Journal of Mycology and Plant Pathology
Vol. 54 - Number 4 (December 2024) 341-349
https://doi.org/10.59467/JMPP.2024.54.341

ISSN (Print) : 0971-9393
ISSN (Online) : 0975-4180

Research Article

Emerging Trends in the Management of Soil Borne Diseases of Yard Long Bean

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Abstract

Soil borne fungal diseases *viz.,* vascular wilt (*Fusarium oxysporum*), basal stem rot and blight (*Sclerotium rolfsii)* and collar rot and web blight (*Rhizoctonia solani*) result in drastic yield loss in yard long bean vegetable crop. Synthetic fumigants have been banned owing to the hazards they pose to human beings, ozone layer and the environment. Thus, the present research work was undertaken to identify potential alternatives to synthetic fumigants. An emerging technique *viz.*, biofumigation when evaluated by paired plate technique using 2.5 g bulbs of *Allium sativum* (garlic) could completely (100%) inhibit the mycelial growth of all the three pathogens, but not that of the bioagent, *Trichoderma asperellum,* revealing the compatibility between the biofumigant and the bioagent. Steam distillation and further, gas chromatography - mass spectrometry (GC-MS) of garlic essential oil could identify diallyl disulphide (DADS), as one of its major components. DADS (0.30%) completely (100%) inhibited the mycelial growth of all the three fungal pathogens and promoted germination of seeds of yard long bean. It was also compatible with arbuscular mycorrhizal fungi (AMF) as evidenced by enhanced germination percentage, maximum nodule number and vesicle percentage in roots. Besides fungicidal potential, DADS also revealed insecticidal property against the two major insect pests of yard long bean *viz*., black aphid (*Aphis craccivora*) and pulse beetle (*Callosobruchus chinensis*) indicating the possibility of integrated pest management in the crop. The contact toxicity and mean repellence of DADS (LC 50) against pulse beetle were 666.90 ppm and 71.1 ppm per cm^2 respectively, when tested by film residue method. The fumigant and contact toxicity of DADS against black aphid were 0.029 µl mL^{-1} air and 6.87 $mgcm^{-2}$ respectively, when tested by head space analysis. Soil fumigation using garlic bulbs (10g per pot) two weeks prior to planting and soil plastering using cowdung slurry followed by soil application of *T. asperellum* multiplied in cowdung: neem cake mixture (9:1 ratio) after one week as well as soil drenching using 0.30 per cent DADS followed by *T. asperellum* multiplied in cowdung: neem cake mixture (9:1 ratio) after one week were effective in reducing the incidence and severity of the soil borne diseases. Further studies are in progress to identify the upregulation of genes of various pathways in *T. asperellum* to reveal the principle behind its compatibility with DADS by transcriptome analysis.

Key words: *Allium sativum*, biofumigant, diallyl disulphide, soil borne pathogens, *Trichoderma asperellum*, *Vigna unguiculata sesquipedalis*

Citation: Sajeena A, Pathrose B, Mathew D and John J. 2024. Emerging trends in the management of soil borne diseases of yard long bean vegetable crop. *J Mycol Pl Pathol* 54(4): 341-349 https://doi.org/10.59467/JMPP.2024.54.341)

Smt Guman Devi Verma Best Women Scientist Award 2023 - Winner. Presented in 3rd ISMPP Asian Congress at Sardar Krushinagar Dantiwada Agricultural University, Sardar Krushinagar, Gujarat from February 7-10, 2024