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Screening of Clusterbean Germplasm and varieties for resistance against *Sclerotium rolfsii* causing stem rot disease in Clusterbean

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Abstract
A field study was conducted during kharif 2018-19 crop season at department of Plant Pathology and experimental farm, College of Agriculture, Sawmi Keshwanand Rajasthan Agriculture University, Bikaner, Rajasthan to test the resistance of 31 germplasm/varieties against *Sclerotium rolfsii* under field condition. Pure culture of pathogen was mixed in soil before one week of sowing. Each germplasm/varieties were sown in second week of July in three rows of 5 m row length keeping 10 cm plant to plant distance. The disease incidence was recorded using 0-9 rating scale. Among thirty one varieties/germplasm two two genotypes *viz*.GR-13 and GP-15 were highly resistant, nine genotypes/varieties *viz*., GR-3, GR-5, GR-6, GR-7, GR-8, GR-10, RGC-1066, RGC-1055 and GP-17 were categorized as resistant. Another twelve genotypes/varieties *viz*., GR-1, GR-2, GR-4, RGC-1033, GP-12, GP-13, GP-14, GP-16, GP-18 GP-19, GR-11 and GR-12 were moderately resistant, five genotypes/varieties were moderately susceptible *viz*., GR-9, GR-14, RGC- 1017, RGC-1031 and RGC-1003, two genotypes/varieties RGC-936 and RGC-986 were susceptible, and remaining one variety RGC-197 was highly susceptible.

Keywords: Germplasm, varieties, *Sclerotium*, Clusterbean, *Cyamopsis tetragonoloba* L.

Introduction
Clusterbean [*Cyamopsis tetragonoloba* L.] Taub is an important leguminous crop of kharif season in arid and semi-arid region of India. Clusterbean is also popularly called as Guar. It is a very hardy and drought tolerant crop. Its deep penetrating root enables plant to utilize available moisture more efficiently and thus find better scope for rainfed cropping. The crop survives best even at moderate salinity and alkalinity. There is no other legume crop so hardy and drought tolerant as clusterbean, hence suitable for cultivation in arid and semi-arid tracts of Rajasthan. Clusterbean is being grown in India since ancient time. Clusterbean is grown for different purposes *viz*., vegetable, green fodder, green manure and production of seeds. It is also use as a concentrate for animals and for extraction of gum, mainly present in the seed endosperm, provides a useful raw material for a wide range of industrial products (Joshi and Arora, 1993) [5]. Seeds of clusterbean contain 28 to 33 per cent gum. Cluster bean gum is used in all types of industries *viz*., textile, paper, petroleum, pharmaceuticals, food processing, cosmetics, mining, explosives and oil drilling etc. Besides, it increases soil fertility by fixing considerable amount of atmospheric nitrogen. Guar gum and its derivatives are in great demand all over the world. Green, long, slender pods of clusterbean are largely consumed as vegetables. It is rich in minerals like calcium, phosphorus and iron as well as vitamin A and C. Clusterbean is grown in India, Pakistan, Indonesia, America, Italy, Mexico, Brazil and South Africa. India is the leading country in the world concerning area and production of guar, where it occupies 55.8 lakh hectares with annual production of 27.51 million tonnes of seed (2015 – 16 Anonymous). In India, this crop is mostly grown in the state of Rajasthan, Haryana, Punjab U.P. and M.P. In India, area under the clusterbean crop is 23.30 lakh hectare, production 11.98 lakh tons and with productivity of 428 kg/ha (2016-17 Anonymous). In Rajasthan, total area under the clusterbean crop is 19.95 lakh hectare, production 7.33 lakh tones and with productivity of 370 kg/ha. The production and productivity of clusterbean in terms of grain and fodder is highly affected by a number of phytopathogenic fungal and bacterial diseases *viz*., Bacterial blight (*Xanthomonas axonopodis pv. cyamopsidis*), Alternaria leaf spot (*Alternaria cyamopsidis*), Anthracnose (*Colletotrichum capsici f. sp. cyamopsicola*),

Curvularia leaf spot (*Curvularia lunata*), Charcoal rot/Damping off (*Macrophomina phaseolina*), Dry root rot/Leaf blight (*Fusarium solani* and *Rhizoctonia solani*), Myrothecium leaf spot (*Myrothecium roridum*), powdery mildew (*Oidiopsis taurica*), wilt (*Fusarium caeruleum*). Stem rot of clusterbean caused by *Sclerotium rolfsii* Sacc. has become a serious problem in recent years and cause yield losses ranging from 50-70 *per cent* depending upon disease severity. Considering, the severity and its destructive nature, it has become a limiting factor for the cultivation of clusterbean crop. Therefore to point of this disease, chemical minimization in crop and environmental safety it becomes essential to evaluate available germplasm lines/varieties for seed yield along with the prevailing disease of the area. In view of this fact, thirty one lines/varieties were evaluated for *Sclerotium rolfsii* incidence which may be used as resistant donor in clusterbean breeding programme.

