



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2023; 12(8): 2516-2519  
© 2023 TPI  
[www.thepharmajournal.com](http://www.thepharmajournal.com)  
Received: 19-06-2023  
Accepted: 23-07-2023

**Deependra Singh Shekhawat**  
Research Scholar,  
Division of Plant Pathology,  
RARI, Durgapura, SKNAU,  
Jobner, Rajasthan, India

**RK Bagri**  
Associate Professor,  
Division of Plant Pathology,  
RARI, Durgapura, SKNAU,  
Jobner, Rajasthan, India

**Bhagchand Yadav**  
Research Scholar,  
S.K. Rajasthan Agricultural  
University, Bikaner, Rajasthan,  
India

**Suresh Kumawat**  
Research Scholar,  
S.K. Rajasthan Agricultural  
University, Bikaner, Rajasthan,  
India

## Cultural and pathogenic variability analysis of different isolates of *Rhizoctonia solani* causing root rot of fenugreek

**Deependra Singh Shekhawat, RK Bagri, Bhagchand Yadav and Suresh Kumawat**

### Abstract

Root rot of fenugreek (*Trigonella foenum-graecum* L.) caused by *Rhizoctonia solani* has become an important constraint to the growers of fenugreek in Rajasthan. Root rot affected plants of fenugreek were collected from surveyed areas of Rajasthan viz., Jaipur, Ajmer, Jhunjhunu, Bikaner and Nagaur districts. Isolation was done from the diseased roots of fenugreek samples, collected during survey from the fields showing higher per cent of disease incidence. Purified cultures of twelve samples were provisionally identified as *Rhizoctonia solani* based on morphological and colony characters. Thus, twelve isolates were established from each district and decoded as JPR Rs-1, JPR Rs-2, BKN Rs-3, BKN Rs-4, AJM Rs-5, AJM Rs-6, JN Rs-7, JN Rs-8, NAG Rs-9, NAG Rs-10, LCL Rs-11 and LCL Rs-12. Among twelve isolates, JPR Rs-1 (23.85 mm day<sup>-1</sup>) indicated slow growing nature and does not covered whole petri plate within 96 h followed by LCL Rs-12 (25.28 mm day<sup>-1</sup>) and fastest growth rate observed in JN Rs-7 (39.12 mm day<sup>-1</sup>). The isolate JPR Rs-1 showed texture as smooth and raised at periphery, isolate LCL Rs-12 i.e., rough and raised colony and showed dull white, JPR Rs-2 i.e., smooth colony and looked hyaline white in colour whereas, JN Rs-7 i.e., wrinkled colony appear off white colour. JPR Rs-1 caused maximum disease incidence (57.36%) which was significantly higher over other isolates, followed by LCL Rs-12 (53.44%) and JPR Rs-2 (52.99%). Lowest disease incidence (35.61%) was observed with NAG Rs-10 isolate. Among these twelve isolates, highly pathogenic was JPR Rs-1 isolate while NAG Rs-10 isolate was weak pathogenic.

**Keywords:** Cultural variability, pathogenic variability and root rot disease

### Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is an important seed spices originated in South - Eastern Europe and belongs to the *Fabaceae* family. Fenugreek plays an important role in human life as food and medicine. It is grown for its seeds and is used as a condiment, in dishes, in pickles, etc. used. It contains the steroid "diosgenin" used in the preparation of contraceptives (contraceptive drugs) (Bakrim *et al.*, 2014) [4]. Fenugreek stimulates the digestive process. Fenugreek seeds are used to extract steroids and alkaloids. The medicinal properties of fenugreek are attributed to its antioxidant and anti-inflammatory properties. Its green leaves are used to prepare vegetables, while its dried leaves and flowers are used to flavor vegetables and curries (Arya, 2000) [3].

The nutritional value of 100 grams of fenugreek is energy - 1350KJ, 58.35 grams of carbohydrates, 23 grams of protein, 6.41 grams of total fat, 24.6 grams of dietary fiber, 60 micrograms of vitamin A, 3 mg of vitamin C, 1,640 mg of niacin, 1.640 mg, riboflavin, Thiamine 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 296 mg of Phosphorus [Source- United States Department of Agriculture (USDA) Nutrient Database].

