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Diseases of Coconut Seedlings at Nursery Stage in Awka, Anambra State

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Abstract

The Coconut (*Cocos nucifera*) fruit is a fibrous drupe with multiple uses and is widely disseminated on almost all continents. Coconut production is threatened by diseases causing significant economic losses. This study investigated Diseases of Coconut Seedlings at Nursery Stage in Awka, Anambra State. The study was carried out in two nurseries, one in Oby Okoli and another in Udoka Estate. The medium used for the isolation of pathogens in the samples collected was Sabouraud Dextrose Agar (SDA). Inocula were prepared from unhealthy coconut leaves and nuts that showed symptoms of leaf spot, leaf blight and nut rot. Isolation of fungi was done by agar dilution plate method. Subcultures were prepared using inocula from different organisms in the mixed cultures to obtain a pure cultures. Physical observations revealed bud spot, leaf blight, and nut rot in infected seedlings. *Fusarium solani, Rhizopus stolonifer, Phytophthora parasitica,* and *Aspergillus niger* were identified as primary fungal pathogens, with *Fusarium solani* and *Rhizopus stolonifer* dominating. No bacterial growth was detected, possibly due to inadequate moisture. The study highlights the significance of fungal diseases in coconut production and emphasizes the need for effective management strategies. Integrated Pest Management (IPM) practices, accurate identification of fungal isolates and targeted disease management are crucial for maintaining healthy coconut palms.

Keywords: Diseases; Coconut; Seedlings; Nursery; Stage; Awka; Anambra, State

Introduction

Plant diseases are abnormal conditions that affect the growth, development, and productivity of plants. They can be caused by various factors, including pathogens (bacteria, viruses, fungi, and nematodes), environmental stressors (temperature, light, water, and nutrients), and genetic disorders [8]. Coconut (*Cocos nucifera L.*) is a versatile and highly valuable crop that plays a significant role in the economy and food security of many tropical countries [27]. However, coconut seedlings are susceptible to various diseases at the nursery stage, which can lead to significant losses in terms of seedling mortality, reduced growth, and decreased productivity [21]. Seedlings of coconut are affected by diseases mostly of fungal disease. Such as, leaf spot (Pestalotia leaf spot, Curvularia leaf spot, Alternaria leaf spot, Cercospora leaf spot), leaf blight (Phytophthora leaf blight, Cercospora leaf blight) and bud rot caused by *Phytophthora* sp., *Fusarium* sp. and *Curvularia* sp [22].

Healthy seedlings are prime need and basic raw material for establishment of plantation for the production of coconut. That is why seedling diseases are an important consideration for coconut production [10]. Seedling is frequently affected by physical and physiological disorders as well as diseases caused by fungi, bacteria and viruses. Seed-borne pathogens affect nursery seedlings and reduce seedling vigor [15]. So, seedling diseases of coconut are one of the important problems in the tropics. Although a huge number of nurseries are engaged in producing seedlings, they fail to produce quality seedlings due to lack of their knowledge about diseases [17]. Seed after germination are liable to attack by different soil borne organisms. Even after emergence of the seedling, it could be attacked by different diseases which may produce distinct symptoms in the nursery bed or it may carry the organisms when it is transplanted in the orchard or any selected place [18]. In severe cases, diseases cause mortality of many seedlings after plantation. For these reasons, seedlings are to be reared up with proper care in order to avoid the diseases and to ensure quality and quantity production and increasing yield of coconut. Thus, production of healthy seedlings ensures good plantation and save money, labour and energy of coconut gardener [27].

Diseases of Coconut Seedlings at nursery stage can be caused by several factors which may

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include biological, environmental, chemical, physical factors and management practices [5]. Fungal pathogens such as *Rhizoctonia solani, Pythium spp., Phytophthora spp.,* and *Colletotrichum spp*., bacterial pathogens such as *Xanthomonas axonopodis*., viral pathogens such as coconut leaf blotch virus (CLBV) and coconut cadangcadang virus (CCCV), and nematode pathogens such as *Meloidogyne incognita* and *Heterodera schachtii*., can cause diseases to coconut seedlings [26]. High humidity creates an ideal environment for fungal growth, Waterlogged soil leads to root rot and crown rot, Temperature extremes and Drought stresses coconut seedlings, making them more susceptible to diseases [14]. Soil pH can affect the availability of nutrients, leading to nutrient deficiencies. Poor nursery management, including overcrowding, poor sanitation, and inadequate watering can affect coconut seedlings [7]. Inadequate nutrient management leads to nutrient deficiencies that can weaken coconut seedlings [3]. Mechanical damage such as damage to seedlings during handling or transplanting; insect vectors, such as scales, mealybugs, and aphids can transmit diseases to coconut seedlings [16]. Exposure to toxic substances such as pesticides and fertilizers; deficiencies in essential nutrients like nitrogen, phosphorus and potassium; soil contamination with pollutants like heavy metals; inadequate watering; inadequate pruning and overcrowding can make seedlings more susceptible to diseases [9].

