

OVERVIEW ON MANAGEMENT OF DISEASE INCIDENCE OF FLUTED PUMPKIN (*Telfairia occidentalis*) IN NIGERIA

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SUMMARY

Disease incidence on fluted pumpkin in South Eastern Nigeria was evaluated. This was done with the view to knowing the disease types, damage and management practices for such disease and hence, aims to increase yield of the crop. The method adopted was research approach. Literature were consulted and documented. From the study, a host of biotic agents pose threat to the production of fluted pumpkin including bacteria, fungal and viral pathogens. The best management measure to adopt involves the integrated pest management which should incorporate biological, cultural, chemical and physical methods of disease control. However, some farmers still involve solely on the so used of synthetic chemicals which is not environment friendly. The result gotten from the study can be used to advise farmers in disease management for optimum yield of fluted pumpkin.

Keywords: Biotic agents, synthetic chemicals, biological control, cultural practices.

FLUTED PUMPKIN is a tropical vine in the family *Cucurbitaceae* and occurs in the forest zone of West and Central Africa, most frequently in Benin, Nigeria and Cameroon (21). Common names for the plant include fluted gourd, fluted pumpkin, Ikong ubong and Ugu (33). Fluted pumpkin is cultivated for its edible leaves and seed, it is fast assuming great importance in Nigeria and other

countries in West Africa because it is contributing to her dietary needs. For the Igbo tribe in eastern Nigeria, it is by far the most popular leafy vegetable because of its versatility for use in the preparation of various dishes like soup and sauces (18). It is also a source of oil used for cooking and making of soap, margarine, paints and varnishes. The production of pumpkin has been on the increase in

Nigeria due to increased awareness of its nutritional values (22).

The seeds of fluted pumpkin (*Telfairia occidentalis*) are high in fat, protein and therefore contribute to a well-balanced diet (24). It contains minerals like magnesium, iron, potassium and vitamins A and C (13). The fibre content of the leaves renders good roughage, which is important for efficient digestion. About 30-35 million people in Nigeria use pumpkin traditionally and the ethnic groups mostly identified are the Igbo, Efik, Ibibio, Urhobo, IkaAboh, Edo and Isoko (3). The seeds have lactating properties and are in high demand by nursing mothers (12). The leaves are rich in iron and used to cure anaemia while also being high in protein content. The first pruning of fluted pumpkin is four weeks after emergence to stimulate branching and such increase the growth (21). Irrigation is necessary for high leaf or fruit production especially under sole cropping in the dry season. Watering is done once every 3 days. Organic manure or inorganic fertilizers are used in traditional systems.

A major challenge to pumpkin production however, is that there are separate male and female plants (dioecy) (12) such that the sex cannot be known until after flowering which

takes about 4 months after planting (29). According to (2), seed propagation has more than fifty percent chance of being the less desirable male type, whose shoots are coarser and less succulent than the female and does not set fruit. Hence, female leaves and plants are in higher demand by housewives and farmers respectively since they bring additional monetary returns (12).

DISEASES OF FLUTED PUMPKIN (*Telfairia occidentalis*)

1. BACTERIAL DISEASES

a) Bacterial Leaf Spot (BLS)

Bacterial leaf spot is caused by *Xanthomonas cucurbitae* (syn=*X. campestris* pv. *cucurbitae*) (9). Lesions appear first on the underside of the leaves as small, water soaked yellow dots on the upper side of the leaf. Lesions are especially small in pumpkin, winter squash and gourd leaves. As lesions enlarge, they can coalesce and look like Angular Leaf Spot (ALS), however, leaf spots caused by *X. cucurbitae* are initially smaller than those caused by the angular leaf spot pathogen (11, 37). Occurrence is common following heavy rains, dew or overhead irrigation (10). Bacterial leaf spot disease blocks the water-conducting tissue of the plant with xanthan, a mucilaginous sugar. Its most important means of transmission is on seed and as little as 0.03% infection

can cause epidemics. Bacterial leaf spot affects leaves, stems, and fruit of fluted pumpkins.

