Symposium I - Virus Division Monday, 14:00-16:00

Viral biocontrol

Symposium I Monday, 14:00 **5**

Dr. Flavio Moscardi and his relevant contribution to viral biocontrol in South America

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Dr. Flavio Moscardi was graduated in Agricultural Sciences at ESALQ/University of São Paulo (Brazil) in 1973. He got the Master and PhD degrees at the University of Florida (USA), from 1975 to 1979, developing studies on the biology and ecology of the velvetbean caterpillar and on its pathogenic virus, the *Anticarsia gemmatalis multiple nucleopolyhedrovirus* (AgMNPV). Back to Brazil he started to work as a scientist at Embrapa, the Brazilian Agricultural Research Corporation, where he began to implement a velvetbean caterpillar control program with baculovirus. This was the most successful program worldwide with a virus pesticide, starting from early eighties and lasting for more than thirty years. The virus was also used in Argentina, Colombia, Bolivia, Paraguay and Mexico. The maximum peak of AgMNPV use occurred in the season 2003/2004, when approximately two million ha of soybean were applied in Brazil. Afterwards, the virus use declined sharply due to changes in farmers' procedures to control pests in soybean. Currently about 300,000 ha are being treated yearly. Dr. Moscardi had been also an effective consultant in countries as Argentina, Paraguay, Uruguay, Nicaragua, Indonesia, Philippines, North Korea, Tanzania and India. During his carrier, he published more than 200 publications and advised many graduated and undergraduated students. Due to his relevant contributions, Dr. Moscardi was elected to the Brazilian Academy of Sciences in 2003 and received 25 prizes/titles, such as the Young Scientist First Prize from CNPq (1983), and the Commend of the National Order of Scientific Merit from the President of Brazil (2002).

Symposium I Monday, 14:30 **6**

Baculovirus: research and commercialization in Colombia

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Baculoviridae family is the most numerous and extensively studied of all entomopathogenic viruses. In Colombia only two viruses of this family have been registered and commercially exploited, one nucleopolyhedrovirus of *Trichoplusia ni* denominated "Trichovirus", that was used between 1970 and 1973 for controlling this insect in cotton crops, with such success that in a few years the pest disappeared almost completely. The other is a granulovirus of the potato moth *Phthorimaea operculella* denoted "Baculovirus Corpoica" which is currently commercialized for controlling *Tecia solanivora* in stored potato tubers with more than 80% of efficacy. Recently the interest in developing, registering and marketing biopesticides based on baculovirus has increased considering its high pathogenicity and virulence, specificity and shelf life. In this sense several researches have been directed to collect and characterize new native isolations from *Tecia solanivora* and *Spodoptera frugiperda*. In these works an interesting genetic diversity in Colombian viruses has been observed. Then, an emulsifyble concentrated was developed with one granulovirus of *T. solanivora* and a microencapsulated wettable powder with one nucleopolyhedrovirus of *S. frugiperda*, both products including efficient protection against ultraviolet radiation and with efficacies higher than 80% in potato and maize crops respectively. The manufacture process of both biopesticides has been scaled up to a pilot plant level and registration process is now in course. In a nearby future, Colombian farmers will have new biopesticides based on baculoviruses for the management of two limiting pest in agricultural production.

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Application of slow-killing granuloviruses to control leaf-rollers in tea fields in Japan

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The size of the Asian microbial control market is increasing, and comprises *Bacillus thuringiensis*, fungi and viruses. China is the biggest market, followed by India and Japan. Two microbial control agents based on baculoviruses are currently registered in the Japanese market: a mixture of granuloviruses (GVs) to control leaf-rollers (*Adoxophyes honmai* and *Homona magnanima*; Lepidoptera, Tortricidae) in tea fields, and a nucleopolyhedrovirus (NPV) to control armyworm (*Spodoptera litura*; Lepidoptera, Noctuidae). Both agents are required to control these pests, which have acquired resistance against chemical pesticides. The GVs for *A. honmai* and *H. magnanima* are well adapted to control leaf-rollers in tea systems, and are also advantageous for virus production using living insects. A notable feature of this system is that a single virus application can suppress the leaf-rollers through a whole year, during which four generations of the pest occur. This is because the virus kills the host slowly and thus enables progeny virus to transmit itself to young insects in the next host generation. The prolonged survival period of first-generation GV-infected hosts has no detrimental economic impact, because the first tea harvest in May is the most valuable and leaf-roller populations become abundant only after this first harvest. A natural field survey of *A. honmai* populations in Ibaraki prefecture revealed that an entomopoxvirus was highly prevalent, followed by *A. honmai* NPV. These viruses also kill the host more slowly than typical NPVs such as *Autographa californica* NPV. Slow-killing viruses may have adapted to leaf-roller pests of evergreen and perennial tea plants.

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The use of *Cydia pomonella* granulovirus in organic and integrated pest management

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Since its first description in 1964 the *Cydia pomonella* granulovirus (CpGV-M) has become an important biocontrol agent of codling moth in both organic and integrated production of apples, pears and walnut. Today, CpGV is the active ingredient of one of the economically most successful commercial baculovirus products that is used in nearly all pome fruit growing areas all over the world. It is highly effective, environmentally friendly and can be ideally combined with chemical insecticides. Therefore, it plays an increasingly important role in integrated plant protection strategies, esp. as it helps to provide long-term population control and to reduce residues of chemical insecticides on the fruit. However, this success was threatened in 2005, when first reports on codling moth populations with a dramatically decreased susceptibility to CpGV products became available. Since then, CpGV resistance has been noted in more than 40 orchards in different European countries. Though the resistance mechanism is still not fully elucidated, it was shown that a dominant, Z-linked inheritance of the resistance allele has contributed to the rapid emergence of CpGV resistance. Fortunately, other than CpGV-M isolates are able to overcome CpGV resistance and are now registered and used in Europe. The diversity of CpGV isolates provides the necessary tools to improve codling moth control and may also allow controlling other tortricids, such as *C. molesta*. In the light of more than 20 years of experience with commercial CpGV application strategies of resistance management are highly recommended.

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