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Survey of Sharpshooters in Citrus Orchards with Decline Diseases in Misiones, Argentina*

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ABSTRACT. Citrus orchards in Misiones are affected by decline diseases such as citrus blight and citrus variegated chlorosis (CVC) which have been associated with xylem-inhabiting bacteria. Five orchards with declining trees were surveyed from June 1984 to June 1986 for the presence of sharpshooters and related insects using yellow sticky traps. The most common species encountered were *Molomea consolidata*, *Oncometopia facialis*, *Scoposcartulla oculata*, *Acrogonia* sp., *Scaphytopius near bolivianus*, *Sonesimia grossa*, and *Ceresa ustulata*. Populations of most species peaked in the summer months and were lower at other times of the year. There were differences in populations of some species among the individual orchards. Although none of these species are proven vectors of *Xylella fastidiosa*, the causal agent of CVC, the high populations and diversity of sharpshooters present indicate that there is potential for spread of this bacterium in citrus in Misiones.

Index words. blight, citrus variegated chlorosis.

The citrus industry of Misiones, Argentina has suffered severe losses due to decline diseases. In the late 1960s and the 1970s, most plantings, which consisted primarily of Calderon sweet orange on trifoliate orange rootstock, were eliminated by an unknown decline disease (15). Subsequently, many orchards were replaced with trees on rough lemon, citranges, and other rootstocks.

Many of the declining trees were found to be affected by citrus blight as determined by low water uptake in trunk xylem, high zinc concentrations in trunk wood, and the presence of amorphous plugs in the xylem (2, 16). However, the disease syndrome described previously (15) included "fruta bolita," the production of small, hard fruit which is more characteristic of citrus variegated chlorosis (CVC) described recently in Brazil (7, 14) than of citrus blight.

The cause of blight is unknown, but *Xylella fastidiosa* has been isolated from sharpshooters fed on blight-affected trees in Florida (4), and some of the symptoms have been reproduced by inoculation of citrus trees with this bacterium (5). *Xylella fastidiosa* is associated with CVC (14). Symptoms

similar to those of CVC have been found in Misiones and are also associated with a xylem-limited bacterium (1). Sharpshooter species (Cicadellidae: Homoptera) are known vectors of *X. fastidiosa* (13).

The purpose of this study was to determine the prevalence, seasonal occurrence and identity of sharpshooters, other related leafhoppers, and membracids encountered in citrus orchards in Misiones.

MATERIALS AND METHODS

All orchards surveyed were located in the Montecarlo-Eldorado area, the most important citrus-growing area of Misiones. The orchards selected were: 1) Schwarz-Calderon sweet orange on trifoliate orange rootstock; 2) Libusky-Calderon sweet orange on trifoliate sweet orange; 3) Laharraque-Valencia sweet orange on 20 different rootstocks; 4) La Fundadora-Valencia and Westin sweet orange on six different rootstocks; 5) Jontza-Valencia sweet orange on rough lemon rootstock. The first four sites had many trees affected by declines, whereas the fifth was free of the problem.

Yellow sticky traps were used to sample sharpshooter populations as described previously (18). On each sample date, 20 traps were hung in each orchard on the southeast side of the

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tree about 1.5 m above the ground. Traps were placed in two rows on every third tree. Traps were exposed for about 10 days, removed, and the sharpshooters counted. Bimonthly surveys from all sites were made from June 1984 to June 1986. Samples for identification were stored in 70% ethanol. Most identifications were based on the work of Young (19).

RESULTS

The following species were the most commonly collected:

Molomea consolidata (Schroder) is about 1.0 to 1.1 cm long and is brown with greenish spots. The head, scutellum, and the last segment of the abdomen are red. The abdomen has a broad yellowish stripe on the side extending up to the penultimate segment. The legs are reddish with dark spots on the femur and tarsus (Fig. 1A).

Oncometopia facialis (Signoret) is 1.0 to 1.3 cm long. The head is red with a triangular black spot, and the rostrum and eyes are dark. The scutellum is black on the dorsal side and reddish on the ventral side. The wings are brownish yellow and transparent on the posterior end. The abdomen is red. The legs are yellowish with reddish femurs (Fig. 1B).

Acrogonia sp. is 1.0 to 1.1 cm long. In the dorsal view, the head is pointed and black with irregularly distributed white spots. The thorax and eyes are brown, and the wings are brown with yellow veins. The scutellum is black with yellow spots. In ventral view, the rostrum is whitish yellow, and the abdomen and legs are yellow (Fig. 1C).

Sonesimia grossa (Signoret) is 1.0 to 1.2 cm long. In dorsal view, the head has two parallel stripes and the eyes are dark. The wings are brown with obvious yellow veins. In ventral view, the rostrum is divided by a black stripe. The abdomen has two parallel black lines and the legs are brown (Fig. 1D).

