Severity of Viral Diseases and Types of Weeds as Alternative Viral Hosts in *Dioscorea* Fields in Southern Guinea Savannah Agroecology of Nigeria

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ABSTRACT

The incidence and severity of viruses infecting yam and weeds were determined on 60 *Dioscorea* farms in Southern Guinea Savannah Agroecology of Kwara State, North-Central Nigeria. Double Antigen Sandwich Enzyme-Linked Immunosorbent Assay (DAS-ELISA) was used as a serological technique to detect Yam mosaic virus (YMV) and Cucumber mosaic virus (CMV) on *Dioscorea* and weeds collected from the farms. The survey indicated virus incidence on *Dioscorea* between 62.8% and 100% and virus severity between 2 and 5 score values. DAS-ELISA

detected YMV in all the *Dioscorea* leaf samples and mixed infection of YMV with CMV in 13 samples. Twenty-nine (29) weed species were found to be predominant on *Dioscorea* fields which comprised of annuals and broadleaves. DAS-ELISA revealed high YMV titer values for the weed species, *Eclipta alba*, *Euphorbia heterophylla*, *Oldenlandia herbacea*, *Cynodon dactylon* and *Phyllanthus amarus*. However, CMV was not found in any of the sampled weed species. The study showed a high occurrence of viruses on *Dioscorea* and the preponderance of weeds which could serve as vectors of viruses. There is a need for efficient management strategies for virus and weed elimination within and around yam fields which will invariably be an attraction to farmers with limited resources for optimum yam production.

Keywords: Ecology, Farming household, Virus transmission, Weeds, Yam production

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INTRODUCTION

Yam (*Dioscorea* spp.) is very important in food security and poverty reduction in Nigeria, as it is consumed in a variety of ways. The major producing states in

Nigeria are Adamawa, Benue, Cross River, Delta, Edo, Ekiti, Imo, Kaduna, Kwara, Ogun, Ondo, Osun, Oyo, and Plateau (Akanji *et al.*, 2003). The important yam species grown in Africa are *Dioscorea rotundata* (white yam), *Dioscorea cayenensis* Lam (yellow yam), *Dioscorea dumetorum* (bitter yam), *Dioscorea alata* (water yam), *Dioscorea bulbifera* (aerial yam) and *Dioscorea esculentus* Lour (Chinese yam) (Asala and Ebukiba, 2016). The variety *D. rotundata* is the principal commercial yam and constitutes about 80% of the total yam produced in Nigeria (Degras, 1993).

Yam may be cooked or fried with rice, beans, plantain, sweet potato, lamb, chicken and butternut as squash soup (Umar *et al.*, 2006). The tubers may be peeled and sliced into tiny pieces and dried to very low moisture contents and milled into yam flour and flakes (Udoh *et al.*, 2005) and in some communities, yam is perceived as a religious, social, and cultural crop (Obidiegwu and Akpabio, 2017). More importantly, yam tubers have organoleptic qualities which make them the preferred carbohydrate staple and can contribute up to 350 dietary calories per person each day (Osei *et al.*, 2019). Tubers of *Dioscorea* are used as

“body refrigerant” during summer and are also used to treat diarrhea (Dutta, 2015). Therefore, improving yam productivity can increase food production and farmers’ income in the producing areas, particularly in West Africa (Hgaza *et al.*, 2010).

Diseases constitute a major constraint to global yam production and are responsible for significant yield losses (Kolombia *et al.*, 2017). Yam viruses have been reported in most of the yam growing areas of West Africa (Odu *et al.*, 1999), causing a reduction in yield and restriction of international exchange of germplasm (Ita *et al.*, 2020). In Nigeria, yam mosaic virus and cucumber mosaic virus are the most prevalent ones that occurred on 78% of yams (Atiri *et al.*, 2003).

