfly

family. For this reason the family may be truly called the growing bud at the end of the Tenthredinoid branch.

The other main stem of the sawflies (the Orthandria) had meanwhile broken up into numerous groups. Before this fraction occurred, however, the anterior ends of the sterno-pleural sutures had met on the meson and the mesoepisterna had formed a presternal bridge in at least some measure. Apparently, also, one of the apical spurs of the front tibiae had become furcate as in the Tenthredinidae.

The Megalodontoidea were the first group to break off. This occurred before the head had changed from the primitive open type. This group early resolved itself into its component families, the Xyelidae, Pamphilidae, and Megalodontidae, which have evolved along entirely different paths and clearly indicate their early separation by their fundamental differences, set forth on page 35.

After the digression of the Megalodontoidea, the Orthandria split dichotomously into the Siricoidea and Cephoidea. Both groups are represented in our fauna only by wood-boring or stem-boring species or parasites of wood-boring insects.

The Siricoidea developed the genaponta, fig. 19, almost immediately after their differentiation as a group. They also lost the preapical tibial spurs. There has been a very marked tendency towards a consolidation of the body sclerites in all four families of this superfamily.

Syntectidae is the most primitive family of the Siricoidea. It has distinct sterno-pleural sutures, fig. 130, which are similar in position to those of the Xyelidae and suggest a close relationship of these two families. The mesoepisterna are curiously produced anteriorly and are probably an orthogenetic expression of this relationship. The pronotum, fig. 122, is like the rectangular type found in the Megalodontoidea and Cephoidea, and forms a convenient intermediate between these sawflies and the remainder of the Siricoidea. The Xiphydriidae, fig. 123, have the pronotum much more reduced on the meson, and have developed a secondary suture across the mesonotum between the wings. The Siricidae, fig. 127, have undergone a great consolidation of the sclerites of the thorax and of the metathorax with the abdomen. The praescutum is only faintly discernible, the transverse suture across the mesonotum is present as two lateral diagonal grooves, and the scutellar sutures have the same groove-like appearance. The mesoepisterna and mesosternum have completely fused, leaving only a very faint trace of the sterno-pleural suture; according to this trace and the position of the furca, figs. 137, 138, there is a very narrow presternal bridge. The entire thorax and base of the abdomen form a solid mass, with no flexibility remaining. The antennae, fig. 18, have migrated ventrally on the head and come to lie adjacent to the

pretentorinae; the clypeus is half turned under, and the labrum is almost entirely concealed under it.

The Orussidae, fig. 142, like the Siricidae, have a solid and inflexible thorax and abdomen. The praescutal sutures are present, but do not join on the meson, continuing longitudinally to the secondary suture across the scutum. This suture is as well marked as in the Xiphydriidae. The wing venation, fig. 177, has been greatly reduced by atrophy, and is obviously a derivative of the Xiphydriid type of venation. The antennae, clypeus, and part of the frontal region have migrated on to the ventral aspect of the head, presumably a more advanced expression of the tendency shown in the Siricid head. In the Orussidae, also, the antennae are adjacent to the pretentorinae, both being situated on the ventral aspect of the head.

The three families Xiphydriidae, Siricidae, and Orussidae comprise an interesting complex. In all of them the paraglossae and alaglossa have become decidedly fused, either entirely or in part. They have the secondary transverse suture across the mesoscutum, which is also a conspicuous feature of many of the Apocrita. All three families, also, have the tentorium deflected antero-ventrally, and in the last two mentioned the antennae and other parts of the head have migrated ventrally.

The Orussidae have been placed as a separate suborder by Rohwer and Cushman (1917) and held as such since then by various authors. The parasitic habit of the larva of *Orussus*, the ventral position of the antennae and the closed condition of the end of the abdomen of the male were the chief characters upon which the family was raised to subordinal rank. Considering that both the Xiphydriidae and Siricidae have tree-boring larvae, there is reason to suppose that an offshoot of their branch might produce a parasite whose host was a wood-borer, as is the host of *Orussus* (*Dicerca*, Buprestidae; see Burke, 1917). The reduction of the thoracic legs in the larvae of *Orussus* could easily be purely adaptative to a parasitic life. It seems no more fundamental than the loss of abdominal legs by the Cephidae and other Siricoidea, which have boring larvae. The ventral position of the antennae in *Orussus* is one of the strongest arguments proving its close relationship to the Siricid stem, rather than one for separating it widely from all the sawfly group. It is true that the Orussidae have some extremely distinctive characters, such as the unique type of male genitalia, fig. 169, the form of the praescutal sutures, the atrophy of the supratentorial arms, and the atrophy of many of the wing veins. But on the other hand they are of decided Siricoid stock and actually possess no more distinctive characters than the Siricidae. For this reason it seems a better expression of their relationship to consider them as belonging to the Siricoidea.

The other major group of the ancestral Siricoid stem developed into

the Cephidae. In these, the wing venation, fig. 175, has remained to the present day almost exactly as we find it in the Syntectidae and Xiphydriidae. The hind wings, however, have lost the short row of bristles present at the base of the wing in the Xyelidae and the two latter families, figs. 171, 176. The preapical spurs on the tibiae are still retained; but the single apical spur on the front tibiae is different from any others in the group, figs. 114-119. There are several characters found in this family which apparently represent the beginnings of specializations found in the Apocrita or higher Hymenoptera: the metanotum is very closely united with the mesonotum, and the first abdominal tergite with the metanotum, whereas a marked constriction has developed between the first and second abdominal terga and a rudimentary articulation exists between them; the corpotentorium has a very small corpotendon and the supratentorial arms join the exoskeleton near the margin of the eye; the cenchri are absent; the mesopostnotal apodeme is long, as in fig. 152; and the wings show a decided tendency towards the atrophy of the first radial cross-vein.

The Braconidae (which are accepted as the most primitive family of the Apocrita) apparently arose from a Cephoid ancestor. The chief differences between the Braconids and the sawflies may be summarized as follows:

<i>Symphya</i>	<i>Braconidae</i>
1. Abdomen not petiolate (except slightly in Cephidae).	1. Abdomen petiolate, a distinct articulation between tergites 1 and 2.
2. Postgenae and maxillariae not shelved in around maxacava.	2. Postgenae and maxillariae angled in to form a shelf around maxacava.
3. Corpotendon absent (except in Cephidae).	3. Corpotendon distinct and large.
4. Mesopostnotal apodeme short (except in Cephidae, Siricidae).	4. Mesopostnotal apodeme long, similar to Cephidae.
5. Male genitalia with harpes distinct (except in Cephidae).	5. Male genitalia with harpes entirely fused with gonostipes.
6. Cross-vein <i>lr</i> present (except in Orussidae and some Cephidae).	6. Cross-vein <i>lr</i> absent.

This tabulation shows the close relationship of the Cephidae and Braconidae. It is not intended to use this as an argument for grouping the Cephidae with the Apocrita, for they are essentially sawflies in every sense of the word. The significant point is that many specializations of the lower Apocrita beyond the sawflies have at least some expression in the Cephidae. In other words, it establishes the hypothesis that the Cephidae represent the ancestral form of the primitive Apocrita.

The more specialized Apocrita have developed the transverse suture across the mesonotum and the longitudinal condition or entire atrophy of the parapsidal (praescutal) sutures, such as we find in the Orussidae and Siricidae, respectively. These conditions, however, are not found in



the Braconidae, which have a mesonotum similar to that of the Cephidae.

According to the hypotheses set forth in this reconstruction, the Orthandria constitute a veritable experimental ground from a biological sense. The most primitive members are external leaf feeders, the more specialized ones are stem and wood borers, and two separate branches have each produced a parasitic form, the Orussidae from the Siricoidea and the Braconidae from the Cephoidea. The former was accompanied by several changes in the adult insect, but none of these were more than would be expected from an aberrant offshoot. In the case of the Braconidae, however, the entire adult has undergone a radical reorganization which has been a marked change from the prevailing condition among the sawfly groups. This is exemplified in the head, especially the tentorium, and the articulate, petiolate abdomen. The product resulting from this reorganization has apparently been vigorous and well adapted to a predator-parasitoid rôle. Furthermore, this adaptability has been very flexible, as is evidenced by the numerous types of parasitic, predaceous, phytophagous, and omnivorous biologies which have evolved from it. Whereas their closest relatives, the Siricoidea and Cephoidea, are at the present time in the class of decadent groups, the Apocrita constitute a very abundant, virile stem successfully following a large number of avenues of existence.

It is interesting to note in this connection that of all the sawflies the superfamily Tenthredinoidea alone has the appearance of being an ascending and not a decadent group. Among these, the family Tenthredinidae stands out as the most virile stem of the entire superfamily. At the present day it contains approximately eighty per cent of all the species of the Symphyta.

No attempt has been made to place the family Blasticotomidae in the present phylogenetic arrangement. It has been impossible to obtain specimens for dissection of *Blasticotoma filiceti* (Klug), the sole representative of the family. Consequently the course of the sterno-pleural sutures (which are atrophied) and the orientation and composition of the male genitalia could not be determined. Without knowledge of these parts and others which must be dissected out, it is impossible to make any accurate placement of the family.

#### *Comparison with Other Classifications*

In the main features of arrangement, the present classification is similar to that of Konow (1905), which was the first really comprehensive one to be outlined. The categories are quite different from Konow's, but this is chiefly due to the subsequent elevation of lower groups to family ranking.

Ashmead (1898) proposed a radically different classification using units based on such characters as wing venation and relative body proportions. It has been abandoned by all authors since that time, and has been found equally untenable by the present author.

The classification proposed by MacGillivray (1908) is subject to much the same criticism as Ashmead's. The entire group is considered as one superfamily, divided into nine families, and one of these, the Tenthredinidae, into twenty-four subfamilies. The basis for the entire classification is the wing venation. Figuring prominently among the characters are the presence or absence of the radial cross-vein, the condition of the anal cells, the parallel or divergent condition of M and *lm-cu*, and cell R 1&2 being appendiculate or not. These characters are subject to variation between the two indicated extremes, and have been one of the richest grounds for parallel development. The use of this single set of characters has led to the following misconceptions: (1) grouping together unlike families due to parallel evolution of certain features of the wings (e.g., Megalodontidae and Siricidae); and (2) improper stratification of groups. This last is well exemplified by his treatment of the Tenthredinidae. The families Argidae, Cimbicidae, and Diprionidae are in reality units of about the same status as the family Tenthredinidae. The family Tenthredinidae includes the subfamilies Nematinae, Selandriinae, Blennocampinae, and others, which are comparable to subfamilies of the Diprionidae and Cimbicidae, not to the entire families themselves. Yet on the basis of only one set of characters, MacGillivray has listed these groups of different status (Diprionidae, Cimbicidae, Nematinae, Selandriinae) as units of the same category (subfamilies).

In the family Tenthredinidae as herein restricted, the wing venation has proved to be the best basis yet known upon which to make subfamily divisions. In these, many of MacGillivray's subfamilies have proved highly satisfactory, but others again reflect the use of too variable characters.

Rohwer (1911e and subsequent emendations) has followed Konow's classification very closely. He has added to that a large number of new characters and made use of superfamily and family categories to bring out more fully the phylogenetic significance of the groupings. The family units are at great variance with those employed by MacGillivray, but seem to be logical from the standpoint of utility and comparability. They are accepted in this paper with but one or two exceptions.

The chief differences between Rohwer's classification and the one embodied herein are as follows: (1) Rohwer considers the Orussidae to represent a separate suborder, the Idiogastra, whereas it is considered here to be a family allied to the Siricidae, Xiphydriidae, and Syntectidae; (2) the Cephidae are here considered as a separate superfamily,

whereas they are grouped with the Megalodontoidea by Rohwer; (3) the unique genus *Syntexis* is placed in the Cephidae by Rohwer, but here is transferred to the superfamily Siricoidea and placed in a separate family, the Syntectidae.

Enslin (1912-18) used a system differing markedly from any of these, in that the Megalodontoidea and Tenthredinoidea of this paper are grouped by him into a single family. This seems to have been done chiefly on the basis of the tibial spurs. The Cephidae were considered a subfamily of the Siricidae. A more complete analysis of this arrangement will show it to be strikingly similar in one or two important respects to that proposed in this paper, except for a difference in the ranking of the different groups. For instance, the tribes and subfamilies used by Enslin are the subfamilies proposed by Rohwer and myself. Aside from this the close relationship of the Cephidae and Siricoidea is expressed, and also the fact that the Tenthredinoidea are more closely related to the Megalodontoidea than to any other group.

Boulonge (1924), in his study of the musculature of the male genitalia, arrives at these same two conclusions. He states, furthermore, that the Siricidae have the most primitive male genitalia of any sawfly, and from this infers that this family is the most primitive of the Symphyta. The highly specialized characters of the family indicate rather that it separated from its progenital stem almost as early as any group.

#### LARVAL CHARACTERS

The morphological data presented by Yuasa (1923) in his classification of larval sawflies and horntails neither substantiates nor refutes the main hypotheses just presented. In the first place, the larvae have relatively few differentiated areas or parts as compared with the adults. For instance, there are no definite sclerites on the thorax and no structures comparable to the male genitalia bearing a number of characters and parts. In the second place, what parts are evident do not present the wide range of difference the same part does in the adult. This is well shown in the maxillae and labia. In the larvae they differ only in number of segments of the appendages and only slightly in shape. In the adults these same parts assume a great variety of shapes.

The most significant larval characters seem to be the lack of segmented thoracic legs in the Siricoidea and Cephoidea. This, however, may be correlated more with the stem-boring habits of this group than with phylogeny. This same condition is approached by the leaf-mining genera of the distantly related Tenthredinidae. The Siricoidea and Cephoidea are further set off in having reduced or atrophied ocellaræ and reduced mouthparts.

On the whole, it would appear that characters affording distinct grouping of the sawfly group into large segregates either are not present or have not yet been located in the larvae. It may well be that their characters are adaptive to their habits and environment to such an extent as to obscure phylogenetic differences.

One valuable indication the larvae do give, the probable antiquity of some dichotomies in our genealogical tree. These points are of considerable interest in a few cases, which will be discussed in detail.

The Xyelidae and Megalodontidae are closely related, yet differ more in head structure of adult than any other two families of sawflies. The larvae show equal diversity. Those of the Xyelidae have larvapods on all segments of the abdomen and no subanal appendages; those of the Megalodontidae have no larvapods but have well developed subanal appendages. This difference adds much weight to the opinion that the dichotomy of these two families is very old.

Yuasa considers that a combination of the characters of these two families would give a hypothetical ancestral larva for the sawflies, with the following: abdomen with larvapods on all segments, subanal appendages, functional metaspiracles, and little indication of annulations on the segments.

The Tenthredinoidea are unique in having some abdominal segments, at least the first and ninth, sometimes also the seventh and eighth, without larvapods while the remainder possess them. This morphological differentiation on the abdomen is probably a significant character, in view of the distinctness of the group based on adults.

A study of the leaf-mining Tenthredinidae brings out clearly how rapidly larval changes accompany burrowing habits. The subfamily Phyllotominae consists of a genus of free leaf feeders, *Caliroa*, and a number of leaf-mining forms, such as *Phyllotoma*, *Metallus*, and *Fenusa*. These latter genera have the antennae reduced from five segments to four, three, two, or one; the thoracic legs sometimes with trochanters and tibiae fused with femur, in one instance (*Phyllotoma*) with the tarsal claws represented by only fleshy tubercles. This does not reach the state of reduction found in the Siricoidea but shows how soon such a state could be acquired in connection with the burrowing habit.

#### BIOLOGY

The biology of the sawflies adds some interesting points to their phylogenetic considerations. Alone they do not seem of great importance but taken in conjunction with what has just been discussed they present some corroborative evidence. A brief résumé will first be given of the more diagnostic points in their biology. I have definite information only on nearctic families.

TENTHREDINOIDEA.—Larvae external leaf-feeders with the following exceptions: three genera of the Tenthredinidae (*Lycaotella*, *Euura*, and some *Nematus*) are gall makers; several species of *Nematus* form a leaf curl; all the Tenthredinid tribe Phyllotominae except *Caliroa* are leaf miners; one Tenthredinid genus *Caulocampus* is a petiole miner in maple leaves; another, *Hoplocampa*, mines in fruits of Rosaceae; and several Argidae are leaf miners in their early instars. The pupae of the Argidae, Cimbicidae, and Diprionidae are all enclosed in hard cocoons which can be formed on an open surface. The pupae of the Tenthredinidae are divisible into two groups: (1) the subfamilies Cladiinae and most Nematinae form cocoons similar to the preceding; (2) the pupae of the remainder of the family have either a weak cocoon or none and are dependent for protection on earthen cells or chambers in twigs, rotten wood, etc. The pupae are quiescent.

MEGALODONTOIDEA.—Larvae either free leaf feeders, leaf curlers, or feed in the staminate cones of pine. Pupae formed in a cell in the ground. The few recorded observations known indicate that the pupae are active. Mr. J. M. Langston has written me as follows concerning the pupae of *Megaxyela langstoni*: "One interesting point was that the pupae came to the surface of the soil and there cast the pupal skins. They are able to walk before casting these skins." This active condition is similar to the condition found in the Megaloptera. It undoubtedly represents the most primitive pupal condition in the Hymenoptera.

SIRICOIDEA (except Orussidae) AND CEPHOIDEA.—The larvae of these are exclusively stem borers, the Cephidae in smaller stems such as grasses and raspberries, the Siricoidea in trees. The pupa, which is inactive, is formed in a thin cocoon at the terminus of the mine.

ORUSSIDAE.—This family is parasitic on the larvae of Buprestidae (Coleoptera). The larvae are extremely reduced as far as appendages are concerned compared to other members of the family (Rohwer and Cushman, 1917).

In applying this information to the phylogeny, it is evident that the parasitic Orussidae arose from a wood-boring ancestor. Interesting is the fact that its host is a wood-boring beetle larva.

Since the more primitive Apocrita, or higher Hymenoptera, are predator-parasites and the Cephidae are stem borers, there is no biological reason why the former could not have arisen from the latter.

#### *Host Plants*

It was thought at one time that a list of plant families indicating the sawfly groups feeding on them would have a marked significance in determining the primitiveness of the sawflies. When the tabulation was

started it was soon found that the exceptions obscured whatever significance there might be in it.

Two circumstances are worthy of note. The commonest hosts are all very primitive plants and include Polypodiaceae (ferns), Pinaceae (conifers), Graminales (grasses and sedges), Amentifera (willows, alders, hickories, oaks, etc.), and Rosaceae (almost every native genus). There are sawflies which feed on other hosts, but aside from these named few sawflies attack them. Thus only a few species of sawflies feed on such highly specialized families as the Ericaceae, Caprifoliaceae, and Compositae.

A few sawfly groups are very narrowly restricted in host range. The family Diprionidae feeds only on Pinaceae, most of the subfamily Selandriinae (Tenthredinidae) only on Polypodiaceae, and in other groups many genera are confined to a single plant genus. A few groups show a striking range of hosts within a single phylogenetic complex. For instance, in the Nematinae (Tenthredinidae), *Pikonema* feeds only on *Picea* (spruce), *Pachynematus* on grasses and sedges, and *Pristiphora* on a wide variety of plants including *Betula*, *Ribes*, *Sorbus*, and some conifers; yet these three sawfly genera are difficult to separate on external characters.

It is evident, therefore, that host relationships must remain purely corroboratory in making decisions on sawfly phylogeny.

In this regard there is an interesting bit of speculation. The sawfly group has been demonstrated to be an offshoot of an early Panorpid branch (Ross, 1936a). It has been shown by several paleontologists that the diversification and splitting up of the Panorpid complex progressed at a rapid gait during the Permian of the Palæozoic era, so it is possible to assume that the sawfly branch arose at this time also. Granting this, it is necessary to assume that ferns and conifers were their earliest hosts, since none of their other hosts were known to exist at that early period. On the basis of this hypothesis it would seem that the sawflies flourished concurrently with a rapidly evolving flora.

#### SUMMARY OF PHYLOGENY

Every source of evidence shows that the sawflies form two distinct groups, the Strophandria (Tenthredinoidea) and Orthandria (Megalontoidea, Siricoidea, and Cephoidea).

The Strophandria are a unique, detached group of early origin and have evolved into a large number of phytophagous groups. No existing members can be classified as strictly archaic.

The Orthandria are of a different nature. The archaic family Xyelidae, with its primitive venation and active pupa, links the Hymenoptera to a Mecopteroid ancestor, while the Cephidae link the sawfly

group to the parasitic and more specialized Hymenoptera. This substantiates still further the hypothesis of Ross (1936a) that the Hymenoptera are a close derivative of the Panorpid complex as shown by the wing venation.

The abundance of fundamental differences in head capsule, tentorium, subdivisions of the mesonotum and mesosternum, and structure of larvae, found within the Orthandria eclipse the differences within the Apocrita or higher Hymenoptera. This indicates (1) that the groups contained in the Orthandria are of great geologic age, and (2) that the Orthandria represent the early experimental grounds of the Hymenoptera.

## TAXONOMY

The opinions previously expressed in regard to the morphology and phylogeny have been applied in this section to the arrangement and differentiation of the families, subfamilies, and genera represented by the fauna of nearctic America.

### CONSTRUCTION OF KEYS

Many of the characters considered of importance in the phylogeny of the group have proved unsatisfactory in making keys for the recognition of the families. Some are confined to one sex, such as the male genitalia; others, such as the mouthparts, are impossible to see without relaxing the specimen; and still others, such as the structure of the head capsule, can be seen only after clearing and dissecting the specimen. In the key to families, therefore, only characters which are easily seen and interpreted have been used. A key is primarily for use in identification and not necessarily for bringing out phylogenetic relationships, and for this reason all the keys given below have been made with a view to practicability and accurate determination.

The keys in this paper are designated for separating only the groups known to occur in the nearctic region. They are purely artificial, the phylogenetic angles being discussed in the text. This is in the interest of simplicity and has aided greatly in making many keys easy to interpret.

### IDENTIFICATION OF SEXES

In many keys to the genera it is necessary to key out the two sexes separately. They can be differentiated thus: In the *female*, the apical sternites are cleft by a variously shaped, scabbard-like sheath, fig. 293. In the *male*, the apical sternites are not divided along the meson, fig. 424.

## ORDER HYMENOPTERA

### SUBORDER SYMPHYTA

The suborder Symphyta includes those Hymenoptera in which there is neither a narrow constriction nor a ball and socket articulation between the first and second abdominal segments, figs. 139-143.

### *Treatment of Superfamilies*

The characterization of the superfamilies is more a matter of phylogenetic interest than an essential to classification. It is easier to construct an artificial key to the families of the entire sawfly group than to burden



the identifier with keys to the superfamilies. These are described on page 33, and no further keys are given.

#### KEY TO FAMILIES

1. Antennae inserted on the ventral aspect of the head, fig. 24.....**Orussidae**  
Antennae inserted on anterior aspect of head, fig. 1.....2
2. Antennae have 3 segments, figs. 97, 98.....**Argidae**  
Antennae composed of more than 3 segments.....3
3. Third antennal segment very long, surmounted by a slender terminal filament composed of 9-25 segments, figs. 86, 87.....**Xyelidae**  
Antennae without a slender terminal filament subordinate to an elongated third segment.....4
4. Antennae capitate, figs. 99, 100.....**Cimbicidae**  
Antennae not capitate, at most clavate, fig. 101.....5
5. Antennae with six segments, fig. 95; scutellum with anterior margin sinuate, fig. 126.....**Acorduleceridae**  
Antennae with more than 6 segments; scutellum with anterior margin V-shaped, figs. 120-124.....6
6. Front tibia with two apical spurs, figs. 113, 114.....10  
Front tibia with one apical spur, figs. 116-119.....7
7. Mesoscutum with two diagonal furrows running from the lateral margin of the scutum to the anterior margin of the scutellum, fig. 127, y; praescutum almost obsolete.....**Siricidae**  
Mesoscutum without diagonal furrows; praescutum distinctly set off by sutures, figs. 121, 123.....8
8. Pronotum reduced to a narrow collar on the meson, fig. 123..**Xiphydriidae**  
Pronotum not greatly reduced on the meson, figs. 121, 122.....9
9. Apical spur of front tibia with inner margin pectinate, fig. 118..**Syntectidae**  
Apical spur of front tibia with inner margin simple, fig. 119.....**Cephidae**
10. Antennae composed of 7-12 segments, figs. 101-104.....**Tenthredinidae**  
Antennae composed of 13 or more segments, figs. 88, 105.....11
11. Antennae slender and simple, fig. 88.....**Pamphiliidae**  
Antennae either serrate, figs. 106, 107, or pectinate, fig. 105.....**Diprionidae**

### SUPERFAMILY TENTHREDINOIDEA

#### FAMILY ARGIDAE

This family is at once recognized by its three-segmented antennae, which are furcate in the males of some genera, fig. 98.

*Diagnostic characters.*—Antennae three-segmented, fig. 97, furcate in the males of some genera, fig. 98. Posterior margin of mesoscutellum without a post-tergite, anterior margin V-shaped or slightly sinuate. Mesosterno-pleural sutures usually present, fig. 134, but sometimes atrophied. Preapical spurs present in one genus, *Arge*. Both apical spurs of front tibiae simple.

At present it does not seem advisable to attempt to divide the Argidae into subfamilies. They obviously form a closely knit group. Furthermore, the family contains many tropical genera, a greater knowledge of which would undoubtedly alter any conceptions based on the nearctic fauna.

## KEY TO GENERA

1. Males.....2  
Females.....4
2. Third antennal segment furcate for its entire length, fig. 98.....6  
Third antennal segment entire, fig. 97.....3
3. Hind wing with cell  $R_1$  closed at apex as in fig. 218.....**Arge** (pt.)  
Hind wing with cell  $R_1$  open at apex as in fig. 214.....**Atomacera** (pt.)
4. Both front and hind wings with cell  $R_1$  closed at apex, fig. 218...**Arge** (pt.)  
At least hind wing with cell  $R_1$  open at apex, fig. 214.....5
5. Tarsal claws bent over at nearly a right angle, just below middle, fig. 215,  
and with the base forming a wide tooth.....**Atomacera** (pt.)  
Tarsal claws not bent much, and only towards apex, the base narrow, not  
forming a tooth, figs. 216, 217.....6
6. Head wide and shallow, without a raised crest between antennae,  
fig. 212.....**Lyrola**  
Head not so wide but deeper, with a raised crest between antennae,  
fig. 213.....**Sterictiphora**

*Arge* Schrank

*Cryptus* Jurine, 1801, p. 163. Monobasic, genotype.—*Cryptus segmentarius* Panzer.

Name set aside by International Zoological Congress, 1935.

*Arge* Schrank, 1802, p. 209. Genotype by subsequent designation of Rohwer, 1911b.

—*Tenthredo enodis* Linnaeus.

*Hylotoma* Latreille, 1802, p. 302. Monobasic, genotype.—*Tenthredo rosae* Linnaeus.

*Cryptus* Panzer, 1805, Heft 88, pl. 17. Monobasic, genotype.—*Cryptus segmentarius* Panzer.

*Corynia* Imhof et Labram, 1836, p. 23. Genotype by subsequent designation of Rohwer, 1911b.—*Corynia rosarum* Imhof et Labram.

*Acanthoptenos* Ashmead, 1898, p. 212. Genotype by original designation.—*Acanthoptenos weithii* Ashmead = *Arge macleayi* (Leach).

*Characteristics*.—Hind tibiae with a preapical spur on outer margin. Both wings with cell  $R_1$  closed at apex, fig. 218. Antennae simple in both sexes, flagellum in female clavate, in male filiform. Tarsal claws simple, long and slender.

Contains a considerable number of nearctic species which are badly in need of revision.

*Atomacera* Say

*Atomacera* Say, 1836, p. 212. Monobasic, genotype.—*Atomacera debilis* Say.

*Micrarge* Ashmead, 1898, p. 213. Genotype by original designation.—*Atomacera ruficollis* Norton. *New synonymy*.

*Characteristics*.—Tibiae without preapical spurs. Wings with cell  $R_1$  open at apex due to atrophy of apex of vein  $R_1$ . Antennae simple in

both sexes, flagellum subclavate. Tarsal claws, fig. 215, bent over at a sharp angle before middle.

As far as known, restricted to the nearctic region, and contains only three or four species.

*Sterictiphora* Billberg

*Characteristics*.—Flagellum clavate in female, lyriform in male, fig. 98. Head with distinct, carinate crest between antennal sockets. Front wings with cell  $R_1$  either open or closed at apex, hind wing with this cell open and vein 2A various.

The members of this genus in the broad sense form a closely knit group, united by the lyriform male antennae, mesal crest on the head, and similar general appearance. There is no doubt, however, that the species known at present can be segregated into distinct phylogenetic units which it seems convenient to keep separate. These differences are to be seen chiefly in the genitalia, but most of the groups have some external characteristic correlated with them. At present these groups, here considered subgenera, have been worked out only for those species occurring north of Mexico. When others are known it will probably be necessary to subdivide some groups further.

KEY TO SUBGENERA

1. Tarsal claws with apical tooth cleft, fig. 217.....**Neoptilia**  
Tarsal claws with apical tooth simple, fig. 216.....2
2. Front wings with cell  $R_1$  open at apex, fig. 214.....3  
Front wings with cell  $R_1$  closed at apex, fig. 218.....**Ptenos**
3. Hind wing with vein 2A atrophied, resulting in the loss of the anal cell, fig. 225.....**Leston**  
Hind wing with vein 2A present, anal cell present, fig. 224.....4
4. Hind wing with anal cell much longer than its apical petiole, fig. 223.....**Sterictiphora**  
Hind wing with anal cell subequal to or shorter than its apical petiole, fig. 224.....**Sphacophilus**

Subgenus *Ptenos* Norton\*

*Ptenos* Norton, 1872, p. 77. Genotype by subsequent designation of Rohwer, 1911b.  
—*Ptenos niger* Norton.

*Characteristics*.—Front wings with cell  $R_1$  closed at apex, fig. 218, hind wings with vein 2A atrophied, fig. 225. Tarsal claws simple, long and curved at apex, fig. 216. Hind basitarsus shorter than the three following combined.

This subgenus contains probably a dozen nearctic species, known to occur in either Mexico or the extreme southwestern United States.

\*Preoccupied. Use *Ptenellus* Malaise, 1937, Entomologisk Tidskrift, p. 56. Genotype by original designation.—*Ptenos nigripectus* Norton.

Subgenus *Neoptilia* Ashmead

*Neoptilia* Ashmead, 1898, p. 213. Genotype by original designation.—*Neoptilia mexicana* Ashmead.

*Characteristics*.—Differs from *Ptenos* chiefly in having the tarsal claws cleft at the apex, the two rays close together, fig. 217.

A single species, *N. malvacearum* Cockerell, has been described from North America.

Subgenus *Sterictiphora* Billberg

*Sterictiphora* Billberg, 1820, p. 99. Monobasic, genotype.—*Hylotoma furcata* Fabricius.

*Schizocera* Lepeletier, 1828, p. 572. Genotype by subsequent designation of Westwood, 1840.—*Hylotoma furcata* Villers.

*Cyphona* Dahlbom, 1835, p. 8. Genotype by subsequent designation of Rohwer, 1911b.—*Hylotoma furcata* Villers.

*Characteristics*.—Differs from *Ptenos* in venation, as follows: front wing with cell  $R_1$  open at apex, hind wing with vein 2A distinct, joining 1A near *cu-a*, so that cell 1A has only a very short petiole, fig. 223.

Contains two nearctic species, *sericea* (Norton) and *prunivora* (Dyar).

Subgenus *Sphacophilus* Provancher

*Sphacophilus* Provancher, 1889, p. 427. Monobasic, genotype.—*Sphacophilus crawii* Provancher.

*Characteristics*.—Differs from *Sterictiphora s. st.* chiefly in having cell 1A of the hind wing short, with an apical petiole as long as the cell, fig. 224.

Contains an undetermined number of nearctic species, including many whose range extends into the neotropical region. The South American group, *Brachyphatnus*, Konow (1906, p. 250) is a close relative of this subgenus.

Subgenus *Leston* new subgenus

*Characteristics*.—As for *Sterictiphora*, having high, sharp median crest between antennae, flagellum clavate in female and lyriform in male, both wings with cell  $R_1$  open at apex, and tarsal claws slender, curved at apex. Differs in having 2A atrophied in the hind wing so that cell 1A is open posteriorly, fig. 225.

*Genotype*.—*Schizocerus zabriskei* Webster and Malley by present designation.

Contains only a single species, the genotype.

*Sterictiphora zabriskei* (W. & M.)

*Schizocerus zabriskei* Webster and Malley, 1900, p. 51.

*Schizocerus sericeiformis* Rohwer, 1908, p. 112. *New synonymy*.

*Schizocerus lineatus* Rohwer, 1909, p. 12. *New synonymy*.

*Schizocerus collaris* Rohwer, 1909, p. 13. *New synonymy.*

*Schizocerus johnsoni* MacGillivray, 1909b, p. 403. *New synonymy.*

### *Lyrola* new genus

*Characteristics.*—Head wide and transverse, the area between the antennal sockets almost flat, not produced into a crest, fig. 212. Third antennal segment of female distinctly fusiform and shorter than width of head. Front wing with appendiculate cell absent as in fig. 214. Hind wing with 2A joined to 1A half the distance from base to *cu-a*. Tarsal claws slender, curved towards apex, fig. 216. Hind coxae of males contiguous at apex, of females slightly separated. Male subgenital plate convex and curved dorsad, so that its axis is oblique.

*Genotype.*—*Schizocera brunniiventris* Cresson, original designation.

The neotropical genus *Sericocera* will key out with this one. *Sericocera* differs in having the hind coxae of the female separated by at least their width at apex and the subgenital plate of the male concave transversely, not curved dorsad, its axis therefore longitudinal.

The genotype is the only species known to belong in this new genus.

### *Lyrola brunniiventris* (Cresson) new combination

*Schizocera brunniiventris* Cresson, 1880, p. 2, ♂, ♀.

*Schizocera tristis* Cresson, 1880, p. 52, ♂, ♀. *New synonymy.*

*Schizocerus tristis* var. *fumipennis* Dyar, 1893, p. 195, ♂, ♀. *New synonymy.*

This species occurs in southern California and Arizona, and has been reared from various legumes, including *Lotus* and *Hosackia*. The abdomen in both sexes varies from rufous through brown to black.

### *Themos* Norton

*Themos* Norton, 1867, p. 58. Monobasic, genotype.—*Themos hyaline* Norton.

This genus originally included a single species represented by a unique specimen and has not since been studied. The characters used to differentiate it from other Argids are not satisfactory; furthermore, Norton expresses the belief that the locality label "Pennsylvania" of the type specimen is probably an error and perhaps should be Mexico or South America. For these reasons *Themos* is simply mentioned here.

### FAMILY ACORDULECERIDAE new family

*Diagnostic characters.*—Antennae filiform, 6-segmented, fig. 95. Mesoscutellum without a post-tergite, its anterior margin sinuate, fig. 126; praescutal sutures with their posterior portion atrophied, so that postero-mesally the praescutum is confluent with scutum. Meso-

sterno-pleural sutures absent. Middle and hind tibiae with preapical spurs, the apical spurs of the front tibiae simple.

This family contains only one genus, *Acordulecera* Say. It has previously been considered as a subfamily of the Pterygophoridae by Rohwer (1911e). The two differ as follows:

<i>Acorduleceridae</i>	<i>Pterygophoridae</i>
Antennae . . . . . 6-segmented, filiform.	Multisegmented, serrate in ♀, pectinate in ♂ (as in figs. 106, 105, respectively).
Tibiae . . . . . Preapical spurs present.	Preapical spurs absent.
Mesosternum . . . . . Sterno-pleural sutures absent.	Sterno-pleural sutures present.
Mesonotum . . . . . Praescutal sutures atrophied posteriorly.	Praescutal sutures complete.
Anterior margin of scutellum sinuate.	Anterior margin of scutellum V-shaped.
Distribution . . . . . American.	Australian.

The male genitalia of the two families are practically identical, fig. 164, so that there seems little doubt of their close relationship. In view of the striking differences between them, however, it seems advisable to separate the two groups as distinct families.

#### *Acordulecera* Say

*Acordulecera* Say, 1836, p. 210. Monobasic, genotype.—*Acordulecera dorsalis* Say.

The only genus in the family, therefore characterized as in the latter.

The genus is restricted to the nearctic and neotropical regions. Dr. O. Conde, of Riga, Latvia, has revised in manuscript the nearctic species, of which about 20 have been described.

#### FAMILY DIPRIONIDAE

*Diagnostic characters*.—Antennae composed of 13 or more segments, serrate in the female, fig. 107, and pectinate, fig. 105, or bipectinate in the male. Mesosterno-pleural sutures atrophied, mesoscutellum with anterior margin V-shaped, posterior margin with an extremely narrow and cord-like post-tergite. Tibiae without preapical spurs; apical spurs of front tibiae simple.

This family has been divided into two subfamilies on the basis of the anastomosis or separation of veins 2A & 3A and 1A in the front wing, and the unipectinate or bipectinate male flagellum. On the basis of other characters, especially genitalia, the family seems too closely knit to necessitate such a grouping.

The best digest of the nearctic members of the group is given by Rohwer, 1918b.

## KEY TO GENERA

1. Males.....6  
Females.....2
2. Supraclypeal area of head raised into a large tubercle below antennal sockets, fig. 231.....**Monoctenus**  
Supraclypeal area not tuberculate, in profile confluent with the clypeus, fig. 232.....3
3. Head and thorax polished, practically impunctate, and metallic blue-black. Antennae with 14 segments.....**Augomonoctenus**  
Head and mesoscutellum either not metallic or with dense conspicuous punctuation. Antennae with 16 or more segments.....4
4. Pulvillar pad of hind basitarsus almost as long as the basitarsus, fig. 229. Abdomen greenish-yellow or transversely banded with black or brown and yellow.....**Zadiprion**  
Pulvillar pad of hind basitarsus about one-half as long as the basitarsus, fig. 228. Abdomen brown, rufous or darker without transverse bands of yellow.....5
5. Mesoscutellum large, with its anterior margin forming a wide V, and entirely covered with large punctures, fig. 220.....**Diprion**  
Mesoscutellum smaller, with its anterior margin forming a narrower V, and only the apical or lateral portions bearing large punctures, fig. 219.....**Neodiprion**
6. Flagellum with all segments unipectinate, fig. 233.....7  
Flagellum with at least basal ten segments bipectinate, fig. 234.....8
7. Supraclypeal area of head tuberculate and raised above level of clypeus, fig. 231.....**Monoctenus**  
Supraclypeal area not tuberculate, confluent with profile of clypeus, fig. 232.....**Augomonoctenus**
8. Apical five segments of flagellum unipectinate, fig. 235.....**Zadiprion**  
All but last segment of flagellum bipectinate, fig. 236.....9
9. Mesoscutellum large, with its anterior margin forming a wide V, and entirely covered with dense, coarse punctuation, fig. 220.....**Diprion**  
Mesoscutellum smaller, with its anterior margin forming a narrower V, and with much sparser punctuation, fig. 219.....**Neodiprion**

*Monoctenus* Hartig

*Lophyrus* subg. *Monoctenus* Hartig, 1837, p. 171. Monobasic, genotype.—*Tenthredo juniperi* Linnaeus.

*Characteristics*.—Front wings with  $Sc_2$  present, 2A & 3A fused for a variable distance with 1A. Head with supraclypeal area tuberculate, fig. 231. Antennae serrate in female, unipectinate in male, with 14-22 segments. Head and thorax not metallic.

Five nearctic species have been described.

*Augomonoctenus* Rohwer

*Augomonoctenus* Rohwer, 1918b, p. 81. Monobasic, genotype.—*Augomonoctenus libocedrii* Rohwer.

*Characteristics*.—Front wings with  $Sc_2$  absent, 2A & 3A fused for a distance with 1A. Head with supraclypeal area confluent in profile with clypeus, area behind and above eyes considerably swollen and enlarged. Antennae of female serrate, 14-segmented, of male unipectinate. Head and thorax metallic blue-black with practically no punctuation.

Contains only one species, the genotype.

#### *Zadiprion* Rohwer

*Neodiprion* subg. *Zadiprion* Rohwer, 1918b, p. 83. Genotype by original designation.—*Diprion grandis* Rohwer.

*Characteristics*.—Front wings with at least base of  $Sc_2$  present, and 2A & 3A separated from 1A by a cross-vein. Head with supraclypeal area not tuberculate, area above and behind eyes wide and flattened. Antennae of female serrate, with 20-26 segments, male with 22-26 segments, the flagellum bipectinate except for the terminal five segments which are moniliform and undivided, fig. 235. Female with pulvillar pad of hind basitarsis subequal to length of basitarsus, fig. 229, male with pad only one-fourth length of basitarsus.

The genus contains four species.

#### *Neodiprion* Rohwer

*Neodiprion* Rohwer, 1918b, p. 83. Genotype by original designation.—*Lophyrus lecontei* Fitch.

*Characteristics*.—Differs from *Zadiprion* in the following points: male flagellum with all segments bipectinate except the apical one, fig. 236; female with pulvillar pad of hind basitarsus one-half or less length of basitarsus, fig. 228.

Contains a large number of nearctic species which have not been revised since 1869.

#### *Diprion* Schrank

*Pteronus* Jurine, 1801, p. 163. Monobasic, genotype.—*Tenthredo pini* Linnaeus. Name set aside by International Zoological Congress, 1935.

*Diprion* Schrank, 1802, p. 209. Genotype by subsequent designation of Rohwer, 1910d.—*Tenthredo pini* Linnaeus.

*Lophyrus* Latreille, 1802, p. 302. Monobasic, genotype.—*Tenthredo pini* Linnaeus. Preoccupied.

*Anachoreta* Gistel, 1848, p. 9. New name for *Lophyrus* Latreille.

*Cristiger* Gistel, 1848, p. 144. Monobasic, genotype.—*Tenthredo pini* Linnaeus.

*Characteristics*.—Similar to *Neodiprion*, with the following principal exception: scutellum large, its lateral margins fairly long, anterior margin forming a wide V, and densely covered with large punctures, fig. 220.

The genus is Eurasian in the native sense, but a few species have become established in recent years on conifers in North America.



## FAMILY CIMBICIDAE

*Diagnostic characters.*—Antennae capitate, fig. 100. Lateral margins of the abdomen sharply angulate. Mesosterno-pleural sutures barely indicated by a slight ridge; mesoscutellum without a post-tergite and with the anterior margin V-shaped; tibiae without preapical spurs, and apical spurs of the front tibiae simple.

