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CONTRIBUTIONS TOWARD A CLASSIFICATION AND BIOLOGY
OF THE NORTH AMERICAN CERAMBYCIDÆ.

LARVÆ OF THE PRIONINÆ.

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INTRODUCTION.

The need of a study of the cerambycids injurious to forests and forest products in their larval stages for the proper identification of the species is all too evident. The larvæ of most wood and bark boring insects can be found within their host for the greater part of the year, while the adults occur for but a short time. Again and again correspondents send in to the Bureau of Entomology material under the name of "worms" or "grubs" with the statement that these are destructive to the wood and trees and asking what they are and how they can be combated. If the material can not be identified the required information can not be given.

The writer took up the study of longicorn beetle larvæ in 1910, in connection with his work in the Pennsylvania State College, but had little material for study compared to the large series of larvæ in the United States National Museum collections and especially in that made by the Forest Insect Investigations of the Bureau of Entomology. The material in the latter collection has been accumulated during the past 24 years by Dr. A. D. Hopkins and other members of the office, especially Messrs. H. E. Burke, W. F. Fiske, and J. L. Webb. Mr. Fiske did a great amount of work on the species of the southeastern United States, and his notes are of unusual interest. The more important observations of the different collectors will be referred to under each species.

When the writer undertook this study in the Bureau of Entomology in 1912 the collection contained the larvæ, authentically determined by Mr. J. L. Webb, of about 50 species. These larvæ have been generically treated by Mr. Webb in Technical Series No. 20, Part V, Bureau of Entomology, United States Department of Agriculture, "A Preliminary Synopsis of Cerambycoid Larvæ" (1912). This is the first attempt made in the United States to form a synopsis of the family as a whole; but Mr. Webb was handicapped by a relatively small amount of properly identified material and rarely more

than one identified species on which to base the characters of a given genus. For this reason the key is purely artificial and only in part applicable to the other congeneric species.¹

During the past two years the writer has carried through to imagines larvæ from all available sources. This has resulted in the identification of some 200 additional species, making available the large amount of heretofore unidentified material in the forest insect collection.

Great care is needed in the methods of rearing these larvæ. Often a single piece of infested wood will contain from five to a dozen different species of Cerambycidæ. It has sometimes occurred that adults and larvæ which have been found together in the wood have been wrongly associated by the collector, and the larvæ have been preserved in the collection under the name of the adult. As a matter of fact, however, it is more often the case that larvæ and adults which have been found together are of different species rather than of the same, because the greater part of a brood of one species generally transforms about the same time. My practice has been to cut the larvæ out of the infested wood, separating the species as nearly as possible, and then to cage each larva individually. As the adult emerges the larval skin is preserved for careful comparison with the alcoholic specimens. Many methods have been tried for proper preservation of the material. The most satisfactory for all purposes is to kill the specimens by boiling in water for from 5 to 10 minutes, according to size, and then place them in 75 per cent alcohol. This gives especially good results for anatomical work. Whiter specimens may be had by placing in a mixture of strong alcohol and a small amount of acetic acid for a few minutes, or by killing in a boiling solution of this mixture. The latter method, however, often interferes with a subsequent study of the muscles.

The larvæ of Cerambycidæ are primarily and probably without exception phytophagous, boring in the ligneous tissue of, for the most part, the arborescent flora, though a few species are confined to herbaceous plants, in this case being usually pith or root feeders. Some are confined to one species of tree, as is usually the case with those attacking living tissue, others to a single genus, and again there are species which will have a wide variety of host plants among either the conifers or the hardwoods, but the larvæ of the same species will rarely attack both indiscriminately.

Great diversity is shown in the feeding habits and larval mines. Some species bore exclusively in decayed moist wood, others in dead

¹ The writer is desirous of securing other larval material in this family from all sources, especially such genera as *Derobrachus*, *Stenodontes*, and species of *Prionus* not treated in this paper. Collections will be gladly looked over and material determined. Exotic material is also much desired, and exchanges will be made.—F. C. C., Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C.

dry wood, and many under the bark of recently dead or dying trees, either completing their larval growth between the bark and wood, or going into the sapwood, deep into the heartwood, or into the outer bark to pupate.

Even the frass or borings of these larvæ are usually characteristic, the latter on account of the peculiar shape of the mandible. Thus a mandible with gougelike cutting edge produces broader chips, while the acute mandible cuts a narrower shredded chip. The galleries are either packed with tight, fine frass, filled with fibrous chips, or left open.

Certain groups or species will excavate their emergence holes through the exterior before pupation, suggesting that the imagines had emerged; but in most cases this is left for the adult.

A few species construct their mines in the outer corky bark of living trees; others in the inner bark and cambium, sapwood, or heartwood of living and dead trees; others girdle living twigs and either live in the girdled portion or work downward into the living branches.

It is remarkable to what extent the exact conditions of decay and moisture will limit the activities of certain species. For example, in a long vine of bittersweet (*Celastrus scandens*) from which as many as five to six species have been reared, that portion of the vine near the ground, more moist and decomposed, will hold exclusively one or two species; higher up in drier wood there will be another; and if the branch merges into living wood here, still another. Even in these local limits some will mine the pith, others the wood, and others the bark.

Closely correlated with their biology is the form of the larvæ. Bark-boring species are more or less flattened, and if the final stages are passed in the same environment, the adult will often be more or less flattened. If they go into the wood, the larvæ attain a more cylindrical form. Those boring in the pith of stems nearly always have a very cylindrical form, as have the adults. If they work in living tissue, especially when all the species of a genus have the same habit, the larvæ are, with scarcely an exception, armed with chitinous asperities on the thorax and ampullæ. In general the form and size of matured living larvæ is a good criterion of that of the adult, but when preserved for study the expansion or contraction renders the length unreliable. For this reason size is not given much importance in this paper. If an adult is large it necessarily follows that the matured larva is likewise. Matured larvæ are always well filled, the intersegmental skin expanded and usually of a whiter color, becoming more contracted in the prepupal stage and the integument wrinkled before pupation.

From the nature of their environment, protected as they are in woody tissue, it naturally follows that the larvæ are soft, fleshy, and covered by a tough white or yellowish integument which is but slightly chitinized; usually this integument is pubescent, but the amount of pubescence varies with the environment.

Legs persist in all but one subfamily of the Cerambycidæ, but are generally so poorly developed as to be almost functionless; yet in those groups of larvæ which live in very soft, decayed wood, making broad galleries (Lepturinae) which the body fills rather loosely, the legs are best developed and may assist in locomotion, whereas some genera which as a whole are borers in solid wood may have them developed only as a minute spine or may lack them entirely.

Locomotion is secured through the use of the well-developed dorsal and ventral ambulatory ampullæ, contracted from the anterior or posterior end of the body in peristaltic succession. This constitutes an efficient and rapid mode of locomotion, and is especially helpful to the larva boring in solid wood when it braces itself to the sides of its gallery, moving the head and thorax with a sidewise motion and chiseling off the wood. The noise made in this way, which Perris describes as "resembling the patter of a gentle rain," can be heard in the forests on a still, warm night.

The manner of oviposition varies. Many forms lay their eggs in crevices of the bark; others will insert them deep into soft wood; again, some adults will gnaw a hole through the bark, laying either a single egg or a group of eggs. Few will oviposit on dry, seasoned wood, but this occurs in some species, and in some cases (e. g., *Parandra*) it is very probable that the adults often do not emerge, but copulate and lay eggs in the wood in which they are working.

When numerous eggs have been laid in a group it often happens that the young larvæ develop a cannibalistic habit and devour one another. As soon as they begin to bore into the wood the individual mines are kept strictly separate, and even when these mines cross the larvæ often bore beneath or above the older gallery.

The immature stages of these insects vary in duration from one to three or more years. By far the most usual cycle is one year, although in some groups a cycle covering two or three years is normal. Moisture and available food supply tend to increase or diminish the normal time by months or years. The literature records several examples in which lumber made into furniture many years has been found to contain living larvæ which finally emerged as imagines.

CLASSIFICATION OF THE CERAMBYCIDÆ AS BASED UPON THE LARVÆ.

It is a well known fact to anyone who has worked with the adults of this family that the present system of classification is very inadequate. One might say that the family is overclassified, until at

present it is impossible in many cases to recognize a genus. However, the species are generally distinct, not only in the usual specific characters, but also in profound anatomical structures.

The larvæ of the family show much more similarity to one another than do the adults, but although they possess fewer characters, after the elimination of those developed under the influence of a peculiar and special environment, these few, it seems, will offer a very important index to the natural classification.

The most important of these larval characters, considered as showing the relationship of the subfamilies, is the form and structure of the head; for even if one species in a certain subfamily may bore into the living trunk of a tree, while another may work in the roots of an herbaceous plant, even making its gallery in the ground and feeding on the bark of the root, the form of the head and the structure of the mouth parts, especially the shape of the mandibles, are not altered as a result of these divergent habits.

