

Relatório

Auxílio Pesquisador Visitante – APV

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Visitante: Prof. Dr. Zengzhi Li¹

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Technological exchange between Brazil and China on the
mass-production and release of entomopathogenic fungi for
biological control of insects

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VISIT REPORT

Under the grant of the National Council for Scientific and Technological Development (CNPq) of Brazil, Prof. Zengzhi Li of Anhui Agricultural University (AHAU), China, was invited for a visit in Brazil from 29 June to 15 August, by Prof. Drauzio Eduardo Naretto Rangel of Universidade do Vale do Paraíba, for the purpose of enhancement of academic and technological exchange in the field of biological pest control between Brazil and China, the two major countries in fungal pesticide production.

Institutions visited

During his stay in Brazil, the following universities, research institutes and companies which produce fungal insecticides for biological control of insects were visited: four universities including UNIVAP (São Jose dos Campos), ESALQ/USP (Piracicaba), FCAV/UNESP (Jaboticabal) and UNICAMP (Campinas), four institutes including EMBRAPA/CENARGEN (Brasília, DF), EMBRAPA/FLORESTAS (Curitiba, PR), EMBRAPA/MEIO AMBIENTE (Campinas, SP), INSTITUTO BIOLÓGICO DE CAMPINAS (Campinas, SP), and five companies including ITAFORTE, Itapetininga, SP, BIOCONTROL, Sertãozinho, SP, Turfal, Curitiba, PR, Usina Univalem, Araçatuba, SP, and Usina Sao Martinho, Pradópolis, SP.

Future collaboration

The following intention has been decided for the future collaboration between UNESP/FCAV and AHAU; UNIVAP and AHAU; and EMBRAPA/CENARGEN, AHAU and UNIVAP. The last one will be the triple collaboration including a large grant proposal and the MOU (Memorandum of Understanding) is being drafted and will be signed by the respective parties.

Visit contents

We visited laboratories, classrooms, workshops, sugarcane field, and sugarcane factories, met people, talked and discussed with university faculty, institute staff and students, company scientists and technicians, and make altogether 21 presentations in which a total of 178 people were present for them, with the following 6 titles:

- (1) The current technology of mass production and application entomopathogenic fungi in China;
- (2) *Beauveria bassiana* plus chemical attractant: a new technique for pine sawyer control;
- (3) Environmental safety of entomogenous fungi against insect pests;
- (4) Application strategy of entomopathogenic fungi for sustainable cpest control;
- (5) Studies on Entomogenous Fungi for Medicine/Food Development in China;
- (6) A short introduction to Anhui Agricultural University, a Chinese University.

In addition, Dr. Drauzio E.N. Rangel presented at UNESP and EMBRAPA/CENARGEN his PhD work done at Utah State University entitled: Phenotypic variability of *Metarhizium anisopliae* for virulence and tolerance to UV-B radiation and heat'

Visit highlights

- (1) Massproduction of fungal pesticides

This is main issue which has been focused, inquired and discussed in all procedure of the visit, either in universities and research institutes or in companies where fungal insecticides are produced. People are interested in the following aspects of Chinese production of fungal insecticides, mainly *Beauveria bassiana*: 1) substrate, mainly wheat bran; 2) biphasic fermentation; 3) non-woven fabric formulation; 4) molecular markers for tracing released fungi; 5) entomopathogenic fungi for medical and healthy food use. For Brazilian production system, the most interesting is the plastic culture

method and some commercial machines for spore extraction. The good quality products of Itaforte <http://www.itafortebioproductos.com.br> and Biocontrol <http://biocontrol.com.br>, and the staff enthusiasm of Usina Sao Martinho and Usina Univalem (Cosan) gave us deep impression in the development of biological control, but some techniques in most of the companies were found to be improved, including: 1) drying; 2) formulation.

(2) Application of fungal insecticides

Sugarcane fields of Usina Sao Martinho and Usina Univalem were visited. Spittlebug cadavers infected by *Metarhizium anisopliae* were found easily, confirming the efficacy of the application. The ecosystem of sugarcane field was compared to forest ecosystem and application strategies, such as application frequency and dosage in sugarcane field, were discussed to make the control method more reasonable ecologically, environmentally and economically.

(3) Massproduction of *Cotesia flavipes* wasps

The scale of massproduction and application of the parasitoid in Brazil was very impressive. It is really one of the biggest biological control programs in the world and is of great prospect

Consensuses

Through investigation and discussion, the following common view was reached on the similarities in the development of fungal insecticides in Brazil and China, which make Brazil and China rank the most successful developing countries in the world with their largest production and application for biological pest control.

1. Vigorous development displayed
2. Indigenous strains used
3. Convincement of the application achieved
4. Local substrates used
4. Simple techniques adopted
5. Development strategy tendency to small market and multiple products
6. Solid culture adopted
7. Low price competitive
8. Characteristic application
9. Environmental friendliness

On the contrary, the following was also noticed to be improved:

1. More government support to be given
2. Registration of the products to be sped up
3. Formulation to be improved
4. Drying techniques to be improved
5. Fermentation techniques to be further improved
6. Mechanization to be enhanced
7. Working condition to be further improved

Paper

Through investigation and discussion, a collaborative paper has been prepared and has been invited for publication as a review by the prestigious Biocontrol Science and Technology, entitled "Development of mass-production and application of fungal insecticides for insect control in Brazil and China". The publication reviews the history and current status in detail, explains why the biological control program in both countries have been so successful, and presents a good development model for the developing countries. The manuscript has been finished by Dr. Zengzhi

Li and Dr. Drauzio E.N. Rangel and actually it has been polished to submission.

Future research proposals

During Dr. Zengzhi Li stay, was discussed several topics for research that Brazil and China should pursue together. One of the main topics is to advance the methods in conidia or spore formulation. Formulation technology is a major current limitation between the two countries in the development of fungi for insect control. Formulation is frequently simple or nonexistent (see Li, Rangel et al. manuscript). It is through formulation that improved shelf life, environmental persistency, and field targeting.

The second topic is to study the biodiversity of the genus *Cordyceps* (Ascomycota: Clavicipitaceae) in Brazil. There are no reports on *Cordyceps* in Brazil and the Zengzhi Li group could greatly help Brazilian scientists to start study this genus. *Cordyceps* spp. are the teleomorphs stage of several anamorphs such as *Metarhizium*, *Beauveria*, *Isaria* (= *Paecilomyces*) etc. Therefore, the study of this genus will greatly help to study the phylogeny, ecology and biodiversity of the entomopathogenic fungi.

The third topic, which also included the second topic, is to improve teachings methods on morphological techniques for fungal taxonomy in Brazil as well in China. Dr. Zengzhi Li and Dr. Drauzio E.N. Rangel thought that we should teach more students on morphological taxonomy as a tool for fungal identification. Together with molecular tools such as the genetic marker 28S rDNA group I intron type as well as morphological technology should be taught to graduate students to improve the fungal taxonomy, especially in Brazil, which have few researchers doing this type of work. In China, on the other hand, especially in Dr. Li's lab, several graduate students are currently working in their degree in fungal taxonomy using the old (morphological) and modern (genetic) techniques for identification of fungi. Zengzhi Li thinks that the Chinese could greatly help the Brazilian colleagues in this type of work. Therefore, we are thinking to exchange graduate students and postdocs researchers between UNIVAP and AHAU to improve the knowledge between both countries. Brazil have the biggest fungal biodiversity in the world, especially in forests, therefore, Brazilians should have obligatorily mycologists specialists in fungal taxonomy.