Pest and disease management is an integral component of nursery operations for the successful production of quality coconut seedlings [4]. This is equally as important as selection of healthy and superior mother palms as well as selection of quality seed nuts for production of vigorous seedlings. A healthy and vigorous coconut seedling maintained by good agricultural practice would therefore result in a hale and hearty palm capable of producing a sustained yield [27]. Some of the nursery pests such as ash weevil, whiteflies, scale insects and mealy bugs affect the appearance of coconut seedlings. Though such seedlings may be vigourous, preference by farmers is lost due to damage symptoms on coconut seedlings [16]. Since the nut production is by and large initiated after a period of at least three years for dwarf coconut cultivars and seven years for tall varieties, timely and needbased health management techniques hold the key for better output [2].

Effective disease management in coconut seedlings at the nursery stage is crucial for ensuring the health and productivity of coconut crops [24]. Management strategies may include: maintaining good nursery hygiene, using clean and disinfected tools and equipment, remover and disposer of infected seedlings, avoiding overwatering and ensure good drainage, providing adequate air circulation, and using of raised beds or mounds to improve soil drainage [24]. Fungicides, bactericides, insecticides and nematicides can be used to control pathogenic diseases [19]. Using beneficial microorganisms to control diseases, and trap cropping to control insect vectors may also be helpful. A combination of cultural, chemical, and biological control methods will be effective in tackling pest and diseases of coconut seedlings at nursery stage [11].

Materials and Methods

Study Area

The research was carried out in Awka metropolis. Awka lies between latitude ($7^{0}00$ and $7^{0}10^{1}$) E and ($6^{0}05$ and $6^{0}15^{1}$) N in Anambra state.

Field Survey and Data Collection

Two different coconut nurseries located in Awka metropolis was visited to gather information about the diseases affecting coconut prevalent in the nurseries. Thorough physical observations were carried out on the coconut seedlings, especially on the leaves, stem and nut. Also, questions relevant to the study were asked and answers were recorded from the response of the nursery managers. Questionnaires used were adopted from [1].

Collection of Samples

Diseased parts of coconut seedling (*Cocos nucifera*) especially the leaves and nuts were collected from the nurseries around Oby Okoli Avenue Unizik Junction Awka and Udoka Housing Estate Awka Anambra State, Nigeria. They were placed in a sterile polythene bag and brought to the Department of Botany Laboratory Nnamdi Azikiwe University Awka for culturing, isolation and identification.

Media preparation

The medium used for the isolation of pathogens in the samples collected is Sabouraud Dextrose Agar (SDA). Ten grams each of the powder was dispensed into two 100 ml conical flasks containing distilled water and then stopped tightly with cotton wool and foil. 0.5g of 250mg chloramphenicol was added to one of the conical flasks and then 0.5g of 250 mg fluconazole was also added into the other conical flask and both were properly labelled; it was heated in water bath for about 2 hours until the agar is melted. The prepared medium was then sterilized using autoclave at 120^{o}C and 30 psi [6, 13] for 1 hour. Thereafter, it was allowed to cool and the gel was dispensed into the Petri dishes

Preparation of Sample Inocula

Inocula were prepared from unhealthy coconut leaves and nuts that showed symptoms of leaf spot, leaf blight nut rot. The samples were first washed in sterile water and then surface sterilized using 70% ethanol. A sharp sterile kitchen knife was used to cut each of the samples so as to reveal the boundary zone between the rotten and healthy part of the leaf and nut. Small bits were cut from the boundary zone of each sample and transferred to sterile Petri dishes and later used for isolation of disease pathogens.

Isolation of Test Fungi from Rotten Coconut Corms

Isolation of fungi was done by agar dilution plate method. The method was used by [12]. The inoculum prepared from the diseased leaf and nut samples was used for isolation of pathogens. Three pieces each of the samples of the plant was placed in each Petri dish containing SDA media. All plates were wrapped externally with masking tape and incubated at ± 27^{o}C for 72 hours and observed daily for growth of fungi.

Sub Culturing and Identification of Test Pathogens

Subcultures were prepared using inocula from different organism in the mixed cultures to obtain a pure culture; this was done by transferring from the colony edge of the mixed cultures to fresh sterile SDA plates with the aid of a scalpel. The plates were wrapped externally with masking tape and incubated for 72 hours. The resulted pure cultures were used for subsequent identification of isolates. The identification was on the basis of their micro and macromorphological characteristics using standard taxonomic key used previously by [25].