Virus disease pandemics and major epidemics affected plants are cultivated not only to feed humankind and livestock but also to provide other benefits such as fibre, ornamental plants, or medicinal products. The role of weeds in the occurrence and spread of virus diseases is an integral part of the ecological aspect of virus transmission. Weeds have the potential to alter the function of ecosystems either as pests themselves and are

potential sources of primary viral inoculum of both known and unidentified virus species. This ensures the paramount importance of weeds in the management of virus diseases for optimum yam production (Asala *et al.*, 2014; Rybicki, 2015).

The objectives of the study were to evaluate the incidence and severity of virus diseases on yam fields; identify the predominant weed species on yam fields and detect the occurrence of Yam Mosaic Virus (YMV) and Cucumber Mosaic Virus (CMV) on yam leaf and weed samples in the Southern Guinea Savannah Agroecology of Kwara State, Nigeria.

MATERIALS AND METHODS

Sampling Technique and Estimation of Virus Incidence and Severity

A virus disease survey was carried out on sixty (60) yam fields with a farm size not less than 0.2 hectares across the 3 districts of Kwara State, Southern Guinea Savannah Agroecology of Nigeria. The predominant yam species grown in the study area are white yam (*Dioscorea rotundata*) and water yam (*Dioscorea alata*). The survey of farmer's fields was done in the months between

August to January 2018 and 2019. The size of an average yam heap in the study area was about 0.77 m². Yams were manually planted under rain-fed conditions with no pesticides or fertilizers applied.

Virus disease incidence was estimated on fifty (50) plant observations per field based on typical yam virus symptoms expressed on leaves (Chaubé and Pundhir 2005). Observations on the 50 plants were taken by walking across a "W" shaped path in a field, with 10 plants per side spaced at an equal distance of 0.75 m X 0.25 m from each other. Percentage virus incidence was calculated based on the formula derived from Abraham *et al.* (2020), as shown below formula;

$$\text{Percentage incidence} = \frac{\text{Number of infected (symptomatic plants)}}{\text{Total number of sampled plants (50)}} \times 100.$$

The collected data on virus incidence were subjected to analysis of variance (ANOVA) and treatment means where significant, were separated using the New Duncan Multiple Range Test at 5% level of probability.

The severity of symptomatic plants (Figure 1) was assessed by rating fifty plants from 1 to 5 scale, where 1 = plant with no visible symptoms on the leaves; 2 = symptoms on 1 – 24 % of infected leaves; 3 = symptoms on 25 – 50 % of infected leaves; 4 = symptoms on 51 – 75 % of infected leaves and 5 = symptoms on more than 75 % - 100 % of infected leaves (Toualy *et al.*, 2014).

Collection of Yam and Weed Samples and Virus Identification

Symptomatic and asymptomatic 20 yam leaves (2-3 months old) were randomly collected from each yam field at the onset of the rainy season (August-October). The predominantly grown yam species in the study area were *Dioscorea rotundata* and *Dioscorea alata*. The weeds on the farms and adjoining areas of the farms were collected and enumerated in a 50 m x 50 m area using a random sampling technique in which ten points were located for the placement of 1 m² wooden quadrat (Awodoyin *et al.*, 2013). The weed species and other low-growing plants within each quadrat were identified to species level using the weed identification manual of Akobundu *et al.* (2016). The collected yam leaves and weed samples were separated, sealed in

dispenser sachets labeled and preserved over ice prior to serological analysis in the laboratory.

The test protocol for the detection and identification of the viruses infecting samples were carried out at the Virology Laboratory of the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria using Double Antigen Sandwich Enzyme-Linked Immunosorbent Assay (DAS-ELISA) (Kumar, 2009). The optical density (OD) values were measured at an absorbance of 405nm (A405) after one hour in each well, using a BIO-RAD Microplate Reader (ELx800, Universal Microplate Reader). An optical density value greater than twice the mean of the negative controls (virus-free plants) was considered positive for a particular virus (Preller *et al.*, 2018).