Little systematic work has been done by the entomologists on the immature stages of North American cerambycids. Isolated descriptions are scattered. These, chiefly by Packard, Riley, and Osten-Sacken, are often too vague to be of value in identifying a species. European literature is richer in such work. The unexcelled work of Perris¹ and of Schiodte² stand as landmarks. The writer has adopted the latter's division for subfamilies and only slightly modified his characterization of them.

THE FAMILY CERAMBYCIDÆ.

The larvæ of the family Cerambycidæ may be characterized as follows:

Form rather robust, fleshy, usually cylindrical. Texture thin, slightly coriaceous, more so on prothorax, never deeply pigmented, pubescent.

Head extended, deeply invaginated into prothorax, occiput large, occipital foramen very large, opening on underside.³ Ventral mouth parts retracted.⁴ Clypeus distinct, membranous; labrum distinct, thrust forward; mandibles short, quadrangular; labial palpi distinct, conical.

Prothorax large; membranous collar articulating head with the prothorax wide; mesothorax and metathorax narrower. Feet either small or wanting, widely distant, conical; tarsi claw-shaped.

Abdomen extended, segments readily telescoping on one another, dorsally and ventrally bearing a fleshy protuberance (ambulatory

¹ Perris, Edouard. Larves de Coléoptères. Paris, 1877. 590 p., 14 pl. Extrait des Annales de la Société linnéenne de Lyon, v. 22, 1876.

² Schiodte, J. M. C. De Metamorphosi Eleutheratorum Observationes, pt. 9-12. Kjøbenhavn, 1876-1883. From Naturhistorisk tidsskrift, ser. 3, bd. 10, p. 369-458; bd. 11, p. 479-598; bd. 12, p. 513-598; bd. 13, p. 415-426.

³ Except *Distinea*, in many respects a remarkable genus.

⁴ As ventral mouth parts I designate maxillæ, labium, mentum, and submentum.

ampulla of Perris). Spiracles oval annuliform, two-lipped, respiratory opening narrow; lips membranous, clothed with setigerous tubercles. Anal lobes three (rarely two), exerted.

KEY TO THE SUBFAMILIES OF CERAMBYCIDÆ. (Plate I.)

Head transverse, broader than long.

Epistoma projecting over clypeus; front projecting over epistoma, dentate or carinate (except *Parandra*); clypeus as wide at base as epistoma; mandibles acute. Legs present..... PRIONINÆ.

Epistoma not projecting; front smooth and rounded.

Mandibles acute; clypeus occupying space between condyles.

Sides of epicranium meeting behind front, fused for some distance, then separating. Dense brush of hairs on gena behind pleurostoma. Ninth abdominal segment bearing a pair of chitinous spines. Form cylindric..... ASEMINÆ.

Sides of epicranium meeting behind front, then separating (not fused), angulate. Caudal spines usually absent. Lateral zone usually distinct on all abdominal segments. Form depressed.

LEPTURINÆ.

Mandibles with cutting edge rounded (gouge shaped).

Clypeus not as wide at base as epistoma..... CERAMBYCINÆ.

Head oblong, sides parallel or narrowing behind.

Clypeus as wide at base as epistoma; mandibles obliquely acute. Sides of epicranium behind front fused for entire distance. Legs absent (rarely present)..... LAMINÆ.

GENERAL ANATOMICAL CHARACTERISTICS OF THE PRIONINÆ.¹

The larvæ of the Prioninæ form a very natural, distinct, and easily recognized group. In form they are of large size, robust and remarkably glabrous, cylindric or tapering posteriorly.

The head is large, robust, strongly chitinized in front and widening posteriorly; it is deeply embedded in the prothorax. The dorsal margins of the epicranium are partly fused behind the triangular front, then separated, giving a deep emargination behind. The epistoma (Pl. I) is characteristic in North American forms (except *Parandra*) of this group in that it projects over the posterior angles of the clypeus in two triangular lobes, more or less distinct or connected; it bears three distinct setæ on each side (epistomal setæ, Pl. III). The anterior margin of the front (Pl. I) is produced over the epistoma into a dull or dentate carina (*Prionus*, *Mallodon*, and *Orthosoma*) or is variously modified into teeth or tubercles (*Ergates*, *Tragosoma*); affording characters of good specific value (Pl. III). Anterior to the epistoma is the trapezoidal membranous clypeus, to which is attached the more coriaceous semicircular or cordate labrum.

¹ The terminology used here follows in part that of Dr. A. D. Hopkins, "Contributions Toward a Monograph of the Scolytid Beetles. I. The Genus *Dendroctonus*." U. S. Dept. Agr., Bur. Ent., Tech. Ser. 17, pt. 1, 164 p., 95 figs., 6 pl., June 30, 1909; also Dr. A. Böving, "On the Abdominal Structures of Certain Beetle Larvæ of the Campodeiform Type." Proc. Ent. Soc. Wash., v. 16, no. 2, p. 55-61, pl. 3-6, June, 1914; Snodgrass, R. E., "The Thorax of Insects and the Articulation of the Wings." Proc. U. S. Nat. Mus., v. 36, p. 511-595, pl. 40-69, June 18, 1909, separate No. 1687; Crampton, G. C., "A Contribution to the Comparative Morphology of the Thoracic Sclerites of Insects." Proc. Acad. Nat. Sc. Phila., v. 61, p. 3-54, 21 figs. 4 pl., Jan., 1909.

The ventral mouth parts are large (Pl. II, fig. 4), fleshy, and more strongly coriaceous than in other longicorns, attached by the submentum to the gula. The maxillary palpi are short, conical, and robust, three-jointed, the joints often being wider than long; the last joint is relatively short, either cylindrical, blunt, or conical, the tip being truncate and bearing a sensitive impression; the ligula is large, fleshy, and very densely covered with short, stiff hairs.

The gula (Pl. I) is short, its lateral sutures diverging behind to meet the large fovea, in which are attached the inferior retractor muscles of the head. Beside the gula on each side lies the large hypostoma, with its external sutures convex and meeting the attachments of the tentorial bridge; this last is a trapezoidal transverse plate separating the occipital foramen into an anterior and a posterior portion. (Pl. I, *Orthosoma*.)

Laterally between the articulations of the mandibles is the heavily chitinous region, the pleurostoma, on which the ocelli are situated. Behind the ventral articulation of the mandibles is a prominent tubercle or process, for which I propose the name, subfossal process. Behind the dorsal mandibular articulation on the front is a more or less prominent carina, for which I propose the name, postcondylar carina.

The antennæ are placed at the extremity of the frontal sutures, between the pleurostoma and the distal angle of the front. They are two or three jointed with a jointlike membranous base, conical, retractile, and protected by a projecting chitinous shield from the front, above the antennal ring. The last joint is barrel-shaped or cylindrical, obliquely truncate, hollowed at the tip, and bears in several genera a small third joint in this fovea. In *Parandra* this third joint is quite long.

In harmony with other structures the mandibles are strong and robust, triangular from the outer side, with that face more or less strongly rugose. The apex is extended and acute, the cutting edge obliquely emarginate, the molar portion either rounded, produced in a blunt tooth, or flattened into a striated plate.

The body, as in all Cerambycidæ, consists of three thoracic and ten abdominal segments, the tenth being the anal lobes.

Of the thoracic segments (Pl. II, fig. 5) the first is the largest, nearly equal in size to the second and third. It is always more strongly chitinized than any other body segment and bears scattered coarse hairs. The prothoracic segment differs considerably from the mesothoracic and metathoracic segments. The pronotum is median, nearly square, the posterior half limited at each side by a longitudinal suture; it is smooth anteriorly, rugose to a varying degree posteriorly. The mesonotum and metanotum are very short and each is divided by two diagonal sutures which intersect medially. Just

beneath each of these median dorsal areas is a lateral dorsal area. This is large and trapezoidal on the prothorax, narrow and elongate on mesothorax and metathorax. Ventrad of this latter area is the transverse lateral zone. On this area on the prothorax in some species (*Malldon*) a group of chitinous spines occurs, as also a teat-like tubercle or projection. The lower limit of the lateral zone is defined by the pleural suture separating it from the hypopleurum adjacent to and partly surrounding the coxal lobes. The hypopleurum is relatively small in all thoracic segments, probably crowded by the development of the coxal lobes. The region (Pl. II) of the prothorax consisting of presternum, ensternum, and sternellum, is rectangular. The presternum is large, somewhat enveloping the triangular eusternum, from which it may or may not be distinctly separated by a curved suture. The eusternum is separated by a straight transverse suture (at the extremities of which lie the coxæ) from the sternellum. The sternellum is narrow, transverse. On the mesothorax and metathorax a transverse suture divides the ventral region into two folds, the anterior of which is the eusternum and the posterior the sternellum, both folds being narrow and transverse.

The terminology of the thoracic segments as given here is as yet only provisional. It is merely homologized from that of the abdominal segments and has not been worked out thoroughly by a study of the muscular structure.

