



Virus symptom types associated with fluted pumpkin (*Telfairia occidentalis* hook f.) in Benue state

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ABSTRACT

Objective: To identify common types of symptoms associated with virus infections, their patterns and distribution on pumpkin leaves in Benue State, Nigeria.

Methodology and results: Pumpkin fields and private gardens in nine pumpkin producing local government areas (LGAs) of Benue State were sampled between June to July 2015 for virus symptom expressions, types, their frequencies and distribution. Using visual observation of virus symptoms in pumpkin farms, 486 plants from 81 fields were examined and symptomatic plants counted according to symptom types. Young leaf samples from plants showing symptoms and those without symptoms were collected. These were preserved on cotton wool in 25 cm bottles containing CaCl₂ for other investigations. Data on types of symptoms were converted to percentages and analysed using ANOVA ($p \leq 0.05$). Symptom types differed significantly ($P \leq 0.05$) among pumpkin fields from 2% in necrosis to 25% in mosaic. Six symptom types and a mixture of symptoms were observed on pumpkins in the field. Significant differences ($P \leq 0.05$) were recorded on symptom types also across LGAs. Most of the mosaic and vein banding symptoms (31%) and (19%), respectively were observed on pumpkins in Buruku LGA followed by Gwer (27%). Leaf size reduction were more (20%) in Vandeikya while necrosis was found only in Makurdi (7%) and Ukum (9%) LGAs. Mixed symptoms were found in all the LGAs surveyed except Makurdi, being highest (33%) in Vandeikya and Oju LGAs. Patterns of symptom spread were mostly scattered (67%)

Conclusion and application of findings: Data provided by this study will serve as a guide for field detection of the virus diseases of the crop by farmers and researchers in the field for further identification and management measures of the diseases.

Key words: Symptom types, *Telfairia*, Virus, Survey

INTRODUCTION

Fluted pumpkin, *Telfairia occidentalis*, is a tropical vine in the family *Cucurbitaceae*. Common names for the plant include fluted gourd, fluted pumpkin, Iroko and Ugu. Cultivated for its edible leaves and seeds, the crop is fast assuming great importance in Nigeria because it is contributing to her dietary needs and other countries in West Africa (Asiegbu, 1985;

Ossom, 1985). Pumpkin plays a very important role in income generation particularly for the rural farm families. Being fairly drought tolerant, it is often the dominant leafy vegetable in the dry season. It offers a significant opportunity for the peasants to earn their living as producers and sellers during this season without requiring large capital investment

(Schippers, 2000). 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 (Fasina and Okeowo, 1998). It is also a source of oil used for cooking and making of soap, margarine, paints and varnishes (Irvine, 1969). The production of pumpkin has been on the increase in Nigeria due to increased awareness of its nutritional values (Odiaka, 2005). It contains minerals like magnesium, iron, potassium and vitamins A and C. The leaf is rich in oil (13%) and protein (21%) (Bosa *et al.*, 1983), while the kernel is known to contain 53% fat and 27% crude protein (Longe *et al.*, 1983). 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, Ika Aboh, Edo and Isoko (Akoroda, 1990). Although studies have shown that the roots are poisonous and contains toxic compounds such as resins, alkaloids and saponins lethal to animals like rats and mice, fish and even man if consumed (Akubue *et al.*, 1980), these compounds can be harnessed and used as industrial oil, botanicals or medicine. Medically, the crop is consumed as pot-herb. In addition, pregnant women and patients suffering from anaemia use the leaf juice to improve

the blood level while the oil seeds have lactating properties and thus in high demand by nursing women (Asiegbu, 1987; Schippers, 2000; Grubben and Denton, 2004). In spite of this importance, the average yield of pumpkins in Nigeria remains low due mainly to biotic and abiotic stresses, poor agricultural practices and inappropriate farm management (Asoegwu, 1988). 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* (Shoyinka *et al.*, 1986) followed by *Pepper veinal mottle virus* (PVMV), genus *Potyvirus* (Schippers, 2000). So far, some work has been done on the aetiology and spread of virus diseases on pumpkins especially in the southern part of Nigeria. However, the status of viruses infecting this crop in Benue State is lacking. More so, knowledge of the common symptoms of viruses on pumpkins, which forms the first line of field diagnosis, is grossly inadequate. Data on symptom types due to viral infection have been inadequate on pumpkins in Benue State. Thus, this work was initiated to provide baseline information on the types of symptoms associated with virus infections, their patterns and distribution on the crop in the study area.

