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Management of Okra Yellow Vein Mosaic Virus and its Vector through Plant Extracts

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Abstract

Four plants extract i.e. *Azadirachta indica* (neem), *Allium sativum* (garlic), *Zingiber officinale* (ginger) *Allium cepa* L (onion) were evaluated to manage OYVMV and its vector. For this purpose four Okra varieties Sabz pari, Pahuja, Pusa sawani and Lush green was sown under RCBD design. Data obtained from vector population and disease incidence was analyzed through ANOVA. Sabz pari was found moderately resistant. Pahuja showed tolerant behavior while Lush green and Pusa sawani showed moderately susceptible and susceptible response respectively. Among four plants extract *Azadirachta indica* (Neem) at 5% concentration was effective as compared to control and other extracts in reducing the whitefly and OYVMV disease incidence under field condition.

Keywords: Okra cultivar; RCBD design; Plant extracts; Extracts concentrations; Disease incidence; White fly population; Anova

Introduction

Okra (*Abelmoschus esculentus L.* Moench) belongs to genus *Abelmoschus* and its family is Malvaceae. It is also known as ladyfinger. It is an important growing crop of Indo-Pak sub-continent. Okra fruit contains 80% water. The approximate nutrient value for 100 g of fresh edible fruit is 20 cal energy; 2 g protein; 0.1 g fat; 2.7 g carbohydrates; 660 g vitamin A; 0.2 mg thiamin; 0.06 mg riboflavin; 1 mg niacin; 44 mg vitamin C; 81 mg Ca; 0.8 mg Fe; 20 mg K and 10 mg Na. Average production of Okra in worldwide is 12.035 million tons. In Pakistan, it is cultivated on an area of 13.900 h and a total production of about 113,200 thousand tons [1]. Okra crop is attacked by various pathogens, which cause various diseases. These pathogens include Viruses, bacteria, fungi, mycoplasmas, nematode and insects. Some important diseases are Damping off, Fusarium wilt, Powdery mildew, Cercospora leaf spot, Leaf curl virus and Bhindi Yellow Vein Mosaic virus. The total loss of vegetable on this regard is about to 20% to 30%, which may increase up to 80% to 90% [2].

This viral disease infects during all the stages of growth. White fly transmits it. The most susceptible stage of is from 35 to 50 days. The initial symptoms on young leaf are a diffuse, mottled appearance. Clearing of small veins starts near the leaf margin at various points, about 15 to 20 days after infection. Afterward vein clearing develops into a vein chlorosis. In infected leaves, interveinal chlorosis occurs due to fibrous deficiency and all leaves turn yellow. The infected fruits are covered with yellow or creamy color, fibrous, small and tough [3]. Alegbejo [4] stated that whiteflies could transmit probably 21 viruses in Nigeria. Most of these viruses belong to Gemini virus. Due to this transmission, about 15% to 100% losses are seen. Whiteflies mostly affect tuber crops, oil seed crops, legumes as well as vegetables. The many controls of OYVMV have been studied. Treatment includes chemicals as well as plant extracts. Pathologists are trying to evaluate different plant extracts to control this disease. Worldwide scientist is preferred to adopt such measures, which don't affect the human health.

Different management practices will be adopted to control plant viral disease to overcome the okra production losses. The use of plant extracts to control OYVMV disease and its vector is a cheap source as compared to all other expensive control measures.

The objective of this study is to evaluate different plant extracts against okra yellow vein mosaic virus disease incidence and *B. tabaci* population.

Materials and Methods

The experiment was conducted in the research area of department of plant pathology, University of Agriculture Faisalabad. In these experiment four different okra varities viz; Sabz pari, Pahuja, Pusa sawani and Lush green were sown in 10th July 2015. Seed of four okra varieties were taken from vegetable section of Ayub Agriculture Research Institute, Faisalabad for raising disease-screening nursery. Each replication consists of four entries with row-to-row distance 60 cm and plant to plant distance 20 cm. All the agronomic practices were followed to maintain the okra nursery in good condition. Thus, okra germplasm was subjected to natural viral inoculum, invasion and buildup of white fly (*B. tabaci*) Population density. The disease on each entry was assessed by following the diseases rating scale (Table 1).

Five treatments each with three replications were sprayed against whitefly at economic threshold level (4-5 whiteflies/leaf). The treatments were randomly applied on each block of variety thus designing the experiment according to randomized complete block design (RCBD). Following treatment were applied at 5% concentration

T1 = *Azairachta indica* (Neem) 5%

T2 = *Allium sativum* (Garlic) 5%

T3 = *Zingiber officinale* (Ginger) 5%

	Rating Scale	Severity Range (%)
0	Immune	0%
1	Highly resistant	1% to 10%
2	Moderately resistance	11% to 25%
3	Tolerant	26% to 50%
4	Moderately susceptibility	51% to 60%

Table 1: Disease rating scale used for study.

