Pine-tree Lappet moth (PtLM)

The pine-tree lappet moth (*Dendrolimus pini*) is found throughout Europe into W. Asia and is a major defoliator of Scots pine especially in Poland and Germany where outbreaks frequently cover many thousands of hectares and require control. The larvae feed on the needles of Scots pine and are also capable of feeding on other pine and many conifer species including Sitka spruce. Adult male moths of the species had only been recorded as rare migrants on the south coast of England up until 2004. However, since then they have been caught in increasing numbers near Inverness and were confirmed breeding at a number of sites in 2009. Statutory Notices (timber movement controls) have been put in place to prevent its spread.

Research evidence has revealed

- Male moth populations can be monitored using light and pheromone traps; monitoring for caterpillars uses glue bands and soil surveys (overwintering larvae).
- *D.pini* is currently at very low population densities, very restricted in its distribution and has only been found in even-aged commercial pine plantations.
- Early indications suggest that *D pini* is spreading to new areas.
- Provisional DNA analysis shows that Scottish *D.pini* COI mitochondrial sequences are identical. Nuclear microsatellite genetic diversity is also low suggesting the Scottish population has gone through a genetic bottleneck due to small numbers of individuals.
- Ongoing mitochondrial DNA analysis of *D.pini* from across Europe formed 3 distinct groups: northern, south western and southern. Scottish moths appear to be part of the latter which are far less likely to have spread to and colonised Scotland naturally.
- Initial climate projections to 2080 indicate an increased probability of conditions conducive to outbreak in the Great Glen, Black Isle, Kiltarlity, and Culbin Forest with outbreaks potentially occurring 6-9 years in every decade.

Known evidence gaps

The presence of Pine-tree Lappet moth close to areas of ancient Caledonian pine forest may pose particular difficulties in mounting a control or eradication programme. Particular requirements are:

- Development of degree-day predictive models for spring larval emergence and summer egg hatch to enable precise timing of insecticide applications.
- Improved understanding of rates of growth, development and life cycle duration.
- Density/damage relationships to develop and inform risk models.
- Continued monitoring of populations and rates of spread.
- Determination of potential effect of predators, parasites & biological control on *D.pini*.
- Interaction and effect on native insect fauna.
- Research on novel control techniques for *D.pini*.

Potential impact

Within its natural range in Europe and Asia, the moth reaches population densities that frequently result in complete defoliation of thousands of hectares of Scots pine trees, loss of growth increment and weakening of trees making them vulnerable to other biotic and abiotic factors.