

CONTRIBUTIONS TO THE LARVAL HISTORY OF PACIFIC COAST COLEOPTERA.

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The study of systematic entomology affords the student but a dim idea of what insects are noxious and what are innoxious. The distinctive characters upon which the systematic entomologist builds classification need not be and generally are not the characters of prime importance to the economic entomologist. The names of many of the groups of Coleoptera afford a slight generalized description which is often misleading. In the present state of entomologic science, where systematic is given precedence over biology, it is dangerous to attempt to make a general statement of the habits of a single genus and impossible to generalize the habits of a group or family.

The most valuable contribution to the life history of American insects which is generally accessible is Dr. Packard's "Insects Injurious to Forest and Shade Trees."* In his introduction the author states that this work is purely tentative and designed to elicit the results of the observations of students of economic entomology. It is on that account that I feel at liberty to comment upon or question certain of Dr. Packard's statements.

On page 118, *op. cit.*: *Prionus laticollis*, Drury, is noted as injurious to the poplar. If *Prionus* destroys living trees in other parts of America it has no such destructive habit in California; in fact the charge against borers that they destroy trees is a very old one, but by no means substantiated by my own observations. *P. Californicus* goes through its transformations in the roots of oaks, but these roots were dead in every case observed by me and usually belonged to

*U. S. Entomological Commission, Bulletin 7, Washington, 1881.

stumps whose trunks had been felled years before. Last year I bred several from the decayed part of an old oaken chopping block. In fact Dr. Packard himself throws some doubt upon the destructive habit of *P. laticollis*, for in his note he quotes the report for 1872 of Prof. S. J. Smith, Entomologist to the Connecticut Board of Agriculture, as follows: "I have noticed it in logs of poplar, bass-wood and oak, and in the trunks of old, decaying apple trees."

On page 137 *op. cit.* is the following: "We have found Buprestid and Longicorn borers in a dead sweet gum tree." The caption at the head of the page, "Insects Injurious to the Sweet Gum," seems designed to lead to the inference that these borers killed the tree. But my observation is that the larvæ of insects of the two families noted feed only on dead wood.

Again, on the same page, *Ptilinus basalis* and *Micracis hirtella* are listed as injurious to the California Bay. These species are both found in Berkeley, and I have observed their habits for the last seven years, and as a result of such observation I am in a position to assert that they bore into the twigs of the tree mentioned only when dead, dried and decaying.

On page 71, *op. cit.*, we find a figure of *Oncideres cingulatus* in the act of girdling a hickory twig. In connection with this insect we meet with one of the most interesting and remarkable points in the whole range of insect biology. For, knowing that its larva will have to feed upon dead and sapless wood, this beetle, at the time of depositing its egg in the living and easily penetrated green wood, has instinct or forethought to girdle the twig, and thus assure the future larva the conditions necessary for its metamorphosis.

The question, "Are *Curculio* larva lignivorous?" has been partially discussed in Bulletin of the Brooklyn Entomological Society, vol. vii, page 150, by Warren Knaus, and in *Entomologica Americana*, vol. i, page 18, by W. H. Harrington. The question was brought up by the finding of

Wollastonia quercicola in cottonwood logs in an advanced stage of decay. The Curculios are a group of insects in systematic value the equivalent to a sub-order, and known as the Rhynchophora (Latreille), which bear certain intimate resemblances to one another in the perfect and final forms, while in their larval stage they may and certainly do differ in many particulars of habit. *W. quercicola* belongs to the Calandridæ, a family abounding in species whose habit in the larval stage is preëminently to feed on dry food. The metamorphoses of the Rhynchophora (Latr.) are not at all well known, but I have bred the following, belonging to this sub-order, and have found them to be lignivorous in the larval stage:

PLATYRHINUS LATIROSTRIS Fabr. — Decaying oak stumps highly charged with mycelia of a fungus.

SCOLYTUS DESTRUCTOR Oliv. — Dead sapwood of elm.

MESITIS TARDII Woll. — Decaying beech.

MONARTHURUM HUTTONI Woll. — Various hard woods.

HYLESINUS CRENATUS Fabr. — Dying ash.

ANTHRIBUS ALBINUS Lin. — Old wood.

BRACHYTARSUS SCABROSUS Fabr. — Elm bark.

RYNCOLUS — several species. — Bark of trees.

The foregoing are old world species of Curculios that do not affect a herbaceous diet; and the three following species are of similar habits.

