PRELIMINARY STUDIES ON ANTITERMETIC PROPERTIES OF COMMON WOODS OF PAKISTAN AND THEIR EXTRACTIVES

Hanif Gul, M.I. Chaudhry, M. Farooq
and
Rahmatullah Jan*

Abstract

Studies on the natural resistance of common timbers of Pakistan against termites were initiated in the Pakistan Forest Institute, Peshawar under a PL–480 Project to obtain information valuable for more efficient utilization. For testing the natural resistance of woods, stakes of 25x4x4 cms size of *P. wallichiana*, A.B. Jackson *P. roxburghii*, Sargent *Platanus orientalis*, L. *Dalbergia sissoo* Roxb, *Melia azadarach*, L., *Salmalia malabarica* (D.C) Schott and Endlicher, *Acacia nilotica*, L. *Albizia lebbek*, (L). *Eucalyptus camaldulensis, Populus x euramericana, Juniperus excelsa* M.B. *Cedrus deodara* (Roxb Ex. Lanb) G. Don and *Morus indica* L. were installed in the termites activity areas in different ecological zones during 1985-86. Observations recorded revealed that *Platanus orientalis*, L. *Melia azadarach* Linn. and *Dalbergia sissoo* Roxb. out of the broad leaved species and *Cedrus deodara* (Roxb Ex. Lanb) G. Don in the coniferous timbers showed antitermitic properties at Peshawar, National Park Lal-Soharna (Bahawalpur) and Changa Manga so for.

Wood extractives of *Cedrus deodara* (Roxb Ex. Lanb) G. Don inner and outer wood portions, *Abies webbiana, Lindl., P. roxburghii*, Sargent inner and outer portion and Platanus orientalis. L. heart wood were extracted with Acetone solvent in the soxhelt apparatus. The laboratory trials of the wood extractives revealed that termites longevity was minimum in the *Platanus orientalis*, L. among the broad leaved tree species and *Cedrus deodara* Roxb Ex. Lanb and *P. roxburghii* Sargent from conifers while in *Abies webbiana* Lindl there was no significant difference in extractives and check (no treatments).

Introduction

Wood species commonly used as timbers in Pakistan are *Pinus wallichiana* A.B. Jackson *P. roxburghii* Sargent *Platanus orientalis* L. *Dalbergia sissoo* Roxb. *Melia azadarach* L. *Salmalia malabarica* (D.C.) Schott and Endlcher *Acacia nilotica, Albizia lebbek* (L). *Eucalyptus camaldulensis, P. x euramericana, Juniperus excelsa* M.B. *Cedrus deodara* (Boxb Ex. Lanb) G. Don and *Morus indica* L. The natural resistance of various timbers to termites has been an old subject but still information available about the all timbers of Pakistan is scanty. Work has been started in the Pakistan Forest Institute, Peshawar for determining the natural resistance of common woods and for evaluation of chemical extracts of woods for their termicidal effects.

*The authors are Systematic Entomologist, Director Entomology, Assistant Forest Chemist and Scientific Officer in the Pakistan Forest Institute, Peshawar respectively.

Review of Literature

Methods of testing natural termite resistance of timbers in the laboratory under controlled conditions of temperature and humidity have been developed by many workers. Pence (1957) worked in prolonged maintenance of termites in the laboratory. Hardy (1961) described quick laboratory method of determining the termite resistance of materials. Bampton et al (1966) tested 30 Nigerian timbers for their resistance to subterranean termites in the field for one year and Butterworth et al (1966) conducted laboratory trials with some Nigerian timbers for their resistance to termites. Williams (1973) evaluated field and laboratory methods for testing termite resistance of timbers and building materials in Ghana. Abramushkina (1973) and Panfilova (1973) have reported on the termite resistance trials in USSR. Tylor (1973) worked out termite resistance of wood plastic composites by exposing them to laboratory colonies. Kakaliev and Saparliev (1976) tested treated and untreated materials for termite resistance by three mothods. Placing of test materials on the surface above ground part of the nest attracted termites after 2-3 days while those placed on the soil around the nest or in the soil around the nest attracted termites after 15–20 days.

