REACTION OF OKRA CULTIVARS TO OKRA LEAF CURLS VIRUS MAIDUGURI BORNO STATE, NIGERIA

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Abstract

A field trial was conducted at the teaching and research farm of the Department of crop protection, faculty of agriculture, university of Maiduguri in the 2006 cropping season. The aim was to evaluate the reaction of five okra cultivars to okra leaf curl virus and okra mosaic virus disease in Maiduguri. The trial was laid out in a randomized complete block design (RCBD) and replicated three times. The result shows that all the five cultivars (long yellow and red pod, samara 46, green velvet, long and lady finger and long pods) were highly susceptible. However, incidence of okra leaf curl virus disease was significantly (P=0.05) lower in the cultivars long yellow and red, and red pods at 2WAG, 6WAS, 8WAG and 10WAG. Although, at 8WAG, and at 10WAG, long yellow and red, samara 46 and green velvet cultivars were significantly (P=0.05) susceptible to the mosaic virus disease. The cultivars green velvet and long pod had the highest disease incidence throughout the growing period. In other to develop environmental safe management practice for both okra leaves curl virus disease in this agro-ecological zone, the use of resistant cultivars, removal of weeds or alternate hosts for the vectors, adjusting the time of planting combined with minimal application of insecticides is recommended.

Key words: *Albelmoschus esculentus*, leaf curl, Incidence, Host, Vectors, Maiduguri, Nigeria.

Introduction

Okra, *(Abelmoschus esculentus L. Moench*) is a widely-grown fruit vegetable; it is grown on about 2 million hectares annually in Nigeria (FMAWRRD, 1989). It is one of the leading fruit and vegetables in the Nigerian fresh fruits market on the basis of land area, production, volume and value (Taylor, 1996) and it features daily in the diets of most Nigerians. The crop is known by its local name in different parts of the world. In Nigeria for instance it is kwon as "ila" in Yoruba, "okwuru" in ibo and "kubewa" in Hausa, okra in English (Tindal 1983).

Okra is an erect, annual crop, some species growing up to 2m in height. The first pods are ready for harvest in about two months after planting, but plants continue to bloom. Okra is a warm season crop and does well in humid condition. A wide range of soil type has been found suitable for okra but well drained fertile soil with organic material is generally more suitable. (Adelana, 1985). Most cultivars are adapted to high temperature throughout the growing period,

a monthly average temperature range of 20 – 30^0c is considered appropriate for growth, flowering and pod development. Okra is tolerant to a wide range of climatic conditions; supplementary irrigation may be required during the fruiting period (Tindal, 1983).

At Ibadan, Nigeria, the stalk rose when left standing in the field provided a suitable support for climbing cowpea which produced a significant yield. Increase of 58% and 32% pods per plants, pod length and seed weight were favorably affected by the support (Wilson and Mettai, 1977). The nutritive value of okra (green pod) includes water, protein, fat, carbohydrate, fiber, calcium, iron, thiamine, Riboflavin, Nicotinamide and Ascorbic acid (Tindal, 1983). In terms of caloric value the whole fruits yields 321.90cal of energy (Oyenuga 1978). In northern Nigeria, particularly Borno state okra is grown mainly during the wet season (June – October) by local farmers although the crop is also grown during the dry season (November – April) as an off-season crop in small garden where regular supply of irrigation water is available. However, during off season crop, okra may not produce sufficient a fruit that cannot meet the market demand though the crops ensures supply of okra fruits to the market all year round.

