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Journal of
Aquaculture Research & Development

Research Article

Morphological and Pathogenic Variability in Different Isolates of *Fusarium oxysporum* f. sp. *cumini*

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ABSTRACT

Wilt of cumin incited by *Fusarium oxysporum* f. sp. *cumini* is one of the important disease and a big constraint in successful cultivation. Therefore, in the present study, 7 isolates of *Fusarium oxysporum* f. sp. *cumini* collected from different cumin growing areas of Rajasthan were assessed for morphological and pathogenic variations. The different isolates produced sickle shaped macro conidia and spores of varying width, length having variable number of septa. The isolate I_2 produced highest length and number of septa in macro conidia. The length of macro conidia varied from 22.77 µm in isolate I_3 to 29.65 µm in isolate I_2 whereas, micro conidia length varied from 7.54 µm in I_4 to 11.53 µm in I_6. In study of pathogenic variability, among different isolate, the isolate I_1 proved most virulent as it showed disease symptoms earliest whereas, isolate I_5 proved least virulent.

Keywords: Cumin; Wilt; *Fusarium oxysporum* f. sp. *cumini*; Variability

INTRODUCTION

A spice is substance of plant origin, primarily from various parts of the plant such as dried seed, fruit, root or bark which is used in very small quantities as a food additive for flavor, color or as a preservative. It is used for flavoring the food products but in addition it is also used in preservation of food and provision of nutritional and health benefits [1]. Cumin (*Cuminum cyminum L.*) locally known as 'zeera' is an important seed spice and one of the earliest known minor spices used by mankind. It belongs to family umbelliferae (apiaceae) and believed to have originated from Egypt and Syria [2]. Cumin have good antioxidant potential and this spice can be used to produce novel natural antioxidants as well as flavoring agents that can be used in various food products [3]. Seeds have pleasant aroma and spicy taste due to presence of aromatic alcohol 'cuminol' (cuminaldehyde). The crop suffers from many diseases such as wilt (*Fusarium Oxysporum* f. sp. *Cumini*), Blight (*Aternaria burnsii*), Powdery mildew (*Erysiphe polygoni*) and some other diseases. Among these wilt is an important disease of cumin with incidence up to 25.7% but may be 60% in some cases. Wilt is an important disease of cumin with incidence up to 25.7% but may be 60% in some cases. Losses in yield up to 25% have been reported from North Gujarat and up to 60% from Rajasthan [4-6]. Mathur and Mathur[7] reported wilt of cumin from Rajasthan and identified the causal organism to be *Fusarium oxysporum* (Schl.) Snyder and Hansen. In this context an investigation was planned to isolate, identify pathogen from infected plants of cumin and to study the variability in *F. oxysporum* f. sp. *cumini*.

MATERIALS AND METHODS

Variation and variability

Single spore cultures were raised from isolates of different collections of *Fusarium oxysporum* f. sp. *cumini* on 2 per cent Potato dextrose agar slant. A total 6 isolates obtained on isolation from the surveyed district and a local isolate from Agronomy farm of SKNCOA, Jobner were used in present study. Isolates were transferred separately on 2 per cent PDA in petridishes to study in detail for their discernible characters on the basis of cultural characters such as the amount and color of aerial mycelium [8], colony growth and pigmentation of substratum.

The isolates were coded as:

Code	Place of collection of isolates
I_1	Jalore
I_2	Nagaur
I_3	Jodhpur
I_4	Pali
I_5	Sirohi

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Received: June 14, 2021, **Accepted:** June 25, 2021, **Published:** July 02, 2021

Citation: Choudhary S, Godika S (2021) Morphological and Pathogenic Variability in Different Isolates of *Fusarium oxysporum* f. sp. *cumini*. J Aquac Res Development. 12:646.

I_6 Ajmer

I_7 Agronomy farm S.K.N. COA, Jobner

Morphological variability

To detect morphological variability in conidia formed by different isolates, purified culture of each isolate was grown in PDA containing plate. From 7-day old culture of each isolate, 2 mm diameter bits were cut from periphery of the growth with the help of a sterilized cork borer. One such bit was transferred aseptically with the help of sterilized inoculation needle to inoculate one PDA plate. Four petridishes each inoculated with 1 bit of the same isolate constituted 4 replications for that isolate. The inoculated petridishes were incubated at 25±1°C temperature. On 7th day of incubation, spores were collected from culture in each petridish according to the following procedure.