RESULTS

Incidence and Severity of Virus Disease on Yam Fields

The incidence and severity of virus disease on yam in the study are shown in Table 1. The results indicated significant differences ($P < 0.05$) on virus incidence among districts ranged

from 62.8 % in Omupo (Kwara south district) to 100 % in the respective locations of Kosubosu, Lafiagi (Kwara north district), Osin/Agogo, Aleara, Lasoju, Ago-Oja, Budo Adan, Molete, Oloru (Kwara central district), Idofian,

and Igbaja (Kwara south district). The highest incidence by districts was in Kwara central (96.4 %) and Kwara north (91.5 %) while Kwara south district (88.8 %) recorded the lowest virus incidence.

Figure 1. Viral disease symptoms on *Dioscorea rotundata* (A and B) and *Dioscorea alata* (C and D) observed in surveyed farms; (A) severe mosaic bleached leaves in *Dioscorea rotundata*, (B) leaf curl and chlorotic mosaic in *Dioscorea rotundata*, (C) mottled leaves and vein banding in *Dioscorea alata* and (D) *Dioscorea alata* manifesting stunted growth, reduction in leaf size and shoe stringing symptoms.

Table 1. Incidence and severity of viruses on yam

Farm location	District	% Incidence	Severity
Wode	North	95.8	3
Magya	North	83.8	3
Dzwajiwo	North	80.1	3
Kaiama	North	82.0	2
Alapa	North	84.0	4
Okuta	North	83.3	4
Gobi	North	81.6	3
Gwanara	North	93.3	5
Kosubosu	North	100	3
Teshe	North	86.8	3
Bioweite	North	88.5	4
Igbogi	North	94.9	5
Sebo	North	96.9	5
Kemanji	North	98.3	2
Ilesha	North	95.6	2
Kuliji	North	93.2	5
Bani	North	97.5	5
Woro	North	95.5	4
Shonga	North	98.4	4
Lafiagi	North	100	4
Osin/Agogo	Central	100	3
Aleara	Central	100	3
Afon	Central	97.9	1
Lasoju	Central	100	2
Owode	Central	99.7	2
Onire	Central	88.3	3
Sapati Ile	Central	98.3	3
Ago Oja	Central	100	4
Budo Alfa	Central	89.0	4
Fufu	Central	99.9	3
Laduba	Central	96.5	3
Temidire	Central	98.8	2
Gaa Adio	Central	99.8	5
Budo Adan	Central	100	5
Gaa Jawuro	Central	83.3	5
Lanwa	Central	86.9	4
Molete	Central	100	4
Oloru	Central	100	3
Paiye	Central	99.5	3
Ejidon Gari	Central	89.9	3

Omupo	South	62.8	3
Ilofa	South	77.9	1
Osi	South	81.1	1
Ajase-Ipo	South	79.9	3
Oke-Onigbin	South	88.5	3
Edidi	South	91.1	3
Eruku	South	93.3	4
Obo	South	98.8	5
Araromi-opin	South	89.9	5
Agunjin-Ora	South	91.1	4
Idofian	South	100	4
Igbaja	South	100	3
Ijara-Isin	South	99.9	3
Esie-Ijan	South	98.7	1
Offa	South	91.1	3
Ira	South	80.9	5
Ora	South	85.5	5
Isapa	South	99.8	4
Omu-Aran	South	91.7	4
Koro	South	73.2	5

The virus severity ranged from 2 to 5 score values for all the locations in the districts. The symptoms observed were mostly mild mosaic, mottling, yellowing and mild necrosis on few leaves to severe mosaic and severe stunting of the entire yam plants. The highest severity (5) were recorded in 5 locations in Kwara north (Gwanara, Igbobi, Sebo, Kuliji and Bani); 3 locations in Kwara central (Gaa Adio, Budo Adan and Gaa jawuro), and 5 locations in Kwara south (Obo, Araromi-opin, Ira, Ora and Koro). There were however no significant differences at $P = 0.05$ among the virus severity of Kwara north (3.4), Kwara central (3.7) and Kwara south (3.3) districts.