Okra is known to be susceptible to a wide range of diseases and pests, which result in considerable losses in the field and after harvest. In wet and dry weather, fruits can be attacked by various pathogens (James, 1988). Ugoji, (1993) showed various fungi colonizing the rhizosphere of okra. The major pests of okra are whitefly *Bemisia tabaci*, Beetles *podagrica spp. And* Nisotra dilecta (Lana and Taylor, 1975, Atiri; 1984) some common fungal disease includes *Oidium abelmoschii*, *Cercopora abdmoschii*, *Fusarium oxysporium*, *Erysiphe cichoraceam* and *Sphaerotheca fuliginea* which can cover the whole leaf, which may die out and drop as a result of the diseases. There are a number of other fungi and bacteria associated with okra that are known to be seed transmissible, *Ascochyta abelmoschi* (pod spot) and *Macrophomina phaseolina* (charcoal rot) are frequently found to infect seedling at an early stage. Also, *Pseudomonas syingae* (bacterial blight) can be transmitted by seed (Schippers, 2000). Apart from fungal and bacterial diseases, the crop is highly susceptible to attack by virus diseases, the common virus disease known to infect okra are the okra leaf curl and okra mosaic virus. The leaf curl disease mostly occur during the wet season in the southern part of Nigeria and okra mosaic virus is the most important and widespread virus dieses of okra in Nigeria (Ewete, 1974, lana,*et al*, 1974, Odedumi and Oshikanlu, 1977, Atiri,1984). Both the okra leaf curl and okra mosaic virus is known to cause a yield reduction of between 30% and 70% economic loss. The virus is not seed borne although infectivity assay test indicates the presence of the virus in every floral part of the infected plant including the testa and embryo of immature seeds of infected cowpea, green gram and okra. Okra mosaic virus is transmitted in a non-persistent manner by the coleopteran *Podagrica decolorata* (Brunt et al, 1990). The virus is

also sap-transmissible, elicit variable symptoms on infected plants, Systemic infection first appear on the youngest as vein clearing, followed by light green mosaic (Givord and Koenig, 1974). Typical symptoms of okra mosaic virus on okra include vein-chlorosis, vein-banding, mosaic and stunting. Most post-harvest disease originated in the field where pathogens attack the growing and mature produce, part of the strategies suggested for post-harvest loss prevention by James (1988) include the use of an integrated crop management system involving pre-and post-harvest chemical sprays using BENLATE (benomyl), carbaryl and cypermethrine to reduce spoilage of fruits after harvest. Okra mosaic is very difficult to control with insecticides or by eliminating the virus host. There is no information available on host resistance to okra mosaic virus. However, depending on the period of infection, in early infections, disease plants are stunted with few pods in late infections however; pods that develop are only reducing in size. The first symptom of the disease is thickening of the veins, later the leaf texture becomes rough and warty and the leaves begin to curl in an adaxial direction. Okra leaf curl diseases can be transmitted both by grafting and by whiteflies (*Bemisia tabaci* Genn). The disease was also successfully transmitted by both grafting and whiteflies to cotton, tobacco and tomatoes. The cultural control of the virus includes the removal of weeds or alternate hosts, adjusting the time of planting combined with minimal application of insecticides to suppress victor population and the use of resistant cultivars such as ABK102 was found to be resistant and ten times high-yielding, moderately resistant cultivars to the virus at Samaru northern Nigeria were found. Atiri and Fayoyin (1989), Atiri (1990) and Alegbejo (unpublished).

Objective of the Study

The objective of the study is to evaluate the reaction of five okra cultivars to okra leaves curl virus (OLCV) and okra mosaic (OMV) disease in Maiduguri.

Material and Methods

The study was conducted at the teaching and research farm of the faculty of Agriculture University of Maiduguri. The experiment was conducted during the rainy season of 2006, July – October. The okra cultivars used for the study were collected from IAR Zaria and faculty of Agriculture University of Maiduguri seed unit. The cultivars were; long pod, green velvet, long yellow and red pod, Samaru 46 and long and ladyfinger respectively. The trial was laid out in a randomized complete block design (RCBD) each retreatment replicated 3 times. The total area for the experiment was 209m^2 with each plot measuring 3mx3m. There were 15 plots in all. Inter and intra row spacing was 60cm and there were twenty-five plants per plot. There were five rows per plot; five seeds were sown per hole and later thinned to two for proper growth and development. Hoe was used for land clearing and preparation of seed bed; seed were sown on flat bed after harrowing and pulverization. Data were collected on the germination percentage, disease incidence, and disease severity at two, four, six, eight, and ten weeks after germination.

Disease Incidence

The diseases incidence was calculated thus:

$$\text{Disease incidence (\%)} = \frac{\text{No of plants infected}}{\text{Total No of plants in the plot}} \times 100$$

Disease severity

Disease severity was scored base on a scale outline by Alegbejo, (1997) using a scale of 1-5 as

$$\text{Disease severity (D.S)} = \frac{\Sigma n}{Nx5}$$

Where: Σn = Sum of individual rating
N = Total No of plants assessed
5= Highest score on the severity scale.