From each petridish, constituting one replication, 3 bits (each of 2 mm diameters) were cut with the help of sterilized cork borer from random points on peripheral growth. Three bits were shaken in 5 ml water for 10 minutes on a horizontal shaker. The harvested spores were stained with dilute solution of cotton blue and examined microscopically. For each isolate, 10 macro-conidia and 10 micro-conidia from the total number of spores separated out from 3 bits per replication were separately examined for their size, shape and septation. Thus, 60 macro-conidia and micro-conidia from each isolates were examined for their size, shape and septation.

Pathogenic variability

Cumin cultivar RZ-19 was raised in 30 cm earthen pots. The pots were surface sterilized with 2 per cent formalin solution. After 24 hrs of sterilization, each pot was filled with sterilized soil (Soil: FYM = 3:1) sterilized at 1.045 Kg/cm^2 for one hour for three consecutive days. These pots were inoculated with fungus inoculum (@ 10 per cent w/w soil) multiplied on sorghum grain medium. Five pots were sown with fifteen surface sterilized seeds in each pot that were treated as five replications for each of the isolates. Disease incidence was recorded regularly commencing after 15 days till 60 days of sowing and per cent incidence was calculated as under:

Per cent disease incidence = Number of infected plants/ Total number of plants × 100

RESULTS AND DISCUSSION

Morphological variability

Macro-conidia: All the isolates produced sickle shaped macro-conidia. Among different isolates, isolate I_3 and I_6 were similar and produced spores of minimum length and isolate I_2 produced spores of maximum length as compared to other isolates (Table 1).

The different isolates produced spores of varying width and the isolate I_4 showed significantly maximum width of spores (5.20 µm) than all other isolates. The isolate I_5 showed minimum width of spore (3.25 µm) that was similar with isolate I_1 and significantly lower than all other isolates.

All the isolates showed wide variability in number of septa present. The isolate I_1 produced significantly lowest number (2.50) of septa while isolate I_2 produced significantly highest (3.80) number of septa than all other isolates.

Micro-conidia: All the isolates formed ovoid micro-conidia. The isolate I_4 gave minimum length (7.54 µm) whereas maximum length of micro-conidia (11.53 µm) was found in isolate I_6, (Table 1). The different isolates produced spores of varying width and the isolate I_6 showed significantly maximum width of spores (4.10 µm) that was similar with isolate I_3. The isolate I_1 showed minimum width of spore (2.90 µm) than all other isolates.

The isolate I_1, I_3, I_5 and I_6 did not differ significantly so far as number of septa is concerned. However, the isolates I_3, I_5 and I_6 produced significantly lower number of septa than I_4 that produced highest number of septa amongst all isolates.

Pathogenic variability

The data regarding the time taken by different isolates to produce first symptom of disease and per cent incidence Table 2 revealed that isolate I_1 was found highly virulent as it showed 86.66 per cent wilt incidence on 19th day of inoculation when no other isolate was able to produce disease symptoms. On 21th day of inoculation, in addition to isolate I_1, the isolate I_2 also showed disease symptoms with disease incidence (81.66%). The isolate I_5 proved least virulent as plants inoculated with this isolate show disease symptoms up to 30th day of inoculation and showed lowest disease incidence as compared to other isolates. On 34th day of inoculation, the isolate I_1 remaining at par with isolates I_2 exhibited significantly highest disease incidence as compared to isolates I_3 I_4, I_5 and over I_6 and I_7.

Table 1: Morphological variations in macro and micro conidia of different isolates of *F. oxysporum* f. sp. *cumini* on PDA medium.

Isolates	Macro-conidia			Micro-conidia		
	Length µm	Width µm	No. of septa	Length µm	Width µm	No. of septa
I_1	27.5	3.9	2.5	9.5	2.9	0.87
I_2	29.65	4.5	3.8	10.65	3.75	0.92
I_3	22.77	4.35	3.65	10.72	4.02	0.8
I_4	28.3	5.2	3.5	7.54	3.94	0.97
I_5	26.45	3.25	2.98	9.42	3.5	0.75
I_6	24.1	5	3.15	11.53	4.1	0.77
I_7	25.75	4.25	3.75	10.25	3.15	0.9

Table 2: Pathogenic variability among the isolates of *F. oxysporum* f. sp. *cumini*.

