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Research Article

Studies on the Incidence of *Fusarium* Wilt Disease of Lady-Finger in Meerut, Uttar Pradesh

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Abstract

Lady-finger is one of the most cultivated and popular vegetable crops. It is affected by several fungal, bacterial, and viral diseases. Among these *Fusarium* wilt caused by *Fusarium oxysporum* causes 10-45% yield loss. This survey is conducted to investigate the incidence of *Fusarium* wilt in Meerut District. Nine villages of three Tehsils of district Meerut, Uttar Pradesh, India, were surveyed for the occurrence of wilt of okra (lady-finger). The wilt disease incidence ranged from 13.3%to 17.3%. Maximum wilt incidence is found in Tehsil Sardhana in Kaili village 22%, and minimum wilt incidence is found in Tehsil Meerut in Dimoli village 11%. The result of the present study revealed that wide range of wilt disease infection occurred in the major lady-finger growing areas in Meerut district.

Keywords: *Ladyfinger; Fungal diseases; wilt disease; Fusarium.*

Introduction

Lady-finger (*Abelmoschus esculentus*) is commonly known as Okra or bhindi in India. It is one of the important vegetable crops grown in tropical and subtropical areas. All parts of okra plant are used in the different applications such as okra fruits are used as vegetable; roots and stems are used for cleaning the sugarcane juice; leaves and stems are used for making papers, fiber and ropes etc. (Shah, *et al*., 2015). It is an excellent vegetable source for overcoming global malnutrition and rural poverty (kumar, M. *et al*., 2016). Okra is a well grown crop globally due to its nutritional and economic benefits. Okra crop cope with the major challenges of poor production, adaptability and management that may not allow the okra seeds to express their full potential (Nkongho, *et al*., 2022).

India is one of the largest producers of okra (67.1%) followed by Nigeria (15.4%) and Sudan (9.3%). The other major okra-producing countries are Mali, Pakistan, Cameroon, Ivory Coast, Ghana, and Benin etc. Globally, okra has a production of 8.71 metric tonne sand productivity of 7.8 Ton/hectare (kumar, M. *et al*., 2016; Nkongho, *et al*., 2022).

Diseases are major constraints to the quality and quantity of ladyfinger produced globally. Okra plants are attacked by various diseases caused by different viruses, bacteria, fungi, mycoplasmas, nematode, and insects. Mostly, okra crop is attacked by various soil borne plant pathogenic fungi like *Macrophomina phaseolina*, *Rhizoctonia solani*, *Fursarium oxysporum*, caused 10-45 percent losses under the favourable conditions (Anwar &Mckenry, 2010; kumar, M. *et al*., 2016).

Among these, the causal agent of Fusarium wilt *i.e.,Fusarium oxysporum* f. sp. *vasinfectum*is one of the most serious diseases in India causing considerable yield loss in *Malvacease* species (Keinath, *et al*., 2022). This pathogen causes vascular wilt in okra and cotton. *Fursarium oxysporum* is the causal pathogen of

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*Fusarium*wilt of okra. It is also observed that damage caused by *Fusarium oxysporum* is dependent upon the age of the crop viz., 61 percent at seedling stage and 43 percent at flowering stage. *Fursarium oxysporum* f. sp. *vasinfectum* was significantly more virulent when cultured on a saline-enriched medium (Gowda, *et al*., 2020). The fungus invades the roots, colonizes the vascular system and there by restricts water translocation. Cutting the base of the stem reveals a dark woody portion along with dark brown streak underside of bark (Nagesh and Mulge, 2017).

Therefore, the major objective of this study was to investigate the incidence and distribution of fusarium wilt disease in okra plant grown in different areas of Meerut, Uttar Pradesh India, and to generate the basic information on this aspect of plant pathology.

Material and Methods

Study Areas

The various locations of Meerut city were selected to investigate the incidence and distribution of *fusarium* wilt disease in okra crops. The average rainfall ranges from 50-80 mm annually, while the temperature ranges between 2-45°C. The pH of the soil was between 5.6 to 6.5. To conduct this survey study, we have selected the major villages (areas) growing the crop of okra in Meerut, Uttar Pradesh, India. Further, we have chosen nine villages in Meerut District to perform the designed study (Table 1).

Table 1: List of the villages selected for the study

Sr. No.	Tehsil	Villages
1	Sardhana	Siwaya
		Kaili
		Daurala
2	Mawana	Kithor rural
		Machhra
		Dhikauli
3	Meerut Sadar	Dimoli
		Govindpur
		Kharkhauda

Selection of Study Sites

Survey of lady-finger (okra) fields was carried out in district Meerut, Uttar Pradesh to collect the wilted plant at different stages of plant growth. In this field survey, first we have selected the district Meerut to understand the incidence of wilt disease in this district. Further, we have selected three Tehsil and among each Tehsil, we have selected three villages where lady-finger crop is grown.

