Studies on Different Host Rangeof Root Rot (*RhizoctoniasolaniKühn*)under Pot House

Abstract

The pathogen, *Rhizoctoniasolani* has a wide host range infecting crops. In order to find out the host range of *R. solani* causing root rot of fenugreek, 13 plant species were selected which are commonly found in fenugreek growing ecosystem. Root rot caused by *Rhizoctoniasolani* has become an important constraint to the growers in Rajasthan. *Rhizoctoniasolani* cause root rot in chick pea, chilli, coriander, fenugreek, cumin, wheat, barley, okra, field pea, tomato, fennel and cabbage but spinach was not infected.Out of these plants maximum disease incidence was observed in paanmethi (*Trigonellafoenum-graecum*) *i.e.,* 57.82 per cent whereas, minimum 28.31 per cent disease incidence was observed in barley (*Hordeumvulgare*).

Comment [H81]: The abstract should be well structured. It should include a brief of introduction, aim of the study, methodology, result and conclusion.

Key Words - Host range, *Rhizoctoniasolani* and Disease reaction

INTRODUCTION

Fenugreek (*Trigonellafoenum-graecum*L.) is an important seed spice, originated in South - Eastern Europe belonging to the family *Fabaceae*. Fenugreek has wonderful importance in the life of human beings as rations as well as medicine. It is cultivated for seeds, which can be used as condiments as well as flavoring agent, food, pickles *etc.* It has steroid 'diosgenin' which is used in preparation of contraceptives (drug serving to prevent pregnancy) (Bakrim*et al.*, 2014). Fenugreek stimulates the digestive process. Fenugreek seeds are utilized for extraction of steroids and alkaloids. Medicinal properties of fenugreek are due to the presence of antioxidant and anti-inflammatory compounds. The green leaves are used for preparation of vegetables whereas dried leaves and flowers are applied for flavoring vegetable and curries (Arya, 2000).

Fenugreek has nutritional value per hundred grams as energy - 1350 KJ, carbohydrate 58.35 g, protein 23 g, total fat 6.41 g, dietary fiber 24.6 g, vitamin A 60 µ, vitamin C 3 mg, niacin 1.640 mg, riboflavin 0.366 mg, thiamin 0.322 mg, cholesterol 0 mg, sodium 67 mg, potassium 770 mg, calcium 176 mg, magnesium 191 mg, zinc 2.50 mg, iron 33.35 mg, cobalt 1.110 mg and phosphorus 296 mg [Source- United States Department of Agriculture (1977) Nutrient Database]. Green leaves are used as leafy vegetable for human consumption and forage

for cattle and to some extent for medicinal purposes. Medicinal properties of fenugreek are due to the presence of antioxidant and anti-inflammatory compounds such as genistein, kaempferol, quercetin, rutin, apigenin, selenium and superoxide-dismutase (Girardon*et al*., 1985).

At present time, fenugreek is an important spice crop in India. The total cultivation area of fenugreek in India for 2021-22 was 1.26 lakh ha with a production of 1.82 lakh tonnes (Anonymous, 2022) which occupy third place in spices after cumin and coriander. The genus *Rhizoctonia* was erected in the year 1815 (De Candolle, 1815) to accommodate the nonsporulating root pathogen *R. crocorum* D.C. ex. Fr. It was described under the name*Rhizoctoniasolani* which was earlier reported about 100 years ago by German scientist Julius Kühn on diseased potato tubers. Since then, the fungus has gained the reputation of being one of the widest spread destructive and versatile plant pathogens. The species *R. solani*affects many agricultural, horticultural crops, turf grasses, ornamentals and forest trees and causes banded leaf and sheath blight in maize, sheath blight in rice and sorghum, damping-off in cotton, aerial blight and stem rot in green gram and soybean, sheath rot in sugarcane, head rot in cabbage, black scurf and sprout canker in potato and foliar blights of fruits *etc*., inflicting yield losses averaging up to 20 per cent yearly in over 200 crops worldwide.

Comment [H82]: This part of the introduction is not suitable for the study. If the study was centered on this particular plant "Fenugreek" then it would be fine, but there's need to revisit this part of the introduction if the topic is left like this.

