



Fungal Pathogens Associated with Damping-off Disease of Cashew Seedlings in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MOO, CII and OOK conceived and designed the experiment. Authors MOO, CII and OOK performed the experiment. Authors MOO, CII and OOK analyzed the data and wrote the paper. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study was designed to isolate fungal pathogens associated with damping-off of cashew seedlings.

Study Design: The cashew seedlings for this study were selected randomly from a number of infected cashew seedlings in the screen house.

Methodology: Associated fungal pathogens were grown on potato dextrose agar (PDA) and identified using their characteristics and morphological features observed under the microscope with reference to published identification manuals.

Results: The result showed that damping-off of cashew seedling is mostly associated with fungal pathogens such as *Fusarium spp.*, *Colletotrichum gloeosporioides*, *Pythium spp.*, *Alternaria sp.*, *Curvularia sp.*, *Aspergillus niger*, and *Lasiodiplodia theobromae*. However, *Fusarium spp.* and *Pythium spp.* were predominant and frequently isolated than other pathogens.

Conclusion: The knowledge of these pathogens is important for designing strategies to safeguard cashew plant health against diseases in order to ensure sustainable cashew production in Nigeria.

Keywords: Cashew seedling; fungal pathogens; cashew disease; Nigeria.

1. INTRODUCTION

Cashew (*Anacardium occidentale* L.) is a tropical tree, which is currently grown in most tropical countries around the world and it has become an intensively grown cash crop since the 1990s. West Africa is one of the most recent and dynamic cashew production areas in the world, owing to its highly diverse agro-climatic conditions, which grant the potential for a remarkable agricultural production of immense crop diversity, allowing vigorous increase in production volumes of most crops for exports. In 2018, West Africa was responsible for 49 % of the world supply of Raw Cashew Nut (RCN), producing 1,795,000 Metric Tons, with most significant productions coming from Ivory Coast, Nigeria, Guinea-Bissau, Benin and Ghana [1].

Unfortunately, cashew is plagued by several biotic and abiotic constraints ensuing in substantial yield losses all over the region. Diseases are a major biotic constraints, very destructive and compromise the cashew plant health, including growth and nut yield in terms of quality and quantity. Over 12 diseases have been reported to infect cashew plant globally [2-5]. Most of these diseases are caused by fungi. Cashew is susceptible to more than 10 diseases caused by fungi [6]. Anthracnose foliar blight, fruit rot (*Colletotrichum gloeosporioides*) and gummosis of twigs and trunk (*Lasiodiplodia theobromae*) are some of the diseases considered most relevant causing severe damages across cashew producing countries [7-9]. Other diseases include black mold, powdery mildew, *Fusarium* Wilt Disease, die back and damping off. [10-12].

In Nigeria, reports on cashew pathogens and diseases are very few and mostly on cashew inflorescence [9,3,13]. However, there are other noticeable diseases. These include leaf spot disease [14], leaf blight, red rust, root rot, nut blight and damping-off.

Damping-off is a disease that attack cashew at seedling stage. This disease is a common occurrence in seedlings of many tree species all over the world. It is caused by different pathogens such as *Phytophthora* spp., *Pythium* spp., *Rhizoctonia* spp., *Fusarium* spp., and many others [15]. These pathogens have been reported as causal agents of damping-off in seedlings of several trees [16-21]. However,

there is handful information on damping-off disease of cashew seedling in Nigeria. Recently, incidences were observed in a set of cashew seedlings growing in screen house, which prompted us to examine the fungi associated with the disease. This study will give an insight and serve as pointer towards the disease control and management.

2. MATERIAL AND METHODS

2.1 Sampling of Infected Seedling Organs

Eight stands were selected randomly from sets of infected cashew seedlings (Fig. 1) growing in the screen house at Cocoa Research Institute of Nigeria, Ibadan. The samples were packaged in plastic bags and taken to the laboratory.

2.2 Isolation and Identification of Fungi

The leaves, stems and roots of infected cashew seedlings were cut separately into pieces using sterile scalpel, surface-sterilized in 10 % hypochlorite and rinsed severally in sterile distilled water. The diced samples were blot-dry by sandwiching in sterile Whatman No. 1 (150 mm) filter paper. Acidified potato dextrose agar (PDA) was prepared in the laboratory for the isolation. It was sterilized at 121°C for 15 minutes, allowed to cool to about 45°C on the bench, and poured into Petri dishes. The samples were aseptically inoculated onto the acidified PDA in Petri dishes and incubated at 28 ± 2°C for seven days. The resulting mixed cultures were sub cultured to obtain pure cultures. The identification of the isolates was done based on observed colony characteristics and morphological features observed under the microscope with reference to published identification manuals [22,23].

3. RESULTS AND DISCUSSION

Fungal isolates identified in this study showed that different species of fungi are associated with damping-off of cashew seedling. In total, 19 fungal isolates belonging to 7 different fungal genera were isolated; namely *Fusarium*, *Colletotrichum*, *Pythium*, *Alternaria*, *Curvularia*, *Aspergillus* and *Lasiodiplodia* (Table 1). The percentage occurrences of the isolated fungi are shown in Fig. 1. *Fusarium* spp and *Pythium* spp had high percentage occurrences compared with other isolates. They were predominant and

