

same stage of development and only wait the warm moist condition of the early spring to burst forth and attack the tender foliage.

In the *Erythroneura* at least ten months of the year are passed in the adult stage and in many cases this is prolonged into twelve or more. The overwintering females appear late in the spring and lay eggs through at least a two month period, the first generation adults do not begin to lay eggs for some time after they emerge and use up another six weeks before they are through, all of which serves Nature's purpose of delaying the time of abundance until the time of mature foliage.

ACTING PRESIDENT R. N. CHAPMAN: This concludes the reading of the papers which were scheduled to appear this morning. We will now pass to the first group of papers under the general title "Insects Affecting Cereal, Forage and Field Crops." The first paper is by Herbert Osborn.

NOTES ON THE ECONOMIC STATUS OF CERTAIN CUBAN HOMOPTERA

By HERBERT OSBORN, *Columbus, Ohio*

ABSTRACT

Biological and economic notes on a number of Cuban Homoptera.

During the past winter I had an opportunity in connection with the Tropical Plant Research Foundation to make a survey of the Homopterous fauna of Cuba with more especial reference to association with the sugar cane crop but with no restriction as to localities or crops concerned. I am greatly indebted to the Foundation for many courtesies extended on the trip as also to the Cuba Sugar Club and to the officers at a number of the Centrals where I was given the best facilities possible to render my work effective and agreeable.

It is well known of course that the Cuban sugar crop is a very large one, the most important of any for the island and a major source of supply for the American market. Any destructive agencies are therefore worthy of attention as a factor in the cost of the sugar crop.

My collections were made at many different points on the island ranging from the extreme eastern end to near the west end but were most extended in the eastern central part where some of the most extensive plantations are located. They were directed primarily toward securing the species of homoptera that occur on cane and upon grasses associated with cane, especially such species as migrate readily from cane to grass or the reverse, since the grasses are quite evidently the native

hosts for many of the species that are found on cane and may serve as the hosts to plant diseases such as mosaic.

A complete list of the species secured with distributional notes will appear in another article and I wish here to present in brief form some of the distinctly economic phases of the survey.

As in other tropical regions the homoptera constitute a very conspicuous feature of the insect fauna and while the species in Cuba are perhaps much fewer in number than in Central or South America there are many species that are represented by an enormous number of individuals so that they must constitute a great drain upon the crops attacked. The economic importance of these species cannot be questioned even if we consider only the effects of their feeding upon the plants which are their natural hosts. However the relation which they may bear to the transmission of plant diseases which has been determined for a number of species has emphasized their importance and it is in this connection that they are receiving particular attention at the present time. For this reason it is of special importance to determine the host plants and the extent of migration as well as the possible limit of hosts for the species that occur in grasses and cane.

It is of course impossible to say what species may serve as carriers for plant diseases and only extended experiment with varying conditions will warrant positive conclusions. The species so far connected with transmission are too seldom found on cane to justify the conclusion that they are the only species capable of serving as vectors while on the other hand extended tests with species that would seem well adapted, have resulted negatively. It seems clear that further tests, with all possible approach to natural conditions, should be carried on so as to determine as certainly as possible which species are responsible for spread of mosaic.

While cane pests claim first attention this crop is not the only one to suffer. The species affecting cane directly or having it as primary host are comparatively few and considered simply as cane feeding species might be considered generally as almost negligible for this crop in Cuba. The West Indian Cane leaf hopper, *Stenocranus saccharivora*, and the cane arrow leaf hopper are the only species found in all stages on cane in such numbers and under such conditions as to indicate that they are permanent feeders on this crop or mainly dependent on it for subsistence and growth. The Cane leaf hopper, *perkinsiella*, once so destructive in Hawaii is not known in Cuba and with careful attention to imported "seed" probably may be permanently excluded.

However, many species living by preference on other crops make

frequent attacks upon sugar cane and should be treated as potential sources of loss even if not directly responsible for the dissemination of cane diseases.

