

Forest Insects in Hawaii

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(Submitted for publication December, 1960)

The forest insects in Hawaii are especially interesting, since they are mainly endemic insects which have developed with the forests, concurrently with their natural enemies. As far as their numbers are concerned, they exhibit a balanced condition, with only occasional fluctuations in population density. Our knowledge of Hawaiian forest insects is derived from the publication FAUNA HAWAIIENSIS, based on the extensive investigations of Dr. R. C. L. Perkins during the years 1892 to 1901, and on the studies of Dr. O. H. Swezey, which extended over a period of nearly fifty years (1905 to 1954), and which culminated in the publication in 1954 of his FOREST ENTOMOLOGY IN HAWAII.

The insects attacking the arborescent flora, as is usual with forest insects, are defoliators, borers, sap-suckers, leaf and stem miners, seed and bud destroyers, etc. As the greater part of the forest cover is composed of a relatively few plant species, (e. g. ohia, *Metrosideros polymorpha*; koa, *Acacia koa*; mamani, *Sophora chrysophylla*; kukui, *Aleurites moluccana*; naio, *Myoporum sandwicense*) the insects found on these plants represent fairly well the nature of the forest depredators.

The koa insects are probably the most numerous. One group that occasionally become plentiful enough to cause noticeable damage are the geometrid loopers of the genus *Scotorythra*, of which there are many species. Curculionid weevils of the genus *Rhyncogonus* also feed on the foliage, as does *Pantomorus godmani* (Crotch), an immigrant from California; and lygaeid bugs of the genus *Nysius*. The borers are cerambycids of the genera *Plagithmysus* and *Neoclytarlus*, aglycyderids of the genus *Proterbinus*, and the bostrichids *Sinoxylon conigerum* Gerstaecker and *Xylopsocus castanoptera* (Fairmaire). The bark and twig-eating beetles include species of the anthribid genus *Araecerus* and species of the curculionid genera *Dryophthorus*, *Antheorus* and *Oodemus*; also many species of the ciid genus *Cis*, species of the scolytid genus *Hypothenemus*, and a species of the elaterid genus *Eopenthes*. Bud worms include the tortricid *Amorbia emigratella* Busck and the lycaenid *Vaga blackburni* (Tuely). Seed destroyers include the larvae of the tortricid genus *Cryptopplebia*. Sap-suckers include the scutellid *Coleotichus blackburniae*, White, delphacids of the genus *Nesosydne*, the flatid *Siphanta acuta* (Walker) (an immigrant bug from Australia), species of the cixid genus *Oliarus*, the cicadellid *Nesophrosyne pluvialis*, Kirkaldy, and several species of mealybugs. Flower and foliage feeders include various species of thrips. The termite *Neotermes conexus* Snyder feeds on dead koa wood.

The ohia insects are very similar in kind to those of koa, though generally different species. However, there is one striking difference, apparent at once to the collector. The ohia trees are generally covered with psyllid galls, made by species of the genus *Trioxa*. Ohia is also attacked by psyllids belonging to the genus *Kuwayama*, which, however, do not make galls on this plant.

It is not thought that the aborigines in Hawaii had any idea of insects damaging their forest plants. Their conception of injurious insects only went as far as their knowledge of the pest species encountered in their day-to-day existence, such as the house fly, the louse, the flea, etc. For these they had names just as they had for the plants, indicating they were able to distinguish them in some way one from another. Cooke on his 1778 voyage to Hawaii had in his crew a surgeon named Ellis who reported the presence of the house fly, spider, moth and dragon fly. Kotzebue in his voyage to Hawaii in 1824 was accompanied by Escholtz, who reported the presence of flies, also twenty species of beetles. Byron in his voyage was accompanied by Bloxam, who reported the presence of the butterfly, *Vanessa tammeamea* Escholtz. But it was seafaring men, merchants, and missionaries, who came to the islands for permanent settlement, who brought about the gradual civilization of the natives and introduced ideas of natural history. Through education and by learning to read the Hawaiians gradually became familiar with a conception of plant and insect combinations as host and enemy. David Malo, a native author, in his historical writings refers to certain well-known insects by name as follows:

Dragon fly:	pinao
butterfly:	okai-palele hua
lepidoptera:	lepe lepe ahina
house fly:	nalo
wasp:	nalo puka
cockroach:	ilelu
caterpillar:	poko pelua
flea:	ukulele

There is another group of plants in Hawaii whose representatives are not generally thought of as being trees, but which do, however, have many examples which are arborescent. For instance, there are the tree grasses (bamboos), tree ferns (*Cibotium*, *Sadleria*), tree lobelias, tree lilies, coconuts and other palms, bananas (*Musa*), and other banana-like plants. These have each their respective insect enemies. The coconut (*Cocos nucifera*) exists in large groves near the seashore in many parts of the islands, and is probably a natural immigrant that has been washed ashore thousands of times, since the nuts float on the sea. This plant with its feather duster plume of foliage is continually being ravaged by the pyraustid leaf-roller *Hedylepta blackburni* (Butler) and also has been attacked within recent years by the coleophorid miner *Agonoxena argaula* Meyrick, an

immigrant from the south (Samoa, Fiji). Several beetles also attack coconut, particularly the curculionids *Rhabdoscelus obscurus* (Boisduval) and *Diocalandra taiiensis* (Guerin). The former bores into the trunk while the latter feeds on the leaf blades. Both species were probably brought into the islands with introduced plant material. There are also three important coccids found regularly on the coconut. The palm mealybug, *Pseudococcus palmarum* (Ehrhorn), believed to be an immigrant, is not especially injurious except to young trees when it occurs in masses in the crown. *Chrysomphalus ficus* Ashmead, a red armored scale, is often an important pest; and another armored scale, *Pinnaspis buxi* (Bouche), is ubiquitous and often very damaging. The loulu palms (*Pritchardia* spp.) are only occasionally found in the forest. They are attacked by insects similar to those found on the coconut palm as well as several additional native species not found on coconut. The tree ferns *Cibotium chamissoi* Kaulfuss and *Sadleria cyatheoides* Kaulfuss are an integral part of our forests and have an attached insect fauna, species of the aglycyderid genus *Proterbinus* and of the curculionid genus *Oodemas* and other forest insects, also an Australian immigrant curculionid *Syagrius fulvitaris* Pascoe which does considerable damage. The tree lobelias also harbor species of *Oodemas* and *Proterbinus* and other insects like the delphacids, *Nesosydne* spp. The bananas are attacked by pyralid leafrollers of the genus *Hedylepta* (*blackburni* (Butler), *meyricki*, *musicola*, *maia*, *euryprora* and *fullawayi* (Swezey)).