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# NORTH AMERICAN CERAMBYCID LARVÆ

A CLASSIFICATION AND THE BIOLOGY OF  
NORTH AMERICAN CERAMBYCID LARVÆ

BY

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# NORTH AMERICAN CERAMBYCID LARVAE

## A Classification and the Biology of North American Cerambycid Larvae

BY

F. C. CRAIGHEAD,

*Entomologist, Division of Forest Insects, Entomological Branch*

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### INTRODUCTION

The cerambycids or long-horned beetles constitute a group of insects which rank next to the scolytids in their economic relation to our forests and forest products. They occasion an annual loss of millions of dollars by their destruction, both to living trees as well as to felled trees and to lumber.

With a few exceptions, it is only in the larval stage that these insects are injurious, and it is in this stage, almost exclusively, that they are sent to the Entomological Branch with requests for identification and method of control. It is absolutely essential, therefore, that our entomologists should be able to determine these insects in their larval stages, and know their biology; otherwise the only recourse is the laborious, lengthy and costly process of rearing, and under such conditions recommendations for remedial measures cannot be given in time to afford the necessary relief. In this bulletin there are presented tables for the identification of the larvae of all economic species of cerambycids which have any importance to forest resources. The bulletin also treats of the essential biological features necessary for recognition of these forms in the field, as well as data which must form the basis for all control or preventive measures.

The objects of the bulletin, therefore, are to describe those species of cerambycid larvae which have been reared and to give some information on their food habits and biology which will serve as a basis for a more practical discussion of the injurious aspects and control; also to indicate the systematic relationships of these larvae in the hope that these may be of assistance in the identification of the species in the larval stages and in the recognition of more exact relationships among the imagines.

Limited as this discussion is to part of the North American fauna, the difficulty of showing any broad relationships is recognized. Probably the better expression of such taxonomic positions, as shown by the larvae, will be found in groups of related genera or species where sufficient series of larvae have been available. For this reason no attempt is made to show any taxonomic relationships in the keys, but to use artificial arrangements based on the more evident characters, so as to allow the determination of the genera and species by the most expedient means. In the text the discussion of the genera expresses the writer's ideas of their relationships.

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Before his appointment to the Dominion Entomological Service, Dr. Craighead had been studying the classification and biology of the cerambycid larvae for a number of years and had drawn up into manuscript form the description and discussion of a large number of species. The work was originally begun while at the Pennsylvania State College, but practically completed while at the United States Bureau of Entomology. Since coming to Canada in January, 1921, he has continued his studies, adding some Canadian species and a considerable amount of biological data to those already studied. Dr. L. O. Howard, Chief of the United States Bureau of Entomology and Dr. A. D. Hopkins, in charge of Forest Insect Investigations, have given their consent to the use in this bulletin of the manuscript already prepared, and for this co-operation we are indeed grateful.

ARTHUR GIBSON,

*Dominion Entomologist*

Following each description is given the note number of the specimens which served as the basis for the larval description either in the collections of the Entomological Branch, the Forest Insect collection of the United States Bureau of Entomology or the collections of the United States National Museum. These numbers also associate the described larvae with the reared adults and the biological notes. In the case of specimens having no number, the data on the label within the vials are noted.

Since the following material and observations on hosts and habits have been obtained from the sources mentioned above and since many of the observations on the more common species have been duplicated over and over again by a number of men associated with the institutions mentioned, it would require considerable space to refer to these in detail. It has, therefore, seemed advisable to mention the names of observers only in cases of rarer species or where special studies or unusual records were made. By far the greater part of these records were made by A. D. Hopkins, J. M. Swaine, Ralph Hopping, J. L. Webb, H. E. Burke, W. F. Fiske, T. E. Snyder, and the author.

Several entomologists in other institutions have made special efforts to assist in this work and to secure larval material and biological data, notably Mr. A. B. Champlain, of the Bureau of Plant Industry, Harrisburg, Pennsylvania, whose field observations are especially detailed and accurate, and to whom the writer is indebted for a very large amount of data. Mr. J. N. Knull of the same institution has likewise given much assistance.

Mr. George Dimmock kindly turned over to the United States National Museum his entire collection (part of which had been accumulated by the late Mr. Frederic Knab), consisting of many species and excellent biological notes, that it might be incorporated in this contribution.

Mr. E. Rosenberg, of Copenhagen, Denmark, kindly sent to the United States National Museum considerable material representing the European fauna.

The writer also wishes to express his appreciation of the assistance given by Dr. E. A. Schwarz, particularly for his many suggestions concerning the systematic position of these insects, and for reference to literature and interesting biological observations.

The photographs of larvae have been made by Mr. H. B. Kirk; the writer is much indebted to him for the care and pains taken to show the characteristics which have special significance. In several cases the full details could not be brought out because of the poor preservation of the material available.

The drawings have been made by Miss Esther Hart and Miss Mary Carmody, both of the United States Bureau of Entomology. Mr. A. B. Champlain has drawn the diagrammatic figures illustrating the pupal cells.

The adults reared from these larvae have been determined by Mr. W. S. Fisher, and the dipterous parasites by Mr. C. T. Greene. Mr. Fisher's determinations were largely made previous to 1918, when the manuscript was outlined, and for this reason are not in all cases the nomenclature accepted at present. However, it was deemed best not to bring the names up-to-date without Mr. Fisher's authority.

## CLASSIFICATION OF THE LARVAE AS CORRELATED WITH THAT OF THE ADULTS

A review of the many schemes of classification based on the characters of the imagines alone shows a great variety of systems and wide diversity of opinion among the different systematists. This variation of opinion is no doubt due to the many distinctive anatomical structures presented by nearly all genera and even species, the systems of classification resulting being merely the authors' various conclusions as to what particular characters are conceived to be fundamental.

Schiodte in 1863-1864 (30)<sup>1</sup> published a classification of the adult cerambycids of the Danish fauna, introducing new characters and a new system. The primary divisions were based on the mouth structures. He discussed the work of previous writers on this group, stating that they had gradually worked away from the fundamental characters (mouth structures) and that they laid too much stress on secondary modifications. Schiodte also gives an admirable discussion of the relation between the types of mouth structures and the form and habits of the adult insects.

Some years later, 1876-1883 (31) Schiodte published his unexcelled papers on the larval structures of certain European coleoptera, including the cerambycids. In these studies he corroborates entirely the conclusions on which his former classification of the adults was based, and shows that both stages can be correlated in a natural system. Here, again, he uses head structures as fundamental. This was the first and only attempt to correlate the larval and adult characters. It constitutes a most remarkable piece of work, showing profound studies into the smallest details of structure. In 1881, Ganglbauer (12) complementarily reviewed this work and deplored the fact that it had been so neglected by other systematists.

That in the formation of natural systems of classification importance should be attached to the consideration of all biological stages and factors is generally conceded but by no means widely adhered to. Fabre (9) in chapter 7 of "The Hunting Wasps," says, "It is no use telling me that this or that species has so many joints on its antennae, so many nervures to its wing, so many hairs on a region of its belly or thorax; I do not really know the insect until I am acquainted with its manner of life, its instincts, and its habits."

Tutt (33) in discussing the classification of the lepidoptera says: "No scheme based on a single set of characters belonging to only one stage of an insect's existence could possibly be only approximately perfect;" and discussing modification, he goes on to say: "it follows that no scheme of classification that is not founded on a consideration of the structural details and peculiarities of the insects in all their stages can be considered as really sound or as founded on a natural basis. It is also evident that the results of the various systems—whether based on oval, larval, pupal or imaginal characters—must be compared and the sum total of evidence brought together if a satisfactory result is to be obtained."

While studying these larvae the author avoided as much as possible, consideration of the adults, hoping thus to be free from any bias resulting from a knowledge of their systematic position and therefore to be able to perceive and express more clearly the true larval relationships. Later in the preparation of the manuscript various systems of adult classification (1, 4, 11, 13, 17, 19, 20, and 30) were reviewed and often the scheme of this or that systematist is referred to as agreeing with an arrangement based on the larvae. It is hoped that such a discussion will aid in the future classification of this family and in

<sup>1</sup> Numbers in parentheses refer to "Literature cite. 11."

the formulation of a more natural system. When a certain adult shows affinities towards two groups or genera and the larval characters show clear affinities to one of these, it certainly would be logical to consider that the true position of the adult was indicated by these larval characters.

As an example of many instances in which the larval and adult characters can be correlated, LeConte and Horn's assignment of the tribe Methiini to the Lamiinae may be taken. A study of these larvae clearly shows them to be the cerambycine type, and indeed later systematists have placed the adults in the sub-family of Cerambycinae. Again and again in rearing unidentified larvae it has been possible, from a knowledge of their structure and habits, to predict very accurately the systematic position of the adults which will be reared therefrom. All of this goes to show that a certain correlation exists.

In these larvae a relatively small number of characters or modifications of these characters have been found available for use in the classification. Some larvae can be immediately recognized by a striking peculiarity common to it alone, but the great majority are to be recognized only by certain combinations of characters. The same character may be of only specific value in one sub-family, and in another subfamily it may characterize all the species. It would be possible by a single or a few characters to place a species or genus almost anywhere, but the position given is that suggested by the greatest number of points in common, both anatomical and biological, the latter to a limited extent.

It is not proposed definitely to erect a group or genus by the present study, but to indicate and suggest the affinities between the species or larger divisions and to let the adult systematists adopt such suggestions if they can be used. For instance, such genera as *Plagionotus*, *Calloides*, *Cyllene*, and *Arhopalus* are all so intimately related by larval structures and biological habits that it is impossible to separate them generically when the genus contains more than one species. Again, such a genus as *Elaphidion* shows three very distinct groups of larval structures which are likewise supplemented by the habits. *Hylotrupes bajulus* is in no respects similar to *Hylotrupes ligneus* and *H. amethystinus*. Throughout the text such relationships are suggested.

Certain structures are subject to great modifications in larvae living in different environments. So striking are these modifications that closely related larvae often seem quite different, and on the other hand, widely separated forms superficially may appear almost identical. By the elimination of such characters and the use of others which are more constant it is believed that a good basis for classifying these larvae can be made.

Those larval characters considered as showing the relationships of the subfamilies are based on the form and structure of the head; for although the habits and environment may differ as widely as do those of herbaceous root feeders from those of borers in the living trunk, or those of bark feeders from either, these head characters are scarcely altered.

Such characters being used as a basis, the larvae of the Cerambycidae studied by the writer may be divided into six subfamilies, namely, the Prioninae, Aseminae, Lepturinae, Cerambycinae, Lamiinae, and Disteniinae. It seems of little consequence whether these groups are regarded as of equal rank or whether certain of them are considered as constituting higher groups, with the exception of Disteniinae, which probably should constitute an entirely separate family. It is certainly possible to find a more gradual transition between any two of the first four of these subfamilies than between any of these and the Lamiinae. On such a basis two large groups can be made. On the other hand, the Cerambycinae, in clypeal and mandibular characters, are set off quite distinctly from any other cerambycids, although in the tentorial structure they are similar to the Prioninae, and in many ways such genera as *Opsimus* and *Oeme* suggest connections with the Aseminae. *Distenia* will be discussed in more detail in a joint paper with Dr. A. G. Boving, where all the coleopterous families are

considered. The adults of the Aseminae are often classified with those of the Cerambycinae. Through such genera as *Ulochaetes* and *Necydalis* the Lepturinae cannot be sharply separated from the Aseminae. It would be possible from a majority of the characters to separate Prioninae and Cerambycinae into one group, and the Lepturinae and Aseminae into another. Because of interrelations and the absence of definitely connecting forms for the present the cerambycid larvae are regarded as divided into the six subfamilies previously named.

The family Spondylidae is here included in the cerambycids. Only the larvae of *Parandra* have been seen, and these from their larval characters cannot be considered as other than prionines. Larvae of *Spondylis* have not been studied, but judging from the descriptions of the European species they agree in all respects with those of the Aseminae.

### BIOLOGICAL CHARACTERISTICS AS CORRELATED WITH ANATOMICAL STRUCTURES AND THEIR USE IN TAXONOMY

It is quite evident, from even limited observations of the food habits of the cerambycid larvae, that in widely separate species and genera which live under the same environment or have similar habits there exists a striking parallel modification of certain morphological features. In the author's experience this was the source of serious confusion in field determinations before the fundamental anatomical characters on which the larger groups are based were recognized.

This parallel modification under similar habits and environment is found not only in the larvae but in some adults as well, suggesting that structures (more particularly form) in the adult may be modified through the influence of habit and environment on the larva. Evidence of this has been found in experimental rearing in such characters as size and colour pattern, and observation in nature suggests that it may be carried even further.

Dr. Hopkins (16) has admirably discussed parallel modifications and physiological characteristics in the Scolytoidea in relation to the taxonomy of the adult beetles. His statements are certainly borne out by all the writer's observations in the Cerambycidae, which are to the effect that the same habits are paralleled through various species and groups of all subfamilies; that together with these paralleled habits appear similar anatomical modifications in widely different groups; and that the food habits alone will not afford a natural arrangement of the imagines, but that there are certain of these physiological characteristics which do serve as a guide to specific or generic distinctions.

Such paralleled food habits appear in all subfamilies of the cerambycid larvae and such habits or environments show many corresponding developments of the larvae in form and in the armature and texture of the body integument.

One of the most constant correlations is that between the form of the larva and the particular condition under which it feeds. This is even subject to change in the same larva when, as it matures, it takes a different portion of the tree in which to feed. There are many species feeding between the bark and wood during the entire larval development, as those belonging to the genera *Pachyta* and *Rhagium* in the Lepturinae and *Plectura* and many species of *Liopii* in the Lamiinae. All of these larvae are of very depressed form, especially if they live under the bark before it has started to decay. Many species feed under the bark during about half the larval development and during this time maintain the characteristic depressed form. When, however, they enter the wood, they begin to assume a more cylindrical form as in the case of *Monochamus*. Strictly wood-boring forms are always cylindrical, as represented by *Neoclytus* of the Cerambycinae; most of the Prioninae; *Centrodera* of the Lepturinae;

and *Plectrodera* and *Ecyrus* of the Lamiinae. Those which pack the frass tightly behind them are shorter and more robust, as *Neoclytus*, or if the mines are more open the larva is more elongate, as represented by *Chion*, of the Cerambycinae, and *Goes* of the Lamiinae.

The correlation between form and environment can be shown further in those larvae which feed in the centre of branches, as the girdlers, or those feeding in the pith of herbaceous stalks. When so feeding and expelling the frass the larval mine is consequently restricted in diameter but free and open along its axis. Such larvae are always elongate, slender and cylindrical, as illustrated by *Elaphidion villosum*, *E. subpubescens*, and *E. tenue* of the Cerambycinae, and *Hippopsis*, *Ataxia*, and *Oberca* of the Lamiinae. *Elaphidion villosum* represents an adaptation only in the general cylindrical form, but a progressive development of better adaptation is shown in *E. subpubescens*, *Hippopsis*, and *Oberca*, in which the ampullae have become very abruptly projecting and the intersegmental skin of the abdomen very long, affording and allowing rapid movement in the larval mines. Still further is this carried by *Oberca*, in which the prothorax and ampullae have become asperate.

*Elaphidion subpubescens* and related species and species of *Oberca* have the common habit of expelling the frass through a straight series of small holes along the stem. The work is so similar in all that often it cannot be distinguished generically except by an examination of the surface of the gallery for marks made by the acutely-pointed mandible of one and the obtuse gouge-edged mandible of the other.

In several of these genera in different subfamilies the larvae can scarcely be distinguished from one another except by an examination of the contrasting types of head structures.

In the foregoing species, representing more specialized habits, the adults are slender cylindrical forms, a fact which certainly would seem to have some correlation to the larval habits.

Another example is afforded by the armature of the ampulla and pronotum. Although the surface of these ampullae closely adheres to a certain type in each subfamily, as granulate in the Cerambycinae or tuberculate in the Lepturinae and Lamiinae, a general well-marked tendency exists for the ampullae of all those species which attack living trees to become asperate (probably produced to afford better adhesion to the wet surfaces encountered under such conditions.) This is especially emphasized if the species of the genus are predominantly live-wood feeders. Among the Cerambycinae no typical case exists, but a velvety pubescence is developed in *Xylotrechus* and becomes asperate pubescence in *X. aceris*, which attacks living maples (*Acer* spp.). *Leptura nitens*, working in the living bark of chestnut (*Castanea*), has developed asperities on the tubercles of the ampullae. Among the Lamiinae are many species which attack living trees. *Goes*, for instance, includes six species, five of which have a finely asperate pronotum and more distinctly asperate ampullae and all attack living trees, while the sixth species, *G. oculatus*, is found in dead wood and the ampullae are glabrous, while the pronotum is asperate to velvety pubescent.

The genera *Saperda* and *Oberca* show the highest development of such armature. In the species of these genera the asperities of the pronotum are large, sharp, and recurved, affording an excellent device for gripping the side of the wet, sappy mines. The ampullae likewise are set with sharp, erect, chitinous points.

*Acanthoderes* contains four species of which the larvae are known. This is typically a genus of decayed-wood feeders and the ampullae are glabrous, shining; but one species, *A. morrisii*, attacks living gum trees (*Nyssa sylvatica*) and the pronotum and ampullae show distinct velvety to asperate pubescence.

The body integument and hairs are structures which are subject to considerable variation, depending on the environment. Thus those species which



bore in dry, hard, seasoned wood have a thin integument, often granulate, and the body hairs are fine and silky, such as *Hylotrupes bajulus*, *Smodicum*, and *Obrium* of the Cerambycinae, *Necydalis* of the Lepturinae, and *Heterocmis* of the Lamiinae. Those species which inhabit soft, moist, decaying wood have a tough, shining integument beset with coarse stiff hairs, as many Prioninae, many Lepturinae (notably *Anthophilax* and *Acanthoderes* and *Hoplosia* of the Lamiinae. All intermediate degrees occur together with intermediate conditions of decay and moisture content of the wood.

The legs, like the ampullae, are more strictly subfamily variations of certain systematic value, yet some significance must be placed in the fact that the Lepturinae, which show them more strongly developed, are predominantly decayed-wood feeders, constructing mines of a greater diameter than the body, in which case the legs would be of more value in locomotion and the ampullae of less value. The same is true of the Prioninae, while in the Cerambycinae, although legs are usually present, they are absent or represented by only minute spines in those genera which feed consistently in solid dead wood in close-fitting burrows; thus they are very minute in *Neoclytus*, and in *Xylotrechus* they are absent.

The foregoing modifications of anatomical characters show that in deciding the taxonomic position of the genera and species of these larvae a knowledge of the biological habits is necessary in order that too much significance be not attached to conspicuous but easily modifiable characters, developed under similar environments.

On the other hand, many of these habits or physiological characteristics are of great use in the identification of species. Some are so characteristic as to identify a certain species immediately, while others that are paralleled must be considered in connection with the anatomical structures. For example, the peculiar pupal cells of *Oeme* immediately distinguish this genus from all other cerambycids, as do also the pupal cells of *Arhopalus* and *Rhagium*. The habit of girdling twigs, however, is peculiar to quite a few genera; if the larva is a *Xylotrechus* it can be immediately identified as *X. quadrimaculatus*, as this is the only known species with such habits in the genus; but if the girdled branch has a series of small holes through the bark the larvae concerned are those either of certain species of *Elaphidion* or of *Oberca*, in which cases the larvae must be examined for proper identification of the genus and species.

## SUMMARY OF BIOLOGICAL HABITS

Under each species a short discussion of such food habits or biology as will assist in recognition of the insect is included. To present in a more comparative manner these habits the following resumé is given.

Although the adults are not discussed in this paper, a short account of their habits may furnish a proper introduction to the succeeding paragraphs relating to the larvae.

Most of the adults are short-lived. They emerge, copulate, lay their eggs, and die in from a few days to several weeks. The males die much sooner than do the females. Prionine adults have been kept in captivity from 30 to 40 days, doing no feeding. The lamiines often live this length of time feeding daily.

Feeding by the adults is confined almost exclusively to the Lepturinae and Lamiinae. A few cerambycine adults, as *Batyle* spp., *Cyllene robiniae*, and *Euderces* spp., also have been observed to feed. The food of the adults consists of pollen, leaves, the bark of tender twigs, or the fruiting pustules of certain fungi. The species of *Leptura* and the few cerambycines are pollen feeders. On bright sunny days the former (*Leptura* spp.) congregate in large numbers on the flowers of specially favoured plants. They are the most active ceram-

bycids and easily disturbed. When so disturbed some take flight quickly, while others fall and conceal themselves in the ground litter. Although a few laminae have been noted eating pollen, they prefer green cellular tissue. Some species eat the leaf cells, either between the veins or only in the veins themselves, and others the bark on tender shoots. The genera of *Liopii* nearly all feed on the fruiting pustules of bark fungi, as the chestnut bark-canker (*Endothia parasitica*).

Such feeding usually proceeds and continues through the ovipositing period. Under such conditions the life of the adult is greatly prolonged. As contrasted with the species of *Leptura* the laminae are more retiring or shade-loving, and many are active only at night.

No species are known to hibernate except in the pupal cell.

The eggs are laid in a few simple ways. By far the great majority of adults merely place them under crevices of the bark, where they are concealed as much as possible. The prionines, which have strong ovipositors, often insert them deep into the soft wood or (e.g., *Prionus*, Pl. XXXVI, fig. 1) into the earth at the base of the tree on which the larvae are to feed. Some forms take advantage of the entrance burrows or emergence holes of scolytids. A few species that attack dry wood from which the bark has been removed place the egg in season checks (*Hylotrupes bajulus*) or rarely lay them conspicuously on the surface (*Chion cinctus*). Herbaceous stem feeders and those attacking twigs often place the egg in the axil of a leaf petiole (*Elaphidion* spp.). The only specialization in ovipositing has been found in the laminae, and in this group all species that have come under observation gnaw a hole or egg scar (often quite conspicuous through the bark and insert the egg into this scar. Pl. XXXVI, fig. 3). This varies little except in size, in which respect it is usually dependent on the size of the adult and the thickness of the bark. Two genera, *Oncideres* and *Oberea*, are known to girdle twigs for the purpose of ovipositing. The former lays the egg in the girdled portion, the latter in the living portion just beneath the girdle.

A certain preference has often been noted in some species for the underside of a log (lying on the ground), while others invariably will take the upper side on which to oviposit. The eggs hatch in from a few days to thirty days.

A rather constant correlation exists between the size of an adult and the length of the larval life, throughout the northern part of the temperate zone. A few species have several generations or an overlapping of generations each year, such as those of *Cyrtinus*, *Atimia*, and *Hyperplatys*. A few larger species, as *Xylotrechus colonus*, that feed in dead wood, also have a complete and partial second generation each year. Farther south many dead-wood feeders have an overlapping of generations. The usual life cycle is completed in one year. In other species it is extended to two, three, or even four or five years, as in *Prionus* and some species of *Goes*. Larvae of many species, especially those the adults of which appear early in the spring, mature by late summer and pass the winter as pupae or adults. Those species living as larvae two or more years do little or no feeding the last year, but after constructing a pupal cell in the late summer remain dormant until the metamorphosis takes place.

The regularity or irregularity of emergence and development shows some diversity. From a brood of *Xylotrechus colonus* developing from eggs laid during a single week in June adults appeared that September, from June to September of the second year, and a few appeared early the third year. On the other hand, species such as *Cyllene pictus* will emerge, lay eggs, and the adults disappear in two weeks. The resulting larvae develop regularly, the entire brood transforming to pupae within a week (in the fall) and emerging the next spring within a few days. The same is true of *Neoclytus capraea* and others.

Cerambycid larvae can be found in a variety of wood conditions, from living trees to thoroughly decayed logs, and from dry to almost saturated tissue, but each species is dependent on a very exact condition to produce the

normal development. This can be well illustrated by a gradually dying tree or shrub where each stage of deterioration will have its particular species. Some require freshly-cut wood (*Cyllene pictus*), others wood which has seasoned for several months or a year, and for others the wood must have been dead some time and have been lying on the moist ground. Again, the condition of a tree which died or was cut during the growing season differs from that of one which died or was cut during the dormant season, so that it is preferred by certain species in the one case and by certain other species in the other. Old pine rafters of buildings seasoned for years are suitable for *Hylotrupes bajulus*, while many species of *Leptura* require very wet dead or decaying wood in situations where it is not subject to desiccation. Many larvae are very sensitive to changes of humidity. Placing an infested branch in a dry room will prolong the larval existence of some species, several to many years, or, in the case of moisture-loving forms, quickly prove fatal. Those species breeding in living trees (*Goes*) will soon die if the tree is cut before the larva is mature. On the contrary, *Callidium antennatum*, requiring dry seasoned pine logs (*Pinus*), can be reared in freshly-cut wood, but the resulting adults are far below normal size and the life cycle is greatly lengthened.

It is difficult to classify the many ways in which the larvae feed, since many species at different periods of their development acquire habits that in others obtain throughout the entire life-cycle. In arborescent plants certain species feed entirely in the outer scaly bark, as *Encyclops* and *Microclytus*; others mine entirely in the bast and even pupate there, as *Acanthocinus*, but require dead bark and enter the inner layers of the tissue. Again, there are those that feed only beneath the bark, and pupate there (*Rhaquium*) or mine beneath the bark, scarring and feeding on the wood (many species). Such feeders may pupate either in the bark, between the wood and bark, or in the sapwood. With such forms the thickness of the bark usually regulates the position of the pupal cell. The presence of bark is necessary for the early stages of nearly all species, although such forms as *Neoclytus caprea* (Pl. XXXV) in dead wood, or *Goes* (Pl. XXXIII, fig. 1) in living wood, use it only as a protection for the young larvae, which almost immediately enter the wood and feed in the wood through the entire development.

A particular portion of a tree is often selected exclusively. Certain species feed only in the twigs, as *Dysphaga*; others attack the larger branches, the main trunk, the base, as *Mallodon*, or the roots, as *Prionus* and *Distenia*. Some species prefer the heartwood, as *Eburia*, and others live only in the sapwood.

Among root feeders are those which attack the living roots, eating only the bark in early stages and later often completely hollowing the root, as *Prionus*; and those which mine between the bark and wood of dying or dead roots, as *Distenia*. Some root feeders, as *Prionus* and *Tetraopes*, burrow extensively through the ground. *Crossidus* and *Mecas* (Pl. XXXIII, fig. 2) feed in the base and roots of shrubby or herbaceous plants, sagebrush (*Artemisia*) and wild aster (*Aster*) and usually pupate in the base of the stem.

A few genera of the Lepturinae (*Anthophilax*, *Gaurotes*, and *Pachyta*) that mine in very decayed wood, or between the bark and wood, just before pupating bore out of the log in which they are feeding, fall to the ground, and pupate in the soil and leaf mold.

Certain species may be said to feed almost exclusively in the pith of the stem, as many girdlers of twigs, or *Desmocerus* in the base of *Sambucus*.

A very characteristic mode of feeding is to be found in the twig-girdlers. This habit sometimes appears among unexpected genera, i.e., where the habits of the other species are quite different. In the genus, *Oncideres*, the adult girdles the twig. The girdling done by the larva may be either for the purpose of providing dead wood in which to feed, or to cause the branch to drop to the ground after the larva has finished. In the former case (*Xylotrechus 4-maculatus*) the egg is laid near the point of cutting, the young larvae feeding beneath

the bark, then entering the wood, and by concentric mines in one plane cutting all but the outer strands of wood. In this case it then proceeds to burrow up the stem, which soon breaks off. Quite frequently the limb breaks before the larva has started to mine the branch, in which case the larva is killed. *Elaphidion villosum* cuts the twigs in the same manner, but just before pupation, after it has hollowed the twigs from the terminal bud down to the point of cleavage. *Purpuricenus axillaris* has been found working like *E. villosum*. Another type of girdling is characteristic of *Oberca* spp. and *Elaphidion subpubescens* (Pl. XLII, fig. 3) and related species. The larvae start mining down the small twigs of living trees into branches from one-fourth to one-half inch in diameter. All along the stem a series of round holes, in a straight line, are made through the bark from which the frass is exuded, and at irregular intervals that portion of the branch eaten is cut off from the inside. In *Oberca* and in one species of *Elaphidion* the cut is made at right angles to the axis around the inside of the stem. In other species of *Elaphidion* this cut is very oblique or V-shaped (Pl. XLII, fig. 5). Pupation may take place in a section cut off or in the basal section which is still green. *Ataxia* sometimes girdles branches in like manner.

A few species feed in herbaceous plants, chiefly composites, hollowing out the centre of the stem and transforming in the base.

The attacks of several species of *Saperda* in twigs cause swellings or galls (Pl. XLI.) *S. obliqua* forms a gall at the base of *Alnus*, and *Desmocercus piperi* a very large swelling at the base of *Sambucus*. *Xylotrechus aceris* forms a gall on the trunks of young red maple trees (*Acer rubrum*).

The dry, hard cones of *Pinus attenuata* are eaten by *Paratimia*; and the seeds of mangrove (*Rhizophora mangle*) by a species of *Leptostylus* and by the larva of *Ataxia sulcata*. A species of *Lepturges*, *L. spermophagus*, has been taken feeding in the seeds of cowpeas (*Vigna*) from Mexico.

Boring dust or frass (Pl. XL, figs. 3-5) produced by the larvae in feeding is of two sources: (first) that passed through the digestive tract, and (second) that which is not eaten. The former is very fine and powdery, usually in small pellets; the latter is composed either of short flaky chips or of fibrous shreds. The shreds are produced by acute mandibles and the flakes by rounded, gouge-edged mandibles. They are often quite characteristic for a species or group. This frass may be either packed tightly behind the larvae, as in the case of true wood-borers, as *Smodicum*, *Neoclytus caprea* (Pl. XXXV) and *Eburia*, or less tightly packed and the mine open for a greater distance behind the larvae. Again, it may be entirely extruded through a small hole, usually the point where the egg was laid, as in *Cyllene* (sens. lat.), some species of *Elaphidion*, *Goes* (Pl. XXXIII, fig. 1), etc.

As intimated before, pupation may take place in the bark, under the bark, in the sapwood, in the heartwood, in the base of stalks, or in the ground. Just as variable are the types of pupal cells. The simplest type is an oval enlargement at the end of the larval mine. If the frass is packed close behind no barrier is erected, but in more open galleries a heavy wad of frass is tightly packed behind the larva before it pupates. Sometimes such a wad is placed both in front and behind the larva (Pl. XLII, fig. 4). Where one wad is used the larva either turns and faces this wad so that the adult may chew out through it, as in *Romaleum* (Pl. XLIII, fig. 2), or the adult gnaws the exit hole through the wood, as in *Goes* (Pl. XLIII, fig. 3) and many other forms.

Species feeding between the bark and wood may go into the wood and form a long, curved pupal cell which ends blindly. In this case the larva turns and constructs a wad of frass in front of it (*Molorchus*) (Pl. XLII, fig. 1). The adult gnaws through this plug and also through the bark, or the bark may have been previously opened by the larva (Pl. XLII, fig. 7, *Cyllene*); the wad in this case being the only barrier to the outside. A short burrow may be made into the sapwood and the plug placed at the edge of the sapwood and protrude (Pl.

XLII, fig. 9) as in *Acanthoderes*. Again, a U-shaped cell is often made which may be plugged at one end, as in *Monochamus* (Pl. XLIII, fig. 1) or at both ends, as in *Eupogonius*. Bark-feeding species which do not enter the wood may construct an oval cell of nest-like appearance, as in *Rhagium* (Pl. XLII, fig. 6), having a surrounding wall of shredded frass, or merely an oval cell searing the sapwood and having no wall, as in *Cyrtinus* (Pl. XLII, fig. 2).

A few species pupating in the ground make an oval cell of earth held together by a secretion of some kind, as in *Prionus* (Pl. XXXVI, fig. 2).

Larvae of some species (*Goes* and the girdlers) feed individually, so that only one larva is found in a tree or in a certain portion of that tree. In such cases they either kill a small part of the tree or go into the dead heartwood to feed. Others, usually dead-wood feeders, when the wood is found in the proper condition for attack, breed in it in great numbers. In one species (*Tetropium velutinum*), the individuals are gregarious, in the sense that their existence depends on simultaneous attack. This species feeds between the bark and wood of living and weakened *Larix* and *Tsuga*, and if a sufficient number of larvae are not present to kill the tree they are unable to mature in the living wood, and die.

The cerambycids are all phytophagous, for the most part attacking arborescent plants, although a few are found in herbaceous growths. Those species feeding on living trees are more often restricted to a single species or genus of trees. Most of the species of *Saperda* and *Goes* are confined to a particular host. A peculiar case came under observation where *Goes tigrina*, feeding, so far as known, only on white oak (*Quercus alba*), laid a number of eggs in a sour gum (*Nyssa sylvatica*). This gum was growing in a grove of oaks and the bark very closely resembled that of the oaks. Such examples are rare. Species which require freshly-cut wood have a wider variety of hosts but do not show the indiscriminate choice of purely dead-wood feeders. The conifers and deciduous or hardwood trees present barriers that are rarely crossed. *Orthosoma* and a few species of *Leptura* attack either, but it must be well decayed. Such indiscriminate feeders are those species which are most abundant numerically.

## ANATOMICAL CHARACTERIZATION.<sup>1</sup>

The larvae of the Cerambycidae may be said to be the most readily recognized by their form and texture. They are, in general, fleshy, cylindrical, elongate forms, having a thin body texture, which is never strongly chitinized and is covered with fine hairs or pubescence. The coleopterous larvae most likely to be confused with them would probably be those of some genera of the Melandryidae, which resembles *Leptura*, or those of some genera of *Erotylidae*, which are *Hippopsis*-like. Both of these types have deeply retracted mouthparts.

This general characterization of the form includes, however, a great amount of variation. Very elongate, slender larvae are represented by *Hippopsis* and *Oberea* (Pl. XXXII, fig. 4); thick, robust types almost like those of the Scarab-

<sup>1</sup> The definition of both the abdominal and thoracic areas of these larvae is based on a study of the muscles by means of which the areas in different subfamilies have been homologized. This discussion was made the subject of another paper by the author (7), in which certain names were proposed for these areas, but given only as provisional. In discussing the anatomical structure in the present paper only such details are gone into as will be essential for the proper understanding of the descriptions.

Several of the terms used in the present paper may be found to differ from those applied by the author in previous papers (1915, 1916). In such cases the changes are based on renewed comparative morphological studies, jointly undertaken by Dr. A. G. Boving and myself on a considerable amount of adult and larval stages of different insects. This revised terminology expresses our present contentions and consequently we regard the terminology expressed in our earlier publications as cancelled and not to be drawn into further discussion. For explanation of most of the subsequent terms, see: (1) John B. Smith: Explanation of Terms used in Entomology (published by Brooklyn Entomological Society, Brooklyn, N.Y., 1906); (2) A. D. Hopkins: The Genus *Dendroctonus*. (U.S. Dept. Agr., Bur. Ent., Tech. Ser., No. 17, Pt. I, 1909); (3) Kemner, A.: Beiträge zur Kenntnis einiger Schwedischen Koleopterenlarven. (Arch. f. Zool., Vol. 7, pp. 2-4, 1912); (4) F. C. Craighead: Larvae of the Prioninae. (U.S. Dept. Agriculture, Off. Sec. Rept. No. 107, 1915); (5) The Bibliography in G. C. Crampton's publication: The Thoracic Sclerites of Immature Pterygotan Insects, with Notes on the Relationships Indicated. (Proc. Ent. Soc. Wash., Vol. 20, No. 3, p. 60; 1918.)

baeidae are represented by *Monilema* (Pl. XXIX, fig. 5) and *Tetraopes* (Pl. XXXII, fig. 1); then there are purely depressed types, as *Rhagium*; larvae that are compressed, especially posteriorly, as *Eburia* (Pl. XXVIII, fig. 3) and *Ecyrus*; and, again, those that are quadrate in cross-section, as *Atimia* (Pl. XXV, fig. 4), *Helvachthes* and *Hectoemis*. The form is most constant in the Prioninae and most diversified in the Lamiinae.

The texture and body hairs, likewise, show a great many modifications. A heavy, tough texture, remarkably glabrous, characterizes the Prioninae, as also certain genera in all subfamilies; the opposite extreme, a very delicate, thin, shining skin, beset with fine silky hairs, is found in such genera as *Obrium* and *Encyclops*. The skin may be dull and finely granulate, as in *Tillomorpha* and *Pogonocherus*; or rugulose, as in *Tetraopes*. Again, the skin may be very densely hairy, as in *Tetraopes*, or it may bear coarse, stiff, almost setose hairs, as in *Anthophilax*, or a mixture of coarse hairs and short fine pubescence, as in *Saperda*. Special differences of texture found on the ampullae and the pronotum will be discussed in the following pages, where the modifications of these structures are treated.

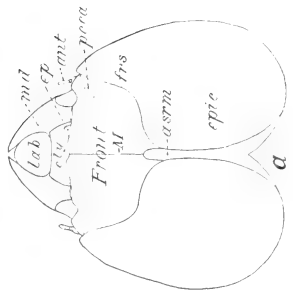
The body is divided into the head, three thoracic segments, and nine abdominal segments; a tenth abdominal segment is probably represented by the anal lobes.

#### HEAD

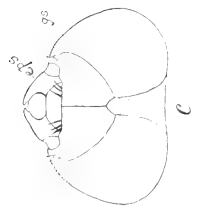
Two fundamental types of head are found, one in which the sides are rounded and diverge posteriorly, and the other (Lamiinae only, text fig. 1, *i* and *j*) in which the sides are parallel or converge posteriorly. No intergradations between these types have been found, and the latter may be said to possess the only character not common to more than one subfamily. The head is usually depressed, but becomes thicker or occasionally even circular in cross-section, as in *Hippopsis*. Usually it is deeply embedded in the prothorax, but sometimes is salient in the Lepturinae and few Lamiine genera. It is attached to the prothorax by a continuous band, the collar (*co.*), which is an extension of the prothoracic skin attached around the opening of the occipital foramen (*occ. for.*). This collar allows the extension and contraction of the head, produced by the superior (*asrm*) and inferior (*vrn*) retractor muscles. When the head is deeply invaginated the collar is broad; when the head is salient, short. The exposed portion of the head is more or less heavily and darkly chitinized, the extreme being represented by the Prioninae. Dorsally the head-capsule is composed of two *epicranial halves* (*epic*) and the triangular, well-defined or obscure front (*F.*). The manner in which the halves of the epicranium meet or fuse behind the front offers good subfamily characters. In the Cerambycinae, Prioninae, and Aseminae the margins of the epicranial halves fuse for a short distance behind the front and then diverge; in the Lepturinae and Disteniinae they are entirely angulate from the posterior limit of the front, while in the Lamiinae they are fused for their entire dorsal length and are posteriorly jointly rounded. Ventrally, these epicranial halves are bridged anteriorly by the hypostoma (*hy*) with the gula (*gu*) and posteriorly by the tentorial structures. Posteriorly and ventrally lies the large occipital foramen; it becomes almost directly posterior in some lamiines, and even posterior-dorsal in *Distenia* (Pl. XI, fig. 7). The anterior chitinized portion of the head is called the mouth frame (Pl. X); it supports the ventral mouth-parts, the mandibles, and the clypeus with labrum.

*Gula, Hypostoma, and Tentorium:* The gula, hypostoma, and tentorium are so fused with one another that they are best discussed together. The *hypostoma* (*hy*) is that portion of the mouth-frame between the ventral mandibular articulations. In most coleopterous larvae it consists of two trapezoidal plates separated by the gula, but in all cerambycids (except *Distenia*) these two plates have fused medially with the gula, forming a broad anterior con-

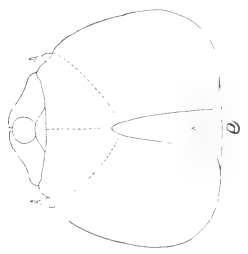
Prioninae



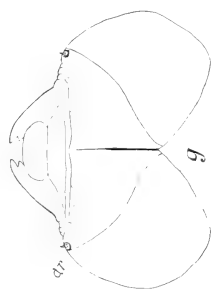
Aseminae



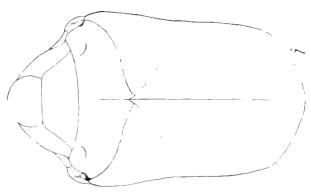
Cerambycinae



Lepturinae



Lamiinae



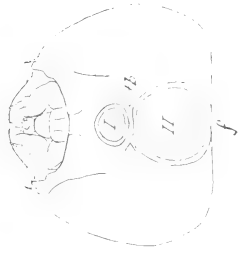
Orthosoma



Aseman



Xylotrechus



Rhaquium



Graphisurus

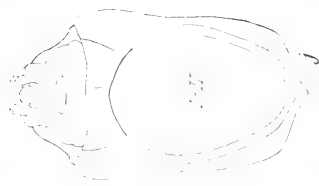


FIG. 1. Diagrammatic illustration of head types of various subfamilies of Cerambycidae. For explanation of abbreviations see page 150.

nection just behind the ventral mouth-parts. The anterior or maxillary margin of hypostoma is that portion between the ventral mandibular articulation and the intersection of hypostoma and gula, which intersection also corresponds, in most forms, to the articulation of the tip of the cardo. The *gula* (*gu*) lies between the hypostomal plates just behind the submentum. It can be well seen in *Asemum*, where the gula has the typical shape. Here it is wide, the protuberant sutures; in other forms it is obsolete or represented only by a faint gular line. The *tentorium* is indicated externally by two pits or invaginations at the posterior inner angle of the hypostomal plates [see *Asemum* (Pl. VIII, fig. 8), *Rhagium* (Pl. XI, fig. 3)] from which extends dorsal to the frontal sutures, two ligamentous arms (*ta*). In the Asemiinae, Lepturinae, and Lamiinae, these arms have a short cross-connection immediately inside the head. The modification of such tentorial structures can be traced through *Opsimus* to the Cerambycinae where the pits sensibly widen, that part of the ligamentous arm between the pit and the cross-connection shortens, and the cross-connection comes to lie in the same plane as the hypostoma, forming another bridge across the ventral surface of the head. This is also the structure in the Prioninae (*tb*). This hole in front of the tentorial cross-arm is Schiodte's (31) "fovea" in which, according to his description, the inferior retractor muscles of the head are attached, or, more precisely expressed, some of these muscles are attached to the tentorium near the pits. In *Distenia* (Pl. XI fig. 7) the tentorial cross-arm has broadened out and pushed forward until it forms the entire ventral connection of the epicranial halves; the hypostomal plates have not fused across the head (except with the tentorial cross-arm), and the tentorial pits on hypostoma occur in this genus at the anterior margin of the ventral bridge of the head. *Distenia* is also peculiar in that, apparently, no gula is present, the submentum articulating (*sa*) directly by the collar to the prothorax. The writer believes, however, that this portion of the collar in reality is the gula, or rather that it has been termed the gula when it has become chitinized and is attached to the surface of the fused hypostomal plates or lies between these plates when they are separated.

*Labrum*: The labrum (*lab*) is distinct and movable, varying in shape from transverse to elongate, roundly rectangular to orbicular, semicircular, fungi-form, or cordate. The degree of chitinization varies. Usually only the anterior half is beset with coarse or fine, long or slender hairs; again, only the margin is ciliate.

*Clypeus*: The clypeus (*cly*) is always present just behind the labrum and is constant in shape within the subfamilies. It is either trapezoidal, widest behind, and attached to the epistoma between the entire width of the dorsal articulations of the mandibles, as in the Prioninae, Asemiinae, Lepturinae, Disteniinae, and Lamiinae; or it is never as wide as the epistoma except by a hidden membranous connection, characteristic of the Cerambycinae (text fig. 1, *e, f*). The clypeus never bears any setae or hairs.

*Front*: The front (*frons*) or anterior dorsal plate of the head is triangular. It is laterally limited by the *frontal sutures* (*frs*) which are either distinct, well defined, as in the Lepturinae, or indistinct, as in most Cerambycinae, and Prioninae and in some Lamiinae. These sutures extend forward to the *antennal ring* (*ar*) which they either bisect and open behind, as in the Lepturinae, Asemiinae, and some Lamiinae, or do not bisect. The *median suture* (*M*) is well-defined in the Lepturinae, Asemiinae, *Distenia*, and some Cerambycinae. A transverse suture occurs in a few genera, as in *Anthophilax* (Pl. XI, fig. 8). On the front just behind the dorsal articulations of the mandibles in the Prioninae is a curved carina, called the *postcondylar carina* (*pcca*).

*Epistoma*: The epistoma (*ep*) is considered the anterior region or margin of the front; an infolding or thickening between the dorsal mandibular articulations. It has been seen in the Prioninae, where it forms the lower projecting



series of dentations beneath the tuberculate or carinate edge of the front. It is straight or deeply emarginate and bears several hairs on each side, the *epistomal setae* (*eps*); in the Cerambycinae two epistomal setae are constant on each side, in the Lamiinae and Prioninae usually three, in other subfamilies three to many.

*Mandible*: Three distinct types of mandibles (*md*) are found. In the Prioninae [(Pls. XII and I), Aseminae (Pl. II), and Lepturinae (Pl. I and IV)] it is short and more or less triangular; the ventral apex is produced and acute; the cutting edge is very oblique, emarginate, or straight; a true molar part is never developed, but the dorsal angle of the cutting edge is either toothed, as in many Lepturinae, or flattened into a plate (*Orthosoma*) and this plate is often striated, as in *Parandra*, *Ergates*, the *Aseminae*, and some species of *Leptura*. In some Lepturinae the mandible is more elongate, with a short cutting edge, as in *Gaurotes* and *Rhagium*. Another mandibular type occurs in the Cerambycinae (Pl. I); it is short, robust, and especially characterized by the cutting edge rounded and gouge-like. A third form occurs in the Lamiinae (Pls. V and II); it is a more slender mandible, narrowing toward the apex, which is produced to some extent; the cutting edge is oblique; the dorsal angle is sometimes produced into a tooth, as in *Dectes* (Pl. V, fig. 7) and *Hippopsis*. The mandible of the Cerambycinae is often divided by a difference in structure into a basal and apical half (Pls. II and I). The apical half often bears a shallow impression or fovea. The mandible has two to many setae on the outer face, and this face also presents a great variation of texture and sculpture, as smooth, shining, dull, granulate, or rugulose.

*Pleurostoma* and *Gena*: The lateral region of the epicranium and mouth-frame (Pl. X) between the dorsal articulations of the mandible is considered the *pleurostoma* (*pl*). It may be smooth or rugulose and on its ventral portion just behind the ventral articulation of the mandible is often found a conical process or tubercle, called the *subfossal process* (*sf. sp.*). The *gena* (*g*) is the region of the epicranium just behind the pleurostoma. It is variously modified and may be abruptly shouldered or gradually receding.<sup>1</sup>

It is more or less hairy and in some forms, as *Asemum* (Pl. VIII, fig. 8) beset with dense recurved hairs, called *genal setae* or *bristles* (*gs*); in others, as *Elaphidion subpubescens*, etc., with a few long hairs (Pl. X, fig. 3), and in *Callichroma* (Pl. IX, figs. 5 and 8) with very fine pubescence.

*Ocelli*: The ocelli (*o*) are situated on the anterior part of the gena. They occur in the great majority of larvae and vary from one to five in number. They may be indistinct beneath the chitin, as in some species of *Callidium*; abruptly projecting; contiguous with the antennae, as in *Merium*, or separated from the antennae, and are often more or less surrounded by a fold of the gena. The ocelli are usually of generic value but only occasionally of specific value.

*Antennae*: The antennae (*ant*) are three-jointed and have a large basal membrane (*am*) into which the other joints are more or less retractile. On the second joint beneath the third occurs a minute "supplementary joint" (*sj*), to which Perris (25) attached much importance as a systematic character in the Coleoptera. In the Cerambycinae and Prioninae the antennae are salient, but in the other subfamilies they are entirely retractile into the antennal ring (*ar*). For this reason in certain larvae the relative lengths of the joints cannot be used to any extent in descriptions.

*Ventral mouthparts*: "Ventral mouthparts" is a collective name proposed to designate the following structures on the ventral surface of the head, namely, *submentum*, *mentum*, *labium proper*, and *maxillae*. The variation in these structures occurs, first, in mobility of the parts; in all except the Lamiinae the cardo

<sup>1</sup> This distinction is used in the keys and descriptions and may be found difficult to determine. When the gena is shouldered the ocellus is usually turned so that it faces squarely forward, while when the gena is receding the ocellus faces obliquely to the side.

and maxillary sclerite (or maxillary articulating area) are distinct and movable, but in that subfamily (Pls. X, XII, XIII) they are indistinct, fused in a continuous area and only the stipes is movable. In the second place, the mode of attachment to the head varies; in the lamine form the ventral mouthparts are attached by the fused base to the whole ventral surface of the head between the mandibular articulation, while in the Cerambycinae (Pl. XI) and Asemiinae (Pl. VIII, figs. 5, 6, 7, 8) the cardo articulates near the edge of the gula on the hypostoma. In *Distenia* (Pl. XI, fig. 7) the submentum is connected directly with the collar skin of the prothorax. A third variation occurs in the arrangement of palpifer and stipes. In the Cerambycinae (Pls. VIII and IX), Prioninae and Disteniinae, the palpifer<sup>1</sup> is small and joint-like and the lacinia apparently is borne on the stipes, but in the other subfamilies the palpifer is large, bearing both the palpus and the lacinia.

The *mentum* (*m*) is either separated by a transverse suture from the *submentum* (*sm*) or fused with it. The *labium proper* is attached to the mentum and is composed of a median tongue or *ligula* (*li*), the two fused *labial stipes*, each of which bears a two-jointed palpus (*lp*). Each *maxilla* consists of a basal articulating piece, or *cardo* (*c*), the *maxillary sclerite* or articulating lobe (*mxsc*) attaching the cardo to the submentum, the *stipes* (*st*), and the *palpifer* (*p*), which bears the *lacinia* (*lac*) on the inside and the *palpus* on the outer side. The lacinia is usually slender and cylindrical, but occasionally fleshy (*Necydalis*, Pl. XI, fig. 2); lanceolate (*Opsimus*, Pl. VIII, fig. 6), or flattened and broader toward the apex (Cerambycinae). The maxillary palpi normally are three-jointed, but in *Opsimus*, *Pogonocherus*, *Lepturges*, some species, *Tetraopes* (Pl. XII, fig. 2), and *Cyrtinus* (Pl. XII, fig. 9), they are two-jointed. On the outer face of the palpifer in the Cerambycinae a small fleshy process often is found; this the writer proposes to call the process of the *palpifer* (*pp*). A similar process is sometimes present on the basal joint of the maxillary palpus. It is well developed in *Methia* (Pl. VIII, fig. 4).

#### THE BODY SEGMENTS

The fleshy body of the cerambycid larva is capable of considerable contraction and expansion which enables it to move in its close-fitting burrows,

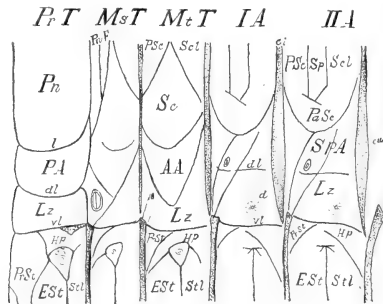


FIG. 2. Diagrammatic illustration of sclerites and lines of a larva of the Prioninae. For explanation of abbreviations, see page 150.

the legs being of little or no use. This shortening and contracting of the segments is produced by the muscles; the expansion and lengthening of the segments and the swelling of the ampullae is caused by a relaxation of the muscles

<sup>1</sup> Later studies in coleopterous larvae have suggested that this difference is more apparent than real, and only a difference in the degree of fusion of the palpifer and the stipes. Also the lobe termed lacinia may be more correctly spoken of with the indefinite expression mala.

and an accompanying increase (in those segments) of the body fluids. A considerable amount of this longitudinal expansion is permitted by a peculiar arrangement of the intersegmental skin (as described by Boving, 2). This *intersegmental skin* consists principally of a dorsal and a ventral wedge-shaped perpendicular band, the dorsal and ventral *cunei* (*cu*), the extremities of which overlap along the sides.

The length of the body is largely dependent on the width of these *cunei* and the manner in which they are placed. In short, robust forms of larvae they are very narrow and set almost directly in the same vertical plane, i.e., one directly above the other, in which case very little contraction is permissible. In very elongate and slender larvae, as *Distenia*, *Elaphidion subpubescens*, or *Oberea*, and usually in forms that can move rapidly in their mines, the *cunei* themselves are very wide and the ventral situated some distance behind the dorsal, and not only the *cunei* themselves are capable of contraction but also the intervening intersegmental skin.

Approaching the thoracic segments the *cunei* always shorten and between these segments they are in the same plane, one situated directly above the other, so that little or no expansion is permitted.

A well-defined protuberant fold or region, the *lateral zone* (*Lz*) or epipleurum as it is here termed, is developed along the entire side of the body (compare *Leptura* larvae), though less conspicuous on the thoracic segments. It readily separates the dorsal and ventral regions of the segments. This epipleurum represents only a portion of the adult pleurum.

#### THORAX

The dorsal region of the thorax above the epipleurum is divided into the following areas: *prescutum*, *scutum*, *scutellum*, and *alar area*. The term *notum* (*N*) is used to indicate the complete plate formed by the fusion of the prescutum, scutum, and scutellum. The term *tergum* (*T*) is used to designate the entire dorsal region above the epipleurum.

The region of the thorax below the epipleurum is divided into *presternum*, *eusternum*, *sternellum*, *coxa*, and *hypopleurum*. When these areas are fused and indistinct the whole region is collectively termed *sternum* (*S*).

The prothoracic segment (*PrT*) is always much larger than the other

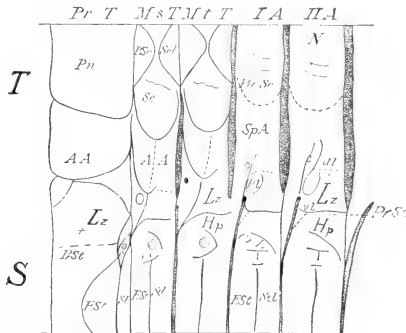


FIG. 3. Diagrammatic illustration of sclerites and lines of a larva of the Aseminae. For explanation of abbreviations, see page 150.

thoracic segments, usually about the size of the other two combined, and is more subject to modification. The mesothorax (*MsT*) and metathorax (*MtT*) are of about equal size or the latter is somewhat larger.

The discussion of these segments can be most conveniently followed by taking as the type the mesothorax of the Lepturinae, in which the areas are more distinct, and contrasting it with the modifications in the thoracic segments of other subfamilies.

*Epipleurum:* The epipleurum (*Lz*) of the mesothorax is shaped somewhat like an hour-glass, narrow in the middle with anterior and posterior extremities extended. The dorsal and ventral curved sutures limiting this zone will be termed the *dorso-lateral* (*dl*) and *ventro-lateral* (*vl*) sutures. It is often divided by an oblique suture extending forward ventrally into an anterior triangle, the *pre-epipleurum*, which bears the mesothoracic spiracle. In the Cerambycinae and in the metathoracic segment of the Lamiinae the anterior ventral angle extends much farther downward than usual below the upper end of the ventral cuneus, the projection includes the presternum (*PrSt*), which is not defined dorsally by the usual suture.

The epipleurum in the prothorax is crescent-shaped in the Lepturinae (fig. 5); rectangular in the Prioninae (fig. 2), the Lamiinae (fig. 8) and some of the Cerambycinae (fig. 4), and entirely or only anteriorly fused with the ventral elements in some Cerambycinae and in the Disteniinae (fig. 6).

*Alar area:* Above the V-shaped dorso-lateral suture lies the *alar area* (*AA*). It is characteristically wedge-shaped, with the apex below; in the Lamiinae and some Prioninae almost bisecting the epipleurum. Dorsally the alar area is limited by a more or less concave longitudinal suture which meets the cuneus posteriorly at the same muscle notch as does the lower end of the scutellum.

In the prothorax the alar area (*PA*) is trapezoidal to rectangular and may or may not be completely set off from the area above (the pronotum, *Pn*) by a suture. It is usually more or less chitinized and clothed in varying degrees of hairiness. When designated in descriptions it is spoken of as the *pro-alar area*.

*Notum, Prescutum, Scutum, and Scutellum:* The remaining dorsal areas are either entirely fused (in many Lamiinae) and spoken of as the *notum* (*N*), or separated by x-shaped sutures into a triangular *prescutum* (*PSc*), a triangular

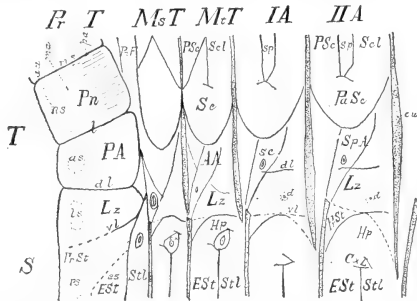


FIG. 4. Diagrammatic illustration of sclerites and lines of a larva of the Cerambycinae. For explanation of abbreviations, see page 150.

*scutellum* behind (*Sc*), and laterally a diamond-shaped or triangular *scutum* (*Sc*), all of whose apices meet in the longitudinal median-dorsal line. In the metathorax of some Cerambycinae and Lamiinae a single transverse suture marks off an anterior transverse prescutum and a posterior transverse scutellum, the region below being the scutum. The extremities of these areas, however, are then not definitely defined. In both the mesothorax and metathorax of the Lepturinae and in the metathorax of the Prioninae and the Lamiinae a small triangle is marked off, which possibly is part of the alar area, but is here considered as a lower portion of the scutum.

**Pronotum:** These notal areas have fused in the prothorax into a large rectangular plate, the *pronotum* (*Pn*). When not fused with the alar area, it is limited below by a lateral suture or impression, the *lateral suture* (*l*) of pronotum which may extend along the entire prothorax or only for a short distance. Sometimes the pronotum is also divided by a longitudinal *median suture* (*m*) of pronotum, which may or may not be impressed for the entire width of the pronotum. The pronotum is variously modified by differences in sculpture and texture to a greater extent than any other body region. Usually it is definable into an *anterior area* (*aa*), more or less chitinized, smooth and shining; a *median punctured area* (*ma*), and a *posterior area* (*pa*). This posterior area shows the greatest variation; it may be smooth and shining or finely or coarsely granulated and either opaque or shining; reticulate; finely, coarsely or pinnately striate; protuberant in various shapes; or finely velvured to coarsely asperate. This variation offers one of the most valuable specific characters.

**Postnotal fold:** In the Prioninae and nearly all the Cerambycinae a transverse fold, the *postnotal fold* (*Pnf*), is found just behind the fused notal areas of the prothorax. It is considered a development of the intersegmental skin.

**Presternum:** The presternum (*PrSt*) is represented by a triangular area lying in front of the segment, against the ventral cuneus and just below the epipleurum. Occasionally it extends ventrally until the apices meet medially. This is usually the case in the prothorax, where it becomes quite large, and in some of the Cerambycinae, in the Aseminae, and in the Disteniinae it is fused with the epipleurum into a broad ventral region.

**Eusternum and Sternellum:** A transverse line across the segment between the coxae sets off an anterior transverse eusternum (*Est*) and a posterior transverse sternellum (*Stl*). In the prothorax the eusternum is often not defined, but when so it usually has a roundly triangular form and is variously sculptured. The sternellum in the prothorax forms in the Cerambycinae a very distinct

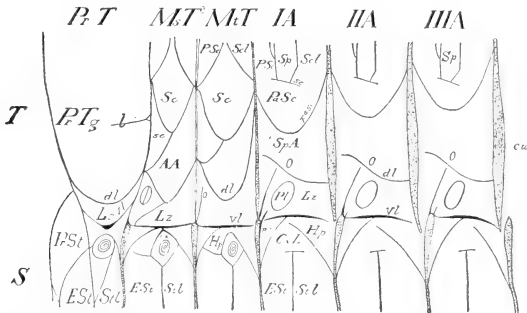


FIG. 5. Diagrammatic illustration of sclerites and lines of a larva of the Lepturinae. For explanation of abbreviations, see page 150.

fold by the fusion with a portion of the hypopleurum, and its extremities often extend to or beyond the spiracles. In such cases it is spoken of as the *sternellar fold* and bears the legs. In other forms this sternellar fold is not distinct at its extremities but fused with the epipleurum.

**Hypopleurum:** The hypopleurum (*Hp*) lies beneath the epipleurum, behind the presternum and contiguous with the basal portion of the leg. In many coleopterous larvae it is chitinized and divided into an anterior *prehypopleurum* and a posterior part (*posthypopleurum*), but in none of the cerambycid larvae does any chitinization occur, nor is it ever entirely divided in these forms. The nearest approach to this condition is found in the Lepturinae.

*Coxa and leg:* Legs are in general poorly developed in the cerambycid larvae. In one subfamily, the Lamiinae, they rarely occur. They are also absent in some of the Cerambycinae, or only developed as a minute spine, but in other Cerambycinae they are two-, three-, four- or five-jointed. In the remaining families they always are present, best developed in the Lepturinae. The fleshy lobe or joint forming the base of the leg is the *coxa* (*cx*), which is surrounded, above by the hypopleurum and beneath by the eusternum and sternellum. In the prothorax of the Prioninae and Lepturinae the coxae meet or almost meet, medially. The last joint, the claw-like *tarsus* (*t*), is most extensively modified and may be a short conical or a long spine; in the Lepturinae a long seta often extends from near the base on the inner face. The other joints are, named from the base outward, trochanter, femur, and tibia (Pl. XXII). When the leg is represented only by a short spine it is assumed that these middle joints are lost.

The *prothoracic, tergal, lateral, sternal, and eusternal plates or spots:* The anterior margin of the prothorax in many cerambycid larvae tends to become more or less chitinized. This chitinization is stronger at certain points in rectangular or oval plates or spots. Four *tergal plates* occur, of which two are

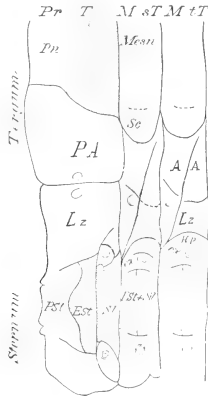


FIG. 6. Diagrammatic illustration of sclerites and lines of thorax of a larva of the Disteniinae. For explanation of abbreviations, see page 150.

*pronotal* (*ns*) and two, one on each side *proalar* (*as*); two *lateral spots* (*ls*), one on each side, occur on the epipleurum and two are *presteral* (*ps*). The eusternum also often bears two similar spots of *chitinization* (*es*). These plates or spots are more distinct on living larvae and usually are some shade of yellow. They afford good descriptive characters.

#### THE ABDOMEN

As before stated, the epipleurum separates the abdominal segments into a dorsal and ventral region. These regions above and below the epipleurum are divided into certain areas, some of which can be homologized with thoracic areas and are similarly named. Others are special abdominal developments or are questionably homologizable with the thoracic areas. In either case a new name has been applied. The abdominal areas above and below the epipleurum are as follows:

Above the epipleurum the region is divided into *prescutum*, the *scutal plate*, the *scutellum*, the *parascutum* (*ParSc*), and the *spiracular area* (*Spa*) or *alar area*.

Below the epipleurum the region is divided into *presternum*, *eusternum*, *sternellum*, *hypopleurum*, and the *coxal lobe* (*Cxl*).

*Epipleurum*: The epipleurum is often the most conspicuous abdominal area. It is strongly protuberant on all segments in most Lepturinae and many Lamiinae. In other Lamiinae it is only protuberant on five to seven segments, while in still others and in all the Cerambycinae, Prioninae, Aseminae and Disteniinae it is protuberant only on the last three abdominal segments. Typically the region is somewhat oblique, the anterior extremity being slightly higher than the posterior. In the Cerambycinae and the Aseminae the sutures defining the epipleurum above are often indistinct on those segments on which it is not protuberant.

*Pleural tubercle* and *disc*: On the epipleurum in many larvae is a more or less conspicuous lobe or tubercle, the *pleural tubercle* (*Pl*). It is usually better developed on those segments on which the epipleurum is protuberant. The shape of this tubercle and the number of hairs or setae it bears offer very good specific characters.

In the Prioninae and Cerambycinae a disc of contrasting texture is found on the epipleurum in those segments where it is not protuberant. This disc, the *pleural disc* (*d*), is most conspicuous on the first three abdominal segments, becoming less so posteriorly. It may be present on from three to six segments. Near its centre is a small pore or pit surrounded by radial or sinuous striations or by a dull, finely granulate to rugulose integument. Again, it is somewhat obliterated by the pleural tubercle in some Cerambycinae. In the Lamiinae a homologous structure occurs on the pleural tubercle. At each extremity of this tubercle in many genera can be found a *chitinous pore* or *pit* (*cp*). The anatomy of these structures has been described by Hess (13) and associated with chordotonal organs.

*Ampullae*: Probably the most conspicuous abdominal structures of many cerambycid larvae are the dorsal and the ventral protuberances of the first six or seven segments. These protuberances are used by the larvae in moving in their burrows and have been named the *ambulatory ampullae* (*Amb Amp*) by

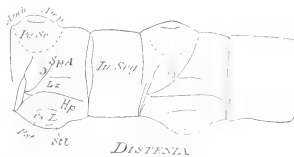


FIG. 7. Diagrammatic illustration of sclerites and lines of abdomen of a larva of the Disteniinae. For explanation of abbreviations, see page 150.

Perris (23). These ampullae are formed from a dorsal protuberance of the prescutum, scutal plate, parascutum, and scutellum, and from a ventral protuberance of the eusternum and sternellum.

It would be expected that developments of such constant use to the larvae would be greatly modified to conform to various conditions of life habits. This is certainly the case, and the wide variation in their shape and armature is of special systematic value, furnishing specific, generic and subfamily characters.

The ampullae (Pls. XXIX, XXX, XXXI, XXXII) may be projecting and with a flat surface, as in *Cyllene*, having one to several transverse impressions and often a small longitudinal furrow. The transverse impressions may be parallel or converging toward a lateral impression so as to form a hexagonal,

elliptical, or diamond-shaped area. In other forms, as *Atimia*, *Callimoxys*, *Encyclops*, and *Hetoemis*, they are more prominently projecting and the longitudinal furrow is deepened until the ampullae appear completely divided into two separate lobes. The surface texture of these ampullae is always in contrast to that of the other portions of the body; it may be granulate, with the granules dull or shining, fine, coarse, or even placoid; or tuberculate, with small or large, distinct or confluent tubercles arranged in two, three, or four regular or irregular rows; or it may be striate. The tubercles or even the flat surface may be finely pubescent or velvety to strongly asperate. In the Prioninae seven ampullae are developed, large projecting lobes with a flat surface usually more or less rugulose; dorsally they bear two transverse impressions, ventrally one; within this group is found the least variation. In the Aseminae they are usually finely velvety, in the Cerambycinae granulate in various degrees, in the Lepyturinae and Lamiinae tuberculate or some variation therefrom.

*Prescutum, Scutellum, and Scutal plate:* In most larvae the dorsal ampullae have two transverse impressions that meet a lateral one on each side. For the inclosed region the writer proposes the name "scutal plate" (*sp*) (scutum of Craighead, 1915). In many Aseminae and Lamiinae another lateral impression

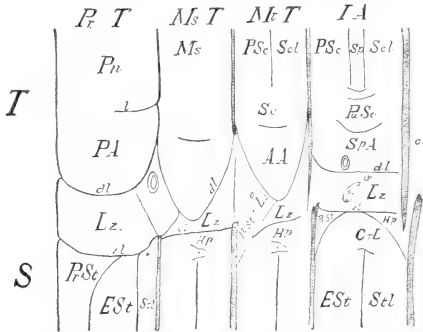


FIG. 8.—Diagrammatic illustration of sclerites and lines of a larva of the Lamiinae. For explanation of abbreviations, see page 150.

is often found, produced by a division of the large muscle that contracts the ampullae. In front of the scutal plate is a poorly-defined region, and behind the latter a similar one, respectively interpreted as the *prescutum* and *scutellum*. These regions correspond more or less to those of the thorax.

*Parascutum:* Directly below the scutal plate is a large region, the *parascutum* (*PaSc*). Ventrally it is defined by a curved line that coincides more or less with the basal limit of the ampullar protuberance. Often this line is indistinct, but then there usually can be found a muscle scar just above and behind the spiracle representing its position. Between this muscle mark and the scutal plate is a row of similar marks produced by longitudinal muscles characteristic of this area. Dorsally the anterior and posterior dorsal limits of the parascutum are not distinct from the prescutum and scutellum. This parascutum is supposed to be homologous with the whole thoracic scutum and in reality includes the scutal plate, but is so definitely separated by the transverse suture (when ampullae are developed) that different names are deemed appropriate.

*Spiracular area or Alar area:* Between the parascutum and the epipleurum lies a large area bearing the spiracle, the *spiracular area* (*SpA*) (Boving, 2). Its apices extend dorsad both anteriorly and posteriorly following the curved



parascutum. The ventral limit is well-defined when the epipleurum is protuberant: otherwise it has to be located by a faint line marking the dorsal margin of the epipleurum or by a few muscle marks just below the spiracle.

In the Prioninae, Aseminae, Cerambycinae, and Disteniinae the spiracular area bears a protruding elliptical region in the centre of which the spiracle is situated. It also apparently takes in part of the epipleurum extending from the notch on the ventral cuneus. When spoken of it will be called the *spiracular ellipse* (*se*), but it is not regarded as a definite area. It is formed by certain muscle attachments and becomes more pronounced in those forms in which the epipleurum is less protuberant.

*Hypopleurum* and *Coxal Lobe*: Just beneath the epipleurum is a broad transverse region extending down to a short transverse suture on each side of the ampullae. This region consists of two distinct areas, the *hypopleurum* (*Hp*) and the *coxal lobe* (*CxL*). The hypopleurum is above and separated by an oblique line from the coxal lobe. In the Cerambycinae and Aseminae the hypopleurum is nearly transverse (to the segment) and very large; the coxal lobe is quite small. In the other subfamilies the hypopleurum is pushed backward by the enlarging of the coxal lobe until it forms a triangular area limited below by an oblique line extending from near the middle of the epipleurum. In some larvae the ventral ampullae are flat and the hypopleurum and coxal lobe strongly protrude laterally. *Curius* (Pl. XXVII, fig. 4) shows this development very well.

*Presternum*: Anteriorly, just below the epipleurum is found a small triangular area, the *presternum* (*PrSt*). In the Cerambycinae and Lamiinae it is often not definitely separated from the epipleurum but superficially appears as though it were merely an anterior ventral protrusion of this region.

*Eusternum* and *Sternellum*: The ventrally protruding region of the segment forming the ampullae has, in most larvae, a transverse impression usually meeting laterally a shorter longitudinal one. The area in front of this transverse line is the *eusternum* (*Est*), that behind, the *sternellum* (*Stl*). Neither can be definitely limited laterally but they fuse to a greater or lesser extent with the coxal lobe or hypopleurum.

#### NINTH ABDOMINAL SEGMENT

The ninth abdominal segment, together with the *anal lobes* (*al*), may be more or less telescoped into the preceding segment. Such is the case in the Cerambycinae and most other cerambycid larvae, but in the Prioninae it is swollen and extended. In one genus, *Aneflus*, this segment is heavily chitinized.

*Caudal Spines* and *Cerci*: The ninth abdominal segment often bears on the tergum one or two chitinous points of various shapes or sizes, the caudal spines or cerci (*ci*).

*Anal Lobes and Anal Spines*: Contractible into the ninth abdominal segment are three lobes, the *anal lobes* (*al*), which surround the anus. One is situated dorsally, the others latero-ventrally. Rarely, as in *Ptychodes* (Pl. VII, fig. 15), only two lobes are present, a dorsal and a ventral. Occasionally, as in *Dorcaschema* (Pl. VII, fig. 9), the dorsal lobe bears a spine, the *anal spine* (*ai*).

## BRIEF CHARACTERIZATION OF LARVAE OF THE FAMILY CERAMBYCIDAE.

The larvae of the family Cerambycidae may be briefly characterized as follows:

Body rather robust, fleshy, usually more or less cylindrical. Integument thin, slightly coriaceous, brown on prothorax; never deeply pigmented nor chitinized; very pubescent or hairy. Head extensible; occiput large; occipital foramen very large, opening on underside. Ventral surface of head bridged by the broad hypostoma; gula short, lying on top of the hypostoma; anterior edge of hypostoma scarcely retracted relative to the ventral articulation of the mandible. Ventral mouth-parts compact, not retracted; maxillary stipes not free (movable only in one species); maxillary sclerite distinct, often cushioned. Clypeus and labrum distinct. Mandibles short, quadrangular, no molar part.

Prothorax large, membranous; collar articulating head with prothorax wide. No hypopleural chitinization on thorax. Legs either small or wanting, widely distant, conical, tarsus claw-shaped.

Abdomen extended, segments readily telescoping on one another, dorsally and ventrally bearing fleshy ambulatory ampullae. Spiracles bilabiate, the two-lipped respiratory opening narrow; lips membranous, clothed with setigerous tubercles. Cerci absent, or chitinous unjointed processes. Anal lobes three (rarely two), ex-erted, terminal.

### KEY TO THE SUBFAMILIES OF CERAMBYCIDAE

Head transverse, wider behind the middle.....	1
Head oblong, sides parallel or converging behind.....	6
1. Mandibles with oblique cutting edge (except in <i>Opsimus</i> ).....	2
Mandibles with rounded, gougelike cutting edge.....	5
2. Dorsal margins of epieranal halves partly fused behind front.....	3
Dorsal margins of epieranal halves separated behind front.....	4
3. Epistoma projecting over clypeus; front projecting over epistoma, dentate or carinate (except in <i>Parandra</i> ); tentorial cross-arm in same plane as hypostoma, forming a bridge behind it. Legs present.....	<i>Prioninae</i>
Neither epistoma nor front projecting; tentorial cross-arm internal. Legs present.....	<i>Aseminae</i>
4. Tentorial cross-arm internal; palpiifer large, bearing lacinia and palpus; epipleurum protuberant on all abdominal segments. Legs present.....	<i>Lepturinae</i>
Tentorial cross-arm in same plane as hypostoma, bridging the anterior ventral surface of the head; palpiifer small, joint-like; lacinia apparently borne on stipes. Form very elongate, slender. Legs present.....	<i>Disteninae</i>
5. Epistoma never projecting; tentorial cross-arm in same plane as hypostoma and forming a bridge behind it; clypeus never filling space between dorsal articulations of mandibles; epipleurum protuberant only on last three abdominal segments. Legs present or absent.....	<i>Cerambycinae</i>
6. Epistoma never projecting; tentorial cross-arm internal; epipleurum variously protuberant. Legs usually absent.....	<i>Lamiinae</i>

### Subfamily PRIONINAE

The Prioninae constitute a group of uniformly large larvae. They are remarkably glabrous for cerambycids and of robust form. In all except *Parandra* the epistoma projects over the head in a more or less dentate carina, and the anterior margin of the front is variously modified into a carina, teeth, or tubercles. The ampullae are broad and flat, conspicuously marked by two transverse parallel impressions. The pleural discs are conspicuous in this group as large circular spots of a rugulose or radially striate texture. They may be present on from three to six segments. The last abdominal segment is usually enlarged and more protrusive than in other cerambycids. Legs are always present.

The Prioninae constitute a well-defined group with no sensible gradations into other subfamilies.

### FOOD HABITS

Generally speaking, these larvae feed in wood in contact with the ground or those portions of a tree beneath the ground. They require considerable moisture and are easily affected by drying. One species, *Sphenostethus taslei*,

attacks dry, dead, seasoned tops of various hardwoods. The larval mines are large, extensive burrows rather loosely packed with coarse shredded frass. They are often associated with species of *Leptura* and continue working in the same dead log or stump until it is completely consumed. Some species are peculiar to conifers, others only to hardwoods, and a few *Orthosoma* indiscriminately attack either. The genus *Prionus* has been found only in the roots of living trees. It burrows extensively through the ground from root to root.

The larvae require from two to four years to complete their development. From the same group of eggs laid by a single female *Orthosoma* some adults appeared after two years and others after three years.

#### CHARACTERIZATION OF LARVAE OF THE SUBFAMILY PRIONINAE.

The characters of the Prioninae larvae may be briefly summarized as follows:

*Head* transverse, dorsal margins of epicranial halves behind front fused for some distance, later separating, angulate; tentorial cross-arm lowered in a plane parallel to the hypostoma (i.e. occipital foramen apparently divided into an anterior and posterior portion).

*Mandibles* wedge-shaped, cutting edge broadly emarginate, apex produced, acute.

*Epistoma* produced in two triangular lobes or a dentate carina over clypeus (except in *Parandra*); three epistomal setae on each side; front produced over epistoma, dentate or carinate. Clypeus thick, trapezoidal, as wide at base as epistoma. Labrum broad, thick, semicircular or cordate.

*Maxillae* moveable; cardo distinct; maxillary sclerite full, cushioned; palpifer not distinct, small; lacinia borne on stipes; ventral mouth-parts attached to hypostoma by little more than width of gula.

*Antennae* strong, partially retractile.

*Prothorax* having presternum and epipleurum distinct; eusternum of prothorax partially or entirely distinct; coxal lobe, large, surrounded by large hypopleurum. Mesothoracic spiracle protruding somewhat into prothorax. Legs short, stout, conical.

*Epipleurum of abdomen* protuberant only on last three segments; hypopleurum distinct; coxal lobes large; spiracle in a well defined, elliptical region. Dorsal ambulatory ampullae bearing two transverse impressions; the ventral, one impression.

*Ninth abdominal segment* large, extended, never telescoped within the eighth.

