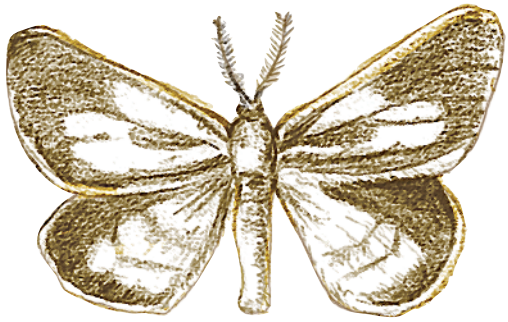
# Pine looper moth

## (*Bupalus piniaria*)



This moth lives in a healthy balance in the Caledonian Forest, but occasionally becomes a serious pest of pine plantations

*Male pine looper moth on a blaeberry plant* (Vaccinium myrtillus) *in Glen Affric.*

## Worldwide Distribution

The pine looper moth occurs in coniferous woodlands throughout Europe and northern Asia, extending to the Caucasus Mountains and eastern Siberia, and in parts of North Africa and the Near East. It is mainly associated with pine trees, especially Scots pine (*Pinus sylvestris*), which itself has a vast range, from Scotland to the Okhotsk Sea in eastern Siberia, and from northern Scandinavia to southern Spain. It also occurs with European black pine (*Pinus nigra*) and has been recorded with larch (*Larix decidua*), Norway spruce (*Picea abies*) and lodgepole pine (*Pinus contorta*), with the latter being a non-native species that is widely planted in Europe.

## Distribution in Scotland

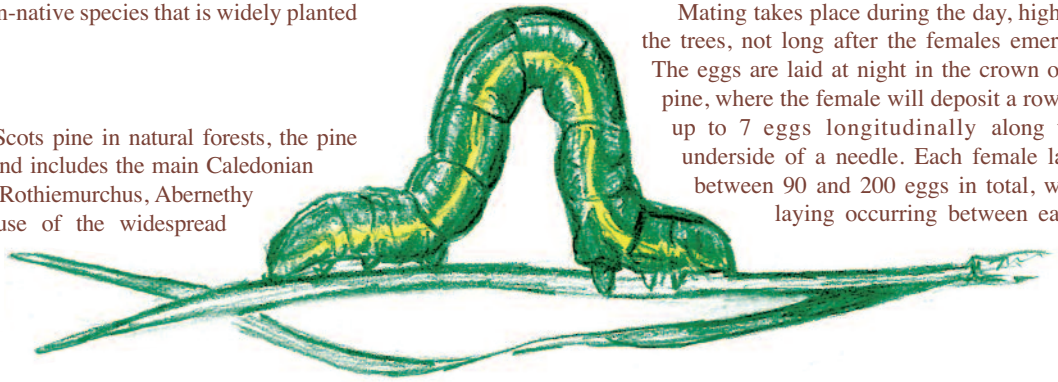
As it is primarily associated with Scots pine in natural forests, the pine looper moth's distribution in Scotland includes the main Caledonian Forest remnants, such as Rannoch, Rothiemurchus, Abernethy and Glen Affric. However, because of the widespread planting of Scots pine and lodgepole pine in commercial plantations in Scotland, it occurs more widely, particularly in the northeast, where the pine plantations are concentrated. It has also been recorded on Rum, in the southwest of Scotland and in the Borders area. In commercial plantations it sometimes occurs in huge numbers, causing serious economic damage to the trees, and this has happened at Culbin Forest in Moray and Tentsmuir Forest in Fife.

## Physical characteristics and behaviour

Also known as the bordered white, the pine looper moth is a member of the family Geometridae, which consists of those moths whose larvae or caterpillars move with a looping method of locomotion, due to the positioning of their legs.

An adult pine looper moth has a wingspan of 28 – 35 mm, and it is notable in being one of the few moth species that rests with its wings closed. The species displays considerable sexual dimorphism, meaning that the males and females are quite different in their physical appearance. The males are more brightly-coloured, with white or cream wings that have a dark brown border, and it's from this feature that the alternative common name is derived. Females have a duller, more uniform brown colouration to their wings. Females have narrow, hair-like antennae, whereas the males have distinctive feathery antennae that are used to detect smells, including those emitted by female moths.

