

# Effect of Okra Yellow Vein Mosaic Virus (OYVMV) on Plant Growth and Yield

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**Abstract:** Okra yellow vein mosaic virus (OYVMV) is one of the most destructive diseases of okra plant. In the current study, effect of okra yellow vein mosaic virus (OYVMV) was assessed on plant growth and yield in naturally infected crop under agro-ecological conditions of Hyderabad district. The virus showed the significant reduction in plant height, number of leaves, flowers, fruits, and over all pickings and yield of all the locations wherever the crop was examined in the district. The significant reduction in plant height (48.67 cm) in infected plants as compared to healthy plants (62.96 cm) was recorded. Similarly, significant difference in the flowers formation per plant at all four locations was recorded in diseased (0.912) and healthy (2.165) plants. Fruit weight was also significantly reducing due to the disease prevalence at all four locations (73.25 g) as compared to healthy observed fruits (91.50 g). Interestingly, on overall basis there were more numbers of leaves (20.66) in infected plants as compared to healthy one (16.33). It is obvious from the results that virus (OYVMV) showed significant increase in number of leaves but reduced plant height, flowers, fruits and yield at all four observed locations, thus, pathologists and breeders are advised to work more on evaluation of resistant varieties using advanced molecular tools. The growers are also advised to adopt preventive as well as curative control measures so that the yield losses may be decreased.

**Keywords:** *Abelmoschus esculentus* L., OYVMV, Growth and yield.

## INTRODUCTION

Okra lady's finger (*Abelmoschus esculentus* or *Hibiscus esculentus* L.) is one of the most popular vegetable crops cultivated in many parts of the world and is thought to be native either of tropical Africa or Asia [1, 2]. It is good source of vitamin A, B, C and is also rich in protein, carbohydrates, fats, minerals, iron and iodine [3, 4]. The stem of the okra plant provides fiber which is used in the paper industry [5].

Beside its economic importance, okra plants suffering due to number factors including diseases, insect pests and weeds. However, this vegetable is attacked by a number of diseases caused by fungi, bacteria, virus, mycoplasma and nematodes. The total loss of vegetable on this account has been estimated up to 20-30% but if pathogens are allowed to develop, this may increase up to 80-90% [6-8]. The important diseases such as charcoal rot or root or collar rot and damping-off disease caused by *Macrophomina phaseolina* (Tassi) Goid. [*Rhizoctonia bataticola* (Taub) Britton Jones], *R. solani*, *Fusarium solani* and *Pythium butleri* [9, 10]; angular leaf spot caused by *Cercospora abelmoschii* [11]; powdery mildew caused by *Erysiphe*

*cichoracearum* [12]; root /stem rot caused by *Phytophthora palmivora* [13], wilt (*Fusarium oxysporium*), root and stem rot (*Phytophthora palmivora*), root knot nematode (*Meloidogyne* sp.), leaf spot (*Alternaria* sp., *Cercospora malayensis*), okra yellow vein mosaic virus and some other viral diseases [10, 14- 18]. Among them, okra yellow vein mosaic virus is the most destructive disease, belongs to the genus Begomovirus and family Geminiviridae [19], which causes colossal losses in the crop by affecting the quality and yield of the fruits. Generally, whitefly (*Bemisia tabacci*) in a persistent circulative manner transmitting this disease [20]. The most susceptible stage of the crop is from 35 to 50 days after sowing (DAS) is noticed in the current study. The disease is characterized by a homogenous interwoven or mottled appearance network of yellow veins enclosing islands of green tissues within younger leaves. In case of severe infection, the infected leaves become yellowish or creamy color. Infected plants remain stunted and bear very few deformed fruits. The fruits are also yellow, small, and reduced in size having irregular yellow areas. It is causing great loss by affecting quality and yield of fruits, as high as 93.80% depending on age of plant at the time of infection [14, 21].

A very little work has been done specially in Pakistan on this prevailing issue. The objective of the present study was to determine the effect of disease on

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plant growth and to evaluate yield losses under the agro ecological condition of Hyderabad district, Pakistan.

## MATERIAL AND METHODS

### Study Area

The effect of okra yellow vein mosaic virus (OYVMV) on plant growth and yield in naturally infected crop was studied under agro-ecological conditions of four localities viz: Tando Jam, Tando Qaiser, Moosa Khatian and Khesano Mori of district Hyderabad.

