

## EVALUATION OF SOYBEAN CULTIVARS FOR RESISTANCE TO ALTERNARIA LEAF SPOT CAUSED BY *ALTERNARIA ALTERNATA*

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**Abstract:** The present study was undertaken to study Biology and Management of *Alternaria* leaf spot of soybean caused by *Alternaria alternata*, as the disease is quite destructive in all the soybean growing areas. The field experiment was conducted two consecutive years *Khari* season 2018 and 2019 at Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur. Ten cultivars of soybean were screened for these diseases under artificial inoculated field conditions and results revealed that 3 cultivars namely (JS-9305, JS-9752 and RVS 2002-04) exhibited moderately resistant (MR) reaction, while 5 cultivars viz. JS-2029, RKS-18, RKS-113, JS-9560 and RKS-45 exhibited moderately susceptible (MR) reaction. Rest of cultivars viz. RKS-24 and JS-335 showed susceptible (S) reaction.

**Keywords:** *Alternaria* leaf spot, Cultivars, Resistance, Soybean

### INTRODUCTION

Soybean (*Glycine max* L.) is a member to family Leguminosae and sub-family Papilionaceae. It is an important oil seed crop grown in several developed countries like USA, China, Brazil, Mexico, Russian federation and India. Soybean has originated from China during 2800 BC, containing about 43.2 per cent protein, 20.9 per cent oil, 19.5 per cent fat, 3.7 per cent fibre and small amount of vitamin B complex and vitamin E (Singh, 2010). In India, it ranks third after groundnut and rapeseed-mustard in vegetable oil economy and is cultivated on 10.47 million hectares with total production of 1.07 million tonnes and average yield 1207 kg/hac. In Rajasthan it is mainly grown in Jhalawar, Chittorgarh, Kota, Bundi, Baran, Banswara, Pratapgarh, Udaipur and Bhilwara districts, covering an area of 0.89 million hectares with production of 1.07 million tonnes and average yield 1049 kg/hac. (Anonymous, 2017-18).

The area under soybean is consistently increasing every year in Rajasthan. However due to continuous monocropping, same variety use, seed material exchanges becoming routine and found contributing for increasing severity of foliar diseases of soybean and yield losses year after year. Among the foliar diseases of soybean, *Alternaria* leaf spot is distributed throughout the soybean growing areas of India but it is of special significance in Madhya Pradesh, Maharashtra, Rajasthan and Delhi (Gupta and Chauhan, 2005). Members of genus *Alternaria* are cosmopolitan in nature and important fungal pathogen which mostly cause diseases on aerial parts of many plants worldwide. The members of this genus like *A. alternata*, *A. solani*, *A. porri*, *A. helianthi*, *A. duaci*, *A. carthami*, *A. tenuissima* and *A. macrospora* causes different diseases in their respective hosts (Rostem, 1994). All the aerial parts

of the soybean plant are susceptible to *Alternaria spp.* which reduces the quality and quantity of seed yield. In present situation cultivated soybean varieties by the farmers are susceptible to the diseases. The diseases can be managed successfully by using chemical sprays but to avoid ecological pollution and to reduce the input cost use of resistant varieties against these diseases is of prime importance to overcome these losses. Use of resistant cultivar of crop plays an important role in combating the losses caused by diseases as it is eco-friendly, easy and cost-effective disease management strategy. A genotype with disease resistance and high yield potential offered scope in breeding programme to evolve multiple tolerance genotypes combined with good yield. Keeping in view the importance of crop, disease and considering scope of resistant varieties in IDM technology, the present study was conducted to screen the soybean advance lines against *Alternaria* leaf spot diseases with high yield superiority for the identification of resistant sources in available cultivars.

### MATERIALS AND METHODS

**Soybean cultivar seed-** The ten cultivars/varieties of soybean received from All India Coordinated Research Project on Soybean, Agriculture Research Station, Kota (Agriculture University, Kota) were screened against the most virulent isolate *A. alternata* ( $1 \times 10^3$  conidia ml<sup>-1</sup>) found in pathogenic potential studies were used.

**Screening of cultivars/varieties-** Under artificial inoculated field conditions, 10 cultivars/varieties were evaluated at the field of Department of Plant Pathology, Rajasthan College of Agriculture, Udaipur. Seeds were sown in rows each of 3 m length and maintaining row to row and plant to plant distance as 30 x 5 cm, with three replications in

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Randomized Block Design (RBD). Observations on disease rating were recorded two times first at pre-flowering stage and second at maturity stage, when the crop was 45 days old and the expression of disease was clear, using a standard (0-5 disease

rating scale). Observations for percent disease index were recorded by visual scoring as per the standard disease rating 0-5 scale (Sangeetha and Siddaramaiah, 2007).

