Report Of Powdery Mildew Disease Condition on Chasew in Nigeria

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Abstract. Cashew is an economic crop of export and livelihood sustenance for households in Nigeria. It is grown in more than 20 states in Nigeria but its productivity is limited by moribund farms, interlocking canopies, nutrient depleted soils, low yielding genotypes, attack of insects and diseases. These have resulted into decline production and poor quality of raw nuts and kernels. Priorly, powdery mildew was not a major disease on cashew but its emergence is assuming a major concern for growers in Nigeria. Survey of diseases on cashew farms was carried out in 2023/2024 during flowering and fruiting season, in selected farming communities which are major producing areas in Nigeria. Cashew parts; leaves, inflorescence, apples and nuts were examined using a 1m quadrant on East and West sides of the trees and diseases were documented based on symptoms on the parts. Expression of mildew disease conditions on cashew leaves, flowers, nuts and apples were of emerging status in Nigeria. Cashew parts showing typical symptoms of powdery mildew disease (grey or white dust on surface of infected panicles, flowers, fruits, leaves, coarse and cracking of apples were observed in study farms. Disease situation was common and similar in many farms in Nigeria. Despite the negative impact of mildew and potential effect to lower nut yields and quality, there are scare information on current infection status and management strategies in Nigeria. Future studies will examine prevalence patterns and timing of pathogen onset as a pointer to develop management measures.

1 Introduction

Cashew (*Anacardium occidentale* Linn.) is an evergreen perennial tree in the flowering family, an economically important export cash crop across producing ecologies in Nigeria. Cashew farmers in growing areas observed changes in physical appearance of cashew apples and some instances the nut on trees. The condition was not a common sight on cashew trees in growing areas but the situation spread to many cashew farms across ecologies of Nigeria. Cashew been a seasonal crop, tension of damages done by the disease situation declined after fruiting season but crop losses was not quantified. A repeated occurrence was experience in more cashew farms spreading from the north central belt of cashew ecologies of Nigeria

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affecting many farms in cashew communities borders of Benue and Kogi states and this spread progresses southwards affecting cashew farms in Kwara, Oyo and Edo states. These conditions have been confirmed in much more farms across the states but validation is required. The expression of a grey or white dust on surface of infected cashew parts and cracking of apples were similar to powdery mildew disease (PMD) conditions on cashew [1–3]

The conducive environment for PMD are cold nights which are followed by warm daytimes leading to mist and fog conditions in the early mornings. An optimum temperature ranges between 25 – 28ºC with optimum at 26ºC. Relative humidity that is conducive to the environment ranges between 80 – 100% with optimum at 95% [4,5]. However, information about powdery mildew in Nigeria are scarce, thus it is imperative to track the current re-surgency of PMD on cashew and investigate the suspected cases further using molecular tools. This will establish a baseline, generate data and develop a compendium of diseases with similar or closely related characteristics on cashew.

2 Materials and methods

The survey, field study and observation of cashew trees and parts for powdery mildew disease (PMD) in cashew farms was conducted in six major cashew growing states which were prominent in volume of raw cashew nut production in Nigeria. The study states were Benue, Edo, Enugu, Kogi, Kwara and Oyo states were predominantly cashew producing states of major production status. Also communities majorly growing cashew growing were selected from each states and a total of ten farms were surveyed in each state. The communities with cashew trees showing incidence of PMD were randomly selected without prior report or record of PMD and listed in table 1 and their ecological mapped in figure 1. At least one hectare of cashew trees were mapped for the disease survey in each community and the farm evaluation was based on symptoms and expressions of PMD on cashew parts: leaves, flowers, pseudo apple and nuts. The disease inventory of the trees was conducted at different phenological stages of tree growth.

The field survey was carried after mapping of a cashew sole cropping cashew farmland, random selection of trees through diagonal and transact movement. The physical observation and inspection of tagged trees was done through the use of quadrant for the evaluation of PMD on cashew canopies. A 1 square meter quadrant was placed/hanged on the peripheral of tagged trees on the east and west sides and incidence of PMD was observed and scored based on number of infected cashew parts over total number of parts assessed.

3 Results and discussions

The field study to survey the insurgence of powdery mildew disease on cashew trees was conceived as feedback from the field activities of cashew growers in Nigeria. The study was conducted in selected cashew communities in major cashew growing states. Table 1 shows the geo-referenced study locations where cashew farms been surveyed were located, the communities in the selected cashew growing states in Nigeria. The powdery mildew disease of cashew infects different parts of the trees at varied phenological stages and growth. This occurrence was found across various cashew growing states in Nigeria (table 1).

