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Traditional Knowledge on Termite Control in North Kerala, India and Their Preliminary Laboratory Screening

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Abstract Termites are one of the most destructive insect pests of buildings across the world. Though chemical termiticides are widely used for controlling termites, it has many limitations for indoor use. Thus, an attempt was made to collect the traditional knowledge on termite control in Northern Kerala, and to test out the promising methods in the laboratory. Thirty houses each were surveyed in three geographical areas- Highland, Midland and Coastal area. Questionnaire survey was done for collecting information on the control methods adopted or known by the homeowners. The study showed that all the 90 homeowners are aware of at least one traditional method of termite control and 54 among them attempted controlling the termites using any of such methods. Ten traditional control methods were selected for preliminary screening in the laboratory of which seven were disproved. The three materials that gave positive results included Kerosene (undiluted), salt solution (1:1 in water) and *Acrostichum aureum* (The Golden Leather Fern). But these results only have indicative value and requires further detailed studies to understand better. The scope of present study was limited to collection of traditional knowledge and their preliminary screening mainly to falsify the ineffective methods.

Keywords: *Acrostichum aureum, Building termites, Termite control, Traditional knowledge, kerosene*

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1. Introduction

Termites are a group of social insects belonging to the order Blattodea (Infra order: Isoptera). They play a very significant role in the ecosystem as an efficient decomposer. They are also one of the most destructive insect pests of buildings, crops and forests across the world. Several methods are being employed for controlling the termite attack by farmers and home owners worldwide. Mostly chemical insecticides with many known ill effects are used to overcome the issue. Use of locally available materials and methods for termite control is also a common practice in many areas of the Indian subcontinent since ages [1,2,3]. Such traditional knowledge has to be documented and tested scientifically for conservation of the knowledge and wider acceptance and use. Proving the efficacy of a traditional method would be a laborious task, but disproving the claim would be much easier. The present study is an attempt for collecting the traditional knowledge on termite control and their preliminary screening in the laboratory.

2. Methodology

2.1. Study Area

The survey on traditional knowledge was done in the two Northern Districts of the Kerala State viz. Kannur and Kasaragod. Kannur District is located within the geographical limits 11˚52'08" N latitude and 75˚21'20" E longitude and Kasaragod District is located within 11° 18' to 12° 48' N latitude and 74° 52' to 75° 26' E longitude. The whole area is geographically divided in to three zones – the Coastal area on the west, the Western Ghats on the east (Highland / hill area) and the Laterite plain (Midland / plane area) in between the two. The three areas differ in terms of altitude from sea level, soil type and wood materials used for building. The three areas were selected for survey, expecting a difference in the traditional knowledge mainly due to difference in the availability of plant materials.

2.2. Survey

Thirty houses each were selected at random from each area viz., Hill, Plain and Coastal area. Older houses with

more wooden structures were given preference in selection. Termite attack incidence and control methods adopted by the homeowners were recorded in detail with direct observation and questionnaire survey. Questions were specifically asked to check their awareness about the common traditional practices and materials on termite control along with the recording of other methods they know or practice.

2.3. Laboratory Screening of Promising Materials/Methods

The lab experiment was aimed at testing the efficacy of some of the common materials/methods which were suggested by the homeowners to have anti-termite effects. Ten materials were selected for laboratory evaluation based on availability of materials and convenience.

1. *Acrostichum aureum* (The Golden Leather Fern; Figure 1)
2. *Hyptis suaveolens* (The Pignut)
3. *Ocimum sanctum* (Tulsi)
4. *Gliricidia sepium* (Mexican Lilac)
5. *Vitex negundo* (Chinese Chaste Tree)
6. *Maranta arundinacea* (Arrow Root)
7. *Trigonella foenum-graecum* (Fenugreek)
8. *Curcuma longa* (Turmeric)
9. Salt
10. Kerosene

Figure 1. *Acrostichum aureum*

***Preparation of extracts and feeding material*:** All the materials were made into 5ml each concentrated liquid forms. Leaves of the first five materials were crushed and the extract was taken without adding water. Arrow Root tubers were also crushed to get the extract. Turmeric powder and salt were dissolved in distilled water (0.1g/ml) and the kerosene was taken undiluted. Extract of fenugreek was taken by keeping 2 grams in 10ml water for 12 hrs and by collecting the supernatant. All the solutions were taken in small beakers and labeled. Distilled water was used as control. Cardboard (brown, corrugated) pieces of size $1cm^2$ were cut and two pieces each were immersed for half an hour in the solutions prepared. Then the pieces were taken out, dried and used as the feeding material. The prediction to be tested was that, if the material has any antitermite property, termite will not feed and keep away from the cardboard treated with that material.