SCOLYTIDÆ.

MONARTHURUM SCUTELLARE Lec. — Bark of dead *Quercus agrifolia*.

MONARTHURUM DENTIGERUM Lec. — Bark of dead *Quercus agrifolia*.

MICRACIS HIRTELLA Léc.—Dead branches of California laurel, *Umbellularia Californica*.

The Brenthidæ are well known to have the general habit of perforating trees and of depositing a single egg in each hole thus made, by this means providing that the larva shall have a full supply of the wood upon which it feeds.

The question, then, should not be: are *Curculio* larvæ lignivorous? but rather, how many have that habit? In a great group like this of *Curculios*, comprising many forms varying greatly from one another, one can easily appreciate the fact that we meet with many different tastes and habits. Some are known to feed upon all kinds of grain in store; one finds its food in rice, another in barley, and others in maize. Many species of *Balanus* undergo their changes in nuts, the larva feeding upon the kernels; another group is to be found in *Cynips* galls; and one species, geographically distributed from San Diego to Alaska, is to be found beneath seaweed upon the shores. Enough has been instanced to show clearly that we can draw no inference from the fact that two insects are found in the same natural group, that for that reason their habits are similar; and it is evident that a classification by habits would be of little aid to the systematic entomologist.

CHRYSOMELIDÆ.

DIABROTICA 12-punctata Oliv.—This is a most destructive insect to our peach orchards, and is not as yet sufficiently studied. If it resembles in habit the eastern species of the genus, and feeds in the larva stage upon the roots of cereals, it may be possible to rid ourselves in some degree of this pest by some rotation of crops. In the meanwhile sprays and washes are beyond a doubt not only useless, but in most cases a positive injury. We shall have to study further before speaking positively of the larval history of this insect pest.

The Ptinidæ is a family of limited extent, whose habits seem to be very similar wherever members of it are found. In California I have observed the following:

MELANDRYIDÆ.

DIRCÆA RIVERSII Lec.—Larva feeds in decaying trees of Madrona, *Arbutus Menziesii*. In trees in position the insect is found in the primary forks of the roots, and in prostrate logs among the more seasoned fibers of the wood.

PTINIDÆ.

PTINUS INTERRUPTUS Lec.—Black fungus of the laurel, *Umbellularia Californica*.

PTINUS QUADRIMACULATUS Melsh. — Decayed *Ceanothus thyrsiflorus*.

HEDOBIA GRANOSA Lec.—Dead branches of *Umbellularia Californica*.

HADOBREGMUS GIBBICOLLIS Lec.—Decaying wood of *Myrica Californica* and dead willow.

VRILLETTA CONVEXA Lec.—Dead *Quercus agrifolia*.

PTILINUS BASALIS Lec.—Dead twigs of *Umbellularia Californica*.

SINOXYLON DECLIVE Lec.—Any dead tree or unpainted wood, very partial to wine casks and oak barrels. The depredations are done by the beetle while boring for a suitable place to deposit its eggs. Its burrow is straight across the grain of the wood, reaching the interior of the cask, causing waste and deterioration of the contents. Hot solution of alum applied to the outside of the casks will prevent boring.

POLYCAON STOUTII Lec.—Dead and dried willow.

POLYCAON CONFERTUS Lec.—Found boring into a slab of chestnut oak that had been deposited for years in the museum of the University of California; also bred from the stem of dead apricot trees that had been grafted on a peach root.

There appears strong evidence that these trees were not destroyed by the borer, but through the influence of the "black knot" on the roots, they being diseased with knobs as large as a man's fist on every root; while all the trees killed had the root diseased, only a portion was infested with the larva of this beetle.

Many similar observations made by myself and others go to show that in the larval stage this beetle is xylophagous. On the other hand, there is indisputable proof that this larva infests living trees by entering the twigs at the axils of the leaves.

LYCTUS STRIATUS Melsh.—Devastates furniture made of California laurel, *Umbellularia Californica*. Dr. Packard, *op. cit.* p. 75, quotes Dr. LeConte as saying that it affects the trunks and branches of *Carya tomentosa*. This is not borne out by my observations, as I am well satisfied that the larva lives in dead and dry wood.

SCARABÆIDÆ.

