ALTERNATION OF HOST PLANTS AS A SURVIVAL MECHANISM OF LEAFHOPPERS *Dilobopterus costalimai* AND *Oncometopia facialis* (HEMIPTERA: CICADELLIDAE), VECTORS OF THE CITRUS VARIEGATED CHLOROSIS (CVC)

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ABSTRACT: *Dilobopterus costalimai* (Young) and *Oncometopia facialis* (Signoret) are two of the most important species of citrus leafhoppers, vectors of bacterium *Xylella fastidiosa* which causes the Citrus Variegated Chlorosis (CVC) disease. To develop a rearing technique for these species under laboratory conditions, the egg laying preference and nymph development were studied in different breeding systems: Rangpur lime (*Citrus limonia*) and "falso boldo" (*Vernonia condensata*) as host plants. Trials were set up in a randomized block design with three treatments (n=8). Females of *D. costalimai* had particular preference for ovipositing on Rangpur lime leaves while *O. facialis* females placed a higher number of eggs on "falso boldo", but it did not differ statistically from the Rangpur lime. The nymphal viability of *D. costalimai* was null in Rangpur lime and 58% in "falso boldo". For *O. facialis* the nymphal viability was 25 and 78% in Rangpur lime and "falso boldo", respectively. "Falso boldo" is more suitable as a host plant to rear the two species of citrus leafhoppers. The alternation of host plants seems to be an important survival mechanism of the CVC-vector species, as shown in natural conditions.
Key words: biology, nutritional ecology, host preference

ALTERNÂNCIA DE HOSPEDEIROS COMO MECANISMO DE SOBREVIVÊNCIA DAS CIGARRINHAS *Dilobopterus costalimai* E *Oncometopia facialis* (HEMIPTERA: CICADELLIDAE), VETORAS DA CLOROSE VARIEGADA DOS CITROS (CVC)

RESUMO: *Dilobopterus costalimai* (Young) e *Oncometopia facialis* (Signoret) são duas das mais importantes espécies de cigarrinhas dos citros, transmissoras da bactéria *Xylella fastidiosa* causadora da doença conhecida como Clorose Variegada dos Citros (CVC). Com o objetivo de se desenvolver uma técnica de criação destas espécies, em condições de laboratório, estudou-se a preferência por postura e o desenvolvimento ninfal, em diferentes sistemas de criação, tendo como plantas hospedeiras limão cravo (*Citrus limonia*) e falso boldo (*Vernonia condensata*). O delineamento experimental foi em blocos casualizados com três tratamentos e oito repetições. Fêmeas de *D. costalimai* tiveram acentuada preferência para ovipositar em folhas de limão cravo, enquanto que fêmeas de *O. facialis* colocaram maior número de ovos em falso boldo, embora não diferisse estatisticamente de limão cravo. A viabilidade ninfal da espécie *D. costalimai* foi nula em limão cravo e de 58% em de falso boldo. Para a espécie *O. facialis* a viabilidade ninfal foi de 25 e 78%, em limão cravo e falso boldo, respectivamente, confirmando ser o falso boldo uma planta hospedeira mais adequada para a criação das duas espécies de cigarrinhas dos citros. Na natureza, a alternância de hospedeiros parece ser um importante mecanismo de sobrevivência das espécies vetoras da CVC.
Palavras-chave: *biologia,* ecologia nutricional, preferência hospedeira

INTRODUCTION

Since the late 1980s, when the Citrus Variegated Chlorosis disease (CVC) or "Amarelinho" was identified in groves of the producing regions of the state of Sao Paulo, a significant increase of the rate of infested plants and degree of severity of the disease took place, presently reaching 34.4% of the citrus area or 68 million trees with CVC symptoms. The disease is caused by bacterium *Xylella fastidiosa*, which develops on xylem vessels of infected plants (Paiva et al. 1996). Some leafhopper species of the family Cicadellidae have been identified as vectors of this bacterium in citrus plants in Brazil, among which species *Dilobopterus costalimai* and *Oncometopia facialis* (Roberto et al., 1996; Lopes et al., 1996).