#### Standard disease rating scale

Scale	Description of the symptom
1.	Small irregular spots covering <5% leaf area.
2.	Small irregular brown spots with concentric rings covering 5.1-10% leaf area.
3.	Lesions enlarge, irregular brown with concentric rings covering 10.1-25% leaf area.
4.	Lesions coalesce to form irregular and appears as a typical leaf spotting symptoms covering 25.1-50% leaf area.
5.	Lesions coalesce to form irregular and appears as a typical leaf spotting symptoms covering >50% leaf area.

The above rating scales or grades are utilized for the calculation of PDI using the following formula - The average intensity of each plot was worked out by using formula

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of all individual disease rating}}{\text{Total no. of plants ass.} \times \text{maximum rating}} \times 100$$

The disease reaction was qualitatively expressed as resistant (score 1), moderately resistant (score 2), moderately susceptible (score 3), susceptible (score 4) and highly susceptible (score 5).

## RESULTS AND DISCUSSION

Host plant Resistance is one of the best effective tools to get rid of the diseases. Utilization and proper screening of resistant sources is most important. To find out the stable sources of resistance against *Alternaria* leaf spot in soybean ten released varieties (RKS-113, RKS-18, JS-9752, JS-9560, JS-9305, RKS-24, JS-2029, JS-335, RVS-2002-04 and RKS-45) were screened under artificial epiphytotic conditions during both the years *i.e.* Kharif 2018 and 2019. The experiments were conducted in single row plot 3 m row length with plant to plant distance 5 cm, three replications using RBD (Table-1).

Data shows that, including 10 varieties of soybean, JS-9305 exhibited lowest disease in both the observation *i.e.* at pre flowering and maturity stage with PDI 14.2 and 16.7%, respectively. This was followed by JS-9752, which showed PDI 15.6 and 18.4% respectively at both the stages. RVS 2002-04 and JS-2029 showed PDI 16.8 and 30.0%, respectively at pre flowering and 17.9 & 32.2 per cent disease index at maturity stage. Rest of the

entries *viz.* RKS-18, RKS-113, JS-9560, RKS-45, JS-335 and RKS-24 showed the disease intensity in the range of PDI 33.1 to 61.6, at pre flowering and in the range of 35.2 to 63.4 per cent disease index, at maturity stage in the year 2018 (Table 1 and Fig 1). The similar results were also reported by Mahesha *et al.* (2009) evaluated 204 genotypes under natural and laboratory conditions against major disease and reported several genotypes having multiple resistance sources.

In the year 2019, Data shows that JS-9305 exhibited lowest disease in both the observation *i.e.* at pre flowering and maturity stage with PDI 16.3 and 19.6%, respectively. This was followed by JS-9752, which showed PDI 18.2 and 21.7% respectively at both the stage. RVS 2002-04 and JS-2029 showed PDI 18.7 and 32.6%, respectively at pre flowering and 20.8 & 34.8 per cent disease index at maturity stage. Rest of the entries *viz.* RKS-18, RKS-113, JS-9560, RKS-45, JS-335 and RKS-24 showed the disease intensity in the range of PDI 35.5 to 63.3, at pre flowering and in the range of 38.5 to 65.8 per cent disease index, at maturity stage (Table 1 and Fig 1). The similar results were also reported by Dhurwey (2015) screened 30 soybean varieties against *Alternaria* leaf spot and reported that the incidence of *Alternaria* leaf spot ranged from 3.0 to 18.0 per cent in cultivar Bragg and Shivalik, higher incidence of *Alternaria* leaf spot was recorded in cultivars NRC 12, NRC 37, MAUS 61, MAUS 71, VLS 47 from 13.0 to 17.0%.

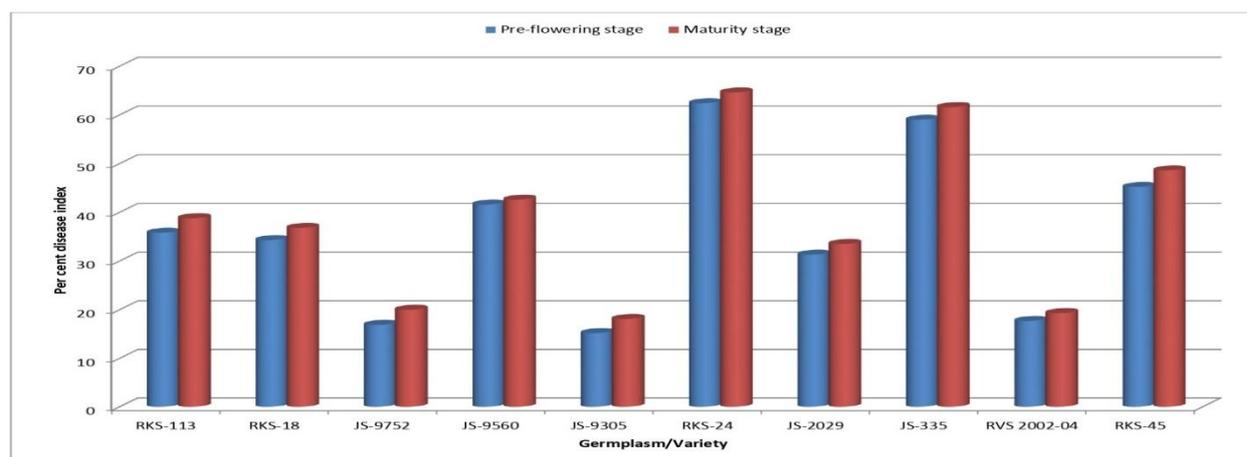
None of the tested varieties showed immune reaction, however three varieties namely (JS-9305, JS-9752 and RVS 2002-04) exhibited moderately resistant (MR) while five varieties (JS-2029, RKS-18, RKS-113, JS-9560 and RKS-45) showed moderately susceptible. Rest others were categorized as susceptible to highly susceptible.

