



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2023; 12(9): 578-581

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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 01-06-2023

Accepted: 08-07-2023

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## ***In vitro* efficacy of plant extracts against pearl millet downy mildew caused by *Sclerospora graminicola* (Sacc.) Schoret**

**SV Waghmare, GP Jagtap, KD Dahiphale and PP Ambilwade**

### **Abstract**

Pearl millet (*Pennisetum glaucum* (L.) popularly known as bajra is a major warm-season cereal, largely grown under rainfed conditions in India. Downy mildew incited by *Sclerospora graminicola* (Sacc.) Schoret is the most widespread and destructive disease of pearl millet in India and Marathwada region of Maharashtra. India is the largest producer of pearl millet, both in terms of an area, production and productivity. *In vitro* efficacy of Plant extracts against pearl millet downy mildew studies showed that, among eight plant extracts, T<sub>1</sub>: Datura metel leaf @ 10% (4.00%) which was on par with T<sub>6</sub>: *Allium sativum* bulb extract @ 10% (5.33%), followed by T<sub>3</sub>: *Azadirachta indica* leaf extract @ 10% (9.33%), significantly reduced the incidence of downy mildew disease.

**Keywords:** Downy mildew, pearl millet, *Sclerospora graminicola*, plant extract

### **Introduction**

Pearl millet (*Pennisetum glaucum* (L.) is a major warm-season and one of the most drought, heat tolerant cereal crop in India, which is popularly known as Bajra. Pearl millet is grown in different type of soils, such as sandy loam, light and very light soils, with low inherent fertility, good drainage and mild salinity. In the arid and semi-arid environments pearl millet fight against food insecurity (Bailey *et al.*, 1979; Buerkert *et al.*, 2001) [3, 4]. It is grown in the ecologies of South Asia (SA) and sub-Saharan Africa (SSA) which are characteristically challenged by low or erratic rainfall, high mean temperature and with low organic carbon and poor water-holding capacity (Serba *et al.*, 2020) [15]. Pearl millet has emerged as a highly productive and remunerative crop in the hot and dry summer season in the northern and western parts of India (Yadav and Rai, 2013) [18]. The area, production and productivity in India is 7.57 M ha, 10.86 MT and 1436 kg/ha respectively. In Maharashtra pearl millet is grown as sole crop for grain and fodder purposes. The area, production and productivity is 0.64 M ha, 0.64 MT and 1003 kg/ha respectively (Anonymous, 2021a) [1]. Marathwada region occupies 0.137 M ha with an annual production 1.22 MT and productivity of 994 kg/ha (Anonymous, 2021b) [2]. Disease is the most important yield reducing factor among many constraints in pearl millet production. Downy mildew caused by *Sclerospora graminicola* is a highly destructive and widespread disease in most pearl millet growing areas of Asia and Africa. The disease spreads in more than 20 countries all over the world (Safeulla, 1976) [11]. Downy mildew was quite severe in Ahmednagar, Jalgaon, Aurangabad and Jalna districts of Maharashtra state (India) with mean disease incidence of 56%, 40%, 35% and 32%, respectively (Sharma *et al.*, 2012) [16]. The average downy mildew incidence in different districts of Rajasthan *viz.*, Bikaner, Jodhpur, Sikar, Jaipur and Alwar varied from 9.87 to 17.95 percent (Saini *et al.*, 2020) [11]. There is hazardous effect of repeated application of fungicides due to their non-target effects, some of them are losing their effectiveness, because of development of resistant strains of pathogens and contribute to greater production costs and environmental pollution therefore Integrated disease management is the only key for effective long term control of downy mildew disease of pearl millet to avoid all inherent ill effects *viz.*, environmental pollution, residual toxicity, development of resistance by the pathogen, cost ineffectiveness etc. caused by the continuous use of chemicals apart from this the use of plant extract approaches may serve as an alternate line for the ecofriendly management of the disease under *in vitro* condition. Hence *in vitro* efficacy of plant extract against pearl millet downy mildew caused by *Sclerospora graminicola* studies conducted.

## Material and Methods

The present studies are conducted at National Agriculture Research Project, Aurangabad during *Kharif* season of 2019-20. Aurangabad is located in the Marathwada region of Maharashtra state. The city is also a popular tourism hub, with tourist destinations like the Ajanta and Ellora caves lying on its outskirts which lies between latitude and longitude 19.8762 North and 75.3433 East, respectively.

### Efficacy of plant extracts against *Sclerospora graminicola*

A greenhouse experiments was conducted to find out the effect of plant extractson the incidence of downy mildew. Seeds treated with the plant extract agent as described above were sown in earthen pots filled with autoclaved soil, sand and manure in the ratio 2:1:1. There were three replications per treatment. These were arranged in a randomized complete block design.