There are two thoracic spiracles. One of these is situated between the prothorax and the mesothorax, probably belonging to the mesothorax; the other, small and rudimentary, is placed on the metathorax. The first thoracic spiracle is always larger than those on the abdominal segments.

The legs are short and conical and consist of five joints, the fleshy coxal lobe considered as the basal joint. The trochanter is very small and often invisible from the outer side; the femur and tibia are cylindrical, about as broad as long, and often armed with a circlet of short, stiff hairs. The tarsus is represented by a single long, slender, more or less chitinous spine.

The abdomen (Pl. II, fig. 5) consists of ten segments, eight of which bear spiracles. The first seven segments are similar in structure. The tergal and sternal areas are developed into a large, fleshy protuberance, the ambulatory ampulla (Perris). This structure, variously modified throughout the longicorns, is uniform in the Prioninæ, slightly more rugose but differing little from the remaining body texture, those in some genera differing by the presence of chitinous asperities on the ampullæ. The dorsal ampullæ bear two transverse impressions; the ventral ampullæ, one.

Surrounding the ampullæ on all except the last two segments is an elliptical area, protruding or swollen laterally. The dorsal of these surrounding areas has been named the parascutal lobe (Böving) and

the ventral, the hypopleurum. Below the parascutal area is an elliptical lobe bearing the spiracle, and posteriorly of this area and reaching behind the ampulla is the postscutellum. All nine abdominal segments bear a longitudinal lateral zone, which is swollen and very distinct on the last three segments. Each lateral zone bears a tubercle—the pleural tubercle—which bears several long setæ and is largest on the last three segments. On the lateral zone of the first three, four, or six segments (according to the species) occurs a circular or elliptical disc surrounding a deep pore. For this structure I propose the name, the pleural disc.¹ (Compare with Perris, *Larves des Coléoptères*, 1878, p. 419.)

The eighth and ninth abdominal segments are less differentiated than the preceding. They bear neither dorsal nor ventral ampullæ, but are uniformly smooth and undivided into areas. The ninth is longer than any other abdominal segment; it is large and inflated, and never deeply telescoped into the eighth as in the *Cerambycinæ*.

The tenth abdominal segment or anal lobe is situated directly posterior, or dorso-posterior, to the ninth segment. Three sutures divide it into three equiangular lobes—one dorsal and two latero-ventral. Often the dorsal lobe protrudes beyond the others. They are smooth or rugose according to the species.

Between the segments are two overlapping bands of skin, known as intersegmental skin. This allows free longitudinal expansion and contraction of the segments. In the thoracic segments this skin is very narrow.

The larval characters of the *Prioninæ* may be briefly summarized as follows:

Head transverse, dorsal margins of epicranium behind front fused for some distance, later separating, angulate (i. e., head emarginate behind). Inferior retractor muscles of head inserted in a deep fovea before cervical foramen.

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 setæ 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.

Maxillæ movable; cardo distinct; maxillary sclerite² full, cushioned; palpifer not distinct, small; lacinia borne on stipes.

Antennæ strong, partially retractile.

Legs short, stout, conical.

¹ This disc has proved of great value in the identification of the larvæ in certain subfamilies of *Cerambycidae*. The structure of the whole organ is interesting and will be the subject of a later paper.

² Kemner, A. Beiträge zur Kenntnis einiger schwedischen koleopterenlarven. *Amara similis* Gyll., *Emus hirtus* L., *Creophilus mazillosus* L. und *Leistotrophus murinus* L. 31 p., 20 figs., 4 pl. (Arkiv för zoologi, Bd. 7, heft 4, N:o 31), Feb. 12, 1913.

Eusternum of prothorax partially or entirely, and the lateral zone, distinct; coxal lobe large, surrounded by large hypopleurum; mesothoracic spiracle protruding into prothorax.

Lateral zone of abdomen protuberant only on last three segments; hypopleurum distinct; parascutal and coxal lobes large; spiracle in a well defined, elliptical region. Ambulatory ampullæ bearing two transverse dorsal impressions and one ventral impression.

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

KEY TO THE GENERA OF THE PRIONINÆ.

- Epistoma not projecting over clypeus. Posterior area of pronotum and the ampullæ asperate (Pl. III, fig. 1)..... *Parandra*.
- Epistoma projecting over clypeus, front either dentate or carinate. Neither pronotum nor ampullæ asperate.
- Presternum and eusternum of prothorax partly fused, not completely divided by suture (Pl. II, fig. 1)..... I.
- Presternum and eusternum of prothorax divided by well defined curved suture (Pl. II, fig. 2)..... II.
- I. Front produced in a smooth transverse carina or not at all. Anterior area of lateral zone of prothorax bearing a group of short conical chitinous spines (Pl. II, fig. 1). Last joint of palpi very small, blunt..... *Mallodon*, *Stenodontes*.
- Front produced in a transverse dentate carina divided in middle (edge not acute). Lateral zone not armed.
- Carina distinctly divided into four broad lobes; last joint of maxillary palpi shorter than second; texture rugose.. *Derobrachus*.
- Carina not distinctly divided into four broad lobes; last joint of maxillary palpi longer than second, acutely conical; texture smooth..... *Orthosoma*.
- II. Front projecting over epistoma, dentate. Last joint of palpi conical. Pleural disc finely rugose, distinct on first three or four abdominal segments. Labrum as long as or longer than wide.. A.
- Front projecting over epistoma in a transverse carina, never dentate. Last joint of palpi cylindric. Pleural disc radially striate, distinct on six abdominal segments. Labrum wider than long (Pl. III, fig. 3)..... *Prionus*.
- A. Body texture dull, finely and densely rugose (Pl. VI, fig. 2).. a.
- Body texture smooth, shining..... b.
- a. Ocelli scarcely visible, fused in pleurostoma. Front of head bearing four large, blunt, rounded teeth (Pl. III, fig. 7)..... *Ergates*.
- Ocelli 3 to 4, prominent. Front bearing four broad, flattened, acute edged, dentate teeth (Pl. III, fig. 1).. *Tragosoma*.
- b. Front bearing four regular, flattened, acuminate teeth (Pl. III, fig. 5), three prominent obovate ocelli..... *Sphenostethus*.

DESCRIPTIONS OF LARVÆ OF PRIONINÆ.

Parandra brunnea Fab.

Form cylindric, slightly tapering; texture smooth, shining, very sparsely pubescent.

Head suborbicular from above, not strongly chitinized; gena having a shallow constriction behind middle. Epistoma roundly

declivous, smooth, nearly straight, not projecting over trapezoidal clypeus; three epistomal setæ each side, median ones short, approximate. Labrum elongate ovate, with a few scattered hairs; mandibles trapezoidal from side, smooth, lower angle triangular, acute, molar portion flattened into trapezoidal plate, bearing a number of deep longitudinal striæ. Antennæ long, fleshy, scarcely retractile, three-jointed, the second longest and bearing the third and a small supplementary one. Ventral mouth parts in general as in Prioninæ; palpi more slender, last joint of maxillary conical, equal in length to last joint of labial; lacinia rather slender, cylindrical, sparsely haired. Postcondylar carina and subfossal spine absent.

Prothorax subelliptical. Posterior area of pronotum, lateral posterior angles of presternum, and median area of eusternum armed with short chitinous asperities. Eusternum completely separated from presternum. Legs slender, rather long for a prionine larva.

Abdominal ampullæ projecting abruptly, sparsely asperate. Pleural tubercle distinct, lateral zone prominent on last three abdominal segments; abdominal spiracles suborbicular, not strongly chitinous rimmed; anal lobes glabrous, dorsal slightly larger.

The larva of *Parandra* is typically a heartwood feeder, attacking nearly all eastern coniferous and hardwood trees. Although scarce as an adult, the larva is one of the most commonly found Cerambycidæ in matured trees. It normally attacks the lower trunk or rarely the larger limbs, gaining entrance through some wound. To park and shade trees its damage is probably greater than any other wood-borer, for it completely destroys the heartwood and later the living sapwood, causing the trees to break off in the wind. Mr. T. E. Snyder reports it as one of the most serious enemies to telegraph and telephone poles. Observations by Mr. Snyder and the writer show that the adult does not always emerge, but remains in the hollow base of the tree, where copulation takes place and the eggs are laid. Trees which have been long infested often reveal dozens of these dead adults in hollow cavities. The eggs are laid in large numbers, closely grouped, and inserted deep into the wood by means of the powerful ovipositor.

The systematic position of *Parandra* has been shifted from place to place in various families by many writers. Considering it a cerambycid, as its larva undoubtedly is, it falls into no division as naturally as into the Prioninæ. One essential character, the projecting epistoma, is lacking, but this has been found to be absent on several specimens of prionine larvæ from Africa. The form belongs typically to this group. The dorsal ampullæ bear two transverse folds; the ventral, one, as in other Prioninæ. These bear chitinous asperities which do not occur in any other North American genera of Prioninæ, but this character is only of generic value. Mandibles, clypeus, and head belong here. The writer has never seen specimens of *Spondylis*,

but from European descriptions it is more aberrant from *Parandra* than is *Parandra* from the Prioninæ and has been placed by Perris in the Aseminæ.