MATERIALS AND METHODS

Survey area: Survey was carried out among pumpkin producing areas in the three geopolitical zones of the State. These were zone A, zone B and zone C. Nine Local Government Areas (LGAs) were selected and surveyed from June to July, 2015 cropping season. Ukum (Lat. 7° 47' N; Long. 9° 37' E), Vandeikya (Lat. 7° 15' N; Long. 9° 6' E) and Kwande (Lat. 8° 42' N; Long. 9° 18' E) LGAs were selected from zone A; Buruku (Lat. 7° 7' N; Long. 8° 45' E), Gwer (Lat. 7° 18' N; Long. 8° 28' E) and Makurdi (Lat. 7° 74' N; Long. 8° 51' E) LGAs were selected from zone B while Otukpo (Lat. 7° 11' N; Long. 8° 8' E), Oju (Lat. 6° 51' N; Long. 8° 25' E) and Ogbadibo (Lat. 6° 59' N; Long. 7° 35' E) were selected from zone C, respectively (Jagtap, 1995) (Figure 1). Each geopolitical zone constituted a block, the LGAs were replications and symptom types were treatments.

Field sampling for virus symptoms, sample collection and preservation: Three fluted pumpkin fields were

sampled per LGA. Leaves of pumpkin plants in fields visited were examined for virus symptoms. Sampling was based strictly on visual observation of virus symptoms on pumpkins. In each LGA, fields were selected and sampled at random. A "W-shaped" path was followed in each field during sampling (Twizeyimana *et al.*, 2009). Six leaf samples; both those showing symptoms and those without symptoms (for latent infections in further investigations) were collected per field. Fifty-four leaf samples were collected in each LGA and 486 leaves showing symptoms and those without symptoms were collected randomly from farmer's fields, private gardens and orchards. Samples were preserved in sample collection bottles with calcium chloride anhydrous, serving as a desiccant, cotton wool was used as a cushion between the sample and calcium chloride, CaCl₂. Samples were clearly labelled for full identity. Symptoms expressed by plants were captured using a digital

camera. Other information obtained about sampled fields were the source of seeds for planting, varieties grown, size of farm, age of crop at time of survey, level of awareness of virus diseases on the crop, patterns of symptoms on each farm, crops grown in the neighbouring fields, age and level of education of farmer interviewed.

Data Analysis: Counts of virus symptom types on the crop of each LGA from the survey were changed to percentages and analysed using descriptive statistics, correlation analysis and ANOVA while means were separated using F-LSD ($P \leq 0.05$) as detailed by Triola and Triola (2006).

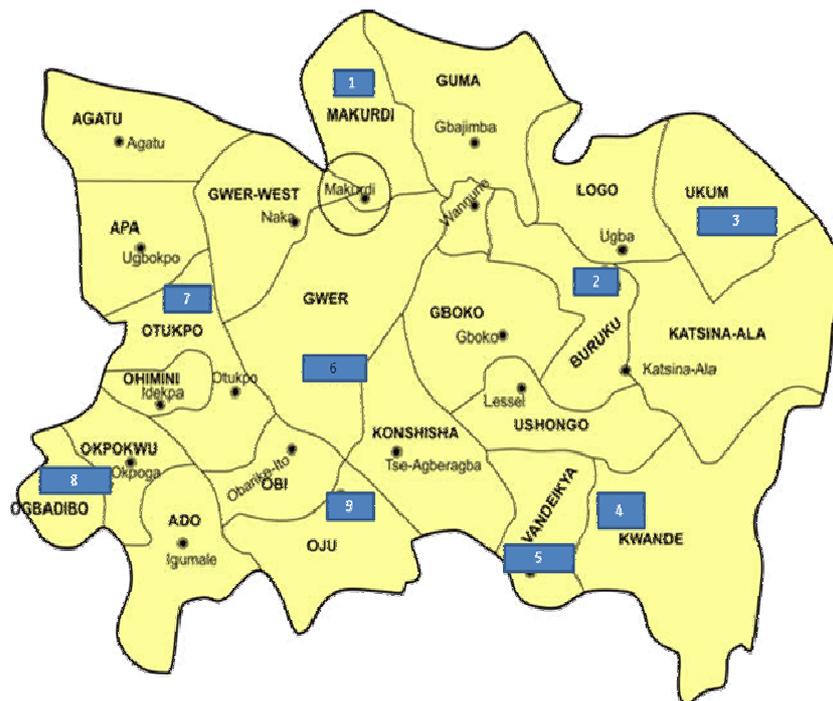


Figure 1: Map of Benue State showing local government areas visited for virus disease symptom assessment on field-grown pumpkin plants during survey. Bands and numbers shown in the map indicate locations visited.

