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Survey of Rhizoctonia Aerial Blight of Soybean in Khandwa District of Madhya Pradesh

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Abstract

A wandering survey to assess the incidence of Rhizoctonia aerial blight of soybean in Khandwa district was undertaken. The incidence of disease was observed between the range of 9 to 12 percent indicating an alarming situation of Rhizoctonia aerial blight in the vicinity of Khandwa district. Among the five villages Titiya Joshi, Jaswadi, Lohari, Bediya and Singot, the maximum disease incidence was 12 percent in Singot and the findings shows that the disease incidence favours to irrigated black soil whereas red and light black soil shows lower incidence of disease. Out of five isolates, four isolates were same in colony colour and growth pattern having black and appressed. The pattern of three isolates were dense and two isolates having sparse and colour and thickness of all isolates having same, brown and thick. On the basis of their size two isolates were large, one isolate is medium and two were small. On the basis of their pattern three isolates were dense and two isolates having sparse.

Key words : *Soybean, aerial blight, rhizoctonia.*

Introduction

Soybean (*Glycine max* L.) is an important oilseed crop of India as well as in MP. It is considered as one of the main oilseeds crop all over the world. It is a native of North China, Asia belongs to family fabaceae. It is a multipurpose and absorbing crop with immeasurable potential of not only improving agriculture but also sustaining industries (1). Soybean (*Glycine max* L.) has an important place in world's oilseed cultivation circumstances, due to its high productivity, profitability and vital contribution towards maintaining soil fertility. It contains 40-42% protein and 20-22% edible oil on dry weight basis. As well, it contains high level of amino acids such as lysine, leucine, lecithin and huge quantity of phosphorus. Currently, it is being used for manufacture of nutritional product for human being. Soybean is used for preparation of milk, curd, cheese etc. and can be afforded by lower class of people also. It has capability to fix atmospheric nitrogen, with the help of Rhizobium and enhanced soil fertility (2). In India, it is cultivated in 11.07 mh with an annual production of 12.49 mt and productivity 1127 kg/ha. In Madhya Pradesh, Soybean is cultivated on 6.1 mh with annual production of 6.4 mt and productivity of 1147 kg/ha in 2017 (3).

The crop is also affected by many diseases such as yellow mosaic disease (Mungbean yellow mosaic virus), charcoal rot (*Rhizoctonia bataticola)*, collar rot (*Sclerotium rolfsii*), Rhizoctonia root rot and Rhizoctonia aerial blight caused by *Rhizoctonia solani*. Rhizoctonia aerial blight is also known as Rhizoctonia foliar blight. Rhizoctonia foliar blight has been reported to cause epiphytotics in soybean throughout the world (4,5,6). In M.P. the disease is gaining importance as the disease is appearing every year in severe form. During Kharif 2016, this disease appeared in severe form on some of genotypes of soybean at Khandwa causing considerable losses (7).

Materials and Methods

Survey : Survey was conducted in five major soybean growing villages of Khandwa District to find out the incidence of Rhizoctonia aerial blight. For such survey five villages were randomly selected and fields were also randomly selected. The Rhizoctonia aerial blight incidence was recorded at different stages of the crop. In each selected field the disease incidence was recorded on four randomly selected patches of 1 m^2. The mean disease severity of all the four patches of the field represents the incidence of the field. The mean of all the fields of the village represented the severity of the village.

Cultural and morphological characteristics : The cultures of *Rhizoctonia solani* were purified by subculturing the single hyphal tip method and maintained by mass transfer on potato dextrose agar medium at room temperature. After purification these isolates of *Rhizoctonia solani* were identified by observing the colony against light. The dot like *sclerotia visible* with the naked eyes and later confirmed with the help of microscope. The *sclerotia morphology* and growth-patterns of isolates were studied. The isolates were grown on potato dextrose agar medium and maintained at room temperature for further

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Table-1 : Incidence of Rhizoctonia aerial blight on farmers fields in Khandwa district.

Location	Symbol	Farmer Name	D.I.	Average D.I.	Soil Type	Irrigated
Jaswadi	S_1	Ramesh Gurjar	9	9.66	Black soil	Irrigated
	S_2	Rammohan	8		Light black soil	Irrigated
	S_3	Madan Lal	12		Black soil	Irrigated
Titiya Joshi	S_4	Sitaram	8	9.33	Red soil	Irrigated
	S_5	Dinesh Singh	10		Black soil	Irrigated
	S_6	Pramod Kumar	10		Light Black soil	Irrigated
Bediya	S_7	Ravi Yadav	10	9.33	Light Black soil	Irrigated
	S_8	Surendra Babu	9		Red soil	Irrigated
	S_9	Ramlal	9		Black soil	Irrigated
Lohari	S_{10}	Mohan	8	9.00	Red soil	Irrigated
	S_{11}	Mukesh Jadav	10		Light Black soil	Irrigated
	S_{12}	Rajesh Singh	9		Light Black soil	Irrigated
Singot	S_{13}	Bhagwandas	12	12	Black soil	Irrigated
	S_{14}	Vivek Gurjar	13		Black soil	Irrigated
	S_{15}	Narayan	11		Black soil	Irrigated
Avarage				9.86		
Range				9-12		

Table-2 : Colony characters of various isolates of *R. solani* on Potato dextrose agar media after 7 days of inoculation.

