

# Pine-tree Lappet

## Questions and Answers

### **BACKGROUND:**

Male adults of Pine-tree Lappet moth (*Dendrolimus pini*), and several larvae (caterpillars) and a cocoon have been found in pine forests in Inverness-shire. The presence of larvae prove that there is a local breeding population, rather than long-distance, male-only migrants that very occasionally make their way to Great Britain.

DNA analysis is being undertaken to try to determine whether the Scottish population represents a recent introduction or a hitherto undiscovered native population. We are also looking at climate data, present and future, as well as site factors to compare Scottish conditions with those locations in Europe where this moth has been a significant pest.

The caterpillar feeds on the needles of pine and, occasionally, spruce and other conifer trees in its native range in continental Europe, Russia and Asia. It is a forestry pest because, if a population reaches epidemic levels, it can affect thousands of hectares and last up to eight years before declining. This can result in seriously reduced tree growth, tree decline and tree deaths, especially because trees defoliated by this moth become susceptible to other risks such as bark beetles, wood-boring insects and disease.

If the conditions in Scotland are suitable, deaths and weakening of significant numbers of trees would risk serious ecological disruption to Scotland's forests, and reduced habitat for many other forest-dwelling species such as red squirrels, capercaillie and Scottish crossbill. Of particular concern would be the ancient Caledonian pinewoods. It would also increase the risk of forest fires from the build-up of fuel in the form of excess dead wood.

Some of the tree species which the caterpillars attack, particularly Scots pine, Lodgepole pine and Sitka spruce, are commercially important in Scotland's economy, so any significant damage to these species would also threaten jobs and businesses, particularly in economically fragile rural areas.

We therefore believe we must consider a range of options to control or, if thought necessary, eradicate this species from Scotland while the population is still small and before it has the potential to cause serious damage and spread to other areas. We are discussing our

options with the Scottish Government, Scottish Natural Heritage and Butterfly Conservation.

## **Questions and Answers**

### **1. Where does Pine-tree Lappet come from?**

Its natural range is the Scots pine forests of continental Europe, Russia and Asia. It has also been reported in North Africa.

### **2. Has it ever occurred in Britain before?**

There have been occasional sightings of single specimens. There are a couple of records of occurrences on the south coast of England and in the Channel Islands in the mid-20<sup>th</sup> century, followed by a report of an adult male found on the Isle of Wight in August 1996, and two others in Guernsey in 1989 and 1997. Another was recorded in Cornwall in August 2003. These were probably migrant males blown across the English Channel. There is a report that a caterpillar found in Essex in 1999 on a pine tree imported from Italy was bred out to produce a female moth.



### **3. Is it possible that this is a native species that has only just been discovered in Scotland?**

Given the size of both the caterpillar and the adult moth of this species, we believe it is unlikely that a viable population of pine-tree lappet could have remained undetected for hundreds of years in such a heavily researched and visited habitat as Scotland's pine forests. If damage had occurred in the past, it would have been investigated, which would almost certainly have led to their detection.

### **4. If it's a recent arrival, how did it get here?**

We cannot be sure, but the most likely possibilities are that it was brought in on an imported pine tree, or in association with wood products or wood packaging. It is also possible that it was either accidentally or deliberately released. However, we have no

information to confirm which of these possible routes led to the current finds.

## **5. What species of tree does it attack?**

Its preferred host is Scots pine (*Pinus sylvestris*). However, it is also known to live and feed on Sitka spruce (*Picea sitchensis*), Douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*), which are grown commercially in Scotland. Other host species include common juniper (*Juniperus communis*), which is a British native species, Swiss stone pine (*Pinus cembra*), Siberian larch (*Larix siberica*) and silver fir (*Abies alba*).

## **6. What is the likelihood that it would survive in Scotland?**

Very high. There is a plentiful supply of its preferred host trees, and the climate and other environmental conditions in Scotland are similar to, or more benign than, those in its native range.

## **7. How would it spread?**

By flying from tree to tree, and by 'abiotic' natural means such as being carried by wind or water. Older caterpillars are able to crawl from one tree to another, and even from one stand of trees to another. Eggs and larvae could be spread on harvested logs being transported on lorries, or on plants or foliage.

