Researchers have identified a possible way of reducing the survival rate of the pine processionary moth, a destructive pine forest pest. Including patches of broadleaf trees in pine woodland could trick the caterpillars into pupating in soil that is unsuitable for their survival.

The pine processionary moth is one of the most damaging pine forest pests in Southern Europe. The caterpillars defoliate pine trees by feeding on the needles. Once they have finished feeding, they form long processions to open spaces where they bury themselves in the soil and pupate. The caterpillars are also a public health problem – they release small hairs which, on contact, can cause skin irritation for humans.

The survival of the moths is directly related to the type of land cover in neighbouring areas and they have a higher survival rate if they pupate in open areas adjacent to pine forests. In this study, the researchers, working in the Landes de Gascogne Forest in South-West France, relocated pupae to different soil types underneath pine forest cover, broadleaf tree cover or in open spaces to explore how the type of cover and soil affected the survival of the caterpillars.

Significantly more moths emerged from pupae in open areas than under forest cover (around 56 per cent compared with less than 45 per cent). Their survival was reduced, however, if during pupation, the open area was covered by a canopy of broadleaved trees, which are leafless throughout winter and early spring, i.e. the area is actually only open for part of the year. Thus what may appear as open areas to the caterpillars when they go to pupate in March can end up beneath a dense leafy cover in April and May, which leads to deaths of many pupae.

Although the researchers were aware that areas of broadleaved trees seemed to suppress moth infestation in nearby pine trees, they originally assumed this was because broadleaved patches provide predators with suitable refuge. However, findings from this study suggest that soil conditions in broadleaved forests are also at least partly responsible for different survival rates of pupae.

The researchers measured the physical conditions of the soil in the experimental plots and found that pupae have a higher chance of survival if they are buried in warmer, more humid soil – as is found in open areas. Even a relatively small difference in average soil temperature (18.6°C in open areas compared to 16.1°C under broadleaf forest cover) soon after the caterpillars pupate can make a difference to survival rates. A forest canopy reduces the sunlight reaching the ground, lowering soil temperatures and killing the pupating larvae.

To avoid the cooler temperatures beneath the closed canopies of pine forests, the caterpillars migrate to neighbouring open habitats to pupate. Pine soil is also less humid than soil from open areas or areas of broadleaved trees.

This discovery could allow forest managers to set an ‘ecological trap’ for the caterpillars by interspersing patches of broadleaf trees within pine forests, which appear to be open areas to the caterpillars at the time of year they are searching for soil in which to pupate. However, more research is needed before the method could be put into practice, as the caterpillars’ preferences for different sites to pupate in are not yet fully understood.


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