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Eco-friendly Management of Downy Mildew of Opium Poppy

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A B S T R A C T

The opium poppy is one of important medicinal plant. Morphine, Codeine and Thebaine alkaloids are the products that are prepared from it. The crop is damaged by a number of fungal diseases, which causes heavy losses. An experiment was designed to evaluate the efficacy of few chemical fungicides and biofungicides, cow urine, buttermilk and botanicals against downy mildew of Opium poppy. Downy mildew (DM) caused by *Peronospora arborescens*, is a serious disease in Opium poppy (*Papaver somniferum* L.), which has a world-wide spread. Minimum disease incidence 10.12 per cent was recorded in T_6 (Seed treatment and three foliar spray of Ridomyl MZ) followed by 14.21 in T_5 (Seed treatment and three foliar spray of Mancozeb @ 0.25 per cent), Maximum reduction (83.82 per cent) in disease intensity was found in T_6 followed by T_5 (77.30%).The untreated plot showed high disease intensity (62.58 per cent) Maximum latex yield (kg/ha) was found in T_6 (40.15 kg/ha) followed by T_5 (38.33 kg/ha.) and in control plot it was found minimum, 30.98 kg/ha, Similar to latex yield the maximum seed yield (13.83 q/ha) was found in T_6 followed by T_5 (12.3 q/ha). The minimum seed yield was found in control plot 9.5q/ha. The use of plant products and 7 days old buttermilk and fresh cow urine were not associated with any health hazards and environmental and soil pollution. These plant product, have not received yet commercial attention, However botanicals and cow urine and buttermilk significantly reduced disease incidence as well as increase the yield.

Introduction

Opium poppy (*Papaver somniferum* L.) of the family Papaveraceae is a strategic crop for the pharmaceutical industry because it is the only source of morphine, codeine, and thebaine alkaloid drugs. Among the various alkaloids Morphine is a preferred analgesic for cancer patients and codeine is a cough depressant (Kapoor, 1995). Opium poppy is cultivated in different parts of the world such as Tasmania, Afghanistan, Egypt, India and Pakistan for the production of pharmaceutically important alkaloids including morphine, codeine, thebaine and papaverine. These alkaloids are frequently used as an analgesic, anti-tussive and anti-spasmodic in modern medicine. Morphine is given as in form of injection during high pain and Morphine pat is used to cancer patients. Morphine is the major

alkaloid present in opium ranges from 7-17 per cent mainly used to relieve from almost all type of severe pains. India is among the producing country having area under cultivation in Madhya Pradesh, Rajasthan and Uttar Pradesh. Its cultivation was distributed among the districts of Neemuch Mandsaur and Ratlam in Madhya Pradesh; in Faizabad, Barabanki, Bareilly and Shahjahanpur in Uttar Pradesh, and in Chittoor, Jhalawar, Udaipur and Kota in Rajasthan. In India, it is cultivated on an area of 5328 ha with a production and productivity of 317.86 tones at 70 consistency and 59.65 Kg/ha and in Rajasthan, it is cultivated on an area of 2503 ha with a production and productivity of 158.4 tones at 70 consistency and 63.28 Kg/ha during 2013- 14, respectively (Khatik *et al.,* 2016). Downy mildew (DM) of Opium poppy caused by the biotrophic Oomycete *Peronospora arborescens* (Berk.) (Landa *et al*.,2007) is one of the most important diseases for this crop worldwide (Yossifovitch, 1929; Khristov, 1943; Kapoor, 1995; Landa *et al.*,2005). The first symptom appear as small chlorotic leaf lesions, which can evolve to curled and thickened tissues that become deformed and necrotic as the disease develops. The disease caused loss in yield as it reduces the photosynthesis area.

Materials and Methods

The Experiment was conducted at Horticultural and Medicinal Farm, Acharya N.D. University of Agriculture and Technology, Kumarganj, Ayodhya during 2018-2019 in Randomized Block Design replicated three times consisting 7 treatments with furrow application of Neem cake mixture 100g/m^2 *viz*-T_1- Garlic bulb extract @ 10 per cent, T_2- Fresh cow urine @ 10 per cent, T_3 –Neem leaf extract @10 per cent , T_4- 7 days old Buttermilk @ 10 percent, T_5 –Seed treatment with 8g/kg seed and foliar spray of Mancozeb @ 0.25 per cent, T_6 – S.T 8g/kg seed and foliar spray of Ridomyl MZ @ 0.25 per cent and T_7-Control (Untreated). The Opium cultivar NOP-4(Kirtiman) was used in the experiment. Experimental Field was ploughed once with Disc harrow and thrice with cultivar followed by Planking for making a fine tilth. Recommended doses of Nitrogen, phosphorous and Potash were broadcast and mixed thoroughly in soil by light harrowing before sowing .The experimental field having plot size was 3×2 m^2. The Spacing b/w rows was 30×10 cm

