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In vitro evaluation of botanicals against blast of foxtail millet caused by *Pyricularia setariae*

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Abstract
Foxtail millet is a highly nutritious crop affected by several diseases, of which leaf blast is an important disease, hindering productivity. The present study was conducted to evaluate the *in vitro* efficacy of different botanicals. Nine botanicals extracted from different plants are evaluated under *in vitro* condition by using Poisoned food technique. these different plant extracts were tested at three (10, 20 and 30 %) concentrations among these botanicals highest mycelial growth inhibition showed by eucalyptus (82.74 %) at 30 % concentration followed by jamun (65.45 %) at 30 % concentration and least mycelial growth inhibition observed in ashoka plant extract (12.23%) at 10 % concentration.

Keywords: Botanicals, mycelial growth inhibition, poisoned food technique, *Pyricularia setariae*

Introduction
Foxtail millet [*Setaria italica* (L.) Beauv.] Is an ancient cultivated crop and most economically important species of the genus *Setaria* belongs to family poaceae and Native to China (Vavilov, 1926 [11]). This crop has high importance as it is a rich source of nutrients and grown for both food and fodder purpose. It is also known by several other names such as German millet, Italian millet, Chinese millet and Hungarian millet (Baker, 2003 [1]). It ranks 2nd in the total world production of millets and continues to have an important place in the world agriculture providing around six million tons of food to millions of world population, mainly on marginal or poor soils in Southern Europe and in temperate, subtropical and tropical Asia (Marathee, 1993 [5]). It is widely grown throughout Africa, China, India, Russia, and the United States.

In India foxtail millet is grown on about 1 million ha, mainly in northern Karnataka, parts of costal Andhra Pradesh, Uttarakhand, Tamil Nadu, and some parts of the northeastern states. The grain is used as both food and fodder. It is a good source of carbohydrate, protein and essential amino acids and it is a very good datary component for diabetic and heart patients because it contains magnesium (Marathee, 1993 [5]). The grains are good source of protein, minerals (calcium, iron, potassium, magnesium and zinc) and vitamins (Rai, 2002 [8]). It is widely used as an energy source for pregnant, lactating women, sick people and children (Sema and Sarita, 2002 [9]). It has got medicinal value as it is used as curative for rheumatism and measles (Wright and Finch, 1962 [13]) and also it has been suggested that foxtail millet is used as a food component to cardiovascular diseases and type 2 diabetes (Choi *et al*., 2005 [2]).

Although foxtail millet has high nutritional importance and grown for both food and fodder purpose, the crop is affected by several biotic and abiotic constraints. Among the biotic constraints fungal diseases like leaf blast, brownspot, rust, downy mildew and bacterial diseases like bacterial streak are limiting the production of the crop. Among these diseases, blast caused by the fungus *Pyricularia setariae* Sacc. (teleomorph: *Magnaporthe setariae*) is the most destructive disease and affects both forage and grain production of foxtail millet. Symptoms of the disease appear as circular spots with straw colored centers on leaf blades. The spots are small and scattered, 2 to 5 mm in diameter and surrounded by a dark brown margin. When the disease appears in severe form during humid weather conditions, especially with a dense plant stand, the leaves wither and dry. Plants are infected at all growth stages of crop growth (Gaikwad, and D' Souza, 1987 [3]); lower leaves are the most severely affected. Recognizing the importance of foxtail millet and the constraint caused by the leaf blast disease, the present study was planned to evaluate different botanicals under *in vitro* condition to generate primary data on botanicals against *P. setariae* and identified potential botanicals will be used in designing Integrated Disease Management strategies for management of blast there by production and productivity of the crop will be enhanced.

Material and methods

In vitro evaluation of botanical products to find the effect on growth of *P. setariae* was done by the poisoned food technique (Nene and Thapliyal, 1973 [6]). The different botanical with parts used for extraction is listed in table 1.

