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SCREENING OF FENNEL GENOTYPES AGAINST WILT DISEASE INCITED BY *Fusarium pallidoroseum* UNDER FIELD CONDITIONS

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ABSTRACT

Fennel (*Foeniculum vulgare* Mill.) is a cross pollinated seed spice crop, which belongs to family *Apiaceae* (*Umbelliferae*) with chromosome number $2n=22$ and is cultivated as an annual crop in *Rabi* season. An experiment was conducted under natural conditions to find out the resistance varieties/germplasm against *Fusarium pallidoroseum*. The average of two years shown that wilt incidence was ranged from 15.50 per cent to 58.50 per cent among tested 40 varieties/genotypes and it was lowest (15.50%) in the variety RF-205 while it was maximum in RF-125 (58.50%). None of the genotypes/varieties was found immune and highly resistant. However, three varieties (RF-101, RF-143 and RF-205) were found resistant while, three varieties (RF-290, RF-145 and RF-178) were found moderately resistant against wilt of fennel. Twenty-four varieties/genotypes (RF-157, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-271, UF-64, UF-114, UF-46, UF-3, RF-289, RF-281, UF-229, UF-200, UF-201, UF-202, UF-175, UF-166, UF-261, UF-226 and UF-228) were found susceptible. Ten varieties/genotypes (RF-125, UF-82, UF-110, UF-43, UF-33, UF-45, UF-32, UF-4, UF-23 and UF-69) were found highly susceptible to wilt of fennel.

Keywords : Fennel, *Fusarium pallidoroseum*, Wilt incidence, RF-205 and RF-125.

Introduction

Fennel (*Foeniculum vulgare* Mill.) is a cross pollinated seed spice crop, which belongs to family *Apiaceae* (*Umbelliferae*) with chromosome number $2n=22$ and is cultivated as an annual crop in *Rabi* season. Fennel plant is tall and grows about 2.5 m in height. Leaves are alternate, pinnately compound, measuring up to 40 cm in length and are deeply dissected into several fine segments of 0.5 mm width (Diaz-Maroto *et al.*, 2006).

In nature, Fennel crop is attacked by many fungal and bacterial pathogens causing diseases viz., powdery mildew (*Leveillula taurica*, *L. taurica* var. *languinosa*), Leaf spot (*Cercosporidium punctum* Syn. *Passolora foeniculi*, *Cochliobolus lunatus*, *Alternaria umbellifericola*), blight (*Ramularia foeniculi*, *Alternaria tenuis*, *Cercospora foeniculi*), root rot

(*Sclerotinia sclerotiorum*), leaf diseases (*Phytophthora syringae*), vascular wilt (*Fusarium oxysporum*) and root and foot rot (*Rhizoctonia solani*) (Shaker and Alhamadany, 2015).

Fungi constitute the largest group among seed borne pathogens. Many fungal pathogens infect the developing and maturing seeds and reduce their germination capability and yield (Boughalleb *et al.*, 2019).

The common methods of disease managements are use of fungicides and resistant variety. However continuous use of fungicides to manage diseases is neither environmentally safe nor economically cheap. The literature on wilt resistant germplasm of fennel is scanty. Therefore, identification of wilt resistant / tolerant genotypes of the crop will be useful for

development of resistant variety where the disease is prevalent and causing high economic losses.

Materials and Methods

An experiment was conducted under natural conditions to find out the resistance varieties/germplasm against *Fusarium pallidorozeum*. A total of forty (40) fennel varieties/germplasm i.e. RF-101, RF-157, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-271, UF-64, UF-114, UF-46, UF-3, RF-289, RF-281, UF-229, UF-200, UF-201, UF-202, UF-175, UF-166, RF-143, RF-205, RF-290, RF-145, RF-178, UF-261, UF-226, UF-228, RF-125, UF-82, UF-110, UF-43, UF-33, UF-45, UF-32, UF-4, UF-23 and UF-69 were collected from the Department of Plant Breeding and Genetics (AICRP on Seed Spices), SKN College of Agriculture, SKNAU, Jobner. Screening test was carried out during Rabi, 2023-24 and Rabi 2024-25 at Plant pathology farm, S.K.N.CO.A Jobner, Jaipur.

The fennel seeds were sown in a field where an inoculum (Plate-1) of *Fusarium pallidorozeum* (multiplied on sorghum grains) was added artificially in furrows @ 20 g/m row length to increase the pathogen population up to 1.3×10^4 cfu/g of soil (Prasanna and Patel, 2022). Three replications were maintained for each variety. Three replications were maintained for each variety. Actual data in percentage were converted to angular transformed values, before analysis according to the table given by Walter (1997). Fischer's method of analysis of variance was used for analysis and interpretation of the data as outlined by Gomez and Gomez (1984). The level of significance used in 'F' and 'T' tests was $p=0.05$. Critical differences were calculated wherever 'F' test was significant.