Osten-Sacken¹ gives a good description of *Parandra*, regarding it as most nearly allied to the Lepturinæ. This is only superficially so, as the fundamental character is the position of the inferior retractor muscles of the head, which are attached in a deep fovea behind the gula, as in Prioninæ; also, the sides of the epicranium behind the front are fused and are not entirely angulate as in Lepturinæ.

Le Conte places *Parandra* and *Spondylis* in a separate family, but says, "it is more natural to regard them as subfamilies, having the same relation to each other as the subfamilies and tribes of Cerambycidæ.

***Mallodon dasystemus* Say.**

Form robust, cylindric; texture smooth, shining, sparsely hairy, the hairs castaneous; eighth and ninth sternites very shiny, intersegmental skin between ampullæ smooth.

Epistoma with two broadly triangular lobes projecting over the extremities of the clypeus; front produced in a distinct dull carina which is more prominent at sides, less corneous than that of other prionines. Mandibles short, pointed, outer face rugose, indistinctly carinated on inner upper face. Labrum suborbicular, sparsely covered with hairs, broadly rounded and densely ciliate in front. Three indistinct ocelli. Joints of palpi short; last maxillary equaling last labial, cylindric, about one-half length of last joint of antennæ, roundly truncate at tip. Ligula broad and fleshy. Subfossal process reduced to a broadly obtuse tubercle.

Anterior portion of lateral zone of prothorax bearing group of about six fleshy, conical, chitinous-tipped spines, as also a short fleshy lobe, roughly papillate, which may often be nearly obsolete. Eusternal area of prothorax not entirely distinct.

Last abdominal segment large; anal lobes protruding dorsally, sparsely pubescent. Spiracles narrowly oval. Pleural discs distinct on first and second abdominal segments, faint on next three, rugose.

Pupa: Form as in adult; head glabrous; disc of pronotum beset with fine erect asperities, and a few on mesonotum and metanotum; abdominal tergites regularly and more thickly beset with coarser asperities, which extend on to lateral zone; anterior margin of third, fourth, fifth, and sixth segments bearing a curved carinate projection under which fits a fleshy projection from posterior margin of anterior segment.

Described from specimens labeled Hopk. U. S. No. 12294a, from which a large series of adults was reared. Collected by Mr. J. B.

¹ Osten Sacken, R. Descriptions of some larvæ of North American Coleoptera. *In Proc. Ent. Soc. Phila.*, v. 1, no. 5, p. 105-130, pl. 1, Jan., 1862. *Parandra brunnea* Fabr., p. 118-121.

Gill, of the Bureau of Entomology, who found it working in the heartwood of living willow from Mississippi.

Range: From Virginia through the southern United States west into Arizona.

Specimens have been taken from willow, oak, and box elder. Packard records it as injurious to oak roots.

A number of specimens of *Mallobdon* have been reared which have not yet been definitely determined. One other distinct form of larva is at hand in which the body texture is dull and the intersegmental skin coarsely rugose. The lateral zone of the prothorax bears a long, fleshy, teatlike projection which is densely pubescent. (Hopk. U. S. collection Nos. 12239a, 12680.)

Mallobdon melanopus L.

General form and characteristics as in *Mallobdon dasystemus*. The labrum is distinctly broader in front, and covered with hairs nearly to base, while in *dasystemus* these are sparse, except on anterior margin. Joints of palpi more robust, shorter, and broader, last labial in thickness more than one-half length of last joint of antennæ. Anal lobes finely and densely pubescent on inner faces.

Described from specimens in the United States National Museum collected by H. G. Hubbard at Crescent City, Fla.

Packard¹ gives a description of this larva, but it is not specific enough to distinguish it from *dasystemus*. H. G. Hubbard² records this insect as boring in the living roots of oak, causing a large gall and often killing the trees or causing a stunted growth. E. A. Schwarz records it in the heartwood of hackberry (*Celtis*).

Stenodontes Serv.

A few specimens in the United States National Museum collection labeled as belonging to the genus *Stenodontes* Serv. can not be generically separated from *Mallobdon*. The form is slightly more robust and distinctly more pubescent, and the antennal and palpal joints are more contracted and broader than in *M. melanopus*.

Orthosoma brunneum Forst.

Form cylindrical, slightly tapering; texture smooth, shining; body of yellowish or lemon tinge.

Epistoma slightly projecting over clypeus at extremities; front projecting in two broad dentate plates of varying prominence. Mandibles short, broadly triangular; cutting edge oblique, truncate,

¹ Packard, A. S. Fifth report of the U. S. Entomological Commission, being a revised and enlarged edition of Bulletin No. 7, on Insects injurious to forest and shade trees. Washington, 1890. pl. 35, fig. 1. The live-oak root-borer, *Mallobdon melanopus* Linn., p. 50-52.

² Riley, C. V. Report of the entomologist. In Ann. Rpt. U. S. Comr. Agr. for 1884, p. 285-418, pls. 10. Washington, 1884. Dwarfing of oaks by *Mallobdon melanopus*, p. 410-411.

toothed at upper angle; no striated plate. Labrum roundly cordate, about as wide as long, anterior edge densely covered with short cilia. Antennæ long, last joint very long, cylindric, slender. Ocelli three, not very prominent. Palpi slender, tapering; last joint of maxillary palpi equal to that of labial, acutely conical. Postcondylar carina visible. Subfossal spine short, obtuse.

Posterior area of pronotum coarsely rugose. Eusternal area of prothorax not distinct in front.

Pleural disc quite prominent, circular, on first and second abdominal segments less conspicuous, on third and fourth finely rugose. Anal lobes glabrous. Abdominal spiracles oval.

Pupa: Form as in adult; head glabrous; disc of pronotum sparsely beset with short conical chitinous asperities; mesonotum and metanotum glabrous; abdominal tergites sparsely beset with acute chitinous points, these reflexed, some bidentate at apex; anterior margin of third, fourth, fifth, and sixth segments bearing a curved chitinous flangelike carina, and fitting under this on posterior margin of anterior segments are two oval foveæ with protruding rims; last tergite produced in two latero-dorsal, chitinous, dentate flanges.

Range: Southeastern Canada, south through eastern and central United States.

The larva of *Orthosoma* has been found in dead and decaying logs of practically all arborescent species of eastern hardwoods and conifers. Its chief economic status is the destruction of cross-ties, telegraph and telephone poles, and structural timbers in contact with the ground. It has been described by Packard.¹ The adult is found from June to September.

Derobrachus sp.

Form as in *Orthosoma*; integument thick, firm, finely rugose all over body.

Epistoma scarcely projecting over clypeus at extremities; front produced in four transverse, finely wrinkled, blunt-edged tubercles (not round, as in *Ergates*, nor acute edged, as in *Tragosoma*), resembling *Orthosoma*, except that they are much heavier; mandibles shorter and more robust than in *Orthosoma*, scarcely rugose, tooth on molar surface not striate. Labrum as in *Orthosoma*, only thicker, hairs on perimeter; last joint of antennæ very short, obtuse conical; basal joint of maxillary palpi larger than next two, last very minute, globular, not one-half length of second; hairs on lacinia and ligula dense. Ocelli three, distinct; postcondylar carina distinct; subfossal spine triangularly conical, large.

¹ Packard, A. S. Fifth report of the U. S. Entomological Commission, being a revised and enlarged edition of Bulletin No. 7 on Insects injurious to forest and shade trees. Washington, 1890. *Orthosoma brunneum* De Geer, p. 702-703, fig. 238.

Posterior area of pronotum rugose, eusternal area not distinct in front. Pleural disc rugose, most distinct on first four segments. Abdominal spiracles oval.

Described from one specimen in the United States National Museum, from San Jose, Cal., collected in white oak by Mrs. A. E. Bush (Bureau of Entomology, No. 2412).

Ergates spiculatus Lec.

Form robust, nearly cylindrical, slightly tapering posteriorly; texture leathery, finely rugose.

Epistoma more or less produced over clypeus for entire width, more so at extremities; front projecting in four large, round, shining, blunt teeth. Mandibles acutely triangular from side, rugose, upper inner face dully striated. Three indistinct ocelli. Labrum cordate, tapering anteriorly, longer than wide, front edge ciliate. Antennal joints thick, short, last joint cylindrical, little longer than thick; palpi elongate conical, last joint very short, acutely conical, that of maxillary palpi shorter than labial; labial palpi widely distant at base. Subfossal spine acute, conical; postcondylar carina prominent, acute edged.

Posterior area of pronotum finely rugose. Eusternal area of prothorax distinct.

Pleural discs visible on six abdominal segments, though distinct on but three of them, finely rugose, not radially striate. Abdominal spiracles narrowly oval. Anal lobes rugose, bearing a few slender hairs.