Symptoms can appear at any growth stage as yellow, V-shaped lesions that extend toward the base of the leaf resulting in wilt and necrosis. The pathogen may move into the petiole and spread up the stem or into the roots and become systemic. As the disease progresses, the veins of infected tissues turn black and the normal flow of water and nutrients is inhibited. Bacterial leaf spot is often followed by invasion of soft-rot organisms (11).

The bacteria can persist in infected plant debris for up to two years; it survives in the soil for 40-60 days. It is enhanced by warm temperatures and symptoms may not appear in the seedbed, allowing infected plants to be transplanted into the field. It spreads within the field by splashing water, wind, equipment, people, and insects. The pathogen can spread to long distances by infested seeds and transplants.

A number of management strategies which can be used to control the disease are;

- * Selection of seeds that has been certified as disease-free (6).
- * Use of hot water treatment on the seed to eradicate the bacteria. Treatment of seeds for 15- 30minutes

at 50° C, dry, and test for germination (5). This process must be done carefully and it is recommended that a small sample of Practicing of seed be tested for the effect on germination first.

- * Avoiding dense seeding rates which can prolong periods of leaf infection and enhance pathogen spread. Monitoring of seedlings and promptly remove and destroy infected seedlings.

- * Use of clean and dry tools as bacteria are easily spread by contaminated tools.

- * Practising of three-year rotation and control cruciferous weeds (19).

- * Do not on work fields when they are wet and avoid overhead irrigation.

- * Use of plant extracts to control disease has been reported. For instance, (26) observed that aqueous extracts of *Azadirachta indica* seed, *Piper guineensis*, *Citrus sinensis* and *Chromolaena odorata* were effective in inhibiting the growth of bacterial spot pathogen (*Xanthomonas campestris* pv. *vesicatoria*) *in vitro* and *in vivo*. The inhibitory effect of some plant extracts (pawpaw seeds, water melon seeds, orange peels and moringa seeds) in the control of bacterial leaf spot of okro have been demonstrated

(27). Chemical recommendations of Cupric hydroxide (Kocide 4.5LF) has been reported and application done as soon as disease appears on a 7-10-day schedule (19).

b) Angular Leaf Spot (ALS)

Angular leaf spot is caused by *Pseudomonas syringae* pv. *lachrymans*. Characteristic symptoms of ALS in cucurbit foliage (cucumber, melons, squash and pumpkin) are irregularly-shaped lesions that are water soaked when young, and bleach to gray as lesions expand. The centre of the lesion becomes brittle and breaks, leaving a “shot hole” on the leaf surface. Early lesions on the fruit are water soaked and oval to circular in shape (11, 37). Under humid conditions, bacterial exudates can ooze from the lesions in leaves and fruits and when dry the exudates look like a whitish residue. *Pseudomonas syringae* pv. *lachrymans* is seed borne, specifically associated with the seed coat, therefore infection occurs as early as cotyledons emerge. This pathogen is dispersed by rain. Insects, machinery, labour clothing and hands can also aid plant-to-plant dispersal (6).

Management practices includes; Use of disease-free seeds, use clean and dry tools as the bacteria are easily spread by contaminated tools (5). Avoid work on fields when they are

wet and avoid overhead irrigation and do not locate cull piles near fields or storage areas.

Incorporate crop residues after harvest to speed decomposition promptly (19).

c) Bacterial Soft rot

Bacterial soft rot disease is an infection that can devastate a crop of fleshy vegetables such as carrots, onions, tomatoes and cucumbers, though it is most widely known for its attacks on potatoes (28). Soft rot disease is most easily recognized in these vegetables by soft, wet, cream to tan coloured flesh surrounded by a dark brown to black ring. When conditions are right, these necrotic spots begin on the outside or skin of the crop and works inward. Initially, there is no odour, but as the soft rot disease progresses, secondary infections invade and the blackened potato emits a foul smell (6).

