PLATYPUS PINHOLE BORER AFFECTS SPRINKLER STORAGE OF LOGS IN NEW ZEALAND

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ABSTRACT

The pinhole borer, Platypus apicalis *White, was found to damage* Pinus radiata *D. Don logs stored under water sprays at Balmoral State Forest, North Canterbury, although it is not normally endemic in this forest. The initial attack probably originated from infested logs carried down the adjacent Hurunui River during floods and stranded nearby. The* Platypus *attacks were initiated soon after the stockpile was completed, while logs were still fresh, and also in those which had been stored for up to 3 years.* P. apicalis *is considered to impose a constraint on sprinkler storage of logs.*

INTRODUCTION

Clifton (1978) described the first storage of logs under water sprays in New Zealand at Balmoral State Forest following extensive windthrow of pines in Canterbury in August 1975. He reported that degradation of the stored logs, which were principally radiata pine, was minimal after two years, and concluded that a satisfactory solution to the problem of long-term storage had been found. He noted that sapwood moisture content initially declined to a minimum of 107% in September 1976, then subsequently increased to 160% by April 1978.

Platypus apicalis White occurs throughout New Zealand forests from the North Auckland peninsula to Stewart Island and in the Chatham Islands, and utilises a wide range of indigenous and exotic hosts. In exotic conifer forests it is typically found in stumps. Prior to the establishment of the log stockpile it was not recorded from Balmoral State Forest, though this, with other Canterbury forests, had been sampled regularly by New Zealand Forest Service Forest Health Officers (previously designated as Forest Biology Observers) since 1956, and sporadically by forest entomologists. A survey of insects potentially damaging to windthrown pines was initiated immediately after the 1975 Canterbury windthrow, and any increases were subsequently monitored (N.Z.

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Forest Service, 1976; 1978); at this time *P. apicalis* was not found. The absence of *P. apicalis* had been accounted for by the rapid drying of potential host material during the summer, when north-westerly fohn winds prevail, coupled with a low mean annual rainfall, which, for a 10-year period ending 1979, was 594 ± 106 mm.

CHRONICLE OF EVENTS

1. *May 1978*

The regional Forest Health Officer found the first indication that *P. apicalis* might occur at Balmoral when he discovered two abortive tunnels containing only males in a waste radiata pine log some 4 km west of the stockpile, and within 500 m of the Hurunui River bed which forms the southern boundary of the forest.

2. *13 June 1980*

The Forest Health Officer found active workings of *P. apicalis* in the last row of logs to be erected in the stockpile which lay about 400 m from the river.

3. *19 June 1980*

The Timber Officer, Forest Health Officer, and Forest Entomologist together found lesser concentrations of attacked logs in a further 3 rows of the stockpile. Thirty attacked logs were marked, though it was impossible to determine *in situ* what proportion this formed of the total affected. Most of the tunnels examined were producing larval frass and so were probably initiated in the 1978-9 flight season, or possibly in the preceding season. However, some were producing adult frass, indicating that they were initiated in the 1979-80 flight season (Milligan, 1979). In some logs tunnels of both age-classes were present. When log sections were dissected the tunnels were found to extend throughout the sapwood and to contain large numbers of final instar larvae, but no pupal chambers were seen, indicating that most tunnels were initiated in the 1978-9 season rather than prior to this.

Approximately 3 km from the river an area had been clear-felled in the previous summer, but no trace of *P. apicalis* could be found in the stumps; thus it seemed that it had not become generally distributed in the forest.

Canterbury Conservancy Office was advised that more extensive damage to the stored logs could be expected if affected logs

were allowed to remain over the following summer, when large numbers of adult beetles would emerge. The Conservator decided that the stockpile should be dismantled and disposed of promptly.

4. *August 1980*

Some severely damaged logs were transported to the Forest Research Institute at Rangiora to serve as rearing material for current studies on *P. apicalis* pheromones. Selected material was cut from the logs and stacked in two heaps, together occupying about 6.2 m^3, under black polyethylene sheeting with window traps attached at one end (Milligan, 1982).

5. *26 August 1980*

Beetles began to emerge from the rearing material at FRI and emergence continued steadily from this date, particularly from one of the two heaps.

6. *4 November 1980*

Some *P. apicalis* infestations were found in a few scattered radiata pine stumps in a swampy area near the river margin of Balmoral Forest and about 11 km north-west of the stockpile site. Abortive tunnels were found in crack willow (*Salix fragilis* L.) growing nearby at the river bank.

7. *31 December 1980*

By this date 7623 *P. apicalis* had emerged from rearing material, 5363 of which came from the heap from which adult beetles first appeared.

8. *26 August 1981*

One year after emergence started 26 931 beetles from the Balmoral log samples had been sexed and recorded, but the total would have exceeded this, first because dead and damaged specimens were not recorded, and secondly because during 2 weeks in February there was nobody available to cope with emerging beetles. For the remaining 14 days of February the two log piles produced an average of 182/day. Therefore one could reasonably estimate that 30 000 *P. apicalis* emerged from the samples in a year.

