

MOLECULAR EPIDEMIOLOGY AND INTEGRATED MANAGEMENT OF HUANGLONGBING (*ASIATICUS* AND *AMERICANUS*) IN THE STATE OF SÃO PAULO

Armando BERGAMIN Filho

Luiz de Queiroz Agriculture School / University of São Paulo (ESALQ/USP)



Liberibacter-like particles in sieve tube on *Citrus* spp. in São Paulo, Brazil. (photo by Francisco A.O. Tanaka)

This research project has ten subprojects. Its joint analysis will allow a better understanding of the structure and behavior of the Huanglongbing pathosystem in São Paulo, a *sine qua non* condition for the definition of a more rational disease management. The proposed subprojects are: (1) development, evaluation and application of real time PCR for diagnosis and detection of *Ca. Liberibacter asiaticus* and *Ca. L. americanus* in plants and insect vectors and in the study of the vector (*Diaphorina citri*) infectivity; (2) spatial and temporal molecular epidemiology of HLB (*asiaticus* and *americanus*) in greenhouse conditions considering two different inoculum sources; (3) spatial and temporal analysis of HLB epidemics in commercial orchards; (4) determination of acquisition and inoculation periods of *Ca. Liberibacter americanus* and *Ca. L. asiaticus* for *Diaphorina citri*; (5) determination of incubation and latent periods of HLB (*asiaticus* and *americanus*) after transmission by *Diaphorina citri*; (6) effect of temperature and geographic region on the progress of HLB (*asiaticus* and *americanus*); (7) geographic distribution of *Ca. Liberibacter americanus* and *Ca. L. asiaticus* in the São Paulo State; (8) progress of HLB colonization (*asiaticus* and *americanus*) in different citrus varieties with different ages; (9) determination of natural infectivity of the vector (*Diaphorina citri*) in orchards with different HLB (*asiaticus* and *americanus*) incidences; (10) strategies of HLB control in commercial orchards based on more favorable times for elimination of symptomatic plants and vector control. The project core is the HLB epidemiology, always considering both, *Ca. L. americanus* and *Ca. L. asiaticus*. All subprojects will be assessed through visual inspection and molecular methods. These methods will be applied for the first time in the epidemiological study of HLB. The final objective is to control the disease in a more rational way.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

Assessments of diseased trees by visual symptoms were made in 36 groves from 8 farms in the Central citrus region of São Paulo State. 124 HLB spatial maps (varying from 0.1 to 34.8% of disease incidence) were analysed, considering squares sizing 2x2, 4x4, 6x6 and 8x8 trees, by the binomial index of dispersion and the binary form of Taylor's power law. The dispersion binomial index for various squares sizes suggested aggregation of HLB-symptomatic trees for about 40% of the plots. The relationship between log of observed variance and log of binomial variance was highly significant for the four squares sizes (R^2 of 0.99, 0.97, 0.93, and 0.88 for squares sizing 2x2, 4x4, 6x6 and 8x8 trees, respectively). Estimated parameters of the binary form of Taylor's power law provided an overall measure of aggregation of HLB-symptomatic trees for all square sizes tested. All estimates of a and b values were statistically different from 1, which indicated a general and significant symptomatic plants pattern aggregation for all squares sizes tested. B values were 1.03, 1.05, 1.10, and 1.09 for squares sizes of 2x2, 4x4, 6x6 and 8x8 trees, respectively. Log a values were 0.10, 0.24, 0.45 and 0.45 for squares sizes of 2x2, 4x4, 6x6 and 8x8 trees, respectively. The degree of aggregation was positively related to disease incidence.

An evaluation of control methods was also carried out. A total of 716,476 citrus plants (*Citrus sinensis*), from five to ten years old, distributed in 357 blocks (mean of 2006.9 trees per block) were submitted to different number of insecticide sprays (3 to 12) during three growing seasons. Insecticide sprays were aimed to control citrus huanglongbing (HLB) throughout the control of its vector, *Diaphorina citri*. Eradication of symptomatic trees was carried out in the whole area 4 to 8 times per growing season. Incidences of HLB in all blocks ranged from 0.0 to 8.35 % of symptomatic trees. The relationships between the number of eradicated plants and the number of insecticide sprays were investigated considering (i) the three growing season, (ii) the grouping blocks according to classes of initial disease incidence, and (iii) eradicated plants in the last season (to minimize the influence of a long latent period) and the total number of insecticide sprays in all seasons. We have not found any significant negative relationship between the number of sprays and HLB incidence. We suggest that, in the farm conditions, the low incidence of HLB was mainly due to eradication of symptomatic trees than to insecticide sprays.

MAIN PUBLICATIONS

Bassanezi RB, Amorim L, Montesino LH, Gasparotto MG, Bergamin Filho A. 2008. Relationship between huanglongbing severity and relation of yield in Valencia orange. *Phytopathology*. **98**: S19-S19.

Bergamin Filho A, Gasparotto MG, Amorim L, Bassanezi RB. 2008. Number of insecticide sprays has no effect on the incidence of citrus huanglongbing in a commercial orchard in São Paulo, Brazil. *Phytopathology*. **98**: S21-S21.

Armando Bergamin Filho

Escola Superior de Agricultura Luiz de Queiroz (ESALQ)
Universidade de São Paulo (USP)
Av. Pádua Dias, 11 – Centro
13418-900 – Piracicaba, SP – Brasil
+55-19-3429-4124 r. 213
abergami@esalq.usp.br