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Vijaykumar KN
Ph.D. Scholar, Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Shripad Kulkarni
Professor of Plant Pathology, Nodal Officer (KVK), Directorate of Extension, University of Agricultural Sciences, Dharwad, Karnataka, India

Vijaykumar AG
Seed Production Officer, Seed unit, University of Agricultural Sciences, Dharwad, Karnataka, India

Channakeshava C
Ph.D. Scholar, Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Vijaykumar KN
Ph.D. Scholar, Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Field evaluation of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) genotypes against powdery mildew under natural epiphytotic conditions

Vijaykumar KN, Shripad Kulkarni, Vijaykumar AG and Channakeshava C

Abstract
Powdery mildew is an important foliar disease of cluster bean in Karnataka which results in huge economic loss. Disease first appears on the lower leaves at thirty days after sowing and continue to produce white mycelial growth on various aerial plant parts upto the harvest. Fungicides have been recommended for the control of the disease however, use of fungicides is expensive and not eco-friendly. The best approach to control the disease is by using resistant genotypes. Hence, in this study 41 genotypes were screened against powdery mildew disease under natural epiphytotic conditions in the field to identify the resistance source. The results revealed that none was found to be immune or resistant. However, two genotypes *viz.*, Samrat and Usm Deepti were found moderately susceptible and thirty seven genotypes were found susceptible. The remaining two genotypes *viz.*, Dhanshree and Naveen were found highly susceptible with maximum grade nine in (0-9) scale.

Keywords: *Leveillula taurica*, Pusa navbahar, moderately resistance, grade

Introduction
Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) is a versatile and multipurpose vegetable under exploited leguminous vegetable crop of arid and semi-arid regions of India belongs to the family Fabaceae. It is a drought tolerant, hardy, deep rooted, summer annual legume cultivated for its green pod, feed, fodder and manure. India produces about 80 per cent of the world cluster bean production with an area of 5.15 m ha and production of 2.46 mt with a productivity of 478 kg ha^{-1} (Anon., 2015). In Karnataka it is cultivated round the year in limited area in districts like Dharwad, Belagavi, Vijayapur, Haveri etc. for tender vegetable pods. The productivity of cluster bean has been very low because of its highly susceptible nature to the diseases. Among the foliar diseases, powdery mildew caused by *Leveillula taurica* is an important disease causing the yield loss upto 50-55 per cent (Channamma *et al*., 2015) [2, 3]. The studies carried on cluster bean are very few and as such there is no information related to powdery mildew disease and its resistant genotypes. Therefore, the present study is designed with the above objective.

Materials and Methods
Available cluster bean genotypes from private and public sector organizations were subjected for screening under field conditions during *rabi* 2017-18 at Main Agriculture Research Station, UAS Dharwad in augmented design with a plant spacing of 30 cm × 10 cm (row to row and plant to plant) to find out resistance source against powdery mildew under natural epiphytotic conditions. 41 genotypes were screened against the powdery mildew disease with Pusa navbahar as the susceptible check. All the recommended packages of practices including fertilizer management were adopted for raising the crop except disease management practices. The disease severity was recorded using 0-9 scale (Mayee and Datar, 1986) [4] by randomly selecting five plants and the maximum disease grade was recorded on each genotype at 80 days after sowing when the disease was severe. Based on their reaction, genotypes were categorized into immune (0%), resistant (< 1%), moderately resistant (1-10%), moderately susceptible (11-25%), susceptible (26-50%) and highly susceptible (>50%).

Disease scoring scale (Mayee and Datar, 1986) [4]

Grade	Disease	Description
0	No symptoms of powdery mildew on leaves.	Immune
1	Small powdery specks covering 1 per cent or less leaf area.	Resistant
3	Powdery lesions small (upto 5 mm in size) covering 1-10 per cent of leaf area.	Moderately Resistant
5	Powdery lesions enlarging 11-25 per cent of leaf area.	Moderately Susceptible
7	Powdery lesions coalesce to form big patches covering 26-50 per cent of leaf area.	Susceptible
9	Big powdery patches covering 51 per cent or more of leaf area and defoliation occurs.	Highly Susceptible

Results

Forty one genotypes were screened against *Leveillula taurica* under natural epiphytotic conditions in the field to identify the resistance source and results are presented in Table 1 and 2. The results of the present experimentation revealed that out of forty one genotypes screened, none was found to be immune or resistant. However, two genotypes *viz.,* Samrat and Usm Deepti were found to be moderately susceptible with five grade and thirty seven genotypes *viz.,* Sarpan Hybrid-101, Varsha, Neelam-61, Dharsha, Nylon-66, NCB-12 (Nandini), NS-662, Jawari, Dhara-5, Amrith-11, Sonal, Milan-51, Gaurishankar, HG-100 and Swati 222^{++} *etc.* were found to be susceptible with seven grade. The remaining two genotypes *viz.,* Dhanshree and Naveen were found to be highly susceptible with maximum nine grade.