#### KEY TO THE KNOWN GENERA OF THE PRIONINAE

Epistoma not projecting over the clypeus. Posterior area of the pronotum and the ampullae asperate.....	<i>Parandra</i>
Epistoma projecting over clypeus; front either dentate or carinate	
Neither pronotum nor ampullae asperate.....	1
1. Pleural discs distinct on two to four abdominal segments.....	2
Pleural discs distinct on six abdominal segments.....	7
2. Mandible having cutting edge entire.....	3
Mandible with upper portion of cutting edge flattened into a striated plate.....	6
3. Front carinate.....	4
Front bearing four acuminate teeth. Three prominent ocelli.....	<i>Sphenostethus</i>
4. Front produced in a smooth transverse carina or not at all. Anterior area of epipleurum of prothorax bearing a group of short conical chitinous spines. Last joint of palpi very short, blunt.....	<i>Mallodon</i> and <i>Stenodontes</i>
Front produced in a transverse dentate carina divided in the middle. Epipleurum of prothorax not armed.....	5
5. Carina of front distinctly divided into four broad lobes; last joint of maxillary palpi shorter than second; texture rugose.....	<i>Dicrobachius</i>
Carina not distinctly divided into four broad lobes; last joint of maxillary palpi longer than second, conical; texture smooth.....	<i>Orthosoma</i>
6. Front extended in four large, blunt, rounded teeth. Ocelli scarcely visible.....	<i>Ergates</i>
Front extended into four flattened, acute-edged, dentate teeth. Ocelli 3 to 4, prominent.....	<i>Tragosoma</i>
7. Front projecting over epistoma in a transverse carina; never dentate; epistoma usually of two lobes.....	<i>Prionus</i>
Epistoma projecting in four flat, obtuse tubercles.....	<i>Homotestsis</i>

NOTE.—In a previous paper the author of the following genera: *Parandra*, *Mallodon*, *Stenodontes*, *Dicrobachius*, *Orthosoma*, *Prionus*, *Ergates*, *Tragosoma*, and *Sphenostethus*. Several other species have been reared since and the pupae of some of the preceding found, which are treated in this paper. They are the larvae and pupae of *Homotestsis* and the pupae of *Parandra*, *Mallodon*, *Orthosoma*, *Ergates*, *Sphenostethus*, *Tragosoma*, and *Prionus*.

## HOMAESTHESIS Leconte

in many respects scarcely separable from *Prionus* by larval characters. The palpi, and general form are very similar; the only distinctive character is the short, more convex mandible with the less oblique cutting edges, and the shape of the epistoma, either as large or larger than the distal.

As far as known, feed on the roots of grasses and related plants. They burrow under the ground.

## HOMAESTHESIS EMARGINATUS Say

[Pl. I, fig. 10; Pl. XII, figs. 10, 11, 12]

*Larva*—cylindrical, slightly tapering posteriorly; integument very finely granulate, shining, sparsely clothed with lemon-yellow hairs.

*Head* subrectangular, slightly constricted on sides behind gena and somewhat produced at base behind attachment of dorsal retractor muscles; epistoma projecting over clypeus in four prominent, flat, obtuse tubercles, the two median approximate; front scarcely projecting in a dull rounded transverse carina. Labrum transverse, subtrapezoidal, sparsely haired; mandibles robust, strongly curved on outer face (when seen from above), basal portion brownish, shining apical dull black, cutting edge straight, very little obliquely inclined, dorsal angle not strongly toothed; antennae three-jointed (as in *Prionus*), first joint shortest, transverse, second globular, bearing the minute third. Ventral mouth-parts rather soft, fleshy, maxillary palpi conical, two basal joints transverse, last slightly larger, cylindrical, and bluntly round, about equal to last labial. Postcondylar carina faint; subfossal spine acutely conical.

*Prothorax* quadrangular. Anterior area of pronotum with transverse band of short hairs, posterior rugulose. Eusternum completely separated from presternum. Legs short, hairy, tarsus a slender spine.

*Abdominal ampullae* rather prominently projecting. Pleural disc radially striate, distinct on first six abdominal segments. Spiracles rather small, oval, peritreme slightly chitinized.

*Pupa*: As studied from a larval skin no difference can be seen from *Prionus*. It is absolutely unarmed and pupates in an earthen cell, as does *Prionus*.

*Egg*: Elongate ovoid, 5 by 1.5 mm., largest beyond middle opposite micropyle, from which it gradually tapers to apex; texture firm, tough, strongly or finely pitted or honeycombed.

[Described from specimens Hopk. U. S. 11860j.]

The larva of this species feeds on the roots of grasses, burrowing through the earth from plant to plant. It occasionally does considerable damage by killing the plots of grass. Adults were collected flying, about the middle of July and the males were attracted by lights. The eggs are laid in the earth at the base of grass stems, where they hatch in about 30 days. The larva requires three years to mature, finally pupating in an earthen cell. The foregoing interesting observations were made by Mr. W. D. Edmonston at Larkspur, Colo.

HOMAESTHESIS sp. (INTEGER LeConte?)<sup>1</sup>

Distinguished from *H. emarginatus* only by the fact that the distal teeth or projections on the epistoma are quite small and acute and some distance from the median ones, the medial larger and obtusely rounded; the carina of the projecting front is sharper edged and distinctly arcuate, and a short carina is present in the region of the ocelli.

[Described from specimens Hopk. U. S. 9906a.]

These specimens were sent in from Nebraska by a correspondent who stated that the larvae had destroyed a large portion of the corn (*Zea mays*) in a field by eating the roots. The specimens (three) are uniformly distinct from *H. emarginatus* and are therefore described as the other species of that genus. A specimen has been seen that was collected in the tuber of a sweet potato (*Ipomoea batatas*) by F. C. Pratt.

## KEY TO DESCRIBED PUPAE OF PRIONINAE

Margin of pronotum entire; two acute caudal cerci.....*Parandra*  
 Margin of pronotum denticulate, serrate, etc.  
 Anterior margin of third, fourth, fifth and sixth abdominal terga bearing two distinct carinae.

<sup>1</sup> Described by LeConte.

No caudal cerci.....	<i>Mallodon</i> <sup>1</sup>
Two caudal cerci present.....	
Margin of abdominal carinae entire.....	<i>Orthosoma</i> <sup>1</sup>
Margin of abdominal carinae dentate.....	
Cerci obtusely conical, tuberculiform.....	<i>Ergates</i> <sup>1</sup>
Cerci acutely conical.....	<i>Sphenostethus</i> <sup>1</sup>
Anterior margin of third, fourth, fifth and sixth abdominal terga bearing no carinae.....	
Body armed with small chitinous spines; two caudal cerci.....	<i>Tragosoma</i>
Body glabrous; no cerci.....	{ <i>Prionus</i> <i>Homöostethis</i>

### PARANDRA BRUNNEA Fabricius

[Pl. XXVI, fig. 4]

*Pupa*: Form similar to that of adult; head glabrous, pronotum armed with scattered, minute conical spines on lateral borders and posterior margin; several groups of smaller ones on mesonotum and metanotum; each abdominal tergum armed with similar recurved spines, which are more numerous posteriorly; the epipleurum also, which is slightly protuberant, bearing a group; last tergum bearing two stout acuminate spines widely separated at base, extending posteriorly and laterally.

*Egg*: Elongate, cylindrical, 1.5 mm. by 0.5 mm.; widest at middle, tapering slightly to both ends, which are bluntly rounded; bearing a rather large micropyle at the larger end; texture smooth, no trace of sculpturing.

The larva was first described by Osten-Sacken (22).

### TRAGOSOMA HARRISHI LeConte

*Pupa*: Form similar to that of adult; head and thoracic segments glabrous; abdominal terga bearing numerous acute, conical, chitinous points, the central median ones larger, on first tergum fewer and smaller, increasing posteriorly; epipleurum of all but first three bearing a group of short conical spines; ninth tergum armed with two acutely conical, widely separated, chitinous processes. No carina present on abdominal tergum.

### SPHENOSTETHUS TASLEI Buquet

*Pupa*: Form similar to that of adult; head and thoracic segments bearing a few scattered, minute, chitinous points; abdominal terga bearing a transverse row of acutely triangular, flattened points, more numerous and strongly chitinized on posterior segments; carina on abdominal terga finely crenulate or dentate; epipleurum beset with several points similar to tergal; ninth tergum with two diverging, acutely conical, chitinous processes or cerci.

### PRIONUS IMBRICORNIS Linnaeus

*Pupa*: Form as of adult; body entirely glabrous, devoid of any chitinous spines or points; abdominal terga very finely wrinkled and epipleurum strongly so; ninth abdominal tergum bearing two small, globular, fleshy protuberances.

The pupae of this genus are remarkable in that they are entirely devoid of any chitinous markings, so characteristic of other pupae in the family. This may have some correlation with their habit of transforming in an earthen cocoon. From the two species which have been studied it is impossible to draw specific differences.

### PRIONUS CALIFORNICUS Motschulsky

[Pl. XXXVI, fig. 2]

*Pupa*: The pupa of this species cannot be distinguished from *P. imbricornis*. It is likewise totally glabrous and devoid of any spines.

The described specimens were collected at Missoula, Montana, by Josef Brunner. The larvae feed on the roots of *Amelanchier* and *Rhus*, often killing the plants.

<sup>1</sup> For description see Craighead (6).

## Subfamily ASEMINAE

including the typical genera included in LeConte's group *Asemi*, the larvae form a sharply defined series; but with the consideration of *Tetropium*, *Atimia* must be included and the less closely related (by larval characters) genus *Opsimus*. Through this last genus is indicated the transition to the Cerambycinae, from which subfamily it can be separated by only one character. As a whole the Aseminae present at the same time strong affinities to the Lepturinae and through *Atimia* show a well-graduated transition to that subfamily. In fact the Nocydalini could be as well placed with the Aseminae as in the true Lepturinae.

The present consideration is based on the following genera: *Asemmum*, *Criocephalus*, *Nothorhina*, *Spondylis*, *Tetropium*, *Atimia*, *Paratimia*, and *Opsimus*.

## GENERAL HABITS

All species of the Aseminae, so far as known, are confined to the coniferous trees. With several exceptions, they have very similar habits and on this basis can be divided into two groups which coincide more or less closely with those based on the larval characteristics. The species of *Asemmum*, *Criocephalus*, and *Nothorhina* can be said to be wood borers mining under the bark but a very short time; in *Asemmum moestum* entering only the sapwood, but in other species the deep heartwood. Pupation normally takes place in the wood. The larval mines are closely packed with mixed granular and fibrous frass. Species of the genera *Tetropium* and *Atimia* are strictly bark feeders, spending the whole larval stage between the bark and wood. Pupation occurs in the outer sapwood or bark. Their mines also are tightly packed with frass which, however, is more granular than in the case of related forms. *Opsimus* is more strictly a sapwood feeder, but a short part of the larval period is spent between the bark and wood. *Paratimia* has the peculiar habit of mining in dry, seasoned pine cones (*Pinus*).

A rather large amount of moisture is requisite to all species, except probably *Paratimia*. Trees which have practically dried out are never attacked. This is especially true of *Atimia*, which attacks the cedars on which the bark dries quickly. Many of the species feed only in the stumps and portions close to the ground. An upright tree is seldom attacked, except at the base, but if felled the whole trunk is liable to injury.

The oviposition of those species in which it has been observed (*Asemmum*, *Criocephalus* and *Atimia*), is accomplished by merely inserting the egg in deep crevices of the bark.

Two species of *Tetropium* are of economic importance, as they attack living or weakened trees under favourable circumstances. Great numbers of *Tsuga*, *Larix*, and *Abies* have been reported killed by these insects.

*Paratimia*, *Atimia*, and *Opsimus* pupate in the fall, over-wintering as adults. All other species transform in the spring.

## CHARACTERIZATION OF LARVAE OF THE SUBFAMILY ASEMINAE

The characters of the Aseminae may be summarized as follows:

*Head*—transverse; dorsal margins of epicranial halves behind front fused almost to base, notched behind; tentorial cross-arm internal in a plane at right angles with hypostoma (i.e., notched behind); clypeus apparently divided into an anterior and a posterior portion.

*Mandibles*—broadly truncate from side, cutting edge broadly emarginate, having the dorsal angle rounded or flattened (except in *Opsimus*), apex produced acute.

*Pronotum*—setae produced over clypeus, five to many epistomal setae. Clypeus trapezoidal, filling space between the dorsal condyles of the mandible. Labrum transverse, semicircular or subtriangular.

*Mouth-parts*—movable; cardo visible; maxillary articulating lobe full; ventral mouth-parts attached to hypostoma for nearly its entire breadth; palpifer large, distinct, bearing lacinia.

*Antennae*—small, short, very retracile.

*Eusternum of prothorax* distinct, triangular; presternum and epipleurum fused; coxal lobe small, opposite sternellum. Mesothoracic spiracle not protruding into prothorax. Legs moderate in size, slender.

*Abdominal ampullae* with two lateral impressions on each side; regions bearing spiracle distinctly defined, elliptical; hypopleurum large; coxal lobe small; epipleurum protuberant only on seventh, eighth and ninth abdominal segments; pleural disc never present.

#### KEY TO THE GENERA AND SPECIES OF ASEMINAE

- Labrum as long or longer than wide; dorsal angle of mandibles flattened into a triangular plate..... 1  
 Labrum wider than long, transverse, dorsal angle of mandibles simply rounded..... 2
1. Asperities of pronotum<sup>1</sup> coarse; caudal spines acutely conical, nearly contiguous at base, usually slightly incurved..... *Criocephalus*  
 Asperities or pronotum finer; caudal spines either bluntly conical, contiguous at base, or separate and shortly tuberculate..... *Asemum*  
   Caudal spines broadly conical, suddenly acute at apex..... *A. moestum*  
   Caudal spines separated, blunt tubercles..... *A. nitidum*
- Asperities of pronotum finer; caudal spines flatly triangular, concave from behind..... *Nothorhina*
- Asperities of pronotum finer; mandibles near tip abruptly notched at right angle to inner edge; caudal spines short, blunt, widely separate..... *Spondylis*
2. Cutting edge of mandibles obliquely emarginate; lacinia normal; two caudal spines.  
   Caudal spines approximate; ampullae dull, covered with velvety pubescence..... *Tropium*  
   Caudal spines fused, bifurcate at tip..... *T. cinnamopterum*  
   Caudal spines separated, blunt tubercles.  
     Gena beset with dense bristles..... *T. velutinum*  
     Gena essentially glabrous..... *T. abietis*  
   Caudal spines separated more than twice their length, incurved; ampullae glabrous, shining, deeply bilobed; pronotum posteriorly finely velvety pubescent..... *Atimia*  
   Caudal spines straight, separated more than twice their height; ampullae not bilobed; pronotum glabrous..... *Paratimia*  
 Cutting edge of mandibles rounded, gouge-like; lacinia lanceolate; no caudal spines..... *Opsimus*

#### ASEMUM Eschschötz, CRIOCEPHALUS Mulsant, and NOTHORHINA Redtenbacher

The species of *Asemum*, *Criocephalus*, and *Nothorhina* cannot be separated generically as larvae. Without exception every character found either varies within the genus or is of only relative value and can be recognized only in the species. Their similarity when a large series is studied is very striking. The best character of specific value is the shape and position of the caudal spines. In general it may be said that *Criocephalus* and *Nothorhina* are more robust and more densely haired. The asperities on the posterior area of the prothorax are much coarser and darker in colour and the glabrous spots more numerous in *Criocephalus*. The species may be collectively recognized as follows:

Head rather salient; labrum cordate, longer than wide; no ocelli; genal bristles long and dense; mandibles having ventral apical angle sharply acute and dorsal angle of cutting edge flattened into a triangular, more or less striated plate; gula longer than wide. Pronotum posteriorly very finely asperate or velured, as also the ampullae, but much less so.

#### ASEMUM MOESTUM Haldeman

[Pls. VI, fig. 8, 12; XXV, fig. 1, 2]

*Form* rather robust, anteriorly slightly depressed, posteriorly slightly compressed; integument thin, shining, sparsely covered with fine brownish pubescence.

*Head* depressed, widest behind middle; mouth-frame strongly chitinized; epistoma roundly declivous, slightly curved. Labrum cordate, widest triangular from side, dorsal plate feebly striate. Antennae three-jointed, second and third joints equal; antennal ring open behind; ocelli absent; genal setae rather dense, reddish brown. Hypostomal plates large, trapezoidal, anterior margin thick, distinct and broadly curved; gula longer than wide, sutures concave. Ventral mouth-parts fleshy; joints of maxillary palpi gradually shorter, basal largest, last labial joint equal to last maxillary; lacinia very slender, cylindrical; mentum wider than long.

*Prothorax* trapezoidal, widest in front; a chitinized light ochraceous band across anterior margin of protergum, widening laterally, and two triangular plates on epipleurum; pronotum

<sup>1</sup> These asperities on the pronotum in *Asemum moestum* and *A. atrum* are individually distinguishable as fine points with a Zeiss 4 eyepiece and No objective, while in *A. nitidum* they cannot be so separated but blend together. In *Criocephalus* they are distinguishable with a 20X hand lens; in *Nothorhina* they are similar to *A. nitidum*.

... anteriorly very finely asperate and beset with a few setae; eusterium finely asperate and setose; sternellum finely asperate, glabrous. Mesosternum, ... finely asperate. Legs of three distinct joints, the basal shortest; tarsus ... bearing ampullae on seven segments, these very finely asperate, impressed by a ... lateral furrow. Epipleurum shining and sparsely hairy; protuberant on last three ... tubercle broadly oval, bearing about five setae. Spiracles broadly oval, chitinous ... med. Caudal spines contiguous at base, large conical, then suddenly acute at apex. Anus

*Pupa*.—Forms in adult. Pronotum anteriorly bearing a few minute chitinous points; ... metanotum, metanotum, and first abdominal segment unarmed; abdominal terga bearing two groups of chitinous points in a transverse row; caudal segment armed with two slender, acute, ... spines.

The larva of this species breeds in *Picea*, *Larix* and *Abies* throughout eastern and central North America. It attacks dead trees, preferably shortly after their death. The mines are constructed under the bark for a short distance, then into the sapwood, rarely penetrating more deeply. The pupal cell is either made in the bark proper or in a long cell in the sapwood parallel to the grain. The life cycle is completed in one or often two years.

Packard (23) has described *Asemum moestum*, but evidently he has confused this larva with that of some other species. The description indicates a species of *Neoclytus*.

#### ASEMUM ATRUM Eschscholtz

[Pl. VI, fig. 1]

Some typical forms from the Pacific Slope can be recognized by the gradually conical, acute caudal spines, but all intermediate grades are found between these and the true *moestum*.

[Described from specimen Hopk. U. S. 11065b.]

Habits similar to *A. moestum*, of which it is supposedly the western form, occurring throughout the Sierra and Rocky Mountain regions of North America. It has been found in *Picea*.

#### ASEMUM NITIDUM LeConte

[Pls. II, III, VIII]

Distinguished from *A. moestum* by the larger size of matured larvae, the finer asperities on the prothorax and ampullae, and the longer genal setae. The caudal spines consist of two very short, blunt tubercles separated a distance equal to about twice their height.

[Described from specimens Hopk. U.S. 9014a.]

*Pupa*: Distinguished from that of *A. moestum* by the coarser points on the pronotum, as well as on the metanotum. All abdominal segments bearing much coarser chitinous points, closely and irregularly disposed. Caudal spines nearly contiguous at tip.

The larva of this species has been collected from *Abies*, *Pseudotsuga*, and *Pinus*. It is more of a heartwood borer than *A. moestum*. The adult flies from May to July in the Pacific Coast region. Observations by Dr. A. D. Hopkins and Messrs. H. E. Burke and B. T. Harvey.

#### CRIOCEPHALUS Mulsant

From a series of several hundred specimens two species can be distinguished by the larvae, both of which have been reared. One is eastern, the other western.

#### CRIOCEPHALUS PRODUCTUS LeConte

[Pls. II, III, VI, XXIII, XXV]

... described for *A. moestum*, but readily distinguished by the much coarser asperities on the pronotum and the numerous interspaced glabrous spots. Mandibles robust, dorsal part of cutting edge strongly striate; genal bristles more dense; asperities of ampullae of about the same size as those on the prothorax of *A. moestum*. Caudal spines acutely conical and slightly inwardly curved toward each other). Form more robust and densely pubescent.

*Pupa*: Resembles that of *A. nitidum* except that the prothorax is sparsely and regularly covered with fine whitish pubescence.

[Described from specimens Hopk. U. S. 11076a<sup>1</sup> and 9528.]



This species, occurring throughout the Rocky Mountains and the Pacific Coast regions attacks dying and dead species of *Pinus*, *Abies*, and *Pseudotsuga*. It is strictly more primary in its attack than *Asemum*, being often found mining under the bark of trees infested by *Dendroctonus* long before the leaves begin to fade. The larva is more of a heartwood feeder, probably living in this stage at least two years. The mines are tightly packed with fibrous frass. The adults have been collected from June to August.

#### CRIOCEPHALUS OBSOLETUS Randall

This species averages smaller in size than in *C. productus*, the asperities are finer, and the pubescence much finer and yellowish white instead of reddish brown as in *C. productus*. The chitinized portion of the proalar area is nearly glabrous. The caudal spines are on a common base and slightly compressed.

[Described from specimens Hopk. U. S. 9733 and 11874e.]

The larva mines in the stumps of eastern species of *Pinus*, near the surface of the ground and down into the roots. The work is similar to that of *C. productus*. The adults appear during June and July. Observations by W. F. Fiske and the author.

#### CRIOCEPHALUS MONTANUS LeConte

Specimens cannot be distinguished from those of *C. obsoletus*.

It has been reared from *Pinus ponderosa*.

#### NOTHORHINA ASPERA LeConte

[Pl. VI, Fig. 10]

*Form* and pubescence as in *Criocephalus productus*. Caudal spines sharply triangular, flat, concave posteriorly, situated on a common projecting base. Epistoma abruptly declivous; second antennal joint longer than third; mandibles more robust, dorsal plate strongly striate. Asperities of pronotum and ampullae similar in texture to those of *A. moestum*. Pleural tubercle rather densely hairy.

[Described from specimens Hopk. U. S. 12674a.]

This larva has been found only in dead heartwood of *Pseudotsuga*, in Rocky Mountain and Pacific Coast regions. The galleries are tightly packed with fibrous frass. Adults fly from July to September. The larva is described from specimens collected in Colorado by Mr. A. B. Champlain.

#### SPONDYLIS Fabricius

[Pls. I, III, VI]

The writer has not seen any specimens of this genus, but places it here following Perris. Perris's description is utilized and from it the characters are taken as given in his table in "Larves des Coleopteres." Judging from the remarkable similarity between European species of *Tetropium*, *Asemum*, and *Criocephalus* which the author has compared with our American forms, the characters given here will hold for *Spondylis upiformis*. The figures are from Perris.

The adults of our species have been collected from dead logs of *Pinus* in the western United States and British Columbia. It flies from May to July.

#### TETROPIUM Kirby

*Form* rather short; robust; pubescence fine and short. Head less salient, depressed; labrum transverse; mandibles short, robust, apex blunt, dorsal angle of cutting edge rounded or bluntly toothed, not flattened; last joint of maxillary palpi sharply conical; gula very short, transverse. Pronotum posteriorly very finely asperate or rather velvety pubescent, ampullae also velvured. Caudal spines either short, blunt, and approximate or projecting and bifurcate at tip.

## TETROPIUM CINNAMOPTERUM Kirby

[Pls. II, VI]

rather slender, cylindrical, closely clothed with fine yellowish-white pubescence by the fact that the caudal spines are connate conical to apex, then suddenly  
 Labrum densely hairy in front; genal bristles short, fine, dense; hypostoma deeply  
 Velvety pubescence on posterior prothorax and ampullae light, castaneous, extremely

*Pupa:* Form as in adult. Pronotum sparsely beset with chitinous-tipped papillae; mesonotum and metanotum glabrous; abdominal terga beset with a posterior band of chitinous papillae; caudal segment bearing two very slender, acute, widely separated, incurved

[Described from specimen Hopk. U. S. 9734.]

The larvae feed only in dead trees. They have been collected from *Abies balsamea*, *Pinus*, and *Picea*. The mines are constructed entirely under the bark until the short pupal cell is made in the outer sapwood or bark. Its range extends through the eastern and northwestern North America. Adults have been collected from June to September.

## TETROPIUM VELUTINUM LeConte

[Pl. VI, XIV, XXII]

*Form* more robust than *T. cinnamopterum*: (epistoma more abruptly declivous; labrum entirely covered with hairs. Pronotum and ampullae more darkly though less densely velured. Caudal spines minute chitinous tubercles separated little more than their length.

*Pupa:* From the specimens studied this pupa can not be distinguished from that of *cinnamopterum*.

[Described from specimens Hopk. U. S. 11908a and 12628.]

This insect is of considerable economic importance, causing the death of *Tsuga heterophylla* and *Larix* throughout the Rocky Mountains and the Pacific Coast region. It has also been found in *Pseudotsuga* and *Pinus*. The larvae mine between the bark and wood, entering their pupal cells constructed in the outer sapwood or bark late in the summer. The adults fly from May to August. Webb describes the work of this insect.

## TETROPIUM ABIETIS Fall

[Pl. III, VIII]

Distinguished from *T. velutinum* by the almost total absence of genal bristles and the shining glabrous spot on the center of the labrum. The form is slightly more robust.

*Pupa:* Easily recognized by the absence of papillae on the pronotum and the coarse, very chitinous ones of the dorsal abdominal segments.

[Described from specimens Hopk. U. S. 10897c.]

This *Tetropium* is also of economic importance, killing species of *Abies* at high elevations throughout the Pacific Coast region. Its habits are similar to those of *velutinum*, and it is probably often confounded with that species. It rarely pupates in the sapwood, but usually in the inner bark. The adults fly from April to August.

## ATIMIA Haldeman

*Head* not very salient, depressed, widest slightly behind middle; labrum transverse, fleshy; mandibles more slender than those of *Tetropium*, apical and dorsal portions of cutting edge roundly, slightly toothed; genal setae very long and slender; one pair of ocelli. Pronotum very slender behind except for an irregular central area. Ampullae glabrous, shining, fourth, fifth, and sixth multiply bilobed, giving abdomen a four sided form. Caudal spines short, acute, incurved, separated more than twice their length.

## ATIMIA DORSALIS LeConte

[Pls. III, VI, VII, XXIII, XXV]

*Form* elongate, semi-robust, anteriorly slightly depressed; integument thin, shining, very sparsely clothed with short whitish pubescence.

*Head* depressed; ocelli sometimes nearly obsolete; epistoma thin, curved; hypostoma transverse; gula very short; ventral mouth-parts fleshy, palpal joints subequal.

*Prothorax* about twice as wide as long, with an anterior, dorsal, transverse, light ochraceous band divided into four plates extending across protergum; pronotum anteriorly shining, posteriorly very finely velvety pubescent except for central area (pubescence sometimes nearly obsolete); eusternum having a narrow, transverse, posterior band of velvety pubescence. Mesonotum and metanotum extremely finely velured.

*Abdomen* shining; ampullae rarely at all pubescent, fourth, fifth and sixth deeply bilobed, these lobes tending to be tuberculate. Spiracles small, middle abdominal ones orbicular. Caudal spines two, widely separated.

[Described from specimens Hopk. U. S. 4240g.]

The species of *Atimia* are found only in the Cupressae. The larvae of this species mine under the bark of recently dead trees, pupating and transforming to adults in the late summer, but not emerging until spring. *A. dorsalis* has been reared from *Cupressus*, *Juniperus*, and *Libocedrus* through the Pacific Coast region. Observations by Messrs. H. E. Burke and J. M. Miller.

#### ATIMIA CONFUSA Say

This species can only be distinguished from *A. dorsalis* by the more slender form and by its different distribution.

*Pupa*: Form, as in adult. Beset with short, stiff hairs as follows: Several groups of three on front of head; finer ones around perimeter of pronotum; two groups on mesonotum and metanotum; a transverse row on each abdominal tergum, denser on second and third. Caudal spines reflexed.

[Described from specimens Hopk. U. S. 9483 and 11820.]

This larva has been taken in *Juniperus*, *Thuja*, and *Chamaecyparis*. Two broods of adults occur each year: one in early spring and the other in early fall. From eggs laid by the spring brood some adults appear in the early fall, some larvae over winter and transform to adults for the early spring flight, and sometimes a few larvae live until the following fall before they transform. The fall brood shows the same irregularity of development.

#### PARATIMIA CONICOLA Fisher

[Pl. VI, XL]

*Form* semi-robust, anteriorly depressed; integument firm, shining, very sparsely covered with short whitish pubescence.

Very closely resembling *Atimia*, from which it is distinguished by the absence of any veluring on prothorax or body. Pronotum trapezoidal, widest behind, smooth, glabrous, shining. Ampullae prominent, projecting, shining, not bilobed, marked by a transverse furrow. Caudal spines separated about three times their height, very attenuately acute, straight, projecting dorsally.

[Described from specimens Hopk. U. S. 10856d.]

The peculiar habits of this species were discovered by Messrs. J. M. Miller and P. D. Sergeant. The larva feeds in the dry, dead cones of *Pinus attenuata*, boring through pith scales and seeds. Adults were found in the pupal cells in October. Collected at Waldo, Oregon.

#### OPSIMUS Thomson

This genus forms a distinct transition between the Aseminae and the Cerambycinae. The ventral mouthparts are fused to the whole width of the hypostomal plates; the clypeus extends out narrowly to the dorsal condyles as in the Aseminae, but is much shorter. The lacinia is borne on the palpifer, which is large and also bears the palpi as in the Aseminae. The mandibles have the gouge-shaped cutting edge typical of the Cerambycinae. The eusternum is triangular and distinct.

#### OPSIMUS QUADRILINEATUS Mannerheim

[Pls. III, VIII]

*Form* subquadrate, elongate, slightly tapering; integument thin, white, shining; sparsely covered with fine lemon-yellow hair.

*Head* transverse, gradually widening behind, narrowest in front, exposed surface brown, chitinized excepting hypostoma; clypeus and labrum thin, latter twice as wide as long; mandibles

antennae very short, retractile, conical, first and second joints broad, third joint with a longer third and a shorter supplementary joint; ocelli one, white, touching antennae; gena very hairy. Ventral mouth-parts fused to entire width of labium; maxillary palpi two-jointed, last slender, twice as long as second, equal to last labial; lacinia thin, lanceolate, hairy, fringed on inner margin; ligula small, orbicular; gula not

slightly depressed; pronotum rectangular, posteriorly dull, finely granulate, anteriorly hairy; lateral sutures complete, no median suture, eusternum triangular, dull; sternum not distinct. Legless.

Abdomen dull, not definitely marked, the first three pairs flat, the fourth, fifth and sixth projecting and somewhat bilobed as in *Atimia*. Spiracles distinct, chitinous-rimmed, thoracic oval, abdominal orbicular.

Described from specimens Hopk. U. S. 11043a.]

This larva bores in sound, recently dead, or dying branches of *Picea*, *Abies* and *Tsuga*, and old fire-sears. The mines are extended principally in the sapwood, where pupation occurs in the fall of the year. The insect overwinters as an adult, flying from April to May. It occurs in Oregon, Washington, British Columbia and bordering regions.

### Subfamily CERAMBYCINAE

The larvae of the Cerambycinae as here considered form a sharply defined group. Most systematists include in this group the Aseminae and Lepurinae, each of which has been treated here as of subfamily rank. Including such groups it would be necessary (by larval characters) to treat all other cerambycids excepting the Lamiinae as belonging in one subfamily.

They are most readily recognized by the short mandible having a rounded, gouge-like cutting edge and the small clypeus not filling the space between the dorsal articulations of the mandibles. They usually have fairly-well developed legs, but in some genera and species these are lacking. The larvae are quite hairy or pubescent. This is a large subfamily showing many variations in biological and anatomical structures.

The characters of the Cerambycinae may be briefly summarized as follows:

#### CHARACTERIZATION OF LARVAE OF THE SUBFAMILY CERAMBYCINAE

*Head* transverse; dorsal margins of epicranial halves behind front fused for some distance, later separating, angulate; tentorial cross-arm lowered in a plane parallel to hypostoma (*i.e.*, occipital foramen apparently divided into an anterior and a posterior portion).

*Mandible* short, trapezoidal, cutting edge gougelike, never having apex or dorsal angle produced.

*Epistoma* not produced over clypeus, two setae on each side; clypeus narrow, not as wide at base as epistoma; labrum small, usually more or less circular.

*Maxillae* moveable; cardo distinct; maxillary sclerite full; ventral mouth-parts attached to hypostoma by little more than width of gula; palpifer small; lacinia borne on stipes.

*Antennae* quite salient, rarely entirely retractile.

*Prothorax* having presternum and epipleurum often fused, sometimes distinctly separated; eusternum rarely distinct; coxae small, opposite sternellum. Postnotal fold usually present. Mesothoracic spiracle not protruding into prothorax. Legs either wanting or developed.

*Abdomen* having an elliptical region surrounding the spiracle, protruding and well defined; epipleurum protuberant only on last three segments; pleural discs present; hypopleurum large; coxal lobe small.

#### ARTIFICIAL KEY TO THE GENERA OR TRIBES OF THE CERAMBYCINAE

One or no ocelli.....	I
Two ocelli.....	II
Four ocelli.....	III

#### I.

Gena not shouldered.....	1
Gena more or less shouldered, enclosing ocellus.....	15
1. Postnotal fold behind prothorax absent; antennae conical.....	<i>Methini</i> , <i>Oemini</i>
Postnotal fold present; antennae salient.....	2
2. Genal setae present, usually dense, long, stiff.....	3
Genal setae absent, or sparse fine hairs.....	8

- |   |   |
|---|---|
| 3. Pleural discs, large, circular, finely granulate.....  | 4   |
| Pleural discs indistinct.....   | 5   |
| 4. Legs short, ampullae broad, flat; form contracted.....   | <i>Callidiini</i>                         |
| Legs slender, ampullae projecting, form elongate.....   | <i>Elaphidion subpubescens</i> and allies |
| 5. Genal setae very short and dense.....  | <i>Callichroma</i>                        |
| Genal setae very long, curved.....  | 6   |
| 6. Last joint of maxillary palpi longer than second.....  | 7   |
| Last joint of maxillary palpi not longer than second.....   | <i>Elaphidion subpubescens</i> and allies |
| 7. Hypopleurum of abdominal segments laterally protuberant; skin between several middle ventral ampullae distinctly rugulose.....     | <i>Curius</i> and <i>Euderes</i>          |
| Hypopleurum normal or ventrally protuberant with ampullae; ampullae usually strongly bilobed; skin between segments not rugulose..... | <i>Molorchini</i>                         |
| 8. Pleural discs, distinct, circular, either having a deep pore or finely granulate.....  | 9   |
| Pleural discs indistinct; femur plus tibia shorter than maxillary palpi.....  | 12  |
| 9. Yellowish presternal plates of prothorax distinct.....   | <i>Malocopterus</i>                       |
| Presternal plates absent.....   | 10  |
| 10. Prosternum never more than twice as wide as long (i.e., between notchlike ventro-lateral sutures.....                             | <i>Calidiini</i>                          |
| Prosternum more than twice as wide as long (i.e., between notchlike ventro-lateral sutures.....                                       | 11  |
| 11. Prothorax somewhat depressed; ampullae flat; form not elongate.....   | <i>Heterospini</i>                        |
| Prothorax quadrate; ampullae strongly protuberant; form elongate.....   | <i>Elaphidion subpubescens</i> and allies |
| 12. Eusternum distinct, triangular, shining.....  | <i>Smodicum</i>                           |
| Eusternum not distinct.....   | 13  |
| 13. Pronotum not striate or, if so, having the median suture deeply impressed.....  | <i>Clytini</i>                            |
| Pronotum striate, no median suture.....   | 14  |
| 14. Pronotum about twice as wide as long; last joint of maxillary palpi longer than second.....                                       | <i>Anaglypti</i>                          |
| Pronotum but little wider than long; last joint of maxillary palpi not longer than second.....  | <i>Tylonotus</i>                          |
| 15. Yellowish presternal plates of prothorax present.....   | <i>Stenaspini</i>                         |
| Yellowish presternal plates of prothorax absent.....  | 16  |
| 16. Metanotum having x-shaped impressions.....  | <i>Phoracanthini</i>                      |
| Metanotum having a single transverse impression.....  | 17  |
| 17. Pleural discs finely granulated, or a deep pore.....  | 18  |
| Pleural discs indistinct, obstructed by a tubercle.....   | 19  |
| 18. Prosternum between notch-like ventro-lateral sutures, not twice as wide as long.....  | <i>Callidiini</i> .                       |
| Prosternum between notch-like ventro-lateral sutures more than twice as wide as long.....   | <i>Heterospina</i>                        |
| 19. Both ventro-lateral and median dorsal suture of pronotum impressed.....   | 20  |
| Neither ventro-lateral nor median dorsal suture of prothorax impressed.....   | <i>Anaglypti</i>                          |
| 20. Metanotum with a single transverse suture.....  | <i>Eburini</i>                            |
| Metanotum with x-shaped sutures.....  | <i>Phoracanthini</i>                      |

## II

- |   |                          |
|---|--------------------------|
| Postnotal fold (behind prothorax) absent; antennae conical.....   | <i>Haplidus</i>          |
| Postnotal fold (behind prothorax) present; antennae salient.....  | 1                        |
| 1. Metanotum having x-shaped sutures.....                         | <i>Phoracanthini</i>     |
| Metanotum having a single transverse suture.....                  | 2                        |
| 2. Pleural discs finely granulate.....                            | 3                        |
| Pleural discs indistinct, obstructed by a tubercle.....           | <i>Cyllenes</i> (rarely) |
| 3. Ventro-lateral sutures of prothorax absent.....                | <i>Ibidiioni</i>         |
| Ventro-lateral sutures distinct, widely diverging anteriorly..... | <i>Rhopalophora</i>      |

## III

- |   |                           |
|---|---------------------------|
| Ocelli sharply defined; median suture of pronotum impressed.....                | <i>Hylotrupes bajulus</i> |
| Ocelli often indistinct, or fused; median suture of pronotum not impressed..... | <i>Cyllenes</i>           |

## SMODICUM Haldeman

Most writers, in discussing the adult of this genus, agree that it is an aberrant form and place it at the beginning of the Cerambycinae. The larva is likewise perplexing, not from any peculiarities of structure but because of a striking absence of any definite characters which might give a clue to its relationship. It is typically a cerambycine, but in some respects suggests a prionine. The rather distinct triangular eusternum suggests the Asciminae, and allied forms. On the strength of this single character and the opinion of

the adult systematists it is retained here. The correlation in form between the adult and the larva so often seen in the Cerambycidae does not hold in this species. The depressed adult suggests a bark-feeder, while the larva is cylindrical and mines in solid wood.

### SMODICUM CUCUJIFORME Say

[Pl. XVIII]

*Form* cylindrical, slender, slightly tapering; integument thin, white, and shining, sparsely covered with very fine white hair.

*Head* suborbicular, a sudden constriction at base, rather abruptly broad in front; mouth frame white, never corneous; clypeus and labrum small, fleshy, later transverse; mandible short, basal half light, distal piecous, having a groove on outer face; antennae fleshy, first and second joints subequal, short, about as long as thick; one small black ocellus contiguous to base of antennae. Ventral mouth-parts white, fleshy; last joint of maxillary palpi one and one-half times the length of second; lobe of palpifer minute. Gula narrow, sides slightly concave.

*Prothorax* quadrate, tergal plates dull lemon-coloured; pronotum square, posterior area shining, finely, irregularly striate, median suture not impressed. Sternum finely hairy; eusternum distinct, triangular, glabrous; poststernellar fold not distinct at extremities, fused into epipleurum; ventro-lateral suture not impressed. Mesonotum and metanotum not distinctly impressed by sutures. Legs minute, three-jointed, shorter than maxillary palpi.

*Abdomen:* Ampullae prominent, small, shining alutaceous; inter-segmental skin long, ampullae widely separated. Pleural discs distinct on three segments, not distinctly granulate. Spiracles minute, orbicular, peritreme thin.

[Described from specimens Hopk. U. S. 9791 n.]

This larva is a typical heartwood borer in very old dry and seasoned wood of *Quercus* and *Hicoria*. Its work is often found under old fire-scars on oaks, where the larvae bore in connection with *Eburia quadrigeminata*, completely honeycombing the heartwood. The mines are tightly packed with granular frass. The larva sometimes attacks seasoned products. The adult flies in June and July throughout the eastern United States. Hopkins records the adults under bark of *Fagus*, *Ulmus* and *Gleditsia* in West Virginia. Observations by A. B. Champlain and the author.

### Tribes OEMINI and METHINI

The following five genera, *Oeme*, *Haplidus*, *Dysphaga*, *Methia*, and *Idoemea*, undoubtedly show close affinities and here are grouped together. This does not mean that they are to be considered as one tribe, but as only a few of the larvae in these groups of adults have been studied and two of the genera have not been reared (*Haplidus* and *Methia*), they are so grouped for the present. *Oeme* and *Dysphaga* each show characters of distinct tribal value. The species of *Oeme* show important affinities to the Aseminae and are considered as related to them.

They may be recognized by the slender form and depressed prothorax; antennae short and conical, retractile; antennal ring bisected by rather distinct frontal sutures (in *Oeme*); genal setae usually dense; sternum broad and not very long; ventro-lateral sutures obliquely impressed, diverging anteriorly; eusternum often faintly indicated by sutures; prosternellar fold strongly fused into epipleurum at extremities; no median pronotal suture; fold behind pronotum wanting; mesonotum and metanotum each with a transverse suture; legs very short, conical, three or four jointed; pleural discs a deep pore (in *Oeme*), or indistinct.

The following key will separate the described genera:

#### KEY TO THE GENERA OF OEMINI AND METHINI

- Head not bearing a short carina behind ventral articulation of mandible.  
 Articulation of submentum to gula sunken below anterior edge of hypostoma.  
   Genal setae dense, conspicuous..... *Oeme*  
   Genal setae very few, in two small groups..... *Idoemea*  
 Articulation in line with edge of hypostoma..... *Haplidus*  
 Head bearing a short carina behind ventral articulation of mandible.  
   Process of palpifer indistinct..... *Dysphaga*  
   Process of palpifer large, bearing long, recurved setae..... *Methia*

## OEME Newinan

The species of *Oeme* are very similar by larval characters. They can be recognized as follows. Head subtriangular, widest behind; antennae short, conical, retractile; one ocellus; genal bristles dense; submentum deeply and suddenly sunken below anterior margin of hypostomal plates and fused with fleshy gula; prothorax depressed, transverse; no median suture on pronotum; postnotal fold absent; ventro-lateral sutures oblique, widely diverging anteriorly; sternellar fold not distinct at extremities; pleural discs conspicuous; dorsal ampullae with two lateral and two transverse impressions, wider in middle; legs short; form slender.

The larvae of this genus breed in the dead wood of the Cupre-sae and one species of *Pinus*. All, so far as known, complete the life cycle in one year. The younger larvae mine beneath the bark, exuding much granular frass. Shortly before pupating they enter the sapwood or heartwood, where a characteristic cell is constructed. At the outer extremity of this pupal cell a disc of wood is left, perforated in the center, which partly closes the cell.

## KEY TO THE SPECIES OF OEME

- Labrum orbicular, body hairs silky ..... *O. rigida*  
 Labrum transversely oval.  
 Ultimate joint of maxillary palpi equal to penultimate, body hairs coarser. Breeds  
 in *Pinus* ..... *O. costata*..  
 Ultimate joint of maxillary palpi equal to penultimate, body hairs silky ..... *O. strangulata*

## OEME RIGIDA Say

[Pls. VIII, XX, XLII]

*Form* elongate, slender, cylindrical; integument thin, shining, sparsely covered with long, light, castaneous hairs.

*Head* subtriangular, depressed, strongly tapering anteriorly; mouth-frame slightly corneous; clypeus and labrum thin, latter orbicular; mandibles black, shining, slightly constricted near apex, basal piece indistinct; antennae short, retractile, conical, last joint slender, much longer than third, supplementary distinct; one black ocellus, not contiguous with antennae. Ventral mouth-parts indistinguishably fused by submentum with gula; process of palifer distinct, as also process on first maxillary joint; maxillary palpi short, conical, ultimate joint slightly shorter than penultimate, shorter than last labial; gula soft, deeply sunken below anterior curved edge of hypostomal plates; gena not shouldered, bristles dense, long and slender.

*Prothorax* transversely depressed, short, pronotum rectangular, of essentially same texture throughout, or slightly reticulated behind, no median suture; sternum shining, reticulated, ventro-lateral sutures widely diverging anteriorly; sternellar fold broadly fused at extremities into epipleurum. Mesonotum and metanotum with straight transverse impression. Legs short, conical, four-jointed, joints globular, femur and tibia shorter than maxillary palpi.

*Abdominal segments* elongate; dorsal ampullae alutaceous, shining, marked by two lateral impressions, a shallow median longitudinal furrow, and two transverse impressions forming a fusiform diamond-shaped area. Pleural disc faint on first segment, distinct on second and third, faint on fifth. Abdominal spiracles minute, oval, peritreme thin.

[Described from specimens Hopk. U. S. 11847z]

The larva has been collected in *Taxodium* and *Juniperus*. A. B. Champlain records the adults ovipositing in the exit holes of *Phloeosinus*, in Connecticut, July 15. By October most of the larvae had constructed their pupal cells. W. F. Fiske has made a number of observations on this species in the south. He records two generations or an overlapping of broods in some localities, since he found adults in September.

## OEME COSTATA LeConte

Distinguishable from *rigida* only by the coarser and more densely set hairs, often chitinous tarsus, usually white ocellus, and transversely oval labrum.

*Pupa*: The pupa is characterized by almost total absence of spines on the body. The tergum of the mesothorax has a small group of spines near the posterior median margin, and a transverse band of from six to eight small spines occur on the first three dorsal abdominal segments.

[Described from specimens Hopk. U. S. 12677a.]

The larval habits are similar to those of *O. rigida*. It is more commonly found in branches. It has been collected by A. B. Champlain from *Pinus edulis* in Colorado and by M. Chrisman from *Pinus ponderosa* in Arizona.

## OEME STRANGULATA Horn

Similar to, but distinct, a-hedle from *O. rigida*. In both *rigida* and *costata* the ultimate joint of the maxillary palpus is much shorter than the penultimate, while in *strangulata* the two joints are subequal; the labrum transversely oval; the body hairs are fine, silky and whitish.

*Pupa*: The pupa entirely lacks the group of spines on the metathorax, while each abdominal segment bears two small groups on the anterior part of the dorsal surface.

[Described from specimens Hopk. U. S. 10329c.]

This larva has been collected in the small branches of *Cupressus* and *Juniperus* in Arizona by M. Chrisman. The adult flies in June.

## HAPLIDUS TESTACEUS LeConte

[Pl. IX, Fig. 6]

*Form* very elongate, slender; integument rather firm, shining, sparsely covered with whitish hairs.

*Head* transverse, twice as wide as long, rather broad in front, sides curved; mouth-frame scarcely corneous; clypeus and labrum thin, latter transversely oval; mandible tapering, long, basal piece short, about one-fourth length of distal, latter pieceous, impression at base on outer face; antennae short, retractile, third joint globular, fourth slender; ocelli two, black, prominent, enclosed by very abruptly shouldered gena bearing numerous fine, short, white bristles; ventral mouth-parts fleshy, fused with gula; palpi long, slender, ultimate joint of maxillary palpi about twice length of penultimate, equal to last labial; gula wide, sutures strongly diverging behind.

*Prothorax* transverse; pronotum posteriorly finely rugulose with a tendency to striation; sternal region smooth, shining; sternellar fold broadly fused at extremities into epipleurum. Legs short, basal joint globular, second longer than third, tarsus twice as long as second.

*Abdomen* dorsal ampullae alutaceous, shining, marked by two lateral and two transverse impressions and a median longitudinal furrow. Spiracles sub-rectangularly oval.

[Described from a single poor specimen, Hopk. U. S. 2779.]

The specimen on which this description is based was not reared, but collected and associated with the adult by A. D. Hopkins. It was working in the small dead branches of *Pinus jeffreyi*, in Ventura Co., California.

## DYSPHAGA TENUIPES Haldeman

[Pls. VIII, XXVI]

*Form* cylindric, slender, elongate; integument thin, shining, sparsely covered with short yellowish hairs.

*Head* transversely sub-orbicular, rather thick, mouth-frame light lemon-coloured, not strongly corneous; labrum fleshy, transversely oval; mandible rather robust and broad at apex, basal piece distinct, light, castaneous, slightly shorter than apical, latter pieceous; antennae minute, conical, retractile; ocellus indistinct, white, oval; gena not shouldered, bearing a row of 6 to 8 very long, slender, recurved bristles. Ventral mouth-parts fleshy, last maxillary joint longer than second; process of palpifer absent; submentum sunken below anterior margin of hypostoma, fused with membranous gula; epicranium bearing a short prominent carina just below the ventral articulation of the mandible.

*Prothorax* subquadrate, depressed; pronotum rectangular, with a border of long hairs in front, posteriorly substrate, merging into dull fine granulations, no median suture; postnotal fold absent; eusternum faintly defined, triangular; ventro-lateral sutures impressed, widely divergent anteriorly; sternellar fold broadly fused at extremities into epipleurum; legs minute, about as long as labial palpi; tarsus not chitinized.

*Abdomen*: Ampullae shining, granulate, with two faint lateral and one faint transverse impression; pleural discs indistinct. Spiracles orbicular, minute, peritreme not corneous.

*Pupa*: Slender, cylindrical, essentially unarmed except for a transverse row of double-pointed (one point extending anteriorly, the other posteriorly) chitinous spines on second, third, fourth, fifth and sixth abdominal terga; seventh armed with simple spines irregularly disposed, this segment also broadly emarginate below.

[Described from specimens Hopk. U. S. 9786d.]

The larva breeds in small dead branches of *Quercus*, *Fagus* and *Hicoria*, and is rarely found in twigs over one-fourth of an inch in diameter. It completely hollows these twigs, forming pupal cells between two wads of frass. Pupation and transformation to adult occur in late summer or fall. Observations by A. B. Champlain and the author. Range, throughout eastern United States.



## METHIA PUSILLA Newman

[Pl. VIII]

*Form*, integument and body characters similar to those of *Dysphaga*. The larvae can be easily recognized by the processes of the maxillary palpifer and the first palpal joint, being well-developed and bearing long incurved setae, the latter being much heavier and extending beyond the palpus. The head tapers more in front than in *Dysphaga*; the labrum is orbicular, and the ocellus is black. [Described from several poor specimens, Hopk. U. S. 1910h.]

The larvae on which this description is based have not been reared but were collected with adults by W. F. Fiske, who found it boring in very small branches of *Taxodium*, in Georgia.

## IDOEMEA sp.

*Form* very elongate, slender; integument thin, shining, very sparsely clothed with very short, fine, whitish hairs.

*Head* rather broad; mouth-frame not corneous; epistoma thin, fused with membranous clypeus which indistinctly fills space between condyles; labrum thick, transversely rectangular; mandible short, shining, basal half somewhat shorter than distal; antennae very short retractile; ocellus large, black, conspicuous (not protruding); gena not shouldered, having a row of five to six short setae above ocellus and another row some distance behind ocellus. Ventral mouth-parts little chitinized, first and second maxillary joints transverse, last equal to last labial, cylindrical; gula sunken below hypostoma as in *Oeme*.

*Prothorax* less than twice as wide as long; pronotum anteriorly densely beset with very fine short hairs, posteriorly finely reticulated to dull granulate behind; sternal region uniformly hairy, undifferentiated, sternellar band short, broadly fused into lateral regions at extremities. Mesonotum and metanotum and sterna dull granulate. Legs two-jointed, very minute, not longer than labial palpi.

*Abdomen* very elongate, slender; ampullae small, very widely separated, shining, very finely alutaceous, having two lateral and two faint oblique transverse impressions and a slight median longitudinal furrow; pleural discs distinct on five segments, surrounding area protuberant. Spiracles minute, indistinct, orbicular; anal lobes protuberant, finely pubescent.

[Described from specimen Hopk. U. S. 12699a and 7132 and 10650r.]

An adult was reared with the last number. The other larvae have not been reared but were collected in twigs of *Juniperus* and *Cupressus* associated with the adult of *Idoemea* sp. by M. Chrisman, 7132a at Paradise, Ariz., and 12699a in the Catalina mountains.

## MALACOPTERUS LINEATUS Guerin

[Pls. XVIII, XIX.]

*Form* elongate, cylindrical, slightly depressed; integument thin, shining, very sparsely covered with short brownish-yellow hairs.

*Head* subtrapezoidal, slightly tapering in front; mouth-frame corneous, smooth, dark castaneous; clypeus and labrum fleshy, latter orbicular, shortly stalked, densely ciliate; mandibles tapering, longer than basal width, smooth, shining, basal piece reddish brown, about one-half length of apical piece, latter pieceous, having a short sulcus on outer face; antennae rather thick, joints subequal, supplementary minute; minute ocelliform tubercle; gena receding, not shouldered, sparsely haired. Ventral mouth-parts fleshy, a chitinous band across stipes; ultimate joint of maxillary palpi much longer than penultimate, slightly larger than last labial; process of palpifer minute.

*Prothorax* subtrapezoidal, with four chitinized tergal and two sternal plates; pronotum shining, length about two-thirds width, posteriorly finely reticulated to very finely granulate, this area slightly raised and extending medially forward, median suture impressed anteriorly, faintly keeled posteriorly; sternal region reticulated, shining ventro-lateral sutures impressed, convergent anteriorly. Legs short, joints globular, basal largest, exclusive of tarsus shorter than maxillary palpi.

*Abdominal segments* elongating caudally; ampullae transverse, oval, prominently projecting, dull, finely granulate, each with a deep lateral impression and a shallow median longitudinal furrow, transverse impressions indistinct. Pleural disc distinct on first segment, faint on second third and fourth. Spiracles narrow, elliptical, peritreme thin.

*Pupa*: Form similar to that of adult; essentially glabrous except for a few conical chitinous tipped points on disc of pronotum; also recurved points on first to eighth abdominal terga, most numerous on second, third and fourth; anal lobes bearing two or three recurved points.

[Described from specimens Hopk. U. S. 10532b.]

All larvae and adults in the collections have been taken from dead *Salix* and *Populus* in Arizona. The larvae construct very long meandering galleries

through the heartwood and sapwood, always packing them tightly with granular material. The work resembles that of *Neoclytus capraea* in ash. Pupation occurs deep in the wood, the adults emerging late in the summer. It is generally associated with a species of *Acanthoderes* and one of *Elaphidion*, both of these working in the decaying sapwood. Range, throughout southwestern United States. The specimens were collected by M. Chrisman.

The adult of this species is generally associated by systematists with *Oeme*, but the larva has few characters in common with the latter and in fact seems to be quite isolated in the subfamily.

#### Tribe CALLIDIINI

The larvae of the *Callidiini* with one exception (*Hylotrupes bajulus*) form a homogeneous and natural group. They can be distinguished by a group of characters usually very constant. The legs are relatively short, three or four jointed, the coxa very small, and the joints more or less globular; exclusive of the tarsus they are never longer, usually shorter, than the maxillary palpi; the maxillary palpifer bears a distinct fleshy process on its lateral face nearly as long as or longer than the last joint of the maxillary palpus; a similar process is borne on the first joint of maxillary palpus, though shorter. A distinct pleural disc is present on three to six abdominal segments. It has a deep pore surrounded by a dull granular area. The prothorax is rather thick and hairy, the hairs of the lateral region are never of two forms, the pronotum is never twice as wide as long, and the median suture, often partially impressed, is never complete; the sternum is broad and never differentiated (*i.e.* into presternum and eusternum) and is fused with the hypopleurum and the epipleurum into one broad area; the ventro-lateral sutures are never impressed; the median central area of the sternum has two circular glabrous spots of contrasting texture; the sternellar fold or area never passes the spiracles and the extremity is usually indistinct and fused into the lateral region. The mesonotum has no distinct x-shaped impression but only the scutellum distinct; the metanotum has a single transverse impression. The ampullae are broad, usually granulate when marked, having two lateral, an anterior connecting transverse, and sometimes a posterior transverse impression. This last one is never complete. The intersegmental skin is very short, thus giving the larvae a more or less contracted, robust form.

In this group a study of the larvae indicates that the formation of genera has been carried too far. In many cases it is impossible to recognize the genera, especially if they contain several species. Thus it would seem that only three distinct groups of genera of larvae occur, one consisting of *H. bajulus*, which is with difficulty included in the Callidiini. It has a distinct triangular eusternum, the mesonotum and the metanotum each with an inverted v-shaped impression (*i.e.* scutellum distinct) and no pleural discs. All writers agree in the position of the adult, hence it will be retained here and may be a radical case of development due to its peculiar habitat. Another generic group would include the two species of *Hylotrupes* *ligneus* and *amethystinus*, and those of *Callidium* and *Phymatodes* in which the sides of the head recede from the antennae (*i.e.* are not shouldered). The species of *Callidium* and *Phymatodes* can not be separated generically. A third would contain those forms having the gena shouldered, inclosing the ocellus, and would include *Callidium antennatum*, *C. janthinum*, *Physocneum*, *Gonocallus* and *Merium*. Within this last larval group several genera might be recognized, but it is doubtful if it could be done if they included more than one species.

The larvae show well-marked affinities to the Clytini and Anaglypti. In fact some of the species of *Callidium* superficially can be confused easily with *Neoclytus*, *Clytanthus*, etc., while *Gonocallus* and *Merium* resemble genera of the *Anaglypti* and many characters of *H. bajulus* are to be found in the species of *Cyllene*. The absence of pleural discs and the relatively shorter legs and process of the palpifer will mark off the *Clytini*-like groups.

These larvae likewise are similar in their habits. All are feeders on the inner layer of bark for the greater part of the larval life, going into the wood (sometimes the bark) only to pupate. All normally mature in one year. The exception is *Hylotrupes bajulus*, which lives in dry seasoned wood, and often requires many years to mature.

#### KEY TO THE GENERA OR SPECIES OF CALLIDIINI

- Three pairs of ocelli..... *Hylotrupes bajulus*  
 One pair or no ocelli.  
 Gena receding from antennae, never shouldered so as to enclose the ocelli; ocelli one or none.  
 Gena bristles short and dense; no ocelli; last joint of maxillary palpi shorter than second; pronotum not distinctly striate..... *Hylotrupes ligneus*, *H. amethystinus*.  
 Gena bristles absent or very long; one or no ocelli; last joint of maxillary palpi longer than second; pronotum usually striate..... *Ropalopus*, *Callidium* and *Phymatodes*.  
 Gena shouldered and more or less corneous, enclosing ocelli.  
 Anterior edge of hypostoma bearing four tuberculiform projections.. *Callidium antennatum* and *C. janthinum*

Anterior edges of hypostoma smooth or merely roughened.

Subfossal spine indistinct. . . . . *Physocnemum*

Subfossal spine conical, acute.

Epicranium not bearing a distinct tuberculiform carina above antennae.

Pronotum having a median suture impressed on posterior half; body hairs lighter. . . . . *Gonocallus*

Pronotum with no median suture; body hairs castaneous. . . . . *Merium*

Epicranium bearing a distinct tuberculiform carina above antennae. . . . *Xylocrius* (?)

### HYLOTRUPES BAJULUS Linnaeus

*Form* rather robust, slightly depressed; integument thin, shining, very sparsely covered with very long yellowish hairs.

*Head* subtrapezoidal, widest behind; mouth-frame very slightly chitinized (light lemon colour); epistoma swollen; clypeus and labrum fleshy, latter twice as wide as long; mandibles broad, basal piece light brown, distal black, shining, having a deep longitudinal impression; antennae fleshy, first and last joints sub-equal, second much longer, supplementary minute; ocelli three, oval, projecting, usually black; gena somewhat shouldered, not setose; ventral mouth-parts soft, fleshy, last maxillary joint shortest, shorter than last labial; process of the palpifer distinct, not as long as last maxillary joint; gula narrow, sutures concave.

*Prothorax* rectangular, depressed; pronotum but little wider than long, shining, anteriorly sparsely beset with long hairs, posteriorly smooth, shining, with a few irregular indistinct striae; median suture deeply impressed; eusternum distinct, glabrous, shining; sternellar fold not distinct beyond spiracles. Metanotum marked with inverted v-shaped impression. Legs short, four-jointed.

*Abdomen:* Dorsal ampullae rather prominently projecting, shining, coarsely sub-reticulate approaching tuberculate, having two lateral and two transverse impressions and a deep median furrow. Pleural discs indistinct, not granulate. Spiracles broadly oval, small, peritreme thin. [Described from specimens Hopk. U. S. 9731 and 11866h.]

The larval habits of this species are very different from those of the other Callidiini. It attacks dry-seasoned wood of conifers, excavating extensive galleries loosely packed with mixed, fine, powdery, small pellet-like frass, though a great deal of this is extruded. This species is of economic importance and many references in literature discuss its habits and the great length of its larval life. It often mines for years in a finished piece of furniture. Mr. George Dimmock has given me the following unpublished note: "Adult emerged from wood of microscope box June, 1885; this instrument was imported from Germany in 1881, first sign of work noticed by exuded frass in 1882."

The writer found the pine trestles of a railroad bridge completely destroyed by these larvae, necessitating their removal. It has been collected from *Pinus* and *Picea*.

### HYLOTRUPES AMETHYSTINUS Leconte

[Pls. X, XV, XVIII, XIX, XXXIV]

*Form* robust, sub-depressed; integument shining and sparsely covered with yellowish-white hairs.

*Head* subtrapezoidal, narrowing in front; mouth-frame dark brown, chitinized; clypeus very short, labrum suborbicular, very thick, widest at middle; mandible entirely black, shining, without prominent basal piece; no ocelli; antennae slender, first and second joints subequal, last very short; gena receding from antennae (not shouldered), bristles dense and short; ventral mouth-parts rather strongly chitinized; joints of maxillary palpi gradually shorter, last shortest, equal to last labial; process of palpifer large, longer than last maxillary joint.

*Prothorax* rectangular, twice as wide as long, rather densely and finely hairy; pronotum nearly twice as wide as long, anteriorly finely rugulose, posteriorly rugulose striate except for dull granulate posterior border, median suture faintly impressed; eusternal spots glabrous, contiguous, ventro-lateral suture not impressed. Mesonotum and metanotum dull, finely granulate, the former with an incomplete X and the latter with a transverse impression. Legs short, indistinctly four-jointed.

*Abdomen:* Ampullae broad and flat, dull, finely granulate or laterally alutaceous, bearing two lateral, also one complete and one incomplete transverse impression, the seventh ventral segment having a wrinkled corneous, rugose plate at each side. Pleural discs distinct on first, second, third and fourth segments. Spiracles large, oval, peritreme thick.

*Pupa:* Head and thorax unarmed, but beset with a few short, stiff hairs on posterior border of pronotum and on metanotum; abdominal terga 1 to 5, bearing two patches of very short chitinous points in a transverse band, most numerous on second and third.

[Described from specimens Hopk. U. S. 4340c and 9032d.]

The larva breeds normally in species of *Cupressus*, working under the bark and deeply scattering the wood. It enters the wood only to construct a long prepupal gallery. This is rarely constructed in the bark. The mines are loosely packed with granular frass. The life cycle is completed in one year. It has been collected from *Cupressus*, *Libocedrus*, *Thuja*, and *Abies*. Range, in the Pacific Coast and Rocky Mountain regions south to Arizona. H. E. Burke records it in one case attacking a living tree of *Libocedrus*.

#### HYLOTRUPES JUNIPERUS Fisher

This larva can be separated from *amethystinus* only by the coarse castaneous body hairs. Described from specimens Hopk. U. S. 12698.]

Collected by M. Chrisman in Arizona, attacking and killing living junipers. It constructs a very large pupal cell at nearly right angles to the axis of the tree.

#### HYLOTRUPES LIGNEOUS Fabricius

[Pls. XXVI, XLII]

In general similar to *amethystinus*, though smaller, differing in that the genal bristles are not so numerous; the pronotum is less rugose; the ampullae are entirely finely granulate, dull; and the last ventral ampulla lacks the lateral corneous plates.

*Pupa*: Arrangement of spines as in *amethystinus*, but scarcely chitinized and each having a bristle.

The habits of this species are the same as those of *amethystinus*. It has been recorded from *Juniperus*, *Thuja*, *Sequoia*, *Tsuga*, *Libocedrus*, *Picea*, *Pseudotsuga*, *Abies*, *Larix*, *Chamaecyparis*, and *Pinus*. Range, throughout North America. The numerous colour forms of the adults cannot be distinguished in the larva stage.

#### PHYMATODES Mulsant and CALLIDIUM Fabricius

The following species of *Phymatodes* and *Callidium* cannot be separated generically in the larval stage. *C. antennatum* is quite distinct from these forms.

#### KEY TO SPECIES OF CALLIDIUM AND PHYMATODES

- Ocelli absent or not distinctly protuberant, often a black spot beneath chitin.
- Median suture of pronotum not or faintly impressed.....*Callidium aereum*
  - Median suture of pronotum distinctly impressed.
    - Genal bristles wanting.....*Phymatodes variabilis*
    - Genal bristles long and numerous.
      - Pronotum posteriorly striate.....*P. nitidus*
      - Pronotum irregularly rugulose.....*Callidium hirtellum*
- Ocelli distinctly protuberant, usually white.
- Second joint of antennae longer than first, first as long as wide.
    - Protergal plates distinct (orange).....*P. amoenus*
    - Protergal plates not strikingly distinct.
      - Spiracles orbicular, peritreme thin.....*P. dimidiatus*
      - Spiracles narrowly oval, peritreme thick.....*P. vulneratus*
  - Second and first joints of antennae equal, slender.
    - Eastern.....*P. varius*
    - Western.....*P. decussatus*

#### CALLIDIUM AEREUM Newman

[Pls. XV, XIX]

*Larva*: Subcylindric, slightly depressed; integument firm, smooth, not very shining, densely covered with lemon-yellow hair.

*Head*: Subtrapezoidal, gradually widening behind antennae; mouth-frame corneous, castaneous to dirty black; labrum fleshy, transversely oval; mandibles about as long as wide at base, basal process brown, narrow, one-third width of distal, latter piceous, shining, median impression on each face; antennal joints slender, second joint longest, supplementary slender, distinct; ocelli none; gena receding not shouldered, no bristles; ventral mouth-parts scarcely coriaceous; lobe of palpifer distinct; ultimate joint of maxillary palpi twice length of penultimate, equal to last labial; subfossal spine absent; gular sutures parallel.

*Prothorax*: roundly rectangular; pronotum one and one-half times as wide as long, hairy on anterior half, posteriorly very finely and regularly striate, merging into finely granulate, median

impressions faint, pronotal and proalar plates distinct, ochraceous; sternum undifferentiated, hairy, having a dull granulate band in centre, bordered by two glabrous shining spots. Mesonotum and metanotum dull, finely granulate. Legs small, four-jointed, about equal to maxillary palpi.

*Abdomen:* Segments wider ventrally, ampullae with no definite transverse impressions, dull, finely granulate. Pleural discs distinct on first, second, and third abdominal segments. Spiracles narrowly oval, peritreme thin.

*Pupa:* Form similar to that of adult, pronotum bearing a small obtuse tubercle on anterior margin, unarmed except for an irregular row of a few tiny, short, acute, chitinous points on posterior margin of second to last abdominal terga.

[Described from specimens Hopk. U. S. 11947*h* and 11845*l*.]

This larva, so far as known, mines only under the bark of dead or dying *Castanea* and *Quercus*, constructing extensive meandering and crossing mines. The frass is packed behind the larva. The mines are often confused with those of *Agrilus*, from which they can be distinguished by the fact that *Agrilus* intermittently breaks the mine by going into the bark or outer layer of wood for very short distances, whereas *Callidium* always works between the bark and the wood, the mine being always plainly visible. It pupates in early spring, either in the bark or in the outer layers of the sapwood. The adults commonly emerge through April and May or June in the North. Fiske records it as hastening the death of diseased chestnuts in the South. Range, throughout the eastern United States and Canada.

#### PHYMATODES VARIABILIS Fabricius

[Pl. XVIII]

No genal setae; ocelli a black spot beneath chitin, not protuberant; last joint maxillary palpi little longer than second, equal to last labial; first and second joints of antennae subequal, little longer than thick; striae of pronotum coarse, irregular, merging into a granulate band behind; ampullae shining, coarsely granulate, these granules flattened into tiny plates; faintly marked with a transverse and two lateral impressions; pleural discs distinct on first, second, third, fourth, fifth, and sixth abdominal segments; legs four-jointed; texture shining, granulate.

[Described from specimens Hopk. U. S. 11847*g* and 9793*a*.]

The larva mines chiefly in the bark of oak (*Quercus*) and is often of economic importance in the tan-bark industries. In thin bark it burrows between the bark and the wood, making a short curved pupal cell in the sapwood. It pupates in the early spring. A. D. Hopkins and W. F. Fiske have both recorded it from *Picea* and *Tsuga*.

#### PHYMATODES NITIDUS Leconte

Genal bristles numerous, long; ocelli not distinct, a dark spot beneath chitin; last joint of maxillary palpi slightly longer than penultimate; first and second antennal joints short, little longer than thick, subequal; pronotum posteriorly marked with fine and regularly impressed striae; median suture impressed; ampullae finely granulate; pleural discs distinct on first, second, and third segments; legs three-jointed.

[Described from specimens Hopk. U. S. 2348 and 11858*b*.]

*Pupa:* Unarmed except for several conical chitinous-tipped papillae on sixth abdominal tergum and four on seventh.

The larva mines beneath the bark of *Cupressus*, *Sequoia* and *Thuja*. Pupation occurs in the sapwood or between bark and wood. Found in the Pacific Coast region. Collected by H. E. Burke and F. M. Trimble.

#### CALLIDIUM HIRTELLUM Leconte

Genal bristles numerous and long; ocelli not distinct, a dark spot beneath chitin; last joint of maxillary palpi one and one-half times the length of second, shorter than last labial, basal joints transverse; second joint of antennae slightly longer than first, neither longer than thick; pronotum posteriorly bearing a few irregular markings, tending to be rugulose, median suture impressed; ampullae altaceous, with a deep median furrow; pleural discs distinct on first, second and third segments; legs indistinctly three-jointed.

[Described from specimens Hopk. U. S. 9488*c* and 10074.]

The larva has been collected in the small dead twigs of *Pinus ponderosa* by A. D. Hopkins and J. M. Miller in California.

## PHYMATODES AMOENUS Say

[Pl. IX, XIX]

No genal bristles; ocellus prominent; last joint of maxillary palpi nearly twice length of first, second and third joints larger than last labial, basal joints transverse; second joint of antennae slightly longer than first, latter as thick as long; anterior edge of hypostoma thick; prothorax bearing numerous shining dark ochraceous tergal plates; pronotum posteriorly with slightly oblique, sharply impressed striae, median suture impressed; ampullae alutaceously sub-tuberculate, with a deep median furrow; pleural discs distinct on second and third segments, fainter on first and fourth; legs three-jointed.

[Described from specimens Hopk. U. S. 12228a.]

This species has been collected in dead grapevines (*Vitis*). The larval mines are extended principally through the wood and are tightly packed with frass. Pupation takes place very early in the spring. Range, eastern United States and Canada.

## PHYMATODES DIMIDIATUS Kirby

No genal bristles; ocelli prominent; last joint of maxillary palpi longer than second, equal to last labial, basal joints transverse; second joint of antennae slightly longer than first, latter as thick as long; pronotum posteriorly bearing a few striae, median suture impressed; ampullae alutaceously granulate; pleural discs most distinct on second and third segments, faint on first, fourth, and fifth; legs four-jointed; spiracles nearly orbicular; very small, peritreme thin.

[Described from specimens Hopk. U. S. 11835 and 12693a.]

The larva has been found in *Picea*, *Tsuga* and *Larix*. It mines beneath the bark, constructing a rather long prepupal mine in the wood. Range, throughout eastern United States and Canada to the Rocky mountains.

## PHYMATODES VULNERATUS LeConte

No genal bristles; ocelli very prominent, black pigmentation directly under protuberance; last joint of maxillary palpi longer than second, slightly shorter than last labial; antennae slender, second joint longer than first, first a little longer than wide; pronotum posteriorly strongly striate. Median suture impressed; ampullae shining, alutaceously reticulated; pleural discs large and distinct on second and third segments, faint on first; legs four-jointed; spiracles narrowly oval, about as long as ocellus, peritreme heavy. Integument tough, shining, densely haired.

*Pupa*: Body glabrous, except for small chitinous-tipped papillae on abdominal terga, becoming stronger posteriorly and tending to form an oval grouping; last tergum bearing four small spines, two usually larger.

[Described from specimens Hopk. U. S. 14415d.]

Collected by F. B. Herbert at Placerville, Cal., in dead dry branches of *Acer macrophyllum*.

## PHYMATODES VARIUS Fabricius

[Pl. XXXIII]

No genal bristles; ocellus large, prominent; last joint of maxillary palpi slightly longer than second, shorter than last labial; joints one and two of antennae subequal, slender; striae of pronotum short and slightly oblique, ending in a granulate area, median suture impressed; ampullae dull, very finely granulate; pleural discs distinct on first, second and third segments; legs three-jointed.

[Described from specimens Hopk. U. S. 10075p.]

The larvae work as those of *Callidium aereum* and usually are associated with it beneath the bark of white oaks (*Quercus*). It has been collected from Eastern Canada to Arizona.

## PHYMATODES DECUSSATUS LeConte

This species can not be distinguished from *varius*, except by the somewhat finer granulations of the ampullae.

*Pupa*: Unarmed except for a few (about six) small, scarcely chitinous-tipped, tuberculiform points in a single row, on second to seventh abdominal terga.

[Described from specimens Hopk. U. S. 1925.]

These larvae were collected by A. D. Hopkins and H. E. Burke beneath the bark of *Quercus* at Elma, Wash.

## CALLIDIUM ANTENNATUM Newman

[Pl. X]

*Form* robust, somewhat depressed; integument rather thick, more or less reticulated, shining, covered with long castaneous hairs.

*Head* rectangular, nearly as wide in front as behind; mouth-frame very heavily cornified, reddish brown to piceous, often much wrinkled; epistoma straight; labrum rather thick, transversely semicircular; mandibles longer than basal width, basal piece dark brown, two-thirds width of distal, latter shining, piceous; second antennal joint longest, first and last subequal, supplementary, minute, indistinct; ocellus large, yellow, widely enveloped by very large tuberculate genal shoulder. Ventral mouth-parts somewhat coriaceous, process of palpi as long as last maxillary joint, joints of maxillary palpi successively shorter, last labial joint longer than last maxillary; anterior edge of hypostoma bearing four black, prominent, conical projections; subfossal spine distinct; gular sutures widely diverging behind.

*Prothorax* short, rectangular, pronotum one and one-half times as wide as long, anteriorly hairy, posteriorly sparsely irregularly striate to alutaceously reticulated, no median suture; sternum reticulated, shining, not differentiated into areas; sternellar fold rather strongly fused at extremities into eipleurum. Legs four-jointed, without tarsus about as long as maxillary palpi.

*Abdomen*: Dorsal ampullae alutaceous, shining, bounded by two lateral converging folds which are joined anteriorly by a transverse one, ventral with two deep lateral impressions; pleural discs visible on first, second, third, fourth, fifth and sixth segments. Spiracles oval, large, peritreme castaneous, thin, but distinct.

*Pupa*: Form similar to that of adult, armed with very small, blunt, chitinous points, a few on posterior edge of pronotum, two small groups on mesonotum and metanotum, and on each abdominal tergum, growing fewer posteriorly. In some forms from Colorado these points are scarcely chitinized.

[Described from specimens Hopk. U. S. 11857.]

This species spends the greater part of the larval period boring between the bark and wood. The latter is deeply scarred, but not entered until before pupation, when a long pupal cell is constructed parallel to the grain of the wood. The frass loosely fills the burrows and much is expelled. The pupal cell is opened to the exterior by the larvae. One generation occurs each year. This insect often becomes of economic importance in rustic work. Specimens have been collected from *Pinus* and *Picea*, while other forms, probably distinct species, breed in *Thuja*, *Juniperus* and *Chamaecyparis*.

## CALLIDIUM FRIGIDUM Casey

A few specimens which may be this species have the body covered with white hairs; the pronotum is more regularly and finely striate and the tubercles on hypostoma very small or inner pair nearly obsolete. This is also the case in some of the western forms of *antennatum*.

[Described from specimens Hopk. U. S. 11913b.]

Habits similar to those of *antennatum* though more confined to the north-western United States and higher elevations.

## PHYSOCNEMUM ANDREAE Haldeman

[Pl. XXIX]

*Form* elongate, depressed; integument rather dull, thick, alutaceous, sparsely covered with fine whitish hairs.

*Head* subtrapezoidal, widest behind; mouth-frame strongly corneous, reddish brown; labrum thick, fleshy, sub-rectangular; mandibles little longer than basal width, apical half about three times the length of basal, having a groove on outer face, entirely black, shining; one large ocellus contiguous with antennae, enveloped by genal shoulder; antennae long, slender, second joint longest, last very slender and tapering; genal bristles short, stiff; last joint of maxillary palpi equal to second, shorter than last labial; lobe of palpi large; gula not very prominent, sutures diverging; no subfossal spine.

*Prothorax* rectangular, transverse; pronotum one-third wider than long, anteriorly finely rugose, hairy, posteriorly obliquely rugulose, striate, shining; lateral sutures entire, median faintly impressed; prosternum rugulose, shining; sternellar fold not passing beyond spiracles. Mesonotum and metanotum dull, alutaceous, with a transverse impression; legs indistinctly four-jointed.

*Abdomen*: Ampullae broad, flat, alutaceous, shining, dorsally marked by two lateral longitudinal folds and one transverse one connecting them anteriorly, ventrally marked by two lateral, deep triangular impressions and sixth and seventh laterally bounded by a series of

longitudinal corneous carinae. Spiracular area and epipleurum projecting in prominent lobes; spiracles distinct on third, fourth and fifth segments; spiracles broadly oval, large, peritreme distinct. [Described from specimens Hopk. U. S. 3381b.]

The larval mines resemble those of *H. amethystinus*, but often are still more extensive. Pupation takes place in the sapwood. The life cycle is completed in one year. All specimens have been taken from *Taxodium* in the southeastern United States.

#### PHYSOCNEMUM BREVILINEUM Say

*Form* and in general as in *andreae*, but differing in that the texture is smooth and shining, the spiracle and epipleurum less distinct, the pronotum without median suture and the striations fine and very regular, the genal bristles few and fine, and the lateral carina absent on sixth and seventh ampullae.

[Described from specimens Hopk. U. S. 9791z.]

The larval habits of this species are unusual in this tribe. It has only been taken mining in the outer bark of living *Ulmus*. The burrows are rather extensive and meandering, tightly packed with granular frass. Pupation occurs in a cell in the bark. Similar feeding-bark habits occur sporadically in several other genera in the Cerambycinae. Observations by A. B. Champlain and the author.