On the scale 0 – No symptom
No visible symptom
3-Mild mosaic but no leaf distortion
Severe mosaic and curling of leafs

Resistant Level was Determined Using the Scale Outline below (Alegbejo, 1997)

Resistant level	Percentage infection	Disease severity
Immunity	0.00	1.00
Resistant	1.00 – 15.00	1.00- 2.00
Moderately Resistant	15.10 – 25.00	2.10 – 2.00
Highly Resistant	25.10 and above	2.10 – 3.00 3.10 and above

Results and Discussion

Table 1: Okra cultivars evaluated for resistant to okra leaf curl virus (OLCV) and okra mosaic virus (OMV) at Maiduguri during the 2006 cropping season.

Cultivars category	Means of disease Severity (%)	Resistance
Long yellow and red pod	27.36	HS
Samaru 46	31.36	HS
Green velvet	29.76	HS
Long and lady finger	28.48	HS
Long pods	31.84	HS

HS = highly susceptible

Result for okra cultivars evaluated for resistant to okra leaf curl virus and okra mosaic virus at Maiduguri during the 2006 cropping season is presented in table 1. The results show that all the cultivars were highly susceptible to the disease symptoms. Expression was use as the basis for determining the diseased plants in the fields, using the scale of 1-5 (Alegbejo, 1997) based on the percentage infection. The mean of the disease severity indicated that all the cultivars had a mean of disease severity greater than 25% meaning that all the cultivars were highly susceptible. On the incidence of okra mosaic virus, the result shows that none of the cultivar was resistant. However, long and lady finger was least susceptible, while the rest of the cultivars were significantly (P=0.05) susceptible at 2 weeks after germination (WAG), 4WAG, and 6 WAG. Although at 8WAG and 10 WAG, long yellow and red pod, samara 46 and green velvet cultivars were highly susceptible to the okra mosaic which is in consonance with the works of Givord and Koening, 1974; Lana *et al*, (1974) and Alegbejo, (1997). They stated that the mosaic virus is one of the wet season diseases of okra, and that the virus could produce variable symptoms on infected plants, fruits of severely infected plant could develop some chlorotic flecks and the incidence may reach 100 percent before harvest in experimental and commercial plantings. On naturally infected plants, a typical mosaic leaf shows an early symptom as yellowing interposed with green island, a greenish yellow mosaic with green irregular vein chlorosis which progresses further to irregularly dark and light green or whitish area on subsequent leaves.

Table 2: Incidence of okra mosaic virus disease evaluated at Maiduguri during the 2006 cropping season.

CULTIVARS	DISEASE INCIDENCE (%)				
	2WAG	4WAG	6WAG	8WAG	10WAG
Long yellow and red pod	12.8c*	11.2c*	10.4b	08.0c	30.4a
Samaru 46	27.2a	30.4a	11.2a	19.6b	27.2a
Green velvet	30.0a	36.0a	11.2a	28.0a	19.2b
Long pod	23.2b	28.8b	10.4b	23.6a	12.8c
Long and lady finger	12.8c	18.4c	09.6c	18..8b	18.0b
LSD	**16.65**	**21.33**	**6.33**	**20.30**	**10.23**

* Data are means of three replications

** In each column, values followed by different letters are significantly different at 5% level of probability.

The incidence of okra leaf curl virus disease is presented in table 3: The result shows that the incidence of okra leaf curl virus disease is significantly (P=0.05) low in the cultivar; long yellow and red pod at 2 weeks after germination (WAG) 4WAG, 6WAG and 8WAG. However, highest disease incidence (11.2%, 12. 0%, 17.2%, 22.2% and 30.4%) was recorded on the cultivars green velvet and long pod at 2WAG, 4WAG, 6WAG 8WAG and 10WAG respectively. The symptoms of the okra leaf curl virus started appearing 2WAG. which these resultshow early symptom of the disease as against of (Atiri, 1990), where he stated that, the symptoms of okra leaf curl virus disease usually start appearing 4 to 6 weeks after planting which is the age at which plants are most prone to progresses to a stunted growth with fewer pods, thickening of the vein, later the leaf texture becomes rough and warty and the leaves begins to curl in an adaxial direction (Atiri and Fayoyin, 1989).

