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## Study the pathogenic variability among *Macrophomina phaseolina* Isolates in sterilized and unsterilized soil of different crops

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### Abstract

All eight isolates of *Macrophomina phaseolina* (Tassi.) Goid. tested for their pathogenic variation using susceptible varieties viz. RMG 62 of mungbean, RGC 1003 of clusterbean and Gaurav of linseed had varying disease incidence per cent in sterilized and unsterilized soil. The isolate Bikaner on mungbean, Narnaul on clusterbean and Kota on linseed were highly virulent in both types of soil. The incidence of disease appeared first in mungbean followed by clusterbean and linseed in sterilized as well as unsterilized soil.

**Keywords:** Pathogenic, variability, *Macrophomina phaseolina*, *Vigna radiata* L.

### Introduction

*Macrophomina phaseolina* (Tassi.) Goid is a pathogen with an broad host range. Thus, Mungbean (*Vigna radiata* L.), Clusterbean (*Cyamopsis tetragonoloba* Taub.) and Linseed (*Linum usitatissimum* L.), the important crops of Rajasthan, were taken for the study of pathogenic variations of the pathogen. These crops suffer from several fungal, bacterial and viral diseases. However, dry root rot caused by *Macrophomina phaseolina* (Tassi) Goid [*Rhizoctonia bataticola* (Taub) Butler] is considered as the most devastating disease in almost all the crops growing areas of country. The disease is quite wide spread in Rajasthan state due to congenial weather conditions and causes considerable yield losses to the these crops (Philip *et al.*, 1969; Grewal, 1988) [5, 3]. The eight isolates, five from Rajasthan and two isolate Haryana (Hisar and Narnaul) and one from Indian Agricultural Research Institute, New Delhi were studied for their pathogenic variations on three crops viz. mungbean, clusterbean and linseed. All eight isolates tested for their pathogenicity using susceptible varieties viz. RMG 62 of mungbean, RGC 1003 of clusterbean and Gaurav of linseed had varying disease incidence per cent in sterilized and unsterilized soil. Mungbean [*Vigna radiata* (L.) Wilczek] also known as green gram is a source of protein (25%) with high quality of lysine (4600 mg/g N) and tryptophan (60 mg/g N). It is consumed as dal or whole grain by the people and also commonly used as fodder and green manure. The major mungbean growing states in India are Andhra Pradesh, Orissa, Maharashtra and Rajasthan. In Rajasthan, the total area of mungbean is 10.19 lac hectare with 3.91 lac tonnes of production and 384 kg/ha of productivity (Anonymous, 2014) [1]. Clusterbean (*Cyamopsis tetragonoloba* Taub.) commonly known as guar, is an important leguminous crop of Rajasthan. It is the most hardy and drought resistant among the leguminous crops which is specially suited to light textured soils. Clusterbean is grown for different purposes such as vegetable, green fodder, green manure and seed production. In Rajasthan, total area under clusterbean is 4.56 million hectares with a production of 2.02 million tones where productivity being 447 kg/ha (Anonymous, 2014) [1]. Linseed (*Linum usitatissimum* L.) also known as flax is a food and fibre crop. Flax is grown for its oil, used as a nutritional supplement and as an ingredient in many wood –finishing products. Flax fibres are used to make linon. In Rajasthan, linseed occupies 2106 ha area with a production of 2845 tonnes and productivity being 1351 Kg/ha (Anonymous, 2014) [1]. The disease is widely prevalent in sandy soil of Rajasthan where climatic conditions are dry and temperature remains high. Therefore, it was thought desirable to undertake the studies to find out the causes for disease development and its suitable control measure. Though the disease has been investigated in depth all over the country, yet the importance of its study can not be ignored because of prevailing climatic conditions of Rajasthan state.

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Therefore, it is obvious and important to undertake the studies of pathogenic variability and antagonistic effect to manage this disease.