Preparation of botanicals

The leaf extract of Neem and Bulb extracts of Garlic were prepared by cold water extraction method described by Shekwat and Prashad (1971). The samples were washed separately in tap water and finally three changes in distilled water. They were crushed in pestle and mortar by adding distilled water @ 2ml/g fresh weight. The extracts were clarified by passing through two layers of Cheese cloth and finally through Whatmann No. 1 filter paper. The filter extracts were quoted in the study as 100% extracts.

Preparation of Botanical Pesticides concentration

The appropriate volume of Plant extracts was mixed in sterilized distilled water to make the desired concentration (v/v) for experiments. For Bioassay, double strength concentrations of botanicals were prepared by dissolving 10 ml of plant extracts in 90ml of sterilized distilled water, respectively to get the final concentration of 10 per cent.

Observation recorded

Five plants from each plot were randomly selected and tagged. Observations were recorded on per cent disease control and yield. Yield was recorded after the harvest of the crop. Latex yield was expressed in kg/ha, and seed yield was recorded in q/ha. The

Disease intensity was calculated by using formulae:

$$\text{Disease Index} = \frac{\text{Sum of all individuals rating}}{\text{No of plant assessed} \times \text{Max. Disease rating}} \times 100$$

Percent decrease in disease intensity on the basis of efficacy of different treatment over the control was calculated by following formula,

$$\text{Percent decrease in Disease intensity} = \frac{\text{Disease intensity in control} - \text{Disease intensity in treatment}}{\text{Disease intensity in control}} \times 100$$

Scales used for Downy Mildew given in table 1.

Statistical analysis

The data, collected for all the characters studied, were subjected to the statistical analysis by adopting 'Analysis of variance' techniques.

Results and Discussion

The efficacy of chemicals and botanicals biofungicides, Fresh cow Urine and 7 days old buttermilk against Downy mildew disease of Opium Poppy resulted reduction in disease intensity and significantly increases the yield, represented in Table 2. The Minimum disease intensity (10.12 percent) was recorded in T_6 (S.T. and three foliar spray of Ridomil MZ) followed by 14.21, 29.06, 30.10, 30.43, 32.43 per cent disease intensity in T_5 (S.T. and three foliar spray of Mancozeb @ 0.25 per cent), T1(garlic bulb extract @ 10 per cent), T_3 (neem leaf extract @ 10 per cent), T_2 (fresh cow urine @10 per cent) and T_4 (7 days old buttermilk @ 10 per cent), respectively, on other hand, control (untreated plot) showed high disease intensity (62.58 per cent). Maximum reduction (83.82 per cent) in disease intensity was found in T_6 followed by T_5 (77.30 per cent), T_1 (53.56 per cent), T_3 (51.90 per cent), T_2 (51.37) and T_4 (48.17 per cent). This finding is supported by Sharma *et al.*, (2003) and reported that out of the eight fungicides tested *in vitro*, Ridomil-MZ proved the most effective with average reduction (82.41 %) of sporangial formation of *Pseudoperonospora cubensis* at all the concentrations (500, 700, 1000 ppm), while Indofil M-45 was less effective with average reduction of sporangial formation i.e. 69.38 percent at same concentration. Furthermore repeated and continuous use of these Plant Products is not associated with any health hazards and environmental pollution.

Table.1

Scale	Description of the symptom
0	Leaves free from infection
1	Small creamy white to light brown spots on leaves covering <5% leaf area
2	Small creamy white to light brown spots with cottony downy growth covering 5.1-10% leaf area
3	Creamy white to light brown spots with cottony growth covering 10.1-25% leaf area
4	Creamy white to light brown spots with cottony growth covering 25.1-50% leaf area
5	Creamy white to light brown spots with cottony growth covering 25.1-50% leaf area

