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Editor's Note

This is the first time we are releasing a second number of the same volume of the African Journal of Sustainable Development (AJSD) since2011.This issue contains 14 papers of researches conducted in Africa. As usual, the papers cover various aspects of sustainable development practice including health, education, infrastructure, administration, environmental science, and natural resources. The Journal can also be accessed via http://www.ajol.info/index. php/ajsd.

Like previous editions, we received many manuscripts, both solicited and unsolicited. Some of the papers in this issue were presented at the fourth annual Ibadan Sustainable Development Summit (ISDS) held in August, 2013. The review process was thorough and all contributors were involved.

We like to thank the contributors for the opportunity to share their research work on sustainable development issues through the AJSD. To our reviewers, collaborators and patrons, especially the financial support of the John D. and Catherine MacArthur Foundation, we say THANK YOU.

We implore you to look forward to the Special Issue of AJSD Volume 4 Number 3 which will be released later in the year. The Special Issue will be published in collaboration with the University of Tokyo Graduate Programme in Sustainability Science Global Leadership Initiative (GPSS-GLI) (http://www.sustainability.k.u-tokyo.ac.jp/) and the Next Generation Researchers (NGRs) of the global network.

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Comparative Assessment of Pathological Condition of Selected Mahogany Trees

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Abstract

Sustainability of mahogany trees have been threatened by the pandemic of fungal diseases, but variation exists in the level of occurrence of the diseases among the trees. Thus, diagnosing the level of susceptibility of mahogany to the diseases will be the first step to ameliorating the impact of the diseases on the trees' abundance. This study comparatively investigated the pathological status of selected mahogany trees (*Khaya senegalensis* and *Entandrophragma cylindricum*. Diseased samples of the tree species were collected from a mahogany forest located in Ijebu-Ode, Ogun State, Nigeria. Data were collected through laboratory analysis of the samples and statistically analyzed with the use of ANOVA and t-test at $\alpha_{0.05}$. Result shows that *E. cylindricum* is more susceptible to fungal attack by collectotrichum (66.67%), aspergillus (22.22%) and fusarium (18.51%). While in *K. senegalensis*, the frequency of occurrence (FOC) of the diseases were 62.96%, 14.81% and 14.81% respectively. There was however, no significant different in the FOC of the two species. But on utility, it is better to adhere to *K. senegalensis*:it has less pathological weakness.

Keywords: Tree collectotrichum, frequency of occurrence (FOC), mahogany fusarium

Introduction

One of the major ways to attain sustainable development is through environmental sustainability (Hasna, 2007). According to World Bank (2013), the forest is a key pillar of sustainable development. However, sustainable environment is incomplete without the health of forests components. It has been well established that our forests, both the planted and naturally existed ones are fast vanishing as a result of potentially damaging agents such as fire, disease, insects, etc. Study has shown that trees in mahogany family are not exempted from the targets of these damaging agents (Ikotun, 2011)

The name mahogany refers to timber of the genus Swietenia (True mahogany) (Lim *et al.*, 2008), but related species with similar properties include the genera *Khaya, Entandrophragma Cedrela, Lovoa, Toona, and Chukrasia* (Lim *et al.*, 2008). These trees belong to the family Swietenioideae and Meliaceae, and are all prone to various kinds of tree diseases (Lim *et al.*, 2008). These trees are distributed throughout the tropics and exhibit high degree of within morphological variability because inter-fertile closely related members give rise to hybrids (Lim *et al.*, 2008).

Khaya is a genus of seven species of trees in the mahogany family Meliaceae, native to tropical Africa and Madagascar. All species become big trees 30-35m tall, rarely 45m, with over 1m trunk diameter and often with buttress at the base. The leaves are pinnate, with 4-6 pairs of leaflets and absent terminal leaflet. Each leaflet is 10-15cm long abruptly rounded toward the apex but often with an acuminate tip. The leaves can be either deciduous or evergreen depending on the species. The flowers are produced in loose inflorescences, each flower is small, with four or five yellowish petals and ten stamens. The fruit is a globose, four or five-valved capsule 5-8cm diameter, containing numerous winged seeds.

The timber of *Khaya senegalensis* is called African mahogany, the only timber widely accepted as mahogany besides that of the true mahogany, of the genus *Swietenia* (Joffe, 2007). In West Africa, Fulani herdsmen prune the tree during the dry season to feed their cattle. In addition, the bark of *K. senegalensis* is often harvested from natural populations as well as plantations and used to treat many diseases.

