SHORT COMMUNICATION

IN VITRO EFFICACY OF ESSENTIAL OILS ON *FUSARIUM MONILIFORME* VAR. *SUBGLUTINANS* CAUSING POKKAH BOENG DISEASE OF SUGARCANE

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Abstract

Sugarcane is one of the important cash crops in India and pokkah boeng disease caused by *Fusarium moniliforme* var. *subglutinans* Sheldon is a serious threat to its cultivation in terms of quality and production. Management of the disease using fungicides has been attempted earlier but no reports are available on the use of essential oils. In the present study, essential oils of mint (*Mentha arvensis*), lemongrass (*Verbena officinalis*), *lemontulsi* (*Cymbopogon martini*), citronella (*Cymbopogon nardus*) and *patchouli* (*Pogostimon patchouli*) were tested against the pathogen under in vitro conditions. Mint oil was found superior over the other essential oils as it inhibited 44.26% fungal growth at 2000ppm concentration.

Key words : Pokkah boeng, *Fusarium moniliforme* var. *subglutinans*, essential oils, bioefficacy

Sugarcane is one of the important cash crops in India grown for not only white sugar but also biofuel, baggase, molasses, press mud, etc. Diseases are important among the many constraints in achieving high yields and pokkah boeng caused by *Fusarium moniliforme* var. *subglutinans* Sheldon is emerging as a serious threat of sugarcane in Tarai region of Uttarakhand. Although well known in sugarcane for a long time, it was reported in severe form in two commercial varieties Co7219 and CoC671 in Maharashtra during 1983-1984 (Patil and Hapase 1987). Further, it has been reported to affect almost all sugarcane cultivars recommended for general cultivation in different agro-climatic regions (Vishwakarma et al. 2013). The disease reduces the quality of harvested crop with sugar yield loss of about 40.8-64.5% depending upon the variety (Duttamajumder 2004). Several attempts have been made to manage diseases caused by *Fusarium* sp. with fungicides in other crops (Paul et al. 2007; Sultana and Ghaffar 2010) and pokkah boeng in sugarcane (Sharma and Kumar 2015). Similarly, essential oils have been evaluated against *Fusarium* sp. (Istianto and Emilda 2011; Nosrati et al. 2011). Sreenivasa et al. (2011) found that citronella oil from *Cymbopogon nardus* inhibited growth of *Fusarium* sp., and lemongrass and peppermint oils too were fully inhibitory to pathogen growth. The essential oils of *Cinnamomum zeylanicum* and *Syzigium aromaticum* were effective in inhibiting mycelial growth of *Fusarium oxysporum* f. sp. *cubense* (Monteiro et al. 2013). In the present investigation, the efficacy of selected essential oils of different plant origin was tested against pokkah boeng pathogen in the laboratory as a prelude to further field studies.

Five essential oils, viz. mint (*Mentha arvensis*), lemongrass (*Verbena officinalis*), *lemontulsi* (*Cymbopogon martini*), citronella (*Cymbopogon*

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nardus) and *patchouli (Pogostimon patchouli)* were evaluated against *F. moniliforme* var. *subglutinans* by dual culture method. After solidification of the PDA medium, the plates were inoculated with 7-day old disc of the test pathogen and filter paper disc by placing them in a straight line at a distance of 1 cm from the edges of plates. Next, with the help of micropipette, varying concentrations of different essential oils were poured on filter paper discs. For each concentration of an essential oil, three replications were maintained along with check (control). In control, sterile distilled water was poured on the filter paper disc instead of essential oil. Inoculated Petri plates were incubated at 25 ± 2ºC and periodical observations on the growth of test fungus were made. The colony diameter (mm) was recorded at 24 h interval until the check Petri plates were fully covered with mycelial growth. The effect of essential oil was then calculated as percent growth inhibition. The data collected during the experiments were subjected to appropriate statistical analysis. Treatments were compared by means of least significant difference (LSD) at 5% level of significance.