Table 1. Selected cashew community with severe cases of PMD and organs affected

Community	**State**	**Infected parts**
Ola-udo	Benue	Apple
Odoba Otukpa	Benue	Apple, nut
Ikabigbo	Edo	Apple, nut
Ayanran	Edo	Apple, nut
Ekwotsor	Edo	Apple, nut
Obollo Orie	Enugu	Leaf, apple
Ezimo Uno	Enugu	Leaf, apple
Didi Igboto	Enugu	Leaf, apple
Nkpoka Amukpa	Enugu	Leaf, apple
Agu-Amanyi	Enugu	Leaf, apple
Ochaja	Kogi	Leaf
Okabo	Kogi	Leaf, apple, nut
Ochenwa	Kogi	Leaf, flora
Imane	Kogi	Leaf, apple
Igbotele	Kwara	Leaf, apple, nut
Okerimi-Oro	Kwara	Leaf, apple
Edidi	Kwara	Apple
Isanlu	Kwara	Leaf
Adigun-Agbonda	Kwara	Leaf, apple
Gaa Mai-Nasara	Kwara	Apple, nut
Yowere-Ajinmosi	Kwara	Nut
Babanla	Kwara	Apple
Ago Are	Oyo	Apple
Aba Ogbomoso	Oyo	Apple, nut
Dagbolu	Oyo	Apple
Awaye	Oyo	Leaf, apple, nut
Onisa	Oyo	Apple, nut
Okomaaro	Oyo	Nut
Kishi	Oyo	Apple

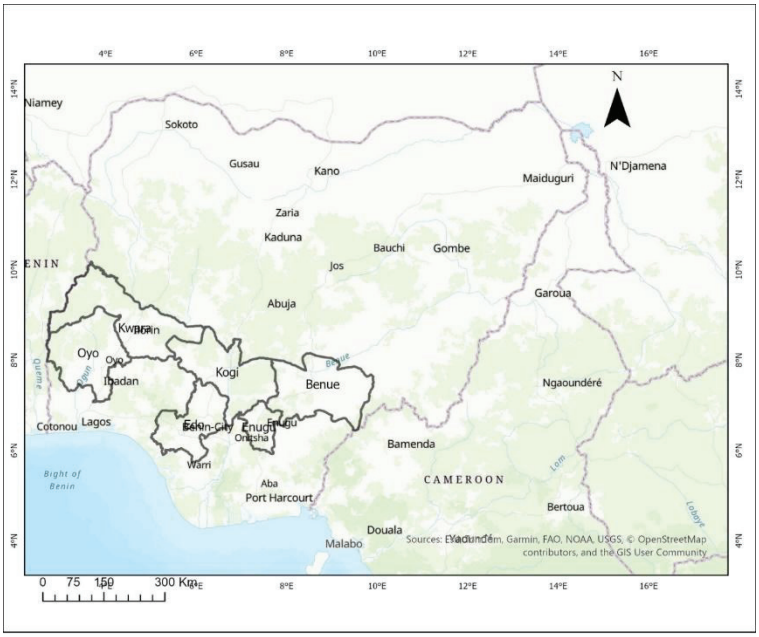

Fig. 1. Map of Nigeria showing the states surveyed for PMD

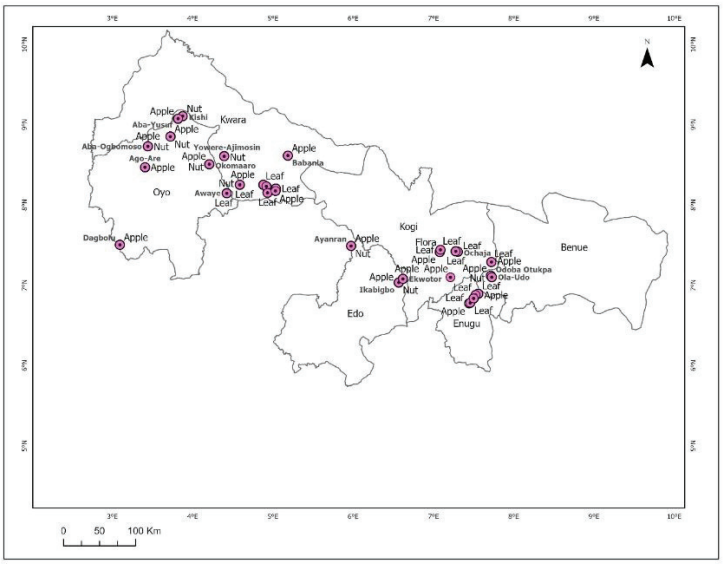

Fig. 2. Distribution of PMD on cashew parts

Infected cashew parts were more in some farm locations, less in others and a complex disease situation recorded in yet other farms. The most complex powdery mildew disease condition on cashew was recorded in Igbotele (Kwara state), Okabo (Kogi state) and Awaye in Oyo state. In this situation, typical symptomatic expressions of powdery mildew disease

were recorded on the leaves, fruits and nuts of cashew. Cashew trees with only the fruits infected were observed in Ola Udo, Edidi, Babanla, Ago Are, Dagbolu, Kishi cutting across Benue, Kwara and Oyo states, infected nuts were recorded in Yowere-Ajimosin, Okomaaro in Kwara and Oyo states respectively but infected leaves only found in Ochaja (Kogi state). Other cashew trees have combinations of one infection types or the other on cashew parts in the study areas with symptoms on the flora, the apple etcetera (figure 2).

