SECURING MARKET ACCESS FOR NEW ZEALAND WOOD PRODUCTS

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In a pest risk assessment study (Anonymous 1992), the Now Zealand native huhu beetle was identified as one of seven major quarantine pests which would pose a risk if imported into the USA on New Zealand Pinus radiata. Huhu. infests dead parts of living trees, stumps, logs and untreated sawn timber. The larvae feed in sapwood and heart wood and may ultimately completely destroy the host wood leaving only a thin outer shell (Hosking 1978).

Fumigation with methyl bromide (MeBr) is currently the only accepted quarantine treatment against huhu prior to export to markets such as the USA. While North Asian markets do not require mandatory fumigation, substantial volumes of logs are fumigated with MeBr at the port of arrival. An estimated 4.8 million m^3 of logs were with MeBr in 1996 against forestry quarantine pests (J. Maud, New Zealand Ministry of Forestry, pers. comm. 1997). MeBr has been identified as an environmentally hazardous toxic gas and as a major contributor to ozone depletion (WMO 1994). Due to world-wide concerns about its impact on human health and the environment, there is an urgent need to develop alternative disinfestation methods in order not to jeopardise New Zealand's wood exports.

Our programme aims to develop alternative postharvest disinfestation methods to MeBr to control insects in forestry products, taking a broad approach by testing a range of promising technologies. Previous research has already identified gamma irradiation as a potential disinfestation method for huhu (Lester et al. 1997). Here we report on research conducted to determine the efficacy of elevated temperature and low Oxygen atmospheres. Experiments were carried out in a controlled temperature room using air or low oxygen controlled atmospheres (CA) flowing at about one chamber change every hour.

For air experiments, huhu were exposed to temperatures of 30, 35, 40 and 45°C and an average relative humidity of about 75%. These air experiments were carried out at static temperatures, i.e. the temperature was established before the insects were exposed.

CA experiments were conducted at 40°C, and these experiments were started from ambient temperature and air conditions. The following atmospheres were used: (i) pure carbon dioxide (CO_2), (ii) pure nitrogen (N_2) or (iii) a 50/50 (vol/vol) mixture of CO_2 and N_2. Gas concentrations were measured using O_2 and CO_2 gas analysers, and a typical CA establishment rate achieved an average 0.4% O_2 concentration after 5-6 hours. All experiments were carried out with a photoperiod of 16:8 (L:D) h.

Huhu larvae collected from the forest were separated in the laboratory into "small" (0-500 mg), "medium"(500-1500 mg), and "large" (>1500 mg) weight classes. Insects

were held overnight at 20°C, about 70% RH and a photoperiod of 16:8 (L:D) h before being treated the next day. Larvae in glass tubes were exposed to a range of treatment conditions for 5 different time periods (from 2 hours to 10 days depending on heat and CA conditions) to provide a range of mortalities. Following treatment, all insects were held for 3-4 days until mortality assessment.

Time-mortality data for each experiment were analysed with a complementary log-log model (Preisler and Robertson 1989) with time as the explanatory variable to derive estimated hours for 99% mortality (LT99). The results from the different weight classes were combined for analyses since there was no trend to indicate a difference in tolerance level to heat or CA conditions. An estimated 40 days at 30°C air was needed to achieve 99% mortality (LT99) of huhu larvae. This time decreased with increasing temperature to 3 hours at 45°C.

When treating huhu with CAs at 40°C, the LT_{99} value for huhu exposed to CO_2 (6.9 hours) was lower ($P = 0.008$) than that for N_2 (8.3 hours), but similar to the LT_{99} value for the CO_2/N_2 mixture (7.6 hours). There was no statistical difference between the N_2 or CO_2/N_2 mixtures. All CA conditions at 40°C resulted in faster kill when compared to air treatments at 40°C (LT_{99}: 24 hours; $P < 0.001$).

Further research will concentrate on different CA conditions at elevated temperatures, and natural products for insect disinfestation in collaboration with Dr Stephen Parker and colleagues at HortResearch, Hamilton, New Zealand. In addition, physiological research aimed at understanding how insects are affected by treatment stresses will further underpin the development of successful disinfestation treatments. Once promising treatments have been identified, the tolerance of other huhu life stages to these treatments will be determined inside logs, and a quarantine protocol. developed.

References

Anonymous. 1992. Pest risk assessment of the importation of *Pinus radiata* and Douglas-fir logs from New Zealand. United States Department of Agriculture. Forest Service. *Miscellaneous Publication No. 1508.*

Hosking, G.P. 1978. *Prionoplus reticularis* White (Coleoptera: Cerambycidae). Huhu beetle. *Forest and timber insects in New Zealand, No. 35.* Forest Research Institute New Zealand Forest Service.

Lester, P.J., Rogers, D.J., Petry, R.J. and Roberts, P.B. 1997. Gamma irradiation for postharvest disinfestation of huhu beetle *(Prionoplus reticularis)* in New Zealand export pine trees. J. *Econ. Entomol.* Submitted.

Preisler, H. K. and Robertson, J. L. 1989. Analysis of time-dose-mortality data. J *Econ. Entomol.* 82:1534--1542.

WMO. 1994. Scientific assessment of ozone depletion: 1994. *World Meteorological Organisation global ozone research and monitoring project, report no 3 7, WMO, Geneva.*