From the results presented in Table 1, it is evident that at 250 ppm concentration, maximum inhibition was recorded in the case of lemongrass followed by *lemontulsi,* mint and citronella whereas least inhibition was found in case of *patchouli* when compared to check. At 500, 100 and 2000 ppm concentrations, use of mint oil proved to be the best in inhibiting the growth of the test pathogen followed by lemongrass, *lemontulsi*, citronella and *patchouli* as compared to check where no oil was amended. Out of these, mint, lemongrass and *lemontulsi* showed maximum inhibition of the mycelial growth of the pathogen at 250 ppm, 500 ppm, 1000 ppm and 2000 ppm concentrations and found significantly effective. Least inhibition was recorded by *patchouli* oil. With the increase in concentration of oils, there was increase in

Table 1. In vitro effect of selected essential oils on radial growth of pokkah boeng fungus

Essential oil	Radial growth of fungus at different concentrations (mm)				Growth inhibition at different concentrations (%)			
	250 ppm	500 ppm	1000 ppm	2000 ppm	250 ppm	500 ppm	1000 ppm	2000 ppm
Mint	65.8	57.5	51.0	50.2	26.9	36.1	43.3	44.3
Lemongrass	60.3	61.5	59.0	55.8	33.0	31.7	34.4	38.0
Lemontulsi	63.2	62.8	61.3	58.2	29.3	30.2	31.9	35.4
Citronella	67.5	66.8	64.5	62.3	25.0	25.7	28.3	30.7
Patchouli	71.5	67.8	65.7	64.7	20.6	24.6	27.0	28.2
Control	90.0	90.0	90.0	90.0	00.0	00.0	00.0	00.0
	A (treatment)		B (dose)	A x B (interaction)				
LSD at 5%	0.21		0.17	0.43				
CV	4.00							

percent growth inhibition of fungus. The ranking of the essential oils in the decreasing order of effectiveness was mint > lemongrasss > *lemontulsi* > citronella > *patchouli*. In an earlier study, Ćosić et al. (2010) and Nosrati et al. (2011) successfully used essential oils to suppress the growth of different Fusarium species. The present studies indicate that essential oils have the potential to inhibit pokkah boeng pathogen. Further in vivo studies are needed to explore the prospects of utilizing these agents in the management of the disease.

References

Cosic J, Vrandecic K, Postic J, Jurkovic D, Ravlic M (2010) In vitro antifungal activity of essential oils on growth of phytopathogenic fungi. POLJOPRIVREDA 16(2):25-28.

Duttamajumder SK (2004) Bacterial diseases of sugarcane in India: a bird′s eye view. In: Rao GP, Saumtally AS, Rott P (eds) Sugarcane Pathology: Bacterial and Nematodes Diseases, pp.15-50. Science Publishers.

Istianto M, Emilda D (2011) Preliminary study of the activity of some essential oils against *Fusarium oxysporum* f. sp. *cubense*. J Fruit Ornamental Plant Res 19(2):111-121.

Monteiro FP, Ferreira LC, Silva JL, Pacheco LP, Souza PE (2013) Influence of plant extracts and essential oils against Panama disease *(Fusarium oxysporum* f. sp. *cubense)* in banana seedlings. J Agric Sci 5(4):1-15.

Nosrati S, Alireza S, Hosseini E, Sarpeleh A, Shahrbabak M, Soflaei Shahrbabak Y (2011) Antifungal activity of spear mint (*Mentha spicata* L.) essential oil on *Fusarium oxysporum* f. sp. *radicis-cucumerinum* the causal agent of stem and crown rot of greenhouse cucumber in Yazd, Iran. Int Conf Environ Agric Engng 15:52-56.

Patil AS, Hapase DG (1987) Studies on pokkah boeng disease in Maharashtra. Indian Phytopath 40:290.

Paul PA, Lipps PE, Hershman DE, McMullen MP, Draper MA, Madden LV (2007) A quantitative review of tebuconazole effect on Fusarium head blight and deoxynivalenol content in wheat. Phytopath 97:211-220.

Sharma DDK, Kumar A (2015) Efficacy of fungicides and antibiotics against spore germination and sporulation of *Fusarium moniliforme* Sheldon causing pokkah boeng disease of sugarcane. Agriways 3(2):95-102.

Sreenivasa Y, Marikunte A, Regina S, Adkar D, Charith R, Mysore P, Prasad N, Premila N, Achar N, Janardhana R (2011) Assessment of the growth inhibiting effect of some plant essential oils on different *Fusarium* species isolated from sorghum and maize grains. J Plant Dis Prot 118(6):208–213.

Sultana N, Ghaffar A (2010) Effect of fungicides, microbial antagonists and oilcakes in the control of *Fusarium solani*, the cause of seed rot, seedling and root infection of bottle gourd, bitter gourd and cucumber. Pakistan J Bot 42(4):2921-2934.

Vishwakarma SK, Kumar PL, Nigam A, Singh A, Kumar A (2013) Pokkah boeng: an emerging disease of sugarcane. J Plant Path Microbiol l4:32.

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