Figure 3: Infection condition of powdery mildew on cashew leaves

Powdery mildew condition on cashew leaves is obvious situation both in the initial and at advance stage of infection as shown in figure 3. The disease comes as whitish powdery expressions on the leaves followed by wrinkled patches with whitish grey appearance and yellow colouration at the most advance stage of infection

Figure 4: Fresh powdery mildew condition on cashew leaves (A) and flowers (B)

Figure 4 shows fresh incidence of PMD on green cashew leaves and infection status on cashew inflorescences affecting the flowers. Whitish patches similar to what occurred on the green leaves were observed on the flowers which can cover some flora or entire inflorescence in some instance.

Figure 5: Powdery mildew condition on cashew apples

The establishment of PMD pathogen on cashew apples are expressed in figure 5 showing brown patches, cracking and splitting of the juicy apple on cashew trees. This incidence results into losses of the apples thereby reducing the economic potential of the trees by wastage of the apples instead of been processed into juice. The quality of the raw nuts are also compromised on many situations.

Figure 6: Powdery mildew condition on young cashew nuts and apples

Powdery mildew also infects young green succulent nuts and developing apples on the tree with brown patch expressions that mask round the nuts and apple (figure 6). Significant yield losses of both the nut and apples are common on farms with this condition.

The powdery mildew disease has not been a common occurrence on cashew farms in Nigeria, although priorly not major on cashew but information on its prevalence on the crop is scarce. The advent of climate change related challenges has possibly initiated the recent insurgence of PMD in Nigeria, a survey of the disease in growing areas have only established conditions similar to expressions of powdery mildew disease on cashew parts. Powdery mildew is a widely distributed, detrimental plant disease that occurs on a variety of economically important crops. Symptoms of powdery mildew first appear on its hosts as white powdery spots which can spread over large areas., resulting into reduced fruit and nut quantity and severe infections can lead to death of the plant [6]. All cashew varieties are susceptible to PMD but at different levels, most unimproved varieties succumb more to disease compared to improved varieties, which have a certain level of resistance or tolerance [7].

The disease is caused by *Oidium anacardii* [8,9] and reported to infect over 10,000 flowering plant species worldwide. Powdery mildews are one of the most prevalent plant pathogens in the world with an estimated 873 species within 18 genera and 5 tribes [10]. The disease affects all young parts of the shoot, including leaves, inflorescences, apples, and nuts, reducing the visual quality and yield of cashew apples and nuts [11], as well as the nutritional status [12].

Powdery mildew disease infests all tender tissues of the trees, mainly tender leaf and inflorescence including the part not well unfolded and seldom attacks old and mature leaves [1]. A white powdery growth is formed on infested fruit bearing branches and inflorescence. The lesions of infected parts turn to brown and after 2 – 3 weeks they shrink gradually and become dry and shed, leading to drying out and drop of numerous flowers and tender fruits. Infected apples turn dull and their skin becomes much coarser. The apples when heavily infected show deep cracks on the surface and gradually shrivel and dry up [1] and tender nuts deformed on shell when infected. The lesions turn grey on infected tender apples and nuts, the nuts deteriorate in quality during storage, decays easily and produce poor quality kernels when processed [8,9,13]

The powdery mildew spores are mainly dispersed by wind as rainfall inhibits its development. However, perennation and survival of the pathogen from one season to another takes place in fallen infested leaves, water shoots and off-season flowers [13]. Powdery mildew disease is not dormant and can occur on the tree canopy all the year round by wind dispersal [8,9]. Overlapping branches and twigs under the crown without penetration of sunlight and lack of rains are optimum condition for the powdery mildew fungus to survive [8,14].

4 Conclusion

The suspected cases observed on farmers field were similar to PMD on cashew parts as reported in East Africa and recently unpublished presence in West Africa belt. The insurgence of PMD on cashew organs on trees in growing communities of Nigeria is assuming a major status, the spread and popularity of the condition is fast advancing. Phytopathologist and molecular biologist need to validate the existence of the pathogen and establish its identity on cashew.

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