The green leaves are used as vegetables for human consumption as well as fodder for cattle and in some cases for medicinal purposes. The medicinal properties of fenugreek have been attributed to the presence of antioxidant and anti-inflammatory compounds such as genistein, kaempferol, quercetin, rutin, apigenin, selenium, and superoxide dismutase (Girardon *et al.* 1985) [6].

*Rhizoctonia* root rot is caused by the soil-borne fungus *Rhizoctonia solani*. This pathogen can be found in most soils where resistant structure sclerotia are formed (spores are very resistant survival structures). Root rot is one of the main diseases that reduce crop yield (up to 48%). Newly emerged seedlings are fall over and most seedlings will die before or after emergence

**Corresponding Author:**  
**Deependra Singh Shekhawat**  
Research Scholar,  
Division of Plant Pathology,  
RARI, Durgapura, SKNAU,  
Jobner, Rajasthan, India

in prominent areas. The first symptom is seed rot, which is rarely seen in the field. Post-emergence symptoms are brown to red lesions on stems and roots below the soil line. This reddish-brown fungus will pit and surround the stem, killing the plant. Plants often appear stunted or less often die throughout the season. The disease mainly attacks the roots but can also infect other parts of the plant such as green leaves, seeds, and hypocotyls (Acharya *et al.*, 2014) [1]. The root system is poorly developed and thin roots will not develop or rot. Plants show stunted growth and can easily be pulled out. Under natural field conditions, the incidence of root rot of fenugreek was recorded up to 20.00 per cent in Jaipur district of Rajasthan (Anonymous, 2007-08) [2]. Yadav *et al.*, (2019) [11] surveyed different districts of Rajasthan and reported 26.50-36.17 per cent disease incidence. Kumari and Poonia (2021) [7] surveyed root rot incidence in paan methi varied from 20.65 to 33.50 per cent in four surveyed tehsils of Nagaur district, Rajasthan. Singh and Rao (2015) [9] recorded 34.67 per cent incidence of root rot of fenugreek (*Rhizoctonia solani*) from Chhattisgarh with yield loss of 55.26 per cent.

### Material methods

Survey in major fenugreek growing districts of Rajasthan *viz.*, Jaipur, Ajmer, Jhunjhunu, Bikaner and Nagaur was undertaken during last week of December to first week of January. The twelve isolates was collected during survey from the fields to investigate the per cent of disease incidence, morphological and colony characters of *Rhizoctonia solani* causing root rot disease of fenugreek. All of the twelve isolates were grown on potato dextrose agar (PDA) medium and cultural characters like colony diameter, coloration and increase pattern were studied. Colony growth rate was recorded through measuring colony diameter after forty eight hours and ninety six h at 25±1 °C while the remark on colony coloration and texture were recorded at seventh day of incubation. Required quantity of the above-mentioned medium was prepared and sterilized at 1.05 kg cm<sup>2</sup> pressure for 20 mins. Sterilization of Petri dishes become performed at 180 °C for two hours in a warm air oven. In each Petri dish, 25 mL of medium became poured. every petri dish was inoculated with a mycelial bit of five mm diameter maintained on undeniable agar. The color of the colony became observed from lower side of the culture with the assist of the Munsell' soil coloration Chart. The observations were

taken on the mycelia growth of 7 days of incubation. primarily based at the colony pigmentation the cultures were assigned to special groups. The diameter every isolate (three replications) was measured via meter scale at the interval of forty eight h and ninety six h. On the basis of mycelial increase, the isolates were categorized into three groups. group one included those isolates which have been fastest developing inside the sense that they covered the whole petri plate within 48 h in their inoculation, the group consisted of those isolates which took seventy two h to attain that growth stage and group 3 included those isolates which did not cover the complete plate *i.e.*, after ninety six h. For pathogenic variability, the susceptible variety (RMt-351) was inoculated with different isolates separately. The investigations were carried out in the Division of Plant Pathology, Rajasthan Agricultural Research Institute, Durgapura, Jaipur. The disease incidence percentage of fenugreek was recorded as per the formula given below.

$$\text{Per cent disease incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