This family has been divided into two subfamilies on the basis of the anastomosis or separation of 2A & 3A and 1A, but the division seems to serve no useful purpose, so it is not used here.

## KEY TO GENERA

1. Posterior coxae contiguous at base, fig. 227.....**Zaraea**  
Posterior coxae well separated at base, fig. 226.....2
2. Posterior femora with a ventral tooth near apex, fig. 230.....**Trichiosoma**  
Posterior femora without a ventral tooth.....**Cimbex**

*Zaraea* Leach

*Zaraea* Leach, 1817, p. 113, no. 4. Monobasic, genotype.—*Tenthredo fasciata* Linnaeus.

*Abia* Leach, 1817, p. 113, no. 5. Genotype by subsequent designation of Curtis, 1825.  
—*Tenthredo sericeus* Linnaeus.

*Parabia* Semenov, 1891, p. 174. Genotype by original designation.—*Parabia jakowlewii* Semenov.

*Characteristics.*—Posterior coxae contiguous at base, fig. 227, front wings with 2A & 3A fused for a distance with 1A. Hind femora unarmed. Antennal club, fig. 99, not sharply set off from remainder of antennae.

Five species have been assigned to this genus in the nearctic region.

*Trichiosoma* Leach

*Trichiosoma* Leach, 1817, p. 108. Genotype by subsequent designation of Curtis, 1825.—*Tenthredo lucorum* Linnaeus.

*Characteristics.*—Body conspicuously hairy. Posterior coxae well separated at base. Posterior femora with a ventral tooth near apex, the tooth much larger in male than in female. Front wings with 1A and 2A & 3A separated by a short cross-vein. Antennal club much more sharply set off from the remainder of the antenna. Mandibles almost perfectly symmetrical, much longer and sharper in the male than the female, figs. 221, 222.

The several described nearctic species are badly in need of intensive study to determine the species limits.

*Cimbex* Olivier

*Crabro* Geoffroy, 1762, p. 261. Genotype by subsequent designation of Bradley, 1919.  
—*Crabro humeralis* Fourcroy. Name set aside by International Zoological Congress, 1935.

*Clavellarius* Olivier, 1789, p. 22. Genotype by subsequent designation of Latreille, 1810.—*Tenthredo lutea* L. Application has been made to the International Commission on Zoological Nomenclature to have this name set aside, as with *Crabro*.

*Cimbex* Olivier, 1790, p. 762. New name for *Clavellarius* Olivier.

*Clavellaria* Lamarck, 1801, p. 264. Emendation of *Clavellarius* Olivier.

*Characteristics*.—Differs from *Trichiosoma* as follows: Body not hairy. Hind femora unarmed beneath. Mandibles asymmetrical, dextral one polished, with a long, thin, apical tooth, sinistral one striate and roughened, apical tooth blunt and short.

The taxonomic status of the nearctic species of this genus is similar to the above.

#### FAMILY TENTHREDINIDAE

*Diagnostic characters*.—Antennae with 7-10 segments, varying in shape from setaceous and filiform, fig. 93, to clavate, figs. 101-103, the male of *Cladius pectinicornis* (Geof.) having the first three or four segments of the flagellum pectinate, fig. 104. Mesothorax with sterno-pleural sutures lacking, anterior margin of scutellum V-shaped and the posterior margin usually with a distinct post-tergite, figs. 124-125. Tibiae without preapical spurs; apical spurs of front tibiae (except in some Nematinae) with the longer spur cleft at the apex, fig. 114.

The division of this family into units has been one of the most controversial subjects in the study of sawflies. In the last thirty-five years different arrangements have been proposed by Ashmead (1898), Konow (1905), MacGillivray (1906), Rohwer (1911e), and Enslin (1912). The opinions brought out by these authors are startling in their great divergence. In attempting to arrive at the correct groupings of the genera contained in the family it soon became evident that there were no characters known at present which would separate the family by simple divisions into clean-cut subfamilies. For this reason it was necessary to adopt a different line of attack, which is embodied in the following procedure:

1. An exhaustive survey was made of all the genera, and their characters were tabulated.

2. The genera resembling each other more than any other genus were grouped into units. These were homogeneous by the very nature of their selection. This step sorted out about three-quarters of the genera.

3. The remaining genera were then studied in comparison with the groups formed in step 2. Many resembled one or another group so closely that they were placed in it. Others proved to be connecting forms between two groups which had perforce to be united into one. After this there remained less than half a dozen genera which had not been satisfactorily placed.

4. By a comparison of these genera and generic units with each other and with other groups of sawflies, a hypothetical type or primitive ancestor was deduced. From this hypothetical ancestor all the conditions present in the Tenthredinoidea could be derived through comparatively simple changes.

5. After the deduction of the primitive ancestor, the generic units and the unplaced genera were arranged in a family tree in such a way that there was as far as possible a progression of all characters from the generalized or hypothetical to the specialized. This involved considerable "trial and error" manipulation.

#### *Principal Sets of Characters Used*

*Cervical sclerites.*—In the more primitive members of all the subfamilies the cervical sclerites are angulate and separated on the meson, fig. 155. In the Allantinae and Tenthredininae the more specialized genera have the mesal margins truncate and adjacent, figs. 157, 158, as is the case with the Dolerinae. In all three subfamilies this condition is probably for the purpose of strengthening the head articulation, and has been evolved independently in each group.

*Mandibles.*—A first glance at the mandibles of different members of the family gives the impression of random diversity (Plate III). The more different types are the four-toothed mandibles of the specialized Tenthredininae, figs. 42, 43, the scythe-like right mandibles of the specialized Allantinae, the curious bidentate type shown in fig. 47, and the flattened knife-like mandibles of the specialized Nematinae, fig. 59. Yet almost all of these different types may be traced back through the more primitive members of the subfamily to a simple bidentate type, figs. 46, 51, 53, and 57. The ancestor of the family undoubtedly possessed these simple mandibles, and each group branching away from it has ultimately developed its own characteristic modifications of these appendages. Various types of mandibles within the family are shown on Plate III arranged genealogically.

*Anal veins.*—An interesting case of reaching the same modification from the same basis by different methods is shown in the condition of the anal veins. The unmodified anal region of the front wing of the Tenthredinidae is the same as that in the sawfly ancestor, having the anal cross-vein present and 2A & 3A forming a distinct angle where they join, fig. 203. In the Nematinae, figs. 202, 200, 198, 2A has gradually fused first with the anal cross-vein then basally along 1A, reducing the first anal cell to a small loop. Finally the distal portion of this loop has atrophied, leaving only the basal portion of 3A present as a short stub. In the Blennocampinae the same fusion of 2A & 3A with the anal cross-

vein started, but the distal portion of the serial vein atrophied before it had anastomosed with 1A to any great extent, figs. 206, 208. In the Phylotominae the distal portion of 2A & 3A has gradually atrophied without any fusion with the anal cross-vein or 1A, figs. 205, 207, 209. In all three cases the result has been the production of an isolated apical anal cell.

In some groups M is divergent from *lm-cu*, fig. 182. In others, however, the two are parallel, fig. 181. In a few they may be either

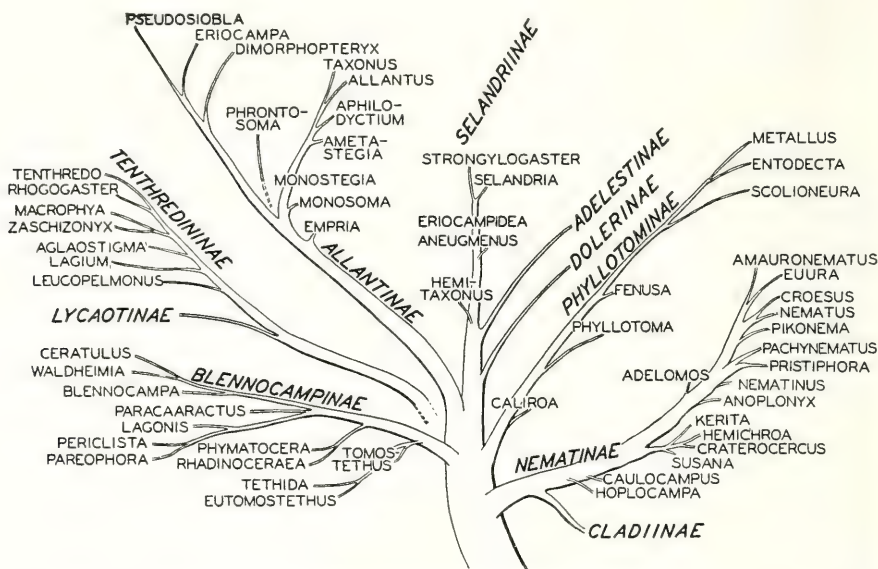


CHART 2.—GENEALOGICAL ARRANGEMENT OF SUBFAMILIES AND PRINCIPAL GENERA OF THE NEARCTIC TENTHREDINIDAE

parallel or divergent. It would seem, therefore, that in the primitive condition this juxtaposition was not fixed, and has become stabilized in some groups after their separation from the parent stem.

The condition of the prepectus and the anal veins have been considered major characters for the differentiation of the subfamilies of the Tenthredinidae by most authors. Yet it is apparent that in these characters the primitive members of almost all the subfamilies are at least somewhat similar, and furthermore, that in half the subfamilies at least two conditions of these characters are present.

#### *Phylogeny of the Family Subgroups*

Using the mandibles and wing venation as evidence, it is certain that (1) the family Tenthredinidae has subdivided into a large number

of groups which have arisen from the parent stock in a radiating, palmate fashion, Chart 2; (2) in many cases the primitive genera of some branches are more difficult to separate from the primitive genus of another branch than from specialized genera of the same branch.

It seems apparent that the hypothetical ancestor of the family possessed (1) a prepectus; (2) bidentate mandibles; (3) simple antennae; (4) proximal anal cell contracted in middle and separated from the distal anal cell by the anal cross-vein, as in fig. 203; (5) media in front wing joining radius at point of separation of  $R_s$ , and probably fluctuating in respect to being parallel or not to  $2m-cu$ .

This condition is found only in some specimens of the genus *Hemitaenionus*, but is approached by most genera in its subfamily, the Selandriinae. We may, then, safely consider the Selandriinae to be the most primitive subfamily of the Tenthredinidae.

From some such condition there has been a steady evolution along several diverse lines, leading ultimately to such specialized forms as the higher Nematinae, Tenthredininae, and Allantinae.

#### KEY TO SUBFAMILIES

1. Front wings with vein 2A & 3A complete and not fused with 1A, figs. 183, 185, 203.....2  
 Front wings with vein 2A & 3A either partially atrophied, figs. 205, 209, or fused for a distance with 1A, fig. 201.....9
2. Front wings with anal cross-vein present, fig. 181.....3  
 Front wings with anal cross-vein absent, fig. 183.....**Selandriinae**, pt.
3. Front wings with  $2r-m$  present, fig. 181.....4  
 Front wings with  $2r-m$  absent, fig. 182.....**Dolerinae**
4. Front wings with proximal anal cell markedly constricted near base, figs. 203, 204, vein M at most joining R very little proximad of fork of  $R_s$ , fig. 184.....5  
 Front wings with proximal anal cell only feebly constricted, fig. 197, vein M joining R half its length proximad of fork of  $R_s$ , fig. 196.....**Tenthredininae**
5. Mesopleurae rugose with large, crater-like punctures, fig. 329.**Allantinae**, pt.  
 Mesopleurae at most with separate, inconspicuous punctures.....6
6. Front wings with  $R_s + M$  straight, fig. 186.....7  
 Front wings with  $R_s + M$  markedly curved, fig. 184.....8
7. Front wings with M parallel with  $1m-cu$ , fig. 186.....**Allantinae**, pt.  
 Front wings with M and  $1m-cu$  divergent, fig. 185.....**Phyllotominae**, pt.
8. Front wings with proximal anal cell as long as distal anal cell, fig. 204.....**Adelestinae**  
 Front wings with proximal anal cell twice as long as distal anal cell, fig. 181.....**Selandriinae**, pt.
9. Front wing with M partially atrophied, fig. 195.....**Nematinae**, pt.  
 Front wing with M present for its entire length, fig. 193.....10
10. Front wings with M and  $1m-cu$  parallel or nearly so, figs. 192, 194.....11  
 Front wings with M and  $1m-cu$  markedly divergent, figs. 187, 191.....13

11. Front wings with M joined to R half-length of M proximad of fork of  $R_s$ , fig. 194.....**Tenthredininae**, pt.  
Front wings with M joined to R at or near fork of  $R_s$ , fig. 192.....12
12. Front wings with proximal abscissa of 2A & 3A distinct for its entire length, fused to 1A for only a short distance, fig. 192.....**Lycaotinae**  
Front wings with proximal abscissa of 2A & 3A atrophied for a distance, figs. 190, 208.....**Blennocampinae**, pt.
13. Front wings with M joined to R half-length of M proximad of fork of  $R_s$ , fig. 191, giving cell 1M five sides.....**Nematinae**, pt.  
Front wings with M joined to R at or near fork of  $R_s$ , fig. 188, cell 1M not markedly five-sided.....14
14. Front wings with  $2r$  absent.....**Cladiinae**  
Front wings with  $2r$  present, but sometimes faint.....15
15. Prepectus present, fig. 243.....**Blennocampinae**, pt.  
Prepectus absent.....**Phyllotominae**, pt.

#### SUBFAMILY SELANDRIINAE

Prepectal suture present as a distinct suture or a furrow. Propleurae, fig. 155, with mesal margins pointed and not meeting. Front wings, fig. 181, with M either parallel with  $1m-cu$  or not, meeting R at or near fork of  $R_s$ ;  $R_s + M$  with a decided bend; these conditions obscured in *Selandria* due to the enlargement of R, fig. 183. Anal cross-vein present or absent; when present the proximal anal cell is considerably longer than the distal cell. Mesopost-tergite normal.

The members of this subfamily are quite uniform in fundamental structure. The chief differences occur in the proportions of the antennae, tarsal claws, shape of clypeus and male genitalia. The range of variation in genitalia within the genus *Strongylogaster*, however, is almost as great as the known extremes in the subfamily, so that their study concerns species more than genera.

In addition to having an abundant nearctic fauna, the Selandriinae have developed greatly in the neotropical regions. Several species taken in Arizona and New Mexico represent this neotropical assemblage in the United States.

#### KEY TO GENERA

1. Front wing with anal cross-vein present, fig. 181.....2  
Front wing with anal cross-vein absent, fig. 183.....4
2. Prepectus a distinct sclerite, separated from episternum by a suture, fig. 243.....3  
Prepectus a raised shoulder, separated from episternum by a furrow, fig. 244.....**Strongylogaster**
3. Antennae with sixth segment more than twice as long as wide, fig. 238.....**Hemitaxonus**  
Antennae with sixth segment less than twice as long as wide, fig. 237.....**Eriocampidea**

4. Mesepisternum with an inverted V-shaped prepectal suture, forming a prepectus-like area on the postero-dorsal corner of the sclerite, in addition to the true prepectus on the anterior angle, fig. 242.....**Selandria**  
Mesepisternum without this posterior "prepectus," only the anterior prepectus present, fig. 243.....5
5. Antennae with last four segments reduced in size, together less than twice the length of third segment; flagellum at least somewhat fusiform; pedicel longer than wide, fig. 241.....**Aneugmenus**  
Antennae with total length of last four segments three or four times as long as third segment; flagellum almost filiform; pedicel no longer than wide, fig. 240.....6
6. Prepectus and adjoining portion of episternum flat, on the same plane, and separated by a line-like suture, fig. 243.....**Eustromboceros**  
Prepectus shoulder-like, raised above level of episternum, and separated from it by a depressed suture or furrow, fig. 244.....**Strongylogaster**

### *Hemitaxonus* Ashmead

*Hemitaxonus* Ashmead, 1898, p. 311. Genotype by original designation.—*Taxonus dubitatus* Norton.

*Epitaxonus* MacGillivray, 1908b, p. 365. Genotype by original designation.—*Taxonus albidopictus* Norton.

*Characteristics*.—Clypeus truncate or slightly emarginate; antennae long and slender, fig. 238; body long and slender. Some specimens with M and 1m-cu of front wing distinctly diverging. Contains three or four species.

### *Eriocampidea* Ashmead

*Eriocampidea* Ashmead, 1898, p. 256. Genotype by original designation.—*Eriocampidea arizonensis* Ashmead.

*Cockerellonis* MacGillivray, 1908b, p. 365. Genotype by original designation.—*Cockerellonis occidentalis* MacGillivray = *Eriocampidea arizonensis* Ashmead.

*Characteristics*.—Clypeus slightly emarginate; antennae short, fig. 237; body of medium robustness.

Represented by a single southwestern species, *E. arizonensis*.

### *Aneugmenus* Hartig

*Characteristics*.—Anal cross-vein absent in front wing. Antennae with pedicel longer than wide, flagellum fusiform and proportioned as in fig. 241. Tarsal claws with an inner tooth which is parallel to outer and quite stout, fig. 245. Prepectal suture varying from a line to a deep furrow.

The larger species of this group (occurring in the tropics) have been considered as members of *Stromboceros* Konow, but they differ radically from that genus in antennae and tarsal claws and instead are related to the smaller northern species usually considered as decidedly not congeneric.

## KEY TO SUBGENERA

1. Legs entirely lemon yellow.....**Aneugmenus**  
 Legs mostly black.....**Stromboceridea**

Subgenus *Aneugmenus* Hartig

*Aneugmenus* Hartig, 1837, p. 253. Monobasic, genotype.—*Tenthredo* (*Emphytus*) *coronata* Klug.

*Polyselandria* MacGillivray, 1914a, p. 104. Genotype by original designation.—*Selandria floridana* MacGillivray = *Aneugmenus flavipes* var. *flavitaris* Rohwer.

Contains three or four species set off by their short antennae, with the third segment slightly longer than half the length of the last four segments together.

Subgenus *Stromboceridea* Rohwer new combination

*Stromboceros* subgenus *Stromboceridea* Rohwer, 1911d, p. 392. Genotype by original designation.—*Stromboceros* (*Stromboceridea*) *pilosulus* Rohwer.

Contains many Mexican species, set off by the short terminal segments of the antenna, the last four being little longer than the third. A few species have been taken in the extreme southwestern United States.

*Selandria* Leach

*Selandria* Leach, 1817, p. 126. Genotype by subsequent designation of Brullé, 1846.—*Tenthredo serva* Fabricius.

*Coryna* Lepeletier, 1828, p. 567. Genotype by subsequent designation of Rohwer, 1911b.—*Selandria flavans* Klug.

*Paraselandria* Ashmead, 1898, p. 255. Genotype by original designation.—*Selandria flavescens* Thomson = *Selandria flavans* Klug.

*Selandridea* Rohwer, 1911d, p. 388. Genotype by original designation.—*Selandridea vanduzeei* Rohwer.

*Pseudoselandria* MacGillivray, 1914a, p. 103. Monobasic, genotype.—*Pseudoselandria oxalata* MacGillivray = *Selandria vanduzeei* (Rohwer).

This is an aberrant genus in many respects. In the hind wing *1r-m* joins R basad of  $R_s$  and *cu-a* joins the anal veins at the union of 1A and 2A & 3A. In *S. vanduzeei* (Roh.), the front wing has costa and radius greatly swollen, fig. 183, and this occurs to some extent also in the other nearctic species, *S. decorata* Cress.

*Eustromboceros* Rohwer new combination

*Stromboceros* subgenus *Eustromboceros* Rohwer, 1911d, p. 394. Genotype by original designation.—*Stromboceros* (*Eustromboceros*) *melanopterus* Rohwer.

*Characteristics*.—Front wings without anal cross-vein. Antennae stout, filiform, the segments of the flagellum decreasing only slightly in length from base to apex; pedicel almost twice as broad as long, fig. 240.



Tarsal claws long and slender, with a narrow minute inner tooth midway to base.

A few unidentified specimens from Arizona belong to this genus. They may represent species already described from Mexico.

*Strongylogaster* Dahlbom

*Strongylogaster* Dahlbom, 1835, p. 13. Genotype by subsequent designation of MacGillivray, 1908b.—*Tenthredo cingulata* Fabricius.

*Thrinax* Konow, 1885a, p. 19. Genotype by subsequent designation of MacGillivray, 1908b.—*Strongylogaster contigua* Konow. *New synonymy*.

*Prototaxonus* Rohwer, 1910a, p. 49. Monobasic, genotype.—*Prototaxonus typicus* Rohwer. *New synonymy*.

*Pseudotaxonus* A. Costa, 1894, p. 157. Monobasic, genotype.—*Tenthredo flicis* Klug. *New synonymy*.

*Polystichophagus* Ashmead, 1898, p. 310. Genotype by original designation.—*Tenthredo flicis* Klug.

Of the five names listed above, *Pseudotaxonus*, *Polystichophagus*, and *Prototaxonus* are based on species which possess the anal cross-vein, the character upon which they have hitherto been separated from the other members of the genus. *Thrinax* and *Strongylogaster* lack this cross-vein. These latter two differ from each other in the tarsal claws, *Thrinax* having a claw without a tooth and *Strongylogaster* one with a very small tooth. In the absence of other differences this does not seem to be of much generic importance.

In a survey of the species of the nearctic fauna of *Strongylogaster* it is strongly evident that the genus can best be divided into groups on the basis of the male and female genitalia. One group, including *lineata* Christ, *longulus* Norton and *distans* Norton, has the sheath with large, lateral, wing-like expansions; another, including *tacitus* (Say), has a small sheath with small cup-like lateral expansions; and still another, including *politus* Prov., has a small sheath without lateral ornamentation. These groupings are substantiated by the punctuation of head and thorax and by various characters of the clypeus. The species hitherto placed in *Pseudotaxonus* (*flicis* and *tibialis*) agree in sheath, punctuation, and clypeus with the group including *politus* Prov., so closely that the latter group is evidently related more to *Pseudotaxonus* than to many other species of *Strongylogaster s. st.* It will be seen from this that the division previously made on the basis of the inter-anal cross-vein is an unnatural one. When a detailed study of the genus is made, *Pseudotaxonus* and *Thrinax* may serve to designate subgeneric units if these are necessary in the classification.

ADELESTINAE new subfamily

Prepectus absent. Mesonotum with post-tergite apparently not differentiated. Propleurae with mesal margins narrow and pointed, as in

fig. 155. Front wings, fig. 184, with full complement of veins and cross-veins; R + M with a distinct bend; *a* transverse; cell DA almost as long as cell PA. Hind wings with *1r-m* joining  $R_s$  near its separation from R.

This subfamily is erected for a single species originally described by Norton (1867, p. 254) as *Selandria nova*. The species was relegated to the "lost" list. Recently, however, I was fortunate in obtaining for study a female so identified by Harrington, and undoubtedly Norton's species.

The bent vein R + M places the species definitely in the Selandriine group. It differs from the Selandriinae in lacking a prepectus and in the long distal anal cell; from the Dolerinae in possessing cross-vein *2r-m*, and in having the anal cross-vein transverse; and from both in lacking a post-tergite.

#### *Adelesta* new genus

*Characteristics*.—Body short and robust, shining, with practically no punctate areas. Head with antennae slightly serrate, fig. 239, of approximately the same thickness throughout. Clypeus very slightly emarginate. Labrum narrow and triangular. Mandibles not fully visible, but short, stocky, and at least bidentate. Malar space as wide as is middle of front tibiae. Legs with basitarsus subequal to following three together. Tarsal claws long and slender, without an inner tooth.

*Genotype*.—*Selandria nova* Norton (original designation).

#### SUBFAMILY DOLERINAE

*Characteristics*.—Prepectus absent. Mandibles quadridentate or tridentate, fig. 52. Cervical sclerites approximate and semitruncate on meson. Front wings with *2r-m* absent, both anal veins present, separated by an oblique anal cross-vein, and with cell PA constricted near middle, fig. 182. Hind wing with typical venation, possessing *3r-m*, *m-cu* and 2A.

Contains only a single genus, *Dolerus*.

#### *Dolerus* Panzer

This genus contains over 40 described nearctic species of which most are in *Dolerus s. st.* and only four in *Loderus*. These have been revised by Ross (1931 and 1935a).

#### KEY TO SUBGENERA

1. Eyes emarginate mesally, fig. 246, and long.....**Loderus**
- Eyes straight mesally, fig. 247, and short.....**Dolerus**

#### Subgenus *Dolerus* Panzer

*Dolerus* Jurine, May 30, 1801, p. 163. Genotype.—*Tenthredo gonager* Fabricius.  
Set aside by International Zoological Congress, 1935.

*Dolerus* Panzer, September 3, 1801, Heft 82, pl. 11. Monobasic, genotype.—*Dolerus pedestris* Panzer = *pratensis* (Linnaeus).

*Dosytheus* Leach, 1817, p. 127. Genotype by subsequent designation of Brullé, 1846.—*Tenthredo eglanteriae* Fabricius = *Dolerus pratensis* (Linnaeus).

*Characteristics*.—Head and thorax partially or completely rugose or coarsely punctate. Antennae setaceous or slightly fusiform. Tarsal claws with a tooth, either large or small.

#### Subgenus *Loderus* Konow

*Loderus* Konow, 1890, p. 240. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo pratorum* Fallén.

Similar to *Dolerus s. st.*, except as mentioned in the key. Some of the species lack an inner tooth on the tarsal claws.

#### SUBFAMILY PHYLOTOMINAE

*Characteristics*.—Prepectus absent. Cervical sclerites pointed mesally, not approximate. Mandibles variable, either bidentate or tridentate. Front wings with M and *1m-cu* divergent; first abscissa of  $R_s$  present or absent, *2r-m* always present; anal veins extremely variable. Venation of hind wings variable, *3r-m* always absent.

The genus *Caliroa* is the most generalized member of the group. It possesses bidentate mandibles, front wings with anal veins fully represented, and hind wings with cell R closed, and cross-vein *m-cu* present. The larvae are external, slug-like, leaf feeders.

The remaining members are leaf miners in the larval stage. The mandible pattern changes to a tridentate condition, fig. 55, but other changes are almost entirely due to atrophy of veins. The ultimate reduction is shown in some species of *Fenusa*, in which only 1A is left in either pair of wings, the front wings lack the base of  $R_s$ , and the hind wings have cell R open and cross-veins *3r-m* and *m-cu* both absent.

The few small genera comprising this group have been very poorly understood in North American literature, as can well be seen in the discussion of *Entodecta*, p. 71.

#### KEY TO GENERA

1. Front wings with vein 2A & 3A well marked for its entire length, figs. 203, 205.....2  
    Front wings with 2A & 3A with conspicuous portions of the basal abscissa atrophied, figs. 207, 209.....3
2. Head with anterior aspect markedly convex, fig. 251.....**Caliroa**  
    Head with anterior aspect depressed between eyes and meson, fig. 252.....**Phyllotoma**
3. Hind wings with cell  $R_1$  open at apex, fig. 259.....4  
    Hind wings with cell  $R_1$  closed at apex, fig. 258.....5

4. Mesopleurae black.....**Fenusa**  
 Mesopleurae yellow or rufous.....**Profenusa**
5. Antennae with third segment nearly as long as the fourth and fifth together, segments 4 to 9 diminishing only slightly, fig. 253.....**Scolioneura**  
 Antennae more nearly with all segments of flagellum gradually diminishing in length, fig. 254.....**6**
6. Front wing with  $2r$  curving sharply down to meet  $R_s$  at almost a right angle, fig. 250.....**Entodecta**  
 Front wing with  $2r$  curving only gradually and meeting  $R_s$  obliquely, fig. 257.....**Metallus**

*Caliroa* O. Costa

*Caliroa* O. Costa, 1859, p. 59. Monobasic, genotype.—*Caliroa sebetia* O. Costa = *cinxia* (Klug).

*Eriocampoides* Konow, 1890, p. 239. Genotype by subsequent designation of MacGillivray, 1909a.—*Tenthredo limacina* Retzius = *Caliroa cerasi* (Linnaeus).

*Periclistoptera* Ashmead, 1898, p. 255. Genotype by original designation.—*Monostegia quercus-alba* Norton.

*Endelomyia* Ashmead, 1898, p. 259. Genotype by original designation.—*Monostegia rosae* Harris = *Caliroa aethiops* (Fabricius).

*Characteristics*.—Head robust, fig. 251, anterior aspect convex. Mandible bidentate. Antennae slender and slightly fusiform. Front wings, fig. 185, with first abscissa of  $R_s$ , and all anal veins present. Hind wings with cross-vein *m-cu* present and 2A present.

Contains about a dozen species which have not been revised thoroughly.

*Phyllotoma* Fallén

*Phyllotoma* Fallén, 1829, p. 25. Genotype by subsequent designation of Rohwer, 1911b.—*Phyllotoma vagans* Fallén.

*Heterarthrus* Stephens, 1835, p. 94. Monobasic, genotype.—*Tenthredo (Emphytus) ochropoda* Klug.

*Decatria* Stephens, 1835, p. 94. Monobasic, genotype.—*Tenthredo (Emphytus) ochropoda* Klug.

*Druida* E. Newman, 1838, p. 484. Monobasic, genotype.—*Druida parviceps* E. Newman = *Phyllotoma nemorata* Fallén.

*Phlebatrophia* MacGillivray, 1909a, p. 345. Monobasic, genotype.—*Phlebatrophia mathesoni* MacGillivray = *Phyllotoma nemorata* Fallén.

*Characteristics*.—Head narrowed, with elongate concavities running along the inner margins of the eyes, appearing excavated from dorsal view, fig. 252. Antennae long, slender, and filiform, with 10-12 segments. Venation complete but with many parts faint. Hind wings with *m-cu* absent.

Contains a single species in North America, *P. nemorata* Fallén, which is probably an introduced European species.

*Scolioneura* Konow

*Scolioneura* Konow, 1890, p. 249. Genotype by subsequent designation of MacGillivray, 1909c.—*Tenthredo (Allantus) betuleti* Klug.

*Parabates* MacGillivray, 1909c, p. 262. Genotype by original designation.—*Parabates histrionicus* MacGillivray. *New synonymy*.

*Melanobates* MacGillivray, 1916, p. 158. Monobasic, genotype.—*Parabates leucostomus* Rohwer. *New synonymy*.

*Characteristics*.—Head robust. Antennae as in fig. 253, with third segment subequal to fourth and fifth together. Venation variable; front wing with first abscissa of  $R_s$  faint or absent and both anal cells open posteriorly; hind wing with cell  $R_1$  closed at apex, fig. 258, and cell 1A also closed.

Contains six described nearctic species which have not yet been revised.

#### *Entodecta* Konow

*Entodecta* Konow, 1886, p. 184. Genotype by subsequent designation of MacGillivray, 1909c.—*Tenthredo (Allantus) pumila* Klug.

*Polybates* MacGillivray, 1909c, p. 264. Monobasic, genotype.—*Polybates slossonae* MacGillivray. *New synonymy*.

Differs from *Scolioneura* chiefly in the antennae, which have all the segments of the flagellum gradually diminishing in length.

This genus contains only a single known nearctic species, whose synonymy is given below. The species *alaskana* Kincaid, placed in this genus by MacGillivray, belongs in *Scolioneura*.

The head sculpture and antennal proportions resemble *Metallus* in many respects and it may be necessary later to consider *Entodecta* as a synonym of that genus. This latter view is held by Benson, 1936.

#### *Entodecta capitalis* (Norton) new combination

*Selandria capitalis* Norton, 1867, p. 247, ♀.

*Polybates slossonae* MacGillivray, 1909c, p. 265, ♀. *New synonymy*.

*Polybates secundus* Rohwer, 1910c, p. 202, ♀. *New synonymy*.

*Entodecta humilis* Konow, 1908, p. 84, ♀. *New synonymy*.

This species varies somewhat in color and has a wide distribution, ranging from the Atlantic to the Pacific. The name *capitalis* was referred to *Metallus* by MacGillivray (1909c), but an examination of Norton's type proves it to be a light specimen of the species described by MacGillivray as *Polybates slossonae*.

#### *Metallus* Forbes

*Metallus* Forbes, 1885, p. 87. Monobasic, genotype.—*Metallus rubi* Forbes.

*Characteristics*.—Front wing without basal loop of 2A & 3A; first abscissa of  $R_s$  faint or absent. Hind wing with cell  $R_1$  closed at apex, vein 2A fully developed and joining 1A. Antennae with second segment small and annular, flagellum of male large and flattened, of female swollen.

Contains only one species, whose complete synonymy is presented here for the first time.

*Metallus rubi* Forbes

*Metallus rubi* Forbes, 1885, p. 87, ♂.

*Metallus rohweri* MacGillivray, 1909c, p. 267, ♀. *New synonymy.*

*Metallus bethunei* MacGillivray, 1914c, p. 366, ♂, ♀.

The larva of this sawfly mines the leaves of blackberry. The color of the mesonotum of the adult varies from rufous through dark brown to black.

*Fenusa* Leach

*Fenusa* Leach, 1817, p. 126. Monobasic, genotype.—*Tenthredo* (*Emphytus*) *pumilus* Klug (preoccupied, *nec* *Tenthredo* (*Allantus*) *pumilus* Klug) = *Fenusa pusilla* (Lepeletier).

*Kaliosysphinga* Tischbein, 1846, p. 79. Monobasic, genotype.—*Kaliosysphinga dohrnii* Tischbein.

*Aphadnurus* O. Costa, 1859, p. 40. Monobasic, genotype.—*Aphadnurus tantillus* Costa = *Fenusa pusilla* (Lepeletier).

*Kaliofenusa* Viereck in Smith, 1910, p. 591. Genotype by subsequent designation of Rohwer, 1911b.—*Fenusa ulmi* Sundevall.

*Characteristics.*—Antennae with 9 segments. Front wings with first abscissa of  $R_s$  atrophied, base of 2A & 3A either present as a semi-sclerotized loop, fig. 209, or absent. Hind wings with cell  $R_1$  open at apex, fig. 259; 2A either entirely atrophied, present for its full length, or in various intermediate conditions. Head thick and rounded in front, as in *Caliroa*, fig. 251.

This genus contains quite a variety of forms. When more species are known by both sexes it may be advisable to subdivide it into subgenera. It has been briefly revised by Ross, 1937a.

*Profenusa* MacGillivray

*Profenusa* MacGillivray, 1914c, p. 364. Monobasic, genotype.—*Profenusa collaris* MacGillivray = *Profenusa canadensis* (Marlatt).

Differs from *Fenusa* chiefly in possessing the first abscissa of  $R_s$ , having longer and more slender wings and with vein 2A of the hind wings fully developed.

*Profenusa canadensis* (Marlatt) new combination

*Scolioneura canadensis* Marlatt, 1895, p. 235, ♀.

*Profenusa collaris* MacGillivray, 1914c, p. 364, ♂, ♀. *New synonymy.*

This is the only known species in the genus. The larva mines the leaves of *Crataegus*.

## SUBFAMILY CLADIINAE

*Characteristics.*—Prepectus present, sometimes indistinct. Mandibles bidentate, the inner tooth small, fig. 56. Front wings with M joined to R a short distance before divergence of  $R_s$ ,  $2r$  absent, 2A & 3A fused to

1A so that the basal abscissa of the former is a short loop. Hind wings with full complement of veins and cross-veins. Tarsal claws cleft with a short inner tooth.

This group contains a few small genera of uniform habitus. The genera are best characterized by the saws of the female. Rohwer and Middleton (1922) revised the group but several species described a year previously by MacGillivray have never been incorporated into the keys.

The Cladiinae are remarkably similar in many characters to the Nematinae but appear to be a distinct, separate offshoot of the Nematine stem.

#### KEY TO GENERA

1. Males.....2  
Females.....3
2. First three segments of flagellum pectinate, fig. 104.....**Cladius**  
First three segments of flagellum not pectinate,  
fig. 256.....**Trichiocampus, Priophorus**
3. Third antennal segment strongly compressed bilaterally, short and emarginate beneath, fig. 255.....**Cladius**  
Third antennal segment round, long and scarcely emarginate beneath, fig. 256.....4
4. Ventral margin of saw nearly straight, armed with 12-14 serrations, fig. 260.....**Trichiocampus**  
Ventral margin of saw concave, armed with 8 large teeth,  
fig. 261.....**Priophorus**

#### *Trichiocampus* Hartig

*Cladius* subg. *Trichiocampus* Hartig, 1837, p. 176. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus grandis* Lepeletier = *Trichiocampus viminalis* (Fallén).

*Characteristics*.—Antennae long, slender, and setaceous, somewhat bilaterally compressed in male, the third segment in the male with a basal projection in some species. Front basitarsus shorter than the three following segments combined. Saw without lateral armature, but with twelve or more segments, fig. 260.

Six described species belong in this genus, but the synonymy has not yet been worked out.

#### *Priophorus* Dahlbom

*Nematus* subg. *Priophorus* Dahlbom, 1835, p. 4. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus (Priophorus) pilicornis* Dahlbom = *Priophorus pallipes*. (Lepeletier).

*Stevenia* Brullé, 1846, p. 667. No included species.

*Characteristics*.—Differs from *Trichiocampus* chiefly as follows: third segment of antennae of male never with basal projection, front basitarsus usually subequal to length of three following segments combined and saw with distinct lateral armature and only eight segments, fig. 261.

Contains about fifteen species which are badly in need of revision.

*Cladius* Rossi

*Cladius* Rossi, 1807, p. 27. Genotype by subsequent designation of Latreille, 1810.—*Tenthredo difformis* Panzer.

*Characteristics*.—Antennae of female shorter than in two preceding genera, the third segment short and concave ventrally; of male slender, with third, fourth, and fifth segments pectinate, fig. 104. Front basitarsus equal in length to three following segments combined. Saw similar to that of *Priophorus*, fig. 261.

Contains only one species in North America, *C. isomerus* Norton, which attacks cultivated roses and is probably a synonym of a European one.

## SUBFAMILY NEMATINAE

This subfamily has been divided into two or three subfamilies by various authors, but to do so destroys the picture of its composition. The various genera coming within its limits present an almost perfectly intergraded chain of conditions ranging from the most primitive genus, *Hoplocampa*, to a closely knit, specialized group of genera including *Pristiphora*, *Nematus*, and *Euura*.

In *Hoplocampa* the front wings, fig. 191, have *2r* present, the basal abscissa of 2A & 3A present and showing the typical angulation, and *3r-m* received in cell 3R<sub>s</sub>; the mandibles are triangular from a side view, fig. 270; and the penis valves of the genitalia are composed of only one leaf at the apex. Through differences shown in such genera as *Hemichroa*, *Anoplonyx*, and *Platycampus*, these gradually resolve themselves into the following: front wing, fig. 193, with *2r* absent, basal abscissa of 2A & 3A absent, and *3r-m* received in cell 2R<sub>s</sub>; mandibles with dorsal portion concave, appearing blade-like from a side view, fig. 272; and penis valves with apex composed of two leaves, a mesal membranous one and a lateral sclerotized one, fig. 314.

The only exception to this trend is the small group containing *Pseudodineura* and *Kerita*, in which the mandibles are distinctly tridentate, fig. 318. There is slight indication of a beginning of the middle tooth in *Susana* and *Hemichroa*, fig. 317, so that this tridentate mandible apparently marks an early offshoot of the Nematinae.

The higher group of genera must have evolved some highly beneficial biological characteristics, because they are at present the most abundant boreal sawfly group in number of species and probably also in population. Most of them are not large or conspicuously colored, so that they are seldom collected abundantly by the general entomologist, but a close search usually reveals them in numbers. The most valuable paper in dealing with these forms is the revision of Marlatt, 1896b.



