New Zealand Journal of Zoology, 1979, Vol. 6, 583–586

Larvae of *Aenetus virescens* (Lepidoptera: Hepialidae) in decaying wood

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Larvae of *Aenetus virescens* (Doubleday) have previously been recorded only from the wood of live trees or shrubs. This paper describes the circumstances in which larvae occupy decaying wood in the forest habitat. Young larvae are considered to exist in dead wood for no more than a year. They then disperse to live trees, in which development is completed.

Gosset (1878), Hudson (1885, 1892, 1898), and Quail (1900, 1902) provided quite detailed accounts of the larval behaviour and habitat of the puriri moth, *Aenetus virescens* (Doubleday), describing the characteristic '7'-shaped tunnels that are excavated in the trunks and branches of various live trees (Fig. 1A). It was believed that the entire larval stage was spent in this situation (Illige & Quail 1901). Illige (1899) supported this view with the demonstration (for Australian species of *Aenetus*) that the larvae died if the host plant tissues died. In keeping with this, it was believed that the adult female deposits eggs indiscriminately over the forest (Illige 1889 [for Australian species], Sharell 1971) or on the ground (Dumbleton 1937), and that on hatching the larvae search for a suitable host (Alma 1977). However, the larvae are already well grown when they first form tunnels in trees (Miller 1971).

Recent accounts (Miller 1971, Milligan 1974, Alma 1977) suggest that the early instars attack the thin bark of regenerating beech (*Nothofagus*) trees before entering a tunnel-constructing phase. This was based on laboratory trials in which hatching larvae were presented with 1-m-high seedlings cut back to 0.5 m for potting. The larvae climbed the host and fed on the thin bark of the live branches, and it was therefore inferred that this was possibly the normal behaviour of larvae in their forest habitat (J.S. Dugdale, pers. comm.).

I am currently studying the biology of *A. virescens*, and have not been able to find young larvae in such a situation. I have examined both regenerating vegetation and the small branches of trees during and after the 1978 flight period in areas with an established population of older larvae.

In February 1979 a number of hepialid larvae were found in a decaying log on the forest floor at Te Kareta Inlet, Lake Waikaremoana. They corresponded to *A. virescens* in general structure and colour; this identity was subsequently confirmed by closer examination of their morphology.

Young larvae have been found in dead, rotting wood at Wainuiomata, Lake Pounui Reserve (Wairarapa), and the Orongorongo Valley. This dead host wood includes putaputaweta (*Carpodetus serratus*), kamahi (*Weinmannia racemosa*), wineberry (*Aristotelia serrata*), and mahoe (*Melicytus ramiflorus*). One larva has been taken in an emergence trap placed on a dead fallen rimu (*Dacrydium cupressinum*) trunk by M.J. Meads (pers. comm.), suggesting that this species too may be a host for young larvae. Living wood of putaputaweta, kamahi, and wineberry is suitable for older larvae. I have found no larvae in live rimu or mahoe in the Wellington region, although mahoe is recorded as a live host by Scott (1873) and Meyrick (1889). Possibly they were referring to *Oemona hirta* (F.) (Coleoptera: Cerambycidae) tunnels (J.S. Dugdale, pers. comm.).

The larvae appear to occur only in decaying wood which, although still quite firm, has been invaded by fungal hyphae, and have been found feeding on emergent fruiting bodies. Two species of fungi have been identified – *Phomes* sp. on *Northofagus* sp., and *Echinochaete russiceps* on *Carpodetus serratus*. Generally larvae are located on the underside of the trunk or branch, either in shallow cavities excavated on the surface and under the bark (if present) or in relatively short, roughly '7'-shaped tunnels. They may be solitary or occur in groups under the same cover. The angle between the two sections of tunnel is less acute than in live trees – about 90°. The tunnel illustrated (Fig. 1B) is representative of the usual form and dimensions. Feeding cavities not covered by bark have extensive covers of silk and frass, and do not conform to any particular shape; they are either quite wide (3–4 cm) or the width of one larva. There appears to be no physical barrier between larval 'territories' such as would occur between adjacent feeding surfaces in live trees. The

Received 8 August 1979

larvae are not confined to logs on the forest floor – two larvae were found 2.5 m above ground in a dead standing tree. The larvae show a strong tendency to move backwards, and if disturbed in normal conditions they will readily retreat into their tunnels, as will larvae in live trees.