S. No.	Category based on PDI	variety
1.	Absolutely Resistant	NIL
2.	Resistant	NIL
3.	Moderately resistant	JS-9305, JS-9752 and RVS 2002-04
4.	Moderately susceptible	JS-2029, RKS-18, RKS-113, JS-9560 and RKS-45
5.	Susceptible	RKS-24 and JS-335
6.	Highly susceptible	NIL

**Table 1.** Screening of soybean cultivars against *Alternaria* leaf spot under inoculation of *A. alternata* Kharif 2018 and 2019

S. No.	Germplasm/Variety	Pre- flowering stage Per cent Disease Index (PDI)			Maturity stage Percent Disease Index (PDI)			Disease Reaction
		2018	2019	Pooled	2018	2019	Pooled	
1.	RKS-113	34.2 (35.7)	37.4 (37.6)	35.8 (36.7)	37.5 (37.7)	40.2 (39.3)	38.8 (38.5)	MS
2.	RKS-18	33.1 (35.1)	35.5 (36.5)	34.3 (35.8)	35.2 (36.3)	38.5 (38.3)	36.8 (37.3)	MS
3.	JS-9752	15.6 (23.2)	18.2 (25.2)	16.9 (24.2)	18.4 (25.4)	21.7 (27.7)	20.0 (26.5)	MR
4.	JS-9560	40.8 (39.7)	42.4 (40.6)	41.6 (40.1)	41.3 (39.9)	43.9 (41.5)	42.6 (40.7)	MS
5.	JS-9305	14.2 (22.1)	16.3 (23.8)	15.2 (22.9)	16.7 (24.1)	19.6 (26.2)	18.1 (25.2)	MR
6.	RKS-24	61.6 (51.7)	63.3 (52.7)	62.4 (52.2)	63.4 (52.7)	65.8 (54.2)	64.6 (53.5)	S
7.	JS-2029	30.0 (33.2)	32.6 (34.8)	31.3 (34.0)	32.2 (34.5)	34.8 (36.1)	33.5 (35.3)	MS
8.	JS-335	58.4 (49.8)	59.6 (50.8)	59.0 (50.1)	60.7 (51.8)	62.5 (52.2)	61.6 (51.7)	S
9.	RVS 2002-04	16.8 (24.2)	18.7 (25.6)	17.7 (24.9)	17.9 (25.0)	20.8 (27.1)	19.3 (26.08)	MR
10.	RKS-45	44.2 (41.6)	46.3 (42.8)	45.2 (42.2)	47.2 (43.3)	50.0 (45.0)	48.6 (44.2)	MS
	SEm±	1.42	1.49	0.89	1.77	1.62	1.05	
	CD at 5%	4.22	4.43	2.55	5.27	4.97	3.03	
	CV%	7.06	6.98	7.02	8.30	7.29	7.78	

**Category based on PDI:** - 0 = Free from disease (I= Immune), 1 = 1 to 10 PDI (R= Resistant), 2 = 10.1 to 25 PDI (MR=Moderately resistant), 3 = 25.1 to 50 PDI (MS= moderately susceptible), 4 = 50.1 to 75 PDI (S = Susceptible), 5 = >75 PDI (HS= Highly susceptible)



**Fig. 1.** Screening of soybean cultivars against *Alternaria* leaf spot under inoculation of *A. alternata* during Kharif 2018 and 2019 (Pooled)

The work on identification of multiple disease resistance sources in cultivable and wild soybean has been undertaken many workers like Anonymous (2016), Ingle *et al.* (2016). In current investigation, entries showed varied reaction ranging from HR to S. This might be due to the availability of inoculum or differential interactions of host genotypes with different varieties. Zade *et al.* (2018) evaluated 33 advance lines under natural field conditions against *Alternaria* leaf spot and reported 12 genotype exhibited Highly Resistant (HR) reaction, While 14 genotype shown Moderately Resistant (MR) reaction and 4 genotype exhibited Moderately Susceptible (MS) reaction. Rest of genotype showed Susceptible (S) reaction.

In the present study, varieties *viz.*, JS-9305, JS-9752 and RVS 2002-04 which have shown maximum resistance against the *Alternaria* leaf spot. Thus, these resistant sources of soybean varieties may have scope in future for breeding in development of varieties or in integrated disease management programme.

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