

## Biological Control

### Codling Moth Granulovirus: Its History and Mode of Action

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*Abstract:* The granulovirus of codling moth (CpGV) was first isolated from infected larvae in Mexico and described by Tanada in 1964. CpGV is one of the most virulent baculoviruses (insect-specific viruses). The LD<sub>50</sub> for neonate codling moth larvae was determined by Huber to be less than 2 virus granules/larva. Following ingestion by neonate larvae, the proteinaceous coat or granule is dissolved in the alkaline pH of the gut. The virions first infect the gut epithelial cells prior to attacking a wide range of host tissues, including and most importantly, the fat body. Virus replication or virogenesis takes place within 48 hours following infection. Symptoms of the disease develop slowly. There are no obvious symptoms of the disease until day 4 when the larvae start to swell and become glossy and moribund. The larvae stop feeding around day 7 as they begin to die. In the terminal phase of the disease (day 10), the larvae become milky and liquefy.

CpGV was first mass cultured and field tested in California from 1965 to 1972. Sandoz Corporation developed the first commercial formulation (SAN 406) and granted an experimental use permit by the EPA in 1981. SAN 406 was tested worldwide between 1981 and 1984. Sandoz terminated all work on insect viruses in 1984 and the commercial development of CpGV products in the USA was largely terminated until recently. Currently, there are 3 formulations registered in the USA. They include Cyd-X (1995), Certis USA, Virosoft (2000), Biotepp and Carpovirusine (2001), Sumitomo Corporation. CpGV was used on an estimated 10,000 to 12,000 acres in 2003. In Europe, the first field tests on CpGV were conducted in 1970. In 1979, the Commission of European Communities (CEC) initiated the "Biological Control in Apple Orchards" program. The CEC supported research on the use of CpGV in orchards throughout Europe. After Sandoz terminated work on SAN 406, European government agencies working in conjunction with companies, developed and commercialized CpGV products. This collaborative effort led to the registration of 3 products including Madex (1988), Andermatt Biocontrol, Switzerland, Granupom (1991) Hoerst, Germany and Carpovirusine (1993), Calliope, France. In 2003, CpGV was used on an estimated 200,000 acres in Europe.

The specificity of CpGV for codling moth and safety to nontarget organisms has been very thoroughly documented. Its use will contribute significantly to the conservation of other natural enemies in the orchard agroecosystem. Given its virulence and specificity to codling moth, CpGV is an important technology for inclusion in pest management programs in pome fruits and walnuts.