RESULTS

During the surveys, symptoms observed on *Telfairia* plants were variable. Common virus symptoms observed on plants in the field were mosaic, mottling and leaf size reduction (Plate 1). Six symptom types occurred at different proportions in pumpkin fields and differed significantly ($P \leq 0.05$) from one to the other (Table 1). Mosaic symptoms on leaves were most common (25%), followed by leaf size reduction (17%) and leaf necrosis were least (2%). The rest of the symptoms were found to occur at lower ($< 15\%$) frequencies. Also observed were mixtures of different symptoms on the same plants and on same leaves of plants in many locations. Most of the mosaic symptoms (31.1%) on pumpkins were observed in Buruku LGA, Vandeikya had more (20.4%) of leaf size reduction as single symptoms while necrosis was found only in Makurdi (6.7%) and Ukum (9.8%) LGAs (Table 2). Mixed symptoms were found in all the LGAs surveyed

except Makurdi. It was highest (32.7%) in Vandeikya and Oju LGAs, however. Most of the farmers interviewed during the survey were in the age range of 22 to 64 years and a good number were tertiary educated. More farmers (74%) cultivated the crop sole and their seed source (56%) was mainly from previous harvest. The farm sizes in studied area ranged from 0.01 to 0.4 ha. Two major cultivars were encountered in the cultivated fields (Table 3). Ugwu-ala was more (58%) favoured and grown by the farmers while ugwu-elu was grown on a lower scale (42%). Pumpkin plants sampled were mostly within the age of 4 to 8 weeks and the patterns of symptom spread in sampled fields were mostly the scattered (67%) type. Farmers were generally observed to have little or no knowledge of virus symptom types associated with the crop in the study area, whether learned or not.



Plate 1: Healthy (A) and diseased pumpkin leaves showing mosaic (B), leaf size reduction (C) and that showing mixed symptoms: mottling, puckering and chlorosis (D).

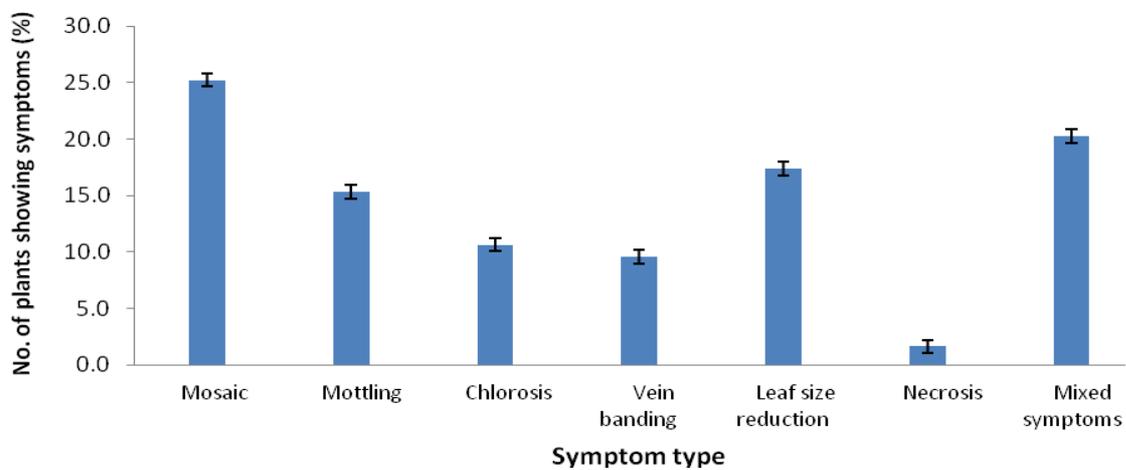


Figure 2: Common symptoms observed on fluted pumpkin plants across surveyed locations.

Table 2: Symptom type expressed by pumpkin plants in surveyed locations

LGA*	Symptom type						
	Mosaic	Mottling	Chlorosis	Vein banding	Leaf size reduction	Necrosis	Mixed symptoms
Makurdi	24.4	22.2	22.2	8.9	15.6	6.7	0.0
Gwer	26.7	24.4	11.1	17.8	17.8	0.0	2.2
Buruku	31.3	16.7	2.1	18.8	16.7	0.0	14.6
Vandeikya	25.0	12.5	6.3	6.3	18.8	0.0	31.3
Kwande	24.0	14.0	8.0	4.0	20.0	0.0	29.9
Otokpo	23.5	11.8	11.8	11.8	11.8	0.0	29.4
Oju	26.7	6.7	6.7	6.7	20.0	0.0	33.3
Ogbadibo	22.0	12.0	14.0	2.0	18.0	0.0	31.9
Ukum	23.5	17.6	13.7	9.8	17.6	7.8	9.8
LSD	10.07	9.60	9.93	6.43	7.59	6.81	6.78
p-value	3.39	3.23	3.34	2.16	2.55	2.29	2.28
SEM [†]	0.6972	0.0518	0.0192	0.0004	0.7242	0.1151	< 0.0001