### Observations

The data on presence of OYVMV was recorded by visual observation based on typical symptoms produced by OYVMV under naturally infested field conditions. Randomly ten plants in each replication were selected and tagged for observation at each location. Observation was recorded up to the 5<sup>th</sup> picking on plant height, number of flowers, numbers of fruits, fruit weight and number of leaves per plants.

Randomly 100 plants were selected and the plants showing OYVMV symptoms were counted to estimate incidence percent with the following formula:

$$\text{Disease incidence (\%)} = \frac{\text{No. of diseased plants}}{\text{No. of examined plants}} \times 100$$

### Statistical Analysis

Data were analysed according to standard procedures for analysis of variance, ANOVA (linear model), and separation of means (least significant difference, LSD) of all parameters was determined using Statistix 8.1 [22]. All differences described in the text were considered significant at the 5 % level of probability.

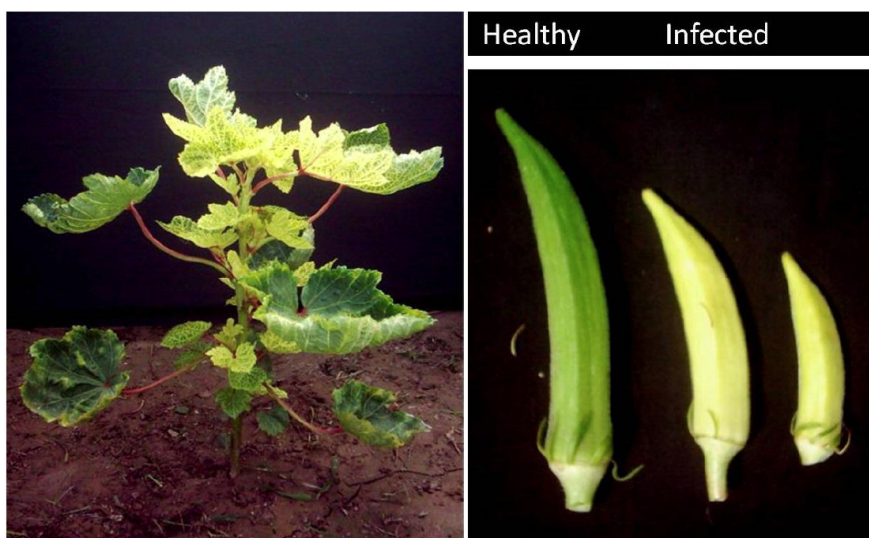
## RESULTS AND DISCUSSION

### Symptomatology

During the observation it was noted that affected okra plants were showing number of typical symptoms with varying intensity. The most susceptible stage of



**Figure 1:** Okra leaves showing symptoms of okra yellow vein mosaic virus (OYVMV).



**Figure 2:** Symptoms of okra yellow vein mosaic virus (OYVMV) on young plant fruits.

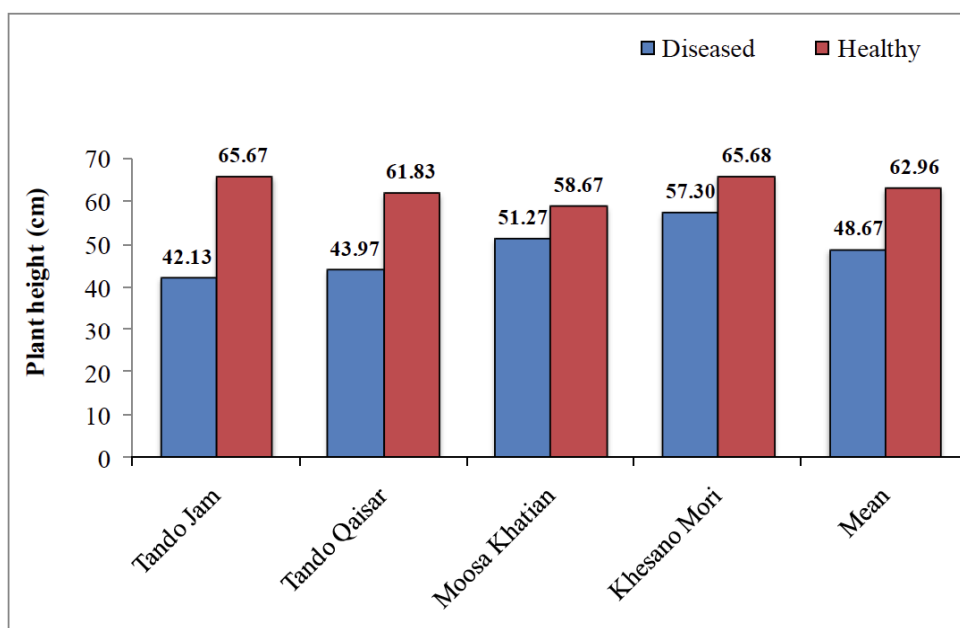
the crop was noticed from 35 to 50 DAS was recorded in current stage. Initial symptom on young leaves was observed as diffuse and mottled appearance. In case of older leaves irregular yellow areas in interveinal were recorded. Clearing of the small veins starts near the leaf margins, at various points, about 15 to 20 days (Figure 1).