### Material and Methods

**Pathogenic variations:** To study the pathogenic variations of *Macrophomina phaseolina* on different crops, the earthen pots (25 cm diameter) were filled with soil of Agronomy Farm, Bikaner. Sand maize flour medium (10 g maize flour, 90 g sand and 20 ml distilled water in each flask) was autoclaved in 250 ml Erlenmeyer's flasks. Each flask was inoculated with pure culture isolates of *Macrophomina phaseolina* separately and incubated at  $28 \pm 1^\circ\text{C}$  for 15 days. Fungal infested sand maize flour medium was mixed in soil of each pot with a ratio of 1: 200. The pots were watered regularly and kept moist for two days. Pathogenic variations of pathogen was studied in sterilized as well as unsterilized soil. The susceptible varieties RMG-62 (mungbean), RGC-1003 (clusterbean) and Gaurav (linseed) were used to study pathogenic variations. The seeds, treated with 0.1 per cent mercuric chloride for one minute to remove any microbial infection present on the surface of the seeds were sown in the pots and ten plants were maintained in each pot after germination. *Macrophomina phaseolina* was isolated and purified. Koch's postulates were proven and pathogenic nature of each isolate was established.

### Results and Discussion

**Pathogenic variation of mungbean:** All eight isolates tested for their pathogenic nature using susceptible RMG 62 variety of mungbean were found virulent in sterilized as well as in unsterilized soil. Koch's postulates were proven for each isolate. The mungbean root rot incidence (%) in sterilized soil and unsterilized soil varied from 26.67 to 96.67 and 20.00 to 76.67, respectively (Table. 1 and Fig. 1). Isolate Bikaner was highly virulent followed by isolates Sriganganagar, Hisar, Narnaul, Churu, Delhi, Alwar and Kota in sterilized soil. Isolate Bikaner was highly virulent followed by isolates Sriganganagar, Narnaul, Hisar, Churu, Delhi Alwar and Kota in unsterilized soil. Isolates of Hisar and Narnaul in sterilized soil and Alwar and Kota in unsterilized soil were at par in virulence. Symptoms of root rot appeared after 35 days of germination in sterilized soil while it was delayed upto 45 days in unsterilized soil. Devi and Singh (1998) [2] categorized 56 isolates of *M. phaseolina* from blackgram and greengram crops from different parts of India and observed higher incidence of root rot in sterilized soil than in unsterilized soil as investigated in the present studies. Sindhan *et al.* (2002) [7] isolated *R. bataticola* from dry root rot affected chickpea plants on potato dextrose agar medium, purified by single hyphal tip method and proved pathogenicity collected from 11 different locations of North, South, North-East and Central India, into six distinct morphological groups. The isolates were categorized as highly virulent, moderately virulent and weakly virulent on the basis of disease incidence and intensity on black gram and green gram. They observed higher incidence of root rot in sterilized soil than in unsterilized soil at all inoculum levels in both the crops. where they were isolated which was shown by the variability in pathogenic characters. Similarly Umer and Tariq (2014) [9] isolated 65 isolates of *Macrophomina phaseolina* from Punjab and Khyber Pakhtun khwa provinces of Pakistan and found variation in their pathogenic nature, thereby confirming the present findings.

### Pathogenic variation of clusterbean

The incidence (%) of disease of all 8 isolates of *Macrophomina phaseolinain* RGC-1003 variety of clusterbean varied between 46.67 to 93.33 and 30.00 to 50.00 in sterilized and unsterilized soil, respectively (Table 2 and Fig. 2). Isolate Narnaul was highly virulent followed by isolates Hisar, Bikaner, Alwar, Delhi, Churu, Kota and Sriganganagar in sterilized soil. The isolate Narnaul was also highly virulent in unsterilized soil followed by isolates Bikaner, Hisar, Delhi, Kota, Churu, Sriganganagar and Alwar. The isolates Bikaner and Hisar, Delhi and Kota as well as Sriganganagar and Alwar were at par in virulence in unsterilized soil. In unsterilized soil the reaction of isolates was less and delayed as compared to sterilized soil. Symptoms of root rot appeared after 42 days of germination in sterilized soil while it was delayed upto 54 days in unsterilized soil. Ratnoo *et al.* (1997) [6] indicated cultural and pathogenic variability among the isolates of *Rhizoctonia bataticola*.