Virus Detection on Yam Leaf Samples

The serological detection of YMV and CMV on yam leaf samples is presented in Table 2 and collected weed samples with viral symptoms are shown in Figure 2. The results indicated the detection of YMV in all yam samples. The result further indicated that there was a mixed viral infection of the two viruses in 21.7 % of samples. These were in samples from Dzwajiwo, Alapa, Teshe, Sebo, Woro, Lafiagi (Kwara north district), Lasaju, Fufu, Gaa Adio, Molete (Kwara central district), Eruku, Igbaja and Koro (Kwara south district).

Predominant Weed Species and Virus Occurrence

A total of 29 weed species belonging to 26 genera with 11 families were identified to be predominant on yam fields in the study (Table 3). Four weed families encountered have made up to 68.97% of the weed spectrum and Asteraceae and Poaceae were the predominant families with 7 and 6 weed species enumerated, respectively. The weed spectrum had 62.07 % broadleaves, 20.69 % grasses and 13.79 % sedges. In terms of the life cycle, 62.07 % were annuals, 27.59 % were perennials and 10.34 % were either annuals or perennials.

The DAS-ELISA revealed the absence of CMV in all tested weed species, however, YMV was detected on 9 weed species. The majority of the weeds found harboring YMV were either broadleaves or annuals with the following titre values; *Eclipta alba* L. (0.753), *Euphorbia heterophylla* L. (0.611), *Oldenlandia herbacea* (L.) Roxb (0.471), *Cynodon dactylon* (L.) Pers (0.437), *Phyllanthus amarus* Schum & Thonn (0.429), *Mariscus flabelliformis* Kunth (0.402), *Spigelia anthelmia* L. (0.310), *Melampodium divaricatum* L. (0.304) and *Veronica parrottetii* Sch.Bip (0.289).

DISCUSSION

The study reported a high incidence and severity of viral infection in the yam fields. The field infections occurred as single and mixed virus pathogens of the tested YMV and CMV. This is an indication that yam productivity in the study area can be severely compromised by the impact of these yam viruses. These findings are also supported by experimental submissions of Odu *et al.* (1999), Yeyeh *et al.* (2014) and Asala *et al.* (2012). Variation in virus incidence between locations detected in the study can be elucidated by dynamics such as initial inoculum sources, host species and vectors occurring in the respective locations. In addition, the use by farmers of virus-contaminated yam setts and lack of diagnostic tools could also be contributory factors. This is because the natural transmission of viruses that can be accentuated by infected planting materials and vectors as posited by Eni *et al.* (2013).

The presence of weeds in close proximity to yam fields has been shown

Figure 2. Samples of weeds with viral symptoms that were ELISA positive for YMV; (A) *Euphorbia heterophylla*, (B) *Eclipta alba*, (C) *Mariscus flabelliformis*, (D) *Phyllanthus amarus*, (E) *Spigelia anthelmia*, (F) *Cynodon dactyla*, (G) *Oldenlandia herbacea*, (H) *Vernonia parrottetii* and (I) *Melampodium divaricatum*

to be associated with diminished tuber yield. The prominent weed species identified on yam fields in the study

area are in the family of Poaceae and Asteraceae. This finding is in agreement with reports of Singh *et al.* (1986) and

Ekanayake and Asiedu (2003). The presence of large weed species is an indication of a reservoir of viruses which can thus be transmitted from weed species to yam and other arable crops. This claim is supported by Odedara (2008) and Gumedzeo (2002).

The study detected YMV occurrence on the weed samples. This result is similar to reports by Mukhtar *et al.* (2012) that also identified yam mosaic virus to be the dominating virus on weed samples around yam fields. It

is the view of Groves *et al.*, (2002) and Hily *et al.* (2014) who indicated that plant viruses require alternate hosts to continue the virus-host-vector association. The majority of plant viruses that cause disease in agricultural crops rely on biotic vectors for transmission and survival. It is therefore an indication that the weed species found positive to YMV could serve as alternative hosts for YMV and contribute as inoculum sources to secondary dissemination of viruses and reduction in food production.

