

# 1 Studies on Different Host Range of Root Rot (*Rhizoctonia solani* 2 *Kühn*) under Pot House

## 3 4 Abstract

5 The pathogen, *Rhizoctonia solani* has a wide host range infecting crops. In order to find  
6 out the host range of *R. solani* causing root rot of fenugreek, 13 plant species were selected  
7 which are commonly found in fenugreek growing ecosystem. Root rot caused by *Rhizoctonia*  
8 *solani* has become an important constraint to the growers in Rajasthan. *Rhizoctonia solani* cause  
9 root rot in chick pea, chilli, coriander, fenugreek, cumin, wheat, barley, okra, field pea, tomato,  
10 fennel and cabbage but spinach was not infected. Out of these plants maximum disease incidence  
11 was observed in paan methi (*Trigonella foenum-graecum*) i.e., 57.82 per cent whereas, minimum  
12 28.31 per cent disease incidence was observed in barley (*Hordeum vulgare*).

Comment [11]: Use full name here

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13 **Key Words - Host range, *Rhizoctonia solani* and Disease reaction**

## 14 INTRODUCTION

15 Fenugreek (*Trigonella foenum-graecum* L.) is an important seed spice, originated in  
16 South - Eastern Europe belonging to the family *Fabaceae*. Fenugreek has wonderful importance  
17 in the life of human beings as rations as well as medicine. It is cultivated for seeds, which can be  
18 used as condiments as well as flavoring agent, food, pickles *etc.* It has steroid 'diosgenin' which  
19 is used in preparation of contraceptives (drug serving to prevent pregnancy) (Bakrim *et al.*,  
20 2014). Fenugreek stimulates the digestive process. Fenugreek seeds are utilized for extraction of  
21 steroids and alkaloids. Medicinal properties of fenugreek are due to the presence of antioxidant  
22 and anti-inflammatory compounds. The green leaves are used for preparation of vegetables  
23 whereas dried leaves and flowers are applied for flavoring vegetable and curries (Arya, 2000).

24 Fenugreek has nutritional value per hundred grams as energy - 1350 KJ, carbohydrate  
25 58.35 g, protein 23 g, total fat 6.41 g, dietary fiber 24.6 g, vitamin A 60  $\mu$ , vitamin C 3 mg,  
26 niacin 1.640 mg, riboflavin 0.366 mg, thiamin 0.322 mg, cholesterol 0 mg, sodium 67 mg,  
27 potassium 770 mg, calcium 176 mg, magnesium 191 mg, zinc 2.50 mg, iron 33.35 mg, cobalt  
28 1.110 mg and phosphorus 296 mg [Source- United States Department of Agriculture (1977)  
29 Nutrient Database]. Green leaves are used as leafy vegetable for human consumption and forage  
30 for cattle and to some extent for medicinal purposes. Medicinal properties of fenugreek are due

31 to the presence of antioxidant and anti-inflammatory compounds such as genistein, kaempferol,  
32 quercetin, rutin, apigenin, selenium and superoxide-dismutase (Girardon *et al.*, 1985).

33 At present time, fenugreek is an important spice crop in India. The total cultivation area  
34 of fenugreek in India for 2021-22 was 1.26 lakh ha with a production of 1.82 lakh tonnes  
35 (Anonymous, 2022) which occupy third place in spices after cumin and coriander. The genus  
36 *Rhizoctonia* was erected in the year 1815 (De Candolle, 1815) to accommodate the  
37 nonsporulating root pathogen *R. crocorum* D.C. ex. Fr. It was described under the name  
38 *Rhizoctonia solani* which was earlier reported about 100 years ago by German scientist Julius  
39 Kühn on diseased potato tubers. Since then, the fungus has gained the reputation of being one of  
40 the widest spread destructive and versatile plant pathogens. The species *R. solani* affects many  
41 agricultural, horticultural crops, turf grasses, ornamentals and forest trees and causes banded leaf  
42 and sheath blight in maize, sheath blight in rice and sorghum, damping-off in cotton, aerial blight  
43 and stem rot in green gram and soybean, sheath rot in sugarcane, head rot in cabbage, black scurf  
44 and sprout canker in potato and foliar blights of fruits *etc.*, inflicting yield losses averaging up to  
45 20 per cent yearly in over 200 crops worldwide.