#### GONOCALLUS COLLARIS Kirby

[Pl. X]

*Form* cylindrical, rather robust; integument firm, rather glossy, white, densely covered with long castaneous hairs.

*Head* subquadrate, rather broad in front; mouth-frame corneous, dark chestnut brown; epistoma swollen and wrinkled; labrum thin, little wider than long; mandibles longer than wide at base, basal piece brown, distal pieceous, shining, one and one-half times length of basal; antennae slender, second joint, slightly longest; ocellus large, white, enclosed by slightly shouldered gena, latter bearing three to four long bristles. Ventral mouth-parts slightly coriaceous, joints of maxillary palpi subequal, last shorter than last labial; subfossal spine distinct; gula narrow, sutures slightly diverging.

*Prothorax* rectangular, thick, yellow tergal plates prominent; pronotum little wider than long, hairy, posteriorly irregularly striate, merging into finely granulate, median suture entirely impressed; sternum rugulose, reticulated. Mesonotum and metanotum smooth. Legs four-jointed, without tarsus as long as maxillary palpi.

*Abdomen*: Dorsal ampullae finely granulate, dull, impressed by two lateral sutures, converging and meeting the transverse one. Pleural disc distinct on first, second and third abdominal segments. Spiracles small, suborbicular, peritreme thin.

[Described from specimens Hopk. U. S. 10385c and 12610a.]

The larva feeds in the stems of young pines and spruce (*Pinus* and *Picea*), boring beneath the bark and pupating in the wood, completing the life cycle in one year.

#### MERIUM PROTEUS Kirby

[Pls. XV, XIX]

*Form* robust, cylindrical; integument firm, rather dull, densely covered with long, light castaneous hairs.

*Head* transverse, rather broad in front; mouth-frame strongly chitinized, dark brown; labrum about one and one-half times as wide as long; mandibles longer than wide at base, basal piece reddish-brown, one-half as wide as distal piece, latter pieceous, shining, with a faint longitudinal groove; first and second antennal joints subequal, last one-half as long as first; one large white ocellus contiguous with antennae, enclosed by shouldered gena; a few long genal bristles. Ventral mouth-parts slightly coriaceous, joints of maxillary palpi successively shorter, last slightly shorter than last labial; hypostomal edge often roughened; subfossular spine distinct; sutures diverging convex.

*Prothorax* rectangular, hairy; pronotum little wider than long, posteriorly substriate to granulate, no median suture; sternum undifferentiated, rugulose, hairy, except for two glabrous shining spots; sternellar fold not passing spiracle, rather broadly fused into epipleurum. Mesonotum and metanotum finely alutaceous, bearing a transverse impression. Legs short, four-jointed, without tarsus equal to maxillary palpi.



*Abdomen:* Dorsal ampullae rather narrow, alutaceous, two oblique lateral impressions connected anteriorly by a transverse one, skin behind ventral ampullae transversely wrinkled. Pleural discs distinct on first, second and third abdominals, faint on fourth. Spiracles oval, small, the last orbicular, peritreme thin, ochraceous.

[Described from specimens Hopk. U. S. No. 12652a.]

This species has been found only in *Picea*. The larva bores beneath the bark of dead trees, entering the wood to pupate, and completing the life cycle in one year. It causes much damage to rustic work in Maine and eastern Canada. It occurs from eastern Canada to the Rocky Mountains.

#### XYLOCRIUS LeConte<sup>1</sup>

Several larvae in the U.S. Forest Insect Collection belonging to the *Callidini* are quite similar to *Merium* and *Callidium*. They have never been reared or associated with adults, but by elimination have been placed in this genus until their position can be verified. They may be recognized as follows:

Integument tough, shining, densely covered with long, dark, castaneous hairs; head much depressed; gena broadly shouldered and tuberculate, enclosing distinct, protuberant ocellus and bearing several inconspicuous hairs; labrum small, roundly rectangular; last joint of maxillary palpi shortest, shorter than last labial; palpifer and first palpus joint bearing distinct process; gula indistinct; hypostoma smooth. Thorax and abdomen much as in *C. antennatum*; spiracles broadly oval, peritreme thin; pleural discs distinct on first three or four abdominal segments; seventh ventral ampulla lacks chitinous plates.

[Described from specimens Hopk. U. S. No. 11919.]

It has been collected in Colorado in *Pinus flexilis* by Geo. Hofer, A. B. Champlain and the author. The work resembles that of *Callidium antennatum* in the form of mine beneath the bark, the expulsion of frass from a small hole and the long pupal cell in the wood which is opened through the bark by the larva. It attacks dying trees, probably hastening the death of the branches.

#### Tribe GLYTINI

The following larvae form a natural group of several distinct genera; they may be recognized as follows:

*Form* robust, contracted, rather thick, tapering to last few segments, then suddenly swelling. *Head* trapezoidal, widest behind; ocelli small, one to three; gena never shouldered; no genal setae; labrum never longer than wide; thick; mandible without sulcus or groove on outer face; subfossal spine wanting or very minute; process of palpifer minute or wanting; last joint of maxillary palpi relatively short. *Prothorax* thick, having distinct proalar plates and short, more or less subulate hairs on the lateral region; pronotum posteriorly raised, projecting forward along the median line, glabrous or velvety pubescent, never striate; median suture absent or impressed; eusternum never distinct but region marked by two round, glabrous, shining spots; ventrolateral sutures a short notch; sternellar fold distinct at extremities, passing beyond spiracles; mesonotum bearing the posterior half of an x-shaped impression (scutellum distinct); metanotum with one transverse impression; legs wanting, one, two or three jointed, femur plus tibia never as long as maxillary palpus. *Ampullae* broad, oval, flat, the dorsal and ventral surfaces parallel, bearing two lateral and a transverse impression, though often indistinct; pleural discs not distinct nor granulate, usually a half disc of wrinkled texture; the other half obliterated by a tubercle-like swelling.

The general tendency of these larvae is to be wood-borers, spending a proportionately shorter time between the bark and wood and a greater length of time in the wood proper. A striking correlation between habits and structure is well illustrated within the species. The species of *Cyllene* normally spend about half the larval growth between the wood and bark, several not entering it before constructing the pupal cells, but deeply scoring the wood (as those of *Archopalus* and *Cyllene pictus*); others enter earlier and mine in the wood considerably (as those of *C. antennatus* and *C. robiniae*). *C. robiniae* attacks living trees and the body hairs have become short and rather stiff. The species of *Neoclytus* are typical wood-feeders, often completely honeycombing the wood in which they are boring, the extreme cases illustrated by *N. capraea* and *N.*

<sup>1</sup>Since writing this description the adult was reared. It was described by W. S. Fisher as *Elatotrypes* *ho* i. *Pro* Ento. Soc., Wash. Vol. 21, p. 38, 1919.

An intermediate position is that occupied by most species of *Xylotrechus*, though a few also illustrate the extremes. All the species of *Neoclytus* lack the velvety pubescence of the pronotum and ampullae, as do two species of *Xylotrechus*, both of which are typical wood-borers. On the remaining species of *Xylotrechus* the ampullae are clothed with velvety pubescence, though to a varying degree; in some forms only the perimeter is pubescent, in others the entire surface (e.g. *Xylotrechus oblitteratus*, which bores in the softer moist wood of *Populus* and *Salix*). Two species of *Xylotrechus* (*acris* and *quadrinaculatus*) attack living trees. In both of these the velvety pubescence has become much coarser and stiffer or velvety asperate. In one (*quadrinaculatus*), which girdles branches mining in the living wood until the branch is dead, the perimeter only of the ampullae is pubescent; in the other (*acris*), which occurs in the trunk of living trees, the ampullae are entirely covered.

#### KEY TO THE GENERA OF CLYTINI

- Ocelli normally three; no median pronotal suture; legs three-jointed.....*Cyllenes*  
 Ocelli one.  
 Median suture of pronotum not impressed.  
 Legs at least two-jointed; neither pronotum nor ampullae velvety pubescent; subfossal spine absent.....*Neoclytus*  
 Legs absent; otherwise as *Neoclytus*.....*Clytus*  
 Median suture impressed.  
 Legs absent or minute spines.  
 Posterior area of pronotum and ampullae usually velvety pubescent; pronotum never striate, subfossal spine present, very small.....*Xylotrechus*  
 Posterior area of pronotum striate, neither it nor ampullae velvety pubescent, latter dull, granulate; subfossal spine absent; legs minute spines.....*Clytanthus*  
 Legs at least two-jointed; pronotum striate; ampullae shining, sub-tuberculate; subfossal spine absent; breeds in *Vitis*.....*Clytoleptus*

#### Group CYLLENES

The following genera *Plagionotus*, *Arhopalus*, *Calloides*, and *Cyllene*, cannot be recognized in the larval stage. They are here considered to form a natural genus. They can be recognized as follows:

Legs three-jointed, femur plus tibia much shorter than maxillary palpi; three ocelli normally present, sometimes fused into two or one; process of palpifer minute; posterior area of pronotum shining, never pubescent, no median suture; ventro-lateral suture a short notch; sternellar fold distinct, extremities passing spiracles; ampullae granulate or alutaceous; form robust, contracted.

All these larvae have several habits in common. They mine beneath the bark rather deeply scoring the wood until nearly two-thirds grown, when they enter the wood. During the larval growth much of the frass is exuded through an opening (marking the point where the egg was laid) that is enlarged as the larva grows, so that when the larva is ready to pupate this hole is large enough to permit the escape of the adult. The pupal cell, deep in the wood, is plugged far from the exit hole by one wad of fibrous frass. The pupa always faces toward this exit.

#### KEY TO THE SPECIES OF THE GROUP CYLLENES

- No process of palpifer present; ampullae dull, finely granulate, breeds in maple (*Acer*).....*Plagionotus speciosus*  
 Process of palpifer minute but distinct; ampullae variable.  
 Ampullae alutaceous, rather shining.  
 Integument, tough, dull, breeds in *Quercus* at surface of ground.....*Calloides nobilis*  
 Integument thin, shining; breeds in trunks of *Quercus* and *Castanea*.....*Arhopalus fulminans*  
 Ampullae dull, finely granulated.  
 Posterior edge of pronotum finely velvety pubescent; spiracles narrowly oval, body hairs silky; breeds in *Hicoria* (rarely in *Celtis*, *Fraxinus*, *Toxylon*, and *Vitis*).....*Cyllene pictus*  
 Posterior edge of pronotum not velvety pubescent; spiracles narrowly oval; body hairs very long and silky; breeds in *Prosopis*.....*Cyllene antennatus*  
 Posterior edge of pronotum velvety pubescent; spiracles broadly oval or orbicular; body hairs coarser, light castaneous; breeds in *Robinia*.....*Cyllene robiniae*

## CALLOIDES NOBILIS Say

[Pl. X]

*Form* robust, tapering posteriorly to last few segments; integument tough, rather dull, hairs coarse, short, dark castaneous.

*Head* distinctly trapezoidal, narrowing in front; mouth-frame strongly corneous, dark; clypeus and labrum thick, fleshy, latter shortly stalked, sub-orbicular, densely ciliate on perimeter; mandibles tapering, narrow at apex, dull black basal piece about one-half length of apical, no fovea on outer face; first antennal joint slightly shorter than second, about equal to third, supplementary distinct; ocelli, three, indistinct or fused unto one or two, set in a slight genal impression; gena not shouldered. Ventral mouth-parts rather coriaceous; palpal joints acute, last labial and last and second maxillary all subequal; process of palpifer minute though distinct; no subfossal spine.

*Prothorax* thick, about twice as wide as long, four tergal plates distinct, lateral region densely clothed with short, subulate, dark castaneous hairs except for numerous glabrous spots; pronotum coarsely punctured, posterior area reticulately rugose, embossed and extending anteriorly along median line, no median suture; sternum having two glabrous chitinous spots; ventrolateral suture a short notch. Mesonotum bearing a v-shaped impression (scutellum distinct), metanotum with one transverse impression, both alutaceously granulate. Legs short, conical, of two transverse joints and a short, conical, chitinous tarsus.

*Abdomen* slightly compressed; ampullae large, broadly oval, abruptly raised, alutaceously granulate, dorsal bearing two short lateral and one transverse impression. Pleural discs indistinct. Spiracles broadly oval, dark reddish-brown, peritreme thin.

*Pupa*: Lateral margins of pronotal disc spinulose; mesonotum and metanotum glabrous; eighth abdominal terga bearing short, acute, chitinous papillae, on first six segments, these extending posteriorly, last two recurved.

[Described from specimens Hopk. U. S. 11851.]

The larva has been found only in the base of recently cut or dying *Quercus* stumps and bases of trees. It requires considerable moisture and a great proportion of the mine is extended beneath the ground along the surface of the roots, between the bark and wood. The full-grown larva constructs a long prepupal burrow sometimes 12 inches in length deep through the heartwood. If this is constructed in a stump it opens near the centre on the cut surface; if in a tree, it is turned obliquely out to the bark and never penetrates so deeply into the heartwood. This hole is left open to the exterior by the larva, giving the appearance that the adults had emerged. Most of the brood transform in one year, though some remain over the second year. This is a more northern species in eastern and central United States and Canada. Observations by the author.

## ARHOPALUS FULMINANS Fabricius

PL. XLII

*Form* less robust than that of *Calloides nobilis*; integument thin, shining, hairs on abdomen fine, of a dark lemon colour.

*Head* in general as in *Calloides*, mouth-frame less chitinized, light reddish brown; labrum transversely oval, widest behind, covered with long silky hairs, except for glabrous spot in centre, process of palpifer distinct; process on first joint of maxillary palpi distinct, last joint of maxillary palpi shorter than second, and shorter than last labial.

*Prothorax* having hairs of proalar and lateral regions shorter, denser, and finer than in *Calloides*, light castaneous; pronotum posteriorly shining with a few elongate punctures to short fovea. Spine of legs not strongly chitinized.

*Abdomen*: Ampullae dull, finely alutaceous. Spiracles narrowly oval, dark lemon colored, peritreme thin.

*Pupa*: Pronotum regularly beset with slender, straight, acute points, longer on sides and less numerous on disc; metanotum bearing two oblique rows of short bristles; each abdominal tergum armed with two transverse rows of slender acute spines projecting backward, except those on hind border of the seventh and eighth segments, which are longer and recurved.

[Described from specimens Hopk. U. S. 11832.]

The larva bores beneath the bark, deeply scoring the wood until half grown, when the sapwood is entered from 4 to 6 inches. Not so much frass is extruded as by the species of *Cyllene*. The most striking feature of the work is the pupal cell, constructed at the end of the prepupal gallery, which is suddenly turned at an angle of from 40 to 45 degrees, cutting across the grain of the wood. Observations by the author. It has been collected in *Quercus* and *Castanea* throughout the eastern United States.

## PLAGIONOTUS SPECIOSUS Say

... led from *Callioides nobilis* by the absence of the palpifer process; last joint of palpi shorter than second; labrum subquadrate, widest at or before middle; ampullae dull, very finely granulate.

[Described from specimens in the collection of G. Dimmock.]

The habits of this species have been adequately discussed in literature. It attacks living hard maples (*Acer*). The larvae during the first year mine beneath the bark, often girdling the branch and causing its death. The second year a deep burrow is made obliquely up and into the heartwood at the end of which the larva pupates. Two years are required to complete the development. This species occurs throughout the northeastern section of the United States and Canada, and has been found in West Virginia by A. D. Hopkins.

## CYLLENE PICTUS Drury

[Pls. XV, XVIII, XX, XXVI]

*Form* robust, contracted, laterally compressed to last few segments; integument dull, hairs dense, fine, silky, lemon-coloured.

*Head* subtrapezoidal; mouth-frame heavily corneous; epistoma thick, abruptly raised, deeply emarginate at centre; labrum orbicular, fleshy, finely ciliate; mandibles tapering, narrow at apex, dull, not grooved on outer face; first antennal joint slightly shorter than second, third small; ocelli distinct; last joint of labial palpi and of second and third maxillary subequal; process of palpifer minute, distinct.

*Prothorax* transverse, short, and thick, densely covered with short fine hairs on sternal, alar and lateral regions; prothorax with four distinct ochraceous tergal plates; pronotum posteriorly very finely rugulose, striate to finely granulate, a band of dark velvety pubescence on posterior margin of pronotum and eusternal region. Legs consisting of two transverse joints and a short chitinous spine.

*Abdomen* laterally compressed, dorsal and ventral surfaces flat, parallel; ampullae large, prominent, oval, white, dull, very finely granulate having the impressions faint. Spiracles narrowly oval to oval. Otherwise as in *Calloides nobilis*.

*Pupa*: Disc of pronotum armed with many short, not sharply acute, chitinous points; a few on mesonotum and metanotum; more acute ones on each abdominal tergum, those on seventh and eighth very strongly chitinized, long, acuminate, and strongly recurved; usually twelve on seventh tergum and four on eighth.

[Described from specimens Hopk. U. S. 9457a.]

This species is of economic importance and has been discussed in literature. Pupation occurs in the fall, the adults emerging in the early spring. A remarkable uniformity in the transformation to pupa is shown. All larvae transform at nearly the same time, and during the winter it is impossible to find a single larva unless it be a deformed or injured specimen, and even this is rare. It normally feeds in *Hicoria* and often in *Toxylon* and has been found in Pennsylvania in *Fraxinus* by A. B. Champlain and in *Celtis* and *Vitis* by E. M. Craighead and J. N. Knull. A. D. Hopkins records it from *Gleditsia* and possibly from *Morus*, in West Virginia.

## CYLLENE ROBINIAE Forster

Easily distinguished from *pictus* by the broadly oval to orbicular spiracles; the abdominal hairs are coarser; the posterior edge of the pronotum and pro-eusternum are velvety pubescent.

*Pupa*: Armature stronger, but otherwise similar to *C. pictus*, except that the metanotum has fewer spines and the abdominal segments, especially the hind margin of the last two, more numerous spines.

[Described from specimens Hopk. U. S. 6062.]

This species is of considerable economic importance, doing great damage to living black locust (*Robinia pseudacacia*), especially in plantations. The character of the work is similar to that of other species; the life cycle is completed in one year, adults emerging in the early fall. Extensive biological data have been collected and published.

## CYLLENE ANTENNATUS White

More robust and larger than *pictus*; the body hairs are long, silky, white to yellowish white, even those on the lateral region of the prothorax being decidedly more slender. The posterior edge of the pronotum and pro-eusternum does not have the velvety pubescence; spiracles narrowly oval.

[Described from specimens Hopk. U. S. 12646 and 12648.]

This is a southwestern species similar in habits to *C. pictus*. Its favoured host plant is *Prosopis*, but it has been recorded also from *Acacia*. Observations by W. F. Fiske, J. L. Webb, and M. Chrisman.

## NEOCLYTUS Thomson

This genus can be distinguished from *Xylotrechus* by the presence of minute legs of at least two joints; posterior area of pronotum never finely pubescent, but usually clear white, dull, finely granulate; no median suture impressed; ampullae dull, finely granulate and never bordered by velvety pubescence; no subfossal spine.

The species are very uniform in habits; all, so far as known, mine beneath the bark for a very short time, then penetrate the sapwood and heartwood, completely honeycombing them. The mines are very extensive and tightly packed with granular frass. The larvae attack both coniferous and hardwood trees. Most species complete the life cycle in one year. Usually by early fall all species have pupated and transformed to adults, emerging during the first warm days of spring.

## KEY TO THE SPECIES OF NEOCLYTUS

Last joint of maxillary palpi about equal in length to second.

Anterior edge of hypostoma thick, swollen and somewhat projecting forward at sides of gula.

Band of dull granulation on posterior border of pro-eusternum bisected in middle by longitudinal band of hairs.

Breeds in *Fraxinus*..... *N. capraea*

Breeds in *Quercus*..... *N. conjunctus*

Band of granulation continuous..... *N. scutellaris*

Anterior edge of hypostoma normal.

Band of granulation of posterior border of pro-eusternum bisected by longitudinal band of hairs. Breeds in citrus trees..... *N. cordifer*

Band continuous. Breeds in *Hicoria*..... *N. luscus*

Last joint of maxillary palpi much longer than second.

Second joint of antennae slender, longer than first..... *N. erythrocephalus*

First and second joints of antennae subequal, about as long as thick.

Ocellus large. Breeds in *Pinus*..... *N. muricatus*

Ocellus minute. Breeds in *Quercus*..... *N. longipes*

## NEOCLYTUS CAPRAEA Say

[Pls. I, X, XXXV.]

*Form* robust, short, contracted, tapering to last few segments, then dilated; integument firm, rather dull, rather densely covered with fine lemon-white, silky hairs.

*Head* trapezoidal, widest behind mouth-frame, strongly corneous and much thickened; labrum thick, subconvex, orbicular, hairs few and rather long; mandibles short, piceous, shining, narrowed at apex, rather abruptly constricted on outer face above basal piece; first and second antennal joints subequal, third shorter; ocellus one, distinct, contiguous with base of antennae; gena neither shouldered nor setose; pleurostoma and anterior edge of hypostoma very thick, swollen and somewhat protuberant; ventral mouth-parts rather strongly coriaceous, joints of maxillary palpi subequal, basal transverse, last shorter than last labial; process of palpifer minute.

*Prothorax* thick, trapezoidal; posterior pronotum dull, smooth and finely reticulated and alutaceous to finely granulate on posterior edge; sternum finely granulate, dull along posterior margin, but divided by median band of hairs. Legs minute, consisting of a single joint and a soft spine.

*Ampullae* broad, flat, oval, dorsal and ventral surfaces straight and parallel, dull, finely granulate, not distinctly marked except by a few lenticular impressions. Pleural discs not distinct. Spiracles narrowly oval, peritreme not thick.

*Pupa*: Unarmed except on second to seventh abdominal terga which bear minute chitinous points, becoming more numerous, larger, and more acute posteriorly.

[Described from specimens Hopk. U. S. 9091a and 10341a.]

This species illustrates the extreme in the wood-boring activity in this genus. It mines very little under the bark and completely honeycombs the sapwood and outer heartwood. The mines are tightly packed with granular frass. One generation occurs each year. It often becomes of considerable economic importance. It has been collected throughout the United States and eastern Canada in *Fraxinus*. W. F. Fiske and M. Chrisman record it from *Prosopis* and *Quercus* in Arizona and A. B. Champlain from *Quercus* in Colorado.

Clerid larvae of the genus *Chariessa* frequently prey on this larva.

#### NEOCLYTUS CONJUNCTUS LeConte

This larva can scarcely be separated from that of *capraea* except in the nearly matured form, when the anterior edges of the hypostoma are not greatly swollen. The spiracles are smaller (middle abdominal ones scarcely larger than ocellus) and more narrowly oval.

*Pupa*: Armed on the first seven abdominal terga with small fleshy papillae, which are chitinous-tipped, these being from 15 to 20 in number while *capraea* has about 40 on some segments.

[Described from specimens Hopk. U. S. 9016 and 9592.]

Habits similar to those of *capraea*. It is a common species from the Rocky Mountain region west, breeding in *Fraxinus*, *Quercus*, *Arbutus*, and *Pyrus*.

#### NEOCLYTUS SCUTELLARIS Oliv

*Form* more slender than in *capraea*; hairs light castaneous, sparse. Pleurostoma and anterior edge of hypostoma swollen and heavily corneous to the same degree as in *conjunctus*, somewhat bisinuous; second joint of antennae longest, first about as long as thick; last labial joint shorter, second equal to last labial. Posterior area of pro-eusternum having a dull, transverse, finely granulated band; mesosternum and metasternum also dull granulate. Spiracles small, oval, middle abdominal ones scarcely larger than ocellus. Otherwise as *capraea*.

[Described from specimens Hopk. U. S. 12604.]

This larva has only been found in *Quercus alba*, always associated with a dry fungus rot. It works similarly to *capraea*, but the mines are not so extensive. Range, eastern United States.

#### NEOCLYTUS CORDIFER Klug

[PL. XIX]

In general as in *erythrocephalus*; posterior transverse border of prosternum very narrow and bisected in middle by longitudinal band of short stiff hairs; body more densely hairy, these hairs castaneous. Joints of palpi subequal, second joint of antennae longer than first or third.

*Pupa*: Abdominal terga beset with fine chitinous asperites and a few short recurved hooks not disposed transversely, very large on seventh segment. Hind and middle femora with two long conical processes at tibial articulation.

[Described from specimens Hopk. U. S. 9902i.]

These specimens were sent in by a correspondent who stated that they were killing the branches of pomegranate trees (*Punica granatum*) at Chase, Fla. Dr. E. A. Schwarz states that this species has been introduced from Cuba, where it is very destructive to orange (*Citrus*), pomegranate, and mango (*Mangifera indica*) trees.

#### NEOCLYTUS LUSCUS Fabricius

*Form* and body characters similar to those of *erythrocephalus*; second joint of antennae longer than third; palpal joints subequal; posterior band of granulation on proeusternum continuous; body covered with light castaneous hairs.

*Pupa*: Prothorax with numerous small chitinous points; spines on abdominal terga as in *capraea*; short conical points on middle and hind femora.

[Described from specimens Hopk. U. S. 11840, 11830c.]

This larva attacks dying or dead *Hicoria*, mining about as much beneath the bark as in the wood. It is often associated with *Scolytus*-killed trees. Range, eastern United States.

## NEOCLYTUS ERYTHROCEPHALUS Fabricius

A more slender species, sparsely covered with long whitish hair; last joint of maxillary palpi much longer than second; second and third joints of antennae subequal, slender; anterior edges of hypostoma normal. Posterior area of pronotum dull, finely granulate; ampullae dull more coarsely granulate; ochraceous tergal plates more distinct and narrowly transverse in this species; posterior border of pro-eusternum dull, finely granulate.

*Pupa:* Pronotum bearing a fleshy median tubercle on the anterior margin, no spines; in an irregular transverse row each abdominal tergum bears from 12 to 20 minute chitinous spines, increasing on posterior segments; seventh bearing 6 to 10 larger spines on fleshy bases.

[Described from specimens Hopk. U. S. 9782g.]

The larva feeds in a great variety of hardwood trees, working in the same manner as *N. capraea*. It sometimes becomes very destructive to round timbers in the woods, especially in the south, where several generations occur each year. It has been collected throughout the eastern and central United States from *Hicoria*, *Fraxinus*, *Quercus*, *Juglans*, *Betula*, *Fagus*, *Ostrya*, *Acer*, *Celtis*, *Vitis*, *Cornus*, *Cercocarpus*, *Ilex*, *Prosopis*, *Cercis*, *Diospyros*, *Syringa*, *Gleditsia*, *Lonicera*, *Prunus*, *Sassafras*, *Robinia*, *Liriodendron*, and *Castanea*.

A. D. Hopkins records it from *Pinus* and W. F. Fiske from *Taxodium*, but these records are questionable.

## NEOCLYTUS MURICATULUS Kirby

*Form* and in general as in *erythrocephalus*; sparsely clothed with yellowish hairs; last joints of labial and maxillary palpi subequal, latter much longer than second; first and second antennal joints subequal, about as long as thick; ocellus large, larger than abdominal spiracles; anterior edge of hypostoma not swollen; labrum transversely oval, sparsely haired; posterior granulation of pro-eusternum continuous.

[Described from specimens Hopk. U. S. 12695.]

This is the only species of the genus which has been found living in coniferous trees. It completely riddles the small branches of *Picea*, *Larix*, *Pseudotsuga*, and *Pinus*. Range, conforming to that of the spruces.

## NEOCLYTUS LONGIPES Kirby

Very similar to *erythrocephalus*; antennal joints subequal, first and second globose, scarcely longer than thick; palpal joints relatively more robust, but last joint of maxillary palpi longer than second; ocellus minute or indistinct.

*Pupa:* Distinguished by the fact that the spines on abdominal terga are arranged in a single transverse row, or the last bearing a double row of small recurved hooks, each set on a fleshy conical papilla; protergum with scattered distinct spines on disc.

[Described from specimens Hopk. U. S. 9765.]

The larva feeds in small dry oak (*Quercus*) saplings. It pupates and transforms to adult in the early fall, hibernating in the cell.

## CLYTUS MARGINICOLLIS Laporte.

*Form* contracted, subcylindric; integument firm, shining, clothed with fine yellowish-red hairs.

*Mouth-frame* greenish-yellow; labrum roundly oval, slightly wider than long; mandibles short, robust, basal piece reddish, about one-half length of distal, latter having no foveae; first antennal joint transverse, second longest, third shortest; ocellus distinct, contiguous with base of antennae; gena neither shouldered nor setose. Ventral mouth-parts fleshy; joints of maxillary palpi subequal, basal transverse, second about as long as wide; process of palpifer about equal to last maxillary joint; gula distinct; anterior portion of hypostomal plates swollen and wrinkled.

*Prothorax* having four distinct tergal plates, alar and lateral areas sparsely haired; pronotum posteriorly shining and irregularly wrinkled; eusternal spots glabrous, shining. Mesonotum and metanotum dull, finely granulate. Legs absent.

*Ampullae* faintly shining, finely granulate, having only lateral impressions; pleural discs indistinct; abdominal spiracles broadly oval to suborbicular, a little larger than the ocellus, peritreme thin.

*Pupa:* Short, erect, chitinous points on anterior margin and perimeter of pronotum; irregularly dispersed over abdominal terga, becoming larger and more numerous posteriorly and forming a row on hind margin of the seventh and eighth, these points recurved.

[Described from specimens Hopk. U. S. 11890.]

These larvae were reared from eggs laid by the adults from May 6 to 15, 1916, on small branches of *Pinus virginiana* cut during the winter at Falls Church, Va. The larvae bore beneath the bark until about half grown, feeding on both bark and wood; later, entering the wood, they extend a long burrow, at the end of which the pupal cell is constructed. Pupation occurred in September. Observations by J. N. Knull and the author.

The larva in many respects resembles that of *Neoclytus*.

#### XYLOTRECHUS Chev.

These larvae are recognized as being legless (one species possessing a minute spine); the head bears one ocellus; process of palifer very small; posterior area of pronotum usually velvety pubescent, as also the perimeter of the ampullae; median suture of pronotum impressed behind; ventro-lateral sutures a mere notch; sternellar fold distinct at extremities, passing spiracles; form robust, contracted.

A variety of habits are represented in this genus, but common to all is that of boring a great deal in the wood proper. In nearly all species over half the larval life is spent in the wood. A few species attack living trees, one girdling branches, another mining the trunks of small trees. The remainder feed only in dead wood. All tightly pack the granular frass behind them. The position of the pupa in its cell varies in the different species, but the adult always gnaws its way through the bark. The life cycle is completed normally in one year.

#### KEY TO THE SPECIES XYLOTRECHUS

Posterior area of pronotum not velvety pubescent; ampullae not surrounded by velvety pubescence.

Labrum suborbicular; legs usually a minute spine; breeds in *Crataegus*; eastern... *X. convergens*

Labrum distinctly wider than long; legless; breeds in *Quercus* and *Eucalyptus*;

western..... *X. nauticus*

Posterior area of pronotum and border of ampullae velvety pubescent;

Pronotal and ampullar areas covered with velvety pubescence; hairs on lateral region of prothorax short but not stiff.

Spiracles smaller, oval to orbicular.

Last joint of maxillary palpus nearly globular, shorter than second. Breeds

in *Tsuga*..... *X. fuscus*

Last joint of maxillary palpus more slender, longer than second.

Breeds in hardwoods..... *X. colonus*

Breeds in coniferous woods.

Ocelli about size of basal joint of maxillary palpi..... *X. undulatus*

Ocelli smaller..... *X. sagittatus*

Spiracles large, twice or more as long as wide.

Ampullae entirely covered with velvety pubescence..... *X. obliteratus*

*X. sp 10359*

Ampullae velvety pubescent only on perimeter and median stripe..... *X. insignis*

Pronotal and ampullar area covered with asparate velvety pubescence; hairs on lateral region of prothorax stiff, subulate.

Ampullae not entirely pubescent; girdles branches of *Abies*, *Fagus*, and

*Betula*..... *X. quadrimaculatus*

Ampullae entirely covered with pubescence; breeds in small living trees of *Acer*.. *X. aceris*

#### XYLOTRECHUS CONVERGENS LeConte

Readily distinguishable from all other species by the fact that the posterior area of the pronotum does not bear the velvety pubescence, but is dull and faintly reticulately rugulose or finely granulate (resembling *Neoclytus*); legs usually developed as a minute spine. Maxillary palpal joints subequal in length; first and second joints of antennae subequal, third shorter; labrum sub-orbicular; spiracles very broadly oval, peritreme thin; body hairs light castaneous.

*Pupa*: Very minute, scattered, setiferous points on pronotum; mesonotum and metanotum unarmed; first six abdominal terga bearing small, acuminate, curved spines projecting posteriorly, becoming more numerous caudally; seventh bearing four larger recurved spines on posterior border and smaller ones on disc; eighth bearing two.

[Described from specimens Hopk. U. S. 9792c.]

The larva has been found only in the dead wood of *Crataegus*. It mines deep into the heartwood, completely honeycombing it. Pupation occurs in the late spring. Range, throughout eastern United States. Observations by the author.



## XYLOTRECHUS NAUTICUS Mannerheim

Similar to *convergens*, but legs wanting; labrum distinctly wider than long; first joint of antennae globular, equal to last, very much shorter than second.  
[Described from specimens Hopk. U. S. 13158a, and 13168a.]

The larval habits are likewise similar to those of *convergens*. It is a true wood-borer; collected from *Quercus* and *Eucalyptus* in California by F. B. Herbert.

## XYLOTRECHUS COLONUS Fabricius

[Pls. XVIII, XX]

*Form* semirobust, contracted, subcylindric, tapering to last few abdominal segments; integument, firm, rather dull, densely covered with fine, soft, lemon-coloured hairs.

*Head* trapezoidal, gradually tapering anteriorly; mouth-frame corneous, very finely wrinkled, reddish-brown; labrum rather thick, soft, suborbicular, widest behind middle, with very short hairs; mandibles dull black, short, tapering rapidly to apex, basal piece about one-third length of apical, no fovea on outer face; first antennal joint about equal to last, much shorter than second, supplementary distinct; one distinct ocellus contiguous with base of antennae; gena tapering, not shouldered, bearing several very fine hairs. Ventral mouth-parts rather fleshy; all joints of labial and maxillary palpi subequal, basal joints of latter transverse; process of palpifer short, distinct, subfossal spine small.

*Prothorax* rectangular, about twice as wide as long, thick; four distinct ochraceous tergal plates; lateral regions thickly beset with short orange hairs, those on sternum longer except for the large, suborbicular, glabrous eusternal spots; pronotum wider than long; median suture slightly impressed punctured and sparsely hairy anteriorly, posteriorly covered with dark-ochraceous, velvety pubescence and a posterior band on pro-eusternum; mesonotum, metanotum and anterior half of sterna also covered with velvety pubescence; ventral-latero sutures a mere notch. Legless.

*Abdomen*: ampullae large, transverse, flat, dull, very finely granulate, surrounded by velvety pubescence; ventral bearing a longitudinal median stripe, of velvety pubescence, no distinct impressions. Pleural disc indistinct. Spiracles narrowly oval to broadly oval, peritreme thin,

The larva feeds in almost all of the eastern hardwood trees. It is chiefly a bark feeder, mining between the bark and wood, rarely scoring the latter, and if the bark is thick it mines entirely in it. The life cycle is often completed from spring to early fall, or it extends over to the following season. Pupation may take place in either the bark or the sapwood.

## XYLOTRECHUS (ANNOSUS) FUSCUS Kirby.

*Pronotum* posteriorly velvety pubescent, as are also the borders and often a median longitudinal band of the ampullae; antennae rather thick, second joint not twice as long as thick, first globular, last more than half as long as second; labrum orbicular; last joint of maxillary palpi shorter than second; abdominal spiracles narrowly oval, first and last broadly oval, peritreme light orange coloured; body hairs very light castaneous.

[Described from specimens Hopk. U. S. 10081t and 9792a.]

The larva feeds between the bark and wood, entering the latter when about half grown, where extensive mines are excavated. The same tree is usually attacked from shortly after it has fallen until well decayed. As the wood becomes softer the larvae bore deeper. It has been collected from *Abies* and *Tsuga*. Range, in eastern United States and Canada.

## XYLOTRECHUS SAGITTATUS Germar.

Distinguishable from *annosus* by the subequal palpal joints; last joint of antennae one-half length of second and second scarcely twice as long as thick, basal globular; ocellus very small, spiracles not so darkly rimmed; labrum broad on anterior margin, suborbicular; body hairs lighter.

[Described from specimens Hopk. U. S. 12266 and a specimen, Craig. 241b, collected at State College, Pa.]

Habits similar to those of *undulatus* but more commonly found in *Pinus*. Recorded also from *Picea* and *Abies*. Range, from Rocky Mountains east.

## XYLOTRECHUS UNDULATUS Say

*Prothorax* posteriorly velvety pubescent, this darker than in most species, and often reduced to a narrow border, non-pubescent portion white, ruglose; ampullae bordered with velvety pubescence, and often a median band pubescent; first and last antennal joints subequal, first quadrate, second much longer, about twice as long as thick; palpi joints subequal; ocellus large; labrum transversely oval; spiracles very small, middle abdominal ones scarcely larger than ocellus, peritreme thin; body hairs light castaneous.

Described from specimens Hopk. U. S. 9522a, 12693b, 12652b, 11923a and 12682. Specimens 9522a may be different from the others.]

Habits similar to *annosus* but it prefers more solid wood. A suitable place of attack is old fire scars or axe wounds where the larvae can gain entrance to the heartwood. It has been collected in *Pseudotsuga*, *Tsuga*, *Abies*, *Pinus* and *Picea*. Ranges through Rocky Mountain region and west.

## XYLOTRECHUS sp. 10359

*Form* similar to *undulatus*, but easily recognized by the ampullae being entirely velvety pubescent; spiracles large, very narrowly oval and conspicuously reddish brown in colour, peritreme thick; labrum orbicular, or rarely a little wider at middle; antennae more slender; palpi joints subequal.

*Pupa*: Margin of pronotum regularly beset with erect chitinous points; each abdominal tergum armed with longer ones, curved posteriorly, except on seventh and eighth, which are recurved, the eighth bearing four points smaller than those on seventh.

[Described from specimens Hopk. U. S. 10359, 10075w, and 11786.]

This species has been collected only in the dead or dying wood of *Populus* and *Salix*. It mines extensively in the heartwood. Range, through Rocky Mountain region west and in Canada. Observations by H. E. Burke, J. Brunner, N. Criddle, and the author.

## XYLOTRECHUS OBLITERATUS LeConte

This species can be distinguished from the preceding only by the smaller and lighter coloured spiracle, which is scarcely as wide as the ocellus; and by the finer pubescence of the ampullae, which cannot be distinguished individually with a° objective and No. 4 eyepiece, as in the preceding.

[Described from specimens Hopk. U. S. 10982d.]

These larvae have been collected only in the base of living aspen (*Populus tremuloides*) at elevations above 8,500 feet in the Rocky Mountains. The larvae mine the heartwood of the base and roots, often causing the trees to break off in great numbers. Observations of G. Hofer and the author.

## XYLOTRECHUS INSIGNIS LeConte

[Pl. XV]

This species has the large elongate abdominal spiracles similar to the preceding, but the abdominal ampullae are covered with velvety pubescence only on the perimeter and a median stripe; the ocellus is small and the last joint of the maxillary palpi is slender, longer than the second.

[Described from specimens Hopk. U. S. 1316a².]

These larvae were collected by F. B. Herbert in Berkeley, Cal., in the wood of a dying willow (*Salix lasiandra*).

## XYLOTRECHUS ACERIS Fisher

[Pl. XV]

Posterior pronotum and entire ampullae covered with asperate velvety pubescence, this very dark on pronotum; hairs on lateral region of pronotum stiff, subulate, dark castaneous; joints of maxillary palpi subequal or last slightly longer than second; second and last antennal joints subequal, first transverse, second about as long as thick; labrum suborbicular; spiracles narrowly oval, peritreme thick, dark castaneous.

*Pupa*: Anterior half and sides of pronotum armed with short, acute, chitinous points; those on abdominal terga becoming larger and more slender to seventh, which bears six acuminate recurved ones.

[Described from specimens Hopk. U. S. 9724.]

This species infests the trunks of small red maples (*Acer rubrum*), causing a gall-like swelling in which the larvae feed. Before pupation a straight burrow is extended into the heartwood, above or below the gall. At the extremity of this the larva pupates, the adult crawling back and emerging through the gall. The work is common throughout the eastern United States and Canada. Observations by A. B. Champlain and the author.

#### XYLOTRECHUS QUADRIMACULATUS Haldeman

[Pl. XL]

Distinguished from *aceris* in that the ampullae are not entirely covered by pubescence, but the centre is glabrous, dull granulate; dorsal ampullae without pubescence on anterior edge; first joint of antennae transverse, second about one and one-half times as long as thick; labrum slightly wider than long; abdominal spiracles more narrowly oval except first and last.

*Pupa*: Similar to *aceris* but spines all more slender and not so heavily chitinized, the two median ones on each abdominal tergum conspicuously larger than others.

[Described from specimens Hopk. U. S. 9768 and 9785<sup>2</sup>.]

The larva has the peculiar habit of girdling branches of *Betula* and *Fagus*. It cuts the branch from the inside, causing it to drop early in the fall. It then constructs a long burrow up the centre. The work is often common in *Betula* on the tops of mountains. Observations by F. E. Brooks and the author.

#### CLYTANTHUS RURICOLA Oliver

[Pl. XIX]

*Form* semirobust, cylindric, contracted; integument rather firm, shining, sparsely covered with short light yellow hairs.

*Head* subtrapezoidal; mouth-frame corneous; labrum thick, transversely broadly oval, having a very few short hairs; mandibles robust, broader at apex than other Clytini, shining basal piece about one-third length of apical; first joint of antennae globular, one-half length of second, equal to last; one distinct ocellus contiguous with base of antennae; process of palpifer minute; joint of maxillary palpi equal in length, last equal to last labial; gena neither shouldered nor setose.

*Prothorax* stout, trapezoidal, sparsely hairy, the hairs short, castaneous; pronotum anteriorly regularly and sparsely haired, posteriorly alutaceous, shining to dull, granulate on hind margin, median suture deeply impressed; sternal glabrous spots smooth, shining or reticulate. Mesonotum and metanotum dull granulate; legs minute chitinous spines.

*Abdomen*: Ampullae dull, granulate, not surrounded by velvety pubescence. Pleural discs indistinct. Spiracles broadly oval, peritreme rather thick.

*Pupa*: Pronotum regularly beset with acuminate points resembling short stiff hairs, except on centre; abdominal terga bearing acuminate points, those on the first six segments projecting posteriorly, on the seventh segment four much larger and recurved; two similar ones on eighth.

[Described from specimens Hopk. U. S. 11815 and 11861a.]

This species very closely resembles *Xylotrechus convergens* and can scarcely be separated generically. The form is more slender, the granulation of ampullae coarser, and the spines representing the legs always distinct and larger.

The larva has been found in *Acer*, *Hicoria*, *Sorbus*, *Betula*, and *Fagus*. It is always in decaying wood associated with a fungus marked by irregular black lines in the wood. Range, eastern United States and Canada.

#### CLYTOLEPTUS ALBOFASCIATUS Laporte (Casey)

*Form* more slender and cylindric than in *ruricola*; integument shining, hairs light castaneous, finer and more dense.

*Head* roundly trapezoidal; mouth-frame lightly corneous, labrum transversely oval; basal piece of mandible one-half length of apical; first joint of antennae globular, about one-half length of second; one very large white ocellus; gena bearing a few long setae; last labial joint longer than last maxillary, which in turn is longer than second; anterior edge of hypostoma very shallowly but broadly notched by insertion of submentum.

*Pronotum* having median suture deeply impressed behind, posterior area coarsely and somewhat obliquely striate; ampullae alutaceous, shining often subtuberculate; no trace of ventrolateral suture. Legs minute, fleshy, two-jointed. Spiracles broadly oval, peritreme thin, somewhat sunken.

[Described from specimens Hopk. U. S. 11844b.]

This larva from some characters might be regarded as belonging to the Anaglypti. It is as distinctly separable from *Clytanthus ruricola* as *Clytanthus* is from *Actebias* and may in that sense be retained as a genus, to which rank Casey (1912) has raised it.

It has been found in dead grapevines (*Vitis*) associated with *Phymatodes amoenus* and also in partially living vines. The mines are rather extensive and tightly packed with frass. Range, eastern United States and Canada.

#### Tribe ANAGLYPTI

These larva are more slender in form than those of the Clytini and the ampullae are small, oval, with a deep median furrow. Head rather broad in front, produced by distinctly shouldered gena enclosing a large ocellus (larger than spiracles); last joint of maxillary palpi much longer than second; process of palpifer relatively large. Pronotum posteriorly striate, not projecting forward along median line, no median suture; no trace of ventro-lateral suture; sternellar fold distinct at extremities; legs two to four jointed, shorter than maxillary palpi.

The affinities of this tribe evidently ally it with Clytini, but the group seems to be distinct enough to be regarded as of equal rank with the latter. The characters suggest certain species of Callidiini.

#### KEY TO THE GENERA OF ANAGLYPTI

Genae very strongly shouldered, somewhat tuberculate; striae of pronotum very fine. *Cyrtophorus*  
Genae not so strongly shouldered, nor so corneous; pronotal striae coarse.

First antennal joint longer than wide, first and second subequal; body smooth, shining. *Microclytus*

First antennal joint globular, much shorter than second; body finely granulate. *Tillamorph*

#### CYRTOPHORUS VERRUCOSUS Oliver

[Pls. IX, X, XIX]

*Form* rather slender; integument thin, shining, densely covered with fine yellowish hair.

*Head* broad in front, mouth-frame lightly corneous; labrum thick, transversely oval to suborbicular; mandible rather broad at apex, basal piece reddish-brown, one-fourth width of apical; first and second antennal joints scarcely longer than wide, first slightly shorter than second, supplementary rather long, acute; one large, white ocellus enveloped by the abruptly shouldered tuberculate gena; gena setose; first and second joints of maxillary palpi transverse, third much longer, equal to last labial; process of palpifer distinct.

*Prothorax* transversely rectangular; pronotum posteriorly finely striate, shining, then granulate, no median suture; no trace of ventro-lateral suture. Legs shorter than maxillary palpi, three-jointed.

*Abdomen*: Ampullae small, shining, granulate, indefinitely marked, but with a deep median furrow; pleural discs indistinct. Spiracle broadly oval, much smaller than ocellus, peritreme thin.

*Pupa*: Pronotum regularly beset with erect, slender, acute chitinous points; shorter ones on mesonotum and metanotum; stouter spines with a papilla-like base on each abdominal tergum arranged more or less in rows, six on posterior margin of seventh tergum (in groups of three and four on eighth).

[Described from specimens Hopk. U. S. 12254.]

The larva works like a *Neoclytus* in solid dead *Quercus* where it is often associated with *N. longipes*. The life cycle is completed in one year, the adults transforming in the fall or early spring. It has been collected also from *Prunus*, *Cornus*, *Pyrus*, *Diospyros*, *Betula*, *Benzoin*, and *Acer*. Range, eastern United States and Canada.

#### MICROCLYTUS GAZELLULA Haldeman

[Pl. XIX]

*Form* slender, somewhat tapering; integument smooth, shining, very hairy. Head similar to that of *Tillamorph* except that the genae are not so corneous; the labrum is thin and transversely semicircular, much wider than long; the last palpal joints are relatively longer, though not quite twice the length of the second; first and second joints of antennae subequal, longer than wide.

The striae of the pronotum are distinctly separated, rather coarse; mesonotum and metatergum granulate while not noticeably so in *Cyrtophorus*. Legs very small, three or four joints, joints globular. Ampullae coarsely granulate. Spiracles broadly oval, peritreme thin.

*Pupa*: Several long setae on head, a transverse row on anterior and posterior margin of pronotum, as also on each abdominal tergum becoming more numerous and longer posteriorly; several on articulation of femur and tibia.

[Described from specimen Craig, 364, collected at State College, Pa.]

This larva feeds in the outer scaly bark of *Quercus*, usually associated with *Encyclops caeruleus*. The life cycle is completed in one year, the adult transforming in the fall or early spring. Observations by the author in Pennsylvania. W. S. Fisher records it from *Hicoria*.

#### TILLAMORPHA GEMINATA Haldeman

*Form* rather slender; integument shining, very finely granulate, covered with fine whitish hairs.

*Head* transversely oval, slightly tapering anteriorly; mouth-frame lightly chitinized; labrum thin, transversely oval, mandible broad at tip, basal piece reddish-brown, about one-third length of apical, latter piceous, shining, bearing a longitudinal fovea on outer face; first antennal joint globular, much shorter than second, supplementary long; ocellus large, white, prominent, contiguous with antennae, enclosed by corneous-shouldered gena, which bears no hairs; last joint of maxillary palpi equal to last labial, shorter than second; process of palpifer distinct.

*Prothorax* widely transverse; pronotum slightly wider than long, anteriorly beset with a few slender hairs, posteriorly irregularly and faintly striate, then dull granulate, no median suture; no trace of ventro-lateral suture. Legs very small, fleshy, three-jointed.

*Abdomen*: Dorsal and ventral ampullae dull, granulate, granules distinct, flattened. Pleural discs not distinct. Spiracles smaller than ocellus, orbicular, peritreme thin.

*Pupa*: Very similar to that of *Cyrtophorus verrucosus*, but the mesonotum and metanotum are unarmed and only four spines occur on the posterior border of the seventh tergum and two on the eighth.

[Described from specimens Hopk. U. S. 9789°.]

Habits resemble those of a *Neocyclus*, as it mines between the bark and wood, but only goes into the latter to pupate. Occasionally pupation takes place beneath the bark. It pupates very early in the spring. The larvae have been collected in *Quercus*, *Nyssa*, *Hicoria*, *Vitis*, and *Cornus*. Observations by H. B. Kirk and the author.

*Tillomorpha* has been associated with *Euderces* by some writers, but its affinity through larval characters is not at all distinct. It is much more closely allied to *Microcyclus* and *Cyrtophorus* by the form of the head, the shouldered gena, and the sternellar fold, which is not broadly fused into the epipleurum, as in *Euderces*.

#### Tribe MOLORCHINI

The following genera form a very homogeneous group of larvae. They are evidently allied to *Curius* and in some respects to *Rhopalophora*. The adults have been placed in two tribes, but the larvae do not warrant such a grouping. They can be recognized as follows:

*Head* depressed, transversely oval, widest about middle; gena not shouldered, bristles numerous; one or no ocelli; first and second joints of antennae very short, usually subequal; last joint of maxillary palpi always much longer than second; process of palpifer rather large; pronotum posteriorly striate, median suture rarely impressed; sternum short and broad; eusterium often distinct; ventro-lateral suture oblique, widely diverging anteriorly; sternellar fold not passing spiracles and usually somewhat fused into epipleurum; legs absent or very small. Ampullae often bilobed, granulate; pleural discs indistinct; spiracles very small, sunken.

The peculiar bilobed ampulla in this group occur in *Obrium rufulum* and *Callimoxys fuscipennis*. Dorsally it is produced as much by the extension of the parascutal region, and ventrally as much by hypopleurum and coxal lobe, as by the ampulla itself. On segments bearing these unusual ampullae the parascutal and hypopleural regions are very conspicuous from the side.

#### KEY TO THE GENERA AND SPECIES OF MOLORCHINI

Labrum not twice as wide as long; legs essentially wanting.

Ocellus distinct; ampullae deeply bilobed; median suture of pronotum impressed.

Genal setae stiff, brownish.....*Obrium rufulum*

Genal setae fine, whitish.....*Obrium maculatum*

Ocellus indistinct; ampullae not deeply bilobed, dull granulate; median suture of pronotum absent.

Last joint of maxillary palpi twice length of second; prosternum coarsely granulate.

*Molorchus bimaculatus*

Labrum twice as wide as long; legs three-jointed; ampullae deeply bilobed.

*Callimoxys fuscipennis*

## OBRIMUM RUFULUM Gahan RUBRUM Newman

[Pls. XVIII, XIX, XXX.]

*Form* very elongate, slender, cylindrical; integument thin, shining, sparsely covered with fine whitish hairs.

*Head* depressed, transversely oval; mouth-frame scarcely corneous; clypeus and labrum thin, latter rectangularly oval, sparsely hairy; mandibles robust, basal piece reddish brown, about one-third length of the distal, latter pieceous, shining; antennae short, first and second joints globular, transverse, second slightly longer; ocellus large, not protruding; gena not shouldered, bearing numerous long, rather stiff brownish bristles. Ventral mouth-parts rather elongate, last joint of labial and maxillary palpi slender, twice the length of second maxillary joint; process of palpifer large, distinct, also a process on first joint of maxillary palpi; gula triangular, distinct.

*Prothorax* depressed; pronotum rectangular, about twice as wide as long, uniformly hairy in front, posteriorly shining, with a few widely separated striae, often a faint median suture; sternum very broad, narrow; eusternum faintly distinct; ventro-lateral suture faint, oblique; sternellar band fused into lateral region at extremities. Mesonotum and metanotum dull, granulate. Each leg an almost invisible joint.

*Abdomen* very slender, with wide intersegmental skin; first and second dorsal and ventral ampullae dull, granulate, third, fourth, fifth and sixth deeply bilobed, the lobes teat-like, projecting; intersegmental skin between fifth and sixth dorsal ampullae dull, coarsely granulate. Pleural discs not distinct. Spiracles orbicular, very minute, smaller than ocellus, peritreme thin.

*Pupa*: Several long setae on disc of pronotum and a large group near posterior border, mesonotum and metanotum glabrous; third, fourth, fifth and sixth abdominal terga bearing an anterior irregular band of fine, slender, curved points and a posterior band of setae; seventh with two large hooks on posterior margin.

[Described from specimens Hopk. U. S. 9784e1.]

The larva has been found only in the dead branches of ash (*Fraxinus*). It works beneath the bark for a short time, spending most of the larval life in the wood. Several generations continue to breed in the same twigs, which they completely honeycomb. This is a true dry wood borer. The mines are tightly packed with granular frass. One year is required to complete the life cycle. Range, eastern United States and Canada. Observations by A. B. Champlain and the author.

OBRIMUM MACULATUM Oliver  
PHYTON PALLIDUM Say

In general as in *O. rufulum*, but differing in having a less elongate form and shorter body hairs; genal bristles fine, whitish; ocellus rather indistinct; process of palpifer as long or longer than entire palpus; gula longitudinally striate; posterior area of pronotum raised, extending forward in the middle, faintly and sparsely striate; dorsal ampullae projecting, marked by a single transverse fold (in *rufulum* two folds are present).

[Described from specimens Hopk. U. S. 15128.]

The larva breeds in branches of *Quercus*, *Celtis*, *Acacia* *Hicoria*, *Morus* and *Castanea*. It does not bore so extensively in the wood as *O. rufulum*. The life cycle is completed in one year. Range, eastern United States and Canada.

## MOLORCHUS BIMACULATUS Say.

[Pl. IX, XLII]

*Form* depressed, elongate, tapering posteriorly; integument thin, shining, sparsely covered with fine whitish hairs.

*Head* as in *Obrimum rufulum*, but thicker in front; one indistinct ocellus; genal setae more numerous and longer; first and second antennal joints transverse, subequal, third longer; last joint of maxillary palpi as long as two transverse basal ones; process of palpifer distinct.

*Pronotum* about twice as wide as long, posteriorly reticulate, shining, then dull granulate; sternum coarsely granulate, shining. Mesonotum and metanotum granulate, shining. Legless.

*Ampullae* coarsely granulate, shining. Pleural discs indistinct. Spiracles very minute, inconspicuous, orbicular, peritreme thin.

*Pupa*: Three transverse groups of long setae on pronotum; mesonotum and metanotum glabrous; several finer setae on second abdominal tergum, third, fourth, fifth and sixth abdominal terga bearing two groups of from three to six small chitinous setiferous points; two recurved points and several setae on seventh; eighth bearing many long setae.

[Described from specimens Hopk. U. S. 11847z.]

This species attacks a variety of recently dead trees, mining the smaller branches. The larvae practically mature beneath the bark, making irregular mines 8 to 10 inches long. On entering the wood a long curved pupal cell is made, often 3 inches in length. At the posterior end the larva pupates behind a wad of fibrous frass. One generation occurs each year, but the larvae mature very rapidly. From eggs laid in April pupae and adults can be found in late August. The adults hibernate in the cells. It has been reared from *Cercis*, *Cornus*, *Liquidambar*, *Castanea*, *Quercus*, *Vitis*, *Juglans*, and *Acer*. Collected by A. D. Hopkins, W. F. Fiske, H. B. Kirk, J. N. Knull, and the author.

### CALLIMOXUS FUSCIPENNIS LeConte

[Pl. XXI]

*Form* more robust, quadrangular, tapering posteriorly; integument thin, shining, sparsely covered with whitish hairs.

*Head* as in *Obrium maculatum*; labrum transversely oval, nearly twice as wide as long; ocellus large but little protuberant; first and second joints of antennae subequal, about as long as wide, third longer; last joint of maxillary palpi not quite twice length of second; process of palpifer and that of first maxillary palpal joint distinct, the former larger.

*Prothorax* thick, pronotum but little wider than long, anteriorly sparsely hairy, posteriorly regularly striate; sternum alutaceous, shining. Third, fourth, fifth and sixth ampullae deeply bilobed, teat-like, conspicuously projecting. Legs minute, two or three-jointed. Pleural discs indistinct. Spiracles very small, inconspicuous, suborbicular, peritreme thin.

[Described from specimens Hopk. U. S. 13165b.]

Habits and seasonal history similar to those of *Molorchus bimaculatus*. Specimens collected by H. B. Herbert from *Ceanothus thyrsiflorus*, Muir Woods, Cal.

### Tribe CURIINI

The larva of *Curius* has many striking characters by which it is easily recognized. These peculiarities are found also in *Euderces*. None of the adult systematists have suggested such relationships for these forms, but as larvae they will be here considered together. A peculiar character common to both, though probably of little taxonomic value, is the rugose texture of the ventral intersegmental skin between the middle abdominal segments. The affinities point towards those forms about *Obrium*. They may be recognized as follows:

Process of palpifer unusually long; last joint of maxillary palpi very long; gena not shouldered, bristles long (numerous in *Curius*, few in *Euderces*); ventro-lateral suture absent; sternellar fold broadly fused at extremities into epipleurum; hypopleural area of abdomen strongly protuberant laterally; pleural disc rather indistinct, but somewhat granulate; legs very small, three-jointed, form contracted.

Genal setae numerous; median suture of pronotum not impressed.....*Curius dentatus*  
Genal setae few, four in a row; median suture impressed.....*Euderces picipes*

### CURIUS DENTATUS Newman

[Pls. IX, XV, XX, XIX]

*Form* stout, very much depressed; integument thick, shining, sparsely covered with fine whitish hairs.

*Head* depressed, trapezoidal, wide behind and very suddenly narrowed in front; mouth frame corneous, smooth; clypeus and labrum thick, latter rectangularly oval, coarsely punctured; mandibles dull, except tips, broad, basal piece about one-third width of distal; antennae, fleshy, first and second joints subequal, little longer than wide, third longer, supplementary minute; ocellus large, protuberant; gena not shouldered but densely covered with slender bristles; ventral mouth-parts quite long; first and second joints of maxillary palpi transverse, last twice length of second, equal to last labial; process of palpifer as long as last maxillary joint.

*Prothorax* depressed, trapezoidal; pronotum trapezoidal, about two-thirds as long as wide, anteriorly sparsely hairy, posteriorly dull, covered with small, flat, regular granulations, no median suture; sternum broad, posteriorly granulate; ventro-lateral suture not impressed; sternellar fold short, protuberant at extremities and broadly fused into epipleurum. Mesonotum and metanotum dull, granulate. Legs minute, three-jointed, very short.

*Abdomen* depressed; hypopleural area strongly protuberant laterally, as well as spiracular region; dorsal ampullae broad, flat, dull, granulate, no markings; ventral similar except that the third, fourth, fifth and sixth are divided in the middle by a longitudinal band of very rugose, semi-corneous texture. Pleural discs on second abdominal segment dull, granulate. Spiracles minute, smaller than ocellus, sub-orbicular.

*larva*: The pupa is very similar to that of *Molorchus* in the arrangement of hairs and spines. There are two transverse bands of hairs on pronotum; mesonotum and metanotum glabrous; each abdominal segment bearing two transverse rows of very small points, arranged in four groups of two, anterior smaller; the seventh and eighth have several large recurved spines and the anal lobes bear two.

[Described from specimens Hopk. U. S. 12286 and 11876i.]

The larva feeds between the bark of small branches of *Pinus*, *Taxodium*, and *Juniperus*. A few specimens were also reared from dead branches of *Acer* at Falls Church, Va. It deeply scores the wood, later often extending a long mine through the twig and finally making a broad, flat pupal cell nearly at right angles to the grain. The life cycle is completed in one year. Range, southeastern United States. Observations by A. D. Hopkins, W. F. Fiske, and the author.

### EUDERCES PICIPES Fabricius

[Pls. VIII, XVIII, XIX]

*Form* semi-robust, short, contracted; integument tough, shining, sparsely covered with fine whitish hairs.

*Head* suboval, widest behind, with a slight anterior taper; mouth-frame lightly corneous; clypeus rather wide; labrum thin, transversely oblong; mandibles broad at apex, basal piece narrow, reddish brown, about one-fourth width of apical, which is piceous, shining, with a shallow fovea on outer face; antennae slender, second and third joints subequal, third about equal to fourth, supplementary long, one-half length of fourth; ocellus large, white, not very protuberant nor contiguous with antennae; gena abruptly rounded, scarcely shouldered, bearing a row of four long setae behind ocellus. Ventral mouth-parts rather long, curving over lower face of mandible, bearing numerous long hairs; last joint of maxillary palpi much longer than second, slightly shorter than last labial; process of palpifer as long as last maxillary joint; gula narrow, sutures protuberant, concave.

*Prothorax* subrectangular, rather thick; pronotum little wider than long, anteriorly regularly though sparsely hairy, posterior area with a few irregular faintly impressed striae ending in an irregular band of lenticular punctures, then finely granulate; median suture impressed; sternellar band at extremities broadly fused into epipleurum. Legs not longer than maxillary palpi, of two globular joints and a minute fleshy spine.

*Abdomen* rather contracted; ampullae prominent, last three dorsal ones, oval, dull, granulate, granules rather flat, with faint lateral impressions and median furrow; hypopleural region strongly protuberant; skin between fourth and fifth ventral ampullae strongly rugose. Pleural discs granulate on first, second, and third segments. Spiracles smaller than ocellus, sub-orbicular, peritreme thin.

[Described from specimens Craighead collections 238s.]

The larva constructs long mines beneath the bark, entering the wood to make a short pupal cell. The adult is common on flowers. Larvae have been collected from *Castanea*, *Hicoria*, *Quercus*, *Cercis*, *Celtis*, *Juglans*, *Robinia*, *Nyssa*, *Cornus*, and *Pyrus*. Range, eastern United States and Canada.

### CALLICHROMA PLIGATUM Leconte

[Pl. IX, figs. 5 and 8]

*Form* robust, cylindrical, tapering.

*Head* broad behind, tapering rapidly to a narrow front; mouth-frame scarcely corneous; epistoma thick, abruptly protuberant, wrinkled; clypeus small; labrum large, very thick, oblong, rectangular; mandibles tapering to apex, broad at base, yellowish basal piece as wide as piceous, shining distal piece; second joint of antennae, about as long as wide, covered with minute fine pubescence; one small ocellus, prominent, distinctly separated from antennae. Gena not shouldered, covered with very fine short pubescence, as is also the front of the head. Ventral mouth-parts fleshy; palpifer and maxillary palpus pubescent; joints of maxillary palpi subequal, first transverse, third slender, equal to last labial; process of palpifer very minute; ligula so small as to be concealed.

*Prothorax* sparsely covered with very short fine hairs; pronotum posteriorly embossed and irregularly closely striate, median suture impressed behind; sternellar fold not passing beyond spiracles. Legs of three large globular joints and a short spine-like tarsus. Spiracles oval, peritreme thick.

[Described from two poor specimens in the U. S. National Museum, collected in *Morus* at Savannah, Ga.]

Until better material can be had for study, further details cannot be discussed.



## Tribe RHOPALOPHORINI

*Rhopalophora* undoubtedly represents a distinct tribe. Its position is rather perplexing, but it shows affinities toward *Heterachthes* and also those forms about *Molorchus*. The characters are described under the species.

## RHOPALOPHORA LONGIPES Say.

[Pl. XXI, fig. 1; Pl. XV, figs. 1 and 12.]

*Form* elongate, subcylindric; integument firm, shining, smooth, sparsely covered with short, fine, light yellowish hairs.

*Head* subtrapezoidal, rapidly narrowing on front, mouth-frame slightly corneous; epistoma broadly emarginate in middle; clypeus thin, short; labrum transversely oblong, thin; mandibles rather broad, basal half reddish brown, one-third width of distal, latter piceous, shining, sulcus on outer face; antennae rather stout, first joint globular, equal to slender third, shorter than second, supplementary very minute; two bead-like, prominent ocelli below antennae, not enveloped by gena, which is beset with a number of rather stiff bristles; last joint of maxillary palpi about twice the length of transverse second, about equal to last labial; process of palpi and that of first maxillary joint, large, distinct.

*Prothorax* narrowly rectangular, depressed; pronotum twice as wide as long, posterior area embossed, very regularly and finely striate, sparsely haired, no median suture; sternum narrow, transverse; ventro-lateral sutures very obliquely diverging; sternellar fold not distinct beyond spiracle. Mesonotum and metanotum granulate, shining, former with an inverted v-shaped impression (i.e., scutellum distinct), the latter with a transverse suture.

*Legs* well developed, four-jointed, femur and tibia about equal in length to maxillary palpi.

*Abdomen* cylindrical, segments deeply constricted; ampullae small, bearing two irregular rows of small shining tubercles, last ventral substriate. Pleural disc a very large, dull, finely striate area on second, third and fourth abdominal segments.

*Spiracles* suborbicular, very small (about size of ocellus), peritreme thin.

[Described from specimens Hopk. U. S. 11844a.]

The larval habits of this species are similar to those of *Molorchus bimaculatus*, but the adult does not transform until the spring. It has been reared only from *Cercis*. Collected by A. D. Hopkins, T. E. Snyder, and the author.

## TYLONOTUS Haldeman

This is the only larva of the adults generally associated with it that has been studied, except *Chion* and *Eburia*. It can in no way be grouped with *Chion* but does show a relationship to *Eburia*, *Romaleum*, and the species of *Elaphidion* having two ocelli. The larva of the European *Stromatium* can be placed with it. The writer regards it as a form intermediate between *Malcopterus* and the true species of *Elaphidion*.

## TYLONOTUS BIMACULATUS Haldeman

[Pl. IX, fig. 7; Pl. XXI, fig. 4; Pl. XVIII, fig. 2; Pl. XV, fig. 13]

*Form* subcylindric, elongate, slender; integument rather firm, shining, sparsely covered with short, light yellowish hairs.

*Head* roundly rectangular, almost suborbicular; mouth-frame corneous, smooth, greenish brown; clypeus long as labrum, latter transversely oval, somewhat stalked, ciliate in front; mandibles rather slender, entirely black, basal piece about one-half length of distal; antenna slender, first and second joints subequal, or first a little shorter, third shorter; supplementary minute; ocellus large, clear, projecting, contiguous to antennae, not enclosed by gena (i.e., gena not shouldered). Ventral mouth-parts: palpi slender, last joint of maxillary palpus slightly longer than second, about equal to or slightly shorter than last labial; process of palpi distinct.

*Prothorax* about two-thirds wider than long, four tergal plates distinct, ochraceous; pronotum slightly wider than long, anteriorly sparsely hairy, hairs short, posteriorly finely and regularly striate, median suture not impressed; sternum narrow, eusternal spots contiguous, glabrous, wrinkled, shining; ventro-lateral suture a mere notch; sternellar fold not passing spiracles, distinct at extremities. Mesonotum having scutellum distinct; metanotum with a transverse impression. Legs very short, three-jointed, basal joints transverse, shorter than maxillary palpi.

*Abdominal* segments elongate, space between ampullae (intersegmental skin) twice wider than ampullae; dorsal ampullae projecting, oval, finely alutaceous, shining, marked by two lateral and two transverse impressions, setting off a fusiform area. Pleural discs indistinct. Spiracles broadly oval to orbicular, peritreme distinct.

Process of palpifer beset with a few short stiff hairs on a papilla-like base; mesonotum with a few small points on posterior half; two groups of small points on the posterior half of each abdominal tergum, becoming larger posteriorly and very large on seventh and eighth, the latter having six on the hind margin.

[Described from specimens Hopk. U. S. 10323.]

The larva usually is found attacking living ash (*Fraxinus*) trees, and it often kills them. It mines beneath the bark and wood, first in the larger branches and later in the main trunk as the trees become weakened. It is often associated with several species of cossids. Immature larvae and pupae can be found at the same time, indicating a life-cycle extending over several years. Range, eastern United States and Canada. Observations by A. D. Hopkins, W. F. Fiske, A. B. Champlain, J. L. Webb, and the author. It occasionally attacks privet hedges (*Ligustrum*), causing the death of the plants.

#### Tribe EBURIINI

LeConte (20) placed *Eburia* in the group Cerambyci with *Chion*, *Elaphidion* etc. Lacordaire (19) makes a separate tribe of this and allied forms. Based on larval characters Lacordaire's grouping seems more natural, as these forms are quite different from the others with which they have been tribally associated on imaginal characters. They can be recognized as follows:

*Form* robust, cuneate; labrum large, fleshy; gena bearing no setae and usually one large ocellus; pronotum posteriorly striate, with a deeply impressed median suture; ventro-lateral sutures strongly impressed behind; sternellar fold distinct at extremities; legs long, four-jointed; pleural discs not granulate, rather indistinct.

If a larger number of species was available for study it is doubtful if these two genera could be separated.

#### KEY TO THE GENERA OF EBURIINI

Process of palpifer minute, indistinct.....*Eburia*  
 Process of palpifer very large.....*Brothylus*

#### EBURIA QUADRIGEMINATA Say.

[Pls. XXI, XXVIII]

*Form* cuneate, compressed posteriorly, robust; integument tough, shining, sparsely covered with slender golden hairs, mouth-frame corneous, dark orange to lemon-coloured; clypeus very short; labrum thick, suborbicular, somewhat stalked, very hairy; mandibles short, stout, basal piece ochraceous, wide, two-thirds shorter than distal, latter black, piceous with a sulcus on outer face; antennae slender, first and second joints subequal, each twice or more as long as wide, third shorter, supplementary minute; ocellus large, white, contiguous to base of antennae, enveloped by the somewhat shouldered gena. Ventral mouth-parts rather thick, corneous; last joint of maxillary palpi, shorter than second, shorter than last labial; process of palpifer very minute; gula parallel, anterior margin sunken.

*Prothorax* very thick, quadrangular, with four prominent, pale yellow plates; pronotum a little wider than long, anteriorly covered with short hair, posteriorly alutaceously striate, with numerous lenticular impressions, median suture entire, deep behind; sternum hairy, wrinkled except two glabrous spots on eusternal area; ventro-lateral sutures impressed behind. Metanotum having a transverse impression. Legs four-jointed, long, tarsus chitinous-tipped.

*Abdomen* laterally compressed; dorsal ampullae alutaceous, shining, marked by two lateral and two transverse impressions. Pleural disc wrinkled, indistinct. Spiracles large, narrowly oval, peritreme indistinct.

[Described from specimens Hopk. U. S. 9791L.]

This larva is a true heartwood borer in *Quercus*, *Hicoria*, *Robinia*, *Fraxinus*, and *Castanea*, so far as recorded. It prefers dry solid wood, in which it excavates large contorted mines very tightly packed with frass. Mature oaks having a "catface" or scar through which the larvae can gain access to the heartwood are often badly damaged. A correspondent sent in a larva taken from a wooden bed which had been in use over 20 years. Dr. Hopkins records the adults under the bark of *Ulmus* and *Fagus*.

## EBURIA sp.

(Probably *ovicollis* LeConte or *mutica* LeConte)

*Form*, texture, and in general as in *E. quadrigeminata*, except that the hairs on the body are finer and lighter in colour. The posterior pronotum is more finely striate, these striae tending to be somewhat finely reticulated; ampullae alutaceous to flat, granulate.

[Described from two specimens in the U. S. National Museum collected at Brownsville, Tex., May 24, 1905, by H. S. Barber, in the wood of huisache (*Acacia*)].

## BROTHYLUS GEMMULATUS LeConte

The form, texture, and general characteristics are similar to those of *Eburia*, but this larva differs in having a large process of the palpifer about equal to the last joint of the maxillary palpi, and also a process on the first palpal joint; last joint of antennae less than half the length of the second; ocelli indistinct; gena more abruptly shouldered; submentum more deeply sunken below edge of hypostoma.

[Described from specimens Hopk. U. S. 12614 and 12618c.]

Mr. A. B. Champlain collected these specimens from the base of dry dead scrub oaks (*Quercus*) in Colorado. The samples of work were similar to those of *Eburia quadrigeminata*.

## Tribe PHORACANTHINI

The larvae of the species included in *Romaleum*, *Eustroma*, *Aneflus*, and *Elaphidion* (in part) constitute one of the most easily recognized groups of the Cerambycinae. It is impossible to group the larvae of the species here considered, as they are arranged in adult classifications, but a simpler arrangement is possible by splitting the genus *Elaphidion*. *Romaleum* and *Eustroma* can be separated from the species of *Elaphidion* but not by very good generic characters. *Eustroma* is more like *Romaleum atomarium* than is the latter like *R. rufulum*. Again, the species of *Elaphidion*, 10500a, 10961d, and 10055, are much more distinct from forms like *mucronatum* than are the latter from *Romaleum*, and are considered, from the larval standpoint, as a distinct genus.

Some species of *Elaphidion* cannot be even grouped with those discussed in the preceding paragraph. *E. alienum* is closely allied to *Stenosphenus* and is here treated with it. Those forms about *E. tenue*, etc., are still more distinct and are regarded as a transition from the *Stenosphenus*-like species to those of the tribe *Stenaspes*.

The species of *Romaleum*, *Eustroma*, and the species of *Elaphidion* which have two ocelli may be characterized as follows:

*Form* elongate, produced by wide intersegmental skin; head usually depressed; normally two ocelli enclosed by a more or less shouldered gena; process of palpifer large, small in a few species; prothorax depressed, sternal region very broad for its length; pronotum posteriorly having a few coarse striae, median suture impressed; ventro-lateral suture impressed behind; eusternal glabrous spots more or less fused; sternellar fold distinct at extremities; mesonotum and metanotum with x-shaped impressions; legs rather long, four-jointed, without tarsus longer than maxillary palpi; ampullae alutaceously tuberculate, having two lateral and two transverse arcuate impressions, also a deep median furrow; pleural disc indistinct or a deep pore in some species.

## KEY TO THE SPECIES OF ROMALEUM, EUSTROMA, AND THOSE OF ELAPHIDION HAVING TWO OCELLI

Process of palpifer distinct; pleural disc indistinct, crowded by a tubercle; spiracles larger. . . . I  
Process of palpifer minute, indistinct; pleural disc distinct, finely granulate; spiracles small, orbicular. . . . II

## I

Ocelli one or indistinctly two, crowded by a chitinous fold on pleurostoma; hairs on lateral region of prothorax stiff, subulate.

Ocellus one, large not sunken in foveae produced by fold of gena.

Hypostoma transversely and coarsely wrinkled. . . . *Romaleum* sp. 11871

Hypostoma longitudinally (to head) and finely wrinkled. . . . *Romaleum rufulum*.

Ocellus one or indistinctly two, in a deep fovea.

- One or rarely no ocellus; process of palpifer not so long as last joint of maxillary palpi.  
 Eastern ..... *Romaleum atomarium*  
 Two very small ocelli; process of palpifer large, as long as last joint of maxillary palpi.  
 Western ..... *Eustroma validum*  
 Ocelli two, distinct; hairs on lateral region of prothorax more slender.  
 Labrum suborbicular.  
 Head in cross-section twice as wide as deep; hairs on labrum not as long as labrum itself.  
 ..... *Elaphidion mucronatum*  
 Head not so depressed; hairs on labrum longer than labrum itself.  
 Third joint of antennae longer than second..... *E. inermis*  
 Third joint of antennae shorter than second..... *E. villosum*  
 Labrum wider than long.  
 Epistoma broadly curved; spiracles suborbicular..... *E. incertum*  
 Epistoma broadly curved; spiracles oval..... *E. sp. 12283L*  
 Epistoma nearly straight; spiracles oval..... *E. arizonense*

## II

- Epistoma shallowly emarginate.  
 Second joint of antennae longer than first..... *E. sp. 10500a*  
 First and second joints of antennae equal..... *E. sp. 10055*  
 Epistoma suddenly and deeply emarginate behind clypeus; second joint of antennae longer than first..... *E. sp. 10961d*

## ROMALEUM RUFULUM Haldeman

[Pl. I, fig. 6; Pl. VIII, fig. 13; Pl. XX, fig. 6; Pl. XIX, fig. 13; Pl. XVIII, fig. 9; Pl. XV, fig. 3; Pl. XXXIX, fig. 1; Pl. XL]

*Form* robust, elongate, anteriorly depressed; integument tough, firm, shining, sparsely covered with short, coarse, castaneous hairs.

*Head* roundly rectangular, slightly narrowed in front; mouth-frame heavily corneous, piceous; labrum transversely oblong, hairs short, stiff; mandibles stout, piceous, basal piece about one-half length of distal, fovea on outer face; antennae slender, first and second joints subequal, third slender, shorter, supplementary a mere point; ocellus large, globular, clear, somewhat enveloped by gena. Ventral mouth-parts more corneous than usual; last joint of maxillary palpi more slender and shorter than either second or last labial; process of palpifer distinct; hypostomal edge finely longitudinally wrinkled, the outer striae becoming transverse; gula longer than wide.

*Prothorax* depressed, little more than twice as wide as long; hairs on lateral region short, subulate, ferruginous; pronotum nearly twice as wide as long, with a border of short hairs on anterior margin, posterior area slightly embossed, protruding forward in centre, irregularly pinnately striate; median suture faintly impressed behind; sternum narrowly rectangular, very broad; ventro-lateral sutures distinct; mesonotum and metanotum bearing x-shaped impression. Legs long, four-jointed.