### Result and Discussion

#### Cultural variability

The cultural characteristics such as colony diameter, colony growth rate, colony texture and colony colour were recorded in different isolates of *Rhizoctonia solani* by growing them on PDA medium (Table 1) Observations on cultural characters revealed the existence of variation among the twelve isolates. The colony growth rates of isolates were measured at 48 and 96 h after inoculation. Among twelve isolates, JPR Rs-1 (23.85 mm day<sup>-1</sup>) indicated slow growing nature and does not covered whole petri plate within 96 h followed by LCL Rs-12 (25.28 mm day<sup>-1</sup>) and fastest growth rate observed in JJN Rs-7 (39.12 mm day<sup>-1</sup>). All the twelve isolates showed the different types of colony texture *i.e.*, smooth, raised, circular, wrinkled and wavy. The isolate JPR Rs-1 showed texture as smooth and raised at periphery, isolate LCL Rs-12 *i.e.*, rough and raised colony and showed dull white, JPR Rs-2 *i.e.*, smooth colony and looked hyaline white in colour whereas, JJN Rs-7 *i.e.*, wrinkled colony appear off white colour. Similar findings have also been reported by Lal and Kandhari 2009 [8], Susheela and Reddy, 2013 [10] and Gaurav *et al.*, 2017.

**Table 1:** Cultural variability among different isolates of *Rhizoctonia solani* causing root rot of fenugreek

S. No.	Isolate Code*	Colony diameter (mm)		Colony growth (mm/day)	Colony texture (at 7 <sup>th</sup> day)	Colony colour (at 7 <sup>th</sup> day)
		48 h	96 h			
1.	JPR Rs-1	26.78	57.61	23.85	Centrally smooth and raised periphery	Light brown
2.	JPR Rs-2	29.37	54.82	29.12	Smooth colony	Hyaline white
3.	BKN Rs-3	42.25	67.05	32.25	Rough and raised colony	Centrally and periphery brownish and white
4.	BKN Rs-4	34.55	63.38	38.45	Rough colony	Light brownish
5.	AJM Rs-5	34.62	58.94	31.08	Rough colony	Dark shade of brown
6.	AJM Rs-6	31.86	56.39	34.95	Centrally smooth and slightly raised at periphery	Whitish brown
7.	JJN Rs-7	38.49	64.53	39.12	Wrinkled colony	Off white
8.	JJN Rs-8	35.26	59.68	31.92	Wrinkled and raised at periphery colony	Dull white
9.	NAG Rs-9	21.67	42.54	35.69	Smooth colony	Whitish
10.	NAG Rs-10	24.50	47.27	27.68	Smooth colony	Whitish
11	LCL Rs-11	34.82	58.42	31.77	Rough colony	Reddish brown
12	LCL Rs-12	39.79	67.52	25.28	Rough and raised colony	Dull white and dark brown

\*Rs (*Rhizoctonia solani*), JPR (Jaipur isolate), AJM (Ajmer isolate), BKN (Bikaner isolate), JJN (Jhunjhunu isolate), NAG (Nagaur isolate), LCL (Local isolate)



**Pathogenic variability**

The pathogenic nature of twelve isolates of *Rhizoctonia solani* were tested on susceptible variety (RMT-351) of fenugreek under pot house condition (Table 2). JPR Rs-1 caused maximum disease incidence (57.36%) which was significantly higher over other isolates, followed by LCL Rs-

12 (53.44%) and JPR Rs-2 (52.99%). Lowest disease incidence (35.61 %) was observed with NAG Rs-10 isolate. Among these twelve isolates, highly pathogenic was JPR Rs-1 isolate while NAG Rs-10 isolate was weak pathogenic. Similar findings have also been reported by Gaurav *et al.*, 2017 [5].

**Table 2:** Pathogenic variability among different isolates of *Rhizoctonia solani* causing root rot of fenugreek

S. No.	District	Tehsil	Village/locations	Isolate code <sup>#</sup>	Disease Incidence (%) <sup>*</sup>
1.	Jaipur	Dudu	Boraj	JPR Rs-1	57.36 (49.23)**
2.	Jaipur	Phagi	Nimeda	JPR Rs-2	52.99 (46.71)
3.	Bikaner	Nokha	Madiya	BKN Rs-3	47.73 (43.70)
4.	Bikaner	Dungargarh	Jetasar	BKN Rs-4	54.58 (47.63)
5.	Ajmer	Kekri	Chandali	AJM Rs-5	53.79 (47.17)
6.	Ajmer	Kishangarh	Tokra	AJM Rs-6	45.77 (42.57)
7.	Jhunjhunu	Chirawa	Jhanjhot	JJN Rs-7	46.34 (42.90)
8.	Jhunjhunu	Nawalgarh	Dundlod	JJN Rs-8	43.83 (41.46)
9.	Nagaur	Nawa	Aabas	NAG Rs-9	38.44 (38.32)
10.	Nagaur	Merta	Dandavas	NAG Rs-10	35.61 (36.64)
11.	Bikaner	Bikaner	Disease plot	LCL Rs-11	46.21 (42.83)
12.	Jaipur	Jaipur	Disease plot	LCL Rs-12	53.44 (46.97)
				S.Em <sub>+</sub>	1.89
				CD (p=0.05%)	5.53