When these larvae were first discovered, the possibility of their not being *A. virescens* was an important consideration. There are two hepialid subfamilies in New Zealand, Oxycaninae and Hepialinae. Larvae from the dead wood were found by comparison not to conform to oxycanine larvae (J.S. Dugdale, pers. comm.). The only hepialine species other than *A. virescens* found in the North Island is *Aoraia leonina* (Philpott), but this has been recorded only from Mt Egmont and Mt Ruapehu (Dumbleton 1966). *A. virescens* is therefore the only known possibility for the identity of the larvae.

As far as could be determined the small larvae did not differ morphologically from older larvae found in live trees in any way as to suggest that they were of a different species. In particular, the presence of a lateral sensory pit on the prothorax immediately placed them in genus *Aenetus* (Quail 1902). Quite conclusive behavioural evidence for their identity came from an experiment designed to record movement of larvae from decayed wood to live material. A retaining cage was constructed on the trunk of a *Nothofagus truncata* tree, and in early March 1979 five larvae were placed inside, along with pieces of decayed wood, which the larvae occupied. Two larvae have since left the decayed wood, and during May and June 1979 constructed a tunnel and entrance cover on the trunk.

It therefore appears that two distinct stages occur in the development of *A. virescens* larvae: an initial period of growth in dead, fungus-infested wood, followed by dispersal to live trees, where development is completed. The number of instars of puriri moth larvae is not yet known, but a convenient