Rhizoctonia root rot is caused by the soilborne fungus *Rhizoctoniasolani*. This fungus can be found in most soils and survives as sclerotia (Very resistant fungal survival structures) in soil. Root rot is one of the important diseases which reduces the yield of the plant significantly (up to 48%). The freshly emerged seedlings fall over and die and most of the seedlings may die at pre or post-emergence in severely infected areas. Both pre-emergent and post-emergence seedling death can occur with this disease. Pre-emergence symptoms are seed decay and are often not visible in the field. Post-emergence symptoms on seedlings will be the appearance of brown to reddish lesions on stems and roots just below the soil line. These reddish-brown lesions may become sunken and girdle the stems and kill the plant. Plants may often appear stunted and unthrifty throughout the season or, less commonly, will die. Often the stand will appear uneven because of stunted plants. On older plants, the pathogen causes a reddish brown dry cortical root rot that may extend into the base of the stem. Later in the season, infections at the base of the plant (cortical rot) may result in plants snapping off during high winds. Root rot can greatly reduce nodulation. Foliar symptoms may include yellowing or wilting of leaves. Damage from *Rhizoctonia* is commonly observed in areas when there is a long history of soybean production with close rotations or during weather conditions not favorable for seed germination and rapid

growth of seedlings. The pathogen mainly attacks the root and underground parts, but it is also capable of infecting the other plant parts like the green foliage parts, the seeds and the hypocotyls (Acharya *et al.*, 2014). The roots are poorly developed, finer roots are either not formed or rotted. Plants show stunted growth and can easily be pulled out. The present investigation is carried out for the identification of host range of *R. solani* causing root rot of fenugreek. Hence, there is a need to collect information on the off season survival of *R. solani* in fenugreek ecosystem on different plant species. Considering the above reason, the present study was under taken by using different crops from fenugreek growing ecosystem.

Comment [H83]: This should be added to the topic

MATERIALS AND METHODS

The investigations were carried out with *Rhizoctoniasolani*Kühn, the incitant root rot of fenugreek, in the Division of Plant Pathology and also at the Research Farm of Rajasthan Agricultural Research Institute, Durgapura, Jaipur. The Research Farm is situated at 26°840 north latitude and 75°790 east longitude with an altitude of 400 meter above mean sea level. The region falls under Semi-Arid Eastern Plain (Agro Climatic Zone III A) of Rajasthan.

Comment [H84]: This section should be written under the subheading "Study area"

Reaction of host to the virulent isolate of *Rhizoctoniasolani*

Raising of hosts

Thirteen pots each containing ten plants of thirteen host plants *viz*., chick pea (*Cicer arietinum*), spinach (*Spinaciaoleracea*), chilli (*Capsicum frutescens*), coriander (*Coriandrum sativum*), fenugreek (*Trigonellafoenum-graecum*), cumin (*Cuminumcyminum*), wheat (*Triticumaestivum*), barley (*Hordeumvulgare*), okra (*Abelmoschus esculentus*), field pea (*Pisum sativum*), tomato (*Lycopersicon esculentum*), fennel (*Foeniculum vulgare*) and cabbage (*Brassicaoleracea var. capitata*) were used in three replications during *Rabi* 2022.

Preparation of mass culture and inoculation technique

Most virulent isolate (JPR Rs-1) was mass multiplied on sorghum seeds. The inoculum of most virulent isolate of *Rhizoctonia* was air dried ground and placed uniformly in 5 cm band in each pot before transplanting (Panella *et al.*, 1995).

Observations

The appearance of lesions was observed after seven day after inoculation up to thirty days of inoculation. Disease incidence and percent mortality were recorded in each tested host plant species after 45 days of transplanting/sowing.

RESULT & DISCUSSION

The inoculum of *R. solani*was placed uniformly in 5 cm band in each pot before sowing / transplanting. Thirteen pots each containing ten plants of each crop were sowed / transplanted during *Rabi* 2022-23.The data presented in table indicated that the symptoms of disease were seen in chickpea (*Cicerarietinum*), chilli (*Capsicum frutescens*), coriander (*Coriandrum sativum*), fenugreek (*Trigonellafoenum-graecum*), cumin (*Cuminumcyminum*), wheat (*Triticumaestivum*), barley (*Hordeumvulgare*), okra (*Abelmoschus esculentus*), field pea (*Pisum sativum*), tomato (*Lycopersicon esculentum*), fennel (*Foeniculum vulgare*) and cabbage (*Brassica oleracea var. capitata*).The incubation period varied from 18 to 28 days. The maximum disease incidence was observed in fenugreek (*Trigonellafoenum-graecum*) *i.e.,* 57.82 per cent followed by fennel (*Foeniculum vulgare*) *i.e.,* 56.80 per cent. barley (*Hordeum vulgare*) showed the least incidence *i.e.,* 28.31 per cent while crop spinach (*Spinacia oleracea*) was not infected (Plate 1).

