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Evaluation of Botanicals against Powdery Mildew (*Oidium mangiferae* Berthet) of Mango (*Mangifera indica* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and is a native of the Indo-Burma (now Myanmar) region. The fungal diseases occur in higher proportions leading to huge economic losses for the growers. Out of various fungal diseases, powdery mildew (*O. mangiferae*) is the most destructive malady encountering almost all the commercial cultivars. In the present study total eight botanicals were tested against powdery mildew under field. Minimum powdery mildew severity (10.83 %) and maximum disease reduction (76.67 %) over control were recorded in treatment with Neem leaf extract at 10 per cent concentration. The next best treatment was Garlic clove extract at 10 per cent concentration which was found on par with Onion bulb extract, Zinger clove extract and Turmeric rhizome extract in per cent disease severity and per cent disease reduction respectively.

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Keywords: Mango; powdery mildew; Oidium mangiferae; botanicals.

1. INTRODUCTION

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and is a native of the Indo-Burma (now Myanmar) region, cultivated in the Indian subcontinent for well over 4000 years [Candolle, (1904) and Mukherjee, (1951)] It is one of the most cultivated and favourite fruit of the tropics and has developed its importance all over the world. Being a useful and delicious fruit, it is the part of culture and religion since time immemorial. Because of its taste and its good qualities, it is called “The King of Fruits”.

Though, a tropical fruit, mango is cultivated under subtropical conditions in 89 countries of the world. India is also a prominent exporter of fresh mangoes to the world. The country has exported 22963.76 MT of fresh mangoes to the world for the worth of Rs. 378.49 crores (48.53 USD Millions) during the year 2022-23 (https://apeda.gov.in). In India total area under mango cultivation is 2371.00 thousand hectares with 20946.00 MT productions. The top ten mango production states are Uttar Pradesh (4807.83 MT), Andhra Pradesh (4676.06 MT), Karnataka (1745.57 MT), Bihar (1549.97 MT), Telangana (1157.73 MT), Gujarat (997.83 MT), West Bengal (889.69 MT), Orissa (847.81 MT), Tamil Nadu (693.64 MT) and Madhya Pradesh (526.23 MT) (Anon., 2022).

Major constraint in the commercial cultivation of mango is its proneness to a large number of diseases at all stages of its development right from plant in the nursery up to fruit production under orchard conditions. The average yield however, is not appreciable due to the negligence of growers and the attack of several diseases. The most important reported diseases are anthracnose *Colletotrichum gloeosporioides* Penz and Sacc), powdery mildew (*Oidium mangiferae* Berthet), malformation (*Fusarium moniliforme var. subglutinans* Edwards), bacterial leaf spot (*Erwinia mangiferae* Stapp), mango bacterial black spot (*Xanthomonas campestris pv. Mangiferae indicae*), crown gall (*Agrobacterium tumefaciens* Smith & Townsend), sooty mould (*Capnodium mangiferae* Cooke & Broome), fruit rot (*C. gloeosporioides* Penz and Sacc and *Aspergillus niger* van Tieghem), root rot (*Rhizoctonia solani* Khun and *Fusarium oxysporum* (E.F.Smith) Snyder & Hansen), dieback (*Diplodia netalensis* Pole-Evans) and sudden decline (Prakash, 2004).

Among these, fungal diseases occur in higher proportions and lead to huge economic losses for the growers. Out of various fungal diseases, powdery mildew (*O. mangiferae*) is the most destructive malady encountering almost all commercial cultivars irrespective of different geographical and ecological situations. Mango cultivars differ in susceptibility to powdery mildew and it attacks the flowers, young fruits and leaves (Campbell and Campbell, 2003; Ploetz and Ploetz, 2003). The disease was first recorded on mango in 1914 in Brazil and the fungus was named and described by Berthet (Jones, 1923; Uppal et al., 1941). Powdery mildew affects almost all the parts of the plant *viz.,* trunk, branch, twig, leaf, petiole, flower and fruit (Adhikary et al., 2013). Fruit yield can be drastically reduced or even lost due to powdery mildew. It is a widespread disease of leaves, panicles, blossom clusters, and fruit and has been reported in most of the important mango producing countries in the world (Sinha et al., 2001). Chemicals are available for the management of powdery mildew of mango, however, health conscious people prefer organic food and ready to pay premium price. Looking at the significance of the problem and need the present investigation was planned.

