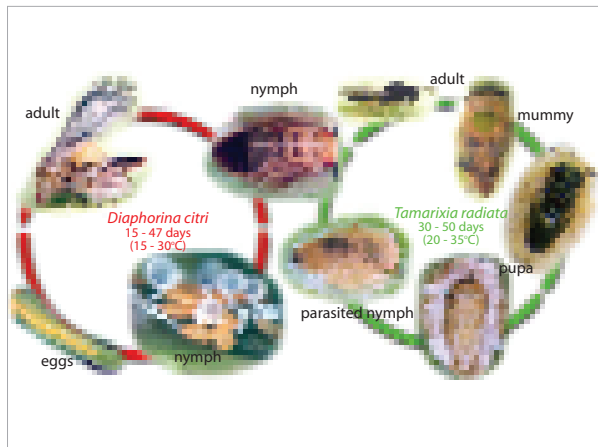


### BIOECOLOGY AND ESTABLISHMENT OF CONTROL STRATEGIES FOR *Diaphorina citri* KUWAYAMA, 1908 (HEMIPTERA: PSYLLIDAE), CITRUS GREENING (HUANGLONGBING) CAUSING AGENT

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Brazilian citriculture is responsible for one third of the world's orange production with São Paulo State accounting for 80% of the nation's yield. The entire production can be compromised by several phytosanitary problems, including native and exotic pests. The bacteria *Candidatus Liberibacter asiaticus* and *Ca. L. africanus* are the main citrus disease-causing agents worldwide. In Brazil, a new species, *Ca. L. americanus* was detected in association with an unidentified phytoplasma in citrus greening symptomatic plants in São Paulo State. In Brazil, greening transmission has been associated with the psyllid *Diaphorina citri*. Although *Diaphorina citri* has been reported since 1942, few studies have been conducted until 2004 since this vector has been considered a secondary pest. There is a great concern on São Paulo citriculture being decimated by greening disease, similarly to what happened in some Asian countries, if vector, disease control and management measures are not quickly developed. The objectives of this project are: to study insect vector, including its taxonomy; to determine regions where the pest could be of major concern; to study vector x bacterium interactions and their population dynamics, as well as the population dynamics of native natural enemies, and to establish control strategies, including alternative (biological, microbial, plant volatile compounds, plant resistance) as well as chemical methods, especially the use of selective products. These studies will allow the development of a series of measurements (a technological package) that can be used to manage the greening insect pest in citrus groves in São Paulo State.

## SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

*Murraya paniculata* and *Citrus limonia* are the most suitable hosts for rearing *D. citri*. The pest's temperature requirements and biological studies have shown that *D. citri* can withstand higher temperatures in Brazil than its counterpart in the USA. However, there has been an indication that insect development is impaired above 30°C. It has been also observed that low RH values affects the nymphal stage of *D. citri*. Based on genotypic variation analysis of the mitochondrial cytochrome oxidase I gene (Col) from *D. citri* populations, we concluded that distinct biotypes do occur. All *D. citri* symbionts, identified at the molecular level, are vertically transmitted. Comparative analyses between aposymbiont and associated lines pointed out that some of those symbionts play a role in the process of development and reproduction of *D. citri*, indicating their potential for the development of alternative control methods against the pest, by breaking down *D. citri* – symbiont interactions. Feeding behavior studies using the "Electrical Penetration Graph" technique and additional evaluations, demonstrating transmission of the bacterium *Candidatus Liberibacter spp.* for several weeks after acquisition, indicated a persistent and propagative relationship between the bacteria and *D. citri*.

The population dynamics of *D. citri* is similar in the various areas studied, although population levels have changed between regions. In 2005 - 2006 more *D. citri* individuals were captured in the summer (followed by fall and spring, with smaller populations in winter). Population peaks have occurred during the spring, but in some years peaks have occurred in the winter, possibly due to more frequent chemical control applications in the spring and summer periods, when vegetative growth is more intense. At high population densities, a clumped distribution pattern can be observed, whereas a random distribution occurs at low populations.

By using a Geographic Information System, we were able to obtain monthly distribution maps for the development of *D. citri* and its parasitoid *T. radiata*. Around 13 to 20 *D. citri* generations, and 27 to 35 *T. radiata* generations may occur throughout the year in the Northeast citrus-growing regions of São Paulo State. In the Southeast and Southwest regions, however, the number of generations ranges from 6 to 13 and from 19 to 27 for the pest and parasitoid, respectively. *T. radiata* was released in citrus-growing areas of Araras, Cordeirópolis, and Limeira cities, where the parasitism ranges from 40% to 80%. This results have shown that this parasitoid is quite promising. A promising isolate of the pathogen *Beauveria bassiana* (Esalq PL63), affecting *D. citri* nymph's physiology during its metamorphosis period, as well as the insect's immune system, has also been selected for *D. citri* control.

The repellent effect of guava-derived volatiles (*Psidium guajava*) has been demonstrated for *D. citri* adults. The identification and synthesis of such compounds are currently underway. Resistance management monitoring revealed significant differences in the susceptibility of *D. citri* populations to neonicotinoids and high toxicity of those products to *T. radiata*. We expected that these results and continued research will allow the generation of a technological package in order to control this important citrus disease.

## MAIN PUBLICATIONS

Gómez Torres ML, Parra JRP, Nava DE. 2007. Development of a rearing technique for the parasitoid *Tamarixia radiata* (Hym., Eulophidae) to control of the psyllid *Diaphorina citri*. *Journal of Insect Science*. **7**: 22-23.

Nava DE, Torres MLG, Rodrigues MDA, Bento JMS, Parra JRP. 2007. Biology of *Diaphorina citri* (Hem., Psyllidae) on different hosts and at different temperatures. *Journal of Applied Entomology*. **131**: 709-715.

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