Pupa: Form as in adult; head glabrous; disc of pronotum smooth, remainder finely rugulose; mesonotum and metanotum glabrous, transversely wrinkled; abdominal tergites rather thickly beset with coarse chitinous asperities; the anterior margin of third, fourth, fifth, and sixth segments bearing a curved carina, under which fits a projection from posterior margin of anterior segments; last tergite ending dorsally in two short, conical, fleshy protuberances.

Range: Throughout the western United States and Canada, and eastward through the Rocky Mountains.

This larva attacks only dead or decaying coniferous logs. The mines are very large, extending through both sapwood and heartwood. The principal flight of the adult is in July and August.

Tragosoma harrisii Lec.

Epistoma projecting over clypeus in two distinct triangular lobes; front of head carinate, divided into four flat, dentate teeth, edge acute. Mandibles as in *Ergates*, though shorter. Labrum cordate, longer than wide, anterior edge ciliate, the cilia fine and sparse. Three or four prominent regular ocelli. Antennæ short, conical, last joint

cylindric, with distinct supplementary joint. Palpi short, conical; last joint of maxillary one-half length of last joint of labial, very short, conical. Postcondylar carina acute, projecting. Subfossal process short, triangularly acute.

Posterior area of pronotum slightly rugose. Eusternal area of prothorax distinct.

Pleural discs as in *Ergates*. Spiracles narrowly oval, small. Anal lobes rugose, dorsal lobe prominently projecting. Form robust, cylindric, scarcely tapering. Texture leathery, finely rugose.

Range: Mountains of Virginia and Pennsylvania, northward through Canada and the western United States. Confined to the higher elevations.

The work and habits of this larva are similar to those of *Ergates*, though it is confined to sapwood and decaying wood.

Prionus Geoff.

Head robust, trapezoidal, widest behind; front projecting over epistoma in a dull transverse carina; mandibles robust, upper inner face not striate; labrum transverse; ocelli absent; last joint of antennæ with a small lobe on truncate tip; palpi conical. Eusternum distinctly separated by curved suture from presternum. Pleural discs distinct on six abdominal segments, radially striate; form tapering to last segments; texture tough, shining.

Four species have been reared from this genus. As larvæ they are separable with difficulty, the distinctions lying chiefly in the labrum and palpal joints. The series studied under each species is rather limited, and some of the described characters may be variable. This is a genus of much economic importance.

Prionus imbricornis L.

Epistoma projecting in a dull dentate carina over clypeus, distal extremities and two median teeth largest; front produced in a straight transverse carina, rather sharp edged, divided in middle; mandibles from side subtrapezoidal, robust, short, outer face rugose, cutting edge obliquely truncate, upper inner angle produced in a short obtuse tooth, not striate. Labrum transversely oval, not twice as wide as long, densely hairy, the hairs extending from anterior edge to beyond middle. Ocelli absent. Antennæ short, thick, last joint slightly longer than thick, bearing a small supplementary joint. Palpi short, conical, last joint of maxillary palpi cylindric, as long as or longer than second is wide, hairs on lacinia and ligula so dense that integument can not be seen through them. Postcondylar carina distinct; subfossal spine acute conical.

Posterior area of prothorax not strongly rugose; eusternal area distinct; legs very hairy, last two joints (not spine) subequal; pleural disks very prominent on first six abdominal segments; an orbicular

radially striate area with deep pore. Abdominal spiracles broadly oval. Form tapering gradually to anal segments, anal lobes with two to four stiff hairs, about equal in size; texture firm, shining.

All specimens of this species examined have been collected from the living roots of oak and chestnut. It occurs throughout the eastern and central United States. The adults fly through June, July, and August. Dr. Hopkins finds it especially destructive to chestnut in West Virginia, causing death of the tops and branches. Adults fly from June to September. The females lay from 100 to 200 eggs, deposited in groups about the base of trees. The young larvæ feed in the bark before penetrating into the heartwood of the roots; later they completely hollow them. The larval stage extends over a period of at least three years. Larvæ hatched from eggs after one year were rarely over 2 centimeters in length. Several adults reared during July, 1914, of both *P. imbricornis* and *P. popularis* showed a peculiar habit in pupating. (Pl. VIII, fig. 1.) The larvæ left the roots in which they were boring, came to within 4 inches of the surface, and there made a large oval pupal cell about 7 by 4.5 centimeters in size, consisting of earth and sand held together by a secretion of the larvæ. The inside dimensions were just large enough to contain the pupa. The inner walls were very smooth and lined with a secretion. The adult emerged through the ground.

Since these observations were recorded the writer's attention has been called to a note by Riley¹ in which similar pupation habits are recorded.

Prionus laticollis Drury.

Epistoma projecting in a dull dentate carina, heavier than in *imbricornis*; front produced in a straight transverse carina (less extended than in *imbricornis*), divided in middle; mandibles short, outer face strongly rugose, cutting edge obliquely truncate, upper inner angle bearing a short, obtuse, nonstriate tooth. Labrum transversely oblong, twice as wide as long, sparsely haired behind anterior margin; antennæ as in *imbricornis*. Palpi conical, last joint of maxillary palpi conical, not longer than second is wide; hairs on lacinia and ligula not dense, integument distinctly seen between them. Ocelli absent. Postcondylar carina faint; subfossal spine acute conical.

Body as in *imbricornis*, except that the legs are less hairy and the last joint (not spine) is much longer than the penultimate.

This species has been recorded attacking a large variety of hardwoods, causing serious damage to the roots of living trees, chiefly oak, poplar, and chestnut. Throughout Virginia and some of the Southern States serious injury and often malformation of the tree have been recorded as caused by this insect.

¹ Riley, C. V. Notes of the year. In U. S. Dept. Agr., Div. Ent., Bul. 12, old ser., p. 32-45, 1886. The tile-horned *Prionus* in prairie land, p. 39.

It has been found associated with *imbricornis* in chestnut, in chestnut roots, and probably has similar habits. It occurs throughout the eastern and central United States.

Prionus californicus Mots.

Epistoma projecting over clypeus for its entire width, farther at extremities, narrowing in middle into two blunt teeth, although rarely not dentate; front produced over epistoma into a broad, straight, undivided, dull carina; mandibles very coarsely rugose on outer face, molar portion toothed, not striate. Labrum transversely oval, about one and one-half times as wide as long. Otherwise similar to *imbricornis*.

Pleural discs very finely radially striate, distinct on six abdominal segments; spiracles broadly oval; dorsal anal lobe slightly larger. Form tapering, texture shining.

This insect, like the eastern species, is a serious pest to oaks. The writer has observed its work on the Oregon oak. Mr. B. T. Harvey, of this office, reports it as causing death, stag top, and stunted and distorted growth in California black oak, Garry white oak, western cottonwood, western white alder, and madroña. It is most abundant in California black oak. Mr. Harvey further states that the young larvæ bore into the bark at the base of the tree and when about an inch long penetrate the roots. The mines are packed with sawdust and sand. Trees on hillsides and in thin soil are much more frequently attacked than those in other situations. The adult flies from July to August.

Prionus pocularis Dalm.

Epistoma as in *laticollis*, but sharply edged and longitudinally wrinkled or striate; labrum transversely oval, not twice as wide as long, hairs extending behind middle; last joint of maxillary palpi conical, as long as second is wide; hairs on lacinia and palpi not so dense as in *imbricornis* and much coarser, subulate.

Prothorax with a very dark ochraceous, conspicuous band on anterior dorsal margin, extending down over the sides; this much more distinct than in other species. Other characters as in *laticollis*.

This species has been collected only from dead pine logs and stumps. It probably does not attack hardwoods or living trees. It is more common through the South. It pupates in the ground, making an earthen cell, as described under *imbricornis*.

Prionus sp.

Epistoma projecting for entire width over clypeus, distended into an acute tooth at distal extremities and with two larger, obtuse, median teeth; front produced in a transverse bisinuate carina, divided in middle; mandibles trapezoidal from outer face, more slender than in other species of *Prionus*, not coarsely rugose, cutting edge obliquely

truncate, rather dull. Labrum transversely trapezoidal, widest behind, anterior margin straight, coarsely haired; last joint of antennæ and of labial palpi globular; basal joints of maxillary palpi strongly transverse, last shortly conical; hairs on lacinia and ligula sparse, short, stiff, subulate. Other characters as in the genus; spiracles small, orbicular.

These specimens were received through correspondents from Nebraska, who stated that they were doing much damage to the corn-fields, killing the stalks by eating off the roots.¹

Sphenostethus taslei Buq.

Form cylindrical, tapering; texture tough; very shining and glabrous.

Epistoma projecting over base of clypeus in two elongate, flattened, suddenly tapering teeth; front bearing four similar processes, distal ones long and flattened, acute. Mandibles more slender, acute, outer face rugose, edge obliquely emarginate, inner upper angle toothed. Labrum roundly cordate, about as long as wide. Three prominent oval ocelli. Last joint of antennæ elongate, cylindrical. Palpi short, conical; last joint of maxillary and labial palpi about equal, blunt, slightly conical. Postcondylar carina visible.

