PINE SAWFLIES IN NORTHERN THAILAND

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ABSTRACT

A brief description is given of the biology of two species of sawfly (*Nesodiprion biremis* (Konow) and *Gilpinia marshalli* (Forsius) (Hymenoptera : Diprionidae)) which attack pine trees in Northern Thailand. Notes are also given on causes of mortality, the defense mechanisms of the larvae and possible control measures.

During the past year, we have been studying the biology of two species of sawflies (Hymenoptera : Diprionidae) which attack pine trees in Northern Thailand. The species are *Nesodiprion biremis* (Konow) and *Gilpinia marshalli* (Forsius). The former has been recorded in the area by Mr. Damrong Chaiglom of the Royal Forest Department, Bangkok (CHAIGLOM), 1970). The latter has not been recorded before from Thailand. Both species are also known to occur in China (Smith, 1972). Both species are potential pests of the pine plantations that are being grown in Northern and North-Eastern Thailand. Although little damage seems to have been caused as yet, some mortality of seedling trees caused by the sawfly larvae feeding on the needles has been reported at Bo Luang Forest Station in Changwat Chiangmai and at the nearby Thai-Danish Pine Project. In Europe and North America, heavy infestations of pine sawfly larvae sometimes defoliate larger trees and cause a considerable reduction in their growth rate, even though the trees are not usually killed COPPEL & BENJAMIN, 1965; KULMAN, 1971). The following is a preliminary report on our findings.

The adult female sawfly uses her saw-like ovipositor to cut small pockets in the pine needles. She lays one egg in each pocket. *N. biremis* can lay up to 150 eggs, *G. marshalli* probably not more than 100. When the eggs hatch, the larvae begin to feed on the pine needles. In *N. biremis*,

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there are normally five feeding larval instars in both sexes. In *G. marshalli* the female larva may have one more feeding instar than the male. In both species, there is a final non-feeding larval instar. The first and second instar larvae eat only the epidermal and mesophyll layers of the needles. The third and later instars eat the whole needle and cause most of the damage to the trees. The larvae of both species tend to feed in groups, but those of *G. marshalli* tend to be more gregarious than those of *N. biremis*. All species of pine (two native and five exotic) planted experimentally at Bo Luang and Bo Kaew Forest Stations are attacked, and the larvae do not appear to show strong food preferences for particular pine species.

Soon after moulting to the last instar, the larva searches for a suitable site to spin its cocoon. In *N. biremis*, the cocoon is almost always spun among the bases of the pine needles close to the stem. Most of the larvae of *G. marshalli* drop to the ground and spin their cocoons among the litter at the ground surface. A smaller proportion spin their cocoons part way along the pine needles, well away from the stem. The cocoons made by male larvae are smaller than those made by female larvae, particularly in *G. marshalli*. Inside the cocoon, the larva pupates, and then changes into an adult. The adult cuts its way out of the cocoon, removing a circular cap from one end. The adults emerge sexually mature, and the female begins to lay eggs immediately after mating. The whole life cycle takes at least six weeks at 25–30°C in the laboratory, and must take longer in the mountains where temperatures are lower. Larvae can be found on the trees at all times of year, and there are evidently several broadly overlapping generations each year.

There is considerable mortality at all stages of the life cycle. Some eggs die because the needle in which they are laid dries up. First instar larvae frequently die because they are unable to bite through the hard cuticle of the needle to begin feeding. Others are knocked from the needles by rain. All larval stages are attacked by predators such as birds, spiders and ants. In the field, many larvae were found that had apparently died from a bacterial (or viral) infection. The larvae are attacked by several parasitoids which do not kill their hosts until they have made their cocoons. *N. biremis* larvae are attacked by the tachinid

fly, *Palexorista* sp. (*?subnajama* (Townesend)), and an undetermined species of Ichneumonidae. *G. marshalli* larvae are attacked by a different species of tachinid and by two species of ichneumonid wasp (including the species attacking *N. biremis*. Five species of hymenopteran parasitoid attack the cocoons. The following species have been bred from both species of sawfly : *Monodontomerus dentipes* Dalman (Torymidae), *Eurytoma* sp. (Eurytomidae) and *Gelis* sp. (Ichneumonidae). *Cleptes* sp. (Cleptidae) has been bred only from *N. biremis*, though it probably attacks both species. An unidentified, probably hyperparasitic species of Eulophidae has been bred only from *G. marshalli*. Probable predators of the cocoons include birds, small rodents and shrews.

The larvae can defend themselves to some extent against the attacks of predators and parasites. They respond to disturbance by raising the head and thorax (and sometimes also the hind end) from the needle and regurgitating a drop of sticky resinous fluid. They may try to touch the disturbing animal with the sticky droplet. This defense mechanism is probably more effective when there are many larvae feeding together and when the larvae are of larger size. It has been shown for other pine sawflies (PROP, 1960) that displays of this kind will effectively deter predators such as birds and ants. They are less effective against insect parasitoids. The early instars of both species are greenish in colour and difficult for visual predators (birds) to see among the pine needles. The later instars of *N. biremis* have a more conspicuous yellow and black colour pattern which may, perhaps, be considered as an example of warning colouration. The later instar feeding larvae of *G. marshalli* show polymorphism. The head capsule may de black, or yellow-brown ranging to dark reddish-brown. The body colour varies from light green to almost black, and there may be white or black longitudinal stripes along the body.

At present, the combined action of the different mortality factors seems to be keeping the populations of both sawflies at low levels. However, if, for some reason, sawfly numbers do increase greatly, there will be a considerable potential danger to young plantations. Control measures then need to be considered. It is possible to control outbreaks by spraying affected trees with insecticide, but this is expensive except

on a local scale, as in the forest nurseries. It is also likely to kill the predators and parasites, possibly leaving the residual sawfly population without effective natural controls. The sawfly population can then build up again and frequent spraying with chemical insecticides becomes necessary to control it creating a recurring expense. Viral control has been used successfully in North America and Europe against sawfly pests (COPPEL & BENJAMIN, 1965). A viral suspension can be easily sprayed over large areas, but considerable preliminary work would be necessary to develop this method for use in Thailand. In the plantations, unless damage is severe, it may be better to accept a reduced growth rate for one or two years until natural control reestablishes itself.

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