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Obeche (*Triplochiton scleroxylon* K. Schum.): poor products development wood but good environmental tree in Nigeria

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ABSTRACT

Obeche (*Triplochiton scleroxylon* K. Schum.) is a large tropical tree, the wood products of which are either in solid or reconstituted forms. These items are extremely vulnerable to concomitant insect attack. Although established as a successful plantation species for veneering and plywood production, Obeche is also considered as a good environmental tree in Nigeria. However, there is very little specific information that substantiates this potential. We report on the organisms inducing biodeterioration of Obeche wood products and describe the characteristics of Obeche trees in terms of environmental suitability between 2012 and 2016. All the 47 Obeche wood-based products (OWBPs) studied, comprising 12 beehives, 10 food canteen stalls, 10 office tables, 10 laboratory cabinets and 5 office walls were economically and dominantly co-infested by beetles and termites. Interestingly, during the four-year observation period, all the eight Obeche trees encountered were found to exhibit high stability with excellent resistance to hollowness and to degradative pests, even at around 2 m Diameter at Breast Height (DBH). This reflects its robust biophysical protective barrier mechanisms. Additionally, there were observations of enhanced coexistence with other tree species, including shrubs and grasses. This indicates a tolerance potential role at improving the relative contributions of several species (plants community) to ameliorate tropical environmental degradation.

Keywords: Ecophysiology, environmental services, organisms inducing biodeterioration, Sterculiaceae, *Triplochiton scleroxylon*, co-infestations

1. INTRODUCTION

Obeche, *Triplochiton scleroxylon* (Family: Sterculiaceae) also known as *Arere* (Yoruba, Nigeria) is an environmentally and economically important African tropical tree and it was a successful plantation tree species in Nigeria. Obeche has moderately adequate broad leaf structure and specialty stem characters such as self pruned cylindrical bole of 30 m [1], good anchorage buttress of 6 m and trunk diameter of 1.5 m [2]. The timber is naturally widely distributed in its range with recognized three sections: from Sierra Leone to Togo, from the Benin Republic to Nigeria and from Cameroun to Zaire [1].



Figure 1. Pests infested *Delonix regia* damaging the University of Port Harcourt fence.

Traditionally, Obeche parts have few uses, including its young leaves as forgone draw-based soup in Nigeria [3, 4]. Obeche is one of the key indigenous species specially planted in Nigeria for industrial plywood productions. Hence its wood found wider usefulness in interior joinery, lining of drawers and cupboard and in plywood manufacture where it is used as core veneers [5, 6]. The wood also found application in beekeeping but the hives are highly vulnerable to attack by beetles, termites and ants [7, 8].

Environmental services of trees are no doubt having unquantifiable global notability benefits but the choice of many trees may limit their potential. The calamity resulting from the use of introduced species as urban tree in Nigeria is impacting both direct and crossing-over effects. The pressing need of trees for environmental quality restoration and improvement is a global goal, and good candidate character is in its highly adaptability and resistance to degrading agents [9, 10]. Most of the exotic (*Casuarina equisetifolia* L., *Terminalia mantaly* H. Perrier, *Eucalyptus camaldulensis* Dehnh., *Polyalthia longifolia* var.

pendular etc) and few indigenous (*Delonix regia* (Hook.) Raf., *Khaya* spp.) trees used for environmental amelioration have been observed to be highly prone to combine pests attack, human inclusive. It can generally be considered in Nigeria that pests are a major source of tree losses in human dwelling environments with many causing economic damage to property as in case of Figure 1. Obeche is a successful long-lived tropical organism native to Africa and regrettably, exploration of its success for environmental uses in Nigeria has been grossly ignored. While the uses of Obeche wood have been widely intensified [5, 6, 11-13], little attention has been paid to the potential ecological uses of Obeche tree. This study aimed at filling this gap by substantiating *T. scleroxylon* potential as top environmental tree for restoring and improving tropical environmental conditions.

2. MATERIALS AND METHODS

2. 1. The study area

The study was carried out in Southern Nigeria within the University of Port Harcourt (UNIPORT) (Latitudes 4° 53' 53" and 4° 54' 34" N, Longitudes 6° 53' 50" and 6° 55' 13" E), and University of Ibadan (UI) (Latitudes 7° 25' and 7° 27' N, and longitudes 3° 52' and 3° 54' E). The area is a mixed habitat comprising diversity of introduced and indigenous trees. The climate in this region is tropical humid type with rainfall ranging between 1250 and 2400 mm [14, 15]. The soil type is however diversified ranging between Precambrian Basement Complex in UI [16], and Coastal Plain of the Eastern Niger Delta in UNIPORT [17]. UNIPORT land area is originally around 400 hectares [8] but, about 50% of the land has been encroached by host communities [18]. In UNIPORT, a few native tree species such as *Alstonia boonei* De Wild., and *Musanga cecropioides* R. Br. were scantily retained as environmental trees while massive Obeche wood-based products (OWBPs) are under services. UI study land area covers about 586.19 hectares from over 1,032 hectares of land and diversity of native tree species including *Triplochiton scleroxylon* was retained.