Posterior area of pronotum sparsely rugose. Eusternal area of prothorax distinct.

Pleural discs plainly distinct on three segments. Abdominal spiracles subelliptical. Anal lobes nearly dorsal, glabrous.

Range: Pennsylvania south through the eastern United States.

The larva bores in the dead dry stag-tops of oak and chestnut, and is also found in redbud (*Cercis canadensis*) and probably occurs in many other hardwoods. This is a peculiar habit in this subfamily, as all other North American forms, so far as known, breed in moist situations. The galleries are packed tightly with small pellets of frass. The adult is considered rare, but larvæ can be found quite commonly.

Elateropsis sp.

Scarcely distinguishable from *Sphenostethus taslei*, except that the projections of the front over the epistoma are very minute, while the pleural disks on the fourth abdominal segment are hardly visible.

Described from a specimen in the United States National Museum from Montego Bay, Jamaica.

Lameere² has placed *Elateropsis* with *Sphenostethus* as subgenera under *Derancistrus*. From larval characters this would seem perfectly justifiable.

¹ Riley, in Bulletin 12 (old series), Division of Entomology, Department of Agriculture, page 39, refers to a species, which he calls a small variety of *P. imbricornis*, feeding on grass roots throughout the prairie States. This is probably the same thing, which is very different by larval characters from the typical *P. imbricornis*.

² Lameere, A. Cerambycidae: Prioninæ. (Coleopterorum catalogus auspiciis et auxilio W. Junk, editus a S. Schenkling, pt. 52.) 108 p. May 20, 1913.

EXPLANATION OF PLATES.

The following drawings were made with camera lucida under the supervision of the author by Miss Esther H. Hart.

The photographs were made by Mr. H. B. Kirk.

PLATE I.

LARVÆ OF CERAMBYCIDÆ.

Subfamilies as based on the anatomical characters seen in the head.

- a. i. r. m.*, attachment of inferior retractor muscles of head.
- ant.*, antenna.
- a. s. r. m.*, attachment of superior retractor muscles of head.
- c.*, cardo.
- cly.*, clypeus.
- epic.*, epicranium.
- epist.*, epistoma.
- fr. s.*, frontal suture.
- gu.*, gula.
- hyp.*, hypostoma.
- l.*, ligula.
- lab.*, labrum.
- lac.*, lacinia.
- l. p.*, labial palpus.
- l. pal.*, labial palpifer.
- m.*, mentum.
- md.*, mandible.
- m. palif.*, maxillary palpifer.
- m. s.*, median suture.
- mx. p.*, maxillary palpus.
- mx. sc.*, maxillary sclerite.
- occ. for.*, occipital foramen.
- p. c. ca.*, postcondylar carina.
- s. f. sp.*, subfossal spine or process.
- s. m.*, submentum.
- st.*, stipes.
- tent.*, tentorium.
- I, anterior portion of occipital foramen.
- II, posterior portion of occipital foramen.

PLATE II.

LARVÆ OF PRIONINÆ.

FIGS. 1 AND 2.—Difference in structure in the presternum between (1) *Mallodon* and (2) *Prionus*.

- p. st.*, presternum.
- st.*, eusternum.
- plr. z.*, lateral, pleural, zone.
- hyp.*, hypopleurum.
- stl.*, sternellum.

See also the group of spines on the anterior part of the lateral zone in *Mallodon*.

FIGS. 3 AND 4.—Showing the ventral mouth parts of the Prioninæ, and the difference in shape of the joints of the maxillary palpi between *Prionus* and *Orthosoma*. (Lettering as in Pl. I.)

FIG. 5.—Diagrammatic lateral view of prionine larva.

- amb. amp.*, ambulatory ampulla.
cly., clypeus.
fr., front.
hyp., hypopleurum.
in. seg., intersegmental skin.
lab., labrum.
md., mandible.
mx., maxilla.
pl. dis., pleural disc.
pl. z., lateral, or pleural, zone.
pa. sc., parascutal area.
p. scl., postscutellum.
pl. tu., pleural tubercle.
p. n., pronotum.
sf. sp., subfossal spine or process.
sp. a., spiracular area.
st., eusternum.
stl., sternellum.

PLATE III.

LARVÆ OF PRIONINÆ.

Anterior parts of the head in various genera, and the form of epistoma, front, labrum, and prothorax of *Sphenostethus* and *Parandra*.

- FIG. 1.—*Tragosoma harrisii*.
 FIG. 2.—*Mallodon dasystemus*.
 FIG. 3.—*Prionus laticollis*.
 FIG. 4.—*Orthosoma brunneum*.
 FIG. 5.—*Sphenostethus taslei*.
 FIG. 6.—*Parandra brunnea*.
 FIG. 7.—*Ergates spiculatus*.

PLATE IV.

LARVÆ OF PRIONINÆ.

Modification of the mandibles in various genera. Note the molar part, which is either a blunt process or flattened into a striated plate.

- FIGS. 1 AND 2.—*Ergates spiculatus*, lateral view of outer face and (2) inner face showing cutting edges.
 FIG. 3.—*Tragosoma harrisii*, lateral view of outer face.
 FIGS. 4 AND 5.—*Parandra brunnea*.
 FIGS. 6 AND 7.—*Orthosoma brunneum*.
 FIGS. 8 AND 9.—*Prionus californicus*.

PLATE V.

LARVÆ AND PUPA OF PRIONINÆ.

- FIG. 1.—*Orthosoma brunneum*.
 FIG. 2.—Larva and pupa of *Mallodon dasystemus*.

Note the general form and texture of the body. *Orthosoma* is slender and its texture is very shining, while *Mallodon* is more robust and very dull. Twice enlarged.

PLATE VI.

LARVÆ OF PRIONINÆ.

- FIG. 1.—*Prionus laticollis*.
 FIG. 2.—*Ergates spiculatus*.

Note tapering form of *Prionus* as compared to robust cylindrical form of *Ergates*; also, the dorsal ampullæ of *Ergates* and their rugose texture. Twice enlarged.

PLATE VII.

LARVAL WORK OF PRIONINÆ.

Work of *Malldon dasystemus* in living willow tree. Collected by J. B. Gill in Mississippi. Note how heartwood is first destroyed. Reduced.

PLATE VIII.

PUPATION OF PRIONINE LARVÆ.

FIG. 1.—Pupal cell of *Prionus imbricornis*. About natural size.

FIG. 2.—*Orthosoma brunneum*, dorsal view of pupa. Note peculiar carina on anterior extremity of abdominal tergites and fleshy lobe of preceding segment which projects under. About twice enlarged.

FIG. 3.—*Orthosoma brunneum*, ventral view of pupa. About twice enlarged.

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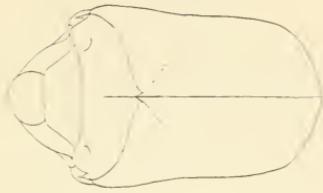
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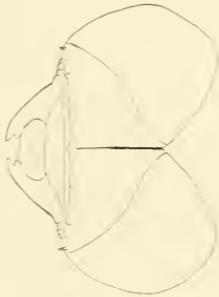
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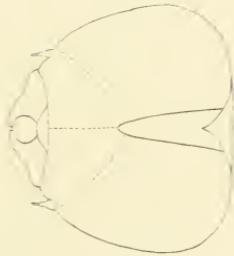
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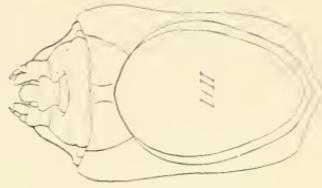
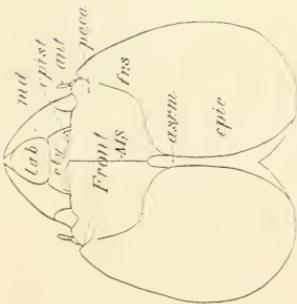
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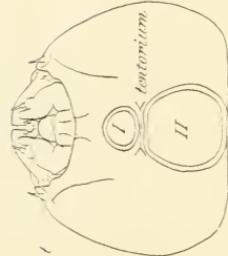
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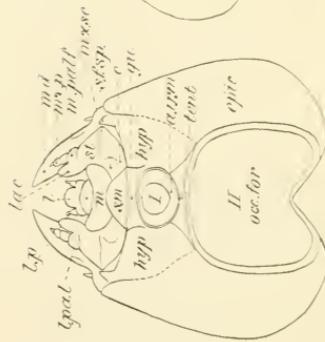
Rhagium



Xylotrechus

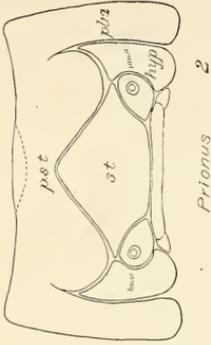


Aseum



Orthosoma

LARVAE OF CERAMBYCIDAE.