Discussion

The management of the disease through host plants resistance has been the best choice in all the disease management programmes. Utilization of resistant cultivars in farming system is the most simple, effective and economical method in the management of disease. Besides this, these resistant cultivars conserve natural resources and reduce the cost, time and energy compared to the other methods of disease management.

The results are in line with Sharmila *et al*. (2005) and Channamma (2015) [2, 3] who mentioned that none of the genotypes in chilli and guar were immune or resistant against powdery mildew respectively.

Table 1: Reaction of cluster bean genotypes against powdery mildew caused by *Leveillula taurica*

Sl. No.	Genotypes	Source	Maximum grade observed (0-9 Scale)	Reaction
1	Sarpan Hybrid - 101	Sarpan Hybrid Seeds Co. Pvt. Ltd., Dharwad, Karnataka	7	S
2	Varsha	Rasi HyVeg (Pvt.) Ltd., Gurgoan, Haryana	7	S
3	Neelam-61	Gujarat Farm Seeds (Pvt.) Ltd., Anand, Gujarat	7	S
4	Samrat	Prabhakar Hybrid Seeds, Bangalore, Karnataka	5	MS
5	Dharsha	Somanath Crop Science India Pvt. Ltd., Bangalore, Karnataka	7	S
6	Usm Deepti	Unisem Agritech, Bangalore, Karnataka	5	MS
7	Nylon-66	Dhanvi Agri Genetics Pvt. Ltd., Hyderabad, Andhra Pradesh	7	S
8	Dhanshree	R. K. Seed Farms (Regd.), Azadpur, Delhi	9	HS
9	Naveen	Esha Agri Seeds Pvt. Ltd., Hyderabad, Andhra Pradesh	9	HS
10	NCB-12(Nandini)	Nirmal Seeds Pvt. Ltd., Jalgoan, Maharashtra	7	S
11	NS-662	Namdhari Seeds Pvt. Ltd., Ramnagar, Karnataka	7	S
12	Jawari	Ceres Agri Solutions, Hubballi, Karnataka	7	S
13	Dhara-51	Dhara Seeds, Vadodara, Gujarat	7	S
14	Amrith-11	Bharat Crop Sciences India Pvt. Ltd., Jodhpur, Rajasthan	7	S
15	Sonal	Bombay Super Hybrid Seeds Pvt. Ltd., Rajkot, Gujarat	7	S
16	Milan-51	Gujarat Seeds Company, Anand, Gujarat	7	S
17	Swati 222^{++}	Devkishanji Vaktaji and Sons, Himatnagar, Gujarat	7	S
18	Gourishankar	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
19	Maru Cluster bean	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
20	RGC 486	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
21	HG 2 – 20	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
22	GDM 1	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
23	RGC 1003	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
24	RGC 1033	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
25	RGC 1055	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
26	GG 2	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
27	HG 884	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
28	RGC 197	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
29	HG 258	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
30	HG 75	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
31	RGC 936	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
32	RGC 9031	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
33	GAUG 13	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
34	HG 182	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
35	RGC 1066	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
36	RGC 1038	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
37	RGC 471	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
38	RGC 1017	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
39	RGC 1002	AICRP for Dryland Agriculture RARS, Vijayapura	7	S

40	HG 100	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
41	HG 365	AICRP for Dryland Agriculture RARS, Vijayapura	7	S
42	Pusa Navbahar (Standard Check)	Gajanan seeds, Dharwad, Karnataka	9	HS

Table 2: Grouping of cluster bean genotypes based on reaction against powdery mildew caused by *Leveillula taurica*

Grade	Reaction	Genotypes	No. of Genotypes
0	I	-	0
1	R	-	0
3	MR	-	0
5	MS	Usm Deepti, Samrat	2
7	S	Sarpan Hybrid-101, Varsha, Neelam-61, Dharsha, Nylon-66, NCB-12 (Nandini), NS-662, Jawari, Dhara-51, Amrith-11, Sonal, Milan-51, Swati 222$^{++,}$ Gourishankar, Maru Cluster bean, RGC 486, HG 2 – 20, GDM 1, RGC 1003, RGC 1033, RGC 1055, GG 2, HG 884, RGC 197, HG 258, HG 75, RGC 936, RGC 9031, GAUG 13, HG 182, RGC 1066, RGC 1038, RGC 471, RGC 1017, RGC 1002, HG 100 and HG 365	37
9	HS	Dhanshree, Naveen	2

Conclusion

The results of screening of cluster bean genotypes against powdery mildew which reveal that, out of forty one genotypes screened under natural epiphytotic condition, none of them were either found immune or resistant. Only two genotypes found to be moderately susceptible and thirty seven genotypes were found to be susceptible. Genotypes such as Dhanshree and Naveen depicted highly susceptible reaction. merit. Similarly length at 95 DAS, number of nodes at 95 DAS, number of branches at 45 DAS were the good general combiners.

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