In Brazilian conditions, little is known about the bioecological and nutritional aspects of the citrus leafhoppers, however, the variation of host plants in its eating system seems to be very important for the development of the immature and adult stages of this group of insects. Thus, Lopes et al. (1998) cited *D. costalimai* and *O. facialis* as species occurring in citrus and coffee areas and they suspected that they were a common vector of bacterium *Xylella fastidiosa* for both crops. Almeida & Lopes (1999) verified that the mortality of the nymphal stage of species *D. costalimai* and *O. facialis* reared on the upper third part of citrus seedlings (sprouts) was 80.5 and 75.4%, respectively, and over 66% of the mortality occurred on the first instar. Yamamoto & Gravena (2000), while studying the populational abundance of citrus leafhoppers classified the species *D. costalimai* and *O. facialis* as accidentally occurring in citrus groves.

The free amino acids found in the sap of plants are the base diet of the leafhoppers feeding on the xylem or plant phloem, which determines the selection of the primary host plants and dispersion of leafhoppers in different habitats and times of the year (Russel et al. 1987, Andersen et al. 1993). For species *Homalodisca coagulata* the selection of host plants and the adult population were verified to be positively correlated with the concentration of a few amino acids found in standard plants regarding feeding, and the nymphs failed to develop successfully on the hosts preferred by the adults due to the fact that they cannot assimilate as efficiently as the adults the essential nutrients in nutritionally unbalanced plants (Brodbeck et al. 1990; 1995).

The aim of this work was to test the development and egg laying of species *D. costalimai* and *O. facialis*, under laboratory conditions, in rearing systems involving Rangpur lime and “falso boldo”.

MATERIAL AND METHODS

In an incubator set at 25 ± 2°C, RH 60 ± 10% and 14-hour photophase, carrying out two similar experiments evaluating the egg-laying preference and nymphal mortality for species *Oncometopia facialis* and *Dilobopterus costalimai* (Figure 1). Leafhopper couples were placed in rearing cage (containers), available in the market, on which side openings were made and sealed with a voil cloth. Openings were also made on the lids to allow the introduction of small tubes containing Rangpur lime and “falso boldo” seedlings (Figures 2 and 3). The tubes were supported by metal grids and then placed onto plastic trays (35 × 40 × 80 cm) containing a nutritive solution.

Each experiment had 3 treatments replicated 8 times. The treatments were: 1) rearing system using exclusively citrus (Rangpur lime) as a host plant; 2) rearing system, using exclusively “falso boldo” as a host plant; 3) rearing system combining “falso boldo” and citrus (Rangpur lime) as host plants. A randomized block design was performed and the results were submitted to analysis of variance and the means were compared by Tukey’s test at 5% probability.

RESULTS AND DISCUSSION

Females of *D. costalimai* had a clear preference to oviposit on Rangpur lime leaves in comparison with “falso boldo” (Figure 4). In a free-choice situation, as in system 3, in which small tubes of Rangpur lime and “falso boldo” were placed in the same cage, the egg laying preference for Rangpur lime was also evident (Figure 5). That probably occurred because the egg laying is endophytic and the Rangpur lime leaf is more consistent and favors the introduction of the ovipositor by the female, which does not happen with the “falso boldo” leaf. That trend was not observed for species *O. facialis*, that is, there was no preference between hosts in the no-choice test (Figure 6). Under free-choice conditions the higher number of egg lays was observed in citrus (Figure 7). This variation can be related with the fact that the *O. facialis* egg laying is not endophytic.

The “falso boldo” seedlings offered best conditions for the development of *D. costalimai* nymphs, with the reduction of mortality to about 42%, while in the system in which the nymphs fed exclusively on citrus leaves the mortality was 100% (Figure 8). These data are in accordance with those found by Almeida & Lopes (1999), who observed a high mortality of nymphs of *D. costalimai* and *O. facialis* reared on citrus cuttings.

