

Incidence and Severity of Termites Infestations on *Azadirachta indica* A. Juss. Used as Avenue Trees in University of Port Harcourt, Nigeria

¹Adedeji, G. A., ²Emerhi, E. A. And ¹Nyenke, E

¹Department of Forestry and Wildlife Management, University of Port Harcourt, Nigeria

²Department of Forestry and Wildlife, Delta State University, Asaba, Nigeria

Abstract: Termites are economic pest of both wood under services and standing trees, which have become routine burden of research and responsibility globally. Much research progress has been largely concentrated on woods under services with little attention given to standing trees; however, few literatures have reported the infestations of standing trees by termites in Sub-Saharan Africa. Therefore, the incidence and severity of termites' infestations on *Azadirachta indica* used as avenue trees in University of Port Harcourt (UNIPORT) from Delta axis road to Ofrima/Senate roundabout was investigated between July and October, 2014 using field surveys and observations. Survey showed that 62 trees or 29.8% of the 208 trees studied were infested by termites. 21 (10.1%) were severely infested, 11 (5.3%) were more severely infested while 30 (14.4%) were most severely infested. *Amitermes evuncifer* Silvestri was the dominant termite species observed in all the 62 infested trees while 4 trees were co-infested by *Macrotermes bellicosus* Smeathman. The ability of the trees to ameliorate and support the university population has been hindered and most of trees represent potential sources of hazard. The result indicated that *Azadirachta indica* could not sustain the expected environmental service functions of avenue trees over time.

Keywords: Avenue trees, burden, environmental services, infestation, Port Harcourt

I. Introduction

Termites are important factor of forest and its associated ecosystems including micro human-modified environments, contributing immensely to soil formation, and fertility through cellulosic biomass degradation processes. Woods under services provide structures for humans and their degradation by termites has become human's routine burden. On the other hand, standing trees provide complex structures and ensure biosecurity of human environments and their infestations by termites are less care for. Though, few estimates of the national burden of wood degradation by termites have been reported but largely geared towards woods under services [1-6]. While Africa is recognized as region with the highest distinct diversity of termites globally [7], characterization of termites' species in Nigeria, being the giant of the region has not been fully explored and reported. Termites are renowned for utilizing ligno-cellulosic materials for nutrition. However, they showed special preference for woods among the cellulosic materials as diet. This could be attributed to stable bulk density of biomass in woods. Hence, woods remain the principal foraging items globally. Termites' infestations studies and responsibilities have become increasingly more concentrated on wood under services. In Nigeria, information on the extent of infestations by termites to both wood under service and standing trees are scanty. More importantly, little is known about the infestations of ornamental live trees by termites.

Neem (*Azadirachta indica* A. Juss.) locally known as Dongoyaro is one of the popular tree species grown for landscaping purposes in Nigeria. Despite the pyramid of its parts antimicrobial and insecticidal properties reported, Neem was reported to be vulnerable to fungus (*Ganoderma lucidum*) attack which caused more than 40% mortality of *Azadirachta indica* used as avenue trees in the University of Port Harcourt, Nigeria [8]. Recently, termites were observed as distinct secondary contributing factor to decline of the avenue trees. The extent of termites' infestations and their contributing impacts are of great importance to the decline of the trees. Surprisingly, considering the wide range of environment services rendered by woody ornamentals in human immediate environments, few researches have been reported on the causes of ornamental trees decline in Nigeria. Therefore, the study was undertaken to record the severity of termites' infestations and their impact on the increasing decline of the *A. indica* used as avenue trees in the University of Port Harcourt, Nigeria.

II. Materials And Method

The study area, tree species and data collection

The study was carried out from Delta axis main road to Ofrima/Senate roundabout (Latitude 40 54' 6.14'' and 40 54' 23.26''N and longitude 60 54' 24.63'' and 60 55' 8.98'' E) between July and August, 2014 within the University of Port Harcourt. The University is located on a land area of about 400 hectares in

Obio/Akpor Local Government Area of Rivers State. The area is tropical climate in Mangrove/swamp freshwater forest zone characterized with two seasons, the dry season (November to March) and wet season (April to October). The rainfall distribution is nearly all year round though its intensity is seasonal and variable. The monthly mean maximum temperature ranges from 28°C to 33°C while the monthly minimum temperature ranges from 17°C to 24°C [9].

Azadirachta indica A. Juss. locally known as Dongoyaro is one of the important indigenous cultivated Meliaceae family trees used for landscaping purposes especially avenue trees in UNIPORT, Nigeria. The age of the studied avenue trees was 36 years and the two rows of the trees were spaced 7m apart with attainment of Diameter at Breast Height (DBH) range between 40.90cm and 73.18cm. Incidence and severity of termites' infestations study was carried out from Delta axis main road to Ofirima/Senate roundabout between July and October, 2014.

The survey and observations covered the incidence of termites on the roots, stems and crowns of 208 trees. The visual assessment scoring scale (table 1 and fig.1) of termites' infestations severity following the method of reference [10] used for insect infestation on date palm was adopted with slight modification. While the termites' species identification characteristics following the method of reference [11] were employed to identify infesting termites' species.

