

A NOTE ON THE BIOCIDAL EFFICACY OF AGAVE EXTRACT ON BAMBOOS

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Introduction

Conventional wood preservatives developed during the last century are being replaced by new formulations due to environmental and commercial reasons. Many of these new formulations also contain chemicals, which have been subsequently found controversial. One approach to protect wood and other ligno-cellulosic materials like bamboo, reeds and other grasses from biodegradation is the use of natural toxicants extracted from plant materials. Plants have evolved an array of potent microbial compounds to protect themselves from various pests. Some of these chemicals have been found to be active against wood and bamboo inhabiting fungi and insects. Extracts of Neem (*Azadirachta indica*), Calotropin powder (*Calotropis gigantea*), Stemonacol (*Stemona tuberosa*) are good examples of plant extracts being used to protect bamboo products in some countries to prevent insect infestation (Liese and Kumar, 2003).

Exploratory studies on finding bio-protecting agents from various plants are going on around the world. Li *et al.* (2007), investigated the efficacy of Cinnamon oil based formulation for protection against moulds and stain fungi. Saxena and Dev

(2002) reported on the efficacy of *Ipomoea* spp. extract against subterranean termites.

Rambans (*Agave* sp.) grows wild in the State of Uttarakhand and many southern states of India. In Uttarakhand, villagers use this plant to produce fibre by squeezing out the sap. The extract (sap) of this plant is believed to have biocidal properties and the locals use the extract as an insect repellent. No scientific studies have been done on this plant except that it is good source of fibre for making ropes. Preliminary studies were conducted by Uttarakhand Bamboo & Fibre Development Board, Dehra Dun through the Chemistry Division of Forest Research Institute, Dehra Dun. The results showed that the plant has some biocidal activity although the target microorganisms used for these tests were different from those attacking the woody materials like bamboo (FRI, 2005).

It was therefore considered worthwhile to have preliminary trials on its microbial activity against wood destroying organisms. If found effective, this material will be quite handy for treating bamboos as conventional wood preservative formulations are quite expensive and generally not locally

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available in small packing required by the small scale users.

Tests against Termites

(i) *Preliminary Tests*

Materials and Methods : About 300 ml juice was mechanically extracted from the stem for preliminary testing its efficacy against fungi and termites.

Eight strips of fresh green bamboo (15 cm x 2.5 cm) free from any rot and insect infestation were prepared for treating with Agave extract under different conditions.

Treatment by Boiling : Three green strips were boiled in water for 30 minutes and immersed immediately in cold Agave extract at ambient room temperature. The strips were removed after two hour soaking. The treated strips were dried in the sun for three hours along with one untreated control strip.

Treatment by Hot and Cold Process : The other set of three strips dried in the sun,

Fig. 1



Treated and untreated strips buried half around a termite infested fence post

were heated in Agave extract to near boiling and then were allowed to cool for two hours to ambient room temperature, keeping the samples totally submerged in the Agave extract.

The samples were allowed to air dry for one day after treatment.

All the eight samples including two untreated controls were buried half in the ground around a termite infested untreated wooden fence post (Fig. 1).

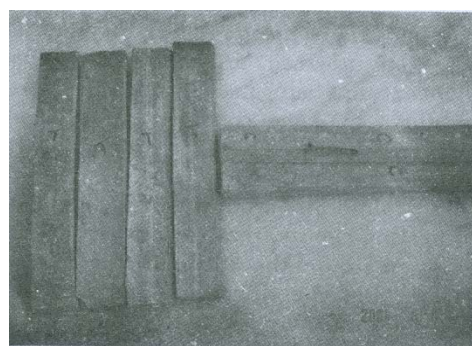
Results : While the wooden fence post showed vigorous attack by termites, the bamboo strips did not show any attack after 6 months. The control samples were partly attacked by termites. This indicates that the extract does possess some termite repellent/resistant properties (Fig. 2).

There was no difference in the performance of the two treatment methods adopted

(ii) *Termite Mound Test*

Two sets of samples were prepared

Fig. 2



Bamboo strips after 6 months ground burial. Untreated controls show mild termite attack.

for testing efficacy of Agave extract against termites in termite mounds as reported by Jain and Kumar (1991)

Treatment by Boiling : Samples numbering T₁ to T₅ (15 cm long and 2.5 cm wide) were boiled in water for two hours. The hot samples were immersed in cold Agave extract and allowed to cool overnight.

Treatment by Hot and Cold Process : Samples numbering T₆ to T₁₀ (15 cm long and 2.5 cm wide) were air dried and then treated by boiling in Agave extract for one hour and then allowed to cool for one hour.

The samples were installed in a termite mound near Rajpur (Dehra Dun) as per method developed for testing efficacy against termites (Jain and Kumar, 1991).

Results : The samples were removed in May 2006 after exposure in termite mounds for nearly 6 months. Only one set treated by hot and cold (one hour heating and one hour cooling) was retrieved. While the untreated control showed over 75% destruction, treated samples suffered 25-50% degradation.

The other set was removed after the monsoons in November. Only partly damaged three samples could be retrieved. One treated sample along with control were missing and were probably totally destroyed by termites.

Efficacy against Mould

Seven pieces of bamboo strips (15 cm long and 2.5 cm wide) were prepared from

a freshly felled bamboo (*Dendrocalamus strictus*). Five samples were given a dip in freshly extracted Agave extract. These along with two untreated controls were stored overnight while wrapped in a poly bag. All the samples showed covering by white mould the very next day. Further storage for about one month showed coverage by black mould and fungus. It appears that the extract has little potential for protection against mould and decay fungi.

Efficacy against Borers

Four pieces of bamboo strips having fresh borer holes (15 cm long and 2.5 cm wide) were treated with Agave extract by prolonged dipping overnight (16 hours). Existing borer holes were marked with a marker to ascertain fresh activity of borers on treated samples. They were stored in UBFDB office along with two untreated controls having borer holes (marked with a marker) to observe the borer activity. The experiment was carried out during swarming season for borers (October 7, 2005). No fresh borer attack was observed till end of November.

Conclusion

This preliminary investigation shows that Agave extract has potential for developing termite resistant formulations. Short-term studies to fix the dosage and treating schedules will help rural artisans to make use of this naturally available material. Studies to identify active components and their degree of activity are needed to develop standard formulations.

SUMMARY

Results of preliminary tests on efficacy of *Agave* spp. locally called 'Rambans' extract against bamboo inhabiting moulds, borers and termites are reported. Agave extract has been found to resist termite and borer attack in bamboo, but has been found ineffective in preventing growth of mould fungi.

Key words : Agave extract, Biocides, Preservation, Bamboo, Fungi & Insects.

बांसों पर एगेव निस्सार की जीवनाशी प्रभावकारिता पर एक टिप्पणी
एस०टी०एस० लेप्चा व सतीश कुमार
सारांश

इस अभिपत्र में बांसों पर लगने वाले छत्रकों, छिद्रकों और दीमकों के विरुद्ध एगेव की जातियों के जिन्हें यहां स्थानीय लोगों द्वारा रामबांस कहा जाता है, निस्सार की प्रभावकारिता पर किए गए प्रारम्भिक परीक्षणों के परिणाम सूचित किए गए हैं। एगेव का निस्सार दीमकों और छिद्रकों का बांसों में लगता रोकता पाया गया है परन्तु छत्रक कवकों की वृद्धि रोकपाने में यह प्रभावशाली रहता नहीं पाया गया।

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