The PDA media has been prepared and sterilized in an autoclave. The medium was cooled to 40 ° C. The stock solution of 100% botanicals was made based on weight per volume and stock solution of each plant extract was filtered through a muslin cloth. An appropriate amount of botanical stock solution was added to the medium, to obtain a required concentration of 10, 20 and 30 per cent and the conical flasks were gently shaken to completely disperse the botanical solution. About 15-20 mL of poisoned media was poured into 90 mm Petri dishes and the plates were turned clockwise for even distribution of the media. The active growth culture was cut in aseptic conditions using a cork borer and transferred to the center of each Petri dish containing the poisoned medium. A control was maintained in which the fungal pathogen was grown under similar conditions on agar medium without any botanical extract. The inoculated plates were incubated at 27 ± 1 ° C for fourteen days and radial growth of the *P. setariae* was recorded in three directions and the average diameter was calculated. The per cent inhibition of growth over control was determined (Vincent, 1947 [12]).

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

Where.,
I = Per cent inhibition of mycelium
C= Growth of mycelium in control
T = Growth of mycelium in treatment

Statistical analysis

The data generated by different experiments were analyzed using the WASP software developed by ICAR- Central Coastal Agricultural Research Institute, Goa and the inferences were made with a probability of one per cent.

Table 1: Botanicals used against *P. setariae* in poison food technique

S. No	Common name	Scientific name	Family	Plant part used
1	Pongamia	*Pongamia pinnata*	Fabaceae	Leaf
2	Neem	*Azadirachta indica*	Meliaceae	Leaf
3	Ashoka	*Saraca asoca*	Fabaceae	Leaf
4	Zinger	*Zingiber officinale*	Zingiberaceae	Rhizome
5	Garlic	*Allium sativum*	Amaryllidaceae	Bulb
6	Citrus	*Citrus limon*	Rutaceae	Leaf
7	Eucalyptus	*Eucalyptus globulus*	Myrtaceae	Leaf
8	Jamun	*Syzygium cumini*	Myrtaceae	Leaf
9	Jackfruit	*Artocarpus heterophyllus*	Moraceae	Leaf

Results and discussion

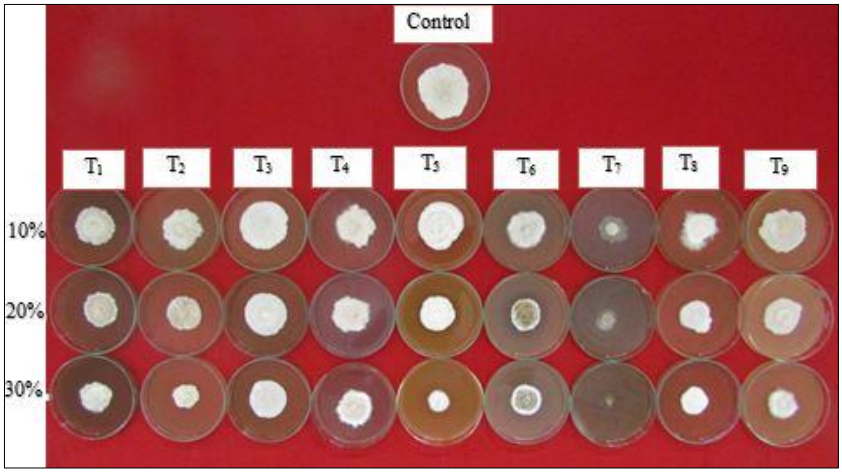
Nine different plant extracts were tested for their efficacy to inhibit the growth of *P. setariae* under *in vitro* condition by using poisoned food technique as described in material and methods. these botanicals were tested at three (10, 20 and 30 %) concentrations among these botanicals highest mycelial growth inhibition showed by eucalyptus (82.74 %) at 30 % concentration followed by jamun (65.45 %) at 30 % concentration and least mycelial growth inhibition observed in ashoka plant extract (12.23%) at 10 % concentration (Table 2, plate 1, fig 1).