The grass crop is probably the most universally infested with leaf hoppers and while damage to grasses is usually overlooked it should be remembered that mosaic occurring on grasses is likely to be widely distributed by homopterous insects and that hosts of leaf hoppers feeding normally on grasses will scatter widely, especially to more succulent plants if the grasses from prolonged drouth are excessively drained and lose their attraction as host plants.

Of the distinctly grass feeding species *Cicadella similis*, *Draeculacephala sagittifera*, and *reticulata*, *Xerophloea viridis*, *Deltocephalus flavicosta* and *sonorae*, *Euscelis obscurinervis* and *Chlorotettix viridius* are of primary importance but many other species occur in such numbers as to cause extensive loss. Sweet potatoes, an important Cuban crop are largely infested with *Empoasca fabae* and many garden crops suffer infestation, some noticeable instances being *Protalebra braziliensis* on carrots and *Cicadula maidis* on corn.

Cicadella similis (Walk.)

This species is a well-known and widely distributed tropical and sub-tropical form and one which occurs on a wide range of food plants including many of the grasses and it was taken at practically every station where collections were made and especially from Parana and Guinea grass but also in numbers from sugar cane and many species of grasses as well as upon various garden plants. It has been recorded from numerous host plants and recognized as of economic importance but experiments have failed to show that it is a carrier of mosaic of sugar cane. Its economic status so far as known lies in the fact that it is capable of extensive injury to various crops, especially those belonging to the grass family. Considering its very general distribution and wide range of food plants it may be considered as a possible agent in the dissemination of various plant diseases under favorable conditions. It is found in Florida and may extend its distribution, but so far as present observation goes it seems to be confined to tropical and sub-tropical areas.

Draeculacephala sagittifera (Uhler)

This species was found in abundance in nearly all stations in Cuba and it is of known distribution in many of the West Indian Islands. It is very nearly related to *reticulata*, a species which has become quite

destructive to various crops in the southern states. This species occurs particularly on Bermuda grass but is found commonly on other species of grasses and frequently in close association with sugar cane. Bermuda grass is in all probability the favored host and quite certainly one of the species upon which it may pass the nymphal stages. It has not been noted commonly on sugar cane and has not been credited with the transmission of any of the diseases, although it would seem a possible carrier especially for such diseases as might affect the different species of grass on which it may occur. It might in this way be an agent in the extension of plant diseases and in this way of greater economic importance. Simply as a feeder upon grass; it must be counted a distinctly important species since it occurs in such abundance as to act as a severe drain upon the affected plants.

Draecelacephala mollipes (Say)

Our very common *mollipes* is also an abundant and widely distributed species in Cuba and occupies a very similar position, both ecologic and economic, since it occurs on a number of different grasses especially upon Parana and the coarser grasses of the "savannas." It was not observed on cane and considering its distribution is perhaps not a very probable carrier of cane diseases although it might easily serve as such for the different grasses on which it occurs.

Xerophloea viridis (Fabr.)

This species has a very remarkable distribution, having been recorded all the way from Argentina northward through the tropics and temperate North America as far as to the northern United States. It is a very common species on grasses affecting a large number of species and in Cuba it was taken at practically all localities where collections were made. It was not, however, taken in great numbers but, of course, might be more abundant at other seasons of the year. Considering its wide range of food plants and common occurrence amongst the grasses and weeds in and around the cane fields it would seem to be a quite possible agent in the transmission of plant diseases. Although it has not been proven to have such a relationship it may, perhaps, best be looked upon as a species which should receive attention and possible extended experimentation in order to determine its status.

Deltocephalus flavicosta (Stal)

This species in another widely distributed form occurring throughout tropical and sub-tropical regions both north and south, being known as

far as northern United States and south to Argentina. It is very abundant in meadows, and fields of grasses and on account of its abundance must be counted an economic species. In Cuba it was taken in the cane fields and on grasses, and also on cane but very abundantly in the grasses bordering the cane fields. Aside from its injury to the crop directly it would seem to be quite open to suspicion as one of the species that might easily transmit the mosaic disease common to grasses and cane.

