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Studies on survey and management of linseed wilt (*Fusarium oxysporum* f. sp. *lini*.)

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Abstract

Linseed (*Linum usitatissimum* L.) also known as *Alsi* or *Tisee* is one of the most important oilseed crops in India. The present investigation were carried on Studies on management of linseed wilt *Fusarium* f. sp. *lini*. The result of survey was conducted during 2018-19 *Rabi* crop season in Eastern Uttar Pradesh districts of Jaunpur, Varanasi and Mirzapur. The highest average disease incidence was recorded in linseed crop at Mirzapur (28.33%), followed by Jaunpur (23.33%) and Varanasi (20.00%). Evaluation of five different fungicides against linseed wilts *in-vivo* under wilt sick field conditions. The most effective fungicide Raxil was showed minimum average disease incidence (0.60%) and its percentage disease control (98.06) followed by Thiram (01.00%, 96.77), Captan (02.05%, 93.38), Vitavax (05.10%, 83.54) and Agrosan-GN (09.75%, 68.54) respectively. The bio-agents *Trichoderma* sp. was showed minimum disease incidence (10.25%) and its percentage disease control (66.93) followed by *Pseudomonas* sp. was least effective bio-agent which exhibited the (15.50%) average disease incidence and minimum percentage disease control 50%.

Keywords: Linseed wilt, disease incidence, fungicides, bioagent

Introduction

Flax or linseed is a oil seed crop it is scientifically known as (*Linum usitatissimum* L.) (2n=30) belonging to the family Linaceae produce flowering annual herb that produce small flat seed varying from reddish brown color. Linseed crop can reach heights up to 40 to 60 cm and have highly branched stems, whereas fibrous linseed plants can reach heights up to 80 to 120 cm and have fewer branching stems. Linseed can be divided in two species, brown and golden. Golden linseed develops for grow in very cold climate. While brown develops for grow in warmer and more humid climate. flaxseed have 40-50% oil and meal contain 23-34% protein, 4-5% viscous fiber (mucilage) and lignin precursors (9 to 30 mg) of defalld meal. (Muir, *et al.*; 1996 Muir and Westcott 2003) [7, 6]. One of the highest main sources of the linolenic acid (18:3 (cis) 9:12; 15) ALA, which is known for its health advantages, is found in flax seed, an oil crop, which is emerging as a important functional food ingredient. (Akhtar *et al.*; 2013; Goyal, *et al.*; 2014; Hall, *et al.*; 2006 Jhala and Hall, 2010) [2, 3, 4, 5]. The linseed was first introduced in united state by colonist; primary to produce fibre for clothing. The major linseed growing countries are Canada, Russia, China, India, USA, and Ethiopia. The yearly area under the linseed cultivation in the world is 2764340, hectares with total production of 2,925,282 tonnes, giving the average yield of 1058.2 kg/hectares. Cultivation of linseed crop in India accounts for about 293,000 hectares with seed production of 125000 tonnes and national average yield of 426.6 kg/hectares. (Somesh *et. al.*, 2019) [13]. The major flaxseed crop growing states are Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Bihar, Orissa, Jharkhand, West Bengal, Nagaland and Assam. The early on work of lined wilt was started in the United States in (1890) by Otto Luggler, a biologist in the Minnesota agricultural experiment station. *Fusarium* wilt was recognized as a major flax disease problem in North America at the beginning of the 20th century (Rashid, 2003) [9].

Materials and Methods

Experimental site

The present experiment was conducted in laboratory of Plant Pathology, Student Research Farm Pili kothi T.D.P.G. College, Jaunpur.

Survey of linseed wilt

A regular survey was conducted at regular interval during *Rabi* crop season in session 2018-2019 on farmer field in of three village in each three districts of Eastern Uttar Pradesh - Jaunpur, Varanasi and Mirzapur. The prevalence and severity of the wilt disease in linseed crop diseased samples were collected from different linseed growing areas of Eastern Uttar Pradesh. The observation was recorded by selecting randomly five subplots of one square meter and counting the n. of wilted and healthy plants. The average disease incidence was calculated in percent by applying the following formula –

$$\% \text{ Diseased incidence} = \frac{\text{Total no. of diseased plants}}{\text{Total plant population}} \times 100$$