Isolates	Interval between inoculation and 1st appearance of disease (days)	Wilt disease incidence (%)
I_1	19	86.66(68.58)*
I_2	21	81.66(64.64)
I_3	24	66.66(54.73)
I_4	27	46.66(43.08)
I_5	30	33.33(35.26)
I_6	32	79.99(63.43)
I_7	34	73.33(58.91)
	SEM+	2.05
	CD (p=0.05)	6.10
	CV%	6.11

** Values in parenthesis are angular transformed values

The different isolates produced sickle shaped macro conidia and spores of varying width, length having variable number of septa. Thus, isolates of the pathogen showed great variation in morphological characters as reported by Mathur and Prasad [9]. Some isolates ceased sporulation on continuous culturing but regained it on passing through the host.

Among different isolate, the isolate I_1 proved most virulent as it showed disease symptoms earliest whereas, isolate I_5 proved least virulent. Mehta et al. studied ten isolates of *Fusarium oxysporum* f. sp. *Cumini* for their discernible characters such as the colour of mycelium, pigmentation of substrate, type and amount of mycelia growth, virulence and nutritional requirement [10]. All the isolates were found to be pathogenic though they differed in the percent disease incidence. Deshwal and Kumari [11] reported phylogenetic relationships among fungal isolates of *Fusarium oxysporum* f. sp. *cumini*, collected from different regions of Rajasthan correlates with variation exist at pathogenicity [12].

CONCLUSION

The different isolates produced sickle shaped macro conidia and spores of varying width, length having variable number of septa. The isolate I_2 produced highest length and number of septa in macro conidia. The length of macro conidia varied from 22.77 µm in isolate I_3 to 29.65 µm in isolate I_2 whereas, micro conidia length varied from 7.54 µm in I_4 to 11.53 µm in I_6. In study of pathogenic variability, among different isolate, the isolate I_1 proved most virulent as it showed disease symptoms earliest whereas, isolate I_5 proved least virulent.

REFERENCES

1. Nazeem PA. The spices of India. The Herb, Spice and Medicinal Plant Digest/(USA). 1995.
2. Edison S, Johny AK, Nirmal Babu K, Ramadasan A. Spices varieties: A compendium of morphological and agronomic characters of improved varieties of spices in India. ICAR IISR; 1991.
3. Nadeem M, Riaz A. Cumin (*Cuminum cyminum*) as a potential source of antioxidants. Pak J Food Sci. 2012;22(2):101-7.
4. Khare MN, Tiwari SP, Sharma YK. Disease problems in the cultivation of I. Cumin (*Cuminum cyminum L.*) II. Caraway (*Carum carvi L.*) and their management leading to the production of high quality pathogen free seed. Int J Seed Spices. 2014;4(1):1-8.
5. Lodha S, Mawar R. Cumin wilt management: A review. J Spice Aromat. Crop. Jul 1;23(2):145-55.
6. Dange SR. Diseases of cumin (*Cuminum cyminum L.*) and their management. J Spices Aromat Crops. 1995;4:57-60.
7. Mathur RL, Mathur BL. Annual report of scheme for research in wilt disease of zeera **(***Cuminum cyminum L.*) in Rajasthan. 1956.
8. Maerz A, Paul MR. Dictionary of Color. (2nd edn), McGraw Hill Book co, Inc., New York, Toronto, London. 1950;p:208.
9. Mathur BL, Prasad N. Studies on *Fusarium* wilt of cumin (*Cuminum cuminum L.*) with reference to nature of variation in the causal organisms. Proceedings of National academy of science India. 1967;37:161-71.
10. Sangeeta M, Gaur VK, Jagdish P. Morphological and physiological variation among isolates of *Fusarium oxysporum f.* sp. *Cumini* causing wilt of cumin. Plant Disease Res. 2013;28(2):186-90.
11. Deshwal RK, Kumari N. Regional variation in genetic structure and pathogenecity of *Fusarium oxysporum f.* sp. *Cumini* isolated from *Cuminum cyminum L.* Asian J Biosci. 2012;5(1):30-8.
12. Kaur A, Sharma VK, Sirari A, Kaur J, Singh G, Kumar P. Variability in *Fusarium oxysporum* f. sp. *ciceris* causing wilt in chickpea. African J Microbiol Res. 2015;9(15):1089-97.