## KEY TO GENERA

1. Base of vein 2A & 3A present, figs. 200, 202.....2  
 Base of vein 2A & 3A atrophied, fig. 198.....8
2. Prepectus invisible, apparently wanting.....**Susana**  
 Prepectus not reduced, triangular and distinct.....3
3. Tarsal claws without an inner tooth, fig. 262.....**Anoplonyx**  
 Tarsal claws with an inner tooth, either large or small.....4
4. Antennae with second segment longer than wide, subequal in length to eighth, fig. 281.....5  
 Antennae with second segment wider than long, at most half the length of eighth, fig. 282.....6
5. Tarsal claws bent over a sharp angle near middle, with a long inner tooth, fig. 263. Front wing with *2r* absent.....**Caulocampus**  
 Tarsal claws only gently curved, with a short inner tooth, as in fig. 266. Front wings with *2r* present.....**Hoplocampa**
6. Malar space greater than length of first antennal segment, subequal to length of first two combined, fig. 292.....**Platycampus**  
 Malar space no greater than length of first antennal segment, fig. 291.....7
7. Antennae stocky and approximately of same thickness throughout, fig. 282. Clypeus deeply and circularly incised.....**Craterocercus**  
 Antennae slender and tapering, fig. 283. Clypeus shallowly or angularly emarginate, fig. 291.....**Hemichroa**
8. Hind wings with vein 2A & 3A present, fig. 287.....10  
 Hind wings with vein 2A & 3A atrophied, fig. 288.....9
9. Ocelli forming a wide triangle, fig. 294.....**Pseudodineura**  
 Ocelli forming a flatter triangle, fig. 295.....**Kerita**
10. Front wings with cross-vein *2r* present, fig. 285.....11  
 Front wings with cross-vein *2r* atrophied.....12
11. Tarsal claws cleft, with a large inner tooth, fig. 269.....**Adelomos**  
 Tarsal claws simple, without an inner tooth, fig. 262.....**Neopareophora**
12. Hind basitarsus greatly expanded, fig. 277.....**Croesus**  
 Hind basitarsus no wider than tibia, fig. 276.....13
13. Front wings with cross-vein *2r-m* present, fig. 193.....14  
 Front wings with cross-vein *2r-m* atrophied, fig. 195.....**Euura**
14. Tarsal claws without an inner tooth, fig. 262.....**Pristiphora**  
 Tarsal claws with an inner tooth, figs. 264-268.....15
15. Males.....27  
 Females.....16
16. Ninth segment extremely large and wide, ventrally, fig. 293.....**Nematinus**  
 Ninth segment much shorter or narrower ventrally than fig. 293.....17
17. Tarsal claws with inner tooth either small, appearing as a subtooth of the outer one, fig. 264, or quite a distance from it, fig. 265.....18  
 Tarsal claws with inner tooth at least approaching outer one in length and more or less parallel with it, figs. 266-268.....23
18. Sheath with lateral face polished, flat and with only microscopic setae....19  
 Sheath with lateral face either rough, mound-like or with most of its surface covered with conspicuous setae.....20

19. Sheath projecting considerably beyond apex of cerci, fig. 298....**Pikonema**  
 Sheath projecting scarcely at all beyond cerci, fig. 304.....**Pristiphora**
20. Inner and outer teeth of tarsal claws forming a more or less semicircular clasp, fig. 265.....**Micronematus**  
 Inner tooth of tarsal claws merely a projection at base of outer tooth, fig. 264.....21
21. Sheath with a definite scopa, or shelf-like lateral process at apex as in figs. 308, 311.....**Pristiphora**  
 Sheath without a scopa.....22
22. Clypeus almost truncate, not emarginate on meson, fig. 297.....**Pristiphora**  
 Clypeus definitely emarginate on meson, fig. 296.....**Pachynematus**
23. Left mandible seen in lateral view with base bulbous and apical portion long, thin, and blade-like, as in fig. 272.....25  
 Left mandible either gradually tapering in width from base to apex, fig. 270, or with the apical portion short and stubby, fig. 273.....24
24. Antennae very long, slender, and markedly tapering, fig. 283....**Hemichroa**  
 Antennae shorter, stocky, and at most only slightly tapering, as in fig. 279.....**Euura**
25. Head, figs. 299, 300, with median crest rounding off fairly evenly in lateral view, not hump-like and protuberant.....**Amauronematus**  
 Head, figs. 301, 302, with median crest protuberant and somewhat angled in lateral view.....26
26. Sheath with a wide scopa as in fig. 308.....**Pristiphora**  
 Sheath without a scopa, at most with the apical margin slightly thickened.....**Nematus**
27. Clypeus emarginate on meson, forming two lateral lobes, fig. 296.....29  
 Clypeus not emarginate on meson, fig. 297.....28
28. Penis valve with apical process of lateral flap on dorsal side, fig. 316.....**Nematus**  
 Penis valve with apical process of lateral flap not on dorsal side, figs. 313, 314.....**Pristiphora**
29. Apical sternite wide and emarginate at apex, fig. 306.....30  
 Apical sternite either much more narrowed towards apex or not at all emarginate.....31
30. Left mandible tapering fairly regularly from base to apex without a neck-like constriction between base and apical blade, fig. 271.....**Nematinus**  
 Left mandible with base bulbous and with a definite narrowing between base and blade-like apex, fig. 272.....31
31. Tarsal claw with inner tooth very small and situated some distance from apex, fig. 264.....32  
 Tarsal claw with inner tooth either larger, fig. 265, or situated closer to apex, fig. 266.....33
32. Eighth tergite with a procidentia, i.e., a median, raised process set off from the lateral areas by declivous sides, fig. 324.....**Pikonema**  
 Eighth tergite produced or carinate but never with the median process set off from the lateral areas by declivous sides.....**Pachynematus**
33. Left mandible with the narrowed apical portion long, fig. 272.....34  
 Left mandible with the narrowed apical portion short and stubby, fig. 273.....**Euura**

34. Tarsal claws with inner tooth situated some distance from apex and curved to form a semicircular clasp with outer tooth, fig. 265.....**Micronematus**  
Tarsal claws with inner tooth situated closer to apex, not forming the semicircular outline as above, fig. 266.....35
35. Head, figs. 299, 300, with median crest rounding off fairly evenly in lateral view, not prominently humped.....**Amauronematus**  
Head, figs. 301, 302, with median crest protuberant and somewhat angled in lateral view.....36
36. Eighth tergite with small, narrow, and inconspicuous procidentia, fig. 325, and apical sternite very short, bluntly-rounded at apex, fig. 305 **Pristiphora**  
Either eighth tergite with a conspicuous, well-differentiated procidentia, as in fig. 324, and the apical sternite produced and more angulate apically.....**Nematus**

### *Hoplocampa* Hartig

*Hoplocampa* Hartig, 1837, p. 276. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo* (*Allantus*) *brevis* Klug.

*MacGillivraya* Ashmead, 1898, p. 257. Genotype by original designation.—*MacGillivraya oregonensis* Ashmead. Preoccupied.

*Macgillivrayella* Ashmead in Smith, 1899, p. 606. New name for *Macgillivraya* Ashmead.

*Characteristics*.—Small sawflies, usually shorter than 5 mm. Front wings with  $2r$  and base of  $2A$  &  $3A$  present. Antennae fairly short and robust, slightly tapering, the two basal segments together subequal to the third. Tarsal claws with small to medium-sized inner tooth. Malar space variable. Saw without marked transverse bands of setae. Penis valves simple, not divided into mesal and lateral flaps, but sometimes with filamentous lateral processes.

### *Caulocampus* Rohwer

*Caulocampus* Rohwer, 1912b, p. 239. Genotype.—*Priophorus acericaulis* MacGillivray.

*Characteristics*.—Similar to *Hoplocampa* in venation and general features. Differs in having the antennae shorter and stockier, and the inner tooth of the tarsal claws large and thick, fig. 263.

Contains only a single species, *C. acericaulis* (MacG.), which mines the petioles of maple leaves.

### *Susana* Rohwer and Middleton

*Susana* Rohwer and Middleton, 1931, p. 93. Genotype by original designation.—*Susana cupressi* Rohwer and Middleton.

*Characteristics*.—Front wings with  $2r$  absent or present,  $2m-cu$  joining cell  $2R_s$  or  $1R_s$ , and base of  $2A$  &  $3A$  present. Antennae slender, long and setaceous. Tarsal claws with a moderate inner tooth. Prepectus

reduced to a very thin sclerite, usually invisible, along the antero-dorsal margin.

Contains two nearctic species.

#### *Craterocercus* Rohwer

*Craterocercus* Rohwer, 1911d, p. 385. Genotype by original designation.—*Hemichroa phytophagica* Dyar.

*Characteristics*.—Venation similar to *Susana*, usually with *2r-m* and *2m-cu* interstitial. Antennae long, slightly robust, and of the same thickness throughout, fig. 282. Clypeus narrow, arcuately emarginate, the lateral lobes pointed and finger-like. Malar space narrow. Saw with transverse rows of spines. Penis valve with lateral flap represented by a broad spine-like process.

This genus contains about eight species, which have been keyed out by Rohwer, 1918d. It is very closely allied to the European genus *Mesoneura*, differing chiefly in possessing the basal abscissa of vein 2A & 3A in the front wing.

#### *Hemichroa* Stephens

The two subgenera listed here may ultimately prove to be distinct genera. At the present, however, the male of one is unknown and no good diagnostic character of significance has been discovered for the female. On the other hand there is every evidence that the groups are closely related.

#### KEY TO SUBGENERA

1. Base of 2A & 3A pigmented and forming a distinct loop, fig. 289 **Hemichroa**  
Base of 2A & 3A unpigmented and forming a smaller loop, fig. 290.... **Varna**

#### Subgenus *Hemichroa* Stephens

*Hemichroa* Stephens, 1835, p. 55. Genotype by subsequent designation of Westwood, 1849.—*Tenthredo alni* Linnaeus.

*Leptocerca* Hartig, 1837, p. 228. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo alni* Linnaeus.

*Engages* Gistel, 1848, p. 9. New name for *Leptocerca* Hartig.

*Leptocercus* Thomson, 1871, p. 76. Emendation of *Leptocerca*.

*Characteristics*.—Venation too variable to be described other than falling within the subfamily definition. Antennae long and setaceous, fig. 283. Clypeus, fig. 291, wide and angularly emarginate. Malar space short. Tarsal claws with a large inner tooth. Genitalia of both sexes similar to *Craterocercus*.

This subgenus contains only one nearctic species which is probably truly holarctic in distribution. Its full synonymy has not been given heretofore.

*Hemichroa crocea* (Fourcroy)

*Tenthredo crocea* Fourcroy, 1785, p. 364.

*Dineura americana* Provancher, 1882, p. 292. *New synonymy.*

*Hemichroa pallida* Ashmead, 1890, p. 15. *New synonymy.*

*Hemichroa dyari* Rohwer, 1918d, p. 171. *New synonymy.*

*Hemichroa washingtonia* Rohwer and Middleton, 1931, p. 97.

The variant described by Provancher as *Dineura americana* has usually been considered a distinct species close to *crocea*. Three series of females from New York, Quebec, and England show both extremes and the bridging intermediates, so that the differentiation cannot be used.

Subgenus *Varna* new subgenus

*Characteristics.*—Both mandibles triangular from a lateral view, fig. 270. Front wings with base of vein 2A & 3A either weak or absent, 2m-cu received in cell 1R<sub>s</sub>, and *r* absent; tarsal claws deeply cleft, the inner tooth subequal and subparallel to the outer tooth; clypeus deeply and circularly emarginate; antennae very long, slender, and gradually tapering to apex. Based on female, since no males have yet been described.

*Genotype* by original designation.—*Nematus militaris* Cresson.

This genus may be separated by means of the accompanying key from those genera of the Nematinae in which the base of vein 2A & 3A is present. Of those genera in which the base of vein 2A & 3A is atrophied, *Varna* most closely resembles *Nematus* in general appearance, but can easily be separated from this latter genus on the basis of the left mandible being triangular, fig. 270, from the lateral aspect. In *Nematus* it is hollowed out dorsally and the lateral aspect is as shown in fig. 272. According to Yuasa's classification of the immature stages, the larva of *Varna* differs from that of *Nematus* in lacking suranal processes on the tenth abdominal tergum.

*Varna* includes three nearctic species, *thoracicus* (Harrington), *militaris* (Cresson), and *amelanchieridis* (Rohwer) which have formerly been placed in *Nematus* (*Pteronidea*).

*Pseudodineura* Konow

*Dolerus* subg. *Pelmatopus* Hartig, 1837, p. 244, preoccupied. Monobasic, genotype.—

*Dolerus* (*Pelmatopus*) *minutus* Hartig.

*Pseudodineura* Konow, 1885c, p. 297. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo* (*Allantus*) *parvula* Klug.

*Characteristics.*—Front wing with 2*r* present and base of 2A & 3A absent. Hind wing with 2A atrophied, fig. 288. Prepectus typical. Antennae subfiliform, fig. 279. Malar space absent. Right mandible short and uniformly tapering from base to apex, fig. 319, tridentate, the two

inner teeth shorter than in fig. 318. Tarsal claws simple, without an inner tooth. Male abdomen without a procidentia.

The nearctic fauna in this genus is unexplored. To date only one North American species, *parva* (Norton), has been described.

#### *Kerita* new genus

*Characteristics*.—Venation typical of the Nematinae, the front wing, fig. 195, with  $2r$  present,  $2r-m$  absent, and the basal loop of  $2A$  &  $3A$  absent; and with the free stem  $M$  represented by a minute basal stub. Mandibles tridentate as in fig. 318, the outer tooth largest. Antennae slender and setaceous, fig. 284, the second segment wider than long, the remainder long and diminishing in length only gradually. Ocelli small, fig. 295, grouped together in a low triangle and separated from the eyes by a wide area. Malar space present, almost as long as the second antennal segment. Tarsal claws slender and simple, as in fig. 262.

*Genotype*.—*Kerita fidala* new species.

This genus represents, with *Pseudodineura*, the end of a small, specialized branch of the Nematinae. The progenitors of this group were probably forms allied to *Hemichroa*. The genus *Kerita* resembles only *Pseudodineura*, from which it differs in the smaller and more compact ocellar triangle, the distinct malar space, and the larger inner teeth on the mandibles. At present it is known only from the genotype.

#### *Kerita fidala* new species

*Female*.—Length 3.75 mm. Color black with the following parts piceous: mandibles, trochanters, femora, tibiae, and base of basitarsus. Wings very slightly smoky, venation brown.

Head and body shining, clothed with sparse setae. Head with ocellar basin absent, represented by a narrow raised area extending from the ocelli to the supraclypeal area, with a slight concavity down the middle. At the anterior end of this raised area is a shallow, sunken, U-shaped area, the median fovea. Clypeus long and wide, its sides sloping and apical margin straight, the apex flat and the base slightly raised. Supraclypeal area hump-like, rising sharply from the clypeus. Thorax robust, scutellum practically flat, with a distinct post-tergite. Sheath slender and blade-like, practically identical with that of *Pseudodineura*, fig. 309. Saw with lance of 10 segments, humped in the middle and tapering to a point at apex; lancet, fig. 310, with 13 segments separated only by faint sutures, each lobe with 6-12 minute teeth, the last tooth produced basad to form a projection on the apical eight segments, the entire surface of the lobate area covered with sparse but conspicuous setae.

*Holotype, female*.—Muncie (spelled "Munsey" on label), Illinois, April 25, 1914. In the collection of the Illinois State Natural History Survey.

*Neopareophora* MacGillivray

*Neopareophora* MacGillivray, 1908a, p. 289. Genotype by original designation.—

*Neopareophora martini* MacGillivray = *litura* (Klug).

*Dineuridea* Rohwer, 1912b, p. 240. Monobasic, genotype.—*Marlattia erythrothorax* Rohwer.

Characteristics similar to above with the following distinctions: malar space distinct; antennae long and tapering, fig. 280; mandibles narrow, right one appearing thin and blade-like from lateral view, fig. 275; hind wings with 2A present, fig. 287.

Female with sheath thick, margins shelf-like, with long cerci, figs. 308, 311.

Contains two nearctic species which have been revised by Ross (1935b).

*Adelomos* Ross

*Adelomos* Ross, 1935b, p. 201. Genotype by original designation.—*Adelomos cleone* Ross.

*Characteristics*.—Front wing with 2r present, base of 2A & 3A absent. Hind wings with a radial cross-vein, fig. 286, and with 2A present. Prepectus present, triangular, well defined, and of moderate size. Antennae, fig. 278, almost filiform, the segments of the flagellum distinctly narrower at the base and wider at apex. Right mandible, fig. 274, broad at base with a fairly narrow blade. Tarsal claws cleft, the inner tooth stout and almost as long as the outer, fig. 269

Includes only the genotype. This form is unique among sawflies in possessing a radial cross-vein in the hind wing.

*Anoplonyx* Marlatt

*Anoplonyx* Marlatt, 1896a, p. 18. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus pectoralis* Lepeletier.

*Marlattia* Ashmead, 1898, p. 287. Genotype by original designation.—*Hoplocampa laricis* Marlatt. *New synonymy*.

*Characteristics*.—Front wings with 2r present or absent, 2m-cu joining cell 2R<sub>s</sub>, basal loop of vein 2A & 3A present. Antennae very slender and setaceous. Tarsal claws without an inner tooth, fig. 262. Saw curved at apex with curved rows of spines on each segment. Penis valves with a mesal membranous flap and a sclerotized, spike-like lateral one.

*Anoplonyx* and *Marlattia* have more recently been considered as subgenera of *Platycampus* and *Hemichroa* respectively. The two groups were separated on the basis of the presence or absence of the second

radial cross-vein. In *Platycampus sens. st.* this cross-vein is always absent, but in *Hemichroa sens. st.* it may be present or absent. Furthermore, in a series of three specimens of *Anoplonyx laricis* (Marl.), one has *2r* absent, one has it weakly developed and the third has it well developed. It is, therefore, impossible to use this character as a basis for separating the genera. The species placed here, however, are allied by such distinctive attributes as simple tarsal claws and a type of saw peculiar within the group.

*Anoplonyx occidentis* new name

*Platycampus (Anoplonyx) laricis* Rohwer and Middleton, 1931, p. 95. Preoccupied by *A. laricis* (Marlatt), 1896b, p. 257.

The merging of *Marlattia* and *Anoplonyx* brings into the same genus the two names *laricis*. Since the later species described by Rohwer and Middleton is a good species it is necessary to give it a new name.

*Platycampus* Schiödte

*Nematus* subg. *Leptopus* Hartig, 1837, p. 104, preoccupied. Monobasic, genotype.—

*Nematus (Leptopus) hypogastricus* Hartig = *Platycampus luridiventris* (Fallén).

*Platycampus* Schiödte, 1839, p. 20. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus (Leptopus) hypogastricus* Hartig = *Platycampus luridiventris* (Fall.)

*Erasmusinus* Gistel, 1848, p. IX. New name for *Leptopus* Hartig.

*Camponiscus* E. Newman, 1869, p. 215. Monobasic, genotype.—*Camponiscus healaei* E. Newman = *Platycampus luridiventris* (Fallén).

*Characteristics*.—Front wings with base of 2A & 3A present as a distinct loop, but *2r* absent. Mandible triangular from a side view. Antennae long and setaceous. Malar space very wide, greater than length of first antennal segment. Tarsal claws with a large inner tooth. Saw with indistinct lateral armature.

The species *juniperi* Rohwer, originally described in *Platycampus*, belongs in *Susana*. The removal of this species and *Anoplonyx* from *Platycampus* leaves a residue of four described nearctic species which form a compact genus. The specific status of the species is indefinite.

*Nematinus* Rohwer

*Nematinus* Rohwer, 1911b, p. 99. Genotype by original designation.—*Tenthredo abdominalis* Panzer.

*Characteristics*.—Front wings with both *2r* and base of 2A & 3A atrophied. Mandibles representing an intermediate condition between the tapered and blade-like types, fig. 271. Antennae long and setaceous. Tarsal claws with a small inner tooth. Female with segment at base of sheath extremely large and broad at base, fig. 293. Male with no en-



largement of apex of abdomen, eighth tergite produced into a broad, rounded lobe on meson, fig. 326, and with apical sternite emarginate, fig. 306.

*Male*.—Length 6 mm. Color brownish yellow with the following parts piceous or black: two basal segments of antennae; a large, diamond-shaped mark on ocellar region, reaching from eye to eye and antennae to back of head; posterior aspect of head; praescutum and scutum; mesopectus; and some indefinite blotches on the metanotum and first abdominal tergite. Wings stained with brown basad of stigma; beyond they are hyaline; venation brownish yellow.

General structure as given under genus. Penis valve, fig. 315, with mesal and lateral flaps not differentiated, but with apex divided into two small, membranous lobes and lateral face with a sclerotized spur. This is the spur which later tips the lateral flap in the more specialized genera.

*Allotype, male*.—Hampton, N. H., June 5, 1908, S. Albert Shaw. In the collection of the Illinois State Natural History Survey.

Several species, such as *chloreus* (Norton), have been incorrectly placed in this genus. When restricted according to the above diagnosis, it contains four or five very closely related if not identical species in the nearctic region.

#### *Specialized Nematinae*

The genera treated below form the "blossom" of the Nematine stem. Many are difficult to separate in a key but at the same time obviously form distinct phylogenetic groups. Large numbers of species are involved so that it was felt that as many phylogenetic units should be considered genera as possible. The plan followed has been simple—if key characters were found the groups were given generic rank, if not, subgeneric rank.

The entire assemblage has the following characters in common except where noted: front wings with  $2r$  and base of  $2A$  &  $3A$  atrophied, fig. 193; right mandible with base bulbous and apex slender and blade-like, fig. 272; antennae setaceous, with the two basal segments short.

This entire group of genera is in chaotic condition taxonomically. The conventional specific differences of head sculpture and body color, etc., are entirely inadequate for the task. Detailed studies of genitalia and larval characters will be the very least that can be used in the future.

#### *Pristiphora* Latreille

*Characteristics*.—Clypeus usually truncate, fig. 297, in a few species decidedly emarginate. Tarsal claws varying from simple to possessing a medium sized tooth. Head with lateral walls of ocellar basin usually absent, at most merely indicated as ridges; the ocellar basin itself usually absent and represented by an area raised above the level of the surround-

ing areas. Front wings with first abscissa of  $R_s$  frequently atrophied. Genitalia of both sexes variable.

Judging by the male genitalia, this genus is the oldest of the specialized Nematinae. This is indicated first by the extreme differences evolved in the male genitalia and secondly that what might be considered as the generalized type of *Pristiphora* has a penis valve with the tooth of its lateral flap dorsal, whereas it is ventral in the others. There appear to be some distinct phylogenetic groups within the genus but a more detailed study of both nearctic and exotic species is necessary to bring out their worth as genera. Three of these are here classed as subgenera on the basis of genitalia.

#### SYNOPSIS OF SUBGENERA

1. Male with apex of eighth tergite with a fan-shaped mesal area which is either convex or somewhat carinate. Penis valves various, but not as in fig. 313. Female saw either with a "scopa" or pointed and subtriangular, its sides usually coarsely punctured. Tarsal claws various....**Pristiphora**
2. Male with apex of eighth tergite possessing a small, tapering procidentia, fig. 325. Penis valve with apical spur bent at right angles to valve, fig. 313. Female sheath provided with a distinct scopa. Tarsal claws with a moderate inner tooth.....**Sala**
3. Male with apex of eighth sternite fan-shaped, but with a definite, narrow procidentia which is not produced beyond the apex of the segment. Female saw with a distinct scopa, differing from those of *Pristiphora s. st.* in having the disto-ventral margin incised so that the apex is pointed. Tarsal claws simple.....**Gymnonychus**

#### Subgenus *Pristiphora* Latreille

*Pristiphora* Latreille, 1810, p. 294. Genotype by original designation.—*Pteronus testaceus* Jurine.

*Diphadnus* Hartig, 1837, p. 225. Monobasic, genotype.—*Nematus fuscicornis* Hartig = *Pristiphora pallipes* (Lepeletier).

*Lygaeonematus* Konow, 1890, p. 238. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus pini* Retzius = *Pristiphora abietinus* Christ.

*Neotomostethus* MacGillivray, 1908a, p. 290. Genotype by original designation.—*Neotomostethus hyalinus* MacGillivray. *New synonymy.*

This group contains some thirty or forty described North American species. The genus *Neotomostethus* was originally described in the Blenocampinae but its genotype is obviously a typical *Pristiphora*.

The gooseberry sawfly is referred to unanimously in North American economic literature as *Diphadnus appendiculatus* Hartig but it should be called *Pristiphora pallipes* (Lep.). This synonymy has been recognized by European authors for many years.

#### Subgenus *Gymnonychus* Marlatt

*Gymnonychus* Marlatt, 1896a, p. 122. Genotype by original designation.—*Gymnonychus californicus* Marlatt.

Contains only one known species, the genotype.

Subgenus *Sala* new subgenus

*Characteristics*.—Clypeus emarginate. Antennae long and tapering. Dorsal portion of head without distinct ridges, ocellar basin represented by a raised area with sloping boundaries. Frontal crest raised and appearing somewhat angulate from side view, as in fig. 302. Depressions between eyes and antennal sockets neither very deep nor extending much above antennae. Tarsal claws with a long inner tooth subparallel with outer one, as in fig. 269. Female sheath with a scopa set off by a deep depression. Male with apical sternite round and short, fig. 305; eighth tergite with a narrow procidentia, fig. 325; and lateral flap of penis valve with a dorsal tooth bent over at right angles to the axis of the shaft, fig. 313.

*Genotype* by original designation.—*Nematus chloreus* Norton.

The genotype has been described or placed in both *Nematinus* and *Nematus* (*Pteronidea*) but it does not belong in these genera. Its only ally is *Pristiphora*, in which it seems to form a quite distinct subgroup.

*Pristiphora chloreus* (Norton) new combination

*Nematus chloreus* Norton, 1867, p. 221, ♀.

*Nematus pallifrons* Cresson, 1880, p. 6, ♂. *New synonymy*.

*Pteronus quercus* Marlatt, 1896a, p. 67, ♀. *New synonymy*.

This species feeds on oak, and is distributed from New York to Texas. I have examined the types of the three names involved. Another species described as *Amauronematus vaculus* MacGillivray from Oregon is either another synonym or a very closely allied species.

*Pachynematus* Konow

*Pachynematus* Konow, 1890, p. 238. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus capreae* Panzer = *Pachynematus trisignatus* (Förster).

*Characteristics*.—Clypeus emarginate. Tarsal claws with a very small tooth situated some distance from apex of outer tooth, fig. 264. Frontal crest and lateral boundaries of ocellar basin sharp, although sometimes low. Female sheath never with scopa, tapering to a pointed apex. Male with apical sternite always at least somewhat produced; eighth tergite either with a carina-like procidentia or a long, convex produced one, penis valve with the tooth of the lateral flap ventral.

Contains 30 or 40 described species from North America. The association of the two sexes of many species is not known, and indicates the need for intensive study of the genus. The larvae of most of the species of this genus differ from those of all related genera in feeding on grasses and sedges and in having the posterior end of the body markedly tapering and pointed.

*Micronematus* Konow

*Micronematus* Konow, 1890, p. 239. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus pullus* Förster = *Micronematus monogyniae* (Hartig).

Very similar to *Pachynematus*, differing chiefly as follows: Size small, 4-5 mm. Inner tarsal claw tooth large, so that the two teeth form a C-shaped arc, fig. 265. Female sheath short, its ventral margin evenly rounded. Male with apical sternite tapering to a narrow, round tip; eighth tergite with a narrow, carinate procidentia which projects beyond the margin of the segment.

Contains one nearctic species, *gregarius* (Marlatt).

*Micronematus gregarius* (Marlatt)

*Pachynematus gregarius* Marlatt, 1896b, p. 256, ♂, ♀.

*Pachynematus rarus* MacGillivray, 1921a, p. 30, ♀. *New synonymy.*

Yuasa (1923) first pointed out the placement of this species in *Micronematus* on the basis of larval characters. The larvae feed gregariously on *Salix*.

*Pikonema* new genus

Similar in general structure to *Pachynematus*, differing as follows: Female sheath long, polished and projecting considerably beyond cerci, fig. 298. Male apical sternite, long, apex tapered to a semi-truncate point, fig. 307; eighth tergite with a procidentia projecting beyond segment, fig. 324.

*Genotype* by original designation.—*Nematus dimmockii* Cresson.

A compact genus of five species feeding on spruce.

*Nematus* Panzer

*Characteristics.*—Clypeus emarginate. Tarsal claws with a large inner tooth subparallel with outer, figs. 267, 268. Head with ocellar basin distinct and usually with well defined lateral walls. Frontal crest appearing angulate from lateral view, fig. 301. Depressions between eyes and antennal sockets not so deep or long as in *Amauronematus*.

The genus has hitherto been considered as three or four separate ones. There seem to be no constant adult, larval, or biological differences, at least none that coincide with each other. For this reason these groups are considered here as subgenera, with no effort to give absolute diagnostic differences between them.

## SYNOPSIS OF SUBGENERA

1. Large species, usually over 9 mm. in length, with outer side of hind tibia and basitarsus markedly grooved, fig. 276. Antennae long and setaceous.....**Nematus**
2. Medium to small species with outer side of hind tibiae usually convex or without such a distinct groove as in fig. 276. Antennae always long and setaceous in both sexes. Larvae not inhabiting leaf-curls or galls except in early instars.....**Pteronidea**

3. Small species, usually less than 5 mm. in length, with hind tibiae only indistinctly grooved. Antennae almost always filiform in female, frequently markedly setaceous in male. Larvae inhabiting leaf-curls or galls for their entire life.....**Pontania**

The entire genus contains about 200 described nearctic species. When a thorough study of the males is made it will probably be possible to define the subgenera in terms of male genitalia. All the groups are very imperfectly understood at present.

#### Subgenus *Nematus* Panzer

*Nematus* Panzer, 1801, Heft 82, pl. 10. Monobasic, genotype.—*Tenthredo* (*Nematus*) *lucida* Panzer.

*Hypolaepus* Kirby, 1882, p. 324. Monobasic, genotype.—*Hypolaepus abbottii* Kirby. *New synonymy.*

*Holcocneme* Konow, 1890, p. 238. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo crassa* Fallén.

Contains only three or four nearctic species.

#### Subgenus *Pteronidea* Rohwer

*Pteronidea* Rohwer, 1911b, p. 98. Genotype by original designation.—*Nematus ventralis* Say.

This contains the larger proportion of the species in the genus. Later studies on genitalia will undoubtedly show that it is composed of several distinct phylogenetic groups.

#### Subgenus *Pontania* O. Costa

*Pontania* O. Costa, 1859, p. 20. Genotype by subsequent designation of Marlatt, 1896a.—*Nematus gallicola* Stephens.

Members of this subgenus have been confused with those of *Euura*, since the venation of *Euura* is variable and the two have been separated hitherto on this basis. *Pontania* contains some 40 or 50 described nearctic species.

#### Genus *Euura* E. Newman

*Euura* E. Newman, January, 1837, p. 259. Genotype by subsequent designation of Rohwer, 1911b.—*Euura gallae* Newman.

*Nematus* subg. *Cryptocampus* Hartig, March, 1837, p. 221. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus* (*Cryptocampus*) *medullaris* Hartig.

*Characteristics.*—Essentially similar in general appearance to *Nematus* subg. *Pontania*. Head with ocellar basin sometimes indistinct, antennae usually filiform. Front wings usually with *2m-cu* absent. Differs from all related genera in having the blade of the left mandible shortened and stubby, fig. 273. Larvae of all species form leaf, petiole, or stem galls on willow.

Several species possessing this abbreviated mandible have in addition the cross-vein *2r-m*, which has led to their description in *Pteronidea* and

*Pontania*; these it is necessary to remove to *Euura*. Among these are the following known to me:

<i>Pontania gracilis</i> Marlatt	<i>Pontania pisum</i> Walsh
<i>Pontania kincaidi</i> Marlatt	<i>Pontania pomum</i> Walsh
<i>Pontania pacifica</i> Marlatt	<i>Pteronus kincaidi</i> Marlatt

*Euura hoppingi* new name

*Pteronus kincaidi* Marlatt, 1896a, p. 55; ♂, ♀. Preoccupied in *Euura* by *Pontania kincaidi* Marlatt.

*Croesus* Leach

*Croesus* Leach, 1817, p. 129. Monobasic, genotype.—*Tenthredo septentrionalis* Linnaeus.

*Characteristics*.—Apparently very closely related to *Nematus* differing from it and other Nematinae, however, in the expanded and foliaceous hind basitarsus and apex of hind tibiae, fig. 277.

Contains only three recorded species from North America. The larvae are extremely similar to those of *Nematus* and indicate a close relationship between them.

*Amauronematus* Konow

*Amauronematus* Konow, 1890, p. 237. Genotype by subsequent designation of Rohwer, 1911b.—*Nematus fallax* Lepeletier.

*Pontopristia* Malaise, 1921, p. 12. Genotype by present designation.—*Pontopristia suavis* var. *fusca* Malaise. *New synonymy*.

*Characteristics*.—Clypeus emarginate. Antennae slender and setaceous. Head with frontal crest appearing evenly convex from lateral view, fig. 299; ocellar basin usually without distinct antero-lateral corners; depressions between eyes and antennal sockets deeper, longer, and situated closer to eye than in *Nematus*. Tarsal claws with a large inner tooth subparallel with outer one.

This genus is a large one, containing forty or fifty species.

SUBFAMILY ALLANTINAE

Prepectus absent. Propleurae with mesal margins either pointed and not approximate, fig. 155, or truncate and meeting, fig. 158. Front wings, fig. 186, with M parallel with *1m-cu* and meeting radial stem near origin of  $R_s$ ; *a* present. Mesopost-tergite triangular and well developed. Mandibles various.

KEY TO GENERA

1. Mesonotum and pectus entirely covered with thick coarse punctation.....*Pseudosiobla*  
 Mesonotum and pectus with large areas at most with small punctures which are not confluent.....2

2. Mesopleurae entirely covered with close, crater-like punctures, fig. 329....3  
Mesopleurae finely striate or with only small punctures.....4
3. Praescutum with anterior portion of each half prominently raised, the posterior portion flat, fig. 331.....**Eriocampa**  
Praescutum with each half almost evenly convex over its entire length, fig. 330.....**Dimorphopteryx**
4. Abdomen with a pair of more or less oval, opalescent areas on the five or six basal tergites, giving it a unique, fenestrated appearance, fig. 340.....**Empria**  
Abdomen without such areas.....5
5. Malar space narrow, shorter than length of second antennal segment, fig. 334, and propleurae acute and not meeting on meson, fig. 155.....**Phrontosoma**  
Either malar space longer than length of second antennal segment, or propleurae truncate and meeting on meson, fig. 158.....6
6. Hind basitarsus at least one and one-third times as long as the remainder of the tarsal segments together, fig. 347.....7  
Hind basitarsus subequal to or shorter than remainder of tarsal segments together, fig. 348.....8
7. First abscissa of  $R_s$  atrophied, fig. 186.....**Macremphytus**  
First abscissa of  $R_s$  present, see fig. 170.....**Taxonus**
8. First abscissa of  $R_s$  atrophied, fig. 186.....9  
First abscissa of  $R_s$  present, see fig. 170.....10
9. Anterior margin of clypeus circularly emarginate for one-half its mesal length, fig. 327.....**Allantus**  
Anterior margin of clypeus emarginate for only a third or less of its length, and the incision forming a flatter arc, figs. 320, 322...**Ametastegia** in part.
10. Anal cross-vein nearly transversely placed across the anal cell, fig. 337.....**Ametastegia** in part.  
Anal cross-vein sloping more, as in fig. 338.....11
11. Clypeus, fig. 328, narrow, its anterior margin incised to form narrow lateral tips.....**Aphilodyctium**  
Clypeus, figs. 332, 333, wide, the incision either shallow or angled to form wide, obtuse lateral portions.....12
12. Hind tarsal segments almost cylindrical, fig. 345; together almost equal in length to the hind tibia.....**Monosoma**  
Hind tarsal segments considerably wider at apex and tapering to base, fig. 346; together only two-thirds the length of the hind tibia...**Monostegia**

The genus *Empria* probably represents the most generalized member of the subfamily. The other genera may be grouped around it into three tribes, as follows:

(1) *Allantini*. A regular series of genera lead from *Empria*, through *Monostegia*, *Monosoma*, *Ametastegia*, *Aphilodyctium*, and *Allantus* to the two most specialized genera of the group, *Macremphytus* and *Taxonus*. These latter two differ from *Empria* in having the propleurae truncate and approximate on the meson, fig. 158, the right mandible re-

duced to a unidentate hook, fig. 49, and the praeputial processes incised to form narrow apical lobes, fig. 343.

(2) *Phrontosomini*, including only one nearctic genus, *Phrontosoma*, characterized by the very narrow malar space, and the very small, low praeputial processes in the male genitalia. In other respects the genus is quite generalized, and it is difficult to place it phylogenetically.

(3) *Eriocampini*, including *Pseudosiobla*, *Eriocampa*, and *Dimorphopteryx*. These three genera are grouped together chiefly on the rugose mesopleurae, but differ radically from each other in mandibular and antennal structure and genitalia. The praeputial lobes of the genitalia, fig. 341, resemble those of *Empria*, fig. 342, to some extent and probably indicate that these three genera are aberrant offshoots of an early stem.

#### *Empria* Lepeletier

This genus contains seven nearctic species revised by Ross, 1936b. They are separated on the basis of saws and male genitalia, and grouped into two subgenera.

#### KEY TO SUBGENERA

Head entirely black.....**Empria**  
 Head with inner orbits yellow.....**Parataxonus**

#### Subgenus *Empria* Lepeletier

*Empria* Lepeletier, 1828, p. 571. Genotype by subsequent designation of Brullé, 1846.—*Dolerus (Empria) pallimacula* Lepeletier.

*Poecilostoma* Dahlbom, 1835, p. 13. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo guttatum* Fallén.

*Prosecria* Gistel, 1848, p. X. New name of *Poecilostoma*.

*Poecilosoma* Thomson, 1871, p. 227. Emended spelling of *Poecilostoma*.

*Poecilostomidea* Ashmead, 1898, p. 256. Genotype by original designation.—*Emphytus maculatus* Norton.

*Tetratneura* Ashmead, 1898, p. 256. Genotype by original designation.—*Selandria ignotus* Norton.

*Empria* subg. *Triempria* Enslin, 1914, p. 213. Genotype by original designation.—*Empria tridens* Konow.

Both mandibles bidentate, as in fig. 51. Propleurae with mesal angles pointed and not approximate, fig. 155. Clypeus with a median keel, variously incised, fig. 323. Antennae variable. Front wings with *a* oblique, first abscissa of  $R_s$  present or absent. Abdomen with at least the four or five basal segments bearing a pair of opalescent areas, fig. 340.

#### Subgenus *Parataxonus* MacGillivray

*Parataxonus* MacGillivray, 1908b, p. 367. Genotype by original designation.—*Taxonus multicolor* Norton.

*Leucempria* Enslin, 1913, p. 187. Genotype by original designation.—*Tenthredo candidula* Fallén. *New synonymy*.



Differs from *Empria s. st.* in having the clypeus, fig. 321, with a wide, angular incision forming triangular lobes, and without a median keel; also in having a peripheral vein around the hind wing in the male, fig. 180.

*Monostegia* O. Costa

*Monostegia* O. Costa, 1859, p. 60. Genotype by subsequent designation of MacGillivray, 1908b.—*Tenthredo abdominalis* Fabricius.

Clypeus wide and only moderately emarginate, fig. 333. Hind tarsi only two-thirds the length of the hind tibiae, each segment wider at apex and tapering to base, fig. 346. Propleurae with mesal margins slightly truncate. Antennae with third segment almost as long as third and fourth together. Venation similar to *Empria*. Abdomen without opalescent areas.

This genus is closely related to *Empria* and is considered a subgenus of it by Enslin and others. It is represented in North America by only a single holarctic species, *abdominalis* (Fabr.), which has two synonyms hitherto unrecorded in North American literature.

*Monostegia abdominalis* (Fabricius)

*Tenthredo abdominalis* Fabricius, 1798, p. 216.

*Monostegia martini* MacGillivray, 1908b, p. 366, ♀. *New synonymy.*

*Monostegia nearctica* Rohwer, 1912b, p. 209, ♂, ♀. *New synonymy.*

The only nearctic records for this species are along the Atlantic coast.

*Monosoma* MacGillivray

*Monosoma* MacGillivray, 1908b, p. 368. Genotype by original designation.—*Taxonus inferentia* Norton.

*Monosoma* Viereck in Smith, 1910, p. 583. Emended spelling of *Monosoma*.

Judging from MacGillivray's later papers and by his handwritten labels in his collection, the original spelling "*Monosoma*" was a *lapsus calami* and the emended spelling should stand.

Hind tarsi almost as long as hind tibiae, fig. 345, the segments almost cylindrical. Front wing with distal anal cell short, narrow, and sharply triangular, fig. 339. Clypeus wide and only moderately emarginate, fig. 332. Propleurae with mesal portion wide and almost truncate. Antennae with third segment subequal to length of fourth and fifth together.

*Ametastegia* A. Costa

The nearctic species of this and the following two genera have been revised by Ross (1937b). In common with other genera of the subfamily, they contained a great many synonymous names and misplacements.

KEY TO SUBGENERA

Front wings with first abscissa of R<sub>5</sub> present.....*Ametastegia*  
 Front wings with first abscissa of R<sub>5</sub> absent.....*Protemphytus*

Subgenus *Ametastegia* A. Costa

*Ametastegia* A. Costa, 1882, p. 198. Monobasic, genotype.—*Ametastegia fulvipes* A. Costa = *Ametastegia glabrata* (Fallén).

*Aomodictium* Ashmead, 1898, p. 309. Monobasic, genotype.—*Strongylogaster abnormis* Provancher = *Ametastegia glabrata* (Fallén).

*Unitaxonus* MacGillivray, 1921b, p. 32. Genotype by original designation.—*Unitaxonus repentinus* MacGillivray = *Ametastegia equiseti* (L.).

Clypeus only slightly or moderately emarginate, figs. 320, 322, the corners sharp. Mandibles, fig. 51, both bidentate. Antennae long. Front wings with *a* almost perpendicular, distal anal cell shorter than proximal anal cell beyond constriction; first abscissa of  $R_s$  present; hind wings with both *3r-m* and *m-cu* always lacking. Head with walls of ocellar basin mound-like and not linear. Male genitalia with praeputial processes triangular, fig. 335, penis valve without "shelves" in dorsal portion.

Subgenus *Protomphytus* Rohwer

*Protomphytus* Rohwer, 1909, p. 92. Monobasic, genotype.—*Emphytus coloradensis* Weldon.

*Emphytina* Rohwer, 1911d, p. 399. Genotype by original designation.—*Emphytina pulchella* Rohwer = *Ametastegia recens* (Say).

*Simplemphytus* MacGillivray, 1914c, p. 363. Monobasic, genotype.—*Simplemphytus pacificus* MacGillivray = *Ametastegia tener* (Fallén).

Differs from *Ametastegia* in having the first abscissa of  $R_s$  absent in front wings, and in having shelf-like folds in the dorsal portion of the penis valves.

*Aphilodyctium* Ashmead

*Aphilodyctium* Ashmead, 1898, p. 310. Genotype by original designation.—*Strongylogaster rubripes* Cresson = *Aphilodyctium fidum* (Cresson).

*Polytaxonus* MacGillivray, 1908b, p. 368. Genotype by original designation.—*Taxonus robustus* Provancher = *Aphilodyctium fidum* (Cresson).

Clypeus narrow and deeply emarginate, the two corners forming short, triangular processes, fig. 328. Mandibles bidentate. Mesal portion of propleurae narrowly truncate and approximate. Antennae slender, segments of flagellum gradually diminishing in length. Front wings with *a* oblique, and  $R_s$  entire, hind wings with *3r-m* and *m-cu* absent. Male genitalia with apex of praeputial lobes forming more or less definite, narrowed projections, fig. 336.

Contains only one nearctic species, *fidum* (Cresson), whose synonymy has been discussed by Ross (1937b).

*Allantus* Panzer

*Allantus* Panzer, 1801, Heft 82, pl. 12. Monobasic, genotype.—*Tenthredo (Allantus) togatus* Panzer.

*Emphytus* Klug, 1818, p. 273. Genotype by subsequent designation of Curtis, 1833.—*Tenthredo cinctus* (Linnaeus).

Clypeus deeply, circularly emarginate, often with a ridge around the edge, fig. 327. Right mandible bidentate, left one unidentate, fig. 50. Propleurae with mesal portion truncate. Antennae long and slender, slightly bilaterally compressed in male. Front wings with first abscissa of  $R_s$  absent,  $a$  oblique and cell DA subequal to cell PA beyond constriction. Hind wings  $3r-m$  and  $m-cu$  absent. Abdomen black except for a transverse white band on the fifth tergite of the female. Hind basitarsus slightly shorter than remainder of tarsal segments together, fig. 348.

The four nearctic species have been revised by Ross (1937b).

#### *Macremphytus* MacGillivray

*Macremphytus* MacGillivray, 1908b, p. 368. Genotype by original designation.—*Harpiphorus varianus* Norton.

