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Investigation of root rot disease of fenugreek/paan methi (*Foenum-corniculata*) in Nagaur district of Rajasthan, India

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Abstract

Root rot of Paan methi/Kasuri methi (*Foenum-corniculata*), induced by the fungus *Rhizoctonia solani* has become a vital constraint to the growers of paan methi in Rajasthan. Two field surveys were conducted during the Rabi 2018-19 and 2019-20 cropping seasons to determine the distribution and importance of Paan methi root rot incidence in Nagaur district, Rajasthan. The associations of disease incidence with biophysical factors were evaluated. The disease incidence varied among soil types, crop management practices, and cropping seasons. Disease incidence was higher in 2019-20 (28.45%) than in 2018-19 (26.80%). Cropping season, soil type, and previous crop were pathogen-host were significantly associated with root rot incidence. Root rot incidence varied from 20.65 to 33.50 percent in four surveyed tehsils of Nagaur district, Rajasthan. Maximum disease incidence in both years (2018-19 and 2019-20) was recorded in Nagaur Tehsil (33.50%) followed by Jayal (30.07 %), Merta (24.50 %), and Degana (22.00 %). In the Nagaur district of Rajasthan, the overall average disease incidence was 27.65 percent in 48 fields of 24 villages of four tehsils. The survey among areas revealed that none of the locations was found free from the disease.

Keywords: Disease incidence, Paan Methi, root rot, *Rhizoctonia solani*, survey

1. Introduction

India has been the “home of spices” since time ancient. It is the world's largest producer, consumer, and exporter of seed spices which are being cultivated widely in the country over different agro-climatic zones (Sharma and Sharma, 2017) ^[1]. Fenugreek/Paan methi/Kasuri methi is an important leaf spices crop of Rajasthan. *Panmethi* (*Trigonella corniculata*) is an important seed-spices crop of Rajasthan, it comes under the scented group (Kasuri methi) of fenugreek (Kumawat *et al.*, 2018) ^[6]. It is one of the important crops which are prevalently grown in the Nagaur district and some part of Jodhpur district in Rajasthan state. Nagauri (Paan) methi is being grown by more than 3000 farmers in the 4100 hectares area (Pawariya, *et al.*, 2020) ^[7]. The majorly grown area is Nimdi, Kuchera, Run, Khajwana, etc. of the district. Fenugreek is majorly grown in the state of Rajasthan, Kashmir, Punjab, and upper Gangetic plains. Fenugreek has two species i.e. *Foenum-granum* (common methi) and *Foenum-corniculata* (Nagauri/Paan methi). This crop is being grown in the Rabi season in Rajasthan. A moderate rate of rain can be bear by this crop. Pusa Paan, Pant Ragini, and Pusa early bunching are major released varieties of this crop. So lesser number of variety advancement in the Nagauri (Paan) methi. The dried leaves and flowers are also used for flavoring vegetable curries (Arya, 2000) ^[2]. Fenugreek contains different alkaloids, flavonoids, and saponins, proteins, vitamins, Choline, etc. Fenugreek seed contains volatile oil and fixed oil in small quantities. Fenugreek is widely used in food preparation such as curries, handi recipes, or as a garnishing product. Fenugreek (Kasuri Methi) is an amazing magic herb that can cure several ailments (Abhani and Raut, 2016) ^[3].

Paan methi attacked by several fungal diseases viz., root rot (*Rhizoctonia solani*), powdery mildew (*Erysiphe polygoni* and *Leveillula taurica*), wilt (*Fusarium oxysporum*), leaf spot (*Cercospora traversiana*), charcoal rot (*Macrophomina phaseolina*), and rust (*Uromyces anthyllidis*) (Godara *et al.*, 2010) ^[5]. Among these, root rot also known as collar rot or foot rot or damping-off of fenugreek caused by *Rhizoctonia solani* is one of the most important diseases which reduce the yield of the plant significantly. The main symptom of this disease is damping off. The freshly emerged seedlings fall over and die and most of the seedlings may die at pre or post-emergence in severely infected areas.

