



EUPHRESCO Final Report

| Project Title (Acronym) |
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| Phytosanitary Efficacy of Kiln Drying (PEKID) |

This document contains only the Executive Summary.

The Full Report may be obtained from the Project Leader on request.

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Project Summary

Phytosanitary Efficacy of Kiln Drying (PEKID)

The EU Directive 2000/29/EC, which covers the plant health legislation for the 27 member states, recommends as one possible phytosanitary treatment that the regulated wood “has undergone kiln-drying (K.D.) to below 20 % moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule.” In this framework the term “appropriate time/temperature schedule” is not specified. Kiln drying in general can be carried out at different treatment temperatures which may be below temperatures commonly used to eliminate harmful organisms from wood, such as 56°C for at least 30 minutes, the heat treatment parameter used for phytosanitary treatment of wood packaging laid down in the IPPC International Standard for Phytosanitary Measures No. 15. “Regulation of Wood Packaging in International Trade” (ISPM No. 15).

Main objectives

The aim of the project was to determine whether harmful organisms related to wood would be killed by kiln drying processes according to the requirements of the EU-Directive 2000/29/EC. The reduction of the moisture content to less than 20 % should be carried out using different temperature regimes. Results were aimed to clarify whether the phytosanitary effect of a K.D. treatment is achieved by desiccation of the wood to make it unsuitable as host resource for e.g. insects, or the thermal effects on the target organisms.

Methods

Investigations have been carried out using nematodes, insects and fungi as test organisms. The efficacy of a K.D. treatment concerning wood inhabiting nematodes of the genus *Bursaphelenchus* has been analysed using fresh pine wood artificially inoculated with *B. xylophilus* or *B. mucronatus*, respectively. Naturally infested pine and spruce wood was used for the insect trials and naturally infested pine wood for fungal tests.

The drying of the wood was either carried out in laboratory climate chambers, semi-operational or professional kilns. The treatment parameters were aimed to finally result in a wood moisture content of less than 20 %. Kiln temperatures in the main schedule were 35 °C to reach the target m.c. followed by heat treatments with a duration of 15, 30 and 60 minutes at temperatures of 45°C, 56°C and 65°C in the core of the wood. For single investigations modifications for the time/temperature schedule were made.

Results

A method could be developed to use artificial inoculation of pine wood with *Bursaphelenchus* species to produce infested test wood with nematode densities of more than 100,000 animals per test log which allows investigations on Probit 9 level. *B. xylophilus* and *B. mucronatus* survived a K.D. treatment (wood m.c. < 20 %) using temperatures of 35 °C. Neither *B. xylophilus* nor *B. mucronatus* survived any treatment which includes ISPM No 15 treatment when treating *Pinus sylvestris* wood. Surviving *B. mucronatus* in *P. pinaster* wood in tests which included ISPM 15 treatment are in contrast to results obtained world-wide with different wood species and it cannot be ruled out that this issue results from a treatment or temperature measurement failure. Unfortunately the test could not be repeated in the project duration.

The tested insects survived different time/temperature combinations depending on the insect species:

- *Pityogenes chalcographus* in *Picea abies* wood survived a K.D. treatment at 30°C treatment temperature;
- *Ips sexdentatus* and *Ips tyographus* did not survive a K.D. treatment at 35 °C followed by a heat treatment of 45 °C for 15 minutes using a chamber temperature of 50 °C;
- *Monoctonus sartor*, *Tetropium castaneum*, *T. fuscum* in *Picea abies* wood and

Arhopalus rusticus in *Pinus sylvestris* wood survived a K.D. treatment at 35 °C followed by a heat treatment with 45 °C up to 60 minutes.

- *Chrysobothrys* sp. survived a K.D. treatment at 35 °C followed by a heat treatment at 45 °C for 60 minutes.
- *Acanthocinus griseus* and *Arhopalus syriacus* in *Pinus pinaster* survived a 35 °C K.D. treatment followed by a heat treatment with 56 °C core temperature for 15 minutes.

All variants which included the parameter of ISPM No. 15 with temperatures of 56 °C in the wood core for at least 30 minutes led to complete mortality of the tested bark beetles (Scolytidae), long horned beetles (Cerambycidae) and Buprestidae. Only some specimens of *Orthotomicus erosus* survived the ISPM 15 parameter but were killed after 60 minutes application of a core temperature of 56 °C using a chamber temperature of 60 °C. This result is remarkable but would need further investigations to rule out a treatment failure. As already discussed concerning the unexpected survival of *B. mucronatus*, a replication of this experiment was not possible because of the limited project duration.

The ISPM No. 15 thermal treatment (56°C for at least 30 min core temperature) did not eliminate wood inhabiting fungi in *Pinus nigra* but profoundly changed composition of fungal community in the wood.

Conclusions

The results of the investigations using nematodes and insects clearly show that a low temperature K.D. treatment leads to the recommended wood moisture content of less than 20 % but does not eliminate the tested harmful organisms.

It is known that fungi include many thermo-tolerant species that may not be eliminated even at temperatures exceeding the ISPM No. 15 parameter. Also for ISPM No. 15 it is agreed that not all fungi are covered by the heat treatment of 56 °C for 30 minutes in the core. Although there are only few examples describing that fungi have been spread by infected wood, the risk for spreading insects and nematodes (if the vector is available) is much higher. Therefore the risk posed by surviving fungi also during treatments such as heat treatment of ISPM 15 is believed to be acceptable in contrast to the risk for insects and nematodes. Nevertheless further investigations are needed to assess the risk of international spread of harmful fungi and to develop effective parameter for phytosanitary treatments.

K.D. treatments can fulfil the requirements of quarantine regulations such as the EU-Directive 2000/29/EC but are not an efficient phytosanitary treatment. The application of the ISPM No. 15 treatment parameter to wood in the current investigations leads to the necessary phytosanitary efficacy. In general, phytosanitary recommendations focussing only on the wood moisture content without any recommendations concerning the treatment parameter do not guarantee a sound phytosanitary treatment.