

ROOT ROT DISEASE OF FIVE FRUIT TREE SEEDLINGS IN THE NURSERY

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ABSTRACT

The incidence of root rot disease in the nursery of *Chrysophyllum albidum*, *Dacryodes edulis*, *Persea Americana*, *Irvingia gabonensis* and *Annona muricata* was assessed. Ten fungal pathogen were isolated using serial dilution and pathogenicity tests were carried out on the 5 fruit trees with the 10 isolated fungi. The 5 fruit tree seedlings were then potted in polypots filled with forest soil. The disease organisms were confirmed by Koch's postulates. The experiment was laid out in a completely randomized design replicated three times. *Fusarium oxysporum* and *Aspergillus flavus* were implicated as the causal agent of root rot in the 5 fruit trees. The percentage incidences were 39%, 25%, 20%, 9% and 10% for *A. muricata*, *I. gabonensis*, *P. Americana*, *D. edulis* and *C. albidum* respectively. The results provide baseline data for management of root rot disease in fruit trees at the nursery.

Key words: root rot disease, fruit tree, seedlings, nursery

INTRODUCTION

Soursop (*Annona muricata*) Wild mango (*Irvingia gabonensis* O'Rorke), Avocado pear (*Persea Americana* Mill), Local pear (*Dacryodes eaulis* G. Don) and Star apple (*Chrysophyllum albidum* G. Don) are important fruit trees in Nigeria especially in the southern part of the country. The crops are widely cultivated in traditional agroforestry plantations and compound farms. They constitute one of the main sources of farm income from fruit trees in the poor rural communities. Raising seedlings from these trees had been hampered by root diseases in the nursery, especially root rot (Meentemeyer et al., 2008; Morrison, 2000). Root diseases are in some cases difficult to identify, measure and manage (Filip, 1999). Root rot pathogens may spread from plant to plant causing widespread death of the seedlings in the nursery. These diseases are some of the tree hazards that cause seedling or cutting failure due to structural defect imposed on them. Our experience in the nursery in Port Harcourt had been that many tree species of the tropical region are susceptible to root rot diseases of fungal origin. The fungal invasion of the succulent root tissues causes the young tree seedlings to dieback; their leaves becomes discoloured, wilted and eventually dead.

The invasion of fruit trees by root pathogen had been reported Rainer, 1983; Pathak, 1986; Burdon, 1987; Morison, 2000) and it had been established that this soil borne pathogen are important in tree disease dynamics (Bruehel, 1987; Filip, 1995 and 1999; Lenne, 1990 and 1991; Meentemeyer et al., 2008). However, scientific investigation of root rot discuss in young seedlings in the nursery has not been adequately done and documented in Nigeria. The present work investigated root rot disease of five fruit trees to determine (i) the causal organism(s) of the disease and (ii) the incidence of the disease in the nursery. The result of the investigation will provide

some preliminary baseline data for the development of management strategy for the disease(s).

MATERIALS AND METHODS

The study was carried out at the nursery site of the Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Port Harcourt, Nigeria which lies on Lat 04^o 53^o 38.3N and Long 00.6 54^o 38.0^o E.

Seedlings of *C. albidum*, *P. Americana*, *A. muricata*, *I. gabonensis* and *D. edulis* were raised at the nursery in 2010. Three hundred seedlings of each species in three replicates were potted in 30 x 25 x 25cm. polypots filled with top soil collected from a forest land. Controls were with oven sterilized topsoil for the five species. A survey was done on the top soil for fungi. The top soil was sexually diluted and samples at 10⁻⁵ were plated in acidified PDA. The plates were incubated for 3 days at 25^oc and the fungi recovered there from were purified. Pathogenicity tests was carried out with each of the isolates and on each of the plant species.

The potted seedlings were then observed for incidence of disease during a period of six months. Percentage infections were recorded and 10 samples each were uprooted for laboratory analysis of their roots. 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^oc for 7 days. The fungi growing out of the sections were then isolated. The isolates were purified; pathogenicity tests and Koch's postulates were carried out. Percentage disease incidence was determined as follows

$$\% \text{ Disease Incidence} = \frac{\text{Number of Seedlings infected}}{\text{Total number of Seedlings}} \times 100$$

RESULTS

Table 1: Pathogenicity test of the isolates from the forest top soil on the five fruit tree seedlings.

Fungus	SEEDLINGS				
	<i>C. allidum</i>	<i>P. americana</i>	<i>A. muricata</i>	<i>I. Gabonesis</i>	<i>D. edulis</i>
<i>Aspergillus flavus</i>	+	+	+	+	+
<i>Aspergillus niger</i>	-	-	-	-	-
<i>Fusarium oxysporum</i>	+	+	+	+	+
<i>Macrophomina phaseolina</i>	-	-	-	-	-
<i>Penicillium sp</i>	-	-	-	-	-
<i>Rhizoztonia sp</i>	-	-	-	-	-
<i>Rhyzopus sp</i>	-	-	-	-	-

<i>Sclerotina sp</i>	-	-	-	-	-
<i>Sclerotium rolfsii</i>	-	-	-	-	-
<i>Trichodema harzianum</i>	-	-	-	-	-

Key: + = presence of root rot disease
 - = absence of root rot disease

Table 1 shows that 10 fungi was isolated from the forest top soil. Two of the isolates *Aspergillus flavus* and *Fusarium oxysporum* were pathogenic to the five fruit trees, and caused root rot of the seedlings. The incidence of the disease was observed in the 5 species as show on figure 1.

Anona muricata was the most susceptible to the disease with 39% infection of seedlings. this was followed by *I. gabonensis*, *P Americana*, *C. albidum*, and *D. edulis* in a decreasing order of magnitude.

