INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

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PRELIMINARY EVALUATION OF INCIDENCE AND SEVERITY OF POWDERY MILDEWS OF SOME CROP PLANTS IN MAKURDI, BENUE STATE, NIGERIA

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ABSTRACT
A survey of two important crop plants (*Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq.) on cultivated farms showing symptoms of powdery mildew disease was carried out in Makurdi Local Government Area of Benue state Nigeria. Disease incidence was determined by using rate and severity of the disease by using severity scale of 0- 4. The plants sample *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq. showing symptoms of disease were collected from study areas. The disease plants (stem, leaves and roots) were cut into small pieces, surface sterilized in 5%w/v ethanol for 1 minute and rinsed with sterile distilled water. The different plant parts were cultured on Potato Dextrose Agar (PDA) in Petri dishes. Pure cultures were obtained using single spore method. Pathogen identification was by microscopy using relevant fungi identification keys after which pathogenecity test of the isolated organism was conducted. The results showed that incidence ranged from 15.7% - 30.0% on stem and leaves of both crops in the studied areas. The severity was 0 – trace, (1 – 20%) and 2- mild (21 – 40%) on stem and leaves of both crops using severity scale. Significant differences (P= 0.05) were observed in disease incidence among the sampled areas, indicated a rising trend in the disease which could result in low yield in plants. Results of isolation of pathogens associated with disease plants showed the predominance of *Erysiphe species.*

KEYWORDS: Disease Incidence, Powdery mildews, *Erisiphe* species.

INTRODUCTION

Powdery mildew is a disease that affects angiospermic plants (Hirata, 1966). Powdery mildew is limited to disease caused by many different species of fungi in the order *Erysiphales* from the division ascomycotina (Brayan, 1969; Cagas, 1981). The disease account for yield losses up to 40% - 80% reported by (Singh and Singh, 1977 & Bem *et al*., 2005). The disease is known to attack the plants on the lower most leaves near the soil and resistant spore store in seeds (Mundkur, 1949, Bem *et al*., 2005). Powdery mildews are obligate, biotrophic fungi, meaning they can survive only on cells in specific living hosts despite their restrictive host specificity (Jules, 2008). They are parasites of angiosperms with great physiological specialization (*i.e*. having strains or races confined to a narrow range of host plants). Members extend from the trophic to the arctic and from below sea level to 40,000m (Hirata, 1966). Many biotrophic fungi such as the rusts and powdery mildews have evolved a less confrontational but a more complex strategy to gain access to plant (Robert *et al.*, 1997). Parasitic powdery mildew fungi have to overcome basic resistance and manipulate host cells to establish a haustrium as a functional feeding organ in a host epidermal cell (Ruth and Ralph, 2007). The parasitic powdery mildew fungus develops on the leaf surface (Kaye *et al.*, 2006). Currently, it is of central interest how plant factors negatively regulate basal defense or whether they even support fungal development in compatible interactions. It is one of the easier diseases to spot, as its symptoms are quite distinctive (Kavanah, 2005). The symptoms include chlorotic or necrotic leaves, stems and fruits covered with mycelium and fruiting bodies of the fungus (Kavanagh, 2005). The symptom is a white or gray, powdery growth on leaves and stem which will not usually kill a plant, however it may weaken plants and it is unsightly (Master Gardener, 2006). Infected plants display white powder-like spots on the leaves and stems. The lower leaves are the most affected but the mildew can appear on any part of the plant that shows above the ground (Frauenstein, 1986). As the disease progresses, the spots get larger and thicker as a massive numbers of spores form and the mildew spread up and down the length of the plant that become diseased with one of the powdery mildews fungi (Stephen and Chatfield, 2005). Although the fungi that causes powdery mildews are usually different on different plants all of the powdery mildew disease are similar in appearance. Powdery mildews are fungal diseases that are very host – specific. It is common to see it on roses, lilacs, melons, cucumbers, turf grass, tomatoes, beans and many other plants. They infect almost all ornamental plants (Stephen, 2005). Powdery mildews are commonly seen only on those plants more naturally susceptible to the disease (Stephen and Chatfield, 2005). Susceptible woody plants includes some deciduous a zeleas, buckeye, catalpa, cherry, a few of the flowering crabapples, dogwood, English Oaks, honey suckles, horse chestnut, lilac, privet, roses, service berry, silvermaple, sycamore, some viburnums, and winter

creeper (Stephen *et al.*, 2003). In most cases, prompt recognition and control actions can prevent severe damage to plants from powdery mildews diseases (Jim, 2006). In similar vein, evaluation of the incidence and severity of disease on *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq. in Makurdi, Benue State Nigeria has not been documented. Therefore, this study evaluated the incidence and severity of diseases encountered in different farmers farm in Makurdi metropolis.