Collection of termites and screening: The termite species used for the screening was *Odontotermes obesus*, a common pest species of the study area. Termites and soil were collected from a mound of the species located in the campus of Payyanur College. Petri plates (10cm diameter) were labeled with the name of test material. The bottom of the plates were layered with 5gram mound soil and 30 termites (25 workers and 5 soldiers) were introduced to each plate carefully using a hand brush. The two cardboard pieces were kept in each plate without disturbing the termites (Figure 2). All the plates were kept in a large basin and maintained with adequate humidity. The activity of termites were observed at six hour interval and recorded. Percentage of the material fed by termites after 48 hrs was measured and recorded.

Figure 2. Experimental set up in laboratory

3. Results

3.1. Traditional Knowledge Documented

The type of material and method of use varied among the respondents in the survey. The methods suggested by homeowners are listed in Table 1.

All the 90 respondents in the survey were aware of one or other traditional method of termite control. Marked difference in the awareness could be recognized between the respondents of the three geographical regions. For example, the use of *Acrostichum aureum* was completely unknown for the homeowners of the hilly area. Among the total 90 homeowners surveyed, 54 actually attempted controlling termites with any one or more of the traditional methods (Hill area-16; Plain area-26, Coastal area-12). Highest number of attempts was recorded from the plain area and the most commonly employed control method was that with kerosene. Out of the 54 attempts, 45 employed kerosene.

Table 1. Traditional knowledge on termite control documented from the survey.

Sl. No	Material / plant	No. of response			Method of use and other details
		Hill	Plane	Coast	
1.	Kerosene	30	28	26	Direct application on affected area / wood – It was the most popular and most widely used method for instant result. It has limitation for indoor use.
2.	Black Oil (Used engine oil)	30	26	25	Painted on wood to prevent termite attack - usually followed as a preconstruction method. It has limitations as it affects the external appearance of wood.
3.	*Acrostichum aureum* (The Golden Leather Fern) - a mangrove fern	0	9	8	The leaves of this plant is spread over the wooden roof of ground floor (in ancient double storied houses) and plastered with mud over it. The wooden roof of ground floor is called 'mach' in Malayalam, and hence the plant is named 'Machinthoal' or 'Machila' in malayalam. This knowledge was available with most of the respondents in plain area.
4.	*Vitex negundo* (Chinese Chaste Tree)	1	4	0	Leaves and twigs are used – method same as that of *Acrostichum aurium*
5.	*Tectona grandis* (Teak)	0	5	0	Leaves are used – method same as that of *Acrostichum aurium*
6.	*Ochlandra* sp. (Reed Bamboo)	1	3	0	Leaves are used – method same as that of *Acrostichum aurium*
7.	*Trigonella foenum-graecum* (Fenugreek)	2	2	0	Extract of fenugreek seeds taken by keeping it overnight in water
8.	*Curcuma longa* (Turmeric)	2	1	0	Turmeric powder for infested wood and planting turmeric for protecting agriculture crops from termites.
9.	*Salt solution*	0	0	6	Pouring salt water in termite infested areas – reported from coastal area
10.	*Maranta arundinacea* (Arrow root)	2	1	0	Extract from Arrow root for termites in buildings and in agriculture, seedlings of arrowroot planted around crops which are susceptible to termite damage.
11.	*Hyptis suaveolens* (The Pignut)	0	3	0	Direct application of leaf extract
12.	*Ocimum sanctum* (Tulsi)	0	3	0	leaf extract and whole leaves
13.	*Gliricidia sepium* (Mexican Lilac)	0	2	1	leaf extract and whole leaves
14.	Lime powder	0	1	1	Powdering with lime on affected area