Table 2. DAS-ELISA absorbance value of Yam samples recorded at one hour post substrate addition and overnight for the two viruses YMV and CMV

Farm location	District	Viruses/Absorbance at 450 nm			
		YMV	YMV	CMV	CMV
		1 hour	Overnight	1 hour	Overnight
Wode	North	0.633 (+)	1.485 (+)	0.106 (-)	0.247 (-)
Magya	North	0.509 (+)	1.539 (+)	0.099 (-)	0.220 (-)
Dzwaiwo	North	0.662 (+)	1.191 (+)	0.102 (-)	2.241 (+)
Kaiama	North	0.641 (+)	1.655 (+)	0.101 (-)	0.212 (-)
Alapa	North	0.663 (+)	0.934 (+)	0.117 (-)	0.844 (+)
Okuta	North	0.760 (+)	1.910 (+)	0.157 (-)	0.204 (-)
Gobi	North	0.493 (+)	1.161 (+)	0.120 (-)	0.265 (-)
Gwanara	North	0.662 (+)	1.128 (+)	0.114 (-)	0.258 (-)
Kosubosu	North	0.541 (+)	0.965 (+)	0.113 (-)	0.277 (-)
Teshe	North	0.677 (+)	1.220 (+)	0.106 (-)	0.724 (+)
Bioweite	North	0.542 (+)	0.859 (+)	0.117 (-)	0.299 (-)
Igbogi	North	0.637 (+)	1.122 (+)	0.123 (-)	0.364 (-)
Sebo	North	0.519 (+)	1.157 (+)	0.619 (+)	2.328 (+)
Kemanji	North	0.538 (+)	1.163 (+)	0.102 (-)	0.242 (-)
Ilesha	North	0.603 (+)	1.170 (+)	0.108 (-)	0.268 (-)
Kuliji	North	0.547 (+)	1.120 (+)	0.103 (-)	0.235 (-)
Bani	North	0.762 (+)	0.809 (+)	0.109 (-)	0.271 (-)
Woro	North	0.617 (+)	1.183 (+)	0.505 (+)	1.262 (+)
Shonga	North	0.714 (+)	0.939 (+)	0.125 (-)	0.291 (-)
Lafiagi	North	0.585 (+)	1.178 (+)	0.721 (+)	1.304 (+)
Osin/Agogo	Central	0.706 (+)	1.105 (+)	0.136 (-)	0.320 (-)
Aleara	Central	0.823 (+)	1.122 (+)	0.133 (-)	0.305 (-)

