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## First record of target leaf spot disease of soybean and progression of other fungal foliar spots in Karnataka

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**Abstract**

A survey was conducted from *Kharif* 2017 to 2019 to know the severity of fungal foliar pathogens, other than rust and pod blight which are major diseases in soybean. During survey, target leaf spot was recorded for the first time from Karnataka. Other minor diseases *viz.*, Alternaria leaf spot and Frogeye leaf spot was recorded from the results, it is revealed that there is a progression of these foliar spots.

**Keywords:** Soybean foliar spots, target leaf spot, alternaria leaf spot, frogeye leaf spot

**Introduction**

Soybean (*Glycine max* (L.) Merrill) is a protein rich oilseed crop which is considered as a golden bean, miracle bean and wonder crop of the 20<sup>th</sup> century because of its characters and usage. Though, soybean is a legume crop but it is widely used as oilseed due to its poor cooking ability on account of inherent presence of trypsin inhibitor that limits its usage as pulse crop. Over 100 pathogens are known to affect soybean of which about 35 are economically important. The crop mainly suffers from fungal diseases like rust (*Phakopsora pachyrhizi*), charcoal rot (*Macrophomina phaseolina*), purple seed stain (*Cercospora kikuchi*), fungal foliar spots like Alternaria leaf spot, Frogeye leaf spot and Target leaf spot. In Karnataka, though the rust is major disease, due to introduction of rust resistant varieties *viz.*, DSb 21 and DSb 23 in recent years and climate change some of the minor diseases like target leaf spot and other foliar leaf spots *viz.*, Alternaria leaf spot and Frogeye leaf spot are becoming major diseases in soybean growing areas of Karnataka. Hence initial record of fungal foliar spots in major soybean growing areas of Karnataka was conducted from 2017 to 2019 to know its severity.

The disease target leaf spot of soybean was first reported during 1945 in USA (Olive *et al.*, 1945) [3]. The yield losses of about 18-32 per cent have been recorded in susceptible soybean lines when rainfall was above normal in August and September (Sinclair, 1982) [6]. The disease affects leaves, stems and pods. An intensive roving survey was conducted from *kharif* 2017 to 2019 to record the severity of target leaf spot and other fungal foliar spots *viz.*, in major growing areas of northern Karnataka *viz.*, Belagavi, Dharwad, Haveri and Bagalkote. In each district, five talukas and in each taluka five villages were randomly surveyed to know the incidence of diseases.

**Target Leaf spot:** The severity of the disease in all the surveyed areas which ranged from 12.45 to 42.16 per cent (Table 1). Among the four districts surveyed, maximum disease severity was noticed in Haveri district (39.05%) followed by Belagavi (28.02%) and Dharwad district (19.18%). The mean minimum disease severity was noticed in Bagalkote district (18.25%). Severity of the disease was more when the crop was at reproductive stage and less at flowering stage. Variety JS 335 showed susceptible reaction in all the surveyed areas. The symptoms were observed on all the above ground plant parts like leaves, stems and pods. On leaves spots are rounded to irregular and dark brown in colour and size varies from small specks to big mature spots. These spots are surrounded by a dull green or yellowish green halo (Plate 1a). At later stages the leaves become yellow and drop prematurely. On stem and petiole the spots are dark brown and spindle shaped (Plate 1b). Isolation of the pathogen was done from leaves showing typical symptoms of the disease target leaf spot. The pure culture of the pathogen was obtained after confirming it by microscopic observation as *Corynespora cassiicola*.

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Conidia are formed either singly or in chains of 2-3 which are produced at the tip of the conidiophore. These conidia are slightly curved or straight having 8-10 pseudosepta and hilum at the base (Plate 1c). Similar type of symptoms were also

observed by Sharma (2005) [5], Patel (2005) [4] and Kurre (2016) [2] and isolation were done from the infected soybean leaves to get the pathogen *C. cassiicola*.

