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TOXOPTERA CITRICIDUS,(*HOMOPTERA APHIDIDAE*) A VECTOR OF CITRUS TRISTEZA VIRUS (CTV) IN GUADELOUPE DISTRIBUTION AND DISEASE INVESTIGATION

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ABSTRACT

In Guadeloupe the most efficient vector of citrusTristeza virus (CTV), *Toxoptera citricidus*, was discovered at the end of 1991. The distribution of this vector was determined based on surveys made in each locality of the archipelago. At the same time, the search for Tristeza disease by an ELISA test was undertaken and results were all negative. From now on, regular control of all the nurseries, in order to deliver only healthy material, and the use of resistant rootstock are highly recommended. An integrated control program against *T. citricidus* must also be started. Finally, it is necessary to continue the watch for citrus Tristeza virus (CTV) on a regular basis, so as to detect it as soon as it appears and take the immediate and necessary measures. Finally the general distribution of *T. citricidus* and CTV in the Caribbean area is presented.

RESUMEN

En Guadalupe, el vector el mas eficiente de la Tristeza, *Toxoptera citricidus* , fue descubierto en el fin del ano 1991. Prospecciones efectuadas en todos los municipios del pais permitieron establecer un mapa preciso de la distribucion de este vector. Al mismo tiempo, la busqueda de la Tristeza (por el test ELISA) fine emprendida y todos estos tests se mostraron negativos. Desde ahora, una inspeccion regular de todos los viveros para proporcionar solamente material sano y el uso de patrones de injerto resistentes para las nuevas plantaciones son medidas que hay que aconsejar. Una lucha racional debe tambien se emprendida contra *T. citricidus* Por ultimo, la busqueda de la Tristeza debe ser seguida regularmente para detectar su aparicion y tomar en seguida las medidas necesarias. Finalmente se presenta la distribucion general de T. citricidus y del Tristeza es presentada.

INTRODUCTION

In Guadeloupe, five species of aphids one of which appeared very recently, attack citrus. Collections made between 1985 and mid-1991 found *Aphis gossypii* Glover (most common), *Aphis spiraecola* Patch (= *A. citricola* Van der Goot) and *Toxoptera aurantii* (Boyer de Fonscolombe) (very common), and *Aphis craccivora* Koch (least common). *Toxoptera citricidus* (Kirkaldy) was only discovered at the end of 1991 (Leclant et al. 1992a, Etienne et al. 1992b). Until then, it had been found only in Trinidad for the Caribbean Archipelago. (Anonymous 1961). This aphid is found mainly on Rutaceae and develops primarily on young citrus shoots. This differentiates it from other species found on citrus, most of which are polyphagous. Apart from the direct damage

it can cause, *T. citricidus* is also the principal vector of Citrus Tristeza virus (CTV). This disease is particularly serious and is dreaded in citrus growing countries. Throughout many countries e.g., Argentina and Brazil millions of trees have already been destroyed by CTV (Aubert et al. 1992). According to Leclant et al. (1992) it mainly affects citrus that have been grafted onto sour orange because of an incompatibility problem concerning the graft. In limes and grapefruits, trees appear scraggy often associated with stem pitting. Finally, particularly virulent strains can provoke growth problems in orange and tangerine trees which no longer produce marketable fruit. Shortly after *T. citricidus* was discovered in Guadeloupe, an investigation of this aphid was conducted, to determine its distribution on the island. Simultaneously, the young infested citrus shoots were kept and used to sample for CTV (using ELISA tests). Knowledge of the phytosanitary situation of this disease in Guadeloupe, is needed to answer questions about how the vector is distributed and where the disease is located. This information would help to develop methods for delaying or limiting its spread.

DISTRIBUTION OF *T. CITRICIDUS* IN GUADELOUPE

Stroyan (1961) noted 7 species of aphids that are most frequently found on citrus and indicated which keys are needed to identify them. Six of these species are found in Guadeloupe; among them is Myzus persicae (Sulzer), which has not been found on citrus, but is found on other vegetables.

Among the five species found on citrus in Guadeloupe, *T. citricidus* is undoubtedly the most dangerous because of its ability to transmit the virus. It is often confused with *T. aurantii* under the following common name black citrus aphid. But a clear identification of these 2 species is absolutely necessary in order to draw an accurate map of the distribution of this chief vector of CTV.

Diagnosis of 2 species of Toxoptera

The 2 species of Toxoptera collected on citrus are shiny brown to brownish black when adult and paler brown when immature. T. citricidus is an aphid generally much larger than *T. aurantii*. Winged and apterous forms of the two species are identified as follows (Fig. 1).