Observation on per cent disease incidence was recorded. On the basis of disease incidence, the varieties were categorized as per criterion followed by Mayee and Datar, 1986.

Percent disease incidence (PDI) was calculated as follows:

$$\text{Disease incidence (\%)} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

Results and Discussion

It is evident from the data that all the tested varieties and genotypes had showed significantly varied incidences of wilt of fennel as compared to check susceptible variety, during both the years as well as pooled basis (Table 2 and 3; Plate 2). The average of two years shown that wilt incidence was ranged from

15.50 per cent to 58.50 per cent among tested 40 varieties/genotypes and it was lowest (15.50%) in the variety RF-205 while it was maximum in RF-125 (58.50%).

Based on disease reaction, thirty three tested varieties and genotypes had significantly reduced incidence of fennel wilt as compared to check susceptible variety, during both the years as well as under pooled basis. None of the genotypes/varieties was found immune and highly resistant. However, three varieties (RF-101, RF-143 and RF-205) were found resistant while, three varieties (RF-290, RF-145 and RF-178) were found moderately resistant against wilt of fennel. Twenty four varieties/genotypes (RF-157, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-271, UF-64, UF-114, UF-46, UF-3, RF-289, RF-281, UF-229, UF-200, UF-201, UF-202, UF-175, UF-166, UF-261, UF-226 and UF-228) were found susceptible. Ten varieties/genotypes (RF-125, UF-82, UF-110, UF-43, UF-33, UF-45, UF-32, UF-4, UF-23 and UF-69) were found highly susceptible to wilt of fennel.

Similar results were also observed by Kumawat *et al.* (2024) in the screening experiment of thirty varieties/germplasm. Result of this experiment showed that the highest root rot incidence was recorded in RF-125 (70.00 %) and UF-33 (70.00 %) and minimum (20.0 %) root rot incidence was recorded in RF-101 and RF-205. Rehman *et al.* (2014) studied the resistant sources in pea varieties/advanced lines against *Fusarium oxysporum* f.sp. *pisi* with twelve genotypes under natural conditions. Only one variety Jumbo was found to be highly resistant, while advanced lines (26709 and 26711) were found resistant, two lines (26702 and 26714) were found moderately resistant and six lines (18372, 18374, 26710, 26712, 26715 and 26723) were found susceptible. Bodah *et al.* (2016) evaluated pea accessions and commercial cultivars for *Fusarium* sp. resistance under greenhouse conditions based on root disease severity (RDS) values. From the study they found that there was significant reduction in root dry weight in 14 genotypes and plant height in 5 genotypes compared to control out of 33 genotypes.

Table 1 : Disease rating scale (Mayee and Datar, 1986)

Rating scale	Disease scale (%)	Reaction
1	0 - 10	Highly resistant (HR)
2	10.1 - 20	Resistant (R)
3	20.1 - 30	Moderately resistant (MR)
4	30.1 - 50	Susceptible (S)
5	> 50	Highly susceptible (HS)

Table 2 : Screening of fennel genotypes/varieties against *Fusarium pallidoroseum* under field conditions

S. No.	Genotypes/varieties	Disease incidence (%)			Disease reaction
		2023-24	2024-25	Pooled	
1	RF-101	13.066 (21.10)	17.33 (24.03)	15.00 (22.56)	R
2	RF-125	57.67 (49.42)	59.33 (50.39)	58.50 (49.90)	HS
3	RF-290	28.00 (31.93)	30.00 (33.19)	29.00 (32.56)	MR
4	RF-143	21.00 (27.25)	19.33 (25.81)	20.00 (26.53)	R
5	RF-145	25.00 (29.98)	27.66 (31.28)	26.00 (30.63)	MR
6	RF-205	15.00 (22.59)	16.00 (23.54)	15.50 (23.06)	R
7	RF-178	28.00 (31.93)	26.00 (30.64)	27.00 (31.28)	MR
8	RF-157	40.33 (39.41)	43.00 (40.95)	41.67 (40.18)	S
9	UF-102	41.00 (39.80)	43.33 (40.96)	42.00 (40.38)	S
10	UF-57	39.67 (39.02)	46.33 (42.68)	42.83 (40.85)	S
11	UF-103	35.00 (36.25)	38.66 (38.04)	36.50 (37.14)	S
12	UF-1	48.00 (43.84)	48.00 (43.84)	48.00 (43.84)	S
13	UF-49	38.00 (37.98)	42.00 (40.38)	40.00 (39.18)	S
14	UF-206	31.00 (33.75)	30.00 (33.12)	30.50 (33.44)	S
15	UF-104	42.00 (40.38)	40.00 (39.21)	41.00 (39.80)	S
16	UF-271	41.00 (39.80)	43.00 (40.96)	42.00 (40.38)	S
17	UF-64	48.00 (43.84)	50.33 (44.98)	49.00 (44.41)	S
18	UF-114	31.00 (33.81)	36.00 (36.85)	33.50 (35.33)	S
19	UF-82	56.33 (48.63)	59.00 (50.16)	57.67 (49.40)	HS
20	UF-110	55.00 (47.85)	56.00 (48.42)	55.50 (48.14)	HS
21	UF-46	41.00 (39.80)	44.00 (41.54)	42.50 (40.67)	S
22	UF-43	50.00 (44.98)	55.66 (47.85)	52.50 (46.42)	HS
23	UF-33	57.00 (49.01)	57.33 (49.21)	57.17 (49.11)	HS
24	UF-45	56.00 (48.43)	57.00 (49.03)	57.17 (48.73)	HS
25	UF-32	53.00 (46.71)	57.00 (49.03)	55.00 (47.87)	HS
26	UF-3	45.00 (42.10)	47.00 (43.26)	46.00 (42.68)	S
27	UF-4	53.00 (46.70)	51.33 (45.55)	52.00 (46.13)	HS
28	UF-23	53.00	57.00	55.00	HS

