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Evaluation of integrated disease management modules against major diseases downy mildew of opium poppy

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Abstract
Downy mildew of opium poppy (*Papaver somniferum* L) caused by *Peronospora arborescens* has been occur in India since 1918 and reported to reduce quality and quantity of opium. Field experiment was carried out during rabi, 2019 and 2020 with 9 treatments to find out suitable integrated disease management strategy. The results have demonstrated that furrow application of FYM (500g/m^2) enriched with *T. harzianum* + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing along with seed treatment in streptocycline sulphate @ 0.030% (300ppm) and metalaxyl @ 2.5g/kg. On appearance of disease symptoms first spray of *T. harzianum* and *P. fluorescens* @ 0.5 % after 15 days intervals second and third spray with streptocycline sulphate @ 0.030% (300ppm) and metalaxyl @ 0.25% was gave significant effect for minimized downy mildew disease and enhanced latex and seed yield of opium poppy.

Keywords: downy mildew, opium poppy, *trichoderma harzianum, pseudomonas fluorescens*, integrated disease management

Introduction
Opium poppy (*Papaver somniferum* L) is an annual medicinal herb. It contains many alkaloids that are frequently used as an analgesic, anti-tussive and antispasmodic in modern medicine. Besides, it is also grown for edible seed and seed oil. The capsule is most important organ of plant, which provides raw opium and edible seeds. The capsule contains about 70 percent of the total morphine synthesized by the plant. Opium poppy is an extremely delicate plant and greatly susceptible to attack fungi and bacteria caused disease on the different parts of plants and affect opium yield. Downy mildew caused by *Peronospora arborescens* (Berkeley) is one of the serious and wide spread diseases of opium poppy (Landa *et al.*, 2005) [7]. It changes in the metabolic processes of plant tissues such as respiration, photosynthesis and transpiration (Ingram, 1981) [6]. The severity of disease strongly depends on the rain, humidity and temperature (Weltzien, 1981, Calderon *et al.*, 2014) [15, 2]. In the wet weather, the pathogen produce high amount of sporangiophore with sporangia on the abaxial surface of leaf and dispersed from a few hundred meters up to hundred kilometers by air current in a viable conditions. In view of the importance of disease, the field trial was conducted to evaluate the efficacy of integrated disease management package against the downy mildew of opium poppy.

Materials and Methods
Field experiment was carried out during rabi, 2019-20 with 9 treatments *viz;* T_1. Furrow application of FYM (500g/m2) enriched with *Trichoderma harzianum* + *Pseudomonas fluorescens* @ 2.0% 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300 ppm) and Metalaxyl @ 2.5 g/kg. On first appearance of disease spray *T. harzianum and P. fluorescens* @ 0.5% followed by second and third spray at 15 days interval. T_2. Furrow application of FYM (500g/m2) enriched with *T. harzianum* + *P. fluorescens*@ 2.0% 4-5 days prior to sowing. After appearance of disease spray of Garlic bulb extract @10% and neem oil @ 2.0 % for thrice at 15 days interval. T_3. Furrow soil application of FYM (500g/m2) enriched with *T. harzianum* + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 2.5g/kg. On appearance of disease symptoms spray of *T. harzianum and P. fluorescens* @ 0.5 %. Second and third spray with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 0.25% at 15 days interval.T_4. Furrow application of FYM (500g/m2) enriched with *T.*

harzianum + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 2.5g/kg. On appearance of disease symptoms (any disease) three spray of Bordeaux mixture @ 5000 ppm at 15 days interval.T_5. In furrow soil application of FYM (500g/m2) enriched with *T. harzianum* + *P. fluorescens*, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl MZ 35 SD @ 5g/kg.T_6. On appearance of disease symptoms spray *T. harzianum* + *P. fluorescens*@ 0.50% and repeat the second and third spray at 15 days interval. T_7. On appearance of disease symptoms (any disease) three consecutive spray of Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 0.25% at 15 days interval.T_8. On appearance of disease symptoms (any disease) three spray of Bordeaux mixture @ 5000 ppm at 15 days interval, T_9. Control Experiment was conducted in randomized block design with three replication. The plot size was 3.0 X 2.0 meters and spacing was maintained 30 x 10cm. 15 days before sowing *Trichoderma harzianum* and *Pseudomonas fluorescens* were mixed in rotted cow dung for proper colonization of biotic agents. Prior to 5 days sowing *Trichoderma harzianum* and *Pseudomonas fluorescens* were mixed in soil @2.o% with furrow application. Seed treatments were done with streptocycline sulphate @ 2.5g/kg and metalaxyl @ 5.0g/kg seed. The crop was sown in the third week of October. The standard agronomical practices of opium poppy were adopted. The first disease appearance in each treatment was recorded. The spraying of fungicides and bioagents were done as per treatments. The data of disease intensity and disease severity were recorded pre-flowering, flowering and post flowering stage Data of disease intensity and disease severity were calculated as per formula described by Sohi and Sridhar (1972) [11]. Yield data was recorded in all treatments at the time of harvest.