- Median vein with 2 branches, pterostigma black, antennae articles III, IV, V lower part pale and apex darkened to winged and apterous..... .....*T. aurantii*

- Median vein with 3 branches, pterostigma lightly pigmented (yellowish for the living insect) antennae with article III black for winged and entirely pale for apterous..... .T. *citricidus*

Figure 2 shows that surveys have been carried out in the territory of the 26 towns of Guadeloupe and that prompt controls have been established in some islands of the archipelago. The black citrus aphids have been sought on citrus with young shoots because this is where these insects develop.

The importance in the *T. citricidus* populations varies considerably throughout the island.Populations of the aphid are found everywhere on Basse Terre, except in the Deshaies area. On Grande-Terre the aphid has only been found in 5 areas in isolated colonies, each of them consisting of a limited number of individuals. In the N.E. region, which is much drier and lacks orchards, the surveys were made on isolated trees around dwellings. No *T. citricidus* were collected from the 165 trees inspected in this region. Only 10 % of the trees had *A. gossypii, A. spiraecola* and *T. aurantii aphids.*

T. citricidus is typically found in humid tropical areas. Observations on its present distribution confirm this. It was very common in the humid areas of Basse-Terre, but only a few colonies were

found in Grande-Terre and none in the drier zones.

INVESTIGATION FOR CITRUS TRISTEZA VIRUS (CTV)

Aphid vectors

Research on aphids which are vectors of CTV (Roistacher & Bar-Joseph, 1987) has indicated that *T. citricidus* is the most efficient vector of this disease. Moreover, it is the only aphid species which is almost exclusively limited to citrus whereas other species which are polyphagous may be found on this crop intermittantly. It has been shown that *A. gossypii* can transmit CTV, but less efficiently. *A. spiraecola* and *T. aurantii* were of minor importance as vector of CTV. One single *T. citricidus* can transmit the disease very rapidly (less than an hour), whereas it takes a great number of individuals of other aphid species to transmit the disease. *T. citricidus* and *A. gossypii* transmit CTV in a semi persistent way. The length of time needed to acquire the virus can be very short (less than one hour) but 24 hours seem to be the optimal time. After 24 hours, it loses its ability to transmit the virus provided individuals do not feed on CTV infected plants.

Citrus Tristeza virus research

Although CTV can spread without any vectors, by movement of infected plant materials, it is obvious that the presence of *T. citricidus* considerably increases the likelihood of disease spread. Different techniques have been developed to detect this disease (Rocha Pena & Lee, 1991). Among these, an ELISA test gives quick results (less than 24 hours) and was therefore chosen for CTV detection.

A total of 655 ELISA tests were done in 1992 and 1993. These tests were carried out from samples collected either from isolated trees infested by *T. citricidus* or from plant material (nurseries) multiplied and prepared for new tree fields. All these samples were tested with the dDAS-ELISA test (Double Antibody Sandwich Direct, prepared by SANOFI) and they all stood negative.

CONCLUSION

In Guadeloupe, the study of the T. citricidus distribution, which was started as soon as it was discovered, showed that this aphid had colonized the whole of the island except for the North and the East where the climate is dry. At the same time, a search for CTV detection by means of the ELISA test was started in all the zones with important populations of *T. citricidus* and all the tests proved negative. Such tests will have to be done periodically so as to detect and destroy areas of possible infestation.

From now on, the use of resistant understock to develop new plantations, and regular control of existing nurseries is recommended. It has been proven (Bar-Joseph and et al., 1989) that the scattering of CTV by infected material is one of the major causes of the spread of this disease. These measures must be accompanied by an integrated control against the main vector *T. citricidus*. This should not only preserve the aphid's natural enemies, but also avoid other possible citrus pests because of a break in the balance.

Generally, the surveys undertaken in the Caribbean area have indicated that T. citricidus is present in many islands (Fig 3). It was indeed reported in 1992 in Guadeloupe, Martinique, Saint Lucia, Dominican Republic (Leclant et al, 1992; Etienne et al, 1992b) an in Puerto Rico (Garnsey and Yokomi, 1992) then in 1993 in Saint Kitts (Etienne, unpublished data), in Jamaica (Etienne et al, 1993) and in Cuba (anonymous, 1993). In this area, CTV is presently mentioned only from Trinidad (Barbeau, 1992) and from Puerto Rico (Aubert et al, 1992). In Dominican Republic, though T. citricidus was reported only recently, itseems quite obvious that it has been present in this country for a longtime and in these conditions, the hypothesis was expressed that CTV itself

might be also present in this country (Etienne et al., 1992a). Moreover, that was confirmed during the CFCS meeting held in this country in August 1992 (Abud-Antun, personal comunication).