Differs from *Allantus* in having the antennae either moderately or strongly bilaterally compressed in both sexes,  $m-cu$  usually present in the hind wing, and the hind basitarsus one and a third times as long as the segments beyond it together. Antennae usually bicolored.

There are nine described nearctic species, including some synonyms.

#### *Taxonus* Hartig

*Taxonus* Hartig, 1837, p. 297. Genotype by subsequent designation of Konow, 1896c.—*Tenthredo* (*Allantus*) *nitida* Klug = *Taxonus agrorum* (Fallén).

*Ermilia* O. Costa, 1859, p. 106. Monobasic, genotype.—*Ermilia pulchella* O. Costa = *Taxonus agrorum* (Fallén).

*Strongylogastroidea* Ashmead, 1898, p. 308. Genotype by original designation.—*Strongylogaster apicalis* Say.

*Parasiobla* Ashmead, 1898, p. 308. Genotype by original designation.—*Strongylogaster rufocinctus* Norton.

*Hypotaxonus* Ashmead, 1898, p. 311. Genotype by original designation.—*Strongylogaster pallipes* Say.

Clypeus deeply emarginate, the lateral angles produced into finger-like tips except in *epicera*. Left mandible with outer tooth cleft to give appearance of a tridentate condition, figs. 47, 49, right mandible unidentate. Antennae cylindrical. Front wings with  $R_s$  entire,  $a$  oblique. Hind wing with  $3r-m$  and  $m-cu$  present or absent; in male with a peripheral vein, fig. 180, partially or entirely lost in one or two species. Hind basitarsus one and one-third times as long as the following segments together.

#### *Phrontosoma* MacGillivray

*Phrontosoma* MacGillivray, 1908b, p. 366. Genotype by original designation.—*Phrontosoma atrum* MacGillivray.

Body short and robust. Clypeus, fig. 334, incised to form rounded lateral lobes. Propleurae with mesal angles narrow and sharp, fig. 155. Antennae, as in fig. 349, short and stout, third segment as long as the two

following together, the apical six almost subequal to each other. Front wings with  $R_s$  entire,  $a$  oblique. Hind wing with  $3r-m$  absent,  $m-cu$  present.

Only a single species is known, *belfragei* (Cresson). The new synonymy connected with it is presented here.

*Phrontosoma belfragei* (Cresson) new combination

*Selandria belfragei* Cresson, 1880, p. 15, ♀.

*Caliroa nortonia* MacGillivray, 1894, p. 324, ♂. *New synonymy.*

*Phrontosoma atrum* MacGillivray, 1908b, p. 367, ♂. *New synonymy.*

*Phrontosoma daeckei* MacGillivray, 1908b, p. 367, ♀. *New synonymy.*

*Phrontosoma collaris* MacGillivray, 1908b, p. 367, ♀. *New synonymy.*

The body of the male is entirely black, of the female either black or with the mesonotum or mesopleurae and mesonotum rufous. The range of the species is extensive, records having been assembled for the following states: Alberta, Illinois, Iowa, Kansas, New York, Ontario, Pennsylvania, Quebec, and Texas.

*Eriocampa* Hartig

*Eriocampa* Hartig, 1837, p. 279. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo ovata* Linnaeus.

Mesopleurae with large, adjacent, crater-like punctures. Mesonotum and sternum polished and almost impunctate. Praescutum with anterior half prominently raised, posterior portion flat. Mandibles both unidentate. Propleurae only slightly truncate on meson. Clypeus only slightly emarginate.

Contains two or three nearctic species.

*Dimorphopteryx* Ashmead

*Dimorphopteryx* Ashmead, 1898, p. 308. Genotype by original designation.—*Strongylogaster pinguis* Norton.

Differs from *Eriocampa* chiefly in having the praescutum evenly convex for its entire length, the mesonotum coarsely punctured, and the mandibles bidentate. The genus was revised by Rohwer (1915a).

*Pseudosiobla* Ashmead

*Pseudosiobla* Ashmead, 1898, p. 308. Genotype by original designation.—*Macrophya excavata* Norton.

Entire head and thorax with large, adjacent punctures. Propleurae with mesal portion thin and angular. Clypeus only very shallowly emarginate.

Contains three nearctic species.

## SUBFAMILY BLENNOCAMPINAE

*Characteristics.*—Front wing, fig. 190, with M joining R at point of separation of R<sub>s</sub>, 2r present, M parallel with 1m-cu except in a few cases, 2A & 3A with basal abscissa either very faint, fig. 206, or atrophied beyond bend, figs, 208, 210. Hind wings with venation variable. Prepectus present or absent. Mandibles bidentate. Cervical sclerites pointed and not appressed on meson.

Rohwer divides this group into two, using as the primary difference the presence or absence of the prepectus. It is plain, however, that the prepectal suture is highly unstable in the Blennocampinae. In *Paracharactus rudis* (Norton) it may be either entirely absent or well developed as a furrow. In such closely allied genera as *Phymatocera* and *Rhadinoceraea* it is present in one and not in the other.

Almost all the species in this subfamily are robust, short, and stocky. Approximately a hundred nearctic species have been described but such is the state of keys and literature that three-quarters of them are either synonyms or placed in the wrong genus. The separation of genera is difficult due to a lack of outstanding characters upon which to base phylogeny. It is hoped that future studies of both adults and larvae will bring to light more significant structures.

## KEY TO GENERA

1. Antennae conspicuously serrate as in fig. 355.....**Ceratulus**  
Antennae either not or only slightly serrate.....2
2. Front wings with M and 1m-cu markedly divergent, fig. 188.....**Tomostethus**  
Front wings with M and 1m-cu not markedly divergent, fig. 190.....3
3. Last four antennal segments much shorter than fifth and together only as long as third, fig. 351.....**Waldheimia**  
Last four antennal segments either subequal to fifth or together much longer than third.....4
4. Front wing with stub of 2A & 3A furcate at apex, fig. 359.....5  
Front wing with stub of 2A & 3A not furcate at apex, figs. 358, 360.....7
5. Head and abdomen black, thorax rufous.....**Paracharactus**  
Body unicolorous, black or piceous.....6
6. Prepectus present.....**Phymatocera**  
Prepectus absent.....**Rhadinoceraea**
7. Prepectus present.....8  
Prepectus absent.....10
8. Third and fourth antennal segments subequal, fig. 354.....**Paracharactus**  
Third antennal segment at least one and one-half length of fourth, fig. 349.....9
9. Prepectus flat and triangular, set off by a suture, fig. 361.....**Tethida**  
Prepectus raised and shoulder-like, set off by a deep furrow, fig. 362.....**Eutomostethus**
10. Front wing with stub of 2A & 3A turned up at apex, fig. 358.....16  
Front wing with stub of 2A & 3A straight at apex, fig. 360.....11

11. Fourth and fifth antennal segments not noticeably longer or thicker than sixth to ninth, fig. 356.....12  
 Fourth and fifth antennal segments noticeably longer and thicker than sixth to ninth, fig. 352.....**Waldheimia**
12. Third and fourth antennal segments of same length, fig. 354.....13  
 Third antennal segment longer than fourth, fig. 350.....15
13. Antennae with seventh and eighth segments less than twice as long as wide, fig. 356.....**Rhadinoceraea**  
 Antennae with seventh and eighth segments much longer than twice width, fig. 354.....14
14. Tarsal claws with a long but slender, inner tooth, fig. 357.....**Claremontia**  
 Tarsal claws without an inner tooth.....**Paracharactus**
15. Malar space as narrow as width of tibial spur, fig. 367.....**Blennocampa**  
 Malar space wider than width of tibial spur, figs. 365, 366.....16
16. Posterior orbits with a row of large punctures along posterior margin of eye, fig. 370.....**Valco**  
 Posterior orbits smooth or only finely punctate along posterior margin of eye.....17
17. Antennae with third and fourth segments subequal in length, fig. 353....18  
 Antennae with third segment markedly longer than fourth, fig. 350.....19
18. Eyes removed almost their own length from dorso-caudal margin of head, fig. 365.....**Lagonis**  
 Eyes less than half their length from dorso-caudal margin of head, fig. 366.....**Periclista**
19. Tarsal claws simple.....20  
 Tarsal claws with a distinct inner tooth.....**Periclista**
20. Eyes small, removed a considerable distance from dorso-caudal margin of head, fig. 369.....**Valco**  
 Eyes large, close to dorso-caudal margin of head, fig. 368.....**Pareophora**

### *Tomostethus* Konow

*Tomostethus* Konow, 1886, p. 184. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo nigrita* Fabricius.

*Characteristics*.—Front wings with M markedly divergent from *1m-cu*, and base of 2A & 3A represented by a faint, sinuate line, fig. 206. Head with malar space practically obsolete, reduced to a thin line. Antennae stocky and filiform, with third segment as long as fourth and fifth together, four to nine gradually decreasing in length. Prepectus triangular, different in texture to episternum. Tarsal claws simple. Sheath short and expanded laterally at apex.

Contains only one described nearctic species, *multicinctus* Rohwer.

### *Tethida* new genus

*Characteristics*.—Front wings with M parallel with *1m-cu*, base of 2A & 3A with apex practically indistinguishable. Malar space, antennae, and sheath as in *Tomostethus*. Prepectus, fig. 361, unusually

large, shining, of same texture as episternum and set off by a line-like suture. Tarsal claws with a short, stocky inner tooth near base.

*Genotype* by original designation.—*Tenthredo cordigera* Beauvois.

*Tethida cordigera* (Beauvois) new combination

*Tenthredo cordigera* Beauvois, 1805, p. 97, ♀.

*Tenthredo bardus* Say, 1836, p. 218, ♀.

*Selandria dubia* Cresson, 1865, p. 244, ♀.

This is the only known species in the genus. The application of *cordigera* to this species was pointed out by Dalla Torre in 1895 but has not been followed by North American students.

*Eutomostethus* Enslin

*Tomostethus* subg. *Eutomostethus* Enslin, 1914, p. 286. *Genotype* by original designation.—*Tenthredo luteiventris* Klug.

*Tomostethus* subg. *Atomostethus* Enslin, 1914, p. 287. *Genotype* by original designation.—*Tenthredo ephippium* Panzer. *New synonymy*.

*Characteristics*.—Differs from *Tethida* as follows: front wings with 2A & 3A represented only by a basal stub which may be curved up at the end, fig. 358; prepectus narrow, raised, and shoulder-like, fig. 362, set off by a deep furrow; tarsal claws simple; sheath narrow and blade-like.

Contains several species which appear to be truly holarctic.

*Paracharactus* MacGillivray

*Paracharactus* MacGillivray, 1908a, p. 292. *Genotype* by original designation.—*Paracharactus obscuratus* MacGillivray.

*Characteristics*.—Front wings with M usually parallel with *1m-cu* but sometimes slightly divergent from it; stub of 2A & 3A straight at apex. Antennae narrow and slightly tapering, the segments of the flagellum decreasing almost imperceptibly in length. Malar space very narrow but distinct. Prepectal suture furrow-like, sometimes imperceptible. Tarsal claws simple or with a very small tooth. Sheath long, deep, thin and blade-like. Saw very simply serrate.

The few species in this genus have not yet been revised.

*Claremontia* Rohwer

*Claremontia* Rohwer, 1909, p. 397. Monobasic, *genotype*.—*Claremontia typica* Rohwer.

Differs from the above as follows: prepectus always absent. Tarsal claws with a longer tooth, fig. 357, and with the outer tooth more curved. Saw with lobiform teeth, resembling many species of *Blennocampa*.

Contains only the *genotype*.

*Blennocampa* Hartig

*Blennocampa* Hartig, 1837, p. 266. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo* (*Allantus*) *pusilla* Klug.

*Monophadnus* Hartig, 1837, p. 271. Genotype by subsequent designation of Ashmead, 1898.—*Tenthredo albipes* Gmelin. *New synonymy*.

*Monophadnoides* Ashmead, 1898, p. 253. Genotype by original designation.—*Monophadnus rubi* Harris. *New synonymy*.

*Characteristics*.—Front wing with stub of 2A & 3A straight, fig. 360. Antennae with third segment longer than fourth, fourth to ninth practically subequal, as in fig. 350. Malar space narrow to subobsolete, never wider than width of tibial spur. Prepectus absent. Tarsal claws and sheath various.

The nearctic species of this genus have never been revised. Probably a dozen valid species occur in this region.

*Waldheimia* Brullé

*Waldheimia* Brullé, 1846, p. 665. Genotype by original designation.—*Tenthredo braziliensis* Lepeletier.

*Erythraspides* Ashmead, 1898, p. 128. Genotype by original designation.—*Blennocampa pygmaea* Say. *New synonymy*.

*Characteristics*.—Differs from *Blennocampa* chiefly in the antennae, figs. 351, 352. The last four segments are reduced in length, usually together no longer than third; the fourth and fifth are longer and wider than the apical ones; the third is the longest and is wider at the apex. The species *carbonaria* (Cresson) differs from the others in having somewhat less differentiation among the antennal segments, but it is without doubt a generalized member of this genus.

Several species occur in the nearctic region but the largest representation of the genus occurs in the neotropical region.

*Periclista* Konow

*Periclista* Konow, 1886, p. 184, no. 2. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo* (*Allantus*) *lineolata* Klug.

*Mogerus* MacGillivray, 1895, p. 281. New name for *Periclista*.

*Isodyctium* Ashmead, 1898, p. 127. Genotype by original designation.—*Isodyctium caryicolum* Dyar.

*Neocharactus* MacGillivray, 1908a, p. 293. Monobasic, genotype.—*Neocharactus bakeri* MacGillivray. *New synonymy*.

*Aphanisus* MacGillivray, 1908a, p. 295. Genotype by original designation.—*Aphanisus lobatus* MacGillivray. *New synonymy*.

*Apericlista* Enslin, 1914, p. 265. Genotype by original designation.—*Tenthredo albipennis* Zaddach. *New synonymy*.

*Characteristics*.—Front wings with stub of 2A & 3A curved up at apex, fig. 358. Head with malar space wider than width of tibial spur, often as wide as length of second antennal segment; clypeus little de-



flected from head; frontal crest rounded off and not jutting forward, fig. 366. Antennae slightly tapering, fourth to ninth segments gradually decreasing in length, third usually longer than fourth. Prepectus absent. Tarsal claws with a medium-sized inner tooth. Males of many species with a peripheral vein as in fig. 180.

This is undoubtedly the largest Blennocampine genus in the nearctic region. The species whose biology is known feed on *Quercus* or *Hicoria*.

#### *Pareophora* Konow

*Pareophora* Konow, 1886, p. 184. Genotype by subsequent designation of Rohwer, 1911b.—*Pareophora luridiventris* Konow = *nigripes* (Klug).

Differs from the above chiefly in having simple tarsal claws. The head of our only species has long eyes with their inner margins parallel, fig. 368, and fairly short antennae.

#### *Pareophora minuta* (MacGillivray) new combination

*Monophadnus minutus* MacGillivray, 1908a, p. 291, ♀.

*Pareophora guara* MacGillivray, 1923a, p. 54, ♀. *New synonymy*.

*Pareophora guana* MacGillivray, 1923b, p. 29, ♀. *New synonymy*.

To date this is the only recorded nearctic species.

#### *Valco* new genus

*Characteristics*.—Front wings with stub of 2A & 3A curved up at apex, fig. 358. Prepectus absent. Malar space slightly wider than width of tibial spur. Clypeus projecting at a distinct angle from head, frontal crest also projecting prominently, and with postocellar furrows very deep and short. Antennae short, with third segment longer than fourth, fig. 350. Tarsal claws simple or with a small inner tooth.

*Genotype* by original designation.—*Selandria irrogata* Cresson.

This genus and several others, such as *Ardis*, *Pareophora*, *Eupareophora*, and *Monardis*, each contain only a few species and may need grouping together at a later date. Until more material is studied, however, there seems little choice but to draw the generic limits closely.

#### *Lagonis* new genus

*Characteristics*.—Front wings with stub of 2A & 3A curved up at apex, fig. 358. Head with wide malar space; eyes small, removed their own length from dorso-caudal margin, fig. 365. Antennae long and slender, third, fourth, and fifth segments subequal, sixth to ninth gradually decreasing in length, fig. 353. Prepectus absent. Scutellum and dorsal portion of mesepisternum with large, round punctures. Tarsal claws with a short inner tooth.

*Genotype* by original designation.—*Selandria nevadensis* Cresson.  
Known only from the genotype.

*Lagonis nevadensis* (Cresson) new combination

*Selandria nevadensis* Cresson, 1880, p. 13, ♀.

*Paracharactus leucostomus* Rohwer, 1912b, p. 230, ♀. *New synonymy*.

The mesothorax of the female varies in color from almost totally rufous to totally black. The species is western in distribution.

*Phymatocera* Dahlbom

*Phymatocera* Dahlbom, 1835, p. 11. Monobasic, genotype.—*Tenthredo* (*Allantus*) *aterrima* Klug.

*Pectinia* Brullé, 1846, p. 664. Genotype by original designation.—*Tenthredo* (*Allantus*) *aterrima* Klug.

*Melanoselandria* Ashmead, 1899, p. 606. Monobasic, genotype.—*Melanoselandria* *zabriskiei* Ashmead. *New synonymy*.

*Hypargyricus* MacGillivray, 1908a, p. 290. Genotype by original designation.—*Hypargyricus infuscatus* MacGillivray. *New synonymy*.

*Characteristics*.—Front wings with stub of 2A & 3A furcate at apex, fig. 359. Malar space narrower than width of tibial spur. Antennae fairly filiform, usually with the fourth segment the longest, often with the apices of the segments considerably wider than the base. Prepectus present as a polished shoulder. Tarsal claws with a small inner tooth. Sheath blade-like, thin.

This genus contains five or six nearctic species which have never been revised. Most of them have the wings heavily and darkly infuscated.

*Rhadinoceraea* Konow

*Rhadinoceraea* Konow, 1886, p. 184. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo* (*Allantus*) *micans* Klug.

Differs from the above chiefly in lacking the prepectus. The tarsal claws may lack an inner tooth.

The few nearctic species resemble those of *Phymatocera* in appearance and also are in need of revision.

*Ceratulus* MacGillivray

*Ceratulus* MacGillivray, 1908c, p. 454. Genotype by original designation.—*Ceratulus* *spectabilis* MacGillivray.

*Characteristics*.—Front wing with stub of 2A & 3A straight, fig. 360. Antennae serrate, fig. 355, the lower, distal corner of the fourth to ninth segments markedly produced into a thumb-like process and the third segment triangular. Malar space about as long as width of tibial spur. Tarsal claws deeply cleft, the two rays subequal in size.

The genotype is the only species placed as yet in the genus, known only from Arizona.

## SUBFAMILY LYCAOTINAE

*Characteristics*.—Prepectus absent. Cervical sclerites pointed and not approximate on meson. Front wings, fig. 192, with 2*r* present, M parallel with 1*m-cu*, 2A & 3A fused for a short distance with 1A, and the basal abscissa of 2A & 3A with only a poorly indicated sinuation, fig. 201. Hind wings with typical venation. Mandibles bidentate, fig. 46.

This is a small group which is undoubtedly the present day representative of the ancestor of the Tenthredininae. It contains two genera, separated basically by the radical differences in the female sex. Malaise (1933) has reunited these on the basis that genera are invalid if based only on characters confined to one sex or characters of an adaptive nature. This point of view seems to me untenable when one considers first the arbitrary nature of genera and secondly the difficulty encountered finding other diagnostic characters in many groups.

The characters of the members of this subfamily have been illustrated in detail by Ross (1932a).

## KEY TO GENERA

1. Legs almost entirely black and wings entirely dark brown.....*Lycaota*  
 Legs light reddish brown and wings almost hyaline.....*Lycaotella*

*Lycaota* Konow

*Lycaota* Konow, 1903, p. 147. Monobasic, genotype.—*Selandria sodalis* Cresson.

*Characteristics*.—Hind tarsi shorter than middle tarsi but of same proportions, with a small tarsal claw with an exceedingly small tooth near middle, fig. 109. Tibial spurs of hind tarsi short, one-third length of tibia, fig. 109. Lancet of female saw with lobe-like teeth, fig. 363. Penis valve of male with circular head, fig. 371.

Contains only one species, the genotype.

*Lycaotella* Ross

*Lycaotella* Ross, 1932a, p. 41. Genotype by original designation.—*Selandria spissipes* Cresson.

*Characteristics*.—Similar in general to above. Differs as follows: female with front and middle tibiae and tarsi as for *Lycaota*, fig. 109, but with hind tibiae, fig. 111, thicker, evenly tapered and with tarsal segments short and stout, fig. 111, the tibial spurs three-fourths length of basitarsus and tarsal claw large with a long, pointed basal tooth giving the claw a chelate appearance. Female saw with serrate ventral margin, fig. 364. Male penis valve with rectangular head, fig. 372.

Contains only two species.

## SUBFAMILY TENTHREDININAE

*Characteristics.*—Prepectus absent. Front wings, fig. 194, with M parallel with *lm-cu*, M joining R considerably basad of separation of  $R_s$ , and the sinuation of 2A & 3A almost smoothed out. Hind wings normal, sometimes with a peripheral vein in the male. Cervical sclerites, mandibles, and other characters various.

This subfamily represents one of the peaks of specialization in the Tenthredinidae. Within the subfamily can be traced a straight line development from the more primitive genera to the specialized. Apparently three characters have evolved hand in hand, the eyes, mandible, and cervical sclerites. Representative of the generalized condition is *Leucopelmonus*—mandibles bidentate, fig. 45, cervical sclerites pointed on meson, as in fig. 155, and eyes small, as in fig. 373. The specialized condition is found in *Tenthredo*—mandibles quadridentate, fig. 42, cervical sclerites truncate and appressed on meson as in fig. 158, and eyes usually large, fig. 375. Intermediates are furnished by *Zaschisonyx* and *Rhogogaster*.

The more primitive group is represented by several genera containing few species. They undoubtedly are remnants of evolutionary development, scattered widely over the holarctic region.

The recorded habits of the adults indicate that they are predaceous, which has probably paralleled the development of the specialized head.

## KEY TO GENERA

1. Front wing with cell DA almost twice length of cell PA, fig. 380.....2  
Front wing with cell DA less than one and one-half length of cell PA, fig. 381.....3
2. Inner margins of eyes straight and almost parallel, fig. 373.....**Lagium**  
Inner margins of eyes distinctly converging below, fig. 375.....5
3. Sclerotized portion of basal plates forming a wide V on meson, nearly dividing the segment, fig. 379.....**Zaschisonyx**  
Sclerotized portion of basal plates either completely contiguous on meson or forming a V no wider than in fig. 378.....4
4. Tarsal claws with inner tooth much shorter than outer one and well separated from it, fig. 389.....**Leucopelmonus**  
Tarsal claws with inner tooth as long as the outer one and appressed to it, fig. 386.....5
5. Eyes seen from anterior aspect short and widely separated at base as in figs. 373, 374.....6  
Eyes seen from anterior aspect larger and closer together at base as in fig. 375.....7
6. Clypeus with anterior margin straight or slightly sinuate, fig. 374.....**Aglaostigma**  
Clypeus with anterior margin definitely emarginate, forming two lateral lobes, as in fig. 375.....**Rhogogaster**
7. Mandibles with two subapical teeth, the upper one sharp and the lower one truncate, fig. 382.....**Rhogogaster**

- Mandibles with more than two subapical teeth or not with the second one truncate, figs. 42, 43.....8
8. Middle coxae small, not overlapping the hind coxae, fig. 384.....**Macrophya**  
Middle coxae larger, overlapping base of hind coxae, fig. 383.....9
9. Hind femora distinctly swollen in outline, fig. 385.....**Macrophya**  
Hind femora slender, more nearly cylindrical, fig. 388.....**Tenthredo**

### *Leucopelmonus* MacGillivray

*Leucopelmonus* MacGillivray, 1916, p. 83. Monobasic, genotype.—*Leucopelmonus annulatus* MacGillivray = *confusus* (Norton).

*Characteristics*.—Mandibles with only two teeth. Tarsal claws with inner tooth smaller than outer and separate from it, fig. 389. Clypeus deeply emarginate. Antennae long, slender, and setaceous. Eyes small and parallel, set far apart. Hind coxae not tremendously developed.

This genus is very closely related to the European *Perineura*, but differs in wing venation, mandibles, and genitalia.

Only a single species, the genotype, is known. Its synonymy has been given by MacGillivray (1919).

### *Lagium* Konow

*Lagium* Konow, 1904, p. 246. Genotype by original designation.—*Tenthredo atroviolaceum* Norton.

*Characteristics*.—Mandibles with only two teeth. Tarsal claws with inner tooth same size as outer but not appressed to it. Clypeus shallowly but distinctly emarginate. Antennae long, slender, and setaceous. Eyes small and parallel, set far apart. Hind coxae large, appearing almost subequal in lateral area to mesoepisternum and sternum. The known species have the head, thorax, wings, and almost all the legs black.

There are five described species in the genus, but the status of some is open to question.

### *Aglaostigma* Kirby

*Aglaostigma* Kirby, 1882, p. 325. Monobasic, genotype.—*Aglaostigma eburnei-guttatum* Kirby.

*Laurentia* A. Costa, 1890, p. 173. Monobasic, genotype.—*Laurentia craverii* A. Costa = *Tenthredo gibbosa* Fallén. *New synonymy*.

*Bivena* MacGillivray, 1894, p. 328. Genotype by original designation.—*Bivena maria* MacGillivray = *Laurentia semilutea* (Norton). *New synonymy*.

*Homoeoneura* Ashmead, 1898, p. 313. Genotype by original designation.—*Pachyprotasis delta* Provancher = *Laurentia semilutea* (Norton). *New synonymy*.

*Neopus* Viereck in Smith, 1910, p. 585. Genotype by original designation.—*Tenthredo 14-punctata* Norton. *New synonymy*.

*Macrophyopsis* Enslin, 1913, p. 128. Genotype by original designation.—*Macrophya nebulosa* Ed. André. *New synonymy*.

*Astochus* MacGillivray, 1914a, p. 107. Genotype by original designation.—*Astochus fletcheri* MacGillivray = *Laurentia rubens* (Cresson).

*Kincaidia* MacGillivray, 1914b, p. 137. Genotype by original designation.—*Tenthredopsis ruficornis* MacGillivray.

*Parallomma* Malaise, 1933, p. 53. Genotype by original designation.—*Rhogogaster lichtwardti* Konow. *New synonymy*.

*Neurosiobla* Conde, 1935, p. 79. Genotype by original designation.—*Neurosiobla malaisei* Conde. *New synonymy*.

*Characteristics*.—Mandibles bidentate. Tarsal claws with inner tooth at least as stout and long as outer one, the two rays closely appressed, fig. 386. Antennae long and setaceous. Clypeus, fig. 374, with anterior margin straight or slightly sinuate. Eyes small, separated below by a distance greater than their height, their inner margins parallel or slightly converging below. Supraclypeal area raised and nodiform, pretentorinae large. Basal plates only partially fused on meson. Posterior coxae only moderately developed.

Seven species are represented in our fauna, involving considerable synonymy.

#### *Zaschizonyx* Ashmead

*Zaschizonyx* Ashmead, 1898, p. 257. Genotype by original designation.—*Hoplomampa montana* Cresson.

*Opisthoneura* Ashmead, 1898, p. 287. Genotype by original designation.—*Opisthoneura crevecoeursi* Ashmead = *Zaschizonyx montana* (Cresson).

*Characteristics*.—Mandibles with a third small tooth below apical pair, fig. 44. Tarsal claws as above. Labrum distinctly and angularly incised at apex. Clypeus deeply, circularly emarginate, the lateral angles sharp. Antennae short and filiform, the third segment considerably longer than the fourth. Head almost evenly convex, without deeply excavated furrows or high ridges. Eyes distant, distinctly converging below. Basal plates deeply excavated posteriorly on meson, fig. 379.

Contains only one species, the genotype.

#### *Rhogogaster* Konow

*Rhogogaster* Konow, 1884, p. 338. Genotype by subsequent designation of Rohwer, 1911b.—*Tenthredo viridis* Linnaeus.

*Rhogogastera* Konow, 1885b, p. 123. Emended name for *Rhogogaster*.

*Characteristics*.—Mandibles tridentate, the basal tooth on the right mandible small, on the left mandible large, fig. 382. Tarsal claws with appressed teeth. Antennae fairly long and setaceous. Labrum rounded, truncate, or slightly emarginate. Clypeus deeply emarginate. Supraclypeal area sloping up to form an angular crest between antennal sockets. Head shallow, eyes fairly distant and converging below, varying between the conditions shown in figs. 374, 375. Hind coxae not greatly developed. Basal plates various.

Contains four nearctic species, involving some synonymy.

#### *Tenthredo* Linnaeus

*Tenthredo* Linnaeus, 1758, p. 343. Genotype by subsequent designation of Latreille, 1810.—*Tenthredo scrophulariae* Linnaeus.

*Labidia* Provancher, 1886, p. 21. Monobasic, genotype.—*Labidia columbiana* Provancher = *opimus* Cresson.

*Tenthredella* Rohwer, 1910d, p. 117. Genotype by original designation.—*Tenthredo atra* Linnaeus.

*Zamacrophya* Rohwer, 1912b, p. 221. Genotype by original designation.—*Zamacrophya nigrilabris* Rohwer. *New synonymy*.

*Characteristics*.—Mandibles quadridentate, fig. 42, the apical tooth large, and simple, the next three more or less grouped together, the base sometimes projecting beneath this to form a tooth-like process. Eyes large and close together, fig. 375. Labrum usually slightly pointed, clypeus emarginate, antennae various. Head with deep furrows between eyes and antennae, and a crest between the antennal sockets. Tarsal claws with appressed teeth. Hind coxae only moderately developed.

This genus is one of the largest in the sawflies. Judging from present indications the genus has developed along many specialized lines in several parts of the world to form a large number of distinct phylogenetic units. Many of these units, however, are indicated only by male genitalia, and most can be separated only imperfectly by external characteristics. Many generic names have been applied to them but it seems best to reduce these to subgenera and thus remove unnecessary obstacles from the generic keys.

I believe that a satisfactory division of the genus into subgenera can be accomplished only after the world fauna is studied. Most of the nearctic species may be referred to one group with only few exceptions, so no effort is made here to subdivide the genus.

#### *Macrophya* Dahlbom

*Macrophya* Dahlbom, 1835, p. 11. Genotype by subsequent designation of Westwood, 1840.—*Tenthredo rusticus* auct., *nec.* Linnaeus = *Macrophya montana* Scopoli.

*Pachyprotasis* Hartig, 1837, p. 295. Genotype by subsequent designation of Westwood, 1840.—*Tenthredo rapae* Linnaeus.

*Zalagium* Rohwer, 1912b, p. 216. Genotype by original designation.—*Zalagium clypeatum* Rohwer. *New synonymy*.

*Characteristics*.—Mandibles quadridentate, forming more of a regularly decreasing series than in *Tenthredo*, fig. 43, the apical tooth largest. Eyes large and close together, fig. 375. Head without marked crest between or just above antennal sockets. Labrum usually truncate, clypeus variable. Tarsal claws with appressed teeth. Hind coxae large, appearing from lateral view nearly as large as mesosternum and episternum, and hind femora usually distinctly enlarged towards apex, fig. 385.

This genus contains a large nearctic fauna which is at present badly in need of revision.

## SUPERFAMILY MEGALODONTOIDEA

## FAMILY XYELIDAE

*Diagnostic characters.*—Antennae with the third segment elongate with a slender terminal filament composed of 9-25 segments, figs. 86, 87. Praescutum and scutellum distinct, scutum not divided transversely. Middle and hind tibiae with preapical spurs; front tibiae with two apical spurs, the longer one cleft at the apex, as in fig. 114. Front wings with vein  $R_s$  divided, except in some species of *Xyela*.

Five genera are recognized in the nearctic fauna. They are markedly distinct from each other in many characters, including entirely different maxillae, clypei, wings, etc. This is another indication of the archaic nature of the family, for in no other group in the sawflies have the genera become so distinct morphologically.

The nearctic species have been discussed and keyed out by Ross (1932b) with the exception of the genus *Xyela* which was revised by Rohwer (1913).

## KEY TO GENERA

1. Subcosta 2 either indistinguishable, fig. 392, or joining R before separation of  $R_s$ , fig. 387.....2  
    Subcosta 2 joining  $R_1$  beyond separation of  $R_s$ , fig. 393.....4
2. Media fused with  $R_s$  very close to R, fig. 387.....**Xyelecia**  
    Media either not fused with  $R_s$ , fig. 172, or fused with it a considerable distance from R, fig. 390.....3
3. Antennae with apical thread as long as, or longer than, third segment, as in fig. 87.....**Xyela**  
    Antennae with apical thread shorter than third segment, fig. 86...**Pleroneura**
4. Clypeus produced into an irregular pointed apex, fig. 398.....**Megaxyela**  
    Clypeus produced into a regular, bilobate apex, fig. 395.....**Macroxyela**

*Xyela* Dalman

*Pinicola* Brebisson, 1818, p. 116, preoccupied. Genotype by subsequent designation of Rohwer, 1911b.—*Pinicola julii* Brebisson.

*Xyela* Dalman, 1819, p. 122. Genotype by subsequent designation of Curtis, 1824.—*Xyela pusilla* Dalman.

*Tritokreion* Schilling, 1825, p. 43. No included species.

*Mastigocerus* Klug, M. S., in Lepeletier, 1823. Reference unknown, a synonym of *Xyela* by Lepeletier (Rohwer, 1911).

*Neoxyela* Curran, 1923, p. 20. Monobasic, genotype.—*Neoxyela alberta* Curran.  
*New synonymy.*

*Characteristics.*—Antennal thread with nine segments, as long as, or longer than, third segment. Maxilla, fig. 61, with lacinia lobe-like; galea with an apical portion demarked by a crease, thus forming a distal "segment"; palpus with third segment very long, terminal thread mostly membranous and indistinctly divided into several segments. Front wings,



fig. 392, with subcosta either appressed to radial stem or distinct from it, with  $Sc_2$  joining R before separation of  $R_s$ ; so-called  $R_2$  present or absent, cross-veins variable in number and position. Hind wings with cross-vein  $2r-m$  absent. Female sheath either straight or curving downward, fig. 402.

The species of the genus are in need of a thorough revision based on enough specimens to give an accurate determination of variation in the characters now used in their classification.

The genus *Neoxyela* was erected by Curran for a species in which vein " $R_2$ " was atrophied, fig. 390. A series of specimens has shown that this is a variable character of no particular significance.

#### *Pleroneura* Konow

*Pleroneura* Konow, 1897a, p. 56. Genotype by subsequent designation of Rohwer, 1911b.—*Xyela dahli* Hartig.

*Pleuroneura* Ashmead, 1898, p. 214. Misspelling of *Pleroneura*.

*Manoxyela* Ashmead, 1898, p. 214. Genotype by original designation.—*Manoxyela californica* Ashmead.

*Characteristics*.—Antennae with terminal filament much shorter than third segment. Mouthparts and venation similar to *Xyela*. The front wing, fig. 172, is unique among sawflies in having  $R_s$  and M entirely separate, with three cross-veins between them. Female sheath sabre-like, curving dorsad, fig. 403.

Seven nearctic species have been described in the genus but the status of most of them is not on a fundamental basis.

#### *Xylecia* Ross

*Xylecia* Ross, 1932b, p. 159. Monobasic, genotype.—*Xylecia nearctica* Ross.

*Characteristics*.—Antennae very long, fig. 87, antennal thread longer than third segment, composed of 24 or more segments. Maxillae as in fig. 62; lacinia knob-like; distagalia lobate and set with short, peg-like setae; palpus with third segment very long, terminal thread fused into a simple, elongate, submembranous segment, clothed with long setae. Front wings, fig. 387, with subcosta distinct and short,  $Sc_2$  joining R before separation of  $R_s$ , M joining  $R_s$  close to radial stem. Hind wings with  $2r-m$  atrophied. Female sheath very short and broad, fig. 391.

Contains only one species, the genotype.

#### *Megaxyela* Ashmead

*Megaxyela* Ashmead, 1898, p. 214. Genotype by original designation.—*Xyela major* Cresson.

*Odontophyes* Konow, 1899a, p. 42. Monobasic, genotype.—*Pleroneura avinigrata* Dyar.

*Paraxyela* MacGillivray, 1912, p. 294. Genotype by original designation.—*Xyela tricolor* Cresson.

*Characteristics.*—Clypeus with a large, median, triangular tooth, fig. 398. Antennae with third segment three times as long as terminal filament, which has eight or nine segments. Maxillae as in fig. 65; lacinia spatulate; mesal lobe of galea short and broad; palpi with four segments, the last two subequal, the fourth sclerotized, with only weak setae, the apex membranous. Labial palpus with four segments. Front wings with subcosta distinct and long,  $Sc_2$  joining R, beyond fork of  $R_s$ . Hind wings with  $2r-m$  present, fig. 176. Tarsal claws deeply cleft, the two rays subparallel.

Contains about five species.

#### *Macroxyela* Kirby

*Macroxyela* Kirby, 1882, p. 351. Genotype by original designation.—*Xyela ferruginea* Say.

*Protoxyela* MacGillivray, 1912, p. 294. Genotype by original designation.—*Xyela aenea* Norton.

Differs from the above as follows: clypeus, fig. 395, with two anterior lobes separated by a distinct emargination; labial palpi three segmented.

At present three species are placed in this genus, but the known differences between them are unsatisfactory and the species limits need further study.

#### FAMILY PAMPILIIDAE

*Characteristics.*—Antennae long, slender and multi-segmented, fig. 88. Head capsule, figs. 4, 5, with clypeus turned under and fused on venter with postgenae, labrum asymmetrical and carried on venter. Abdomen flattened, with sharp lateral margins. Remainder of body similar to Xyelidae. Wings with  $R_2$  always absent.

This family is a close relative of the European family Megalodontidae, but differs in possessing a presternal bridge, vein  $Sc$  in the front wing and in lacking processes on the antennae of the male.

The nearctic species form a very uniform group. Very few characters have been discovered upon which to divide the group into definite segregates. The key characters listed below represent almost all those which seem to be definite and constant. These include the relative size of the tarsal claws, presence or absence of certain preapical spines on the tibiae, presence or absence of vein  $Sc_1$  in the front wing and the shape of the seventh abdominal sternite in the female. Other characters, such as the post-genal ridge, relative length of the third antennal segment, and the junction of M with R or  $R_s$  in the front wing, have been used to split off genera, but too many intermediate conditions arise for them to be employed for generic diagnosis. This arrangement of the genera is the same as that proposed by Rohwer in 1910b.

## KEY TO GENERA

1. Anterior tibiae with a preapical spur, fig. 399.....**Acantholyda**  
Anterior tibiae without a preapical spur.....2
2. Front wing with Sc<sub>1</sub> entirely or partially atrophied, figs. 396, 400.**Neurotoma**  
Front wing with Sc<sub>1</sub> present, fig. 401.....3
3. Tarsal claws with a small tooth some distance below apex, fig. 404. **Cephalcia**  
Tarsal claws with a large tooth near apex, which consequently appears bifid, fig. 405.....**Pamphilius**

*Acantholyda* A. Costa

*Acantholyda* A. Costa, 1894, p. 232. Genotype by subsequent designation of Rohwer, 1910b.—*Tenthredo erythrocephala* Linnaeus.

*Itycorsia* Konow, 1897d, p. 13. Genotype by subsequent designation of Rohwer, 1910b.—*Tenthredo hieroglyphica* Christ.

*Characteristics*.—Anterior tibiae with a preapical spur, fig. 399. Front wing with Sc<sub>2</sub> present. Tarsal claws with a small subapical tooth as in fig. 404. Female with seventh abdominal sternite divided on meson by a sub-triangular depression, fig. 409.

Contains a large number of nearctic species which have not been treated comprehensively. The group *Itycorsia* has been segregated on the basis of having a postgenal carina, but the character is not constant enough for accurate use.

*Cephalcia* Panzer

*Cephalcia* Panzer, 1805, Heft 86, pl. 9. Genotype by subsequent designation of Rohwer, 1911c.—*Cephalcia arvensis* Panzer = *Cephalcia signata* (Fabricius).

*Cephaleia* Jurine, 1807, p. 68. Genotype by subsequent designation of Rohwer, 1911c.—*Cephaleia arvensis* Panzer = *Cephalcia signata* (Fabricius).

*Caenolyda* Konow, 1897d, p. 15. Genotype by subsequent designation of Rohwer, 1910b.—*Tenthredo reticulata* Linnaeus.

*Liolyda* Ashmead, 1898, p. 209. Genotype by original designation.—*Lyda frontalis* Westwood.

Differs from *Acantholyda* in lacking the preapical spur on the front tibiae. Several nearctic species belong in the genus.

*Neurotoma* Konow

*Neurotoma* Konow, 1897d, p. 18. Genotype by subsequent designation of Rohwer, 1910b.—*Tenthredo flaviventris* Linnaeus.

*Gongylocorsia* Konow, 1897d, p. 19. Monobasic, genotype.—*Lyda mandibularis* Zaddach.

*Characteristics*.—Anterior tibiae without preapical spur. Front wings with Sc<sub>1</sub> partially or entirely atrophied, figs. 396, 400. Tarsal claws with a large inner tooth near apex. Female with seventh abdominal sternite incised on meson as in fig. 409.

Contains only two described nearctic species.

*Pamphilius* Latreille

*Pamphilius* Latreille, 1802, p. 303. Monobasic, genotype.—*Tenthredo sylvatica* Linnaeus.

*Lyda* Fabricius, 1804, p. 43. Genotype by subsequent designation of Curtis, 1831.—*Tenthredo sylvatica* Linnaeus.

*Anoptolyda* A. Costa, 1894, p. 233. Genotype by subsequent designation of Rohwer, 1910b.—*Lyda alternans* A. Costa.

*Kelidoptera* Konow, 1897d, p. 20. Monobasic, genotype.—*Lyda maculipennis* Stein.

*Bactroceros* Konow, 1897d, p. 21. Genotype by subsequent designation of Rohwer, 1910b.—*Tenthredo vafer* Linnaeus.

*Characteristics*.—Anterior tibiae without preapical spur. Front wings with  $Sc_1$  present. Tarsal claws with a large, inner tooth near apex, which appears cleft, fig. 405. Female with seventh abdominal sternite not incised but convex and slightly produced on meson, fig. 408.