Afon	Central	0.469 (+)	0.961 (+)	0.119 (-)	0.256 (-)
Lasoju	Central	0.682 (+)	1.107 (+)	0.109 (-)	0.806 (+)
Owode	Central	0.822 (+)	0.909 (+)	0.155 (-)	0.430 (-)
Onire	Central	0.981 (+)	1.138 (+)	0.130 (-)	0.308 (-)
Sapati Ile	Central	0.821 (+)	1.137 (+)	0.133 (-)	0.261 (-)
Ago Oja	Central	0.549 (+)	0.918 (+)	0.114 (-)	0.271 (-)
Budo Alfa	Central	0.492 (+)	1.124 (+)	0.129 (-)	0.336 (-)
Fufu	Central	0.686 (+)	1.108 (+)	0.610 (+)	0.925 (+)
Laduba	Central	0.713 (+)	0.927 (+)	0.122 (-)	0.264 (-)
Temidire	Central	0.690 (-)	0.877 (+)	0.133 (-)	0.284 (-)
Gaa Adio	Central	0.619 (+)	0.957 (+)	1.120 (+)	2.244 (+)
Budo Adan	Central	0.510 (+)	1.109 (+)	0.125 (-)	0.314 (-)
Gaa Jawuro	Central	0.874 (-)	1.123 (+)	0.116 (-)	0.267 (-)
Lanwa	Central	0.938 (-)	1.108 (+)	0.108 (-)	0.248 (-)
Molete	Central	0.474 (+)	0.951 (+)	0.117 (-)	0.912 (+)
Oloru	Central	0.666 (+)	0.907 (+)	0.127 (-)	0.320 (-)
Paiye	Central	0.586 (+)	0.906 (+)	0.106 (-)	0.229 (-)
Ejidon Gari	Central	0.694 (+)	1.101 (+)	0.107 (-)	0.260 (-)
Omupo	South	0.528 (+)	1.107 (-)	0.117 (-)	0.193 (-)
Ilofa	South	0.835 (+)	1.229 (+)	0.100 (-)	0.306 (-)
Osi	South	0.646 (+)	1.194 (+)	0.123 (-)	0.287 (-)
Ajase-Ipo	South	0.543 (+)	1.169 (+)	0.129 (-)	0.300 (-)
Oke-Onigbin	South	0.549 (+)	1.176 (+)	0.108 (-)	0.235 (-)
Edidi	South	0.486 (+)	0.758 (+)	0.107 (-)	0.239 (-)
Eruku	South	0.658 (+)	1.137 (+)	0.508 (+)	2.230 (+)
Obo	South	0.488 (+)	1.165 (+)	0.129 (-)	0.382 (-)
Araromi-opin	South	0.449 (+)	1.150 (+)	0.141 (-)	0.494 (-)
Agunjin-Ora	South	0.299 (+)	0.336 (+)	0.103 (-)	0.198 (-)
Idofian	South	0.645 (+)	1.135 (-)	0.102 (-)	0.202 (-)
Igbaja	South	0.806 (+)	1.212 (+)	1.101 (+)	2.218 (+)
Ijara-Isin	South	0.208 (-)	0.285 (-)	0.118 (-)	0.357 (-)
Esie-Ijan	South	0.624 (+)	0.980 (+)	0.111 (-)	0.291 (-)
Offa	South	0.516 (+)	0.751 (+)	0.117 (-)	0.363 (-)
Ira	South	0.169 (-)	0.314 (-)	0.093 (-)	0.189 (-)
Ora	South	0.761 (+)	1.130 (+)	0.098 (-)	0.191 (-)
Isapa	South	0.632 (+)	1.144 (+)	0.103 (-)	0.234 (-)
Omu-Aran	South	0.950 (-)	1.117 (+)	0.103 (-)	0.195 (-)
Koro	South	0.611 (+)	0.877 (+)	0.908 (+)	1.314 (+)
Positive control		1.527	3.346	2.611	3.376
Negative control		0.241	0.102	0.111	0.107
Buffer		0.174	0.968	0.008	0.006

YMV= Yam Mosaic Virus, CMV= Cucumber Mosaic Virus, (+) denotes virus presence, (-) denotes virus absence

Table 3. DAS-ELISA absorbance value of weed species on yam fields recorded overnight post substrate addition for the two viruses YMV and CMV

