Screening of Fennel Varieties/Germplasm against *Fusarium solani* and *Meloidogyne javanica*

ABSTRACT

Aims: To find out the resistance varieties/germplasm against *Fusarium solani* and *Meloidogyne javanica* in fennel.

Study design: The experiment was carried out in CRD design with three replications.

Place and duration of study: Department of Plant Pathology, SKN College of Agriculture, Jobner during rabi season 2021-22.

Methodology: An experiment was conducted on screening of 30 fennel varieties/germplasm to find out the source of resistance against *Fusarium solani* and *Meloidogyne javanica* in fennel. Plants were uprooted 60 days after sowing and the observation was recorded on per cent root rot incidence and root-knot index.

Results: Among the thirty screened varieties/germplasm, 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. In reference to root-galls incidence data showed that minimum number of nematode galls were found in RF-101 (7.67) and maximum number of galls were found in UF-23 (35.34).

Conclusion: Among the screened varieties/germplasm of fennel, only four varieties (RF-101, RF-145, RF-157 and RF-143) showed resistant reaction, whereases, 21 varieties/germplasm showed moderately resistant reaction and five varieties/germplasm showed susceptible reaction.

Keywords: *screening, varieties, germplasm, Fusarium solani, Meloidogyne javanica*

1. INTRODUCTION

Seed spices are very important for human health and widely grown throughout the temperate and subtropical regions of the world. Fennel (*Foeniculum vulgare* Mill.) is one of the most important seed spices, native of Mediterranean region and belongs to the family Apiaceae [1]. Fennel commonly known as "*Saunf*" is an important and highly valued spices crop grown in India. In India area under fennel cultivation is around 83 thousand hectares with a production of 137 thousand MT and productivity of 1.7 MT/hectare. In Rajasthan, estimated area under fennel cultivation is around 30,814 hectares with a production of 33,563 tonnes and productivity of 1089 kg/ha [2]. Development of disease in cultivated crops depends on the complex interaction between host, pathogen, and prevailing environmental conditions. The significant role of nematodes in aggravating fungal diseases is well known in many crops throughout the world. The present

study was planned to know the interactive effect of *Meloidogyne javanica* in enhancing the incidence of root rot by *Fusarium solani*. Twenty-twenty five per cent incidence of root rot caused by *Fusarium solani* in fennel [3]. The damage caused by root knot nematode is much higher in tropical and subtropical countries [4]. In India average loss caused by root knot nematode on fennel may be 21.07 per cent [5]. Disease complex situation in agricultural crops systems is very common in nature. The present study was, therefore, carried out with an objective to screen fennel varieties/germplasm against *Fusarium solani* and *Meloidogyne javanica.*

2. MATERIAL AND METHODS

An experiment was conducted under cage house conditions (Pot) to find out the resistance varieties/germplasm against *Fusarium solani* and root-knot nematode, *Meloidogyne javanica*. A total thirty fennel varieties/germplasm *i.e.* RF-101, RF-125, RF-290, RF-143, RF-145, RF-205, RF-178, RF-157, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-101, UF-64, UF-114, UF-82, UF-110, UF-46, UF-43, UF-33, UF-45, UF-32, UF-69, UF-3, UF-4, UF-23 and UF-22 were collected from the Department of Plant Breeding and Genetics, SKN College of Agriculture, SKNAU, Jobner. The experiment was carried out in CRD design with three replications in the Department of Plant Pathology, SKN College of Agriculture, Jobner during rabi season 2021-22. Earthen sterilized pots were filled with sterilized sandy soil and FYM. Seeds of each variety were sown in the earthen pots containing steam sterilized soil. Pure culture of *Fusarium solani* and *M. javanica* was inoculated in each pot. As inoculum of nematode, a constant level of 2 J_2/g of soil were added per pot and fungus inoculum, multiplied on sorghum grains was added @ 20 g per pot. The plants were uprooted 60 days after sowing and observation was recorded by using the 1-5 rating scale for root-knot nematode [6] and per cent disease incidence for root rot [7]. The observation on root-knot index (RKI) of each germplasm was determine based on galls and egg masses/plant for their reaction against *Meloidogyne javanica* and as furnished in table listed below.