A large number of species are contained in this genus. They have at various times been divided into smaller genera on the basis of M in the front wing joining R or  $R_s$  and whether or not the third antennal segment was subequal to or almost twice as long as the fourth. A study of many species shows that both of these characters intergrade from one extreme to the other, hence they cannot be used for definite dividing points.

## SUPERFAMILY SIRICOIDEA

## FAMILY SYNTECTIDAE

*Diagnostic characters*.—Antennae slender and setaceous, with about 16 segments, fig. 89. Tibiae without preapical spurs, front tibiae with only one apical spur which is pectinate on its inner margin, fig. 118. Mesonotum without a transverse suture, fig. 122.

This family contains only one described genus, *Syntexis* Rohwer, (1915c), with its sole species and genotype *S. libocedrii* Rohwer. It was placed by its describer in the family Cephidae, but differs from this family in having a genaponta instead of a maxaponta, in having cenchri and in lacking the distinct constriction between the first and second abdominal segments. *Syntexis* is most closely related to the Xiphydriidae, the two having similar antennae, wing venation, and type of head. *Syntexis* differs from the Xiphydriidae, however, in lacking the transverse suture of the mesoscutum, and in having a wide trench between the meso- and metanotum, fig. 122. On the basis of these characters Benson (1935b) erected a new family Syntexidae. According to the derivation of the name, however, the stem is *Syntect-*, and therefore the name should be Syntectidae.

The most distinctive characters of the genus are the incisions of the anterior margin of the mesoepisterna, fig. 130, and the curious formation

of the alaglossa of the labium, figs. 78, 79. These two conditions are found nowhere else in the sawflies and form the chief basis for considering the genus a separate family.

#### FAMILY XIPHYDRIIDAE

*Diagnostic characters.*—Antennae slender and setaceous, having about 20 segments, fig. 90. Tibiae without preapical spurs, front tibiae with only one apical spur, which is cleft at the apex, fig. 117. Mesoscutum with a transverse suture, fig. 123; mesosnotum and metanotum approximate, with none of the mesopostnotum visible. Head above the eyes rounded and dome-shaped, fig. 22.

The nearctic species represent only the typical genus.

#### *Xiphydria* Latreille

*Xiphydria* Latreille, 1802, p. 304. Monobasic, genotype.—*Ichneumon camelus* Linnaeus.

*Hybonotus* Klug, 1803, p. 8. Genotype by subsequent designation of Rohwer, 1911b. —*Ichneumon camelus* Linnaeus.

*Xiphiura* Fallén, 1813, p. 11. No species included.

*Xiphidion* Provancher, 1875, p. 374. Monobasic, genotype.—*Xiphidion canadense* Provancher = *Xiphydria mellipes* Harris.

*Konowia* Brauns, 1884, p. 220. Monobasic, genotype.—*Konowia megapolitana* Brauns. *New synonymy.*

*Pseudoxiphydria* Enslin, 1911, p. 177. Genotype by original designation.—*Pseudoxiphydria betulae* Enslin. *New synonymy.*

This genus contains several nearctic species which have been treated by Rohwer (1918a). Except for the wings, all the species have such a similar morphological pattern that it accomplishes nothing to divide them into more than one group. The venation of the front wing is somewhat variable, especially the proximity at their base of veins 1A and 2A & 3A and the completeness of cross-vein 3r-m, which may be complete, reduced to a stub, or absent. These are the characters upon which were based the genera *Konowia* and *Pseudoxiphydria*.

#### FAMILY SIRICIDAE

*Diagnostic characters.*—Antennae filiform, with about 15 segments, fig. 91, frequently bilaterally compressed. Tibiae without preapical spurs, front tibiae with only one apical spur which is cleft at the apex, fig. 116. Mesonotum with the praescutum indistinct, its sutures represented only by faint traces; the scutum with two diagonal furrows running from the lateral margin to the anterior margin of the scutellum, fig. 127.

Bradley (1913) has revised and keyed out the North American species and genera of this family.

## KEY TO GENERA

1. Posterior tibiae with one apical spur.....2  
    Posterior tibiae with two apical spurs.....3
2. Antennae filiform, with less than 18 segments.....4  
    Antennae slender and tapering, with more than 20 segments.....**Xeris**
3. Head with a large white spot behind eye.....**Urocerus**  
    Head without a white spot behind eye.....**Sirex**
4. Antennae with five segments.....**Terodon**  
    Antennae with sixteen or more segments.....**Tremex**

## SUBFAMILY SIRICINAE

Characterized chiefly by the labial palpi having three segments, fig. 84; presence of cerci; antennae with nineteen or more segments; and small cell 2R<sub>1</sub>.

*Sirex* Linnaeus

*Sirex* Linnaeus, 1761, p. 396. Genotype by subsequent designation of Curtis, 1829.—*Sirex juvencus* Linnaeus.

*Paururus* Konow, 1896a, p. 41. Genotype by subsequent designation of Rohwer, 1911b.—*Sirex juvencus* Linnaeus.

*Characteristics*.—Head immaculate. Cornus of female more or less triangular, not constricted at base and widened at apex. Posterior tibiae with two apical spurs.

Contains seven or eight species.

*Urocerus* Geoffroy

*Urocerus* Geoffroy, 1762, p. 264. Monobasic, genotype.—*Ichneumon gigas* Linnaeus.

Differs from *Sirex* in having white marks behind the eyes, and in having a clavate cornus, which is constricted at the base.

There are four recognized species.

*Xeris* A. Costa

*Xeris* A. Costa, 1894, p. 295. Monobasic, genotype.—*Ichneumon spectrum* Linnaeus.

Differs from *Urocerus* in having the hind tibiae with only one apical spur and the ovipositor as long as the body.

Contains three species.

## SUBFAMILY TREMICINAE

Characterized as follows: labial palpi with two segments; cerci absent; antennae with 17 segments or less; front wings with a long cell 2R<sub>1</sub>.

The genus *Terodon* is known only from Cuba and is included in the key for convenience. Our only nearctic genus is *Tremex*.

*Tremex* Jurine

*Tremex* Jurine, 1807, p. 80. Genotype by subsequent designation of Latreille, 1810.—*Sirex fuscicornis* Fabr.

*Xyloterus* Hartig, 1837, p. 385, preoccupied. Monobasic, genotype.—*Sirex fuscicornis* Fabricius.

*Xylocermatium* L. Heyden, 1868, p. 227. New name for *Xyloterus*.

Characteristics as for subfamily. Contains only one nearctic species, *columba* (Linnaeus).

#### FAMILY ORUSSIDAE

*Diagnostic characters*.—Antennae with 10 segments, setaceous in the male, fusiform in the female, fig. 92, situated on the ventral aspect of the head, fig. 24. Tibiae without preapical spurs, front tibiae with two apical spurs, one very short, the other longer and cleft at the apex, fig. 115. Mesonotum with the praescutum more or less indistinct, the lateral sutures reaching the transverse suture of the scutum. Both wings with most of the venation represented only by pigmented bands, fig. 177.

#### KEY TO GENERA

1. Face with two sharp, high carinae, fig. 410.....**Ophrynopus**  
Face without high carinae.....2
2. Front wing with *2r* joining stigma near apex, which is somewhat thickened, fig. 406.....**Ophrynella**  
Front wing with *2r* joining stigma at middle, the apex of stigma gradually tapering to apex, fig. 407.....**Orussus**

#### *Orussus* Latreille

*Orussus* Latreille, 1796, p. 111. Genotype by subsequent designation of Latreille, 1810.—*Orussus coronatus* Fabricius = *O. abietinus* Scopoli.

*Oryssus* Fabricius, 1798, p. 218. Emended name for *Orussus* Latreille.

*Characteristics*.—Head with a crown of three pairs of distinct tubercles on dorsum, without carinae on face. Front wings with M joining  $R_s$  some distance from R; stigma tapering at apex, *2r* joining it near middle, fig. 407. Hind femora more slender than in fig. 411.

Contains several nearctic species which have been treated by Rohwer (1912a).

#### *Ophrynella* new genus

*Characteristics*.—Head with a dorsal crown of five distinct pairs of tubercles forming a wide ring around anterior ocellus, as in fig. 23; front reticulate with close, sharp-walled pits but without carinae; postgenae with a distinct high crassa from mandible to dorsum of head. Maxillary palpi with five segments, the two basal ones short, the three apical ones long and slender. Front wings with stigma long, *2r* joining it near apex, the apex slightly enlarged, fig. 406; base of  $R_s$  subequal to base of M. Hind femora swollen, fig. 411, the adjoining tibiae and tarsi short and stocky.

Genotype.—*Oryssus nigricans* Cameron (original designation and monobasic).

Benson (1936a) treats this species as a member of the genus *Ophrynopus*, but all described species of that genus have two high prominent

carinae with an anterior joining one on the front. The species *nigricans* is undoubtedly closely allied to *Ophrynopus* on the basis of wing venation but seems to form a distinct unit from it.

The genotype is the only species yet placed in the genus. It has recently been captured in Texas.

*Ophrynopus* Konow

*Ophrynopus* Konow, 1897c, p. 605. Genotype by subsequent designation of Rohwer, 1911b.—*Ophrynopus andrei* Konow.

*Stirocorsia* Konow, 1897b, p. 372. Monobasic, genotype.—*Stirocorsia kohli* Konow.

Differs from the above in having a series of high carinae on the front as in fig. 410.

To date only a single unidentified male of this genus has been recorded from the nearctic region, to wit, *Arizona*.

## SUPERFAMILY CEPHOIDEA

### FAMILY CEPHIDAE

(By Donald T. Ries, Ithaca, N. Y.)

*Diagnostic characters*.—Antennae with 20-30 segments, filiform, slightly fusiform, or clavate. Middle and hind tibiae frequently with preapical spurs; front tibiae with only one apical spur which is cleft at the apex, the inner tooth small and the outer tooth large, fig. 119. Cenchri absent, fig. 121. A distinct constriction between the first and second abdominal segments, fig. 143.

Detailed genitalic studies of the nearctic species together with a large number of the genotypes of many of the palearctic genera has shown that a large number of the genera must be grouped together in order to get a clear picture of the phylogeny of the Cephidae. This will result in some changes in the classification of the family as treated by Benson, 1935b. I have been unable to study sufficient species to make a complete classification of the world genera at the present moment but enough to make it possible to ascertain the limits of genera actually involved by nearctic species. For this reason only the generic names which involve nearctic species have been treated in this diagnosis.

In a revision of the nearctic Cephidae now nearing completion these phylogenetic groups will be taken up in greater detail.

#### KEY TO GENERA

1. Hind tibiae with preapical spurs, fig. 110.....2  
     Hind tibiae without preapical spurs.....**Caenocephus**
2. Tarsal claws with base wide and lobular below junction of teeth,  
     fig. 417.....**Janus**
- Tarsal claws with base tapering and slender, fig. 420.....3



3. Flagellum constricted at base for less than one-fourth its length and with marked shortening of the segments occurring beyond the third, fig. 419.....**Hartigia**  
 Flagellum constricted for half its length and with marked shortening of the segments not occurring until the fifth or sixth, figs. 416, 418.....**Cephus**

### *Caenocephus* Konow

*Caenocephus* Konow, 1896b, p. 151. Monobasic, genotype.—*Caenocephus jakowleffi* Konow.

*Characteristics*.—Hind tibiae without preapical spurs. Antennae with third segment longer than fourth. Left mandible with two triangular subequal teeth of similar shape. Hind wings with *3r-m* absent. Tarsal claws with two stout, subequal apical teeth. Male sternites simple.

Contains only two described nearctic species from the Rocky Mountain region. These represent the two sexes of only one species.

### *Cephus* Latreille

This genus embraces a large number of species which differ radically in the genitalia and ornamentation of the seventh to ninth abdominal sternites in the male. All other characters, however, group these species into a single phylogenetic unit, characterized by the shape of the tarsal claws and the antennae.

On the basis of the males it is possible to group the nearctic species into two subgenera as follows:

Eighth sternite at most with row of scale-like setae along apex, fig. 423 **Cephus**  
 Seventh and eighth sternites with distinct cavities filled with long, needle-like setae, fig. 424.....**Trachelus**

### Subgenus *Cephus* Latreille

*Astutus* Jurine, 1801, p. 163. Monobasic, genotype.—*Sirex pygmaeus* Linnaeus.  
 Name set aside by International Zoological Congress, 1935.

*Cephus* Latreille, 1802, p. 303. Genotype by subsequent designation of Latreille, 1810.—*Sirex pygmaeus* Linnaeus.

*Calameuta* Konow, 1896b, p. 159. Genotype by subsequent designation of Rohwer, 1911b.—*Cephus filiformis* Eversmann. *New synonymy*.

*Characteristics*.—Hind tibiae with one or two preapical spurs. Hind wings with *3r-m* present. Tarsal claws various, figs. 421, 422. Antennae slightly clavate beyond tenth segment.

Contains three species in the nearctic region, including the western grain-stem sawfly, *C. cinctus* Norton, and the European wheat-stem sawfly, *C. pygmaeus* (Linnaeus).

### Subgenus *Trachelus* Fabricius

*Astutus* Panzer, 1801, p. 83, preoccupied. Genotype by subsequent designation of Rohwer, 1911b.—*Sirex troglyodyta* Fabricius.

*Trachelus* Jurine, 1807, p. 70. Monobasic, genotype.—*Sirex tabidus* Fabricius.  
*Cepha* Billberg, 1820, p. 98. Monobasic, genotype.—*Sirex tabida* Fabricius.  
*Eumetabolus* Schulz, 1906, p. 211. New name for *Astaxes* Panzer.  
*Trachelastatus* Morice and Durrant, 1915, p. 383. New name for *Cepha* Billberg.

Our fauna contains only the introduced black wheat-stem sawfly, *C. tabidus* (Fabricius).

#### *Janus* Stephens

*Janus* Stephens, 1835, p. 107. Genotype by subsequent designation of Westwood, 1840.—*Janus connectens* Stephens = *Janus luteipes* (Lepeletier).  
*Phylloecus* Newman, 1838, p. 485. Monobasic, genotype.—*Phylloecus faunus* Newman.  
*Ephippionotus* O. Costa, 1860, p. 10. Monobasic, genotype.—*Ephippionotus luteiventris* O. Costa = *Janus compressus* (Fabricius).

*Characteristics*.—Antennae with flagellum narrow at base (first three segments), remainder uniformly wider with the exception of a slight tapering towards apex, fig. 419. Left mandible bidentate, the upper tooth shouldered at base, fig. 415. Tarsal claws with extremely wide base which appears as a broad basal tooth; the two apical teeth long, stout, and curved at a distinct angle to the base, fig. 417. Male abdomen without ornamentation on the sternites. Some species (*Janus abbreviatus* and male of *J. bimaculatus*) exhibit an interesting condition of a partial atrophy of cross-vein 1r.

Contains four nearctic species, two of which have been reared from willow, poplar, and currant.

#### *Hartigia* Schiödte

*Hartigia* Schiödte, 1838, p. 332. Genotype by subsequent designation of Boie, 1855.—*Astaxes satyrus* Panzer = *Hartigia nigra* (Harris).  
*Cerobactrus* O. Costa, 1859, p. 9. Monobasic, genotype.—*Macrocephus ulmariae* Schlectendal = *Hartigia linearis* (Schrank).  
*Cephosoma* Gradl, 1881, p. 294. Monobasic, genotype.—*Cephosoma syringae* Gradl = *Hartigia nigra* (Harris).  
*Copiosoma* Kirby, 1882, p. 364. Misspelling for *Cephosoma* Gradl.  
*Adirus* Konow, 1899b, p. 74. Monobasic, genotype.—*Cephus trimaculatus* Say.  
*Paradirus* Dovnar-Zapolskij, 1931, p. 39. Monobasic, genotype.—*Paradirus algiricus* Dovnar-Zapolskij.

*Characteristics*.—Antennae with flagellum narrow at base (first three segments), remainder fairly stout, slightly and evenly fusiform, fig. 419. Left mandible bidentate, the upper tooth with a wide base and a small nipple-like apex, fig. 414. Tarsal claws slender, with large inner tooth, both teeth curving considerably from axis of claw, fig. 420. Male abdominal sternites simple.

Contains three described species from the nearctic region of which *H. cressonii* (Kirby) mines in the stems of raspberries, blackberries, and roses, and *H. trimaculatus* (Say) bores in blackberries and roses.

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PLATES

Unless otherwise noted, all figures represent parts of adult insects.

## PLATE I

- FIG. 1.—Head of *Tenthredo basilaris* Say, anterior aspect.  
 FIG. 2.—Head of *Tenthredo basilaris*, posterior aspect.  
 FIG. 3.—Tentorium of *Macroxyela ferruginea* (Say), lateral aspect.  
 FIG. 4.—Head of *Acantholyda luteomaculata* (Cress.), anterior aspect.  
 FIG. 5.—Head of *Acantholyda luteomaculata*, posterior aspect.  
 FIG. 6.—Tentorium of *Tenthredo basilaris*, lateral aspect.  
 FIG. 7.—Head of *Cephus cinctus* Nort., anterior aspect.  
 FIG. 8.—Head of *Cephus cinctus*, posterior aspect.  
 FIG. 9.—Tentorium of *Cimbex americana* Leach, lateral aspect.  
 FIG. 10.—Head of *Aleiodes terminalis* (Cress.), anterior aspect.  
 FIG. 11.—Head of *Aleiodes terminalis*, posterior aspect.  
 FIG. 12.—Tentorium of *Janus integer* (Nort.), lateral aspect.  
 FIG. 13.—Labrum of *Lycaotella spissipes* (Cress.).  
 FIG. 14.—Labrum of *Acantholyda luteomaculata*.  
 FIG. 15.—Labrum of *Orussus terminalis* Newm.  
 FIG. 16.—Labrum of *Tremex columba* (L.).  
 FIG. 17.—Tentorium of *Aleiodes terminalis*, lateral aspect.

*Abbreviations*

<i>cl</i> clypeus	<i>l</i> labrum	<i>pg</i> postgena
<i>cp</i> corpotentorium	<i>m</i> mandible	<i>pr</i> pretentorium
<i>cpt</i> corpotendon	<i>mp</i> maxaponta	<i>pta</i> pretentorina
<i>cr</i> crassa	<i>mt</i> metatentorium	<i>ptc</i> postcoila
<i>e</i> compound eye	<i>mtr</i> metatentorina	<i>st</i> supratentorium
<i>ep</i> epicranial stem	<i>mx</i> maxillaria	<i>sta</i> supratentorina
<i>f</i> frontal region	<i>o</i> ocelli	<i>tt</i> course of tentorial
<i>fcl</i> fronto-clypeal suture	<i>oc</i> occipital region	thickenings
<i>g</i> gena	<i>ocul</i> ocularium	
	<i>od</i> odontoidea	

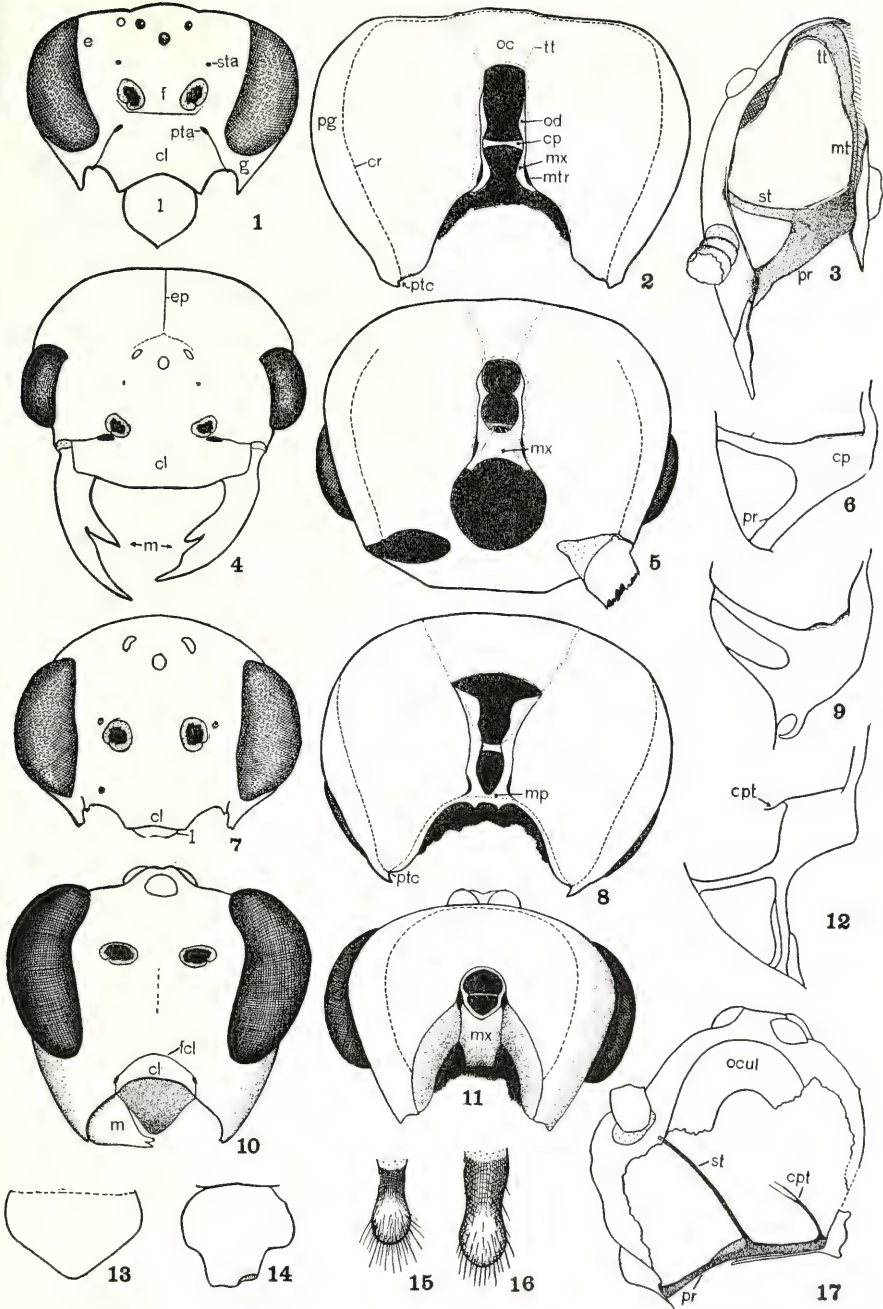


PLATE I

## PLATE II

- FIG. 18.—Head of *Tremex columba*, anterior aspect.  
 FIG. 19.—Head of *Tremex columba*, posterior aspect.  
 FIG. 20.—Head of *Syntexis libocedrii* Rohwer, left half anterior aspect, right half posterior aspect.  
 FIG. 21.—Head of *Syntexis libocedrii*, lateral aspect.  
 FIG. 22.—Head of *Xiphydria maculata* Say, lateral aspect.  
 FIG. 23.—Head of *Orussus terminalis*, left half anterior aspect, right half posterior aspect.  
 FIG. 24.—Head of *Orussus terminalis*, ventral aspect.  
 FIG. 25.—Head of *Xiphydria maculata*, lateral portion cut away to show tentorium.  
 FIG. 26.—Tentorium of *Orussus terminalis*, lateral aspect.  
 FIG. 27.—Tentorium of *Orussus terminalis*, dorsal aspect.  
 FIG. 28.—Tentorium of *Aleiodes terminalis*, dorsal aspect.  
 FIG. 29.—Tentorium of *Macroxyela ferruginea*, dorsal aspect.  
 FIG. 30.—Tentorium of *Tremex columba*, lateral aspect.  
 FIG. 31.—Tentorium of *Tremex columba*, dorsal aspect.  
 FIG. 32.—Left mandible of *Xiphydria maculata*.  
 FIG. 33.—Left mandible of *Syntexis libocedrii*.  
 FIG. 34.—Mandibles of larva of *Sterictiphora apios* Ross, ventral aspect.  
 FIG. 35.—Mandibles of *Macroxyela ferruginea*, dorsal aspect.  
 FIG. 36.—Mandibles of *Janus integer*, dorsal aspect.  
 FIG. 37.—Right mandible of *Orussus terminalis*, lateral and dorsal aspects, respectively.  
 FIG. 38.—Mandibles of *Sterictiphora apios*, dorsal aspect.

## Abbreviations

<i>cl</i> clypeus	<i>gr</i> antennal groove	<i>pr</i> pretentorium
<i>cp</i> corpotentorium	<i>l</i> labrum	<i>pta</i> pretentorina
<i>cpt</i> corpotendon	<i>m</i> mandibles	<i>px</i> proxadentes
<i>da</i> distadentes	<i>mo</i> mola	<i>st</i> supratentorium
<i>f</i> frontal region	<i>mx</i> maxillaria	<i>sta</i> supratentorina
<i>g</i> gena	<i>od</i> odontoidea	<i>tt</i> course of tentorial
<i>gp</i> genaponta	<i>pg</i> postgenae	thickenings



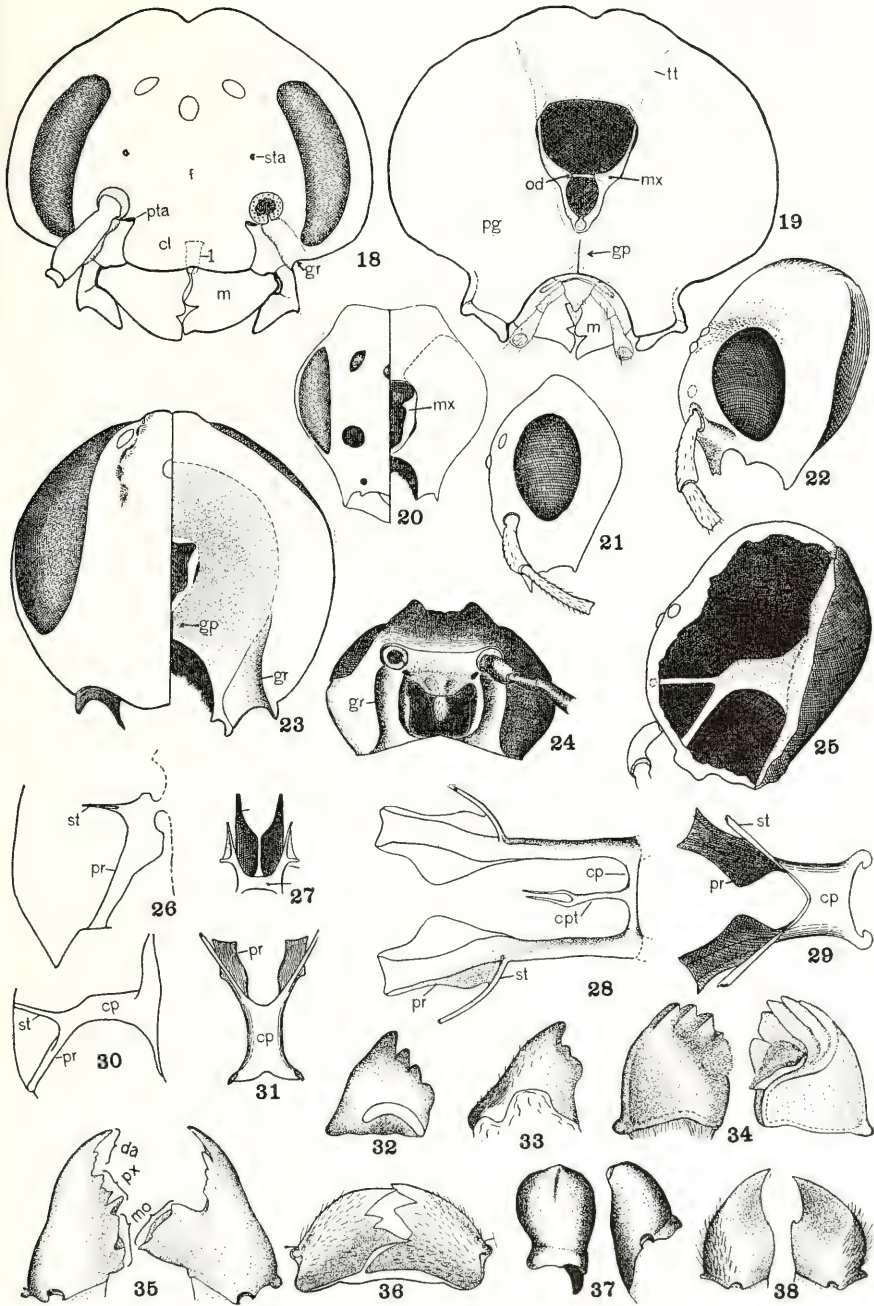


PLATE II

## PLATE III

## MANDIBLES, ANTERIOR ASPECT

- FIG. 39.—Right mandible of *Phymatocera fumipennis* (Nort.).  
FIG. 40.—Right mandible of *Tethida cordigera* (Beauv.).  
FIG. 41.—Right mandible of *Tomostethus multicinctus* Rohwer.  
FIG. 42.—Right mandible of *Tenthredo mellicoxa* Prov.  
FIG. 43.—Right mandible of *Macrophya rapae* (L.).  
FIG. 44.—Right mandible of *Zaschizonyx montana* (Cress.).  
FIG. 45.—Right mandible of *Aglaostigma rubens* (Cress.).  
FIG. 46.—Right mandible of *Lycaotella spissipes*.  
FIG. 47.—Left mandible of *Taxonus pallidicornis* (Nort.).  
FIG. 48.—Right mandible of *Eriocampa rotunda* (Nort.).  
FIG. 49.—Mandibles of *Taxonus epicera* Say.  
FIG. 50.—Mandibles of *Allantus cinctus* (L.).  
FIG. 51.—Right mandible of *Strongylogaster distans* Nort.  
FIG. 52.—Right mandible of *Dolerus acidus* MacG.  
FIG. 53.—Right mandible of *Cairoa cerasi* (L.).  
FIG. 54.—Right mandible of *Phyllostoma nemorata* (Fall.).  
FIG. 55.—Right mandible of *Fenusia dohrnii* (Tischb.).  
FIG. 56.—Right mandible of *Cladius isomerus* Nort.  
FIG. 57.—Right mandible of *Hoplocampa* sp.  
FIG. 58.—Left mandible of *Hemichroa militaris* (Cress.).  
FIG. 59.—Mandibles of *Nematus mendicus* Walsh.  
FIG. 60.—Left mandible of *Euura salicis-nodus* Walsh.

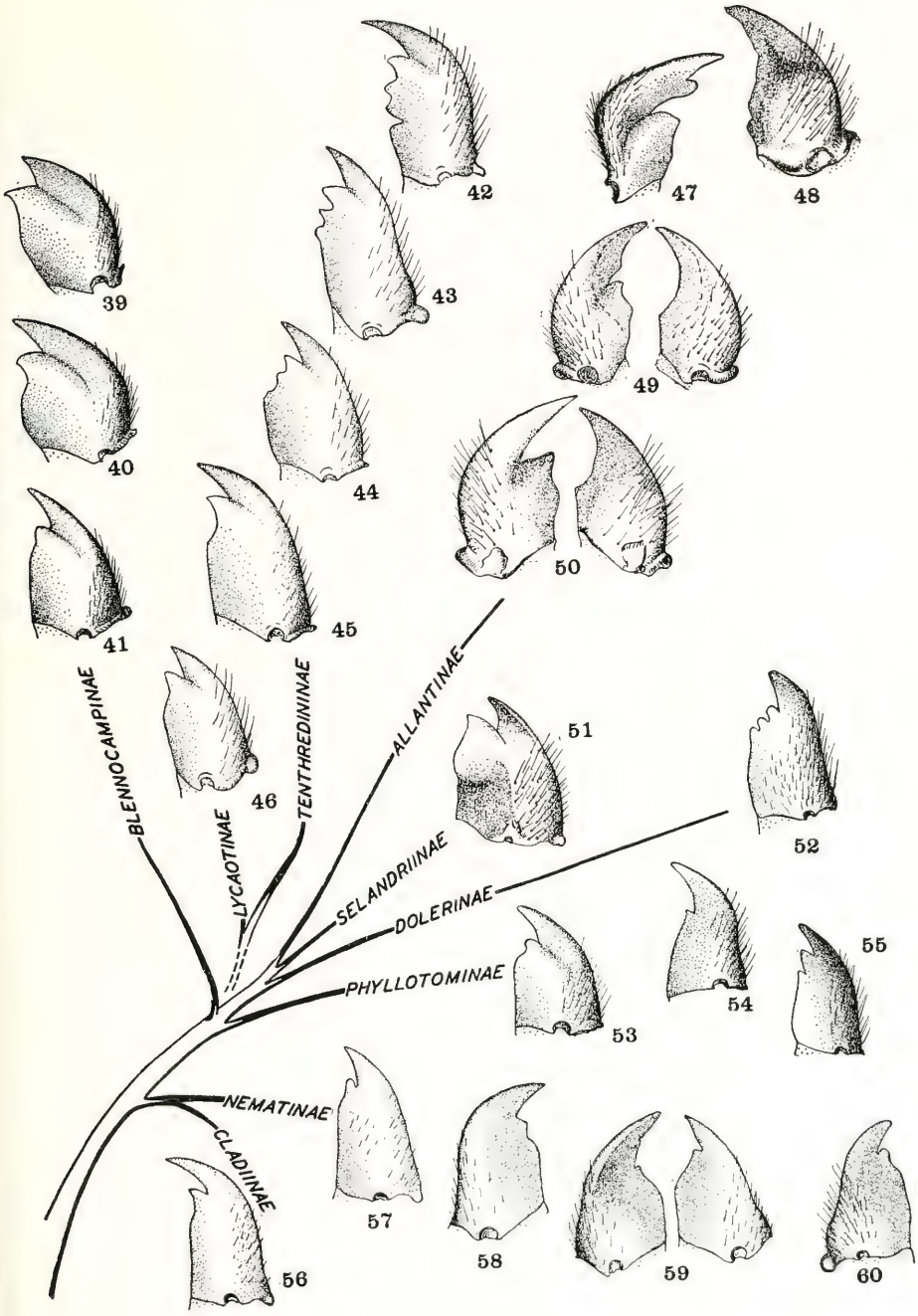


PLATE III

## PLATE IV

## MAXILLAE, POSTERIOR ASPECT

- FIG. 61.—Galea and lacinia of *Pleroneura aldrichi* Ross.  
 FIG. 62.—Galea and lacinia of *Xyelecia nearctica* Ross.  
 FIG. 63.—*Arge pectoralis* (Leach).  
 FIG. 64.—*Trichiosoma triangulum* Kirby.  
 FIG. 65.—*Macroxyela ferruginea*.  
 FIG. 66.—*Cephus cinctus*.  
 FIG. 67.—*Aleiodes terminalis*.  
 FIG. 68.—*Orussus terminalis*.  
 FIG. 69.—*Xiphydria maculata*.  
 FIG. 70.—*Syntexis libocedrii*.

*Abbreviations*

*cd* cardo  
*ecg* ectogalea  
*eg* endogalea

*eus* eustipes  
*gl* galea  
*lc* lacinia

*p* palpus  
*ps* parastipes

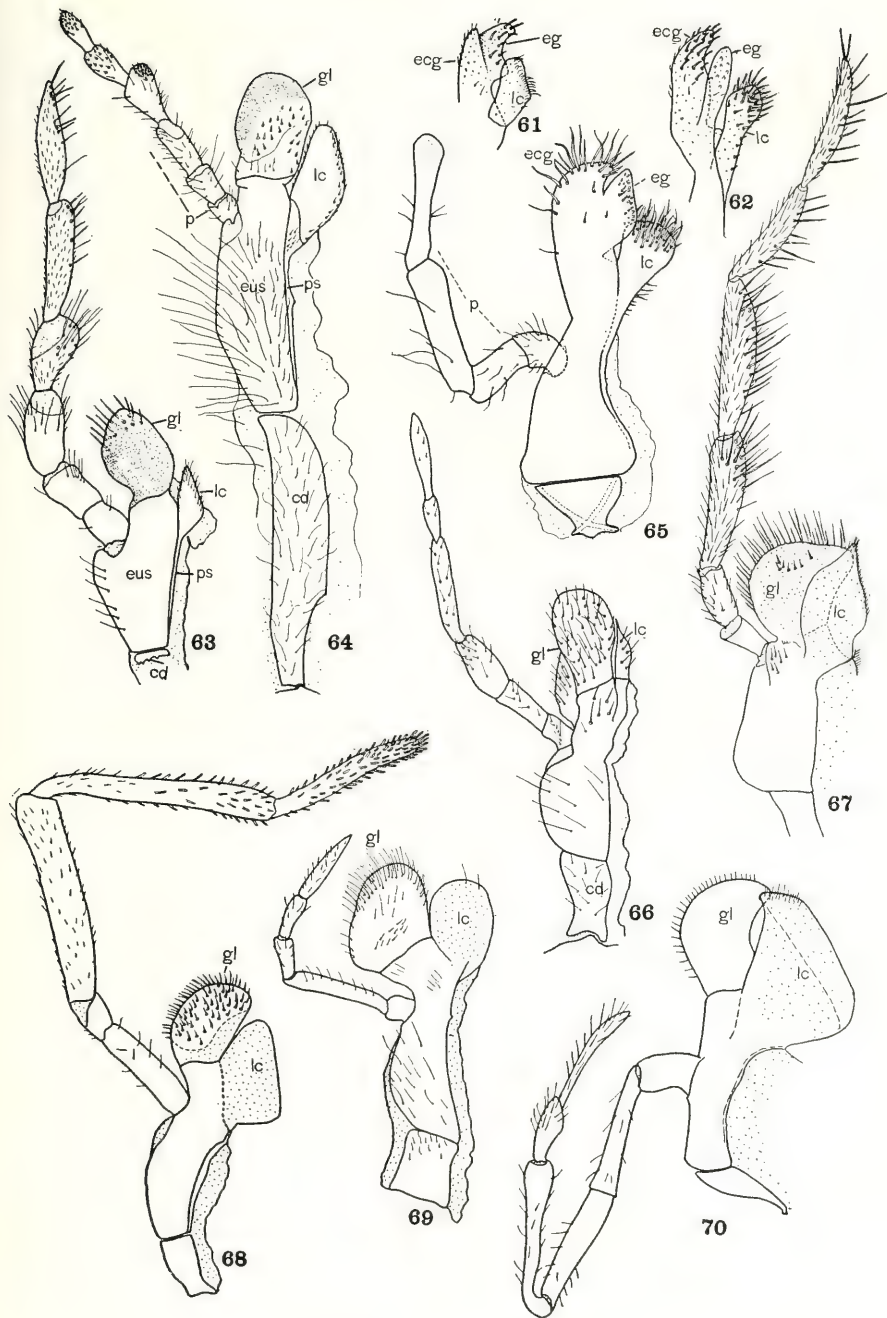


PLATE IV

## PLATE V

- FIG. 71.—Labium of *Trichiosoma triangulum*, posterior aspect.  
 FIG. 72.—Labium of *Arge pectoralis*, lateral aspect.  
 FIG. 73.—Submentum and stipulae of *Arge pectoralis*.  
 FIG. 74.—Labium of *Aleiodes terminalis*, posterior aspect.  
 FIG. 75.—Labium of *Aleiodes terminalis*, lateral aspect.  
 FIG. 76.—Totaglossa of *Incalia hirticornis* Cam., posterior aspect.  
 FIG. 77.—Labium of *Macroxyela ferruginea*, posterior aspect.  
 FIG. 78.—Labium of *Syntexis libocedrii*, posterior aspect.  
 FIG. 79.—Labium of *Syntexis libocedrii*, lateral aspect.  
 FIG. 80.—Labium of *Orussus terminalis*, posterior aspect.  
 FIG. 81.—Labium of *Janus integer*, posterior aspect.  
 FIG. 82.—Labium of *Xiphydria maculata*, posterior aspect.  
 FIG. 83.—Paraglossae and alaglossa of *Xiphydria maculata*.  
 FIG. 84.—Maxillae and labium of *Urocerus flavicornis* Fab., dorsal aspect.  
 FIG. 85.—Labium of *Urocerus flavicornis*, lateral aspect.

