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SHORT COMMUNICATION

First-off Reporting on Termite Infestation in Timber of *Artocarpus chama* Buch.-Ham.

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Abstract

An enormous number of commercial timbers are prone to parasites due to the exudates they possess and are worth protecting. These exudates could be responsible for both susceptibility and resistivity of plants towards diseases. In plants; they are stored into cavities or ducts and are referred as secretions.We observed that an assembly of enemies are lined up to attack only wood hand samples of *Artocarpus chama* and not any other tree species that were stored in Xylarium (DDw) – Forest Research Institute, Dehradun, Uttarakhand, India. On further investigation, *Microtermesobesi* Holmgren; a termite of insect group was identified from microscopic slides and appeared as the first ever reported woody termite on *Artocarpus chama.* Insect attack towards specific timber is attributed to its anatomical, biochemical and physiological features. The findings could be useful in wood seasoning and preservation of *Artocarpus chama* to maintain the durability of timber. A number of heartwood timbers exhibited resistance towards *Microtermes obesi*. Therefore, understanding natural insect durability of wood is critical for making sensible and wise use of wood.

Keywords: *Artocarpus chama,* Termite, Plant exudates, Cavity & ducts, Timber durability.

Introduction

The 'absence of locomotion' i.e., not able to move from one place to another is the major disadvantage of members of Kingdom "Plantae". Unlike animals, these creatures are not able to run away from their enemies (pathogens, parasites, predators etc.). Though, plants cannot change their place; they have developed a certain line of defense to maintain themselves in continuity of race. Secondary metabolites such as terpenes, phenols and alkaloids are the chief compounds of concern for plant resistant against diseases. They provide remarkable immunity to plants. But sometimes these exudates of plants can be a disease-causing factor. They may act as attractants to parasites. The present study deals with invasiveness of termite infestation in timber of *Artocarpus chama*. It furnishes the anatomical structure of *A. chama* as a cause for parasitic invasion. *A. chama* Buch. -Ham. also known as *Artocarpus chaplasha* Roxb. is a tall deciduous tree with an average height of 30-36 m and girth of 3-4 m (Raturi *et al*. 2001). It belongs to family Moraceae and is native to northeastern India, lower Myanmar and the Andaman and Nicobar Islands (Chowdhury *et al*. 2013). The distribution is extended in sub-Himalayan tract, Nepal, and other parts of East Asia (Flora of China 2012). A thorough review of literature explicitly revealed no parasite reporting on *A. chama* timber. The timber is commercially very important and is extensively used for ship building, dugouts, canoes, masts, and oars; for house building as beams, wall plates, scantlings doors, window frames and boarding; for furniture and carts and especially wheel wright's work and bodies, as frames, panels and footboards; for carving in Assam, and by the Ordnance Departments for general purposes and packing cases (Pearson and Brown 1932). Therefore, it is a sound timber species to be encouraged and worth planting and protecting. The study also reflects upon the natural durability of the heartwood of twenty-three Indian timbers against a specific termite which is essential for making practical and wise use of wood.

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Methods

The material for the study was availed from the store of Xylarium (DDw) – Forest Research Institute, Dehradun,

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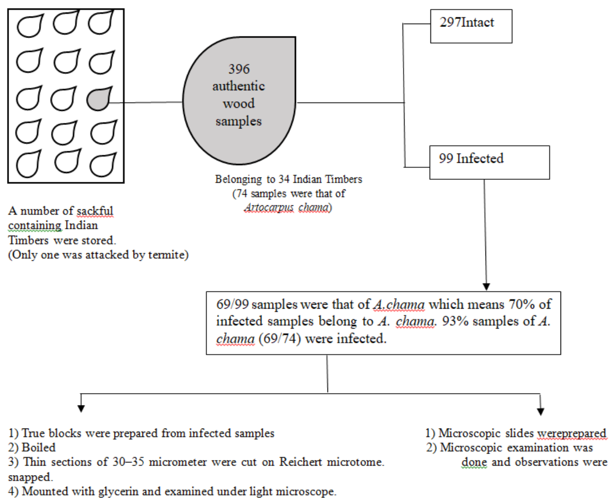