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They may also develop footrot and brownish cankers on the root and stem near the ground level. 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) [11]. The roots of infected plants are poorly developed; finer roots are either not formed or rotted. Plants show stunted growth and can easily be pulled out. Heavy losses are incurred due to root rot. Under natural field conditions, the incidence of root rot in *Panmethi* (*Trigonella corniculata*) was still not investigated but in fenugreek (*Trigonella foenum-graecum* L.) was recorded up to 20.00 per cent in the Jaipur district of Rajasthan (Yadav *et al.*, 2019) [7, 12]. Singh and Rao (2015) [6, 10] reported a 34.67 per cent incidence of root rot of fenugreek caused by *Rhizoctonia solani* from Chhattisgarh with a yield loss of 55.26 percent. Karnataka Rani and Hedge (2017) [8] recorded 48.35 per cent root rot incidence in fenugreek caused by *Rhizoctonia solani* Kuhn. This paper reports the distribution of Paan methi root rot in the major paan methi-growing parts of the Nagaur district of the Rajasthan concerning biophysical factors.

2. Materials and Methods

2.1. Survey areas

Paan methi root rot surveys were conducted in four major paan methi-growing tehsils (Degana, Merta, Nagaur, Jayal) in the Nagaur district of Rajasthan (Fig. 1). The tehsils were selected based on the intensity of paan methi production. The dominant soil type of the study area was sandy and sandy loam, characterized by poor drainage preceding crop taken by farmers was mostly cotton and mung bean, and some were taken til and bajara in both the surveyed season.

2.2. Sampling and disease assessments

The surveys were conducted to know the incidence of root rot disease in 2018-2019 and 2019-2020 cropping seasons in the last week of November and the first week of December and a total of 96 paan methi fields were assessed at the seedling stage of the crop.

The paan methi fields were randomly sampled at intervals of 5-10 km along the main and feeder roads. In each field, five quadrats (1 m² each) were sampled by walking diagonally across each field in an 'X' pattern. Disease incidence was recorded as the percentage of plants showing root rot symptoms in each quadrat, and the averages of the five quadrats were calculated for each field as per the formula given below.

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

Other biophysical factors like the preceding crops, land preparation, cropping system, plant density, sowing time, the extent of weeding, soil type, and crop season were recorded. Randomly sampled diseased plants were collected for further laboratory study.

2.3. Data analyses

Descriptive parameters were used to analyze the incidence of paan methi root rot concerning the independent variables (Table 1). T-tests were used to compare the frequencies of diseased fields between seasons, soil type and land preparation based on the proportion of fields in each district that were assigned to a given disease incidence or severity class (Sahile *et al.*, 2008) [9].



Fig 1: Surveyed four tehsils of Nagaur district

Table 1: Survey and incidence of root rot of Paan methi in major growing areas of Nagaur

S. No.	Tahsil	Village	Soil type	Variety	Preceding crop <i>Kharif</i>		Disease in the preceding crop		*Average PDI		**Mean
					2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	
1.	Degana	Nimbadi	Sandy loam	Local	Cotton	Cotton	Root rot, BLB	Root rot, BLB	19.33	22.00	20.65
		Paladi kalan	Sandy loam	Local	Cotton	Til	Stem rot, Phyllody	Stem rot, Phyllody			
		Butati	Sandy loam	Local	Cotton	Cotton	Root rot, leaf curl	Root rot, leaf curl			
		Sanju	Sandy loam	Local	Cotton	Cotton	Root rot, BLB	Root rot, BLB			
		Dhadhriya	Sandy loam	Local	Mung bean	Mung bean	Leaf spot	Leaf spot			
		Sindhlash	Sandy loam	Local	Mung bean	Mung bean	Leaf spot	Leaf spot			
2.	Merta	Ren	Sandy loam	Local	Mung bean	Mung bean	Leaf spot, mosaic	Leaf spot, mosaic	28.00	24.50	26.25
		Mundwa	Sandy loam	Local	Cotton	Cotton	Root rot, leaf curl	Root rot, BLB			
		Dhadhasani	Sandy loam	Local	Mung bean	Mung bean	Leaf spot, blight	Blight			
		Dangawas	Sandy loam	Local	Mung bean	Mung bean	Leaf spot, blight	Blight			
		Gagrana	Sandy loam	Local	Mung bean	Bajra	Leaf spot	Blast			
		Siradhana	Sandy loam	Local	Cotton	Mung bean	Root rot, BLB	Leaf spot			