*Abdomen:* Dorsal ampullae broadly oval, alutaceous, shining, marked by two lateral and two transverse impressions. Pleural disc wrinkled, indistinct. Spiracles broadly oval, peritreme corneous.

*Pupa:* Pronotum, mesonotum and metanotum sparsely and rather regularly beset with minute erect asperities; abdominal terga armed with well-dispersed, erect, acute spines which become larger and curved posteriorly, arranged in a somewhat oval figure, none on eighth segment.

[Described from specimens Hopk. U. S. 10926 and 11863d.]

The habits of this species somewhat resemble those of *Prionozygus* and *Goes*, as they attack living oak trees (*Quercus*). The egg is laid under scales of the bark and for the first year the larva mines beneath the bark or merely starts its burrow in the wood. During the second year a long upright gallery is made deep into the heartwood at the extremity of which pupation occurs. The adult emerges back through the gallery at the point where the egg was laid. Large quantities of frass are exuded and the mine in the wood is always open. It is of considerable economic importance. Range, through central and eastern United States and Canada. Observations by the author.

## ROMALEUM ATOMARIUM Drury

[Pl. X, fig. 2]

Very similar to *rufulum*, but easily distinguished by having a very small and narrowly oval ocellus or none besides the antennae, set in a deep groove produced by a large chitinous wrinkle of the gena; anterior edge of hypostoma smooth, not wrinkled; ampullae more wrinkled.

*Pupa*: Pronotum, mesonotum and metanotum glabrous, spines of abdominal terga arranged more transversely, those on posterior border of segments larger; eighth spinose.  
[Described from specimens Hopk. U. S. 11849.]

The larva feeds beneath the bark of the base of dead trees or stumps, later going into the sapwood to construct the pupal cells. It has been found in *Quercus* and *Castanea*. The larva opens the mine forming the exit hole through which the adult emerges. Two years are required to complete the development. Range, throughout the eastern United States and Canada. Observations by W. F. Fiske, T. E. Snyder, R. W. Van Horn, and the author.

#### ROMALEUM sp. (11871)

##### XLIV

This larva closely resembles *rufulum*, but can be readily distinguished by the several deep transverse wrinkles or folds across the hypostoma, while in *rufulum* the hypostoma is closely wrinkled or finely striate, longitudinally in reference to the head, and the gula is very short, as wide or wider than long. The body texture is thin, the hairs finer, and the ampullae more closely reticulated almost to a degree of tuberculation.

*Pupa*: Resembles *rufulum* except that the spines are heavier.  
[Described from specimens Hopk. U. S. 11871.]

The larva feeds on the outer thick bark of *Quercus prinus* and probably other oaks, where a long mine, sometimes 3 feet in length, is excavated through the projecting ridges of bark and tightly packed with granular frass. Before pupation a cell is made between the bark and sapwood, scarring the cambium and causing a subsequent black scar or defect which is not effaced for years after, and which mars many following years of growth. The pupal cell is distinguishable on the surface of the tree, as an elliptical scar, parallel to the trunk, resembling a healed axe cut. Caged larvae have lived three years and have not yet pupated. Mr. W. H. Long, of the Bureau of Plant Industry, United States Department of Agriculture, collected specimens of the larvae and has recorded serious damage to the resulting oak timbers in the Ozark mountains.

The larvae of this insect have been under observation for five years, but not until the summer of 1917 was it possible to secure adults, when the writer, with Mr. H. B. Kirk, cut out a pupa and several adults dead in the pupal cell on June 22, 1917, at Charter Oak, Pa. The adult has not been determined as different from other forms here described, but the writer considers it a good species, probably new, and suggests the name *Romaleum cortiphagus*.

#### EUSTROMA VALIDUM LeConte

Similar to *R. atomarium*, but instead of one ocellus, two very small ones are present, almost indistinct; the process of the palpifer is large, as long as the last joint of the maxillary palpi; this joint is very acute; labrum densely hairy on anterior margin, widest near base; pronotum deeply punctured on anterior half, posteriorly finely, somewhat pinnately striate.  
[Described from specimens Hopk. U. S. 10057.]

The larva feeds in dead wood at the base of the tree, excavating large galleries beneath the bark and down into the roots. The pupal cell is made at the end of a long mine in the wood. It has been collected from *Prosopis* and *Parkinsonia* in Arizona by M. Chrisman.

#### ELAPHIDION MUCRONATUM Fabricius

Pl. VIII, fig. 9; Pl. X, fig. 6; Pl. XV, fig. 4]

*Form* robust, elongate, anteriorly depressed; integument tough, shining, rather thickly covered with long golden hairs.

*Head* roundly rectangular, depressed; mouth-frame heavily corneous, dark reddish, bearing a few setae scarcely longer than the antennae; epistoma suddenly and deeply emarginate behind clypeus; mandibles and ventral mouth-parts as in *Romaleum*; labrum suborbicular, hairs dense but not longer than its length; antennal joints subequal or last a little shorter than second; ocelli, two, prominent, globular, inclosed by corneous genal shoulder; process of palpifer very prominent.

like *E. mucronatum*, except that hairs on the pleurite are longer and fewer; ampullae present, and having more of a tendency to be tuberculate; pleural discs not distinct, spiracles broadly oval to suborbicular, peritreme distinct. Other characters as in *E. mucronatum*.

[Described from specimens Hopk. U. S. 10389a.]

The larva feeds in the dead branches of a great variety of hardwoods, mining beneath the bark and deeply scoring the wood, which it enters only to make the pupal cell. This cell enters the wood at right angles to the grain, then suddenly turns parallel to it. It is opened through the bark by the larva. The life-cycle is normally completed in two years. The first year the larva mines beneath the bark. Range, central and eastern United States and Canada. It has been collected from *Quercus*, *Rhus*, *Morus*, *Acer*, *Castanea*, *Cercis*, *Populus*, *Liriodendron*, *Asimina*, *Pyrus*, and *Sassafras*. Mr. W. F. Fiske has collected a number of larvae from *Taxodium* in the South. These larvae have smaller spiracles.

#### ELAPHIDION INERME Newman

[Pl. VIII, fig. 11]

Form as in *mucronatum*; body densely covered with long coarse hairs, those on prothorax very long; head depressed, though not as strongly as *mucronatum*; epistoma broadly emarginate, hairs very long; labrum sub-orbicular, slightly longer than wide, hairs dense, longer than its length; antennal joints 1 and 2 subequal, but little longer than wide, the third much longer; otherwise as in *mucronatum*.

[Described from specimens Hopk. U. S. 10077f collected by H. P. Loding.]

This is a southern species recorded only from the branches of orange trees (*Citrus*). The work is similar to that of *E. mucronatum*.

#### ELAPHIDION VILLOSUM Fabricius

[Pl. XXI, fig. 3]

Immediately recognizable by the very long, lemon-yellow hairs, especially on prothorax, these being as long as the pronotum; short subulate hairs on epipleurum and alar area of prothorax absent. Head broadly oval in cross section; epistoma very shallowly emarginate, bearing a number of long hairs; labrum orbicular, hairs on middle longer than labrum itself; genal shoulder enclosing ocelli less abruptly. Posterior area of pronotum simply, irregularly, coarsely striate; ampullae sub-tuberculate; spiracles broadly oval to orbicular, peritreme indistinct.

[Described from specimens Hopk. U. S. 9781.]

The larva attacks the smaller branches of a great variety of hardwood trees. It burrows down the centre of the stem until nearly mature, when it cuts off the branches from the inside, leaving a thin shell of bark, which later breaks. Rarely are holes made along the mines to exude frass. Pupation occurs between two plugs of frass, in the late fall or early spring. The life cycle is completed in one year. This species often becomes of economic importance and is abundantly cited in literature.

It is sometimes reared from branches which are dead and in this case does not girdle them. This may be a different species, as some of the larvae show variations from the form described.

#### ELAPHIDION INCERTUM Newman

Similar to *mucronatum* but readily distinguished by the greater degree of hairiness, the hairs being very fine; head oval in cross-section, but not so markedly as in *villosum*; labrum, transversely oval, very finely ciliate; hairs about epistoma very short, much shorter than antennae while in *mucronatum* they are about as long as antennae; epistoma thickened, broadly and rather deeply curved, wrinkled. Spiracles small, nearly orbicular, some abdominal ones but little larger than ocellus.

*Pupa*: Head, pronotum, mesonotum, and metanotum unarmed; a transverse row of acute spines on posterior border of first few abdominal segments, becoming arranged in an oval manner on posterior ones; several spines on eighth; a median longitudinal stripe of very fine pubescence on first seven.

[Described from specimens Hopk. U. S. 9791a and 10320.]

The larvae here described have been found only in the outer bark of *Morus*, where an irregular contorted gallery is excavated, sometimes scoring the cambium. Observations by H. B. Kirk, A. B. Champlain, and the author at Harrisburg, Pa. A larger, more robust form, having larger spiracles and finer body-hairs, is found beneath the bark of dead, somewhat decaying hickories. [Hopk. U. S. 9791d.]

**ELAPHIDION ARIZONENSE** Casey

Similar to *E. mucronatum* but more robust; striations on posterior pronotum finer; epistoma nearly straight; labrum semi-circular, usually much wider than long, widest at base; first and second joints of antennae subequal; process of palpifer longer than last joint of maxillary palpus; ocelli small; ampullae coarsely reticulate to sub-tuberculate; spiracles small, oval, peritreme indistinct.

[Described from specimens Hopk. U. S. 10353c and 10065c.]

This is a southwestern species working, much as *E. mucronatum*, beneath the bark of dead *Salix*, *Populus*, and less frequently *Quercus*. It is usually found in somewhat decayed wood associated with a species of *Acanthoderes*. Collected by M. Chrisman and Geo. Hofer in Arizona.

**ELAPHIDION** sp. 12283i

This species very closely resembles *E. arizonense*. The body hairs are silky, short, and less closely set, and the striations on the posterior area, of the pronotum are deeper and more closely set; epistoma broadly emarginate; labrum semi-circular, wider than long, glabrous in middle; second joint of antennae the longest; process of palpifer very large, as also that of first maxillary joint; ampullae somewhat tuberculate along lateral impression; pleural discs rather distinct on first and second segments; spiracles oval, peritreme thin.

[Described from specimens Hopk. U. S. 12283i.]

These larvae were collected from dead *Juglans* branches in Arizona by M. Chrisman. The work is very similar to that of *E. mucronatum*.

Although this larva in many respects closely resembles that of *E. arizonense*, in other characters, chiefly the prominent pleural discs, it suggests the following undetermined species.

**ELAPHIDION** sp. 10500a

*Form* as in *E. villosum*; integument firm, shining; body hairs fine, whitish; head somewhat ova in cross section; epistoma shallowly but suddenly emarginate at centre; labrum broadly ova to sub-orbicular, little wider than long, covered with long hairs; first antennal joint transverse shorter than second, which is about as long as wide; last joint of maxillary palpi equal to second slightly shorter than last labial; process of palpifer minute. Posterior area of pronotum embossed, very smooth and shining, except for a few large punctures, the posterior ones extended into striae; pleural discs finely granulate, with a deep pore on first, second and third segments; abdominal spiracles minute, oval, but little larger than ocellus.

[Described from specimens Hopk. U. S. 10500a.]

The larva feeds in the dead dry stems of *Yucca*. It does not girdle branches. It has been collected in Arizona by M. Chrisman.

**ELAPHIDION** sp. 10055

Distinguished from 10500a as follows: Labrum orbicular; first and second antennal joint subequal, slightly wider than long; epistoma broadly curved, not suddenly emarginate.

[Described from specimens Hopk. U. S. 10055.]

These larvae were collected in the stems of *Rhus* in Arizona by W. D. Edmonston. They do not girdle the branches.

**ELAPHIDION** sp. 10961d

[Pl. VIII, fig. 10]

Resembles 10500a, but the form is more robust and body hairs very coarse; head more depressed; epistoma very abruptly and deeply emarginate behind clypeus; labrum thin sub-orbicular, though wider behind; second joint of antennae slightly longer than wide; palpifer process minute; pleural discs finely granulate with a deep pore on first, second and third abdominal segments; spiracles sub-orbicular small.

[Described from specimens Hopk. U. S. 10961d.]

This species feeds in the small branches of the Chilicote bean (*Erythrina* *co. alloides*) in Arizona, but does not girdle the branches. The specimens were collected by Geo. Hofer.

#### Tribe HETEROSPINI

These larvae, including the genus *Stenosphenus* and *Elaphidion alienum*, are regarded as a distinct group showing a well graded transition from the true species of *Elaphidion*, especially those forms with a deep pleural disc (*E.* 10500a, etc.) to the species of *Elaphidion* having one ocellus (*E. tenue*, etc.). They may be recognized as follows:

One large ocellus, enclosed by a slightly shouldered (corneous or non-corneous) gena; process of palpifer large and distinct; prothorax depressed, ventral region very broad; posterior pronotum regularly striate, no median suture; ventro-lateral suture absent or faintly impressed; sternellar fold somewhat fused into epipleurum; metanotum bearing one transverse and several short oblique impressions; legs four-jointed, slender; pleural discs a deep pore, finely granulate or faintly striate; ampullae alutaceous, shining, with two transverse sutures, the posterior often indistinct.

#### KEY TO THE GENERA OF HETEROSPINI

Gena corneous; pleural discs having a small pore.....*E. alienum*  
 Gena not corneous; pore large.....*Stenosphenus*

#### ELAPHIDION ALIENUM LeConte

[Pl. XXI, fig. 8; Pl. XV, fig. 5]

This larva can only be distinguished from *Stenosphenus* by the smaller pore and larger granulate area of the pleural discs; the striate area of the pronotum protrudes anteriorly along a median line as in the true species of *Elaphidion*; the ventro-lateral sutures are represented as a mere notch (as in *Elaphidion*), and the eusternal glabrous spots are distinctly separated.

*Form* rather robust; integument tough, shining, thickly covered with light castaneous hairs; labrum transversely oval; ocellus enclosed by a dark chitinization of gena; pronotal striae slightly oblique and with a tendency to reticulation; ampullae alutaceous; spiracles broadly oval, middle abdominal ones not larger than ocellus. Otherwise as in *Stenosphenus*.

[Described from specimens Hopk. U. S. 12602 and 12612b.]

The larval work cannot be distinguished from that of *Stenosphenus*. It has been collected from *Prosopis* in Arizona by M. Chrisman.

#### STENOSPHEMUS NOTATUS Olivier

[Pl. XXI, fig. 6; Pl. XV, fig. 8]

*Form* elongate, slightly tapering, thorax depressed; integument tough, shining, rather thickly covered with long, fine, lemon-coloured hairs.

*Head* roundly rectangular, tapering little in front; mouth-frame not heavily corneous, bearing long slender setae; labrum fleshy, sub-orbitally transverse; mandible narrow at apex, basal piece slightly lighter and about one-third as wide as distal, latter piceous with sulcus on outer face; first and second antennal joints subequal, third shorter, slender; ocellus large, globular, somewhat enveloped by non-corneous gena; mentum very hairy; last joint of maxillary palpus slightly longer than second, about equal to last labial; process of palpifer and that of first joint of maxillary palpi large, distinct.

*Prothorax* rather depressed, narrowly rectangular; pronotum less than twice as wide as long, median area deeply punctured and hairy, posterior embossed, finely and regularly striate with a few scattered punctures, no median suture; sternum broad, hairy; mesonotum marked by a single transverse impression; no ventro-lateral sutures; eusternal plates contiguous, glabrous; sternellar fold somewhat fused into epipleurum at extremities. Legs four-jointed, quite long.

*Abdomen*: Ampullae slightly protuberant and narrow, dorsal alutaceous to coarsely granulate, marked by two lateral and two bow-shaped transverse impressions and a deep median furrow. Pleural disc a deep pore on second, third, fourth, and fifth segments. Spiracles small, oval, peritreme thin.

*Pupa*: A few scattered, fine hairs on disc and a few setiferous points on posterior margin of pronotum; a few minute points on mesonotum; first seven abdominal terga bearing a transverse row of small chitinous points, largest on first few segments; eighth bearing several minute points.

[Described from specimens Craig. 335a.]



The eggs are laid in the spring and early summer in crevices of the bark, and from these places of oviposition the larval mines subsequently radiate in all directions beneath the bark. The sapwood is deeply scored until the matured larva bores directly into the wood at right angles to the axis, then suddenly turns parallel to the grain, making a sharply curved and characteristic pupal cell. Pupation takes place in the late summer. The adults hibernate in the cell. It has only been taken from hickory (*Hicoria*) in the central and eastern United States.

**STENOSPHEMUS** sp.

Very similar to *notatus*, but slightly more hairy, these hairs light castaneous; labrum transversely oval; striations on posterior pronotum finer, a row of faint lenticular impressions along posterior edge.

[Described from specimens Hopk. U. S. 10356.]

*Pupa*: Similar to that of *notatus*, but having a few short hairs on the mesonotum and more points on the metanotum.

This is a southwestern species collected only from *Juglans* in Arizona by M. Chrisman. The habits are similar to those of *S. notatus*.

**ELAPHIDION TENUE** LeConte, **ELAPHIDION** spp., and **ANEFLUS**

The following larvae are considered generically distinct from the other species of *Elaphidion* and possibly even of higher rank as they are here placed. These forms show the extreme specialization of the twig-girdling habits peculiar to certain species of *Elaphidion*. The larvae are likewise specialized and approach those of the group *Stenaspis*, though the transition is probably not direct. They can be recognized as follows:

*Form* very elongate, cylindrical; body very hairy; head oval in cross-section; one large ocellus; gena not shouldered and bearing long curved setae; process of palpifer distinct, rather large; prothorax quadrate, ventral region very broad; posterior pronotum embossed, finely and regularly striate, anteriorly densely and longly haired, no median suture; latero-ventral suture absent; eusternal spots very small, fused; sternellar fold somewhat fused into epipleurum, not passing spiracles; metanotum bearing a transverse and several accessory impressions; legs four-jointed, long, slender; ampullae strongly protuberant, small having two lateral, one transverse, and a median impression, all very deep; intersegmental skin very long; pleural discs somewhat variable, usually striate, with a deep pore.

**KEY TO THE SPECIES OF ELAPHIDION HAVING ONE OCELLUS, AND TO ANEFLUS**

Ninth abdominal segment normal.

Anterior edge of hypostoma smooth or wrinkled.

First and second antennal joints subequal.

Gena bearing two or three long setae; spiracles small.....*Elaphidion* sp. 9903s

Gena bearing six long setae in a row; spiracles larger.....*E. subpubescens*

Second joint of antennae much longer than first; pleural discs conspicuous.....*E. tenue*

Anterior edge of hypostoma regularly carinate; ventral ampullae divided in middle, pleural discs conspicuous.....*E. unicolor*

Ninth abdominal segment chitinized and spiny.....*Aneflus*

A gradual transition is shown from the true species of *Elaphion* to this group, through several forms. *E. alienum* has one ocellus which is enclosed, as in most of the species of *Elaphidion*, by the corneous gena. *Stenosphenus* has the gena less shouldered and not so corneous. These species have a still more receding gena. Some of the species of *Elaphidion* with two ocelli (10500a) have a deep pore in the pleural discs, which is true also of *Stenosphenus* and *E. tenue*. The hairs of the gena, likewise, gradually become more setose, from forms such as *E. villosum* through *Stenosphenus* to *E. subpubescens*. The true species of *Elaphidion* have x-shaped impressions on the metanotum; *Stenosphenus* has a transverse impression with a slight wrinkle behind it, but these species have transverse and several other deep impressions. Again, the ampullae have two transverse impressions in the true species of *Elaphidion*; the posterior one is incomplete in *E. alienum*, and is absent in the forms like *tenue*. In *Steno-*

*Elaphidion* the last ventral ampulla is narrow, transverse, and striate, it is still more strongly striate in *E. subpubescens*, and all of the ventral ones are striate in *E. sp.* 9903s.

This gradual transition in anatomical structure is likewise correlated with a specialization in habits. *Elaphidion villosum* illustrates the best example of the girdling habit in the preceding group. It simply cuts the twigs and feeds in the dead portion and never extrudes the frass. The forms of the present group, however, not only cut off the branch but do so after they have burrowed farther down into the living tissue. Along the burrow a series of small holes is made, through which the frass is extruded, keeping the mine entirely open, often for a distance of 3 feet. These larvae are extremely active and by means of the very protuberant ampullae can move through the twig with marvellous rapidity. Several forms cut off the abandoned part of the twig by very complicated incisions. *E. subpubescens*, when in small plants from one-half to one inch in diameter, usually goes down to the base of the ground before completing its mine. Pupation takes place between two wads of frass, somewhere in the more recently excavated portion of the twig.

An interesting parallel between these and some genera of *Lamiinae* of like habits is to be found in anatomical structure. It can be best illustrated by *Oberca*, although also by *Hippopsis* and *Ataxia*. The form of the larva, even to the development of the ampullae, the striations of its lobes, and the shape of the thoracic segments, is similarly developed in both.

Recently several peculiar larvae have been associated with adult remains of *Anufus*. These larvae agree in all essential structural characteristics with the species of *Elaphidion* here discussed. The tenth abdominal segment is enlarged, strongly chitinized, and beset with numerous short spines, the ampullae are tuberculate or nearly so, but otherwise they are structurally similar to *tenue* and *subpubescens*-like forms.

Except for the fact that they bore in larger branches and even in small trees, they are not biologically different.

#### ELAPHIDION sp. 9901q and 9903s

[Pl. XLII, fig 5]

*Form* very elongate, slender; integument thin, rather dull, very thickly covered with long, whitish hairs, becoming golden on prothorax; living larvae a deep orange colour.

*Head* sub-orbicular, thick, oval in cross-section; mouth-frame corneous, light brown; clypeus minute, labrum orbicular, entirely hairy; mandibles short, basal piece about one-third of distal, light brown, latter broad, dull black; first and second antennal joints subequal, about as long as wide, third shorter; ocellus large, prominent, contiguous with base of antennae, not enveloped by gena, which bears several very long setae, curving anteriorly, and one above antennae; last joint of maxillary palpi equal to second, shorter than last labial; process of palpifer distinct, rather large; anterior edge of hypostoma protuberant, carinate, wrinkled.

*Prothorax* sub-quadrate, covered with very long hairs; pronotum anteriorly uniform hairy, with prominent, dark ochraceous tergal plates, posterior area embossed, white, shining, very regularly and deeply striate, no median suture; sternum uniformly hairy; eusternal glabrous spots very small; sternellar fold slightly fused at extremities, not passing spiracles. Metanotum bearing one transverse and several short oblique impressions; legs four-jointed, very long and slender.

*Abdomen*: Segments much distended, space between ampullae twice as great as ampullar width, ampullae very abruptly protuberant, dull granulate, marked by two very short lateral impressions, one transverse and a longitudinal one behind the transverse, impressions all very deep, ventrally the ampullar area behind the transverse impression is finely striate. Pleural disc a rather deep pore, semicircular, dull granulate. Spiracles of abdomen not much larger than ocellus, sub-orbicular.

[Described from specimens Hopk. U. S. 9901q and 9903s.]

The larva girdles the living branches of *Thuberia*. It cuts off successive sections as it bores farther down in the wood. This cut is v-shaped on the upper part of the branch and inverted on the lower. A long series of holes in a straight row is made to the surface. These specimens are collected by H. S. Barber in Arizona.

## ELAPHIDION SUBPUBESCENS LeConte

[Pl. I, fig. 11; Pl. XXI, fig. 5; Pl. XVIII, fig. 3; Pl. XV, figs. 9, 10 and 14;  
Pl. XXVI, fig. 4; Pl. XLII.]

Similar in form and integument to *E.* 9903s, readily distinguished by the much larger sub-orbicular spiracles and by the fact that the gena bears a straight row of six very long, closely set setae, curved forward; the front bears many shorter setae; the epistoma is suddenly emarginate in the middle; the striations on the posterior area of the pronotum are finer; the pleural discs are inconspicuous, and the ventral ampullae, except the last, are divided by a median longitudinal smooth area.

*Pupa.* Similar to *tenuis*, but the spines on the abdomen are heavier and a few are present on the eighth segment.

[Described from specimens Hopk. U. S. 9195k.]

The habits are similar to those of the preceding species, but this species attacks small seedlings from one-half to one inch in diameter. Entering the top it successively cuts off sections about a foot in length, often going below the surface of the ground to pupate. The incision across the branch is nearly transverse. The life cycle is completed in one year. It has been collected in *Quercus* and *Castanea*. Range, southern United States. Observations by H. B. Kirk and the author.

## ELAPHIDION TENUE LeConte

[Pl. X, fig. 3]

Scarcely distinguishable from 9903s, except for the large orbicular to angularly oval, reddish brown spiracles; epistoma only roughened; hairs lighter in colour and posterior area of pronotum more regularly striate, resembling lines of copper engraving; second joint of antennae twice as long as first; only last ventral ampulla striate; pleural disc distinct and radially striate, with a deep pore.

*Pupa:* Head, pronotum, mesonotum, and metanotum glabrous; posterior half of abdominal terga bearing very small chitinous-tipped spines (projecting in all directions), arranged in four more or less regular groups of about the same size on all segments, but few on first and second and none on eighth.

[Described from specimens Hopk. U. S. 10519a, 12668b, 12634a, 12614d, and 12633.]

This species has only been taken girdling oak branches (*Quercus*). The larvæ burrow down the branch until reaching a diameter of three-fourths to one and one-half inch, where a single incision is made. This is a spiral cut from the pith outward, as in *E. villosum*. Holes are made at irregular intervals for extruding frass, but not so numerous as in the case of other species. The specimens have been collected in Arizona by M. Chrisman.

## ELAPHIDION UNICOLOUR Randall

[Pl. VII, fig. 12]

*Form* elongate, slender; integument thick, dull, finely granulate, sparsely covered with long, fine, whitish hairs; colour white.

*Head* and mandibles similar to those of *E. subpubescens*; first and second joints of antennae equal; a long seta above antennae and one behind ocellus; basal joint of maxillary palpi transverse, beadlike, second and third subequal, third shorter than last labial; anterior edge of hypostoma protuberant, regularly carinate; thorax and abdomen as subpubescens, except that the ampullae are less protuberant, and the ventral ampullae are not so distinctly divided by longitudinal, shallow impressions. Pleural discs distinct on first and second abdominal segments. Spiracles about size of ocellus, orbicular.

[Described from specimens Hopk. U. S. 9780k and 9193d.]

Habits similar to those of *E. subpubescens*, but the incision for severing the branches is more oblique. Range, eastern United States. Observations by the author.

## ANEFLUS sp. (PROTENSUS LeConte)

*Form* elongate, cylindrical; integument tough, shining, clothed with stiff reddish hairs.

*Head* subtrapezoidal; anterior margin bearing many short stiff hairs; mouth-frame heavily chitinized, very dark reddish to piceous; clypeus thick, subrectangular, beset with stiff reddish hairs; epistoma broadly emarginate; mandible entirely black, shining, basal piece about one-third length of distal, latter with a fovea on outer face; ocellus prominent, contiguous to anten-



*Abdomen:* Ampullae broad, rather flat, coarsely granulate, dorsal ampullae marked by curved transverse impression, meeting two short lateral ones. Pleural discs finely granulate on second, third, and fourth abdominal segments. Spiracles on abdomen little larger than ocellus, broadly oval, peritreme thin.

[Described from specimens Hopk. U. S. 9784b<sup>1</sup> and 11845c.]

The larva extends the greater part of its mine in the wood proper, where long tunnels are made parallel to the grain. A sudden outward turn of one of these burrows serves as the pupal cell. Its life cycle is normally completed in one year. Range, eastern United States. Observations by W. F. Fiske, A. B. Champlain and the author.

#### HETERACHTHES AENOLUS Bates

Distinguished from *quadrifaculatus* by the coarse striae of the pronotum and the strongly alutaceous ampullae.

Described from a single poor specimen in the United States National Museum collection, reared from grapevines (*Vitis*) in northern Mexico.

#### HETERACHTHES EBENUS Newman

This species can be distinguished from *H. quadrifaculatus* by the coarser striae of the pronotum (each striae being separated from the other by four or five times its width), which posteriorly end in a dull, granulate area; prosternal plates shining and sparsely rugulose; the ampullae more finely granulate; gena somewhat corneous; antennae thick, second joint twice or more length of first; pleural discs distinct on five abdominal segments.

[Described from specimens Hopk. U. S. 10082a.]

Collected by A. B. Champlain in the branches of dead *Pinus rigida* on Long Island, N.Y. The work resembled that of *H. quadrifaculatus*.

#### IBIDION EXCLAMATIONUS Thomson

Distinguished from *Heterachthes quadrifaculatus* as follows:

Labrum elongately orbicular, widest in front; mandibles more salient, basal piece about one-fourth length of distal, set off as an abrupt shoulder; process of palpifer shorter than last joint of maxillary palpi; striae of pronotum coarser and more deeply impressed, extending slightly forward in middle; ampullae strongly alutaceous, shining.

[Described from specimens Hopk. U. S. 6151a.]

The larva was collected by Mr. H. S. Barber in the wood of *Mimosa* at Brownsville, Tex.

#### Tribe STENASPINI

The following species, though placed in several distinct tribes as adults, must be considered in a single group as larvae. In fact, in those genera in which several species have been studied it is usually impossible to formulate generic characterizations. They illustrate as a group the most extreme modification or absence of those structures characterizing the lower groups and are placed at the end of the series of the Cerambycinae.

They may be easily recognized as the only larvae of this subfamily having the median and lateral pronotal and the ventro-lateral sutures impressed for the entire length of the prothorax; also in having the two distinct prosternal yellowish plates on the prothorax. They can be further characterized as elongate, hairy forms, usually of a yellowish colour; head trapezoidal; gena shouldered, enclosing a large ocellus contiguous with antennae; genal bristles wanting; process of palpifer distinct (except in *Crossidius*); prothorax having eight or six (lateral wanting) yellowish plates on anterior margin; pronotum anteriorly punctured and densely hairy; posterior area somewhat raised, white, striate; cuneum never distinct, and glabrous spots never circular; sternellar fold distinct at extremities but not passing spiracles; mesonotum having the scutellum distinct; metanotum with a single transverse impression; legs four-jointed, very long; ampullae projecting, oval, granulate, alutaceous or tuberculate, the dorsal with two lateral and two transverse impressions, though the latter is often wanting, and a broad, shallow, longitudinal furrow; pleural discs usually indistinct, obliterated by pleural tubercle, wrinkled rugulose to granulate, pore never very deep.

The pupae are generally distinguished by an excessive hairiness and by the fact that the mesonotum projects over the metanotum in a more or less triangular process.

These species are typical wood feeders. The larvae bore in the wood a great deal more than beneath the bark. Some species occasionally attack dry seasoned wood on which no bark is present (*Chion*). The frass is rather coarse, granular, and most of it is extruded through one or more holes made as the larva enters the wood from the bark. These mines within the wood are large, straight and more or less parallel to the grain; before pupation the exudation hole (through which the frass is pushed out) is plugged by a protruding wad of frass. This is very characteristic for most of the species. The adult gnaws away this plug to emerge. Correlated with the open larval mines is the elongate form of the larva and well developed ampullae. One species girdles branches (*Purpuricenus axillaris*), and the ampullae tend to be striate as in the species of *Elaphidion* having one ocellus (*tenue*, etc.) and *Oberca* of the Laminae. *Crossidius pulchella* is a root feeder in shrubby plants and shows the greatest departure from this group.

#### KEY TO THE SPECIES OF *STENASPINI*

- Prothorax having eight yellowish plates around anterior margin; ampullae dull, granulate.  
 Mandible bearing a faint carina on outer face.  
 Anterior margin of hypostoma roughened; last ventral ampulla granulate.....*Chion*  
 Anterior margin of hypostoma carinate, wrinkled; last ventral ampulla striate.....*Purpuricenus*  
 Mandible with a sulcus on outer face; process of palpifer indistinct.....*Crossidius (pulchellus)*  
 Prothorax having only six plates, lateral plates lacking; ampullae variable.  
 Presternal plates transversely rectangular, narrowly separated; anterior margin of hypostoma carinate.....*Tragidion (coquus)*  
 Presternal plates nearly square, separated at least the distance of their narrowest dimension.  
 Anterior margin of hypostoma longitudinally striate or carinate.  
 Carina short, not so regular; ampullae alutaceous.....*Metaleptus (batesi)*  
 Carina longer, very regular; ampullae variable.....*Batyle*  
 Anterior margin of hypostoma roughened or tuberculate.  
 Margin smooth, arcuate; ampullae tuberculate.....*Tragidion (armatum)*  
 Margin bearing four tubercles; ampullae alutaceous.  
 Tubercles small; body colour yellowish.....*Shizax (senax)*  
 Tubercles large; body colour white.....*Dendrobias (mandibularis)*

#### *CHION* CINCTUS Drury

[Pl. VIII, fig. 14; Pl. XXVIII, fig. 5]

*Body* elongate, slender, subcylindric; integument firm and tough, somewhat shining, densely covered with long, fine, castaneous hairs; body in life a lemon-yellow to orange colour.

*Head* subquadrate, widest behind and constricted above middle; mouth-frame firmly concave, dark reddish brown; epistoma suddenly emarginate in middle; anterior edges of hypostoma sub-tuberculate; labrum elongately orbicular, entirely covered with long, dense, castaneous hairs; mandible picceous, shining, basal piece reddish, about one-third length of distal, a fine carina on outer face; antennae long, first and third joints subequal, second slightly longer; one large distinct ocellus contiguous to base of antennae and enclosed by shouldered gena, latter not setose; joints of palpi all subequal; process of palpifer long, that on first maxillary joint, distinct.

*Prothorax* transversely rectangular, about twice as wide as long; anterior margin nearing eight transverse ochraceous plates, four tergal, two presternal, and two lateral, the two presternal ones transverse, slightly separated; pronotum anteriorly regularly punctured, bearing dense, fine hairs, posteriorly shining, striate, median suture entirely impressed, deepest behind; sternum hairy; eusternal spots separated, triangular, smooth, shining. Mesonotum having the stercellum distinct; metanotum with a transverse impression. Legs four-jointed, very long and slender.

*Abdomen* elongate, very slightly compressed; ampullae prominent, oval, widely separated, granulate, granules flattened, faintly shining, dorsal ampullae marked by two lateral and two transverse impressions, ventral with one transverse. Pleural disc rugose, not distinct. Spiracles very broadly oval, large, peritreme thin.

*Pupa*: Pronotum beset with dense short hairs except on posterior half of discs; mesonotum and metanotum bearing a few finer ones; abdominal terga beset with short acute asperities projecting posteriorly, those on fourth, fifth, and sixth segments arranged more or less in an oval manner, with two groups of three each in center; seventh with six or eight larger recurved spines on posterior margin; a few small points on eighth; lateral region of abdominal terga hairy.

The larva attacks the rather dry, dead branches or larger limbs of *Hicoria*, *Quercus*, *Juglans*, and *Castanea*, excavating the mines beneath the bark but

principally in the wood proper. The latter part of the mine is sometimes 2 feet long. Much frass is extruded and the greater part of the burrow in the wood is open. Before pupation a large protruding wad of frass is placed in the exudation hole. Normally two years are required to complete the life cycle, but this is sometimes extended to three. The adult transforms in the fall and hibernates in the cell, or pupation takes place in the spring. The eggs have been found laid on dry, barkless branches in checks of the wood.

The habits and larval characters of the western variety are similar. It has been collected from *Quercus* and *Parkinsonia* by J. L. Webb and M. Chrisman in Arizona.

#### PUPURICENUS AXILLARIS Haldeman

*Form* elongate, slender; integument shining; mandible with a very faint carina on outer face; basal joint of antennae short very; joints of palpi obliquely truncate at tip; process of palpifer minute; anterior edge of hypostoma nearly straight, finely wrinkled; presternal plates rectangular, separated by a distance equal to their narrowest dimension; eusternal plates rectangular, contiguous; lateral ones less distinct than in *Chion*; posterior area of pronotum coarsely and deeply striate; mesonotum and metanotum alutaceous, shining; ampullae dull, finely granulate to reticulate, not divided. Abdomen less hairy than the other species. Last ventral ampulle striate behind. Spiracles broadly oval, sunken, middle abdominal ones about as large as spiracles.

[Described from specimens labelled "State College Penn. Ap. 10, 1912. Hickory Twigs."]

This larva is the only species in the tribe in which the habit of girdling has been developed. The work is similar to that of *E. villosum*, but larger branches often 2 inches in diameter are severed. It rarely cuts the branch more than once and this incision is of a spiral form from the centre outward. Frequently it is found in branches which it does not girdle. Much of the frass is exuded, but only from one or two holes. The life cycle is completed in one year. It has been collected in *Hicoria* and *Quercus*. Observations by A. B. Champlain and the author. Range, eastern United States.

#### PURPURICENUS HUMERALIS Fabricius

Distinguished from *axillaris* by the broadly oval and darker spiracles, the smallest being larger than the ocellus; the presternal plates are nearly contiguous, and the ampullae are more finely granulate.

[Described from Specimens Hopk. U. S. 11845e.]

Habits similar to those of *Chion cinctus* but the larval mines are less extensive. Pupation takes place in the early summer. It has been taken in *Quercus*, *Betula*, and *Castanea*. Range, eastern United States and Canada. Observations by A. B. Champlain and the author.

#### TRAGIDION ARMATUM LeConte

[Pl. XXVII, fig. 3]

*Form* elongate, subcylindric, robust; integument firm, yellowish tinged, shining, densely covered with long, fine, light castaneous hairs.

*Head* as in *Chion*, except that the outer face of the mandible has a sulcus; labrum widest behind, hairs sparser; ocellus smaller, more projecting, beadlike; anterior edge of hypostoma arcuate, somewhat protruding, first joint of antennae shortest.

*Prothorax* quadrate; lateral ochraceous plates wanting, presternal oval, separated about their width; sternum entirely hairy, no eusternal glabrous spot; posterior area of pronotum smooth and shining except for a slight irregular tendency of hind margin to be striate; ampullae strongly tuberculate; spiracles narrowly oval, peritreme thin.

[Described from specimens Hopk. U. S. 9901l.]

The larva makes extensive mines in the dry stems of *Yucca*. The habits are typical of the group. Collected by M. Chrisman and H. S. Barber in Arizona.

## TRAGIDION COQUUS Linnaeus

*Form* elongate, rather slender; anterior edges of hypostoma finely carinate and considerably protruding at edge of gula; mandible having a sulcus on outer face; labrum elongate, tapering anteriorly though broadly rounded; first joint of antennae shortest, transverse; posterior area of prothorax strongly embossed, regularly coarsely striate to more finely and pinnately so behind; lateral plates absent; presternal plates transverse, nearly contiguous; eusternal glabrous spots triangular, separated. Mesonotum and metanotum dull, granulate; ampullae alutaceous to extremely finely subtuberculate, distinctly divided in middle. Spiracles broadly oval, large.

[Described from specimens Hopk. U. S. 12681.]

These larvae have been collected in the dead branches of *Quercus* by A. B. Champlain in Colorado. The habits are similar to those of *Purpuricenus humeralis*.

## TRAGIDION FULVIPENNE Say.

Several specimens have been reared from *Alnus* and *Quercus* collected by A. B. Champlain in Colorado and G. Hofer in Arizona. From the larval skins it cannot be distinguished from *coquus*.

## METALEPTUS BATESI Horn

[Pl. I, fig. 8; Pl. X, fig. 1]

*Form* more robust; anterior edge of hypostoma nearly straight, thick and finely carinate. Ochraceous tergal plates on prothorax very conspicuous, presternal ones transverse but separated the distance of their narrowest dimension; eusternal glabrous spots triangular, separated, very smooth and shining; striae of posterior area of prothorax very fine and lightly impressed, a group of deep punctures on anterior margin (of this area) on each side. Mesonotum and metanotum shining; ampullae very finely alutaceous, shining, ventral only divided. Spiracles small, oval, middle abdominal scarcely larger than ocellus, peritreme thin.

[Described from specimens Hopk. U. S. 12681a and 12666c.]

With the exception of one record from *Acacia*, the larva has been collected only in the dry dead branches of *Quercus*. The work in all respects resembles that of *Chion*, though the mines are not so extensive. Pupation occurs in the fall and the adults hibernate in the cells. Collected by M. Chrisman in Arizona.

## SHIZAX SENAX LeConte

Distinguished from *Metaleptus batesi* by the fact that the anterior edge of the hypostoma is very thin, wrinkled at the extremities and having one or two tubercles on each side of the gula. Striae of posterior area of pronotum are irregular or slightly sinuous. Ampullae more coarsely alutaceous and not divided.

*Pupa*. Two groups of hairs on disc of pronotum and a few on posterior and anterior angles; more slender hairs sparsely distributed over mesonotum and metanotum; a transverse band of attenuated, chitinous spines no posterior border of each abdominal tergum, each spine bearing a long hair; a few spines on anterior portion of fifth, sixth, and seventh, the latter uncurved, those on posterior margin of seventh very long; a few short points on eighth.

[Described from specimens Hopk. U. S. 12292<sup>1</sup> and 12602.]

The larva has been reared from *Prosopis*, *Thurberia*, *Zizyphus*, and *Covilla*. In habits it is similar to *Metaleptus batesi*, but mines more extensively beneath the bark. Specimens collected from Arizona by M. Chrisman, G. Hofer, and H. S. Barber. Mr. Hofer notes that the eggs are covered as in many buprestids.

## BATYLE SUTURALIS Say.

A small species of very shining texture; buccal margin scarcely chitinized; anterior edges of hypostoma swollen and very regularly carinated; gula sunken. Presternal ochraceous places small, square, and separated by the distance of their width; posterior area of pronotum irregularly striate, then coarsely granulate behind, the striae rather widely separated and sharply impressed. Ampullae finely granulate, very smooth and shining between granulate area; pleural discs a rather conspicuous granulate area; spiracles very small, nearly orbicular, about as large as ocellus.

*Pupa*: Pronotum glabrous except for a group of hairs on anterior angles and a few on mesonotum and metanotum; abdominal terga bearing very slender acute spines arranged about as in *Chion*, but each having a long hair from base; seventh bearing eight recurved spines on posterior margin; a few very small points on eighth; lateral region of terga hairy.

[Described from specimens Hopk. U. S. 11855a.]



The larva has been found only in small dead twigs of *Quercus* and *Castanea* which it completely hollows. Not much of the frass is extruded and pupation takes place in the early summer between two wads of fibrous chips. It is often found in branches girdled by *Elaphidion*. The adult is common on the flowers of *Chrysanthemum leucotoeca* and *Achillia millefolium*. Range, central and eastern United States and Canada.

**BATYLE IGNICOLLIS** Say.

A single larval skin of this species is the only material found and cannot be adequately described. The anterior margin of the hypostoma is slightly wrinkled but not carinate, as in other species.

[Described from specimen Hopk. U. S. 12695.]

Collected by A. B. Champlain in dead branches of *Pinus flexilis*, Colorado. The work is similar to that of the eastern species.

**BATYLE** sp. (probably **PEARSALLI** Blandford)

Distinguished from *subwalis* as follows: Carinae on hypostoma finer; first joint of antennae transverse, about equal to third, second much longer; irregular striations on posterior area of pronotum deeper; ampullae alutaceous; spiracles larger, somewhat D-shaped.

[Described from specimens 12617b.]

These specimens were collected, but not reared, from *Rhus* in Colorado by A. B. Champlain.

**CROSSIDIUS PULCHELLUS** LeConte

*Form* cylindrical, somewhat robust; integument tough, shining, very hairy; head more strongly tapering anteriorly and gena not so strongly shouldered as in most species; mandible having a sulcus on outer face; ocellus small; labrum sub-orbicular; first joint of antennae about as long as wide, equal to third, second longer; last joint of maxillary palpi indistinctly longer than second; process of palpifer indistinct; anterior edge of hypostoma smooth.

*Prothorax* quadrate, posterior area of pronotum striate; lateral plates distinct; presternal plates square or lengthening posteriorly, widely separated; mesonotum and metanotum finely granulate; ampullae dull, finely granulate; only one transverse suture distinct; pleural discs granulate, rather distinct; spiracles small, sub-orbicular, but little larger than ocellus.

[Described from specimens Hopk. U. S. 10075e.]

The larvae were collected in the roots of *Artemisia*. It was associated with a species of *Mecas* and *Sesia* which, working together, entirely destroy the larger roots and base of the stem. Observations by A. B. Champlain in Colorado.

**DENDROBIAS MANDIBULARIS** Serville

*Form* robust, cylindrical, then slightly compressed posteriorly; sparsely hairy; epistoma suddenly emarginate behind clypeus; labrum broadly oval to sub-orbicular, hairy; antennal joints subequal; mandible with a sulcus on outer face; joints of palpi subequal; process of palpifer very distinct; anterior margin of hypostoma swollen, bearing four more or less distinct tubercles. Pronotum posteriorly coarsely striate, the striae somewhat pinnately arranged behind; tergal plates prominent, lateral absent; presternal plates square, widely separated; eusternal glabrous spots triangular; ampullae strongly alutaceous, shining, posterior ventral ones somewhat divided and between the lobes longitudinally wrinkled. Spiracles narrowly oval, peritreme thin.

[Described from specimens Hopk. U. S. 10066.]

The larva has been collected by Geo. Hofer in the dry dead branches of *Parkinsonia* in Arizona. The work resembles that of *Chion*, but a much longer mine was excavated through the centre of the branch. Pupation occurred between two wads of fibrous frass.

A specimen (Hopk. U. S. 9785e<sup>1</sup>) of larva belonging to this genus from Mexico has the lateral orange plate of the prothorax somewhat distinct, but otherwise the same.

## Subfamily LEPTURINAE

In this subfamily are placed the Neeydalini and other lepturiform cerambycids. Considering the typical forms they comprise a very distinct group, but the Neeydalini show many affinities to the Aseminae. For the present, however, they are retained here.

Considering the typical forms, they are generally more or less depressed and coarsely haired. The dorsal margins of the epicranial halves are entirely angulate behind the front; the clypeus is wide and the mandibles are acute at the apex. The pronotum is rarely defined as a definite plate but fused with the proclavus area to form the large protergum, the anterior margin of which has a transverse chitinous band of contrasting colour. The epipleurum prominently projects on all abdominal segments, and has a distinct tubercle but never a distinct pleural disc. The ampullae are tuberculiform. The legs are well developed for cerambycids.

The characters of the Lepturinae may be briefly summarized as follows:

## CHARACTERIZATION OF LARVAE OF THE SUBFAMILY LEPTURINAE

*Head* transverse, dorsal margins of epicranial halves behind front entirely separated, angulate tentorial cross-arm internal, in a plane at right angles to hypostoma (i.e., occipital foramen not apparently divided into an anterior and a posterior portion).

*Mandibles* usually cuneate, cutting edge oblique, apex produced, acute.

*Epistoma* not produced over clypeus, three to five setae on each side; clypeus trapezoidal, as wide at base as epistoma; labrum transverse, semicircular or cordate.

*Maxillae* movable; cardo visible; maxillary sclerite full; ventral mouth-parts attached by cardo and submentum to edge of hypostoma for nearly its entire width; palpifer large, distinct, bearing lacinia.

*Antennae* frail, short, very retractile.

*Prothorax* having presternum and epipleurum separated by distinct suture; eusternum distinct, triangular; coxae large, almost meeting internally between eusternum and sternellum. Mesothoracic spiracle not protruding into prothorax. Legs slender, quite long.

*Abdomen* with region surrounding spiracle not protruding; epipleurum strongly protuberant on all segments; pleural disc never present; hypopleurum distinct; coxal lobe large.

## KEY TO THE GENERA LEPTURINAE

- Gula distinct, raised, sutures protuberant; antennae fleshy, joints scarcely retractile into a large antennal ring situated more dorsad (easily seen when viewed dorsally); form cylindrical, tapering posteriorly. . . . . 1
- Gula sutures not distinct, usually only a median suture; antennae very retractile, situated more laterally; sides of head more broadly rounded in front. . . . . 3
1. Gula longer than wide; lacinia dilated at apex; no caudal spines. . . . . 2
- Gula as broad or broader than long; lacinia normal, two caudal spines. . . . . *Centrodera*
2. Posterior area of pronotum and ampullae finely asperate. Feeds in base and roots of dead conifers. . . . . *Ulochaetes*
- Posterior area of pronotum and ampullae not asperate. . . . . *Necydalis*
3. Front (of head) bearing a transverse suture behind epistoma. . . . . 4
- Front not divided (except in a few *Leptura*). . . . . 8
4. Abdominal ampullae present on only six segments; two caudal spines; dorsal angle of mandible extended in an abrupt tooth. . . . . 5
- Abdominal ampullae present on seven segments. . . . . 6
5. Two caudal spines; three ocelli, sometimes indistinct. Feeds on decaying wood. . . . . *Anthophilax*  
(Probably not three ocelli). . . . . (*Toxotus*)\*
6. Form subcylindrical; mandibles short, triangular from side; three prominent ocelli; eusternum of prothorax triangular; legs longer than one-half distance between them; Feeds in base and roots of *Sambucus*. . . . . *Desmocerus*
- Form depressed; mandibles very slender from side; ocelli never three. . . . . 7
7. Eusternum trapezoidal; legs shorter; ampullae tuberculate; no caudal spine. Feeds under bark of *Juglans*. . . . . *Gawrotes*..
- Ninth tergum bearing a distinct spine. . . . . *Pachyta*
8. Ampullae present on only six abdominal segments, very deeply bilobed, tuberculate; one large ocellus; proeusternum triangular; spiracles very small. Feeds on the outer dry bark of hardwoods. . . . . *Encyclops*
- Ampullae present on seven abdominal segments (except in a few *Leptura*), of normal form. . . . . 9
9. Mandible deeply bifurcate or notched at apex, slender; form depressed; ampullae dull, very finely pubescent. . . . . 10
- Mandible usually short, triangular, cutting edge long, extending obliquely backward, very obliquely truncate; ampullae variable. . . . . 11

\*Characters taken from Schiodte (31).

10. Head wider than thorax; anterior angles of gena keeled; ocelli indistinct; proeusternum trapezoidal. Feeds under bark of conifers..... *Rhagium*  
 Head not wider than thorax; five ocelli on each side of head; proeusternum triangular..... *Leptalia*
11. Tarsal claws short, broadly dilated at base; eusternum of prothorax glabrous except for two triangular spots of velvety pubescence at posterior extremities; posterior border of spiracles bearing a longitudinal series of carinae..... *Bellamira*  
 Not possessing the above combination of characters..... *Strangalia*

### Tribe NECYDALINI

The larvae of this tribe show a strong and undoubted relationship to the Aseminae. This is illustrated in the tendency (in some species) of the dorsal margins of the epicranium to be slightly fused and in the short, robust, triangular mandible. In *Ulochaetes* it is shown by the velvety asperate pronotum and ampullae, and the two lateral impressions marking off the ambulatory ampullae, caused by the splitting of the strong muscles from the posterior cuneal notch. The legs are weaker than in other Lepturinae and jointed as in the Aseminae.

They may be characterized as follows:

Head subcordate, strongly tapering in front, widest behind middle, having, in some species, the dorsal margin of epicranium behind front slightly fused, suggesting Aseminae; antennae fleshy, situated rather more dorsally than in other Lepturinae, and less retractile, basal membrane incapable of retraction into large antennal fovea, third joint minute; labrum usually transverse; ventral mouth-parts very fleshy and, though widely articulated at base to anterior edge of hypostoma, not filling entire width; lacinia large and usually broader at apex though less so in *Ulochaetes*; ocelli absent or minute, indistinct; gular sutures protuberant.

There is a tendency for these larvae to be covered with fine asperities, most marked in *Ulochaetes*, and the ampullae are closely beset with bead-like tubercles in all species of *Necydalis*. The epipleurum is very narrow. The body is soft and fleshy, slender, tapering, cylindrical.

The species may be separated as follows:

### KEY TO THE SPECIES OF NECYDALINI

- Posterior area of pronotum and ampullae finely asperate; mandibles having a deep sulcus on apical dorsal face..... *Ulochaetes leoninus*  
 Posterior area of pronotum and ampullae not asperate; ampullae tuberculate; mandible variable.  
 Mandible having a deep sulcus; ampullae dull, tubercles very few, almost obsolete..... *Necydalis laevicollis*  
 Mandible without a sulcus; ampullae strongly tuberculate.  
 Gula sutures strongly protuberant; ampullae tubercles many, contiguous..... *N. cavipennis*  
 Gula sutures but slightly protuberant; ampullae tubercles fewer, separated..... *N. mollitus*

### ULOCHAETES LEONINUS LeConte

[Pls. IV, XVII, XXIII, XXIX]

*Form* elongate, robust, cylindrical; integument thin, shining, very sparsely clothed with very fine, short, whitish hairs.

*Head* subcordate, widest just behind middle; mouth-frame dark, corneous, in sharp contrast to white head; epistoma straight, often bearing two small tubercles; clypeus thin; labrum transverse, fungiform, clothed with slender yellowish hairs; mandible triangular from side, shining rugose at base, bearing a deep oblique sulcus on apical dorsal face; antennae very fleshy, retractile, articulating membrane large, conical, first joint shorter than second, third minute; one ocellus, scarcely visible; gena rapidly tapering, beset with short fine hairs as well as anterior part of front and hypostoma. Ventral mouth-parts fleshy; lacinia large, fleshy, broadened at apex, sparsely haired; basal joint of maxillary palpi largest, second and third subequal, third conical, last labial shorter than basal, cylindrical; ligula short, thick, with a median groove; gular sutures rectangular, longer than wide, parallel, prominent, protuberant.

*Prothorax* transversely elliptical, well covered with fine asperities; pronotum rectangular, anteriorly glabrous, posteriorly covered with fine asperities. Eusternum triangular, finely asperate; mesonotum and metanotum and mesosternum and metasternum more finely asperate; legs fleshy, five-jointed (including coxa), tarsus thick, chitinous tipped.

Abdomen cylindrical; ampullae prominent, finely asperate, with two lateral curved sutures impressed on each side; epipleurum narrow, distinct on all segments. Spiracles large, oval, posterior margin finely carinate; peritreme thin.

*Larva*. The pronotum is armed with a number of conical spines, chitinous tipped, disposed on central area; abdominal terga bearing similar spines in a transverse band on each side, last tergum with two long, conical, fleshy cerci having recurved, chitinous tips.

The larva of *Ulochaetes* bores in the dead roots of *Pinus ponderosa*, *Picea*, and chiefly *Pseudotsuga*. The mines are extended through the soft sapwood and deep into the heartwood, tightly packed with fine, shredded frass. Before pupating the larva sometimes works higher into the stump, but usually emerges near the ground. It pupates in May or June. Specimens have been collected by A. D. Hopkins, R. Hopping, H. E. Burke, and W. D. Edmonston throughout British Columbia, Oregon, Washington, and California.

#### NECYDALIS CAVIPENNIS LeConte

[Pls. XI, XXII]

*Form* more slender but in general similar to *Ulochaetes*; labrum broadly cordate, rounded in front; second joint of antennae about twice the length of the first, last minute; mandibles as in *Ulochaetes*, except that the oblique sulcus is absent and the outer face is less rugose. Pronotum anteriorly glabrous, posteriorly rugose; body devoid of all asperities; ampullae thickly covered with small, bead-like, contiguous tubercles, irregularly disposed. Spiracles small, broadly oval, peritreme thin.

[Described from specimens in the United States National Museum collected in heartwood of dead oak (*Quercus densiflora*) in California.]

A number of specimens in the U.S. Forest Insect Collection which cannot be distinguished from this species have been taken by M. Chrisman from dead *Alnus* stumps in Arizona (Hopk. U. S. 10355a), from *Eucalyptus* in California by A. D. Hopkins (Hopk. U. S. 1094), and from *Heteromeles* in California by F. B. Herbert (Hopk. U. S. 13178d).

#### NECYDALIS MELLITUS Say

*Form* slender, slightly tapering. Distinguished from *N. cavipennis* by the fact that the posterior area of the pronotum is smooth and shining, or with few indistinct markings, and the tubercles on ampullae separated, smaller and fewer, irregularly arranged in four rows. The labrum is narrowly transverse, twice as wide as long, the anterior margin densely ciliate; the second joint of the antennae is slightly longer than the first, the last about equal to the first; the gular sutures are less prominent. The posterior angles of the proeusternum have a spot of fine velvety pubescence. The spiracles are minute, sub-orbicular, and the peritreme fleshy.

[Described from specimens Hopk. U. S. 8685a.]

This larva is a heartwood feeder in the solid dead wood of *Quercus* and *Castanea* throughout the eastern United States. The mines are tightly packed with frass. Dr. A. D. Hopkins has collected the larvae at Kanawha, doing considerable damage to solid white oak trestling. The adult flies throughout June and July. Observations by Dr. A. D. Hopkins and the author.

#### NECYDALIS LAEVICOLLIS LeConte

*Form* more slender than in *Ulochaetes*; labrum transverse, roundly rectangular, thin, anterior margin straight, ciliate; mandible as in *Ulochaetes* (sulcus distinct), but more tapering; lacinia very broad at apex, densely ciliate; gular sutures very prominently protuberant. Posterior area of prothorax glabrous, finely wrinkled; proeusternum, mesonotum and metanotum very finely, velvety pubescent; ampullae dull, finely velvety pubescent, bearing a few scattered, shining, bead-like tubercles. Spiracles large, sub-orbicular, fleshy rimmed.

[Described from specimens (Hopk. U. S. 9558b).]

Collected by the writer in solid heartwood of living *Picea engelmanni*. Joseph, Oregon. The larvae entered through an old blaze.

## CENTRODERA DECOLORATA Harris

[Pls. XIV, XI, XXII]

*Form* elongate, cylindrical, slightly tapering; integument finely wrinkled, shining, very sparsely clothed with slender whitish hairs.

*Head* sub-orbicular, narrowing in front, beset with scattered slender setae; mouth-frame not heavily corneous; clypeus thin; labrum transversely sub-orbicular, regularly rounded in front, little wider than long, anterior margin ciliate, hairs golden; mandible trapezoidal from outer face, black, shining, cutting edge very oblique, long, dorsal angle flattened; antennae acutely conical, basal membrane large, not retractile; first, second, and third joints respectively smaller, supplementary joint as large as fourth; one indistinct ocellus. Anterior edge of hypostoma broadly curved; ventral mouth-parts extended; palpi slender, last labial shorter than basal, equal to last maxillary; lacinia short, cylindrical; mentum large, barrel-shaped; gula about as wide as long, strongly protuberant.

*Prothorax* widest in front; pronotum anteriorly shining, posteriorly rugulose; eusternum acutely triangular, velvety asperate, dull; mesonotum and metanotum dull; mesosternum and metasternum tuberculate. Legs five-jointed, tarsus slender, attenuate, femur longer than tibia.

*Abdomen:* Dorsal ampullae bearing four rows of large prominent separated tubercles, ventral two rows; pleural tubercle sub-orbicular, bearing two fine, slender setae. Ninth abdominal tergum bearing two widely separated straight conical spines. Spiracles sub-orbicular, small, peritreme thin.

[Described from specimens Hopk. U. S. 11864.]

These larvae have been reared by the writer from old wet decaying oak logs (*Quercus*) in Pennsylvania. Dr. A. D. Hopkins records it from dead heartwood of chestnut and tulip (*Liriodendron*) in West Virginia. It pupates from May to July.

On June 25, 1915, at Englenook, Pa., the author took numerous larvae of this species working in a hollow dead chestnut (*Castanea*) in connection with *Leptura biforis*. The larvae were feeding in the solid wood, eating only the spring tissue of each annual layer. Large galleries were excavated and a round cell of frass constructed before pupation. An adult was reared in early September.

## ANTHOPHILAX LeConte

Only two species in this genus have been reared, but a number of similar larvae are represented in the U.S. Forest Insect Collection. By locality and elimination probable species names have been assigned to some of these forms and the descriptions given.

They all live in very decayed logs lying on the ground. When the larvae are about mature they bore out to the surface of the log and fall to the ground, where an earthen pupal cell is constructed in the soil beneath the humus.

These larvae may be recognized by the tough body integument and coarse hairs; front of head divided by a transverse suture; three ocelli (often indistinct); mandible short, outer face tuberculate, dorsal angle abrupt toothed; gula not distinct; anterior margin of protergum strongly chitinized, posteriorly faintly rugulose; mesonotum and metanotum dull, velvied, often bearing several tubercles; legs very slender; six dorsal ampullae bearing four rows of bead-like, prominent separated tubercles; two strong caudal spines.

## ANTHOPHILAX ATTENUATUS Haldeman

[Pls. XI, XXII, XXVIII]

*Form* elongate, subcylindrical, tapering; integument tough, smooth and shining, sparsely clothed with stiff reddish hairs.

*Head* sub-orbicular, widest behind middle, entirely dark castaneous, strongly corneous and thickly beset with slender setae; mouth-frame black; epistoma straight; clypeus and labrum thin, latter transversely oval, one and one-half times wider than long, densely ciliate on rounded front margin; front transversely divided; mandible triangular from outer face, tuberculate, dorsal angle abruptly toothed, acute, cutting edge obliquely emarginate; antennae, very small, entirely retractile; three indistinct ocelli. Anterior margin of hypostoma thickened, broadly curved; gula not distinct; palpi very slender, last joint of maxillary palpi slender, acute, longer than second, about equal to last labial; lacinia shortly conical, thick, densely hairy.

*Prothorax* twice as wide as long, more coriaceous than usual; anterior margin of pronotum and proalar area strongly chitinized, castaneous; posterior area of pronotum faintly rugulose;

... notum semi-coriaceous, shining; mesonotum and metanotum velvety pubescent, each with a median group of shining tubercles; mesosternum and metasternum tuberculate. Legs somewhat cornified, slender, tibia longer than femur, tarsus a very slender attenuate spine.

*Abdomen:* Six dorsal ampullae, bearing four irregular rows of very prominent, bead-like, separated tubercles, ventral ampullae bearing two rows; seventh and eighth terga bearing a transverse row of dark reddish hairs; pleural tubercle narrowly oval, bearing five or six long, dark reddish setae; ninth tergum more chitinized, bearing two acutely conical, slightly diverging, strongly chitinous spines, widely separated; anal lobes densely covered with castaneous hairs. Spiracles oval, peritreme strongly chitinized.

[Described from specimens Hopk. U. S. 12631a.]

The larva lives in very moist decaying hardwood logs, chiefly *Fagus*, *Betula*, *Acer*, and *Populus*, making large, irregular galleries loosely packed with fibrous frass. Caged larvae invariably leave the wood and go deep into the ground to pupate. The described specimens were reared from *Populus tremuloides* collected by S. A. Rohwer at Boulder Junction, Wis.

#### ANTHOPHILAX (HOFFMANI Beutenmuller.)

[Pls. XI, XXII]

Distinguished from *A. attenuatus* by the three prominent ocelli; caudal spines contiguous at base, short, conical, the surrounding area darkly chitinized; last joint of maxillary palpi one and one-half times longer than second; claw of the legs equal in length to the tibia. Spiracles rectangularly oval; anal lobes hairy, but not so densely so as in *A. attenuatus*.

[Described from specimens Hopk. U. S. 9790l.]

These larvae were collected by T. E. Snyder and the author on the top of Mt. Mitchell, North Carolina, in decaying logs of *Picea* and *Abies*, but no adults were reared. They have the similar habit of entering the ground before pupation. A deformed adult was reared (Hopk. U. S. 12897), probably *A. hoffmani*, the larva of which is similar to the form described above.

#### ANTHOPHILAX VIRIDIS LeConte

Resembles *A. attenuatus*, but the body hairs are finer and the caudal spines are erect, cylindrical, and suddenly acute at apex.

[Described from specimens Hopk. U. S. 11876c.]

These specimens have been collected by the writer at Charter Oak, Pa., in dead logs of *Fagus*, *Betula*, and *Acer*.

#### ANTHOPHILAX sp. (TENEBROSUS LeConte)

Distinguished from *A. attenuatus* by the larger contiguous tubercles on ampullae; anterior and posterior borders of ampullae velvety asperate; caudal spines very short, not longer than wide at base, approximate.

[Described from a single specimen, Hopk. U. S. 4793c.]

Collected by H. E. Burke from dead *Pseudotsuga*, Oregon. It may be *tenebrosus*.

J. Brunner reports *A. tenebrosus* breeding in old decayed logs of *Picea* and *Pseudotsuga* in Idaho and Montana.

#### TOXOTUS Serville

No specimens of this genus have been studied except the cotype of *T. cursor* described by Schiodte. It very closely resembles our species of *Anthophilax* but has only one ocellus.

#### DESMOCERUS Serville

A single genus represents the tribe Desmocerini in North America. The species of larvae are remarkably similar in the minutest details of structure. They can scarcely be separated except by size and texture of hairs. They possess, as larvae, no distinctive characters setting them off from other Lepturinae as a tribe, but are distinguished only by a combination of characters.

They may be recognized by the sub-orbicular head, tapering in front; short mandible; front divided behind epistoma by a transverse suture (sometimes rather faint); three large, prominent ocelli; gula not distinct; pronotum posteriorly shining, rugulose; mesonotum and metanotum not tuberculate; tubercles of ampullae ill-defined, confluent; no caudal spine.

All larvae have the similar habit of feeding in the base and roots of living *Sambucus*.

### DESMOCERUS PALLIATUS Forster

[Pls. XVII, XXXI]

*Form* elongate, robust, slightly depressed; integument firm, shining, glabrous except for a few long hairs.

*Head* sub-orbicular, tapering in front, sparse long setae on front and gena; mouth-frame strongly corneous and entire head somewhat more than usually chitinized; epistoma thin, semi-tuberculate in middle; clypeus and labrum thin, latter narrowly transverse; mandible short, black, shining, cutting edge short, truncate, dorsal angle of cutting edge not produced; antennae very small, entirely retractile into fovea; ocelli three, prominent, bead-like. Ventral mouth-parts slender; mentum elongate, tapering; lacinia, conical slender, beset with several hairs; last joint of palpi acutely conical, equal to second; gula not distinct, indefinitely fused with submentum.

*Prothorax* transverse, trapezoidal, widest in front; pronotum smooth, shining, posterior edge faintly reticulated, anterior strongly punctate. Eusternum acutely triangular, glabrous, shining, except for several hairs; mesonotum and metanotum not tuberculate, faintly shining; sternum tuberculate; legs very long, tibia longest joint, tarsus short, chitinous-tipped, appendiculate.

*Abdomen*: Ampullae broad, flattened, tubercles ill-defined, confluent; epipleurum distinct on all segments; pleural tubercle narrowly oval, bearing two long setae; tergum of ninth segment broad, extending over anal lobes. Spiracles large, orbicular, deep, peritreme very thin.

*Pupa*. Anterior area of pronotum beset with short, subulate hairs; first six abdominal terga bearing numerous recurved, conical spines, more abundant on posterior margin, seventh and eighth terga bearing attenuate hairs from chitinous pores, ninth with two widely separated, long, slender spines, extending laterally and posteriorly.

The larvae feed in the living roots of *Sambucus*, working deep under the ground until nearly matured, when they come up through the pith and excavate the pupal cell. The mines are packed with coarse, fibrous frass, which is often exuded in large quantities at the base of the stems. Various sizes of larvae can be found at the same time, indicating a larval period of several years. Pupation occurs through April and May. The adults feed on the flowers. Range, throughout the eastern and central United States and Canada.

Rathvon (26) gives a brief note and description of this species.

### DESMOCERUS PIPERI Webb

Distinguished from *palliatus* by the denser castaneous hairs on the anterior margin of the labrum; two broad median impressions on the front; inner apical face of lacinia bearing a dense brush of hairs; mesonotum and metanotum anteriorly dull, covered with very fine velvety asperities; femur and tibia of equal length; ampullae less strongly tuberculate.

[Described from specimens Hopk. U. S. 12300.]

This species makes a large gall, often 10 inches in diameter, at the base of stems of *Sambucus*, sometimes killing them. The larvae feed in this abnormal growth and in the roots, going above ground in the pith to pupate. The pupae were collected March 14, 1914, at Riggins, Idaho. The adults emerged in early May. Observations by Josef Brunner.

### DESMOCERUS CRIBRIPENNIS Horn

Separable from *D. piperi* only by the more slender hairs on head and body, the less distinctly tuberculate ampullae, and the smaller spiracles, which are scarcely chitinous rimmed.

*Pupa*. The pupa is much smaller than that of *D. palliatus*; the hairs on the pronotum are more slender, and there is an additional group of the posterior margin; and each spine on the abdominal terga ends in an attenuate hair.

[Described from specimens Hopk. U. S. 4313a.]

The eggs are laid in the crevices of the bark of *Sambucus* at the base of the stem, the larvae tunnelling through into pith where they continue to

work up and down until each matured larva occupies the entire cavity excavated by it. After cutting an exit hole through to the bark it retreats into the pith to pupate. Pupae and young larvae were found at the same time, indicating a larval period of several years. Many of the stems are killed. Observations by H. E. Burke, April 20, 1906, Pialschie, Wash.

### GAUROTUS CYANIPENNIS Say.

[Pls. IV, XVII]

*Form* strongly depressed, subparallel; integument smooth, shining, sparsely clothed with very long, castaneous, attenuate hairs.

*Head* very depressed, transversely oval, widest at middle, strongly coriaceous and beset with numerous slender setae; epistoma very thin, straight, fused with clypeus at middle; clypeus and labrum thin, latter twice as wide as long, anterior margin rounded, ciliate; front transversely divided; mandible very slender from side, more than twice as long as wide at base, tip dilated slightly, cutting edge short, truncate; antennae very small, retractile; ocelli two, often indistinct. Anterior edge of hypostoma thin, straight; mentum transverse; palpi very slender; last maxillary joint acute, as long as second; last labial acutely conical shorter than basal; lacinia cylindrical; gula not evident, a single suture.

*Prothorax* twice as wide as long; pronotum undifferentiated, smooth, shining. Eusternum smooth, broadly rounded in front; mesonotum and metanotum velvety asperate, only metasternum tuberculate. Legs slender, femur and tibia subequal, tarsus attenuate, curved.

*Abdomen* much depressed; dorsal ampullae bearing four rows of small, prominent, contiguous tubercles; the ventral ampullae, two rows; pleural tubercule oblong, oval, bearing five setae, ninth tergum fringed with numerous long setae. Spiracles orbicular, prominent, peritreme wide, chitinous.

[Described from specimens Hopk. U. S. 10358.]

*Pupa.* Front of head around base of antennae beset with a few strong hairs and a group above eyes; anterior, posterior, and lateral margins of pronotum bearing a single row of closely set, long hairs, row on posterior margin forming an angle; mesonotum glabrous; metanotum bearing two patches of long hairs and each abdominal tergum also bearing a transverse row, broken in middle, of finer hairs; last tergum bearing a short, straight, acute spine.

This species feeds between the bark and wood of dead walnut (*Juglans*) in a manner similar to that of *Rhagium*. It has also been found in *Quercus*, *Prunus*, *Rhus*, *Nyssa*, and *Cornus*. Mr. A. B. Champlain records this larva as leaving the bark and going into the earth or humus to construct its pupal cell.

### PACHYTA Serville

[Pls. I, XXII]

A large series of larvae are represented in the U. S. Forest Insect Collection from which no adults have been reared. They have been associated with adults of *Pachyta*. There are several species represented. All work under the tight, recently dead bark of *Tsuga*, *Abies*, *Pinus*, except one species collected by the writer in apple (*Malus*). Caged larvae have the same habit as *Anthophilax* of entering the ground before pupation.

*Form* elongate, parallel, depressed; quite hairy; head sub-orbicular, depressed; mandible very slender, squarely shouldered at base, apical half strongly bent down, cutting edge very oblique, truncate, abruptly toothed; front bearing a transverse suture behind epistoma; labrum transverse; one prominent ocellus. Posterior edge of pronotum velvety pubescent; seven abdominal segments, tuberculate; dorsal area of ninth segment protruding, slightly chitinized, armed with an obtuse or acutely conical spine, according to the species.

The following specimens representing several species are in the Forest Insect Collection Hopk. U. S. 1849*nb*, 1938*c1*, 2174*g4*, 3305*d*, 3350, 3568, 4241*b*, 4224*e*, 4276*b*, 9188*c1*, and 11813*a*.

### RHAGIUM LINEATUM Oliver

[Pls. I, XI, XVII, XIX, XXII, XXXI, XLII]

*Form* very depressed, elongate, parallel; integument smooth, shining, sparsely clothed with fine, silky, whitish to yellowish hairs.

*Head* greatly depressed, strongly chitinized, wider than prothorax, sparsely covered with fine, silky, short hairs, sides rounded, with a dull carina on anterior margin; epistoma straight, fused into clypeus at middle; front with two elongate, shallow depressions; clypeus and labrum



very thin, latter obtrapezoidal, rounded and widest in front, cilia dense, fine; epistomal setae six or more. Mandibles very slender from side, nearly three times as long as basal width, apex dilated, deeply notched; antennae small, entirely retractile; ocelli indistinct. Ventral mouth-parts well extended; mentum obtrapezoidal; palpi very slender, last maxillary joint attenuately acute, equal to last labial, shorter than first or second maxillary; lacinia slender, cylindrical; anterior margin of hypostoma straight, not distinct from mouth-parts; gula not distinct.

*Prothorax* widest in front, dorsally undifferentiated, entirely smooth, slightly chitinized; eusternum trapezoidal, broadly rounded in front, smooth, shining; mesosternum and metasternum, mesonotum and metanotum dull, very finely velvety pubescent. Legs slender, femur and tibia subequal, tarsus slender, attenuate, not strongly chitinized.

*Abdomen* depressed; ampullae semi-tuberculate at sides, dull, very finely pubescent; pleural tubercle very elongately oval, bearing five or more setae; last abdominal tergum broad, bisinuate on posterior margin. Spiracles orbicular, peritreme distinct, raised, not strongly chitinized.

*Pupa*. Subconvex, tapering; anterior and posterior margins of head and posterior margins of prothorax and metathorax with two transverse bands of upright setae; abdominal terga bearing transverse bands of reflexed subulate setae; last tergum bearing two tri-acuminate spines.

The larvae of *Rhagium* have been collected between the bark and wood of all our coniferous trees excepting the species of Cupresseae. They require a certain amount of moisture, usually preferring trees which have been dead only a short time. The larvae construct an oval, fibrous-rimmed pupal cell, pupating and transforming to adults in the early fall, and overwintering as imagoes. The larval period usually is completed in one season or may extend over two. The species occurs commonly throughout the United States.

Rathvon (26) gives a brief note on this species, stating that it kills pines. It is improbable that such could be the case.

Packard (23) gives a description of the larva and figures it. Although not detailed, these are sufficient to permit of its recognition.

#### LEPTALIA MACILENTA Mannerheim

[Pl. 1, fig. 1]

*Form* depressed, slightly tapering posteriorly; integument thin, dull, very finely granulate, and very sparsely beset with long slender hairs.

*Head* depressed, sub-orbicular; mouth-frame little chitinized; three epistomal setae; labrum twice as wide as long, widest at base, anterior margin rounded from basal angles; mandibles slender, twice as long as basal width, cutting edge short, oblique with dorsal angle very abruptly protruding, tip truncate; five more or less distinct ocelli in two rows. Ventral mouth parts slender; maxillary palpi very slender, joints subequal; ligula broad; anterior edge of hypostoma thin; gular suture sometimes faintly visible.

*Prothorax* transverse, depressed; pronotum entirely smooth; eusternum very finely asperate, dull; mesonotum and metanotum and mesosternum and metasternum dull, very finely asperate. Legs slender, tibia longest, tarsus very attenuate.

*Abdomen*: Ampullae seven, dull, very finely asperate; pleural tubercles very small, oval, projecting, bearing two very slender setae. Spiracles small, orbicular, peritreme very thin.

[Described from specimens in the United States National Museum collected by Kincaid in decaying alder stump (*Alnus*). Popof Island, Alaska.]

Kincaid (18) gives a very good description of this species. It is better than most North American descriptions of cerambycid larvae. The writer has re-described it here to conform with the terminology used throughout this paper.

#### ENCYCLOPS CAERULEUS Say.

[Pls. 1, XXVII]

Very slender, tapering, quadrangular; integument smooth, shining, very sparsely covered with long, silky hairs.

*Head* sub-orbicular, widest at middle; mouth-frame slightly corneous; epistoma thin, fused at middle with clypeus; clypeus and labrum thin, latter transversely oval, broadly rounded on front, beset with few long hairs; mandible slender from sides, tapering apex dull, cutting edge short; antennae very small; retractile, last joint and supplementary joint distinct; ocellus large, distinct. Anterior edge of hypostoma thin, not sharply distinct from mouth parts; mentum transverse; last joint of maxillary palpi distinctly larger than either of others, equal to last labial; gula indistinct.

*Prothorax* slightly wider than long, pronotum glabrous, undifferentiated; eusternum acutely triangular, glabrous; mesonotum and metanotum subtuberculate, shining, sternum tuberculate, shining. Legs slender, very fleshy, femur and tibia subequal, tarsus attenuate, soft.

*Viscera*, tetragonal. Ampullae only six, prominently projecting, bilobed by a deep median furrow, each lobe regularly tuberculate; parascutal and coxal lobes large, protuberant; pleural tubercle large, orbicular, bearing two long slender setae. Spiracles orbicular, small, not larger than ocellus, peritreme fleshy.

*Pupa*. Body covered with a group of fleshy papillae bearing slender, fine hairs, as follows: two lateral groups on epieranium, on lateral margins, and on posterior margins of pronotum; a recurved transverse group on abdominal terga becoming denser at posterior margins of eighth and ninth terga.

[Described from specimens Hopk. U. S. 9792b.]

The larva of *Encyclops* has the peculiar habit of mining in the outer dry corky bark of *Quercus alba*, *Liriodendron*, *Acer*, *Castanea*, *Juglans*, and *Nyssa*. It often works in numbers on certain limited areas of bark, causing the scales to flake off after a time and the bark to appear smooth. The pupal cell is merely a shallow excavation, in which the larva overwinters, transforming in early May and June. It is often associated with *Microclytus*, which has a similar habit. The adult is found throughout the eastern United States, commonly on early shrubby flowers. Both of these insects have a common predatory enemy, a small elaterid larva which has not been definitely determined. Observations by A. B. Champlain and the author.