Presently use of botanicals for the management of diseases is the important strategy in IDM practices and it is also has important role in the organic farming system in this present study nine botanicals were tested against *P. setariae* under *in vitro* condition by using poisoned food technique. The results revealed that eucalyptus found highly effective where as other botanicals such as neem, ginger and garlic also found moderately effective against the pathogen. These results agreed with Jamal *et al.* [4] (2012) tested three botanicals against *M. grisea* under *in vitro* condition and reported that garlic showed highest mycelial growth inhibition. Surender Kumar *et al.* [10] (2017) reported that neem oil and neem oil + neem leaf extract inhibit development of rice blast disease in field condition about 26.20 per cent and 24.15 per cent respectively. Netam *et al.* [7] (2017) described that garlic bulb and onion bulb extract were found effective against *Pyricularia grisea* causing finger millet blast.

Table 2: *In vitro* efficacy of botanicals on *P. setariae*

S. No	Botanicals	Per cent inhibition of mycelial growth			Mean
		10 %	20 %	30 %	
1	*Pongamia pinnata* (Pongamia)	28.79 (32.45)	41.46 (40.08)	47.62 (43.64)	39.29
2	*Azadirachta indica* (Neem)	30.41 (33.47)	35.36 (36.49)	40.75 (39.67)	35.51
3	*Saraca asoca* (Ashoka)	12.23 (20.47)	29.64 (32.98)	38.53 (38.37)	26.80
4	*Zingiber officinale* (Zinger)	18.45 (25.43)	38.53 (38.37)	55.41 (48.11)	37.46
5	*Allium sativum* (Garlic)	30.29 (32.89)	32.43 (34.71)	43.72 (41.39)	35.48
6	*Citrus limon* (Citrus)	24.52 (29.68)	32.10 (34.51)	50.71 (45.41)	35.78
7	*Eucalyptus globulus* (Eucalyptus)	54.25 (65.45)	59.41 (37.12)	82.74 (40.62)	65.47
8	*Syzygium cumini* (Jamun)	47.44 (37.12)	50.43 (40.62)	65.45 (42.35)	54.44
9	*Artocarpus heterophyllus* (Jackfruit)	27.56 (31.67)	36.65 (37.25)	41.57 (40.14)	35.26
10	Control	0.00	0.00	0.00	0.00
11		Botanicals (B)		Concentration (C)	B × C
12	SEm ±	0.88		0.51	1.53
13	CD @ 0.01	1.73		1.00	2.99

Note: Figures in the parenthesis are arc sine transformed values



T1- *Azadirachta indica* (Neem) T2- *Citrus limon* (Citrus)
T3- *Saraca asoca* (Ashoka) T4- *Artocarpus heterophyllus* (Jackfruit)
T5- *Zingiber officinale* (Zinger) T6- *Syzygium cumini* (Jamun)
T7- *Eucalyptus globulus* (Eucalyptus) T8- *Pongamia pinnata* (Pongamia)
T9- *Allium sativum* (Garlic)