2. 2. Methods

The study involved the assessment of OWBPs and trees for pests' infestations in Southern Nigeria for four years (2012 - 2016). The yearly observational schedule was bi-monthly once. Using a purposive sampling approach, UNIPORT and UI, Nigeria were covered through surveys (measurement and observations were made). The Universities were selected based on the availability of data: Obeche wood-based products (UNIPORT) and the life trees (UI). During each observation schedule, organisms inducing biodeterioration, including their evidences such as frass, tunnels, plastering mound, and cavity were noted and recorded. The potential of *T. scleroxylon* as good environmental trees were adjudged by their non susceptibility to degradative agents.

3. RESULTS AND DISCUSSION

3. 1. *Triplochiton scleroxylon* as poor products servicing wood

The infestations of OWBPs by ants, beetles and termites, as shown in Table 1, and Figures 2 and 3 indicate that Obeche wood is extremely susceptible to varying insects' attacks

under indoor and outdoor utilisation conditions. In this empirical observational study, all the OWBPs assessed were attacked but level of severity differed and the pests encountered fall into three groups of insects: ants, beetles and termites.

Table 1. Susceptibility of Obeche wood products to pest insects.

S/N	Forms of wood	Uses	Pest insects	Present conditions
1	Solid wood	Beehives (12)	Ants, beetles, termites	91.7% replaced
		Food canteen stalls (10)	Beetles, termites	100% under service but heavily damaged
2	Reconstituted form (plywood)	Tables (10)	Beetles, termites	100% replaced
		Laboratory cabinets (10)	Beetles, termites	100% under service but lightly attacked
		Office Walls (5)	Beetles, termites	100% under service but moderately attacked

The variation in the level of severity of attack was likely the difference in age and hazard exposure conditions. Those products exposed to external (outdoor) conditions were more severely attacked by ants-beetles-termites combination probably due to the influence of weathering and edaphic factors. Previously, over 51 pest insects which attacked logs and lumbers of *T. scleroxylon* in Nigeria and Ghana have been documented [19-25].

Highly diversified pest insects (50) of *T. scleroxylon* dead/felled wood products in Nigeria reported by Roberts [26], Ashiru [23], Mbah and Chagbe [25] couple with this study results indicate Obeche as poor source of wood for products development. According to AWWPA [27], timber with failure, heavily, moderately, and lightly attack by termites is classified as 0, 4, 7, and 9 resistance classes, respectively. As can be seen in Table 1, and more importantly in Figures 2 and 3, OWBPs levels of attacks fit in well into mostly failure category as 91.7% and 100% of hives and office tables, respectively have been replaced without salvage value.

Although, the costs and ages of all the OWBPs could not be determined but 91.7% (representing 11 hives) of beehives constructed costing ₦71,500 (about US\$230) at the beginning of the study in 2012 were lost to combined ants-beetles-termites attack within four years. In the last 8 decades, it was estimated that one of OWBPs degradative agents, lyctid beetles caused huge economic loss of approximately \$17, 600,000 per annum in the United State and the level of wood destructiveness was adjudged second only to that of termites [28]. While beetles and termites are known as aggressive consumers of wood, the additional impacts of cavity created by ants for shelter in the hives were remarkable.



Figure 2. Honeybee's Hive (A) and food canteen stall (B) attacked by carpenter ants and powder post beetles, respectively.