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

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

## 70 MATERIALS AND METHODS

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

### 76 Reaction of host to the virulent isolate of *Rhizoctonia solani*

#### 77 Raising of hosts

78 Thirteen pots each containing ten plants of thirteen host plants *viz.*, chick pea (*Cicer*  
79 *arietinum*), spinach (*Spinacia oleracea*), chilli (*Capsicum frutescens*), coriander (*Coriandrum*  
80 *sativum*), fenugreek (*Trigonella foenum-graecum*), cumin (*Cuminum cyminum*), wheat (*Triticum*  
81 *aestivum*), barley (*Hordeum vulgare*), okra (*Abelmoschus esculentus*), field pea (*Pisum sativum*),  
82 tomato (*Lycopersicon esculentum*), fennel (*Foeniculum vulgare*) and cabbage (*Brassica oleracea*  
83 *var. capitata*) were used in three replications during Rabi 2022.

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#### 84 Preparation of mass culture and inoculation technique

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

#### 88 Observations

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

92 **RESULT & DISCUSSION**

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

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

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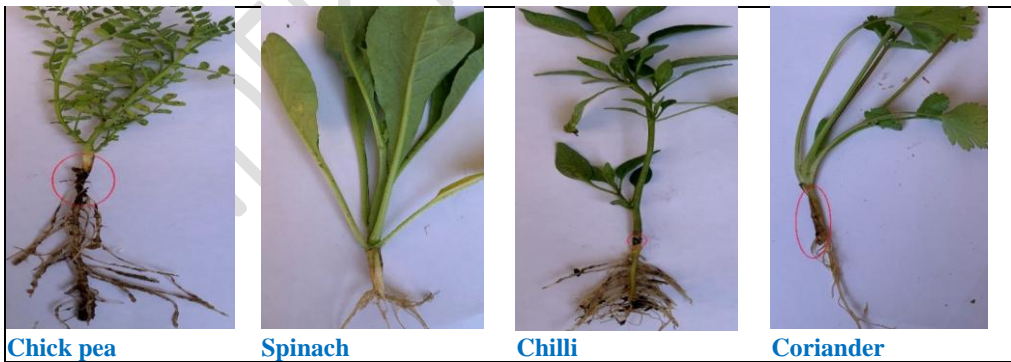
113 **Table 1. Reaction of different host plants to *R. solani* under artificial inoculation conditions**

S.No.	Host plants	Disease reaction (+/-)*	Incubation period (days)	Disease Incidence (%)
1.	Chick pea ( <i>Cicer arietinum</i> )	+	26	42.12
2.	Spinach ( <i>Spinacia oleracea</i> )	-	-	-
3.	Chilli ( <i>Capsicum frutescens</i> )	+	34	34.85

4.	Coriander ( <i>Coriandrum sativum</i> )	+	25	33.31
5.	Fenugreek ( <i>Trigonella foenum-graecum</i> )	+	21	57.82
6.	Cumin ( <i>Cuminum cyminum</i> )	+	27	46.11
7.	Wheat ( <i>Triticum aestivum</i> )	+	20	38.71
8.	Barley ( <i>Hordeum vulgare</i> )	+	19	28.31
9.	Okra ( <i>Abelmoschus esculentus</i> )	+	28	51.38
10.	Field pea ( <i>Pisum sativum</i> )	+	22	42.78
11.	Tomato ( <i>Lycopersicon esculentum</i> )	+	25	35.92
12.	Fennel ( <i>Foeniculum vulgare</i> )	+	24	56.80
13.	Cabbage ( <i>Brassica oleracea var. capitata</i> )	+	18	32.11

114 \* - = Healthy, + = Infected

115



Chick pea

Spinach

Chilli

Coriander



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

116 **CONCLUSION**

117 *Rhizoctonia solani* caused root rot in chick pea, coriander, chilli, fenugreek, cumin,  
 118 wheat, barley, okra, field pea, tomato, fennel and cabbage. Out of these plants maximum disease  
 119 incidence was observed in paan methi (*Trigonella foenum-graecum*) i.e., 57.82 %. Crop such as  
 120 spinach was not infected by *Rhizoctonia solani*.

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