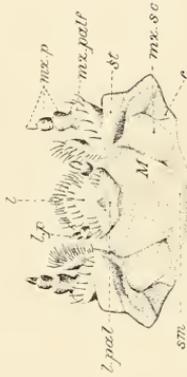


2

Prionus

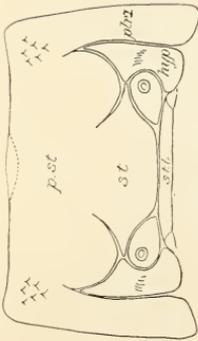


Prionus laticollis 3



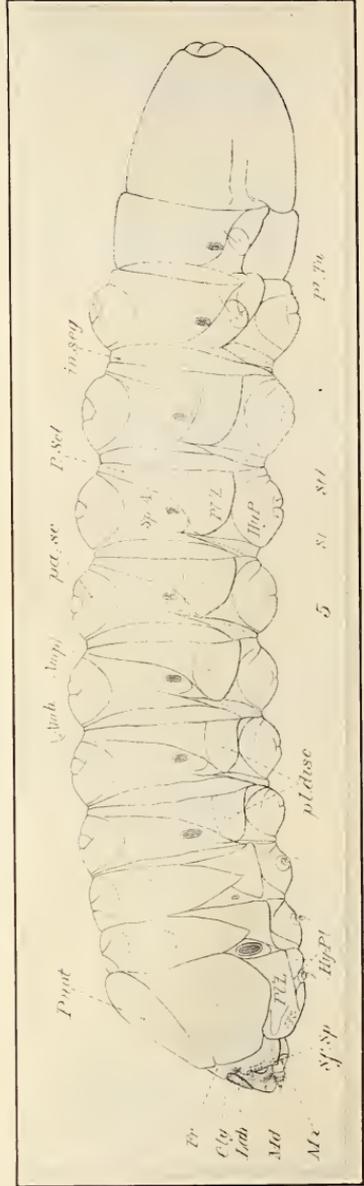
4

Orthosoma brunneum



1

Malleon

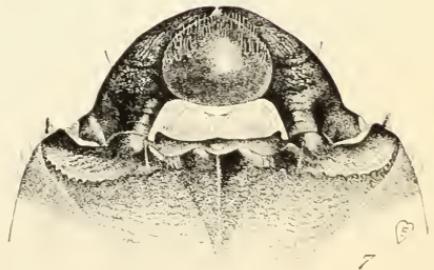
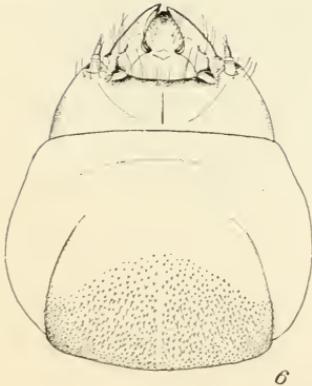
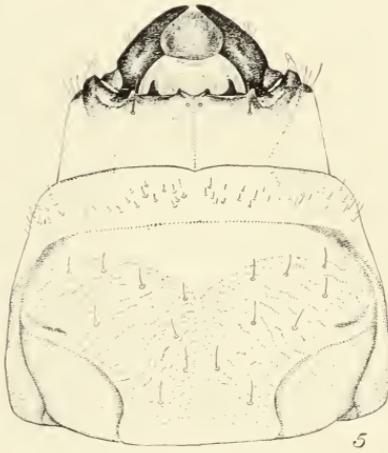
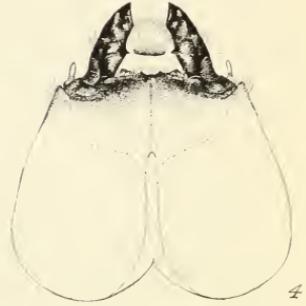
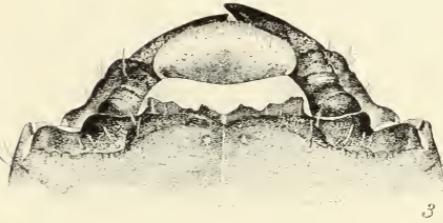
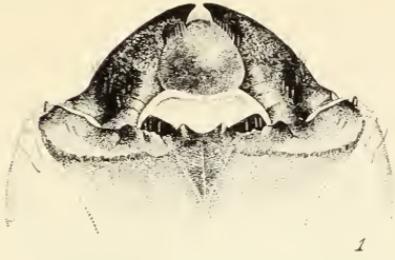