3.	Nagaur	Khajwana	Sandy	Local	Cotton	Cotton	Root rot, BLB	Root rot, BLB	31.50	35.50	33.50
		Gawalu	Sandy	Local	Cotton	Cotton	Root rot, leaf curl	Root rot, leaf curl			
		Gajoo	Sandy	Local	Cotton	Cotton	Root rot, BLB	Root rot, BLB			
		Kuchera	Sandy	Local	Cotton	Cotton	Root rot, BLB	Root rot, BLB			
		Gothra	Sandy	Local	Mung bean	Mung bean	Leaf spot	Root rot, leaf curl			
		Paladi Jodha	Sandy	Local	Til	Cotton	Phyllody, stem rot	Root rot, BLB			
4.	Jayal	Lunsara	Sandy	Local	Cotton	Cotton	Root rot	Root rot	28.35	31.80	30.07
		Rol	Sandy	Local	Cotton	Til	Root rot	Phyllody, stem rot			
		Jodhras	Sandy	Local	Mung bean	Mung bean	Leaf spot	Leaf spot, blight			
		Pharodod	Sandy	Local	Cotton	Cotton	Root rot	Root rot			
		Dharna	Sandy	Local	Til	Til	Phyllody, stem rot	Phyllody			
		Manglod	Sandy	Local	Cotton	Cotton	Root rot, BLB	Root rot			
Overall mean								26.80	28.45	27.62	

*Percent disease incidence

** Average percent disease incidence of six villages of four Tehsil's

3. Results and Discussion

3.1. Characteristics of surveyed farmer fields

The soil type of 50% surveyed paan methi fields was sandy loam and 50% has reported sandy soil respectively. The majority of the farmers (65%) sowed preceding crop Kharif is cotton in both the year of survey, and the remainder (30%) sowed mung bean and (5%) til respectively. Diseases infection in the preceding crop was mainly root rot and BLB in cotton, leaf spot in mung bean and stem rot, and phyllody in til crop (Table 1). During the survey, discussions were held with the farmers concerned, regarding the occurrence and incidence of the disease. As a result of this discussion, it was revealed that disease appeared in most of the fields wherever paan methi in *rabi* and cotton in *Kharif* crop was taken continuously on the same field. The survey revealed that the disease was prevalent in varying intensities in all the tehsils finding are similar to Belete *et al.* (2013) ^[4].

3.2. Distribution, the incidence of paan methi root rot

It is apparent from the data (Table1) that the average incidence of root rot disease was ranged from 20.65 to 33.50 per cent in the Nagaur district of Rajasthan in both surveyed seasons 2018-2019 and 2019-2020, respectively. Mean disease incidence was highest in district Nagaur tehsil (33.50 %) followed by Jayal (30.07 %), Merta (26.25 %) and it was lowest in tehsil Degana (20.65%). During the survey, it was observed that the incidence of root rot was more between 50-60 days after sowing. The overall mean average of disease incidence was 27.62 per cent in ninety-six fields of five major fenugreek growing districts of Rajasthan. Our findings are following the results of findings with (Yadav *et al.*, 2019) ^[7, 12]. Similar results have also been recorded by Singh and Rao (2015) ^[6, 10] who reported a 34.67 percent incidence of root rot of fenugreek (*Rhizoctonia solani*) from Chhattisgarh caused by yield loss of 55.26 percent. Karnataka, Rani and Hegde (2017) ^[8] have also been recorded 48.35 per cent root rot incidence in fenugreek caused by *Rhizoctonia solani* Kuhn. As per the literature screened, this is the first study on the systematic assessment of the disease in surveyed major paan methi growing districts of the state which is very essential for any further study on the disease. Very little information is available in the literature on the biophysical factors helping in the development of root rot of paan methi in Rajasthan.

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