2. MATERIALS AND METHODS

The field experiment was conducted during 2019-20 and 2020-21 at Plot No. 9-10, Experimental Learning Farm, Department of Silviculture and Agro-forestry, College of Forestry, Navsari Agricultural University, Navsari. The eight different botanicals at 10 per cent *viz.,*neem leaf extract, lantana leaf extract, marigold leaf extract, turmeric rhizomes extract, zinger clove extract, datura leaf extract, garlic clove extract, onion bulb extract were tested based on their antifungal activities against *O. mangiferae*, The experiment was laid out in a Randomized Block Design with nine treatment and three replications. Observation on the intensity of disease was recorded using three randomly selected inflorescences from each treatment and graded as per 0 to 5 scales (Akthar and Alam, 2001) and Percent disease Intensity (PDI) was calculated by using the following formula.

PDI = Sum of all numerical ratings / No. of inflorescences examined × Maximum Disease Scale x 100

The per cent disease reduction over control was calculated by using following formula.

Per cent Disease Reduction = PDI in control – PDI in treatment / PDI in control x 100

3. RESULTS AND DISCUSSION

Data on per cent disease severity and per cent disease reduction over control in the year 2019-20 has been presented in Table 1 revealed that minimum powdery mildew severity (11.67 per cent) and maximum disease reduction (73.33 per cent) over control was recorded in treatment with T_1 (Neem leaf extract) at 10 per cent concentration. Next best treatment was T_7 (Garlic clove extract) at 10 per cent concentration with 26.45 per cent severity and 66.67 per cent disease reduction over the control, which was found at par with T_8 (Onion bulb extract), T_5 (Zinger clove extract) and T_4 (Turmeric rhizome extract) with 27.71, 28.78 and 31.00 per cent disease severity and 60.00, 53.33 and 46.67 per cent disease reduction respectively. Maximum per cent disease severity and least per cent disease reduction was observed in treatment T_2 (Lantana leaf extract) with 65.00 per cent disease severity and 6.67 per cent disease reduction followed by treatment T_6 (Datura leaf extract) and T_3 (Marigold leaf extract) with 57.86 and 47.88 per cent disease severity and 20.00 and 26.67 disease reduction respectively.

During 2020-21, data on per cent disease severity and per cent disease reduction over control are presented in Table 2 revealed that minimum powdery mildew severity and maximum per cent disease reduction was recorded in treatment with T_1 (Neem leaf extract) at 10 per cent with 18.43 per cent and 80.00 per cent disease reduction over control. Next best treatment was T_7 (Garlic clove extract) with 24.05 per cent severity and 66.67 per cent disease reduction, which was found at par with T_8 (Onion bulb extract) with 26.45 per cent disease severity and 60.00 per cent disease reduction over control, this was followed by treatment T_5 (Zinger clove extract) and T_4 (Turmeric rhizome extract)

Table 1. Field efficacy of different botanicals against powdery mildew (*O. mangiferae*) of mango under field condition (2019-20)

Tr.No	Treatment Details	Scientific Name	Conc. (%)	PDI		Per cent reduction over Control
				Before spraying	After spraying	
1	Neem leaf extract	*Azadirechta indica* A. Juss	10	41.67* (40.20)	11.67* (19.89)	73.33
2	Lantana leaf extract	*Lantana camera* L	10	31.67 (34.15)	81.67 (65.00)	6.67
3	Marigold leaf extract	*Tagetes erecta* L	10	35.00 (36.13)	55.00 (47.88)	26.67
4	Turmeric Rhizomes extract	*Curcuma longa* L	10	45.00 (42.12)	26.67 (31.00)	46.67
5	Zinger clove extract	*Zinger officinale* (Willdenow) Roscoe	10	41.67 (40.20)	23.33 (28.78)	53.33
6	Datura leaf extract	*Datura alba* Rumph.exNees	10	35.00 (36.18)	71.67 (57.86)	20.00
7	Garlic clove extract	*Allium sativum*L	10	43.33 (41.16)	20.00 (26.45)	66.67
8	Onion buld extract	*Allium cepa*L	10	45.00 (42.12)	21.67 (27.71)	60.00
9	Control	-	-	33.33 (35.17)	100.00 (90.00)	
SEm±				2.10	1.97	
CD at 5%				NS	5.92	
CV (%)				9.43	7.80	

**Figures outside the parentheses are arcsine transformation values where in parentheses are original values*

with 29.93 and 30.00 per cent disease severity and 60.00 and 53.33 per cent disease reduction over control. Maximum per cent disease severity and least per cent disease reduction was observed in treatment T_2 (Lantana leaf extract) with 62.40 per cent disease severity and 13.33 per cent disease followed by treatment T_6 (Datura leaf extract) and T_3 (Marigold leaf extract) with 58.93 and 46.92 per cent disease severity and 20.00 and 33.33 disease reduction respectively.