The seeds of *K. senegalensis* have an oil content of 52.5%, consisting of 21% palmitic acid, 10% stearic acid, 65% oleic acid and 4% "unidentifiable acid" (Joffe, 2007).

Entandrophragma is a genus of eleven species of deciduous trees in the mahogany family Meliaceae, restricted to tropical Africa. At least some of the species attain large sizes, reaching 40-50m tall in height and exceptionally 60m tall with 2m trunk diameter. The leaves are pinnate, with 5-9 pairs of leaflets, each leaflet 8-10cm long with an acuminate tip. The flowers are produced in loose inflorescences, each flower in small with five yellowish petals, about 2mm long and ten stamens. The fruit is a five-valved capsule containing numerous winged seeds.

The timber of a few species is well-known. These are traded under separate names and can be used more or less like mahogany, with that of *Entandrophragma cylindricum* perhaps closest to a mahogany-type wood. Most tropical trees; both the indigenous and exotic are vulnerable to the pandemic of diseases (Ikotun, 2011). But, the extent of vulnerability varies among trees families, genus as well as within trees of the same species (Singh, 1983). Studies abound in the aspect of diseases affecting trees (Singh, 1983; Ginting and Maryono, 2007; Diana *et al.*, 2009; Jones *et al.*, 2011; Owoyemi *et al.*, 2012) however, none has been able to stringently compare the variability in their susceptibility to diseases. Consequently, this has undoubtedly limited decision making by forest managers on what species to plant, method of tending operation as well as preventive and control measures to be used for disease infected trees (Nwoboshi, 1985).

With the present trend of log exploitation almost surpassing the rate of afforestation and reforestation, there is imminent wood shortage which can only be prevented by improved forest protection and conservation to ensure that maximum benefit is derived from every wood fibre (FAO, 2010). Hence, to protect the health of African mahogany trees in Nigeria, it is important to identify existing and potential disease issues and prepare for their control. This study is therefore designed to assess and compare the pathological condition of *K. senegalensis* and *E. cylindricum* trees with a view to identifying their level of resistance to diseases.

Methodology

Diseased leaf samples of *K. senegalensis* and *E. cylindricum* were collected from a mixed forest plantation located at Ijebu-Ode, in Ogun State, Nigeria. Pathological evaluation of the collected samples was carried out at the pathology laboratory of the Department of Crop Protection and Environmental Biology, University of Ibadan.

Fungal culturing medium was prepared according to Ginting and Maryono (2007) by dissolving 3.9g of the PDA powder in 100ml of distilled water in a conical flask. This was sterilized at a pressure of 1.5kg/cm² and temperature of 120°C for 15 minutes using autoclave. The sterilized solution was then allowed to cool and 15ml of the solution was poured into 9cm diameter Petri-dishes. After the solution has been solidified in each of the plates, 2mm x 2mm sections of the infected leaves were cut, surface sterilized, inoculated and incubated at room temperature (28±2°C). Observation were made daily for emergence of colonies after which sub-culturing was done to obtain pure culture of the fungal isolates.

Identification of the isolates was carried out using a standard method (Pelcar and Chan, 1977). The features of each fungal isolate were carefully observed and recorded. Wet mounts of each isolate were prepared, observed under a microscope and detailed structural features of each isolate were recorded. Frequency of occurrence (FOC) of the isolates from each tree species were also recorded and subjected to analysis of variance (ANOVA) and t-test.

Results and Discussion

Fungal diseases identified from the collected pathogen materials for this study include *Fusarium equisetii*, *Aspergillus niger* and *Colletotrichum lindemutheanum* (Table 1). In *K. senegalensis*, collectotrichum had the highest FOC (62.96%). This was followed by aspergillus (22.22%) and fusarium (14.81%). In the same vein, FOC of collectotrichum happened to be the highest (66.67%) in *E. cylindricum*. Next to collectotrichum was fusarium (14.81%) and aspergillus (14.81%). The result may be attributed to the fact that collectotrichum infection permeates through almost any plant surface, but in susceptible herbaceous species such as strawberry and anemone, the crown with its relatively humid microclimate is more infected (Cook, 1993). On the other hand, infection of fusarium and aspergillus permeates only

surface that encourages their growth. The result of this study agrees with that of Singh (1983), who submitted collectotrichum as the most common pathogen associated with leaf spot diseases in *Jatropha curcas*. Similar result was also obtained by Ginting and Maryono (2007) and Diana *et al.* (2009). They discovered in their study that there was a significant variation in the FOC of leaf spot diseases in *J. curcas*.