### BELLAMIRA SCALARIS LeConte

[Pls. I, XVII, XXII, XXXI]

*Form* elongate, slender, tapering, cylindrical; integument smooth, shining, sparsely covered with short fine hairs.

*Head* sub-orbicular, widest behind middle, slightly chitinized; mouth-frame strongly corneous, dark; hypostoma thin, straight; clypeus and labrum thin; latter narrowly oval, twice as wide as long, anterior margin flatly rounded, ciliated with castaneous hairs; mandible slender, triangular from side, apex very acute, dorsal tooth strong, acute, outer face with a band of fine striae across middle; antennae small, retracile; one rather prominent ocellus. Palpi slender, last maxillary joint conical, last labial cylindrical, both shorter than respective penultimate joints; lacinia short, conical; subfossal-spine distinct; gula not distinct.

*Prothorax* widest in front; protergum with a transverse, anterior, lemon-yellow band, widened on lateral area; pronotum beset with few short hairs, posteriorly rugulose; sternum more hairy than usual; eusternum triangular and with two triangular blotches of velvety pubescence on posterior angles. Mesonotum and metanotum velvety pubescent; sterna with an anterior band of velvety pubescence, tuberculate. Legs rather stout, tarsus appendiculate, arcuate.

*Abdomen*: Seven dorsal ampullae bearing four irregular rows of small, projecting, separated tubercles; the ventral ampullae two rows; pleural tubercle sub-orbicular, bearing two long setae on posterior margin. Spiracles narrowly oval, not strongly rimmed.

*Pupa*: Very slender, tapering; pronotum with two groups of short subulate setae on posterior margin, two orbicular ones on metatergum, and two transverse groups on each abdominal tergum, the last bearing two conical fleshy spines and a border of more slender spines along hind margin.

The larvae feed indiscriminately in almost all coniferous or hardwood trees provided the proper conditions of moisture and decay are present. They require well rotted logs in very moist situations. The mines are large and irregular, extend through the sapwood and heartwood, and are filled with loose, fibrous frass. This species has been collected from *Fagus*, *Acer*, *Populus*, *Pinus* and *Tsuga* throughout the eastern United States.

### BELLAMIRA LeConte, TYPOCERUS LeConte, STRANGALIA Serville, and LEPTURA Serville

The genera *Bellamira*, *Typocerus*, *Strangalia*, and *Leptura*, as the adults are grouped by American writers, cannot be recognized as larvae. *Bellamira* has been separated in the key, but in this case only one species is treated. Evidently several good genera are represented by the larvae here described. Scarcely any difference can be found between several species of *Typocerus* and *Strangalia*, while in the genus *Leptura* there are some very characteristic groups, as *subhamata*-like forms having three ocelli and a striated molar plate on the

mandible. Aurivillius (1) separated the North American species of these genera into *Leptura*, *Judalia*, and *Oedecnema* in certain respects this grouping can be substantiated by larval characters, but as the larvae of so few species have been studied, no definite arrangement is indicated at present. The described larvae may be briefly characterized as follows:

*Head* sub-orbicular, widest about middle, usually brownish chitinated; labrum transverse; mandible relatively short, triangular from side, dorsal angle of cutting edge either toothed or flattened into a striate plate, cutting edge very obliquely truncate; ocelli indistinct, or one, two, or three present; edge of hypostoma broadly curved; gula never (exception, *L. subhamata*), distinct. Prothorax transverse. Legs rather slender, tarsus usually slender, attenuate. Prosternum, mesonotum, metanotum, and sterna dull, pubescent, glabrous, or tuberculate, affording good characters. Abdomen slender, tapering.

All species so far as known, with one exception (*L. nitens*), live in dead decaying wood, in very moist situations. The larval period usually extends over more than one year. The species are gregarious, working together for many years in the same log until it is completely converted into sawdust. They are often associated with the Prioninae. The mines meander and intersect and are tightly packed with fibrous frass. The adults are pollen feeders, being the most abundant cerambycids in early summer months, when they can be collected in great numbers on the flowers of various plants.

KEY TO THE DESCRIBED SPECIES OF *TYPOCERUS*, *STRANGALIA*,  
AND *LEPTURA*<sup>1</sup>

Dorsal angle of mandible flattened into a striate plate.....	1
Dorsal angle of mandible merely rounded or bearing an abrupt tooth.....	5
1. One ocellus; mesonotum and metanotum velvety pubescent, except for several tubercles on each.....	<i>Leptura biforis</i>
Three ocelli; mesonotum and metanotum not velvety pubescent, distinctly tuberculate....	2
2. Abdominal spiracles very narrowly oval.....	3
Abdominal spiracles broadly oval.....	4
3. Hairs on body coarse, castaneous.....	<i>L. subhamata</i>
Hairs on body whitish, silky.....	<i>L. plagifera</i>
4. Species not separable.....	<i>L. sanguinea</i>
“    “.....	<i>L. oblitterata</i>
“    “.....	<i>L. propinqua</i>
5. Ampullae tuberculate, the tubercles shining.....	6
Ampullae not tuberculate, or if so, asperate pubescent.....	23
6. Both mesonotum and metanotum bearing tubercles, shining, never entirely pubescent....	7
Mesonotum and metanotum covered with fine velvety pubescence, dull (rarely several tubercles on metanotum).....	9
7. Eusternum of prothorax entirely shining.....	8
Eusternum of prothorax velvety pubescent or at least on posterior extremities.....	<i>Strangalia bicolor</i> , <i>S. famelica</i>
8. Tubercles of ampullae smaller, merely contiguous.....	<i>Leptura proxima</i>
Tubercles of ampullae larger (fewer), somewhat confluent.....	<i>L. chrysocoma</i>
9. Metanotum bearing a small group of three to six shining tubercles; tubercles of ampullae separated.....	10
Metanotum bearing no tubercles.....	12
10. Eusternum of prothorax shining.....	<i>L. nigrella</i>
Eusternum of prothorax covered (or partially so) with fine velvety or asperate pubescence, dull.....	11
11. Labrum widest near base.....	<i>Typocerus velutinus</i>
Labrum widest at middle.....	<i>Strangalia luteicornis</i>
12. Eusternum of prothorax shining.....	13
Eusternum of prothorax dull, covered or partially so with fine velvety pubescence....	18
13. Three ocelli on each side of head.....	<i>Leptura exigua</i>
One ocellus on each side of head.....	14
14. Ampullae present on six abdominal segments.....	<i>L. americana</i>
Ampullae on seven segments.....	15
15. Ampullae completely surrounded by a band of velvety pubescence; tubercles very small, separated.....	<i>L. emarginata</i>
Ampullae not velvety pubescent.....	16

<sup>1</sup> As this key covers only a small percentage of the species, the descriptions must be referred to for further verification. The larvae, so far as studied, are very constant in the characters described and should the specimens to be determined not agree in all points they will probably prove to be another species.

16. Tarsal claw arcuate, short; prosternellar area shining ..... *L. vagans*  
 Tarsal claw attenuate; prosternellar area dull pubescent..... 17
17. Proeusternum regularly beset with stiff hairs..... *L. canadensis*  
 Proeusternum bearing hairs only on lateral margin, none in central area, hairs not more  
 than 8 to 10..... *L. rubrica* 19
18. One ocellus on each side of head..... *L. mutabilis*  
 Three ocelli on each side of head; species not separable..... *L. aspera*  
 " " " "..... *L. lineola* 20
19. Six abdominal segments bearing ampullae..... *L. lineola* 20  
 Seven abdominal segments bearing ampullae..... 21
20. Median band between dorsal ampullae asperate..... 22  
 Median band of dorsal ampullae glabrous..... 21
21. Ventral surface of head finely granulate; proeusternum dull,  
 velvety pubescent..... *Strangalia acuminata*  
 Ventral surface of head shining, smooth; proeusternum shining..... *Leptura crossipes*
22. Proeusternum finely asperate only on posterior lateral extremities..... *L. valida*  
 Proeusternum finely asperate over nearly entire surface..... *L. vittata*  
 23. Labrum more than twice as wide as long; form cylindrical..... *L. sphaericollis*  
 Labrum not more than one and one-half times as wide as long, form depressed... *L. nitens*

### TYPOCERUS VELUTINUS Oliver

[Pls. XIV, XXII]

*Form* elongate, subcylindric, tapering; integument smooth, shining, very sparsely clothed with whitish yellow hairs.

*Head* sub-orbicular, slightly wider than long, somewhat chitinized; mouth-frame strongly corneous; epistoma slightly and roundly protuberant, three or four serae on each side; clypeus and labrum thin, latter semicircular, one and one-half times wider than long, widest behind, bearing scattered hairs; mandible slender from side, apex acute, dorsal angle prominent; antennae small, very retractile, ring oval; ocellus indistinct; anterior edge of hypostoma distinct; hypostoma broadly curved; gula not distinct, palpi slender, last joint of maxillary obtusely conical, shorter than last labial or second maxillary; lacinia cylindrical.

*Prothorax* one-half wider than long, pronotum bearing a distinct transverse brownish band, widened at sides, posterior area slightly rugulose, shining. Eusternum velvety pubescent, dull, except for a triangular anterior spot; mesonotum dull, velvety pubescent, as well as metanotum, except for a central group of shining tubercles; mesosternum and metasternum tuberculate. Legs not so slender, no joint twice as long as thick; tarsus attenuate, chitinous.

*Abdomen*; Ampullae seven, the anterior and posterior margins finely pubescent, bearing small, bead-like, abruptly projecting, separated tubercles; pleural tubercles oval; bearing several slender setae. Spiracles very small, oval to sub-orbicular, peritreme thin.

[Described from specimens Hopk. U. S. 9747.]

One of the commonest lepturiform larvae, found in all sorts of decaying hardwoods and conifers, occasionally in rather solid wood. The adults are commonly found on flowers in May and June throughout the eastern United States and Canada.

### TYPOCERUS LUNATUS Fabricius

[Pl. XIV]

Distinguished from *T. velutinus* by the thinner epistoma, the indistinctly rimmed antennal ring, the more prominent ocellus, smooth and shining eusternum, and the group of tubercles on metanotum usually absent or rarely two. The legs are more slender, the tarsus slightly dilated at base. It is also more hairy than *T. velutinus*.

[Described from specimens Hopk. U. S. 12286.]

This larva was found in dead rotting stumps of *Pinus* by H. B. Kirk and the author. The adult is commonly collected on flowers in late May and June, from Pennsylvania through the south-central States. Observations by W. F. Fiske, H. B. Kirk, and the author.

### TYPOCERUS ZEBRATUS Fabricius

Several specimens of the adults of this species were collected at Falls Church, Va., in a dead stump of *Pinus* by J. N. Knull and the author. The larvae mined in the roots, coming to the top of the stump to pupate. Only larval skins were secured.

The mandible is black, shining, very acute, having a strongly curved cutting edge at the upper extremity of which the dorsal angle is produced into a rectangular abrupt tooth; the labrum is roundly rectangular and the pleurostoma bears a small projecting ocellus.

[Described from specimens Hopk. U. S. 11872*d*.]

### STRANGALIA BICOLOR Swederus

[Pl. XIV]

Form very slender, clothed with whitish hairs; integument very finely granulate; labrum subtrapezoidal, widest behind middle, front edge straight for short distance; epistoma very thin; ocellus small; last joint of maxillary palpi slightly longer than second; metanotum bearing no tubercles. Proeusternum velvety pubescent only on posterior lateral angles. Tarsus very slender, attenuate.

This species has been reared from dead *Acer* and *Quercus*. The adults occur throughout the eastern United States and Canada in June and July.

### STRAGALIA FAMELICA Newman

Differs from *S. bicolor* in that the entire posterior border of the proeusternum is dull velvety pubescent; no trace of tubercles on the metanotum.

[Described from specimens Hopk. U. S. 10914*a*.]

This species has been reared from decaying *Quercus*. The adults are found on flowers in the eastern United States and Canada through June and July.

### STRANGALIA LUTEICORNIS Fabricius

[Pl. XIV, XXX]

Essentially like *Typocerus velutinus*, form more slender; head slightly more elongate; mandibles shorter, little longer than basal width; ocellus prominent; labrum rectangular, sides rounded, front edge straight and (not roundly curved as in *T. velutinus*) widest at middle. Spiracles more strongly chitinized.

[Described from specimens Hopk. U. S. 12280*q* and 11812*a*.]

This larva has been reared from dead, moist, decaying wood of *Vitis*, *Fagus* and *Ulmus*, always in contact with the ground. The adult flies in May and June throughout the eastern United States and Canada.

### STRANGALIA ACUMINATA Oliver

Head bearing many rather stiff hairs, ventral surface and anterior portion of front finely granulate; dorsal angle of mandible prominent; labrum subtriangular, widest at base; one ocellus. Mesonotum and metanotum dull, finely asperate; posterior half of proeusternum and anterior half of sternellum finely asperate; mesosternum and metasternum tuberculate; tarsus attenuate; seven dorsal ampullae bearing four rows of small, nearly contiguous tubercles, no fine asperities between; spiracles broadly oval to orbicular, peritreme strongly chitinized.

*Pupa*. Short, stiff, chitinous setae at base of clypeus and antennae, and above eyes, and on posterior border and angles of pronotum which also bears a few fine hairs on disc; mesonotum and metanotum each bearing several short, stiff setae, and a broken transverse row on each abdominal tergum; ventral anal lobes each bearing a conical, suddenly acute process.

[Described from specimens Hopk. U. S. 10083*l*.]

Collected and reared by A. B. Champlain at Lynne, Conn., in dead *Viburnum* stems.

### LEPTURA BIFORIS Newman

Head very hairy on anterior portion, sides in front of middle rather suddenly tapering; epistoma thin; labrum thin, transverse, anterior margin rounded from middle and sparsely hairy; mandible very black, smooth, shining, dorsal angle flattened into a striate plate, apex very acute; one ocellus; last joint of maxillary palpi cylindrical, shorter than second; gula sutures slightly evident. Proeusternum and sternellum shining; mesonotum and metanotum dull, velvety pubescent except for a group of from three to five shining tubercles on each; femur and tibia subequal, tarsus very slender, attenuate. Ampullae seven, tubercles, large, contiguous, four rows on seventh. Spiracles small, oval, peritreme distinct. Abdomen unusually hairy.

*Pupa*. Form like that of adult; front of head bearing several attenuate coarse setae; two groups of three to five on anterior margin of prothorax and a straight transverse band on posterior margin; several on mesonotum and two groups on metanotum; six to eight shorter setae on each abdominal tergum, becoming more numerous on seventh and eighth and forming a dense fringe on last.

[Described from specimens Hopk. U. S. 11864.]

These specimens were collected by the author from a dead hollow chestnut (*Castanea*) log at Inglenook, Pa., June 24, 1915. Larvae, pupae, and adults were abundant. The larvae were mining the spring wood of a hollow tree. Pupation occurs in a large oval cell. The pupae were congregated about knot-holes through which the adults emerged. A dipterous parasite was taken on about 50 per cent of these pupae, but has not been reared. Associated with this species was the larva of *Centrodera decolorata*.

#### LEPTURA PROXIMA Kirby

[Pls. IV, XXII]

*Head* very hairy, especially front; epistoma abruptly raised; labrum transverse, broadly rounded in front; dorsal angle of mandible acute; one ocellus; last joint of maxillary palpi shorter than second. Proecosternum and sternellum shining; mesonotum and metanotum and sterna tuberculate, shining; femur and tibia subequal, tarsus attenuate; ampullae seven, tubercles large, prominent, contiguous, ventral rows of about nine each, four rows on seventh terga; spiracles oval, dark castaneous.

*Pupa*. Form like that of adult, bearing two rows of three to five setae on anterior prothorax and setiferous papillae on lateral angles of prothorax and metathorax; also two rows on each abdominal tergum and a fringe on last abdominal segment; apical outer face of each femur tipped with a group of setae.

[Described from specimens Hopk. U. S. 11811.]

This species has been reared from *Acer*, *Hicoria*, *Castanea* and *Tilia*. The writer has found it in old standing stubs, which have been completely converted into powder except for an outer shell. Often found in dryer situations than most other species. Pupa collected May 24, 1912, at Charter Oak, Pa.

#### LEPTURA CHRYSOCOMA Kirby

[Pl. XIV]

Only separable from *L. proxima* by the larger, more or less confluent tubercles of the ampullae, the ventral rows number seven or eight. Head less hairy.

*Pupa*. Form as in adult; bearing two transverse bands of short, stiff setae or spines on posterior margin of pronotum, a few on mesonotum, and more numerous ones on metanotum; each abdominal tergum bears a transverse group on each side of the median line and a fringe on the last tergum.

[Described from specimens Hopk. U. S. 12651a and 11921b.]

This larva is described from specimens collected and reared from *Pinus flexilis* and *P. ponderosa* by A. B. Champlain. The adult flies through June and July in the Rocky Mountain and Pacific Coast regions.

#### LEPTURA SUBHAMATA Randall

[Pl. XIV]

*Head* very thickly beset with long hairs; sides rather suddenly tapering in front; labrum cordate, about as wide as long; mandibles slenderly acute, dorsal angle flattened into a striated plate; three distinct ocelli; last joint of maxillary palpi slightly tapering, shorter than second; gular sutures faintly distinct. Proecosternum and sternellum shining, mesonotum and metanotum and mesosternum and metasternum tuberculate, shining. Legs slender; femur and tibia subequal; tarsus slender attenuate. Abdomen very hairy, the hairs castaneous. Ampullae seven, last very small; tubercles prominent, large, contiguous. Spiracles narrowly oval, chitinous rimmed.

*Pupa*. Form as in adult; a group of setae at base of clypeus, at base of each antenna and two on front of head; posterior margin of prothorax with two transverse bands of stiff setae; two oval groups similarly placed, on metanotum and on median area of abdominal terga, the last margined with fleshy conical papillae.

[Described from specimens Hopk. U. S. 11818b.]

A northern species, usually in higher elevations, breeding in dead logs of *Pinus*. Larva and pupa collected at Notch, Pa., in June. The adults have been taken through the northeastern and central United States and Canada. Observations by Dr. A. D. Hopkins, W. F. Fiske, and the author.

## LEPTURA PLAGIFERA LeConte

Distinguished from *L. subhamata* by the very fine silky white hairs on body and head.

*Pupa.* Readily distinct from *L. subhamata* by the absence of the groups of setae on metatergum.

[Described from specimens Hopk. U.S. 4793c, 4711a.]

This larva has been reared only from western yellow pine (*Pinus ponderosa*) Adults collected in July in Oregon and Washington by H. E. Burke and W. D. Edmonston.

## LEPTURA OBLITERATA Haldeman

[Pls. IV, XVII, XXVII]

Slightly less hairy than *L. subhamata*; sides of the head more rounded and gula not distinct. Spiracles broadly oval to sub-orbicular. Tubercles of ampullae smaller and less distinct.

*Pupa.* Groups of setae arranged as in *L. subhamata*, but an additional group of anterior margin of prothorax and one of shorter hairs on disc of prothorax, and on tips of femura.

[Described from specimens Hopk. U.S. 4002d and 9161y.]

This larva breeds in a variety of dead conifers and is often associated with the larvae of *Asemum* and *Criocephalus*. It has been collected from *Abies*, *Pseudotsuga*, *Picea*, *Tsuga*, and species of *Pinus* throughout British Columbia, Washington, Oregon, California, and Montana. It pupates in May and June. Observations by Dr. A. D. Hopkins, H. E. Burke, and E. A. Schwarz.

## LEPTURA SANGUINEA LeConte

This species is always associated with *L. obliterata*, but cannot be separated from it by larval characters. The habits are the same.

## LEPTURA PROPINQUA Blandford

Two specimens of this larva have been studied. The only difference from *obliterata* is a slightly more hairy head and finer whitish body hairs. These characters are not sufficient to determine it definitely.

The larvæ were collected and reared from Engelmann spruce (*Picea engelmanni*) in Colorado by A. B. Champlain. It was associated with larvæ of *Calopus*.

## LEPTURA SOROR LeConte

Larvae of this species cannot be definitely separated from the *obliterata*-like forms. The specimens Hopk. U. S. 14466c were collected by F. B. Herbert in dead lodgepole pine (*Pinus murrayana*) at Meyers, Cal.

## LEPTURA NIGRELLA Say

(Pl. XVII)

*Head* rather thick, robust, clothed with short fine hairs; epistoma roundly declivous; labrum transverse, broadly-rounded from posterior margin; dorsal angle of mandible prominent, broad; one prominent ocellus; last joint of maxillary palpi conical, equal to second. Procuterium glabrous, shining; prosternellum and mesonotum and metanotum dull velvety asperate, except for several tubercles<sup>1</sup> on median area of metanotum; legs robust, femur and tibia subequal; tarsus short, conically acute. Ampullae seven, tubercles very conspicuously protuberant, separated, bead-like. Spiracles broadly oval, peritreme thin.

[Described from specimens Hopk. U.S. 2304c.]

The larvae have been collected and reared in species of *Pinus*, *Picea*, and *Pseudotsuga* from Colorado and Oregon. H. E. Burke collected adults in their pupal cells August 20, 1907, at Joseph, Oregon. Range, throughout the western United States and Canada.

<sup>1</sup> On several immature specimens these tubercles are indistinct.

## LEPTURA EXIGUA Newman

*L. im* more depressed than usual; resembling a small *Gauroles*. Head depressed, widest at middle, bearing a few long hairs on gena and along frontal sutures; labrum thin, semicircular, longest at middle, widest at base, twice as wide as long; mandible rather short, dull black, apex blunt, dorsal angle not toothed; three small black ocelli; anterior edge of hypostoma not distinct from submentum; maxillary palpi long, basal joints subequal, third longest, cylindrical. Proeusternum shining, bearing a few stiff hairs anteriorly; mesonotum and metanotum dull, finely velvety pubescent; mesosternum and metasternum tuberculate, shining. Legs very long, tarsus attenuate. Ampullae seven, covered with tuberculiform wrinkles (resembles *Gauroles*); pleural tubercle bearing two long setae. Spiracles small, sub-orbicular, peritreme thin.

*Pupa*. Form as in adult; bearing scattered stiff hairs on front of head, about disc of pronotum, and on distal portions of femora; mesonotum and metanotum glabrous; abdominal terga bearing short, stiff, spine-like hairs more or less arranged in two transverse rows, longer ones on epipleurum; last segment bearing two slender, straight, acute spines, their under sides parallel.

[Described from specimens Hopk. U.S. 10075*k*.]

These specimens have been collected and reared by A. B. Champlain and Geo. Hofer from Colorado Springs, Col. The larvae mine between the bark and wood of recently dead *Populus*. A round flat pupal cell is constructed resembling that of *Rhagium*. The adults emerged the latter part of May and in June.

## LEPTURA AMERICANA Haldeman

[Pl. XIV]

*Head* quite wide at middle (almost equal to prothorax); labrum roundly rectangular, almost straight across anterior margin; mandible abruptly enlarged at base, slender, cutting edge obliquely truncate, dorsal angle abrupt, bidentate; one prominent ocellus; last joint of maxillary palpi slender, equal in length to second. Proeusternum shining; mesonotum and metanotum velvety asperate, dull; mesosternum and metasternum tuberculate, these larger than abdominal ones; abdomen tetragonal, parascutal and coxal areas large. Ampullae six, projecting, tubercles very small, bead-like, separated. Spiracles oval, not larger than ocellus, peritreme thin. Body hairs long, slender, yellowish white.

[Described from specimens Hopk. U.S. 11845*o*.]

Specimens of larvae and adults collected in dead decaying tulip (*Liriodendron*) stump at Falls Church, by H. B. Kirk.

## LEPTURA EMARGINATA Fabricius

[Pl. XVII]

*Head* quite hairy on anterior portion; epistoma abruptly raised, straight, perpendicular; labrum thick, transverse, broadly rounded from near base, perimeter densely hairy; dorsal angle of mandible abrupt, prominent; one ocellus; last joint of maxillary palpi acutely conical, equal to last labial, shorter than the others; hypostoma somewhat transversely bulging; gular sutures slightly protuberant, roughened. Proeusternum shining, sternellum dull velvety pubescent on anterior two-thirds; mesonotum and metanotum entirely dull velvety pubescent; femur and tibia subequal, tarsus straight, acute. Ampullae seven, surrounded by a narrow band of velvety pubescence, tubercles very small, separated, the two median rows (of dorsal ampullae) separated by a transverse band of velvety pubescence. Spiracles rather small, narrowly oval, peritreme thin.

*Pupa*. Form like that of adult, bearing groups of short attenuate spines on anterior median margin and posterior lateral portions of prothorax; two median oval groups on metanotum; a transverse band of more conical spines on each abdominal tergum becoming more irregularly dispersed posteriorly, also several along region of parascutum and epipleurum.

[Described from specimens Hopk. U.S. 11863*b*.]

This species can be easily recognized by the large size of the matured larvae and the structure of the ampullae, surrounded by velvety pubescence, with also a transverse median band.

These specimens were collected June 11, 1915, from a large fallen beech (*Fagus*) at Kanawha Station, W. Va. Twenty-five years ago Dr. A. D. Hopkins collected a single adult on the then standing tree, it having emerged from the hollow base. Four years ago it was blown over, and examination on above date by Dr. Hopkins and the writer showed it to be entirely honeycombed by the larval mines, and the outer shell full of larvae, pupae, and adults. The



mines are very extensive, packed with coarse fibrous frass, and lined by a dark fungous growth. The pupal cells were constructed in the outer shell. This beetle has been breeding in the same hollow butt for the past twenty-five years. The different stages of larvae found indicate the life cycle to be three years. The writer has collected larvae of this species from a dead stub of *Quercus* at Mt. Vernon, Va., and Mr. A. B. Champlain has taken it from *Betula* at Lyme, Conn.

#### LEPTURA RUBRICA Say.

[Pls. XVII, XXII]

Anterior half of front and gena hairy; epistoma obliquely declivous; labrum transverse, sub-elliptical, anterior edge very broadly rounded from posterior lateral angles; dorsal angle of mandible abrupt; one ocellus; last joint of maxillary palpi acutely conical, shorter than second. Proecosternum shining, sternellum, mesonotum, and metanotum velvety pubescent, dull; mesosternum and metasternum tuberculate, shining; femur and tibia subequal, tarsus attenuate. Ampullar tubercles beadlike, prominent, separated, four rows usually distinct on seventh tergum. Spiracles oval, petritreme strongly chitinized.

[Described from specimens Hopk. U.S. 9782*k* and 10377.]

One of the commonest eastern species of *Leptura*. The larva feeds in a great variety of dead hardwoods and conifers. Both well-decayed and solid wood are suitable to its activity. This is a good illustration of the indiscriminate feeding of our most commonly collected cerambycids. *Typocerus velutinus*, *Xylotrechus colonus*, and *Neoclytus erythrocephalus* are similar examples.

#### LEPTURA CANADENSIS Fabricius

[Pls. XXII, XXVIII]

Head thickened, beset with many slender hairs; epistoma abruptly declivous; labrum transversely oval, broadly rounded from behind middle; dorsal angle of mandible abrupt and strong; one prominent ocellus. Proecosternum shining, beset with a number of regularly disposed hairs, otherwise as in *L. rubrica*, but slightly more hairy and tubercles of ampullae slightly larger and more closely placed.

[Described from specimens Hopk. U.S. 9071*d*.]

The larvae feed in dead, rather solid wood of various species of *Pinus* and *Tsuga*. It commonly attacks the heartwood of living trees, gaining entrance through a wound such as a blaze. Range, throughout the United States and Canada. The adult flies from June to August.

#### LEPTURA VAGANS Oliver

Distinguished from *L. rubrica* by the more prominent ocellus; tarsus shorter than tibia, flattened and arcuate; prosternellar area not distinctly velvety pubescent; tubercles of ampullae fewer, about six in dorsal rows, seventh ampullae bearing only two rows; spiracles sub-orbicular, petritreme dirty-greenish coloured.

[Described from specimens Hopk. U.S. 12608*a*.]

The larvae feed in decaying pine logs throughout the eastern United States and Canada. The larvae were collected and reared by H. E. Kirk. It is often associated with *L. rubrica*. The adults have been taken in June and July.

#### LEPTURA LINEOLA Say.

Head rather thick, hairs short; epistoma thin, labrum but little wider than long, sides broadly rounded; mandible short, dorsal angles abruptly toothed; one small prominent ocellus; last joint of maxillary palpi acutely conical, equal to second. Proecosternum and mesonotum and metanotum velvety asperate; mesosternum and metasternum tuberculate, velvety asperate on anterior border; legs slender; tibia slightly longer than femur, tarsus attenuate. Ampullar tubercles small prominent, present on but six segments. Spiracles orbicular, very small, petritreme lightly chitinized.

[Described from specimens Hopk. U.S. 9789*n*.]

Collected and reared from sapwood of a dead birch (*Betula*) stump, at Cedar Mountain, N.C.

## LEPTURA VITTATA Germar.

[Pl. XVII]

*Head* hairy on anterior portion of front and gena; epistoma roundly declivous; labrum subrectangular, front edge nearly straight, about twice as wide as long; dorsal angle of mandible abrupt; ocellus oval, indistinct; last joint of maxillary palpi cylindrical, obtuse, equal in length to second. Anterior two-thirds of proeusternum and sternellum, and the mesonotum and metanotum dull, velvety asperate, as are also the anterior and posterior borders and the dorsal median band of the ampullae; mesosternum and metasternum tuberculate, anterior and posterior edges velvety asperate; tibia slightly longer than femur, tarsus attenuate. Tubercles of ampullae small, irregularly disposed, separated, only two rows on seventh ampullae. Spiracles orbicular, not chitinous rimmed.

[Described from specimens Hopk. U.S. 11847c and 11800.]

The larvae feed in dead decaying *Abies*, *Pinus*, *Juniperus*, and *Castanea*. It pupates in May and June. Range, throughout eastern United States and Canada.

## LEPTURA VALIDA LeConte

*Head*, sides regularly rounded, bearing a few long setae; labrum transversely oval, about twice as wide as long; mandible rather smooth on outer face, bearing a faint transverse band of striae, dorsal angle very abruptly and strongly toothed; one elongate oval ocellus; last joint of maxillary palpi conical, slightly shorter than second; a single gular suture. Proeusternum velvety pubescent on posterior lateral angles; sternellum velvety pubescent; mesonotum and metanotum velvety pubescent; legs slender, femur and tibia subequal, tarsus slender. Ampullae surrounded by velvety pubescence and having several narrow transverse bands, tubercles very small, abrupt, separated; spiracles oval, scarcely larger than ocellus.

*Pupa*. Head bearing a few setae; two prominent tuberculiform groups of setiferous points on anterior margin of pronotum and two transverse bands on posterior margin; a median spinose tubercle on mesonotum and two on posterior margin of metanotum; a transverse band (divided in middle) of short, acuminate points on posterior margin of each abdominal segment; two recurved hooks on dorsal anal lobe.

[Described from specimens Hopk. U.S. 13548a<sup>1</sup>.]

Mr. H. B. Herbert collected these specimens with many adults in very decayed wood of *Tsuga* and *Abies* in California.

## LEPTURA CRASSIPES LeConte

*Head* beset with fine slender hairs; epistoma thin; labrum transversely oval, anterior edge broadly rounded from posterior angle, constricted at base; mandible very shining; dorsal angle very abrupt and sharp; one transverse ocellus; last joint of maxillary palpi shortly conical, equal to second. Proeusternum shining, sternellum on anterior half and mesonotum and metanotum velvety asperate; mesosternum and metasternum tuberculate, asperate on anterior border; legs rather robust, joints short, especially the tarsal. Anterior and posterior margins of the ampullae asperate pubescent, tubercles rather irregular, contiguous, not so prominent. Spiracles oval, not strongly rimmed.

[Described from specimens Hopk. U.S. 9567.]

The described specimens and adults were collected by the author in a very decomposed log of *Pinus*, at Baker, Oregon, in July, 1911.

## LEPTURA MUTABILIS Newman

*Head*, anterior perimeter dull, very finely punctured; hairs very short; labrum subrectangular, one and one-half times wider than long, anterior edge rounded from middle, flattened in front; mandible short, little longer than width of condyles, dorsal angle shortly toothed; last joint of maxillary palpi conical, acute, much longer than transverse second; three ocelli. Spiracles sub-orbicular, strongly chitinized. Abdomen and thorax as in *L. vittata*.

[Described from specimens Hopk. U.S. 11861h.]

The larvae breed in a variety of dead hardwoods.

They have been collected from *Quercus*, *Betula*, *Acer*, and *Castanea*. They pupate in March and early April. Range, throughout the eastern United States and Canada. Observations by W. F. Fiske, H. B. Kirk, and the author.

## LEPTURA ASPERA LeConte

Scarcely distinguishable from *L. mutabilis*. In the two specimens examined the dorsal angle of the mandible is abrupt and the fine dull punctures on the anterior perimeter of the head do not extend back so far as on *mutabilis*.

[Described from specimens Hopk. U. S. 9192*m* and 11848*d*.]

These larvae were collected and reared from dead *Betula* at Colorado Springs, Colo., by B. T. Harvey.

## LEPTURA SPHAERICOLLIS Say.

[Pl. III, fig. 9; Pl. XVII, fig. 9]

*Head* widest behind middle, epistoma thin; labrum narrowly rectangular, more than twice as wide as long; mandible short, cutting edge deeply emarginate, dorsal angle rounded; one small distinct ocellus; maxillary palpi slender, last joint slender, cylindrical, equal or slightly longer than second. Proecosternum, sternellum, posterior areas of pronotum and mesonotum, metanotum, mesosternum and metasternum exceedingly finely asperate although feebly shining; legs very slender, tarsus attenuate. Ampullae feebly shining, impressed by two transverse folds marking off a narrowly transverse area, and an anterior transverse fold marking off an anterior fusiform area. Spiracles very minute, orbicular, not strongly rimmed; body hairs very fine, slender, yellowish white.

[Described from specimens Hopk. U. S. 9790*o* and 11847*w*.]

This larva has been collected in the decaying sapwood of *Castanea*, *Prunus*, *Betula* in North Carolina by W. F. Fiske, H. G. Champion, and the author. It pupates during April and May.

## LEPTURA NITENS Forster

[Pl. XI, fig. 6; Pl. XVII, fig. 5; Pl. XXXI, fig. 7; Pl. XXXVII]

*Form* much depressed; head very depressed, clothed with a few short, stiff hairs; epistoma very thin, front bearing a transverse suture behind epistoma; labrum roundly trapezoidal, one and one-half times as wide as long; mandible very slender from outer face, dorsal angle scarcely visible; ocelli absent; maxillary palpi slender, last joint very slender, shorter than second; anterior edge of hypostoma broadly fused with ventral mouth-parts. Proecosternum and sternellum shining; mesosternum and metasternum and mesonotum and metanotum dull, velvety asperate; legs very slender, tarsus attenuate. Ampullae dull, finely asperate, marked by two transverse impressed folds, and an anterior one marking off a narrowly fusiform transverse area. Spiracles orbicular, distinctly rimmed. Body hairs coarse, castaneous.

*Pupa.* Form as in adult, covered with very stiff, dark castaneous, subulate setae above clypeus on front and epieranium, two transverse bands on anterior and posterior margin of prothorax, and scattered ones on disc, as also on disc of metanotum, on first six abdominal segments these are coarser than the others; seventh, eighth, and ninth abdominal terga irregularly beset with longer setae, tenth with a bifurcate spine.

The larval habits of this species form an exception in the genus. It is the only one, so far as known, which attacks living trees. The normal food plant is *Castanea*, but occasionally it is found in *Quercus*. The larva bores in the bast fibres of the bark, at the base of the tree or in crotches of limbs where plenty of moisture exists. The burrow is large and irregular, several larvae often extending it from different angles. It is packed with coarse, fibrous frass, which is expelled through a hole in the bark. The pupal cell is formed from an oval rim of this frass. The larval period usually extends over two seasons. The larva pupates in May and June.

This species is of much economic importance in relation to the chestnut bark disease. The larvae and adults have been collected throughout the eastern and central United States by Dr. A. D. Hopkins, W. F. Fiske, T. E. Snyder, E. B. Mason, W. S. Fisher, and the author.

## SUBFAMILY DISTENIINAE

Two species of *Distenia* have come to the author's attention. A close study of these larvae substantially corroborates the opinion of Gahan (11) that subfamily rank or better, even family rank, has to be given to these species.

In general form and structure they are strikingly aberrant from the usual cerambycid type. This divergence is due to the possession of a peculiar combination of lepturine and cerambycine characters, the latter, however, predominating. The position of the occipital foramen is postero-dorsad. All structures on the dorsal surface conform to the type of Lepturinae, and the ventral mouth structures to that of the Cerambycinae. The mandible is of the type characteristic of the Lamiinae. They suggest a very primitive type of cerambycid larva. The peculiar tentorial structures and the attachment of the skin of the prothorax directly to the submentum has been observed in no other cerambycids.

#### CHARACTERIZATION OF LARVAE OF THE SUBFAMILY DISTENIINAE

The characters of the Disteniinae may be briefly summarized as follows:

*Head* transverse, dorsal margins of the epicranial halves behind front entirely separated; occipital foramen postero-dorsad; tentorium very broad, gula and hypostoma not evident.

*Mandibles* rather elongate from side; apex slightly produced, cutting edge obliquely truncate, short.

*Epistoma* not produced over clypeus, three epistomal setae.

*Clypeus* trapezoidal, filling space between dorsal condyles of mandibles.

*Submentum* attached to the collar; maxillae movable, cardo visible; maxillary articulating lobe full; palpifer small, jointlike; lacinia borne on stipes.

*Antennae* frail, retractile.

*Prothorax* with presternum and epipleurum anteriorly fused. Epipleurum large, rectangular; eusternum not sharply defined; coxae small, widely separated, and situated at extremities of sternellum. Mesothoracic spiracles not protruding into prothorax. Legs moderate in size, weak.

*Epipleurum* protuberant only on last three abdominal segments; pleural disc never present. Spiracles in a well-defined, elliptical, protruding region.

#### DISTENIA UNDATA Oliver

[Pl. IV, fig. 5; Pl. XI, fig. 7; Pl. XXX, figs. 1 and 2]

*Form* very elongate, slender, anteriorly depressed, posteriorly cylindrical; prothorax relatively much wider than the other cerambycid larvae, suggesting a buprestid in general shape; integument thin, shining, very sparsely beset with short fine hairs.

*Head* depressed, widest about the middle, slightly tapering anteriorly and posteriorly, rather deeply embedded in the prothorax; mouth-frame darkly chitinized; epistoma nearly straight, rather abruptly raised; clypeus and labrum thin, latter semi-elliptical, widest at base, finely and densely haired; mandibles narrow from side, about twice as long as basal width, cutting edge short, truncate, dorsal angle slightly toothed; no ocelli; antennae conical, first and second joints short, transverse, subequal, terminal joint slender and longer; antennal ring closed behind. Ventral mouthparts rather fleshy, densely and finely haired; palpi conical, last joint longest; process of palpifer small, fleshy; lacinia short, fleshy; mentum longer than wide; labial palpi slender, terminal joint shortest; ligula large, fleshy; neither gula nor hypostomal sutures distinct.

*Prothorax* depressed, transversely oval; pronotum trapezoidal, widest at base, a narrow band of short hairs across anterior margin, posteriorly velvety pubescent; presternum bearing two small, fleshy lobes on anterior margin at base of submentum; eusternum widely trapezoidal, widest at base, posteriorly velvety pubescent; sternellum also velvety pubescent; mesonotum, metanotum, mesosternum, and metasternum transverse, velvety pubescent; scutal and hypopleural areas protuberant. Legs small, slender, three distinct joints; tarsus attenuate, claw-like.

*Abdominal segments* very elongate, slender, cylindrical, intersegmental skin very long; ampullae widely separated, flat, transverse, dull, velvety pubescent, present on only six segments; parascutal and coxal lobes protuberant laterally; ninth segment longer than any other, cylindrical; anus transverse, two lobes ventral, one dorsal; spiracles small, orbicular.

*Pupa.* Head, pronotum, mesonotum, and metanotum covered with numerous long, slender hairs; each abdominal tergum bearing two circular groups of acute points, becoming more slender on last segments, a long hair arises from the base of each point.

This larva feeds in the roots of recently killed hickory (*Hicoria*), especially those infested by hickory barkbeetles. It has also been found in *Cercis* and *Ulmus*. The mines are extended in a meandering manner beneath the bark and tightly packed with coarse granular frass. Pupation occurs in the sapwood, normally two years are required to complete development. The larva assumes

a folded position while burrowing similar to the buprestids. Adults have been observed at night ovipositing in the base of the trees.

Range, throughout eastern United States. Observations by A. B. Champlain, H. S. Barber, and the author.

#### DISTENIA RUGISCOPIIS Bates

This larva can only be distinguished from *D. undata* by the denser and coarser velvety pubescence on pronotum and ampullae.

These specimens were collected by August Busek, May, 1911, along the Trinidad river, Panama, "under the bark of fallen trees."

#### SUBFAMILY LAMIINAE

The Lamiinae larvae show a greater diversity of structural characters, form, and biological habits than any other subfamily. They are all characterized by the oblong head, the sides of which are parallel or converge posteriorly. This form of the head sets them in sharp contrast to all other cerambycids. With one exception (*Michthysoma*) they are all legless.

#### CHARACTERIZATION OF LARVÆ OF THE SUBFAMILY LAMIINAE

The characters of the Lamiinae may be briefly summarized as follows:

*Head* elongate, sides parallel or converging posteriorly; dorsal margins of epicranial halves behind front fused for the entire distance and jointly round behind; tentorial cross-arm internal in a plane at right angles to hypostoma (i.e., occipital foramen not apparently divided into an anterior and a posterior portion).

*Mandible* rather elongate, cutting edge shortly oblique, apex produced.

*Epeistoma* not produced over clypeus, three to many setae on each side; clypeus trapezoidal, filling space between dorsal condyles of mandible; labrum transverse to cordate.

*Maxillae* rigid (only movable from stipes); cardo, maxillary sclerite, and submentum fused and attached for the entire distance between ventral articulations of mandible; palpifer large, distinct, bearing lacinia.

*Antennae* frail, short, very retractile.

*Prothorax* having presternum and epipleurum usually distinctly separated; eusternum distinct or indistinct; coxae indistinct, usually legless.

*Postnotal fold* absent. Mesothoracic spiracle protruding into prothorax. Legs absent (rarely present).

*Abdomen* with region surrounding spiracle not protruding; epipleurum protruberant on from three to all segments; pleural tubercle usually bearing a chitinous pit at each extremity; hypopleurum small, coxal lobe large.

#### KEY TO THE GENERA OF LAMIINAE

- Legs well developed; two distinct ocelli on each side of head; ninth tergum bearing two chitinous spines..... *Michthysoma*. 1
- Legs absent; never more than one ocellus or one caudal spine..... 1
1. Antennal ring open behind (at least deeply angulate), bisected by frontal suture..... 2
2. Antennal ring closed behind, not bisected by frontal suture..... 15
2. Anterior margin of front normal..... 3
- Anterior margin of front bearing a transverse row of carinae..... 14
3. Head depressed, at least twice as wide as thick..... 4
- Head thicker, not twice as wide as thick..... 12
4. Ampullae irregularly tuberculate..... 5
- Ampullae bearing two regular rows of tubercles..... 11
5. Never both ampullae and pronotum velvety pubescent..... 6
- Both ampullae and pronotum velvety pubescent..... 9
6. Gular sutures protuberant: ninth abdominal tergum extended into an acute deflexed spine..... *Plectrura* 7
- Gular sutures not protuberant..... 7
7. Hypostoma transversely protuberant; front behind epistoma bearing striae extending from a row of punctures..... *Synaphoeta* 8
- Hypostoma and front normal..... 8
8. Pronotum rugose on posterior half; ampullar tubercles very large; form robust *Acanthoderes*
- Pronotum either plainly striate or velvety pubescent; tubercles of ampullae smaller; chitinous pore of pleural tubercle very small; form depressed... *Liopus* and *Leptostylus*
- Posterior area of pronotum varying from dull granulate to velvety pubescent usually only on hind margin; pores of pleural tubercle very distinct..... *Hyperplatys*

9. Head widest across anterior border; ampullae velvety pubescent, dull.....10  
 Head widest just before middle; ampullae shining..... *Nyssodrys*
10. Mandibles very slender; no caudal armature..... *Acanthocinurus*  
 Mandibles shorter; a flattened chitinous process on ninth abdominal tergum..... *Graphisurus*
11. Maxillary palpi two-jointed, or, if three-jointed, ninth tergum bearing a long spine..... *Lepturges*  
 Maxillary palpi three-jointed; no caudal spine..... *Eupogonius*
12. Maxillary palpi three-jointed; form elongate..... 13  
 Maxillary palpi two-jointed; form robust; ampullae bearing very large, irregular tubercles; body densely and coarsely hairy; breeds in the roots of *Asclepias*..... *Tetraopes*
13. Molar portion of mandible sharply toothed; pronotum normal..... *Dectes*  
 Molar portion of mandible normal; anterior margin of prothorax bearing a transverse row of carinae..... *Psenocerus*
14. Pleural tubercle having two distinct chitinous pits; pronotum rugulose; ampullar tubercles irregular..... *Hoplosia*  
 Pleural tubercle having no pits; pronotum smooth; ampullar tubercles in two or three regular rows..... *Oncideres*
15. Gula protuberant; posterior area of pronotum finely asperate..... 16  
 Gula not protuberant; pronotum variable..... 19
16. Tubercles of ampullae finely asperate; chitinous pits of pleural tubercle distinct..... 17  
 Tubercles of ampullae glabrous; chitinous pit of pleural tubercle absent; anus two-lobed, a group of chitinous setae beneath ventral lobe..... *Ptychodes*
17. Sides of head suddenly constricted behind middle..... *Monochamus*  
 Sides of head gradually narrowing to base..... 18
18. Body hairs long, not continuous across anterior margin of pronotum..... *Goes*  
 Body hairs short, rather dense, a continuous band across anterior margin of pronotum..... *Plectrodera*
19. Chitinous pore at extremities of pleural tubercle distinct; head depressed..... 20  
 Chitinous pore of tubercle absent; head variable..... 22
20. Last joint of maxillary palpi rarely more than one-half length of penultimate; form cylindrical, dorsally hairy; ampullae strongly protuberant, several with conical papillae; caecus feeders..... *Monilema*  
 Last joint of maxillary palpi as long as or longer than penultimate..... 21
21. Hypostoma transversely bulging; ampullae normal; often a chitinous spine on ninth terga..... *Dorcaschema*.  
 Hypostoma normal; ampullae deeply bilobed..... *Hetoemis*.
22. Head depressed; twice or more as wide as thick..... 23  
 Head oval in cross-section..... 25
23. Posterior area of pronotum glabrous or velvety pubescent..... 24  
 Posterior area of pronotum coarsely asperate, as also ampullae; epipleurum protuberant on all segments; spiracles oval..... *Saperda*
24. Posterior area of pronotum strongly protuberant, pinnately striate; tubercles of ampullae in two regular rows; maxillary palpi two-jointed..... *Cyrtinus*  
 Posterior area of pronotum normal; ampullae obscurely tuberculate, having a deep median furrow; ninth tergum bearing a chitinous process; maxillary palpi often two-jointed..... *Pogonocherus* and *Ecyrus*.  
 Posterior area of pronotum variable; ampullae bearing two regular rows of tubercles; no caudal armature; maxillary palpi two-jointed..... *Lepturges querci* (group)
25. Pronotum shining; ampullae bearing two transverse ridges or rows of tubercles; last abdominal segment swollen; spiracles orbicular..... 26  
 Pronotum asperate, bearing two heavy oblique lateral impressions; ampullae finely asperate or irregularly tuberculate; spiracles lenticular..... 29
26. Hypostoma protuberant in two conical processes; head less salient; all dorsal and ventral ampullae present, protruding..... 27  
 Hypostoma not protuberant; head more salient; ventral ampullae absent on all or many abdominal segments..... 28
27. Eusternum distinct, elliptical; mesosternum and metasternum not tuberculate; last four abdominal segments bearing only one row of tubercles (posterior row); caudal spine incurved ventrally..... *Adetus*  
 Eusternum not distinct; mesosternum and metasternum tuberculate; abdominal ampullae all bearing two rows of tubercles; caudal spine directed straight backward..... *Ataxia*
28. Pronotum entirely smooth, lateral sutures not impressed; mandibles bifurcate at apex; sternellum distinct; all ventral ampullae absent; no caudal spine..... *Hippopsis*  
 Pronotum posteriorly embossed, faintly striate, lateral sutures impressed; mandibles normal; eusternal and sternellar areas fused; latter posteriorly projecting; ventral ampullae present on sixth and seventh segments; ninth tergum bearing a projecting process..... *Spalacopsis*
29. Abdominal ampullae finely asperate..... *Oberea*  
 Abdominal ampullae irregularly tuberculiform..... *Mecas*

## MICHTHYSOMA LeConte

This larva, from the material at hand, strongly suggests the Aseminae, especially the genus *Opsimus*. In fact, the writer believes that it should be placed in this position. However, since the characterization is based only on the larval skins, it is retained where the adult systematists have placed it.

The head structure cannot be definitely determined, but the two-jointed maxillary palpi, the presence of well-developed legs, the bilobed prominent ampullae and the *Atimia*-like caudal spines all strongly suggest affinities to the Aseminae.

## MICHTHYSOMA HETERODOXUM LeConte

[Pl. V, fig. 2; Pl. II, fig. 12; Pl. XII, fig. 8; Pl. XXIV, fig. 10; Pl. XVII, fig. 15; Pl. VII, fig. 10]

*Form* semi-robust, slightly tapering posteriorly; integument thin, shining, very sparsely clothed with rather stiff yellowish-brown hairs.

*Head* depressed, about as wide as long, sides subparallel; mouth-frame corneous; epistoma straight, thin; clypeus trapezoidal; labrum about twice as wide as long, anterior margin broadly curved; mandible slender from side, smooth, apical angle rounded, cutting-edge oblique, dorsal angle rounded, deflexed or sometimes abruptly toothed; antennae very small, two-jointed, with a small supplementary joint; antennal ring not open behind; two prominent white ocelli placed below antennae. Ventral mouth-parts not strongly chitinized, fused for entire width of hypostoma; joints of maxillary palpi subequal, last shorter than last labial, ligula broad, distinct; gula not distinct, anterior margin confluent with submentum.

*Prothorax* transverse, widest in front; a yellowish band, divided in middle, extending across anterior dorsal margin; pronotum entirely smooth, shining, lateral sutures entire, bearing a few scattered hairs; eusternal area distinct, roundly trapezoidal, smooth, shining. Legs well-developed, two-jointed, second twice length of basal, tarsus attenuate, longer than second joint.

*Abdomen* bearing very prominent, shining ampullae, these deeply bilobed and transversely marked by two impressions, somewhat suggesting large tubercles. Ninth tergum armed with two conical, acute spines, separated somewhat more than their height.

[Described from specimens Hopk. U. S. 9784z.]

The larvae were collected in the dead sapwood of hickory stumps (*Hicoria*) at Cedar Mountain, N.C., and reared April 15, 1913, by the author.

## MONILEMA Say.

[Pl. XXIX, fig. 5]

Cylindrical, robust, coarsely haired species; head depressed, sides parallel, broadly rounded posteriorly; clypeus and labrum thick, latter about twice as wide as long; mandible scarcely tapering, about twice as wide as basal width, cutting edge short, roundly emarginate, outline similar to *Michthysoma*; antennal ring entire. Ventral mouth-parts fleshy; mentum distinct from submentum, narrowly transverse, not sunken; chitinization entire across base of labial stipes; last joint of maxillary palpi minute, scarcely one-half the length of second. Posterior area of pronotum narrowly transverse, four times as wide as deep, limited anteriorly by a short impression at each side, often bearing numerous short hairs; dorsal abdominal ampullae irregularly tuberculate or covered with conical papillae, strongly projecting and deeply bilobed, having a single transverse impression, epipleurum protuberant on all segments, tubercle broadly oval, bearing many setae but lacking the chitinous pore at each extremity; spiracles orbicular, peritreme distinct; no caudal armature.

[Described from six specimens in the U. S. National Museum labelled: Encinal, Texas, April 11, 1908, J. D. Mitchell, Colr.; Brownsville, Tex., June 8, 1908, C. R. Jones and F. C. Pratt; Texas, F. C. Pratt; Austin, Nev., April 23, 1908.]

A number of specimens of this genus representing several species have been studied, but none have been reared so as to establish their specific identity. One collected by Hubbard, No. 827, labelled *M. giganteum* (?), differs from the above in having chitinous asperities on the ampullae and pronotum. So far as known, all feed in the stems of cactus and to this peculiar environment the body has become well-adapted. The texture is coarse, covered with stiff hairs, and the ampullae are often covered with projecting papillae. The living larvae strongly suggest some Scarabidae, often assuming the curved form of body. They superficially more closely resemble the larva of *Tetraopes* than that of any other Lamiinae. This probably is a development due to similar methods of feeding.

## PLECTRURA Mannerheim

The form of the adult would suggest something more aberrant than the true Lamiine type of larvae. It is in no way suggestive of *Monilema*, but most closely resembles *Synaphoeta*. The peculiar extension of the last tergum into a pointed process is the most distinctive characteristic.

## PLECTRURA SPINICAUDA Mannerheim

[Pl. XXIV, fig. 2; Pl. XVII, fig. 16; Pl. VII, figs. 6 and 7]

*Form* depressed, elongate, sides parallel; integument firm, shining, sparsely clothed with long, fine, whitish pubescence.

*Head* depressed, sides suddenly constricted near base; epistoma straight; labrum roundly rectangular, about one and one-half times as wide as long; mandible about twice as long as basal width, dull granulate, cutting-edge obliquely truncate, apex truncate; antennal ring open behind; one pair of prominent ocelli. Ventral mouth-parts not chitinized; mentum twice as wide as long, distinct from submentum; maxillary palpi slender, ultimate joint sharply conical, longer than either first or second, slightly longer than last labial; ligula large, fleshy, cylindrical; gular sutures distinct, slightly protuberant.

*Prothorax* trapezoidal, slightly wider behind; pronotum with lateral sutures undefined, entirely glabrous, shining, very finely rugulose; eusternum triangular, distinct, smooth, shining. Mesonotum smooth, shining; metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* depressed; epipleurum distinctly protuberant on all segments, tubercles oval bearing two long setae and a chitinous pore at each extremity; ampullae seven, shining, beset with two rows of irregular tubercles. Ninth segment gradually extended into a sharp, short, deflexed spine. Spiracles orbicular. Anus trilobed.

[Described from specimens Hopk. U. S. 4203a.]

This larva has been collected and reared from *Alnus* and *Rhamnus* in Washington State by H. E. Burke. The larva mines under the dead wet bark, pupating from May to July in the sapwood.

## SYNAPHOETA Thomson

The pronotum, the tuberculation of the ampullae, and the protuberant epipleurum on all segments resemble those of *Plectrura*. Perris (25) describes and figures the related European species *Mesosa nubila*. Both these species, so widely separated geographically, have the peculiar longitudinal striae on the epistoma and the protuberant hypostoma. The larvae are very similar in other respects also.

## SYNAPHOETA GEUXI LeConte

[Pl. XIII, fig. 9; Pl. XVI, fig. 16]

*Form* robust, slightly depressed; integument firm, shining, sparsely clothed with long, slender, golden hairs.

*Head* depressed, sides suddenly constricted behind; mouth-frame heavily chitinized; epistoma nearly straight, distinct, smooth, bearing four pairs of deep setigerous punctures from each of which extends posteriorly a series of fine striae; labrum about twice as wide as long, widest behind, densely haired; mandible short, robust, dull black, about one and one-half times as long as basal width, cutting edge obliquely emarginate; antennal ring open behind; one pair of distinct ocelli. Ventral mouth-parts rather strongly chitinized; mentum not entirely distinct; palpi rather slender, conical, last joint of maxillary shorter than others, about equal to last labial; ligula very large, cylindrical. Hypostoma transversely protuberant behind; gula, a faint white line.

*Prothorax* depressed, rather strongly chitinized, widest behind; pronotum having lateral sutures impressed behind, entirely glabrous, smooth, shining, except for an anterior border of hairs; sternum anteriorly coarsely hairy, laterally smooth, chitinized; eusternum not distinct. Metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* bearing seven pairs of ampullae, dorsally with two or four irregular rows of large tubercles, central ones largest. Epipleurum strongly protuberant on all segments, tubercles orbicular, small, having two setae and one chitinous pore on ventral margin. Last tergum bearing a very minute chitinous tubercle. Anus trilobed.

[Described from specimens Hopk. U. S. 9587.]

This larva feeds in dead and dying wood of *Salix* and *Acer* throughout the Pacific Coast region. The burrows are large, extending through the sapwood



and heartwood and loosely filled with fibrous frass. The writer found them ovipositing in *Salix* dying from the attack of *Saperda hornii*, in August, 1911, at Walker, Oregon. The adult gnaws through the bark before ovipositing. Observations by G. Hofer, F. B. Herbert, and the author.

#### Group MONOCHAMIDES

The following genera are all closely allied and can be distinguished by the following characters:

*Head* depressed; gula distinct and protuberant; antennal cavity closed behind; posterior area of pronotum finely velvured or asperate; ampullae bearing dorsally four rows of tubercles usually velvured or asperate; epipleurum strongly protuberant on all except first two segments, tubercle having one or two chitinous pits.

The larvae feed for a short time beneath the bark, later going into the wood, where they either feed for several years as in *Goec*, *Ptychodes*, and *Plectrodera*, or only to construct short mines and pupal cells as in *Monochamus*.

#### PTYCHODES TRILINEATUS Linnæus

[Pl. V, fig. 5; Pl. XXIII, fig. 7; Pl. VII, fig. 15]

*Form* large, elongate; integument firm, shining, beset with rather stiff brownish hairs.

*Head* depressed, about one and one-half times as long as wide, sides gradually tapering behind; mouth-frame heavily chitinized; epistoma straight, abruptly raised; labrum roundly rectangular, about one and one-half times as wide as long, anterior half densely hairy; mandible about twice as long as basal width, dull, black, cutting-edge obliquely emarginate; antennal ring entire; one pair of distinct ocelli. Ventral mouth-parts somewhat chitinized, palpi slender, each maxillary palpal joint successively longer from base outward, last shorter than last labial, one-half length of first labial; ligula cylindrical, prominent; lacinia cylindrical, fleshy; mentum not distinctly defined; hypostoma heavily chitinized; gula protuberant.

*Prothorax* rectangular, depressed; pronotum defined posteriorly by lateral impressions, anteriorly light yellowish, shining, with an anterior border of hairs, posteriorly densely velvety pubescent, spotted with minute lenticular glabrous spots; sternum anteriorly hairy, laterally yellowish, chitinized; eusternum shining, sparsely haired. Mesonotum anteriorly velvety pubescent, posteriorly shining; metanotum, mesosternum, and metasternum tuberculate. Legless.

*Abdomen* having seven pairs of well developed ampullae, these transversely oval, bearing dorsally four irregular rows of shining tubercles, ventrally two. Epipleurum distinctly protuberant on all segments, tubercle rectangularly oval, bearing four to five setae, no chitinous pores. Spiracles large, oval, chitinous rimmed. Anus transverse, two-lobed, the lower one bearing beneath a group of five to eight short, acutely subulate setae or spines.

[Described from specimens Hopk. U. S. 10543a.]

The larva feeds in living branches and trunks of *Ficus*, *Alnus*, and *Morus* often killing the trees. The work and habits resemble those of *Goec*. It occurs along the Gulf States into the southwestern United States and Mexico. Observations by M. Chrisman and W. D. Edmonston.

#### MONOCHAMUS Serville

*Head* strongly depressed, sides suddenly constricted behind middle; mandible slender, about three times as long as condylar width; antennal ring entire; mentum distinct from submentum; gula protuberant. Posterior area of pronotum finely asperate; dorsal abdominal ampullae bearing four rows of finely asperate tubercles. Epipleurum protuberant on all segments; pleural tubercle elongate oval, having a chitinous pit at each extremity and three or more setae. Spiracles oval.

The species of *Monochamus* are characteristically pine (*Pinus*) feeders, but in the northern part of the range are common in *Picea* and *Abies*. Mr. R. Hopping tells me that in British Columbia the larvae are not common in *Pinus ponderosa*. The eggs are laid in recently dead, dying, or living (*marmorator*) trees. The female gnaws an irregular hole through the bark, inserting from one to six eggs. The larvae feed from one to two months between the bark and wood, and during this time they are very much depressed. The entire bark is loosened from the wood and this space is packed with long fibrous frass.

Later the larva enters the wood through an oval hole, which soon becomes circular as the larva fills out. This chamber is constructed into the pupal cell. It is usually extended parallel to the grain, and then upward to the bark, several inches from the point of entrance, making a U-shaped cell. After pupation the adult emerges by gnawing through the bark. In more northern parts of the range two years are required to complete the life cycle. Rarely the larva will make a *Rhagium*-like pupal cell between the bark and wood. A dipterous (tachinid) parasite commonly attacks these species, killing them in the pupal cells.

The adult beetles feed extensively before ovipositing on the needles of conifers. *Scutellatus* and *marmorator* have been observed gnawing off the bark on small twigs, many of which later die. The red foliage of balsam on these twigs is a very characteristic feature. On spruce trees surrounding logging operations sufficient branches are sometimes killed to cause serious defoliation and malformation of the trees.

### KEY TO THE KNOWN SPECIES OF LARVAE OF MONOCHAMUS

Dorsal anal lobe decidedly protruding posteriorly.....	<i>M. titillator</i>
Dorsal anal lobe not decidedly protruding posteriorly.....	
Tubercles on ventral ampullae glabrous.....	<i>M. maculosus</i>
Tubercles on ventral ampullae beset with fine asperities.....	
Matured larvae more robust, hairs coarse, a continuous band of hairs across anterior area of pronotum.....	<i>M. confusor</i>
Matured larvae less robust, hairs finer, the band of hairs not continuous across pronotum.....	
Body hairs less numerous.....	<i>M. scutellatus</i>
Body hairs more numerous (See description).....	<i>M. marmorator</i>

#### MONOCHAMUS TITILLATOR Fabricius

[Pl. VII, fig. 12]

*Form* very elongate, slightly depressed; integument firm, shining, rather densely clothed with yellowish brown hairs.

*Head* strongly depressed, suddenly constricted behind middle; labrum roundly oval, slightly wider than long, densely hairy in front; antennal ring entire; mandible slender, about three times as long as basal width, cutting edge broadly emarginate. Ventral mouth-parts rather strongly chitinized; mentum distinct, one and one-half times as wide as long; palpi slender, joint of last maxillary acute, shorter than second or last labial; gula protuberant.

*Prothorax* depressed, rectangular; posterior area of pronotum velvety asperate, spotted with small glabrous areas, anteriorly glabrous and having a dense group of hairs at anterior extremities. Mesonotum anteriorly dull pubescent, posteriorly shining; metanotum tuberculate; mesosternum and metasternum bearing two transverse rows of velvety asperities on broken tubercles.

*Abdomen* depressed; dorsal ampullae bearing four rows of tubercles, these more or less confluent in the middle, and all asperate pubescent; ventral ampullae bearing two rows of tubercles. Epipleurum protuberant on all segments; pleural tubercle elongate oval, bearing a chitinous pit at each extremity and about ten setae. Spiracles oval, chitinous rimmed. Dorsal anal lobe large, projecting posteriorly beyond others.

*Pupa:* Form as in adult; antennae folded over wing in several coils. Beset with acute chitinous spines as follows: Groups on front of head and labrum, and on anterior margin, disc, base and lateral tubercles of protergum; two converging rows on mesonotum and metanotum; two transverse bands on posterior border of first six abdominal segments. Last abdominal deeply divided beneath, dorsally projecting into a large acute, chitinous-tipped process.

This species, commonly known as "the southern pine sawyer," has been found from Maine south through Texas. It is very destructive to storm-felled trees, in one season's time often rendering the timber practically valueless. In the extreme south several generations occur each year. Webb (34) gives a detailed account of the habits and economic status of this species.

### MONOCHAMUS SCUTELLATUS Say

[Pl. XIII, fig. 5; Pl. XXIII, fig. 8, Pl. XLIII]

Distinguishable from *titillator* by the fact that the dorsal anal lobe does not project perceptibly, and from *confusor* by characters given in key.

*Pupa.* Distinguished by the smaller, though similarly disposed, spines except that the transverse band across the anterior border of the protergum is lacking.

Including the western variety, this species occurs throughout the northern pine-growing regions of the United States and Canada. It feeds in *Pinus*, *Picea* and *Abies*. Its habits are similar to *M. titillator*. In Massachusetts it has been found commonly pupating between the bark and wood.

### MONOCHAMUS CONFUSOR Kirby

The dorsal anal lobe does not noticeably protrude; the body hairs are coarse, resembling *titillator*. Distinguished from *scutellatus* by the fact that the two groups of hairs on the anterior lateral angles of the pronotum extend in a less dense though continuous band across the area.

*Pupa.* Distinguished by the almost total absence of spines on the protergum.

A northeastern species, common throughout the higher mountains of West Virginia, north into Canada. As far as known, it attacks only *Pinus strobus*. Packard (23) and Hopkins record this species attacking living balsam fir (*Abies balsamea*) at Brunswick, Maine, probably confusing it with *marmorator*.

### MONOCHAMUS MACULOSUS Haldeman

Dorsal anal lobe not protruding; tubercles of ventral ampullae glabrous, not bearing fine asperities.

[Described from specimens Hopk. U. S. 12593.]

This species occurs throughout the western United States and Canada, attacking all species of the western pines (*Pinus*). Habits similar.

### MONOCHAMUS MARMORATOR Kirby

This larva is very difficult to separate from *scutellatus*. In the earlier stages the asperities are much coarser on the pronotum and ampullae. Matured larvae are considerably more hairy, the tubercles on the ampullae are broader and less projecting and the abdominal spiracles are nearly orbicular with a very heavy peritreme usually more darkly coloured. The hairiness can be expressed by comparison of the group of hairs at the extremity of the lateral suture of pronotum (see "a" fig. 8, Pl. XXIII). In *scutellatus* this group varies from 6 to 10, while in *marmorator* from 12 to 20.

[Described from specimens No. 15041 Dominion Entomological Branch.]

This insect is of much economic importance in balsam following spruce budworm outbreaks in eastern Canada and northeastern United States. It attacks the defoliated and weakened trees, causing their death. The adults are active at night, ovipositing under the balsam pustules on the trunk. The large egg punctures and copious flow of balsam from the wounds are very characteristic features of their attack. The larval mines are more transverse than other species, thus more quickly girdling the tree. A more detailed discussion of the habits will be published later.

### GOES LeConte

*Head* strongly depressed, sides very weakly constricted behind middle; mandible robust about twice as long as condylar width (seen from side); antennal ring entire; mentum distinct from submentum; gula protuberant (less pronounced than in *Monochamus*). Posterior area of pronotum finely asperate, dense group of hairs at anterior lateral angles absent; dorsal ampullae bearing four rows of tubercles, these finely asperate except in *oculata*. Epipleurum protuberant, on all abdominal segments; pleural tubercle broadly oval, bearing a chitinous pore at each extremity and rarely more than two setae. Spiracles oval.

The species of *Goës* are essentially less hairy than those of *Monochamus*. The degree can be best indicated by the dense group of hairs on the anterior area of the pronotum being reduced in *Goës* to a very few. The asperate area of the pronotum is deeply notched by a right angle at the anterior lateral extremities. These asperities do not extend forward over the impression (in this notch) made by muscular attachments, as they do in *Monochamus*.

These larvae are all hardwood feeders. They all attack living trees, except *oculatus*, mining beneath the bark a very short time and excavating large mines deep into the heartwood. The larval stage extends over a period of from two to four years. At the point where the egg is laid an opening is maintained throughout the larval existence from which fibrous frass is extruded. Pupation occurs at the top of the larval mine deep in the heartwood, the adults gnawing out through the intervening sapwood and bark.

The much stronger veluring, or rather asperities of pronotum and ampullae is well contrasted with that of the larvae of *Monochamus*, which attack only dying trees. One species, a dead-wood feeder, *G. oculatus*, has not the ampullae so covered.

### KEY TO THE SPECIES OF *GOËS*

- Tubercles of ampullae covered with fine asperities; breeds in living trees.  
 Asperities on ampullae coarse, individual points visible with a hand lens.  
   Asperities on prosternellar area in a continuous transverse band; breeds in trunks and branches of *Quercus*.....*G. tigrinus*  
   Asperities on prosternellar area broken for a short distance in middle breeds in the base or roots of *Quercus*.....*G. tessellatus*  
 Asperities on ampullae finer, individual points not visible with hand lens.  
   First thoracic spiracles twice or more as long as wide; body hairs reddish brown; breeds in hickory (*Hicoria*).....*G. pulcher*  
   First thoracic spiracle not twice as wide as long; body hairs whitish or lemon-coloured.  
     Median oval of tubercles on ampullae three or four times as wide (transversely) as long; breeds in the stems and large branches of *Quercus*, *Fagus*, *Carpinus* and *Ostrya*.....*G. pulverulentus*  
     Median oval of tubercles about twice as wide as long, breeds in the small branches of *Quercus*.....*G. debilis*  
 Tubercles of ampullae glabrous, shining; found in dead wood.....*G. oculatus*

### *GOËS TIGRINUS* DeGeer

[Pl. II, fig. 2; Pl. XXIV, figs. 11 and 12; Pl. XVI, fig. 12; Pl. XXVIII, figs. 1 and 3; Pl. XXXIII, fig. 1; Pl. XL, fig. 3, Pl. XLIII]

*Form* subcylindrical, elongate, robust; yellowish-lemon tinged; integument tough, shining, very sparsely clothed with coarse brownish-yellow hairs.

*Head* strongly depressed, side slightly constricted behind middle; labrum transverse, widest behind, slightly notched in front, densely haired on anterior half; mandible robust, from side not twice as long as condylar width, cutting edge obliquely emarginate; antennal ring entire; one pair of distinct ocelli. Ventral mouth-parts rather chitinized; palpi slender, last joint of maxillary palpi acute, shorter than last labial; anterior edge of hypostoma broadly curved; gula protuberant.

*Prothorax* rectangular, depressed, strongly so anteriorly; pronotum anteriorly smooth, posteriorly very finely asperate pubescent; eusternum well defined, a group of hairs in centre; sternellum entirely finely asperate. Mesonotum smooth or anteriorly finely asperate; metanotum, mesosternum, and metasternum tuberculate, these asperate pubescent.

*Abdomen* nearly cylindrical; dorsal ampullae bearing four rows of asperate tubercles, the ventral two rows; epipleurum protuberant on all segments; pleural tubercle broadly oval to roundly rectangular, bearing a chitinous pit at each extremity and two setae. Spiracle oval, strongly chitinized.

*Pupa*. Body beset with yellowish-brown bristles, those of abdominal terga arranged in two very prominent, closely set blotches; last segment armed with a strong, recurved, chitinous spine, bearing several minute teeth on the margins.

[Described from specimens Hopk. 12666, 11839, and 12673.]

This species has only been taken in *Quercus* and very rarely in any except the white oaks. The life cycle extends over a period of four years. It occurs through the eastern and central United States.

**GOES TESSELATUS** Haldeman

This species is distinguished from *tigrinus* by the asperities of the prosternellar area not being continuous across the fold but broken in the middle.

*Pupa.* Can be distinguished from *tigrinus* only by the coarser and darker coloured bristles of the body; those of the pronotum are about twice as numerous.

[Described from specimens Hopk. U. S. 9785<sup>f</sup>.]

This larva bores in the base of young *Quercus* saplings and rarely in *Castanea* and *Amelanchier*. Often the entire base of the tree is hollowed out, causing its death. It occurs throughout the eastern and central United States.

This material and biological notes were furnished by Mr. Fred E. Brooks, of the Bureau of Entomology, United States Department of Agriculture.

**GOES PULCHER** Haldeman

In general similar to *tigrinus*, but the asperities of the pronotum and the ampullae are much finer and the tubercles of the ampullae not so prominent; body clothed with coarse reddish-brown hairs; median oval of tubercles on dorsal ampullae three to four times as wide as long; first thoracic spiracle twice as wide as long; living, matured larvae of a distinct yellowish colour.

*Pupa.* Similar to *pulverulentus* but with fewer bristles on labrum and pronotum; those of sixth abdominal tergum very few and sparser than on first.

[Described from specimens labelled Annandale, Md., July 23, 1915.]

The larva had been found only in hickory (*Hicoria*). The eggs usually are laid in crotches of branches and the larvae feed a greater porportion of the time under the bark. They mature more rapidly than most other species of the genus, requiring two or three years to complete the life cycle. Found throughout the eastern and central United States and southern Canada.

**GOES PULVERULENTUS** Haldeman

[Pl. XII, figs. 5 and 6, Pl. XLIV]

Distinguished from *pulcher* only by the finer, light lemon-coloured hairs on the body and by the fact that the thoracic spiracles are more broadly oval, not twice as wide as long.

*Pupa.* Bristles arranged in two groups on anterior portion of labrum; front of head sparsely covered; pronotum sparsely beset with shorter bristles; mesonotum and metanotum bearing two irregular blotches of still shorter ones; first six abdominal terga beset with two transverse bands of short, dense, reddish bristles, those of sixth scarcely sparser than the first; last tergum extending dorsad in a fleshy triangular process, suddenly acutely conical and chitinous tipped.

[Described from specimens Hopk. U. S. 11867<sup>a</sup>.]

The larva has been found in the main stems of smaller trees or the branches of larger trees of *Fagus*, *Carpinus*, *Ostrya*, *Quercus*, *Ulmus*, and *Platanus*. The life cycle is normally completed in four years.

**GOES DEBILIS** LeConte

Resembles *pulverulentus*, but has still finer and lighter coloured body-hairs; the thoracic spiracle is not twice as wide as long and the median oval of the ampullae is little more than twice as wide as long.

*Pupa.* Similar to *pulverulentus* except that the bristles are finer and on labrum and front of head they are less numerous.

[Described from specimens Hopk. U. S. 11808.]

This larva has only been found in the lateral branches, from one-half to one inch in diameter, of oak trees (*Quercus*). The life cycle normally is completed in two years.

**GOES OCULATUS** LeConte

[Pl. V, fig. 8.]

Integument thin, shining; body sparsely covered with whitish silky hairs. Gula distinct but scarcely as protuberant as in other species; mandible more slender; posterior area of pronotum covered with velvety pubescence; ampullae tuberculate, the tubercles smooth and shining plural tubercle orbicular; spiracles small, broadly oval.

[Described from specimens Hopk. U. S. 9789<sup>k</sup>.]

This is the only species of the genus which does not attack living trees. It feeds beneath the bark, going into the wood to pupate. It is found in the dead wood of *Cornus*, *Oxydendron*, *Fagus*, and *Castanea* throughout the eastern States, but more commonly south. Observations by A. D. Hopkins, W. F. Fiske, and the author.

#### PLECTRODERA SCALATOR Fabricius

*Form* robust, cylindrical; integument very thin shining, rather densely covered with short, golden-brown hairs.

*Head* as *Goes*, but the mouth-frame much more heavily chitinized and the anterior edge of hypostoma thickened so as to almost obscure the gula. Pronotum anteriorly bearing a continuous transverse row of short golden brown hairs, posteriorly velvety pubescent; eusternum beset with short hairs evenly distributed on anterior half; sternellum velvety pubescent for entire width. Ampullae bearing four rows of very fine velvety pubescent tubercles, these tubercles almost obsolete; pleural tubercle broadly oval, bearing a number of short hairs and two chitinous pits; spiracles broadly oval, a little larger than antennal ring; peritreme heavy.

This larva resembles that of *Goes* in all essential characters. It is distinguished from species of that genus by the short, golden-brown hairs, which are much more thickly set. The anterior margin of the pronotum bears a continuous transverse band of hairs.

These specimens were collected from the base of living *Populus* by F. B. Milliken, Garden City, Kans. Mr. Milliken (21) has described the seasonal history and the injury to cottonwood caused by these larvae. The habits are very similar to those of *Goes*.

#### DORCASHEMA LeConte

The genera *Doraschema* and *Hetoemis* have been placed in the group Monochamides by LeConte and Horn, but Lacordaire retains them in a separate group, Doraschemides, which seems to be justified by the larvae. These species have no essential larval characters in common with the genus *Monochamus*. The larvae of *Hetoemis* also suggest affinities to *Dectes*, and this relationship has been indicated by Gemminger and Harold.

*Head* depressed, sides not sensibly constricted behind middle; mandible short; hypostoma transversely bulging; mentum distinct, sunken; antennal ring entire; palpi very slender, attenuate. Posterior area of pronotum shining, smooth to finely reticulate; eusternum not distinct; pleural tubercle bearing a very small, chitinous pit at each extremity; dorsal abdominal ampullae bearing only two rows of irregular tubercles. Epipleurum protuberant on last three segments. Anal spine present or absent.

#### KEY TO THE SPECIES OF DORCASHEMA

- Dorsal anal lobe unarmed; posterior area of pronotum smooth. Lives in hickory. . . . *D. nigrum*  
 Dorsal anal lobe bearing a chitinous protuberance; posterior area of pronotum reticulate.  
 Lives in mulberry (*Morus*).  
     Chitinous process laterally compressed. . . . . *D. alternatum*  
     Chitinous process conical, reflexed. . . . . *D. wildii*

#### DORCASHEMA NIGRUM Say.

*Form* elongate, subcylindrical; integument rather firm, shining, sparsely clothed with yellowish-white hairs.

*Head* depressed, sides scarcely constricted behind middle; epistoma straight, rather abruptly declivous; labrum thin, fungiform, but little wider than long, anterior margin densely ciliate; mandible short, about one and one-half times as long as basal breadth, dull black, cutting-edge obliquely truncate; antennal ring entire; one pair of white ocelli. Ventral mouth-parts rather extended, hairs very fine; mentum twice as wide as long, sunken, distinct; palpi slender, maxillary longer than lacinia, last joint of maxillary equal to second, slightly longer than last labial; anterior edge of hypostoma thin, curved, hypostoma transversely bulging; gula not distinct.

*Prothorax* trapezoidal, depressed, widest behind; pronotum entirely smooth, shining, or very indistinctly longitudinally striate, lateral sutures impressed behind, anteriorly a group of fine hairs at each side. Mesonotum smooth, shining; metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* cylindrical; ampullae sensibly bilobed, dorsal and ventral with two rows of irregular tubercles divided along median line; pleural tubercle elongate rectangular, a chitinous pore at each extremity; epipleurum protuberant on last three segments. Spiracles orbicular, distinctly rimmed.