The control experiments which had sterilized topsoil showed zero incidence.

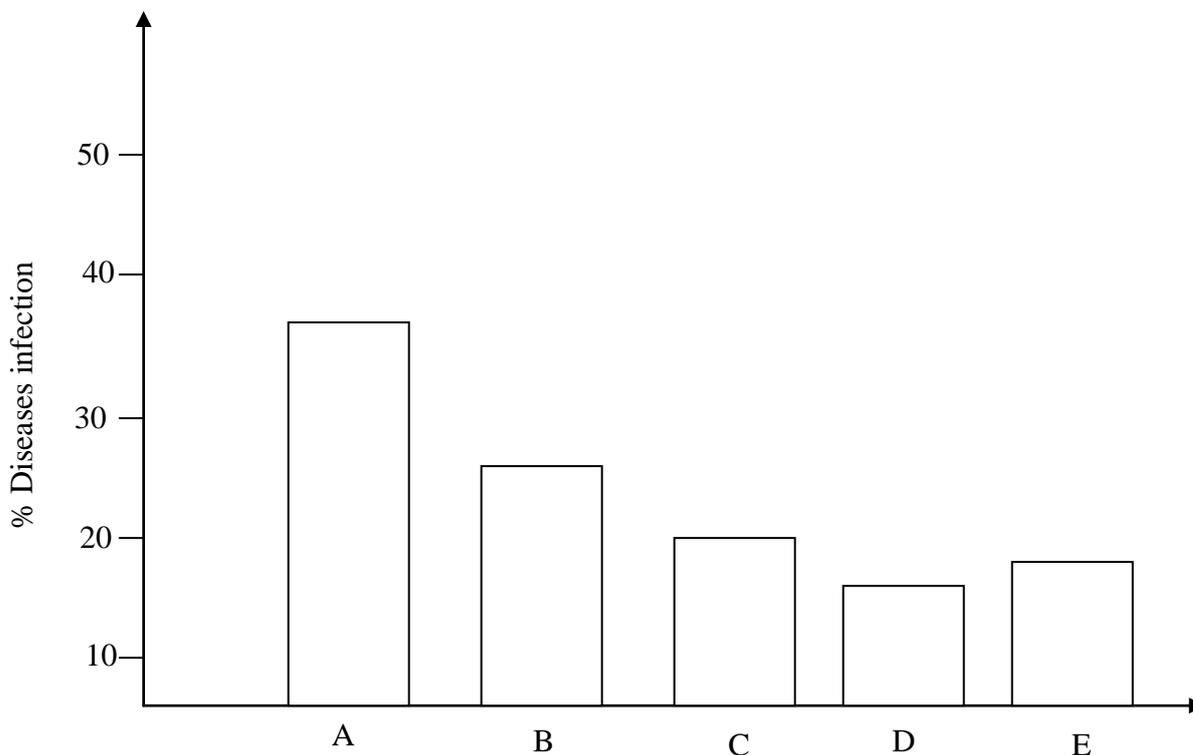


Figure 1: Percentage incidence of root rot disease
 A = *A. muricata*, B = *I. gabonensis*, C = *P. Americana*,
 D. = *D. edulis* E = *C. albidum*

DISCUSSION

All the ten fungi isolated from the forest soil are known common soil fungi that cause various diseases in both aerial and subterranean parts of trees either in the nursery or in the field. (Shaw and Kile, 1991; Thies and Sturrock 1995; Filip, 1999). The two fungi *Fusarium oxysporum* and *Aspergillus flavus* implicated in this study to have caused the disease had been known to cause various other diseases but not root rot. *Fusarium oxysporum* is a known damping of causal agent in different plant at different

stages which may be in some cases as a result of root rot as evidenced in the present investigation. The source of the pathogen in this study was not ascertained but three main sources are suspected viz: at the time and process of transplanting; from the soil; and may be from the air

Most root diseases including the present one under investigation cause above ground foliar discoloration and thinning of the crown due to destruction of the root and subsequent reduction in nutrients and water supply to the foliage. In this study, seedlings with the root rot disease symptoms showed these other above ground symptoms and they did not die simultaneously because they were not at the same stage of decline. Diseased seedlings died one after the other with rotten roots.

Seedlings could be attacked by more than one root rot pathogen in the nursery (Gilbert, 1995). This was the observation in the present study when more than one of the ten isolate were found associated with the condition but most importantly *F. oxysporium* and *A. flavous* were found associated with the condition on the same seedlings. root pathogens attack the fine root hairs that are responsible for water and nutrient uptake as well as the structural roots that stabilize the plants.

CONCLUSION AND RECOMMENDATIONS

The study showed that fruit tree seedlings such as sour sop, star apple, avocado, local pear and wild mango are susceptible to root rot disease in the nursery. That, the disease was caused by (i) *F. oxysporium* and (ii) *Aspergillus flavus*. Seedling wilt, foliar discoloration, die back and eventual death were results of the occurrence of the root rot condition; more than one fungus is found associated in most of the cases. The findings provide baseline data for the management of root rot disease in fruit trees in the nursery.

The following recommendations are important in reducing the incidence of root rot diseases of seedling in the nursery. Prevention of root rot disease in seedlings or trees is better than thoughts of cure. To this end, an integrated forest disease management approach will be the best option. Root disease causing pathogens of seedlings or trees need proper identification in order to apply appropriate management step. Some of these steps could include: thinning regimes in the field for trees; use of resistant trees species; enactment and application of forest laws and regulations; modeling the incidence and severity of root rot disease from one ecological zone to another; avoid wounding seedlings during pricking and transplanting; nursery soil for filling polypots should be collected from disease free sites; and heat sterilization of nursery soil.

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