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Research Article

MANAGEMENT OF PEARL MILLET SMUT PATHOGEN (*Tolyposporium penicillariae*) THROUGH PLANT EXTRACTS

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Abstract- Pearl millet (*Pennisetum glaucum L. R. Br.*) is an important cereal crop in India, which forms stable diet for nearly ten percent Indian population. Smut caused by *Tolyposporium penicillariae* Bref. is the most common and wide spread disease of pearl millet in Northern India. It is also a major biotic constraint for pearl millet grain and fodder production in Northern Madhya Pradesh. In present study a set of twenty plant extracts (at 20% concentration) along with control (Only PDA) were evaluated against test pathogen under laboratory conditions at Agriculture college of Gwalior during 2015-16. All these plant extracts were significantly inhibited mycelial growth of smut pathogen. The highest mycelial inhibition percent was found in case of *Eucalyptus sp.* (86.56%) which was followed by *Azadirachta indica* (seed) (79.65%), *Parthenium historophorus* (74.11%) and *Azadirachta indica* leaves extract (73.52%). The minimum percent inhibition was found in case of *Allium cepa* (16.40%) which was followed by *Zinziber officinale* (18.9%), *Allium sativum* (26.29%), *Aegle marmelos* (27.86%), *Polyalthea longifolia* (29.25%).

Keywords- *Eucalyptus sp.*, Pearl millet, Percent inhibition, Pant extracts, *Tolyposporium penicillariae*

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Introduction

Pearl millet (*Pennisetum glaucum L. R. Br.*) is also known as *bajra* in Hindu or *'yadi'* in Marghi language, is the sixth most important cereal crop annually cultivated as rain fed crop in arid and semi-arid areas of India. It is also a fodder crop of Northern India and forms stable diet for nearly 10% Indian population. More than one hundred diseases caused by fungi, bacteria, viruses and nematodes have been reported [1,2]. Among them major fungal diseases such as ergot, downy mildew and smut adversely affect grain and fodder production. Smut caused by (*T. penicillariae*) is a wide spread disease of pearl millet affecting almost all hybrids and capable of causing significant economics losses in grain yield (mainly affects ovaries and converted into smut sori) upto 30% [3], 20.6% [4]. [5] estimated the pearl millet grain losses due to smut in Morena, Bhind and Gwalior districts is 12.37, 7.03 and 8.87 per cent respectively. Presently this disease is considered important and becomes severe in years when humid weather prevails during flowering [6]. The disease had become more important in Northern India [7]. In Chambal and Gwalior divisions smut occupied a key position among the disease and now it is a major biotic constraint. There is a little information available in literature on the disease management and evaluation of plant extracts against this disease. There is a scope to test a series of plant extracts as an alternative option in place of chemical fungicides for the eco-friendly management of smut. Plant extracts are gaining an importance in disease management because of their specific effect, low in cost, easily available and safe for environment and food chain. Many plant extracts have been identified to be effective in the control of plant diseases. Hence an attempt was made to investigate the effect of different plant extracts against the smut pathogen in laboratory conditions. Keeping in view that the economic loss is caused by smut in pearl millet, present study was undertaken to evaluate the bio-efficacy of different locally available twenty plant extracts for the management of *T. penicillarie* inciting smut of Bajra under *in vitro* condition by adopting poisoned food technique.

Material and Methods

Poisoned food technique (plant extract amended into potato dextrose agar media) was used to screen efficacy different plant extracts *in vitro* [8], 20% concentration of plant extracts were incorporated in potato agar media for inoculation of the test pathogen in sterilized petri plates.

Screening of plant extracts against *T. penicillariae*

The leaf and bulb (rhizome) extracts of twenty selected plants [Table-1] were prepared by healthy and disease free fresh leaf and bulb samples of plant species collected from field and they were brought to laboratory than the samples were washed separately in tap water and finally three times in distilled water and chopped into small bits with sterile sharp knife. They were homogenized in mortar and pestle by adding distilled water 1:1 (w/v). The extracts were clarified by passing through two layers of cheese cloth and finally through Whatmann No. 1 filter paper. These filtered extracts were taken in the study as 100% extract. An appropriate amount of plant extract (20 ml) was mixed in sterilized PDA medium (100 ml) in conical flask (250 ml) to get desired concentration (20%) of each extract and autoclaved at 15 lbs pressure for15-20 minutes. Plant extracts amended PDA was then poured (20 ml) into sterilized petri plates under laminar air flow. On solidification of PDA in Petri plates, the isolated pathogen grown (7 days old culture of test pathogen) on potato agar media were placed at the centre of poured Petri plates and incubated at 25±1ºC for 7 days (BOD incubator). Radial

growth of test fungus was measured after inoculation till 7 days at an interval of 24 hrs.