**Pathogenic variation of linseed:** Table 3 and Fig. 3 reveal that incidence (%) of all 8 isolates of *Macrophomina phaseolinain* Gaurav variety of linseed varied from 13.33 to 43.33 and 6.67 to 33.33 in sterilized and unsterilized soil, respectively. Isolate Kota was highly virulent followed by isolates Sriganganagar, Alwar, Bikaner, Churu, Hisar, Delhi and Narnaul in sterilized soil. The isolate Kota was highly virulent followed by isolates Sriganganagar, Bikaner, Alwar, Churu, Delhi, Hisar and Narnaul in unsterilized soil. Isolates Alwar and Bikaner in sterilized soil, isolates Hisar and Narnaul in unsterilized soil were equally virulent. Symptoms of root rot appeared after 50 days of germination in sterilized soil while it was delayed upto 64 days in unsterilized soil. Grezes-Besset *et al.* (1996) [4] observed that the virulence of *M. phaseolina* isolates as highly variable. Suriachandraselvan and Seetharaman (2000) studied 25 pathogenic geographical isolates of *Macrophomina phaseolina* from different conventional sunflower growing areas of Tamil Nadu. The virulence of the isolates significantly varied for disease incidence, thereby confirming the present findings.

**Table 1:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in RMG-62 variety of mungbean in sterilized and unsterilized soil

Isolate	Disease incidence in per cent		
	Sterilized soil	Unsterilized soil	Mean
Bikaner	96.67 (83.86)	76.67 (61.22)	86.67 (72.54)
Delhi	40.00 (39.23)	26.67 (31.00)	33.34 (35.11)
Churu	46.67 (43.08)	30.00 (33.21)	38.34 (38.14)
Hisar	50.00 (45.00)	33.33 (35.22)	41.67 (40.11)
Sriganganagar	63.33 (52.78)	46.67 (43.08)	55.00 (47.93)
Narnaul	50.00 (45.00)	40.00 (39.23)	45.00 (42.12)
Kota	26.67 (31.00)	20.00 (26.57)	23.34 (28.78)
Alwar	33.33 (35.22)	20.00 (26.57)	26.67 (30.89)
Average	50.83 (46.89)	36.67 (37.01)	43.75 (41.95)

\*Figures in parenthesis are mean angles corresponding to percentage.

	S.Em±	C.D. at 5%	C.D. at 1%
Isolate	1.50	4.25	5.65
Soil type	0.57	1.61	2.14
Isolate x Soil type	2.12	6.01	8.00
C.V.(%)	8.76		

**Table 2:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in RGC 1003 variety of clusterbean in sterilized and unsterilized soil

Isolate	Disease incidence in per cent		
	Sterilized soil	Unsterilized soil	Mean
Bikaner	63.33 (52.78)	43.33 (41.15)	53.33 (46.96)
Delhi	56.67 (48.85)	40.00 (39.23)	48.34 (44.04)
Churu	53.33 (46.92)	36.67 (37.22)	45.00 (42.07)
Hisar	73.33 (59.00)	43.33 (41.15)	58.33 (50.08)
Sriganganagar	46.67 (43.08)	30.00 (33.21)	38.34 (38.14)
Narnaul	93.33 (77.71)	50.00 (45.00)	71.67 (61.36)
Kota	50.00 (45.00)	40.00 (39.15)	45.00 (42.07)
Alwar	60.00 (50.85)	30.00 (33.00)	45.00 (41.93)
Average	62.08 (53.02)	39.17 (38.64)	50.63 (45.83)

\*Figures in parenthesis are mean angles corresponding to percentage.

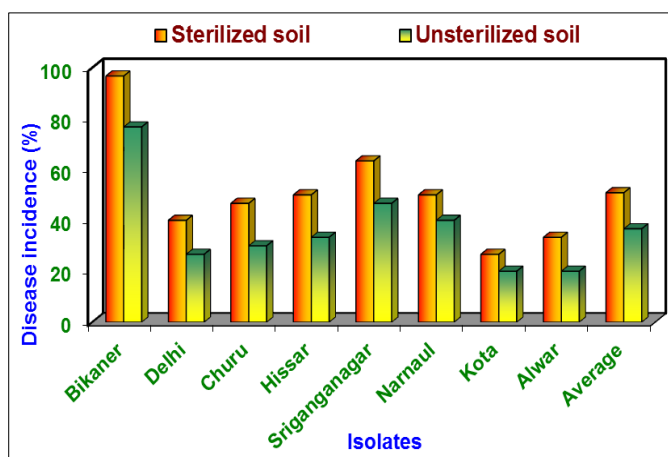
	S.Em±	C.D. at 5%	C.D. at 1%
Isolate	1.91	5.41	7.21
Soil type	0.72	2.05	2.72
Isolate x Soil type	2.70	7.66	10.19
C.V.(%)	10.21		
General Mean	50.62		