		(46.71)	(49.20)	(47.91)	
29	UF-69	56.00 (48.44)	57.67 (49.47)	56.83 (48.96)	HS
30	RF-289	30.00 (33.19)	32.66 (34.42)	31.00 (33.81)	S
31	RF-281	39.00 (38.63)	41.00 (39.80)	40.00 (39.21)	S
32	UF-229	40.00 (39.21)	44.00 (41.54)	42.00 (40.37)	S
33	UF-200	38.00 (38.04)	40.00 (39.13)	39.00 (38.58)	S
34	UF-201	42.00 (40.38)	44.00 (41.53)	43.00 (40.96)	S
35	UF-202	37.00 (37.45)	39.00 (38.60)	38.00 (38.03)	S
36	UF-175	38.00 (38.04)	41.33 (39.80)	39.50 (38.92)	S
37	UF-166	39.00 (38.63)	41.33 (39.80)	40.00 (39.21)	S
38	UF-261	40.00 (39.19)	43.00 (40.96)	41.50 (40.07)	S
39	UF-226	36.00 (36.80)	38.00 (38.04)	37.00 (37.42)	S
40	UF-228	38.00 (38.04)	41.66 (39.87)	39.50 (38.91)	S
SEm±		1.36	1.71	1.54	
CD (P=0.05)		3.84	4.83	4.34	
CV (%)		5.84	7.00	6.42	

*Data in parenthesis are angular transformed values

Table 3 : Reaction of different fennel Varieties/Genotype against *Fusarium* wilt under field conditions

Sr. No.	Disease reaction	Disease incidence (%)	Varieties/Genotype	Total
1	HR- Highly Resistant	0-10%	-	0
2	R- Resistant	10.1-20 %	RF-101, RF-143, RF-205	3
3	MR- Moderately Resistant	20.1-30%	RF-290, RF-145, RF-178	3
4	S- Susceptible	30.1-50%	RF-157, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-271, UF-64, UF-114, UF-46, UF-3, RF-289, RF-281, UF-229, UF-200, UF-201, UF-202, UF-175, UF-166, UF-261, UF-226, UF-228	24
5	HS- Highly Susceptible	>50%	RF-125, UF-82, UF-110, UF-43, UF-33, UF-45, UF-32, UF-4, UF-23, UF-69	10

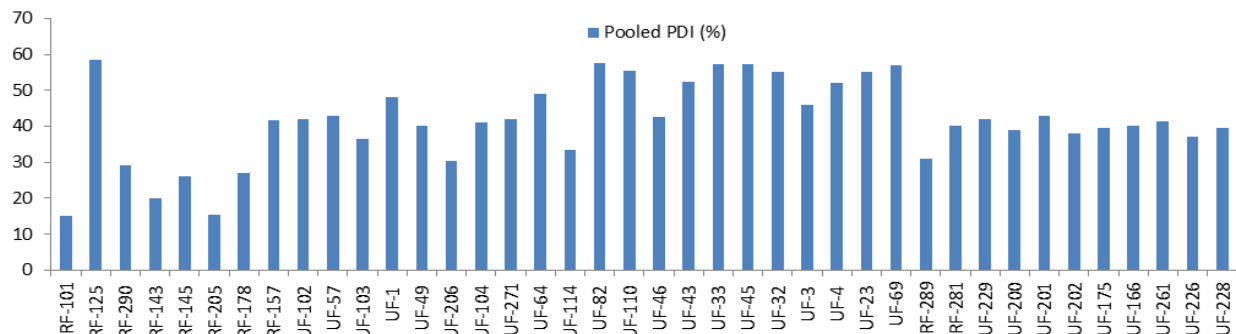


Fig. 1 : Screening of fennel genotypes/varieties against wilt disease under field condition

**Pure culture****Microscopic view****Plate 1 :** Pure culture and microscopic view of *Fusarium pallidoroseum***Plate 2 :** Screening of fennel genotypes against wilt disease under field conditions

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