For *O. facialis* the results were higher, that is, the nymphal viability was 78% in the rearing system using exclusively “falso boldo” seedlings and 25% when the rearing system had only citrus seedlings (Figure 9). Therefore, *O. facialis* nymphs manage to feed and develop on citrus seedlings, unlike the *D. costalimai* nymphs. Although it is not the goal of this study to quantify the hosts under the nutritional point of view, specific chemical compounds, as the amino acid, for instance, are likely to be present in the “falso boldo” plant, ensuring a better development for leafhopper nymphs as observed for the *Homalodisca coagulata* nymphs that need a distinguished feeding with amino acids, found in different hosts in order to develop (Brodbeck et al., 1990; 1995).

Under field conditions, the presence of adults and egg lays in citrus plants are observed, and the nymphs are scarce. This suggests that citrus are not primary but occasional hosts, with other alternative host plants important to the development of the different leafhopper species, as it is the case of the “falso boldo”,

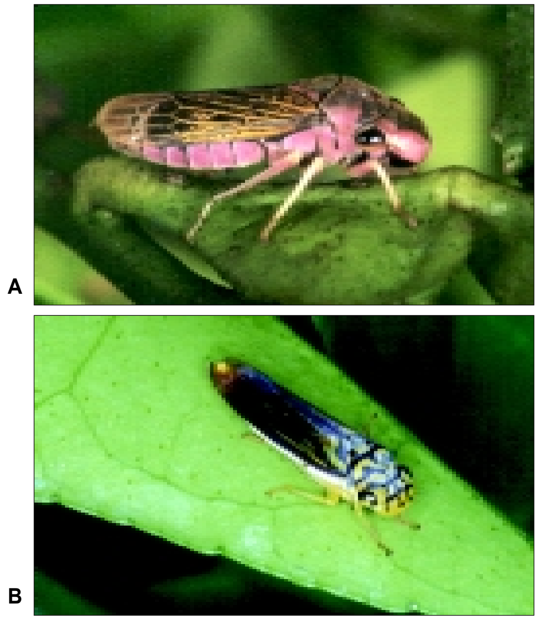

Figure 1 - *Oncometopia facialis* (A) and *Dilobopterus costalimai* (B).

Figure 2 - Rearing cage.

Figure 3 - "Falso boldo" plant.

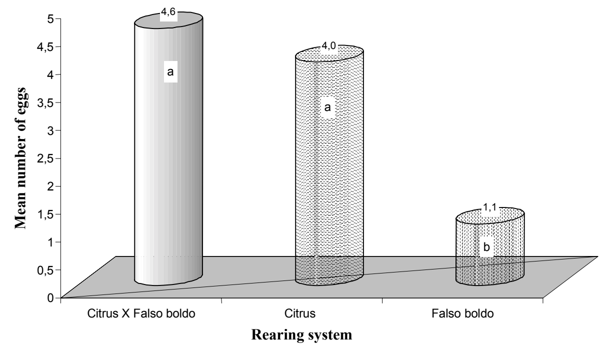

Figure 4 - Egg laying of *Dilobopterus costalimai* in the different rearing systems tested.
Means followed by the same letter do not differ by Tukey's test at a 5% probability level.

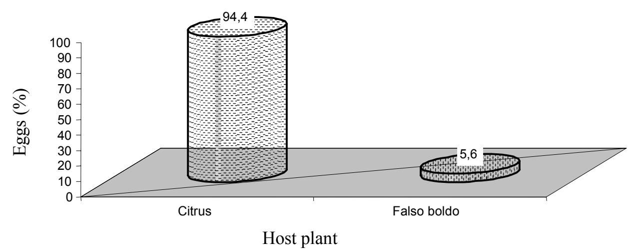

Figure 5 - Percentage egg laying of *Dilobopterus costalimai* in citrus and "falso boldo" seedlings in the citrus x "falso boldo" system.