DISCUSSION

The conditions provided by stockpiling logs under water sprays were evidently peculiarly suitable for the breeding of *P. apicalis*. The row of logs where most attack was concentrated

was completed in November 1976 (Clifton, 1978). Supposing that a low intensity of attack from an outside source occurred here in the 1976-7 season, first brood from successful galleries could be expected to emerge in the 1978-9 season, and those attacking the same material would establish a much larger number of galleries which, in turn, would produce their first brood in the 1980-1 season. It was this age-class of attack which was most evident in June 1980. However, the first galleries would have continued to produce brood over the 1979-80 flight season, with the adults excavating fresh galleries from which adult frass would still be produced in the winter of 1980. While we failed to detect galleries with pupal chambers at that time there was some indirect evidence that such galleries had existed. In our experience of rearing *P. apicalis* those galleries producing brood for the first time do not produce significant numbers before December or January, whereas brood tend to emerge in the second productive season from spring onwards. The fact that only one of the heaps of rearing material produced significant numbers of brood from September onwards suggests that this one contained log samples with galleries started in the 1976-7 season.

Though attacks from outside sources could have occurred each year from November 1976, there was no evidence of this, and it is not necessary to assume it to account for the age classes of galleries found in June 1980.

The question is, therefore, what sort of outside source could have given rise to the initial attack in the stockpile? In this context, it is significant that all three locations where *P. apicalis* attack has been recorded at Balmoral Forest lie within 500 m of the Hurunui riverbed. Like other Canterbury rivers, the Hurunui is subject to periodic flooding, particularly during north-westerly winds which bring rain and snow-melt in the Southern Alps. Logs carried down during floods often become stranded on its braided shingle bed. The chance stranding of logs infested with *P. apicalis* could provide sources from which emerging beetles could colonise suitable material along the southern boundary of the forest. Although its maximum flight range is not known, there is evidence from field studies that flights of more than 500 m are common (Milligan, in prep.). Meantime, it seems most probable that the attacks at the stockpile and at sites 4 and 11 km away each originated from independent sources. Source logs stranded on the exposed riverbed could be carried downstream at the next flood, but if they were to remain in such

an exposed situation over the summer would probably not remain suitable for *P. apicalis* for more than one season.

Alternatively, *P. apicalis* could have been introduced to the stockpile in logs brought from Hanmer State Forest, where there is an endemic population. However, this seems improbable since only 48 hours elapsed between crosscutting and stacking, and logs were carefully checked for damage (Clifton, 1978). Resin flows from logs with a satisfactory moisture content would probably repel any attempted *Platypus* attacks at this stage. Furthermore, such an hypothesis fails to account for attacks found at sites close to the river, but respectively 4 and 11 km away from the stockpile.

Under forest conditions, *P. apicalis* does not usually attack logs which have been felled for more than a year, by which time sapstain invasion is normally extensive. It is therefore of particular interest that logs felled 3 years earlier, and stored under conditions designed to minimise sapstain, remained attractive to attacking males. By this time *Armillaria novae-zelandiae* Stevenson had extended through the phloem and cambium, and the wet sapwood was extensively invaded by bacteria. These micro-organisms could be expected to greatly modify the characteristic host volatiles which attract attacking males. Clifton (1978) comments on the stench of logs stored under water sprays, which seems to be indicative of decomposition of organic materials by anaerobic micro-organisms. He also noted that, after felling, wood moisture declined over the winter months, reaching a minimum of 107% in late September, then slowly increased through the following summer (when one might have expected increased rates of moisture loss), reaching 130% by January 1977. This could be accounted for if biodegradative changes increased the permeability of the wood to applied water.

CONCLUSIONS

There are few parts of New Zealand where logs could be stored under water sprays without risk of damage by *P. apicalis*, and in indigenous or exotic forests with endemic populations one could anticipate more extensive initial damage than occurred at Balmoral Forest. In those forests where the scolytid wood-borer *Pachycotes peregrinus* (Chapuis) occurs an additional damaging agent may appear. *P. peregrinus* thrives under conditions favourable to *P. apicalis*, breeds in very wet wood, but is restricted to softwood hosts (Bain, 1977).

Although pinhole damage has little effect on the strength of structural timbers, under Timber Preservation Authority requirements such damage is not acceptable in those intended for preservative treatment. It is of little consequence in box grades or in chipwood. The end use of extensively damaged logs would therefore be restricted. Greatest economic consequences could be expected if the logs were intended for the production of veneers or finishing grade sawn timbers, or if the logs were to be exported since exported forest produce must be free of live insects.

The extent of damage would plainly depend on the duration of storage. Logs stored for less than two years would not be reinfested by brood of either *Platypus* or *Pachycotes* emerging from the logs, but could be attacked in one or two flight seasons by beetles arising from outside sources. In this event the extent of sources within flight range of the log stockpile would determine the amount of damage. Assuming a flight range for *P. apicalis* of 0.5 to 0.8 km, sources within an area of 0.8 to 2.0 km^2 surrounding the stockpile could contribute to damage. The greatest flight distance recorded for *P. apicalis* is 2 km (Milligan, in prep.), but it seems unlikely that the number of beetles flying so far would be sufficient to cause significant damage. On the basis of present information, it would seem prudent to eliminate major sources of *P. apicalis* within a 1 km radius of logs stored under water sprays.

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