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Evaluation of different chemical fungicides against Myrothecium leaf spot of soybean under *in vivo* condition

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Abstract
Myrothecium leaf spot of soybean caused by *Myrothecium roridum*. Myrothecium leaf spot of soybean is occurring in almost all the major soybean growing areas of India causing about 30 per cent yield loss. Initial symptoms of the disease appear as small round or oval, brown spots with dark brown margin on leaves in the infected plant. In study of the foliar spray of different chemical fungicides against myrothecium leaf spot of soybean under in vivo condition, fungicides *viz.*, Tebuconazole, Hexaconazole, Mancozeb, Pyraclostrobin, Fluxapyroxad and Propiconazole were quite effective in reducing the percent disease index over control. Foliar application of Propiconazole (78.90%) was highly effective in reducing the percent disease index, followed by Pyraclostrobin (73.58%). Minimum percent disease index over control was observed in Tebuconazole (35.75%), followed by Fluxapyroxad (38.99%). These fungicides were also effective in reducing the percent disease index under field conditions.

Keywords: Myrothecium leaf spot, soybean, *Myrothecium roridum*, fungicides

Introduction
Soybean (*Glycine max.* L. Merril) belonging to family Leguminosae is designated as miracle bean established its potential as an industrially vital and viable oilseed crop in many areas of India. Leaf spot of soybean caused by *Myrothecium roridum* Tode ex. Fries is an important disease, which occurred in epidemic proportion entailing into colossal losses to soybean crop in Madhya Pradesh (Shrivastava and Khan, 1994, Singh and Shrivastava, 1994) [4, 5]. Myrothecium leaf spot of soybean is occurring in almost all the major soybean growing areas of India causing about 30 per cent yield loss (Shrivastava and Khan 1994) [4, 5]. The disease severity of myrothecium leaf spot soybean was in the range of 35 to 45 % and disease incidence of myrothecium leaf spot soybean was in the range of 30 to 55 % (Singh and Shrivastava, 1994) [4, 5]. *Myrothecium roridum* is ordinary soil fungi, and survive in this environment as saprophytes in decaying plant tissues (Ellis, 1971).Initial symptoms of the disease appear as small round or oval, brown spots with dark brown margin on leaves in the infected plant. Since it is an economically important disease, management of the disease plays crucial role. There are numerous reports on fungicides in *vivo* condition to control the disease. Daivasikamani *et al.* (2013) [1] studied *in-vivo* screening of some fungicides against *Myrothecium roridum* causing stem necrosis of coffee seedling. Sultana and Ghaffar (2009) reported that the foliar sprays of fungicide Topsin-M significantly reduced the incidence of bitter gourd caused by *M. roridum* and *M. verrucaria.*

Material and methods
Experimental site
All the field experiment were conducted during Kharif 2015 at the soybean experimental field of Department of Plant Pathology situated in the research farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

Experimental designs
Randomized Block Design (RBD) was fallowed in the field experiments.

In vivo evaluation of fungicides
Effect of different fungicides formulation on disease severity were evaluated against myrothecium leaf spot of soybean. The field experiment was laid out in RBD with seven treatment and three replications during 2015 at Plant Pathology Research Farm, IGKV Raipur (C.G.). Seed of JS 97-52 varieties were sown with 30cm × 10cm spacing in plots measuring 5m x3 m. All other cultural and pest control practices were followed as recommended in package of practices.
The fungicides viz. Hexaconazole 5 SC (Contaf), Tebuconazole 250 EC (Folicur), Propiconazole 25EC (Tilt), Mancozeb 75% WP (Dithane M-45), Pyraclostrobin, and Fluxapyroxad were evaluated. The first spray was given as soon as the first symptom of myrothecium leaf spot on the crop was seen in the field. The other one spray of them were given subsequently using Knapsack spray at 15days interval. For recording the observation, five plants of each treatment were randomly selected and tagged and observe the disease severity.