Material and Methods

Screening of genotypes

In this experiment, thirty one genotypes/varieties of clusterbean *viz*, RGC-936, RGC-197, RGC-1033, RGC-1003, RGC-1017, RGC-1055, RGC-1031, RGC-986, RGC-1066, GR-1, GR-2, GR-3, GR-4, GR-5, GR-6, GR-7, GR-8, GR-9, GR-10, GR-11, GR-12, GR-13, GR-14, GP-12, GP-13, GP-14, GP-15, GP- 16, GP-17, GP18, GP-19 were collected from Clusterbean Breeder, Agriculture Research Station, Durgapura and sown and sown in kharif 2018. The sand maize meal inoculum of *S.rolfsii* was applied to experimental field in sufficient quantity prior to sowing of clusterbean genotypes/varieties. Each genotype/varieties was sown in three rows of 5 m row length keeping 10 cm plant to plant distance. The disease incidence was recorded using 0-9 rating scale (Nene *et al*., 1981) [6]. The recommended packages of practices were followed to raise the crop:

Table 1: Rating scale Per cent disease incidence Category

Rating scale	Per cent disease incidence	Category
Highly resista 0-10 Highly resistant (HR) 0-10	0-10	Highly resistant (HR)
1	10.1-30	Resistant(R)
3	30.1-50	Moderatetly Resistant (MS)
5	50.1-70	Moderately susceptible
7	70.1-90	Susceptible
9	>90	Highly susceptible

Result and Discussion

Thirty one clusterbean genotypes were screened out against *Sclerotium rolfsii* under artificial inoculation conditions in field. The disease incidence was recorded by using 0 to 9 rating scale (Nene *et al*., 1981) [6]. Based on disease reactions, clusterbean genotypes were grouped into different categories *i.e.* highly resistant (HR), resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS). Two genotypes *viz.*GR-13 and GP-15 were highly resistant, nine genotypes/varieties *viz.*, GR-3, GR-5, GR-6, GR-7, GR-8, GR-10, RGC-1066, RGC-1055 and GP-17 were categorized as resistant. Another twelve genotypes/varieties *viz.*, GR-1, GR-2, GR-4, RGC-1033, GP-12, GP-13, GP-14, GP-16, GP-18, GP-19, GR-11 and GR-12 were moderately resistant, five genotypes/varieties were moderately susceptible *viz*., GR-9, GR-14, RGC- 1017, RGC-1031 and RGC-1003, two varieties RGC-936 and RGC-986 were susceptible, and remaining one genotype varieties was highly susceptible. Gupta *et al*. (2003) [4] ivastigated that out of 220 genotypesof clusterbean, 67 genotypes were resistant,69 genotyes were susceptible while 10 genotypes were highly susceptible to root rot caused by *Rhizoctontia bataticola.* Similar experiment was conducted by amule *et al.* (2014) [1] who screened out 88 chickpea genotypes against *Sclerotium rolfsii* causing stem rot of chickpea. Among 88 genotypes 13 genotypes found moderately resistant. Tanimu *et al.* (2018) [7] evaluated five varieties for resistance to Basal stem rot disease of cowpea and results revealed that three varieties were immune to infection by the pathogen while two varieties were susceptible.

Table 2: Evaluation of germplasms/varieties of clusterbean against *S. rolfsii* under *in vivo*

Genotype/Variety	Disease incidence (%)	Disease reaction	Genotype/Variety	Disease incidence (%)	Disease reaction
GR-1	48.27 (43.98)	MR	GP-14	38.46 (38.29)	MR
GR-2	42.51 (40.61)	MR	GP-15	6.89 (15.10)	HR
GR-3	13.79 (21.71)	R	GP-16	40.74 (39.61)	MR
GR-4	47.08 (43.31)	MR	GP-17	24.17 (29.32)	R
GR-5	29.25 (32.67)	R	GP-18	37.26 (37.55)	MR
GR-6	25.92 (30.45)	R	GP-19	34.48 (35.90)	MR
GR-7	17.24 (24.22)	R	RGC-1017	60.71 (51.17)	MS
GR-8	14.28 (22.06)	R	RGC-1055	17.24 (24.41)	R
GR-9	55.55 (48.24)	MS	RGC-1031	55.17 (47.95)	MS
GR-10	18.51 (25.45)	R	RGC-1003	64.00 (53.12)	MS
GR-11	37.93 (37.75)	MR	RGC-986	84.00 (66.47)	S
GR-12	44.82 (41.99)	MR	RGC-936	88.50 (70.53)	S
GR-13	3.57 (10.36)	HR	RGC-1066	15.47 (23.10)	R
GR-14	64.17 (53.24)	MS	RGC-1033	28.57 (32.25)	MR
GP-12	40.70 (39.62)	MR	RGC-197	92.85 (75.19)	HS
GP-13	46.15 (42.77)	MR			
S.Em±	2.59				
CD (P=0.05)	7.36				
CV (%)	11.26				

Table 2: Disease reaction of clusterbean germplasms/varieties

Per cent disease incidence	Disease Reaction	Genotype/Varieties
0-10	Highly Resistant	GR-13 and GP-15
10.1-30	Resistant	GR-3, GR-5, GR-6, GR-7, GR-8, GR-10, GP-17, RGC-1066 and RGC-1055
30.1-50	Moderately Resistant	GR-1, GR-2, GR-4, GR-11, GR-12, GP-12, GP-13, GP-14, GP-16, GP-18 GP-19 and RGC-1033.
50.1-70	Moderately Susceptible	GR-9, GR-14, RGC- 1017, RGC-1031 and RGC-1003
70.1-90	Susceptible	RGC-936 and RGC-986
>90	Highly Susceptible	RGC-197

Conclusion

The screening of some selected clusterbean genotypes/varieties for resistant performance against stem rot disease pathogen of clusterbean. Economic and environment safety point of view, use of resistant variety is a cheapest and best method of disease control. Although the selected germplasm/varieties of clusterbean were unable to completely inhibit the pathogen but they can be used in IDM practices to minimize the use of fungicides. The finding of the present investigation could be an important step towards the possibilities of using resistant in disease control.

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