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Sr. No.	Variety	% disease incidence
V1	Sabaz pari	25.38
V2	Pahuja	27.38
V3	Lush green	52.47
V4	Pusa sawani	64.22

Table 2: Response of different Okra cultivars against Okra yellow vein mosaic disease.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F-value
Replication	2	11.51	5.76	
Plant Extract (PE)	4	31531.11	7882.78	6119.33**
T	2	158.44	79.22	61.50**
C	2	2.85	1.43	1.11^{NS}
PE × T	8	7208.71	901.09	699.51**
PE × C	8	782.84	97.86	75.96**
T × C	4	7	1.75	1.36^{NS}
PE × T × C	16	32.39	2.02	1.57^{NS}
Error	88	113.36	1.29	
Total	134	39848.21		
NS=Non-significant (P>0.05); * =Significant (P<0.05); ** =Highly significant (P<0.01)				

Table 3: Analysis of variance table for disease incidence.

Application (days)	Whitefly population
After 1st application	28.987
After 2nd application	27.947
After 3rd application	25.64

Table 4: Mean of whitefly population after 1st, 2nd and 3rd application.

Sr. No.	Treatment	Reduction in OYVMV
T1	*A. indica*	27.77
T2	*A. sativum*	31.21
T3	*Z. officinale*	34.74
T4	*A. cepa*	37.21
	Control	70.10

Table 5: Effect of treatments on OYVMV disease incidence.

Sr. No.	Treatment	Reduction in whitefly population
T1	*A. indica*	24.40
T2	*A. sativum*	25.95
T3	*Z. officinale*	27.17
T4	*A. cepa*	28.15
T5	Control	31.93
	LSD	0.463
*Mean values sharing similar letter do not differ significantly as determined by the LSD test at 5% level of probability		

Table 6: Effect of treatments on whitefly population.

T4 = *Allium cepa* (Onion) 5%

T5 = Water (Control)

Crop was sprayed at 15, 30, 45 and 60 days interval after the day of sowing. Data were recorded on weekly basis. All possible interactions were determined through ANOVA (Table 2). All treatments mean was compared by LSD test at 5% level of probability [5].

Results and Discussion

Among all four varieties no any variety shows immunity against OYVMV disease incidence and whitefly population. Response of these varieties towards OYVMV disease shows variability based on their comparison to each other. Sabz Pari shows moderately resistance response to the disease with 25.38% plant infection. Pahuja variety showed tolerant response with 27.38% plant infection. Lush green variety was fall in moderately susceptible category with 52.47% plant infection. Suceptibility was observed in Pusa Sawani cultivar with maximum plant infection about 64.22% as shown in Table 2. In case of whitefly population, among all plant extracts *A. indica* resulted better and was 24.4% effective against whitefly followed by *A. sativum* 25.94%, *Z. officinale* 27.20%, *A. cepa* 28.20% and control 31.93% (Table 3).

Effective and efficient control of pest can be controls by the use of chemicals but it is hazardous for the environment due to their toxicity [6-8]. There is a need to search for alternative approaches without toxicity problems that are ecofriendly and nit capital intensive. Plant metabolites and plant based pesticides appear to be one of the better alternatives as they known to have minimal environmental impact and danger in contrast to the synthetic pesticides [9]. Pun et al. [10] conducted an experiment that the spray of leaf extract *Propos chilensis* and *Bougainviilea spectabilis* gave very impressive results in controlling yellow vein mosaic virus of Okra. These extracts increased the incubation period of the virus into the plants. Incubation period in plants treated with *Propos chilensis* and *Bougainviilea spectabilis* increase upto 19.1 days and 19.3 days respectively as compared to control which is 10.4 days.

Sarabani et al. [11] has demonstrated the environment friendly management of OYVMV disease of okra with the help tolerant cultivars, cost effective insecticidal sprays, plant extracts to control disease and its vector (*B. tabaci*). They applied four sprays after the interval of 15, 30, 45 and 60 days of sowing which gives the highest yield. Spray application of plant products delayed the occurrence of disease up to 60 days [12]. The mean of whitefly population reduction could be seen in Table 4 after 3 sprays with 15 days interval. While in case of Okra yellow vein mosaic virus disease and whitefly population reduction could be seen in Tables 5 and 6 respectively.

Conclusion

The use of resistant cultivars such as Sabz pari and Pahuja is an effective method to control OYVMV disease and its vector. Among all plant extracts Neem extracts at 5% concentration showed the best response for controlling OYVMV disease incidence and to suppress whitefly population when applied after 15 days interval stating from two weeks after germination.

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