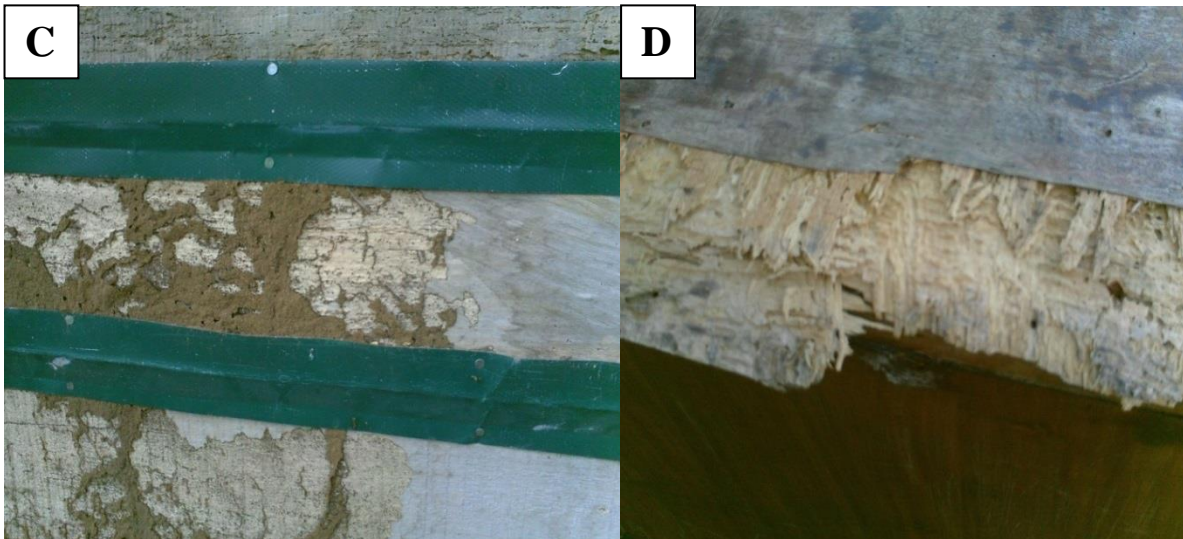


Figure 3. Food canteen stall (C) and plywood made office table (D) attacked by termites and powder post beetles, respectively

3. 2. *Triplochiton scleroxylon* as top quality environmental servicing tree

Figures 4 and 5 showed the stability and resistance of Obeche tree to degradative agents, including fungi. In addition, there were observations of enhanced coexistence with other tree species, including shrubs and grasses reflecting a tolerance potential role at improving the relative contributions of several species (plants community) to environmental amelioration. Eight stands of Obeche tree recorded showed highly firmness and resistance to wind, insects and fungi degradation in the over 68-year-old UI even with the largest DBH of 1.86 m. These outstanding characters are of environmental conservation importance and could be attributed to robustness of its biophysical barrier mechanisms. In the last 7 decades as discussed above, the causal organisms of Obeche wood degradation have been widely studied, with research focusing on the roles of insects.

However, little attention is paid to Obeche and its usefulness for the functionality as quality tree for environmental restoration in Nigeria. While durable wood trees like *Milicia excels* (Welw.) C. Berg., *Anogeissus leiocarpus* (DC.) Guill. & Perr., *Khaya grandifoliola* (Welw.) CDC were found vulnerable to hollowness. To the best of our knowledge and past exploratory indigenous/empirical field research, we have not come across a hollowed Obeche tree in Nigeria. Obeche, being a white wood tree, its indigenous white wood category such as *Vitex doniana* Sweet, *Ceiba pentandra* (L.) Gaertn., *Ficus mucoso* Welw. ex Ficalho, *Funtumia elastica* (Preuss) Stapf were found to be highly vulnerable to hollowness even at lower DBH.

The non-vulnerability of Obeche to hollowness reflects its potential attribute as top quality for long term environmental conservation purposes. Though, the leaves were not assessed for defoliation because of their heights but trees exhibited moderately crown structure. Previous studies in Nigeria and Ghana have reported occasional defoliation by *Anaphe venata* Butler 1878 [26, 29-31) but none extending to extensive outbreaks due to the high degree of species diversity and narrowness of insect host range [24]. Obeche bark unlike *Khayas*, *Alstonia boonei* is of no known high medicinal benefits to man, a probable cause that would have created artificial openings for pest's development is a good property of controlling human induced pest situation.

At nursery stage, Ashiru [23] reported few pests and diseases but recently Siaw et al. [32] documented *T. scleroxylon* excellent (100%) survival compared to 33% of *Terminalia superba* Engl. & Diels., indicating its good standing to maturity. There were observations of enhanced coexistence with other tree species including shrubs and grasses indicating a tolerance potential role at improving the relative contributions of several species (plants community) to ameliorate tropical environments. Obviously, the closeness of highly decayed *Holarrhena floribunda* (G. Don) T. Durand & Schinz to Obeche (Figure 5) without the influence of decay on the Obeche tree, was a reflection of its antifungal potentiality while living.