The newly developed leaves exhibited an interwoven network of yellow vein, which enclose the green patches of the leaf. Fruit develops on infected plants showed irregular yellow areas. The fruits were also Malformed, yellow, small, and reduced in size (Figure 2). Similar symptoms were also recorded by

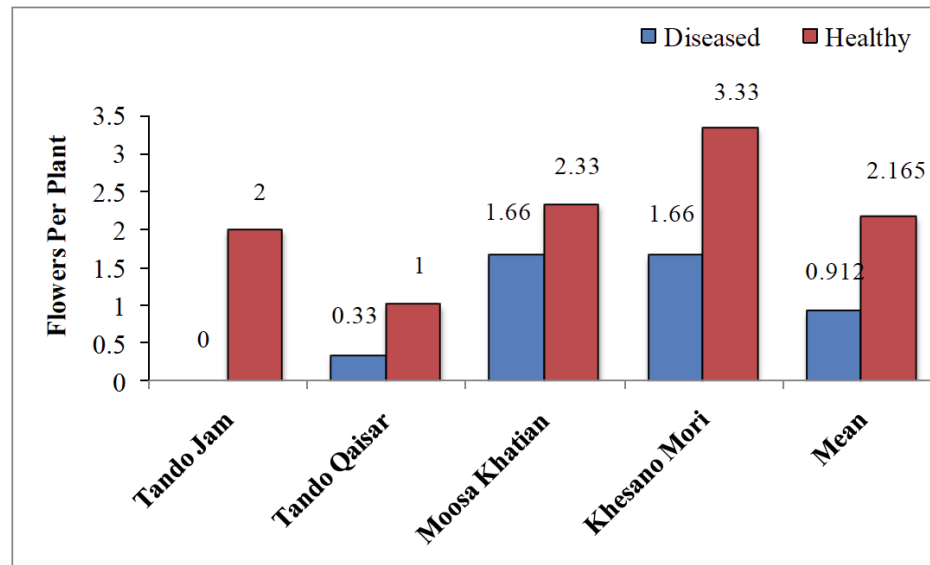
Bhagat *et al.* [21], Fajinmi and Fajinmi [20] and Ali *et al.* [23].

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The result showed that maximum plant height was recorded at Khesano Mori (65.68 cm) and Tando Jam (65.67 cm) while the minimum plant height was observed at Moosa Khatian (58.67 cm) and Tando Qaiser (61.83 cm) in healthy plants. In case of infected plant the minimum plant height was recorded at Tando Jam (42.13 cm) and Tando Qaiser (43.97 cm) while the maximum at Moosa Khatian (51.27 cm) and Khesano Mori (57.30 cm). The result indicated that the



