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Evaluation of germplasm lines against pod blight complex disease of soybean *Glycine max* (L.) Merrill under epiphytotic conditions

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Abstract
Soybean (Glycine max (L.) Merill) is one of the most important oilseed - cum leguminous crop gaining importance during recent years due to its short duration, drought resistance, high yielding ability and nutritive value. It is the world's foremost provider of protein and oil. In Karnataka, the area production and productivity of soybean were 0.27 m ha, 0.17 mt and 639 kg/ha, respectively (Anonymous, 2018). Soybean growing major states in the country are Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, etc. Among the fungal diseases infecting soybean crop, pod blight caused by *Colletotrichum truncatum* (Schew.) Andus and Moore, *Colletotrichum gloeosporoides* (Penz.) Penz. and Sac. and *Rhizoctonia bataticola* (Taub.) Butler is one of the most important and destructive disease. The experiment on screening of available genotypes has taken under natural epiphytotic condition at Ugarkhurdh, Belagavi during *kharif* of 2016 and 2017. Out of 235 entries None of them were immune or absolutely resistant, 6 genotypes *viz.,* JS 97-52, AMS MBS-18, NRC 127, SL 1104, DSb 28-3 and DSb 30-2 showed resistant reaction to pod blight, most of the entries like PS 1347, RSC 10-46, SL 1074, DSb 32 and NRC 86 were moderately resistant and MACS 1520, PS 1569, RUS 2002-4 and RUS 2008-24 are moderately susceptible in reaction. Genotypes like Pusa 97-12, Shivalik, JS 335 and KDS 1045 were showed susceptible reaction and genotypes like KDS 869, KDS 921, KDS 980 and JS 93-05 are highly susceptible to disease.

Keywords: Soybean, genotypes, *Colletotrichum, Rhizoctonia,* resistant

Introduction

Soybean *Glycine max* (L.) Merill is a native of eastern Asia popularly known as Chinese pea or Manchurian bean. Further it is also referred to as Golden bean or Miracle bean and wonder crop of the 20th century because of its characters and usage (Sinclair and Backman, 1989) [8]. It has great potential as an exceptionally nutritive and very rich protein food. It can supply the much needed protein to human diets, because it contains more than forty per cent protein of superior quality and all the essential amino acids particularly glycine, tryptophan and lysine, similar to cow's milk and animal proteins. As soybean, acreage has increased throughout the world, so the pathogens attacking the crop have increased in number and severity (Gupta and Paul, 2002) [3]. Since soybean is highly protein rich (40%) and having good oil percentage (20%) these pathogens becoming major constraint in soybean production both in terms of yield, protein and oil percentage (Rathore, 2005) [6].

The climatic conditions and seasonal differences in tropics vary mainly due to rainfall patterns which affect the distribution and importance of diseases. Yield losses for some diseases range from relatively minor to potentially devastating (Sinclair, 1993) [10]. The world loss of more than seven million tons of soybean is reported due to diseases alone (Sinclair, 1974) [9]. In India, losses due to various diseases are estimated as 12% of total production. It is cultivated over an area of 0.27 million hectare with a production of 0.17 million tonnes and productivity of about 639 kg/ha in Karnataka (Anonymous, 2018) [1]. The state productivity (639 kg/ha) and national productivity (803 kg/ha) are low in comparison with world average (2735 kg/ha). The major soybean growing states in the country are Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, etc. the host plant resistance is paramount because of its eco-friendly nature and cost effectiveness and one of the easiest and cheapest methods to manage the disease is to select the resistant genotypes against pod blight disease complex.

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Materials and Methods

The experiment was undertaken during *kharif* 2016 and 2017 at Ugar Research and Development Unit, Ugarkhurdh, Belagavi. The available sources of resistance were used for this study i.e. yield trial material, rust resistance germplasm lines and multiple disease resistance entries were screened to identify the source of resistance to pod blight disease complex under natural field epiphytotic conditions. The trials were conducted in RBD with plot size of 4 m X 1.4 m (each entry). All the package of practices was carried under unprotected conditions for diseases.

The severity of pod blight was recorded using a disease rating scale 0 to 9 given by Mayee and Datar (1986) [4].