*Local Government Area; [†]Standard Error of the Mean

Table 2: Social and agronomic characteristics of the study area

Location	Age of farmer	Farmer's Education*	Cropping system (%)		Seed source (%)		Farm size (ha)
			Monocrop	Intercrop	Prev. harvest	Market	
Makurdi	29 - 53	0 - 3	44	56	33	67	0.05 - 0.2
Gwer	31 - 60	0-2	44	56	22	78	0.06 - 0.4
Buruku	24 - 48	0-1	56	44	56	44	0.01 - 0.1
Vandeikya	22 - 59	0-1	56	44	44	56	0.1 - 0.2
Kwande	27 - 64	0-2	100	0	67	33	0.08 - 0.3
Otukpo	30 - 56	0-2	100	0	78	22	0.2 - 0.4
Oju	25 - 47	0-1	89	11	67	33	0.01 - 0.3
Ogbadibo	23 - 51	0-2	89	11	78	22	0.1 - 0.3
Ukum	22 - 52	0-1	89	11	56	44	0.09 - 0.3
	22 - 64	0 - 3	74	26	56	44	0.01 - 0.4

*0- No education; 1- primary education; 2- secondary education; 3-Tertiary education.

Table 3: Agronomic characteristics of pumpkin, patterns of symptom spread and farmers' awareness of virus symptoms in the study area

Location	Variety (%)		Age range of crop (Wks)	Pattern of symptom spread (%)		Awareness of virus symptoms	
	Ugwu-ala	Ugwu-elu		Scattered	Concentrated	Aware	Unaware
Makurdi	78	22	4-8	89	11	0	100
Gwer	56	44	4-6	67	33	0	100
Buruku	89	11	5-8	56	44	0	100
Vandeikya	56	44	4-6	44	56	0	100
Kwande	67	33	4-6	56	44	0	100
Otukpo	33	67	5-8	78	22	0	100
Oju	56	44	5-6	56	44	0	100
Ogbadibo	22	78	4-6	67	33	0	100
Ukum	67	33	4-6	89	11	0	100
Average	58	42	4-8	67	33	0	100

DISCUSSION

Before now, data on the symptom types of viruses infecting pumpkins in Benue State has been absent or limited. Much of the information on the crop with respect to virus infection in the study area often comes from other parts of the country. This study provides the first comprehensive report of the symptom types and their distribution on pumpkins in the State. Symptoms observed on pumpkins in the fields during sampling were characteristic of virus infections and agree with the literature. The existence of many different symptoms as observed on plants in the field during survey could be due to heterogeneity in the cultivars planted by farmers, time of infection and the different types of viruses found infecting the crop. Variability in symptoms could as well

be a result of mixed infections as earlier observed by Matthews (1991). Walkey (1991) also explained that viruses are unlikely to cause just one symptom in infected plants and a variety of symptoms may result as the disease spreads within plants. Different viruses have been reported to infect pumpkins in Nigeria: *Telfairia mosaic potyvirus*, TeMV (Shoyinka *et al.*, 1987) later reported to be seed-transmitted (Anno-Nyako, 1988); a Y-Strain of *Cucumber mosaic cucumovirus* (CMV-Y), which infects cowpeas (Atiri, 1985); and a strain of *Pepper veinal mottle potyvirus* (PVMV-TYVC), which induces a yellow vein-clearing symptom in pepper (*Capsicum* sp.), its primary host (Atiri, 1986). A good number of viruses might have been present in the cultivated fields of Benue

State, as suggested by the symptoms, which have not been detected. This is a cause for concern since many viruses have been reported to be of great economic importance to the crop, other cucurbits, vegetables and many other crops all over the globe, reducing both yield and quality. Mixed symptoms encountered in the field might be because of different viruses infecting individual plants at the same time. Farmers interviewed whose ages ranged between 22 and 64 years, with a good number attaining tertiary education represents the active farming ages in Benue State, and assures us of the reliability of information from them concerning farming activities in the area. Monocropping of pumpkin and sourcing of seeds from previous cropping seasons is always a practice that perpetuates pests, particularly diseases from season to season. The range of 0.01 - 0.4 ha given to pumpkins cultivation suggests a large area and emphasizes the

importance of the crop in the land as observed by Odiaka (2005). Data from this work can serve as basis identification and management of virus diseases associated with the crop. It is therefore recommended that farmers and extension agents should be educated on the symptoms of virus infections in this crop and that the practice of always going back to previous harvest for seeds and allowing pumpkin stands from previous season, which may have been infected with diseases should not be used for as seed stock nor left to fruit for seeds on new farms. It is also important that pumpkin leaf samples, both symptomatic and asymptomatic, from study area be indexed. This is to correctly identify the virus species infecting the crop since disease diagnosis at the level of symptoms alone will not be adequate for meaningful conclusion.

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