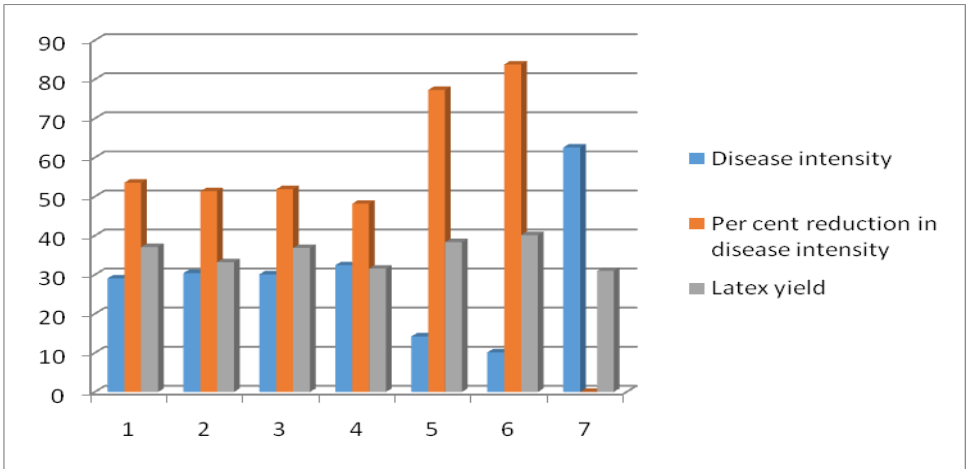
Table.2 Effect of seed treatment and foliar spray of fungicides, Plant extracts and biological treatment on intensity of downy mildew of opium poppy under field condition

S.No	Treatments	Conc %	Disease intensity	Per cent reduction in disease intensity
1	T_1: Garlic Bulb extract @	10%	29.06	53.56
2	T_2: Fresh cow urine @	10%	30.43	51.37
3	T_3: Neem leaf extract @	10%	30.10	51.90
4	T_4: 7 days old Buttermilk	10%	32.43	48.17
5	T_5: S.T*+ Mancozeb MZ	0.25%	14.21	77.30
6	T_6: S.T+ Ridomyl MZ	0.25%	10.12	83.82
7	T_7: Control(Untreated plot)		62.58	00
	SEm±		**2.18**	
	CD@ 5%		**0.92**	
	CV		**2.82**	

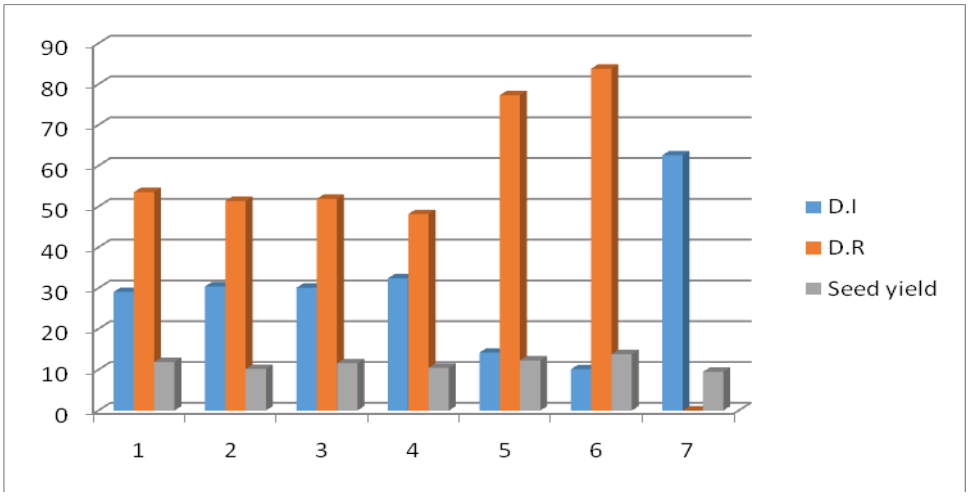
Table.3 Effect of seed treatment, foliar spray of plant extracts, fungicides, cow urine, buttermilk and fungicides on latex yield and seed yield

S.No	Treatments	Conc %	Latex yield kg/ha	Seed yield q/ha.
1	T_1: Garlic Bulb extract	10%	37.10	11.9
2	T_2: Fresh cow urine	10%	33.21	10.2
3	T_3: Neem leaf extract	10%	36.85	11.6
4	T_4: 7 days old Buttermilk	10%	31.56	10.5
5	T_5: S.T*+Ridomyl MZ	0.25%	38.33	12.3
6	T_6: S.T+ Mancozeb MZ	0.25%	40.15	13.83
7	T_7: Control(Untreated plot)		30.98	9.5
	SEm±		**1.44**	**0.47**
	CD@ 5%		**4.44**	**1.45**
	CV %		**7.0**	**7.1**

Graph.1 Effect of disease intensity on Latex yield and reduction due to different treatments



Graph.2 Effect of disease intensity and different treatments on the seed yield



The Graph 1 indicates clearly about the effect of disease intensity on the latex yield and disease reduction due to the different treatment. While in Graph 2 it indicates about the effect of treatments and disease intensity on seed yield.

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