Imbrasia epimetha, the defoliator (edible insect) has been a major pest of *H. floribunda* [33] and its incidence found attacking the tree on yearly basis in the month of August/September during the study without attacking closed Obeche is a further reflection of its quality for long term use for environmental conservation. Overall, the standing value of *T. scleroxylon* should be appreciated as this study recognised that the principal utility potential of the tree lie in its life stands which are of great importance to environmental conservation.



Figure 4. Sound *T. scleroxylon* of 1.86 m DBH

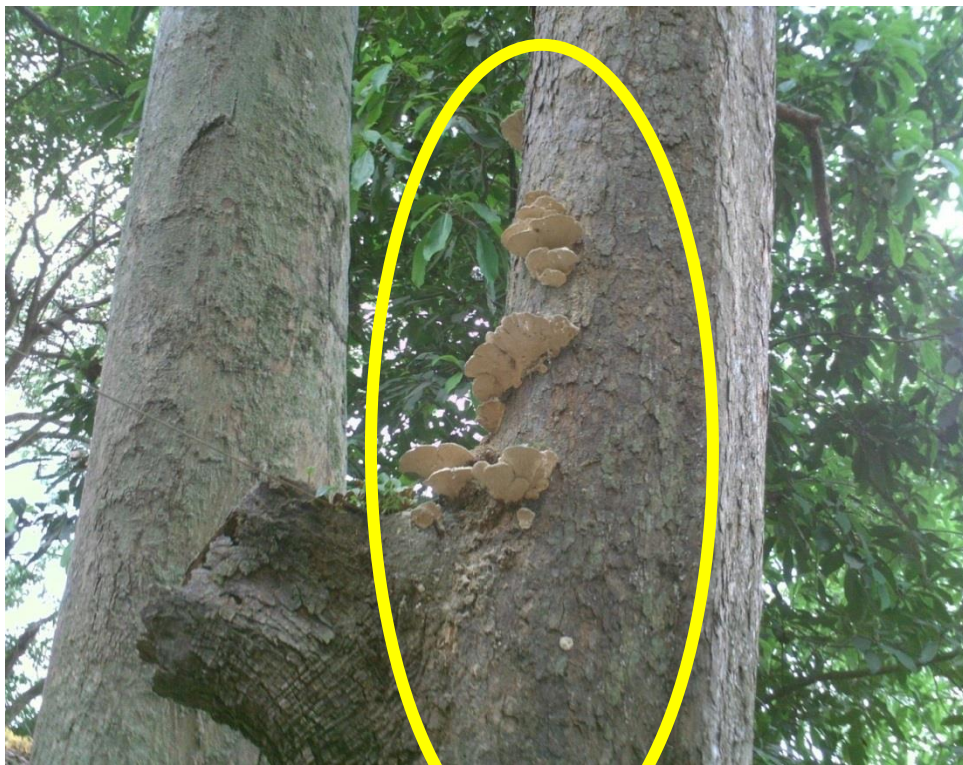


Figure 5. Sound *Triplochiton scleroxylon*, and fungi decayed *Holarrhena floribunda* closely standing

4. CONCLUSIONS

This study confirmed that degradative agents attack heavily on Obeche when used as wood products but revealed little attack when used as environmental tree in Nigeria. Trees like Obeche having excellent characters of long term standing without succumbing to degradative agents is a reflection of greater potential in its life stands than its wood products being extremely susceptible to pest insects. Obeche has provided us with competitive edge against many exotic and indigenous species being used in Nigeria. It has a moderate crown structure and self-pruned capability in its trunk and these meet the basic objective of pruning. Its long trunk and resistance to degradative agents including wind was found to be useful in protection of storey and bungalow buildings in the study area. Problems of tree declining can be eliminated while ex situ domestication in environmental forestry systems should be facilitated through propagation and the use of adaptable native trees. Obeche tree have long since been called “giant” among the tree species in the Western region of Nigeria and it is a common proverbial expression taken from Yoruba folkloric mythology that “*Araba Tun Ra Mu Odo N Gbarere*” (literarily means when giant has fallen: what do we do?). *Araba* (*Ceiba pentandra* (L.) Gaertn.) is also a giant but it is extremely vulnerable to many degradative agents while standing or dead. The myth of Obeche (*Arere*, Yoruba) in this proverbial expression remained unexplained. It is interesting to know that *Arere* in this context is referring to tree and not wood. The results of this study therefore to a large extent might be enough convincing observational evidences to ascertain the truism of this ethno-proverbial expression about Obeche tree. Further study should be conducted on the chemistry of Obeche green stem bark and exudates (sap etc) to ascertain the protectiveness (natural resistance) of Obeche against degradative agents while living

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