**Table 4.3:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in Gaurav variety of linseed in sterilized and unsterilized soil

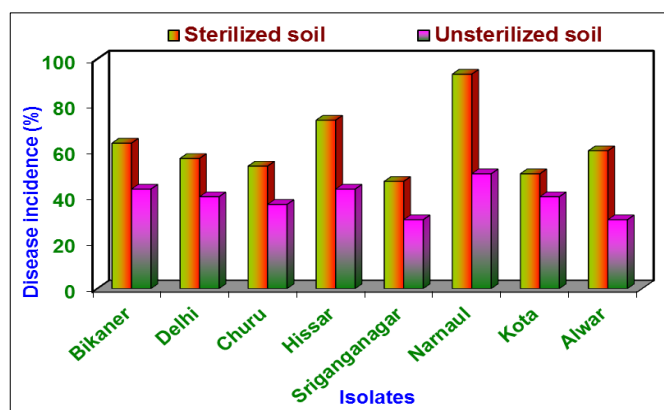
Isolate	Disease incidence in per cent		
	Sterilized soil	Unsterilized soil	Mean
Bikaner	30.00 (33.21)	20.00 (26.57)	25.00 (29.89)
Delhi	16.67 (24.1)	10.00 (18.43)	13.34 (21.27)
Churu	26.67 (31.09)	13.33 (21.41)	20.00 (26.25)
Hisar	20.00 (26.57)	6.67 (14.97)	13.34 (20.77)
Sriganganagar	33.33 (35.26)	26.67 (31.09)	30.00 (33.18)
Narnaul	13.33 (21.41)	6.67 (14.97)	10.00 (18.19)
Kota	43.33 (41.17)	33.33 (35.26)	38.33 (38.21)
Alwar	30.00 (33.21)	16.67 (24.1)	23.34 (28.65)
Average	26.67 (30.75)	16.67 (23.35)	21.67(27.05)

\*Figures in parenthesis are mean angles corresponding to percentage.

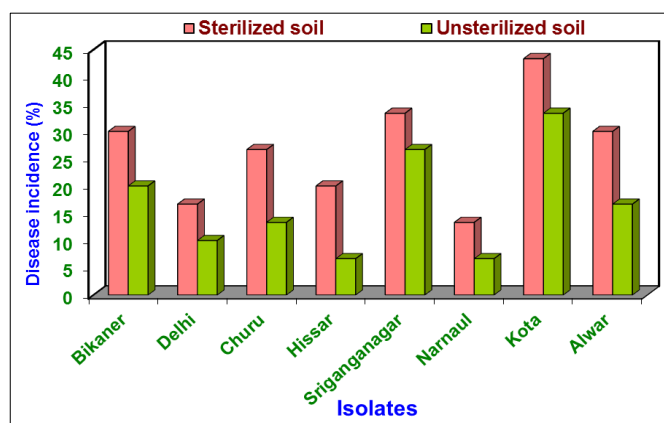
	S. Em±	C.D. at 5%	C.D. at 1%
Isolate	0.84	2.37	3.16
Soil type	0.32	0.90	1.19
Isolate x Soil type	1.18	3.35	4.46
C.V.(%)	7.58		
General Mean	21.67		



**Fig 4.1:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in RMG-62 variety of mungbean in sterilized and unsterilized soil



**Fig 2:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in RGC 1003 variety of cluster bean in sterilized and unsterilized soil



**Fig 3:** Pathogenicity of eight isolates of *Macrophomina phaseolina* in Gaurav variety of linseed in sterilized and unsterilized soil.

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