3.2. Laboratory Screening

From the laboratory testing, only three materials were found to have some effects on termites (Table 2). They were Kerosene, Salt and *Acrostichum aureum*. The cardboard pieces dipped in these materials/extracts were not approached by termites even after 48hours. In all the other 8 cases, including the control, the termites started their building activities and mud-plastering around the material as early as the second hour of observation itself. So, the possibility of the use of any of these materials against termites could be outrightly rejected. The effect of kerosene was as expected. But the effect of salt and *Acrostichum aureum* requires further testing and evaluation. Rather than proving the anti-termite properties of the materials, the aim of the experiment was to disprove the suggested efficacy of some of the materials. Since the data obtained were largely qualitative, no statistical analyses were done.

Table 2. Efficacy of the materials tested in laboratory screening

Sl No	Material	Percentage (volume) of cardboard fed at 48hrs
1	*Acrostichum aureum*	0
2	*Hyptis suaveolens*	22
3	*Ocimum sanctum*	8
4	*Gliricidia sepium*	24
5	*Vitex negundo*	13
6	*Maranta arundinacea*	15
7	*Trigonella foenum-graecum*	17
8	*Curcuma longa*	14
9	Salt	0
10	Kerosene	0
11	Control	21

4. Discussion

Many materials including plant products are mentioned in literature to have anti termite property. Apart from documenting the knowledge, attempts to falsify the claim would help to streamline our effort in search of a promising alternative to chemical termiticides. Around 1800 plants are known to contain phytochemicals, which are toxic or repellent to insects. However, only a few containing pyrethroids, rotenoids and alkaloids have been used commercially. Compounds isolated from some tree species such as 2-methyl anthroquinon from teak wood [4] and α-pinene present in the essential oil from the leaves of *Eucalyptus grandis* and *E. globulus* [5] are reported to repel termites. Treatment with oil and/or seeds of *Pongamia pinnata*, *Azadirachta indica*, *Ricinus communis* and *Swietenia macrophylla* are reported to reduce termite attack in bamboo poles [1]. An effective control of termites damaging crops and trees by using leaves of *Calotropis procera* and seed kernels of *Azadirachta indica* were reported from Rajasthan [6]. However, *neem kernel* when mixed with potting soil was found to be ineffective against subterranean termites attacking eucalyptus [7]. Many plant species such as whole plant of Aak (*Calotropis spp.*), leaves of Arusha (*Adhatoda vasica* Nees), latex/milk of Cactus (*Euphorbia neriifolia L.)*, Asafoetida (*Fernulla narthex*), Tulsi (*Ocimum sanctum*), etc have been used across Indian subcontinent to control termites [8]. Other plant materials like twig of *Aristolochia bracteata* and twig of *Solanum surattense*are also used against termites [2].

In general, it may be mentioned that the fast rate of degradability of the plant products in nature could be a drawback in terms of their applied value. Checking the

scientific validity of some of the common traditional knowledge available in the locality is of importance as it can save time, effort and expense of practicing an ineffective method. As in the present study, many of the methods may get disproved by simple experiments; though confirming the efficacy is not that simple.

Of the different traditional knowledge available, Kerosene was the most widely used, probably due to ready availability and instant effect. But its use inside the house is not much feasible due to fast evaporation. The other two promising materials – salt and *Acrostichum aureum* need further evaluation in lab and field.

5. Conclusion

Though many traditional knowledge are available for termite control, majority of them may get falsified in scientific validation. Out of the ten methods tested in the current study, only three showed promising results. The positive results are not foolproof, and it requires further tests for confirmation and practice. Much traditional knowledge is in practice for various issues faced by humans. Checking their claim through simple tests would help to streamline our research and minimise the wastage of time, effort and resources in practicing an ineffective method. Just like conservation of traditional knowledge, it is also important to test and discard those knowledge, which are baseless.

Conflict of Interest

We declare that there is no conflict of interests regarding this work.

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