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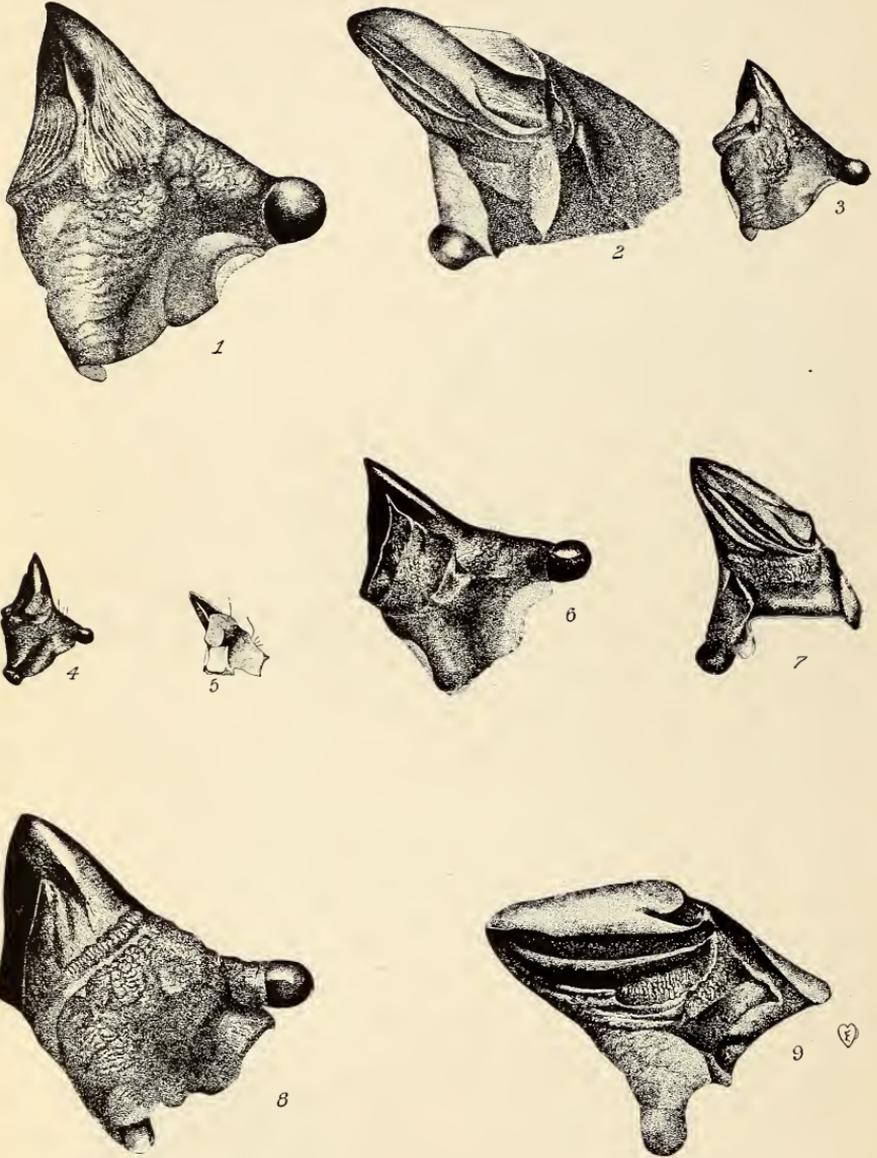
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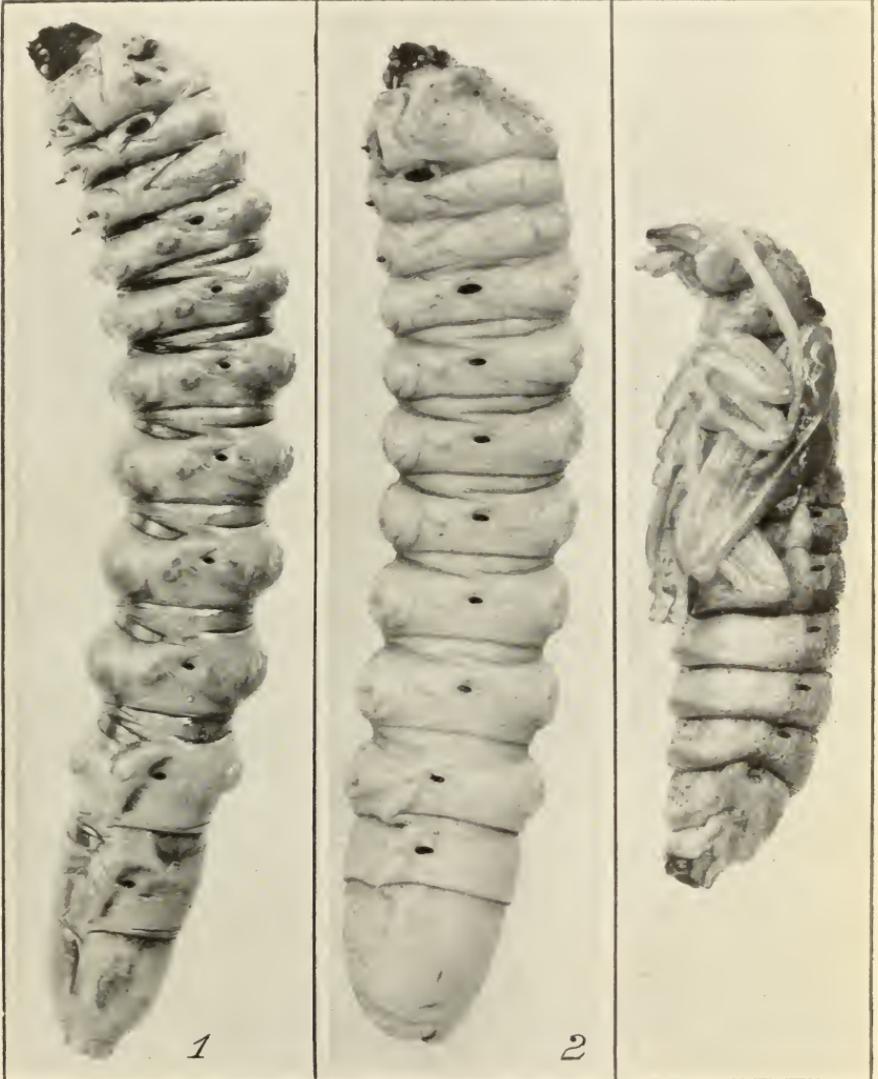
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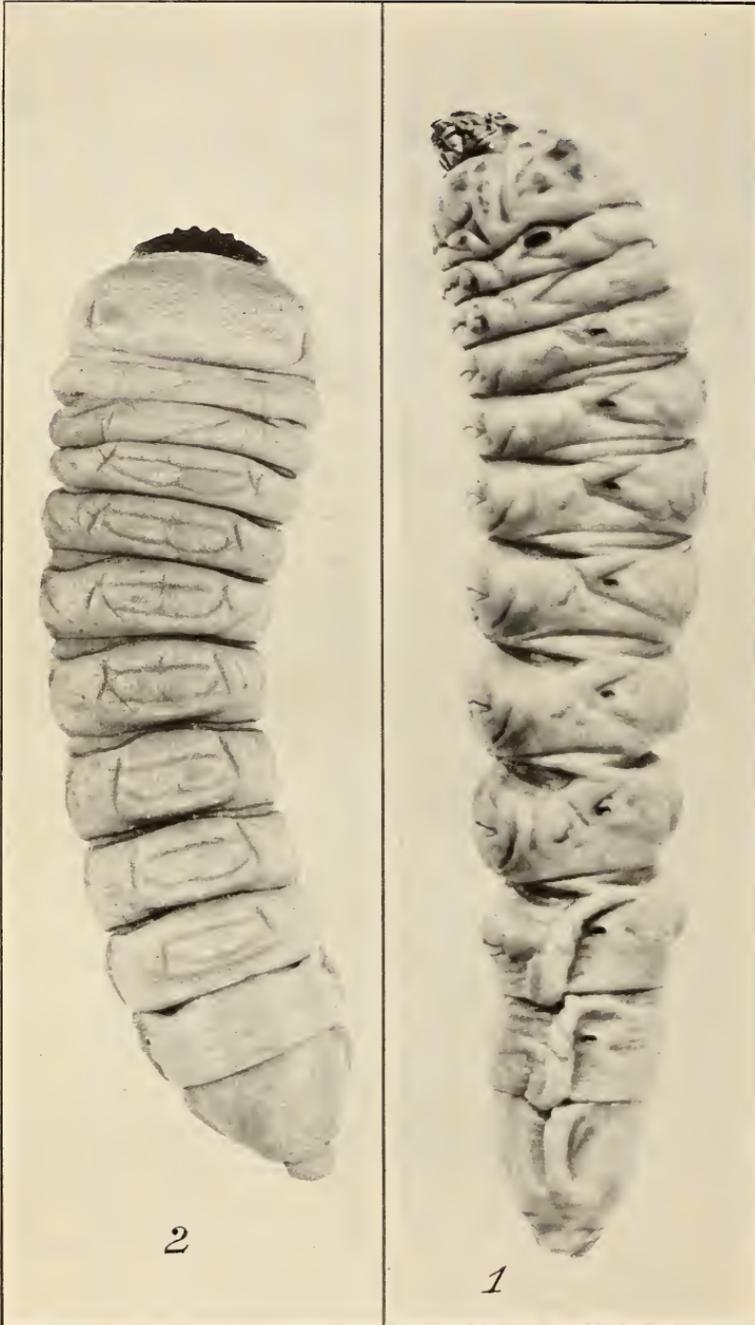
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LARVÆ OF PRIONINÆ.



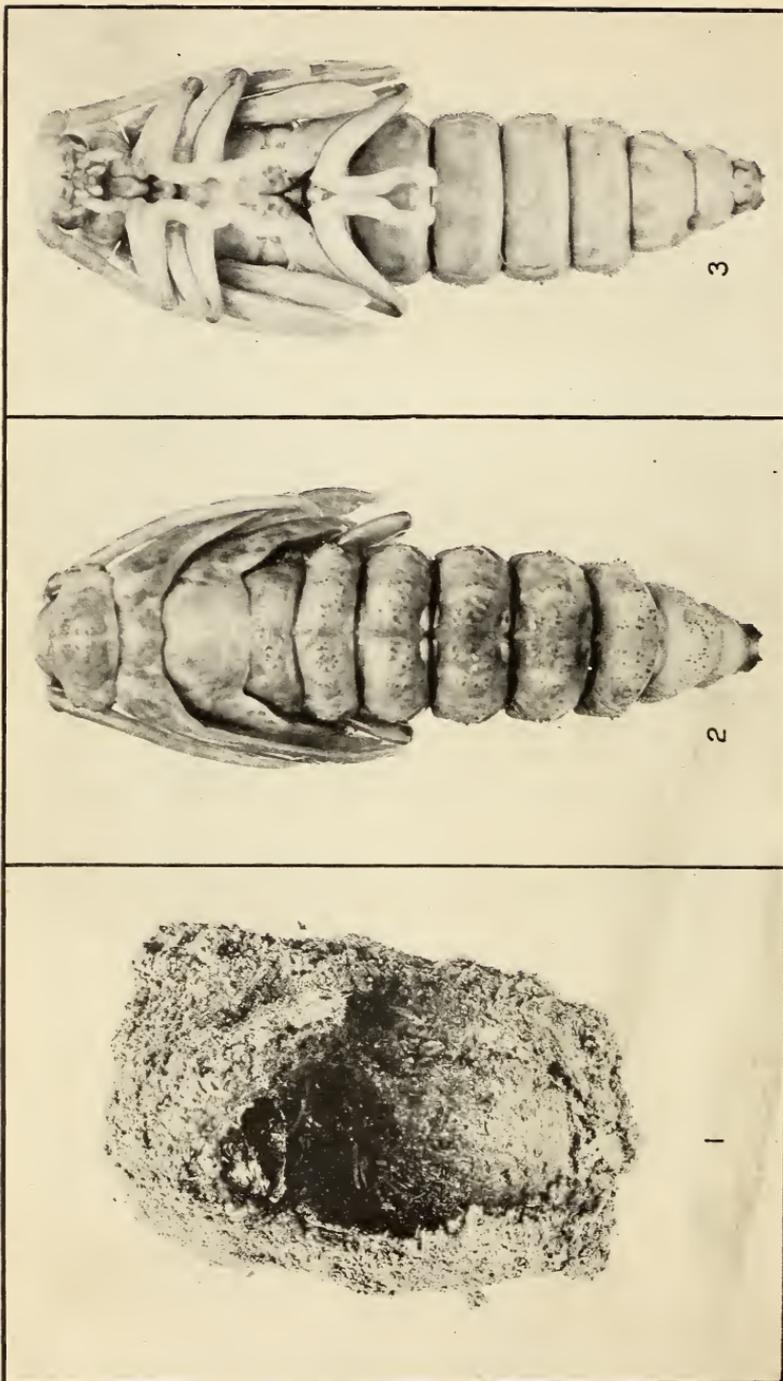
LARVÆ AND PUPA OF PRIONINÆ.



LARVÆ OF PRIONINÆ.



LARVAL WORK OF PRIONINÆ.



PUPATION OF PRIONINE LARVAE.

R 607

Prionine