Table 1. Root knot index

RKI	Galls & egg masses/plant	Reactions
1	No galls and egg masses/plant	Highly resistant (HR)
2	1-10 galls & egg masses/plant	Resistant (R)
3	11-30 galls & egg masses/plant	Moderately resistant (MR)
4	31-100 galls & egg masses/plant	Susceptible (S)
5	101 & above galls & egg masses/plant	Highly susceptible (HS)

Table 2. Per cent disease incidence

Rating scale	Disease scale (%)	Reactions
1	0-10	Highly resistant (HR)
3	11-20	Resistant (R)
5	21-30	Moderately resistant (MR)

7	31-50	Susceptible (S)
9	>50	Highly susceptible (HS)

3. RESULTS AND DISCUSSION

In reference to root-rot incidence data presented in table 3 showed that among the thirty screened varieties/germplasm, the highest (70.00%) root rot incidence was recorded in RF-125 followed by UF-33 (70.00 %), UF-45 (66.67 %), UF-69 (66.67 %), UF-82 (66.67 %), UF-101 (66.67 %), UF-23 (63.34 %), UF-32 (63.34 %), and UF-43 (63.34 %). However, minimum (20.00%) root rot incidence was recorded in RF-101 and RF-205.

While, in reference to root-galls incidence data showed that among the thirty screened varieties/germplasm only four varieties showed resistant reaction with minimum number of galls RF-101 (7.67), RF-145 (8.00), RF-143 (9.00) and RF-157 (9.34), whereases, 21 varieties/germplasm (RF-125, RF-290, RF-205, RF-178, UF-102, UF-57, UF-103, UF-1, UF-49, UF-206, UF-104, UF-101, UF-64, UF-114, UF-82, UF-110, UF-46, UF- 43, UF-45, UF-32 and UF-3) showed moderately resistant reaction against the pathogens. Remaining five varieties/germplasm (UF-33, UF-69, UF-4, UF-23 and UF-22*)* showed susceptible reaction to the disease with maximum number of galls UF-23 (35.34) followed by UF-33 (32.67) UF-4 (32.00) UF-69 (30.67) and UF-22 (30.67) germplasm. While, none of the germplasm showed highly resistant and highly susceptible reaction against the pathogens. Our results are parallel to the results of some findings who screened 11 fennel varieties (*Foeniculum vulgare* Mill.) against root knot nematode, *Meloidogyne incognita* and reported only three varieties as resistant [8]. The results of the present's studies are also supported by various workers. In Assam 32 varieties of green gram were screened and all the varieties were found to be susceptible to the nematode [9]. According to a finding, 282 varieties of green gram against *M. incognita* were screened and all the screened varieties were found to be susceptible or highly susceptible [10]. According to a research, 128 varieties of black gram and 102 varieties of pigeon pea were screened. In black gram out of 128 varieties, 46 varieties were found to be susceptible and remaining 82 be highly susceptible none of the variety was found resistant. Out of 102 varieties of pigeon pea, 14 were recorded as highly resistant, 57 as resistant and 27 as moderately resistant [11]. Our results agree with findings who screened thirty-eight varieties of green gran against *Meloidogyne incognita.* Among them thirty-four varieties were shown resistant reaction with 3-6 number of galls per plant while four varieties showed moderately resistant reaction with 10-11 number of galls per plant [12]. An experiment showed that 16 castor varieties were screened among them six varieties found resistance by producing minimum galls [13]. Similarly, screening of 10 varieties of tomato *viz.*, dev, kanak, badshah, sarathi, arka-rakshak, subriyano, shanshah, sikandar, navuday and emrald was done for their reactions against root-knot nematode *M. incognita* under poly house condition. Results revealed that out of ten varieties of tomato arka-rakshak, sikandar, emrald and sarathi found moderate resistant. badshah, dev, subriyano and shanshah found susceptible and varieties kanak and navoday observed as highly susceptible to root-knot nematode [14]. The resistance or susceptible response of screened varieties/germplasm against pathogen may be found differ with findings of other researchers, it may be due to the nature of variety/germplasm in particular environment or may be due to soil conditions.

Table 3. Reaction of fennel varieties/germplasm against root rot incidence and root-knot nematode.