The severity of pod blight was recorded using a disease rating scale 0 to 9

Category	Reactions	Description
0	Immune	No of lesions / discolouration
1	Resistant	1% area covered with lesions /spots/discolouration
3	Moderately resistant	1.1-10% area covered with lesions /spots/discolouration
5	Moderately susceptible	10.1-25% area covered with lesions/spots/discolouration
7	Susceptible	25.1-50% area covered with lesions/spots/discolouration
9	Highly susceptible	>50% area covered with lesions /spots/discolouration

Per cent disease index/severity was calculated by using formula.

$$\text{Per cent Disease Index} = \frac{\text{Summation of numerical ratings}}{\text{No. of pods observed X Max. disease rating}} \times 100$$

Results and Discussion

One thirty eight genotypes from different sources were screened for pod blight disease complex in soybean at Ugar Research and Development Unit, Ugarkhurdh, Belagavi, during the year *kharif* 2016 and 2017 respectively under natural field ephiphytotic conditions. The results revealed that, out of 138 sources of resistance evaluated none of the entries showed absolute resistant six genotypes *viz.,* JS 97-52, AMS MBS-18, NRC 127, SL 1104, DSb 28-3 and DSb 30-2 showed resistant reaction to pod blight disease in soybean (Table 2). Entries like JS 97-52, EC 241780, EC 241778, DSb 23-2, EC 391336 and EC 379152 showed moderately resistant reaction. The genotypes like VLS 63, VLS 89, SL 688, DSb 21, JS 20-116, PS1572, RUS 2008-24, RUS 2008-8 and GP 268 were moderately susceptible and entries like JS 335, JS 93-05, RAUS 5, KDS 1045, KDS 753, KDS 726, KDS 780 and EC 242104 are susceptible in reaction to pod blight disease, where, the genotypes *viz.,* KDS 869, KDS 921, KDS 980, JS 93-05, Punjab 1, Bragg, RUS 2007-6, RUS 2010-1 and SL 10-28 was highly susceptible to pod blight complex during the seasons of *kharif* 2016 and 2017 respectively.

Similar observations were obtained by Chavan *et al.,* (2018) [2] screened 40 genotypes against pod blight disease of soybean among them MACS series *viz.*, 1201, 1336, 1039 and 1140 showed moderately resistant reaction, JS335 is susceptible and genotype Bragg showed highly susceptible reaction to the disease. The results obtained by Sajeesh *et al.,* (2014) [7] and Pancheshwar *et al.,* (2016) [5] reported that JS 97-52 and JS 97-60 exhibited moderately resistant reaction to pod blight, JS 335 showed susceptible reaction. Whereas, DSb 21 is moderately susceptible and JS 93-05 is showed susceptible reaction to pod blight disease in soybean.

In conclusion, pod blight of soybean is caused by one or association of various pathogens. Hence the effort was made to identify the resistance source for all the pathogens under natural field epiphytotic conditions by evaluating the various available genotypes of soybean i.e. yield trial material, rust resistance germplasm lines and multiple disease resistance entries. These sources can be further utilized in contemporary resistant breeding programmes against pod blight of soybean in future.

Table 1: Reaction of genotypes to pod blight complex disease of soybean during *Kharif* - 2016 under Ugarkhurdh, Belagavi

Sl. No	Grade	Reaction	No. of entries	Name of the entries
1	0	I	0	-
2	1	R	0	-
3	3	MR	25	JS 97-52, SL 525, PS 1569, JS 20-94, JS 20-98, RKS 18, EC 3251, EC 241780, EC 241778, DSb 23-2, EC 391336, EC 379152, EC 291398, EC 308287, EC 383165, M 204, MACS 58, P 1210178, P 1259539, EC 100027, EC 10332, EC 14458, EC 14476, EC 241656 and EC 242086
4	5	MS	37	VLS 58, VLS 59, VLS 63, SL 688, DSb 21, NRC 77, VLS 89, JS 20-116, NRC 117, RS 2010-1, PS 1572, SL 1074, MACS 1460, RSC 10-46, KDS 753, KDS 869, RUS 2007-6, , RUS 2008-24, JS 20-96, RUS 2008-4, RUS 2008-8, EC 242104, GP 268, AGR 166, AGS 2, AGS 95, B 254, EC 107416, EC 245988, EC 280149, EC 333879, EC 34057, EC 39177, EC 457286, EC 467282, EC 615160 and EC 7048
5	7	S	05	JS 93-05, RAUS 5, PS 1042, JS 335 and PS 1347
6	9	HS	02	Punjab-1 and Bragg

Table 2: Reaction of genotypes to pod blight complex disease of soybean during *Kharif* - 2017 under Ugarkhurdh, Belagavi

