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# Fusarium Damping-off of two Timber Species (*Terminalia Ivorensis A.*Chev *and Nauclea Diderrichii* De Wild and Th.Dur) in the Nursery (Pp. 252-260)

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**Abstract**

*The incidence of the damping–off disease of two timber species Terminalia ivorensis and Nauclea diderrichii sown in ground granite, sharp river sand, topsoil and sawdust was assessed at the nursery site of the Department of Forestry and Wildlife Management, University of Port Harcourt. The experiment was laid out in a completely randomised design replicated three times. Fusarium oxysporum was implicated as the causal agent of the disease. Terminalia ivorensis was not susceptible to Fusarium damping-off in the study. A significant effect (P<0.05) was observed in top soil which recorded the highest disease incidence in Nauclea diderrichii. Saw dust showed 0% disease incidence and supported the highest plant growth in both*

*species. The results give an insight into possible management of Fusarium damping-off at the nursery using cultural method of control.*

**Key words:** *Fusarium oxysporum, Terminalia ivorensis, Nauclea diderrichii,* sowing media, disease incidence.

**Introduction**

Terminalia ivorensis (A. Chev) and Nauclea diderrichii (De Wild and Thur) which belong to the families Combretaceae and Rubiaceae respectively are both important timber species in Nigeria. The trees can attain heights of 40-50m and girth of 5m. The branches are whorled in young shoots and foliage (Keay, 1989). Both species can be used for construction and other wood-based purposes. They could also serve as reforestation and afforestation species for the devastated forest ecosystem.

Sustainable artificial regeneration of these species for large scale plantation development has become necessary especially in the Niger Delta regions where oil exploration has led to serious deforestation of these timber species. Pathogens have also been regarded as agents responsible for the specific dynamics of natural forest communities (Dinnor and Eshed, 1984; Van der Kamp, 1991; Dickman, 1992 and Haack and Byler, 1993) and they have not received the desired attention at the landscape level (Heinselman, 1973 and Foster and Boose, 1992). With so much emphasis today on ecosystem management and maintenance of natural disturbance regimes, the role of pathogens deserves careful scrutiny. Numerous diseases attack these forest species both in the nurseries and in the field (Bakshi et al., 1972; Maramorosch et al., 1982 and Rehill and Sen-Sarma, 1982). Damping-off is the most common disease that affects the seeds, germinants and young seedlings, (Huang and Kuhlman, 1990 and Pandey *et al.,* 1990), thus hampering seed propagation in the nursery. This is caused mainly by soil-borne pathogenic fungi among which *Fusarium* species (Blomberg, 1981; Lori et al., 1999 and Jones and Averre, 2000), *Rhizoctonia* sp, *Sclerotium rolfsii* and *Macrophomina phaseolina* (Jones and Averre, 2000) have been considered particularly damaging under warmer and drier conditions. These organisms invade young seedlings leading to heavy losses and general physiological alternations of the seedlings, resulting in root decay and rotten stems at the base. Affected plants show water soaking at ground level causing the seedlings to fall over and die.

Several nurseries have experienced problems with damping-off and root rot diseases either from infected seeds (Lori et al., 1999) or the sowing media used in seed propagation. Thus the aim of this investigation was to determine the best sowing medium or media for the nursery development of *Terminalia ivorensis* and *Nauclea diderrichii* and also identifies the fungal pathogen responsible for the damping-off disease in the nursery in Port Harcourt area.

**Materials and Methods**

The study was conducted at the nursery site of the Department of Forestry and Wildlife Management, University of Port Harcourt, Port Harcourt, Nigeria. Port Harcourt is located on latitude $4^0$ 38'N and longitude $6^0$ 31'E. The rainfall pattern is bimodal with peaks in June and September. Relative humidity is about 90% at optimum level, while average temperature range is between $25^0$C to $35^0$C.

Five hundred treated seeds each of *Terminalia ivorensis* and *Nauclea diderrichii* dried to 18% moisture content were collected from the seed bank of the Forestry Research Institute of Nigeria (FRIN), Ibadan and used for the experiment.

The experiment was conducted between March and September of the 2007 cropping season. Four sowing media namely; ground granite, sharp river sand, topsoil (rich in organic matter) and saw dust were employed in the investigation. The experiment had three replicates in a completely randomised design (CRD). Twelve germination trays were each filled with each of the four media namely ground granite, sharp river sand, topsoil and sawdust, for each of the species. 40 seeds were broadcast per tray, giving a total 480 seeds per species. The trays were watered regularly under high humidity propagators.

Germination counts were done four weeks after sowing. Disease development was assessed eight weeks after seedling emergence, when the secondary leaves (needles) were formed. This was done by assessing the number of collapsed seedlings. Vertical sections of collapsed seedlings were made using flame sterilized scalpels and examined using hand lens. Percentage disease incidence was calculated using the formula below:

$$\% \text{ incidence} = \frac{\text{No. of collapsed seedlings}}{\text{Total no. of germinated seedlings}} \times \frac{100}{1}$$

Growth parameters such as the plant height and stem collar diameter were also assessed 12 weeks after seedling emergence. Data was subjected to one-way analysis of variance (ANOVA) and significant differences among means were determined using least significant differences.

Infected plant materials brought back from the nursery were washed, cut into 5mm segments including margin of infection. The segments were surface sterilized with 0.5% sodium hypochlorite solution and rinsed in three changes of sterile water. The segments were separately dried in between sheets of sterile filter paper and plated (3 pieces/plate) on fresh potato dextrose agar (PDA) medium impregnated with streptomycin and incubated at $28^0$C for 7 days during which the fungi growing out of the sections were isolated. The isolates were purified; pathogenicity tests and Koch's postulates were carried out.