Table 1: Infestation scoring scale

Class	Severity of infestations
1	No infestation
2	Severely infested
3	More Severely infested
4	Most Severely infested

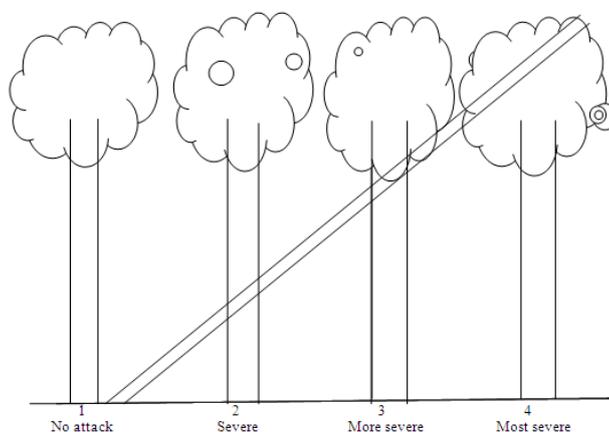


Fig. 1: Diagrammatic representation of termites' infestations severity scoring scale on the trees

III. Results

Incidence and severity of termite's infestation

Termites infestations of 62 trees or 29.8% of the 208 trees studied, the most severely infested had greatest frequency, followed by severely infested and more severely infested (table 2). Generally, all the non-infested trees were at the degrading stage of their growth.

Table 2: Severity frequency of termite's infestation

Severity of infestation	Frequency	Relative frequency (%)
No infestation	146	70.2
Severely infested	21	10.1
More Severely infested	11	5.3
Most Severely infested	30	14.4
Total	208	100

Source: Authors field work, 2014

Identified termites species

Two species of termites belonging to two genera (Amiteritinae and Macrotermitinae) were found infesting the studied trees. *Amitermes evucifer* Silvestri was dominant found in all infested trees (62), while *Macrotermes bellicosus* Smeathman co-infested four (4) trees as represented in Fig. 2.

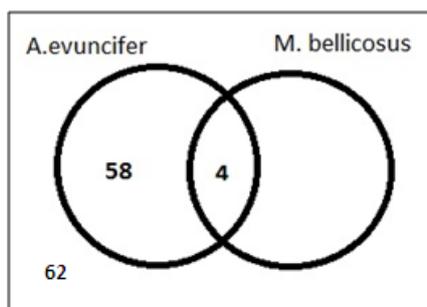


Fig. 2: Venn diagram showing frequency of infestation by two species of termites.



Fig. 3: *Amitermes evucifer* infested heartwood.



Fig. 4: Plastering of the tree stem by *Amitermes evucifer*.

IV. Discussion

This study delineated the severity of termites infestation on *A. indica* used as avenue trees in the University of Port Harcourt. The two species of termites were attracted to degrading, weakened and dying trees. This implied that the termites were secondary pest but apparently appeared to be contributing factor to the decline of the trees. The infestation indicator in the trees was closely related to their age and manifestation of primary pest infection. The contributing accompanied termites infestations effect obviously resulted to decline in trees with more abundant of the termites in the study area. Evidences abound to indicate annual loss basis of this tree species to infestations. Reference [8] documented 212 live trees at the end of the year 2013. And this study surveyed 208 live trees using the same study area and species between July and October, 2014 showing annual loss of 4 trees. Termites especially *Amitermes evucifer* distinctly infested the dead parts of the trees through soil inter-phase mostly stem bark followed by heartwood (Fig. 3) and dead branches while the activities of *Macrotermes bellicosus* were restricted to some damp parts of the species stems not beyond half. This showed that *A. evucifer* was strictly drywood forager. This corroborated the assertions of [11] and [12] that *Amitermes* spp. are drywood feeders. However, this study showed that *M. bellicosus* was more of dampwood feeder than dry wood. The result of severity levels of termites' infestations in this study indicated the closeness of 62 of the 208 trees to death. The most severely infested trees (30) were closest, followed by 11 and 21 trees to death. The extent of plastering (Fig. 4) and tunneling around the whole trees trunks was the most common indicator of severe termites infestations recorded. All the infested trees had cracked dead stem bark. Stem bark infestations status corresponded remarkably to the degree of upper trees branches decline.

A total of 62 *A. indica* trees (29.8%) were confirmed to be obviously infested by *A. evucifer*, as indicated by the presence of black tunnels on the trunks and black soil covers/nests around the stem to the crown. While a total of 4 trees were co-infested by *M. bellicosus* as indicated by the presence of brownish tunnels around the stem only. The dominant frequency of *A. evucifer* in this study corroborated the importance of the species as main drywood degrader in Port Harcourt, Nigeria [12]. This was likely due to their abundance and feeding level or requirement. *A. evucifer* nests were built in contact with opened heartwood, bark along the

stem and crown branches. This flexibility nesting characteristic was probably due to their body size, meeting feeding requirement and survival strategy. Several small nests of *A. evucifer* around and along the trees' stems to the crown were indications of secondary colonies. The activities of *A. evucifer* suggested they were completely dependent on the trees for nutrition and nesting. The activities of *M. bellicosus* on the other hand suggested that they sparingly utilized the trees for nutrition. Therefore, this result further confirmed *A. evucifer* as an outstanding economic important pest of drywood wood in Port Harcourt. Termites' infestations being secondary, their impact was considered to be causing fast decline of weakened or degrading trees.

V. Conclusion

Considerable numbers of *A. indica* used as avenue trees were infested mainly by *A. evucifer*. Infestations of dead parts of the degrading/weakened trees were closely related to the termites feeding level or requirement. Based on the result of severity level of termites' infestations, 30 trees were predicted to be lost in the nearest future, followed by 11 and 21 trees. Trees termites' infestations problems are complex and not limited to a specific ornamental wood species. In the light of this, termite management strategies should be initiated and implemented on existing ornamental trees to halt further damages on the trees. It is also recommended that systematic replacement of the existing vulnerable trees with less vulnerable ones to avoid possible ecological and economic losses due to termites' attacks should be carried out.

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