[Described from specimens Hopk. U. S. 9784b<sup>2</sup>.]

This species has been collected only from dead hickory (*Hicoria*) branches throughout the eastern United States. The larvae feed between the bark and wood, making a curved pupal cell in the sapwood and emerging by a hole at the opposite end from which it entered the wood. The adults emerge during May and June. Based on observations of A. D. Hopkins, J. L. Webb, A. B. Champlain, and the author.

#### DORCASHEMA ALTERNATUM Say.

Distinguished from *nigrum* by the compressed chitinous protuberance on the dorsal anal lobe; the hairs on the body are finer; the labrum is slightly longer and less sparsely ciliate; posterior area of pronotum very finely and irregularly striate to reticulate; tubercles of ampullae less confluent.

*Pupa.* Form as in adult; remarkably glabrous, except for eight to ten small chitinous points on posterior edge of dorsal abdominal segments; last segment bearing a conical, acute-reflexed spine.

[Described from specimens Hopk. U. S. 5829 and 9791m.]

The larva feeds exclusively in mulberry (*Morus*) branches, sometimes attacking green limbs that have been slightly injured. Habits otherwise similar to those of *nigrum*. Adults fly throughout May and June. Observations by A. D. Hopkins, J. L. Webb, A. B. Champlain, and the author.

#### DORCASHEMA WILDII Uhler

[Pl. XXIV, fig. 9; Pl. XVI, fig. 2; Pl. VII, fig. 9]

Matured larvae much larger and more robust than those of other species of the genus; anal process conical, blunt (not compressed), but suddenly constricted above base; posterior area of pronotum distinctly reticulate; mandible deeply notched or emarginate at apex.

[Described from specimens Hopk. U. S. 12807.]

Dr. A. D. Hopkins records this insect as causing the death of small living mulberry trees (*Morus*) at Kanawha Station, W. Va., Sept. 25, 1898. The larvae were working in healthy bark 2 feet above ground. Another record from the Bureau of Entomology files, by J. G. Barlow, in Missouri, Mar. 16, 1887, contains similar observations. This species feeds also in osage orange (*Toxylon*).

Range: Throughout the eastern and central United States.

#### HETOEMIS CINEREA Olivier

[Pl. V, fig. 1]

*Form* slender, tetragonal, slightly tapering; integument thin, shining, very sparsely clothed with fine whitish hairs.

*Head* slightly depressed, sides rapidly narrowed posteriorly and slightly anteriorly, constricted behind middle, widest just before middle; epistoma thin, slightly curved; labrum widest at middle, anterior margin broadly rounded, densely and finely ciliate; mandible rather slender from side, about twice as long as basal width, strongly curved; cutting edge obliquely emarginate; antennal ring closed; one pair of ocelli; ventral mouth-parts fleshy; mentum distinct, one and one-half times as wide as long, sunken; last joint of maxillary palpi very slender, equal to second and last labial; ligula large; hypostoma rather strongly transversely protuberant.

*Prothorax* trapezoidal, thick, widest behind; pronotum posteriorly smooth, shining or very finely rugulose, having lateral angles clothed with fine whitish hairs; sternum anteriorly regularly and finely hairy; eusternum not distinct, glabrous, shining. Mesonotum glabrous, shining; metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* slender, ampullae bearing two irregular rows of tubercles, third, fourth, fifth, sixth and seventh very deeply bilobed, forming two projecting lobes and giving body tetrahedral form; epipleurum protuberant only on last three segments; pleural tubercle elongate, having two large, distinct, chitinous pits and one long slender seta. Spiracles small, nearly orbicular. No caudal spine.

[Described from specimens Hopk. U. S. 9784b<sup>2</sup>.]

The larva mines for the greater part of the time under the bark, going into the wood, often quite deeply, to make a long, curved pupal cell, closed at both ends by a plug of fibrous frass. Larvae have been collected from *Hicoria*, *Celtis*, *Morus*, and *Tilia*. The adults are found throughout the eastern United States during July and June.

Here again occur in the Lamiinae the peculiar bilobed ampullae and similar development of the abdominal areas found in all subfamilies excepting the Prioninae. For example, *Atimia* in the *Aseminae*; *Heterachthes* in the *Cerambycinae*, and *Encyclops* in the *Lepturinae*. The food habits among these are radically different, however, and the character seems to have no taxonomic significance.

#### Group ACANTHODIDES

The genera *Acanthoderes*, *Leptostylus*, *Liopus*, *Lepturges*, *Dectes*, *Hyperplatys*, *Graphisurus*, *Nyssodryx*, *Certographus*, and *Acanthocinus* probably do not comprise a natural group, yet the characters merge into one another so that it is difficult to draw any line of separation. The *Acanthocinus*-like form seems to be most distinct.

*Acanthoderes* has very large, irregularly arranged tubercles on the ampullae, and a ruglose pronotum. *Leptostylus*, *Hyperplatys*, and *Liopus* have similar ampullae though small tubercles, but the pronotum is smooth or velvety pubescent. *Lepturges* has the tubercles arranged in two regular rows. In this genus appear two distinct species groups, those with normal palpi and a chitinous spine on last tergum, and those with two-jointed maxillary palpi and no spine. *Dectes* in form alone is quite aberrant. As it is cylindrical, even to the thickening of the head, it departs from the usual depressed type, but this is no doubt due to its peculiar food habits. All of the foregoing genera have the antennal ring plainly bisected by the frontal suture, while in *Graphisurus*, *Acanthocinus*, and *Nyssodryx* it is only angulate behind; but this is probably due to the heavy chitinization of the head obscuring the suture, which is distinct in *Certographus*. These last genera also all have the velured pronotum. *Nyssodryx* suggests *Leptostylus*, and both it and *Graphisurus* have caudal armature.

The food habits are quite as variable as the anatomical characters.

#### ACANTHODERES Serville

Robust species; head depressed, slightly constricted before middle; mandibles relatively short; antennal annulae open; mentum sunken into submentum, not distinct at base; gula indistinct. Pronotum posteriorly rugulose; ampullae bearing two rows of large irregular and confluent tubercles; epipleurum distinct only on last segments; pleural tubercle oval, bearing two or three setae and two chitinous pores. Spiracles large, orbicular.

The species of *Acanthoderes* can be considered as deadwood feeders; all except *morrisii* feed exclusively in any hardwood which has reached a certain stage of decay. The wood must be soft and pulpy, usually decomposed by fungi. The larval mines are extended between the bark and wood and are not very extensive. The pupal cell is shallow and constructed in the outer sapwood. A coarse fibrous wad of frass protrudes. The four species can be separated as follows.

#### KEY TO THE SPECIES OF ACANTHODERES

- Pronotum shining, rugulose, dead-wood feeders.  
 Mandibles about twice as long as basal width; eastern.  
 Labrum sparsely hairy, these hairs whitish.....*A. decipiens*  
 Labrum very densely hairy, these reddish.....*A. quadrigibbus*  
 Mandibles about one and one-half times as long as basal width; ampullar tubercles very large; southwestern.....*A. sp. 10528*  
 Pronotum dull, velvety pubescent, rugulose; feeds in living trees.....*A. morrisii*



## ACANTHODERES DECIPIENS Haldeman

[Pl. XIII, fig. 8; Pl. XXIII, fig. 4; Pl. XXIV, fig. 13; Pl. XVI, fig. 5]

*Form* short, rather robust, cylindrical; integument firm, white, shining, sparsely clothed with dirty brownish hairs.

*Head* depressed, sides slightly constricted before middle; epistoma straight; labrum about one and one-half times as long as wide, anterior half sparsely hairy; mandible black, shining, from side about twice as long as condylar width, cutting edge very obliquely emarginate; antennal ring open; one pair of rather indistinct ocelli. Ventral mouth-parts thick, rather hairy; mentum not defined at base, sunken; maxillary palpal joints subequal, last equal to last labial; ligula large; anterior edge of hypostoma curved, distinct; gula not distinct.

*Prothorax* rectangular, thick, widest about middle; pronotum anteriorly smooth, chitinized, a dense row of hairs across front, posteriorly shining, rugulose; prosternum hairy; eusternum and sternellum rugulose, shining, former faintly distinct. Mesonotum shining, metanotum, mesosternum, and metasternum shining, tuberculate.

*Abdomen* cylindrical, slightly narrowing posteriorly; ampullae bearing two rows of large, irregularly defined tubercles; epipleurum protuberant only on last segments; tubercle broadly oval, bearing two or three setae and two large distinct, chitinous pits. Spiracles orbicular, peritreme slightly chitinized. No caudal spine.

[Described from specimens Hopk. U. S. 10914a.]

Habits are described under the genus. It occurs throughout the eastern United States and Canada in *Quercus*, *Betula*, *Castanea*, *Nyssa*, *Ulmus*, *Hicoria*, *Prunus*, *Acer*, *Cornus*, *Ostrya* and apple (*Malus*). Pupation takes place in the sapwood from April to June.

## ACANTHODERES QUADRIGIBBUS Say

A few specimens studied show the anterior half of the labrum very densely beset with ferruginous hairs; the pleurostoma below the ocellus and the anterior edge of the hypostoma are dull and finely granulate. The mandible is more slender.

Habits similar to those of *decepiens*. Occurs throughout the eastern United States and southern Canada in *Quercus*, *Castanea*, *Betula*, *Fagus*, *Tilia*, and *Acer*. Based on observations of W. S. Fiske and the author.

## ACANTHODERES sp.

Distinguished from *decepiens* by the much more robust mandible, one and one-half times as long as basal width, and the much larger ampullar tubercles. Form more robust.

*Pupa*. Form as in adult; labrum bearing two transverse chitinous protuberances at base; front of head and pronotum bearing several chitinous setigerous points, as do also the mesonotum and metanotum, on the latter in a v-shaped figure; a short anterior and broader posterior row on each abdominal tergum. Anal segment squarely truncate, with several such points on its perimeter.

[Described from specimens Hopk. U. S. and 12283h.]

Habits similar. It has been reared from *Populus* and *Salix* in Arizona. Collected by M. Chrisman.

## ACANTHODERES MORRISII Uhler

*Form* very much more robust than in others of the genus; pubescence much coarser, stiff and very much sparser. Mandible shorter and more robust. Prothorax more chitinized on sides; posterior two-thirds of pronotum rugulose, dull, covered with sparse velvety pubescence. Ampullar tubercles very large. Spiracles very large and peritreme very strongly chitinized.

[Described from specimens Hopk. U. S. 9786g.]

This species exhibits a character which is considered as developed through its environment, namely, the velured pronotum. All other species are dead-wood feeders, while this one attacks living trees, and has the armature so common among forms with similar habits.

The habits of this species are exceptional to the genus. The larva was taken at Greenville, S.C., from living *Nyssa*. It was found making extensive galleries in the heartwood, very similar to those of *Goes*. Adults were reared in June. Observations by the author.

## DECTES SPINOSUS Say.

[Pl. V, fig. 7; Pl. XII, fig. 4; Pl. XVI, fig. 3]

*Body* slender, cylindrical, slightly curved; integument very finely granulate, shining, sparsely clothed with fine whitish hairs.

*Head* rather thick, exposed portion bearing very long hairs; sides narrowing very slightly posteriorly; labrum about twice as wide as long, widest at base, shortly and coarsely ciliate; mandible rather short, about one and one-half times as long as at base, apex acute, molar angle sharply toothed; antennal ring open behind; one pair of ocelli. Ventral mouth-parts fleshy; mentum distinct, narrow, transverse; last joint of maxillary palpi conical, longer than second, shorter than last labial, basal joints transverse; anterior margin of hypostoma fused with submentum, not distinct in middle; gula not distinct.

*Prothorax* thick, rectangular; pronotum posteriorly very finely rugulose, anteriorly smooth, shining, having a very sparse anterior border of hairs; eusternum not distinct, finely reticulated, very sparsely haired; sternellum smooth, shining. Mesonotum smooth, metanotum, mesosternum, and metasternum faintly tuberculate.

*Abdomen* cylindrical; ampullae strongly protuberant, with a strong median impression, laterally tuberculate in two indistinct rows; epipleurum protuberant only on last three segments, tubercle narrowly oval, having several fine setae and no distinct pits. Spiracles orbicular, small, not strongly chitinous rimmed. No caudal armature, ninth segment sparsely fringed with hairs.

*Pupa*. Form as in adult; remarkable for all absence of spines on head and thorax merely fine setae; abdominal terga armed with a few chitinous tipped papillae, growing more numerous on posterior segment, anal segment tipped with six larger dorsal and smaller lateral points.

[Described from specimens Hopk. U. S. 9784c.]

This larva attacks the living stems of *Ambrosia*, *Eupatorium*, and *Xanthium* and probably other composites. The egg is laid at a leaf base high on the stem and the larva mines down through the pith into the base of the roots, where pupation takes place. The life-cycle is completed in one year. The adult occurs through the eastern and central-western United States during July to August.

## LEPTOSTYLUS LeConte and LIOPUS Serville

*Form* depressed; head depressed, sides slightly constricted for posterior two-thirds; labrum transverse, anterior margin semicircular; mandible about twice as wide as basal width; antennal ring open behind; mentum distinct, but little sunken into submentum; gula not distinct. Prothorax depressed, posterior area of protergum smooth and shining or velvety pubescent; ampullae irregularly tuberculate; epipleurum protuberant on last three segments, tubercle having two chitinous pores and from two to four setae.

*Liopus* can be separated from *Leptostylus* only by the fact that the posterior area of the pronotum is glabrous, shining; but as this characterization will not hold for *Liopus variegatus*, the two genera are treated together. The species are difficult of separation.

The species of *Leptostylus* and *Liopus* are nearly all bark feeders in the larva stage. The usual habit is to feed entirely in the bark proper or between the bark and wood. The burrows are loosely packed with fibrous frass. Pupation occurs in the bark proper, between the bark and wood, or rarely (when the bark is thin) in the outer layers of the sapwood. One year is required to complete the life cycle though occasionally several generations or parts of generations may develop in the same season.

The following key will aid in distinguishing the known species.

## KEY TO THE KNOWN SPECIES OF LARVAE OF LEPTOSTYLUS AND LIOPUS

Posterior area of pronotum velvety pubescent.

Velvety pubescence covering at least one-half of area.

Labrum not twice as long as wide.

Head widest in front.

Pubescence on pronotum and body hairs lighter.....*Leptostylus macula*

Pubescence on pronotum and body hairs much darker.

Breeds in hardwoods.....*Leptostylus aculiferus*

Breeds in conifers.....*Leptostylus nebulosus*

Head tapering slightly anteriorly from middle.....*Leptostylus sexguttatus*

Labrum twice as wide as long, feeds in mangrove seeds.....*Leptostylus terraecolor*

Velvety pubescence only on posterior border.....*Liopus variegatus*

Posterior area of pronotum smooth, shining.

Anterior edge of labrum regularly rounded.....*Liopus alpha*

Anterior edge of labrum straight.....*Liopus punctatus*

**LEPTOSTYLUS MACULA** Say.

[Pl. XVI, fig. 7; Pl. XXXI, fig. 3]

*Form* depressed, semi-robust; integument firm, shining, sparsely clothed with long, whitish, silky hairs.

*Head* depressed, sides slightly constricted about middle; epistoma slightly curved; labrum thin, about one and one-half times as wide as long, semicircular, rounded from basal extremities, sparsely and finely ciliate; mandible slender, little more than twice the length of basal width, cutting edge dull, obliquely truncate; antennal ring open behind; one pair of distinct ocelli. Ventral mouth-parts thin, pubescence fine and silky; palpi slender, last joint of maxillary palpi equal to second, shorter than first, or last labial; mentum distinct, scarcely sunken; hypostoma slightly curved; gula indistinct.

*Prothorax* rectangular, strongly depressed, widest at middle; protergum anteriorly shining, finely reticulated, posteriorly finely velvety pubescent; eusternum and sternellum shining, finely wrinkled, the latter velvety pubescent at extremities. Mesonotum velvety asperate on anterior half. Metanotum, mesosternum, and metasternum irregularly tuberculate.

*Abdomen* depressed; ampullae irregularly tuberculate, the tuberculate area constricted at middle and having a median longitudinal impression; epipleurum protuberant on last three segments, tubercle having a chitinous pore at each extremity and two or three setae. Spiracles orbicular, peritreme scarcely chitinized.

*Pupa.* Form as in adult; slender, chitinous, setigerous points along front of head, a dense row across anterior margin of pronotum, and a few on lateral tubercles, several on mesonotum and metanotum and smaller ones, densely set, over abdominal terga (these not setigerous); last two segments bearing larger ones, and the caudal segment two incurved, slender spines.

[Described from specimens Hopk. U. S. 11810 and 9778p.]

This is one of the most common species of the genus. The larvae are found in a great variety of hardwoods, although chestnut is probably the most common host. In thick bark the larvae will often mine exclusively in it, or, if thinner, between the bark and wood. In small twigs and vines such as *Celastrus* the wood itself is mined, but then only when much decayed. Pupation normally takes place in the bark or between the bark and wood in an oval cell of fibrous frass. The species has been collected from *Castanea*, *Cornus*, *Acer*, *Hicoria*, *Celastrus*, and apple (*Malus*). Observations on the adult of this species show that it lives for several weeks to a month feeding on spores of bark fungi. The pustules of the chestnut bark disease (*Endothia parasitica*) are practically favoured. The adult is common throughout the eastern United States and Canada. It flies from May through July.

**LEPTOSTYLUS ACULIFERUS** Say

This species can only be separated from *macula* by the more robust form of the matured larvae and by the darker coloured, denser pubescence of the protergum; the labrum is widest about the middle instead of at base.

[Described from specimens Hopk. U. S. 11831a.]

Habits similar to those of *macula*. The writer has found it in living bark of apple trees. It normally prefers dead tissue. Adults have been reared from *Liriodendron*, *Rhus*, *Cornus*, *Hicoria*, *Ulmus*, *Juglans*, and apple (*Malus*). The adult flies from May to October.

**LEPTOSTYLUS COLLARIS** Haldeman

Body hairs much longer than in *macula*, otherwise similar.

[Described from specimens Hopk. U. S. 11817.]

Habits similar to those of *macula*. It has been found only in *Castanea*. Adults collected from May to June.

**LEPTOSTYLUS NEBULOSUS** Horn

Resembles *macula*, but larger, the pubescence on posterior area of pronotum much darker, and the body hairs much coarser.

[Described from specimens Hopk. U. S. 12593.]

The larvae feed entirely within the bark of dead *Abies*. Collected by J. M. Miller at Colestin, Oregon.

**LEPTOSTYLUS PARVUS** LeConte

Adults of this species have been reared from *Celastrus* and *Morus*, but only larval skins are available, and by these it can not be distinguished from the other species.

Collected by A. B. Champlain, H. B. Kirk, and the author.

**LEPTOSTYLUS PINI** Schaeffer

A single larval skin can not be separated from the other species. Hopk. U. S. 12241b. It was reared from dead branches of *Pinus* in the Catalina mountains of Arizona. Collected by M. Chrisman.

**LEPTOSTYLUS TERRAEOLOR** Horn

Resembles *macula*, but the labrum is twice as wide as long; the spots of velvety pubescence at the extremities of the prosternellar area are not conspicuous; the body hairs are coarser. [Described from specimens Hopk. U. S. 10081w.]

These larvae were collected by T. E. Snyder at Miami, Fla., in the seeds of mangrove. (*Rhizophora mangle*).

**LEPTOSTYLUS SEXGUTTATUS** Say.

Easily distinguished by the coarse, reddish hairs on the body and the head tapering anteriorly and posteriorly from a point a little before the middle; last joint of maxillary palpi longer than second, equal to last labial; pubescence on protergum very dark reddish brown. [Described from specimens Hopk. U. S. 10080g and 12295a.]

The larva feeds between the bark and wood, pupating in the outer layer of sapwood. It is often associated with *Acanthocinus* and *Monochamus*. Adults have been reared from *Picea* and *Pinus* throughout the eastern United States. It flies in April and May.

**LEPTOSTYLUS BIUSTUS** LeConte

Several specimens in the forest insect collection of the U. S. Bureau of Entomology are in too poor shape to describe. Hopk. U. S. 7540.

The larvae feed under the bark of *Morus*, *Rhus*, *Mimosa*, *Liquidambar*, and *Celtis*. It has been collected in May and June from Virginia southward. Observations of W. F. Fiske and R. W. Van Horn.

**LEPTOSTYLUS ALBIDUS** LeConte

A single specimen reared from *Populus* in Arizona. The larva feeds in the bark. Collected by M. Chrisman. Only the larval skin is available Hopk. U. S. 10339a.

**LIOPUS VARIEGATUS** Haldeman

[Pl. XXIV, fig. 6]

*Form* more robust; integument finely alutaceous, shining. Mandible slender, twice as long as basal width; pronotum anteriorly shining, bearing hairs only across anterior border and lateral anterior angles, posteriorly faintly reticulated except for a very narrow transverse band of velvety pubescence, extending farther forward along median line; ampullae irregularly tubercula e pleural tubercles normally bearing three setae.

[Described from specimens Hopk. U. S. 9784a<sup>1</sup>.]

This species is an intermediate form between *Leptostylus* and *Liopus*, the posterior velvety pubescence of the pronotum and the absence of hairs over the entire anterior area suggesting a closer affinity with *Leptostylus*.

The larval habits of this species are similar to those of *Leptostylus macula*. It has been reared from *Castanea*, *Juglans*, *Morus*, *Ulmus*, *Robinia*, and *Celastrus*. Range, throughout the eastern United States and Canada.

## LIOPUS ALPHA Say

*Form* slender, subdepressed; integument firm, often finely granulate, shining, sparsely clothed with very fine whitish hairs.

*Head* slender; twice as long as anterior width, depressed, sides slightly constricted about middle; labrum transverse, about one and one-half times as wide as long, gradually rounded from just before posterior extremities, anterior half finely hairy; mandible rather robust, from side about one and one-half times as long as basal width, base dull granulate, cutting edge obliquely emarginate; antennal ring open behind; one pair of prominent ocelli. Ventral mouth-parts thin, mentum transverse, last joint of maxillary palpi one and one-half times as long as second, first and second subequal, shorter than last labial; ligula slender; anterior edge of hypostoma slightly curved; gula indistinct.

*Prothorax* trapezoidal, slightly depressed, widest behind; pronotum anteriorly shining, regularly and sparsely haired, posteriorly shining, irregularly reticulated and striate; prosternum hairy, eusternum and sternellum shining, roughened; mesonotum and metanotum finely alutaceous to granulate, the latter faintly tuberculate, mesosternum and metasternum alutaceous to faintly tuberculate.

*Abdomen.* Dorsal ampullae irregularly tuberculate in two indistinct rows, broken in middle; epipleurum protuberant on last three segments, tubercle oval, and bisetose, a faint chitinous pit at each end. Spiracles orbicular, about size of ocellus, not chitinous rimmed.

*Pupa.* Form as adult, in life pinkish red in colour; body covered with slender setigerous points as follows: two at each angle of base of labrum, and fourteen on front of head; five across anterior pronotum, middle ones small, two on lateral protuberance; mesonotum and metanotum glabrous; fine points on abdominal terga, last segment bearing four large ones.

[Described from specimens Hopk. U. S. 12298.]

A number of colour forms of this species have been reared, notably brown from *Rhus*, gray from *Hicoria*, and black from *Castanea* and *Quercus*. The larvae show some slight differences, but until more material is available for a thorough study no attempt will be made to separate them. These forms all breed in small dead twigs, pupating in the wood. They have been reared also from *Acer*, *Celastrus*, *Celtis*, *Morus*, *Diospyros*, *Robinia*, *Juglans*, and *Ampelopsis*.

## LIOPUS PUNCTATUS LeConte

Similar to *L. alpha*; the mandibles are shorter and entirely finely granulate; labrum twice as wide as long, anterior edge nearly straight for a short distance; posterior area of pronotum marked with large reticulations though lines are fine; eusternum also so marked; tubercles on ampullae confluent.

[Described from specimens Hopk. U. S. 9789e.]

This larva is commonly found in persimmon twigs girdled by *Oncideres*. It feeds under the bark and in the outer sapwood, extending the burrow into the pith, where it pupates. It has been reared also from Virginia creeper (*Ampelopsis*), *Cornus*, and plum trees (*Prunus*).

Range, from Virginia southward.

## HYPERPLATYS ASPERUS Say

*Form* subcylindrical, slender; integument very finely granulate, shining, sparsely clothed with fine whitish hairs.

*Head* depressed, exposed portion finely granulate, sides slightly tapering; anterior margin of labrum roundly curved from behind middle, one and one-half times wider than long; mandible slender, twice as long as wide, basal half finely granulate; antennal cavity open; one pair of ocelli. Maxillary palpi slender, last joint slightly shorter than two basal joints, shorter than last labial; mentum distinct, transverse, not sunken; anterior edge of hypostoma roundly curved; gula not protuberant.

*Pronotum* smooth, shining except for very narrow posterior border of dull fine granulations, sometimes extending over one-third of the area.

*Ampullae* tuberculate, the tubercles arranged in two irregular rows; pleural tubercle, with two very distinct chitinous pits and several setae. Spiracles orbicular, about the size of the ocellus, rather strongly rimmed. No caudal spine.

*Pupa.* Form as in adult; about 20 small setigerous points on front of head (including base of antennae), a row of 10 on anterior margin of pronotum, and a group on anterior lateral angles; mesonotum and metanotum glabrous; an irregular median group on abdominal terga (these very small), larger ones on penultimate segment and still larger ones (about 8) on last segment.

[Described from specimens Hopk. U. S. 9778m.]

A large series of this material has been reared in which two forms of adults are found, each being constant in the same food plant in the same locality. An equally large series of larvae, however, show no constant differences. The larvae mine under moist bark, making a short pupal cell in the sapwood plugged with a wad of fibrous frass. The adult emerges through the same hole through which the larvae entered the wood. One complete and a partial second generation occur each year under favourable conditions. Larvae and adults have been collected throughout the eastern and central western United States and Canada from *Rhus*, *Castanea*, *Cornus*, *Tilia*, *Juglans*, *Celtis*, *Alnus*, *Celastrus*, and *Prunus*. Adults fly from April to June.

#### LEPTURGES SYMMETRICUS Haldeman

[Pl. XVI, fig. 1; Pl. VII, fig. 5]

*Form* sub-depressed, slender; integument firm, shining, very finely wrinkled, sparsely clothed with fine whitish-yellow pubescence.

*Head* depressed, exposed parts finely granulate, sides tapering gradually posteriorly; labrum very broadly oval, little wider than long; mandible slender, finely granulate at base, about twice as wide as basal width, cutting edge dull, obliquely rounded; antennal cavity open behind, a slight projection above; one pair of large ocelli. Ventral mouth-parts thin; mentum distinct, not sunken, twice as wide as long, it and stipes finely granulate; last joint of maxillary palpi longer than second, about equal to or slightly shorter than basal and last labial; anterior edge of hypostoma slightly curved; gula not distinct.

*Prothorax* trapezoidal, widest behind; pronotum entirely shining, finely reticulated to alutaceous, a few scattered hairs anteriorly; sternum shining, rugulose, wrinkled, hairy, eusternum and sternellum glabrous. Mesonotum shining, finely wrinkled; metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* shining, subcylindric; ampullae bearing two transverse rows of tubercles; epipleurum protuberant on last three segments; pleural tubercles large, oval, having two chitinous pits and from 3 to 4 setae. Spiracles orbicular, smaller than ocellus, peritreme slightly chitinized. The last abdominal tergum bears a long, very slender, acute, curved, chitinous spine.

[Described from specimens Hopk. U. S. 9778v.]

Working under moist decayed bark the larvae either enter the sapwood or bark to pupate. This species breeds most commonly in *Juglans* but also in *Hicoria*, *Celtis*, *Morus*, and *Castanea*. The adults are found throughout the Eastern United States and Canada during June and July.

#### LEPTURGES SIGNATUS LeConte

A single specimen of this larva, Hopk. U. S. 9789s, shows no decided differences from *symmetricus*. It was collected at Cedar Mountain, N.C., under the bark of *Acer* by the author.

#### LEPTURGES QUERCI Fitch

*Form* subdepressed, slender; integument firm, smooth, shining, sparsely clothed with fine, whitish hairs.

*Head* depressed, sides gradually tapering posteriorly, exposed parts finely granulate; mandible slender, finely granulate at base; antennal cavity closed; one pair of very large ocelli. Ventral mouth-parts thin; mentum distinct, not sunken; maxillary palpi two-jointed, last joint longer than basal; gula not distinct.

*Prothorax* trapezoidal, widest behind; pronotum anteriorly finely granulate and hairy, posteriorly faintly and sparsely striate; eusternum shining, glabrous. Mesonotum shining. Metanotum tuberculate.

*Abdomen* shining; dorsal ampullae bearing two rows of regular tubercles; epipleurum protuberant on last three segments; pleural tubercle large, subrectangular, no chitinous pits. Spiracles very small, orbicular, peritreme chitinized; no caudal spine.

*Pupa*. Form as in adult; a group of 18 to 20 long setae on front of head and at base of antennae; a few scattered finer ones on pronotum; mesonotum and metanotum glabrous; first few abdominal terga with a very few very small chitinous points, becoming more dense on posterior ones, last segment armed with 4 or 5 longer points.

The larva feeds under the bark and often through the sapwood, constructing the pupal cell in the wood or bark of *Juglans*, *Castanea*, *Oxydendron*, *Celastrus*, and apple (*Malus*). Adults are collected throughout the eastern United States from May to June. Observations by A. D. Hopkins, W. F. Fiske, A. B. Champlain, and the author.

## LEPTURGES SPERMOPHAGUS Fisher

Distinguished from *querci* by the more robust form and fine velvety pubescence on the posterior area of the pronotum. The ampullar tubercles are not so regular and are more deeply divided by a longitudinal depression.

[Described from specimens in the United States National Museum collected by D. L. Crawford at Tampico, Mexico.]

The larvae feed on the seeds of cowpeas (*Vigna*).

These species, *L. querci* and *L. spermophagus*, are strikingly different from *symmetricus*-like forms. The closed antennal ring, two-jointed maxillary palpi, absence of chitinous pits on pleural tubercle, and absence of caudal spine are certainly of generic value, and would be sufficient criteria for separating them into a new genus. They are very closely allied to *Pogonocherus* and *Ecryus*.

## ACANTHOCINUS Stephens

*Form* depressed; head strongly depressed, sides suddenly constricted before middle; mandible slender from side, length about three times basal width; antennal ring slightly notched or angulate but not distinctly bisected by frontal suture; mentum distinct; gula not protuberant. Posterior area of pronotum finely, velvety pubescent; ampullae not tuberculate, velvety pubescent, dull; pleural tubercle broadly oval, bearing two chitinous pits and numerous setae. Spiracles orbicular.

The species of this group, like *Monochamus*, are all pine feeders and are invariably associated in the same trees with them. Although often confused with *Monochamus*, *Acanthocinus* is strictly a genus of bark-feeding species. The whole larval period is passed in the bark proper, or in some species beneath the bark, the larvae never penetrating into the sapwood, except occasionally in one species, *A. obliquus*, to pupate. The eggs are laid in a deep pit gnawed by the female, or in scolytid holes, the young larvae soon penetrating into the deeper layers of bark. Pupation takes place near the surface in the dryer tissues. All species normally mature in one season. Many larvae are destroyed by predatory enemies, clerids and trogositids. They are important in destroying *Dendroctonus* spp. Attacking the trees shortly after the bark-beetles, their extensive mines destroy the inner bark and food supply of these beetles. Large numbers of the broods are thus destroyed.

## KEY TO DESCRIBED SPECIES OF ACANTHOCINUS

- Last joint of maxillary palpi much shorter than second; first joint of labial palpi twice as long as last; mentum with four or more setae on each side.  
 Anterior margin of labrum regularly rounded. (Western).....*A. spectabilis*  
 Anterior margin of labrum straight or emarginate. (Eastern).....*A. nodosus*  
 Last joint of maxillary palpi about as long as second; first joint of labial palpi not twice as long as last; mentum never bearing more than two setae on each side.  
 Eusternum and sternellum of prothorax smooth, shining. (Eastern).....*A. obsoletus*  
 Eusternum and sternellum of prothorax roughened. (Western).....*A. obliquus*

## ACANTHOCINUS NODOSUS Fabricius

*Form* elongate, strongly depressed, slightly tapering posteriorly; integument firm, rather densely beset with fine yellowish-white hairs.

*Head* very strongly depressed, sides suddenly constricted before middle; anterior margin very darkly chitinized; epistoma abruptly declivous, faintly carinate; labrum transverse, about twice as long as wide, anterior margin very finely and densely ciliate; mandible very slender, elongate from side, three times the condylar breadth, apex squarely emarginate; antennal ring angulate behind; ocelli not conspicuous. Ventral mouth-parts elongate; mentum twice as wide as long, distinct; maxillary palpi acutely conical, last joint little more than one-half length of second, shorter than last labial, first labial twice as long as last; anterior edge of hypostoma straight, abrupt; gula not distinct.

*Prothorax* strongly depressed, about twice as wide as long; pronotum anteriorly shining, bearing a dense row of very short and fine hairs, posterior two-thirds velvety pubescent, except for numerous small glabrous spots; presternum densely hairy anteriorly; eusternum and sternellum shining, strongly reticulated; mesonotum shining except for anterior margin, reticulated; metanotum, mesosternum and metasternum bearing two transverse rows of velvety pubescence.

*Abdomen*: Ampullae broad, flat, very finely asperate, pubescent; epipleurum strongly protuberant only on last three segments, tubercle oval, a chitinous pit at each extremity and numerous setae; middle abdominal spiracles orbicular, last rarely broadly oval. Anus trilobed.

*Pupa*. Form as in adult. Pronotum bearing a few short chitinous points and many long slender hairs; mesonotum and metanotum glabrous; each abdominal tergum bearing a transverse row of chitinous reflexed points, more numerous at each side of median line; a group on ovipositor near base, and extremity of ovipositor bearing a circle of small incurved points.

[Described from specimens Hopk. U. S. 3475.]

The larval habits have been described under the genus. The species occurs from Virginia southward through Texas. The larvae are very abundant, but the adult so closely resembles the bark on which it occurs that it is not commonly collected. Pupation takes place from May until July. Based on observations of A. D. Hopkins, J. L. Webb, H. E. Burke, and the author.

#### ACANTHOCINUS SPECTABILIS LeConte

[Pl. XIII, fig. 4]

The hairs covering the body are usually whitish and much finer (silky) than in *nodosus* (this is best observed on the anal lobes). The fine asperities of the ampullae are not individually distinguishable with a "Zeiss-4 eyepiece," A<sup>o</sup> objective; while in *nodosus* they can be. The anterior margin of the labrum is uniformly rounded, while in *nodosus* it is straight or slightly emarginate for a short distance.

*Pupa*. Similar to *nodosus*, but the chitinous points on the abdominal segments do not extend across and are not so numerous.

[Described from specimens Hopk. U. S. 10077c.]

This species occurs through the western United States and Canada, but is more abundant in the southwest. The adult flies from April to August.

#### ACANTHOCINUS OBSOLETUS Olivier

In form and general structure similar to *nodosus*, but much smaller. Last joint of maxillary palpi equal in length to second (not shorter); first joint of labial palpi not twice as long as last. Proeusternum and sternellum smooth, shining; anterior border of hairs across protergum relatively longer.

*Pupa*. Distinguished from *spectabilis* by the smaller size and absence of chitinous points on the pronotum.

[Described from specimens Hopk. U. S. 6332a.]

This species has a wider range than the other species of the genus, extending from Texas northward through the New England States and west into Michigan. Pupation occurs from April to July, according to latitude.

#### ACANTHOCINUS OBLIQUUS LeConte

Structurally similar to *obsoletus*. The matured larva is much smaller, and both the velvety asperities and the pubescence are coarser and darker. Proeusternum and sternellum of prothorax slightly roughened.

[Described from specimens Hopk. U. S. 11917a.]

This species occurs through the Rocky Mountains and Pacific Coast regions in *Pinus*. It often works in the inner bark of pines, pupating in the outer layers of sapwood. The adults fly from April to August. A. B. Champlain has recorded it from *Picea parryana*.

#### GRAPHISURUS Kirby

In general similar to *Acanthocinus*. Readily distinguished by the flattened chitinous process on the last abdominal tergum. Mandibles shorter, rarely more than twice the condylar width. Head relatively narrower.

The species of *Graphisurus* are all hardwood feeders. The larvae feed between the bark and wood, pupating in the sapwood, in the bark, or between the bark and wood.



**GRAPHISURUS FASCIATUS** DeGeer

[Pl. XVI., fig. 6; Pl. VII, figs. 3 and 4; Pl. XXXII, fig. 3.]

*Form* depressed, elongate; integument firm, very finely rugulose, rather densely clothed with yellowish white hairs.

Sides of head narrowed before middle; labrum thin, anterior edge broadly rounded, densely hairy; antennal ring angulate; ocelli not visible; last joint of maxillary palpi equal to second, longer than last labial.

*Prothorax* rectangular, depressed; pronotum anteriorly shining, bearing a transverse band of dense hairs, posteriorly velvety pubescent; eusternum velvety pubescent, as also sternellum except for a median glabrous area. Mesonotum, metanotum, mesosternum and metasternum dull velvety pubescent.

*Abdomen.* Ampullae velvety pubescent; pleural tubercle broadly oval, bearing two chitinous pits (ventral often obscure) and numerous fine hairs. Posterior dorsal margin of ninth abdominal segment bearing a small transverse, flattened, chitinous process. Spiracles orbicular.

*Pupa.* Form as in adult; groups of chitinous points arranged as follows: A group at each basal angle of pronotum; a curved band across metatergum; an irregular, transverse posterior band and an anterior median group on each abdominal tergum, and a group on basal half of ovipositor.

[Described from specimens Hopk. U. S. 11806a.]

The larvae feed between the bark and wood of a great variety of hardwoods. They prefer to attack trees the season after their death, provided a certain amount of moisture is present. They are often found in great numbers in a single tree. It has been collected from *Castanea*, *Fagus*, *Quercus*, *Hicoria*, *Liquidambar*, *Acer*, *Juglans*, *Tilia*, and *Betula* throughout the eastern United States and Canada. Pupation takes place from March to July, usually in the earlier months.

**GRAPHISURUS HEBES** Casey

Closely resembling *G. fasciatus*. The specimens examined have the anterior edges of the epistoma and hypostoma produced in a faint carina; proecosternum shining; ampullae wrinkled or semi-tuberculate.

[Described from specimens Hopk. U. S. 9771.]

The adult of this species is of a much lighter colour. It has been taken only from *Hicoria* and pupates in the bark proper. Range, Northeastern United States and Canada.

**GRAPHISURUS TRIANGULIFER** Haldeman

Resembles *G. fasciatus* but the caudal process is much larger and the eusternum and the central area of the sternellum are shining and wrinkled.

[Described from a single poor specimen in the U. S. National Museum.]

Collected under the bark of *Celtis*, Columbus, Texas. Probably this is the same specimen which Packard (23) described. Riley (27) gives a brief note on the food habits of this species.

**NYSSODRYS HALDEMANI** LeConte

[Pl. XII, fig. 7]

*Head* depressed, widest a little distance behind the epistoma (i.e., slightly tapering both anteriorly and posteriorly); mandible slender, several times the length of the condylar width; labrum twice as wide as long, sparsely haired; antennal ring closed; ocelli not distinct; gula indistinct, very shallow.

*Posterior* area of pronotum velvety, having a border of hairs across anterior area; eusternum and median area of sternellum glabrous, wrinkled; metanotum, mesosternum, and metasternum faintly tuberculate, bordered with velvety pubescence.

*Ampullae* irregularly tuberculate; spiracles orbicular. Ninth tergum bearing a very minute flattened median process on posterior border.

*Pupa.* Resembles *Graphisurus* except that the pronotum, mesonotum, metanotum, head at base of antennae and the femoral-tibial articulation are beset with a group of long stiff setae; abdominal terga beset with fleshy papillae, each bearing a silky hair.

[Described from specimens in the U. S. Bureau of Entomology collection No. 3342.]

The larvae were taken from *Celtis* in Missouri.

Very similar to *Graphisurus* except that the caudal spine is extremely minute, scarcely distinguishable with a high-power lens. The ampullae are distinctly tuberculate, consisting of several irregular rows, the dorsal bordered with velvety pubescence.

#### GRAPHISURUS sp.

A larva is present in the collection very similar to *Graphisurus fasciatus*, but it may be distinguished by the absence of a caudal spine, the somewhat coarser pubescence on pronotum and ampullae and by the fact that the last joint of the maxillary palpi is shorter than the penultimate and still shorter than the last labial. The texture is finely granulate.

The antennal ring is distinctly open behind and suggests that this is a normal feature of the group.

[Described from specimens Hopk. U. S. 10075g.]

Collected from *Quercus* in Arizona.

#### CERATOGRAPHUS sp.

From a larval skin (the only available material) this species plainly is related to *Graphisurus*, etc. The antennal ring is open behind and the last joint of the maxillary palpus is longer than either of the basal joints; the basal joints are about as wide as long.

[Described from specimens Hopk. U. S. 9901z.]

Collected from *Pinus* in Colorado.

The species of *Pogonocherus*, *Ecyrus*, and *Cyrtinus* all show many characters in common and are here considered related. They have the robust cylindrical form; closed antennal ring; last joint of maxillary palpus exceptionally long; glabrous, striate pronotum and eusternum; bilobed ampullae indistinctly tuberculate; and usually a caudal process or spine.

#### ECYRUS DASYCERUS Say.

[Pl. V, fig. 9; Pl. XII, fig. 1; Pl. XXIV, fig. 4; Pl. XXXI, fig. 2]

*Form* subcylindrical, tapering posteriorly, then laterally compressed; integument very smooth, shining, sparsely clothed with fine whitish hairs.

*Head* rather thick, sides parallel; labrum thin, broadly oval, widest at middle, nearly glabrous; mandible short, shining except for a band of coarse granulation on outer face, very acute, dorsal angle abruptly toothed; antennal cavities closed; one pair of small ocelli. Ventral mouth-parts fleshy; mentum distinct, narrow, transverse, sunken; maxillary palpi slender, last joint much longer than second, longer than last labial; hypostoma somewhat bulging transversely; gula indistinct.

*Prothorax* thick, trapezoidal, widest behind; pronotum posteriorly shining, very finely striate, anteriorly regularly, densely and finely haired; sternum hairy except for embossed diamond-shaped, smooth, shining eusternum and shining sternellum. Metanotum, mesosternum, and metasternum finely wrinkled, shining.

*Abdomen* rather compressed; ampullae with a broad median longitudinal furrow, subtuberculate at lateral extremities; epipleurum protuberant on last three segments, tubercle very small, abruptly projecting, oval, no chitinous pits and only one slender seta. Ninth tergum armed with a short, small, triangular process.

[Described from specimens Hopk. U. S. 12254.]

This larva is a true wood-feeder, mining small but extensive burrows through the dry sapwood and heartwood of branches and larger limbs. The mines are tightly packed with fine, rather granular frass. Dry seasoned limbs on the trees are preferred. It has been collected throughout the eastern and southwestern United States from *Castanea*, *Quercus*, *Robinia*, *Prosopis*, *Celtis*, *Acer*, *Paulownia*, and *Ampelopsis*. The adult flies from April to July.

**POGONOCHERUS** Latreille

Small, sub-cylindrical species; head thick, sides slightly constricted behind middle; mandible short, granulate on outer face; antennal ring closed; mentum distinct, sunken, narrow, maxillary palpi two-jointed (in *P. negundo*, three-jointed); gula not evident; posterior area of pronotum shining; ampullae with a broad longitudinal median furrow, feebly tuberculate; pleural tubercle abruptly protuberant, no chitinous pits and one seta; ninth tergum bearing a chitinous process or plate.

The species of *Pogonocherus* are very similar in habits to those of *Eupogonius*. They feed under the bark of recently dead hardwoods and conifers (chiefly the latter), making a small *Monochamus*-like pupal cell in the sapwood, plugged at both ends with fibrous chips. The larval period extends through one season. Rather moist conditions are required.

**POGONOCHERUS NEGUNDO** Skinner

Distinguished from *Ecyrus dasycerus* by the coarser body hair and the absence of all tuberculation on the metanotum and ampullae, which are smooth and shining; last joint of maxillary palpi twice as long as second and mandible entirely granulate on outer face.

[Described from specimens Hopk. U. S. 10386a.]

These larvae were collected by M. Chrisman mining in dead and dying branches of boxelder (*Acer*) in the Catalina mountains of Arizona. The mines were rather extensive, meandering through the heartwood. Pupation takes place in a cell in the sapwood. The work is very suggestive of that of *Ecyrus dasycerus*.

The fact that this species of *Pogonocherus* so closely resembles *Ecyrus dasycerus* and like it, has the three-jointed maxillary palpi, would suggest either that it should be included in that genus or that the two genera should be grouped.

**POGONOCHERUS MIXTUS** Haldeman

[Pl. XVII, fig. 19; Pl. VII, figs. 1 and 2]

*Form* cylindrical; integument very finely granulate, shining, sparsely clothed with fine, whitish-yellow hairs.

*Head* rather thick, sides slightly constricted behind middle; clypeus finely granulate; labrum roundly rectangular, about one and one-half times as wide as long, sparsely ciliate in front; mandible not twice as long as basal width, finely granulate on outer face, cutting-edge obliquely truncate; antennal ring closed; one pair of distinct ocelli. Ventral mouth-parts rather thick; mentum little wider than long, distinct, sunken; maxillary palpi two-jointed, last joint longer than last labial; hypostoma slightly bulging transversely.

*Prothorax* trapezoidal, thick, widest behind; pronotum posteriorly finely reticulated, shining, anteriorly very finely rugulose, regularly and finely haired; sternum hairy, shining; sternellum rather broad, smooth, shining; mesonotum and metanotum finely rugulose, reticulated, shining; mesosternum and metasternum smooth.

*Abdomen:* Ampullae with a deep, broad, longitudinal median impression, wrinkled but not tuberculate; epipleurum protuberant on last segments, tubercle small, oval, abruptly projecting, no chitinous pits, one seta; ninth abdominal tergum bearing a large, oval, longitudinally carinate plate considerably smaller than labrum. Spiracles very small, orbicular, slightly chitinous rimmed.

*Pupa.* Form as in adult; remarkable for not having a chitinous process or spine or body except an acute conical one on last abdominal tergum. Coarse hairs in two groups on mesonotum and metanotum.

[Described from specimens Hopk. U. S. 11853b.]

This species feeds in various branches of *Pinus* and *Picea* throughout the eastern and central western United States and Canada. The adult flies throughout June and July.

**POGONOCHERUS PENCILLATUS** LeConte

Similar to *mixtus* but the ampullae are more decidedly tuberculate and the caudal spine is reduced to a mere point or one or two carinae.

[Described from specimens Hopk. U. S. 3771.]

These larvae were collected in *Picea* at Grand Island, Michigan, by W. F. Fiske.

## POGONOCHERUS sp.

This larva resembles *mixtus* but the carinae on the caudal plate are very pronounced, five or six in number, and the ampullae are more tuberculate than wrinkled.

[Described from specimens Hopk. U. S. 10061b.]

The larvae feed under the bark of dead branches of *Pinus flexilis*, working as *mixtus*. Collected by A. B. Champlain at Cascade, Colo.

## POGONOCHERUS SALICOLA Casey

[Pl. VII, fig. 8]

Differs from *mixtus* in the finer whitish hairs on body and in the fact that the caudal plate is about the same size as labrum and the carinae much coarser and from six to ten in number; spiracles hardly visible, peritreme not chitinous rimmed.

*Pupa.* Hairs very fine whitish, caudal spine not chitinous.

These specimens were kindly given the author by C. A. Frost. They were collected in dying *Salix* at Framingham, Mass. This species has also been collected by A. B. Champlain in *Salix* at Colorado Springs, Colo. (Hopk. U. S. 10072a.)

## POGONOCHERUS CALIFORNICUS Schaeffer

*Form* more robust; posterior area of pronotum finely and irregularly longitudinally striate; sternum glabrous, very smooth; caudal process a blunt triangular point.

[Described from specimens Hopk. U. S. 2771.]

This larva has been reared from *Pinus* and *Picea* in Ventura Co., California. Notes by A. D. Hopkins.

## CYRTINUS LeConte

LeConte and Horn (20) have placed this genus in a distinct tribe near *Psenocerus*. Lacordaire (19) has retained this tribe, but places it following the Acanthocinidae. Its larval affinities are evidently close to *Psenocerus*, and since the Apodasyides of Lacordaire, including *Psenocerus* and *Eupogonius*, are related to the Pogonocherides, it is placed near them.

## CYRTINUS PYGMAEUS Haldeman

[Pl. XII, fig. 9; Pl. XXIV, fig. 1; Pl. XLII]

*Form* cylindrical, cuneate; integument thin, shining, very sparsely beset with fine, short whitish hairs.

*Head* depressed, twice as long as wide, sides suddenly constricted near base; epistoma thin, straight; labrum roundly rectangular, about one and one-half times as wide as long, widest at base; mandible slender from side, about twice as long as basal width, shining, cutting edge deeply emarginate, dorsal angle bluntly toothed; antennal ring closed; no ocelli. Ventral mouth-parts not chitinized; maxillary palpi two-jointed, last joint twice as long as basal, longer than last labial; ligula wide; gula indistinct.

*Prothorax* roundly quadrate; pronotum anteriorly smooth, shining, posteriorly not well defined at sides, with a median, smooth, shining, protuberant area, bounded by two rows of pinnately oblique striae on each side, these arising from two longitudinal impressions.

*Ampullae* bearing two transverse rows of very small tubercles. Spiracles orbicular. No caudal spine.

[Described from specimens Hopk. U. S. 10082k and 11845a.]

This larva lives under the dry dead bark of a variety of hardwood twigs. It has been collected from *Quercus*, *Hicoria*, *Cornus*, *Liriodendron*, *Robinia*, and *Acer*. The larvae make a very short meandering gallery before pupating in a convex oval cell scarred into the wood. Several generations of adults appear during the summer, the first emerging about the time the oak leaves are half-formed. Observations by A. B. Champlain and the author.

## HOPLOSIA Mulsant

The striking resemblance of this larva to *Acanthoderes*, both in form and general structure, is at once apparent, and the author believed at first that it was related to this genus. The large pores on the pleural tubercle also confirmed this opinion, but the ampullae resemble those of such forms as *Pogonocherus*, while the open antennal cavity suggests *Eupogonius*; so also do the pupal characters. It may be regarded as representing a form intermediate between these genera. The peculiar carina on the anterior margin of the front is found nowhere else in the subfamily except in *Oncideres*.

## HOPLOSIA NUBILA LeConte

*Form* robust, cylindrical; integument tough, shining, rather thickly beset with coarse reddish hairs.

*Head* depressed, sides very slightly constricted before middle; epistoma abrupt, bearing a transverse row of 18 to 20 coarse carina; labrum thin, roundly rectangular, anterior half beset with short stiff hairs; mandible about twice as long as basal width, cutting-edge weakly emarginate; antennal ring closed; ocelli distinct. Ventral mouth-parts thick; mentum distinct, sunken, about twice as wide as long; last joint of maxillary palpi conical, about equal to penultimate, shorter than last labial; gula indistinct.

*Prothorax* rectangular; pronotum rectangular, posteriorly rugulose; eusternum distinct, triangular, rugulose and coarsely haired; metanotum and metasternum tuberculate.

*Abdomen.* Ampullae rather flat, broad, with a shallow impression in middle, dividing two groups of very large, irregularly disposed tubercles; epipleurum protuberant only on last three segments, tubercles very large, broadly oval, having two exceptionally large chitinous pores and two setae, one much longer than the other. Spiracles orbicular, large, peritreme strongly chitinous.

*Pupa.* Form like that of adult; head bearing a few long setae; setigerous tubercles on pronotum in a dense row on anterior margin, a few on lateral margin, two groups on disc, and one on median posterior margin; mesonotum and metanotum each with a scattered group; abdominal terga armed with a transverse row of short, acute, recurved, subulate, chitinous points; last tergum bearing an acuminate, erect spine, and a smaller one on lateral margin.

[Described from specimens Hopk. U. S. 11869f.]

The larva feeds between the bark and wood of decaying linden (*Tilia*) logs. The matured larva enters the moist sapwood to make a short, broad pupal cell plugged at the entrance with a wad of coarse fibrous frass. It is often associated with *Acanthoderes*, and the work can scarcely be distinguished from species of that genus. The adult occurs throughout the northeastern United States and Canada. Larvae have been collected by H. S. Barber, J. N. Knull, and the author.

## Tribe APODASYIDES

Lacordaire (1869) has included in this tribe our genera *Psenocerus* and *Eupogonius*. The larvae resemble each other in form, in the shining, weakly striate pronotum, and in the two rows of tubercles on the ampullae. For the present this position is held tenable. *Psenocerus*, however, very strongly suggests *Oncideres*, and might equally well be placed as a related genus, while *Eupogonius* shows affinities to the Pogonocherides.

## EUPOGONIUS LeConte

*Form* cylindrical, elongate; head depressed, widest just behind anterior margin, sides strongly constricted behind middle; antennal cavity open; one pair of ocelli; mentum distinct, sunken; pronotum posteriorly shining, strongly longitudinally striate. Ampullae bearing two rows of regular tubercles; epipleurum protuberant on last abdominal segments, tubercles 4-setose, no chitinous pits.

The species of *Eupogonius* feed in the dead branches and twigs of both hardwoods and conifers. The young larvae mine the first season under the bark, the following season entering the wood to form a U-shaped pupal cell lying in the same plane as the grain of the wood; both ends are plugged with fibrous chips. The adult emerges from the opposite end through which it entered. The work resembles that of a minute *Monochamus*. Observations on all caged material show that the species often pass two seasons in the larva stage.

## EUPOGONIUS TOMENTOSUS Haldeman

[Pl. V, fig. 3; Pl. XIII, fig. 6; Pl. XXIV, fig. 14; Pl. XVI, fig. 7]

*Form* cylindrical, elongate; integument firm, smooth, shining, very sparsely clothed with yellowish brown hairs.

*Head* depressed, widest just behind anterior margin, tapering anteriorly and strongly constricted about middle; labrum widest at base, roundly rectangular, a very few short hairs on anterior margin; anterior margin of clypeus flatly granulate; antennal cavity open; one pair of distinct ocelli; mandible about one and one-half times as long as basal width, finely granulate, cutting edge deeply emarginate. Ventral mouth-parts rather thick; mentum distinct, one and one-half times as wide as long, finely granulate; stipes finely granulate; last joint of maxillary palpi longer than second, about equal to basal, shorter than last labial; anterior edge of hypostoma strongly curved, finely granulate; gula indistinct.

*Prothorax* rectangular, thick, widest behind; protergum anteriorly smooth, shining, having a border of short, stiff hairs and a few just in front of posterior striate area; prosternum beset with stiff hairs, finely granulate except for shining eusternum and sternellum; mesonotum shining; metanotum, mesosternum, and metasternum tuberculate.

*Abdomen* cylindrical, ampullae having two well marked rows of regular tubercles, not divided in middle; epipleurum protuberant on all segments, tubercle very large, oval, four setae, no chitinous pits. Spiracles orbicular, smaller than ocellus, chitinous rimmed.

*Pupa*. Form like that of adult; armed with stiff, short setae as follows: A central group on pronotum, two on each side of anterior margin, and two groups of about four on posterior margin; mesonotum and metanotum each with two converging rows; two transverse bands of three or four each on first six abdominal terga; last segment bearing a strong acute, recurved spine.

[Described from specimens Hopk. U. S. 12295b.]

The habits are as described under the genus. It occurs throughout the eastern United States and Canada in *Pinus*, *Picea*, and *Cedrus deodar*. Adults fly in July and August.

## EUPOGONIUS VESTITUS Say.

Very similar to *tomentosus*, except that the band of hair on anterior protergum is not continuous across the segment and these hairs are finer.

*Pupa*. Similar to *tomentosus*, except that only the disc of pronotum has setae and these are arranged in more or less of a circular manner.

Habits similar to those of *tomentosus*. Reared from *Morus*, *Cornus*, *Juglans*, *Cercis*, *Celastrus*, *Acer*, *Fraxinus*, and *Asimina*.

## PSENO CERUS SUPERNOTATUS Say.

[Pl. XIII, fig. 1; Pl. XXIV, fig. 8; Pl. XVI, fig. 4]

*Form* cylindrical, elongate; integument firm, shining, or very finely wrinkled, beset with very short, fine, whitish hairs, denser and reddish-brown on prothorax and last abdominal segments.

*Head* rather thick, oval in cross section, suddenly constricted near base; mouth-frame, gena, and hypostoma rather heavily chitinized, yellowish brown; epistoma straight, thin; labrum roundly rectangular, twice as wide as long, widest at middle; mandible dull granulate, rather short, about one and one-half times as long as basal width, cutting-edge obliquely emarginate, angles rounded; antennal ring open behind; one pair of distinct ocelli. Ventral mouth-parts rather full, last joint of maxillary palpi as long as two basal joints, equal to last labial, both chitinized; ligula large, distinct; mentum not distinct; hypostomal area sharply rectangular, transversely protuberant, quite heavily chitinized, finely granulate; gular suture a faint line.

*Prothorax* roundly rectangular, thick; pronotum defined by lateral sutures behind, anteriorly marked by broad, light ochraceous band, longitudinally carinate in middle, posteriorly protuberant, white, shining, bearing a few faint longitudinal striae; sternum anteriorly and laterally bearing two pairs of light ochraceous spots; eusternum distinct, shining, beset with a number of hairs; mesonotum smooth; metanotum, mesosternum and metasternum tuberculate.

*Abdomen* bearing prominent ampullae on seven segments, these armed with two rows of regular tubercles; epipleurum protuberant only on last three segments, tubercle narrowly oval, elongate, no chitinous pits; ninth segment fringed with long dense hairs, the tergum bearing a very short, cylindrical, truncate process; anus trilobed. Spiracles orbicular, strongly chitinous rimmed, distinct.

*Pupa*. Form as in adult; pronotum bearing two anterior transverse rows of hairs; mesonotum and metanotum glabrous, shining; abdominal terga bearing two rows of setigerous papillae, last segment more densely hairy, ventral areas glabrous.

[Described from specimens Hopk. U. S. 9784f.]

This larva feeds in dead decaying branches of *Celastrus*, *Hicoria*, *Castanea*, *Liquidambar*, *Rhus*, *Lonicera*, *Euonymus*, *Cornus*, and *Ribes*. It is most abund-

ant in *Celastrus*. The larvae extend their mines under the bark for a short time, then go into the wood, and pupate in early spring in a cylindrical cell in the pith. Range, throughout the eastern and central western United States and Canada.

#### SAPERDA Fabricius

Elongate, cylindrical species; head depressed, sides nearly parallel, base broadly rounded; antennal annulae closed; mandible slender, about twice as long as basal width, cutting edge obliquely emarginate; mentum not defined posteriorly, sunken. Pronotum oblique, anteriorly chitinized, posteriorly covered with coarse recurved asperities; eusternum roundly trapezoidal, usually asperate, distinct; ampullae finely asperate, bearing two transverse impressions meeting distally; epipleurum protuberant on all segments, tubercles oval, multisetose, no chitinous pits. spiracles broadly oval, peritreme rather heavy; no caudal armature.

The species of *Saperda* are easily recognized as larvae in which the body armature of chitinous asperities has reached its highest development. This characteristic seems to be confined to those species or genera in which the larvae attack living tissue and is no doubt more of an adaptive character than almost any other. This armature superficially would confuse them with *Oberca*, *Mecas*, and such genera, but they suggest quite a different relationship and appear to have branched from a *Goese*-like stock.

Taken as a whole, the species feed principally on living plants and, as would be expected, are very strictly confined to a certain host. A wide variety of habits is exhibited, from gall-making to bark, sapwood, and heartwood feeding. In this case the causation of galls is probably due only to the smaller size of the branches attacked, in which the tissues are more readily affected, for in the same species, when it attacks thicker branches, the swelling is often scarcely noticeable. The galleries are rather loosely packed with fibrous frass.

The adults of any species live for a long time and feed on the midribs of leaves and the bark of young twigs.

Felt and Joutel (10) have admirably discussed the habits of this genus.

#### KEY TO THE SPECIES OF SAPERDA

The following key will aid in separating the larvae of the known species:

- |   |  |
|---|--|
| Proeusternum bearing few or no asperities; sternellum bearing very few.....   | 1  |
| Proeusternum bearing at least three rows of asperities extending over half or entirely across the area; sternellum densely asperate.....                                    | 5  |
| 1. Asperities of pronotum of the same texture throughout; proeusternum and sternellum bearing no asperities; breeds in vines of Virginia creeper ( <i>Ampelopsis</i> )..... | <i>S. puncticolis</i>                      |
| Asperities of pronotum diminishing in size posteriorly; at least some on prosternellar area.....  | 2  |
| 2. Asperities in a continuous band of several rows across prosternellum, these very coarse; body hairs coarse; breeds in <i>Populus</i> .....                               | <i>S. calcarata</i>                        |
| Asperities of prosternellar area in two groups of only one row each, these finer; body hairs finer.....   | 3  |
| 3. No asperities on proeusternum; breeds in the trunks of <i>Salix</i> .....  | <i>S. hornii</i>                           |
| Few asperities present on proeusternum.....   | 4  |
| 4. Asperities on eusternum in a single transverse row; causes galls on twigs of <i>Salix</i> and <i>Populus</i> .<br>Spiracles twice as long as wide.....                   | <i>S. moesta</i>                           |
| Spiracles not as long as wide.....  | <i>S. concolor</i>                         |
| Asperities on proeusternum in two very small groups; pleural tubercles finely rugulose; causes galls on base of <i>Alnus</i> .....  | <i>S. obliqua</i>                          |
| 5. Asperities of pronotum coarser, extending over two-thirds to three-fourths the length (to border of hairs); body hairs coarse, stiff, light castaneous.....              | 6  |
| Asperities of pronotum finer; extending but little more than one-half the length; body hairs very fine, whitish.....  | 7  |
| 6. Asperities of proeusternum extending over about two-thirds the breadth.....  | <i>S. candida</i>                          |
| Asperities of proeusternum extending entirely across.....   | <i>S. vestita</i>                          |
| 7. Mesonotum bearing a continuous transverse band of dense, fine hairs; peritreme of spiracles thin; breeds under bark of <i>Hicoria</i> .....                              | <i>S. discoidea</i>                        |
| Mesonotal hairs sparse or not continuous; peritreme of spiracles thick.....   | 8  |
| 8. Median disc of dorsal ampullae elliptical; lives in base of <i>Hicoria</i> and rarely <i>Quercus</i> , etc.....  | <i>S. lubralis</i>                         |
| Median disc of dorsal ampullae little wider than long; asperities more sparsely placed.....   | <i>S. tridentata</i> and <i>S. imitans</i> |

**SAPERDA CALGARATA** Say.

[Pl. XXX, fig. 3; Pl. XXIX, fig. 4; Pl. XXXVI, figs. 3 and 4]

Large, robust; integument finely rugulose, clothed with coarse, castaneous hairs; labrum semicircular, widest at base, densely and coarsely haired; pronotum slightly wider than long, asperities very coarse, extending over three-fourths of length; eusternum coarsely haired, bearing a very few (about 20) asperities; sternellum having a very narrow band entirely across. Ampullae coarsely asperate; pleural tubercle bearing two strong setae and fine pubescence. Spiracles oval, peritreme strongly chitinized.

*Pupa.* Form as in adult; head bearing stiff setae on inner margin of eyes, a transverse row at base of clypeus and about base of antennae; anterior median two-thirds of pronotum, scutellum mesonotum, and posterior median disc of metanotum bearing a few short, setigerous chitinous points, such points also occur on abdominal terga in a scattered transverse band more numerous at sides and increasing posteriorly, on lateral ventral parts of last segment very dense.

[Described from specimens Hopk. U. S. 10075*n*.]

The larva of this species is a very serious pest to *Populus* throughout the eastern United States and Canada and west through the Rocky Mountain region. The eggs are laid in June and July on the trunks or larger branches of trees. They are inserted into the cambium in an irregular hole gnawed through the bark. For the first season the young larvae extend transverse galleries between the bark and wood which often entirely cut the cambium, killing the tree. During the second and third seasons large extensive mines are made in the heartwood, where pupation takes place. The trees are so honeycombed that great numbers of them break off in the wind. A knotty swelling is often caused at the point where the young larvae are feeding. Piles of frass several inches deep are noticed below infested trees.

**SAPERDA HORNII** Joutel

[Pl. XXIII, fig. 9]

Less robust than *calgarata*; integument smooth, shining, thickly clothed with fine whitish pubescence; labrum semicircular, finely and densely haired; pronotum slightly wider than long, asperities extending over three-fourths of length; eusternum densely haired, no asperities; sternellum bearing only a few asperities on median region; ampullae coarsely asperate; pleural tubercles bearing two long slender setae and fine pubescence; spiracles narrowly oval, peritreme heavy.

[Described from specimens Hopk. U. S. 9584.]

The habits of this species are similar to those of *S. calgarata*. It is found only in the Pacific Coast region. Adults were observed ovipositing at Yreka, Cal., in 1911, on young willow (*Salix*) trees. Three to four eggs were placed in a single egg-scar at equal angles from one another. The young larvae often devoured one another, so that rarely more than a single one developed. The trees were thickly covered with egg scars and were killed by the young larvae before fall. The larvae construct long, straight galleries in the heartwood at the top of which the pupal cell is constructed. Observations by the author.

**SAPERDA PUNCTICOLLIS** Say.

*Form* rather slender; integument very finely wrinkled, rather densely covered with very light castaneous hairs; labrum thin, transversely oval, sparsely haired; pronotum distinctly wider than long; asperities of same texture throughout, extending over but little more than one-half the length; eusternum densely and coarsely hairy in front, no asperities; sternellum bearing a very few (scarcely visible) asperities on lateral extremities; asperities of ampullae very fine; pleural tubercles suborbicular, many setae; spiracles small, oval, peritreme strongly chitinized.

[Described from specimens Hopk. U. S. 10398.]

The larvae kill the vines of Virginia creeper (*Ampelopsis*). They mine under the bark, pupating in the sapwood. The adult has been collected on *Rhus toxicodendron* and may live in this vine. Range, throughout the eastern and middle western United States. Observation by A. B. Champlain and the author.



## SAPERDA CONCOLOR LeConte

[Pl. XXIII, fig. 10; Pl. XLI]

*Form* slender; integument smooth, shining, clothed with fine, long, whitish hairs; labrum transversely oval; anterior margin of head finely granulate; pronotum about as wide as long, asperities finer, extending over three-fourths the length; eusternum bearing a single row of asperities, and sternellum a few on median area; ampullae finely and rather sparsely asperate; pleural tubercles bearing two long slender setae; spiracles oval, peritreme strongly chitinized.

*Pupa.* Form as in adult; no chitinous points on thoracic segments and but few on abdominal ones; setae fine and slender.

[Described from specimens Hopk. U. S. 9783a.]

The larva of this species causes a gall from 1½ to 2 inches in diameter on the young stems of *Populus* and *Salix*. The larva mines under the bark and into the wood, completing its burrow by a short, straight gallery in the wood parallel to the stem. Pupation occurs at the top of this chamber. Range, throughout the eastern and central western United States and Canada.

## SAPERDA MOESTA LeConte

The larva of the species closely resembles *concolor*, but the body asperities are coarser and the spiracles are more narrowly oval.

*Pupa.* Distinguished from *concolor* only by the stronger asperities on abdomen.

[Described from specimens Hopk. U. S. 12322.]

Mr. Josef Brunner records this species as attacking and killing young trees of *Populus trichocarpa* at Riggins, Idaho. Pupae, adults, and parasites were found in March, 1914.

## SAPERDA OBLIQUA Say.

*Form* rather robust; integument very finely wrinkled, clothed with fine, whitish hairs; labrum subtrapezoidal, widest behind, clothed with very short dense hairs; pronotum wider than long, asperities extending over three-fourths the length; eusternum bearing a group of very long, slender hairs, asperities in two small groups of about ten each; sternellum bearing two small median groups of asperities; ampullae finely and sparsely asperate; pleural tubercles finely rugulose, broadly oval, bearing two long setae; spiracles narrowly oval, peritreme strongly chitinized.

*Pupa.* Form as adult; stiff hairs on head about base of antennae and at inner margin of eyes, two longitudinal rows at base of clypeus, and several on tip of labrum; setigerous chitinous points distributed as in *calcarata*, but much smaller and setae slender; no armature on scutellum or metanotum.

[Described from specimens Hopk. U. S. 10928a.]

This larva has been found only in the base of *Alnus*, where it makes a large gall, often killing the bushes. Its work resembles that of the other gall-making forms. The larvae mine under the bark, later through the wood, and finally a straight upward burrow is made at the top of which pupation takes place. The adults are found throughout the central and eastern United States during May and June. When found it is locally abundant.

A tachinid parasite was found killing about 50 per cent of the larvae at Charter Oak, Pa.

## SAPERDA CANDIDA Fabricius

[Pl. XXIV, fig. 15]

Large, robust; integument very finely wrinkled, shining sparsely clothed with coarse, light, castaneous hairs; labrum coriaceous, semicircular, about twice as wide as long, covered with short stiff hairs; pronotum strongly chitinized, asperities coarse, extending over three-fourths of length; eusternum coarsely haired, asperities in a lenticular group, not quite reaching lateral limits; sternellum strongly asperate for its entire width; ampullae rather coarsely asperate; pleural tubercles oval, bearing two strong setae and usually two finer ones; spiracles very large, broadly oval to nearly orbicular.

*Pupa.* Form as in adult; immediately recognized by presence of a few small chitinous points on head, those on body strong; setae coarse, irregularly disposed on pronotum, a group on scutellum of mesonotum and in a V-shaped group on metanotum; a dense transverse row across abdominal terga.

[Described from specimens Hopk. U. S. 9776.]

The habits of this species have been much discussed in literature as injurious to fruit trees, apple (*Malus*), peach (*Amygdalus*), etc., one of the latest popular accounts being that of Brooks (3). The author has found it in a dense wood in the mountains of Pennsylvania, feeding in the base of living *Crataegus*. The mines are extended under the bark, and later a straight gallery from 4 to 6 inches long is extended up through the sapwood before pupation. Range, throughout the eastern and central western United States and Canada.

#### SAPERDA VESTITA Say.

Very similar to *candida*; body hairs slightly finer; asperities coarser; labrum not coriaceous, finely haired; asperities extending entirely across eusternum, hairs, whitish; pleural tubercles bearing four or five setae; spiracles narrowly oval, peritreme strongly chitinous.

[Described from specimens Hopk. U. S. 11838 and 11847r.]

The habits of this species are somewhat variable, as it attacks both dead and living trees, but so far it has been found only in *Tilia*. Felt and Joutel (9) state that it feeds only on bases of trees, but the writer has observed it in limbs high from the ground. A great part of the larval mine is constructed under the bark. It is very injurious, often causing the death of the trees. Range, eastern United States and Canada.

#### SAPERDA DISCOIDEA Fabricius

[Pl. XLIV]

Rather larger; integument smooth, shining, very densely clothed with fine whitish, silky hairs; labrum widest about middle, densely hairy in front; asperities of pronotum finer, covering little more than one-half the length; a continuous band across eusternum and sternellum but not reaching lateral limits in eusternum; pleural tubercles bearing many slender setae; spiracles rather large, oval, peritreme not strongly chitinous.

*Pupa*. Form as in adult; setigerous points arranged as in other *Saperda* pupae, but these long and slender; on posterior area of pronotum a V-shaped group occurs, as also on metanotum; a single transverse row on each abdominal tergum and eight to twelve, on last abdominal segment these long.

[Described from specimens Hopk. U. S. 7517.]

The larvae feed almost entirely in *Hicoria*, although W. F. Fiske, at Tyron, N.C., records it from *Juglans*. It is a very serious pest to trees weakened by the hickory barkbeetle (*Scolytus quadrispinosus* Say), often attacking them simultaneously with this insect. The mines are extended almost exclusively between the bark and wood, pupation taking place either in the sapwood or bark. Normally the larva matures and transforms in one year. The adults are collected from April to late July throughout the eastern United States and Canada.

#### SAPERDA LATERALIS Fabricius

[Pl. XVI, fig. 9]

Differs from *discoidea* in that the body is much less hairy; integument very finely wrinkled; spiracles more strongly chitinized and the asperities on ampullae coarser; median disc of ampullae elliptical.

[Described from specimens labelled State College, Pa., Mar. 16, 1912.]

This is also a dead-wood feeder, mining between the bark and wood. It is rather an omnivorous species for the genus, living in *Hicoria*, *Ulmus*, *Tilia*, *Acer*, *Fraxinus*, *Quercus*, and *Prunus*, but more commonly in *Hicoria*. Very moist wood, preferably at the base of trees, is preferred. The larvae mature in one year. Range, throughout the eastern and central United States and Canada.

#### SAPERDA TRIDENTATA Olivier

Integument smooth, shining; more hairy than *lateralis*, the median disc of dorsal ampullae little wider than long, and asperities more sparsely placed; otherwise similar.

*Pupa*. Form as in adult; remarkable for very long, stiff setae on head; points small and irregularly disposed on thoracic terga, but setae coarse; abdomen as in *discoidea*, but points shorter and setae coarser; a group of hairs on apical angle of femora.

[Described from specimen labelled Belle Vernon, Pa., March 30, 1912.]

The larva feeds between the bark and wood of dead, dying, and living *Ulmus*, often causing serious injury and death. The work resembles that of *discoidea* and *lateralis*. Trees which have just been felled are preferably attacked. Pupation takes place either in the sapwood or bark. Range, throughout the eastern and central United States and Canada.

#### SAPERDA IMITANS Felt and Joutel

Integument dull, very finely granulate; nearly as hairy as *discoidea*, otherwise similar to *tridentata*.

*Pupa*. Resembles *tridentata* in the strong chitinous points and long setae arising from the base; on the anterior margin of the pronotum is a row of such points and a V-shaped group on posterior half as well as on mesonotum and metanotum; the abdominal terga bear two groups in a transverse row, and a border around last abdominal segment.

[Described from specimens Hopk. U. S. 11845r.]

This species, usually considered rare, has been taken rather abundantly by W. S. Fisher, A. B. Champlain, and H. B. Kirk at Harrisburg, Pa. They record it from *Salix*, *Hicoria*, and *Tilia*. It has also been taken by the writer in *Prunus*. The larva mines between the bark and wood, pupating in the sapwood.

#### ONCIDERES Serville

Cylindrical, semi-robust species; head rather thick but depressed, sides parallel, then suddenly converging to base; epistoma bearing a transverse row of carinae; antennal annulae open (rarely apparently closed); mentum distinct, very slightly sunken, narrow, transverse; maxillary palpi, very slender; posterior area of pronotum elliptical, embossed, white, finely striate; eusternum distinct; ampullae bearing two rows of regular tubercles (and rarely an irregular middle row); epipleurum protuberant on nearly all segments, tubercle oval, no chitinous pores; no caudal armature.

The described species can be separated as follows:

#### KEY TO THE SPECIES OF ONCIDERES

- Last joint of maxillary palpi as long as or longer than second; posterior row of tubercles on last ventral ampullae normal.  
 Epistomal carina coarse, about ten on each side of median suture.....*O. cingulata*  
 Epistomal carina fine, about twenty on each side of median suture.....*O. sp.*  
 Last joint of maxillary palpi shorter than penultimate; posterior row of tubercles on last ventral ampullae chitinous.....*O. putator*.

The larva of only one genus of the large group to which it belongs has been studied; as such the affinities are well marked in two directions. The cylindrical form, thickened, somewhat salient head, embossed pronotum, two rows of tubercles on ampullae, and absence of chitinous pits on pleural tubercle show an intermediate position between such genera as *Psenocerus* and *Eupogonius* on the one hand and *Ataxia* and *Hippopsis*, etc., on the other. The antennal cavity seems to be variable in this genus. In *cingulata* it is apparently closed, but in other species distinctly open.

The adults of this genus, so far as known, have the peculiar habit of girdling the twig in which eggs are deposited. These branches, breaking off, fall to the ground, so that the larvae have dead wood in which to feed. The galleries are constructed under the bark, the larvae eating much of the wood, or in large twigs penetrating entirely into the centre. The frass is pushed out and the burrow left open. Pupation takes place in the late summer. These species often become very injurious, completely deforming the tree.

#### ONCIDERES CINGULATA Say.

[Pl. II, fig. 9; Pl. XIII, fig. 3; Pl. XXXI, fig. 5; Pl. XXXII, fig. 2]

*Form* cylindrical semi-robust; integument smooth, shining, sparsely clothed with whitish silky hairs.

*Head* rather thick, somewhat salient, sides converging behind, often slightly constricted; epistoma abruptly raised, bearing a transverse row of short longitudinal carinae; clypeus and labrum thin, latter broadly oval, narrowed behind; anterior margin finely ciliate; mandibles short, little longer than basal width, shining, cutting edge very obliquely truncate; antennal

very angulate behind; one pair of small black ocelli. Ventral mouth-parts rather fleshy; mentum distinct, narrowly transverse, very slightly sunken; maxillary palpi very slender, last joint acute, slender, longer than second, shorter than last labial; anterior edge of hypostoma not distinct in middle, transversely slightly bulging; gula indistinct.

*Prothorax* subrectangular, thick; pronotum not well defined at sides, posterior area elliptical, embossed, white and finely striate, anteriorly smooth, shining, laterally with a few fine silky hairs; eusternum shining, well defined, triangular; sternellum well defined, shining. Mesonotum dull granulate; metanotum, mesosternum, and metasternum bearing two regular rows of distinct small tubercles.

*Abdominal segments* nearly cylindrical; ampullae very narrow, protuberant, bearing two regular rows of small beadlike tubercles; epipleurum more or less protuberant on seven segments, tubercles oval, abruptly protuberant, several slender setae and no chitinous pits; spiracles very small, orbicular, peritreme thin.