PDI was calculated using the formula of Wheeler (1969) as given here

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of individual rating}}{\text{Number of leaves examined}} \times \frac{100}{\text{maximum disease rating}}$$

Table 1: The doses of fungicidal treatment

S.N.	Treatment	Dosage / ha
T1	Control	Water spray
T2	Tebuconazole	400 ml
T3	Hexaconazole	500 ml
T4	Mancozeb	1250 gm
T5	Pyraclostrobin	500 ml
T6	Fluxapyroxad,	185.33 gm
T7	Propiconazole	500 ml

Experimental details

Design: Randomized Block Design
Treatment: 07,
Replication: 03,
Plot size: 5 x 3
Spacing: 30 x 10 cm
Distance between replication to replication: 1m.
Distance between plot to plot: 1 m.
Date of sowing: 01-07-2015,
Location: Soybean experimental research farm, IGKV Raipur (C.G.)

Result

***In vivo* evaluation of fungicides**

Results of six fungicides are presented in Table 1 and Fig. 1, and 2**.** All fungicides significantly were found effective in reducing the percent disease index of myrothecium leaf spot (10.50%) Foliar application of Propiconazole was significantly superior over all other fungicides followed by Pyraclostrobin (13.50%) and Mancozeb (18.90%). Maximum percent disease index was recorded in Fluxapyroxad (32.5%) followed by Tebuconazole (31.54%) and Hexaconazole (23.16%). Percent disease index in control was (51.20%).

The maximum percent disease reduction over control (78.90%) was recorded in Propiconazole followed by Pyraclostrobin (73.58%). The minimum percent disease reduction over control (35.75 %) was recorded in Tebuconazole followed by Fluxapyroxad (38.99%).

The data also showed that the maximum yield was obtained in Propiconazole (41.60q/ha) followed by Pyraclostrobin (37.30q/ha) and Hexaconazole (33.00/ q/ha). The minimum yield was obtained in control plot (16.00 q/ha).

The present findings are in accordance with the Daivasikamani *et al.* (2013) [1] reported that the fungicides Tilt (Propiconazole) were effective in controlling the stem necrosis and leaf spot disease of coffee seedlings casused by *M. roridum.* Kindo and Tiwari (2015) [3] reported significant reduction of the sheath rot intensity and increase in the grain yield by Propiconazole 25 EC (Tilt).Hexaconazole 5 SC (Contaf) Tebuconazole 250 EC (Folicur) and Carbendazim 50% WP (Bavistin).

Table 2: Evaluation of different fungicides against myrothecium leaf spot of soybean under *in vivo* condition

S. N.	Fungicides	Percent disease index	% Reduction over control	Yield (q/ha)
T1	Control	44.33 (41.72)**		16.00
T2	Tebuconazole	31.54 (34.12)	35.75	22.30
T3	Hexaconazole	23.16 (28.75)	55.65	33.00
T4	Mancozeb	18.90 (25.76)	54.05	30.00
T5	Pyraclostrobin	13.50 (21.53)	73.58	37.30
T6	Fluxapyroxad	32.5 (34.74)	38.99	27.20
T7	Propiconazole	10.50 (18.88)	78.90	41.60
	SE(m) ±	0.641		2.257
	C.D. (5%)	1.998		7.032

