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Fusarium spp. Associated with Cucurbit Diseases

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ABSTRACT

***Fusarium* spp. is a group of soil-borne fungi with many different species. In cucurbits, this genus cause major diseases out of which vascular wilt disease and fruit rot are of highly significance on the basis of the economic losses it causes annually to the cucurbit crops. Vascular wilt of cucurbits is caused by *Fusarium oxysporum* which has a host specific formae speciales (f. sp.) such as *F. oxysporum* f. sp. *melonis* which cause vascular wilt of melon (muskmelon and cantaloupe). These formae speciales also show cross-infectivity and can infect other non-host species in the family cucurbitaceae. Fruit/crown/foot rot of cucurbits is due to *F. solani* which is a post-harvest disease and infects mostly pumpkin and squash. The formae specials in this disease is common to the family cucurbitaceae i.e. *Fusarium solani* f. sp. *cucurbitae*. Although less specific to the cucurbits, other species of *Fusarium* such as *F. proliferatum, F. equiseti, F. pallidoroseum F. semitectum, F. verticillioides* etc. can also be found associated with the cucurbit diseases. *F. oxysporum* and *F. solani* are the primary culprits, whereas several other *Fusarium* species contribute to diseases in cucurbits, hampering its yield as well as quality.**

INTRODUCTION

Plant diseases pose a serious threat to several economically important crops (Shahid, 2023; Shahid et al., 2023a; 2024a). Cucurbits are one of the economically important crops which are very much prone to plant diseases including muskmelons, squashes, cucumber, bitter gourd, pumpkins, bottle gourd etc. Cucurbits have immense recognition as one of the important market vegetables owing to its continued awareness of the several health benefits due to its consumption (Shahid et al., 2025). Plant pathogens which cause serious plant diseases in these crops affects not only quantity but also quality of the fruits. A large number of diseases have been reported in cucurbits due to several plant pathogens such as fungi, bacteria, virus as well as nematodes. High incidence of the disease infections caused by plant pathogens occur in cucurbits because of extreme temperatures, heavy rainfall as well as high humid condition which results in huge losses through reduction in the yield, hampered quality of the produce in addition to elevated cost of crop production.

Several fungi attack cucurbits of which genus *Fusarium* is a devastating one. This genus is soil-borne in nature and widespread all over the world. It can cause losses up to 100% and affects both the quantity as well as quality of the fruit (Shahid and Khan, 2024). Several species of *Fusarium* are found to be associated with cucurbit crops but the major species which attack cucurbits and are responsible for huge losses include *F. oxysporum* and *F. solani* (Din et al., 2020).

Among the major species of *Fusarium*, *F. oxysporum* is the dominant one which causes a very important and damaging disease named Fusarium wilt disease in almost all cucurbits like muskmelons, squashes, cucumber, bitter gourd, pumpkins, bottle gourd etc. (Shahid et al., 2023b). Almost all the stages of plant growth are susceptible/prone to this pathogen, and the symptoms of the disease may be seen in the form of leaf yellowing, stunted plant growth, and early falling of leaves. The root portion appears dark brown in color and develops rotting symptoms near the crown area of the root. In case of severe infection, it causes death of the whole plant. *F. oxysporum* is a host specific fungus and that is why it has formae speciales (f. sp.). These f. sp. are strictly host-specific and is different in each cucurbit crop such as in cucumber (*F. oxysporum* f. sp. *cucumerinum*), muskmelon (*F. oxysporum* f. sp. *melonis*), bitter gourd (*F. oxysporum* f. sp. *momordicae*), etc. (Shahid et al., 2024b). However, mostly these f. sp. are cross-infective/cross-pathogenic in nature i.e. one f. sp. can infect other non-specific cucurbit host for e.g. besides cucumber*, F. oxysporum* f. sp. *cucumerinum* can also infect muskmelon, bitter gourd and/or other cucurbit species.

Another *Fusarium* species i.e. *Fusarium solani* causes crown, foot, and fruit rots in several cucurbits but it primarily affecting pumpkin and squash. It is a postharvest disease which also has f. sp. common to all cucurbits i.e. *Fusarium solani* f. sp. *cucurbitae*. This fungus mainly infects the fruit through wounds, which lead to water-soaked lesions. These lesions later on become sunken and covered in mycelial growth of the fungi which is generally pink to white in colour. The fungi can penetrate though the fruit tissue, entering towards the seed cavity and causing fruit decay. *F. solani* is also soil-borne in nature and it can survive in soil as well as plant debris. High humidity and moisture can help in enhancing the sporulation of the fungi which can lead to promoted disease development (Zhang et al., 2025).

Some other species of *Fusarium* are also found associated with the cucurbit crops namely, *F. proliferatum, F. moniliforme, F. gaminearum, F. equiseti, F. acuminatum, F. avenaceum, F. semitectumm F. verticillioides* and *F. pallidoroseum* (Avinash et al. 2021). Recently, *F. compactum, F. jinanense,* and *F. mianyangense* have also been identified as new causative agents of fruit rot in muskmelon

(Suwannarach et al., 2024). *F. pernambucanum* and *F. sulawesiense* were also found to be associated with *F. jinanense*, causing postharvest fruit rot on melons (Araujo et al., 2021). All these *Fusarium* spp. are less specific to the cucurbits and do not cause severe damage to the crop as compared to *F. oxysporum* and *F. solani*. Although the different species of *Fusarium* have many characteristics in common. *Fusarium* spp. can be spread through infected soil, seeds and plant debris. These can survive for several years in the soil as these produce chlamydospores (besides producing microconidia and macroconidia) which are thick-walled resting spores that can survive in adverse conditions (Shahid et al., 2024c).

These *Fusarium* species affect the cucurbit crops both in terms of quantity and quality due to which the market value of the fruits is reduced. Hence, managing these *Fusarium* diseases is a vital component for the production for cucumbers, melons, pumpkins, squashes, as well as other cucurbit crops which can include sanitation, use of resistant cultivars, use of fungicides, biological control methods, crop rotation and several other management methods (Shahid and Khan, 2016; 2019).

CONCLUSION

Fusarium spp. are a real threat to cucurbit cultivation with regard to the losses they pose to the crop as high as 100%. The fruits of the diseased plants are of poor quality due to which the market value is reduced. A large number of species attack cucurbits and all of them affect the crop more or less in a direct or indirect way. The thick-walled resting structures of the fungi is responsible to help it survive in adverse conditions. Hence, not only one but many species of *Fusarium* might be present at a time in the infected cucurbit crop and proper management measures should be taken to control the diseases caused by them.

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CONFLICT OF INTEREST

All the authors declare no conflict of interest.

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