Isolation Purification and Identification of the Pathogen

The linseed wilted plant were collected from different fields. The causal organism were isolated from affected root of diseased linseed plants. The affected root were first washed in tap water to remove dust particles then root of wilted plant were cut into small pieces (about 2-5 mm.) with the help of scalpel. The root pieces were surface sterilized by dipping, 0.1% mercuric chloride solution for one minutes and then given 3-4 wash with sterilized distilled water so as to remove the trace of mercuric chloride from the surface of root pieces. The excess of water was removed by drying the sterilized diseased material in between the fold of sterilized filter paper. These pieces were then transferred in the sterile 90 mm. Petri plates containing 2% Potato-dextrose-agar medium with the help of forceps. The petridishes were then incubated at 28 ± 1 °C for 4 days. All these steps were carried out under aseptic condition in an isolation chamber. As soon as mycelia growth was observed around the piece, the hyphal tip of mycelial growth was then transferred to culture tubes containing Potato-dextrose-agar (PDA) slant. To confirm the soil born nature of the pathogen seed samples of a highly susceptible variety Chambal were taken. Seed were thoroughly washed with distilled water and dried between blotting paper folds and plated on Potato- dextrose-agar media aseptically maintaining equal distance. To a certain the internally seed born nature of the pathogen the seed were washed with 1.0 percent sodium hypochloride solution then wash twice with distilled water before planting. As soon as the growth of fungal mycelium was observed Isolation and purification was done as per usual procedure. To make the isolates genetically homogeneous, single spore isolation *Fusarium oxysporum* f. sp. *lini* was done. The single spore culture was preserved separately for each isolates in the refrigerator at 4 °C for further use.

Pathogenicity test

The pathogenicity of the fungus isolates from wilted plant root was tested on a highly susceptible linseed variety Chambal. For this, pots (30 cm. diameter) were filled with ordinary loam soil. This was sterilized for 4 hours in

autoclave at 1.1 kg/cm. pressure. The inoculam was prepared by growing the pure culture of the fungus on PDA (9:10) medium, for about 3 weeks inoculation of soil was done one week before sowing of the seed by through mixing of soil with fungus culture. The culture was added @ 5% of the weight of the soil filled in pots. Pots without inoculam served as control the requisite quantity of seed of linseed variety Chambal were disinfected with 0.1% percent mercuric chloride solution for two minutes and then washed with sterilized water, dried and sown in the pots. The pots were watered with sterilized water periodically in order to provide sufficient moisture for seed germination and development of symptoms and confirming Koch Postulates. Final observations were taken after 2 month of sowing.

Symptomatology

Linseed wilt infected plant observed in the field during all stage of their growth. Seedling wilt phase occurs before the third week after sowing when temperature is high. In very young seedling the cotyledons become dull and edge roll inwards, the growth of the plant ceases. The base of hypocotyls or top of radical shows a thin constricted appearance. As disease advances seedling droop over, fall on ground and ultimately die. In case of plant, initial symptoms appear as ill-defined dark or brownish spots on leaves which after yellow from the edge and tan become brown and wither.

Effect different fungicides/bioagents against linseed wilt (*Fusarium oxysporum* f. sp. *lini*.) *in-vivo* condition

The effect of fungicides/bioagent with seed treatment on disease control the eight most effective fungicides along with two bioagent were tested as seed treatment in natural condition on wilt sick field. They were taken individually in 250ml. conical flasks containing fifty gram of seed of a susceptible variety Chambal and mixed thoroughly to achieve uniform coating on the seed. for testing, the efficiency of fungicide in controlling the disease experiment were carried in natural condition on wilt sick field studies the experiment was conducted in wilt sick field with design (RBD) in 1×2 M. Plots with three replication. The wilted plant and average percent incidence and recorded as per procedure given in earlier studies. The detail technical programme is described below: (1) Variety - Chambal. (2) Design- RBD. (3) Replication- 3. (4) Plot size - 1×2 M. (5) Row to row distance -20 cm. (6) Date of sowing- 15-10-2018 (7) Seed rate -24 gram/plot. (8) Treatment -8.

Details of treatment

T₁. Raxil 2 gm/kg of seed, T₂- Thiram 2 gm/kg of seed T₃- Captan 2 gm/kg of seed, T₄. Vitavax 2 gm/kg of seed T₅- Agrosan GN 2 gm/kg of seed, T₆- *Trichoderma* sp. 2 gm/kg of seed, T₇ *Pseudomonas* sp. 2 gm/kg of seed, T₈ –Control.

The percentage of disease control over check was calculated as follows.

$$\% \text{ Disease Control} = \frac{(\text{Disease intensity in control}) - (\text{Disease intensity in treatment})}{(\text{Disease intensity in control})} \times 100$$

Results and Discussion

A survey was conducted during 2018-19 *Rabi* crop season in eastern Uttar Pradesh districts of Jaunpur, Varanasi and Mirzapur. The data revealed that wilt of this crop was of wide occurrence with the average disease incidence ranging from

20 to 28.33 per cent in different districts of Eastern Uttar Pradesh. The highest average disease incidence (28.33%) was recorded in linseed crop at Mirzapur, followed by (23.33%) Jaunpur. Whereas, it was lowest average disease incidence (20.00%) at Varanasi. Naik *et al.*, (2016)^[8] also found during

the nine-year linseed wilt disease survey, which was conducted in the tehsils of Jashipur, Karanjia, Sukruli, Raruan, Kusumi, and Bisoi, the incidence of wilt was found 7.6%.