S. No	Name of variety/germplasm	Root rot incidence		Nematode		
		PDI*	Disease rating scale	No. of galls/plant**	Root Knot Index (RKI)	Reaction of Variety/Germplasm as per RKI
1	RF-101	20.00 (26.06)	R	7.67 (2.93)	2	R
2	RF-125	70.00 (56.76)	HS	14.67 (3.95)	3	MR
3	RF-290	33.34 (35.20)	S	13.00 (3.73)	3	MR
4	RF-143	26.67 (30.28)	MR	9.00 (3.15)	2	R
5	RF-145	30.00 (32.98)	MR	8.00 (2.99)	2	R
6	RF-205	20.00 (26.06)	R	12.67 (3.69)	3	MR
7	RF-178	33.34 (35.20)	S	12.34 (3.64)	3	MR
8	RF-157	46.67 (43.06)	S	9.34 (3.20)	2	R
9	UF-102	46.67 (43.06)	S	13.00 (3.73)	3	MR
10	UF-57	43.34 (41.13)	S	15.34 (4.03)	3	MR
11	UF-103	40.00 (39.21)	S	13.34 (3.78)	3	MR
12	UF-1	53.34 (46.90)	S	20.34 (4.61)	3	MR
13	UF-49	43.34 (41.13)	S	21.00 (4.68)	3	MR
14	UF-206	36.67 (37.21)	S	24.34 (5.03)	3	MR
15	UF-104	43.34 (41.13)	S	27.00 (5.28)	3	MR
16	UF-101	66.67 (54.76)	HS	24.00 (4.99)	3	MR
17	UF-64	53.34 (46.90)	HS	19.67 (4.54)	3	MR
18	UF-114	36.67 (37.21)	S	19.67 (4.53)	3	MR
19	UF-82	66.67 (54.76)	HS	14.34 (3.91)	3	MR
20	UF-110	60.00 (50.83)	HS	17.00 (4.24)	3	MR
21	UF-46	46.67 (43.06)	S	14.67 (3.95)	3	MR
22	UF-43	63.34 (52.75)	HS	23.34 (4.93)	3	MR
23	UF-33	70.00 (56.76)	HS	32.67 (5.80)	4	S
24	UF-45	66.67 (54.76)	HS	26.34 (5.22)	3	MR
25	UF-32	63.34 (52.75)	HS	30.00 (5.56)	4	MR

26	UF-69	66.67 (54.76)	HS	30.67 (5.62)	4	S
27	UF-3	50.00 (44.98)	S	24.00 (4.99)	3	MR
28	UF-4	56.67 (48.82)	HS	32.00 (5.74)	4	S
29	UF-23	63.34 (52.75)	HS	35.34 (6.02)	4	S
30	UF-22	56.67 (48.82)	HS	30.67 (5.62)	4	S
	SEm±	2.45		0.12		
	CD 5%	6.96		0.34		

PDI- Per cent disease incidence
**Figures given in parentheses are angular transformed*
*** Figures given in parentheses are square root ($\sqrt{X+0.5}$) transformed*

