



## **COST ACTION FP1006**

**SHORT TERM SCIENTIFIC MISSION (STSM)**

**“Wood preservation properties of tannin-boron formulations against insects”**

*3-10 April 2012*

**IVALSА-CNR, Laboratorio biodegradamento e preservazione, Sesto Fiorentino , Italy**

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*Host:* **Dr. Sabrina Palanti**

**SCIENTIFIC REPORT**  
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## 1. Purpose of the visit

The short term scientific mission is a very effective tool to establish international collaborations. For this reason I have profited to catch this great opportunity to complete my experience in the field of the biological tests on wood.

Actually I had already a good overview about the termite and white and brown rot fungi, but I had no experience in the tests that are actually run with insects.

Hence, I decided to visit the laboratories of Dr. Sabrina Palanti at the CNR-IVALSA in Sesto Fiorentino – Italy which is one of the very few organizations that daily deals with this subject.

During this visit I wanted to test some tannin-based formulations against *Hylotrupes bajulus* to complete the overview of the efficacy of the formulations after different leaching methods. Some formulations were already tested against other aggressive biological agents, but different leaching and modified formulations were tested as well.

## 2. Description of the work

### *Preparation of the sample*

Six series of 5 samples each were impregnated with different tannin boron formulations and 5 of these impregnated samples were leached with different leaching systems.

The formulations were prepared mixing 100g of mimosa tannin in 400g of a solution 1,25% of boric acid (Fig.1). The pH was than adjusted at the value of 9,0 with NaOH 33%. Hexamine and additives were added in a second step according to Table 1.

<b>Tannin (%)</b>	<b>Boric Acid (%)</b>	<b>Hardner (%)</b>	<b>Additives (%)</b>	<b>Leaching</b>
20	1	Hexamine 1,2		-
20	1	Hexamine 1,2		5 days
20	1	Hexamine 1,2		EN84
20	1	Hexamine 1,2		EN 1250-2
10	0,5	Hexamine 0,6	PEG 20	EN 1250-2
10	0,5	Hexamine 0,6	Caprolactam 33	EN 1250-2

*Table 1. Details of the formulations applied for the impregnation of the scots pine specimens.*

The impregnation has been done following the vacuum- dipping - pressure method: The five scots pine specimens of 50x25x15 mm<sup>3</sup> dimensions (EN113) were put into a desiccator in which 30 minutes vacuum (8 mbar) was applied. The tannin-boron solution was then filled into the desiccator allowing the impregnation process to start. Slow release of pressure was then applied and the 24 hours of penetration time was applied (Fig.2).

The liquid retention of each sample was always higher than 100%.

The impregnated samples were kept 24 hours in an oven at 103°C in order to let the polymerization between tannin and hexamine to occur.

The samples were left at least 2 days at 20°C and 65% RH before leaching.

Three different leaching were done: EN84, EN1250-2 and 5 days leaching. The latter consists in an experimental method in which fresh water was exchanged every 24h for five days (Thevenon et al., 2009).

After leaching the sample were left at least one week at 20°C and 65% RH before the tests against insects were done. In Fig. 3 is reported an example of three series treated with different concentration of tannin.



Fig.1



Fig.2

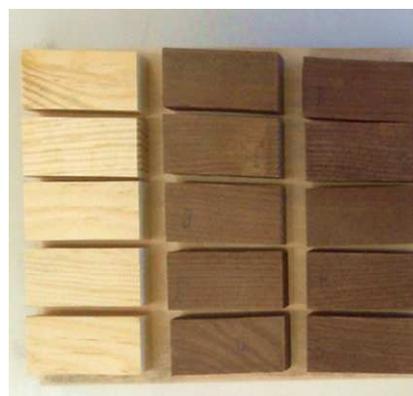


Fig.3

*Fig.1: Preparation of a tannin-boron solution. pH modification.*

*Fig.2: Impregnation of the scots pine specimens with the method of vacuum-dipping-pressure.*

*Fig.3: Example of 50x25x15 mm scots pine specimens before and after treatment.*

#### *Conditioning and preparation of larvae*

Insects of *Hylotrupes bajulus* were prepared in order to have the maximum amount of newborn larvae in the period of the short term scientific mission. More than 150 larvae were selected and arranged to be ready to be inoculated. This process is extremely delicate because in this species of insects it is also possible to observe some cases of intraspecific competition.

#### *Inoculation of the samples*

The stabilized samples were inoculated with the larvae of the *Hylotrupes bajulus* (Fig.4). Each specimen was incised with a nail in six point of the larger surface according to the EN 47 (Fig.5). Each incision was inoculated with a living larva each exemplar was controlled before inoculation and only the active ones were selected for the test. The inoculation was performed through a very fine paint-brush laying carefully the larvae in the incision with the head in contact to wood (Fig.6).



Fig.4



Fig.5



Fig.6

*Fig.4: Description of the Hylotrupes bajulus*

*Fig.5: Diagonal incision and inoculation of a tannin-treated wood sample.*

*Fig.6: Inoculation of the sample with larvae through paint-brush application.*

### **3. Results**

The final results of these tests require an exposure of three to six months. The first unofficial control has shown that many of the larvae are still alive. This means that the leaching of the samples was strongly affecting the network of the tannin-boron preservatives.

However, the final evaluation of the test has to be done in October. At that time the efficacy of the formulations against *Hylotrupes bajulus* will be rated exactly.

The test will be considered valid if at least of 70% of the larvae inserted into the control specimens survive.

### **4. Future collaborations with the host institution**

The work that we have done jointly has allowed to establish a very promising scientific collaboration. In the next months I would like to go again to evaluate personally the efficacy of the tannin-boron formulations.

Together with other tests that I have recently developed in my research the results of these tests will be published in a peer-reviewed scientific journal of the field to complete the overview about the efficacy of tannin-boron wood preservatives.

### **REFERENCES**

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EN113. (1996). Wood preservatives. Test method for determining the protective effectiveness against wood destroying basydiomicetes - Determination of toxic values.

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