S.No.	Location	Colony colour	Growth pattern
1.	Jaswadi	Black	Appressed
2.	Titya Joshi	Light black	Floccose
3.	Bediya	Black	Appressed
4.	Lohari	Black	Appressed
5.	Singot	Black	Appressed

study. The slides of various isolates were prepared in lectophenol. For morphological studies observations of sclerotia were taken under low power (10x 10x) microscopic field of each isolates and number of observations of mycelium width were also taken from each slide under high power (10x 45x). The difference in colony colour, growth-pattern and density of sclerotia per microscopic field were observed. Growth and sclerotial formation were observed on media potato dextrose agar medium. These isolates were categorized in various groups according to growth rate: slow, medium and fast; colour: light black and dark black and colony pattern: fluccose, appressed and cottony.

Results and Discussion

Survey of disease incidence : Survey on farmer's field was conducted in different locations of Khandwa district to trace disease incidence of Rhizoctonia aerial blight of soybean during 2017-18. The data presented in Table-1 indicate the incidence of Rhizoctonia aerial blight. The spread of the disease was found in almost all the fields.

The data showed that maximum average disease incidence was observed in the village Singot (12.00%) followed by Jaswadi (9.66%) Titiya Joshi (9.33%) and Bediya (9.33%) whereas minimum average disease incidence was observed in Village Lohari (9.00%). The disease incidence ranged between 9-12% with an average of 9.86%.The data also shows that the maximum disease incidence favors to irrigated black soil whereas red and light black soil shows lower incidence of disease.

Cultural and morphological characteristics : Significant variations were observed in the cultural and morphological parameters among different isolates of *R. solani* collected from different major soybean growing areas of Khandwa district.

Colony characters of the isolates of *R. solani* were studied on potato dextrose agar, Observations were taken on the 7th day after inoculation on the colony colour and growth pattern. On the basis of colony colour the isolates were categorized in to whitish, smoky, light black and black. Thus considerable variations in the colony colour on potato dextrose agar medium was observed. Out of these five isolates, four isolates were same in colony colour and growth pattern having black and appressed respectively. Only one isolates having light black colony and floccose growth pattern.

All the isolates were cultured on potato dextrose agar media in petriplates. Microscopic observations were made by measuring size of sclerotia (length x width), pattern, shape and colour of sclerotia; width, pattern and colour of hyphae. Measurement of 100 sclerotia were made. The averages, width, pattern, colour, thickness of hyphae, size, pattern shape and colour of sclerotia are presented in (Table-3).

The morphological characters studied the width of hyphae closer to sclerotia and the hyphae away from

Table-3 : Morphological characteristics of various isolates of *R. solani* on Potato dextrose agar media according to hyphae.

S. No.	Hyphae				
	Width closer to sclerotia	Width away to sclerotia	Pattern	Colour	Thickness
1.	10.20	3.90	Dense	Brown	Thick
2.	7.80	3.60	Dense	Brown	Thick
3.	8.70	4.50	Dense	Brown	Thick
4.	7.50	3.60	Sparse	Brown	Thick
5.	7.50	3.90	Sparse	Brown	Thick

Table-4 : Morphological characteristics of various isolates of *R. solani* on Potato dextrose agar media according to Sclerotia.

S. No.	Sclerotia				
	Length x width	Size	Pattern	Shape	Colour
1.	130.37 x 89.30	Large	Dense	Irregular	Black
2.	144.55 x 106.31	Large	Dense	Irregular	Black
3.	113.41 x 94.57	Small	Dense	Irregular	Black
4.	120.47 x 92.75	Medium	Sparse	Irregular	Black
5.	113.96 x 89.09	Small	Sparse	Irregular	Black

sclerotia, pattern and colour of hyphae. On the basis of observations of hyphae closer to sclerotia the isolates were classified in to three categories *viz.,* very thin (below 5.59 µm), thin (5.60-7.59 µm) and thick (above 7.60µm). The hyphal patterns were studied and categorized in to sparse, dense and very dense. Colour of the hyphae were also taken in to consideration for observations and were categorized in to dark brown, brown and hyaline to light brown.