*Pupa.* Form as in adult; front of head bearing numerous fine hairs, and a dense group at base of antennae and on mandibles; scape of antennae bearing a recurved fleshy process; pronotum thickly beset with slender hairs as are also the mesonotum and metanotum; abdominal terga rather densely covered with small, chitinous, setose points, much thicker on caudal segments. [Described from specimens labelled Hummelstown, Pa., May 24, 1912.]

It is a peculiar circumstance that the pupa of *O. cingulata* has the well-developed spine at base of antennae, while it is absent in the adult of this species, although well developed in adults of some of the larger species.

This insect has been recorded from *Hicoria*, *Diospyros*, *Ulmus*, *Populus*, *Nyssa*, *Tilia*, *Gleditsia*, *Cornus*, *Malus*, and *Pyrus* throughout the eastern and southern United States. The adult flies from late July to September. W. F. Fiske has made some interesting observations on this species at Tyron, N.C., and states that "about ninety per cent of girdled twigs are hickory; persimmon is next favoured. The adults often cut off entirely young seedling trees in the forests. Those twigs which were buried in moist humus are the ones from which adults emerged, while in a large percentage of those cut the larvae died. The adult feeds on the bark of young twigs."

#### ONCIDERES sp.

Similar to *O. cingulata*, except that the carinae across the epistoma are very fine, averaging about twenty on each side of the median suture, while about ten occur in *cingulata*. Body clothed more densely with fine hairs, especially on last abdominal segments.

[Described from specimens Hopk. U. S. 10513a.]

Habits similar. This species has been reared from girdled twigs of *Prosopis* and greasewood (*Sarcobatus*).

Range, throughout the southwestern United States. Observations by G. Hofer and M. Chrisman.

#### ONCIDERES PUTATOR Thomson

[Pl. XII, fig. 3]

A much more robust species, hairs coarser; mandibles more slender; epistomal carina coarser than in *cingulata*; last joint of maxillary palpi not as long as second; eusternum densely hairy; dorsal ampullae bearing three rows of large tubercles, middle row irregular, last ventral ampullae having posterior row of tubercles, chitinated.

[Described from specimens in the U. S. National Museum taken in the branches of *Siderocarpus flexicaulis*, from Brownsville, Tex., by H. S. Barber.]

It also attacks *Acacia* and *Prosopis*.

#### ATAXIA Haldeman and ADETUS LeConte.

Lacordaire (19) has placed *Ataxia* in a separate tribe and LeConte and Horn (20) have likewise retained this group, placing *Adetus* in a closely allied tribe. The affinities of these two larvae are very close; in fact they differ only in minor details. The author regards them as belonging to the same tribe, closely allied to the Hippopsini. The assembling in one tribe of these two genera, together with *Spalacopsis*, would constitute a more natural group of larvae than many other larval groups, as they are defined on the characters of the adults.

## ATAXIA CRYPTA Say.

[Pl. V, fig. 6; Pl. XXIII, figs. 1 and 2; Pl. XVI, fig. 13; Pl. VII, fig. 14; Pl. XXXI, fig. 4]

*Form* cylindrical, slender, elongate; integument smooth, shining, rather densely clothed with fine yellowish white hairs.

*Head* very salient, thick, oval in cross section, sides parallel, then suddenly constricted at base; clypeus and labrum thin, latter fungiform, somewhat stalked; mandibles about one and one-half times as long as basal width, acute, cutting-edge obliquely emarginate; antennal ring closed; one pair of small black ocelli. Ventral mouth-parts rather thick; mentum little wider than long, not distinct at base, sunken; last joint of maxillary palpi longer than beadlike second, shorter than last labial; palpifer having a small fleshy process on outer face; ligula large; gula not distinct; hypostoma strongly protuberant, posteriorly developed into two obtuse conical protuberances.

*Prothorax* cylindrical; pronotum defined by complete lateral sutures, posterior area embossed, white, very finely striate, anterior smooth; sternum glabrous except posterior angles, eusternum, and lateral angles of deep sternellum. Mesonotum with x-shaped sutures, lateral triangular areas densely hairy; metanotum, mesosternum and metasternum finely hairy, bearing two rows of tubercles.

*Abdomen* cylindrical; ampullae very narrow, bounded by two lateral impressed lines, and bearing two rows of regular tubercles; epipleurum protuberant on all segments, tubercles very large, oval, having several setae but no chitinous pits; ninth segment swollen, very densely ciliate; tergum bearing a chitinous tipped, suddenly constricted spine, tip truncate; spiracles small, orbicular, peritreme slightly chitinized.

*Pupa.* Form as in adult; front of head bearing a number of fine setae, and a group on mandible; pronotum sparsely setose, more abundantly on lateral margins; mesonotum and metanotum glabrous; abdominal terga bearing two transverse patches of dense, chitinous, setose points, much coarser and thicker on seventh tergum; caudal tergum reflexed in a thin broad flange, nearly as wide as segment, ventrally this segment very densely clothed with chitinous setae.

[Described from specimens Hopk. U. S. 10311b.]

Specimens from the southern and southwestern States show a form in which the caudal spine is sharply acute instead of truncate, and the ampullar tubercles larger. The pupa of this form has the reflexed flange not one-half as wide as the segments and very few chitinous points on the seventh tergum. (Hopk. U. S. 9901s.)

This species has been reared from *Quercus*, *Castanea*, and *Pyrus* in Virginia. Farther south and into the southwest it attacks a variety of herbaceous or shrubby plants, namely, *Xanthium*, *Verbesina*, *Ambrosia*, *Thuberia*, *Smilax*, and cotton (*Gossypium*). The larvae feed in the dead or, rarely, living branches mining a long, narrow tunnel, sometimes several feet in length. The pupal cell is constructed in the fall by placing two fibrous plugs of frass in the hollowed chamber. The adults emerge in May and June.

## ATAXIA SULGATA Fall

*Form* larger hypostomal protuberance much larger and more confluent; posterior area of pronotum faintly striate; tubercles of ampullae large and distinct, posterior row of last ventral ampullae bearing two large projecting tubercles, while those of anterior row are elongate, oval; caudal spine deflexed, acute.

*Pupa.* More hairy than *A. crypta*, especially on the thoracic segments; chitinous setose hairs of the abdominal terga more slender, and on anterior margin of third and fourth abdominal terga two groups of two or three chitinous spines; flange on last tergum bearing a small point in the middle and the extremities projecting much higher than the middle.

These larvae (Hopk. U. S. 10081w and 14935) collected by T. E. Snyder from the seeds of mangrove (*Rhizophora mangle*) in Florida, closely resemble those of *Ataxia crypta*. The adults are much more robust.

## ADETUS SUBELLIPTICUS Bates

[Pl. II, fig. 8; Pl. XXIV, fig. 5; Pl. XVI, fig. 10; Pl. VII, fig. 13]

*Form* cylindrical, slender; sparsely clothed with fine yellowish-white hairs.

*Head* similar to that of *Ataxia*, but protuberances on hypostoma not so sharply conical.

*Prothorax* cylindrical; pronotum rectangular, entirely smooth, shining, somewhat chitinized or posteriorly indistinctly striate; alar area a chitinous plate; sternum trapezoidal, widest in front, laterally bearing an oval chitinous spot; eusternum elliptical; sternellum well defined; mesonotum bearing x-shaped suture, with the lateral elliptical areas well defined; metanotum bearing two regular rows of large tubercles; mesosternum not tuberculate, metasternum bearing a few large irregular ones.

*Thorax* cylindrical, segments short; seven ampullae bearing large regular tubercles, the first three of two rows, the remainder of one, posterior row of about five or six tubercles, ventral similar; epipleurum protuberant on all segments, tubercles large, elongate oval, chitinous pits not distinct; ninth segment swollen, densely ciliate, tergum produced into an inflexed conical, chitinous tipped process.

These larvae in the U. S. National Museum were collected and adults reared by Mr. E. A. Schwarz in a cucurbit vine from Panzos, Guatemala.

### HIPPOPSINI

This remarkable tribe, represented by four North American genera, the larvae of two of which have been found, are strikingly aberrant forms. At first appearance the larvae would rarely be taken for cerambycids. The salient, oval head having the foramen situated almost posteriorly, the protuberant mesosternum and metasternum, the peculiar ampullae and the swollen ninth abdominal segment immediately characterize this group. They are evidently related to *Ataxia* and to the larvae of the European genus *Agapanthia*, from which it differs only in minor details. Our genera are pith feeders, mostly in herbaceous stems, and are very active, crawling up and down the hollowed stem with great rapidity. On being exposed they squirm and wriggle actively.

#### HIPPOPSIS LEMNISCATA Fabricius

[Pl. XIII, fig. 7; Pl. XXIV, fig. 13; Pl. XVII, figs. 17 and 18; Pl. VII, fig. 11; Pl. XXXI, fig. 1; Pl. II, fig. 13.]

*Form* very elongate, slender, curved, cylindrical; integument very finely granulate, shining, very sparsely clothed with hairs.

*Head* extremely salient, oval in cross-section, sides parallel until suddenly constricted at base, foramen posterior and ventral; clypeus and labrum thick, latter transversely fungiform, stalked, sparsely haired; mandibles short, triangular from side, little longer than basal width apex bidentate, dorsal angle abruptly toothed; antennal ring closed; one pair of small ocelli. Ventral mouth-parts thick, sunken; mentum distinct, about twice as wide as long; last joint of maxillary palpi longer than second, equal to last labial, second transverse; hypostoma bulging; no trace of gula.

*Prothorax* cylindrical; protergum smooth, shining; pronotum not defined by lateral sutures, slightly chitinized; prosternum uniformly chitinized, glabrous; eusternum and sternellum rather firmly fused, indicated by two transverse foveae. Mesonotum smooth; metanotum obscurely tuberculate in two rows; mesosternum and metasternum strongly protuberant, a transverse row of setae between sternum and sternellum.

*Abdominal* segments elongate, cylindrical; no ventral ampullae, dorsal strongly protuberant, composed of two transverse, finely striate ridges; epipleurum somewhat protuberant on all segments, pleural tubercles distinct only on eighth, bearing two strong setae; ninth segment swollen, very densely ciliate, sternal area protuberant; spiracles orbicular, scarcely chitinized; no caudal process.

*Pupa.* Form as in adult; head having a dense group of setae at base of antennae; lateral margin of protergum ciliate; thoracic segments glabrous; abdominal terga armed with minute chitinous points, except for a transverse glabrous band, posterior margins with a closely set row of flat setae.

[Described from specimen Hopk. U. S. 9784c<sup>2</sup>.]

The larvae have been collected in the stems of *Ambrosia*, which they completely hollow from the top to the surface of the ground. In a cell at the base the larvae pupate. The life cycle is completed in one year, adults emerging in June and July. Observations by A. B. Champlain, and the author. R. W. Van Horn records taking an adult under bark in December at Great Falls, Va.

#### SPALACOPSIS STOLATA Newman

[Pl. VII, fig. 16]

Very similar in form to *Hippopsis*. Head more strongly narrowed posteriorly; lateral sutures of pronotum impressed, posterior area white, shining, embossed; entire prosternum strongly fused and protuberant posteriorly in a rounded projection. Dorsal ampullae six, these bearing two rows of regular tubercles, ventral ampullae absent except on sixth and seventh segments; ninth abdominal segment swollen, densely ciliate; tergum bearing a fleshy, cylindrical projection, obliquely truncate, having a chitinous point on the ventral margin of the truncate face.

[Described from three poor specimens in the U. S. National Museum collection from San Mateo, Fla., April 19, 1881, boring in the stalk of Jerusalem oak (*Chenopodium botrys*). No collector given.]

#### Group PHYTOCIDES

In this group Lacordaire (19) has placed a number of genera, including, among other North American forms, *Oberea*, *Mecas*, and *Tetraopes*, of which the larvae are known. He has placed *Tetraopes* in a division of equal rank with *Oberea*. *Tetraopes* may be related to *Oberea*, etc., but it has become so peculiarly adapted to its environment (root-feeder) that it is difficult to say where the larvae should be placed. The head in no respect suggests *Oberea*, but more nearly a *Saperda*, and it is here regarded as a development from such a type. In general form it suggests *Monilema*.

*Mecas* likewise has assumed a root-feeding habit, but the larva confines itself more strictly to the inside of the root. The characters of the head clearly show its affinities to *Oberea*, and if *Tetraopes* was related to these genera it would no doubt still retain the peculiar conical type of head.

*Mecas* and *Oberea* larvae seem more closely allied to *Ataxia* and Hippopsi like forms than to any other Lamiinae.

#### TETRAOPES TETRAOPHTHALMUS Forster

[Pl. V, fig. 4; Pl. XII, fig. 2; Pl. XVI, fig. 11; Pl. XXXII, fig. 1]

*Form* robust, fleshy, cylindrical or slightly tapering posteriorly; integument very finely wrinkled shining, densely clothed with long, whitish lemon-coloured hairs.

*Head* rather thick but depressed, sides narrowing posteriorly, suddenly constricted about middle, widest across posterior limit of front; epistoma thick, rugulose; clypeus and labrum thick, latter transverse, roundly semicircular from base, densely haired; mandible from side about twice the basal width, outer face rather rugulose, cutting-edge obliquely truncate, dorsal angle distinctly toothed; antennal cavity bisected by frontal suture; ocelli not distinct. Ventral mouth-parts fleshy; thick; mentum distinct, transverse; maxillary palpi two-jointed, last joint slender, shorter than the basal, equal to the last labial; hypostoma transversely bulging, finely wrinkled; gula less corneous.

*Prothorax* very thick, about twice as wide as long; protergum densely hairy on sides and across anterior border; pronotum posteriorly finely velvety pubescent; prosternum densely hairy, lateral areas swollen; eusternum distinct, swollen; sternellum very narrow, transverse. Mesonotum and metanotum densely hairy, mesonotum with an anterior transverse band of hairs, posteriorly glabrous.

*Abdomen* very densely hairy; ampullae narrow, projecting in large, dull tuberculiform lobes; epipleurum slightly protuberant on all segments, tubercles elongate oval, bearing very many hairs and no chitinous pits; spiracles large, orbicular.

The larva feeds in the base of stems and roots of *Asclepias*. It more usually does not enter the root but burrows in the earth and eats from without the root often only eating the bark, much like some scarabaeids. Galleries were found extending from root to root through the earth, then continued up to near the surface of the ground, where pupation occurs. Infested plants can be recognized by withering tops in late summer. The adult occurs throughout the eastern United States and Canada, in June and July.

The tendency to develop a strong, dense body covering of hairs is true of all forms having somewhat similar habits, while the opposite extreme is represented in those forms which mine in living tissue and develop the strong chitinous asperities.

#### OBEREA Mulsant

Head thick, conical, sides strongly converging posteriorly, ending rather acutely; antennal annulae closed; mandible shortly triangular; mentum indistinct posteriorly, transverse; palpi rather short; pronotum very oblique, posterior area strongly asperate, laterally bearing a deep, oblique sulcus; eusternum roundly trapezoidal, large; ampullae very finely asperate, bearing two transverse impressions, one rather indistinct; epipleurum protuberant on all segments; tubercles without chitinous pits; spiracles oblique, lenticular; no caudal armature.

So far as known, all attack living plants, usually the smaller branches, which they completely hollow and kill. The eggs of many species are laid

near the top of the branch or stem just beneath a spiral incision which girdles and kills the tip. This girdling suggests *Oncideres*. The most characteristic feature of their work is a series of circular holes extending through the bark in a straight line along the branch, from which the frass is expelled. In this respect they resemble some of the species of *Elaphidion*. The larvae are very active in their open burrow, moving with remarkable rapidity by the use of the strongly protruding ampullae, armed with asperities. The pupal cell is constructed by plugging off a chamber of the mine by two fibrous wads of frass.

The species of *Oberea* are very difficult to separate as larvae. Beside the usual ocellus near the antennae these larvae have several secondary ocelli farther back on the head. These ocelli are merely pigment spots beneath the chitin and rarely protrude. They have been used as descriptive characters, but might be found to be variable if a large series were studied. There are many varieties of the species described, and it is probable that when the biology of more of these is known they can be ranked as good species.

### KEY TO DESCRIBED SPECIES OF OBEREA

- Asperities of pronotum covering one-half or more the length, i.e., from posterior asperities to anterior row of hairs.
- Outer face of mandible, near base, granulate.....*O. ocellata*  
 Outer face of mandible smooth.
- Three secondary ocelli; asperities of ampullae coarser (see description).
- Two upper secondary ocelli approximate, just behind primary; feeds in the branches of *Sabx*.....*O. ferruginea*  
 Secondary ocelli not so placed; feeds in the twigs of *Populus*.....*O. schaumii*
- Two secondary ocelli; asperities of ampullae finer; feeds in stems and base of sassafras.....*O. ruficollis*.
- Asperities extending over less than one-half length of pronotum.
- Usually no secondary ocelli, or rarely one.....*O. tripunctata*  
 Usually three secondary ocelli.....*O. bimaculata*

#### OBEREA RUFICOLLIS Fabricius

[Pls. II, XIII, XXIV, XXXII]

*Form* very elongate, slender, cylindrical; integument smooth, shining, covered with extremely few short, stiff, yellowish-brown hairs.

*Head* thick, conical, sides rapidly converging posteriorly; epistoma narrow, abrupt; clypeus swollen; labrum thin, little wider than long, roundly rectangular, thickly haired; mandible from side, short, triangular, cutting edge oblique often having a very small, acute dorsal tooth; one pair of small distinct ocelli; antennal ring closed. Ventral mouth-parts thick, rather fleshy; mentum distinct, transverse; maxillary palpi conical, last joint acute, equalling second and shorter than last labial; hypostoma narrow, transverse, anterior edge deeply curved and sunken; gula not distinct.

*Prothorax*. Pronotum very oblique, long and narrow, anteriorly smooth, shining, chitinized, posterior one-half strongly asperate, the asperities flat, reflexed, becoming smaller posteriorly, just inside lateral suture a strong, deep, oblique fovea; paranotum shining, glabrous, almost perpendicular; prosternum narrow, transverse, lateral areas chitinized, extending behind sternellum; eusternum large, roundly trapezoidal; sternellum very narrow. Metanotum, mesosternum, and metasternum very finely asperate.

*Abdomen* elongate, cylindrical; ampullae very narrow, abruptly projecting, having a deep posterior suture and less distinct anterior transverse one meeting distally, surrounding folds very finely asperate; epipleurum strongly protuberant on all segments, tubercles oval, bearing two setae, no chitinous pits; spiracles oblique, lenticular, chitinous rimmed.

*Pupa*. Form like that of adult; a group of short, stiff hairs on disc of pronotum; a v-shaped row of hairs on metanotum; each abdominal tergum bearing a few strong, chitinous-tipped papillae; epipleurum bearing two strong, reflexed, chitinous, tipped papillae.

[Described from specimens Hopk. U. S. 9729.]

The larva feeds in the stems and roots of young living sassafras one-half to two inches in diameter. The eggs are laid at the tip of a small branch just beneath a small portion girdled by the adult. The larvae work downward through the centre of the stem to the base and thence often deep into the root. The entire gallery, often several feet long, is kept open, the larvae crawling



about in it and when disturbed entering the root. At intervals along the stem the perpendicular holes are opened to the surface through which the frass is exuded. These holes are evident long after as scars on the trees. Pupation takes place near the surface of the ground during May and June. The work of this insect is very abundant through the eastern United States and often causes extensive death of the younger growth. Two or three years are required to complete the development.

#### OBBEREA FERRUGINEA Casey

This is a more slender form than *ruficollis*; body hairs coarser and darker brown; secondary ocelli three, irregularly placed; asperities of pronotum covering one-half the length from posterior asperities to anterior border of hairs; asperities of ampullae much coarser, individually distinguishable with a strong hand lens, while in *ruficollis* they are not so distinguishable.

[Described from specimens Hopk. U. S. 10072a.]

These larvae were collected by A. B. Champlain in the branches and twigs of *Salix* at Colorado Springs, Colo. The larval work is not so characteristic as with other species, as often the holes for extruding frass are absent. The egg scar of the adult resembles an elongate print of a horse's foot.

#### OBBEREA SCHAUMII LeConte

Similar to *ferruginea* except that the two upper secondary ocelli are set very close together and directly behind the primary ocellus.

[Described from specimens Hopk. U. S. 9906r.]

These larvae were reared from *Populus* twigs submitted by a correspondent from Wellington, Kans. The work resembles that of *ferruginea*. Riley (28) described the habits of this species.

#### OBBEREA OCELLATA Haldeman

[Pl. XLIV]

More slender than *ruficollis*; asperities of ampullae a little coarser and body hairs much finer and darker in colour; readily recognized from all other species by the granulate outer face of mandible; two secondary ocelli, the upper situated farther posteriorly, the other below so as to form an equilateral triangle with primary.

[Described from specimens Hopk. U. S. 9791c and 10080k.]

This larva has been found in two species of *Rhus*. The work in all respects resembles that of *ruficollis*, but the larva bores more extensively in the roots. Two years are required for the larva to mature. The adult flies while the laurel is in bloom. Observations by J. J. Davis, A. B. Champlain, H. B. Kirk, and the author.

#### OBBEREA TRIPUNCTATA Fabricius

[Pl. XLIV]

More slender than *ruficollis* and the asperities of pronotum extending not more than one-third the length; secondary ocelli usually one or often indistinct.

*Pupa*. Scarcely distinguishable from that of *ruficollis* except by the smaller size and the finer chitinous papillae on the abdominal terga.

[Described from specimens Hopk. U. S. 9749.]

The larvae mine and girdle small living branches of plum (*Prunus*), quince (*Cydonia*), apple (*Malus*), peach (*Amygdalus*), *Ulmus*, and *Cornus*. The eggs are placed just beneath the girdled tip near the end of the branch, through this branch the larvae mine, hollowing it out and eventually causing it to break off, though it is not cut in the same sense as by *Elaphidion villosum*. Numerous small holes are cut to the exterior along the hollowed portion. Fruit trees are sometimes seriously damaged. The adult emerges during May and June. It occurs throughout the eastern United States. Ruggles (29) gives a good account of the life history.

## OBEREA BIMACULATA Olivier

[Pl. XVI]

This larva cannot be distinguished from that of *tripunctata* except that on all forms examined three secondary ocelli are present.

[Described from specimens in the U. S. National Museum labelled as from raspberry (*Rubus*), Rome, N. Y., October 1, 1872.]

The habits are similar to those of *tripunctata*.

## MECAS PERGRATA Say.

[Pls. XVI, XXXIII]

*Form* short, somewhat robust, cylindrical, tapering posteriorly; integument finely granulate to wrinkled, sparsely clothed with rather stiff hairs.

*Head* thick, conical, tapering posteriorly; clypeus rather narrow; labrum broadly oval, anterior margin beset with short golden hairs; mandible shortly triangular, cutting-edge very oblique, dorsal angle sharply toothed; ocellus distinct; antennal ring closed. Ventral mouth-parts thick, fleshy; mentum not defined posteriorly, transverse; maxillary palpi conical, second joint shortest, last shorter than last labial; anterior edge of hypostoma deeply curved; gula not distinct.

*Prothorax* quadrangular; similar to that of *Oberea* except that no asperities are present on the ventral surface. Mesothorax and metathorax having no asperities or tubercles.

*Ampullae* very narrow, projecting, smooth, shining, dorsal with a lateral short impression and two transverse ones meeting distally, deeply furrowed in the middle; epipleurum protuberant on all segments, tubercles narrow, oval, bearing two hairs but no pores; spiracles lenticular.

[Described from specimens Hopk. U. S. 10071*a*.]

These larvae have been collected in the stems of wild asters (*Aster*) from Colorado. The larva feeds in the stems and down into the roots, completely hollowing the latter. Subsequently that portion of the stem of the plant breaks off at the surface of the ground. Small heaps of frass are exuded about the base of the plant. Only one larvae is found in each stem. Observations by A. B. Champlain.

## APPENDIX

## ADDITIONAL SPECIES

Since compiling the data on the preceding species others have come to the author's attention and are here described with notes suggesting their relationship to those in the previous discussion. Several of these are from the United States National Museum collection and the identifications have not been verified; the others have been reared.

## ACHRYSON SURINAMUM Linnaeus

*Form* elongate, subcylindrical; integument thin, shining, sparsely covered with fine yellowish-white hairs.

*Head* subtrapezoidal, about as wide as long (to tip of mandibles), tapering rather strongly in front, mouth-frame chitinized, dark reddish with a much darker semicircular chitinization on pleurostoma below antennae; labrum roundly trapezoidal, narrowed in front, hairs short; mandible entirely black, basal piece shorter than apical, latter bearing a slight fovea; antennae salient, joints 1 and 3 subequal, second longer; one very small ocellus contiguous with base of antennae; gena receding, not setose; maxillary palpal joints subequal, last equal to last labial, process of palpifer indistinct; hypostoma transversely wrinkled, sutures distinct; gula narrow, slightly longer than wide.

*Prothorax* trapezoidal, bearing slender fine hairs on sides; pronotum anteriorly strongly and regularly punctate, posteriorly shining, finely reticulate and broken with irregular striae, median suture deep, entire; eusternal plates rectangular, the anterior half punctate, the posterior striately reticulate; extremities of sternellar fold distinct, passing spiracle. Mesonotum and metanotum finely granulate, the latter bearing transverse impressions. Legs small, about equal in size to maxillary palpi.

*Ampullae* shining, finely granulately reticulate, the dorsal ones bearing two lateral and in front a connecting transverse impression, and two small foveae on disc; pleural discs distinct on first three abdominal segments, largest on second, consisting of a deep pore surrounded by fine granulations and then by fine striae. Spiracles small, narrowly oval, peritreme thin. Ninth tergum bearing two faint, elongate, chitinous carinae or tubercles.

[Described from specimens Hopk. U. S. 10083*e* and 10083*w*.]

The larva feeds in the wood of *Cercidium*, also *Acacia*, and *Prosopis*, working much as does *Neoclytus*. Specimens have been collected by G. Hofer in Arizona.

The presence of chitinous tubercles on the ninth abdominal tergum is very unusual in this subfamily; in fact this is the only species in which it occurs, as far as known. In the key given to the Cerambycinae the larva runs down to the Callidini, from which it can be separated by the cerci. It does not suggest the Callidini, but more closely resembles *Malcopterus* and is quite distinct from *Oeme* and its allies.

#### ACHRYSON CONCOLOR LeConte

*Form* elongate, rather slender; integument firm, shining, very sparsely covered with fine whitish hairs.

In general similar to *surinamum*, except that the head is proportionately wider and more triangular, slightly wider than long (length to tip of mandible); buccal margin uniformly darkly chitinized; ocellus larger, contiguous with base of antennae; hypostomal sutures not so distinct; gula not distinct; pronotum posteriorly distinctly striate; ampullae alutaceous, shining, the posterior ventral ones divided in middle by a band of dull granulation; prosternal spots anteriorly punctured, posteriorly rugulose to alutaceous; pleural discs finely granulate, most distinct on second and third abdominal segments; abdominal spiracles narrowly oval, somewhat smaller than ocellus; no cerci.

[Described from specimens Hopk. U. S. 15128.]

These larvae were collected by T. E. Snyder at Browns ville, Tex., in limbs of huisache (*Acacia*) girdled by *Oncideres putator*. They feed beneath the bark, pupating in the sapwood. In this same stick of wood 1 foot in length and 1½ inches in diameter six species of cerambycid larvae were feeding.

#### ACMAEOPS DIRECTA Newman

This larva in many respects resembles that of *Pachyta monticola*. The following characters are present: Three small, distinct ocelli and just behind them, a black pigment spot beneath the chitin; mandibles deeply notched, almost bidentate at apex; labrum twice as wide as long; dorsal ampullae bearing four rows of very small but distinct tubercles and not asperate; spiracles small, orbicular, the opening situated anteriorly, i. e., the peritreme is very thick and the posterior margin much wider than the anterior margin; ninth segment bearing a short, acute spine, surrounded by a few stiff hairs, the remainder of the body hairs fine and silky.

[Described from specimens Hopk. U. S. 10625.]

These larvae were secured by caging adults on various species of wood cut at different dates. The adults oviposited on *Liriodendron* and *Castanea*, the resulting larvae boring in the bark. Whether they go into the ground to pupate has not yet been determined.

A large larva in the U. S. Forest Insect Collection (Hopk. U. S. 4241b), collected by H. E. Burke under the bark of *Abies*, state of Washington, has nearly all the important characters in common with this species except that the ampullae are not tuberculate but entirely finely asperate. It is hardly possible to base generic characters on the larvae of the few species described in this paper in the genera *Anthophilax*, *Toxotus*, *Pachyta*, and *Acmaeops*. Many of the characters run together in the species studied, suggesting that if more material were available good generic distinctions in these larvae could not be drawn or that the larvae would suggest other generic groupings.

#### ACROCINUS LONGIMANUS Linnaeus

*Form* elongate, strongly depressed; integument firm, covered with short, rather stiff hairs.

*Head* very strongly depressed, sides regularly and strongly converging posteriorly; epistoma straight; labrum a little wider than long, broadly rounded, widest near base; mandible slender, elongate, length about three times condylar width, cutting-edge shallowly emarginate, antennal ring faintly bisected by frontal suture. Ventral mouth-parts elongate; mentum twice as wide as long, distinct; last joint of maxillary palpus shorter than penultimate, much shorter than last labial; anterior edge of hypostoma straight; gula not distinct.

*Prothorax* depressed; pronotum posteriorly beset with chitinous, conical papillae, as also the ampullae; pleural tubercles broadly oval, having a chitinous pit at each extremity and five or six setae; spiracles broadly oval, peritreme thin.

Described from several specimens in the United States National Museum collection labelled Alta Verapaz, Guatemala, April, 1906, H. S. Barber, collector.]

This larva has been described previously by Chapuis and Candeze (5), but is here re-described to make the description conform to the terminology here used.

*Aerocinus* is undoubtedly closely related to *Acanthocinus*. From the head alone it can scarcely be separated, while the peculiar asperities on the pronotum and ampullae seem to be only a difference of degree from the veluring of *Acanthocinus*.

#### CYLLENE INFAUSTA Lec

Distinguished from the other species of *Cyllene* by having dull finely granulate ampullae, the posterior margin of pronotum shining (lacking band of velvety pubescence) and large oval conspicuous spiracles; body hairs coarse, castaneous.

[Described from specimens No. 8294, Dominion Entomological Branch.]

These specimens were collected and reared by Mr. Norman Criddle at Aweme, Manitoba. The larvae feed in the roots of *Petalostemon candida*.

#### EUCROSSUS VILLICORNIS LeConte

*Form* elongate, robust; integument thin, dull, rather thickly covered with short golden-yellow hairs.

*Head* subtrapezoidal, somewhat depressed; mouth-frame darkly chitinized; epistoma suddenly emarginate in middle; labrum suborbicular, the disc glabrous; mandible black at tip, basal half lighter and shorter than apical, latter with a slight impression on outer face; one pair of large ocelli enclosed by the strongly shouldered and tuberculate gena; genal setae short, dense; antennae salient, first joint shorter than second, a little longer than third; last joint of maxillary palpi shorter than others, shorter than last labial; process of palpifer distinct, as well as the process on first maxillary joint; hypostoma smooth; gula very short, wider than long; no subfossal spine.

*Prothorax* rectangular, densely and coarsely haired at sides and across anterior margin of pronotum; posterior area of pronotum shining and finely alutaceous, projecting forward in middle, hind margin velvety pubescent, no median suture; costal spots large, shining, separated by a fine, dull granulate band. Mesonotum and metanotum dull, very finely velvety pubescent; extremity of sternellar fold distinct, passing beyond spiracles. Legs four-jointed.

*Ampullae* broad, dull, very finely granulate, dorsal bearing two lateral and two transverse impressions. Pleural discs very large and dull granulate, bearing a very deep pore, distinct on five segments, largest on third; spiracles broadly oval, peritreme very thin.

*Pupa*. Disc of prothorax bearing scattered, acute, chitinous points, projecting anteriorly; posterior portion of metanotum and each abdominal tergum also bearing much stronger conical chitinous points, projecting posteriorly, arranged on the anterior segments in transverse rows, and the middle points often set on a chitinized disc; two small curved spines on last tergum.

[Described from specimens Hopk., U. S. 10083g.]

The larvae were collected by F. P. Keen beneath the bark of dead *Pinus torreyana* at San Diego, Cal. The work resembles that of *Callidium antennatum*. The adults were reared at Falls Church, Va.

*Eucrossus* has been placed in the group with *Oeme*, etc., but the larva appears in all respects to belong to the Callidini. In the keys given here it runs down to *Physocnemum*, from which it can be separated by the characters given.

#### IBIDION TOWNSENDI Linell

This larva more closely resembles that of *Heterachtes* than that of *Ibidion*. It is distinguished from *H. quadrangulatus* by the gena not being corneous. Striae of pronotum finer and more regular; prosternal plates fused in middle, forming a transverse triangle and finely striate; pleural discs distinct on second and third abdominal segments, largest on third; spiracles orbicular, not larger than ocellus, peritreme thin.

*Pupa*. Head unarmed, pronotum bearing a transverse row of small acute spines at middle, a few on anterior margin, a group of four between these, and two groups near posterior margin; mesonotum, metanotum, and first abdominal tergum unarmed; remaining abdominal terga bearing 6 to 8 small, chitinous papillae, except the eighth, which bears only two longer ones.

[Described from specimens Hopk. U. S. 15128, collected by T. E. Snyder at Brownsville, Tex.]

The larvae were feeding beneath the bark of an *Acacia* limb girdled by *Oncideres*. They pupate in the sapwood.

## LAGOCHEIRUS ARANEIFORMIS Linnaeus

[Pl. XVII, fig. 14]

*Form* rather robust, sub-depressed; integument rather firm, shining, sparsely clothed with coarse brownish-yellow hairs.

*Head* depressed, sides very slightly constricted behind middle; buccal margin darkly chitinized and roughened; labrum wider than long, densely haired on anterior half; mandible dull black, over twice as long as condylar width, cutting edge obliquely emarginate, dorsal broadly projecting; antennal ring open behind; one pair of prominent ocelli; maxillary palpi slender, last joint shortest, acute, shorter than last labial; ligula widest at apex, truncate; anterior edge of hypostoma curved; gula roughened, not protuberant.

*Prothorax* rectangular, depressed; pronotum posteriorly finely asperate except for a longitudinal median glabrous streak, anteriorly glabrous, shining, except for a transverse row of short hairs; eusternum shining and anteriorly hairy. Mesonotum, metanotum, mesosternum, and metasternum having a transverse band of velvety pubescence.

*Abdomen.* Ampullae seven, velvety pubescent, dorsal bearing two transverse impressions meeting externally; epipleurum protuberant on last five or six abdominal segments, pleural tubercle broadly oval, bearing three to five setae and a chitinous pore at extremities; spiracles very large, oval, peritreme heavily chitinized.

[Described from specimens Hopk. U. S. 10085b.]

These larvae were collected in quarantine at New York City, in the stems of living *Ficus* from the Isle of Pines, Cuba. An adult was reared by the writer at Falls Church, Va. The affinities are suggestive of such forms as *Acanthoderes* and other genera related to *Liopus*.

## OBBEREA MYOPS Haldeman

This larva resembles that of *tripunctata* and that of *bimaculata*, falling in that division as described in the key. One distinct secondary ocellus is present and above it a fainter, purplish-black blotch beneath the chitin. The body hairs are much coarser and darker, those on the epistoma considerably longer than the clypeus; the asperities of the ampullae are longer and stronger than in almost any other species of *Obberea*.

*Pupa.* No chitinous points on thoracic terga and very few on abdominal, these becoming stronger and more conspicuous on last three segments; otherwise as in *ruficollis*.

[Described from specimens Hopk. U. S. 10084i.]

These larvae have been found only in *Rhododendron* and related shrubs. The adult girdles the tip of the stems, inserting an egg in the living portion beneath the girdle. During the first summer the larva bores down the stalk, hollowing out the centre and exuding frass through numerous holes cut to the surface. The second summer the roots are attacked and likewise hollowed, until late summer, when the pupal cell is constructed near the surface of the ground and the stem above is cut off by an oblique incision. The adults fly about the time the host plants are in flower.

## OBBEREA FLAVIPES Haldeman

Resembles the preceding, but two secondary ocelli usually are distinct; the asperities of the ampullae are finer and the body hairs as coarse.

This larva feeds in the stems of *Phlox*, the habits being quite similar in all respects to those of *myops*. Only one year is required for completing the entire development. Observations by A. B. Champlain and the author in the vicinity of Washington, D.C.

## PACHYTA MONTICOLA Randall.

[Pl. I, fig. 3; Pl. XXII, fig. 15]

*Form* elongate, depressed, parallel; integument tough, smooth, shining, sparsely clothed with coarse castaneous hairs.

Other characters than those defined under the genus are: Hypostoma transverse, having anterior edge not distinct from submentum; gula not indicated; anterior half of mesonotum and metanotum dull, finely asperate; tubercles of ampullae irregular, confluent, and finely sparsely asperate; ninth abdominal tergum bearing an acute chitinous spine suddenly turned upwards and immediately surrounded above by six long setae.

Legs in adult, beset with groups of reddish-brown hair as follows: A transverse band on anterior and posterior margin of pronotum; two groups of arching hairs on mesonotum, metanotum, and first four abdominal terga, more dense on first abdominal tergum, becoming thinner posteriorly and again present on eighth; last segment ending in a short, acute spine, and a dense group of hairs.

[Described from specimens Hopk. U. S. 11813.]

In June, 1917, the author found prepupal larvae in earthen cells 6 inches below the surface of the ground beneath a hemlock (*Tsuga canadensis*) log felled 19 months previously. One of the larvae pupated. Adults of *Pachyta monticola* were found nearby and caged on hemlock boughs. Eggs and, later, larvae were secured which agree in all respects with the prepupal larva, thus connecting and completing the life history. After mining for about a year beneath the bark, making meandering burrows, the larvae leave by an elliptical hole through the bark and burrow into the ground to pupate.

Similar larvae have been collected by W. F. Fiske in *Abies* and *Picea*. Range, throughout the mountains of the eastern United States and Canada.

#### POGONOCHERUS CRINITUS LeConte

*Form* elongate, cylindrical; integument tough, shining, sparsely clothed with rather stiff golden hairs.

*Head* depressed, rather thick, sides not restricted behind, widest just behind anterior margin; mouth-frame darkly chitinized; labrum transversely oval, densely ciliate in front, posterior half more darkly coloured; mandible from side about one and one-half times as long as condylar width, cutting edge broadly emarginate, dorsal angle slightly toothed; one indistinct ocellus; antennal ring open behind. Ventral mouth-parts nearly glabrous; palpi darkly chitinized, maxillary three-jointed, apical joint conical, about equal to basal and to cylindrical last labial; mentum distinct, sunken; hypostoma very strongly protuberant posteriorly, anterior margin curved; gular line distinct.

*Protergum* subtrapezoidal, bearing a row of hairs on anterior margin; pronotum rectangular, posteriorly faintly marked with shallow striae; sternum hairy; eusternum triangular; metanotum smooth, shining; mesonotum tuberculate.

*Abdomen* strongly annulated; ampullae seven, protuberant, dorsal bearing three irregular rows of large confluent tubercles; epipleurum protuberant only on last segments, tubercle very elongate oval, no chitinous pits; spiracles quite small, orbicular, peritreme dark; a short conical chitinous spine on ninth tergum; anus trilobed.

[Described from specimens Hopk. 14492a.]

This larva feeds in dead dry branches of *Quercus*. It excavates irregular mines deep in the wood, often in the centre of the branch, tightly packed with fine frass. The pupal cell is constructed deep in the wood, having a projection at right angles to it, extending almost to the surface. The work much resembles that of *P. negundo*, and the life cycle probably extends over more than a year. The material was collected by F. B. Herbert, Los Gatos, Cal.

This species will not run down to *Pogonocherus* in the preceding key of genera. It differs from the other species in the open antennal cavities, three-jointed palpi, and protuberant hypostoma. Under the discussion of *P. negundo* it was stated the genus *Pogonocherus* is composed of two larval types, the *mixtus* type with two-jointed maxillary palpi and a carinate cercal plate, and the *negundo* type, resembling *Ecyrus*, having three-jointed palpi and a spinelike cercus. This species forms a third distinct type. These types represent decidedly better defined genera, from the larval characters, than such genera as *Arhopalus*, *Calloides*, and *Cyllene*.

#### ROPALOPUS SANGUINICOLLIS Horn

*Form* elongate sub-cylindrical, slightly depressed anteriorly; integument firm, shining, reticulated, sparsely beset with short castaneous hairs.

*Head* trapezoidal, widest just behind middle; epistoma straight, thick; labrum thin, sub-triangular, sparsely haired; mandibles slightly longer than basal width, distal half piceous, basal dark castaneous granulate; second joint of antennae longest, supplementary minute; one distinct, black, protuberant ocellus; gena receding, glabrous except for a few scattered hairs; ventral mouth-parts somewhat coriaceous; palpifer process and subfossal spine wanting; palpi joints subequal in length.

*Prothorax* about twice as wide as long with a dull granulate spot on sides; pronotum anteriorly coarsely punctured, posteriorly coarsely striate to alutaceous; median suture faint; sternum alutaceous, shining, not differentiated into areas; legs four-jointed, including tarsus and somewhat longer than maxillary palpus.

*Abdomen.* Dorsal ampullae shining alutaceous, bounded by two lateral converging folds connected anteriorly by a transverse one; ventral divided in middle by a broad, shallow depression; pleural discs distinct on first four abdominal segments; spiracles narrowly oval.

[Described from specimens 15045s Dominion Entomological Branch.]

Mr. J. N. Knull called the writer's attention to this species breeding in the trunks of wild cherry (*Prunus*) near Bathurst, N.B. Many smaller trees up to two, three and four inches in diameter had been killed. The eggs are laid under scales of bark and the larvae mine extensively beneath the bark, killing areas from two inches wide to eight inches long. The mines are packed with granular frass. Later the larvae enter the wood like *Romaleum rufulum*, boring up the stem in the heartwood from six to twelve inches. At the upper end of this tunnel the pupal cell is made and the emergence hole is cut out at the same end. Large masses of gum on the trunks are characteristic of the attack. The life-cycle extends over two seasons.

#### STEIROSTEMA DEPRESSUM Linnaeus

*Form* elongate, subcylindrical; integument thin, shining, very sparsely clothed with coarse hairs.

*Head* depressed, sides not constricted behind, anterior margin darkly chitinized and very finely granulate; labrum thin, transversely oval, widest at middle, anterior half densely hairy; mandible from side about twice as long as condylar width, cutting-edge emarginate, dorsal angle toothed; antennal ring open behind; one pair of ocelli. Ventral mouth-parts beset with coarse hairs; maxillary palpi slender, last joint shortest, truncate at tip, shorter than last labial; anterior edge of hypostoma curved; gula not distinct.

*Prothorax* widest behind; pronotum posteriorly beset with rather coarse, erect, chitinous asperities, except for a large, full, central, finely rugose area, on which these asperities are very fine or absent, also bearing two longitudinal, glabrous, darker spots on the anterior part of this area; anteriorly the lateral angle bears a group of hairs, extending more sparsely across protergum. Metanotum, mesosternum, and metasternum tuberculate.

*Abdomen.* Seven ampullae bearing dorsally four irregular rows of large, glabrous, shining tubercles, ventrally two rows; epipleurum protuberant, tubercle broadly oval, bearing two setae and two chitinous pores; anus trilobed; spiracles large, nearly orbicular.

[Described from specimens in the United States National Museum collection labelled 1189, from cocoanut trees (*Cocos nucifera*), Surinam.]

*Steirosrema* seems to suggest *Acanthoderes* from characters of the head and ampullae.

#### TETROPS JUNCUNDA LeConte

This larva in all essential characters resembles that of *Tetraopes tetraophthalmus*. It differs as follows: Form more slender, body hairs short, few except on last segment, where they form a dense ring; hypostoma very faintly wrinkled; one distinct black ocellus; labrum transversely semicircular, about twice as wide as long, anterior margin fringed with short hairs. Pronotum posteriorly velvety pubescent, darkest on two median projecting patches, eusternum bearing a few hairs along sides; metanotum tuberculate. Ampullae strongly projecting, seven dorsal ones bearing two transverse rows of prominent regular tubercles.

[Described from specimens Hopk. U. S. 10626.]

The author collected larvae of this species feeding in the stem of wild morning-glory (*Ipomoea* sp.) in the vicinity of the District of Columbia. It does not enter the tubers, as has been reported, but feeds only in the long creepers above the ground. The work resembles that of some species of *Oberea* in that it hollows the stems, ejecting the frass through small holes. Eggs were found in small scars gnawed through the bark, and inserted deep in the stems. Matured larvae were found in September by A. B. Champlain and the writer, hence the life-history is completed in one year. Adults are found on the flowers of the host.

The fact that this larva resembles that of *Tetraopes* in all essential characters further corroborates the belief that these genera constitute a group quite distinct from *Oberea*.

**TETROPIUM** sp.

... smaller than *cinnamopterum* and differing from *velutinum* in having the caudal spines edged by very minute, scarcely visible blunt tubercles, separated at least three times the thickness; pronotum and ampullae more finely vellured, that on the former, covering two-thirds of the area, labrum only hairy in front.  
[Described from specimens No. 15044s Dominion Entomological Branch.]

The larvae feed in the outer bark of living spruce. The mines are very meandering and tightly packed with dark brown granular frass. They were collected by the author at Gaspé Basin, Québec, and one adult was reared. This larva is quite distinct from the other species and the adult is extremely small.



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## ABBREVIATIONS USED IN PLATES AND TEXT FIGURES

- I A*, first abdominal segment.  
*II A*, second abdominal segment.  
*III A*, third abdominal segment.  
*1, 2, 3*, first, second and third joints of antennae.  
*a*, apex of mandible.  
*aa*, anterior area of pronotum.  
*A.1.*, alar area.  
*a*, anal spine.  
*al*, anal lobes.  
*am*, basal articulating membrane of antennae.  
*Amb. Amp.*, ambulatory ampullae.  
*an'*, antennae.  
*ar*, antennal rings or annuli.  
*as*, alar spots or plates.  
*asrm*, attachment of superior retractor muscles of head.  
*c*, cardo.  
*ci*, caudal spines or cerci.  
*cly*, clypeus.  
*co*, collar, or skin connection between prothorax and head.  
*cp*, chitinous pits of pleural tubercle.  
*cu*, cuneus.  
*cx*, coxa.  
*Cxl*, coxal lobe.  
*d*, pleural discs.  
*ds*, dorsal angle of cutting-edge of mandible.  
*dl*, dorso-lateral suture.  
*ep*, epistoma.  
*epic*, epicranium.  
*eps*, epistomal setae.  
*es*, eusternal spots or plates.  
*Est*, eusternum.  
*F*, front.  
*f*, femur.  
*frs*, frontal suture of head.  
*g*, gena.  
*gs*, genal setae.  
*gu*, gula.  
*Hp*, hypopleurum.  
*hs*, hypostomal suture.  
*hy*, hypostoma.  
*InSeg*, intersegmental skin.  
*l*, lateral suture of pronotum.  
*lab*, labrum.  
*lac*, lacinia.  
*li*, ligula.  
*lp*, labial palpi.  
*lpal*, labial palpifer.  
*ls*, lateral spots or plates.  
*Lz*, epipleurum.  
*M*, median suture of head.  
*m*, mentum.  
*ma*, median area of pronotum.  
*md*, mandible.  
*Mesn*, mesonotum.  
*mpal*, maxillary palpifer.  
*ms*, median pronotal suture.  
*MsT*, mesothorax.  
*MtT*, metathorax.  
*mzp*, maxillary palpus.  
*mzsc*, maxillary sclerite.  
*N*, notum.  
*ns*, notal spots or plates.  
*o*, ocelli.  
*occ. for.*, occipital foramen.  
*p*, palpifer.  
*PA*, proalar area.  
*pa*, posterior area of pronotum.  
*PaSc*, parascutal area.  
*pcca*, postcondylar carina.  
*Pl*, pleural lobe or tubercle.  
*Pn*, pronotum.  
*PnF*, postnotal fold.  
*po*, pleurostoma.  
*pp*, process of palpifer.  
*PrSt*, presternum.  
*PrT*, prothorax.  
*PrTg*, protergum.  
*ps*, presternal spots or plates.  
*PSc*, prescutum.  
*S*, sternum.  
*s*, spiracle.  
*sa*, skin attachment of ventral mouthparts to prothorax.  
*Sc*, scutum.  
*Scl*, scutellum.  
*se*, spiracular ellipse.  
*sfs*, subfossal spine or process.  
*sj*, supplementary joint of antennae.  
*St*, sternellum.  
*sm*, submentum.  
*sp*, scutal plate.  
*Sp A*, spiracular area.  
*st*, maxillary stipes.  
*Stl*, sternellum.  
*T*, tergum.  
*t*, tarsus.  
*ta*, tentorial arm.  
*tb*, tentorial bridge.  
*ti*, tibia.  
*tp*, tentorial pits.  
*tr*, trochanter.  
*vl*, ventro-lateral suture.  
*vrn*, attachment of ventral retractor muscles of head.

**EXPLANATION OF PLATES**

.

## PLATE I

## MANDIBLES OF LARVAE OF CERAMBYCIDAE

FIG. 1.—*Leptalia macilenta*.

FIG. 2.—*Encyclops caeruleus*.

FIG. 3.—*Pachyta monticola*.

FIG. 4.—*Rhagium lineatum*.

FIG. 5.—*Billamira scalaris*.

FIG. 6.—*Romalium rufulum*.

FIG. 7.—*Necolytus capraea*.

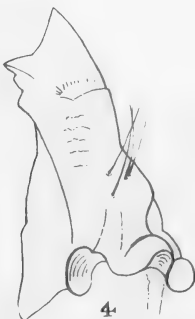
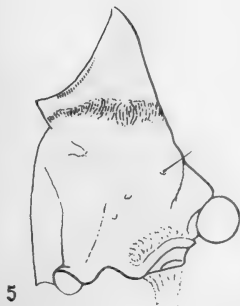
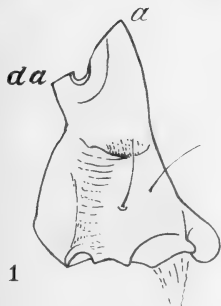
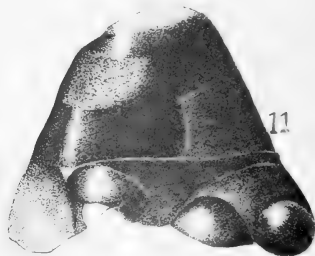
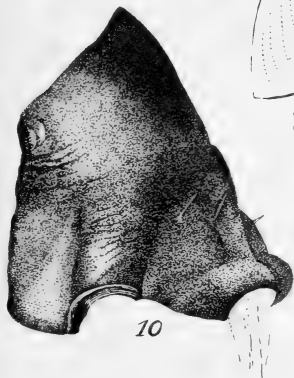
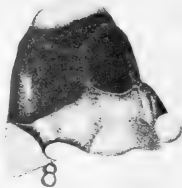
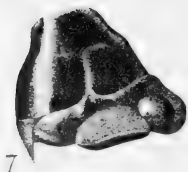
FIG. 8.—*Metaclytus batesi*.

FIG. 9.—*Spondylis buprestoides* (from Perris, Insectes du Pin Maritime).

FIG. 10.—*Homaesthis emarginatus*.

FIG. 11.—*Elaphidion subpubescens*.





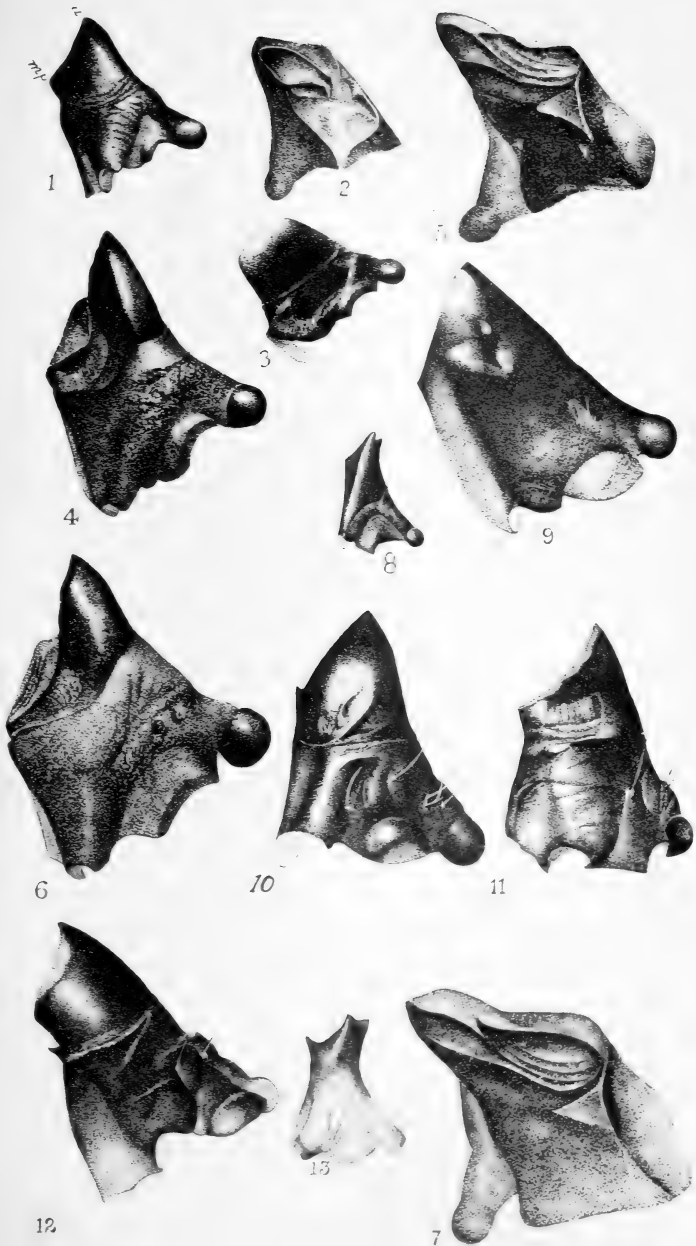




## PLATE II

## MANDIBLES OF LARVAE OF ASEMINAE AND LAMINAE

- FIG. 1.—*Tetropium cinnamopterum*: Outer face of right mandible.
- FIG. 2.—*Tetropium cinnamopterum*: Inner face of right mandible. Note the less produced apex and rounded dorsal angle.
- FIG. 3.—*Opsimus quadrilineatus*: Outer face of right mandible. Note the rounded, gouge-like cutting edge.
- FIG. 4.—*Asemum nitidum*: Outer face of right mandible. Note the produced apex and flattened dorsal angle.
- FIG. 5.—*Asemum nitidum*: Inner face of right mandible.
- FIG. 6.—*Criocephalus productus*: Outer face of right mandible. Similar to *Asemum*, except that the striated plate is more strongly engraved.
- FIG. 7.—*Criocephalus productus*: Inner face of right mandible.
- FIG. 8.—*Adctus subellipticus*: Outer face of right mandible.
- FIG. 9.—*Oncideres cingulata*: Outer face of right mandible.
- FIG. 10.—*Obura ruficollis*: Outer face of right mandible.
- FIG. 11.—*Goes tigrinus*: Outer face of right mandible.
- FIG. 12.—*Michthysoma heterodoxum*, showing tooth that is absent in some forms.
- FIG. 13.—*Hippopsis lemniscata*: Outer face of right mandible.







## PLATE III

## LARVAE OF CERAMBYCIDAE

FIG. 1.—*Crioccephalus productus*: Lateral view of two abdominal segments showing typical structure.

FIGS. 2, 3.—*Spondylis buprestoides*: antennae and labrum (from Perris, Insectes du Pin Maritime).

FIG. 4.—*Atimia dorsalis*: Labrum.

FIG. 5.—*Asemum atrum*: Labrum.

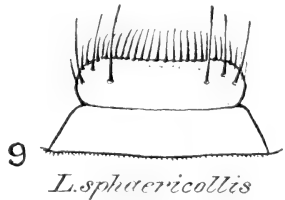
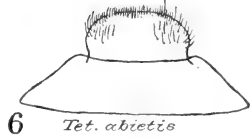
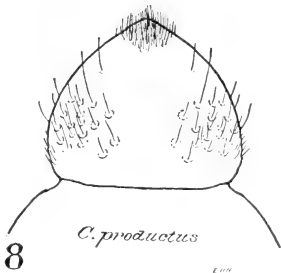
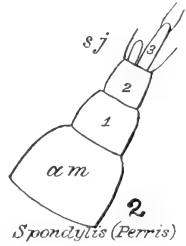
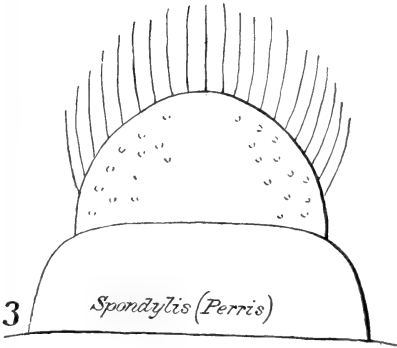
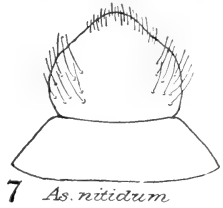
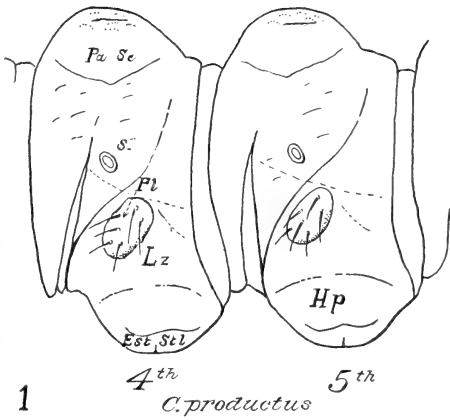
FIG. 6.—*Tetropium abietis*: Labrum.

FIG. 7.—*Asemum nitidum*: Labrum.

FIG. 8.—*Crioccephalus productus*: Labrum.

FIG. 9.—*Leptura sphaericollis*: Labrum.





## PLATE IV

## MANDIBLES OF LARVAE OF LEPTURINAE AND OF A DISTENIINE

FIG. 1.—*Gaurotes cyanipennis*.

FIG. 2.—*Leptura obliterata*. Note the dorsal angle flattened into a striated plate.

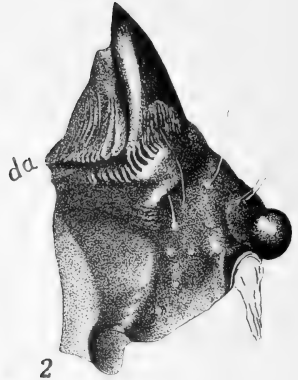
FIG. 3.—*Ulochactes leoninus*. Note the deep, oblique sulcus on the apical portion.

FIG. 4.—*Leptura proxima*.

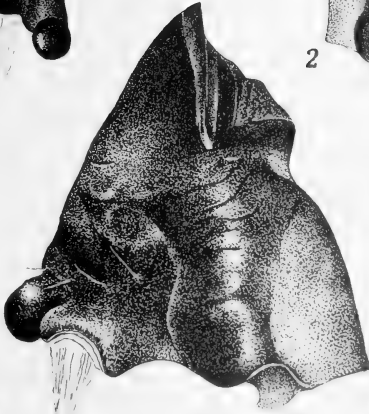
FIG. 5.—*Distenia undata*. The parallel edges of the outer face and the short cutting edge of this mandible suggest the lamiine type.



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## PLATE V

## MANDIBLES OF LARVAE OF LAMINAE

[Note the upper angle of the cutting edge and the texture of the outer face.]

FIG. 1.—*Hectoemis cinerea*.

FIG. 2.—*Michthysoma heterodoxum*.

FIG. 3.—*Eupogonius tomentosus*.

FIG. 4.—*Tetraopes tetraophthalmus*.

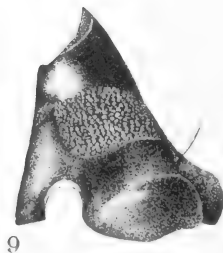
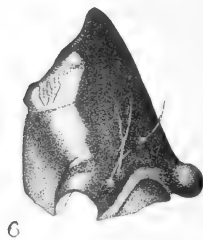
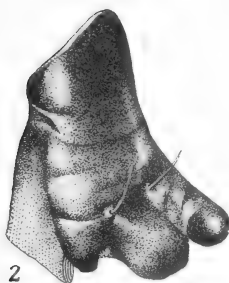
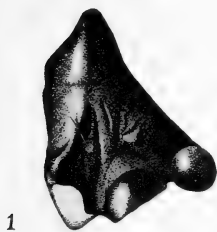
FIG. 5.—*Ptychodes trilineatus*.

FIG. 6.—*Ataxia crypta*.

FIG. 7.—*Deetes spinosus*.

FIG. 8.—*Goes oculatus*.

FIG. 9.—*Ecyrus dasycerus*.





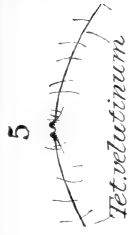




## PLATE VI

## CERCI OF LARVAE OF ASEMINAE

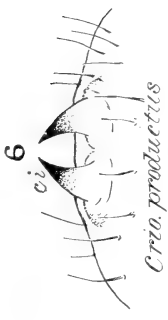
- FIG. 1.—*Asemum atrum*: Cerci or caudal spines, from behind.
- FIG. 2.—*Atimia dorsalis*: Cerci from behind.
- FIG. 3.—*Crioccephalus productus*: Cerci from side.
- FIG. 4.—*Asemum nitidum*: Cerci from behind.
- FIG. 5.—*Tetropium velutinum*: Cerci from behind.
- FIG. 6.—*Crioccephalus productus*: Cerci from behind.
- FIG. 7.—*Paratimia conicola*: Cerci from behind.
- FIG. 8.—*Asemum moestum*: Cerci from behind.
- FIG. 9.—*Tetropium cinnamopterum*: Cerci from behind.
- FIG. 10.—*Nothorhina aspera*: Cerci from behind.
- FIG. 11.—*Spondylis buprestoides*: Cerci from above. (Perris.)
- FIG. 12.—*Asemum moestum*: Lateral view of last three abdominal segments.



*Tet. velutinum*



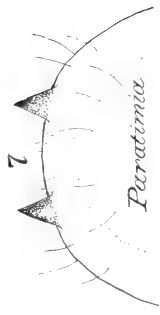
*Atimia dorsalis*



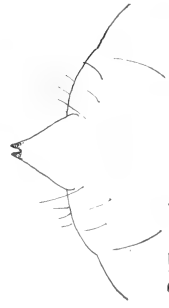
*Crio. productus*



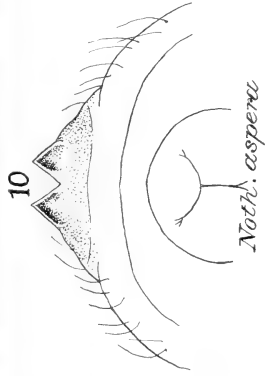
*Crio. productus*



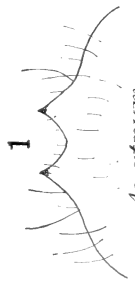
*Paratimia*



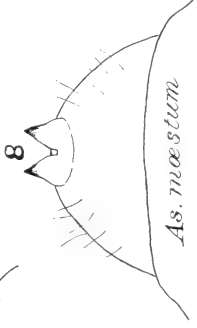
*Tet. cinnamopterum*



*Noth. aspera*



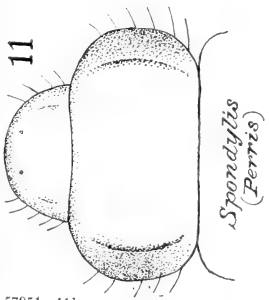
*As. atrum*



*As. noestum*



*As. nitidum*



*Spondylis (Perris)*



*As. noestum*

## PLATE VII

## LAST SEGMENT OF LARVAE OF LAMINAE

- FIG. 1.—*Pogonocherus mixtus*: Last segment from side.  
 FIG. 2.—*Pogonocherus mixtus*: Last segment from above.  
 FIG. 3.—*Graphisurus fasciatus*: Last segment from side.  
 FIG. 4.—*Graphisurus fasciatus*: Last segment from above.  
 FIG. 5.—*Lepturges symmetricus*: Last segment from side.  
 FIG. 6.—*Plectrura spinicauda*: Last segment from above.  
 FIG. 7.—*Plectrura spinicauda*: Last segment from side.  
 FIG. 8.—*Pogonocherus salicola*: Last segment from above.  
 FIG. 9.—*Dorcaschema wildii*: Last segment from side.  
 FIG. 10.—*Michthysoma heterodoxum*: Last segment from behind.  
 FIG. 11.—*Hippopsis lemniscata*: Last segment from side.  
 FIG. 12.—*Monochamus titillator*: Last segment from side.  
 FIG. 13.—*Adetus subellipticus*: Last segment from side.  
 FIG. 14.—*Atazia crypta*: Last segment from side.  
 FIG. 15.—*Ptychodes trilineatus*: Last segment from side.  
 FIG. 16.—*Spalacopsis stolata*: Last segment from side.

*P.spinicauda*

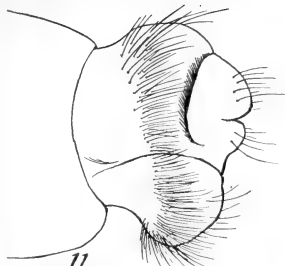


6

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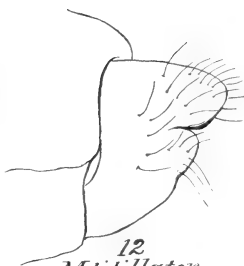


*P.spinicauda*



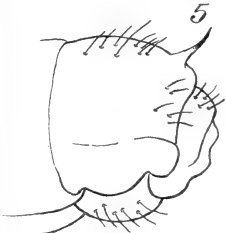
11

*H.lemniscata*



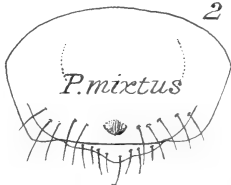
12

*M.titillator*



5

*L.symmetricus*



2

*P.mixtus*



8

*P.salicola*



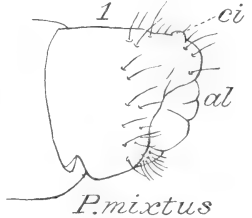
4

*Graphisurus f.*



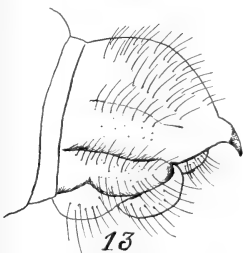
9

*D.wildii*



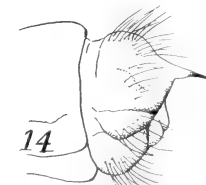
1

*P.mixtus*



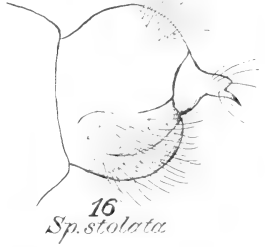
13

*Ad.subellipticus*



14

*At.crypta*



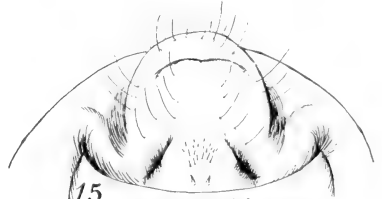
16

*Sp.stolata*



10

*Mich.heterodoxum*



15

*Pty.trilineatus*

## PLATE VIII

## MOUTHPARTS OF LARVAE OF CERAMBYCINAE

FIG. 1.—*Oeme rigida*: Ventral view of head.

FIG. 2.—*Dysphaga tenuipes*: Ventral view of head.

FIG. 3.—*Euderecs picipes*: Ventral view of mouthparts.

FIG. 4. *Methia pusilla*: Ventral view of mouthparts.

FIG. 5.—*Atimia dorsalis*: Dorsal view of head.

FIG. 6.—*Opisimus quadrilincatus*: Ventral mouthparts, showing large palpifer, 2-jointed maxillary palpus, and lanceolate lacinia. Note the gula, not distinct.

FIG. 7.—*Tetropium abieis*: Ventral mouthparts. Note the short gula.

FIG. 8.—*Ascum nitidum*: Ventral view of head. Note the long gula.

FIG. 9.—*Elaphidion mucronatum*: Epistoma and setae.

FIG. 10.—*Elaphidion 10961d*: Epistoma and setae.

FIG. 11.—*Elaphidion incerne*: Epistoma and setae.

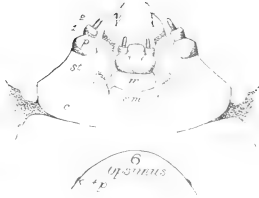
FIG. 12. —*Elaphidion unicolor*: Hypostoma and gula.

FIG. 13.—*Romaleum rufulum*: Ventral view of head.

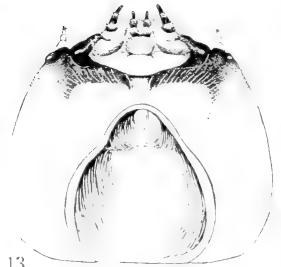
FIG. 14.—*Chion cinctus*: Ventral view of head.



7 *Tectobrevus*



6 *Opimus*  
K+p



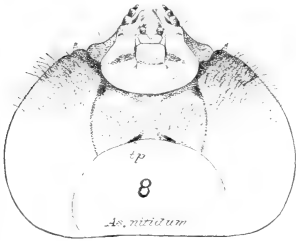
13 *R. rufulum*



11 *E. inermis*

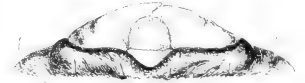


9 *Emucronatum*



8

*A. nigrum*



10 *E. 10961d*



12 *E. unicolor*



1 *O. rigida*

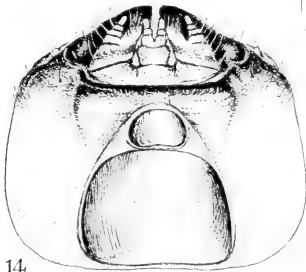


5

*A. demissa*



3 *Enderces picipes*



14 *Chionocinclus*



4 *Melhia*



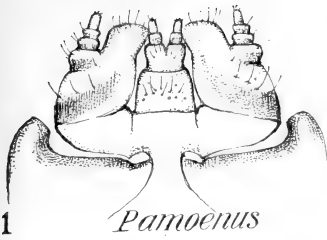
2 *Dys. tenuipes*

## PLATE IX

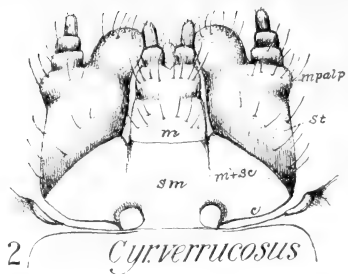
## MOUTHPARTS OF LARVAE OF CERAMBYCINAE

- FIG. 1.—*Phymatodes amoenus*: Ventral mouthparts.  
FIG. 2.—*Cyrtophorus verrucosus*: Ventral mouthparts.  
FIG. 3.—*Curvus dentatus*: Ventral view of head.  
FIG. 4.—*Molorchus bimaculatus*: Ventral view of head.  
FIG. 5.—*Callichroma plicatum*: Ventral view of head.  
FIG. 6.—*Haplidus testaceus*: Ventral view of head.  
FIG. 7.—*Tylonotus bimaculatus*: Dorsal view of head.  
FIG. 8.—*Callichroma plicatum*: Dorsal view of head.

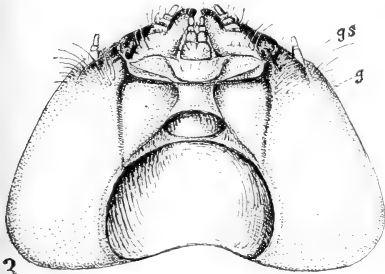




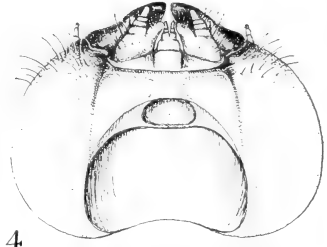
1 *Panoenus*



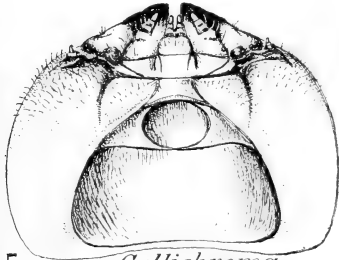
2 *Cyrtverrucosus*



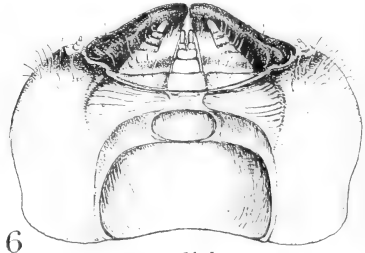
3 *Curius dentatus*



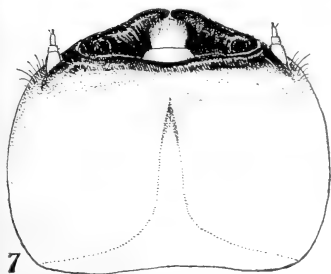
4 *Molorchus bimaculatus*



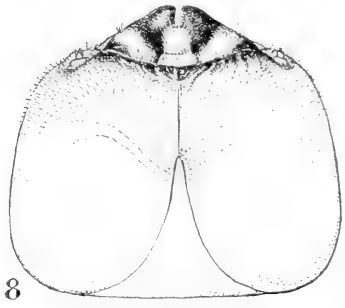
5 *Callichroma*



6 *Haplidus*



7 *Tylonotus*



8 *Callichroma*

## PLATE X

## MOUTH-FRAME OF LARVAE OF CERAMBYCINAE

[View from in front, showing the position of ocellus with relation to the antennae, the shouldered or tapering gena, and the setae.]

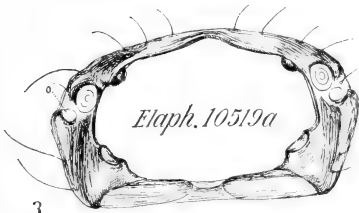
- FIG. 1.—*Metateptus batesi*.  
FIG. 2.—*Romaleum atomarium*.  
FIG. 3.—*Elaphidion tenue*.  
FIG. 4.—*Cyrtophorus verrucosus*.  
FIG. 5.—*Calidium antennatum*.  
FIG. 6.—*Elaphidion mucronatum*.  
FIG. 7.—*Gonocallus collaris*.  
FIG. 8.—*Hylotrupes amethystinus*.  
FIG. 9.—*Ncoelytus capraca*.  
FIG. 10.—*Calloides nobilis*.



1



2



3



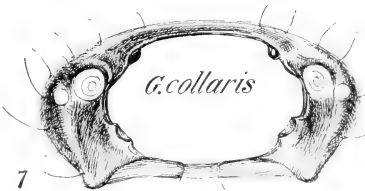
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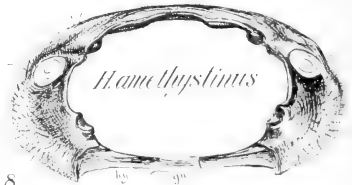
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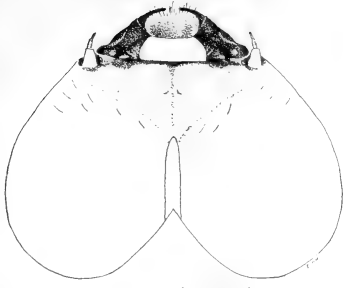


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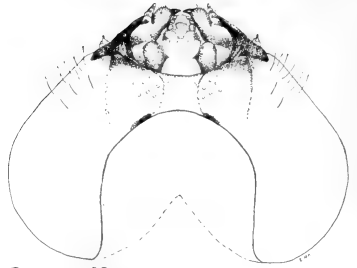
## PLATE XI

## HEAD OF LARVAE OF LEPTURINAE AND OF A DISTENINE

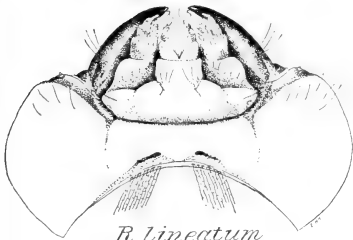
- FIG. 1.—*Necydalis caripennis*: Dorsal view of head. Note the prominent, dorsally placed antennae.
- FIG. 2.—*Necydalis caripennis*: Ventral view of head. Note that the dorsal margins of the epicranium are not entirely emarginate behind the front, as in figure 4. Note also the large lacinia.
- FIG. 3.—*Rhagium lineatum*: Ventral view of head.
- FIG. 4.—*Rhagium lineatum*: Dorsal view of head. Note attachment of inferior retractor muscles of head and compare with *Distenia*. Also note that *Rhagium* has many epistomal setae instead of the usual number.
- FIG. 5.—*Centrodera decolorata*: Ventral view of head, showing wide, prominent gula.
- FIG. 6.—*Leptura nitens*: Ventral view of head with tentorial structures diagrammatically illustrated; these extend dorsally to the front of the head.
- FIG. 7.—*Distenia undata*: Ventral view of head to show the structure. Note that the skin of the prothorax extends over the entire ventral surface of the head and is attached to the base of the submentum. The gula and hypostoma are not developed and the ventral bridge of the head capsule consists of the expanded tentorial bridge.
- FIG. 8.—*Anthophilax* sp. 9790l: Dorsal view of head to show division of front.