Bacterial soft rot is caused by several bacteria, most commonly *Pectobacterium caroterium* (otherwise called *Erwinia carotovora*), *Dickeya dadantii* (formerly *Erwinia chrysanthemi*) and certain species of *Pseudomonas* (*Raslstonia*), *Bacillus* and *Clostridium*. Soft rot bacteria, or *Erwinia cartovorum* is found everywhere (35). It survives in soil

and water sources, even oceans, and is found all over the globe. Almost all commercial crops are affected to some degree by soft rot. Bacteria in the home garden can be introduced by insects, wind-blown rain, or leftovers from the previous year's crop (28). Rot can occur over a wide temperature range, with the worst decay between 70 and 80F, particularly when oxygen is limited (35). Avoidance of overcrowding of plants, and working during wet condition, use resistant species, work with clean and dry tools to avoid contamination and spread of the disease.

d) Bacterial fruit rot

Fruit Rot of fluted pumpkin can be caused by species of gram-negative bacteria, *Erwinia carotovora* and *Pseudomonas* spp. It is a destructive disease of fruits, vegetables, and ornamentals found worldwide (36) and affect genera from nearly all the plant families. Disease spread can be caused by simple physical interaction between infected and healthy tissues during storage or transit or by insects (1). Nwugo and Ihejirika (20) reported losses of *T. occidentalis* due to fruit rot in Nigeria to be about 72.5%. Bacteria are spread in infected crop residue, contaminated seed and water splash.

Management strategy involve rotation of crops with non-cucurbit

crops. Apply copper spray during early formation of the fruit to reduce the incidence of bacterial fruit spot. Maintenance of good phytosanitary measures in the field could be used as control measures (19).

2. FUNGAL DISEASES

i) White leaf spot

White leaf spot disease is a major fungal disturbance on *T. occidentalis*. The fungus frequently isolated from leaf spot lesions on fluted pumpkin leaves is in the genus *Phoma*. This fungus isolated by Asuquo and Opara (9) was found to produced dense mycelia of white to light green in colour with dictyochlamydospores at the tip of hyphal strands as well as the inter colony hyphal cells and turns the growth medium (PDA) red. These authors identified the fungus as *Phomasorghina*. White leaf spot fungus reduces the leaf lamina. It also affects the seed

White leaf spot can be controlled by the use of resistant varieties, biweekly foliar spraying with Dithane M-45 at a concentration of 500 ppm, copper fungicides or zineb give a good control (6). Use of plant extracts is also efficient in the disease management. For example, Asuquo and Opara (9) tested the efficacy of plantain inflorescent ash on control of this disease and showed that, the inflorescence ash inhibited mycelial growth, sporulation and spore

germination with percentage inhibition increasing with increase in concentration.

ii) Powdery mildew

Powdery mildew is caused by the fungus *Fusarium moniliforme*. This fungus forms a dry powdery mass of mycelia on the fruits of fluted pumpkin. Symptom is also observed as greyish powdery areas on older leaves; leaf drop may cause sunburn. First seen on the lower leaf surface, powdery mildew is a white “powdery” covering of spores that move from the lower leaf surface to the upper, eventually defoliating the pumpkin plants. A dusty appearance is due to enormous number of spores formed superficially on the host; black fruiting bodies (cleistothecia) may also develop (6). Spores survive among the soil and crop residue, and are dispersed by wind. It is one of the easiest diseases to identify and unlike other foliar diseases, this disease tends to increase in severity during periods of dry weather. Severely affected leaves dry turn brown and become brittle. Powdery mildew affects fluted pumpkin and other cucurbits including water melon (*Citrullus lunatus*), cucumber (*Cucumis melo*), and other host like African violet (*Saintpaulia ionantha*), Pawpaw (*Carica papaya* L.) (9). Powdery mildew fungi are influenced by plant age, humidity and

temperature. To combat powdery mildew, it is essential to rotate with non-cucurbit crops and treat with fungicide at the first sign.

