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In-Vitro Evaluation of Botanicals against *Fusarium moniliforme* and *Curvularia lunata* Causing Grain Moulds of Sorghum

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Abstract

The experiment was conducted to assess the efficacy of different botanicals on inhibition of mycelial growth of grain mould pathogens *Fusarium moniliforme* and *Curvularia lunata* infecting sorghum. Highest inhibiton of mycelial growth of *F. moniliforme* was observed in 10% pongamia leaf extract (44.44%) followed by garlic bulb extract (41.47%). Least mycelial growth inhibition was observed in adhatoda leaf extract followed by bougainvillea leaf extract (1.82%) at 5% concentration. Tulasi leaf extract (52.22%), followed by pongamia leaf extract (49.62%) and garlic bulb extract (49.25%) were most effective in inhibiting the mycelial growth of *C. lunata* at a concentration of 10%.
Key words : Botanicals, Grain moulds, *Fusarium moniliforme, Curvularia lunata.*

Grain sorghum (*Sorghum bicolor* (L.) Moench) is an important cereal crop grown throughout the world on approximately 48 million ha annually. It ranks third of the world cereal crops. While many pests limit the productivity of the crop, grain mold of sorghum is typically the greatest disease constraint in warm and humid environments. More than 40 fungal genera are reported to be associated with moulded grains and most of them are facultative parasites or saprophytes, only a few fungi infect sorghum flower tissue during early stages of grain development. These include *Fusarium moniliforme* Sheld., *Curvularia lunata* (Wakker) Boedijn, *Alternaria alternata* and *Phoma sorghina* (Sacc.) Boerema, Dorenbosch, & van Kesteren. The predominant fungal species vary in their frequencies and severities under different environmental conditions Bandyopadhyay et al. (1). Keeping in view the importance of the disease, the present investigation was carried out to test the efficacy of different botanicals against *F. moniliforme* and *C. lunata.*

Methods

The experiment was conducted at Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka during 2004. Under *in-vitro* condition, 14 plant extracts were used (Table 1). The extracts were prepared by macerating the surface washed plant parts with grinder in equal amount of water. The macerate was filtered through a double layered muslin cloth. Finally, filtrate

Table 1. List of plant species and their parts used in the study.

	Botanical name	Common name	Plant part used
1	*Adhatoda vasika* Nees.	Adhatoda	Leaf
2	*Allium cepa* L.	Onion	Bulb
3	*Allium sativum* L.	Garlic	Bulb
4	*Azadirachta indica* A. Juss.	Neem	Leaf
5	*Bougainvillea spectabilis* L.	Bougainvillea	Leaf
6	*Clerodendron inerme* Gaertn.	Clerodendron	Leaf
7	*Eucalyptus globus* Labillovoy.	Eucalyptus	Leaf
8	*Eupatorium odoratum* L.	Eupatorium	Leaf
9	*Lantana camara* L.	Lantana	Leaf
10	*Ocimum sanctum* L.	Tulasi	Leaf
11	*Parthenium hysterophorus* L.	Parthenium	Leaf
12	*Pongamia pinnata* L.	Pongamia	Leaf
13	*Tridax procumbens* L.	Tridax	Leaf
14	*Vinca rosea* L.	Periwinkle	Leaf

Table 2. *In-vitro* evaluation of botanicals against *Fusarium moniliforme*.

	Treatments	Per cent mycelial inhibition 5	10	Mean
1	*Adhatoda leaf extract*	1.11 (6.0)	5.55 (13.69)	3.33 (9.85)
2	Bougainvillea leaf extract	1.82 (7.69)	6.83 (15.14)	4.32 (11.41)
3	Clerodendron leaf extract	2.76 (9.41)	8.34 (16.71)	5.55 (13.06)
4	Eucalyptus leaf extract	23.33 (28.86)	24.82 (29.90)	24.07 (29.38)
5	Eupatorium leaf extract	24.07 (29.35)	29.60 (32.51)	26.83 (30.93)
6	Garlic bulb extract	27.77 (32.51)	41.47 (41.63)	34.62 (37.07)
7	Lantana leaf extract	11.43 (19.75)	23.33 (28.87)	17.38 (24.31)
8	Neem leaf extract	20.00 (26.21)	28.88 (32.52)	24.44 (29.36)
9	Onion bulb extract	11.11 (19.43)	31.83 (34.31)	21.47 (26.87)
10	Parthenium leaf extract	12.96 (21.07)	21.10 (25.09)	17.13 (23.08)
11	Pongamia leaf extract	24.34 (29.56)	44.44 (41.78)	34.29 (35.67)
12	Tridax leaf extract	13.70 (20.97)	20.74 (27.08)	17.22 (24.02)
13	Rulasi leaf extract	28.14 (32.04)	39.25 (38.37)	33.69 (35.20)
14	Vinca leaf extract	11.85 (20.10)	20.36 (26.39)	16.10 (23.24)
	Mean	15.31 (21.64)	24.75 (28.85)	20.03 (25.25)
		Treat-ment (T)	Cone (C)	T × C
	SE ±	0.40	0.15	0.57
	CD at 1%	1.53	0.58	2.17

Table 3. *In-vitro* evaluation of botanicals against *Curvularia lunata.* *Arcsine transformed values.