Family	Weed species	VIRUSES/Absorbance at 450 nm			
		MG	LC	YMV	CMV
<i>Acanthaceae</i>	<i>Justicia flava</i> (Forssk) Vahl	B	P	0.177 (-)	0.129 (-)
<i>Amaranthaceae</i>	<i>Gomphrena celosioides</i> Mart	B	P	0.163 (-)	0.128 (-)
<i>Asteraceae</i>	<i>Acanthospermum hispidum</i> DC	B	A	0.193 (-)	0.100 (-)
	<i>Ageratum conyzoides</i> L.	B	A	0.162 (-)	0.128 (-)
	<i>Eclipta alba</i> L.	B	A	0.753 (+)	0.124 (-)
	<i>E. prostrata</i> L.	B	A	0.160 (-)	0.142 (-)
	<i>Melampodium divaricatum</i> L.	B	A	0.304 (+)	0.146 (-)
	<i>Vernonia parrottetii</i> Sch.Bip. ex Walp	B	A	0.289 (+)	0.116 (-)
	<i>Conyza sumatrensis</i> (Retz.) E. Walker	B	A	0.132 (-)	0.103 (-)
<i>Cyperaceae</i>	<i>Cyperus esculentus</i> L.	S	P	0.237 (-)	0.118 (-)
	<i>C. iria</i> L.	S	P	0.166 (-)	0.115 (-)
	<i>C. rotundus</i> L.	S	P	0.296 (-)	0.111 (-)
	<i>Mariscus flabelliformis</i> Kunth	S	P	0.402 (+)	0.199 (-)
<i>Euphorbiaceae</i>	<i>Phyllanthus amarus</i> Schum & Thonn	B	A	0.429 (+)	0.115 (-)
	<i>Euphorbia heterophylla</i> L.	B	A	0.611 (+)	0.096 (-)
	<i>Croton hirtus</i> L'Her	B	A	0.162 (-)	0.136 (-)
<i>Fabaceae</i>	<i>Chamaecrista mimosoides</i> L.	B	A/P	0.201 (-)	0.119 (-)
	<i>Desmodium tortuosum</i> (Sw.) DC.	B	A	0.174 (-)	0.121 (-)
<i>Lamiaceae</i>	<i>Hyptis spicigera</i> Lam	B	A	0.202 (-)	0.107 (-)
<i>Loganiaceae</i>	<i>Spigelia anthelmia</i> L.	B	A	0.310 (+)	0.118 (-)
<i>Malvaceae</i>	<i>Sida garckeana</i> Polak	B	A/P	0.164 (-)	0.116 (-)
<i>Poaceae</i>	<i>Leptochloa caerulea</i> Steud.	G	A	0.189 (-)	0.137 (-)
	<i>Acroceras zizanioides</i> Kunth Dandy	G	P	0.150 (-)	0.115 (-)
	<i>Cynodon dactylon</i> (L.) Pers.	G	P	0.437 (+)	0.148 (-)
	<i>Eleusine indica</i> (L) Gaertn	G	A	0.238 (-)	0.112 (-)
	<i>Eragrostis tenella</i> (A.Rich.) Hochst	G	A	0.219 (-)	0.138 (-)

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Rubiaceae	<i>Brachiaria deflexa</i> (Schumach) C.E.	G	A	0.123 (-)	0.108 (-)
	<i>Mitracarpus villosus</i> (Sw) Dc	B	A	0.186 (-)	0.112 (-)
	<i>Oldenlandia herbacea</i> (L.) Roxb	B	A/P	0.471 (+)	0.193 (-)
	Positive control			2.264	3.432
	Negative control			0.112	0.111
	Buffer			0.009	0.100

MG=morphological group, LC-life cycle, B=broadleaved, S=sedge, G=grass, A=annuals, A/P=annual-perennials,

P=perennials, YMV= Yam Mosaic Virus; CMV= Cucumber Mosaic Virus, (+) denotes presence of virus (-) denotes absence of virus

CONCLUSION

It can be concluded from this study that there was a prevalence of YMV and CMV in the yam species (*Dioscorea rotundata* and *Dioscorea alata*), with variations in the occurrence and intensity of virus diseases among the districts in the study area. *Eclipta alba*, *Euphorbia heterophylla*, *Oldenlandia herbacea*, *Cynodon dactylon* and *Phyllanthus amarus* can be naturally infected by YMV in the field and thus, acting as YMV reservoir to infect yam. Yam is an attractive crop among poor farmers with limited resources and its availability all year round makes it an important food security crop. There is therefore, an urgent need for efficient management strategies for virus and weed elimination within and around yam fields in

the Southern Guinea Savannah Agroecology of Kwara State, Nigeria.

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