

Preparedness in biological control of priority biosecurity threats

Pine Processionary Moth, *Thaumetopoea pityocampa* (Denis & Schiffermüller)

Introduction

Pine processionary moth (PPM; *Thaumetopoea pityocampa* Denis & Schiffermüller) (Lepidoptera: Notodontidae), is native to southern Europe, North Africa and parts of the Middle East. It is an established invasive species in several more northern European countries and its range is continuing to expand northwards (CABI, 2022).

The larvae of PPM feed on the needles of conifer trees specifically species of *Pinus* and the Atlas cedar (*Cedrus atlantica*), and occasionally European larch (*Larix decidua*), Douglas fir *Pseudotsuga menziesii* and white fir *Abies concolor* (EPPO, 2020; CABI, 2022). They can cause severe defoliation of host trees, which can ultimately weaken them leaving them more vulnerable to attack by other pests and diseases and more susceptible to abiotic stresses (CABI, 2022).

Third instar larvae and older are covered in tiny urticating setae which pose a threat to public and animal health causing skin irritation and rashes, eye and throat irritation, conjunctivitis, respiratory congestion and asthma, and sometimes allergic reaction (CABI, 2022).

History of classical biological control against *Thaumetopoea pityocampa*

Although there are many natural enemies associated with *T. pityocampa*, and which are able to regulate populations to a degree, there do not appear to be any that are specifically used as classical biological control agents.

Most promising natural enemies for classical biological control

The most notable parasitoids of PPM are the egg parasitoids *Baryscapus servadeii* (Hymenoptera: Eulophidae), and *Ooencyrtus pityocampae* (Hymenoptera: Encyrtidae), a larval parasitoid *Phryxe caudata* (Diptera: Tachinidae), and the pupal parasitoids *Villa brunnea* (Diptera: Bombyliidae) and *Coelichneumon rudis* (Hymenoptera: Ichneumonidae). Most of these species are found throughout the native range of PPM and appear not to be recorded in areas where PPM is absent (CABI, 2022). Of these, *Baryscapus servadeii*, *P. caudata*, *V. brunnea* and *C. rudis* are specific to PPM and could be considered for potential classical biological control agents against PPM incursions into new areas.

The rates of parasitism for these species are variable according to region and year. Low rates (5.7%) of parasitism by *B. servadeii* have been reported as well as higher rates in excess of 50% and sometimes as high as 72%. This may in part be explained by how long an area has been colonised by PPM with evidence suggesting that the generalist *O. pityocampae* tends to be the dominant egg parasitoid in newly colonised areas (Battisti, 1989). A previous attempt to control PPM with augmented populations of *B. servadeii* resulted in the suppression of PPM levels to such an extent that the parasitoid virtually died out (Buxton, 1983).

Rates of parasitism of PPM for *P. caudata* are highly variable ranging from 0.9% to 37.2% and it achieves two generations per year. This variability was attributed to hyperparasitism by

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hymenopteran species belonging to the Pteromalidae and Chalcididae, and the action of entomopathogenic fungi (López-Sebastián *et al.*, 2007).

In areas where *V. brunnea* is present rates of parasitism range from 5.8% to 76.7%. For *C. rudis*, parasitism rates range from 0.7 -1.3% through to as high as 40%, where it is present, and it is reported to have two generations per year (López-Sebastián *et al.*, 2007).

Other natural enemies for classical biological control

The ground beetle *Calosoma sycophanta* has been used for the classical biological control of several moth species in forestry settings in the USA (Lewis *et al.*, 2016). In Turkey its augmentative release has been used for the control of PPM and the related *Thaumetopoea wilkinsoni* (Akyol and Sarikaya, 2017), so potentially could be used for classical biological control if PPM were to invade and establish in regions where *C. sycophanta* does not naturally exist. Both adult and larvae of *C. sycophanta* feed on PPM larvae as well as pupae and can reduce PPM in nests by >70%.

References

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