Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(2): 1006-1009

Received: 06-12-2020
Accepted: 04-02-2021

P Mahalakshmi
Assistant Professor
(Plant Pathology), Institute of Agriculture, Kumulur,
Tamil Nadu Agricultural University, Tamil Nadu, India

P Ahila Devi
Assistant Professor
(Plant Pathology), Institute of Agriculture, Kumulur,
Tamil Nadu Agricultural University, Tamil Nadu, India

Corresponding Author:
P Mahalakshmi
Assistant Professor
(Plant Pathology), Institute of Agriculture, Kumulur,
Tamil Nadu Agricultural University, Tamil Nadu, India

Integrated management of root rot of sesame (*Sesamum indicum* L.) caused by *Macrophomina phaseolina*

P Mahalakshmi and P Ahila Devi

Abstract
Sesame (*Sesamum indicum* L) is one of the major ancient oilseed crops in India. Although it has been cultivated for a long time, the significant increase in productivity is yet to be achieved. It is well recognized that the diseases constitute a major constraint in increasing the yield level of sesame crop. Root rot caused by *Macrophomina phaseolina* (Tassi) Goid is an important disease of Sesame (*Sesamum indicum* L.) causing 5 to 100 per cent yield loss under field conditions. Field experiment was conducted on integrated disease management practices to combat to root rot and increase the seed yield of sesame during two consecutive years (2015-2016) of kharif seasons at Regional Research station, Vridhachalam, Tamil Nadu Agricultural University, Tamil Nadu. The integrated disease management module consisting of seed treatment with *Trichoderma viride* @ 4g/Kg + *Pseudomonas fluorescens* @10 g /kg + soil application of *P. fluorescens* @ 2.5 Kg/ha + *T. viride* 2.5 Kg/ha enriched in 100 Kg of FYM + neem cake @ 250 kg/ha effectively reduced the root rot incidence which recorded the minimum disease incidence (14.75 and 11.15%) with higher yield of 648 and 651 kg/ha were recorded during Kharif of 2016 and 2017.

Keywords: sesame, root rot, disease incidence, organic amendments, bioinoculants

Introduction
Sesame (*Sesamum indicum* L.) is one of the major oilseed crops cultivated in India occupying the third position. In Tamil Nadu sesame is cultivated in an area of 31,181 ha with average productivity of 518 kg / ha. Sesame seeds and its oil are is in high demand for export as Sesame seeds are a good source of dietary protein, with high-quality amino acids making up 20% of the seed. And it is also endowed with biologically active and health promoting phytochemicals such as sesamin, sesamolin, tocopherols, PUFA, phytosterols, phytates and other phenolics (Pathak *et al*. 2014) [11]. Sesame seeds contain magnesium which has anti-cancer properties. They also contain Potential health benefits of sesame include anti oxidative, anticancer, anti-hypersensitive and anti immunoregulatory actions (Reshma *et al*., 2011).
The productivity is remained stagnant over recent decades because of its susceptibility to biotic and a biotic stresses. Inherently low yield potential apart, biotic and a biotic stresses constitute the major yield destabilizing factors do not as well realize the full potential of the currently available varieties. There are severe biotic stresses, such as root rot /stem rot (*Macrophomina phaseolina*) (Tassi) Goid, (Bacterial blight (*Xanthomonas campestris* pv. *sesame*), Phyllody (a Mycoplasma –like organism), Powdery mildew (*Oidium erysiphoides*), *Alternaria* leaf spot (*Alternaria sesame*) and Cercospora leaf spot (*Cercospora sesame*).
Sesame root rot/stem rot caused by *Macrophomina phaseolina* (Tassi.) Goid (= *Rhizoctonia bataticola*) is one of the important disease as it reduces the crop yield to a greater extent in sesame growing areas especially in summer season and in high temperature areas. It attacks crop plants at different stages of plant growth and causes complex disease syndromes like root rot, seedling blight, charcoal rot, ashy stem blight, wilt, collar rot, dry rot, pod rot and seed rot in several crops (Ma *et al.*, 2010) [6].
At present chemical fungicides are the first choice for the farmers to combat diseases because of their easy adoptability and immediate therapy. Due to health risk and pollution hazards by use of chemical fungicides in plant disease control, it is considered appropriate to minimize their use. Since sesame seed and oil are in high demand for export due to their high unsaturated fat and methionine content. Focus has been shifted to safer alternatives of chemical fungicides in recent years.

The use of eco friendly disease control method has got tremendous scope, since the diseases are controlled without putting any threat to the quality of produce and surrounding ecosystem. Plant products such as oil seed cakes have shown success in plant disease control and are known to be harmless, eco-friendly, non-phytotoxic and readily available (McSorley *et al*., 1999) [8].