Pooled data of both the year on per cent disease severity and per cent disease reduction over control are presented in Table 3. Data revealed that minimum powdery mildew severity and maximum per cent disease reduction was recorded in treatment with T_1 (Neem leaf extract) at 10 per cent with 19.16per cent and 76.67 per cent disease reduction over control. Next best treatment was T_7 (Garlic clove extract) with 25.25 per cent severity and 66.67 per cent disease reduction, which was found at par with T_8 (Onion bulb extract) with 27.08 per cent disease severity and 60.00 per cent disease respectively, this was followed by treatment T_5 (Zinger clove extract) and T_4 (Turmeric rhizome extract) with 29.39 and 30.46 per cent disease severity and 56.67 and 50.00 per cent disease reduction over control. Maximum per cent disease severity and least per cent disease reduction was observed in treatment T_2 (Lantana leaf extract) with 63.70 per cent disease severity and 10.00 per cent disease followed by treatment T_6 (Datura leaf extract) and T_3 (Marigold leaf extract) with 58.39 and 47.40 per cent disease severity and 20.00 and 30.00 disease reduction respectively. Neem based products available in the market has been tested and reported to manage powdery mildew disease by Sani et al. (2022), Mishra et al. (2017), Singh and Prithiviraj (1997), Ravikumar (1998), Sindhan et al. (1999) in mango and other crops.

Table 2. Field efficacy of different botanicals against powdery mildew (*O. mangiferae*) of mango under field condition (2020-21)

Tr.No	Treatment Details	Scientific Name	Conc. (%)	PDI		Per cent reduction over Control
				Before spraying	After spraying	
1	Neem leaf extract	*Azadirechta indica* A. Juss	10	38.33* (38.24)	10.00* (18.43)	80.00
2	Lantana leaf extract	*Lantana camera* L	10	33.33 (35.25)	78.33 (62.40)	13.33
3	Marigold leaf extract	*Tagetes erecta* L	10	36.67 (37.26)	53.33 (46.92)	33.33
4	Turmeric Rhizomes extract	*Curcuma longa* L	10	36.67 (37.26)	25.00 (30.00)	53.33
5	Zinger clove extract	*Zinger officinale* (Willdenow) Roscoe	10	38.33 (38.24)	25.00 (29.93)	60.00
6	Datura leaf extract	*Datura alba* Rumph.exNees	10	31.67 (34.23)	73.33 (58.93)	20.00
7	Garlic clove extract	*Allium sativum*L	10	38.33 (38.24)	16.67 (24.05)	66.67
8	Onion buld extract	*Allium cepa*L	10	40.00 (39.21)	20.00 (26.45)	60.00
9	Control	-	-	33.33 (35.25)	100.00 (90.00)	-
SEm±				1.08	1.52	
CD at 5%				NS	4.55	
CV (%)				5.07	6.11	

**Figures outside the parentheses are arcsine transformation values where in parentheses are original values*

Table 3. Field efficacy of different botanicals against powdery mildew (*O. mangiferae*) of mango under field condition (Pooled)

Tr.No	Treatment Details	Scientific Name	Conc. (%)	PDI		Per cent Reduction over Control
				Before spraying	After spraying	
1	Neem leaf extract	*Azadirechta indica* A. Juss	10	40.00* (39.22)	10.83* (19.16)	76.67
2	Lantana leaf extract	*Lantana camera* L	10	32.50 (34.70)	80.00 (63.70)	10.00
3	Marigold leaf extract	*Tagetes erecta* L	10	35.83 (36.70)	54.17 (47.40)	30.00
4	Turmeric Rhizomes extract	*Curcuma longa* L	10	40.83 (39.69)	25.83 (30.46)	50.00
5	Zinger clove extract	*Zinger officinale* (Willdenow) Roscoe	10	40.00 (39.22)	24.17 (29.39)	56.67
6	Datura leaf extract	*Datura alba* Rumph.exNees	10	33.33 (35.21)	72.50 (58.39)	20.00
7	Garlic clove extract	*Allium sativum*L	10	40.83 (39.70)	18.33 (25.25)	66.67
8	Onion buld extract	*Allium cepa*L	10	42.50 (40.67)	20.83 (27.08)	60.00
9	Control	-	-	33.33 (35.21)	100.00 (90.00)	
SEm±				1.21	1.25	
CD at 5%				3.48	3.60	
CV (%)				7.83	7.04	

**Figures outside the parentheses are arcsine transformation values where in parentheses are original values*

4. CONCLUSION

Minimum powdery mildew severity (10.83 %) and maximum disease reduction (76.67 %) over control was recorded in treatment with Neem leaf extract at 10 per cent concentration. Next best treatment was Garlic clove extract at 10 per cent concentration (18.33 % and 66.67 %) which was found at par with Onion bulb extract, Zinger clove extract and Turmeric rhizome extract in per cent disease severity and per cent disease reduction respectively.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

No AI tools were used for writing this script and it is original research work done during my Ph.D. programme.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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