The morphological characters studied the width of hyphae closer to sclerotia and the hyphae away from sclerotia, pattern and colour of hyphae. the range of width of hyphae closer to sclerotia and the hyphae away from sclerotia is 7.50 to10.20 and 3.60 to 4.50, respectively. The pattern of three isolates were dense and two isolates having sparse. The colour and thickness of all isolates having same, brown and thick.

The other morphological characters studied the size, pattern and shape of sclerotia. On the basis of their size they are classified in to four, categories *viz*., below 100 µrn very small, 100-115 µm small. 116-125 µm medium and above 125 µm large. On the basis of pattern of sclerotic they were divided into two categories dense and sparse.

On the basis of shape of sclerotia they were categorized in to three, categories *viz.,* round to oval, irregular and variously curved. Colour of sclerotia was also observed and categorized as light brown, dark brown and black.

On the basis of their size two isolates were large, one isolate is medium and two were small. On the basis of their pattern three isolates were dense and two isolates having sparse. According to their shape and colour all the isolates having irregular shape and black colour.

Field survey in Khandwa district, recorded maximum incidence of Rhizoctonia aerial blight in the village Singot (12%) followed by Jaswadi (9.66), Titiya Joshi (9.33%) and Bediya (9.33%) with minimum in Lohari (9%). The disease incidence ranged between 9-12% with an average of 9.86% result also shows that the maximum disease incidence favours to irrigated black soil whereas red and light black soil shows lower incidence of disease. During survey in Korea the incidence of the disease was 5-20% (8). (9) also observed the host specificity of *Rhizoctonia solani* with an effect on germination and seedling survival of alfalfa, corn, Kentucky bluegrass, smooth brome grass, soybean, tall fescue, and wheat were determined under greenhouse conditions. *Rhizoctonia solani* reduced germination and survival of Kentucky bluegrass and tall fescue, but not as severely as in soybean. Survival of alfalfa, corn, smooth brome grass, and wheat was not affected.

(10) also reported similar results, survey at eight villages in Multan district to record incidence of diseases and losses of soybean (*Glycine max* L.) caused by root rot fungi. The root rot incidence ranged 10-17% and losses ranged 6.75-15.5%. The evaluation of four PGPR isolates was done in combination with organic amendment for the management of root-rot disease incidence and to reduce the population of the root pathogenic fungi and to increase the yield in the field.

On the basis of colony colour the isolates were categorized into light black and black. Thus considerable variations in the colony colour on potato dextrose agar medium was observed. Out of these five isolates, four isolates were same in colony colour and growth pattern having black and appressed.

The morphological characters studied the width of hyphae closer to sclerotia and the hyphae away from

Plate-1 : Characteristics of *R. solani* on PDA according to hyphae.

sclerotia, pattern and colour of hyphae. the range of width of hyphae closer to sclerotia and the hyphae away from sclerotia is 7.50 to10.20 and 3.60 to 4.50, respectively. The pattern of three isolates were dense and two isolates having sparse. The colour and thickness of all isolates having same, brown and thick On the basis of their size two isolates were large, one isolate is medium and two were small. On the basis of their pattern three isolates were dense and two isolates having sparse. According to their shape and colour all the isolates having irregular shape and black colour.

Only one isolates having light black colony and floccose morphology. (11) *R. bataticola* causing dry root rot of Chickpea grew better on PDA and produced brown to gray coloured mycelium, which turned darker with age. The young hyphae thin, hyline, aseptate and dichotomously branched, which latter produced black sclerotia. The sclerotia formed were black, smooth, spherical or oblong to irregular shaped. (12) studied morphological variability of 40 isolates of *R. bataticola*, causing dry root rot of soybean. Maximum sclerotial size was reported in isolate Rb-33. While, the isolate Rb-40 produced smallest size sclerotia. (13) studied morpho-cultural variability of 15 isolates of *Rhizoctonia solani*, infecting maize and rice, from trans-genetic plains of India. The isolates from maize were fast growing and produced compact dense/fluffy, pale white to yellowish colony on PDA; produced scattered to regular smooth surfaced sparse sclerotia.

Conclusions

Maximum disease incidence (12%) in Singot and minimum disease incidence (9%) in Lohari was recorded and disease incidence favors to irrigated black soil whereas red and light black soil shows lower incidence of disease. The disease incidence ranged between 9-12 percent with an average of 9.86% of Khandwa district.

Out of these five isolates, four isolates were same in colony colour and growth pattern having black and appressed. The morphological characters of three isolates were dense and two isolates having sparse and colour and thickness of all isolates having same, brown and thick. Size of two isolates were large, one isolate is medium and two were small and the pattern of three isolates were dense and two isolates having sparse.

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