*Abbreviations*

<i>alg</i> alaglossa	<i>max.p</i> maxillary palpus	<i>st</i> stipites
<i>cd</i> cardo	<i>p</i> labial palpus	<i>sti</i> stipulae
<i>dgl</i> duplaglossa	<i>pgl</i> paraglossa	<i>tgl</i> totaglossa
<i>gl</i> galea	<i>sm</i> submentum	<i>x</i> sclerotized area
<i>hy</i> hypopharynx		

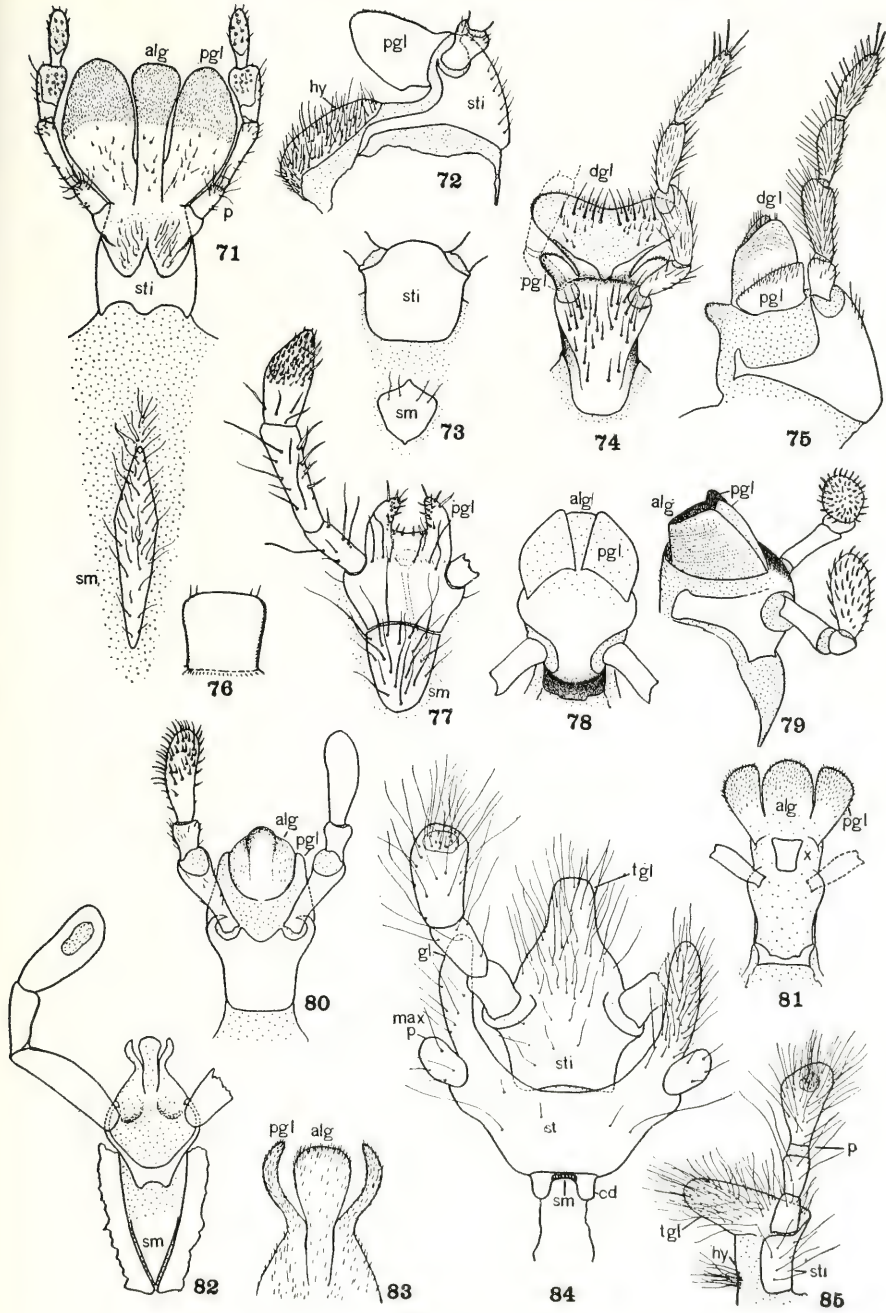


PLATE V

## PLATE VI

- FIG. 86.—Antenna of female *Pleroneura aldrichi*.  
 FIG. 87.—Antenna of female *Xylocia nearctica*.  
 FIG. 88.—Antenna of female *Acantholyda luteomaculata*.  
 FIG. 89.—Antenna of female *Syntexis libocedrii*.  
 FIG. 90.—Antenna of female *Xiphidria maculata*.  
 FIG. 91.—Antenna of female *Tremex columba*.  
 FIG. 92.—Antenna of female *Orussus terminalis*.  
 FIG. 93.—Antenna of female *Hemitaxonus dubitatus* (Nort.).  
 FIG. 94.—Antenna of male *Megalodonta* sp.  
 FIG. 95.—Antenna of female *Acordulecera* sp.  
 FIG. 96.—Antenna of female *Blasticotoma filiceti* (Klug).  
 FIG. 97.—Antenna of female *Sterictiphora zabriskiei* (W. & M.).  
 FIG. 98.—Antenna of male *Sterictiphora cellularis* (Say).  
 FIG. 99.—Antenna of female *Zaraea americana* (Cress.).  
 FIG. 100.—Antenna of female *Trichiosoma triangulum*.  
 FIG. 101.—Antenna of female *Tenthredo subnigriceps* Rohwer.  
 FIG. 102.—Antenna of female *Tenthredo originalis* Norton.  
 FIG. 103.—Antenna of female *Macrophya montana* (Scopoli).  
 FIG. 104.—Antenna of male *Cladius isomerus*.  
 FIG. 105.—Antenna of male *Monoctenus* sp.  
 FIG. 106.—Antenna of female *Neodiprion affinis* Rohwer.  
 FIG. 107.—Antenna of female *Augomonctenus libocedrii* Rohwer.  
 FIG. 108.—Front leg of female *Orussus terminalis*.  
 FIG. 109.—Hind tarsi of female *Lycaota sodalis* (Cress.).  
 FIG. 110.—Hind leg of *Janus integer*.  
 FIG. 111.—Hind tarsi of female *Lycaotella spissipes*.  
 FIG. 112.—Hind tibiae and tarsi of *Xiphidria maculata*.  
 FIG. 113.—Apex of front tibia, tibial spurs and basitarsus of *Neodiprion affinis*.  
 FIG. 114.—Apical spurs of front tibia of *Lycaota sodalis*.  
 FIG. 115.—Apical spurs of front tibia of *Orussus terminalis*.  
 FIG. 116.—Apical spur of front tibia of *Tremex columba*.  
 FIG. 117.—Apical spur of front tibia of *Xiphidria maculata*.  
 FIG. 118.—Apical spur of front tibia of *Syntexis libocedrii*.  
 FIG. 119.—Apical spur of front tibia of *Janus integer*.

## Abbreviations

<i>asp</i> apical spurs	<i>psp</i> preapical spurs	<i>tc</i> tarsal claws
<i>cx</i> coxa	<i>ta</i> tarsi	<i>tr</i> trochanters
<i>fm</i> femur	<i>tb</i> tibia	



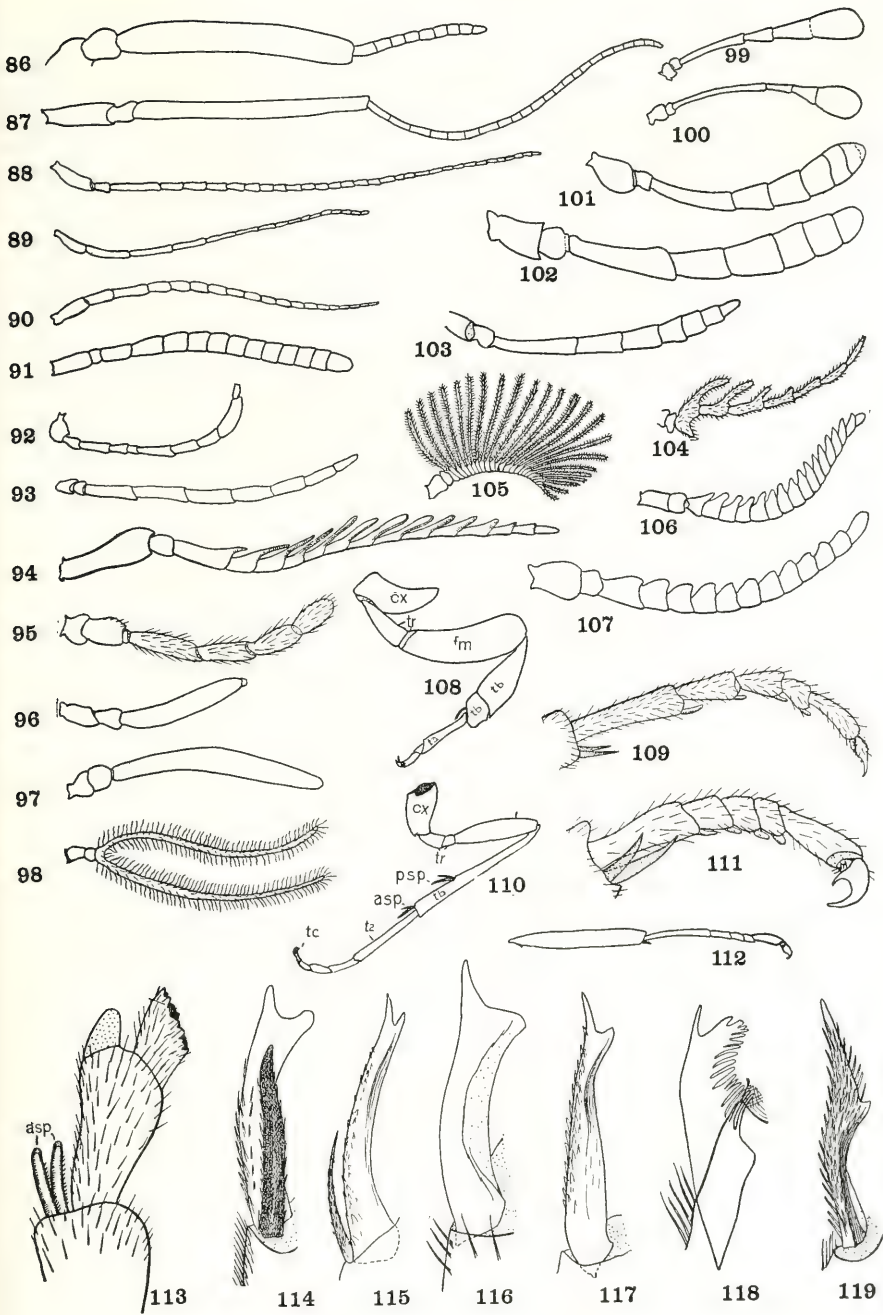


PLATE VI

## PLATE VII

- FIG. 120.—Thorax of *Macroxyela ferruginea*, dorsal aspect.  
 FIG. 121.—Thorax of *Janus integer*, dorsal aspect.  
 FIG. 122.—Thorax of *Syntexis libocedrii*, dorsal aspect.  
 FIG. 123.—Thorax of *Xiphydria maculata*, dorsal aspect.  
 FIG. 124.—Pro- and mesonotum of *Profenusa canadensis* (Marl.).  
 FIG. 125.—Post-tergite of *Dolerus similis* (Norton).  
 FIG. 126.—Pro- and mesonotum of *Acordulecera* sp.  
 FIG. 127.—Pro- and mesonotum of *Tremex columba*.  
 FIG. 128.—Thorax of *Orussus terminalis*, dorsal aspect.  
 FIG. 129.—Thorax of *Macroxyela ferruginea*, ventral aspect.  
 FIG. 130.—Thorax of *Syntexis libocedrii*, ventral aspect.  
 FIG. 131.—Thorax of *Janus integer*, ventral aspect.  
 FIG. 132.—Thorax of *Xiphydria maculata*, ventral aspect.  
 FIG. 133.—Thorax of *Orussus terminalis*, ventral aspect.  
 FIG. 134.—Mesothorax of *Arge pectoralis*, ventral aspect.  
 FIG. 135.—Mesothorax of *Hemitaxonus dubitatus*, ventral aspect.  
 FIG. 136.—Portion of mesothorax of *Allantus cinctus*, ventral aspect.  
 FIG. 137.—Anterior portion of mesosternum of *Tremex columba*, ental aspect.  
 FIG. 138.—Mesothorax of *Tremex columba*, ventral aspect.

## Abbreviations

<i>ax</i> axillary sclerites	<i>pp</i> prepectus	<i>y</i> lobes of meso- scutum
<i>bs</i> basisternum	<i>prs</i> praescutum	
<i>cn</i> cenchri	<i>psb</i> presternal bridge	<i>I, 2</i> first and second segments of abdomen
<i>cv</i> cervical sclerites	<i>pt</i> post-tergite	
<i>eψs</i> episternum	<i>ptn</i> postnotum	
<i>is</i> parascutellum	<i>scl</i> scutellum	<i>I, II, III</i> first, second, and third segments of thorax
<i>ms</i> mesosternum	<i>scut</i> scutum	
<i>pn</i> pronotum	<i>ss</i> spinisternum	

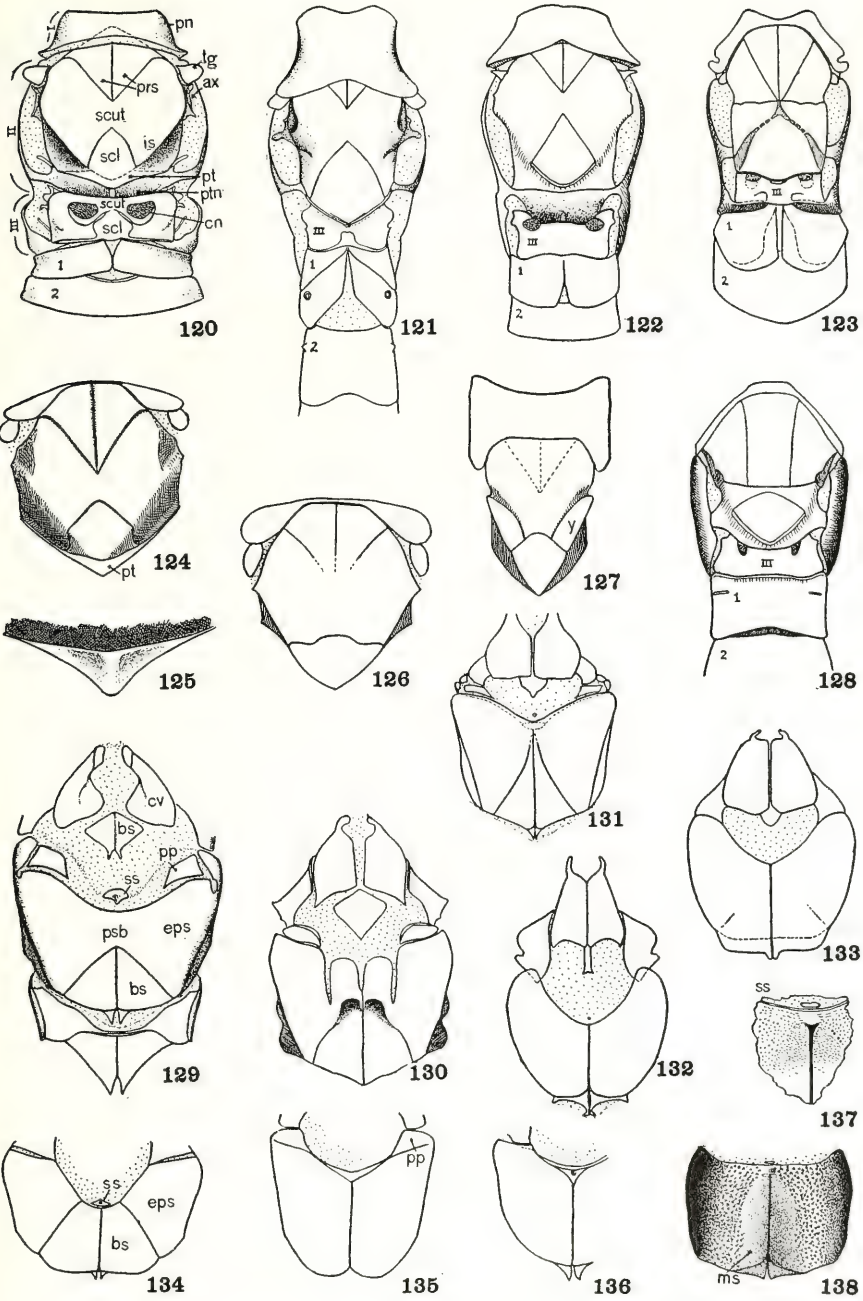


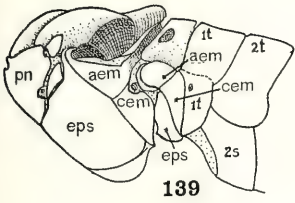
PLATE VII

## PLATE VIII

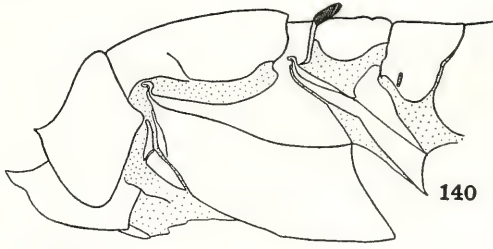
- FIG. 139.—Thorax of *Arge pectoralis*, lateral aspect.  
 FIG. 140.—Thorax of *Syntexis libocedrii*, lateral aspect.  
 FIG. 141.—Thorax of *Xiphydria maculata*, lateral aspect.  
 FIG. 142.—Thorax of *Orussus terminalis*, lateral aspect.  
 FIG. 143.—Thorax of *Janus integer*, lateral aspect.  
 FIG. 144.—Thorax of *Eremotylus* sp., lateral aspect.  
 FIG. 145.—Cervicum and propleurae of *Panorpa sigmoides* Carpenter, lateral aspect.  
 FIG. 146.—Cervicum and propleurae of *Arge pectoralis*, lateral aspect.  
 FIG. 147.—Cervicum and propleurae of *Xiphydria maculata*, lateral aspect.  
 FIG. 148.—Cervicum and propleurae of *Macroxyela ferruginea*, lateral aspect.  
 FIG. 149.—Postnotum of *Macroxyela ferruginea*.  
 FIG. 150.—Postnotum of *Orussus terminalis*.  
 FIG. 151.—Postnotum of *Tremex columba*.  
 FIG. 152.—Postnotum of *Janus integer*.  
 FIG. 153.—Profurcella and mesofurcella of *Acantholyda* sp.  
 FIG. 154.—Cervicum and probasisternum of *Macrophyta formosa* Klug.  
 FIG. 155.—Cervicum and probasisternum of *Strongylogaster distans*.  
 FIG. 156.—Cervicum and probasisternum of *Hemitaxonus dubitatus*.  
 FIG. 157.—Cervicum and probasisternum of *Eriocampa rotunda*.  
 FIG. 158.—Cervicum and probasisternum of *Allantus cinctus*.  
 FIG. 159.—Cervicum and probasisternum of *Zaraea americana*.

## Abbreviations

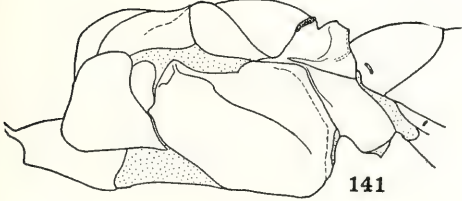
<i>aem</i> anepimeron	<i>fl</i> furcella of prospini-	<i>1t</i> } tergites of first and
<i>cem</i> katepimeron	sternum	<i>2t</i> } second abdominal
<i>cv</i> cervical sclerites	<i>pl</i> propleurae	segments
<i>eps</i> episternum	<i>pn</i> pronotum	
<i>fc</i> furca of mesobasi-	<i>2s</i> sternite of second	
sternum	abdominal segment	



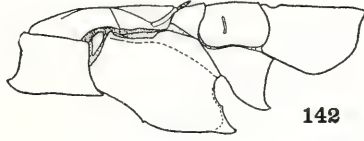
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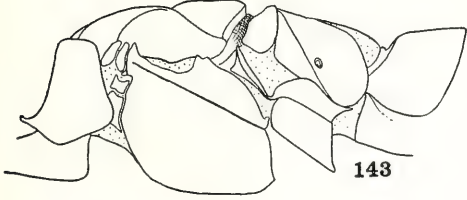
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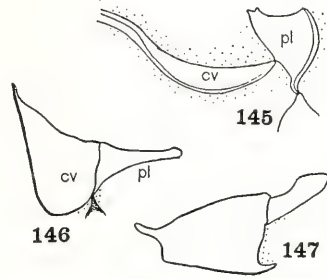
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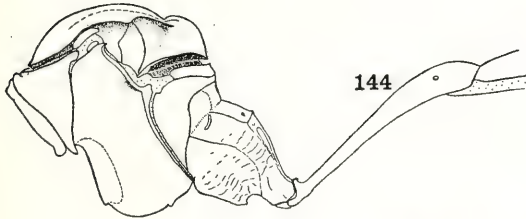
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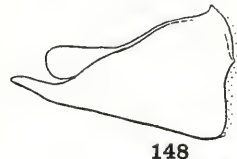
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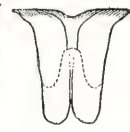
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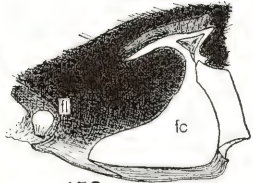
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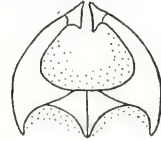
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159

PLATE VIII

## PLATE IX

MALE GENITALIA, figs. 160 and 162-169, with dorsal aspect on left half and ventral aspect on right

- FIG. 160.—*Arge pectoralis*.  
 FIG. 161.—Sagittae and volsellae of *Xiphydria maculata*.  
 FIG. 162.—*Xiphydria maculata*.  
 FIG. 163.—*Trichiosoma triangulum*.  
 FIG. 164.—*Acordulecera* sp.  
 FIG. 165.—*Janus integer*.  
 FIG. 166.—*Urocerus flavicornis*.  
 FIG. 167.—*Macroxyela ferruginea*.  
 FIG. 168.—*Aleiodes terminalis*.  
 FIG. 169.—*Orussus terminalis*.

## Abbreviations

<i>ca</i> gonocardo	<i>go</i> gonostipes	<i>py</i> penis valvae
<i>gg</i> parapenis	<i>h</i> harpes	<i>sa</i> sagittae
<i>gm</i> gonamaculae	<i>ol</i> volsellae	

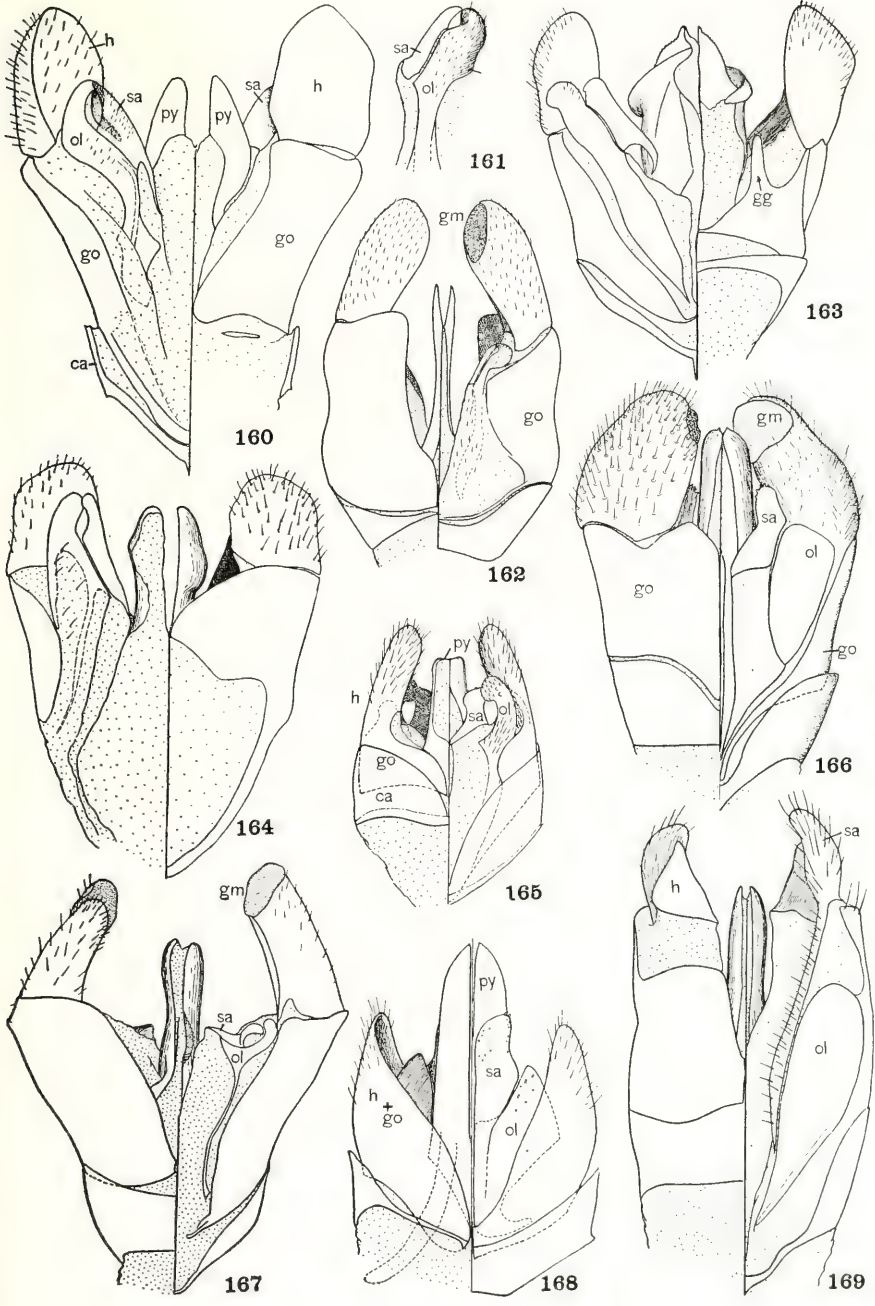


PLATE IX

## PLATE X

- FIG. 170.—Hypothetical front wing of the Hymenoptera.  
 FIG. 171.—Wings of *Syntexis libocedrii*.  
 FIG. 172.—Front wing of *Pleroneura* sp.  
 FIG. 173.—Anal veins in front wing of *Tremex columba*.  
 FIG. 174.—Anal veins in front wing of *Caliroa cerasi* (L.).  
 FIG. 175.—Wings of *Janus integer*.  
 FIG. 176.—Hind wing of *Macroxyela ferruginea*.  
 FIG. 177.—Wings of *Orussus* sp.  
 FIG. 178.—Hind wing of *Arge* sp.  
 FIG. 179.—Front wing of *Tremex columba*.  
 FIG. 180.—Hind wing of *Taxonus epicera* (Say), showing peripheral vein.

## Abbreviations

<i>a</i>	anal cross-vein	<i>m</i>	median axillary sclerite
<i>1A</i>	} first to fourth anal veins	<i>M</i>	} media and its branches
<i>2A</i>		<i>M</i> <sub>1</sub>	
<i>3A</i>		<i>M</i> <sub>2</sub>	
<i>4A</i>		<i>m-cu</i>	} medio-cubital cross-veins
<i>C</i>	<i>1m-cu</i>		
<i>Cu</i>	} cubitus and its branches	<i>2m-cu</i>	} radius and its branches
<i>Cu</i> <sub>1</sub>		<i>R</i>	
<i>Cu</i> <sub>2</sub>		<i>R</i> <sub>1</sub>	
<i>Cu</i> <sub>1a</sub>		<i>R</i> <sub>2</sub>	} radial sector
<i>Cu</i> <sub>1b</sub>	<i>R</i> <sub>3</sub>		
<i>cu-a</i>	cubito-anal cross-vein	<i>r-m</i>	radio-medial cross-vein
<i>cv</i>	cross-vein	<i>Sc</i>	} subcosta and its branches
<i>h</i>	humeral cross-vein	<i>Sc</i> <sub>1</sub>	
<i>ham</i>	hamuli	<i>Sc</i> <sub>2</sub>	



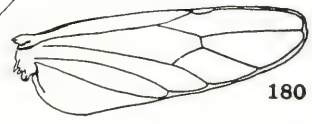
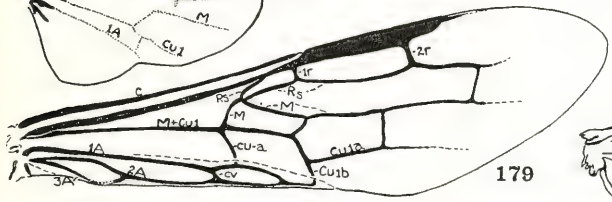
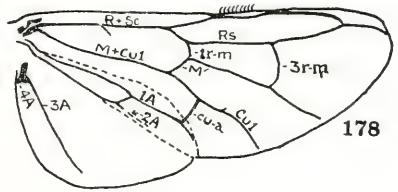
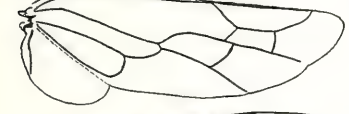
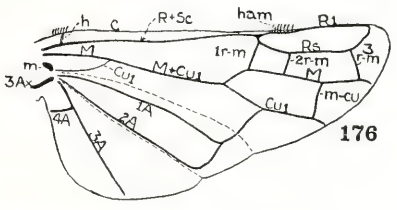
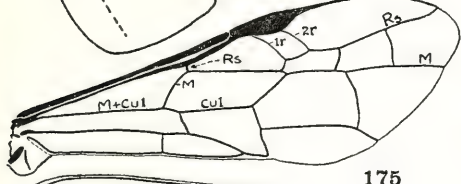
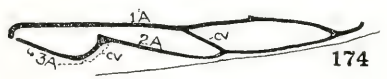
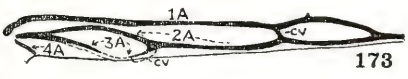
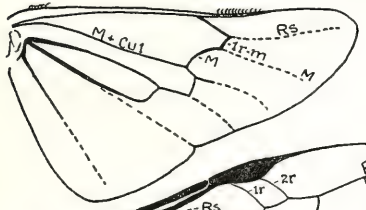
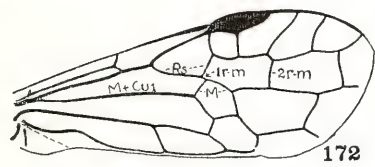
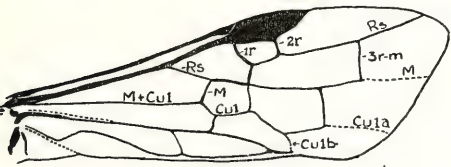
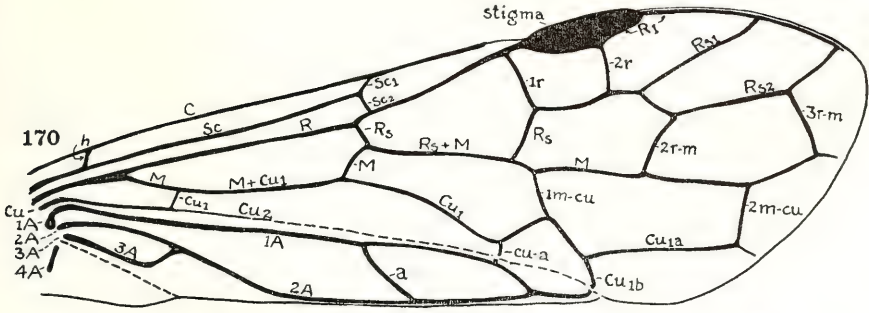


PLATE X

PLATE XI  
FRONT WINGS

- FIG. 181.—*Hemitaxonus dubitatus*.  
FIG. 182.—*Dolerus unicolor* (Beauv.).  
FIG. 183.—*Selandria vanduzeei* (Roh.).  
FIG. 184.—*Adelesta nova* (Norton).  
FIG. 185.—*Caliroa cerasi*.  
FIG. 186.—*Allantus cinctus*.  
FIG. 187.—*Phyllotoma nemorata* (Fall.).  
FIG. 188.—*Tomostethus multicinctus* Rohwer.  
FIG. 189.—*Fenusia pumilla* (Lep.).  
FIG. 190.—*Tethida cordigera*.  
FIG. 191.—*Hoplocampa* sp.  
FIG. 192.—*Lycæota sodalis*.  
FIG. 193.—*Nematus ventralis* Say.  
FIG. 194.—*Zaschizonyx montana*.  
FIG. 195.—*Kerita fidala* Ross.  
FIG. 196.—*Tenthredo rufopectus* Norton.

*Abbreviations same as for Plate X*

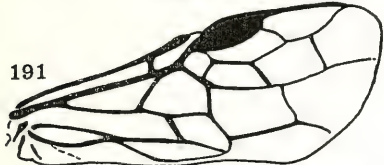
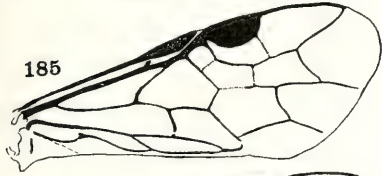
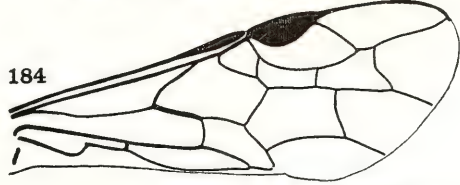
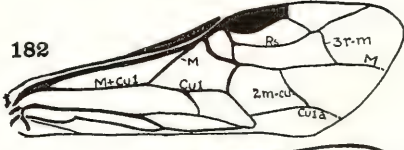
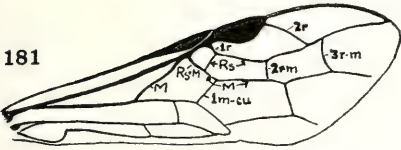


PLATE XI

## PLATE XII

- FIG. 197.—Anal veins of front wing of *Tenthredo mellicoxa*.  
 FIG. 198.—Anal veins of front wing of *Nematus ribesii* (Scop.).  
 FIG. 199.—Anal veins of front wing of *Macrophya formosa*.  
 FIG. 200.—Anal veins of front wing of *Hemichroa crocea*.  
 FIG. 201.—Anal veins of front wing of *Zaschizonyx montana*.  
 FIG. 202.—Anal veins of front wing of *Hoplocampa* sp.  
 FIG. 203.—Anal veins of front wing of *Caliroa aethiops* (Fabr.).  
 FIG. 204.—Anal veins of front wing of *Adelesta nova*.  
 FIG. 205.—Anal veins of front wing of *Phyllotoma nemorata*.  
 FIG. 206.—Anal veins of front wing of *Tomostethus multicinctus*.  
 FIG. 207.—Anal veins of front wing of *Metallus rubi* Forbes.  
 FIG. 208.—Anal veins of front wing of *Tethida cordigera*.  
 FIG. 209.—Anal veins of front wing of *Femusa pusilla*.  
 FIG. 210.—Anal veins of front wing of *Blennocampa rubi* (Harris).  
 FIG. 211.—Front wing of *Caliroa aethiops* showing the nomenclature of the cells.  
 FIG. 212.—Head of *Lyrola brunneiventris* (Cress.), dorsal view.  
 FIG. 213.—Head of *Sterictiphora apios* Ross, dorsal view.  
 FIG. 214.—Portion of front wing of *Sterictiphora apios*.  
 FIG. 215.—Tarsal claw of *Atomacera debilis* Say.  
 FIG. 216.—Tarsal claw of *Lyrola brunneiventris*.  
 FIG. 217.—Tarsal claw of *Sterictiphora mexicana* (Ashm.).  
 FIG. 218.—Portion of front wing of *Sterictiphora niger* (Nort.).  
 FIG. 219.—Scutellum of *Neodiprion lecontei* (Fitch).  
 FIG. 220.—Scutellum of *Diprion polytomum* (Hartig).  
 FIG. 221.—Right mandible of female *Trichiosoma triangulum*.  
 FIG. 222.—Right mandible of male *Trichiosoma triangulum*.  
 FIG. 223.—Anal cells of hind wing of *Sterictiphora cellularis*.  
 FIG. 224.—Anal veins of the hind wing of *Sterictiphora apios*.  
 FIG. 225.—Anal veins of the hind wing of *Sterictiphora zabriskiei*.  
 FIG. 226.—Hind coxae of *Trichiosoma triangulum*.  
 FIG. 227.—Hind coxae of *Zaraea americana*.  
 FIG. 228.—Hind basitarsus and succeeding segment of *Neodiprion lecontei* (Fitch).  
 FIG. 229.—Hind basitarsus and succeeding segment of *Zadiprion grandis* (Rohwer).  
 FIG. 230.—Hind femur of *Trichiosoma triangulum*.  
 FIG. 231.—Head of *Monoctenus fulvus* (Nort.), lateral aspect.  
 FIG. 232.—Head of *Neodiprion lecontei*, lateral aspect.

## Abbreviations

<i>a</i>	anal cross-vein	<i>M-Cu</i>	medio-cubital cell
<i>1A</i>	first anal vein	<i>PA</i>	proximal anal cell
<i>2A&amp;3A</i>	second and third anal veins	<i>R</i>	radial cell
<i>Cu<sub>1a</sub></i>	cell cubitus 1a	<i>1R<sub>1</sub></i>	first cell radius 1
<i>Cu<sub>2a</sub></i>	cell cubitus 2a	<i>2R<sub>1</sub></i>	second cell radius 1
<i>DA</i>	distal anal cell	<i>3R<sub>1</sub></i>	third cell radius 1
<i>1M</i>	first medial cell	<i>1R<sub>s</sub></i>	first cell "R <sub>s</sub> "
<i>2M</i>	second medial cell	<i>2R<sub>s</sub></i>	second cell "R <sub>s</sub> "
<i>3M</i>	third medial cell	<i>3R<sub>s</sub></i>	third cell "R <sub>s</sub> "

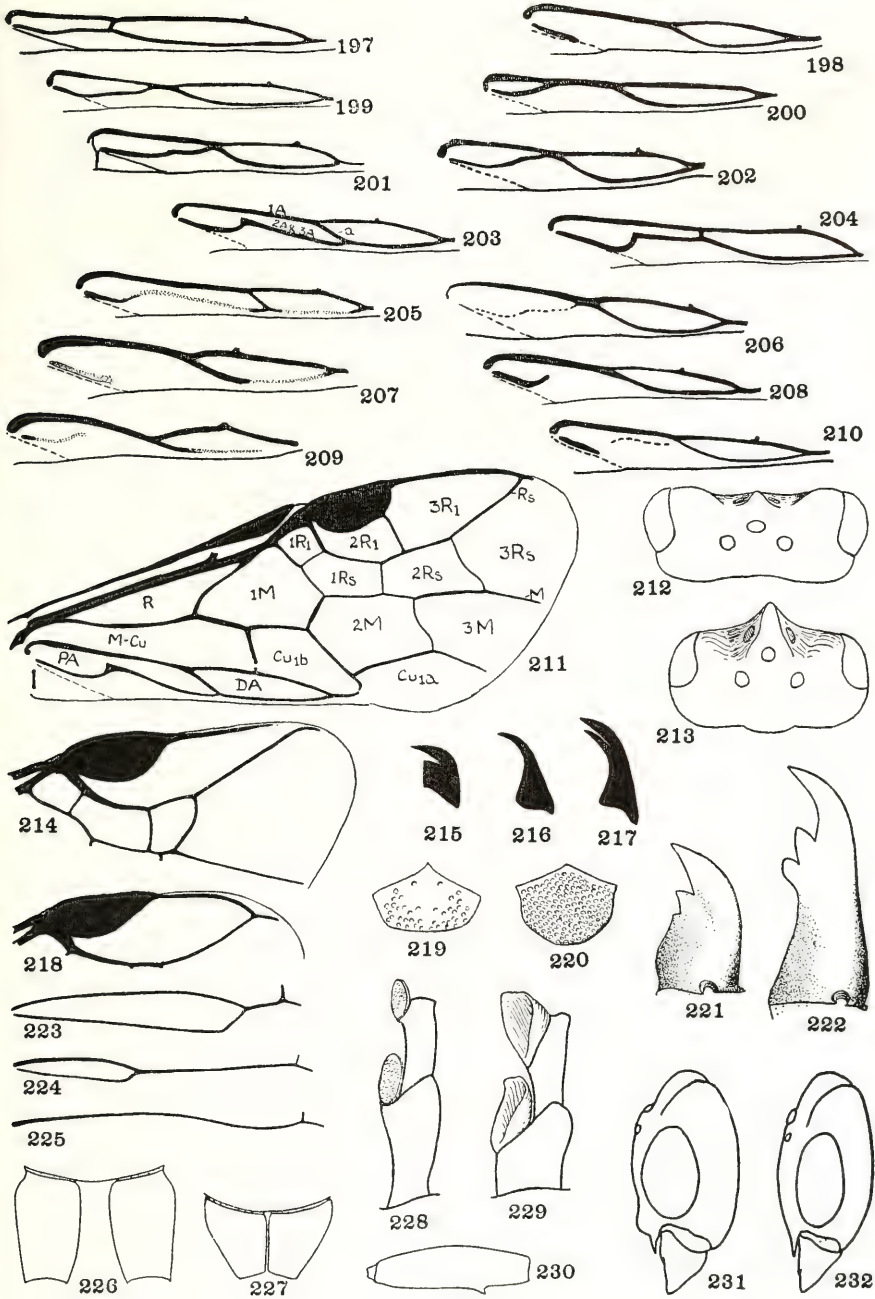


PLATE XII

## PLATE XIII

- FIG. 233.—Cross-section of a unipectinate antennal segment.  
 FIG. 234.—Cross-section of a bipectinate segment.  
 FIG. 235.—Apical segments of antenna of *Zadiprion grandis* male.  
 FIG. 236.—Apical segments of antenna of *Neodiprion lecontei* male.  
 FIG. 237.—Apical segments of antenna of *Eriocampidea arizonensis* Ashm.  
 FIG. 238.—Apical segments of antenna of *Hemitaxonus dubitatus*.  
 FIG. 239.—Antenna of *Adelesta nova*.  
 FIG. 240.—Antenna of *Eustromboceros* sp.  
 FIG. 241.—Antenna of *Aneugmenus flavipes* (Nort.)  
 FIG. 242.—Mesopleurae of *Selandria decorata* (Cress.)  
 FIG. 243.—Prepectus of *Eustromboceros* sp.  
 FIG. 244.—Prepectal ridge of *Strongylogaster distans* (Nort.)  
 FIG. 245.—Tarsal claw of *Aneugmenus flavipes*.  
 FIG. 246.—Compound eye of *Dolerus apricus* (Nort.), anterior aspect.  
 FIG. 247.—Compound eye of *Dolerus elderi* (Kinc.), anterior aspect.  
 FIG. 248.—Tarsal claw of *Adelesta nova*.  
 FIG. 249.—Portion of hind wing of *Adelesta nova*.  
 FIG. 250.—Portion of front wing of *Entodecta capitalis* (Nort.)  
 FIG. 251.—Outline of head of *Caliroa aethiops*, dorsal aspect.  
 FIG. 252.—Outline of head of *Phyllotoma nemorata*, dorsal aspect.  
 FIG. 253.—Antenna of *Scolioneura populi* (Marl.).  
 FIG. 254.—Antenna of *Entodecta capitalis*.  
 FIG. 255.—Basal segments of antenna of *Cladius pectinicornis*.  
 FIG. 256.—Basal segments of antenna of *Priophorus* sp.  
 FIG. 257.—Portion of front wing of *Metallus rubi*.  
 FIG. 258.—Portion of hind wing of *Entodecta capitalis*.  
 FIG. 259.—Portion of hind wing of *Fenusa alumna* (MacG.)  
 FIG. 260.—Saw of *Trichiocampus viminalis* (Fall.)  
 FIG. 261.—Saw of *Priophorus* sp.  
 FIG. 262.—Tarsal claw of *Anoplonyx canadensis* (Harr.).  
 FIG. 263.—Tarsal claw of *Caulocampus acericaulis* (MacG.).  
 FIG. 264.—Tarsal claw of *Pachynematus extensicornis* (Nort.).  
 FIG. 265.—Tarsal claw of *Micronematus gregarius* (Dyar).  
 FIG. 266.—Tarsal claw of *Pristiphora bivittata* (Nort.).  
 FIG. 267.—Tarsal claw of *Nematus ventralis*.  
 FIG. 268.—Tarsal claw of *Euura* sp.  
 FIG. 269.—Tarsal claw of *Adelomos cleone* Ross.  
 FIG. 270.—Left mandible of *Hemichroa thoracica* (Harr.), lateral aspect.  
 FIG. 271.—Left mandible of *Nematinus unicolor* (Nort.), lateral aspect.  
 FIG. 272.—Left mandible of *Nematus ventralis*, lateral aspect.  
 FIG. 273.—Left mandible of *Euura hoppingi* Ross, lateral aspect.  
 FIG. 274.—Left mandible of *Adelomos cleone*, lateral aspect.  
 FIG. 275.—Left mandible of *Neopareophora litura* (Klug), lateral aspect.  
 FIG. 276.—Hind tibia of *Nematus abbottii* (Kby.).  
 FIG. 277.—Hind tibia of *Croesus latitarsus* Nort.