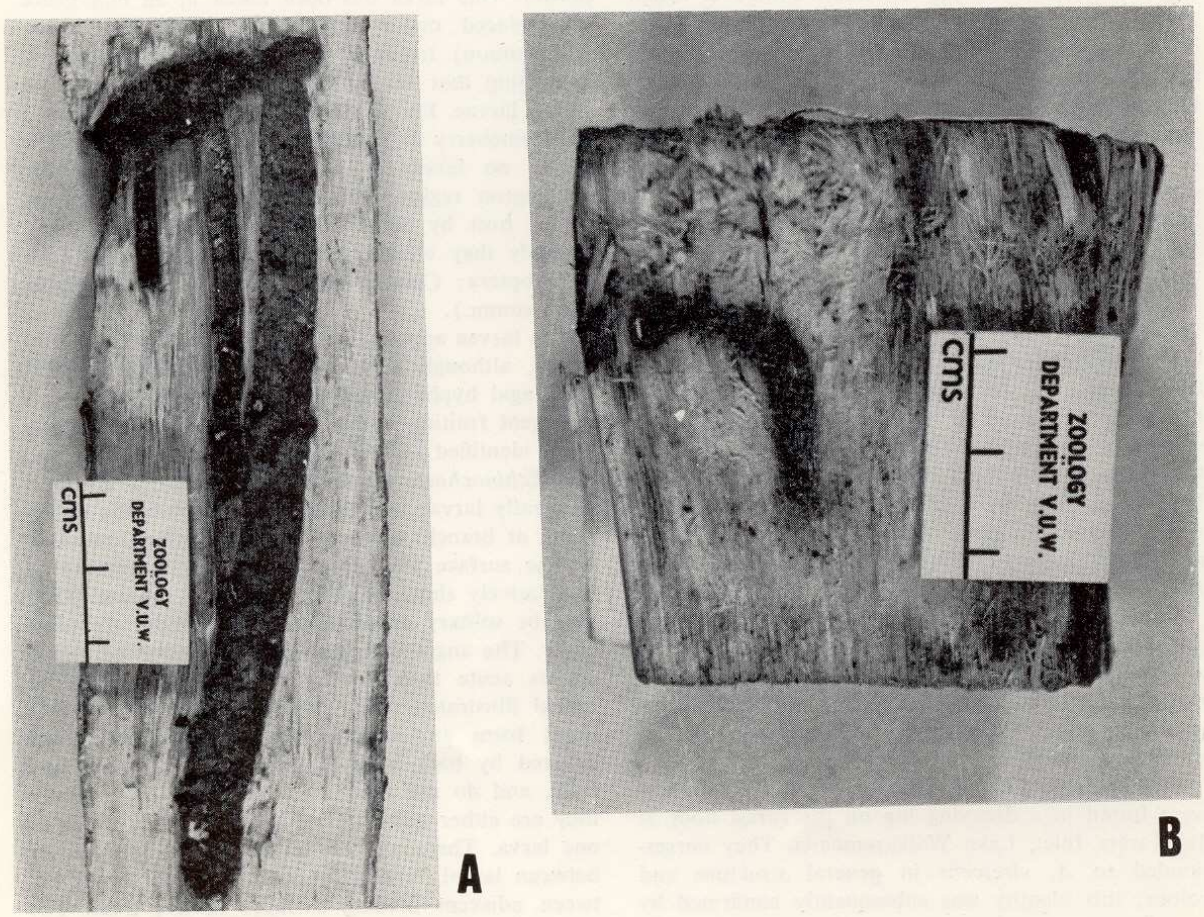

Fig. 1. Tunnels excavated by *Aenetus virescens* larvae in (A) live and (B) dead wood of putaputaweta, *Carpodetus serratus*.

(though imprecise) indicator of growth stages is length. This suffices to show that the size reached by the larvae in decaying wood approximates that of small larvae found in live trees. The largest larvae in decaying wood were about 20 mm long. However, one larva found in a live tree was only 10 mm long, which suggests that there might be considerable variation in the instar at which migration from dead wood occurs.

This change of feeding habit is not unprecedented among the Hepialidae. Larvae of *Oncopera parva* Tindale (Elder 1978) and of *Trioxycanus enysi* (Butler) (J.S. Dugdale, pers. comm.) develop on dead leaf material. The wood-boring genus *Endoclita* is closely related to *Aenetus* (Tindale 1957), and the very young larvae of *E. sericeus* (Swinhoe) live in small tunnels in rotten twigs on the forest floor before moving to living plants in the immediate vicinity (Kalschoven 1965). In the subterranean hepialids *A. virescens* is paralleled by *Oncopera fasiculata* (Walker), young larvae of which shelter communally under silken webs among surface debris for about 2 weeks before constructing individual vertical tunnels in the soil. While on the surface the larvae apparently feed on dead organic matter as well as live grass, but they feed only on live material when living in tunnels (Madge 1954). It is probable that dead material contributes to the diet of young porina larvae (*Wiseana* spp.), since they live in surface soil (Ferro 1976) or litter (Perrot 1974) before constructing tunnels and feeding on live plants.

I believe that *A. virescens* larvae move into live hosts within a year of occupying decaying wood. The instar at which this occurs is unknown, though available evidence suggests that it may vary widely. The larvae spend 3–5 years in live trees (Alma 1977), so the development period may be as much as 6 years.

ACKNOWLEDGMENTS

I am grateful to Dr G.W. Gibbs and Dr B.D. Bell (Victoria University of Wellington), Mr J.S. Dugdale (Entomology Division, DSIR), and Mr M.J. Meads (Ecology Division, DSIR) for valuable assistance and criticism during the preparation of this paper; to Dr G. Cone (Victoria University of Wellington) for identification of fungi; and to Mrs V.L. Grehan and Mrs D.E. Willis for checking the manuscript. The Urewera National Park Board, Mr and Mrs R.A. Page, and Mr S.W. Parsons kindly permitted me to study in areas under their jurisdiction.

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