

Original Research Article

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Survey and Host Plant Resistance of Cultivars in Cluster Bean against Fusarium Wilt caused by *Fusarium solani*

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ABSTRACT

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Fusarium wilt of cluster bean caused by *Fusarium solani* is an important disease which is known to cause heavy crop loss in Rajasthan as well as in India. During the survey the disease fusarium wilt of cluster bean incidence was recorded from 15.66 to 19.20 per cent at Jaipur, Phulera and Renwal tehsil of Jaipur district and Nawa tehsil of Nagaur district. Maximum disease incidence was recorded (19.20%) at kaalakh village of Pulera tehsil and minimum disease incidence was recorded (15.66%) at mundghasoi village of Nawa tehsil. In host plant resistance studies, among ten varieties, RGC-1003, RGC-1031, RGC-1033, RGC-1055, RGR-12-1, RL-19 and RGC-1066 of cluster bean were screened against *Fusarium solani* under artificial inoculation condition. None of the variety was found resistant to Fusarium wilt and RGC-197 was found susceptible and recorded maximum disease incidence in field.

Introduction

Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.], commonly known as *guar* is a member of Leguminosae (*Fabaceae*) family and derives its name from a Sanskrit word Gauaahar which means cow fodder or otherwise fodder of the livestock. It is an important legume crop and mainly grown under rainfed condition of India during *kharif* and *Zaid* seasons. Cluster bean can be grown for different purposes *viz.*, vegetables, green fodder, green manuring, grain and gum. Its seed health gained a great significant in recent past mainly in textiles, paper, petroleum,

pharmaceuticals, food etc. Cluster bean is believed to be originated in Africa but it is grown throughout the Southern Asia since ancient times as a vegetable and fodder crop. It is widely cultivated in countries like India, Pakistan, USA, Morocco, Italy, Germany, Greece and Spain (Hymowitz and Matlock, 1963). Total area under production of guar in India is about 2.56 million ha with the production of 0.72 million tons of guar seed. Rajasthan alone contributes around 70 percent production of India. Besides Rajasthan, it is also cultivated in Haryana, Gujarat, Punjab, Uttar Pradesh and Madhya Pradesh (Pandey and Roy, 2011). In Rajasthan, cluster bean is

cultivated throughout the state. The area, production and productivity are 35.30 million ha, 14.04 million tons and 398 Kg/ha, respectively. The main guar growing districts are Bikaner, Jaisalmer, Barmer, Hanumangarh, Sriganganagar, Jodhpur, Churu, Sikar, Nagour, Jalore and Jaipur (Anonymous, 2016-17). There is no other legume crop so hardy and drought tolerant as cluster bean. Its endosperm is rich source of high-quality protein and galactomannan which is very important for the industry (Punia *et al.*, 2009; Rai *et al.*, 2012). This galactomannan is commonly known as guar gum and forms about 35 per cent of the dry weight of the seed. Pure guar gum contains about 80 - 90 per cent of the galactomannan (Sharma and Sharma 2013). The crop severely attacked by the vagary of disease caused by fungi, bacteria and viruses in the field. Cluster bean is attacked by several fungal pathogens which not only reduces the potency of seed, but degrades the health, beneficial and nutritional quality components. In India wilt of guar (*F. solani* f. *sp. caeruleum*) is a very serious disease and was first reported by Singh (1951) from Kanpur. Mathur and Sinha (1970) reported from Uttar Pradesh that root rot of guar, an important disease, was caused by *Sclerotinia rolfsii* Sacc., The occurrence of *Fusarium solani* on guar causing root rot/wilt was reported from Rajasthan by Mathur and Shekhawat (1988). Singh and Kang (1991) reported *Neocosmospora vasinfecta* var. *vasinfectum* as the cause of wilt of guar. The pathogen causing wilt of guar in Gujarat was identified as *F. vasinfectum* and when later producing perithecia in 8–10 days old culture as *Neocosmospora vasinfecta* (Patel *et al.*, 1998). Seven popular guar cultivars namely Krishna 51, B 53, Pusa Nav Bahar, Swati 55, Neelam 51, BM 83 and Amul 51 (local collection as well as from two different seed companies) were evaluated by Bohr *et al.*, (2011). Therefore the present study was conducted to

survey and identification of cultivars showing resistance/tolerant to this fungal disease in Rajasthan.