Figure 1: Outlined methodology followed in the present study

Uttarakhand, India. A large number of sackful containing authentic wood hand samples of Indian hardwoods and softwoods were stored and checked for their wellness. The coordinates of the storage site are 30° 20′ 27.4″ N and 77 ° 59′ 55.9′′ E. As only one sackful containing *A.chama* was found to be affected, it was further examined. The given table depicts thirty-four Indian timbers of same sackful containing a total 396 authentic wood hand samples out of which 99 were infected. There were 74 wood samples of *A. chama* out of which 69 samples were severely attacked by the Termite. Therefore, the 93% samples of *A. chama* were infected by the Termite. These infected samples of *A. chama* were taken as study material. The methodology followed is outlined through a flow chart (Figure 1).

Timber examination of wood samples

Infected wood samples of *A. chama* were studied to see if samples were those of heartwood or softwood. True blocks (rays perpendicular to tangential surface and parallel to radial surface) of 1 CM^3 were prepared from infected samples and then boiled to soften the tissue. For microscopic examination, 30-35 micrometer thick transverse section (TS), tangential longitudinal section (TLS) and radial longitudinal sections (RLS) were cut on Reichert microtome. Finally, these sections were temporarily mounted with glycerin and examined under light microscope. The photomicrographs of the sections were snapped using Carl Zeiss compound light microscope (Scope. A1. Axio) equipped with Carl Zeiss camera.

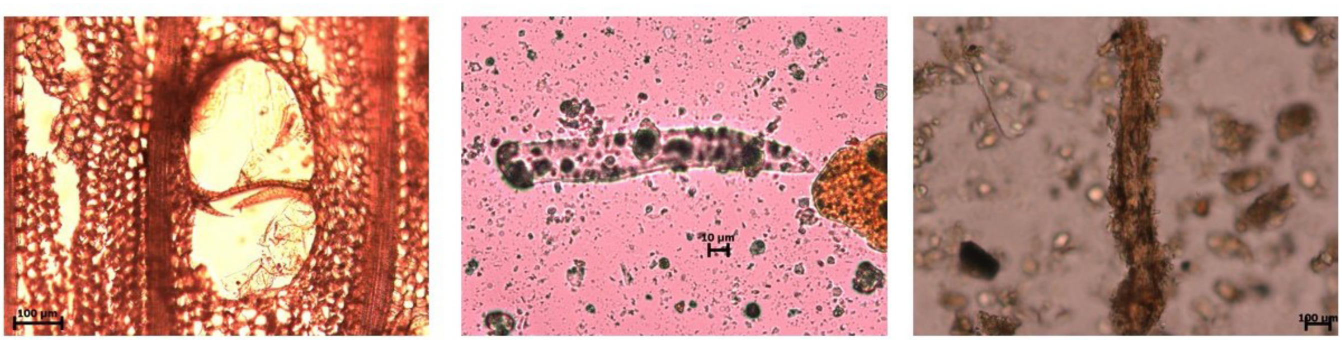
Insect identification

We failed to report the parasite on spot so the material for insect identification was obtained from the infected samples of *A.chama*. Microscopic slides were prepared from the mud covering wood samples (debris) and observations were snapped using Carl Zeiss (Scope.A1. Axio) compound light microscope.