**Results**

*Fusarium oxysporum* was implicated as the causal agent of the damping-off of *Nauclea didrrichii*. No slimy viscous drops were observed when stem cuttings were placed in water. This excluded *Pseudomonas sp* as the causative organism of the condition (Bailey, 1966 and Osuinde and Ikediugwu, 1996). The pathogenicity test confirmed *Fusarium oxysporum* as responsible for the damping-off disease of the species under investigation. Extensive damage was observed to be caused on the roots. However *Terminalia ivorensis* showed no signs of infection. This is the first report of *Fusarium* associated with damping-off of *Nauclea diderrichii* in the area.
Table 1 shows disease incidence in *T. Ivorensis* which was 0% in all the sowing media. *N. Diderrichii* had significant difference ($P<0.05$) among treatments. Topsoil medium recorded the highest incidence and sawdust had the least incidence.

Sharp river sand and ground granite had disease incidence that was not significantly different ($P<0.05$) from one another (Table 1). The effect due to topsoil was significantly different ($P<0.05$) from the other treatments.

Table 2 shows the effect of the various media on plant height. *T. ivorensis* in sawdust (45.34cm) and in topsoil (42.21cm) showed no significant differences ($P>0.05$) but these were significantly different ($P<0.05$) from those in ground granite (35.24cm) and sharp river sand (35.1cm) which were not significantly different ($P>0.05$) (Table 2). Plant height of *N. diderrichii* in sawdust (27.7cm) was more pronounced than heights on other media showing significant difference ($P<0.05$) from them. Collar diameter

measurement results are presented in Table 3. *The diameters on T. ivorensis* on sawdust (5.36mm) and topsoil (5.21mm) were similar and were significantly different (P<0.05) from those in sharp river sand (4.46mm) and ground granite (4.43) which were similar to one another. Plant height of *N. diderrichii* in sawdust was significantly different (P<0.05) from all other media.

**Discussion**

Fungal pathogens play an important role in the infection and loss of seedlings during propagation in the nursery (Moody, 1993 and Mc Clelland and Smith, 1993). *Nauclea diderrichii* seedlings were girdled at the base, collapsed and died after few days. This shows that *Fusarium* damping-off is a serious disease of the species and pose an obstacle to its large scale production in the nursery *Terminalia ivorensis* seedlings showed no visible signs of infection throughout the study, suggesting that the timber species may have been resistant to the *Fusarium oxysporum* isolate associated with the sowing media, but this may not imply resistant to other *Fusarium* isolates or other damping-off pathogens. There existed a relationship between the sowing media and the level of growth of the seedlings as evident in both the plant height and the collar diameter. The study reveals that the various sowing media influenced the overall performance of the seedlings in the nursery. The ability of sawdust to undergo biodegradation for nutrient supply may have made it the best medium for nursery development, thus an important factor to be considered in regeneration. Poor performance of *N. diderrichii* could be attributed to the effect *Fusarium* had on the seedlings. This finding gives credence the observation of Lori and Salerno, (2002), that *Fusarium* species constitute serious growth problems in the production of seedlings for afforestation programmes. Similar findings have also been reported by Jamaludin (1980) on forest species like *Diospyrous melanoxylon*, *Pinus caribaea*, *Pinus wallichiana* and *Tectona grandis*. El-lakany et al., (1981) also reported such experience in *Araucaria* species.

The depletion of the forest ecosystem in the Niger Delta has necessitated the establishment of forest species such as *T. ivorensis* and *N. diderrichii* in the deforested areas. This will guarantee environmental protection and also meet the domestic and international demand for timber and wood. To encourage the use of our indigenous hardwood species for plantation, improvement efforts aimed at disease control at the nursery stages should be intensified.

**Conclusion**

As forestry becomes more focused on sustainable production and ecosystem health, management activities should become more intensive. Management practices, where susceptible species like *N. diderrchii* are planted with less susceptible species like *T. ivorensis* could serve as a cultural control measure to reduce *Fusarium* infection. Sawdusts which are industrial wastes may be considered for seed propagation for effective protection of young seedlings. Integrated disease management approach may include the sterilization of topsoil, ground granite, river sand or any nursery medium before use.

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**Table1**: Percentage incidence of damping-off disease of *T. Ivorensis* and *N. Diderrichii* in four sowing media.

| **Sowing medium** | % **Disease incidence** | |
|---|---|---|
| | *T. ivorensis* | *N. diderrichii* |
| Ground granite | 0.0 | 46.38 |
| Sawdust | 0.0 | 0.00 |
| Sharp river sand | 0.0 | 43.84 |
| Topsoil | 0.0 | 80.76 |
| LSD (0.05) | 0.0 | 10.76 |

Data are averages of three replicate

**Table** 2: Mean height (cm) of *T. ivorensis* and *N. diderrichii* at 12wks after seedling emergence.

| **Sowing medium** | **Plant height** (cm) | |
|---|---|---|
| | *T. ivorensis* | *N. diderrichii* |
| Ground granite | 35.24 | 15.21 |
| Sawdust | 45.34 | 27.70 |
| Sharp river sand | 35.10 | 17.13 |
| Topsoil | 42.21 | 18.46 |
| LSD (0.05) | 6.83 | 5.22 |

Data are averages of three replicates

**Table** 3: Mean collar diameter (mm) of *T. ivorensis and* N. *diderrichii* at 12 wks after seedling emergence.

| **Sowing medium** | **Collar diameter** (mm) | |
|---|---|---|
| | *T. ivorensis* | *N. diderrichii* |
| Ground granite | 4.43 | 4.26 |
| Sawdust | 5.36 | 5.65 |
| Sharp river sand | 4.46 | 4.36 |
| Topsoil | 5.21 | 4.55 |
| LSD (0.05) | 0.7 | 0.52 |

Data are averages of three replicates.