The pathogen is ubiquitous and has got wider host range of cultivated crops as well as forest trees belonging to the different families. The maximum disease incidence was observed in fenugreek (*Trigonellafoenum-graecum*) (57.82 per cent), followed by Fennel (*Foeniculum vulgare*) (56.80 per cent). Barley (*Hordeum vulgare*) showed the least incidence (28.31 per cent). The crop spinach (*Spinacia oleracea*) was not infected by *R. solani*. The variability impacts the relationship of pathogen with its host at many levels and the genetic flexibility allows the fungi to adapt readily to the changing environmental conditions including the introduction of new host genotypes (Kistler and Miao, 1992). Similar findings have been reported earlier by Acharya and Sengupta (1998); Sivalingam *et. al.,* (2006) and Lenka *et. al., (*2014).

Table 1. Reaction of different host plants to *R. solani*under artificial inoculation conditions

S.No.	Host plants	Disease reaction (+/-)*	Incubation period (days)	Disease Incidence (%)

Comment [H85]: This should be fixed under methods not under result discussion.

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Comment [H87]: Update all ancient citations, citations should fall between 2013 till date

1.	Chick pea (*Cicer arietinum*)	+	26	42.12
2.	Spinach (*Spinacia oleracea*)	-	-	-
3.	Chilli (*Capsicum frutescens*)	+	34	34.85
4.	Coriander (*Coriandrum sativum*)	+	25	33.31
5.	Fenugreek (*Trigonella foenum-graecum*)	+	21	57.82
6.	Cumin (*Cuminum cyminum*)	+	27	46.11
7.	Wheat (*Triticumaestivum*)	+	20	38.71
8.	Barley (*Hordeum vulgare*)	+	19	28.31
9.	Okra (*Abelmoschus esculentus*)	+	28	51.38
10.	Field pea (*Pisum sativum*)	+	22	42.78
11.	Tomato (*Lycopersicon esculentum*)	+	25	35.92
12.	Fennel (*Foeniculum vulgare*)	+	24	56.80
13.	Cabbage *(Brassica oleracea var. capitata)*	+	18	32.11

***** - = Healthy**,** + = Infected

Plate 1. Reaction in different host plants to *Rhizoctoniasolani* under artificial inoculation conditions during *Rabi*, 2022-23

CONCLUSION

Rhizoctoniasolani caused root rot in chick pea, coriander, chilli, fenugreek, cumin, wheat, barley, okra, field pea, tomato, fennel and cabbage. Out of these plants maximum disease incidence was observed in paanmethi (*Trigonellafoenum-graecum*) *i.e.*, 57.82 %. Crop such as spinach was not infected by *Rhizoctoniasolani*.

Comment [H88]: What can you recommend from the conclusion?

REFERENCE

Acharya, K., Chakraborty, N., Chatterjee, S. and Basu, S.K. (2014). Fungal diseases of fenugreek. Fenugreek Special Issue, Mar/Apr 2014. *American Journal Social Issues and Humanities*, Pp.176

Acharya, S. and Sengupta, P. K. (1998). Collateral hosts of rice sheath blight fungus, *Rhizoctoniasolani*. *Oryza*, **35**: 89-90.

Anonymous (2022). Spices Board of India, Ministry of Commerce and Industry, Govt. of India. *www.indiaispices.com*.

Arya, P.S. (2000). Spices Crop of India. *Kalyani Publishers*, p-327.

Bakrim, N.M., Alaw, A.K., Al-Ani, I.M. and Hassan, N.M. (2014). The antifertility effect of fenugreek seeds on female rats, animal model. Patent in Contraception. Conference: *IIUMResearch Invention and Innovation Exhibition.*

De Candolle, A.P. (1815). Memoire sur les rhizoctones, nouveau genre de champignons qui attaque les racines, des plantes et en particuliercelle de la luzernecutvee. *Mem. Mus. D' Hist Nat.*, 2: 209-216.

Girardon, P., Bessiere, J.M., Baccou, J.C. and Sauvaire, Y. (1985). Volatile constituents of fenugreek seeds. *Planta Med.*, Pp-583-584.

Kistler, H.C. and Miao, V.P.W. (1992). New modes genetic changes filamentous fungi. *Annu. Rev. Phytopath.*, 30: 131-152.

Lenka, S., Pun, K. B., Saha, M. S. and Rath, N. C. (2014). Studies on the host range of *Rhizoctoniasolani*Kühn causing sheath blight disease in rice. *Oryza*, 51: 100-02.

Panella, C., Guglielmi, F. W., Mastronuzzi, T., & Francavilla, A. (1995). Whole-body and segmental bioelectrical parameters in chronic liver disease: effect of gender and disease stages. *Hepatology*, *21*(2), 352-358.

Sivalingam, P. N., Vishwakarma, S. N. and Singh, U. S. (2006) Role of seed-borne inoculum of*Rhizoctoniasolani*in sheath blight of rice. *Indian Phytopathol*, 59: 445-52.

Comment [H89]: Update all ancient references