Seedlings were maintained at 25–30 °C with 95% relative humidity. Seedlings were watered when required with appropriate fertilization. Seeds treated with sterile distilled water served as control. Two-day-old seedlings were challenge inoculated by whorl inoculation method (Singh and Gopinath, 1985) with the zoospore suspension of *S. graminicola* at a concentration of 4 -6 10<sup>4</sup> zoospores/ml prepared as described earlier. Pots were maintained in greenhouse conditions and thedisease incidence (the number of plants showing the typical symptoms of downy mildew disease such as stunted growth, sporulation, malformation etc.) were recorded after 30 days of sowing.

### Experimental details

Design - Completely Randomized Block Design (CRD)

Variety – Local variety

Replications - 3

Treatment - 9

Treatment details

Tr. No	Treatments
T <sub>1</sub>	<i>Datura metel</i> leaf extract @ 10%
T <sub>2</sub>	<i>Aegle marmelos</i> leaf extract @ 10%
T <sub>3</sub>	<i>Azadirachta indica</i> leaf extract @ 10%
T <sub>4</sub>	<i>Ocimumspp.</i> leaf extract @ 10%
T <sub>5</sub>	<i>Parthenium hysterophorus</i> leaf extract @ 10%
T <sub>6</sub>	<i>Allium sativum</i> bulb extract @10%
T <sub>7</sub>	<i>Helianthus annuus</i> seed extract @ 10%
T <sub>8</sub>	<i>Tagetes erecta</i> leaf extract @ 10%
T <sub>9</sub>	Control (untreated)

## 3. Result and Discussion

The results (Plate 1, Table 1 and Fig. 1) revealed that, pearl millet percent seed germination ranged from 90.66 to 62.66%, as against 59.33% in untreated control. However, it was significantly highest with T<sub>4</sub>: *Datura metel* leaf @ 10% (90.66%), followed by T<sub>6</sub>: *Allium sativum* bulb extract @ 10% (85.33%) and T<sub>3</sub>: *Azadirachta indica* leaf extract @ 10% (74.66%). Rest of the treatments recorded seed germination in the range of 71.33 to 62.66 percent.

Downy mildew incidence ranged from 4.00 to 18.66 percent, as against 23.33% in untreated control. However, it was significantly least with T<sub>1</sub>: *Datura metel* leaf @ 10% (4.00%) which was on par with T<sub>6</sub>: *Allium sativum* bulb extract @ 10% (5.33%), followed by T<sub>3</sub>: *Azadirachta indica* leaf extract @ 10% (9.33%). Rest of the treatments recorded downy mildew incidence in the range of 10.00 to 18.66

percent. While, percent disease reduction over control ranged from 82.85 to 20.01%. However, it was significantly highest with T<sub>4</sub>: *Datura metel* leaf @ 10% (82.85%), followed by T<sub>6</sub>: *Allium sativum* bulb extract @ 10% (77.15%) and T<sub>3</sub>: *Azadirachta indica* leaf extract @ 10% (60.00%). Rest of the treatments were ranged from 57.13 to 20.01%.

The results of present study are in consonance with earlier findings of the several workers who evaluated various leaf extract as potential botanicals against so many plant pathogens. Taha and El-Shennawy (2020) <sup>[17]</sup>. Evaluated efficacy of various aqueous plant extracts against disease incidence on lettuce plants and reported that, the garlic extract was the most effective in reducing disease incidence with 53.3% and 54.38% during 2018 and 2019 respectively.