Euscelis obscurinervis (Stal)

Stal described this species from Brazil and it was later described as *exitiosa* by Uhler from specimens that had been collected in the Carolinas and credited with serious injury to grain crops. This is, probably, a species of South American origin which has migrated northward and covered practically all of tropical and sub-tropical America. It was found very abundantly in Cuba especially in Bermuda grass and various mixed grasses and in different stages of development, throughout the winter. It is another of the species which occurs abundantly in the grass lands adjacent to the cane but was not observed upon cane itself and it is doubtful whether it will attack cane unless possibly in the adult stage. It would hardly seem as liable to transmit disease as some of the other species although it has abundant opportunity to distribute diseases amongst the different grasses on which it occurs.

Euscelis obtusus (Van D.)

This species was not taken in great abundance in my collecting although it is probably more abundant at other seasons of the year and it was frequently so abundant in the southern United States as to cause injury to crops that it must be looked upon as a probable detrimental species in the Islands. No specimens were taken directly from cane but it seems to occur on quite a variety of grasses.

Euscelis bicolor (Van D.)

Similar to the preceding species in habit, occurring on a variety of grasses in an abundant form throughout the large range of the tropical and sub-tropical area. It has not been found in cane but very commonly in grasses and mixed vegetation adjacent to cane fields.

Thamnotettix colonus (Uhl.)

This is one of the very abundant species having a very wide distribution in the West Indies and southern United States. It occurs commonly on Bermuda grass and *Paspalum* and probably feeds on a

number of other species. Distinctly important as a pest of grasses but not observed commonly in cane or as yet connected with any of the plant diseases.

Chlorotettix viridus (Van D.)

One of the most common species throughout the West Indies and southern United States occurring northward as far as Ohio and probably having its distribution from a tropical center. Its most frequent habitat is in grass and it is undoubtedly a grass feeder and was taken quite commonly in grasses adjacent to cane but seldom on the cane itself.

Cicadula maidis De Long

This species was described from Porto Rico but collected in large numbers on corn at Jobabo, all stages being observed during January and February. Wolcott recorded it from carrots and sugar cane and while corn is evidently the normal host at least for the nymphs, it would seem to be a possible carrier for plant diseases and may deserve experimentation with reference to cane mosaic.

Eugnathodus guajanae De Long

This species has a very interesting habit, occurring in the heads of sugar cane in different stages so that cane would seem to be one of its preferred host plants, but it was taken also in heads of grass "raboza" and is also mentioned as growing in Parana grass. It has not been connected with any plant disease but considering its preference for cane it would seem a very possible carrier for cane diseases and it would seem important that any diseases of the nature of mosaic should be excluded from its range. Dr. Orton informs me that a disease similar to mosaic occurring in Africa is transmitted by a species of *Balcultha* and considering the very close relationship to this species it would seem very important that no plants carrying such a disease should be introduced into sugar cane territory.

Empoasca fabae (Harr.)

Our common potato leaf hopper was abundant on various crops, especially sweet potato and the status of the species, so well known in connection with the transmission of potato tip burn, may assume considerable importance where sweet potatoes are planted largely as a border crop to cane.

Oliarius franciscanus (Stal)

This species is known throughout a very large range of the United States and southward to include the West Indies and Mexico and it has

been taken in abundance from grasses and is quite common in cane fields so that it may be counted one of the species of economic importance. It has not been determined to have any relationship to the transmission of plant diseases, but considering its variety of host plants it is quite possible that it might be important in this connection.

Peregrinus maidis (Ashm.)