Results and Discussion

Downy mildew disease was observed 41 days after sowing in T_3 (Furrow soil application of FYM (500g/m^2) enriched with T. harzianum + P. fluorescens @ 2.0%, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 2.5g/kg. On appearance of disease symptoms spray of *T. harzianum* and *P. fluorescens* @ 0.5 %. Second and third spray with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 0.25% at 15 days interval) followed by 40 days in T_5(In furrow soil application of FYM (500g/m2) enriched *with T. harzianum* + *P. fluorescens*, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl MZ 35 SD @ 5g/kg) and 39 days in T_4(Furrow application of FYM (500g/m^2) enriched with *T. harzianum* + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing. Seed treatment with Streptocycline sulphate@ 0.030% (300ppm) and Metalaxyl @ 2.5g/kg. On appearance of disease symptoms three spray of Bordeaux mixture @ 5000 ppm at 15 days interval. Percent disease intensity was found lowest in T_5 (23.34%) and highest in T_9 (30.18%). Whereas percent disease severity was observed lowest in T_3 (25.86) followed by T_4 (26.16) T_2 (26.49), T_5 (26.49). It is might due to soil application of *Trichoderma harzianum* + *Pseudomonas fluorescens* inducing the own defence mechanisms in opium poppy. Induction of systemic resistance by *Trichoderma harzianum* + *Pseudomonas fluorescens* has earlier been reported by several workers (Zehnder *et al.* 2000; Pieterse *et al*., 2000) [16, 10]. Seed treatment with streptocycline sulphate and metalaxyl were able to significantly control the downy mildew disease due to high antisporulent activity. Davidse *et al.* (1983) [3] indicated that metalaxyl inhibited nucleic acid synthesis. These fungicides are effective when used repeatedly after 15days interval. Although, several scientist have reported sensitive response in the pathogen and is known to develop resistance against metalaxyl hence it needs to regular monitoring. Seed treatment with *Pseudomonas fluorescens* suppressed the foliar pathogen by inducing systemic resistance (Wei *et al*., 1996) [14] because of lipopolysaccharides present in the bacterial cell wall act as signal molecules and elicit various defense compounds. Maurhofer *et al.* (1998) [9] was reported that salicylic acid produced by the fluorescent Pseudomonads induced systemic resistance response for control of foliar diseases. Elad (1986) [4] reported that *Trichoderma harzianum* applied in the soil instead of spray resulted 75-90% less downy mildew. The mode of action was found induced resistance. Bladlan (1997) found *Trichoderma harzianum* was effective against *P. cubensis* in cucumber and *Pernospora parasitica* in radish under green house condition. Three consecutive sprays of streptocycline sulphate and metalaxyl minimized the disease intensity (24.32%) and disease severity (27.77%) might be inhibition of fungal colonization. Staub and Young (1980) [12] reported that metalaxyl did not prevent penetration of tobacco roots by *Phytophthora parasitica* but subsequently inhibited fungal colonixation of tissue. Trigiano *et al.* (1983) [13] observed protective and therapeutic action of metalaxyl against *Phytophthora tabacina*. Latex yield was significantly higher in the treated plants, the maximum yield was recorded in Furrow soil application of FYM (500g/m^2) enriched with *T. harzianum* + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing. Seed treatment with streptocycline sulphate@ 0.030% (300ppm) and metalaxyl @ 2.5g/kg. On appearance of disease symptoms spray of *T. harzianum* and *P. fluorescens* @ 0.5 %. Second and third spray with streptocycline sulphate@ 0.030% (300 ppm) and Metalaxyl @ 0.25% at 15 days interval (53.39Kg/ha) and minimum in control (20.45Kg/ha). Seed yield and husk yield were insignificant in between the treatment but it was observed significantly higher in treated plant in comparison to control.

This study demonstrated that furrow application of FYM (500g/m^2) enriched with *T. harzianum* + *P. fluorescens* @ 2.0%, 4-5 days prior to sowing. Seed treatment with streptocycline sulphate @ 0.030% (300ppm) and metalaxyl @ 2.5g/kg. On appearance of disease symptoms spray of *T. harzianum* and *P. fluorescens* @ 0.5 %. Second and third spray with streptocycline sulphate @ 0.030% (300ppm) and metalaxyl @ 0.25% at 15 days interval significant effect was observed for minimized downy mildew disease and enhanced latex and seed yield of opium poppy.