Adult moths are on the wing from the end of May until mid-August, and each one typically lives for about 10 days. During this time they only travel about 150 metres from their point of emergence, so populations are quite localised. The species is active during the day and the males in particular fly around the crowns of trees, often in swarms in sunny weather. By contrast, the females spend a lot time sitting motionless, either on the ground or in the forest canopy.



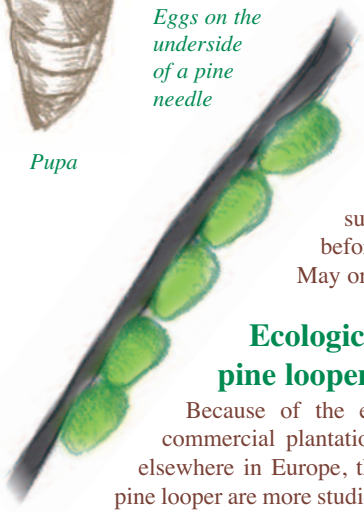
Mating takes place during the day, high in the trees, not long after the females emerge. The eggs are laid at night in the crown of a pine, where the female will deposit a row of up to 7 eggs longitudinally along the underside of a needle. Each female lays between 90 and 200 eggs in total, with laying occurring between early

*Pine looper moth, with its proboscis visible, on a crowberry plant* (Empetrum nigrum) *in Glen Affric.*

June and the middle of August. Larvae hatch from the eggs after about two weeks and initially are a greyish-green colour with a brown head.

Each larva goes through 5 stages of growth, or instars, which are separated by moults. From the third instar onwards the larva has a characteristic green colour with yellow-white stripes running along its body, and this provides near-perfect camouflage amongst the pine needles where it feeds. It can take up to 4 months for the larva to become fully-grown, and it is then about 26 mm long. As with other moths in the Geometridae family, the larva only has legs on its front and back segments and it moves by curving its body into a loop and then advancing forwards. It is this action which gives rise to its common name of pine looper.

*Pupa*



*Eggs on the underside of a pine needle*

In October the larva descends to the litter on the forest floor to pupate. The pupa is about 14 mm long and typically will be located about 2 cm below the surface. There, it will over-winter, before emerging as an adult in late May or early June the next year.

## Ecological relationships of the pine looper moth

Because of the effect that it has had on some commercial plantations of pine, both in the UK and elsewhere in Europe, the ecological relationships of the pine looper are more studied and better known than those for most species of moths.

In a natural forest ecosystem, such as the pinewoods of the Caledonian Forest, the feeding of the larvae on the trees has no serious effect on the pines, as the population of pine loopers is kept in check by various predators and parasites. However, in the artificial monoculture of pine plantations, pine looper numbers occasionally build up to massive proportions, and this can result in complete defoliation of the trees in an area of up to 25 – 30 hectares. This defoliation by itself does not kill the pines, but such an outbreak is usually followed by a population explosion of bark beetles (*Tomicus piniperda*), and this proves lethal to the weakened trees. Studies have shown that the plantations most at risk are those containing trees 25-30 years old, and that are growing on areas of poor sandy soil with a low annual rainfall.

In a natural forest, pine looper larvae are fed upon by various predators, including spiders, birds such as the crested tit (*Parus cristatus*) and wood ants (*Formica spp.*). The latter have also been shown to reduce the number of pine looper pupae by up to 70% within a distance of 5 metres of their nests.

A large variety of other insects are parasitic on the pine looper, and these take the form of parasitoids – parasites that eventually kill their host. The parasitoids typically lay their eggs in either the pupa or larva of their host, which die in due course by being eaten from within by the larva of the parasitoid. The largest group of parasitoid insects that attack the pine looper is the ichneumon wasps, with 56 species recorded as parasitising either the pupae or the larvae. In Britain only two of these are abundant and specialised on the pine looper – one (*Cratichneumon viator*) parasitises the pupae, while the other (*Dusona oxycanthae*) parasitises the larvae. 9 species of flies in the Tachinidae family are also parasitoids of the pine looper, and one of those (*Eucarcelia rutilla*) has been shown to have a significant effect on its host during the massive population explosions that have affected pine plantations.

Considered a serious pest by commercial foresters, the pine looper moth is a classic example of a species that lives in a healthy balance within a natural ecosystem (the Caledonian Forest in Scotland), but that becomes a problem in an artificial monoculture that is 'managed' to maximise economic productivity.

*Pine looper moth caterpillar feeding on a Scots pine on Dundreggan.*



TREES FOR LIFE