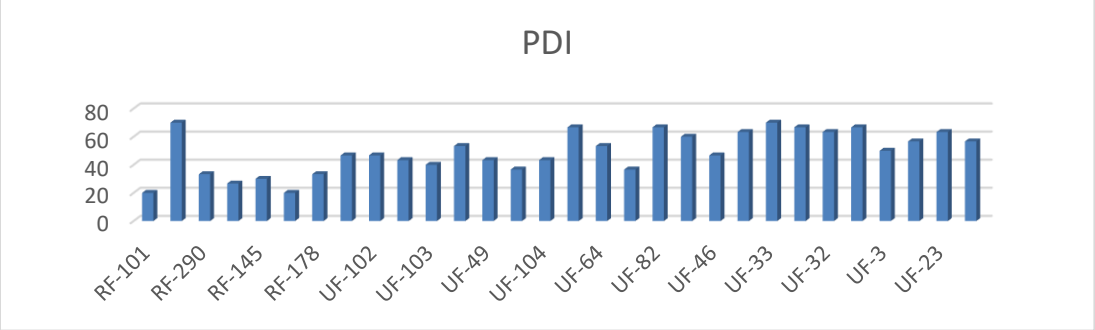

Fig. 1. Reaction of fennel varieties/germplasm on PDI

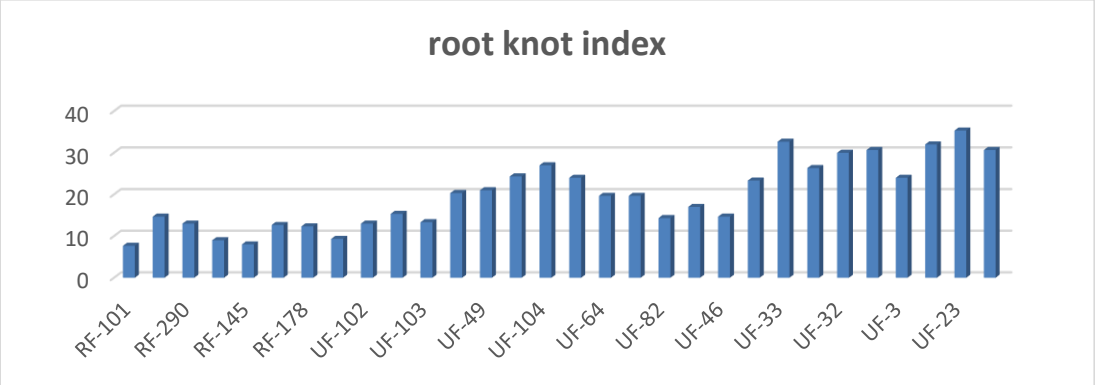

Fig. 2. Reaction of fennel varieties/germplasm on root knot index

4. CONCLUSION

Among the screened varieties/germplasm only four varieties (RF-101, RF-145, RF-157 and RF-143) showed resistant reaction, whereas, 21 varieties/germplasm showed moderately resistant reaction against the pathogens. Remaining five germplasm (UF-33, UF-69, UF-4, UF-23 and UF-22*)* showed susceptible reaction. However, among the thirty screened varieties/germplasm highest root rot incidence was recorded in RF-125 and UF-33 followed by UF-45, UF-69, UF-82 and UF-101 germplasm, minimum root rot incidence

was recorded in RF-101 and RF-205 followed by RF-143. While, none of the germplasm showed highly resistant and highly susceptible reaction against the pathogens.

REFERENCES

1. Omidbaigi R. Production and Processing of Medicinal Plants. Astan Quds Publication, Tehran. Acta Universitatis Sapientiae Agriculture and Environment. 2000;3:132-143.
2. Anonymous. Spice Board Ministry of Agriculture and Farmers Welfare Government of India. 2020-21.
3. Gupta JH, Srivastava VP. A new root rot of fennel caused by *Fusarium solani*. Journal of Mycology and Plant Pathology. 1976;8:206.
4. Taylor AL, Sasser JN. Biology, identification and control of root knot nematode (*Meloidogyne* spp.). North California State University graphs, Releigh, N.C. 1978;111.
5. Patel RG, Patel HR, Vyas RV, Patel BA, Patel BN. Assessment of avoidable yield losses due to root-knot nematode, *Meloidogyne javanica* pathotype 2 in fennel field. Proceedings of National Symposium on Biodiversity and Management of Nematodes in Cropping Systems for Sustainable Agriculture, Jaipur, India. 2002;131-132.
6. Hartman KM, Sasser JN. Identification of *Meloidogyne* species on the basis of different host test and perineal pattern morphology. An Advanced Treatise on Meloidogyne. 1985;2:69-76.
7. Iqbal SM, Haq IU, Bhukhari AG, Haqqani AM. Screening of chickpea genotypes for resistance against Fusarium wilt. Mycopathology. 2005;3(1-2):1-5.
8. Kumar K, Sharma MK, Srivastava AS, Chandrawat BS. Screening of fennel (*Foeniculum vulgare* Mill.) varieties for resistance against root-knot nematode, *Meloidogyne incognita*. Current Nematology. 2017;28(1):25-28.
9. Das P, Sharma DK, Phukan PN. Reaction of some pulse varieties to root-knot nematode, Meloidoyne incognita. Indian Journal of Nematology. 1988;18(1):116.
10. Bora A, Choudhary BN, Rahman MF. Screening of greengram varieties against *Meloidogyne incognita*. Indian Journal of Nematology. 2004;34(2):205-238.
11. Rahman MF, Bora A, Choudhary BN. Screening of some blackgram and pigeonpea varieties for resistance against *Meloidogyne incognita*. Indian Journal of Nematology. 2004;34(2):205-238.
12. Pandey RK, Nayak DK. Screening and evaluation of green gram varieties /cultivars against root-knot nematode, *Meloidogyne incognita.* International Journal of Research and Review. 2016;3(6):1-6.
13. Thagaria, Garima, Bharagawa S, Chandrawat BS, Kumar Kailash, Nama CP. Evaluation of castor (*Ricinuscommunis*) varieties for resistance against root-knot nematode *Meloidogyne incognita* Current Nematology. 2016;27(1):51-54. Iqbal SM, Haq IU, Bhukhari AG, Haqqani AM. Screening of chickpea genotypes for resistance against Fusarium wilt. Mycopathology. 2005;3(1- 2):1-5.
14. Gurjar OP, Sharma MK, Chandrawat BS. Screening of tomato varieties for source of resistance against root-knot nematode, *M. incognita* in poly-house. Journal of Progressive Agriculture. 2021;12(1):69-73.