The wilt affected linseed crop appeared in patches, which were developed, yellow and brownish discoloration in vascular tissues was also observed. The wilt affected plant showed typical yellowing of leaves and in some cases, leaf turn straw colored and complete wilting and light brown vascular discoloration was observed.



Fig 1: Linseed wilt affected plants

Table 1: Effect different fungicides/bioagents against linseed wilt (*Fusarium oxysporum* f. sp. *lini*.)

S. No.	Fungicides/bio-agents	Percentage Disease Incidence Day After Sowing (DAS)		Average % Disease Incidence	Percentage Disease Control
		30 DAS	60 DAS		
1	Raxil @ 2 g/kg of seed	00.60	00.60	00.60	98.06
2	Thiram @ 2 g/kg of seed	01.00	01.00	01.00	96.77
3	Captan @ 2 g/kg of seed	02.00	02.10	02.05	93.38
4	Vitavax @ 2 g/kg of seed	05.00	05.20	05.10	83.54
5	Agrosan @ 2 g/kg of seed	09.50	10.00	09.75	68.54
6	<i>Trichoderma</i> sp. @ 2 g/kg of seed	10.00	10.50	10.25	66.93
7	<i>Pseudomonas</i> sp. @ 2 g/kg of seed	15.00	16.00	15.50	50.00
8	Control	30.00	32.00	31.00	00.00
CD at 5%				1.175	
SE(m)±				0.340	

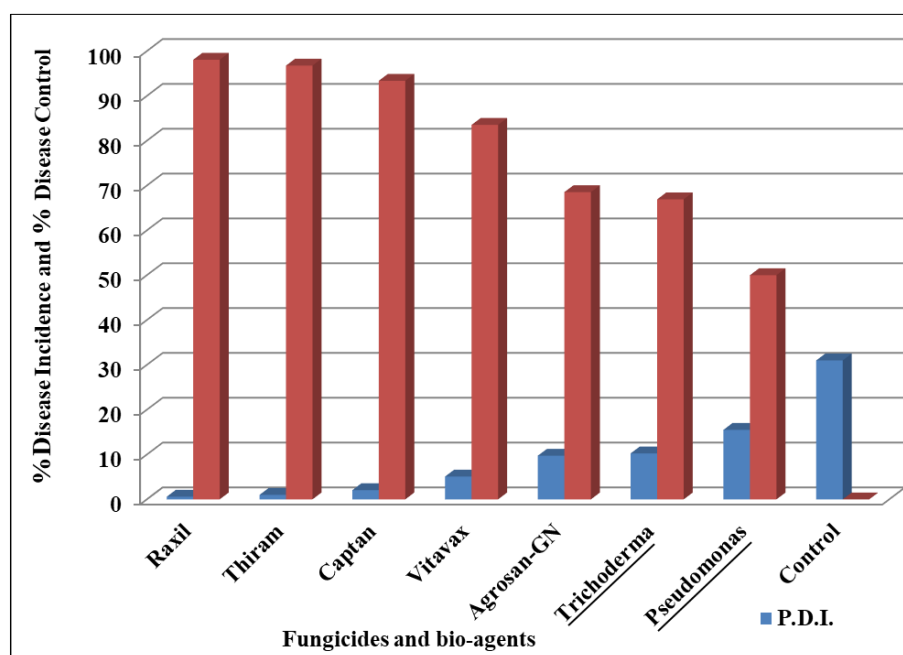


Fig 2: Effect different fungicides/bioagents against linseed wilt (*Fusarium oxysporum* f. sp. *lini*.)

The results presented in table no.1 and its corresponding histogram Fig. 2. revealed that the among the five fungicides and two bioagent. The most effective fungicide Raxil was showed minimum average disease incidence (0.60%) and its percentage disease control (98.06) followed by Thiram (01.00%, 96.77), Captan (02.05%, 93.38), Vitavax (05.10%, 83.54) and Agrosan-GN (09.75%, 68.54) respectively. The bio-agents *Trichoderma* sp was showed minimum disease incidence (10.25%) and its percentage disease control (66.93) followed by *Pseudomonas* sp. was least effective bio-agent which exhibited the (15.50%) average disease incidence and minimum percentage disease control 50%. Verma (1976) also found seed treatment with Vitavax and Captan @ 0.25% protected chickpea plants againsts *Fusarium oxysporum* f. sp.

ciceri. Several other workers (Agrawal *et al.* 1974; Sen and Kapoor, 1975; Sinha and Khare, 1977; Verma and Vyas, 1977; Zarzycka 1979; Shukla *et al.* 1981) [1, 10, 12, 15, 16, 11] have found Thiram to be effective in controlling *Fusarium oxysporum* on various host.

Conclusion

Based on the obtained result it can be concluded that in case of linseed wilt survey in different district of eastern U.P. The highest average disease incidence was recorded in linseed crop at Mirzapur (28.33%), followed by Jaunpur (23.33%) and Varanasi (20.00%) and effect of fungicides/bioagents the most effective fungicide Raxil was showed minimum average disease incidence (0.60%).

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