Table 1: Fungal diseases Identified in the assessed trees

	Average frequency of occurrence FOC (%)			
Tree species	Fusarium	Aspergillus	Collectotrichum	SEM
K. senegalensis	14.81	14.81	62.96	8.28
E. cylindricum	18.52	22.22	66.67	8.68

The result of analysis of variance (Table 2) revealed that there is a significant difference ($p<0.05$) between the FOC of the diseases.

Table 2: ANOVA result for FOC among Fungal diseases

Species	SV	DF	MS	F	p-level
K. senegalensis	Treatment (Fungi)	2	2016.5	13.364	0.006*
	Error	6	150.89		
	Total	8			
E. cylindricum	Treatment (Fungi)	2	2510.3	36.6	0.000*
	Error	6	68.587		
	Total	8			

*= *significant at p=0.05*

Follow-up test with least significant difference (LSD) shows that occurrence of fusarium is not significantly different from aspergillus, but the occurrence of fusarium and aspergillus are both significantly different from collectotrichum (Table 3).

Table 3: Least Significant Difference (LSD) for FOC between Fungal diseases

Fungi	*K. senegalensis*	*E. cylindricum*
Fusarium	14.81ᵃ	18.52ᵃ
Aspergillus	14.81ᵃ	22.22ᵃ
Collectotrichum	62.96ᵇ	66.67ᵇ

FOC with the same superscripts at the same column are not significantly different at p= 0.05

Comparing the level of susceptibility of the tree species to fungal attack, *E. cylindricum* is more susceptible to fusarium, aspergillus and collectotrichum than *K. senegalensis* (Figure 1). In *E. cylindricum*, collectotrichum infected 66.67% of the samples, aspergillus, 22.22% and fusarium 18.51% of total infections. Similarly, in *K. senegalensis*, collectotrichum was also more predominant (62.96% of the sample) than aspergillus and fusarium, which had equal occurrence of 14.81% of total infections. It therefore implies that *E. cylindricum* provides a more suitable growth substrate for these fungal diseases compared to *K. senegalensis*. According to Narayanasamy (2011), fungal pathogens induce symptoms, the severity of which may vary depending on the levels of resistance/susceptibility of the host species, environmental factors and virulence (aggressiveness) of the pathogen.

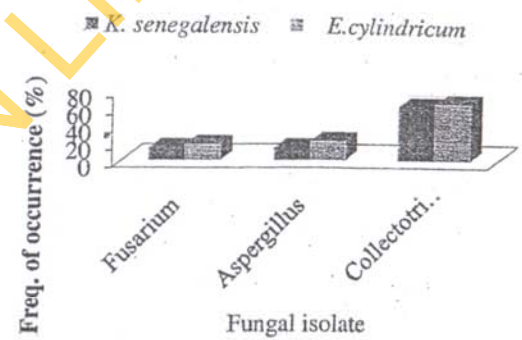

Figure 1: Frequency of occurrence of fungal isolate based on tree species

T-test indicated that the difference in the disease infestation between the tree species was not significant (p>0.05). The insignificant difference observed in the FOC may be attributed to the two tree species belonging to the same family of Meliaceae. This is because trees of the same family in some cases respond similarly to the environmental effect (see table 4).

Table 4: T-test result for FOC of Fungi based on species

Fungal Isolate	T-value	df	p-level
Fusarium	0.707	4	0.519ⁿˢ
Aspergillus	1.00	4	0.374ⁿˢ
Collectotrichum	0.316	4	0.768ⁿˢ

ns= not significant at p=0.05

Conclusion

The study revealed that both *K. senegalensis and E. cylindricum* are suceptible to fusarium, aspergillus and collectotrichum and that there is variation in the occurrence of these fungal diseases.

It was equally observed that *K. senegalensis* has more resistivity to the identified fungal diseases compared to *E. cylindricum*. Howevere, further study is needed to establish this fact more, in as much that the study is preliminary. In these guides, it is therefore pathologically advisable to go for *K. senegalensis* if a large scale production or utilization of either of the two species is to be considered.

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