Table 3: Incidence of okra leaf curl virus disease evaluated at Maiduguri during the 2006 cropping season.

CULTIVARS (%)	DISEASE INCIDENCE				
	2WAG	4WAG	6WAG	8WAG	10WAG
Long yellow and red pod	06.4c*	06.4c**	12.8c	13.4c	18.0b
Samaru 46	10.4b	08.0b	27.2a	27.4a	27.2a
Long and lady finger	11.2a	12.0a	17.2b	22.2b	30.4a
Long pod	11.2a	11.2a	19.2b	26.6a	19.2b
Mean	9.28	9.28	21.84	22.0	21.52
LSD	**6.55**	**18.45**	**21.95**	**25.25**	**10.23**

*Data are mean of three replications

** In each column. Values followed by different letter are significantly different at 5% level of probability.

Table 4: Incidence of mixed infection of okra leaf curl and okra mosaic virus disease evaluated at Maiduguri during the 2006 cropping season.

CULTIVARS (%)	DISEASE INCIDENCE				
	2WAG	4WAG	6WAG	8WAG	10WAG
Long yellow and red pod	04.8c*	04.0c**	12.8c	08.0c	10.4a
Samaru 46	07.2b	04.8b	27.2b	19.6b	08.8a
Green velvet	10.4a	07.2a	32.0b	28.0a	08.8a
Long and lady finger	09.6a	06.4b	13.2c	18.8b	08.0b
Long pod	08.0b	08.8a	24.8b	23.6a	04.8c
mean	8.0	6.24	22.0	19.6	8.16
LSD	**10.12**	**15.31**	**15.39**	**20.31**	**10.34**

* Data are mean of three replications

**In each column, values followed by different letter are significantly different at 5% level of probability.

The incidence of mixed infection of okra leaf curl and okra mosaic virus evaluated at Maiduguri during the 2006 cropping season is presented in table 4: the result showed that none of the cultivar was resistant. However, long yellow and red pods were highly infected, while the rest of the cultivars were significantly (P=0.05) susceptible at 2 weeks after germination (WAG) 4WAG and 8WAG. Although, at 6WAG and 10WAG, Long and lady finger and long pods were highly susceptible to the mixed infection of okra leaf curl and mosaic virus both the mosaic and leaf curl virus disease were found to cause up to 100 percent infectious (Atiri,1984) before harvesting in experimental and commercial planting.

Table 5: Disease severity score of okra leaf and mosaic virus disease evaluated at Maiduguri during the 2006 cropping season

CULTIVARS (%)	DISEASE INCIDENCE				
	2WAG	4WAG	6WAG	8WAG	10WAG
Long yellow and red pod	29.6c*	36.0a**	28.0c	26.4b	16.8c
Samaru 46	29.6b	35.2b	37.6b	29.6a	24.8b
Green velvet	31.2b	31.2c	37.6b	23.2c	25.6a
Long and lady finger	29.6c	37.6a	29.6c	24.8b	20.8b
Long pod	37.6a	34.4b	39.2a	22.4c	25.6a
LSD	**10.88**	**16.97**	**21.07**	**12.4**	**22.00**

*Data are mean of three replications

** In each column, values followed by different letter are significant different at 5% level of probability.

The disease severity of okra leaf curl and mosaic virus is presented in table 5: result shows that the severity of the disease is significantly (P=0.05) higher in the cultivar long pods at 2 weeks after germination (WAG) 6WAG and 10WAG. However, higher disease severity (37.6%, 39.2% and 25.6%) was recorded on the cultivars samara 46 at 4WAG and 8WAG, respectively.

Conclusion

Reaction of okra to leaf curl virus was highly significant, until a high yielding and resistant cultivars were developed and made available, losses due to these diseases will continue to hinder the production of the crop. The alternative use of seed dressing, pesticides, be applied and or the crop. The crops should be grown in isolation from alternative host, development of resistant crops to viruses also need to be considered. The pest and disease problems become more serious as crop production become more intensified. Therefore, strongly the breeding program which sets out to achieve the aims of the okra improvement should be intensified.

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