Susceptibility of the plum fruit moth, *Cydia funebrana* (Lepidoptera: Tortricidae) towards the *Cydia pomonella* granulovirus (CpGV)

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The *Cydia pomonella* granulovirus (CpGV) is effectively used worldwide for controlling *Cydia pomonella* (codling moth) larvae in apple orchards. Although CpGV is known to be highly specific thus not affecting non-target organisms, a few studies have shown that CpGV can infect other *Cydia* spp. and species in the family Tortricidae, in particular, if viral dosages are substantially increased. The plum fruit moth, *Cydia funebrana* is regarded as one of the key pests of plum in Europe, with biological control being severely hold back mainly due to a lack of available and efficient control agents. To test whether infection of plum fruit moth larvae by CpGV is, in principal, possible, viral suspensions of different CpGV isolates were sprayed on green or ripe plums in the laboratory, containing *C. funebrana* eggs in the black-head stage. Experiments were performed in three successive years and virus concentrations were between $3x10^5$, $3x10^6$ or $3x10^7$ occlusion bodies/ml. Sterile water was used as a control. Freshly hatched *C. funebrana* larvae were allowed to feed and to bore into these fruits and were assessed for mortality or for hatch of adults. A substantial number of dead and liquefied larvae were present in the virus treated plums and absent in the control. Presence of CpGV in the cadavers was confirmed with CpGV specific primers in polymerase chain reactions (PCR) and subsequent sequence analysis of obtained PCR products. Highest efficacies between 80- 60% were obtained for CpGV isolate V15 in all three years. An initial series of applications of this isolate in the field indicated that *C. funebrana* larvae had taken up the virus but that mortalities were apparently not high enough to achieve sufficient control levels under field conditions.

Biological control of the box tree moth (*Cydalima perspectalis*) with a baculovirus

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Since several years, box trees (*Buxus* spp.) are severely affected by the box tree moth, *Cydalima perspectalis*, which originated from South-East Asia. It rapidly spreads in Europe and can cause complete defoliation of box trees. In laboratory experiments, the effect of the baculovirus *Anagrapha falcifera* nucleopolyhedrovirus (AnfaNPV) on *C. perspectalis* was investigated. Two isolates of AnfaNPV, BI-235 and Dn10, were propagated in different larval stages of *C.perspectalis* and then purified by sucrose density gradient centrifugation. To assess the virulence of AnfaNPV, a bioassay with neonate larvae of *C.perspectalis* was established. Therefore, suspensions of each virus isolate of varying concentrations were applied to leaf

disks of box tree. Mortality was scored after seven days and the median lethal concentrations (LC_{50}) were determined for both isolates using probit analysis. In comparison, the LC_{50} value for the isolate BI-235 (7.8×10^5 OB/ml) was three times higher than the LC_{50} value for the isolate Dn10 (2.3×10^6 OB/ml). In addition, the infection of *C. perspectalis* larvae with AnfaNPV was verified by light and electron microscopic examinations. Both isolates of AnfaNPV infected fat body, epidermis and tracheal matrix of *C.perspectalis*. These results demonstrated the susceptibility of *C.perspectalis* to AnfaNPV. In conclusion, AnfaNPV might have the potential of a biological control agent of the box tree moth.

First experiments to evaluate the efficacy of entomopathogenic nematodes for biocontrol of the box tree pyralid moth, *Cydalima perspectalis* (Walker 1859)

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The box tree pyralid *Cydalima perspectalis* (Walker 1859) is an invasive alien moth from East Asia which occurs in Central Europe since 2007. It is an insect pest on plants of the genus *Buxus*, causing serious damage. Because of the rapid spread in Germany and nearby countries like Switzerland, one part of this study was testing different ways of eco-friendly regulation with commercially available beneficials and plant extracts like NeemAzal-T/S. In addition to host acceptance and host location tests with *Trichogramma* wasps in the laboratory, the susceptibility of *C. perspectalis* larvae to three entomopathogenic nematode (EPN) species was investigated in various bioassays. *Steinernema carpocapsae* was the most effective nematode which produced mortalities ranging from 80 to 100% at four concentrations (25, 50, 100, 200 EPN/larvae). Also *Steinernema feltiae* produced high mortalities, whereas in the treatment with *Heterorhabditis bacteriophora* only low mortality was recorded. The investigation of the infectivity of various larval instars (2^{nd} and 4^{th}) caused by *S. carpocapsae* demonstrated a mortality of 100% at 50, 100 and 200 EPN/larvae for both larval instars, but 4^{th} larvae were infected faster than 2^{nd} instars. On the other hand, entomopathogenic nematodes are not effective against pupae of *C. perspectalis*. The susceptibility of *C. perspectalis* larvae under more natural conditions was carried out on box trees. The application of *S. carpocapsae* with a pressure sprayer caused a mortality of 95%, despite the formation of feeding webs in the foliage. One experiment was applied to determine the persistence of *S. carpocapsae* on the foliage of box trees. After the application in the field, treated branches where sampled and fed to *C. perspectalis* larvae, followed by incubation in the laboratory. Even after 16 h of exposure, the resulting rate of insect mortality was 95%. An increase in the persistence by using an adhesive could not be shown.