**Figure 3:** Effect of okra yellow vein mosaic virus (OYVMV) on plant height.



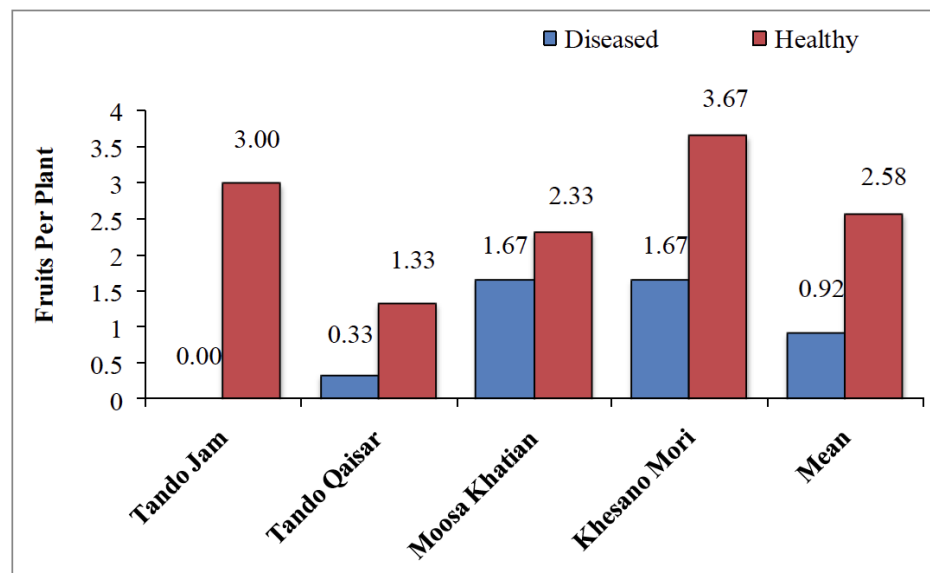
**Figure 4:** Effect of okra yellow vein mosaic virus (OYVMV) on number of flowers per plant.

significant reduction in the plant height was observed at all four locations (48.67 cm) in infected plants as compared to healthy plants (62.96 cm) (Figure 3). The result was compared with Ndunguru and Rajabu [24], indicated that disease symptoms were found in all the surveyed fields with disease incidence that averaged 55% and ranged from 30 to 89%. There was a significant ( $P < 0.05$ ) variation in the above-ground yield components between virus-infected and healthy plants. Compared to healthy ones, diseased plant height was reduced by 19.5%.

No flower formation from diseased plants was recorded at Tando Jam while the 0.33 flowers per plant were observed at Tando Qaisar and 1.66 flowers per

plant at Moosa Khatian and Khesano Mori. The maximum number of flower per plant from healthy observed plants was recorded 3.33 and 2.33 from Khesano Mori and Moosa Khatian, respectively. The minimum number of flower per plant from healthy observed plants was recorded 1 and 2 from Tando Jam and Tando Qaiser, respectively. The significant difference in the flowers formation per plant at all four locations was recorded in diseased (0.912) and healthy (2.165) (Figure 4).

No fruit formation from diseased plants up to the 5<sup>th</sup> picking was recorded at Tando Jam while the 0.33 fruits per plant were observed at Tando Qaisar and 1.67 fruit per plant at Moosa Khatian and Khesano



**Figure 5:** Effect of okra yellow vein mosaic virus (OYVMV) on number of fruits per plant.

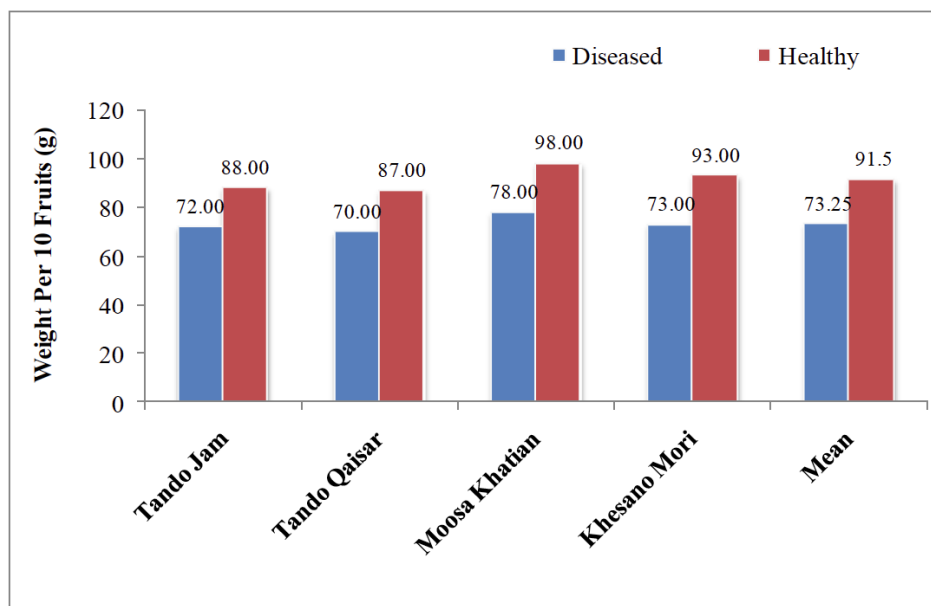


Figure 6: Effect of okra yellow vein mosaic virus (OYVMV) on fruit weight.