MATERIALS & METHODS

Collection of plant samples

Samples of stem, leaves and roots of *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq. suspected to be infected with the fungus were collected from different areas in Makurdi metropolis in November 2009 and conveyed in polythene bags to the Botany Laboratory in Benue State University, Nigeria.

Disease incidence and severity

The percentage incidence of tomato plant diseases using disease symptoms was evaluated by using diseases index (DI) as used by Khanna *et al.*, (1977) with little modification by Bem (2010).

Disease Index (DI) = h/n × 100/1

Where h = number of diseased plants sampled.

n = total number of plants sampled.

Disease severity was determined as reported by Chakravarti (1977) with little modification by Bem (2010) using a numerical scale of 0 – 4 as follows:

0 = No infection
1 = 1 – 20% = mild infection
2 = 21 - 40% = moderate infection
3 = 41 – 60% = high infection
4 = 61 and above = severely infection

Data obtained were subjected to appropriate statistical methods to determine regional effect of disease on plants.

Isolation and identification of fungus associated with diseased plant samples

Affected portions of leaves and stem as well as asymptomatic roots of infected plants were thoroughly washed with distilled water, cut using surgical blades into small section of between 5 – 10mm^2. Cut sections and soaked in 5% sodium hypochloride for 30 seconds for surface sterilization and removed with a pair of forceps. Tissues were further rinsed in changes of distilled water and blotted dry in accordance with methods reported by Fisher *et al*. (1982). Surface sterilized sections of the diseases planted were then place on Petri dishes containing Potato Dextrose Agar and incubated for 3 – 7 days at room temperature. Identification of observed fungal growths was carried out as reported by Leslie *et al.* (2001).

Pathogenicity tests

Healthy plants of both *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq. that are free from injuries were carefully selected randomly. The leaves and stems of the plant were bruised using needles and Inoculation was done with the pure isolate of the culture. Inoculated plant sample were kept in the field having enough condition for fungal growth for 7days. The plants were then taken to the laboratory for culture, isolation, identification and confirmation of the causal pathogen of the disease**.**

RESULTS

Table 1a and 1b show that there were growth of pathogens on stems and leaves of both infected *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq. when plated on Potato Dextrose Agar plates which was not observed in the root culture of both plants. Results presented in Table 2 indicate the presence of gray coloured fungal growth with rapid mycelia growth on PDA (Plate 1) at 30^{o}C $\pm$ 2^{o}C after 72 hours of incubation. The presence of cleistothecia and septate hyphae were also noted (Plate 2 and 3).

TABLE 1a: distribution of pathogens on diseased plant parts sampled

Manihot esculentum Crantz.	Pathogen growth
Stem	+
Leaves	+
Roots	–

Key:
+ = Present
- = Absent

TABLE 1b: distribution of pathogens on diseased plant parts sampled

Elaeis guineensis Jacq.	Pathogen growth
Stem	+
Leaves	+
Roots	–

Key:
+ = Present
- = Absent

TABLE 2: cultural characteristics of isolated pathogen

-	Growth on PDA	Growth Temp. (^{o}C)	Mycelia colour	Spore type	Hypha type
	Rapid	30^{0}C$\pm$ 2^{0}C	Gray and white	Microconidia	Septate