**Table 1:** Average disease incidence of fungal foliar spots of soybean in Karnataka.

Districts	Kharif 2017			Kharif 2018			Kharif 2019			Mean		
	TLS	ALS	FLS	TLS	ALS	FLS	TLS	ALS	FLS	TLS	ALS	FLS
Dharwad	12.45	3.42	2.50	18.65	8.60	3.50	26.45	12.50	3.75	19.18	8.71	3.25
Belgavi	25.46	4.60	6.50	28.45	10.50	8.65	30.15	13.75	13.45	28.02	9.61	9.53
Bagalkote	14.80	3.50	3.40	19.50	7.50	4.75	20.45	10.50	12.50	18.25	7.16	6.88
Haveri	36.45	4.50	7.80	38.56	12.50	11.75	42.16	16.50	15.75	39.05	11.16	11.76
Mean	22.29	4.05	5.05	26.29	9.78	7.16	29.80	13.31	11.36	26.12	9.04	7.85

TLS: Target leaf spot, ALS: Alternaria Leaf spot, FLS: Frog eye leaf spot



**Plate 1a:** Dark brown spots surrounded by a dull green or yellowish green halo.



**Plate 1b:** On stem and petiole the spots are dark brown and spindle shaped

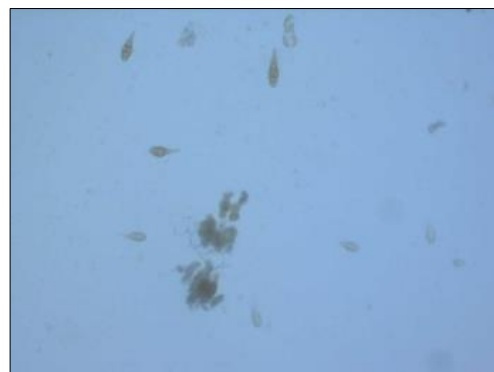


**Plate 1c:** Conidia of *Corynespora cassiicola*.

**Alternaria leaf spot:** The severity of the disease in all the surveyed areas were ranged from 3.42 to 16.50 per cent (Table 1). Among the four districts surveyed, maximum disease severity was noticed in Haveri district (11.16%) followed by Belagavi (9.61%). Alternaria leaf spot of soybean, caused by *Alternaria* spp., is usually a secondary invader following mechanical injury or insect damage. Diseased lesions are round or restricted by a major vein or merge with another lesion. Some have brown concentric rings with a well-defined border. The lesions expand and may combine to yield larger dead areas on the leaves. Infected leaves eventually dry out and fall (Plate 2). Under microscope, when made sections clearly *Alternaria* can usually be distinguished from *Corynespora cassiicola* by its obclavate conidia with a beak at the apex. Conidia usually are mostly formed singly or only in very short chains (Plate 2b). The Alternaria disease is very destructive in many crops when there is congenial conditions like high humidity and continuous rains. In safflower, the disease has been reported to cause seed yield losses to the tune of 10 to 25 per cent, and under severe conditions, it has been reported to cause 50 per cent loss in seed yield (Indi *et al.*, 1986) [1].



**Plate 2a:** On leaf, appears as dark brown lesions, often with concentric rings



**Plate 2b:** On leaf, appears as dark brown lesions, often with concentric rings

**Frogeye leaf spot:** Frogeye leaf spot is a common fungal disease which is recorded every year with a severity on an average of 2.50 to 15.75 per cent. Leaf spots are circular to angular in shape. Leaf symptoms begin as dark brown, water soaked spots and mature into lesions with tan or brown

centers and a narrow reddish brown to purple margin. Older lesions are translucent and have whitish centers containing black dots. In severely infected plants, several lesions may coalesce into larger irregular shaped spots (Plate 3)



**Plate 3:** Symptoms of frog eye spot of soybean

Among the various foliar diseases of soybean, target leaf spot is gaining importance now a days. The survey conducted from 2017 to 2019 during *kharif* data revealed that there was increase in fungal foliar spots. The reasons may be attributed to adaptability of rust resistant varieties *viz.*, DSb-21 and DSb-23 in the farmers field. And also may be due to climate change, as it was observed in *Kharif* 2019 where there was a continuous rain with high humidity which is favourable for the fungal foliar spots. Target leaf spot was first time reported from the Karnataka during the survey conducted in the *Kharif* 2017. Though the *Alternaria* leaf spot and Frogeye spot are minor diseases, when there are favourable conditions, a minor disease can become major disease. Further, the epidemiological factors and management studies are in progress.

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