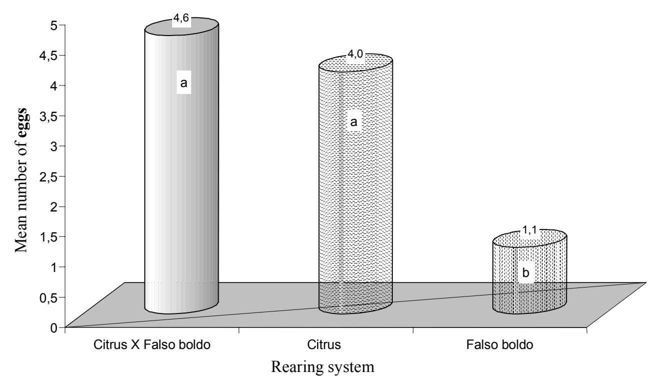

Figure 6 - Egg laying of *Oncomtopia facialis* in different rearing systems tested.
Means followed by the same letter do not differ by Tukey's test at a 5% probability level.

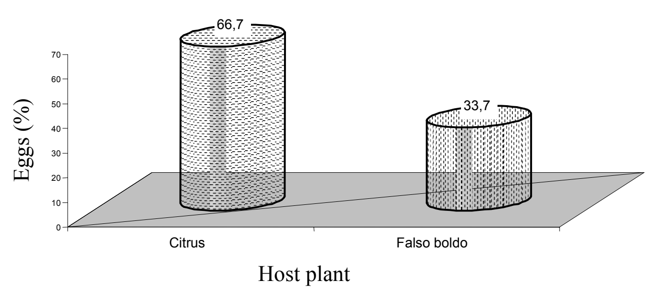

Figure 7 - Percentage egg laying of *Oncometopia facialis* in citrus and "falso boldo" seedlings in the citrus x "falso boldo" system.

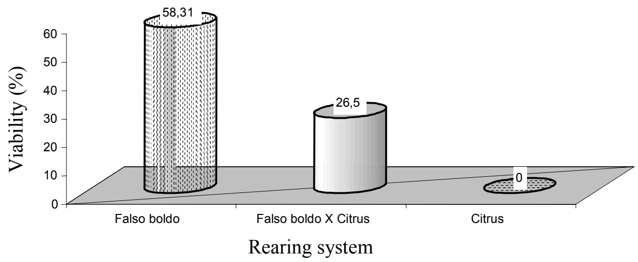

Figure 8 - Viability (%) of the nymphal stage of *Dilobopterus costalimai* in the different rearing systems tested.

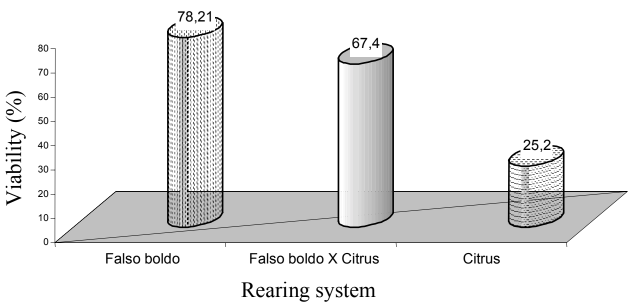

Figure 9 - Viability (%) of the nymphal stage of *Oncometopia facialis* in the different rearing systems tested.

reinforcing the hypothesis of Yamamoto & Gravena (2000), who classified leafhoppers as occasionally occurring in citrus groves. Such discovery may open new perspectives in the control of CVC-vector leafhoppers. "Falso boldo" and other host plants could contain substances that might, once identified and synthesized, function as attractants of these species and be incorporated to Pest Management. Programs Alternation of host plants seems to be an important mechanism of survival of the CVC-vector leafhoppers.

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