Powdery mildew develops quickly under favourable conditions because the length of time between infection and the appearance of symptoms is usually only 3-7 days and a large number of conidia can be produced in a short time. Favourable conditions include dense plant growth and low light intensity. High relative humidity (RH) is favourable for infection and conidial survival, but infection can take place at RH levels as low as 50%. Dry conditions are favourable for colonization, sporulation, and dispersal. Rain and free moisture on the plant surface are unfavourable; however, disease development occurs in either the presence or absence of dew. Infection can occur at 50-90°F; mean temperatures of 68-80°F are favourable (19). Powdery mildew development is arrested at daytime temperatures of 100°F or higher. Plants in the field are often not affected until after fruit initiation.

A number of management strategies are used to control powdery mildew. These are as follows:

1. Use of resistant species: Genetic resistance is used extensively as a control measure in cucumber and

melon, and is being incorporated into other cucurbit crops.

2. Successive cucurbit plantings should be physically separated because older plants can serve as a source of conidia.

3. Use of Fungicide: Fungicides should be applied every 7-10 days beginning early in disease development following detection through an IPM scouting program. Examine upper and under surfaces of five older leaves at ten separate sites or until symptoms are found. Initiate a weekly spray program when symptoms are found (5).

4. For a preventive schedule, applications should begin when plants start to run and/or to produce fruit. To obtain adequate control, fungicide is needed on the under surface of the leaves and on leaves low in the plant canopy because those surfaces are optimum for the development of the fungus. Control is best accomplished by using systemic materials (i.e. triadimefon, benomyl, thiophanate methyl) (19).

5. Another approach is to improve the efficacy of contact materials (i.e. Chlorothalonil, copper) by maximizing spray coverage on under surfaces of leaves.

iii) Downy mildew

This is caused by a downy mildew fungus, *Pseudoperonospora cubensis* (28). Downy mildew is seen as lesions on the upper surface of the foliage. Initially, the lesions are yellow spots or angular water-soaked areas. The lesions become necrotic as the disease progresses (6) and lead to defoliation.

Cool, wet conditions foster this disease. Under favourable condition for disease development, downy mildew develops rapidly resulting in a scorched appearance over an entire field. The spores of downy fungus are also dispersed via wind (6). Planting early season varieties can also reduce the chances of downy mildew infiltrating the crop, as the disease is generally more common late in the growing season when conditions are cool and rains are more likely. Broad spectrum fungicides are somewhat effective against downy mildew.

Most downy mildew fungi require cool weather for reproduction and development. This is not true of the cucurbit downy mildew fungus. Optimum temperature for infection is at 16 to 22° C (19). It can survive when temperatures are over 37.8° C. The most critical factor for infection is a film of moisture and/or long dew periods on leaves.

Disease spread is primarily through wind and rain splash. The fungus attacks only members of the

cucumber family, mostly those that are cultivated, although it can infect wild cucumber and a few other weed hosts

A number of management strategies are used to control downy mildew. These are as follows:

1. Destroy crop residues after harvest.
2. Control cucumber beetles, which are responsible for fungal spread.
3. Spray copper- based fungicides when the disease is observed
4. Avoid humid conditions during storage.

iv) **Anthracnose**

Anthracnose otherwise called dieback disease affects a variety of crops. Anthracnose of fluted pumpkin is caused by the fungus *Colletotrichum graminicola* that attacks the above ground part of the plants (34). Spots or blotches that are angular and located around the veins are generally referred to as anthracnose (32). The disease begins as small, light brown spots outlined with a darker margin that expands as it progresses on susceptible host. Symptoms are more noticeable on fruits. Spots on fruits are circular, brown and sunken (31). Under wet condition, the centres of the spots become salmon coloured due to mass of fungal spores and affected fruits can be attacked by opportunistic soft-rot organisms, which enter through

broken rind. *Colletotrichum graminicola*, the causal organism is seed-born and can survive in crop debris as well as in weeds belonging to the cucurbit family. It has a large host range including water melon, fluted pumpkin, cucumber, gherkin, gourd and muskmelon, cucurbit weeds (31). Also, Chukwu *et al.* (15) reported on the control of anthracnose disease on fluted pumpkin through the use Aloe vera leaf extracts

v) **Sclerotinia rot**

This is caused by a cool season disease that affects many types of vegetables. The pathogen produces sclerotia that can survive in the soil indefinitely (5). Cool temperatures and high relative humidity enhance the development of a white, cottony mold around water soaked infected areas. Black sclerotia grow among the mold and are the size of watermelon seeds. The whole plant, including the fruit rots (28). Spores are spread through wind. There are no disease resistant pumpkin varieties. Fungicides can be effective if applied to young plants.