Carter and Smith 1974 reported feeding and survival responses of *Reticulitermes flavipes* to materials from 11 US coniferous timbers. Survival was generally high on all materials from five species and one source of *Thuja plicata* D. Don. No survival was observed on blocks and unextracted sawdust from four species and a second source of *T. plicata*. With *Pinus ponderosa* Laws survival varied on blocks and unextracted sawdust probably because the determintal was volatilized during the preparation of sawdust. Removal of the determintal substances from the five unfavourable wood was most efficient with successive extraction by pentane and AHW mixture.

Boal et al 1974 comparing survival of *Coptotermes formosanus* on unextracted sawdust, solvent extracted sawdust and extractives from 24 tropical hardwoods found no survival for 8 weeks on absorbent paperpads treated with extracts from 14 woods.

Rust and Reierson 1977 have reported that methanol extracts of least preferred woods were also least preferred when termites were confined to papers treated with their extracts. Carter et al 1979 found that success in extracting antitermitic substances varies with wood and solvents. Saeki et al 1970 have reported that the antitermitic activity of Inumaki wood (*Podocarpus macrophyllus*) is entirely dependent upon the presence of bisnorditerpenoid i.e., Inumarkilacton and its related compounds in the wood.

Saeki et al 1971 have studied the role of essential oil in resistance of coniferous woods to termite attack and have confirmed that the essential oil in various woods perform an important role against termite attack.

Akhtar and Jabben 1980 found maximum survival of *Odontotermes obesus* on solvent extracted sawdust of *Pinus wallichiana* and least survival for 3 hours on essential oil extract applied on blotting paper. Survival of *Coptotermes heimi* was also affected by *Bifiditermes beesoni* was least affected by essential oil of *P. wallichiana*.

Akhtar 1981 testing 3 wood species and their extracts described upperlayer extracts of *Cedrus deodara* toxic to *Bifidtermes beesoni* but minimum feeding on *Dalbergia sissoo* was attributed to its hardness and *P. wallichiana* was not found resistant to this termite.

Akhtar and Raja 1985 found *Albizzia procera* wood resistant to *Bifiditermes beesoni* and its extract in Chloroform Methanol greatly affecting the survival of this termite while its survival on wood and extract of *Bauhinia variegata* was not affected.

Material and Method

For natural resistance test of different wood species in the field stakes of 25x4x4 cms size of *Pinus wallichiana*, A.B. Jackson *Platanus orientalis* L. *Dalbergia sissoo* Roxb. *Melia azadarach* L. *Salmalia malabarica*, (D.C) Schott & Endlicher *Acacia nilotica, Albizia lebbeck*, G. (L). *Eucalyptus camaldulensis, Cedrus deodara* (Roxb Ex. Lanb) G. Don *Morus indica* L. and *Populus x-euramericana* were installed in the termites activity areas at Abbottabad, Bahawalpur, Change Manga, Faisalabad, Gilgit, Quetta, Sibbi and Shinkiari.

Wood extractives of *Cedrus deodara* (Roxb Ex. Lanb) G. Don *Abies webbiana*, Lindl *P. roxburghii* Sargent *Platanus orientalis* L. were extracted at the Chemistry Laboratory in the Pakistan Forest Institute, Peshwar. The wood was chopped with the help of electric sharp blade Wiley Mill. The saw dust of each wood was sieved through a sieve of 60–80 mesh per square inch and dried at room temperature. The moisture of the sample was determined below 100°C to avoid evaporation of volatile active ingredient. Petroleum ether and acetone were used as solvents separately. The wooden particles were soaked in solvent and boiled in soxhelt distillation apparatus of 1000 ml. and 500 ml. capacity.