Mori. The maximum number of fruits per plant from healthy observed plants was recorded 3.67 and 2.33 from Khesano Mori and Moosa Khatian, respectively. The minimum number of flower per plant from healthy observed plants was recorded 1 and 2 from Tando Jam and Tando Qaisar, respectively. The significant difference was recorded in the flowers formation per plant at all four locations in diseased (0.912) and healthy (2.165) (Figure 5).

Maximum fruit weight per 10 fruits was recorded from healthy plant at Mossa Khatian (98.00 g) and Khesano Mori (93.00 g) while the minimum plant fruit weight was observed at Tando Qaisar (87.00 g) and Tando Jam (88.00 g). In case of diseased plants the

lowest plant weight per 10 fruits was observed at Tando Qaisar (70.00 g) and Tando Jam (72.00 g) whereas the highest fruit weight was obtained from Moosa Khatian (78.00 g) and Khesano Mori (73.00 g). It was observed that the fruit weight was significantly reduces due to the disease prevalence at all four locations (73.25 g) as compared to healthy observed fruits (91.50 g) (Figure 6).

It was revealed that on an overall basis there were more number of leaves (20.66) in infected plants as compare to healthy one (16.33). In case of infected plants only 3.91 leaves were free from symptoms while 16.75 leaves per plants showed typical symptoms. However, minimum symptom less leaves and

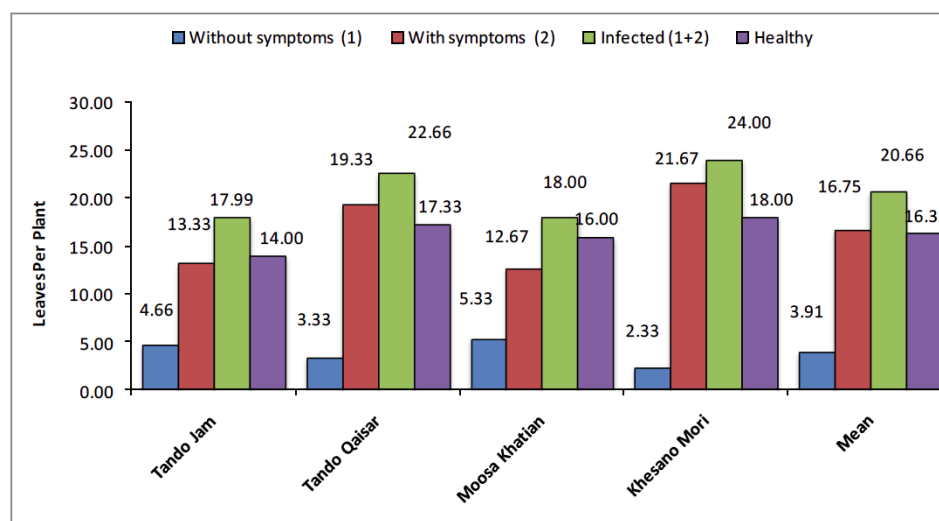
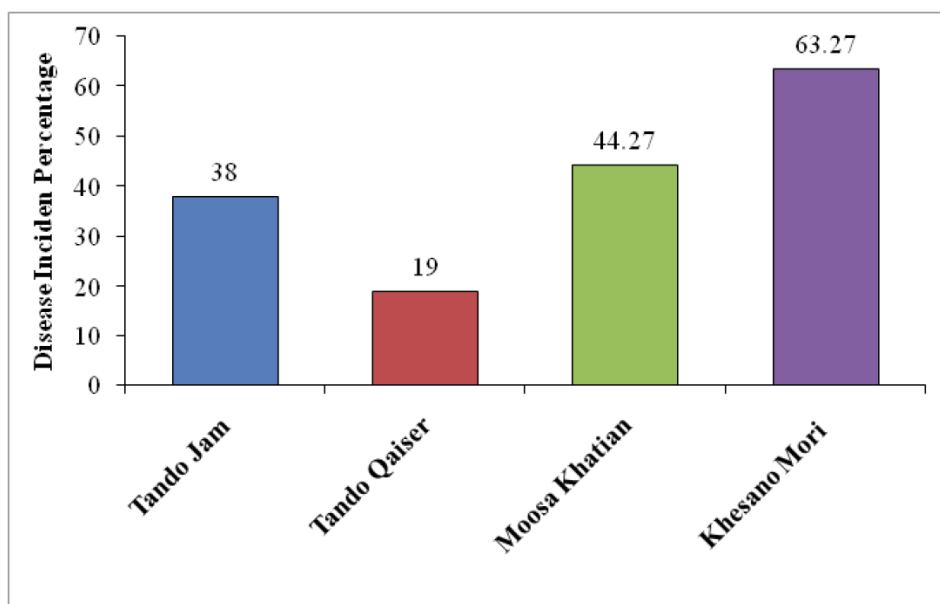