Other cicadellids encountered in substantial numbers were *Scaphytopius* near *bolivianus* (Oman) and *Scopos-*

cartulla oculata (Signoret). *Gypona stalina* Delong & Freytag was detected in preliminary surveys but was never recovered during the 2-yr study period. The following cicadellids were identified during the survey: *Curtara samera* Delong & Freytag, *Labocurtidia hamata* Nielson, *Crepulvia pygmaea* (Linnavuori), *Bahita spiniventris* Linnavuori, *Ponana* sp., and *Osbornella* sp. Other unidentified cicadellids were recovered in small numbers during this survey. Several species of the Membracidae (treehoppers) were found during the survey. One, *Ceresa ustulata* Fairmaire, was found in high numbers throughout the survey period (Fig. 2). Two other species, *Cyphonia claverigera* (F.) and *Leioscyta cornutula* Stål, were also identified. Small numbers of other unidentified membracids were encountered.

Populations of *M. consolidata* rose in the spring (October), peaked in midsummer (December), and declined in late summer, fall, and winter (Fig. 2A). Numbers of *O. facialis* were much lower and peaked in summer in 1985 and 1986 but also showed a peak in August 1986. *Acrogonia* sp. reached maximum numbers in the fall (April) in both years (Fig. 2A). Populations of *S. grossa* were low except for peaks which occurred in summer. Populations of *S. oculata* were low in 1984 and 1985 with a small peak in October 1984 and showed a steady increase early in 1986 (Fig. 2B). *S. near bolivianus* did not show clear seasonal trends and peaked in June 1984 and August 1985 (winter) and in December 1984 (summer). The membracid, *C. ustulata*, was abundant in all locations and seasons and populations peaked in the warmest months (Fig. 2B).

There were differences among the five orchards sampled in the numbers of the different species captured (Table 1). Populations of *M. consolidata* were highest at Laharraque. *O. facialis* was most abundant at Schwarz, Libusky, and Jontza. Laharraque had the lowest numbers of *S. near bolivianus* and the highest populations of *S. grossa*. Num-

Fig. 1. Dorsal and lateral views of the most common cicadellids trapped in citrus orchards in Misiones: A) *Molomea consolidata*, B) *Oncometopia facialis*, C) *Sonesimia grossa*, D) *Acrogonia* sp.

bers of *Acrogonia* sp. were greatest at Schwarz and Jontza, but were highly variable at all locations. Populations of *S. oculata* were highest at Laharraque, La Fundadora, and Jontza.

DISCUSSION

Potential vectors of *X. fastidiosa* and other possible causal agents of decline diseases were found commonly in

Fig. 2. Total number of individuals of the indicated species trapped in all five citrus orchards sampled in Misiones. All values of *Ceresa ustulata* have been divided by ten.

citrus orchards in Misiones, Argentina. Although none of the species found in Misiones have been proven to be vec-

tors of *X. fastidiosa*, many cicadellids in the genera found in Misiones are known vectors (13). *Oncometopia nig-*

TABLE 1
AVERAGE NUMBER OF CICADELLIDS PER SAMPLING PERIOD CAPTURED ON 20 TRAPS IN FIVE ORCHARDS SURVEYED FROM
JUNE 1984 TO JUNE 1986

Location	<i>Molomea consolida</i>	<i>Oncometopia facialis</i>	<i>Acrogonia sp.</i>	<i>Sonesimia grossa</i>	<i>Scaphytapius near bolivianus</i>	<i>Scoposcartulla oculata</i>
Schwarz	5.4 ± 1.8 ²	5.9 ± 1.8	11.9 ± 6.3	1.4 ± 1.1	7.7 ± 4.0	0.5 ± 0.3
Libusky	6.1 ± 4.5	4.7 ± 2.0	4.8 ± 2.0	0.9 ± 0.5	6.3 ± 2.0	0.4 ± 0.3
Laharraque	17.2 ± 4.9	1.1 ± 0.3	6.3 ± 2.3	5.1 ± 2.6	0.2 ± 0.2	3.5 ± 1.6
La Fundadora	3.8 ± 1.0	2.3 ± 0.5	3.2 ± 1.3	0.0	12.6 ± 6.8	4.3 ± 2.2
Jontza	7.0 ± 4.5	7.8 ± 2.6	11.0 ± 4.6	1.5 ± 0.6	10.2 ± 6.5	4.5 ± 2.6

²Means plus or minus the standard error.

ricans was the most abundant sharpshooter species found in citrus orchards in Florida (18).

Although populations of *O. nigricans* were higher in blighted than healthy orchards (8) and *O. nigricans* is a vector of *X. fastidiosa* (13), no relationship of the vector, bacterium, and blight was established (17). In Brazil, species of *Oncometopia* and *Scaphytopius* also have been found in orchards affected by citrus blight (8). Several species of *Scaphytopius* transmit *Spiroplasma citri*, the causal agent of citrus stubborn disease under experimental conditions (3, 6, 10, 11, 12).

The decline diseases of citrus in Misiones have not been well-characterized. Some decline problems are almost certainly related to citrus blight, but the causal agent and possible vectors of this disease are not known. The

bacterium, *X. fastidiosa*, is present in high populations in xylem of some citrus trees in Misiones (1). This bacterium is associated with yellowish spots on the underside of leaves called "pecosita" but has not been specifically related to tree declines as it has been in Brazil (14). A decline disease of Okitsu mandarin has not been related to any other known decline problem. The insects identified in this report should be used in transmission studies to help elucidate the nature and means of transmission of citrus decline disease in Misiones.

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