For purpose of testing the efficacy of these extractives against termites experiments were laid out in the laboratory followed by field trials. The treatments replicated thrice were:

1. Extracted sawdust of the test wood species 5 gm in weight.
2. Unextracted sawdust of the test wood species 5 gm in weight.
3. Extractive treated semul wood block.
4. Solvent treated semul wood block.
5. Semul wood block (check) no treatments.

In the laboratory trials all these treatments were put in petridishes and then 50 workers of termites were released in each treatment. The trial was laid out on randomized block design with three replications of each treatment. All these treatments were put under controlled temperature of 25–27°C and 70–80% relative humidity, and observations on the longevity of termites in each treatment were recorded.

In the field trials laid out at the Pakistan Forest Institute, Peshawar all these treatments were put in earthen pits covered with tin plates for exposing them to termite population found in nature and noting their response to the extractives.

Results and Discussions:

A. *Wood Resistance Trials*:

Observations recorded on wood resistance trials revealed that among the 13 timbers species installed in three replications in the termites activities areas of the Pakistan Forest Institute, Peshawar, Changa Manga, C.D.A. Nursery, Islamabad, Agricultural Research Institute Seriab (Quetta) and Lal-Sohanra National Park (Bahawalpur) *Platanus orientails, Melia azadarach*, and *Dalbergia sissoo* out of the broad leaved species and *Cedrus deodara* from conifers at the Pakistan Forest Institute, Peshawar, National Park Lal-Sohanra and Changa Manga showed resistance against termites. While at Agricultural Research Centre, Seriab (Quetta) *Salmalia malabarica, Pinus wallichiana, Eucalyptus camaldulensis*, were found attacked by termites within four months of layout of the experiment.

B. *Extractive Trials*:

Observations recorded on the longevity in days of 50 termites workers in different treatments of wood extractives in laboratory are as follows:

Longevity of termite workers in various treatments of wood extractives in the laboratory under controlled temperature and humidity

Treatments	Replication			Mean
	1	2	3	
	Pinus roxburghii Sargent			
Extracted sawdust	13	10	14	12.3
Unextracted sawdust	2	11	2	5.00
Semul wood treated with Acetone	6	7	4	5.6
Semul wood treated with sapwood extractive	7	1	4	4.0
Semul wood treated with heartwood extractive	2	4	5	3.6
Check (No-treatment)	4	7	4	5.0
	Platanus orientalis L.			
Extracted sawdust	18	5	15	12.6
Unextracted sawdust	12	13	5	10.0
Semul wood treated with Acetone	12	5	12	9.6
Semul wood treated with extractive	2	4	4	3.3
Semul wood block as check.	13	9	4	9.6

Treatments	Replication			Mean
	1	2	3	
Abies webbiana Lindl.				
Heart wood extractive treated block	13	13	13	13
Acetone treated block	13	10	13	12
Chek	13	13	10	12
Extracted sawdust	15	13	12	13.3
Unextracted sawdust	13	14	13	13.3
Cedrus deodara (Rexb Ex. Lanb) G. Don.				
Unextracted sawdust	7	8	7	7.3
Extracted sawdust	12	6	7	8.3
Semul wood treated with Acetone.	10	10	11	10.3
Semul wood treated with sapwood extractive	7	8	9	8.0
Semul wood treated with heartwood extractive.	6	6	7	6.3
Check	11	12	6	9.6

Statistical analysis was done and F. test was applied to see the significance of treatments applied. On the basis of analysis, it was found that extracted dust treatments were significant for *Pinus roxburghii* and was found significantly different from check and other treatments at 5% level. In other three cases there was no significant difference between the treatments applied.

The data show that the longevity of termites was minimum of 3.3 days in the *Platanus orientalis* extractive treated block and 6.3 days in the *Cedrus deodara* heart wood extractive treated block while in case of *Abies webbiana* there was no significant difference in the extractive treated block and check no treatment.

In the field scale trial the wood extractive of *Dalbergia sissoo* and *Melia azadarach* were also included. Observations on field scale trials of wood extractives of *Cedrus deodara, Platanus orientalis. Abies webbiana, Pinus roxburghii, Dalbergia sissoo* and *Melia azadarach* laid out at the Pakistan Forest Institute, Peshawar revealed that among the broad leaved species only the (*Melia azadarach*) all the treatments exposed to natural population of termites were consumed except the wood extractive treated block and the unextracted saw dust.

