were more abundant on the blossom of Crotalaria and were also found feeding on the blossoms of fire weed, *Erechtites hieraci-folia* (L) Raf. They had eaten off the entire tops of the blossoms of these plants including pistils and stamens. On none of these plants, however, were any larvae, pupa or eggs observed.

In July, 1933 W. W. Yothers and R. L. Miller of the Orlando Laboratory of the Bureau of Entomology, U. S. D. A., observed them feeding on *Trialeurodes variabilis* on papaya. Not only adults but larvae were present on the leaves of the papaya. In August the senior author, together with Mr. Yothers and Dr. Miller again visited the papaya plantation at Orlando. In addition to numerous adults many larvae were seen and several clusters of eggs and several pupae, showing that the beetles are able to breed upon this whitefly and do not use it as a food for adults only.

In April, 1933, the authors took 117 pupa off of one small tangerine tree less than 10 ft. tall. No native lady beetles have ever been observed to become as abundant as were these, and it was very evident that they had been an important factor in controlling aphids in these groves. Although no other control measures had been taken the amount of damage by the aphids was slight. It would seem that with the knowledge that we now have of the possible summer foods for this ladybeetle at a time when aphids are scarce, we are in a position to make it possible for growers to establish this beetle permanently in many groves in Florida and that it will be a very great help in controlling the citrus aphids.

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**INSECT PARASITES OF CITRUS IN CENTRAL AMERICA**

*By Marston Bates*


The insect pests of Citrus anywhere on the American continent may be divided into three large groups: general feeders that number Citrus among their hosts; species that were originally parasites of *Xanthoxylum* or other indigenous Rutaceae, and that have adapted themselves to Citrus where it has been introduced; and Citrus feeding insects that have followed their host in its progress over the world. Many Citrus pests have become so widespread that it would be difficult now to determine their place of origin; others, mostly belonging to the second group, seem still to be of limited range. A thorough study of the Citrus
insects of the world might throw light on many obscure matters in insect distribution; might enable us to place quarantines and control measures on a more rational basis. Certainly a list of the Citrus insects of any one region is always of interest to those who are working on similar forms in other parts of the world.

The work on which this paper is based was done while the writer was in the employ of the United Fruit Company, and he is very much indebted to the officials of that company, especially Dr. Wilson Popenoe, for many favors and courtesies. Insect collections were made in Guatemala, Honduras and El Salvador. Climatic conditions in this region are exceedingly varied, including tropical, sub-tropical and temperate types. The Honduras coast, where much of the collecting was done, is very tropical, with a rainfall of 100 to 175 inches annually. The highlands of Guatemala, on the other hand, are in general temperate, and the rainfall may be no more than 30 inches annually.

At least four genera of Rutaceae are indigenous in this region: *Casimiroa*, *Peltostigma*, *Pilocarpus* and *Xanthoxylum*. Insects were collected from none of these except *Casimiroa*, the fruits of which were found to be infested with *Anastrepha ludens*.

Citrus fruits were introduced into Central America by the Spaniards soon after the conquest, and have become pretty well naturalized in many places. They are distributed everywhere from sea level to well above the frost line, becoming rare above 6000 ft. In most places they are grown only as door-yard trees: a significant factor in a study of their pests, as it means that there are no large stands of food material, that individual plants are generally separated from others of their kind by unrelated growth. In the few commercial orchards that I have seen in the region there were no signs of unusual insect activity.

There has been no real restraint upon the free movement of Citrus products from other parts of the world into Central America, or between the countries themselves; but such traffic is rare, almost confined to the occasional introduction of nursery stock from California. Certain scale insects have probably been introduced by this means; but the value of the improved stock probably over-balances the potential danger of insect introduction by this means.

Within the countries themselves the movement of Citrus fruits is rather wide, as they are often marketed at considerable distances from their place of origin. It would be difficult to say how much this has affected insect distribution; I cannot see that
there is any correlation between trade routes and fruit fly distribution.

ORTHOPTERA

Schistocerca paranensis Burm.
This is the migratory locust of tropical America: a general and ubiquitous pest. Citrus is one of its favorite food-plants.

THYSANOPTERA

Frankliniella insularis Franklin (det. J. R. Watson)
Sometimes common in blossoms; generally distributed.

ISOPTERA

Nasutitermes corniger Motsch (det. T. E. Snyder)
Prof. T. H. Hubbell found the nest and galleries of this species in an old Citrus tree at Puerto Castilla, apparently doing considerable injury. Such cases are not uncommon, but it is difficult to show that the termites attack trees that are not already weakened from some other cause.

HEMIPTERA

Several species of leaf-hoppers and bugs were found on Citrus, but as they were local species, apparently rare or accidental on Citrus, there is no object in enumerating them here.

(Aphididae)
One or more species of *Aphis* were abundant on the young plantings about Tela, Honduras, but Mr. Mason has found it impossible to determine them beyond the genus with the material at hand.

Myzus persicae Sulz. (det. P. W. Mason)
On citrus in Guatemala City; possibly more widely distributed.

Toxoptera aurantii (Boyer) (det. P. W. Mason)
This is the common Citrus aphis of the Pacific coast of Guatemala and El Salvador, occurring at least up to 5000 ft., the lower limit of the temperate zone. It was not collected on the Caribbean coast, but may very well occur there.

(Aleyrodidae)
Although white-flies were noticed about Citrus trees at various times, they were never seen in any abundance, and none were collected from this host. It is notable, however, that Baker (1923) has described a Citrus feeding species from Honduras, *Aleurodicus manni*. 
(Coccidae)

Ceroplastes floridensis Comstock
This species was found rarely in the United Fruit Company's Citrus grove, near Tela, Honduras.

Icerya montserratensis R. & H. (det. H. Morrison)
Occasional specimens of this species were also found in the groves on the Honduras coast.

Icerya purchasi Maskell (det. G. B. Merrill)
This wide-spread insect was found only in the highland cities of Guatemala: in Quezaltenango (8000 ft.), Huehuetenango (6000 ft.), and Guatemala City (5000 ft.). It is probably of recent introduction, and has not yet spread beyond the gardens of these cities, where it is common on various ornamental plants.

Lepidosaphes beckii New. (det. G. B. Merrill)
A rather common insect on Citrus, especially in the subtropical parts of Guatemala. Unfortunately scales of this type were usually collected in only a few localities, so that their exact distribution cannot be given.

Lepidosaphes gloverii Pack. (det. H. Morrison)
In the Citrus groves on the Honduras coast.

Parlatoria pergandei Comst. (det. Morrison, Merrill)
Apparently generally distributed, as it was collected both on the tropical Caribbean coast and on the subtropical Pacific slope.

Pseudacraea (Selenaspis) articulatus Morg. (det. H. Morrison)
On the Honduras coast.

Pseudococcus citri Risso (det. G. B. Merrill)
This insect is sometimes a severe pest of coffee in parts of the Pacific slope of Guatemala, especially in the cloud zone, between 4000 ft. and 5000 ft. in elevation. It and other mealybugs were observed from time to time on Citrus, but only as occasional specimens, never as pests.

Saissetia hemisphaerica Targ. (det. Morrison)
This scale seems to be universally distributed in the region, from the tropical coast well into the temperate zone. It was collected from Citrus in various localities, but not noted especially as a pest. It is sometimes very abundant on young coffee plants.

Tomneyella sp. (det. U. S. Bur. Ent.)
Reported from Citrus aurantifolia in El Salvador by Dr. Calderon.  (To be continued)