## **8. What is its lifecycle?**

Adult moths emerge from pupae (cocoons) in midsummer and live for 9-10 days, during which they mate. The females deposit up to 250 eggs each on twigs, needles and the bark of host trees. The eggs hatch within 16-25 days, and the newly hatched larvae (caterpillars) stay in the tree canopy feeding on pine needles until winter frosts begin. They then move down the trees to over-winter between the litter and soil close to the bases of trees. In spring the caterpillars climb back up to the tree crowns and eat 3-5 times the volume of foliage consumed during the previous autumn while they moult through several stages, each stage larger than the previous one. Larvae can also feed on the bark of young pine shoots. Mature larvae are large, reaching up to 7.5 cm long, and can crawl for

distances of several hundred metres to neighbouring pine stands. Pupation begins in May and June and lasts for 4-5 weeks. Pupae are formed inside loose, partially transparent cocoons, which can be found in tree crowns, bark crevasses and under-storey vegetation.

### **9. Does it have any natural enemies?**

Natural enemies include several bacteria and fungi, parasitoids (parasitic wasps and flies) and predators. Ten species of insects have been reported to prey on the moth.

### **10. Could we use any of these natural enemies as a means of controlling pine-tree lappet moth?**

Possibly, and we might consider this means if the moth does begin to cause damage. However, we would need to do extensive research first to ensure that any organisms that we introduce to Britain to control the moth are not also likely to cause damage in their own right. Such research is expensive and takes many years to produce conclusions, and has to be approved by the Advisory Committee on Releases to the Environment under the Wildlife & Countryside Act 1981.

### **11. What would the economic cost be if the population increases and serious damage is caused to our forests?**

This is difficult to predict with any certainty, but Scotland's forests are estimated to be worth £800 million a year to the Scottish economy in products and services such as timber, venison, tourism, recreation and other benefits. A high proportion of Scotland's forest area is dominated by the species of trees preferred by pine-tree lappet, so the risk could be huge.

### **12. Is there anything the public can do to help?**

We are interested in receiving reports of sightings, and are asking amateur entomologists to be vigilant and report any suspect captures to Forestry Commission Scotland ([fcscotland@forestry.gsi.gov.uk](mailto:fcscotland@forestry.gsi.gov.uk)), telephone 0131 314 6156, including as precise a description of the location as possible: a grid reference is ideal.

### **13. How many have you found?**

As of late October 2009, almost 100 adult moths and several larvae.

### **14. Where were they found?**

At a small number of woodland sites in different ownerships in the Inverness area, including the publicly owned Boblainy Forest managed by Forestry Commission Scotland.

### **15. What do your investigations involve?**

They include surveys of the litter on the ground in the affected woods to check for the presence of over-wintering larvae (caterpillars).

We also attached sticky bands around several hundred tree trunks in the affected and neighbouring woods in the spring to catch larvae returning from the ground to the tree canopy. They were also used later in the year to catch larvae heading for the ground to over-winter, or to return to the tree-tops after being blown out of the trees.

In the summer we erected pheromone traps to capture adult male moths. (Pheromone traps use female hormones to attract males.) Amateur collectors have also been using light traps, which attract moths into them at night.

### **16. Which of your research methods produced results?**

We trapped adult males in pheromone traps in summer 2009, and the sticky bands began to catch larvae in September 2009. Light traps deployed by amateur entomologists in summer 2009 also caught a number of male moths.

### **17. How does DNA analysis help?**

Comparison of the genetic diversity of the Scottish population with that of other European countries might provide an indication of the

size of the original founding material in Scotland, and might also provide evidence of where it came from.

The less genetic diversity found, the more likely it is that they are either:

- a recently established population founded by a small number of recently arrived individuals; or
- the early stages of the recovery of a longer-established population that for some reason had collapsed to a small number of individuals at some point in the past.

Study of mitochondrial (maternally inherited) DNA might also help by indicating where in Europe the nearest population of pine-tree lappets with similar mitochondrial DNA occurs. If the Scottish population's mitochondrial type does not match the mitochondrial type found at the nearest mainland sites in Europe, but instead matches the type found at more-distant sites, such as those in Russia, this would suggest that the Scottish population is not the product of natural migration.

### **18. Any results yet?**

Early results from a small sample revealed little genetic diversity, and therefore either a recently established population or a recovering collapsed population. However, these results are based on a small sample size, and we plan to do more-extensive tests to try to obtain more conclusive results.

### **19. Should we not wait until we know for sure whether it is going to do any harm here?**

No, this approach risks our being too late to mount an effective eradication campaign. This species can spread several kilometres in one year, so a 'wait and see' approach risks the moth becoming too well established and widespread for us to eradicate it. The evidence from other countries indicates that the risks to our forests could be very real. It justifies our adopting the precautionary principle and moving quickly to assess the risks, and if the assessment indicates that we would be justified in doing so, acting quickly to ensure that this species does not become established and spread in Britain.

**Forestry Commission  
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