Materials and Methods

Survey and collection of diseased samples

Experimental Survey was conducted to assess the disease incidence of *Fusarium* wilt of cluster bean. The survey of major cluster bean growing areas in the vicinity of the Jobner which includes Nawa, Renwal, Phulera, and Jaipur tehsils (Table 1). To assess the incidence of disease, two fields randomly selected and 10 square meter area in each field in each village was marked and per cent plant mortality was observed. In the surveyed fields, per cent plant mortality/incidence was calculated by using following formula:

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

In vivo evaluation of cluster bean cultivars against fusarium wilt caused by *Fusarium solani*

Seed of ten cultivars of cluster bean collected from RARI, Durgapura S.K.N. College of Agriculture, Jobner and Private Companies were evaluated against wilt of cluster bean under pot conditions during *khari* season 2018. Inoculum multiplied on sorghum grains was applied in pots (20 g/ pot) to increase the disease pressure. Inoculum was added before sowing. Seeds were washed thoroughly with sterilized water. Ten seeds of each cluster bean cultivar were sown in each pot. Two replications were maintained under pot conditions. Observations on disease incidence were recorded after 60 days of sowing. On the basis of disease incidence, cultivars were categorized as per criterion followed by Nagamma *et al.*, (2015) (Table 2).

Results and Discussion

Survey and collection of Fusarium wilt of clusterbean

Disease infected plant were collected from major cluster bean growing areas which includes Tehsils viz., Nawa, Renwal, Phulera, and Jaipur (Rajasthan) brought to the laboratory. During the survey, discussions were held with the farmers concerned, regarding occurrence and incidence of the disease. As the result of discussion, it is apparent from the data depicted in (Table 3) that Fusarium wilt incidence was observed in clusterbean surveyed areas. The disease Fusarium wilt of cluster bean incidence was recorded from 15.66 to 19.20 per cent. Wilting of plant and infected root of apical region were observed in infected plants and collected for isolation of the pathogen. The fungus was isolated in petri plates from root

region tissues under aseptic condition and incubated at $25 \pm 1^{\circ}\text{C}$ for 7 days. The pathogen culture was purified by single spore techniques. Survey for occurrence and distribution of disease was necessary so that In India wilt of guar (*F. solani f.sp.caeruleum*) is a very serious disease and was first reported by Singh (1951) from Kanpur. Vir and Grewal (1973) observed in their continuous study from 1971 to 1973 that wilt of guar (*F. solani f.sp.caeruleum*) was a serious problem and causes heavy losses to summer sown crop (April to June) under Delhi conditions. Similar observations recorded Lodha (1993) that dry root rot of cluster bean might occur at any stage of the crop from pre- emergence to maturity. Seedling blight occurs primarily on cotyledons as elongated black cankers on growing seedlings. Infected seedlings show bronzing and drooping of upper tender and parts can be easily uprooted.

Table.1 Survey areas for wilt incidence in cluster bean in the vicinity of Jobner (Jaipur) Rajasthan

S.No.	Tehsil	Name of village
1.	Nawa	1. Chosla 2. Mundghasoi
2.	Phulera	1. Pipili ka bass 2. Kalakh
3.	Renwal	1. Dungari khurd 2. Harsoli
4.	Jaipur	1. Basari 2. Lalpura

Table.2 Category for screening cluster bean cultivar against wilt incidence

Category	Per cent disease incidence (PDI)
Resistance	0-20
Moderately susceptible	21-50
Susceptible	51-80
Highly susceptible	81-100

Table.3 Survey of wilt in cluster bean growing areas in the vicinity of Jobner

S.No.	Teshil	Name of village	Percent disease incidence (60 days after sowing)
1	Jaipur	1. Basari	18.30
		2. Lalpura	18.00
2	Nawa	1. Chosla	16.50
		2. Mundghasoi	15.66
3	Phulera	1. Pipili Ka Bass	16.78
		2. Kalakh	19.20
4	Renwal	1 Dungari Khurd	18.25
		2 Harsoli	17.20