This species was described as a pest of corn and has been found to occur in a very large distribution having been recognized in Hawaii, Ceylon, South Africa, Porto Rico, and other tropical regions as well as from the southern states where it was first observed. It is not common on cane but it has been determined that it can transmit mosaic from corn to corn and it is, therefore, a possible source of infection for sugar cane. Aside from this possible relation to plant disease, it is abundant enough to be at times a distinct pest for corn.

Stenocranus saccharivora (Westw.)

The common West Indian cane leaf hopper has been known for many years as a cane feeding insect and since it breeds upon this it is to be considered as definitely a cane insect. However, it occurs on grasses and in the adult stage at least may be found on other plants widely separated from cane, although, I think, no records of serious damage to other crops have been reported. While not determined as a carrier of mosaic disease the fact that it migrates from cane to grass and grass to cane would seem to make it a possible menace in this direction and it is certainly worthy of careful investigation from this standpoint.

Liburnia teapae (Fowl.)

This is a very small species of leaf hopper and one which occurs throughout a very large range and affects a great variety of plants, especially of the grass family. For the smaller species of hoppers it is perhaps one of the forms most likely to be connected with the transfer of diseases as it appears to migrate readily from one plant to another and its abundance is sufficient to furnish a large opportunity for dissemination of plant disease.

Tomaspis bicincta (Say)

One of the very abundant tropical species of frog hoppers and reported in a number of cases as occurring upon sugar cane. It may be found frequently upon grasses and evidently feeds quite promiscuously at least upon different members of the grass family so that it might

very readily serve as a carrier of diseases. It is one of the species which deserves close observation and experiment to determine its relation in this manner.

ACTING PRESIDENT R. N. CHAPMAN: The next paper is by H. H. Knight.

**ON THE DISTRIBUTION AND HOST PLANTS OF THE COTTON
FLEA-HOPPER (*PSALLUS SERIATUS* REUTER)
HEMIPTERA, MIRIDAE**

By HARRY H. KNIGHT, *Iowa State College, Ames*

ABSTRACT

The natural hosts of the cotton flea-hopper are various species of Croton, especially *C. texensis*. The distribution of the insect and a description are given.

In recent years a small Mirid, *Psallus seriatus* (Reuter), has been recognized as causing considerable injury to the cotton plant in Texas and other southern states. Hunter has given a brief account (JOUR. EC. ENT., xvii, 1924, p. 604) of serious injury to cotton caused by this insect in south Texas. Other workers have reported the same type of injury to cotton in Mississippi, Georgia, and South Carolina. Since very little is known as yet regarding this insect I take occasion to record the natural host plant of the bug, which serves no doubt to perpetuate the species in the cotton states and supply infestations to the cotton fields. The natural food plants of this bug appear to be the different species of Croton, especially *Croton texensis* (Klotzsch). I have found it breeding on this plant in Arizona, Colorado, and Missouri, and judging by records of specimens examined the distribution of the bug coincides largely with the natural distribution of this host. Croton grows commonly on waste lands, particularly dry sandy soils, and the bug is usually found breeding where ever the plant is making new growth following rains.

I have examined specimens of *Psallus seriatus* (Reuter) from the following localities: ARIZONA — Texas Pass to Tucson, July 20-22, 1917 (H.H.Knight), on Croton, Tucson, May 24, 1924 (A.A.Nichol), on Croton. Sierrita Mts., alt. 4000ft., Aug. 19, 1924 (A.A.Nichol), on *Croton corymbulosus*. COLORADO — Las Animas, Aug. 6, 1925; Hudson, Aug. 25, 1925 (H.H.Knight), on *Croton texensis*. FLORIDA — Dunedin, April 10, 1923 (W.S.Blatchley). ILLINOIS — Meredosia, Aug. 19, 1913 (C.A.Hart). KANSAS — Topeka, Sept. 3, on *Croton capitatus*. MINNESOTA — Jordan, Aug. 1, 1922 (Wm.E.Hoffmann). MISSOURI — Hollister, July 22, 1915