Table 1: Evaluation of integrated disease management modules against major diseases downy mildew of opium poppy

Treatment	Downy mildew			Latex yield (kg/ha)	Husk Yield (Kg/Plot)	Seed yield (Kg/Plot)
	1st disease appearance (DAS)	PDI	PDS			
T_1	38	24.16 (29.59)	26.71 (31.09)	39.21	9.51	7.52
T_2	27	24.42 (29.58)	26.49 (30.94)	41.02	10.93	8.24
T_3	41	23.48 (28.79)	25.86 (30.54)	53.39	11.12	8.54
T_4	39	24.03 (29.33)	26.16 (30.72)	46.12	11.19	8.07
T_5	40	23.34 (28.89)	26.49 (30.94)	42.09	11.80	8.67
T_6	32	24.29 (29.41)	28.06 (31.96	22.55	9.81	8.40
T_7	25	24.32 (29.50)	27.77 (31.78)	37.47	9.67	8.02
T_8	24	25.51 (30.29)	29.53 (32.87)	25.38	9.65	8.01
T_9	24	30.18 (33.29)	44.61 (41.89)	20.45	8.63	7.21
SEm	-	0.54	0.70	1.50	0.52	0.45
CD at 5%	-	1.57	2.05	4.56	1.58	1.38
CV%	-	3.60	4.32	7.14	9.42	10.64

Figures in parentheses are Angular transform value

References

1. Bedlan G. Biological control of vegetable disease by *T. harzianum*. Gesunde P flazen 1987;49:89-94.
2. Calderon R, Montes- Borrego M, Landa BB, Navas-Cortes JA. Detection of downy mildew of opium poppy using high resolution multi- spectral and thermal imagery acquired with an unmanned aerial vehicle. Precision Agric 2014 Published online 23 April. Do10.1007/s11119-014-9360 y
3. Davidse LC, Hofman AE, Velthius GCM. Specific interference of metalaxyl with endogenous RNA polymerase activity in isolated nuclei of Phytophthora megasperma f.sp. Medicaginis. Exp. Mycol 1983;7:344-361.
4. Elad Y, Mechanisms of interaction between rhizosphere microorganisms and soilborne plant pathogens. In: jense V. Kjoller A, Sorensen LH, eds. Microbial communities in soil. London; Elsevier Applied science 1986, 49-61.
5. Elad Y. Bilogical control of foliar pathogens by means of T. harzianum and potential mode of action. Crop Protection 2000;19:709-714.
6. Ingram DS. Physiology and biochemistry of host - parasite interaction. IN D.M. Spencer (Ed.). The downy mildew (PP143-151). London, Acdemic Press.
7. Landa BB, Montes-Borrego M, Munoz-Ledsma FJ, Jimenes-Diaz RM. First report of downy mildew of opium poppy caused by *Peronospora arborescens* in spain. Plant Disease 2005;89:338.
8. Lebeda A, Cohen Y. Cucurbit downy mildew, bilogy, ecology epidemiology host pathogen instruction. Eur. J Plant Pathol 2020;129:157-192.
9. Maurhofer M, Rejmmann C, Sachere SP, Heeb S, Haas D, Defago D. Salcylic acid biosynthetic gene expressed in P. fluorescens strain P3 improve the induction of systemic resistance in tobacco against TMV. Phytopathology 1998;88:678-684.
10. Pieterse CMJ, Van Pelt JA, Ton J, Parchmmann S, Muller MM, Buchala AJ *et al*. Rhizobacteria mediated induced systemic resistance (ISR) in Arabidopsis requires sensitivity to Jasmonate ethylene but is not accompanied by an increase in their production. Physiol. Mol. Plant. Pathol 2000;57:123-134.
11. Sohi HS, Sridhar TS. Chemical control of downy mildew (*Plasmopara viticola* Beark and Curf) and anthracnose (*Gloeosporium ampelophagum* Curt) of grapes. In Viticulture in tropica, proceeding working group in viticulture. In south east area Bangalore. India
12. Staub TH, Young TR. Fungitoxicity of metalaxyl against Phytophthora parasitica var. nicotianae. Phytopathology 1980;70:797-801.
13. Trigiano RN, Van Dyke CG, Spurr HW Jr. Haustorial development of *Peronospora tabacina* infecting Nicotiana tabacum. Can. J Bot 1983;4:3444-3453.
14. Wei G, Wikloepper J, Tusun S. Induced systemic response to cucumber disease and increased plant growth promoting rhizobacteria under field condition. Phytopathology 1996;86:1508-1512.
15. Weltzien HC. Geographical distribution of downy mildew. In D.M Spencer (Ed) the downy mildew (PP.31-43) London Academic Press.
16. Zehnder GW Yao C, Murphy JF, Sikora F, Kloepper Induction of resistance in tomato against cucumber mosaic cucumovirus by plant growth promoting rhizobacteria. Biocontrol 2000;45:127-137.