Two plots per village were taken for the collection of wilted infected plant specimen of Lady-finger plant. In each plot, two spots of one-meter square quadrat were taken by random samplingand each spot having number of wilted as well as healthy plants were recorded.

Wilt Incidence

To determine the *fusarium* wilt incidence in the okra, a wilt incidence scale was used with wilt percentage (Nene, *et al*., 1981). The below given formula was used to calculate the wilt incidence percentages of each spot.

$$\textbf{Wilted plants Incidence (\%) of each spot} = \frac{\textbf{Number of wilted plants of each spot}}{\textbf{Total number of plants of the same spot}} \boldsymbol{X100}$$

Isolation and Identification of Wilt Causing Fungi

Wilted samples of ladyfinger were brought to the laboratory for the isolation of different fungi. The roots of the wilted plants sample were washed thoroughly in tap water in order to remove the sticking soil particles. These were then surface sterilized by dipping in 0.1 percent NaOCI (Sodium Hypochlorite) solution for two minutes. The roots were washed repeatedly in sterilized distilled water to remove the traces of Sodium hypochlorite. Thoroughly washed roots were kept in sterilized Petri plates lined with sterilized

blotting paper and allowed to dry for some time. The roots were cut into small pieces and transferred in presterilized Petri plates containing Potato Dextrose Agar medium. The Petri plates were incubated at 28±2°C and root pieces were observed daily for appearing fungi from both cut ends upto 7 days. The fungal colonies developed in each Petri plate were isolated separately. The fungi were purified and identified by comparing their morphological & cultural characteristics with authentic cultures as well as with the help of available literature.

Statistical Analysis

The data collected were reviewed and tabulated. Results of the present study were analysed by MS excel (mean, frequency, percentage calculated).

Results and Discussion

The results of this survey study revealed that the ladyfinger cropsare widely affected by *Fusarium* wilt disease and the percent of the disease incidence differs in every village of district Meerut Uttar Pradesh**.**

Table 2: Incidence of Fusarium wilt of ladyfinger in different villages in district Meerut Uttar Pradesh

S.No.	Tehsil	Villages	Wilt% incidences
1	Sardhana	Siwaya	18
		Kaili	22
		Daurala	12
		Mean	17.33
2	Mawana	Kithor rural	16
		Machhra	12
		Dhikauli	17
		Mean	15
3	Meerut Sadar	Dimoli	11
		Govindpur	14
		Kharkhauda	15
		Mean	13.33

The maximum wilt disease incidences were observed in Kaili village of Sardhana Tehsil and least disease incidence occurs in Dimoli village in Meerut Tehsil. Sardhana Tehsil villages was found to have 17.33% fusarium wilt disease incidence in okra crops. The minimum level of fusarium wilt incidence was found in the villages of Meerut Tehsil with an average 13.3% of wilt disease incidence. The result of our study was agreed with the finding of Zhang, *et al*. 2008 who has reported the n average incidence of 5.3 to 13.5% of *fusarium* wilt disease in the cucumber plant.

Fusarium wilts, caused by *Fusarium oxysporum* is one of the most widespread and destructive diseases of okra plants and many other ornamental and horticultural crops. It caused damage to various parts of the plant such as flower and pod abortion, pod and seed rot, shrunken pods, pod and leaf necrosis, discoloration, reduced germination and reduction in plant vigor of various crops (Okwu, *et al*., 2007).

Fusarium wilt is a major disease in the banana crop production in Indonesia. Field observations and sample collections has been done by Australian Centre for International Agricultural Research-projects, were undertaken to generate a Fusarium wilt distribution and incidence map and samples of wilt disease incidence was observed. The incidence of Fusarium wilt was found in the average range of 23.99% which is higher as compared to study reported in this study (Hermanto, *et al*., 2009).

Fig 1: Visit of okra field crop in Meerut district

Fig 2: A pictorial view of the okra crop grown in Meerut district

Fig 3: Wilt diseases okra plant in the crop

Conclusion

The findings of the present study indicate the various soil borne pathogens attack to ladyfinger plants. Amongst the seedborne diseases, fusarium wilt is one of the major diseases occurs in ladyfinger crops and causes a huge loss in the production of crop. The farmers can take precautions to control the wilt disease in the ladyfinger fields.

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