Sl. No	Grade	Reaction	No. of entries	Name of the entries
1	0	I	0	-
2	1	R	05	AMS MBS-18, NRC 127, SL 1104, DSb 28-3 and DSb 30-2
3	3	MR	20	JS 95-60, JS 97-52, SL 958, PS 1092, VLS 58, VLS 59, PS 1347, RSC 10-46, SL 1074, DSb 32, NRC 86, NRC 126, RUS 2009-9, JS 20-34, EC 379152, EC 241780, EC 241778, JS 20-08, DSb 23-2 and EC 391336
4	5	MS	27	NRC 37, DSb 21, SL 688, JS 75-46, JS 72-44, RSC 10-52, RSC 10-70, RSC 10-71, JS 20-116, JS 95-46, VLS 63, VLS 89, DSb 21, RKS 18, PS 1556, PS1572, DS 3105, DS 3106, MACS 1520, NRC 125, PS 1569, RUS 2002-4,

				RUS 2008-24, RUS 2008-8, GP 268, DSb 31 and EC 3551
5	7	S	08	Pusa 97-12, Shivalik, JS 335, KDS 1045, KDS 753, KDS 726, KDS 780 and EC 242104
6	9	HS	09	KDS 869, KDS 921, KDS 980, JS 93-05, Punjab 1, Bragg, RUS 2007-6, RUS 2010-1 and SL 10-28

Table 3: The genotypes showed similar reaction against pod blight disease complex of soybean during *kharif* 2016 and 2017at Ugarkhurdh, Belagavi

Sl. No	Grade	Reaction	No. of entries	Name of the entries
1	0	I	0	-
2	1	R	1	-
3	3	MR	6	JS 97-52, EC 241780, EC 241778, DSb 23-2, EC 391336 and EC 379152
4	5	MS	09	VLS 63, VLS 89, SL 688, DSb 21, JS 20-116, PS1572, RUS 2008-24, RUS 2008-8 and GP 268
5	7	S	01	JS 335
6	9	HS	02	Punjab 1 and Bragg

Fig 1: Disease scoring scale (0 – 9) for pod blight disease of soybean

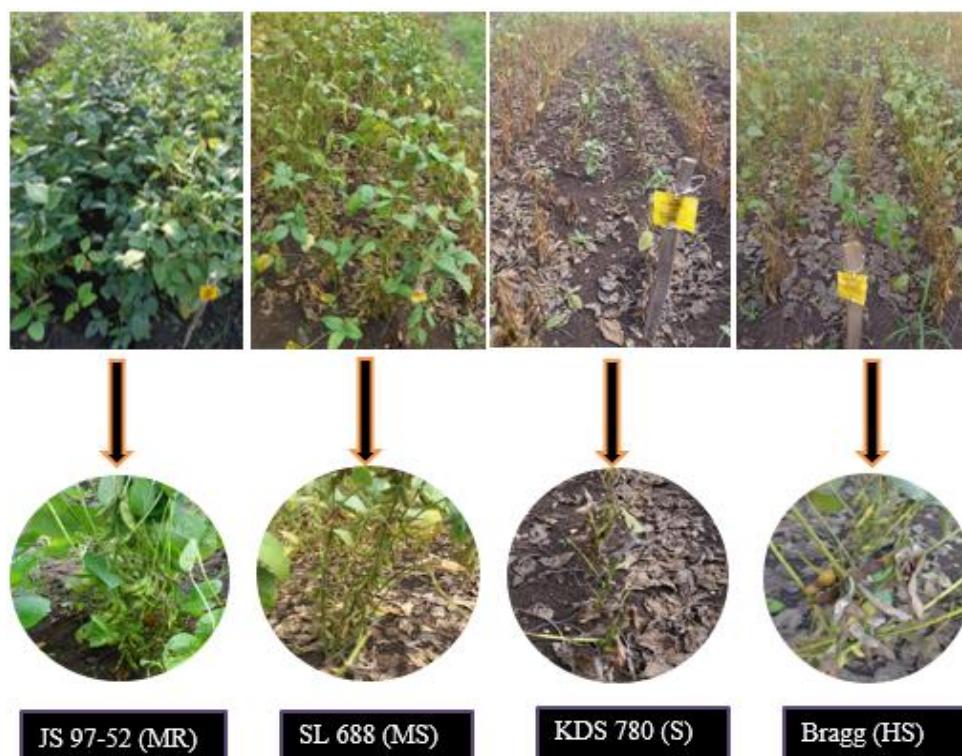**Fig 2:** An overview of screening field at Ugarkhurdh, Belagavi during Kharif 2016 and 2017 respectively

JS 97-52 (MR)   SL 688 (MS)   KDS 780 (S)   Bragg (HS)

Fig 3: Reaction of genotypes to pod blight disease

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