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Field efficacy of formulation of essential oils against blast disease of rice caused by *Pyricularia oryzae* Pv. *Oryzae*

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Abstract
Rice (*Oryza sativa* L.), is one of the most widely cultivated and major food crops of the world. However the productivity of crop was affects by the attack of various fungal as well as bacterial diseases. Among the various diseases the most predominant one was blast disease caused by *Pyricularia oryzae* which is very severe in hot and humid climate of Konkan region. Eight essential oils along with one fungicide were tested under field condition. The results revealed that, the lowest incidence of blast was recorded in treatment T_4 (Nirgundi oil) with disease incidence 52.59% as compare to the control (71.85%).The highest reduction of disease control was 26.80% and was statistically significant over other treatments. This was followed by treatments T_2 (Eucalyptus oil), T_5 (Lemon grass oil), and T_1 (Citronella oil) with disease incidence of 52.9, 52.96 and 57.03 percent respectively as compare to the control and percent disease reduction was in the tune of 26.29%, 26.29% and 20.63% over control. Data also revealed that treatment of Eucalyptus oil (T_2) showed highest yield of 49.03q ha^{-1} as against 39.11 q ha^{-1} in control and was statistically significant. Treatment T_2 recorded 25.36% increase in yield over control. This was followed by T_5 (46.85%) and T_4 (43.40%).

Keywords: Blast of rice, field efficacy, essentials oils, *Pyricularia oryzae* pv. *oryzae*

Introduction
Rice is an important crop contributing approximately 23% of the per capita energy for six billion people worldwide. It is not just a grain; it is the lifeline and the second most important crop next to wheat at global level (Tonny cisse 2005)] [1]. It has been under cultivation from time immemorial, being grown under varying climatic conditions. It is widely affected by many diseases caused by fungi, bacteria, viruses and mycoplasma that results in significant yield losses (Ou 1985) [2]. The blast disease alone is estimated to cause more than US$55 million production losses at each year in South and Southeast Asia. The losses are even higher in East Asia and other more temperate rice growing regions around the world. *Magnaporthe grisea* (anamorph: *Pyricularia oryzae*), a filamentous ascomycetes fungus, parasitizes many grasses, including economically important crops likes wheat, rice, barley and millet (Chanda and Gopalkrishnan 2005) [3]. But the pathogen is best known as the causal agent of the rice blast disease because of its wide distribution and its destructiveness under favorable environments (Pans 1976) [4]. The disease occurs in almost all rice growing areas of the world and is the most serious in temperate and tropical area of non-irrigated environments. In temperate regions, the blast problem is perpetuated by the high pathogenic variability of the fungus while in the upland environments blast exacerbated with drought. Among the fungal diseases; blast is causing yield loss of up to 90per cent (Mehrotra 1998) [5], despite decades of research towards its management.
The practical use of natural compounds as control agents is receiving increased attention and this is partly due to their nontoxicity and biodegradability (Mason and Mathew1996) [12]. Volatile compounds from plants, especially essential oils have been demonstrated to possess potent antifungal, antibacterial, insecticidal and nematocidal activity. Therefore, managing this disease is one of the main goals of rice. Hence present study was undertaken to know the effect of essential oil on *Pyriculria oryzae* in rice.

Materials and Methods

The different essential oils received from Indian Institute of Rice Research, Hyderabad, were used for the experiment. The details of the treatment is as follows

Treatments details

Tr. No.	Treatment composition	Conc./Doses
T1	Citronella oil	2 ml/l
T2	Eucalyptus oil	2 ml/l
T3	Cedar wood oil	2 ml/l
T4	Nirgundi oil	2 ml/l
T5	Lemon grass oil	2 ml/l
T6	Clove oil	2 ml/l
T7	Neem essential oil	2 ml/l
T8	Emulsifier	2 ml/l
T9	Carbendazim	2 ml/l
T10	Control	2 ml/l

The experiment was conducted at Agriculture Research Station, Shirgaon, Dist. Ratnagiri with randomized block design with ten treatments and three replications having plot size 4.5 X 3 m by using the RTN- 24 variety. The natural incidence of the blast disease was observed on second week of January. The first spray of the essential oils with respective concentrations was given after initiation of the disease. The second spray was given seven days after first spray. The observations on disease incidence were recorded 15 days after second spray and the yield related observations were recorded after harvesting of the crop.

Results and Discussion

The data presented in table 1, revealed that lowest incidence of blast was recorded in treatment T_4 (Nirgundi oil) with blast incidence of 52.59 per cent as compare to control (71.85%), with highest per cent disease reduction over control was to the tune of 26.80% over control and was statistically significant over other treatment. This was followed by T_2, T_5, and T_1 with the incidence of 52.96, 52.96 and 57.03 per cent as compare to control disease reduction over control was in the range of 26.29, 26.29 and 20.63 per cent respectively. Data also revealed that treatment T_2 showed highest yield of 49.03q ha^{-1} as against 39.11 q ha^{-1} in control and was statistically significant. Treatment T_2 recorded 25.36% increase in yield over control. This was followed by T_5 (46.85%) and T_4 (43.40%).