* Means of three replications **Arc sine Transformation

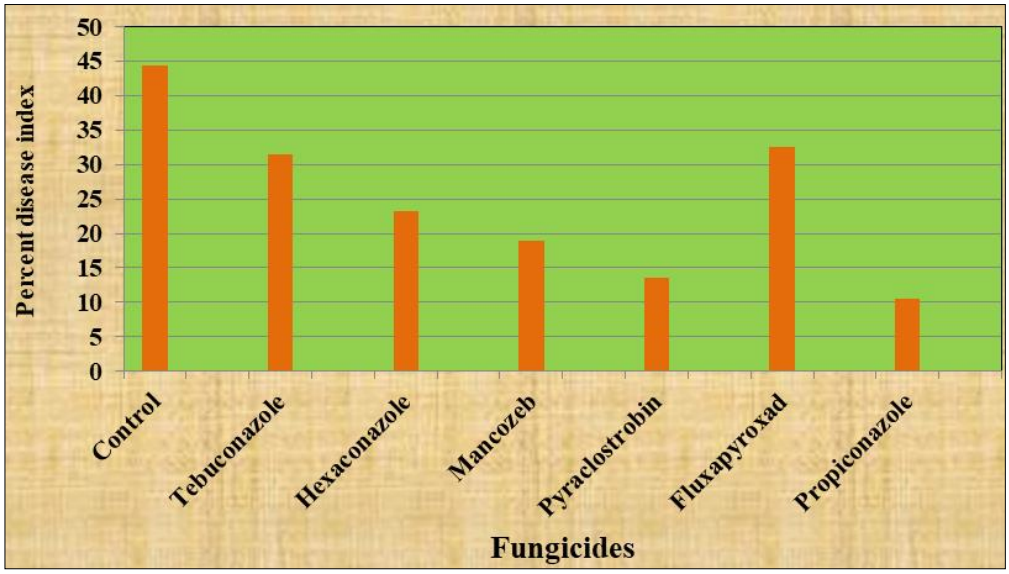

Fig 1: Evaluation of different fungicides against myrothecium leaf spot *of* soybean under *in vivo* condition

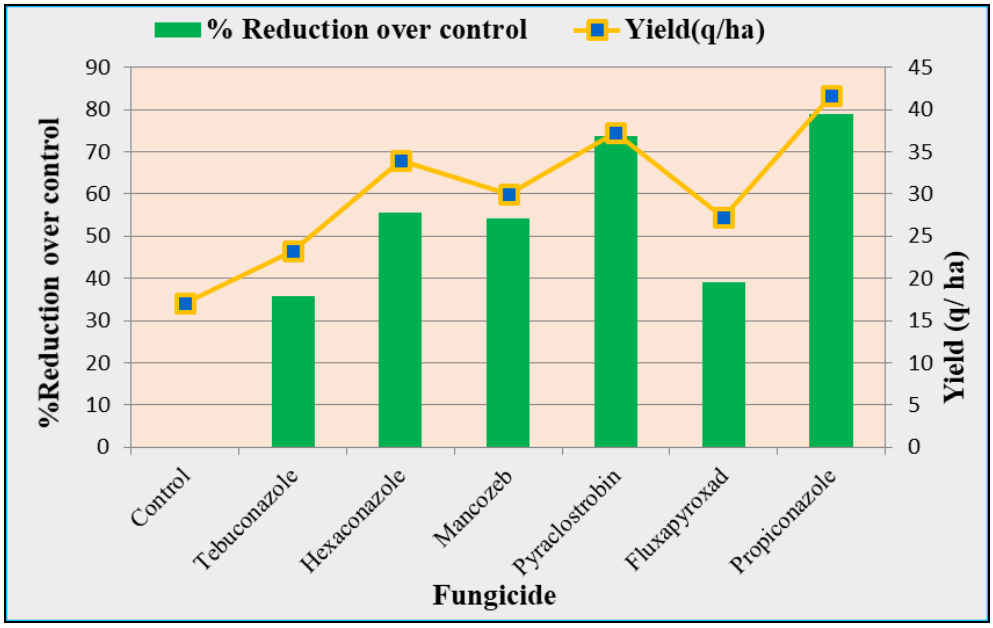

Fig 2: Effect of different fungicides on yield and % reduction of diseases.

Conclusions

The present study in evaluation of fungicides against *Myrothecium roridum* causing leaf spot of eoybean under *in vivo* conditions fungicides *viz.*, Tebuconazole, Hexaconazole, Mancozeb, Pyraclostrobin, Fluxapyroxad and Propiconazole were quite effective in reducing the percent disease index over control. Foliar application of Propiconazole (78.96%) was highly effective in reducing the percent disease index, followed by Pyraclostrobin (73.58%). Minimum percent disease index over control was observed in Tebuconazole (35.75%).

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