Data Analysis

The data obtained was analysed using the statistical package SPSS

version 2023. Data obtained from the study subjected to Analysis of Variance (ANOVA) at 5% significant level. Means were separated using Duncan Multiple Range Test.

Results

Physical Observation Report on the Symptoms of Diseases of Coconut Seedlings

Table 1 shows the physical observations of the coconut seedlings in the two nurseries visited. The results revealed the presence of bud spot disease in the Oby Okoli nursery but was not seen in the coconut nursery at Udoka estate. Leaf blight and nut rot were both seen to affect the leaves and nuts coconut seedlings in both Oby Okoli nursery and Udoka estate nursery.

Occurrence of Fungi Pathogens on Coconut Samples from Different Locations in Awka

Based on the growth of the fungi on the cultured coconut leaf and nut specimens, table 2 revealed the presence of *Fusarium solani, Rhizopus stolonifer, Phytophtora parasitica* and *Aspergillus niger*. *Fusarium solani* and *Rhizopus stolonifer* had an occurrence of 10 and 9 with a percentage occurrence of 30 % and 28 % respectively. While *Phytophtora parasitica* and *Aspergillus niger* had a total occurrence of 6 and 5 with a percentage occurrence of 22 % and 20 % respectively.

Nature of Fungal Growth in SDA and Total Fungi Count of Coconut Samples

Table 3 shows the nature of fungal growth and total colony count of the fungi pathogens isolated from the diseased coconut leaf and nut samples. For the samples collected from both Oby Okoli nursery and Udoka estate nursery, there was heavy growth of the identified fungi pathogens. Also, for the total fungal count, both sites had the high colony count ($160x10^2$ and $160x10^2$) respectively.

Discussion and Conclusion

Various studies have exhibited the Occurrence of fungal on coconut samples. The result from this study revealed the presence of *Fusarium solani, Rhizopus stolonifer, Phytophtora parasitica* and *Aspergillus niger* on the coconut seedlings leaves. With *Fusarium solani* and *Rhizopus stolonifer* having the highest number of occurrences in the two nurseries. This agrees with the study of [28] on tropical fruits. The prevalence of *Fusarium solani* and *Rhizopus stolonifer* suggests these fungi are well-adapted to coconut seedlings and potentially cause significant damage. *Fusarium solani* is known to cause root rot, while *Rhizopus stolonifer* causes leaf blight and stem rot. *Phytophthora parasitica* and *Aspergillus niger*, although less prevalent, still pose significant threats. *Phytophthora parasitica* can cause crown rot, and *Aspergillus niger* can lead to leaf spot and defoliation. These findings highlight the need for effective fungal management strategies in coconut nurseries.

The results revealed the presence of bud spot disease in the Oby Okoli nursery but was not seen in the coconut nursery at Udoka estate. Leaf blight and nut rot were both seen to affect the leaves and nuts coconut seedlings in both Oby Okoli nursery and Udoka estate nursery. This coincides with the assertion made by [20], that bud spot, leaf blight and nut rot were identified as the symptoms of coconut seedlings diseases. The total fungal count was remarkably high, with both sites recording 1.6 x 10^2 CFU/g. These findings suggest severe fungal contamination in coconut samples, posing a potential risk of disease transmission and emphasizing the need for immediate control measures. The study findings align with the work of [23]. The heavy growth of fungal pathogens and high total fungal count in coconut samples from both nurseries pose significant threats to coconut production. The high fungal load and diversity of pathogens underscore the importance of integrated pest management (IPM) strategies.

Future studies can investigate the efficacy of these management strategies and explore biological control methods to mitigate fungal diseases in coconut nurseries.

Table 1: Diseases Affecting Coconut Seedlings in the Nursery.

Nurseries	Bud Spot	Leaf Blight	Nut Rot
Oby Okoli	+	+	+
Udoka Estate	-	+	+

+ = Presence, - = Absence

Table 2: Occurrence of Fungi Pathogens on Coconut Samples.

Fungi Isolates	No of Occurrence	Percentage Occurrence
Aspergillus niger	05	20%
Fusarium solani	10	30 %
Phytophtora parasitica	06	22 %
Rhizopus stolonifer	09	28 %
Total	30	100 %

Table 3: Nature of fungal growth and total colony count.

Parameters	Oby Okoli Nursery	Udoka Estate Nursery
Nature of fungal growth	Heavy	Heavy
Total fungal count ($x10^2$)	160.00	160.00

Conclusion and Recommendation

The presence of fungal pathogens, specifically *Fusarium solani, Rhizopus stolonifer, Phytophthora parasitica,* and *Aspergillus niger,* causing bud spot, leaf blight, and nut rot was observed in the coconut seedlings. Integrated Pest Management (IPM) strategies and targeted disease management are crucial for maintaining healthy coconut palms and ensuring sustainable production.

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