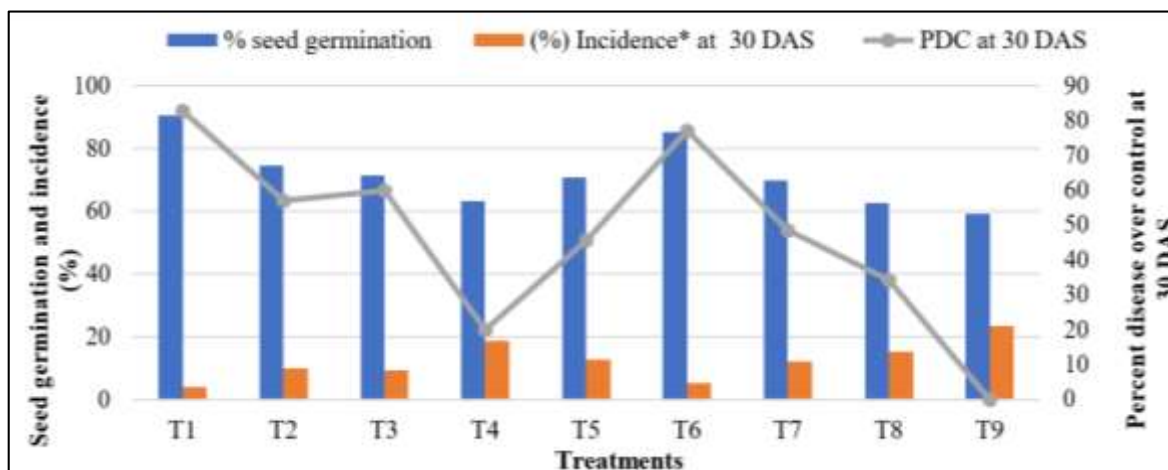


**Plate 1:** *In vitro* efficacy of plant extracts against *Sclerospora graminicola*, causing pearl millet downy mildew, during Kharif 2019-20

**Table 1:** *In vitro* efficacy of plant extract against *Sclerospora graminicola*, causing pearl millet downy mildew, during Kharif 2019-20

Tr. No.	Treatments	Conc.	% Seed Germination*	% DM Incidence* at 30 DAS	PDC* at 30 DAS
T <sub>1</sub>	<i>Datura metal</i> LE (ST)	10%	90.66 (72.23)**	4.00 (11.53)	82.85
T <sub>2</sub>	<i>Aegle marmelos</i> LE (ST)	10%	71.33 (57.63)	10.00 (18.37)	57.13
T <sub>3</sub>	<i>Azardirachta indica</i> LE (ST)	10%	74.66 (59.78)	9.33 (17.75)	60.00
T <sub>4</sub>	<i>Ocimum spp.</i> LE (ST)	10%	63.33 (52.73)	18.66 (25.58)	20.01
T <sub>5</sub>	<i>Parthenium hysterophorus</i> LE (ST)	10%	70.66 (57.21)	12.66 (20.82)	45.73
T <sub>6</sub>	<i>Allium sativum</i> BE (ST)	10%	85.33 (67.49)	5.33 (13.29)	77.15
T <sub>7</sub>	<i>Helianthus annuus</i> SE (ST)	10%	70.00 (56.78)	12.00 (20.21)	48.56
T <sub>8</sub>	<i>Tagetes erecta</i> LE (ST)	10%	62.66 (52.33)	15.33 (23.03)	34.29
T <sub>9</sub>	Control (untreated)		59.33 (50.38)	23.33 (28.86)	--
S.E.±			0.58	0.77	
C.D. (P=0.01)			1.79	2.30	

\* Mean of three replication; DAS-Days after sowing; LE: Leaf extract, BE- Bulb extract ST: seed treatment, PDC: Percent disease control; DM-Downy mildew,\*\* Figure in parenthesis denoted Arc sign transferred values.

**Fig 1:** *In vitro* efficacy of plant extracts against *Sclerospora graminicola* causing pearl millet downy mildew, during Kharif 2019-20

2018 and 2019 respectively Sasode *et al.*, (2018) [14] reported that foliar application of Neem leaf extract @ 10% reduces incidence of pearl millet downy mildew (4.33%) over control (10.19%). Randhava (2015) [10] evaluated various botanicals viz. Neem leaves, Neem seed and Eucalyptus leaves in combination with organic amendments and their combinations against pearl millet downy mildew (*S. graminicola*) and reported that, at 30 DAS, the disease incidence was minimum in treatment Mustard cake + Neem leaves (23.54%), Neem cake + Neem seed (23.62%), Neem seed (23.62), Mustard cake (25.40) and Neem leaves (25.42) over control (44.79%). similar results are also given by Deepak *et al.*, (2005) [5], Patidar (2007) [9], Devaiah *et al.*, (2009) [6], Kamalakannan *et al.*, (2009) [8], Singh *et al.* (2012) [13] and Falade (2020) [7].

### Conclusion

The efficacy of different leaf extract of *Datura metel*, *Aegle marmelos*, *Azardirachta indica*, *Ocimum spp.*, *Parthenium hysterophorus*, *Tagetes erecta*, bulb extract of *Allium sativum*, and seed extract *Helianthus annuus* were evaluated against *Sclerospora graminicola* in green house condition and found that the disease incidence was significantly least with T<sub>1</sub>

*Datura metel* leaf @ 10% (4.00%) followed by T<sub>6</sub>: *Allium sativum* bulb extract @ 10% (5.33%) and *Azardirachta indica* leaf extract @ 10% (9.33%).

### Acknowledgment

This experimental study was supported by all researchers and funding from NARP, Aurangabad and Department of Plant Pathology VNMKV, Parbhani.

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