Percent inhibition in growth was determined with the help of mean colony diameter and calculated by using the following formula:

$$\text{Percent inhibition} = \frac{X-Y}{X} \times 100$$

Where,

X = Colony diameter in check

Y = Colony diameter on amended media

Table-1 *List of botanicals*

S.No.	Botanical name	Local name	Plant part
1	*Eucalyptus sp.*	Neelgiri	Leaves
2	*Calotropis procera*	Aank	Leaves
3	*Azadirachta indica*	Neem	Leaves
4	*Azadirachta indica*	Neem	Seeds
5	*Ocimum sanctum*	Tulsi	Leaves
6	*Lantana camera*	Lantana	Leaves
7	*Allium cepa*	Onion	Bulbs
8	*Aegle marmelos*	Bel	Leaves
9	*Parthenium hysterophorus*	Gajargrass	Leaves
10	*Zinziber officinale*	Adrak	Rhizome
11	*Aloe vera*	Gwarpata	Leaves
12	*Tagetes erecta*	Gainda	Leaves
13	*Bougenvillia* sp.	Dr. Rao	leaves
14	*Datura sp.*	Datura	leaves
15	*Withania somnifera*	Ashwaganda	leaves
16	*Polyalthea longifolia*	Ashoka	leaves
17	*Vigna rosea*	Perwinkle	leaves
18	*Thuja* sp.	Vidhya	leaves
19	*Allium sativum*	Lahsun	bulbs
20	Control (PDA)	PDA	media

* Botanicals were used in crude form at 20% concentration.

Results and Discussion

In the present study, these twenty plant extracts were evaluated in the form of crude extracts @ 20 percent against *T. penicillariae* and the data summarized in [Table-2]. All the tested botanicals/plant extracts were found significantly effective in reducing the percentage mycelial growth of *T. penicillariae* over control. None of them were able to inhibit the growth completely. The least growth of fungal mycelium was recorded in *Eucalyptus sp.* extract (11.33 mm) as compared to control (84.33mm) which was significantly superior over other plant extracts and which was followed by *Azadirachta indica* (seed extract) (17.16 mm), *Parthenium historophorus* (21.83mm) and *Azadirachta indica* leaves (22.33mm). However, the lower inhibition of the plant extract on the fungal mycelial growth was recorded in *Allium cepa* (70.5mm) followed by *Zingiber officinale* (68.33mm), *Allium sativum* (62.16mm). The highest mycelial inhibition percent was found in case of *Eucalyptus sp.* (86.56%) which was followed by *Azadirachta indica* (seed) (79.65%), *Parthenium historophorus* (74.11%) and *Azadirachta indica* leaves extract (73.52%). The minimum percent inhibition was found in case of *Allium cepa* (16.40%) which was followed by *Zinziber officinale* (18.9%), *Allium sativum* (26.29%), *Aegle marmelos* (27.86%), *Polyalthea longifolia* (29.25%). Similarly the effectiveness of *Eucalyptus* was also reported by [9] who evaluated *Parthenium, Eucalyptus* and *Calotropis* in the form of leaf extracts and neem in the form of leaf extract, seed extract and oil against *Tolyposporium penicillariae* under *in vitro* condition and reported that *Eucalyptus* was found best among the plant extracts. [10] screened three forms of *Aloe vera* leaf extracts *viz.,* crude, powdered and ethanol for antifungal activity against ten pathogens *viz.*, *Rhizoctonia solani, Fusarium oxysporum, Sclerotium rolfsii, T. Penicillariae, R. bataticola, Alternaria alternate* so on in *in-vitro* conditions and found that crude extract (20%) was more effective than ethanol and powdered extracts against *R. solani, A. solani* and *T. penicillariae*. Present finding is also supported by [11,5] and observed that all the tested botanicals were significantly superior over control but *Eucalyptus* was found most effective and significantly superior over all the treatments followed by *Parthenium historophorus*.

Table-2 *In-vitro evaluation of crude plant extracts against T. penicillariae.*

Botanical name	Radial growth of fungal mycelium after 7 days of inoculation (mm)*	Percent inhibition(%)
Allium sativum	62.1666667	26.2924901
Aegle marmelos	60.8333333	27.8695652
Aloe vera	41.5	50.7905138
Bougainvillea spectabilis	40.5	51.9762846
Calotropis procera	31.3333333	62.8498024
Datura stramonium	33.3333333	60.4782609
Eucalyptus Sp.	11.3333333	86.5652174
Lantana camera	31.5	62.6482213
Azadirachta indica	22.3333333	73.5217391
Azadirachta indica (seeds)	17.1666667	79.6521739
Allium cepa	70.5	16.4031621
Parthenium historophorus	21.8333333	74.1146245
Polyalthea longifolia	59.6666667	29.256917
Tegetes erecta	53.8333333	36.1699605
Thuja sp.	53.3333333	36.7628458
Ocimum sanctum	54.5	35.3754941
Vigna rosea	42.3333333	49.8063241
Withania somnifera	46.3333333	45.0632411
Zinzer officinale	68.3333333	18.9762846
Control (Only PDA)	84.3333333	
CD (5%)	2.88141	

*Data were mean of three replications

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