frequently isolated than other fungal pathogens. However, *Fusarium spp* had the highest percentage occurrence and were most frequently isolated. Although published information on damping-off disease of cashew seedlings is scanty, notwithstanding a few previous studies have reported *Fusarium spp* and *Pythium spp* as causal agents of damping-off disease of cashew [24,25]. Other fungi associated with different symptoms of infected organs of the cashew seedlings in this study are presented in Table 1. The result underlines fungi which have been implicated in etiology of cashew seedling diseases in different studies. *Curvalaria* leaf spot disease on young cashew seedlings, which was preceded by interveinal chlorosis was reported in Nigeria, where the leaf spot infection appeared as a pin head on the chlorotic lamina and later enlarged with time [26]. In Brazil, *Lasiodiplodia theobromae* was reported to cause infection in grafted cashew seedlings, which could occur through grafting knives or endophytic strains in cashew root-stocks or scions [11]. They are also known to colonize secondary xylem, within the xylem vessels, infecting xylem parenchyma of

cashew plant [27]. *Colletotrichum gloeosporioides* was reported to cause severe leaf and shoot blight on cashew seedlings in the nursery with symptoms similar to those on adult cashew plants [11]. Root rot caused by *Pythium* is another common pathogen of cashew seedlings, which causes yellowish colouration of leaves, followed by wilt and death. Other oomycetes such as *Phytophthora heveae* and *P. nicotiana* have also been observed to cause blight in cashew seedlings during rainy season, which can be devastating if not controlled in few days [11]. Mostly, report has shown that cashew seedling blight is caused by a number of fungi including *Fusarium spp*, *Pythium spp*, *Phytophthora palmivora*, *Cylindrocladium scoparium*, *Sclerotium rolfsii* and *Pythium ultimum*; most of which occurs mainly in the nursery [24]. However, report has also shown that some of these fungi can be endophytic to cashew plants [28], Thus causing diseases when conditions are favourable. Usually, all the fungi isolated can threaten cashew seedling health if measures are not put in place to check them.



Fig. 1. Cashew seedlings showing brown water soaked stem, wilting of stem and defoliation

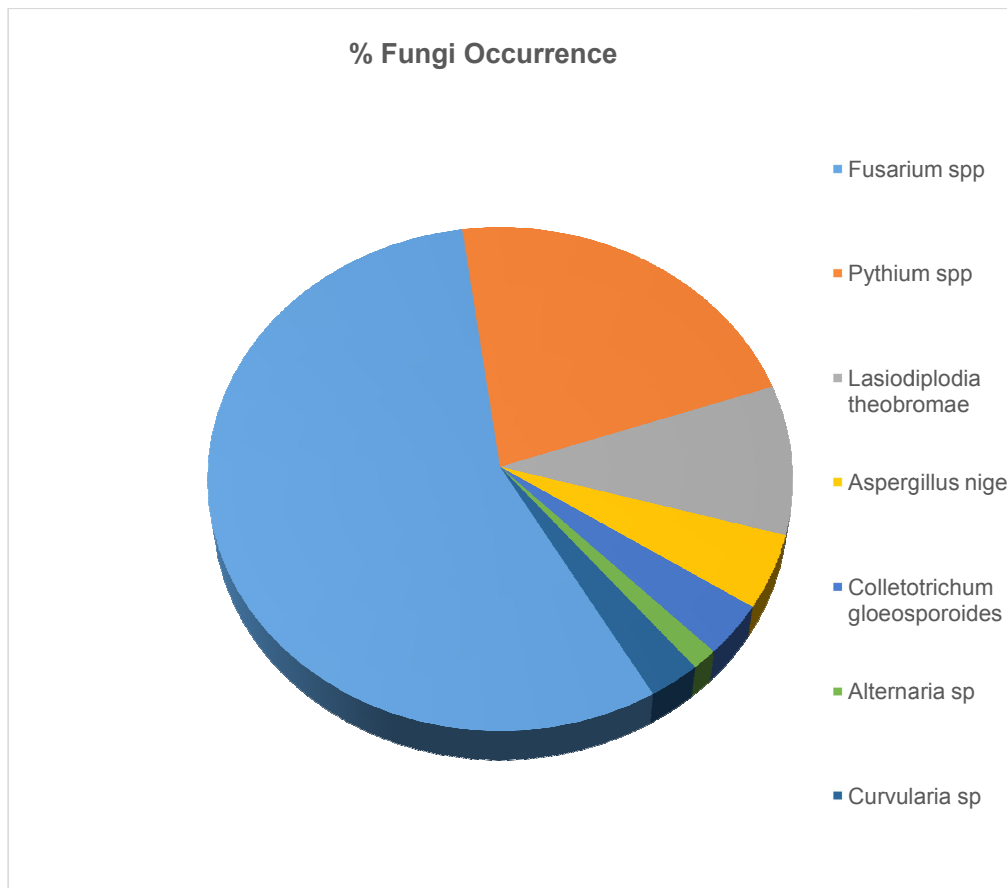


Fig. 2. Percentage fungi occurrence in infected cashew seedlings

Table 1. Symptoms and pathogenic fungi associated with different organs of infected cashew seedlings

Plant Organ	Symptom	Associated fungal pathogen
Root	Dark brown, decaying, water soaked root	<i>Fusarium spp.</i> <i>Pythium spp.</i> <i>Alternaria sp.</i> <i>Lasiodiplodia theobromae</i> <i>Aspergillus niger.</i>
Stem	Brown, soft, water soaked stem	<i>Fusarium spp.</i> <i>Lasiodiplodia theobromae</i> <i>Aspergillus niger.</i>
Leaf	Wilting of leaves	<i>Curvularia sp.</i> <i>Lasiodiplodia theobromae</i> <i>Colletotrichum gloeosporioides</i>

4. CONCLUSION

This study has highlighted the fungal pathogens associated with damping-off disease of cashew seedlings. It is expected that the insight gained will serve as one of the baseline data to develop appropriate management options for the disease.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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