

EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Handbook
of
**The Insects and Other Invertebrates
of Hawaiian Sugar Cane Fields**

Compiled by
FRANCIS X. WILLIAMS

With an Introduction by F. Muir, a Chapter each on the Soil
Fauna of Sugar Cane Fields and on the Nematodes Attack-
ing Sugar Cane Roots by R. H. Van Zwaluwenburg,
and Records of Introduction of Beneficial
Insects Into the Hawaiian Islands, by
O. H. Swezey

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with brown, to form a large solid patch near the tip of the wing. It breeds in the flower-heads of *Bidens*, the ubiquitous weed composite, of *Cosmos*, and probably of other plants of the same family. It is doubtfully a native insect, although other *Tephritis* spp. are certainly endemic and breed in the flower-heads of native Compositae.

The melon fly (*Bactrocera cucurbitae* [Coq.]) is the rather large brown fly with a few brownish marks on its otherwise transparent wings that attacks ("stings" in laying eggs) chiefly the fruits of the melon and tomato family and also various bean pods. The Mediterranean fruit fly (*Ceratitis capitata* Wied.) is considerably smaller than the melon fly and has some dark marks on the otherwise pale thorax and the broad wings barred with light brown. It attacks many kinds of fruits and berries and is very abundant in guavas, of which extremely large and nearly inaccessible areas exist. The melon fly is usually thought to have originated in India and is now generally distributed in the warmer regions of the Old World. It arrived in Hawaii from the Orient in about 1895. The Mediterranean fruit fly is probably of African origin. It was discovered in the Hawaiian Islands in 1910. Parasites for both of these flies have been successfully introduced here; the fact, however, that except when preparing for pupation the maggots of these insects are generally imbedded in the pulp of fruit and vegetables makes it more or less difficult for these fly enemies to get at their hosts and so the percentage of parasitism is not always all that is to be desired. Nevertheless, they have noticeably reduced these two pests.

Both of these insects may be quite common about plantation camps and residences.

These flies have been thoroughly studied here by several entomologists, particularly by Back, Pemberton and Willard. (See "The Mediterranean Fruit Fly in Hawaii," Bull. 536, U. S. D. A., Jan., 1918, and "The Melon Fly in Hawaii," Bull. 401, U. S. D. A., June, 1917, and subsequent papers).

FAMILY DROSOPHILIDAE (Pomace Flies—Vinegar Flies)

"The flies pertaining to this family usually have a somewhat swollen appearance, with light red eyes, and are commonly taken by sweeping herbage. Others are prevalent about decaying fruit, cider presses, wine vats, vinegar factories, etc., where they are attracted by certain by-products of fermentation." (Imms, General Textbook of Entomology, p. 646, 1924.) Others are leaf-miners and some feed upon spider eggs. In the Hawaiian Islands, Drosophilidae exist in great variety, and Perkins estimates that

there must be at least 250 species, of which most are native; of the latter, some are comparatively large, with prettily marked wings, and suggest ortalid or trypetid flies.

The maggots of Drosophilidae are usually rather slender, and the puparia are often provided at the head end with a pair of slender breathing tubes.

Drosophila melanogaster Meigen is 2-3 mm. long; it is pale brown with the abdomen as a rule darker. It reproduces in decaying fruits, etc., and is perhaps the main species we encounter swarming on decayed guavas and bananas.

Because of its cosmopolitan abundance and the ease and quickness with which it may be reared, this fly has become famous in science from a standpoint of genetics, many striking forms having been produced.

Titanochaeta ichneumon Knab, about the same size as the preceding, has a sort of bluish or slaty gray bloom, the legs being pale. It is one of our two drosophilids known to parasitize the egg cocoons of certain spiders that may occur in cane fields. It has been taken at Mountain View, and at Pahala, Hawaii.

Gitonides perspicax Knab. (Fig. 36) measures up to about 4 mm. long; it is pale brown, the thorax finely dotted and splotched with darker, and the abdomen dark banded. Its larva is armed with a couple of spike-like processes at the end of the body. It preys upon various species of mealybugs, including those found on sugar cane. It occurs also in India.

FAMILY AGROMYZIDAE

These are small flies, several species of which are of economic importance, chiefly on account of mining the leaves and stalks of such plants as the cabbage, asparagus, chrysanthemum, etc.

Leucopis nigricornis Egg., in the maggot stage is predacious on plant lice and certain scale insects. It is evidently of European origin, is widespread in the United States and fairly common in the Hawaiian Islands, where it has been known for over twenty-four years. It is a tiny gray fly with a silvery abdomen; the puparium is rather stout with a pair of slender ear-like breathing tubes at the fore end.

Agromyza lantanae Frogg., is an importation by Koebele from Mexico in 1902. Its larva attacks the berries of lantana and in a measure prevents their development. It is hardly 2 mm. long and shining black. It has subsequently been purposely imported into some other tropical countries affected with lantana.