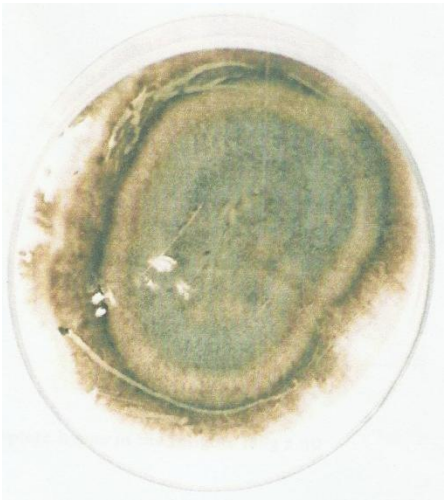

PLATE 1: Dark grey mycelia, of Erysiphe spp showing rapid growth on PDA. Mag x10

PLATE 2: The septate hyphae of a *Erysiphe* spp. Mag x 40

PLATE 3: The micro photograph of cleistothecium of *Erysiphe* spp. Mag x 40

Results shown in Table 3a and 3b indicate a higher disease incidence in both *M. esculentum* and *E. guineensis* in High Level (30%) compared to Akpehe (19.2%), Wadata (16.6%) and North Bank (15.8%) for M. esculentum while E. guineensis recorded Akpehe (21.2%), Wadata (20.8%), and North Bank (15.8%) areas of Makurdi. Results of Disease Severity as shown in Table 4 indicate that while occurrence of disease was mild in Akpehe, Wadata and North Bank, occurrence was moderate in High level areas of Makurdi.

TABLE 3a: incidence of powdery mildew on *M. Esculentum* in Makurdi

Areas/Location	Disease free	Affected	Total	Disease incidence (%)
Akpehe	42.0	10.0	52.0	19.2
Wadata	40.0	8.0	48.0	16.6
North Bank	32.0	6.0	38.0	15.8
High Level	28.0	12.0	40.0	30.0

TABLE 3b: incidence of powdery mildew ON *E. guineensis* in Makurdi

Areas/Location	Disease free	Affected	Total	Disease incidence (%)
Akpehe	41.0	11.0	52.0	21.2
Wadata	38.0	10.0	48.0	20.8
North Bank	32.0	6.0	38.0	15.8
High Level	28.0	12.0	40.0	30.0

TABLE 4: severity of disease in the sampled areas in Makurdi

Areas/Location	Scale level	Severity	Incidence (%)
Akpehe	1	Mild infection	19.2
Wadata	1	Mild infection	16.6
North Bank	1	Mild infection	15.7
High Level	2	Moderate infection	30.0

PLATE 4: pathogenecity test on *M. esculentus*

PLATE 5: pathogenecity test on *E. guineensis*

Pathogenicity studies

The isolated fungi; Erysiphe spp. Infected only the stems and leaves of *Manihot esculentus* Crantz. and *Elaeis guineensis* Jacq indicating the presence of the pathogen as shown in plate 4 and plate 5. The infected plant sample showed disease symptoms similar to those from which they were isolated.

DISCUSSION

The presence of the powdery mildew pathogen on leaves and stems of infected plants in the study agrees with reports of Jim (2006), Kavanagh (2005), Stephen and Chatfield (2005) and Kaye *et al.,* (2006), who stated that the pathogens of the genus Erysiphales are known to develop only on leaf and stem surfaces of plants. The characteristic growth produced by the pathogen in the study did not differ from findings of Takamatsu *et al.,* (2002), Palti (1959) and Palti (1988), Braun *et al.* (2002), Ruth and Ralph (2007) who reported that, the pathogen after 4 days grows rapidly on PDA (Potato Dextrose Agar) at temperature of $30^oC \pm 2^oC$ producing gray and white spreading growth called mycelia, which in turn produces both pseudo chains of conidia and conidiophores with a septate hyphae. *Erysiphe spp.,* the probable causative organism of the disease in the study has also been reported by Liberator *et al.*, (1998) and Szentivanyi *et al.*, (2005) who isolated and identified the pathogen from several mildewed plants. Also, powdery mildew caused by Erysiphe cucurbitarum has been reported as foliar diseases of 'egusi' melon in South Western, Nigeria (Kehinde, 2008). Foliar diseases such as Anthracnose, gummy blight and downy mildew diseases have been reported to be destructive on water melon, a member of the family Curcubitaceae, given the proper environmental conditions (Kehinde, 2008). This powdery mildew can decrease plant canopy, reduce yields through decreased fruit size and number of fruit per plant, and reduce fruit quality, flavour and storage life (Donald, 2008; Keinath and DuBose, 2004; McGrath and Thomas, 1996). The reduced canopy may result in sunscald of the remaining fruit, making them unmarketable. The observed chlorotic spots that occur on the leaves accompanied by sporulation and development of mycelia and conidial on either leaf surface is in consonance with the work Davis *et al.* (2001). The incidence of the disease in the studied area ranged from 15.8 – 30%. These values could attain epidemic levels in the absence of timely application of fungicides and appropriate cultural control measures. Powdery mildew on *M. esculentum* and *E. guineensis* is a rapidly evolving disease with serious impact on their production worldwide. Therefore, resistance screening to emerging races and pathotypes and development of differential lines that can be used to detect these different forms of fungus are of great importance.

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