Figure 7: Effect of okra yellow vein mosaic virus (OYVMV) on number of leaves per plant.



**Figure 8:** Disease incidence percentage of four different locations influenced by okra yellow vein mosaic virus (OYVMV).

maximum leaves with symptoms (2.33 and 21.67) per plant was found at Khesano Mori followed by Tando Qaisar (33.33 and 19.33), Tandojam (4.66 and 13.33) and Moosa Khatian (5.33 and 12.33). Similarly, the maximum number of leaves per plant was observed in infected plants at Khesano Mori (24.00), followed by Tando Qaisar (22.66), Moosa Khatian (18.00) and Tando jam (17.99). In case of healthy plants (showing no symptoms), the maximum leaves per plant (18.00) were observed at Khesano Mori, followed by Tando Qaisar (17.33), Moosa Khatian (16.00) and Tando jam (14.00) (Figure 7).

The result was in accordance with Ndunguru and Rajabu, [24] indicated the effect of diseases on the above-ground morphological yield components of okra in farmers' fields. Disease symptoms were found in all the surveyed fields with disease incidence that averaged 55% and ranged from 30 to 89%. There was a significant variation in the above-ground yield components between virus-infected and healthy plants. Compared to healthy ones, diseased plant height was reduced by 19.5%, number of fruits by 34.7% and petiole length by 32.1%. The highest marketable fruit were recorded on Lucky file 473 (resistance variety), whereas, OP (susceptible variety) produced the lowest yield, 8.96-8.54 T ha<sup>-1</sup> [25]. The results of present study are also in accordance with Batra and Singh [26], they conducted the experiment on screening of okra varieties to yellow vein mosaic virus under field conditions. Similarly, Rashid *et al.* [27] were screened twelve okra germplasms for resistance to okra yellow vein mosaic virus (YVMV) under field conditions. Batra

and Singh [26] also screened okra varieties for resistance to yellow vein mosaic virus under field conditions.

#### Disease Incidence of OYVMV Affected Plants

The result regarding the diseases incidence of OYVMV indicates significant variation among four different locations. The highest disease incidence was recorded for Khesano Mori (63.27%) followed by Moosa Khatian (44.27%) and Tando Jam (38%), respectively. Whereas, the lowest disease incidence was observed for Tando Qaiser (19.00%) during the study period (Figure 8). Incidence of okra mosaic virus at different growth stages of okra plants under tropical condition recorded by Fajinmi and Fajinmi [20] was in accordance with our study. However, Ali *et al.* [28] correlate the OYVMV with environmental factors. They found that minimum temperature and RH had significantly correlated with OYVMV disease severity. As minimum temperature rise, the disease incidence was also increased. The disease incidence that averaged 55% and ranged from 30 to 89% were found in all the surveyed fields was also reported by Ndunguru and Rajabu [24].

#### CONCLUSION

It is concluded from present studies that the virus (OYVMV) showed significant increase in number of leaves but reduced plant height, flowers, fruits and yield at all of the locations wherever the crop was examined in district. The Pathologists and

Entomologists are advised to work in close collaboration to face the situation, because the virus is transmitted through white fly. The breeders are also advised to work more on evaluation of resistant varieties. The growers are advised to adopt preventive as well as curative control measures so that the yield losses may be decreased.

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