In the conifers only in the *Pinus roxburghii* all the treatments were consumed except the sap and heartwood extractive treated blocks. The remaining extractives trials are in progress.

ACKNOWLEDGEMENT

The assistance received from Mr. Fazli Wahid Khan Forest Chemist Pakistan Forest Institute is gratefully acknowledged.

REFERENCES

Abramushkina, E.A. (1973). On the termite resistance of untreated and antiseptic treated wood. Review of Appl. Ento. Ser. A. 61(8): 771.

Akhtar, S.M. and M. Jabeen (1980). Natural resistance of *Pinus wallichiana* to termites. Proc. 1st Pakistan Congress Zool. B. pp. 245–249.

Akhtar, M.S. (1981). Feeding responses to wood and wood extracts by *Bifiditermes beesoni* Gardner (Isoptera Kalotermitidae) International Biodeterioration Bulletin ISSN 0020–6164 17(1).

Akhtar, M.S. and Zahoor Akhtar (1985). Survival and feeding responses of *Bifiditermes beesoni* (Gardner) to wood and wood extracts of *Albizzia procera* and *Bauhinia variegata* Pakistan J. Zool. 17(4): pp 363–367.

Bampton, S.S., D. Butterworth and B.S, Macnulty. (1966). Testing material for resistance to termite attack. Mater. Org. 1(3): 185.

Butterworth, D., D. Kay and B.S. Macnulty. (1966). Testing materials for resistance to termite attack iv. The resistance of some nigerian timbers to Cryptotermes hevilandi. Mater. 1(4): 257–269.

Beal, R.H., Carter, F.L. and Southwell, C.R. (1974). Survival and feeding of subterraneon termites on tropical woods. Forest Prod. J. 24(8): 44–48.

Carter, F.L. and Symthe, R.V. (1974). Feeding and survival responses of *Reticulitermes flavipes* (Kollar) to extractive of wood from 11 Coniferous genera. Helzforschung 28(2): 41–45.

Carter, F.L. Stringer, C.A. and Taras, M.A. (1979). Termiticidal properties of slash pine wood related to position in the tree. Wood Science 12(1): 46–51.

Hardy, I. (1961). A quick laboratory method of determining the termite resistance of materials. Beit. Zur. Ent. 11, pp. 546–556.

Kakaliev, K. and K. Saparliev. (1976). The development of a new method for the full scale testing of materials for termite resistance Izv. Akad. Navk. Turkm. Sar. Ser. Biol. Nauk. 4: 68–70.

Panfilova, A.L. (1973). Termite resistance of wood and polymeric materials. Review. Appl. Ent. Ser. A. 61(8): 77-78.

Pence, R.J. (1957). The prolonged maintenance of the Western sub-terranean termite in the laboratory with moisture gradient tubes. J. Ecen. Ent., 50, pp. 238–240.

Rust, K.M. and Reierson, D.A. (1977). Using wood extract the determine the feeding preferences of the western dry wood termites *Inoistermes minor* (Hogen) J. Chem. Ecol. 3: 391–399.

Saeki, I. Sumimote, M. and Konde, T. (1970). On the antitermetic substances from the wood of *Podocarpus macrophyllus* D. Don. Holzferschung, 24(3): 83–86.

Saeki, I., Sumimete, M. and Kondo, T., (1971). The role of essential oil in resistance of coniferous woods to termite attack. Holzferschung 25(2): 57–60.

Tyler, Jean, M. (1973). The termits resistance of wood plastic composites. Into. Biodeterior Bull 9(3): 75–78.

Williams, R.M.C. (1973). Evaluation of field and laboratory methods for testing termites resistance of timbers and building materials in Ghana, with relevant biological studies. Trop. Post. bull 3: 1–64.