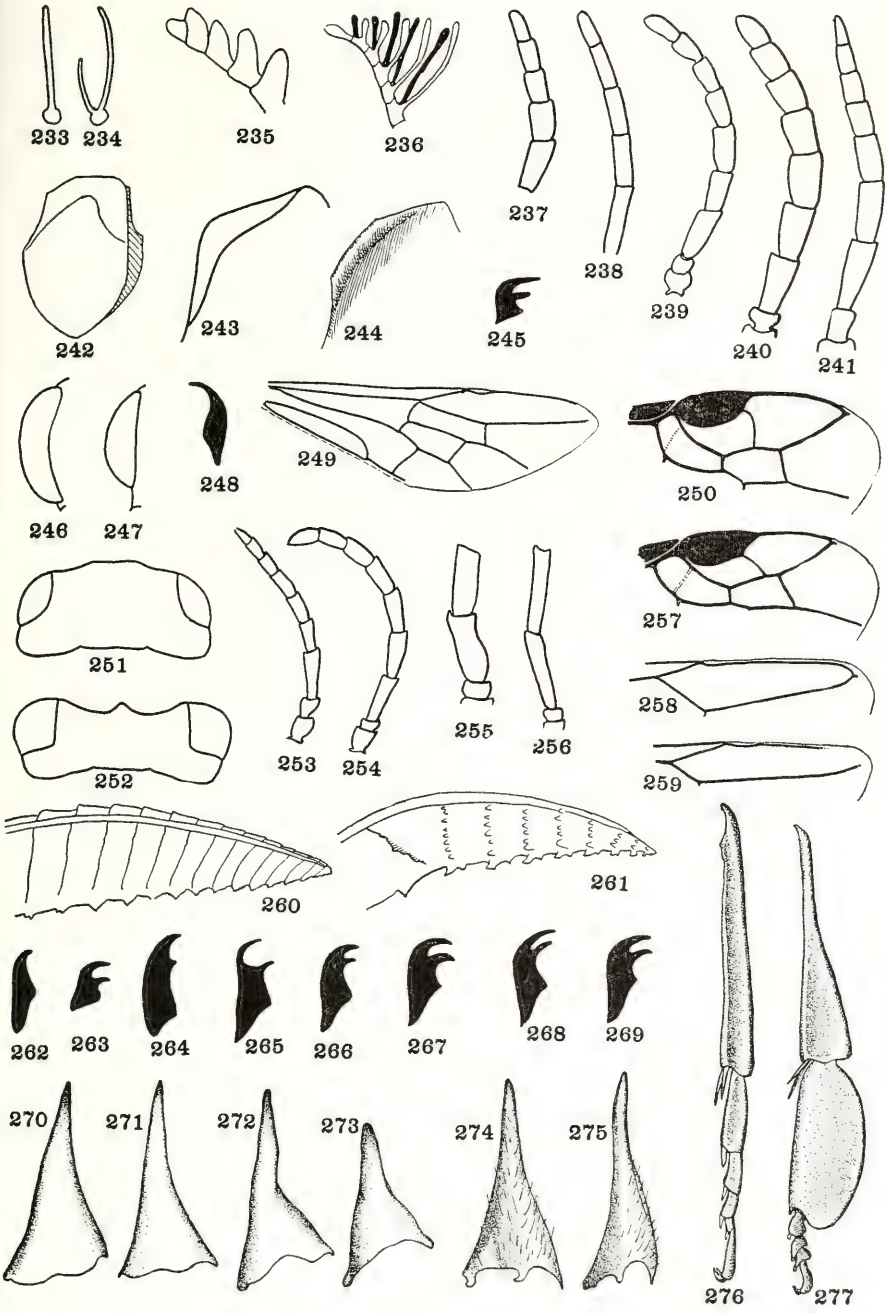


PLATE XIII

## PLATE XIV

- FIG. 278.—Antenna of *Adelomos cleone*.  
 FIG. 279.—Antenna of *Pseudodineura parvula* (Nort.).  
 FIG. 280.—Antenna of *Neopareophora litura*.  
 FIG. 281.—Antenna of *Hoplocampa* sp.  
 FIG. 282.—Antenna of *Craterocercus phytophagica* (Dyar).  
 FIG. 283.—Antenna of *Hemichroa crocea* (Four.).  
 FIG. 284.—Antenna of *Kerita fidala*.  
 FIG. 285.—Portion of front wing of *Adelomos cleone*.  
 FIG. 286.—Portion of hind wing of *Adelomos cleone*.  
 FIG. 287.—Anal veins of hind wing of *Neopareophora litura*.  
 FIG. 288.—Anal veins of hind wing of *Pseudodineura parvula*.  
 FIG. 289.—Anal veins of front wing of *Hemichroa crocea*.  
 FIG. 290.—Anal veins of front wing of *Hemichroa thoracica*.  
 FIG. 291.—Head of *Hemichroa crocea*, anterior aspect.  
 FIG. 292.—Head of *Platycampus* sp., anterior aspect.  
 FIG. 293.—Abdomen of female *Nematinus unicolor*, ventral aspect.  
 FIG. 294.—Head of *Pseudodineura parvula*, dorsal aspect.  
 FIG. 295.—Head of *Kerita fidala*, dorsal aspect.  
 FIG. 296.—Clypeus of *Pachynematus extensicornis*.  
 FIG. 297.—Clypeus of *Pristiphora* sp.  
 FIG. 298.—Sheath of *Pikonema alaskensis* (Roh.), lateral aspect.  
 FIG. 299.—Head of *Amauronematus* sp., lateral aspect.  
 FIG. 300.—Head of *Amauronematus lineatus* (Harr.), lateral aspect.  
 FIG. 301.—Head of *Nematus* sp., lateral aspect.  
 FIG. 302.—Head of *Nematus ventralis*, lateral aspect.  
 FIG. 303.—Sheath of *Adelomos cleone*, lateral aspect.  
 FIG. 304.—Sheath of *Pristiphora erichsoni* (Hartig), lateral aspect.  
 FIG. 305.—Subgenital plate of *Pristiphora chlorea* (Nort.).  
 FIG. 306.—Subgenital plate of *Nematinus unicolor*.  
 FIG. 307.—Subgenital plate of *Pikonema alaskensis*.  
 FIG. 308.—Sheath of *Neopareophora litura*, ventro-lateral aspect.  
 FIG. 309.—Sheath of *Pseudodineura parvula*, lateral aspect.  
 FIG. 310.—Saw of *Kerita fidala*.  
 FIG. 311.—Sheath of *Neopareophora litura*, dorsal aspect.  
 FIG. 312.—Sheath of *Pseudodineura parvula*, dorsal aspect.

## Abbreviations

- 1A first anal vein  
 2A&3A second and third anal veins  
 r, 2r radial and second radial cross-veins, respectively



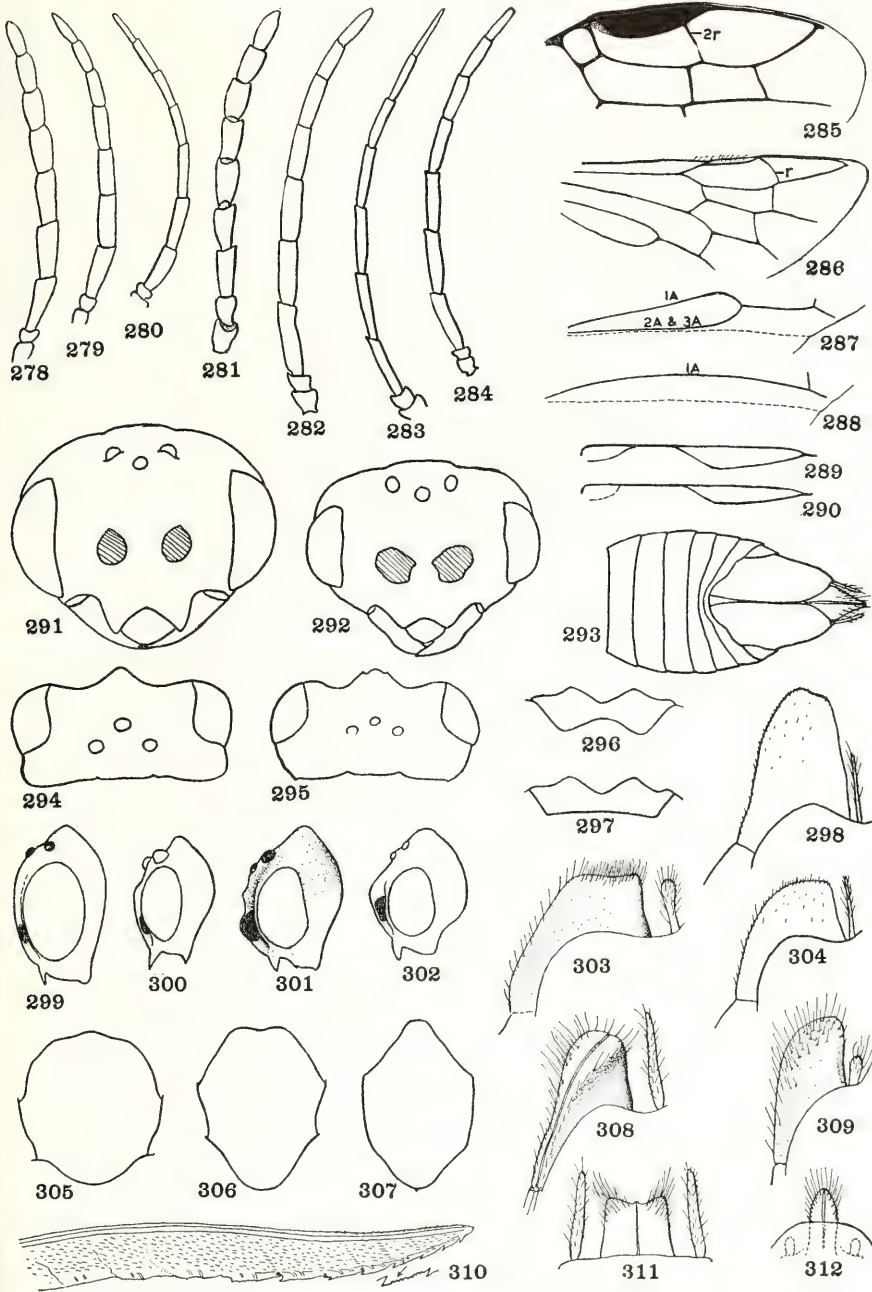


PLATE XIV

## PLATE XV

- FIG. 313.—Penis valve of *Pristiphora chlorea*.  
 FIG. 314.—Penis valve of *Pristiphora erichsoni*.  
 FIG. 315.—Penis valve of *Nematinus unicolor*.  
 FIG. 316.—Penis valve of *Nematus ribesii*.  
 FIG. 317.—Left mandible of *Hemichroa thoracica*.  
 FIG. 318.—Right mandible of *Kerita fidala*.  
 FIG. 319.—Left mandible of *Pseudodineura parvula*.  
 FIG. 320.—Clypeus of *Ametastegia coloradensis* (Weld.).  
 FIG. 321.—Clypeus of *Empria multicolor* (Nort.).  
 FIG. 322.—Clypeus of *Ametastegia tener* (Fall.).  
 FIG. 323.—Clypeus of *Empria nordica* Ross.  
 FIG. 324.—Procidentia of *Pikonema alascensis*.  
 FIG. 325.—Procidentia of *Pristiphora chlorea*.  
 FIG. 326.—Eighth tergite of *Nematinus unicolor*.  
 FIG. 327.—Clypeus of *Allantus cinctus* (L.).  
 FIG. 328.—Clypeus of *Aphilodictium fidum* (Cress.).  
 FIG. 329.—Mesopleurae and sternum of *Eriocampa rotunda* (Nort.).  
 FIG. 330.—Praescutum of *Dimorphopteryx abnormis* Roh.  
 FIG. 331.—Praescutum of *Eriocampa ovata* (L.).  
 FIG. 332.—Clypeus of *Monosoma inferentia* (Nort.).  
 FIG. 333.—Clypeus of *Monostegia abdominalis* (Fabr.).  
 FIG. 334.—Head of *Phrontosoma belfragei* (Cress.), anterior aspect.  
 FIG. 335.—Praeputial plates of *Ametastegia glabrata* (Fall.).  
 FIG. 336.—Praeputial plates of *Aphilodictium fidum*.  
 FIG. 337.—Anal veins of front wing of *Ametastegia equiseti* (L.).  
 FIG. 338.—Anal veins of front wing of *Aphilodictium fidum*.  
 FIG. 339.—Anal veins of front wing of *Monosoma inferentia*.  
 FIG. 340.—Dorsum of abdomen of *Empria obscurata* (Cress.), showing white, paired areas.  
 FIG. 341.—Praeputial plates of *Eriocampa rotunda*.  
 FIG. 342.—Praeputial plates of *Empria maculata* (Nort.).  
 FIG. 343.—Praeputial plates of *Taxonus uncinatus* (Nort.).  
 FIG. 344.—Praeputial plates of *Allantus mellipes* (Nort.).  
 FIG. 345.—Hind tibia and tarsi of *Monosoma inferentia*.  
 FIG. 346.—Hind tibia and tarsi of *Monostegia abdominalis*.  
 FIG. 347.—Hind tarsi of *Taxonus epicera*.  
 FIG. 348.—Hind tarsi of *Allantus cinctus*.

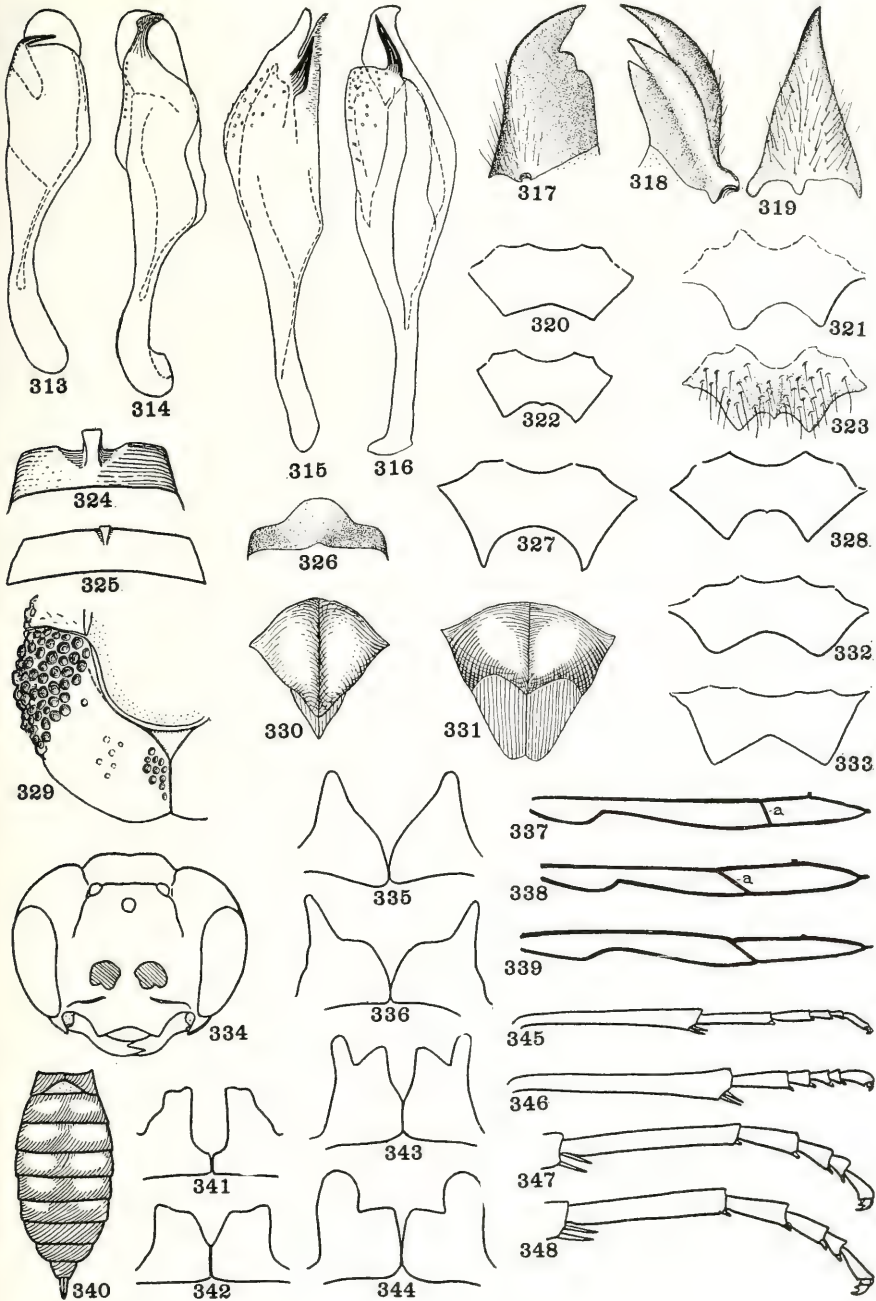


PLATE XV

## PLATE XVI

- FIG. 349.—Antenna of *Tethida cordigera*.  
 FIG. 350.—Antenna of *Valco irrogata* (Cress.).  
 FIG. 351.—Antenna of *Waldheimia pygmaea* (Say).  
 FIG. 352.—Antenna of *Waldheimia carbonaria* (Cress.).  
 FIG. 353.—Antenna of *Lagonis nevadensis* (Cress.).  
 FIG. 354.—Antenna of *Paracharactus rudis* (Nort.).  
 FIG. 355.—Antenna of *Ceratulus spectabilis* MacG.  
 FIG. 356.—Antenna of *Rhadinoceraea aldrichi* (MacG.).  
 FIG. 357.—Tarsal claw of *Claremontia typica* Rohwer.  
 FIG. 358.—Stub of vein 2A&3A of front wing of *Lagonis nevadensis*.  
 FIG. 359.—Stub of vein 2A&3A of front wing of *Phymatocera fumipennis*.  
 FIG. 360.—Stub of vein 2A&3A of front wing of *Paracharactus niger* (Harrington).  
 FIG. 361.—Prepectus of *Tethida cordigera*.  
 FIG. 362.—Prepectus of *Eutomostethus ephippium* (Panzer).  
 FIG. 363.—Apex of lancet of *Lycaota sodalis*.  
 FIG. 364.—Apex of lancet of *Lycaotella spissipes*.  
 FIG. 365.—Head of *Lagonis nevadensis*, lateral aspect.  
 FIG. 366.—Head of *Periclista californica* Roh., lateral aspect.  
 FIG. 367.—Head of *Blennocampa rubi*, lateral aspect.  
 FIG. 368.—Head of *Pareophora minuta* (MacG.), lateral aspect.  
 FIG. 369.—Head of *Valco* sp., lateral aspect.  
 FIG. 370.—Head of *Valco irrogata*, lateral aspect.  
 FIG. 371.—Penis valve of *Lycaota sodalis*.  
 FIG. 372.—Penis valve of *Lycaotella spissipes*.  
 FIG. 373.—Head of *Lagium atroviolaceum* (Nort.), anterior aspect.  
 FIG. 374.—Head of *Aglaostigma rubens* (Cress.), anterior aspect.  
 FIG. 375.—Head of *Macrophyta* sp., anterior aspect.  
 FIG. 376.—Head of *Tenthredo subnigriceps*, lateral aspect.  
 FIG. 377.—Head of *Macrophyta pluricincta*, lateral aspect.  
 FIG. 378.—First and second abdominal tergites of *Rhogogaster viridis* (L.).  
 FIG. 379.—First and second abdominal tergites of *Zaschizonyx montana*.  
 FIG. 380.—Anal veins of front wing of *Lagium atroviolaceum*.  
 FIG. 381.—Anal veins of front wing of *Rhogogaster* sp.  
 FIG. 382.—Left mandible of *Rhogogaster lateraria* (Cress.).  
 FIG. 383.—Middle and hind coxae of *Tenthredo pectoralis* Norton.  
 FIG. 384.—Middle and hind coxae of *Macrophyta lineata* Norton.

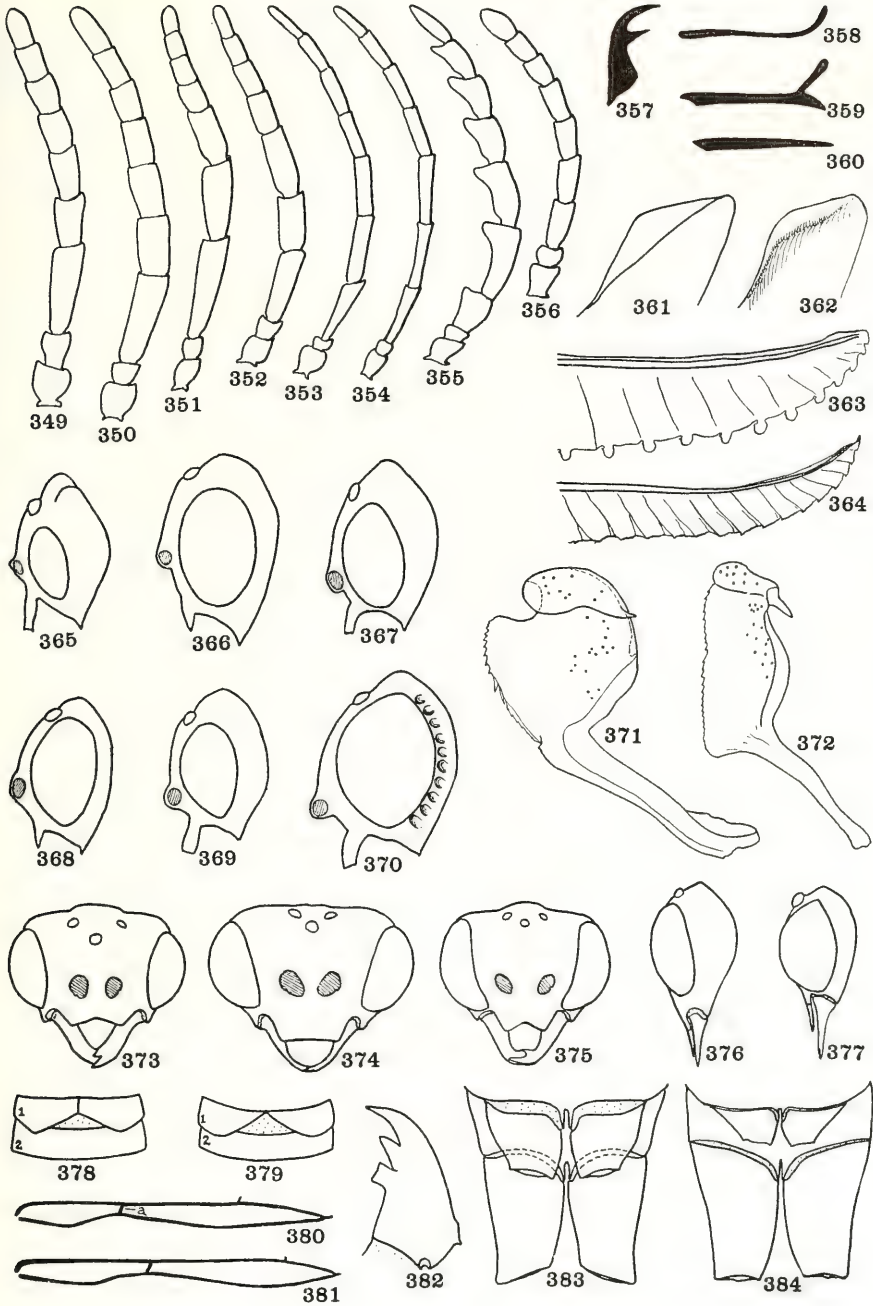


PLATE XVI

## PLATE XVII

- FIG. 385.—Hind femur of *Macrophya pluricincta*.  
 FIG. 386.—Tarsal claw of *Aglaostigma semilutea* (Nort.).  
 FIG. 387.—Portion of front wing of *Xyelecia nearctica*.  
 FIG. 388.—Hind femur of *Tenthredo dubius* (Nort.).  
 FIG. 389.—Tarsal claw of *Leucopelmonus confusus* (Nort.).  
 FIG. 390.—Portion of front wing of *Xyela alberta* (Curr.).  
 FIG. 391.—Sheath of *Xyelecia nearctica*, lateral aspect.  
 FIG. 392.—Portion of front wing of *Xyela* sp.  
 FIG. 393.—Portion of front wing of *Macroxyela ferruginea*.  
 FIG. 394.—Sheath of *Megaxyela aviingrata* (Dyar), lateral aspect.  
 FIG. 395.—Clypeus of *Macroxyela ferruginea*.  
 FIG. 396.—Portion of front wing of *Neurotoma fasciata* (Nort.).  
 FIG. 397.—Sheath of *Macroxyela ferruginea*, lateral aspect.  
 FIG. 398.—Clypeus of *Megaxyela aviingrata*.  
 FIG. 399.—Front tibia of *Acantholyda* sp.  
 FIG. 400.—Portion of front wing of *Neurotoma* sp.  
 FIG. 401.—Portion of front wing of *Acantholyda* sp.  
 FIG. 402.—Sheath of *Xyela* sp., lateral aspect.  
 FIG. 403.—Sheath of *Pleroneura aldrichi*, lateral aspect.  
 FIG. 404.—Tarsal claw of *Cephalcia frontalis* (Newm.).  
 FIG. 405.—Tarsal claw of *Pamphilus* sp.  
 FIG. 406.—Portion of front wing of *Ophrynella nigricans* (Cam.).  
 FIG. 407.—Portion of front wing of *Orussus* sp.  
 FIG. 408.—Seventh abdominal sternite of female *Pamphilus* sp.  
 FIG. 409.—Seventh abdominal sternite of female *Acantholyda* sp.  
 FIG. 410.—Head of *Ophrynopus* sp., anterior aspect.  
 FIG. 411.—Hind femur and tibia of *Ophrynella nigricans*.  
 FIG. 412.—Left mandible of *Cephus clavatus* (Nort.), lateral aspect.  
 FIG. 413.—Left mandible of *Cephus cinctus* Nort., lateral aspect.  
 FIG. 414.—Left mandible of *Hartigia bicincta* (Nort.), lateral aspect.  
 FIG. 415.—Left mandible of *Janus integer*, lateral aspect.  
 FIG. 416.—Antenna of *Cephus clavatus*.  
 FIG. 417.—Tarsal claw of *Janus integer*.  
 FIG. 418.—Antenna of *Cephus tabidus* (L.).  
 FIG. 419.—Antenna of *Hartigia cressonii* (Kby.).  
 FIG. 420.—Tarsal claw of *Hartigia cressonii*.  
 FIG. 421.—Tarsal claw of *Cephus clavatus*.  
 FIG. 422.—Tarsal claw of *Cephus pygmaeus* (L.).  
 FIG. 423.—Apical male sternites of *Cephus pygmaeus*.  
 FIG. 424.—Apical male sternites of *Cephus tabidus*.

## Abbreviations

*M* media  
*Sc*<sub>1</sub> subcosta 1  
*Sc*<sub>2</sub> subcosta 2  
*R*<sub>s</sub> radial-sector

*R*<sub>s1</sub> first branch of radial sector  
*R*<sub>s2</sub> second branch of radial sector  
 2*r* second radial cross-vein

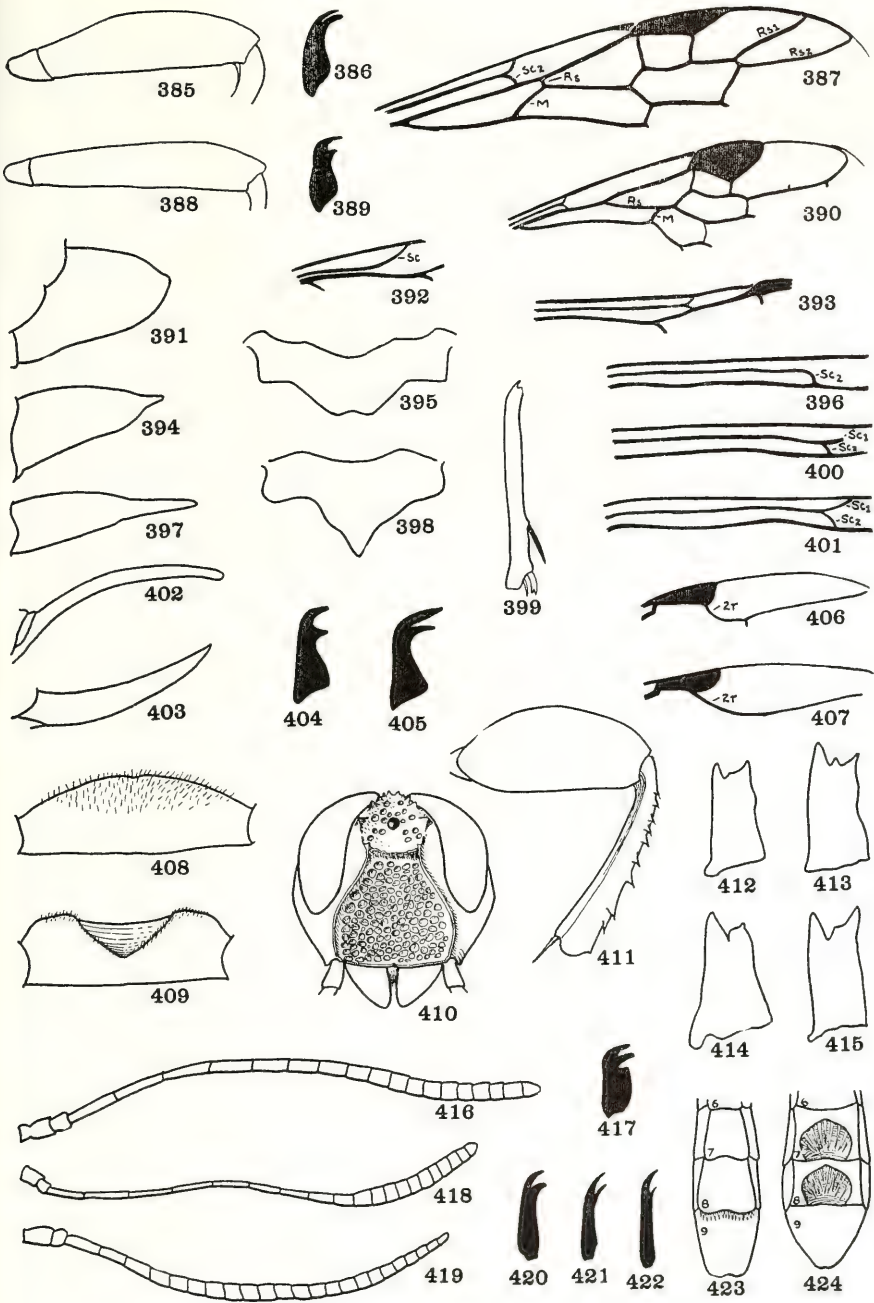


PLATE XVII

## INDEX

- abbottii* Kirby, *Hypolaepus*, 87  
*abbreviatus*, Janus, 116  
*abdominalis* (Fabricius), *Monostegia*, 91  
*abdominalis* Fabricius, *Tenthredo*, 91  
*abdominalis* Panzer, *Tenthredo*, 82  
*Abia* Leach, 59  
*abietinus* Christ, *Pristiphora*, 84  
*abietinus* Scopoli, *Orussus*, 113  
*abnormis* Provancher, *Strongylogaster*, 92  
*Acantholyda* A. Costa, 109  
*Acanthoptenos*, 52  
     *weithii* Ashmead, 52  
*acericaulis* (MacG.), *Caulocampus*, 77  
*acericaulis* MacGillivray, *Priophorus*, 77  
*Acordulecera* Say, 55, 56  
     *dorsalis* Say, 56  
*Acorduleceridae*, 34, 51, 55  
*Adelesta* new genus, 68  
*Adelestinae*, 63, 67  
*Adelomos* Ross, 75, 81  
     *cleone* Ross, 81  
*Adirus* Konow, 116  
*aenea* Norton, *Xyela*, 108  
*aethiops* (Fabricius), *Caliroa*, 70  
*Aglaostigma* Kirby, 102, 103  
     *eburneiguttatum* Kirby, 103  
*agrorum* (Fallén), *Taxonus*, 93  
*alaglossa*, 18  
*albata* Curran, *Neoxyela*, 106  
*albidopictus* Norton, *Taxonus*, 65  
*albipennis* Zaddach, *Tenthredo*, 98  
*albipes* Gmelin, *Tenthredo*, 98  
*Aleiodes*, 32  
*algericus* Dovnar-Zapolskij, *Paradirus*, 116  
*Allantinae*, 63, 88  
*Allantini*, 89  
*Allantus* Panzer, 89, 92  
*alni* L., *Tenthredo*, 78  
*alternans* A. Costa, *Lyda*, 110  
*Amauronematus* Konow, 76, 77, 88  
     *vaculus* MacGillivray, 85  
*amelanchieridis* (Rohwer), *Varna*, 79  
*americana* Provancher, *Dineura*, 79  
*Ametastegia*, 89, 91, 92  
     *equiseti* (L.), 92  
     *fulvipes* A. Costa, 92  
     *glabrata* (Fallén), 92  
     *recens* (Say), 92  
     *tener* (Fallén), 92  
*Anachoreta* Gistel, 58  
*andrei* Konow, *Ophrynopus*, 114  
*anepimeron*, 27  
*Aneugmenus* Hartig, 65, 66  
     *flavipes* var. *flavitarsis* Rohwer, 66  
*annulatus* MacGillivray, *Leucopelmonus*, 103  
*Anoplolyda* A. Costa, 110  
*Anoplonyx* Marlatt, 75, 81  
     *laricis* (Marlatt), 82  
     *occidens* new name, 82  
*antacoila*, 10  
*antennae*, 10, 20  
*antennal sclerites*, 10  
*antennal socket*, 10  
*Aomodyctium* Ashmead, 92  
*Apericlista* Enslin, 98  
*Aphadnurus* O. Costa, 72  
     *tantillus* Costa, 72  
*Aphanisus* MacGillivray, 98  
     *lobatus* MacGillivray, 98  
*Aphilodyctium* Ashmead, 89, 92  
     *fidum* (Cresson), 92  
*apicalis* Say, *Strongylogaster*, 93  
*Apocrita*, 32, 42  
*appendiculatus* Hartig, *Diphadnus*, 84  
*Ardis*, 99  
*Arge* Schrank, 52  
     *macleayi* (Leach), 52  
*Argidae*, 34, 51  
*arizonensis* Ashmead, *Eriocampidea*, 65  
*arvensis* Panzer, *Cephalcia*, 109  
*Astatus* Jurine, 115  
*Astatus* Panzer, 115  
     *satyrus* Panzer, 116  
*Astochus* MacGillivray, 103  
     *fletcheri* MacGillivray, 103  
*aterrima* Klug, *Tenthredo* (*Allantus*), 100  
*atlas*, 23  
*Atomacera* Say, 52  
     *debilis* Say, 52  
     *ruficollis* Norton, 52  
*Atomostethus* Enslin, 97  
*atra* L., *Tenthredo*, 105



- atroviolaceum Norton, Tenthredo, 103  
 atrum MacGillivray, Phrontosoma, 93, 94  
 Augomonoctenus Rohwer, 57  
   libocedrii Rohwer, 57  
 auiingrata Dyar, Pleroneura, 107
- Bactroceros Konow, 110  
 bakeri MacGillivray, Neocharactus, 98  
 bardus Say, Tenthredo, 97  
 basal plates, 29  
 basal ring, 30  
 basisternum, 23  
 belfragei (Cresson), Phrontosoma, 94  
 belfragei Cresson, Selandria, 94  
 bethunei MacGillivray, Metallus, 72  
 betulae Enslin, Pseudoxiphydria, 111  
 betuleti Klug, Tenthredo (Allantus), 70  
 bimaculatus, Janus, 116  
 biology, 46  
 Bivena MacGillivray, 103  
   maria MacGillivray, 103  
 Blennocampa Hartig, 96, 98  
   pygmaea Say, 98  
 Blennocampinae, 64, 95  
 Brachyphatnus Konow, 54  
 Braconid head, 14  
 Braconidae, 42  
 brazilensis Brullé, Tenthredo, 98  
 brevis Klug, Tenthredo (Allantus), 77  
 bruniventris (Cresson), Lyrola, 55  
 bruniventris Cresson, Schizocera, 55  
 bustia, 16  
 Buprestidae, 41
- Caenocephus Konow, 114, 115  
   jakowleffi Konow, 115  
 Caenolyda Konow, 109  
 Calameuta Konow, 115  
 californica Ashmead, Manoxyela, 107  
 californicus Marlatt, Gymnonychus, 84  
 Caliroa O. Costa, 69, 70  
   aethiops (Fabricius), 70  
   cerasi (L.), 70  
   cinxia (Klug), 70  
   nortonia MacGillivray, 94  
   sebetia O. Costa, 70  
 camelus L., Ichneumon, 111  
 Camponiscus E. Newman, 82  
   healaei E. Newman, 82  
 canadense Provancher, Xiphidion, 111  
 canadensis (Marlatt), Profenusa, 72  
 canadensis Marlatt, Scolioneura, 72  
 candidula Fallén, Tenthredo, 90  
 capitalis (Norton), Entodecta, 71  
 capitalis Norton, Selandria, 71  
 capreae Panzer, Nematus, 85  
 carbonaria (Cresson), Waldheimia, 98  
 cardo, 16, 30  
 caryicolum Dyar, Isodyctium, 98  
 Caulocampus Rohwer, 75, 77  
   acericaulis (MacG.), 77  
 cenchri, 26  
 Cepha Billberg, 116  
 Cephalcia Panzer, 109  
   arvensis Panzer, 109  
   signata (Fabricius), 109  
 Cephaleia Jurine, 109  
 Cephidae, 51, 114  
 Cephoidae, 33, 114  
 Cephosoma Gradl, 116  
   syringae Gradl, 116  
 Cephus Latreille, 115  
   filiformis Eversmann, 115  
   tabidus (Fabricius), 116  
   trimaculatus Say, 116  
 cerasi (L.), Caliroa, 70  
 Ceratulus MacGillivray, 95, 100  
   spectabilis MacGillivray, 100  
 Cerobactrus O. Costa, 116  
 cervical sclerites, 22  
 cervicum, 10  
 Cimbex Olivier, 59, 60  
 Cimbicidae, 34, 51, 59  
 cinctus L., Tenthredo, 92  
 cingulata Fabricius, Tenthredo, 67  
 cinxia (Klug), Caliroa, 70  
 chloreus Norton, Nematus, 85  
 chlorea (Norton), Pristiphora, 83, 85  
 Cladiinae, 64, 72  
 Cladius Rossi, 73, 74  
   isomerus Norton, 74  
 Claremontia Rohwer, 96, 97  
   typica Rohwer, 97  
 Clavellaria Lamarck, 60  
 Clavellarius Olivier, 60  
 cleone Ross, Adelomos, 81  
 closed head, 11  
 clypealiae, 10  
 clypeatum Rohwer, Zalagium, 105  
 clypeus, 10  
 Cockerelloniscus MacGillivray, 65  
   occidentalis MacGillivray, 65

- collaris* MacGillivray, *Phrontosoma*, 94  
*collaris* MacGillivray, *Profenusa*, 72  
*collaris* Rohwer, *Schizocerus*, 55  
*coloradensis* Weldon, *Emphytus*, 92  
*columba* (L.), *Tremex*, 113  
*columbiana* Provancher, *Labidia*, 105  
*compound eyes*, 10  
*compressus* (Fabricius), *Janus*, 116  
*confusus* (Norton), *Leucopelmonus*, 103  
*connectens* Stephens, *Janus*, 116  
*contigua* Konow, *Strongylogaster*, 67  
*Copiosoma* Kirby, 116  
*cordigera* (Beauvois), *Tethida*, 97  
*cordigera* Beauvois, *Tenthredo*, 97  
*coronata* Klug, *Tenthredo* (*Emphytus*),  
66  
*coronatus* Fabricius, *Orussus*, 113  
*corpulentarium*, 13  
*Coryna* Lepeletier, 66  
*Corynia*, 52  
*rosarum* Imhof et Labram, 52  
*coxa*, 27  
*Crabro* Geoffroy, 59  
*humeralis* Fourcroy, 59  
*crassa*, 10  
*crassa* Fallén, *Tenthredo*, 87  
*Craterocercus* Rohwer, 75, 78  
*craverii* A. Costa, *Laurentia*, 103  
*crawii* Provancher, *Sphacophilus*, 54  
*crossonii* (Kirby), *Hartigia*, 116  
*crevecoeuri* Ashmead, *Opisthoneura*, 104  
*Cristiger* Gistel, 58  
*crocea* (Fourcroy), *Hemichroa*, 79  
*crocea* Fourcroy, *Tenthredo*, 79  
*Croesus* Leach, 75, 88  
*Cryptocampus* Hartig, 87  
*Cryptus* Jurine, 52  
*Cryptus* Panzer, 52  
*segmentarius* Panzer, 52  
*cupressi* R. & M., *Susana*, 77  
*Cyphona* Dahlbom, 54  
  
*daekei* MacGillivray, *Phrontosoma*, 94  
*dahli* Hartig, *Xyela*, 107  
*debilis* Say, *Atomacera*, 52  
*Decatria* Stephens, 70  
*decorata* Cress., *Selandria*, 66  
*delta* Provancher, *Pachyprotasis*, 103  
*Dicerca*, 41  
*difformis* Panzer, *Tenthredo*, 74  
*dimmockii* Cresson, *Nematus*, 86  
  
*Dimorphopteryx* Ashmead, 89, 94  
*Dineura americana* Provancher, 79  
*Dineuridea* Rohwer, 81  
*Diphadnus* Hartig, 84  
*appendiculatus* Hartig, 84  
*Diprion* Schrank, 57, 58  
*grandis* Rohwer, 58  
*Diprionidae*, 34, 51, 56  
*distantes*, 16  
*distans* Norton, *Strongylogaster*, 67  
*dohrnii* Tischbein, *Kaliosysphinga*, 72  
*Dolerinae*, 63, 68  
*Dolerus* Jurine, 68  
*Dolerus* Panzer, 68  
*minutus* Hartig, 79  
*pallimacula* Lepeletier, 90  
*pedestris* Panzer, 69  
*pratensis* (L.), 69  
*dorsalis* Say, *Acordulecera*, 56  
*Dosytheus* Leach, 69  
*Druida* E. Newman, 70  
*parviceps* E. Newman, 70  
*dubia* Cresson, *Selandria*, 97  
*dubitatus* Norton, *Taxonus*, 65  
*duplaglossa*, 20  
*dyari* Rohwer, *Hemichroa*, 79  
  