Biological control had attained importance in modern agriculture to restrain the hazards of intensive use of chemicals for disease control. Since the efficacy of bio inoculants has been inconsistent due their inability to maintain, considering the importance of root rot and the subsistence sesame cultivation, research priority was given to manage root rot disease. Integrated disease management (IDM) has emerged as the promising approach for management of root rot of sesame (Nayan Kishor Adhikary and Krishnendu Roy, 2019) [9]

To achieve this objective, present investigation was carried out to evaluate the efficacy of bio inoculants with combined application of organic amendments for controlling the root rot and find out suitable eco-friendly management strategies for preventing crop losses.

Materials and Methods

A field experiment was conducted during to evaluate the efficacy of bio inoculants with combined application of organic amendments. Two consecutive Kharif trials of 2016 - 2017 were laid down at Regional Research station, Vridhachalam ,Tamil Nadu Agricultural University , Tamil Nadu with seven treatments integrated manner viz., M_1 - Seed Treatment (ST)with *Trichoderma asperellum* @ 4g/kg + Soil application (SA) of *T. asperellum* @2.5 Kg/ha enriched in 100 Kg of FYM at the time of sowing, M_2 -ST with *P. fluorescens*@ 10 g /kg + SA of *P. fluorescens* @ 2.5 Kg/ha enriched in 100 Kg of FYM at the time of sowing, M_3 - T_1 + neem cake @ 250 kg/ha at the time of sowing, M_4 - T_2 + neem cake 250 kg/ha at the time of sowing, M_5 - M_1 + M_2 + neem cake 250 kg/ha at the time of sowing, M_6 - Seed treatment carbendazim @2g /kg + soil drenching with carbendazim 1g / l and M_7 - Untreated check in Randomized Block Design (RBD) with three replications using the variety –VRI 2. Per cent Disease incidence (PDI) was worked out for root rot of sesame. The grain yield was recorded for each for each plot following the standard protocols. The statistical analysis of the experimental data was carried out by adopting the standard method as described by Gomez and Gomez (1984) [2].

Results and Discussion

The effective bio inoculants and organic amendments were found promising against root rot of sesame under field conditions. The data presented in the Table 1 and 2 revealed that all the IDM module were found to be superior over the untreated control (M7) in reducing the disease incidence and increasing the grain yield and C:B ratio during kharif -2016 and 2017. Of which, IDM module M5including the seed treatment with *T. asperellum* @ 4g/kg + *P. fluorescens* @10 g /kg + soil application of *P. fluorescens* @ 2.5 kg/ha + *T. asperellum* 2.5 kg/ha enriched in 100 Kg of FYM + neem cake @ 250 kg/ha was found to be significantly effective by recording the minimum root rot incidence of 11.86 per cent during kharif 2016 (Table 1) and disease incidence of (14.75%) during summer 2017. This was agreement with the findings of Gyanendra and Verma (2005) [3] who reported that t good compatibility of fungicides carbendazim, Neem products and biocontrol agents (*T. harzianum* and *T. viride*), for control of soybean root-rot. Addition of neem cake promotes biological activity in soil by providing nutrients and favourable conditions for the antagonists besides enhancing host growth and vigour was documented by Mallesh *et al*. (2008) [7]. The result of the present study also confirms that soil application of *T. harzianum and P. fluorescens* exhibited maximum disease suppression when applied in combination than alone. Regarding seed treatment, the modules M2, M3 and M4recorded significantly lesser disease incidence than M7. From this, it was inferred that seed treatment, integrated management by application of bio inoculants and organic amendments provide longer protection than alone which suppress the seed and soil borne pathogens. The present investigation is in line with the report of Rafi *et al* (2016) [13]. Combined effect of bio-priming of seeds with *T. harzianum* spore suspension and amendment of soil with mustard cake @ 1% was found to be most effective for the growth of leguminous and non-leguminous crop plants (peanut, chickpea, okra and sunflower) and for the reduction of root rot caused by *Macrophomina phaseolina*. With respect to grain yield, all the modules recorded significantly higher seed yield and C:B rather than untreated control. Among them, M5 ranked first by recording the highest seed yield (654/kg/ha) and (1.26) C:B ratio during kharif - 2016 (Table 1) and 648kg /ha and C:B 2.60 during Kharif -2017 followed by M3(Table 2). Our results are in confirmatory with those of Harmen *et al*. (2004) [5] and Haikal (2008) [4] who also observed the similar effects of *T. viride* in different crops. Papavizas and Lumsden (1980) [10] opined that changes in soil reaction due to increased activity of introduced *Trichoderma* species might be one among the reasons for the increased seedling growth beside production of growth regulating substances by the antagonists. The highest grain yield and C: B ratio of M5 may be attributed due to the nutrient content of the neem cake and increased nutrient uptake through enhance root growth by Trichoderma and inclusion of only cheap and easily available biopesticides for managing diseases.