The genus *Milichiella* contains several species found in Hawaii. These little flies are often observed in company in the air; their larvae frequent manure and compost heaps.

M. lacteipennis (Loew) is about 2 mm. long, the thorax is

metallic and the abdomen rather dull black and the wings semi-transparent milky white. It was taken here as early as 1905 and occurs in the West Indies, and the more southern portions of the United States.

The fat and shining metallic little *Rhodesiella tarsalis* Adams (Fig. 140) is sometimes found on the leaves of the sugar cane.

Milichia circularis Aldrich is common about Honolulu and is about 3 mm. long; the male with a rather dull black thorax, and a wide abdomen with three broad satiny white bands. It was first collected by Swezey in September, 1926, on the H. S. P. A. Experiment Station grounds in Honolulu.

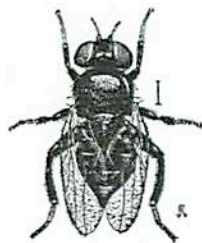


Fig. 140. *Rhodesiella tarsalis*, a small metallic-like fly sometimes found resting on the leaves of sugar cane.

ENEMIES OF THE NUTGRASS (*Cyperus rotundus* L.)

The nutgrass or onion grass (*Cyperus rotundus* L.), belongs to the sedge family and occurs in all warm countries. It is quite a pest in the Hawaiian Islands where it usurps areas intended solely for the cultivation of cane, for garden plants, for lawn grasses, etc. In the Philippines it is known locally as "Mutha," and in Porto Rico as "Coqui-grass." It is a perennial species, the plant sprouting from a hard, bulb-like swelling or "tuber" and sending forth one or more tough roots or rhizomes, swollen here and there to form additional though usually more subterranean tubers. Besides reproducing from seeds, the nutgrass grows "vegetatively" from these "nuts" or underground tubers, and this is why it is so difficult to eradicate. In India, China, the East Indies, and doubtless elsewhere in the Old World and in the New World there are several kinds of boring insects that feed on *Cyperus rotundus* and usually on no other plant. Of three such insects observed, two are the caterpillars of small moths, the leafminer (*Cosmopteryx mimetis* Meyr.), and the stem and bulb borer (*Bactra truculenta* Meyr.) (Figs. 141-143), while the third insect is the grub of a little snout beetle (*Athesapecta cyperi* Marsh.) (Figs. 144 and 145), with habits very similar to the *Bactra*.

Cosmopteryx mimetis (family Cosmopterygidae) is a tiny and delicately made moth the narrow wings of which are fringed with long hair, the front pair being dark brown with a clay yellow band edged with pale gold or silver. It occurs in the Philippines, India, the Australian region, Mauritius, Seychelles, British Guiana, etc., but does not appear to be of much consequence in the control of nutgrass. It was not liberated in the Hawaiian Islands. It was described in 1897, while notes on its habits are given by T. B. Fletcher in Mem. Dept. Agric. in India, VI, p. 102, 1920.

Bactra truculenta (Eucosmidae), the nutgrass moth borer, measures half an inch or more across the outspread wings, which are comparatively broad and marked in shades of brown. It is a very active insect that, when disturbed from the herbage, dashes off in a short low flight, then alighting, wraps its wings about the body and remains quiet and usually unseen. The female lays a number of flat oval eggs measuring about 0.60 by 0.90 mm., in the midrib groove of the upper side of a nutgrass leaf, arranging them in a single line of from two or three to perhaps twenty slightly overlapping eggs; these are in part sculptured with a delicate network of raised lines; at first they are pale green but darken and become blackish when it is time for them to hatch. They hatch in 3 or 4 days. The young were observed not to eat the egg shells; they immediately enter the central leaf bundle and tunnel the stem and, in many cases, destroy the bulb, which may be bored from top to bottom. The affected plant first shows a withering of inner leaves, which become yellow and finally die, causing "dead-heart", the whole plant eventually succumbing. The freshly hatched young is pale, glassy yellowish, excepting that the head is shining black, the prothoracic shield nearly black and the rest of the prothorax permeated with pinkish. The full-fed caterpillar is a half-inch or more in length, when it may be green or pale yellowish. It spins a tube of silk in the stem and in this cocoon sheds its skin to turn into a pupa about 5 to 7 mm. in length. At the end of a few days the pupa, by means of some backward-pointing spines on the abdomen, which it now moves actively, works its way out of the cocoon and, pushing itself part way through a specially made hole in the *Cyperus* stem, splits at the fore end and liberates the moth. Mr. Swezey who reared an adult to maturity found the caterpillar stage to be less than 25 days, and the time from the hatching of the eggs to disclosing the moth occupied 31 days. In another case approximately 38 days were required for the transformation. We have found that only one borer matures in a single stem.

Bactra truculenta together with the nutgrass weevil were first imported here from the Philippines in 1922; that material, however, was not liberated afield but used solely for experimental pur-