POLYPHYLLA DECEMLINEATUS, Say. Larva that produced this species was found in the earth from one to two feet from the surface, among root fibres of a coarse grass and roots of a Californian Laurel. *Umbellularia Californica*. The earth was sandy loam situated upon the banks of a river, and which is overflowed during the rainy season of the year.

ODONTAEUS OBESUS, Lec. This has a light chestnut larva with tufts of bristles surrounding each spiracle. Mandibular and clypeal portions well developed, redder in color and

thicker in texture than any other part. The legs are prominent. Feed upon rootlets of *Umbellularia Californica*. It is much infested with a small, pale-colored mite which is evidently parasitic on the species.

LUCANIDÆ.

PLATYCERUS OREGONENSIS (Westwood) — Dead trees of *Photinia arbutifolia*, *Umbellularia Californica*, *Quercus agrifolia* and *Eucalyptus*.

PLATYCERUS AGASSII Lec. — Decayed trees of *Arbutus Menziesii*; also in wood too much decayed to be identified.

SINODENDRON RUGOSUM Mann. — Decayed oak, *Quercus agrifolia*.

The 522 North American species of *Cerambycidæ* are all borers; the insect deposits its egg in a hole perforated in the wood, and the larva penetrates further and further according to a rhythmic order peculiar to the species until its metamorphoses are completed. The following is a list of the Californian species whose habits I have observed:

CERAMBYCIDÆ.

ERGATES SPICULATUS Lec. — Rotting coniferous trees. Bred from *Sequoia sempervirens*, *Pinus insignis*, *Abies Douglasii*, etc.

PRIONUS CALIFORNICUS Mots. — Bred from rotten damp roots of *Quercus agrifolia*.

ASEMUM NITIDUM Lec. — Decayed *Pinus insignis*.

HYLOTROPES LIGNEUS Fab. — Dead trees of *Libocedrus decurrens*.

ELAPHIDION IMBELLE Lec. — Bred from decayed oak near San Diego, Cal., by F. E. Blaisdell.

HOLOPLEURA HELENA Lec.—Dead twigs of *Umbellularia Californica*.

ROSALIA FUNEBRIS Mots. —Decaying *Umbellularia Californica* among the mycelia of some fungus.

XYLOTRICHUS NAUTICUS Mann.—Dead sapwood of the oak, *Quercus agrifolia*.

XYLOTRICHUS PLANIFRONS Lec.—Dead branches of willow.

NECYDALIS LÆVICOLLIS Lec.—Decayed oak, *Quercus agrifolia*, and in dead *Eucalyptus globulus*.

LEPTURA LÆTA Lec.—Dead *Quercus agrifolia* and *Quercus* sp.

LEPTURA CRASSIPES Lec.—Decayed wood of *Umbellularia Californica*.

SYNAPHÆTA GUEXI Lec.—Dead limbs of California buck-eye, *Æsculus Californica*.

POGONOCHERUS CRINITUS Lec.—Dead branches of *Quercus agrifolia*.

TROGOSITIDÆ.

TROGOSITA VIRESCENS Fab.—Dead *Libocedrus* and several kinds of oak.

CLERIDÆ.

THANASIMUS EXIMIUS Mann.—Dead twigs of *Umbellularia Californica*.

Among many entomological enigmas of long standing is one that is about being solved. From time to time in many parts of the United States, large luminous larvæ of some Coleopteron have been found, and it has been conjectured that these larvæ belong to some of the Elateridæ, the general supposition being that they were larvæ of the genus *Melanactes*. Every attempt at breeding them resulted in

failure because their natural food was unknown. I have recently found what their food consists of. Before making this discovery I had arrived, from a careful study of the anatomy of the mouth parts of these larvæ, at the conclusion now confirmed that they are carnivorous in habit.

Their food consists of the vegetable feeding Myriapoda, particularly of *Julus* and *Polydesmus* with a preference for *Julus*, because the large area of the rings of this genus affords space for the larva to penetrate the interior of the Myriapod. Its manner of feeding is to seize the hinder part of the *Julus*, and perforate a segment, reaching the soft inner parts, which it devours at leisure, creeping through many segments without disjoining them, and remaining inside these rings for days at a time, till one can see little else but the slowly wriggling form of the dying *Julus*.

I have a full fed larva, which I hope will go through its metamorphosis, and solve the problem. And now its mode of life is made known, other persons who are equally anxious with myself that nature shall yield this long kept secret, can apply themselves with renewed energy to the task of discovering the identity of the perfect insect.



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