Results and Discussion

We were intrigued with the observation of susceptibility of *A. chama* timber towards specific parasite. After going back and forth around each infected sample, we were able to observe remnants of insect's body. These body parts were snapped and used for identification. A few parts of the insect body were seen on tangential longitudinal section (TLS) of wood and hence indicate the minuteness of insect. The mandibles were small, thin, delicate, slightly incurved distally and pinkish in colour. Legs were few millimeters long. Head capsule was broadly oval (Figure 2 b,c). Therefore, observations were drawn down to the conclusion that it was *Microtermes obesi* of family Termitidae (Shanbhag and Sundararaj 2011) (R Harish and Ningthoujam 2011) that invaded wood samples of *Artocarpus chama. Microtermes obesi* has wide range of hosts varying from germinating wheat seedlings, ripening wheat and maize seedling and tea growing areas of Barak valley of southern Assam (Singha *et al*. 2011). Host range of trees include *Dalbergia sisso, Gmelina arborea, Mangifera indica, Pterocarpus marsupium, Shorea robusta, Tectona grandis* and *Terminalia alata* (Sen-Sharma *et al*. 1975). The termite is distributed in Bangladesh, India, Myanmar, Pakistan and Thailand (APPPC 1987).

To investigate the cause behind invasiveness of parasite on *A. chama* wood samples, we went down deep to study the



a b c

Figure 2: a. Wood microstructure of *A. chama* showing tyloses (10x) b. Incurved mandibles (40x) c. Oval head capsule (5x)

Table 1: Enlisting the wood hand samples (total, infected and intact) of tree species stored in a common sackful.

S.No	*Name of tree species*	*No. of total samples*	*Infected samples*	*Intact samples*
1	*Anogeissus pendula*	10	0	10
2	*Anthocephalus chinensis*	77	10	67
3	*Anthocephalus indicus*	8	1	7
4	*Antidesma diandrum*	21	0	21
5	*Aphanamixis polystachya*	55	3	52
6	*Aporosa roxburghii*	9	0	9
7	*Aquilaria agalocha*	3	1	2
8	*Araucaria bidwilli*	19	2	17
9	*Araucaria cookie*	11	7	4
10	*Artocarpus chama*	74	69	5
11	*Artocarpus heterophylla*	14	0	14
12	*Artocarpus hirusta*	1	0	1
13	*Artocarpus integrifolia*	3	0	3
14	*Artocarpus lakoocha*	1	0	1
15	*Aspoidosperma desmanthum*	1	0	1
16	*Atalantia missionis*	5	0	5
17	*Atalantia monophylla*	1	0	1
18	*Avicennia officinalis*	22	0	22
19	*Avicennia alba*	13	0	13
20	*Avicennia marina*	3	0	3
21	*Bassia butyracea*	2	0	2
22	*Bassia longifolia*	6	0	6
23	*Bauhinia anguina*	1	0	1
24	*Bauhinia purpurea*	5	1	4
25	*Bauhinia racemose*	3	2	1
26	*Bauhinia retusa*	3	1	2
27	*Bauhinia variegate*	3	0	3
28	*Beilschmiedia argentina*	7	2	5
29	*Beilschmiedia gammieana*	1	0	1
30	*Beilschmiedia roxburghiana*	1	0	1
31	*Beilschmiedia sikkimensis*	5	0	5
32	*Cupressus torulosa*	1	0	1
33	*Fagraea fragrans*	6	0	6
34	*Fagraea racemose*	1	0	1
	TOTAL	396	99	297