From a general point of view, *T. citricidus* progresses to the North along two parallel routes. One is central America, with confirmation of its presence in Costa Rica (Voegtlin and Villalobos 1992), and the other, the Caribbean area as indicated in this paper. If it keeps on spreading, other countries such as Mexico and south of Florida could be invaded soon.

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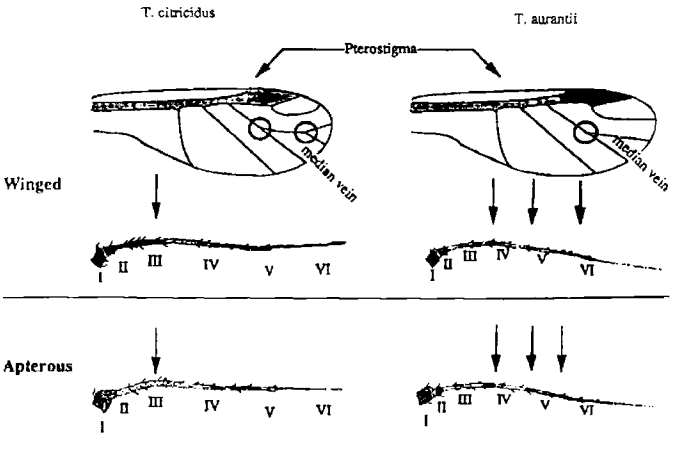

Fig. 1. Main distinguishing characteristics between *T. citricidus* and *T. aurantii*.

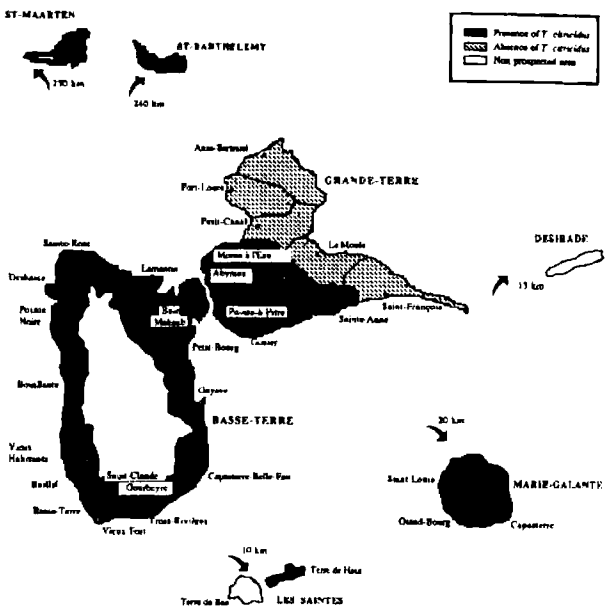

Fig. 2. Map of Guadeloupe archipelago showing the locations of *T. citricidus*

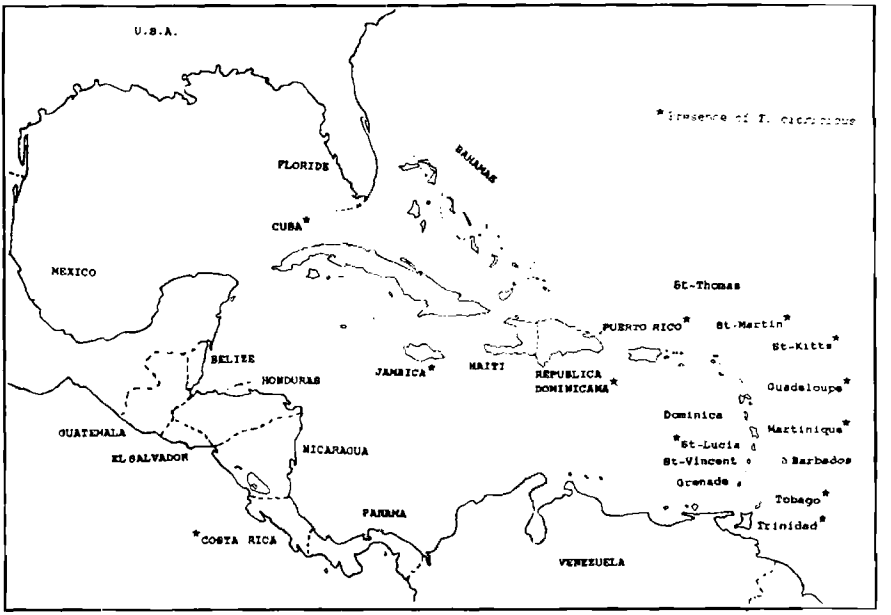

Fig. 3. Geographical distribution of *T. citricidus* in the Caribbean.