\*Average of three replications, variety RMT-351

\*\*Data in parenthesis are angular transformed values

<sup>#</sup>Rs (*Rhizoctonia solani*), JPR (Jaipur isolate), BKN (Bikaner isolate), AJM (Ajmer isolate), JJN (Jhunjhunu isolate), NAG (Nagaur isolate), LCL (Local isolate)



JPR Rs-1



JPR Rs-2



BKN Rs-3



BKN Rs-4



AJM Rs-5



AJM Rs-6





Means: Rs (*Rhizoctonia solani*), JPR (Jaipur isolate), BKN (Bikaner isolate), AJM (Ajmer isolate), JJN (Jhunjhunu isolate), NAG (Nagaur isolate), LCL (Local isolate)

**Fig 1:** Different isolates of *Rhizoctonia solani* showing pathogenic variability with fenugreek (Var. RMt-351)

### Conclusion

The present study shows that maximum root rot incidence of fenugreek was severe in Jaipur, Generally *Rhizoctonia solani* fungus colony with dull whitish growth started appearing after 48 h. Later, the growth was very fast which covered the entire Petri plate within 96 hours. The different location showed different type texture and colony colour, in case of pathogenicity fenugreek seedlings exhibited symptoms like yellowing, stunting, rotting of roots and drying of the leaves. Among twelve isolates, JPR Rs-1 (23.85 mm day<sup>-1</sup>) indicated slow growing nature and does not covered whole petri plate within 96 h.

### Reference

- Acharya K, Chakraborty N, Chatterjee S, Basu SK. Fungal diseases of fenugreek. Fenugreek Special Issue, Mar/Apr 2014. American Journal Social Issues and Humanities; c2014. p. 176.
- Anonymous. Thirty second annual report, All India Coordinated Research Project on Spices, SKN College of Agriculture, Jobner (Jaipur); c2007-08. p. 39.
- Arya PS. Spices Crop of India. Kalyani Publishers; c2000. p. 327.
- Bakrim NM, Alaw AK, Al-Ani IM, Hassan NM. The antifertility effect of fenugreek seeds on female rats, animal model. Patent in Contraception. Conference: IIUM Research Invention and Innovation Exhibition; c2014.
- Gaurav NP, Mehta N, Basavaraj K, Singh S. Cultural, morphological variability and anastomosis behaviour in *Rhizoctonia solani* isolates causing sheath blight of rice. J Mycol. Pl. Pathol. 2017;47(4):382-393.
- Girardon P, Bessiere JM, Baccou JC, Sauvaire Y. Volatile constituents of fenugreek seeds. Planta Med; c1985. p. 583-584.
- Kumari M, Poonia MK. Investigation of root rot disease of fenugreek/pan methi (*Foeniculum-corniculata*) in Nagaur district of Rajasthan, India. Pharma Innovation. 2021;10(3):791-793.
- Lal M, Kandhari J. Cultural and morphological variability in *Rhizoctonia solani* isolates causing sheath blight of rice. J Mycol. Pl. Pathol. 2009;39:77-81.
- Singh AK, Rao SS. Management of root rot disease of fenugreek. Journal of Spices and Aromatic Crops. 2015;24(1):58-60.
- Susheela K, Reddy CS. Variability in *Rhizoctonia solani* (AG-1 IA) isolates causing sheath blight of rice in India. Indian Phytopath. 2013;66:332-350.
- Yadav SL, Ghasolia RP, Yadav R, Yadav P. Studies on survey and epidemiology of *Rhizoctonia solani* causing root rot of fenugreek. International Journal Seed Spices. 2019;9(2):91-95.