*early sawfly stem*, 38  
*eburneiguttatum* Kirby, *Aglaostigma*, 103  
*ectogalea*, 16  
*eglanteriae* Fabricius, *Tenthredo*, 69  
*Emphytina* Rohwer, 92  
*pulchella* Rohwer, 92  
*Emphytus* Klug, 92  
*coloradensis* Weldon, 92  
*maculatus* Norton, 90  
*Empria* Lepeletier, 89, 90  
*tridens* Konow, 90  
*Enages* Gistel, 78  
*Endelomyia* Ashmead, 70  
*endogalea*, 16  
*enodis* L., *Tenthredo*, 52  
*Entodecta* Konow, 70, 71  
*capitalis* (Norton), 71  
*humilis* Konow, 71  
*epicera* Say, *Taxonus*, 93  
*epicranial suture*, 10  
*epimeral suture*, 27  
*Epitaxonus* MacGillivray, 65  
*Ephippionotus* O. Costa, 116  
*ephippium* Panzer, *Tenthredo*, 97

- equiseti (L.), *Ametastegia*, 92  
*Erasminus* Gistel, 82  
*Eriocampa* Hartig, 89, 94  
*Eriocampidea* Ashmead, 64, 65  
   *arizonensis* Ashmead, 65  
*Eriocampini*, 90  
*Eriocampoides* Konow, 70  
*Ermilia* O. Costa, 93  
   *pulchella* O. Costa, 93  
*Erythraspides* Ashmead, 98  
*erythrocephala* L., *Tenthredo*, 109  
*erythrothorax* Rohwer, Marlattia, 81  
*Eumetabolus* Schulz, 116  
*Eupareophora*, 99  
*eustipes*, 16  
*Eustromboceros* Rohwer, 65, 66  
*Eutomostethus* Enslin, 95, 97  
*Euura* E. Newman, 75, 76, 87  
   *gallae* E. Newman, 87  
   *hoppingi* new name, 88  
*excavata* Norton, *Macrophya*, 94  
 eye sclerite, 10  
  
*fallax* Lepeletier, *Nematus*, 88  
 family groupings, 34  
 families, key to, 51  
*fasciata* L., *Tenthredo*, 59  
*faunus* Newman, *Phyllococcus*, 116  
 female, 50  
 femur, 27  
*Fenusa* Leach, 70, 72  
   *pusilla* (Lepeletier), 72  
   *ulmi* Sundevall, 72  
*ferruginea* Say, *Xyela*, 108  
*fidala* new species, Kerita, 80  
*fidum* (Cresson), *Aphilodyctium*, 92  
*filicis* Klug, *Tenthredo*, 67  
*filiformis* Eversmann, *Cephus*, 115  
 first abdominal tergum, 29  
*flavans* Klug, *Selandria*, 66  
*flavescens* Thomson, *Selandria*, 66  
*flavipes* var. *flavitarsis* Rohwer, *Aneug-*  
   *menus*, 66  
*flaviventris* L., *Tenthredo*, 109  
*fletcheri* MacGillivray, *Astochus*, 103  
*floridana* MacGillivray, *Selandria*, 66  
*14-punctata* Norton, *Tenthredo*, 103  
 front, 10  
*frontalis* Westwood, Lyda, 109  
*fulvipes* A. Costa, *Ametastegia*, 92  
*furcata* Fabricius, *Hylotoma*, 54  
  
*furcella*, 23  
*fusca* Malaise, *Pontopristia suavis* var.,  
   88  
*fuscicornis* Fabr., *Sirex*, 112  
*fuscicornis* Hartig, *Nematus*, 84  
  
*galea*, 16  
*gallae*, E. Newman, *Euura*, 87  
*gallicola* Stephens, *Nematus*, 87  
*genae*, 10  
 genapontal head, 12  
 genital capsule, 30  
*gibbosa* Fallén, *Tenthredo*, 103  
*gigas* L., *Ichneumon*, 112  
*glabrata* (Fallén), *Ametastegia*, 92  
*gonager* Fabricius, *Tenthredo*, 68  
*Gongylocorsia* Konow, 109  
*gonamaculae*, 30  
*gonocardo*, 30  
*gonostipes*, 30  
*gracilis* Marlatt, *Pontania*, 88  
*grandis* Lepeletier, *Nematus*, 73  
*grandis* Rohwer, *Diprion*, 58  
*gregarius* (Marlatt), *Micronematus*, 86  
*gregarius* Marlatt, *Pachynematus*, 86  
*guana* MacGillivray, *Pareophora*, 99  
*guara* MacGillivray, *Pareophora*, 99  
*guttatum* Fallén, *Tenthredo*, 90  
*Gymnonychus* Marlatt, 84  
   *californicus* Marlatt, 84  
  
*harpes*, 30  
*Harpiphorus varianus* Norton, 93  
*Hartigia* Schiödte, 116  
   *cressonii* (Kirby), 116  
   *linearis* (Schrank), 116  
   *nigra* (Harris), 116  
   *trimaculatus* (Say), 116  
 head capsule, 9  
 head types, 11  
   closed, 11  
   genapontal, 11  
   maxapontal, 11  
   open, 11  
*healaei* E. Newman, *Camponiscus*, 82  
*Hemichroa* Stephens, 75, 76, 78  
   *crocea* (Fourcroy), 79  
   *dyari* Rohwer, 79  
   *pallida* Ashmead, 79  
   *phytophagica* Dyar, 78  
   *washingtonia* R. & M., 79

- Hemitaxonus* Ashmead, 64, 65  
*Heterarthrus* Stephens, 70  
*hieroglyphica* Christ, Tenthredo, 109  
*histrionicus* MacGillivray, Parabates, 71  
*Holcoeneme* Konow, 87  
*Homoeoneura* Ashmead, 103  
*Hoplocampa* Hartig, 75, 77  
   *laricis* Marlatt, 81  
   *montana* Cresson, 104  
*hoppingi* new name, Euura, 88  
*host* plants, 47  
*humeralis* Fourcroy, Crabro, 59  
*humilis* Konow, Entodecta, 71  
*hyaline* Norton, Themis, 55  
*hyalinus* MacGillivray, Neotomostethus, 84  
*Hybonotus* Klug, 111  
*Hylotoma* Latreille, 52  
   *macleayi* Leach, 52  
   *furcata* Fabricius, 54  
Hymenoptera, 50  
*Hypargyricus* MacGillivray, 100  
   *infuscatus* MacGillivray, 100  
*hypogastricus* Hartig, Nematus (Leptopus), 82  
*Hypolaepus* Kirby, 87  
   *abbottii* Kirby, 87  
*Hypotaxonus* Ashmead, 93  
*hypothesis* of genealogy, 35  
  
*Ichneumon* *camelus* L., 111  
   *gigas* L., 112  
   *spectrum* L., 112  
*ignotus* Norton, Selandria, 90  
*inferentia* Norton, Taxonus, 91  
*infuscatus* MacGillivray, Hypargyricus, 100  
*irrogata* Cresson, Selandria, 99  
*Isodyctium* Ashmead, 98  
   *caryicolum* Dyar, 98  
*isomerus* Norton, Cladius, 74  
*Itycorsia* Konow, 109  
  
*jakowleffi* Konow, Caenocephus, 115  
*jakowlewi* Semenov, Parabia, 59  
*Janus* Stephens, 114, 116  
   *abbreviatus*, 116  
   *bimaculatus*, 116  
   *compressus* (Fabricius), 116  
   *connectens* Stephens, 116  
   *luteipes* (Lepeletier), 116  
   *johnsoni* MacGillivray, Schizocerus, 55  
   *julii* Brebisson, Pinicola, 106  
   *juniperi* L., Tenthredo, 57  
   *juniperi* Rohwer, Platycampus, 82  
   *juvencus* L., Sirex, 112  
  
*Kaliofenusa* Viereck, 72  
*Kaliosysphinga* Tischbein, 72  
   *dohrnii* Tischbein, 72  
*katepimeron*, 27  
*Kelidoptera* Konow, 110  
*Kerita* new genus, 75, 80  
   *fidala* new species, 80  
Keys, 50  
*Kincaidia* MacGillivray, 103  
*kincaidi* Marlatt, Pontania, 88  
*Konowia* Brauns, 111  
   *megapolitana* Brauns, 111  
  
*Labidia* Provancher, 105  
   *columbiana* Provancher, 105  
   *opimus* Cresson, 105  
*labrum*, 15  
*lacinia*, 16  
*Lagium* Konow, 102, 103  
*Lagonis* new genus, 96, 99  
   *nevadensis* (Cresson), 100  
   *laricis* (Marlatt), Anoplonyx, 82  
   *laricis* Marlatt, Hoplocampa, 81  
   *laricis* R. & M., Platycampus (Anoplonyx), 82  
   larval characters, 45  
*Laurentia* A. Costa, 103  
   *craverii* A. Costa, 103  
   *rubens* (Cress.), 103  
   *semilutea* (Norton), 103  
*lecontei* Fitch, Lophyrus, 58  
*legs*, 27  
*Leptocerca* Hartig, 78  
*Leptocercus* Thomson, 78  
*Leptopus* Hartig, 82  
*Leston* new subgenus, 53, 54  
*Leucepmpria* Enslin, 90  
*Leucopelmonus* MacGillivray, 102, 103  
   *annulatus* MacGillivray, 103  
   *confusus* (Norton), 103  
   *leucostomus* Rohwer, Parabates, 71  
   *leucostomus* Rohwer, Paracharactus, 100  
   *libocedrii* Rohwer, Augomonotenus, 57  
   *lichtwardti* Konow, Rhogogaster, 104  
   *limacina* Retzius, Tenthredo, 70

- linearis* (Schrank), Hartigia, 116  
*lineata* Christ, Strongylogaster, 67  
*lineatus* Rohwer, Schizocerus, 54  
*lineolata* Klug, Tenthredo (Allantus), 98  
*Liolyda* Ashmead, 109  
*lobatus* MacGillivray, Aphanisus, 98  
 Loboceridae, 34  
*Loderus* Konow, 69  
*longulus* Norton, Strongylogaster, 67  
*Lophyrus* Latreille, 58  
     *lecontei* Fitch, 58  
*lucida* Panzer, Tenthredo (Nematus), 87  
*lucorum* L., Tenthredo, 59  
*luridiventris* (Fallén), Platycampus, 82  
*luridiventris* Konow, Pareophora, 99  
*lutea* L., Tenthredo, 60  
*luteipes* (Lepeletier), Janus, 116  
*luteiventris* Klug, Tenthredo, 97  
*luteiventris* O. Costa, Ehippionotus, 116  
*Lycaota* Konow, 101  
*Lycaotella* Ross, 101  
*Lycaotinae*, 64, 101  
*Lyda* Fabricius, 110  
     *alternans* A. Costa, 110  
     *frontalis* Westwood, 109  
     *maculipennis* Stein, 110  
     *mandibularis* Zaddach, 109  
*Lygaeonematus* Konow, 84  
*Lyrola* new genus, 52, 55  
     *brunniventris* (Cresson), 55  
  
*MacGillivraya* Ashmead, 77  
     *oregonensis* Ashmead, 77  
*MacGillivrayella* Ashmead, 77  
*macleayi* (Leach), Arge, 52  
*Macremphytus* MacGillivray, 89, 93  
*Macrocephus ulmariae* Schlectendal, 116  
*Macrophyta* Dahlbom, 103, 105  
     *excavata* Norton, 94  
     *montana* Scopoli, 105  
     *nebulosa* Ed. André, 103  
*Macrophyopsis* Enslin, 103  
*Macroxyela* Kirby, 106, 108  
*maculatus* Norton, Emphytus, 90  
*maculipennis* Stein, Lyda, 110  
*major* Cresson, Xyela, 107  
*malaisei* Conde, Neurosiobla, 104  
*male*, 50  
*male genitalia*, 30  
*malvacearum* Cockerell, Neoptilia, 54  
     *mandible*, 10, 15  
     *mandibulariae*, 10  
     *mandibularis* Zaddach, Lyda, 109  
*Manoxyela* Ashmead, 107  
     *californica* Ashmead, 107  
*Manubria*, 30  
*maria* MacGillivray, Bivena, 103  
*Marlattia* Ashmead, 81  
     *erythrothorax* Rohwer, 81  
*martini* MacGillivray, Monostegia, 91  
*martini* MacGillivray, Neopareophora, 81  
*Mastigocerus* Klug, 106  
*mathesoni* MacGillivray, Phlebotrophia, 70  
*maxacava*, 11  
*maxapontal head*, 11  
*maxillae*, 16  
*maxillariae*, 10  
*median sclerotized style*, 30  
*medullaris* Hartig, Nematus (Cryptocampus), 87  
*Megalodontidae*, 108  
*Megalodontoidea*, 33, 35, 106  
*megapolitana* Brauns, Konowia, 111  
*Megaxyela* Ashmead, 106, 107  
*Melanobates* MacGillivray, 71  
*melanopterus* Rohwer, Stromboceros (Eustromboceros), 66  
*Melanoselandria* Ashmead, 100  
     *zabriskei* Ashmead, 100  
*mellipes* Harris, Xiphidria, 111  
*mentum*, 19  
*mesoepimeron*, 27  
*mesoepisternum*, 27  
*Mesoneura*, 78  
*mesonotum*, 25  
*mesopleurae*, 26  
*mesosternum*, 24  
*Metallus* Forbes, 70, 71  
     *bethunei* MacGillivray, 72  
     *rohweri* MacGillivray, 72  
     *rubi* Forbes, 71, 72  
*metapleurae*, 27  
*metanotum*, 26  
*metatentorium*, 13  
*methods*, 7  
*mexicana* Ashmead, Neoptilia, 54  
*micans* Klug, Tenthredo (Allantus), 100  
*Micrarge* Ashmead, 52

- Micronematus* Konow, 76, 77, 86  
   *gregarius* (Marlatt), 86  
   *monogyniae* (Hartig), 86  
*militaris* Cresson, *Nematus*, 79  
*minuta* (MacGillivray), *Pareophora*, 99  
*minutus* Hartig, *Dolerus* (*Pelmatopus*), 79  
*minutus* MacGillivray, *Monophadnus*, 99  
*Mogerus* MacGillivray, 98  
*mola*, 16  
*Monardis*, 99  
*Monoctenus* Hartig, 57  
*monogyniae* (Hartig), *Micronematus*, 86  
*Monophadnoides* Ashmead, 98  
*Monophadnus* Hartig, 98  
   *minutus* MacGillivray, 99  
   *rubi* Harris, 98  
*Monosoma* MacGillivray, 89, 91  
*Monosoma* Viereck, 91  
*Monostegia* O. Costa, 89, 91  
   *abdominalis* (Fabricius), 91  
   *martini* MacGillivray, 91  
   *nearctica* Rohwer, 91  
   *quercus-alba* Norton, 70  
   *rosae* Harris, 70  
*Monsoma* MacGillivray, 91  
*montana* Cresson, *Hoplocampa*, 104  
*montana* (Cresson), *Zaschizonyx*, 104  
*montana* Scopoli, *Macrophya*, 105  
*multicinctus* Rohwer, *Tomostethus*, 96  
*multicolor* Norton, *Taxonus*, 90  
  
*nearctica* Rohwer, *Monostegia*, 91  
*nearctica* Ross, *Xyelecia*, 107  
*nebulosa* Ed. André, *Macrophya*, 103  
*Nematinae*, 63, 64, 74  
*Nematinus* Rohwer, 75, 76, 82  
*Nematus* Panzer, 76, 77, 86, 87  
   *capreae* Panzer, 85  
   *chloreus* Norton, 85  
   *dimmockii* Cresson, 86  
   *fallax* Lepeletier, 88  
   *fuscicornis* Hartig, 84  
   *gallicola* Stephens, 87  
   *grandis* Lepeletier, 73  
   *hypogastricus* Hartig, 82  
   *medullaris* Hartig, 87  
   *militaris* Cresson, 79  
   *pallifrons* Cresson, 85  
   *pectoralis* Lepeletier, 81  
   *pilicornis* Dahlbom, 73  
   *pini* Retzius, 84  
   *pullus* Förster, 86  
   *ventralis* Say, 87  
*nemorata* Fallén, *Phyllotoma*, 70  
*Neocharactus* MacGillivray, 98  
   *bakeri* MacGillivray, 98  
*Neodiprion* Rohwer, 57, 58  
*Neopareophora* MacGillivray, 75, 81  
   *martini* MacGillivray, 81  
*Neoptilia* Ashmead, 53, 54  
   *malvacearum* Cockerell, 54  
   *mexicana* Ashmead, 54  
*Neopus* Viereck, 103  
*Neotomostethus* MacGillivray, 84  
   *hyalinus* MacGillivray, 84  
*Neoxyela* Curran, 106, 107  
   *alberta* Curran, 106  
*Neurosiobla* Conde, 104  
   *malaisei* Conde, 104  
*Neurotoma* Konow, 109  
*nevadensis* (Cresson), *Lagonis*, 100  
*nevadensis* Cresson, *Selandria*, 100  
*niger* Norton, *Ptenos*, 53  
*nigra* (Harris), *Hartigia*, 116  
*nigricans* Cameron, *Oryssus*, 113  
*nigrilabris* Rohwer, *Zamacrophya*, 105  
*nigripes* (Klug), *Pareophora*, 99  
*nigrita* Fabricius, *Tenthredo*, 96  
*nitida* Klug, *Tenthredo* (*Allantus*), 93  
*nortonia* MacGillivray, *Caliroa*, 94  
*nova* Norton, *Selandria*, 68  
  
*obscuratus* MacGillivray, *Paracharactus*, 97  
*occidens* new name, *Anoplonyx*, 82  
*occidentalis* MacGillivray, *Cockerellonis*, 65  
   occipital region, 10  
   occipital suture, 10  
   occipitopostgenal suture, 10  
   ocelli, 10  
*ochropoda* Klug, *Tenthredo* (*Emphytus*), 70  
*oculata*, 10  
*odontoidea*, 10  
*Odontophyes* Konow, 107  
   open head, 11  
*Ophrynella* new genus, 113  
*Ophrynopus* Konow, 113, 114  
   *andrei* Konow, 114  
*opimus* Cresson, *Labidia*, 105  
*Opisthoneura* Ashmead, 104  
   *crevecoeuri* Ashmead, 104

- oregonensis Ashmead, MacGillivraya, 77  
 Orthandria, 30, 36, 37  
 Orussidae, 35, 51, 113  
 Orussus Latreille, 113  
   abietinus Scopoli, 113  
   coronatus Fabricius, 113  
 Oryssus Fabricius, 113  
   nigricans Cameron, 113  
 ovata L., Tenthredo, 94  
 oxalata MacGillivray, Pseudoselandria,  
   66  
 Pachynematus Konow, 76, 85  
   gregarius Marlatt, 86  
   rarus MacGillivray, 86  
   trisinatus (Förster), 85  
 Pachyprotasis Hartig, 105  
   delta Provancher, 103  
 pacificus MacGillivray, Simplemphytus,  
   92  
 pacifica Marlatt, Pontania, 88  
 pallida Ashmead, Hemichroa, 79  
 pallifrons Cresson, Nematus, 85  
 pallimacula Lepeletier, Dolerus (Em-  
   pria), 90  
 pallipes (Lepeletier), Priophorus, 73  
 pallipes (Lepeletier), Pristiphora, 84  
 pallipes Say, Strongylogaster, 93  
 palpi, 16, 19  
 palpifer, 16  
 Pamphiliidae, 35, 51, 108  
 Pamphilius Latreille, 110  
 Parabates MacGillivray, 71  
   histrionicus MacGillivray, 71  
   leucostomus Rohwer, 71  
 Parabia jakowlewi Semenov, 59  
 Paracharactus MacGillivray, 95, 96, 97  
   leucostomus Rohwer, 100  
   obscuratus MacGillivray, 97  
 paracoila, 10  
 Paradirus Dovnar-Zapolskij, 116  
   algoricus Dovnar-Zapolskij, 116  
 paraglossae, 19  
 Parallomma Malaise, 103  
 parapenes, 30  
 parascutellar areas, 25  
 Paraselandria Ashmead, 66  
 Parasiobla Ashmead, 93  
 parastipes, 16  
 Parataxonus MacGillivray, 90  
 Paraxyela MacGillivray, 107  
 Pareophora Konow, 96, 99  
   guana MacGillivray, 99  
   guara MacGillivray, 99  
   luridiventris Konow, 99  
   minuta (MacGillivray), 99  
   nigripes (Klug), 99  
   parva (Norton), Pseudodineura, 80  
   parviceps E. Newman, Druida, 70  
   parvula Klug, Tenthredo (Allantus), 79  
 Paururus Konow, 112  
 Pectinia Brullé, 100  
 pectoralis Lepeletier, Nematus, 81  
 pedestris Panzer, Dolerus, 69  
 Pelmatopus Hartig, 79  
 penis, 30  
 penis valves, 30  
 Pergidae, 34  
 Periclista Konow, 96, 98  
 Periclistoptera Ashmead, 70  
 Perineura, 103  
 Perreyiidae, 34  
 Phlebotrophia MacGillivray, 70  
   mathesoni MacGillivray, 70  
 phragma, 25  
 Phrontosoma MacGillivray, 89, 93  
   atrum MacGillivray, 93, 94  
   belfragei (Cresson), 94  
   collaris MacGillivray, 94  
   daekei MacGillivray, 94  
 Phrontosomini, 90  
 Phylogeny, 48, 62  
 Phylloecus Newman, 116  
   faunus Newman, 116  
 Phyllotoma Fallén, 69, 70  
   nemorata Fallén, 70  
   vagans Fallén, 70  
 Phyllotominae, 63, 64, 69  
 Phymatocera Dahlbom, 95, 100  
 phytophagica Dyar, Hemichroa, 78  
 Pikonema new genus, 76, 86  
 pilicornis Dahlbom, Nematus (Prio-  
   phorus), 73  
 pilosulus Rohwer, Stromboceros (Strom-  
   boceridea), 66  
 pinguis Norton, Strongylogaster, 94  
 pini L., Tenthredo, 58  
 pini Retzius, Nematus, 84  
 Pinicola Brebisson, 106  
   julii Brebisson, 106  
 pisum Walsh, Pontania, 88  
 Platycampus Schiödte, 75, 82  
   juniperi Rohwer, 82  
   laricis R. & M., 82  
   luridiventris (Fallén), 82

- Pleroneura* Konow, 106, 107  
   *aviingrata* Dyar, 107  
*pleural suture*, 27  
*Pleuroneura* Ashmead, 107  
*Poecilosoma* Thomson, 90  
*Poecilostoma* Dahlbom, 90  
*Poecilostomidea* Ashmead, 90  
*politus* Prov., *Strongylogaster*, 67  
*Polybates* MacGillivray, 71  
   *secundus* Rohwer, 71  
   *slossonae* MacGillivray, 71  
*Polyselandria* MacGillivray, 66  
*Polystichophagus* Ashmead, 67  
*Polytaxonus* MacGillivray, 92  
*pomum* Walsh, *Pontania*, 88  
*Pontania* O. Costa, 87  
   *gracilis* Marlatt, 88  
   *kincaidi* Marlatt, 88  
   *pacifica* Marlatt, 88  
   *pisum* Walsh, 88  
   *pomum* Walsh, 88  
*Pontopristia* Malaise, 88  
   *suavis fusca* Malaise, 88  
*postclypeus*, 10  
*postcoila*, 10  
*postnotum*, 25  
*post-tergite*, 25  
*praescutum*, 25  
*pratensis* (L.), *Dolerus*, 69  
*pratorum* Fallén, *Tenthredo*, 69  
*preapical spurs*, 27  
*preclypeus*, 10  
*prepectus*, 26  
*presternal bridge*, 24  
*pretentoria*, 13  
*Priophorus* Dahlbom, 73  
   *acericaulis* MacGillivray, 77  
   *pallipes* (Lepeletier), 73  
*Pristiphora* Latreille, 75, 76, 77, 83, 84  
   *abietinus* Christ, 84  
   *chlorea* (Norton), 85  
   *pallipes* (Lepeletier), 84  
*probasisternum*, 23  
*Profenusa* MacGillivray, 70, 72  
   *canadensis* (Marlatt), 72  
   *collaris* MacGillivray, 72  
*pronotum*, 25  
*propleurae*, 22  
*propleurodeme*, 23  
*propodeum*, 29  
*Prosecriis* Gistel, 90  
*prosternum*, 23  
*prostheca*, 16  
*Protemphytus* Rohwer, 91, 92  
*Prototaxonus* Rohwer, 67  
   *typicus* Rohwer, 67  
*Protoxyela* MacGillivray, 108  
*proxadentes*, 16  
*Pseudodineura* Konow, 75, 79  
   *parva* (Norton), 80  
*Pseudoselandria* MacGillivray, 66  
   *oxalata* MacGillivray, 66  
*Pseudosiobla* Ashmead, 88, 94  
*Pseudotaxonus* A. Costa, 67  
*Pseudoxiphydria* Enslin, 111  
   *betulae* Enslin, 111  
*Ptenos* Norton, 53  
   *niger* Norton, 53  
*Pteronidea* Rohwer, 85, 86, 87  
*Pteronus* Jurine, 58  
   *quercus* Marlatt, 85  
   *testaceus* Jurine, 84  
*Pterygophoridae*, 34, 56  
*pulchella* O. Costa, *Ermilia*, 93  
*pulchella* Rohwer, *Emphytina*, 92  
*pullus* Förster, *Nematus*, 86  
*pumila* Klug, *Tenthredo* (*Allantus*), 71, 72  
*pumilus* Klug, *Tenthredo* (*Emphytus*), 72  
*pusilla* Dalman, *Xyela*, 106  
*pusilla* Klug, *Tenthredo* (*Allantus*), 98  
*pusilla* (Lepeletier), *Fenusa*, 72  
*pygmaea* Say, *Blennocampa*, 98  
*pygmaeus* L., *Sirex*, 115  
  
*quercus* Marlatt, *Pteronus*, 85  
*quercus-alba* Norton, *Monostegia*, 70  
  
*rapae* L., *Tenthredo*, 105  
*rarus* MacGillivray, *Pachynematus*, 86  
*recens* (Say), *Ametastegia*, 92  
*repentinus* MacGillivray, *Unitaxonus*, 92  
*reticulata* L., *Tenthredo*, 109  
*Rhadinoceraea* Konow, 95, 96, 100  
*Rhogogaster* Konow, 102, 104  
   *lichtwardti* Konow, 104  
*Rhogogastera* Konow, 104  
*robustus* Provancher, *Taxonus*, 92  
*rohweri* MacGillivray, *Metallus*, 72  
*rosae* Harris, *Monostegia*, 70  
*rosae* L., *Tenthredo*, 52  
*rosarum* Imhof et Labram, *Corynia*, 52  
*rubens* (Cress.), *Laurentia*, 103



- rubi* Forbes, *Metallus*, 71, 72  
*rubi* Harris, *Monophadnus*, 98  
*rubripes* Cresson, *Strongylogaster*, 92  
*ruficollis* Norton, *Atomacera*, 52  
*ruficornia* MacGillivray, *Tenthredopsis*, 103  
*rufocinctus* Norton, *Strongylogaster*, 93  
*rusticus* auct., *Tenthredo*, 105  
  
*sagittae*, 30  
*Sala* new subgenus, 84, 85  
*satyrus* Panzer, *Astatus*, 116  
*Schizocera* Lepeletier, 54  
    *brunniventris* Cresson, 55  
    *tristis* Cresson, 55  
*Schizocerus* *collaris* Rohwer, 55  
    *johnsoni* MacGillivray, 55  
    *lineatus* Rohwer, 54  
    *sericeiformis* Rohwer, 54  
    *fumipennis* Dyar, *tristis* var., 55  
    *zabriskei* Webster and Malley, 54  
*Scolioneura* Konow, 70  
    *canadensis* Marlatt, 72  
*scrophulariae* L., *Tenthredo*, 104  
*scutum*, 25  
*scutellum*, 25  
*sebetia* O. Costa, *Caliroa*, 70  
*secundus* Rohwer, *Polybates*, 71  
*segmentarius* Panzer, *Cryptus*, 52  
*Selandria* Leach, 65, 66  
    *belfragei* Cresson, 94  
    *capitalis* Norton, 71  
    *decorata* Cress., 66  
    *dubia* Cresson, 97  
    *flavans* Klug, 66  
    *flavescens* Thomson, 66  
    *floridana* MacGillivray, 66  
    *ignotus* Norton, 90  
    *irrogata* Cresson, 99  
    *nevadensis* Cresson, 100  
    *nova* Norton, 68  
    *sodalis* Cresson, 101  
    *spissipes* Cresson, 101  
    *vanduzeei* (Rohwer), 66  
*Selandridea* Rohwer, 66  
    *vanduzeei* Rohwer, 66  
*Selandriinae*, 63, 64  
*semilutea* (Norton), *Laurentia*, 103  
*septentrionalis* L., *Tenthredo*, 88  
*sericeiformis* Rohwer, *Schizocerus*, 54  
*sericeus* L., *Tenthredo*, 59  
*Sericocera*, 55  
  
*serva* Fabricius, *Tenthredo*, 66  
*sexes*, identification of, 50  
*signata* (Fabricius), *Cephalcia*, 109  
*Simplemphytus* MacGillivray, 92  
    *pacificus* MacGillivray, 92  
*Sirex* L., 112  
    *fuscicornis* Fabr., 112  
    *juvencus* L., 112  
    *pygmaeus* L., 115  
    *tabida* Fabricius, 116  
    *troglyodyta* Fabricius, 115  
*Siricidae*, 35, 51, 111  
*Siricinae*, 112  
*Siricoidea*, 33, 35, 110  
*slossonae* MacGillivray, *Polybates*, 71  
*sodalis* Cresson, *Selandria*, 101  
*specialized* *Nematinae*, 83  
*spectabilis* MacGillivray, *Ceratulus*, 100  
*spectrum* L., *Ichneumon*, 112  
*Sphacophilus* Provancher, 53, 54  
    *crawii* Provancher, 54  
*spinisternum*, 23  
*spissipes* Cresson, *Selandria*, 101  
*Sterictiphora* Billberg, 52, 53, 54  
    *zabriskei* (W. & M.), 54  
*sterno-pleural* sutures, 24  
*Stevenia* Brullé, 73  
*stipes*, 16, 30  
*stipulae*, 19  
*Stirocorsia* Konow, 114  
*Stromboceridea* Rohwer, 66  
*Stromboceros* Konow, 65  
    *melanopterus* Rohwer, 66  
    *pilosulus* Rohwer, 66  
*Stromboceridea* Rohwer, 66  
*Strongylogaster* Dahlbom, 64, 65, 67  
    *abnormis* Provancher, 92  
    *apicalis* Say, 93  
    *contigua* Konow, 67  
    *distans* Norton, 67  
    *lineata* Christ, 67  
    *longulus* Norton, 67  
    *pallipes* Say, 93  
    *pinguis* Norton, 94  
    *politus* Prov., 67  
    *rubripes* Cresson, 92  
    *rufocinctus* Norton, 93  
    *tacitus* (Say), 67  
    *tibialis* Cress., 67  
*Strongylogastroidea* Ashmead, 93  
*Strophandria*, 30, 36  
*suavis fusca* Malaise, *Pontopristia*, 88

- submentum, 19  
 Superfamilies of sawflies, 33  
 supratentoria, 13  
 Susana R. & M., 75, 77, 82  
   cupressi R. & M., 77  
 sylvatica L., *Tenthredo*, 110  
 Symphyta, 42, 50  
 Syntectidae, 35, 51, 110  
 Syntexidae, 110  
 Syntexis, 110  
 syringae Gradl, *Cephusoma*, 116  
  
 tabida Fabricius, *Sirex*, 116  
 tabidus (Fabricius), *Cephus*, 116  
 tabidus Fabricius, *Sirex*, 116  
 tacitus (Say), *Strongylogaster*, 67  
 tantillus Costa, *Aphadnurus*, 72  
 tarsal claws, 27  
 tarsus, 27  
 Taxonus Hartig, 89, 93  
   agrorum (Fallén), 93  
   albidipictus Norton, 65  
   epicera Say, 93  
   dubitatus Norton, 65  
   inferentia Norton, 91  
   multicolor Norton, 90  
   robustus Provancher, 92  
 tener (Fallén), *Ametastegia*, 92  
 Tenthredella Rohwer, 105  
 Tenthredinidae, 34, 51, 60  
 Tenthredininae, 63, 64, 102  
 Tenthredinoidea, 33, 34, 51  
 Tenthredo L., 103, 104  
   abdominalis Fabricius, 91  
   abdominalis Panzer, 82  
   albipennis Zaddach, 98  
   albipes Gmelin, 98  
   alni L., 78  
   aterrima Klug, 100  
   atra L., 105  
   atroviolaceum Norton, 103  
   hardus Say, 97  
   betuleti Klug, 70  
   braziliensis Brullé, 98  
   brevis Klug, 77  
   candidula Fallén, 90  
   cinctus L., 92  
   cingulata Fabricius, 67  
   cordigera Beauvois, 97  
   coronata Klug, 66  
   crassa Fallén, 87  
   crocea Fourcroy, 79  
   difformis Panzer, 74  
   eglanteriae Fabricius, 69  
   enodis L., 52  
   ephippium Panzer, 97  
   erythrocephala L., 109  
   fasciata L., 59  
   filicis Klug, 67  
   flaviventris L., 109  
   14-punctata Norton, 103  
   gibbosa Fallén, 103  
   gonager Fabricius, 68  
   guttatum Fallén, 90  
   hieroglyphica Christ, 109  
   juniperi L., 57  
   limacina Retzius, 70  
   lineolata Klug, 98  
   lucida Panzer, 87  
   lucorum L., 59  
   lutea L., 60  
   luteiventris Klug, 97  
   micans Klug, 100  
   nigrita Fabricius, 96  
   nitida Klug, 93  
   ochropoda Klug, 70  
   ovata L., 94  
   parvula Klug, 79  
   pini L., 58  
   pratorum Fallén, 69  
   pumila Klug, 71, 72  
   pumilus Klug, 72  
   pusilla Klug, 98  
   rapae L., 105  
   reticulata L., 109  
   rosae L., 52  
   rusticus auct., 105  
   scrophulariae L., 104  
   septentrionalis L., 88  
   sericeus L., 59  
   serva Fabricius, 66  
   sylvatica L., 110  
   togatus Panzer, 92  
   vafer L., 110  
   viridis L., 104  
 Tenthredopsis ruficorna MacGillivray,  
   103  
 tentorium, 13  
 Terodon, 112  
 testaceus Jurine, *Pteronus*, 84  
 Tethida new genus, 95, 96  
   cordigera (Beauvois), 97

- Tetratneura Ashmead, 90  
 Themis Norton, 55  
   hyaline Norton, 55  
 thoracicus (Harrington), Varna, 79  
 Thrinax Konow, 67  
 tibia, 27  
 tibialis Cress., Strongylogaster, 67  
 togatus Panzer, Tenthredo (Allantus), 92  
 Tomostethus Konow, 95, 96  
   multicinctus Rohwer, 96  
 totaglossa, 19  
 Trachelastatus Morice and Durrant, 116  
 Trachelus Fabricius, 115  
 Trachelus Jurine, 116  
 Tremex Jurine, 112  
   columba (L.), 113  
 Tremicinae, 112  
 Trichiocampus Hartig, 73  
   viminalis (Fallén), 73  
 Trichiosoma Leach, 59  
 tricolor Cresson, Xyela, 107  
 tridens Konow, Empria, 90  
 Triempria Enslin, 90  
 trimaculatus Say, Cephus, 116  
 trimaculatus (Say) Hartigia, 116  
 trisignatus (Förster), Pachynematus, 85  
 tristis Cresson, Schizocera, 55  
 tristis var. fumipennis Dyar, Schizocerus, 55  
 Tritokreion Schilling, 106  
 trochanter, 27  
 trogylogyta Fabricius, Sirex, 115  
 trophacava, 11  
 typica Rohwer, Claremontia, 97  
 typicus Rohwer, Prototaxonus, 67  
  
 ulmariae Schlectendal, Macrocephus, 116  
 ulmi Sundevall, Fenusa, 72  
 Unitaxonus MacGillivray, 92  
   repentinus MacGillivray, 92  
 Urocerus Geoffroy, 112  
  
 vaculus MacGillivray, Amauronematus, 85  
 vafer L., Tenthredo, 110  
 vagans Fallén, Phyllotoma, 70  
 Valco new genus, 96, 99  
  
 varianus Norton, Harpiphorus, 93  
 vanduzeei (Rohwer), Selandria, 66  
 Varna new subgenus, 78, 79  
   amelanchieridis (Rohwer), 79  
   thoracicus (Harrington), 79  
 ventralis Say, Nematus, 87  
 vertex, 10  
 viminalis (Fallén), Trichiocampus, 73  
 viridis L., Tenthredo, 104  
 volsellae, 30  
  
 Waldheimia Brullé, 95, 96, 98  
   carbonaria (Cresson), 98  
 washingtonia R. & M., Hemichroa, 79  
 weithii Ashmead, Acanthoptenos, 52  
 wings, 28  
  
 Xeris A. Costa, 112  
 Xiphidion Provancher, 111  
   canadense Provancher, 111  
 Xiphiura Fallén, 111  
 Xiphidria Latreille, 111  
   mellipes Harris, 111  
 Xiphydriidae, 35, 51, 111  
 Xyela Dalman, 106  
   aenea Norton, 108  
   dahli Hartig, 107  
   ferruginea Say, 108  
   major Cresson, 107  
   pusilla Dalman, 106  
   tricolor Cresson, 107  
 Xyelecia Ross, 106, 107  
   nearctica Ross, 107  
 Xyelidae, 35, 51, 106  
 Xylocermatium L. Heyden, 113  
 Xyloterus Hartig, 112, 113  
  
 zabriskei Ashmead, Melanoselandria, 100  
 zabriskei Webster and Malley, Schizocerus, 54  
 Zadiprion Rohwer, 57, 58  
 Zalagium Rohwer, 105  
   clypeatum Rohwer, 105  
 Zamacrophya Rohwer, 105  
   nigrilabris Rohwer, 105  
 Zараea Leach, 59  
 Zaszchizonyx Ashmead, 102, 104  
   montana (Cresson), 104



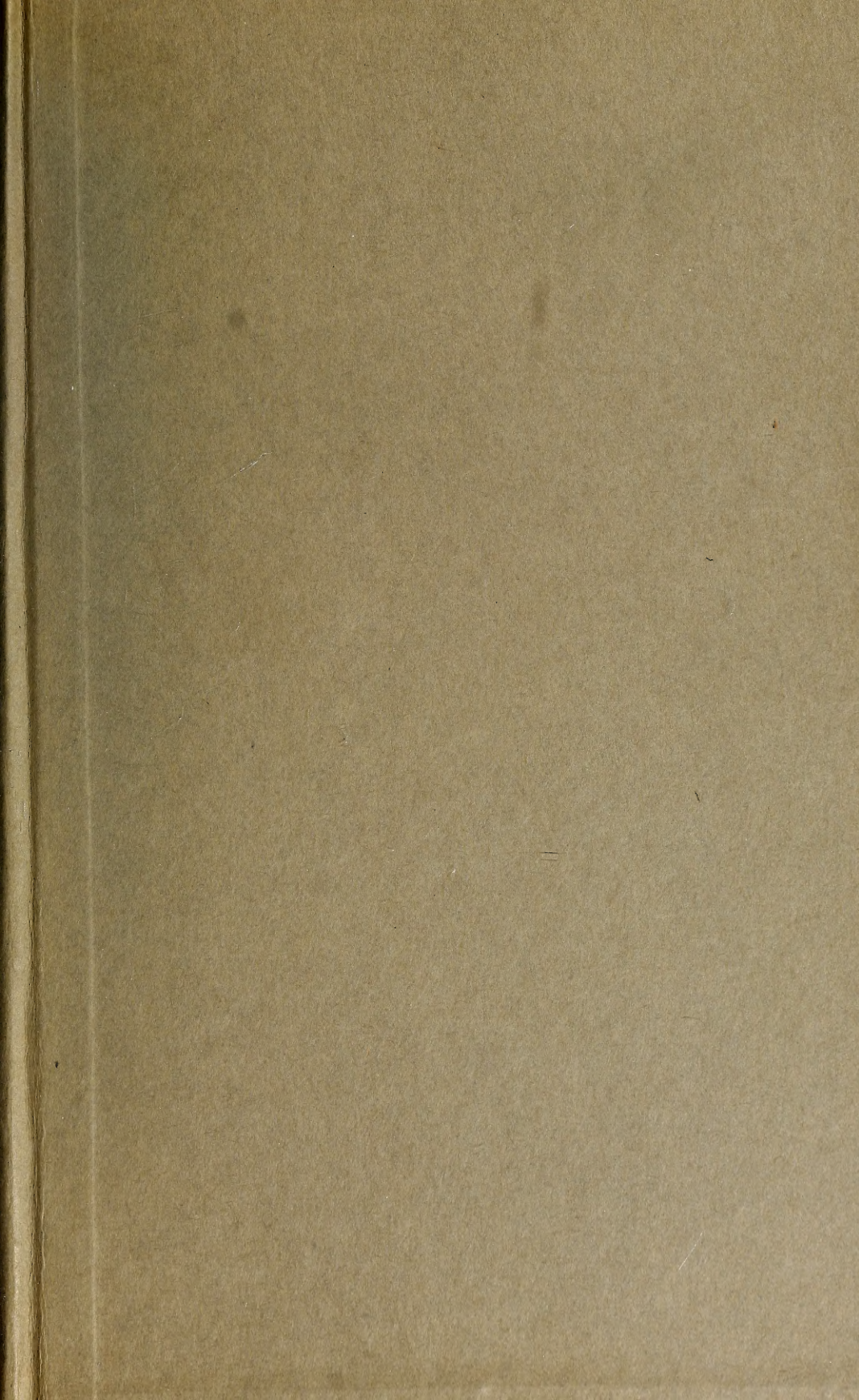












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