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Original Research Article

Effect of Essential Oils against Bacterial Blight and Grain Yield in Eastern Uttar Pradesh

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A B S T R A C T

Bacterial leaf blight (BLB) is considered as a major threat to rice production because of its wide spread, distribution and its destructiveness under favourable conditions. Bacterial leaf blight of rice is among the most devastating pathosystem of rice in nearly all the rice growing localities in tropical and temperate regions especially in Asian countries. The pathogenicity of bacterial leaf blight has confirmed that the causal bacterium is *Xanthomonas oryzae* pv. *oryzae*. Under conditions favoring disease, up to 40-50% of grain yield may be lost. Diseases through various biotic or abiotic stresses. The various chemicals, antagonists, botanicals and nutrient application were recommended in different rice growing area to manage the BLB. Application of bio agents that not only acts as an antagonist to pathogens but also promotes the growth of plant and induces multiple systemic disease resistance. Ten treatment viz. T1- Citronella oil @ 2ml /l, T2- Eucalyptus oil @ 2.00ml/l, T3- Cedar wood oil @ 2ml/l,T4- Nirgundi oil @ 2.0 ml/l, T5-Lemon grass oil @2.0 ml/l, T6- Clove oil @ 2.0 ml/l. T7- Neem essential oil @ 2.0 ml/l, T8- Emulsifier @2.0 ml/l, T9- Carbendazim @0.6 g/l and T10- untreated check were evaluated against Bacterial leaf blight of rice on the most popular variety Chintu from various parts of different villages in Jaunpurviz. Wazidpur, Sarai Khawaja Urf Darbanipur, Chand Pur, Mainpur, Olandganj, and Muradganjdistrict of Eastern U.P. Among the new essential oil to control Bacterial leaf blightEmulsifer @2.0 ml/l was found best in checking the disease severity (6.39%,) and increase the grain yield of rice (80.44%) over check, fallowed by Neem essential oil @ 2 ml/l the disease severity (10.46%,) and increase the grain yield of rice (70.18%) over check

Keywords

Rice, Bacterial leaf blight, Grain yield, Disease

Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food crops of India and is a major source of calories for about 60 per cent of world population and influences the livelihoods and economies of several billion people especially concentrated in Asia. About 53% of the world's rice is grown under irrigated conditions that provide 75% of total global production. In India, rice is an important part of the diet of its people and cultivation of rice is the main occupation of those engaged in agriculture. The crop is regarded as the second major cereal crop of India after wheat with a production of 103.00 million metric tons in an area of 42.75 million hectares with a productivity 3.61 metric tons per hectare (Anonymous, 2016), which share 43 percent of total food grain production and 46 percent of total cereal production in the country. The disease was first observed by the farmers of Japan in

(1884) Tagami and Mizukami, (1962). In 1908, Takaishi found bacterial masses in dew drops of rice leaves but he did not name the organism Mizukami and Wakimoto (1969). Bokura in (1911) isolated a bacterium, and after a study of its morphology and physiology, the bacterium was named *Bacillus oryzae* Mizukami and Wakimoto (1969). Ishiyama (1922) studied the disease further and renamed the bacterium *Pseudomonas oryzae* according to Migula's system. It was later named as *Bacterium oryzae* and subsequently as *Xanthomonas oryzae.* Rice is highly vulnerable at all stages of growth to different pathogens that affect the quality and quantity of its yield Bacterial leaf blight of rice caused by *Xanthomonas oryzae* pv. *oryzae* (Ishiama) Swing *et al.*, (1990) is the disease of great economic in India (Bihar). In India, BLB disease has been observed in most important rice-growing states like Andhra Pradesh, Bihar, Haryana, Kerala, Orissa, Punjab and Uttar Pradesh. BLB disease prevost in almost all the paddy growing region in the state, it is considered to be a major constraint for low rice productivity in Uttar Pradesh. It was first reported from India by Srinivasm *et al.*, (1959) from Maharashtra. It is typical vascular disease, systemic in nature. The disease causes infection at nursery seedling after transplanting and later at booting or heading stage. Antagonistic activity of botanical and new chemical was judged against premising isolates of BLB by Nutrient Agar well plated method (Manav and Thind, 2002). Botanical and new chemical control of BLB can play a vital role in management rice disease (Singh *et al.*, 2010). There are also some reports that seed treatment with botanical and new chemicals influences the germination of seed and growth of seedling in several crops (Sen, 1999, Biswas *et al.*, 2008). BLB is a vascular disease resulting in a systemic infection (Mew, 1987) that produces tannish-grey to white lesions along the veins. Symptoms are observed at the tillering stage, disease incidence increases with plant growth, peaking at the flowering stage (Mew, 1992).BLB is characteristic of yellow lesions with wavy margins on leaf blades that may extend to the sheath. The occurrence of bacterial ooze from infected leaves has been observed in warm and humid climates, which contributes to the spread of this disease. While damage is extensive when kresek precedes BLB, post flowering infections have very little effect on grain yield. BLB is favoured by warm temperatures (25 to 30°C), high humidity, rain, and deep water. A type III protein secretion system exists in this bacterium to directly inject virulence factors into the host Furutani *et al.*, (2009). Crop losses of 10-20 per cent in moderate conditions or severe losses of up to 50 per cent in highly conducive conditions have been recorded in several Asian and Southeast Asian countries Ou (1985). The objective of the present study is to check efficacy of new essential oil compounds and inhibitory effect of the growth of bacterial leaf blight pathogen under field condition.