vi) **Phytophthora blight**

Phytophthora blight is a serious disease caused by a fungal pathogen *Phytophthora telfairia* that can reside in the soil indefinitely and spread rapidly (6). Primary symptoms can be viewed on the fruit and spreads to the

vines (25). A soft rot combined with an expanding area of white, cottony mold is seen. It also afflicts many other crops. Phytophthora blight is most severe when late summer is cool and wet. The fungal spores are dispersed through water splash, wind, and equipment use (19). There are no resistant varieties of pumpkin to disease. Crop rotation may reduce the severity of the disease for future crops as well as avoiding planting in soil that drains poorly or tends towards standing water. Fungicide applications can reduce losses.

3. VIRUS DISEASES

Many biological constraints, particularly diseases of the virus origin have become potent threats to existence of the plant and those of utmost importance is *Telfairia mosaic virus* (TeMV), genus Potyvirus (30) followed by Pepper veinal mottle virus (PVMV), genus Potyvirus (29). Common virus symptoms observed on plants in the field includes mosaic, mottling and leaf size reduction. Mosaic symptoms on leaves were most common (25%), followed by leaf size reduction (17%) and leaf necrosis were least (2%) (33). *Telfairia mosaic virus* (TeMV), causes mottling of the leaves and low leaf yield; it also causes chlorosis, stunting and abnormal fruit development. The pathogen is seed-borne and is therefore transmitted

from generation to generation by mere planting (7).

Management includes the use of resistance variety and use of Aloe vera extracts (15)

NEMATODE DISEASES

Root-knot nematodes are eel-like worms that live in the soil and feed on plant roots. Root-knot nematodes cause serious damage to wide range of members of cucurbits, though fluted pumpkin is known to be resistance to the pathogen (21). Nematodes impair the root system of plants so that infected plants cannot take up water and nutrients; moreover, they create wound on plant root and allow diseases like *Fusarium wilt*, *Verticillium wilt* to infest susceptible hosts. The pathogen, *Meloidogyne* spp. damages plant roots and leads to poorly functioning root system.

Serious root-knot injuries often show stunted appearance and wilted growth in the above ground part with a galled root system becoming progressively worse during the growing season. Other symptoms observed on above ground parts include chlorotic and necrotic patches on leaves of infected plants. Nematode-infested plants are more susceptible to water of temperature stress and exhibit stress symptoms earlier than resistant plants. Odiaka and Schippers (21) had

however reported that fluted pumpkin is resistant to root-knot nematodes.

CONCLUSION

A range of biotic agents including bacteria, fungi, nematodes and viruses influence the production and quality of fluted pumpkin. Environmental factors such as moisture and temperature affect the development of epidemic. Knowledge of the pathogen nature including its level of virulence, ecology and means of spread is essential in management strategy. Synthetic chemicals have been used to manage plant diseases. However, the potential hazards on man from synthetic pesticides has increased the concern of consumers and called for

new approaches in crop disease management.

Management of fluted pumpkin disease involves the combination of cultural, physical, biological control methods. Cultural practices such as removal of diseased leaves and inter-cropping can be utilized by the rural farmers in Nigeria to reduce the incidence and severity of leaf spot disease of fluted pumpkin (20). Use of plant extract and agricultural waste in disease management is ecosystem friendly (13) and is therefore encouraged because certain chemicals contained in plants are toxic to agricultural pest and diseases (5,16) and corresponding increase in crop yield.

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