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In vitro evaluation of commercially available botanicals against *Bipolaris sorokiniana* (Sacc.) Shoem. an incitant of spot blotch of wheat

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Abstract
The warmer parts of wheat growing areas in the world are mainly affected by many diseases and among these, spot blotch or foliar blight caused by *Bipolaris sorokiniana* (Sacc.) Shoem. is one of the most concerning disease in warm and humid regions of India due to its widespread prevalence and increasing severity. Looking into significance of disease various commercially available botanicals *viz*., Crude pongamia oil, Soldier, Multineemore, Crude neem oil and Nimbicidin were evaluated *in vitro* against *B. sorokiniana* at 0.25, 0.50 and 1.0 per cent concentration, respectively. Maximum inhibition of mycelial growth was observed in multineemore at all the concentrations (0.25%: 51.85%, 0.50%: 52.22%, 1.0%: 54.81%) followed by nimbicidin (0.25%: 49.62%, 0.5%: 51.85%, 1.0%: 54.81%) and were significantly superior over other botanicals. Least inhibition was observed in crude pongamia oil at all the concentrations (0.25%: 34.07%, 0.50%: 34.07%, 1.0%: 35.18%) and it was followed by crude neem oil (0.25%: 34.81%, 0.50%: 35.18%, 1.0%: 36.29%) and soldier (0.25%: 34.07%, 0.50%: 34.81%, 1.0%: 54.81%). Irrespective of the concentrations tested, maximum mean inhibition of mycelial growth was observed in multineemore (52.96%) and it was followed by nimbicidin (52.09%) and soldier (41.23%). Increase in concentration increased the inhibition of mycelial growth by all the botanicals.

Keywords: *Bipolaris sorokiniana*, spot blotch, commercially available botanicals

Introduction
Wheat (*Triticum* spp.; family: Poaceae; centre of origin: Abyssinia) the versatile cereal crop is also described as "the shuffle of life" or "king of cereals. In India, wheat is the second most important food crop being next to rice and it contributes nearly 25 per cent to the total food grain production. The total estimated area under wheat cultivation in India during 2017 was 30.59 m ha, with a production of 93.80 mt and average productivity of 3261 kg/ha (Anon., 2017) [1]. In Karnataka, the area under wheat is about 1.74 lakh ha with an annual production of 1.56 mt having productivity of 897 kg/ha (www.indiastat.com, 2017) [6]. Due to continuous rise in temperature during the wheat growing season and high humidity coupled with winter rains, spot blotch is getting favourable conditions to develop aggressively and cause damage to wheat crop at larger scale by affecting significant yield loss up to 18-50 per cent under favourable conditions (Duvellier *et al.*, 2005) [2]. Little information is available on *in vitro* evaluation of commercially available botanicals against *B. sorokiniana* so an attempt was made to evaluate commercially available botanicals against the pathogen.

Materials and Method
In vitro evaluation of Commercially available botanicals
The experiment was conducted at Department of Plant Pathology, College of Agriculture, Dharwad. The commercially available botanicals (Table 1) were evaluated at 0.25, 0.50 and 1.0 per cent concentrations, respectively by poisoned food technique. The calculated quantities commercially available botanicals were thoroughly mixed in the medium before pouring into Petridishes so as to get the desired concentration of active ingredient of each commercially available botanical separately. Twenty ml of poisoned medium (commercially available botanical amended medium) was poured in each of 90 mm sterilised Petridishes and allowed to solidify. The plates were inoculated centrally with five mm disc of eight days old young sporulating culture of *B.* sorokiniana. Controls devoid of fungicides were also maintained. The experiment was conducted in completely randomised block design (CRBD) with three replications in each treatment. The inoculated Petridishes were incubated at 26 ± 1°C. The colony diameters were measured after eight days when the control plates were full of fungal growth. Per cent inhibition of growth was calculated by using formula given by Vincent (1947) [5].

$$I = \frac{C - T}{C} \times 100$$

Where
I = Per cent inhibition
C = Radial growth in control
T = Radial growth in treatment (fungicide).

Table 1: List of Commercially available botanicals used for assay

Sl. No.	Product name	Contents
1	Soldier	*Aegl marbelos* (20%), *Ricinus communis* (20%), *Hygrophila spinosa* (20%), *Laminaria* spp. (20%) and *Lantana camera* (20%)
2	Crude neem oil	Azadirachtin
3	Nimbicidine	Azadirachtin 0.03%
4	Crude Pongamia oil	-
5	Multineemore	Azadirachtin 0.15%

Results and Discussion

In vitro evaluation of botanicals was carried out with respect to inhibition of mycelial growth of *B. sorokiniana* at different concentrations as explained in "Material and Methods" and the data are presented in Table 2, Plate 1.