Similar study was undertaken by S.L. Sukanya and his co-workers 2011 in his study he reported that essential oils from fresh fruit of Piper *nigrum*, *Coriander sativum* and one oleoresin freshly harvested rhizome of a plant *Curcuma domestica* tested against the blast disease of rice reduced the natural infection frequency in *Pyracularia oryzae.* Similar work has been reported by Singh, G. 1999 [6] reported that the use of essential oils has taken a new dimension in controlling certain viruses and nematodes. Dubey *et al.* 2000 [7] reported that essential oils have got high rate of penetration action which especially inhibits seed borne pathogens. Chee, Y.H. and M. H. Lee. 2007 reported that antifungal activity of eucalyptus and clove oil was tested against certain dermatophytic fungi. Pundir and Jain (1994) [9] reported the antifungal properties of essential oils of the turmeric, pepper and coriander against *Staphylococcus aureus.* Nafiseh Katooli, and his coworkers (2011) [11] evaluated the different eucalyptus essential oil against some plant pathogenic fungi, his study showed that eucalyptus essential oil in all concentration had completely inhibition of mycelial growth only in *P. ultimum and R. solani.* Huv *et al*. (2000), that showed *Eucalyptus unigera* oil inhibited mycelial growth *of* three phytopathogenic fungi such as *C. gloeosporioides*, *R.solani* and *Pythium* spp. Muthukumar *et al.* (2018), studied the antimicrobial activities of essential oils against seed borne fungi of rice (*Oryza sati*va L.). In present study also showed the reduction of incidence of blast pathogen and increase the yield as compared to the control.

Table 1: Effect of selected essential oils on blast disease of rice.

Tr. No	Per cent Disease Incidence				Per cent Disease Reduction over control	Yield (q ha^{-1})	Percent increase yield (q ha^{-1})
	RI	RII	RIII	Mean			
T_1	43.33 (41.17)	63.33 (52.73)	64.44 (53.39)	57.03 (49.10)	20.63	41.77	6.80
T_2	60.00 (50.77)	46.67 (43.09)	52.22 (46.27)	52.96 (46.71)	26.29	49.03	25.36
T_3	68.89 (56.10)	63.33 (52.73)	74.44 (59.63)	68.89 (56.15)	4.13	39.19	0.20
T_4	55.56 (48.19)	50.00 (45.00)	52.22 (46.27)	52.59 (46.49)	26.80	43.40	10.97
T_5	61.11 (51.42)	50.00 (45.00)	47.78 (43.73)	52.96 (46.72)	26.29	46.85	19.79
T_6	66.67 (54.74)	54.44 (47.55)	56.67 (48.83)	59.26 (50.37)	17.53	42.26	8.05
T_7	57.78 (49.48)	65.56 (54.07)	63.33 (52.73)	62.22 (52.09)	13.40	41.20	5.34
T_8	65.56 (54.07)	74.44 (59.63)	63.33 (52.73)	67.78 (55.48)	5.67	36.71	-6.14
T_9	63.33 (52.73)	58.88 (50.11)	65.56 54.07()	62.59 (52.30)	12.89	39.46	0.89
T_{10}	75.56 (60.37)	74.44 (59.63)	65.56 (54.07)	71.85 (58.02)	0.00	39.11	0.00
Total	617.79	601.09	605.55	617.79			
S.E(m)±				2.28		2.29	
CD @ 0.05				6.78		6.82	

*Figures in parenthesis are arc sin transformed values.

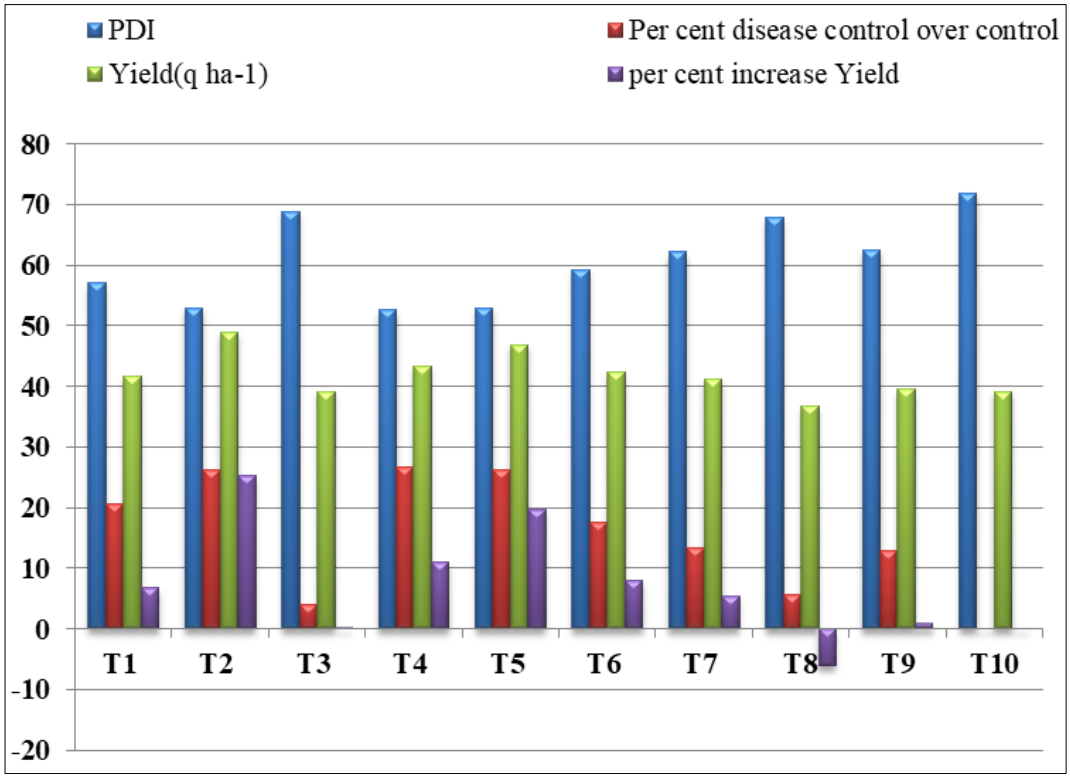

Fig 1: Effect of selected essential oils on blast disease incidence.

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