anatomical features of samples to check if the insect attack could be attributed to sapwood as sapwood may contain moisture or chemicals suitable for parasitic growth. Also, anatomical features postulate the physiological behaviors of trees. From transverse section (TS) and transverse longitudinal section (TLS), tyloses were clearly reported (Figure 2a) and it becomes evident that wood samples were that of heartwood and not that of sapwood. Therefore, insect attack could not be attributed to sapwood. It has been reported that the ray flecks and radial latex ducts are present only in *A. chama* (Singh *et al*. 2017). These features are characteristic to *A. chama* wood as they are absent in other studied *Artocarpus* species viz., *A. heterophyllus*, *A. lakoocha* and *A. nitidus*; In the same study, most ample proportion of vessels (30%); hence tyloses and least abundant proportion of parenchyma (12%) were also observed in *A. chama* among the four species. We could not clearly notify these features because samples were badly infected and hollow. Though, the vessel occlusions such as tyloses and gums are meant for playing a crucial role in limiting spread of pathogens and wood decaying organisms (De Micco *et al*. 2016); in the present communication, they might have served as an attractant for the termite therefore questions their role. We observed that the infestation to wood samples begin from the side where samples were marked for identification. A true wooden block reveals the radial entry of parasite inside the wood tissue which must be for latex as food for insect from radial ducts of *A. chama*. From the table it could be seen that even after the availability of sufficient food (77 samples of *Anthocephalus chinensis*; 55 samples of *Aphanamixis polystachya;* 22 samples of *Avicennia officinalis* and 21 samples of *Antidesma diandrum*), insect invaded only wood samples of *A. chama*. We regret to be not able to study the bioactive compounds of *A. chama* wood which would have emphasized the causal attack. Bioactive studies on leaves of *A. chama*; crude methanol extracts revealed mild to moderate antimicrobial activity (Chowdhury *et al*. 2013) therefore, sturdily provision the present study. Resistance towards termite's attack by other species of *Artocarpus*; especially *A. heterophyllus* is ascribed to the termicidal activity shown due to Artocarpin drug produced by the heart wood of *A. heterophylla* (Chan *et al*. 2018). A thorough review of literature has explicitly revealed no parasite reporting on *A. chama* timber and hence the observation is claimed as the first–off reporting. There is no online published literature available on this. A single publication which we were able to find is in the form of a book accessed in departmental library of Wood Anatomy Discipline, Forest Research Institute, Dehradun, India mentioning two termite species i.e., *Microtermes obesi* and *Microtermes pakistanicus* infecting stumps of *A. chama* (Sen-Sharma *et al*. 1975). Therefore, the present study is consistent with former study and confirms *Microtermes obesi* as a serious termite of *A. chama* timber. The findings are helpful in processing and seasoning of timber to maintain the durability. The observations have also implications in main taining biological diversity of *A. chama* against the reported termite.

The given table (Table 1) depicts the susceptibility and resistivity of thirty-four Indian timbers out of which twenty-

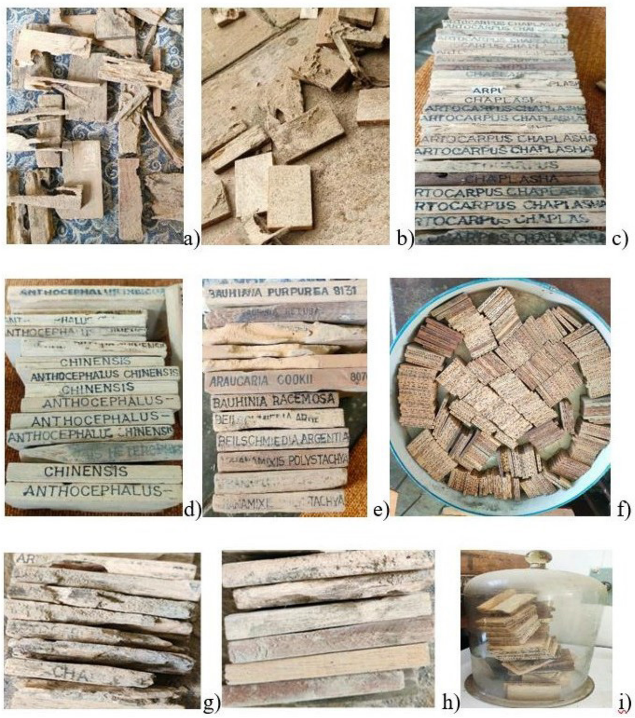


Figure 3 (a-i): (a),(b), Samples destroyed by termites c. Affected samples of Artocarpus chaplasha. d, e. Other affected Plant species f. Intact samples kept for fumigation g. Affected (marked) side of the samples h. Back side of the pic g, i.– Fumigating destroyed samples.

three are resistant to *Microtermes obesi* as none of their wood samples were infected and indicated with a zero in the given table. This illustrates the natural durability of twenty-three Indian timbers against *Microtermes obesi*. We did not study infected wood samples other than *A*. *chama* because a few samples were infected and sufficient number of infected samples were not available to derive a conclusion about them. So, it could not be predicted that ten timber species other than *A*. *chama* were infected with *Microtermes obesi* or by some other species of termite.