Five test botanicals reduced the inhibition of mycelial growth of *B. sorokiniana* at 0.25 per cent, 0.50 per cent and 1.0 per cent concentration. Maximum inhibition of mycelial growth was observed in multineemore (Azadiractin 0.15%) at all the concentrations (0.25%: 51.85%, 0.50%: 52.22%, 1.0%: 54.81%) followed by nimbicidin (Azadiractin 0.03%) at all the concentrations (0.25%: 49.62%, 0.5%: 51.85%, 1.0%: 54.81%) and were significantly superior over other botanicals. Least inhibition was observed in crude pongamia oil at all the concentrations (0.25%: 34.07%, 0.50%: 34.07%, 1.0%: 35.18%) and it was followed by crude neem oil (0.25%: 34.81%, 0.50%: 35.18%, 1.0%: 36.29%) and soldier (0.25%: 34.07%, 0.50%: 34.81%, 1.0%: 54.81%). Irrespective of the concentrations, maximum mean inhibition of mycelial growth was observed in multineemore (52.96%) and it was followed by nimbicidin (52.09%) and soldier (41.23%). Increase in concentration increased the inhibition of mycelial growth by all the botanicals. Similar results were reported by earlier workers *viz.*, Patidar (2014) who found that among the eight botanicals used under *in vitro* study, minimum mycelial growth of *B. sorokiniana* was observed in garlic clove extract (9.56 mm). Extract of eight plants *viz.*, *Curcuma aromatic* Salisbury, *Atylosia lineata* Wight and Arn., *Butea superba Roxb.*, *Striga gesnerioides* (Willd.) vatke, *Calceolaria Mexicana* Bentham, *Adhatoda vasica* (Linnaeus) Nees, *Conyza stricta* Willd. *and Smithia sensitive* Aiton exhibited highest inhibitory activity (>90% inhibition) against *B. sorokiniana* and least antifungal effect (54% inhibition) was displayed by extract of *Emilia sanchifolia*. (Kekuda *et al.*, 2016).

Table 2: *In vitro* evaluation of commercially available botanicals against *Bipolaris sorokiniana*

Sl. No.	Botanical	Percent inhibition of the mycelial growth of fungus			
		Concentration (%)			Mean
		0.25	0.50	1.0	
1	Crude pongamia oil	34.07 (35.71)	34.07 (35.71)	35.18 (36.76)	34.44 (35.93)
2	Soldier	34.07 (35.71)	34.81 (36.16)	54.81 (47.76)	41.23 (39.95)
3	Multineemore	51.85 (46.06)	52.22 (46.27)	54.81 (47.76)	52.96 (46.70)
4	Crude neem oil	34.81 (36.16)	35.18 (36.38)	36.29 (37.04)	35.42 (36.52)
5	Nimbicidin	49.62 (44.78)	51.85 (46.06)	54.81 (47.76)	52.09 (46.20)
	Mean	41.40 (40.05)	41.62 (40.18)	46.62 (43.06)	43.22 (41.10)
				S.Em. ±	C.D. at 1%
	Botanicals (B)			0.30	1.17
	Concentrations (C)			0.23	0.91
	B x C			0.52	2.02

*Angular transformed values

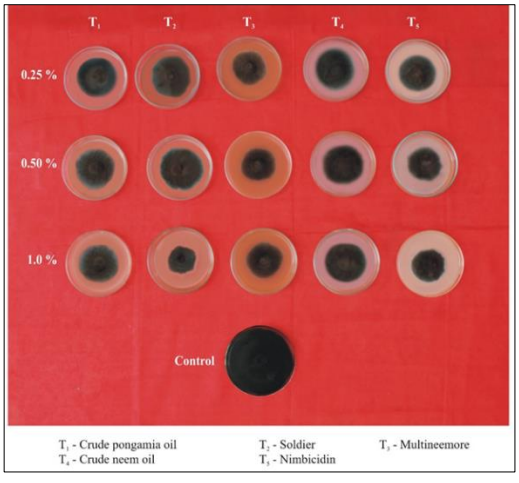

Plate 1: *In vitro* evaluation of commercially available botanicals against *Bipolaris sorokiniana*

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