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ISSN: 0974-4908
Res. Environ. Life Sci.
9(1) 29-30 (2016)

Studies on the transmission of yellow vein mosaic virus disease in okra

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(Received: May 09, 2015; Revised received: November 07, 2015; Accepted: November 10, 2015)

Abstract: Okra yellow vein mosaic disease is caused by Okra yellow vein mosaic virus (genus *Begomovirus* and family *Geminiviridae*) of the most serious disease of okra. The only known method of transmission of OYVMV is through whitefly (*Bemisia tabaci* Genn.). The studies on the transmission of this disease by mechanical, graft and insect vectors were conducted during *Kharif*, 2012 and 2013 at net house and glass house of the Department of Plant Pathology of this University. Results have indicated that OYVMV was readily transmitted by whitefly (*Bemisia tabaci*) and graft inoculation. However, mechanical sap and aphids (*Myzus persicae*, *Aphis gossypii* and *Aphis craccivora*) could not transmit the virus.

Key words: Okra, Transmission, Virus and Yellow vein mosaic

Introduction

Okra (*Abelmoschous esculentus* (L.) Moench), Bhindi or Lady's finger of family *Malvaceae*, is one of the important vegetable crops grown in tropical, subtropical and warm sections of the temperate zones of the world (Charrier, 1984). This crop is suitable for cultivation as a garden crop as well as on large commercial farms. India is the largest producer of Okra covering an area of 4.52 lakh ha with an annual production of 47.97 lakh tones (Anon., 2011). In India, major okra producing states are Uttar Pradesh, Assam, Bihar, Orissa, Maharashtra, West Bengal and Karnataka. Okra, exported from India as a fresh vegetable, comprises 70 per cent of the total fresh vegetable earnings, excluding onion (Anon., 2000). Biotic stresses are one of the most limiting factors for accelerating yield potential of okra. The crop is prone to damage by various fungi, bacteria, viruses, phytoplasma, nematodes and insects, although there is wide variability in their degree of infestation. The most serious disease of okra is yellow vein mosaic virus (YVMV) in India. This disease is most severe one which incurs collosal losses in the crop affecting the quantity and quality of the fruits (Uppal *et al.,* 1940; Capoor and Verma, 1950; Varma, 1952). This disease was first reported in Bombay by Kulakarni (1924) and the viral nature of the disease was established by Uppal *et al.,* (1940) and gave the name "yellow vein mosaic".

The yield losses due to virus ranged from 50 to 90 per cent depending on the stage of the crop growth at which infection occurs (Sastry and Singh, 1974). The characteristic symptoms of the disease comprised of homogenous interwoven network of yellow veins enclosing islands of green tissues. Okra yellow vein mosaic disease is caused by Okra yellow vein mosaic virus (OYVMV), which is a species of genus *Begomovirus*, family *Geminiviridae* (Fauquet and Stanley, 2005). OYVMV is believed to have originated in India. This disease is caused by a complex consisting of the monopartite begomovirus okra yellow vein mosaic virus and a small satellite DNA beta component. The only known method of transmission of OYVMV is through whitefly *(Bemisia tabaci* Genn.) (Aleyrodidae: Homoptera). The objectives of the present investigation are to bring together a comprehensive update of the research on the transmission of okra yellow vein mosaic virus.

Materials and Methods

Transmission of causal viruses: The studies were conducted during *Kharif*, 2012 and 2013 at net house and glass house of the Department of Plant Pathology of Narendra Deva University of Agriculture and Technology, Faizabad. Geographically, the university comes under subtropical zone. The main campus of university is located at Kumarganj on Faizabad Raibarelly road, approximately 43 km away from Faizabad. The experimental site is situated at 26.47^0 North latitude, 82.12^0 East longitude and at an altitude of 113 meters from mean sea level in the north Indo Gangetic plain.

Transmission through mechanical inoculation: Young infected leaves of okra showing severe disease symptoms were collected from natural condition and ground in a pestle and mortar with an equal amount of (w/v) 0.1M phosphate buffer (pH 7.4). The slurry was squeezed through muslin cloth. Sap obtained was centrifuged at 3000 g for 15 minutes and the supernatant was used as standard inoculum. It was mechanically inoculated to the apical leaf (forth from crown) in to five vigorously growing okra plant with the help of cotton pad, soaked in filtered sap by rubbing the upper surface of leaves. The disease symptoms were observed following 15-20 days of inoculation on young leaves of okra plant and per cent transmission was calculated.

Transmission through grafting: Infected okra plants were graft-inoculated with healthy scions. For this experiment, a total five plants (one plant per plot) was used. Scion and stock were maintained firmly with polythene tape and covered with a polythene packet. After establishment, the plants were transferred to insect proof cage and the disease development was recorded.

Transmission through insect vectors: The disease transmission study was determined by allowing the 15-20 insect (whitefly and

Table-1: Transmission of OYVMV through mechanical, grafting and insect vectors

Methods of transmission / vectors	Total No. of inoculated plants	Diseased plants	Healthy plants	Per cent transmission
Mechanical	10	0	10	0.00
Gragting	10	10	0	100.00
Myzus persicae	10	0	10	0.00
Aphis gossypii	10	0	10	0.00
Aphis craccivora	10	0	10	0.00
Bemisia tabaci	10	10	0	100.00

aphids) per plant to feed. Twelve hours of acquisition feeding period and inoculation feeding period were allowed and the transmission was recorded. Ten plants were used for the experiment and percentage transmission was calculated as follows:

% transmission= Diseased plants/ Total Plants (Diseased+ Healthy) x100

Results and Discussion

Transmission of causal virus: Results have indicated that OYVMV under study was not transmissible by mechanical sap inoculation in okra plants. In grafting inoculation trials, after 9-10 days of inoculation, disease was readily transmitted through graft union and symptoms appeared on the scion portion (100.00%). In vector transmission studies, whitefly (*Bemisia tabaci*) easily transmits the OYVMV (100.00%). Whereas, aphids (*Myzus persicae*, *Aphis gossypii* and *Aphis craccivora*) could not transmit the virus (Table-1).

Muniyappa (1980) found that only known method of transmission of OYVMV is through whitefly *(Bemisia tabaci* Genn.). Similar results were also observed by several workers in the world (Burger *et al*., 1988; Pun *et al*., 2005; Magar and Nirmal, 2010). Bhagabati and Goswami (1992) observed that whitefly populations were highest in crops sown in May and the incidence of okra yellow vein mosaic virus was highest (100%) in crops sown in May and June. A high positive correlation was observed between disease incidence and the population of *B. tabaci*. Nath *et al.* (1992) revealed that the incidence of disease caused by okra yellow vein mosaic virus was lowest, when populations of the vector, *Bemisia tabaci,* were low. Significant positive associations were recorded between disease incidence and whitefly population.

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