Conclusion

Thus, we come to the conclusion that due to characteristic anatomical feature, biochemistry and physiology of *A*. *chama*, insect invaded specific timber. It was secretion of radial latex ducts, ray flecks and abundance of vessel proportion (hence tyloses) in *A*. *chama* and not the ink of marker that served as an attractant for the parasite. Further more, the timber showed susceptibility toward insectas other tree species sharing the same sackful under similar environmental conditions were not invaded by the parasite. Other three species of *Artocarpus* viz., *A. heterophyllus*, *A. lakoocha* and *A. nitidus* are resistant to *Microtermes obesi* which must be due to the exudates such as Artocarpin they possess. Heartwood of a number of timber species exhibited** considerable resistance to termite attack and is ascribed to their anatomical and biochemical properties. As a result, understanding natural termite resistance of wood is critical for making sensible and wise use of wood. The samples of the sackful were graded. Infected samples were separated and cleaned. All the samples of attacked sackful (intact and infected) were fumigated with carbon disulfide (CS_2) for further storage. The data related is tabulated and picturized (Figure 3).

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References

APPPC. (1987). Insect pests of economic significance affecting major crops of the countries in Asia and the Pacific region. Technical Document No. 135. Bangkok, Thailand: Regional Office for Asia and the Pacific region (RAPA)

Chan EWC, Wong SK, Tangah J and Chan H T (2018). Chemistry and Pharmacology of Artocarpin: An Isoprenyl Flavone from *Artocarpus* Species. *Systematic Review of Pharmacy*, **9(1):** 58–63. DOI : 10.5530/srp.2018.1.12

Chowdhury F, Pal S, Sharmin T, Rashid RB, Sikder MAA, Kabir S, Rahman MS and Rashid MA (2013). Bioactivities of *Artocarpus chama*Roxb. and *Bougainvillea spectabillis* Willd. *Bangladesh J. Pharmacol*, **16(1):** 63–68. DOI:10.3329/BPJ.V16I1.14493

De Micco V, Balzano A, Wheeler EA and Baas P (2016). Tyloses and gums: a review of structure, function and occurrence of vessel occlusions. *IAWA Journal*,**37(2):** 186–205. DOI 10.1163/22941932-20160130

Flora of China (2012). http://www.floracafe.com/Search_PhotoDetails.aspx?Pho to=Top&Id=270

Pearson RS and Brown HP (1932). Commercial Timbers of India. Volume II, Commonwealth Forestry Association, Dehradun, 939 p.

Harish R and Ningthoujam K (2011). Morphological analysis of population samples of termite soldier castes in mid-hills of Meghalaya. *Indian Journal of Hill Farming,***34(1):** 100–108.

Raturi RD, Chauhan L, Gupta S and Rao RV (2001). Indian Woods – Their identification, properties and uses. Volume VI, Dehradun, Director Forest Research Institute, 64–65 p.

Sen-Sarma PK, Thakur ML, Misra SC and Gupta BK (1975). Wood Destroying Termites of India. F.R.I. Publication, Dehradun, 44, 60 p.

Shanbhag RR and Sundararaj R (2011). An identification guide to the wood destroying termites of south India. *J. Indian Acad. Wood Sci*, **8(2):** 148–151. DOI:10.1007/s13196-012-0028-9

Singh MK, Sharma CL and Sharma M (2017). Comparative wood anatomy of four *Artocarpus* Species of North East India with reference to their identification. In *Wood is Good,* Springer. 73–81.DOI:10.1007/978-981-10-3115-1_8

Singha D, Singha B and Dutta BK (2011). Potential of *Metarhiziumanisopliae* and *Beauveria bassiana*in the control of tea termite *Microtermesobesi*Holmgren in vitro and under field conditions. *J. Pest Sci,* **84:** 69–75. DOI:10.1007/s10340-010-0328-z