Table.4 Evaluation of cultivars of cluster bean against *Fusarium solani*

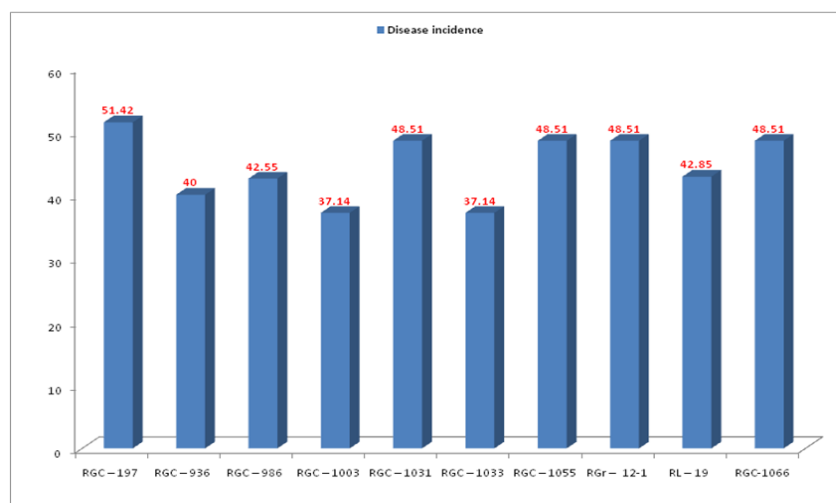
S.No.	Name of cultivar	Disease incidence* (%)	Reaction of cultivars
1	RGC – 197	51.42	S
		(45.81)	
2	RGC – 936	40.00	MS
		(39.23)	
3	RGC – 986	42.55	MS
		(40.72)	
4	RGC – 1003	37.14	MS
		(37.55)	
5	RGC – 1031	48.51	MS
		(44.15)	
6	RGC – 1033	37.14	MS
		(37.55)	
7	RGC – 1055	48.51	MS
		(44.15)	
8	RGr – 12-1	48.51	MS
		(44.15)	
9	RL – 19	42.85	MS
		(40.89)	
10	RGC-1066	48.51	MS
		(44.15)	

* Average of two replications

Figures given in parentheses are angular transformed value.

Where, Resistance (0-20 PDI), MS- Moderately susceptible (21-50 PDI),

S- Susceptible (51-80 PDI), HS- Highly susceptible (81-100 PDI) by Nagmma *et al.*, (2015).

Fig.1 Evaluation of cultivars of cluster bean against *Fusarium solani*

Evaluation of cultivars of cluster bean against *Fusarium solani* pathogen

Ten variety of clusterbean were screened against *Fusarium solani* under artificial inoculation conditions (Table 4). None of the variety was found immune to the wilt pathogen. Varieties, RGC -936, RGC -986, RGC -1003, RGC -1031, RGC -1033, RGC -1055, RGC - 12-1, RL -19. RGC 12-1, RL -19 and RGC -1066 were observed moderately susceptible and RGC -197 as susceptible (Figure 1). Similar results were evaluated by Bohr *et al.*, (2011) for reaction to guar root rot pathogens *F. solani* and *Rhizoctonia solani*. Based on root rot incidence under inoculated (20g inoculum kg-1soil) conditions, Swati 55, Neelam 51, Amul 51, Krishna 51, B 53, BM 53 and PusaNavBahar were considered susceptible. This study shows that most of the available Cluster bean cultivars were susceptible to root rot pathogen and there is need to develop resistant cultivars for its suppression. The results are in agreement with Patel *et al.*, (2002) they also evaluated genotypes of Cluster bean Genotypes GAUG 998, GAUG 9112, GAUG 605and GAUG 9010 showed moderate resistance to wilt (*Neocosmospora vasinfecta*) and Bajwa *et al.*, (2000) found that out of thirty two genotypes

evaluated against *Fusarium* wilt only one line was resistant and four lines were tolerant.

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