	Treatments	Per cent mycelial inhibition 5	10	Mean
1	*Adhatoda leaf extract*	17.40 (24.67)*	32.22 (34.57)	24.81 (29.62)
2	Bougainvillea leaf extract	20.74 (27.08)	23.70 (29.10)	22.22 (28.09)
3	Clerodendron leaf extract	11.11 (19.44)	16.66 (24.12)	13.88 (21.78)
4	Eucalyptus leaf extract	8.51 (16.98)	15.18 (23.29)	11.84 (20.13)
5	Eupatorium leaf extract	1.11 (6.02)	12.22 (20.11)	6.66 (13.06)
6	Garlic bulb extract	39.62 (39.01)	49.25 (44.79)	44.63 (41.90)
7	Lantana leaf extract	20.37 (26.82)	24.81 (29.86)	22.59 (28.34)
8	Neem leaf extract	27.03 (31.34)	37.40 (37.72)	32.21 (34.53)
9	Onion bulb extract	20.00 (26.57)	41.11 (39.87)	30.55 (33.22)
10	Parthenium leaf extract	15.92 (23.51)	24.07 (29.35)	19.99 (26.43)
11	Pongamia leaf extract	35.18 (36.39)	49.62 (45.42)	42.40 (40.90)
12	Tridax leaf extract	20.00 (26.57)	41.48 (40.08)	30.74 (33.32)
13	Tulasi leaf extract	35.18 (36.39)	52.22 (46.22)	43.70 (41.30)
14	Vinca leaf extract	15.92 (23.54)	37.06 (36.39)	26.49 (29.96)
	Mean	20.57 (26.02)	32.64 (34.25)	26.60 (30.18)
		Treat-ment (T)	Cone. (C)	T × C
	Se ±	0.17	0.06	0.24
	CD at 1%	0.65	0.24	0.91

thus obtained from the leaves were used as stock solution. To study the antifungal mechanism of plant extracts, poisoned food technique was followed as suggested by Nene and Thapliyal (2). For this, 5 and 10 ml of stock solution were mixed with 95 and 90 ml of sterilized molten potato dextrose agar medium respectively so as to get 5 and 10% concentration. The medium was shaken thoroughly for uniform mixing of plant extract.

About 20 ml medium was poured into each of the 90 mm sterilized petriplates. Each plate was seeded with 5 mm mycelial discs aseptically taken form the periphery of 7 days old culture and incubated at 27 ± 1 C till the growth of the colony touched the periphery in control plate. Three replications were maintained for each treatment. Suitable control plates were maintained. Mean colony diameter in each case was recorded. The efficacy of the botanicals was expressed as per cent inhibition of mycelial growth over control which was calculated by using the formula as given by Vincent (3).

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

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

Results and Discussion

An *in-vitro* evaluation of botanicals provides useful and preliminary information about efficacy against pathogen within a shortest period of time. In the present investigation, fourteen plant extracts were tested at two concentrations following poison food technique.

Fusarium moniliforme

The data on the effect of plant extracts on the mycelial growth are presented in Table 2. Among the 14 plant extracts tested, garlic bulb extract (34.62%) showed maximum mycelial inhibition which was on par with pongamia leaf extract (34.29%). This was followed by tulasi leaf extract (33.69%). All the plant extracts at 10% concentration were found to be superior over 5% concentration of the same. Among all the plant extracts tested at different concentrations, maximum inhibition of 44.44% was recorded in pongamia leaf extract at 10% concentration. This was followed by garlic leaf extract (41.47%) and tulasi leaf extract (39.25%) at 10% concentration. The least inhibition of 1.11% mycelial growth was observed in adhatoda leaf extract followed by bougainvillea leaf extract (1.82%) at 5% concentration. These results are in accordance with Gohil and Vala (4) who reported that the extracts of garlic and soap nut were found inhibitory to *F. Moniliforme.* Gupta et al. (5) also reported the effectiveness of 1:5 leaf extracts of *P. pinnata, Calotropis gigantia, A. indica* against *F. pallidoroseum, F. moniliforme* and *F. oxysporum.*

Curvularia lunata

Of all the plant extracts tested, highest inhibition (44.63%) of mycelial growth was observed in garlic bulb extract which was on par with tulasi leaf extract (43.70%). Next best treatment was pongamia leaf extract (42.40%), which was at par with tulasi leaf extract (Table 3).

Among the different treatments at two concentrations tested, tulasi leaf extract at ten per cent was found to be most effective with 52.22% inhibition, which was on par with pongamia leaf extract (49.62%) at 10% concentration. Next best botanical was garlic bulb extract at 10% concentration (49.25%). Other effective treatments were tridax leaf extract (41.48%) and onion bulb extract (41.11%) at 10% concentration. Least inhibition (1.11%) was observed in eupatorium leaf extract at five per cent concentration. Similar trend was observed by Meena and Mariappan (6) where in leaf extract and flower extract of *Catheranthus roseus* were found to inhibit the mycelial growth and spore germination of seed borne mycoflora of sorghum seeds. Further they also found that extracts of neem and lantana were more effective.

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