Materials and Methods

The experiment was carried out at various parts of different villages in Jaunpurviz. Wazidpur, Sarai Khawaja Urf Darbanipur, Chand Pur, Mainpur, Olandganj, and Muradganjdistrict of Eastern U.P. were evaluated against bacterial leaf blight of rice on the most popular variety Chintu. Experiment was laid out in one village one replication. Most popular variety used was Chintu and the gross plot size was 50 sq. metres and all packages of practices were followed for conducting the experiment. The bacterial leaf blight infected sample were collected from rice field. The leaves from the diseased plants were collected from the field and cut into small pieces along with healthy

portion. Cut pieces were sterilized by the surface disinfectants e.g. 0.1% mercuric chloride for 30 seconds. After sterilization the cut pieces were washed three times with sterile water. The cut pieces were then placed on sterile blotter paper to remove excess water. The cut pieces were then placed on the Nutrient Agar plate. Inoculation was done with freshly prepared (soaking of infected leaves in distilled water) inoculum of Xanthomonas oryzae pv oryzae. Test chemicals were sprayed at booting stage and repeated after 10 days. Ten treatment viz. T1-Citronella oil @ 2ml /l, T2- Eucalyptus oil @ 2.00ml/l, T3- Cedar wood oil @ 2ml/l,T4-Nirgundi oil @ 2.0 ml/l, T5-Lemon grass oil @2.0 ml/l, T6- Clove oil @ 2.0 ml/l. T7-Neem essential oil @ 2.0 ml/l, T8- Emulsifier @2.0 ml/l, T9- Carbendazim @0.6 g/l and T10- untreated check. The pathogen was multiplied from pure culture on Autoclaved rice culms bits (5-7cm.). Rice plants were inoculated at tillering stage (35-40 DAT) by placing the inoculums between cut of the upper leaf. The fungicides were sprayed twice at 15 days interval starting from just appearance of disease symptoms under artificial inoculation. Control plot were sprayed with ordinary water. Disease observations were recorded after 15 days last spray by fixing 5 sampling unit of one square meter in each plot. The disease severity and percentage decrease over control were recorded in percent and increased in yield (kg/h).

Results and Discussion

There was significant difference among the treatments in sheath blight disease severity and yield. The data on different disease parameters is summarised in table 1.Treated with Emulsifer @2.0 ml/lwas found best in checking the disease severity (59.63%,), percentage decrease over control (6.39) respectively and the better grain yield 5895 kg/ha was recorded. While severity and incidence of BLB had gone to the extent of 63.70 respectively in unsprayed plots. In check plots reduced grain yield was recorded (3267 kg/ha). The plot treated with had also shown good response with T7- Neem essential oil @ 2ml/l the disease severity (57.04%,) and (10.46%) decrease over control, along with good grain yield 5560 kg/ha was recorded. In this treatment 70.18 increased grain yield over untreated check was observed. In treatment combinations (Table 1) T9- Carbendazim @ 0.6 g/l, showed good response 57.04% disease severity and 10.47% decrease over control was observed along with 80.44% grain yield advantage over check..T4- Nirgundi oil @2.0 ml/l 54.81% disease severity and 13.96% decrease over control was observed along with 66.51% grain yield advantage over check T3- Cedar wood oil @2.0 ml/l 49.26% disease severity and 22.67% decrease over control was observed along with 55.18% grain yield advantage over checkT5- Lemon grass oil @2.0 ml/l 48.89% disease severity and 23.85% decrease over control was observed along with 53.71% grain yield advantage over check.

All these essential oil were found effective in checking in disease severity and incidence over untreated control and increased the grain yield of rice at various extent. The essential oil Emulsifer @2.0 ml/l was found best in checking the disease severity (59.63%,), percentage decrease over control (6.39) respectively and the better grain yield 5895 kg/ha was recorded. While severity and incidence of BLB had gone to the extent of 63.70 respectively in unsprayed plots. In check plots reduced grain yield was recorded (3267 kg/ha)., fallowed by Neem essential oil @ 2 ml/l the disease severity (10.46%,) and increase the grain yield of rice (70.18%) over check minimization of disease severity may be one of the possible reasons for enhancement of grain yield by the spraying of these essential oil.

Table.1 Effect of essential oils against bacterial blight and grain yield

Treatments	Dose/L	Disease Incidence %	Disease over control %	Grain Yield kg/ha	Increase in yield over control (%)
T1- Citronella oil	2 ml	45.18	29.07	4859	48.72
T2- Eucalyptus oil	2 ml	40.00	37.21	4210	28.86
T3- Cedar wood oil	2 ml	49.26	22.67	5070	55.18
T4-Nirgundi oil	1 ml	54.81	13.96	5440	66.51
T5- Lemon grass oil	2 ml	48.89	23.25	5022	53.71
T6- Clove oil	2 ml	53.33	16.28	5310	62.53
T7- Neem essential oil	2 ml	57.04	10.46	5560	70.18
T8-Emulsifier	2 ml	59.63	6.39	5895	80.44
T9-Carbendazim	0.6g/l	57.04	10.47	5573	70.58
T10-Control		63.70		3267	
C.V (%)		5.72			
LSD @ 5% (P= 0.05)		3.38			

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