Plate 10: *In vitro* efficacy of different botanicals against *P. setariae*

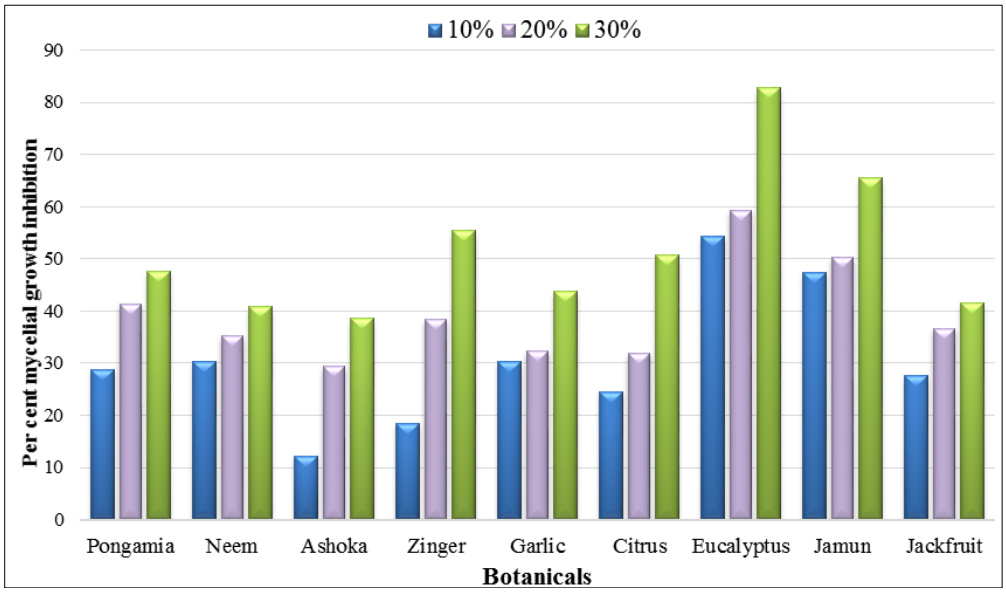


Fig 1: Effect of different botanicals on per cent mycelial growth inhibition of *P. setariae*

Summary
Among nine botanicals evaluated highest mycelial growth inhibition showed by eucalyptus at 30 % concentration followed by jamun at 30 per cent concentration and least mycelial growth inhibition observed in ashoka plant extract at 10 per cent concentration. Identified potential botanicals will be used in designing Integrated Disease Management strategies for management of blast there by production and productivity of the crop will be enhanced.

References

1. Baker RD. Millet production (Guide A-414), New Mexico State University, 2003,
2. Choi Y, Osada K, Ito Y, Nagasawa T, Choi M, Nishizawa N. Effects of dietary protein of Korean foxtail millet on plasma adinopectin, HDL-cholesterol and insulin levels in genetically type 2 diabetic mice. *Biosci. Biotechnol. Biochem*, 2005, 69:31-37.
3. Gaikwad AP, D'Souza TF. A comparative study on *Pyricularia* spp. J Maharashtra Agril. Uni. 1987; 12:134-135.
4. Jamal-U-Ddin Hajano, Mumtaz A, Pathan M, Ali Khanzada, Serwar Shah G. *In-vitro* evaluation of fungicides, plant extracts and bio-controlagents against rice blast pathogen *Magnaporthe oryzae* couch. Pak. J Bot. 2012; 44(5):1775-1778.
5. Marathee JP, Riley KW, Gupta SC, Seetharam A, Mushonga JN. Structure and characteristics of the world millet economy. 159-178.
6. Nene YL, Thapliyal PN. Fungicide in Plant Diseases Control (Ed): Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, 1973, 325.
7. Netam RS, Tiwari RKS, Bahadur AN. *In vitro* and *In vivo* Efficacy of Plant Extract against Pyricularia grisea Causing Finger Millet Blast Disease. Journal of pure and applied microbiology. 2017; 10(4):2957-2962.
8. Rai M. Nutritive cereals. In: Survey of Indian Agriculture. The Hindu, Chennai, Tamil Nadu, India, 2002, 59-62.
9. Sema A, Sarita S, Suitability of millet-based food products for diabetics. J Food Sci. Technol. 2002; 39:423-426.

10. Surender Kumar, Abhilasha Lal A, Narender Kumar, Shweta Jaiswal, Harish Kumar, Amit Kumar *et al*. Effect of bio control agents and botanicals against Blast of Paddy caused by *Pyricularia oryzae.* Int. J Chem. Stud. 2017; 5(1):314-318.
11. Vavilov NI. Studies on the origin of cultivated plants. Appl. Bot. Plant Breed. 1926; 26:1-248.
12. Vincent JM. Distribution of fungal hyphae in the presence of certain inhibitors. Nature, 1947, 159: 850.
13. Wright WG, Finch RC. Firm seeds in the foxtail millets. Proc. Assoc. off. Seed. Ann. North. America. 1962; 52:109-111.