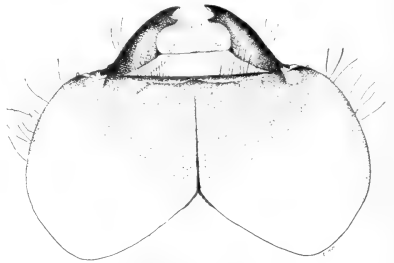
1 *Nec. caripennis*



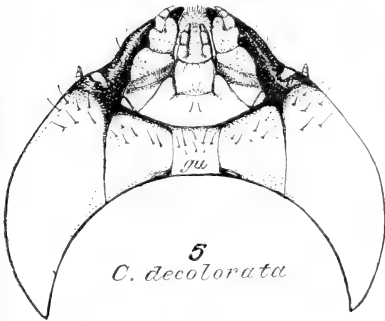
2 *Nec. caripennis*



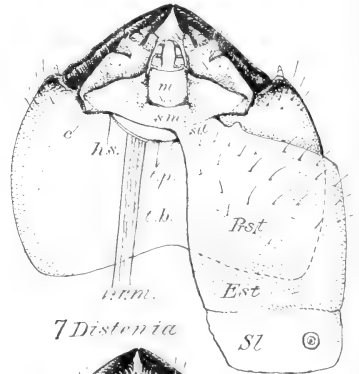
3 *R. lineatum*



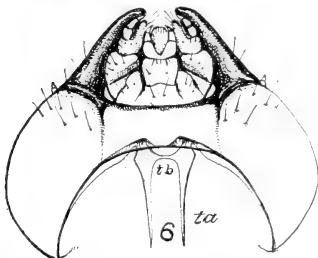
4 *R. lineatum*



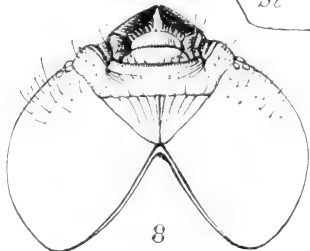
5  
*C. decolorata*



7 *Distenia*



6  
*L. nitens*

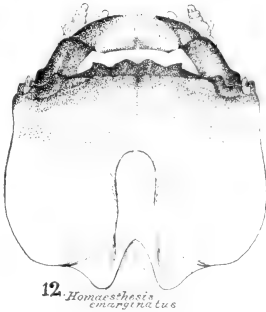
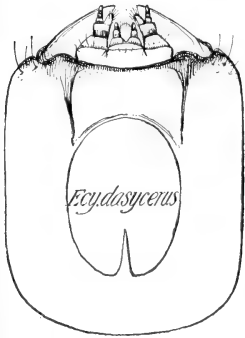
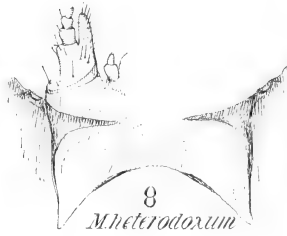
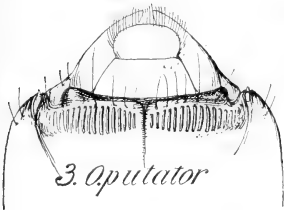
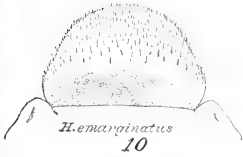
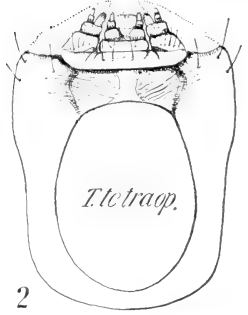
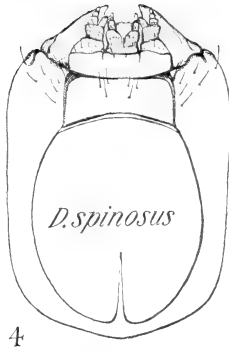
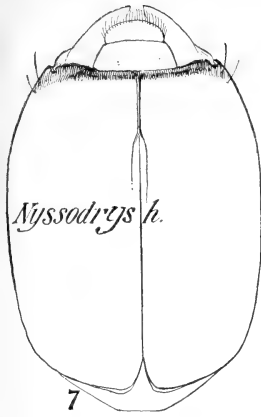


8  
*Anthophila ax*

## PLATE XII

## HEAD OF LARVAE OF CERAMBYCIDAE

- FIG. 1.—*Ecyrus dasyecrus*: Ventral view of head.  
FIG. 2.—*Tetraopes tetraophthalmus*: Ventral view of head.  
FIG. 3.—*Oncideres putator*: Dorsal view of head.  
FIG. 4.—*Deetes spinosus*: Ventral view of head.  
FIG. 5.—*Goes pulcherrulentus*: Ventral view of head.  
FIG. 6.—*Goes pulcherrulentus*: Dorsal view of head.  
FIG. 7.—*Nyssodryis haldemani*: Dorsal view of head.  
FIG. 8.—*Michthysoma heterodoxum*: Ventral mouthparts and hypostoma.  
FIG. 9.—*Cyrtinus pygmaeus*: Dorsal view of head.  
FIG. 10.—*Homaesthis emarginatus*: Labrum.  
FIG. 11.—*Homaesthis emarginatus*: Ventral mouthparts.  
FIG. 12.—*Homaesthis emarginatus*: Dorsal view of head.

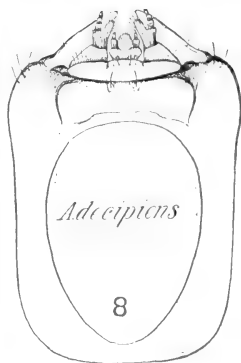
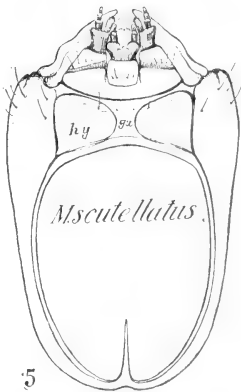
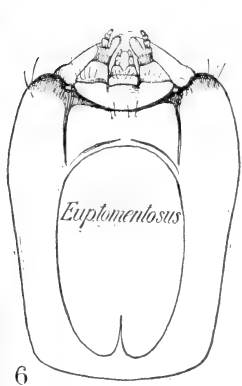
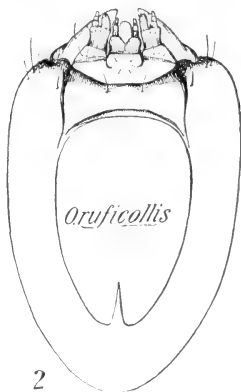
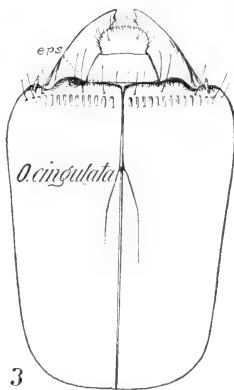
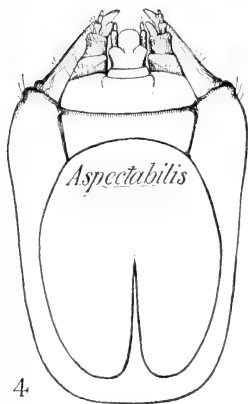
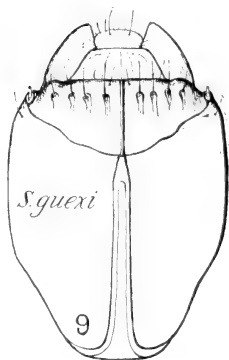
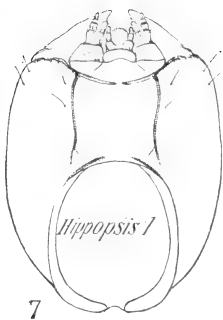
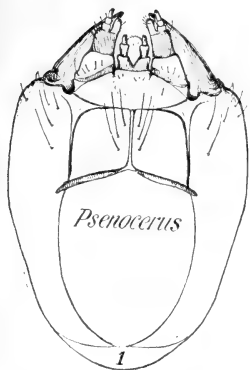


## PLATE XIII

## HEAD OF LARVAE OF LAMINAE

- FIG. 1.—*Pscnoccrus supernotatus*: Ventral view of head.  
 FIG. 2.—*Oberca ruficollis*: Ventral view of head.  
 FIG. 3.—*Oncideres cingulata*: Dorsal view of head.  
 FIG. 4.—*Acanthocinus spectabilis*: Ventral view of head.  
 FIG. 5.—*Mono-hymus scutellatus*: Ventral view of head.  
 FIG. 6.—*Eupogonius tomcosus*: Ventral view of head.  
 FIG. 7.—*Hippopsis lemiscata*: Ventral view of head.  
 FIG. 8.—*Acanthoderes decipiens*: Ventral view of head.  
 FIG. 9.—*Synaphocta guexi*: Dorsal view of head.





## PLATE XIV

## LABRUM OF LARVAE OF LEPTURINAE

[Comparative study principally designed to illustrate characters where species are otherwise quite similar. The line designating the clypeus in living specimens normally appears slightly further forward over the labrum.]

FIG. 1.—*Strangalia luteicornis*.

FIG. 2.—*Strangalia bicolor*.

FIG. 3.—*Leptura chrysocoma*.

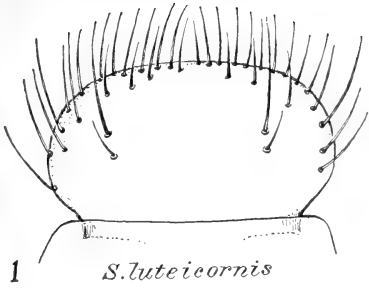
FIG. 4.—*Typocerus velutinus*.

FIG. 5.—*Typocerus lunatus*.

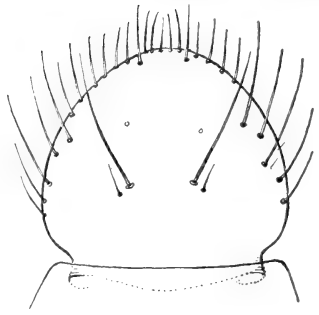
FIG. 7.—*Leptura americana*.

FIG. 8.—*Centrodera decolorata*.

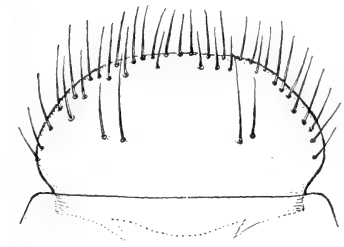
FIG. 9.—*Leptura subhamata*.



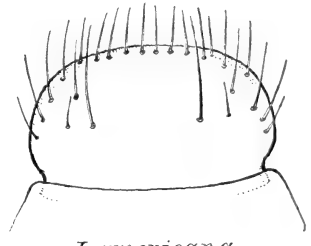
1 *S. luteicornis*



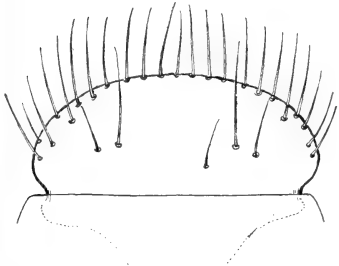
9 *L. subhamata*



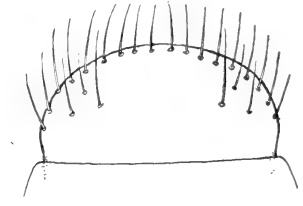
2 *S. bicolor*



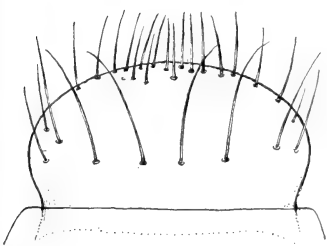
7 *L. americana*



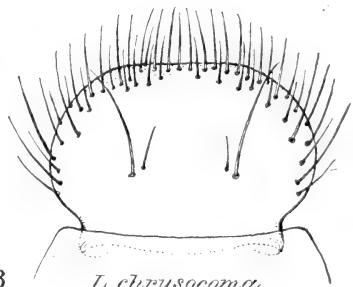
4 *Typ. velutinus*



5 *Typ. lunatus*



8 *C. decolorata*

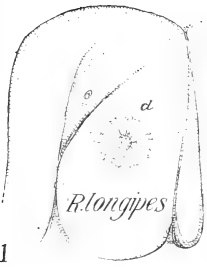


3 *L. chrysocoma*

## PLATE XV

## ABDOMINAL STRUCTURES OF LARVAE OF CERAMBYCINAE

- FIG. 1.—*Rhopalophora longipes*: Lateral view of abdominal segment, showing large pleural disc.
- FIG. 2.—*Cyllene pictus*: Showing pleural disc obscured by tubercle.
- FIG. 3.—*Romaleum rufulum*: Dorsal ampullae.
- FIG. 4.—*Elaphidion mucronatum*: Dorsal ampullae.
- FIG. 5.—*Elaphidion alienum*: Dorsal ampullae.
- FIG. 6.—*Xylotrechus insignis*: Dorsal ampullae.
- FIG. 7.—*Xylotrechus accris*: Dorsal ampullae.
- FIG. 8.—*Stenosphenus notatus*: Pleural disc.
- FIG. 9.—*Elaphidion subpubescens*: Dorsal ampullae.
- FIG. 10.—*Elaphidion subpubescens*: Last ventral ampullae.
- FIG. 11.—*Callidium aereum*: Pleural disc.
- FIG. 12.—*Rhopalophora longipes*: Dorsal ampullae.
- FIG. 13.—*Tylonotus bimaculatus*: Dorsal ampullae.
- FIG. 14.—*Elaphidion subpubescens*: Middle ventral ampullae.
- FIG. 15.—*Merium proteus*: Dorsal ampullae.
- FIG. 16.—*Curius dentatus*: Ventral view of fifth abdominal segment.
- FIG. 17.—*Hylotrupes amethysinus*: Dorsal ampullae.



*R. longipes*



2 *C. pictus*



*R. rufulum*



4 *E. mucronatum*



*E. alienum*



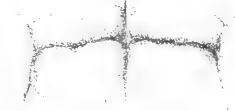
6 *X. insignis*



*X. aceris*



8 *S. notatus*



9 *E. subpubescens*



10 *E. subpubescens*



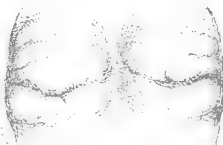
12 *R. longipes*



11 *C. caecum*



13 *T. ylonotus b.*



14

*E. subpubescens*



15 *M. proctus*



16 *Curius d.*



17 *H. anethystrus*

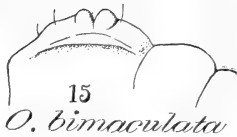
## PLATE XVI

## DORSAL AMPULLAE OF LARVAE OF LAMINAE

- FIG. 1.—*Lepturges symmetricus*.  
FIG. 2.—*Dorcaschema wildii*.  
FIG. 3.—*Dectes spinosus*.  
FIG. 4.—*Psenocerus supernotatus*.  
FIG. 5.—*Acanthodres decipiens*.  
FIG. 6.—*Graphisurus fasciatus*.  
FIG. 7.—*Eupogonius tomentosus*.  
FIG. 8.—*Mecas pergrata*.  
FIG. 9.—*Saperda lateralis*.  
FIG. 10.—*Adctus subellipticus*.  
FIG. 11.—*Tetraopes tetraophthalmus*.  
FIG. 12.—*Goes tigrinus*.  
FIG. 13.—*Ataxia crypta*.  
FIG. 14.—*Oberca bimaculata*.  
FIG. 15.—*Oberca bimaculata*: From side.  
FIG. 16.—*Synaphoeta guezi*.  
FIG. 17.—*Leptostylus macula*.



*D. wildii*



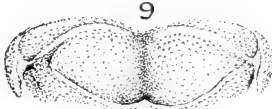
*O. bimaculata*



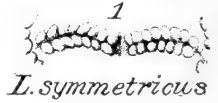
*At. crypta*



*P. supernotatus*



*S. lateralis*



*L. symmetricus*



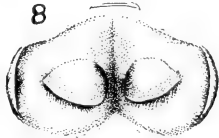
*O. bimaculata*



*Dectes*



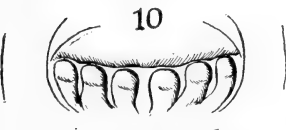
*Graphisurus*



*M. pergrata*



*A. decipiens*



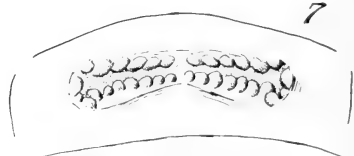
*Ad. subellipticus*



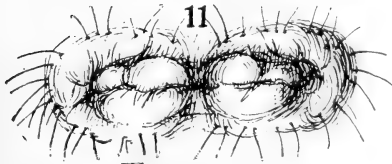
*S. guexi*



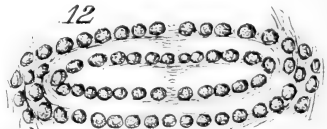
*L. macula*



*Eup. tomentosus*



*T. tetraop.*



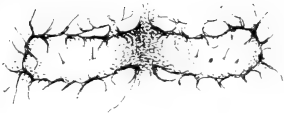
*G. tigrinus*

## PLATE XVII

## ABDOMINAL STRUCTURES OF LARVAE OF LEPTURINAE

- FIG. 1.—*Leptura rubrica*: Dorsal ampullae.  
 FIG. 2.—*Ulochaetes leoninus*: Dorsal ampullae.  
 FIG. 3.—*Leptura nigrella*: Dorsal ampullae.  
 FIG. 4.—*Bellamira seclaris*: Dorsal ampullae.  
 FIG. 5.—*Leptura nitens*: Dorsal ampullae.  
 FIG. 6.—*Gaurotes cyanipennis*: Dorsal ampullae.  
 FIG. 7.—*Rhagium lineatum*: Dorsal ampullae.  
 FIG. 8.—*Leptura emarginata*: Dorsal ampullae.  
 FIG. 9.—*Leptura sphaericollis*: Dorsal ampullae.  
 FIG. 10.—*Leptura obliterata*: Dorsal ampullae.  
 FIG. 11.—*Desmocerus palliatus*: Dorsal ampullae.  
 FIG. 12.—*Lepiura vittata*: Dorsal ampullae.  
 FIG. 13.—*Ulochaetes leoninus*: Abdominal spiracle, showing carinate posterior border.  
 FIG. 14.—*Lagochirus aranciformis*: Dorsal ampullae.  
 FIG. 15.—*Michthysoma heterodorum*: Dorsal ampullae.  
 FIG. 16.—*Plectura spinicauda*: Dorsal ampullae.  
 FIG. 17.—*Hippopsis lemniscata*: Dorsal ampullae.  
 FIG. 18.—*Hippopsis lemniscata*: Dorsal ampullae from side.  
 FIG. 19.—*Pogonocherus mixtus*: Dorsal ampullae.





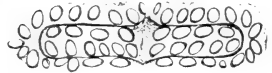
*D. palliatus* 11



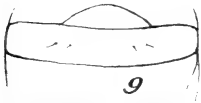
*Lagochirus a.*



*G. cyanipennis*



*L. rubrica*



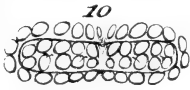
*L. sphaericollis*



*L. nigrella*



*H. lemniscata*



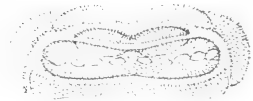
*L. obliterated*



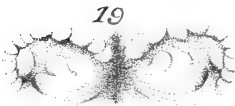
*P. spinicauda*



*U. leoninus*



*L. utens*



*Pog. mixtus*



*L. vittata*



*R. lineatum*



*L. emarginata*



*U. leoninus*



*M. heterodoxum*

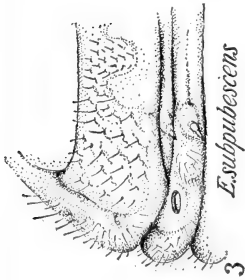


*B. scularis*

## PLATE XVIII

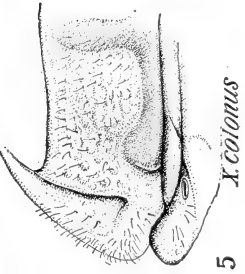
## THORAX OF LARVAE OF CERAMBYCINAE

- FIG. 1.—*Obrium rufulum*: Prothorax and mesothorax from below.
- FIG. 2.—*Tylonotus bimaculatus*: Prothorax and mesothorax from below.
- FIG. 3.—*Elaphidion subpubescens*: Prothorax and mesothorax from below.
- FIG. 4.—*Heterachthes quadrimaculatus*: Prothorax and mesothorax from below.
- FIG. 5.—*Xylotrechus colonus*: Prothorax and mesothorax from below.
- FIG. 6.—*Cyllene pictus*: Prothorax and mesothorax from below.
- FIG. 7.—*Smodicum cucujiforme*: Prosternum and mesosternum.
- FIG. 8.—*Hylotrupes amethystinus*: Prosternum and mesosternum.
- FIG. 9.—*Romaleum rufulum*: Dorsal view of pupa.
- FIG. 10.—*Euderces picipes*: Prosternum and mesosternum.
- FIG. 11.—*Malcopterus lineatus*: Prosternum.
- FIG. 12.—*Phymatodes variabilis*: Protergum.



*Esubpubereus*

3



*X. colonus*

5

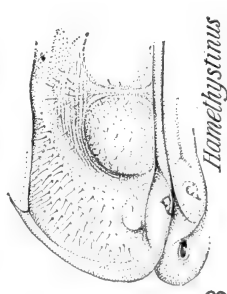


*Tylonotus b.*

2



12. *P. variabilis*



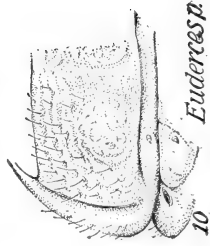
*Hamethystus*

8



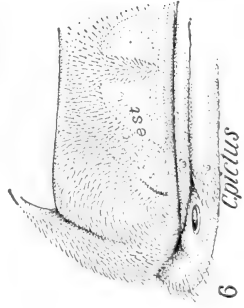
*Smodicum c.*

7



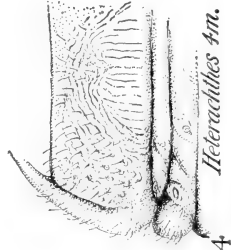
*Euderes* sp.

10



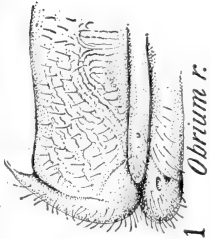
*Cpiclus*

6



*Heteracithes Am.*

4



*O. r.*

1

## PLATE XIX

## THORAX OF LARVAE OF CERAMBYCINAE

- FIG. 1.—*Hylotrupes amethystinus*: Protergum. Note the degree of granulation and the striations; also the median suture.
- FIG. 2.—*Eulerces picipes*: Protergum.
- FIG. 3.—*Malcopterus lineatus*: Dorsal view of prothorax, mesothorax, and metathorax.
- FIG. 4.—*Microclytus gazellula*: Protergum.
- FIG. 5.—*Obrium rufulum*: Protergum.
- FIG. 6.—*Cyrtophorus verrucosus*: Protergum.
- FIG. 7.—*Noclytus cordifer*: Prosternal regions.
- FIG. 8.—*Curius dentatus*: Prothorax, ventral view.
- FIG. 9.—*Callidium arcum*: Protergum.
- FIG. 10.—*Phymatodes amoenus*: Protergum.
- FIG. 11.—*Chytanthus ruricola*: Protergum.
- FIG. 12.—*Mecium proteus*: Protergum.
- FIG. 13. *Romalium rufulum*: Prosternum.



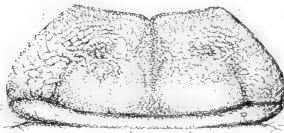
1 *Hamethystinus*



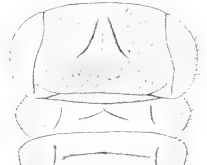
7 *A. cordifer*



2 *Euderes p.*



8 *Curius d.*



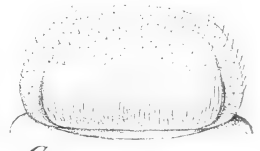
3 *M. lineatus*



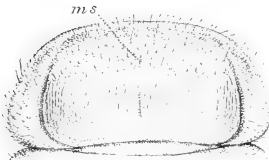
5 *Obruchum rufulum*



4 *Microclytus g.*



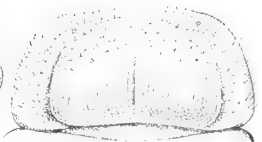
6 *Cyp. verrucosus*



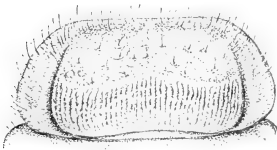
9 *Call. aerum*



10 *Pamocnus*



11 *Cly. ruficornis*



12 *Merium p.*



13 *R. rufulum*

## PLATE XX

## THORAX OF LARVAE OF CERAMBYCINAE

FIG. 1.—*Curius dentatus*: Protergum.

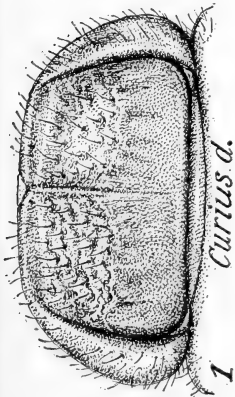
FIG. 2.—*Oeme rigida*: Dorsal view of prothorax, mesothorax, and metathorax.

FIG. 3.—*Cyllene pictus*: Protergum, mesotergum, and metatergum.

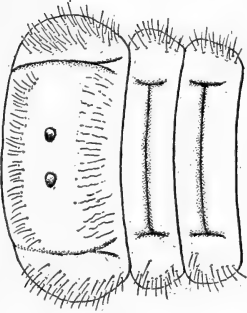
FIG. 4.—*Oeme rigida*: Prosternum.

FIG. 5.—*Xylotrechus colonus*: Protergum.

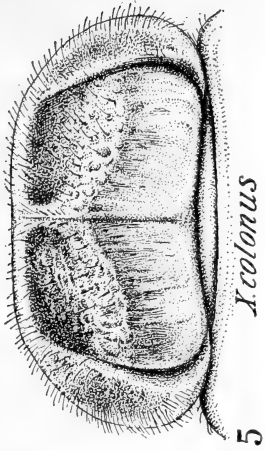
FIG. 6.—*Romaleum rufulum*: Protergum, mesotergum and metatergum. Compare the sutures of the metathorax with those of *Cyllene* (Fig. 3).



*Curus d.*



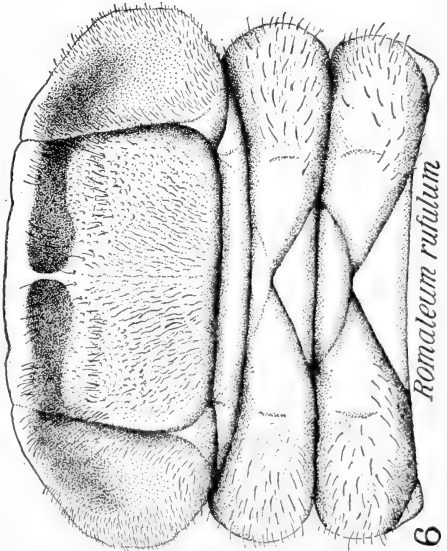
*O. rigida*



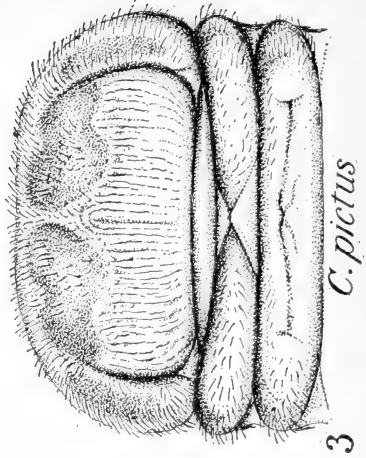
*X. colonus*



*O. rigida*



*Romateum rufulum*



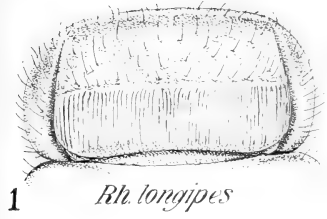
*C. pictus*

## PLATE XXI

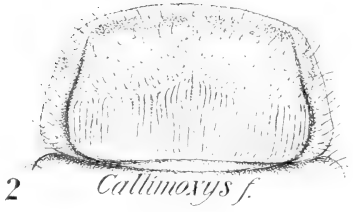
## THORAX OF LARVAE OF CERAMBYCINAE

- FIG. 1.—*Rhopalophora longipes*: Protergum.  
FIG. 2.—*Callimoxys fuscipennis*: Protergum.  
FIG. 3.—*Elaphidion villosum*: Protergum.  
FIG. 4.—*Tylonotus bimaculatus*: Protergum.  
FIG. 5.—*Elaphidion subpubescens*: Protergum, mesotergum, and metatergum.  
FIG. 6.—*Stenosphenus notatus*: Protergum.  
FIG. 7.—*Eburia quadrigeminata*: Protergum.  
Fig. 8.—*Elaphidion alicnum*: Protergum.

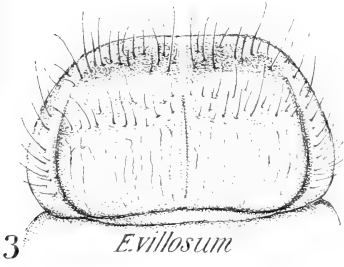




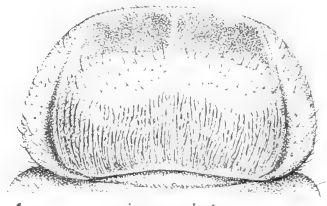
*Rh. longipes*



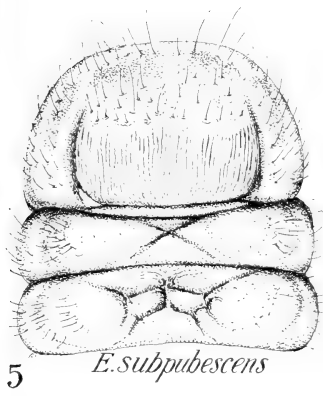
*Callimoxys f.*



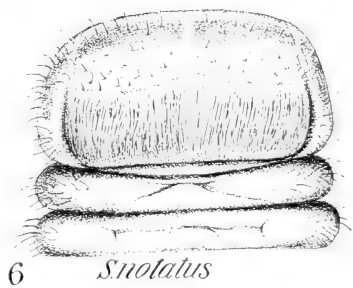
*E. villosum*



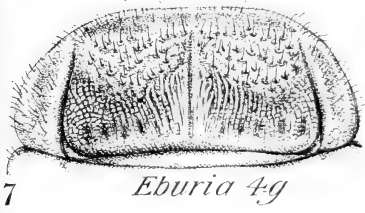
*T. bimaculatus*



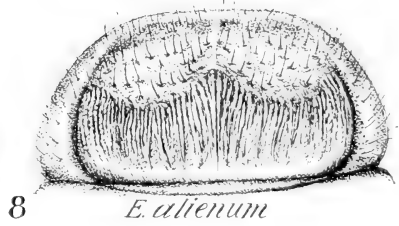
*E. subpubescens*



*Snotatus*



*Eburia Ag*



*E. alienum*

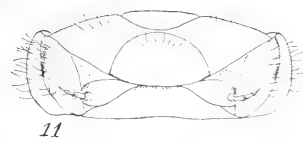
## PLATE XXII

## THORAX AND LEGS OF LARVAE OF LEPTURINAE

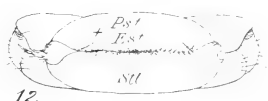
- FIGS. 1-3.—Comparison of mesonotum and metanotum in different species of lepturine larvae. The illustrations show also the first abdominal ampullae.
- FIG. 1. — *Leptura proxima*.
- FIG. 2. — *Typocerus celticus*.
- FIG. 3. — *Leptura canadensis*.
- FIG. 4.—*Leptura rubrica*: Comparison of prosternum. Note the difference in pubescence on the eusternum.
- FIG. 5.—*Bellamira scularis*.
- FIG. 6.—*Anthophilax attenuatus*: Comparison of slender and robust legs. Note especially the difference in the tarsi.
- FIG. 7.—*Bellamira scularis*.
- FIG. 8.—*Necydalis caviennis*: Pronotum, showing rugose texture.
- FIG. 9.—*Necydalis caviennis*: Prosternum, showing triangular, finely pubescent eusternum and coxae nearly meeting at middle.
- FIG. 10.—*Necydalis caviennis*: Dorsal ampullae of third abdominal segment, showing irregularly disposed tubercles.
- FIG. 11.—*Rhagium lineatum*: Prosternum. Note the large, roundly trapezoidal eusternum.
- FIG. 12.—*Rhagium lineatum*: Mesosternum.
- FIG. 13.—*Rhagium lineatum*: Metasternum. Note that these segments are not tuberculate, as they are in nearly all other lepturine larvae.
- FIG. 14.—*Centrodera decolorata*: Caudal spines or cerci.
- FIG. 15.—*Pachyta monticola*: Caudal spines or cerci.
- FIG. 16.—*Anthophilax* sp.: Caudal spines or cerci.
- FIG. 17.—*Anthophilax attenuatus*: Caudal spines or cerci.



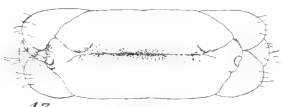
15 *Pachyta n.*



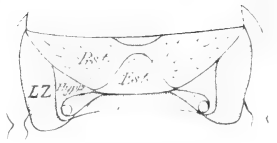
11



12

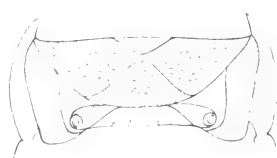


13 *B. leucatum*



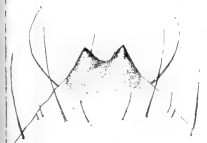
4

*L. rubra*



5

*B. scutipes*



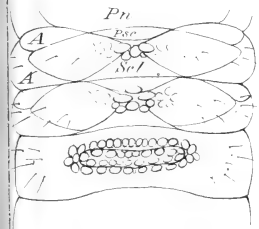
16 *Anthophylax sp.*



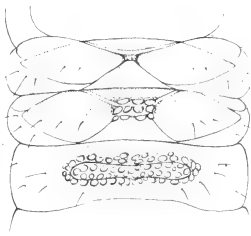
14 *C. colorata*



17 *A. albivittatus*



*L. proxima*



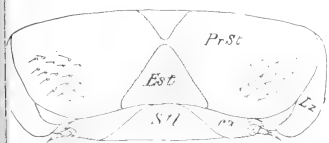
3

*L. quadris*

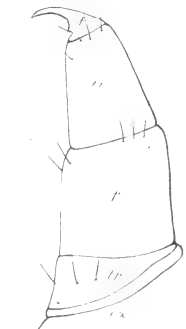


8

*L. Typ. retulimus*



9



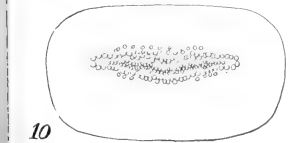
7

*B. scutipes*



6

*Anthophylax*



10

*Nec. cavipennis*

## PLATE XXIII

## THORAX OF LARVAE OF CERAMBYCIDAE

FIG. 1.—*Ataxia crypta*: Pronotum.

FIG. 2.—*Ataxia crypta*: Prosternum.

FIG. 3.—*Acanthoderes decipiens*: Prosternum.

FIG. 4.—*Acanthoderes decipiens*: Pronotum.

FIG. 5.—*Atimia dorsalis*: Protergum, showing pronotum, posteriorly velvety pubescent, and the large irregular glabrous area.

FIG. 6.—*Criocephalus productus*: Protergum, showing pronotum, posteriorly finely asperate, and glabrous spots.

FIG. 7.—*Ptychodes trilineatus*: Pronotum.

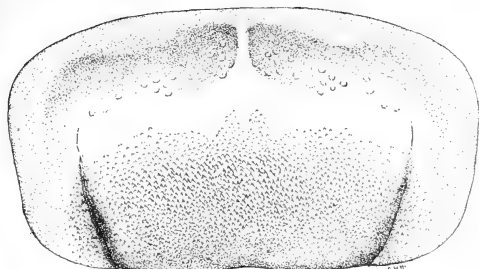
FIG. 8.—*Monochamus scutellatus*: Pronotum.

FIG. 9.—*Saperda hornii*: Prosternum.

FIG. 10.—*Saperda concolor*: Prosternum.

FIG. 11.—*Ulochactes leoninus*: Showing asperities of protergum and well impressed lateral sutures limiting the pronotum.

*At. crypta*

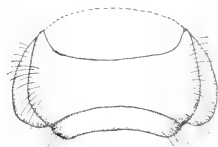


11

*U. leoninus*



1

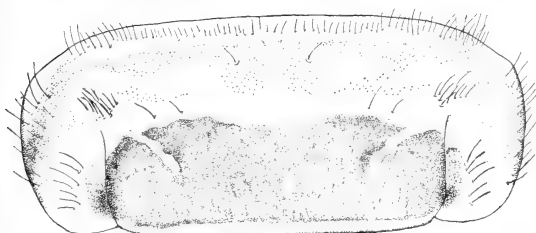


2

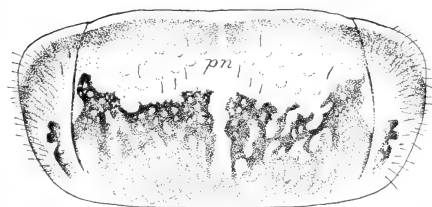
*At. crypta*



10. *S. concolor*



7. *Ptychodes*

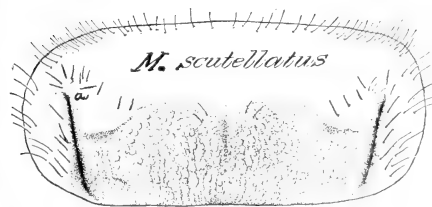


6 *C. productus*

*A. decipiens*



3

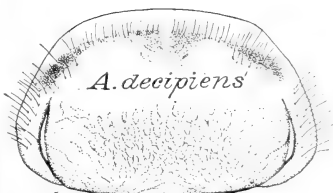


8

*M. scutellatus*

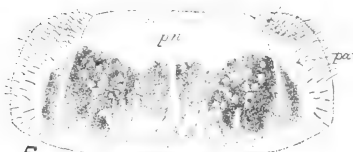


9. *S. hornii*



4

*A. decipiens*



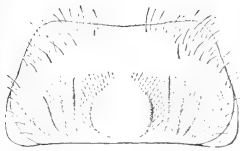
5.

*At. corvata*

## PLATE XXIV

## PROTHORAX OF LARVAE OF LAMINAE

- FIG. 1.—*Cyrtinus pygmaeus*: Pronotum.  
 FIG. 2.—*Plectrura spinicauda*: Pronotum.  
 FIG. 3.—*Oberca ruficollis*: Prosternum.  
 FIG. 4.—*Ecyrus dasyceirus*: Prosternum.  
 FIG. 5.—*Adetus subellipticus*: Prosternum.  
 FIG. 6.—*Liopus variegatus*: Pronotum.  
 FIG. 7.—*Oberca ruficollis*: Pronotum.  
 FIG. 8.—*Psenocerus supernotatus*: Pronotum.  
 FIG. 9.—*Doicaschema wildii*: Pronotum.  
 FIG. 10.—*Michthysoma heterodoxum*: Pronotum.  
 FIG. 11.—*Goes tigrinus*: Prosternum.  
 FIG. 12.—*Goes tigrinus*: Protergum.  
 FIG. 13.—*Hippopsis lemniscata*: Prosternum, mesosternum, and metasternum.  
 FIG. 14.—*Eupogonius tomentosus*: Pronotum.  
 FIG. 15.—*Saperda candida*: Prosternum.



1 *C. pygmaeus*



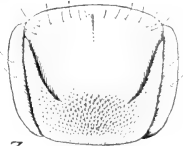
3 *O. ruficollis*



8 *P. superantatus*



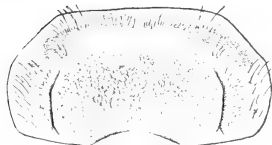
10 *M. heterodoxum*



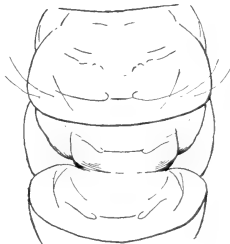
7 *O. ruficollis*



5 *Ad. subellipticus*



9 *D. wildii*



13 *H. lemniscata*



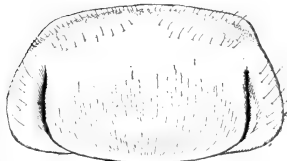
6 *L. Variegatus*



2 *Plectrura*



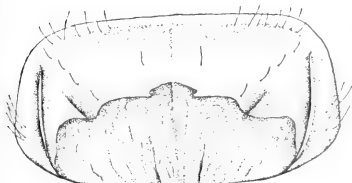
4 *Ecyrus*



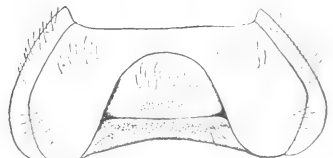
14 *Eup. tomentosus*



11 *G. tigrinus*



12 *G. tigrinus*



15 *S. cecidica*

## PLATE XXV

## LARVAE AND PUPA OF ASEMINAE

FIG. 1.—*Asemum moestum*: Lateral view of larva, showing lateral folds of the body.

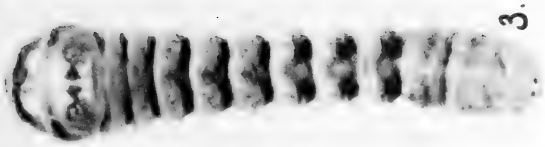
FIG. 2.—*Asemum moestum*: Dorsal view of larva, showing velured pronotum and sutures of terga.

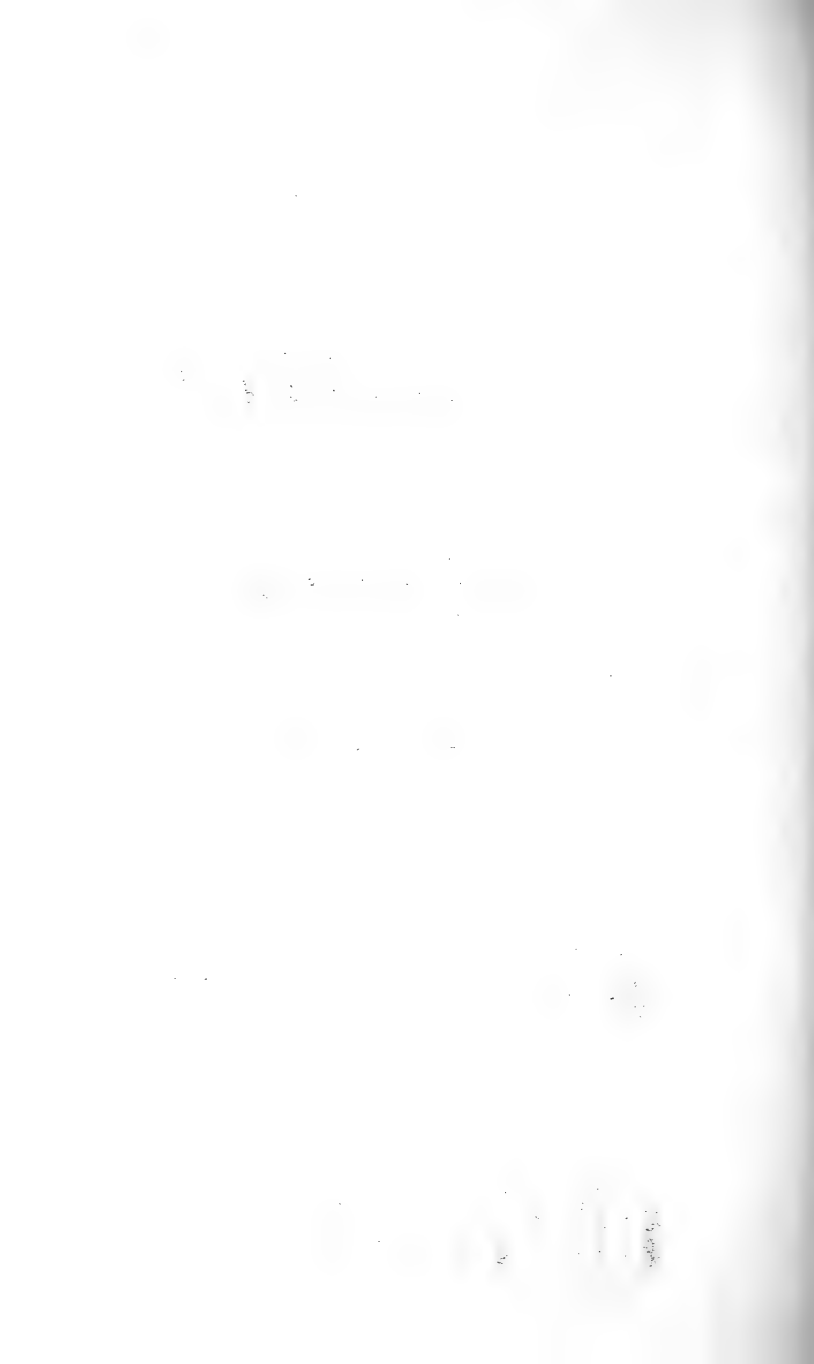
FIG. 3.—*Atimia dorsalis*: Dorsal view of larva.

FIG. 4.—*Atimia dorsalis*: Latero-dorsal view of larva to show bilobed ampullae.

FIG. 5.—*Crioccephalus productus*: Dorsal view of pupa.









## PLATE XXVI

## LARVAE OF CERAMBYCINAE

FIG. 1.—*Cyllene pictus*: Dorsal view of larva.

FIG. 2.—*Cyllene pictus*: Lateral view of larva. Note that the prosternellar fold in front of the spiracle passes beyond it.

FIG. 3.—*Dysphaga tenuipes*: Dorsal view of pupa.

FIG. 4.—*Parandra brunnea*: Dorsal view of head and thorax of larva, to show chitinous asperities.

FIG. 5.—*Hylotrupes ligneus*: Lateral view of larva. Note that the prosternellar fold is broadly fused at the extremity.

FIG. 6.—*Elaphidion subpubescens*: Lateral view of larva.



5.



3.



1.



6.



4.



2.





## PLATE XXVII

## LARVAE OF LEPTURINAE

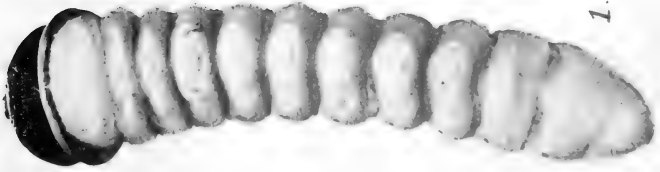
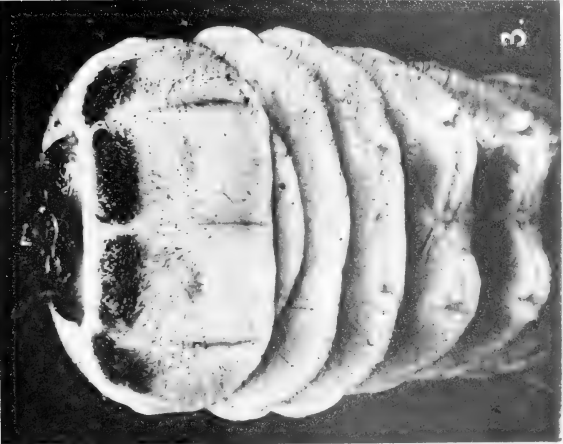
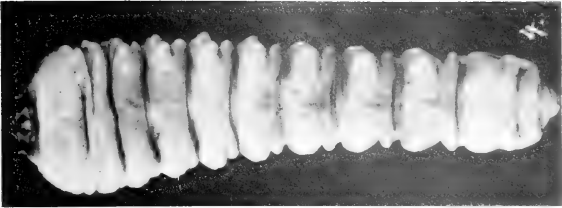
FIG. 1. *Leptura obliterata*: Dorsal aspect of larva, showing tubercles of ampullae, and pigmentation on anterior area of protergum so characteristic of lepturine larvae.

FIG. 2. *Encyclops caeruleus*: Lateral aspect of larva, to show the prominent, projecting, bilobed ampullae.

FIG. 3.—*Tragidion armatum*: Dorsal view of thorax and abdomen, to show the prominent protergal plates.

FIG. 4.—*Curius dentatus*: Ventral view of larva.









## PLATE XXVIII

## LARVAE OF CERAMBYCIDAE

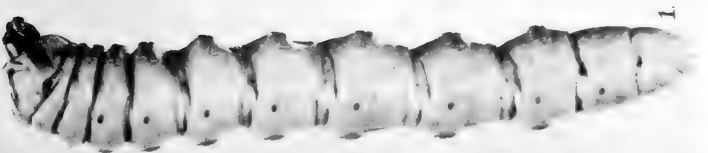
FIG. 1.—*Gots tigrinus*: Lateral view of larva.

FIG. 2.—*Leptura canadensis*: Latero-ventral aspect of larva, showing general form, tubercles of ventral ampullae, and protuberant epipleurum.

FIG. 3.—*Eburia quadrigeminata*: Dorsal view of larva.

FIG. 4.—*Acanthophilax attenuatus*: Lateral aspect of larva. Note that the tubercle on the epipleurum is well indicated, as also the caudal spines.

FIG. 5.—*Chion cinctus*: Lateral view of larva.







## PLATE XXIX

## LARVAE OF CERAMBYCIDAE

FIG. 1. *Physocnemum andrea*: Lateral view of larva.

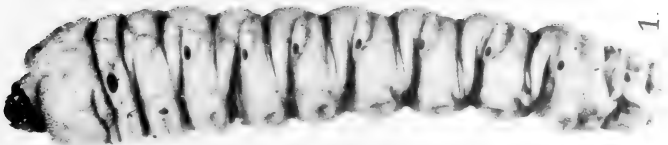
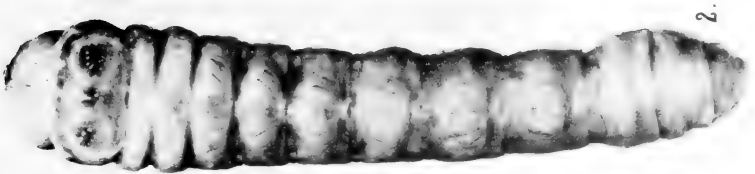
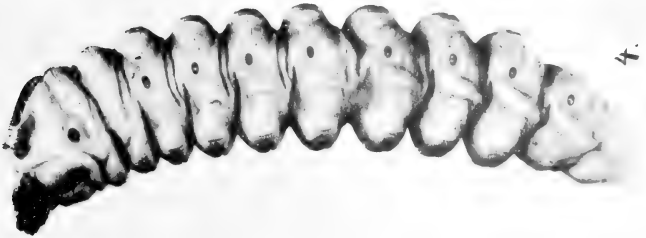
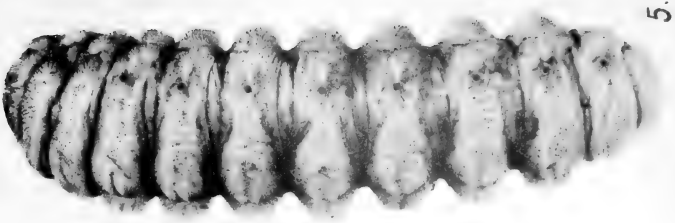
FIG. 2.—*Ulochactes lemnus*: Dorsal aspect of larva. Note the texture of the pronotum and the two lateral impressed lines on the ampullae. The form is abnormally compressed on the left side.

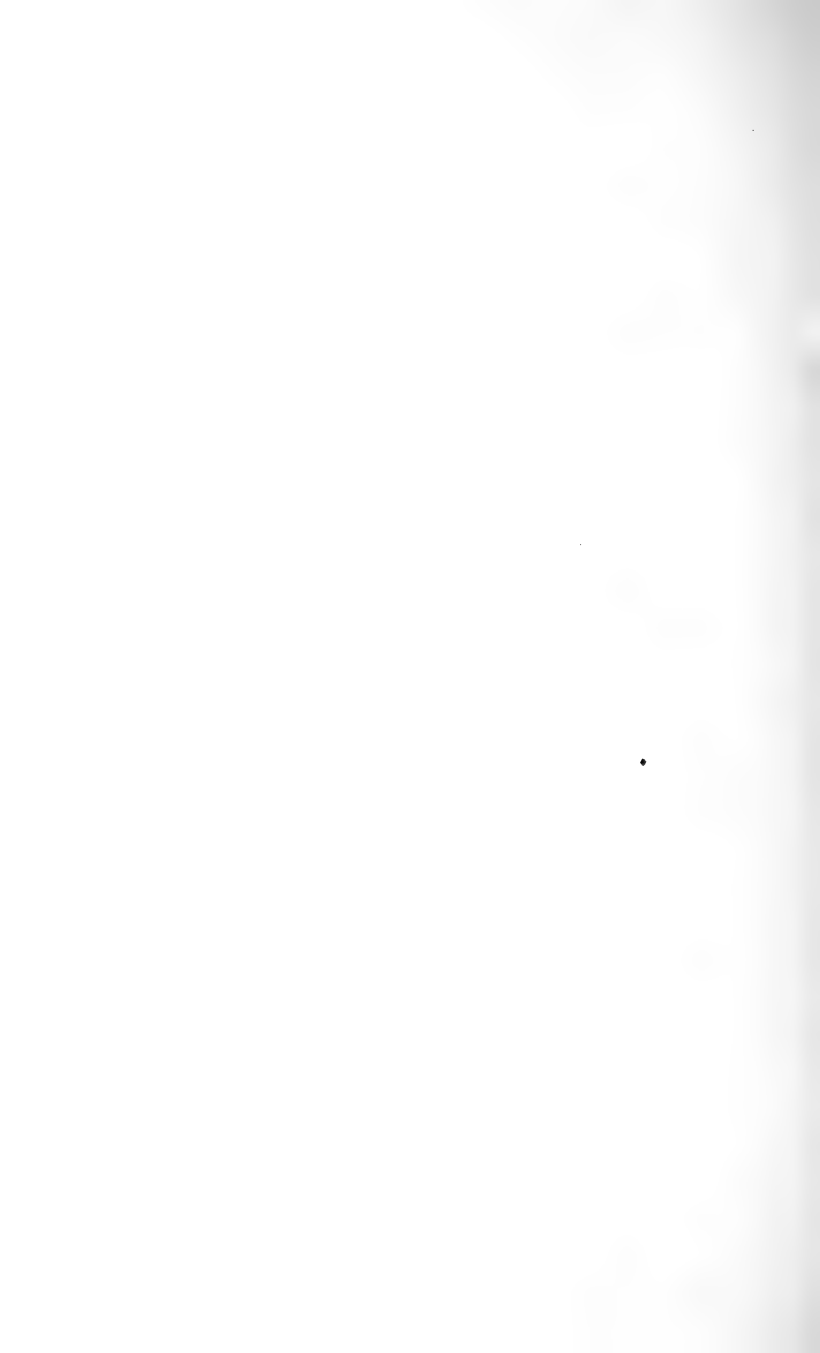
FIG. 3.—*Rhagiium lineatum*: Dorsal view of larva, to show depressed form.

FIG. 4.—*Saperda calcarata*: Lateral view of larva.

FIG. 5. *Moultonia* sp.: Dorsolateral view of larva—a robust type.









## PLATE XXX

## LARVAE AND PUPA OF CERAMBYCIDAE

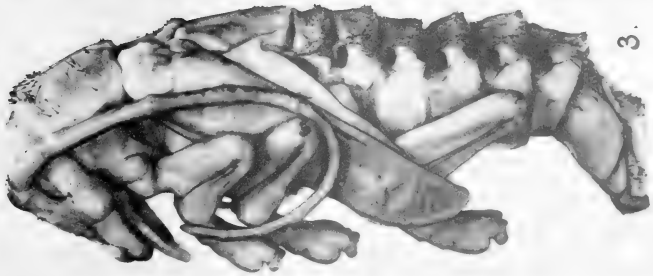
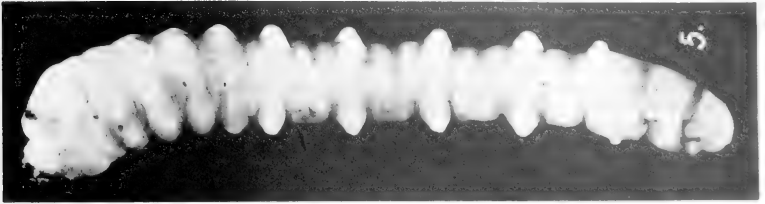
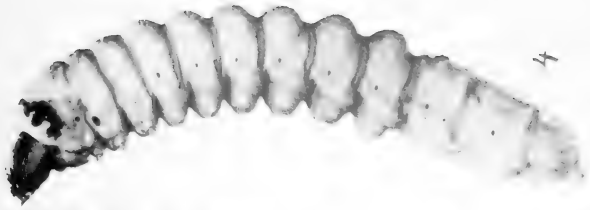
FIG. 1. *Distenia undata*: Dorsal view of larva.

FIG. 2. *Distenia undata*: Lateral view of larva.

FIG. 3. *Sepedia calcitrata*: Lateral view of pupa.

FIG. 4.—*Strangalia luteicornis*: Lateral aspect of larva, to show general form.

FIG. 5.—*Obrium rufulum*: Lateral view of larva, showing projecting ampullae.





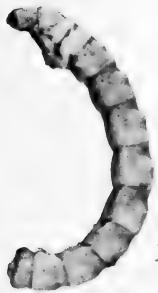


## PLATE XXXI

## LARVAE OF LAMINAE AND PUPA OF LEPTURINAE

- FIG. 1.—*Hippopsis lemniscata*: Lateral view of larva.  
FIG. 2.—*Ecyrus dasycerus*: Lateral view of larva.  
FIG. 3.—*Leptostylus macula*: Dorsal view of larva.  
FIG. 4.—*Ataxia cypta*: Lateral view of larva.  
FIG. 5.—*Oncideres cingulata*: Lateral view of larva.  
FIG. 6.—*Bellamira scalaris*: Lateral aspect of pupa.  
FIG. 7.—*Leptura nitens*: Dorsal aspect of pupa.  
FIG. 8.—*Desmocerus palliatus*: Dorsal aspect of pupa.  
FIG. 9.—*Rhagium lineatum*: Ventral aspect of pupa.





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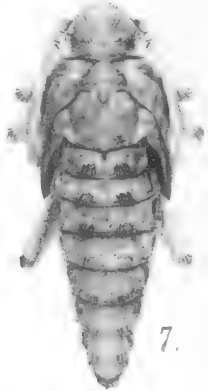
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## PLATE XXXII

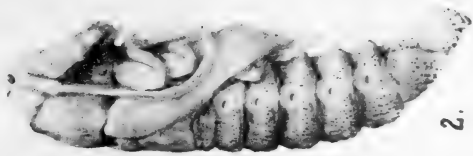
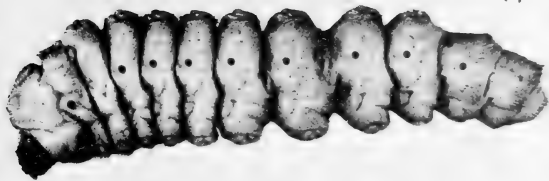
## LARVAE AND PUPAE OF LAMINAE

FIG. 1.—*Tetraopes tetraophthalmus*: Lateral view of larva. Note the hairy body.

FIG. 2.—*Oncideres cingulata*: Lateral view of pupa.

FIG. 3.—*Graphisurus fasciatus*: Dorsal view of pupa.

FIG. 4.—*Oberca ruficollis*: Latero-dorsal view of larva.







## PLATE XXXIII

## WORK OF CERAMBYCIDAE

- FIG. 1.—*Goes tigrinus*: Larval mines in living *Quercus alba*. Note the open type of mine.
- FIG. 2.—*Mecus perygata*: Larval mines in stem of *Aster*.
- FIG. 3.—*Phymatodes varius*: Larval mines beneath bark of *Quercus alba*.



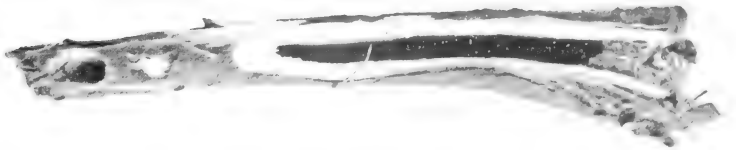
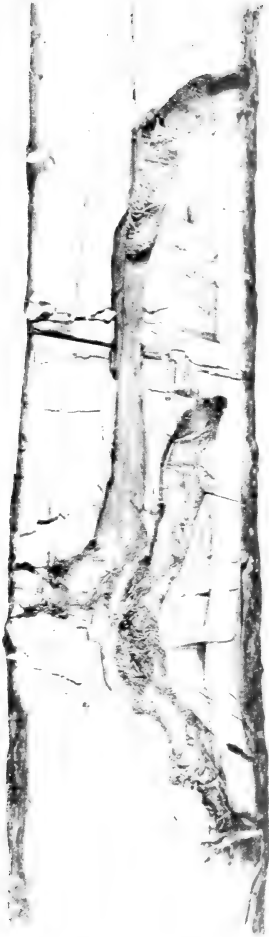


PLATE XXXIV

WORK OF HYLOTRUPES

Larval mines of *Hylotrupes amethystinus* under bark of *Liliodendron*.



## PLATE XXXV

## WORK OF NEOCLYTUS

Larval mines of *Neoclytus caprea* in wood of *Piarinus*. These mines are typical of those made by the true wood-borers, being tightly packed with frass.

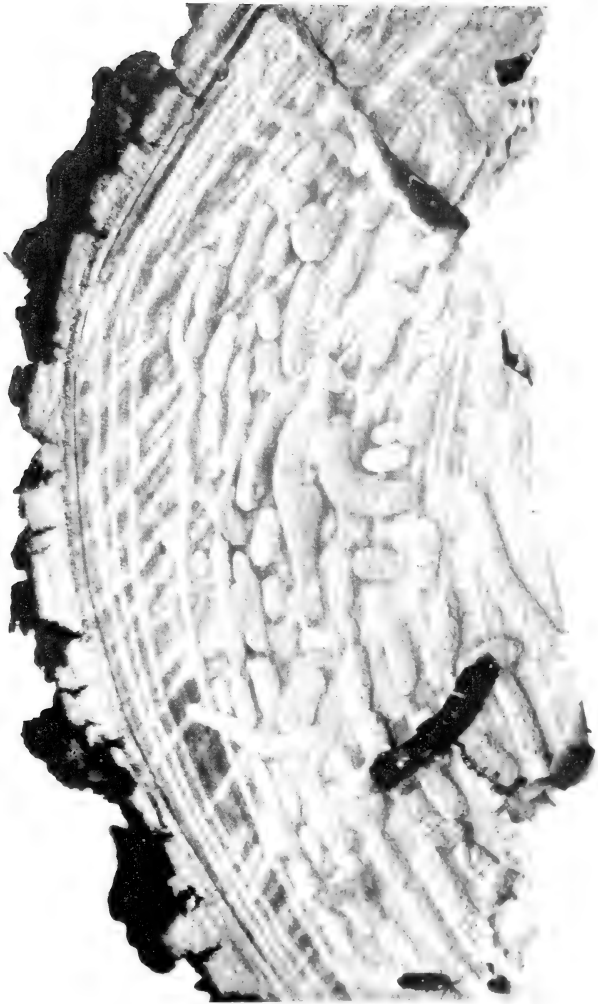


PLATE XXXVI

EGGS AND PREPUPAL LARVA OF CERAMBYCIDAE

FIG. 1.—*Prionus laticollis*: Group of eggs inserted about 1 inch into the ground.

FIG. 2.—*Prionus californicus*: Prepupal larva in earthen cell which it has constructed.

FIG. 3.—*Saperda calcarata*: View of egg scar from beneath, showing eggs.

FIG. 4.—*Saperda calcarata*: Egg scar on bark of *Populus*.

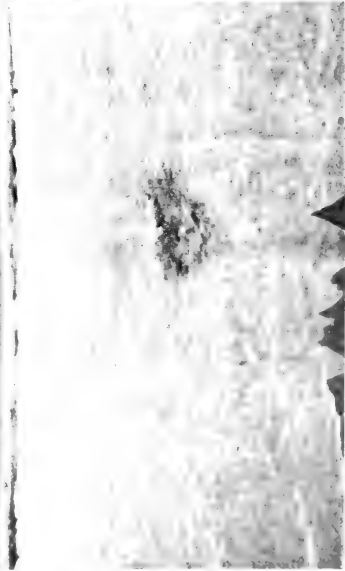
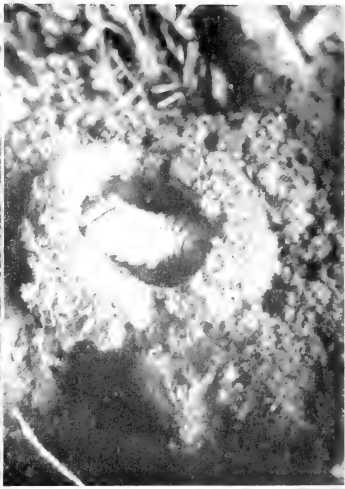
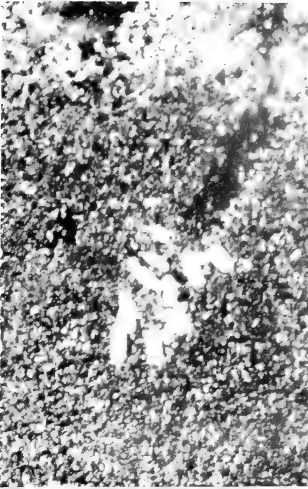


PLATE XXXVII

WORK OF LEPTURA

Larval mines of *Leptura nitens* in bark of *Castanea*.





## PLATE XXXVIII

## WORK OF MONOCHAMUS

Larval mines of *Monochamus maculosus* under bark of *Pinus*. Note several plugs of frass where the larvae entered the wood, and fibrous frass.



## PLATE XXXIX

## WORK OF CERAMBYCIDÆ

FIG. 1.—*Romaleum rufulum*: Larval mines in living *Quercus*.

FIG. 2.—*Oberca ocellata*: Branch of sumac girdled by adult when ovipositing.

FIG. 3.—*Oberca ocellata*: Enlargement of girdle, showing more shallow ring beneath point where egg is placed.



## PLATE XL

## WORK OF CERAMBYCID LARVAE

FIG. 1.—*Xylotrechus quadrimaculatus*: Branch of *Fagus* cut by larvae.

FIG. 2.—*Xylotrechus quadrimaculatus*: Branch of *Fagus* cut by larvae.

FIG. 3.—*Goes tigrinus*: Frass exuded from larval mine, showing fibrous type.

FIG. 4.—*Romalceum rufulum*: Frass exuded from larval mine, showing granular type.

FIG. 5.—*Prionoxystus robiniae*: Frass exuded from larval mine, showing pellet type, for comparison with that of cerambycid borers. In the case of this and other lepidopterous borers the frass is of this type, thus being readily distinguished from that of all coleopterous borers, so far as known.

FIGS. 6 and 7.—Larval mines of *Paratimia conicola* in cones of *Pinus attenuatus*.

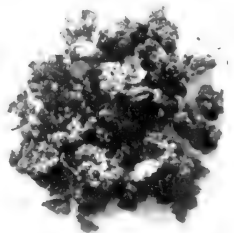
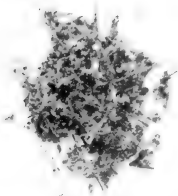
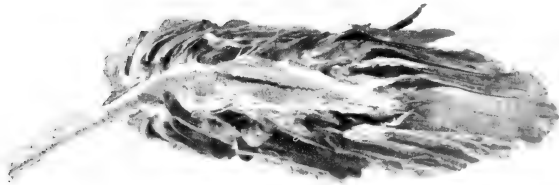
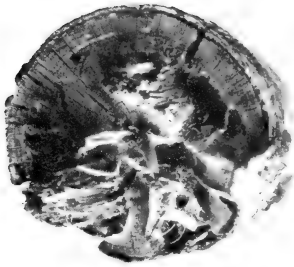
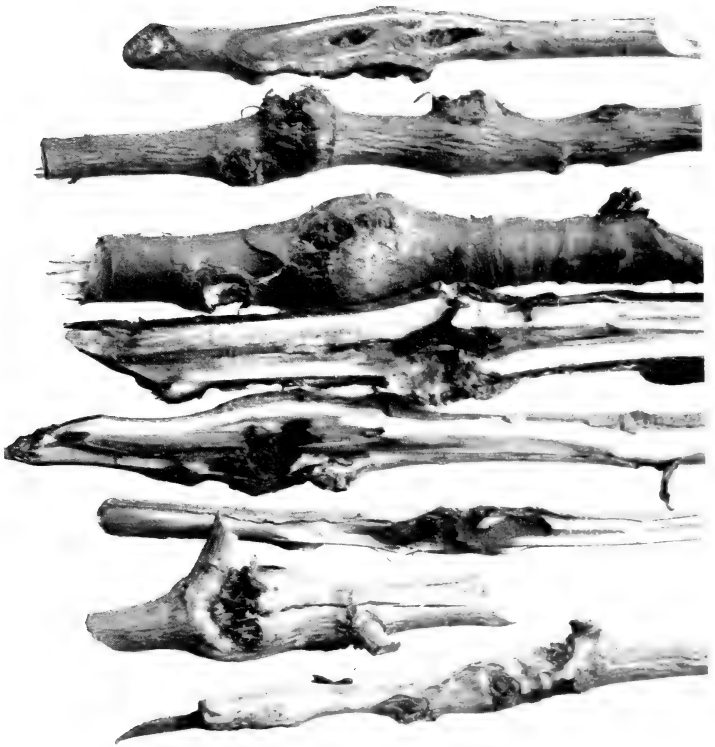


PLATE XLI

CERAMBYCID GALLS

Galls of *Saperda concolor* on twigs of *Populus*.

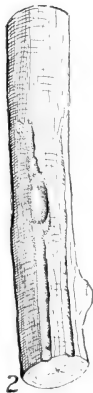
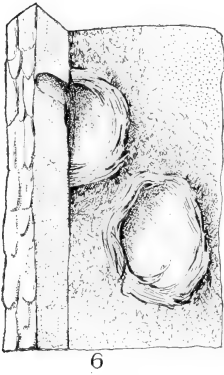
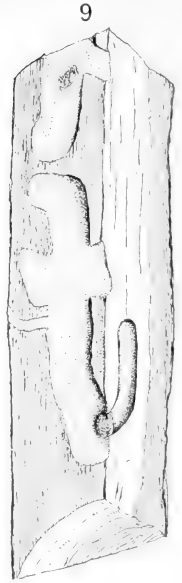
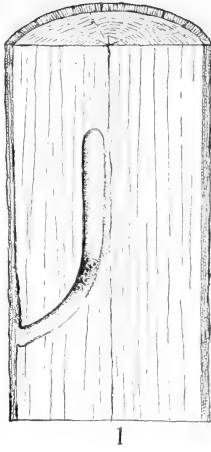
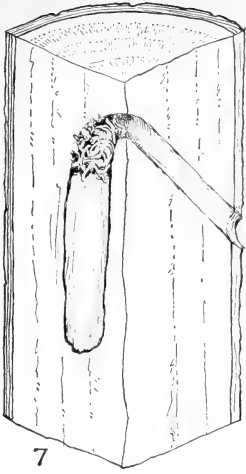




## PLATE XLII

## PUPAL CELLS AND WORK OF CERAMBYCID LARVAE

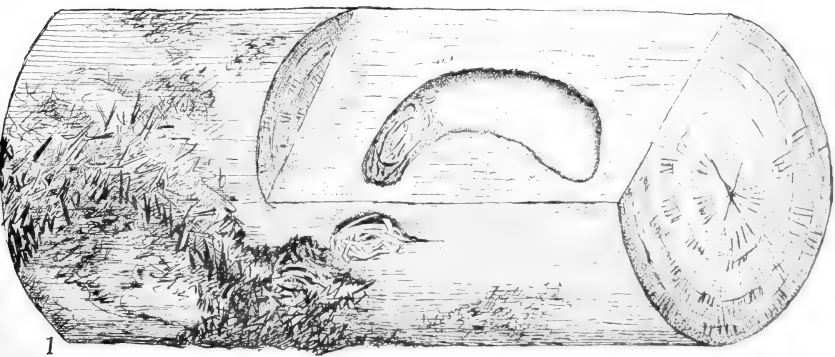
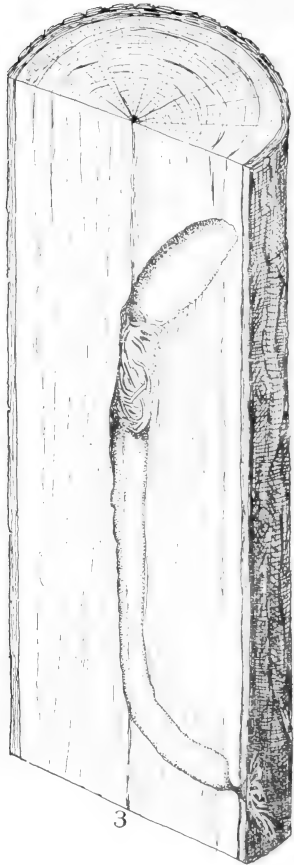
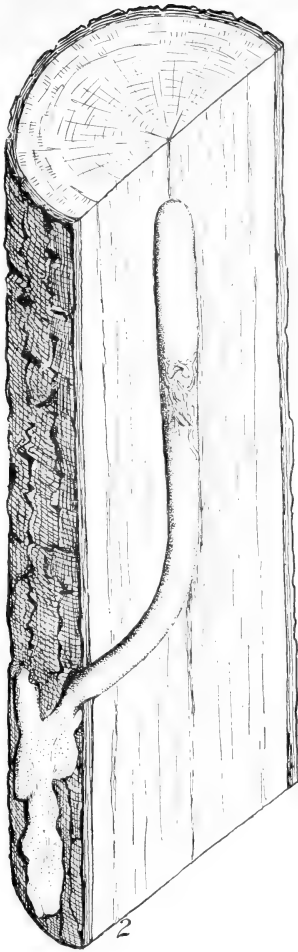
- FIG. 1.—*Molochus bimaculatus*: Simple type of pupal cell in sapwood of *Cercis*. Note the plug of frass in the cell, and that the adult must gnaw only through the bark to escape.
- FIG. 2.—*Cyrtinus pygmaeus*: Simple type of pupal cell under bark in *Quercus*—merely the wood surface scarred.
- FIG. 3.—*Elaphidion subpubescens*: Peculiar series of holes in girdled branch of *Quercus* for exudation of frass. Note type of cut where twig is girdled.
- FIG. 4.—*Elaphidion subpubescens*: Pupal cell in *Castanea dentata* made by two wads of frass.
- FIG. 5.—*Elaphidion* sp. (9901q): Type of cut made by this girdler on twigs of *Thurberia*.
- FIG. 6.—*Rhagium lineatum*: A more elaborate type of pupal cell made of fibrous frass beneath the bark of *Pinus*.
- FIG. 7.—*Arhopalus fulminans*: Angular type of pupal cell in *Castanea dentata*. The pupal cell is open to the exterior except for the wad of frass.
- FIG. 8.—*Oeme rigida*: Pupal cell in *Juniperus*. This is a rather elaborate type, rarely seen in the cerambycids.
- FIG. 9.—*Hylotrupes ligneus*: Simple type of pupal cell in sapwood of *Juniperus*. Note wad of granular frass projecting from the surface of the sapwood. Compare with figure 1.



## PLATE XLIII

## DIAGRAMMATIC FIGURES TO ILLUSTRATE PUPAL CELLS OF CERAMBYCIDAE

- FIG. 1.—*Monoctonus scutellatus*: Pupal cell in *Pinus*. Note the plugged entrance into the wood, the curved type of cell, and the fact that the adult will gnaw through the wood to escape.
- FIG. 2.—*Romalceum rufulum*: Pupal cell in *Quercus*. Note that the plug is below the pupa and that the larva has opened an exit hole to the bark.
- FIG. 3.—*Goes tigrinus*: Pupal cell in *Quercus alba*, showing the plug behind the larva. The adult must gnaw through the wood to escape.



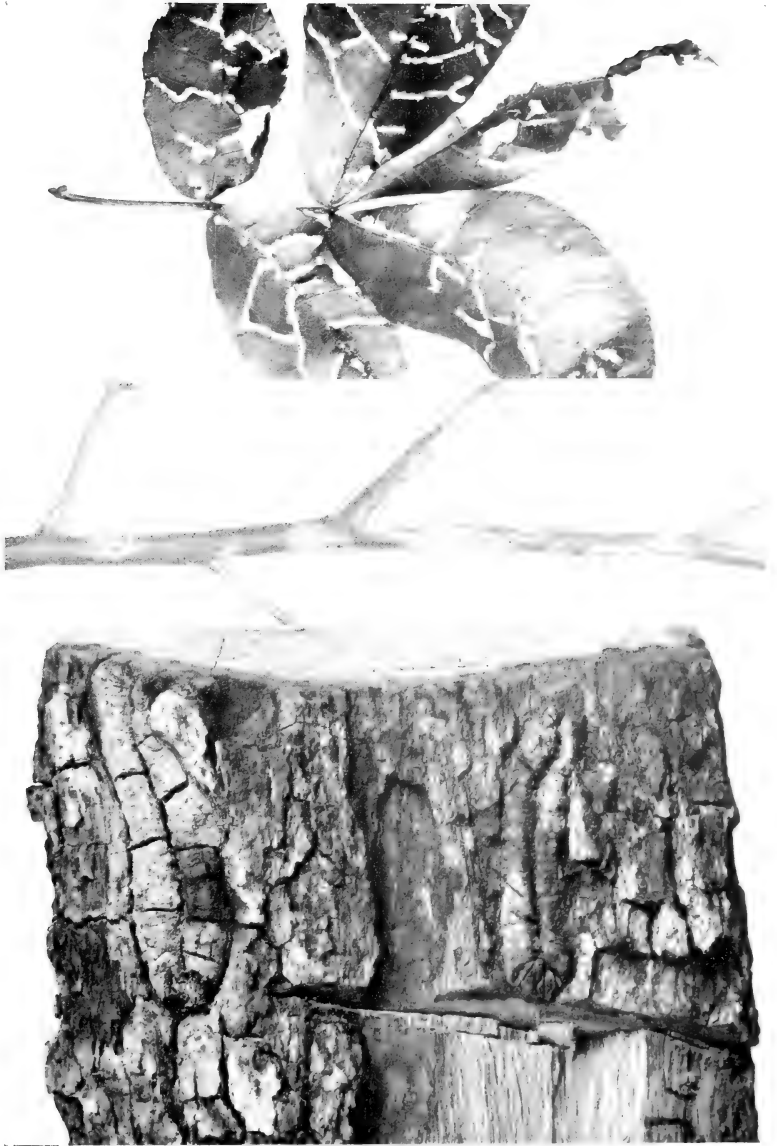
## PLATE XLIV

## FEEDING BY ADULTS OF CERAMBYCIDAE

FIG. 1.—*Saperda discoides*: Feeding of adult on hickory leaves.

FIG. 2.—*Goes pulverulenta*: Feeding of adult on twigs of ironwood.

FIG. 3.—*Romalcum* sp.: Pupal cells and healed scars from old pupal cells on white oak. These scars are very common on large mature oaks.



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C4C7 larvae

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