From the study, it is concluded that IDM module M5including the seed treatment with *T. asperellum* @ 4g/kg + *P. fluorescens* @10 g /kg + soil application of *P. fluorescens* @ 2.5 kg/ha + *T. asperellum* 2.5 kg/ha enriched in 100 Kg of FYM + neem cake @ 250 kg/ha was found to be superior in reducing the diseases and increasing the seed yield coupled with higher cost benefit ratio.

Table 1: Integrated management of root rot disease of sesame Kharif -2016

Module No	Treatments	Disease incidence (%)	Yield (Kg /ha)	C:B ratio
M_1	ST with *T. viride* + SA of *T. viride* 2.5 Kg /h*a* enriched in 100 Kg FYM	28.80 (32.45)	578	1.29
M_2	ST with *P. fluorescens* +SA of *P. fluorescens* 2.5 Kg /h*a* enriched in 100 Kg FYM	25.15 (30.10)	561	1.48
M_3	ST with *T. viride* + SA of *T. viride* 2.5 Kg /h*a* enriched in 100 Kg FYM +Neem cake@250Kg/ha	18.56 (25.51)	621	2.00
M_4	ST with *P. fluorescens* +SA of *P. fluorescens* 2.5 Kg /h*a* enriched in 100 Kg FYM+ Neem cake@250Kg/ha	22.21 (28.11)	615	1.68
M_5	ST *T. viride*+ *P. fluorescens*+ SA of *T. viride*+ SA of *P. fluorescens* enriched in 100 Kg FYM +Neem cake@250Kg/ha	14.75 (22.58)	648	2.60
M_6	ST Carbendazim 2g/Kg +Soil drenching with Carbendazim 1g/l	14.32 (22.23)	651	2.62
M_7	Untreated check	37.21 (37.59)	454	
S.Ed		0.56	7.98	
CD(*P*=0.05)		1.11	17.40	

Table 2: Integrated management of root rot disease of sesame Kharif -2017

Tr. No	Treatments	Root rot (%)	Yield (kg/ha)	C:B ratio
T_1	ST with *T. viride* + SA of *T. viride* 2.5 Kg /h*a* enriched in 100 Kg FYM	22.64 (28.41)	635	1.46
T_2	ST with *P. fluorescens* +SA of *P. fluorescens* 2.5 Kg /h*a* enriched in 100 Kg FYM	27.36 (31.53)	625	1.44
T_3	ST with *T. viride* + SA of *T. viride* 2.5 Kg /h*a* enriched in 100 Kg FYM +Neem cake@250Kg/ha	17.28 (24.56)	610	1.41
T_4	ST with *P. fluorescens* +SA of *P. fluorescens* 2.5 Kg /h*a* enriched in 100 Kg FYM+ Neem cake@250Kg/ha	23.71 (29.13)	595	1.37
T_5	ST *T. viride*+ *P. fluorescens*+ SA of *T. viride*+ SA of *P. fluorescens* enriched in 100 Kg FYM +Neem cake@250Kg/ha	11.15 (19.50)	651	1.5
T_6	ST Carbendazim 2g/Kg +Soil drenching with Carbendazim 1g/l	11.03 (19.39)	659	1.52
T_7	Untreated check	37.45 (37.73)	432	
SEd		1.31	2.92	
CD(P=0.05)		2.86	6.36	

Conclusion

The field experimental study inferred that, seed treatment with *T. asperellum* @ 4g/kg + *P. fluorescens* @10g /kg + soil application of *P. fluorescens* @ 2.5kg/ha + *T. asperellum* 2.5 kg/ha enriched in 100 kg of FYM + neem cake @ 250 kg/ha was found effective in controlling the root rot and it's seem to be promising for practical disease management in farmer's field. Consequently, integrated management appeared not only economical but also eco-friendly strategy for better management of root rot in sesame.

Acknowledgement

This work has been carried out under All india Co ordinated Research Programme (AICRP) at Regional Research Station, Vridhachalam, Tamil Nadu Agricultural University which is sincerely acknowledged.

References

1. Elewa IS, Sahab AF, Mostafa MH, Ziedan EH. Direct effect of biocontrol agents on wilt and root-rot diseases of sesame. Archives of Phytopathology and Plant Protection 2011;44(5):493-504.
2. Gomez KA, Gomez AA. Statistical procedures for Agricultural Research. John Wiley and Sons, New York. 1984, 680-687.
3. Gyanendra SRK, Verma. Compatibility of fungicides and Neem Products against *Fusarium solani* f.sp.*glycines* causing root-rot of soybean and *Trichoderma spp*. Journal of Mycological Research 2005;43:211-214
4. Haikal, NZ. Control of *Rhizoctonia solani* in Soybean (*Glycine max* L) by seed-coating with *Trichoderma viride* and *Gliocladium virens* spores. Journal of Applied Biosciences 2008;1(2):34-39.
5. Harman GE, Howell CR, Viterbo A, Chet I, Lorito M. *Trichoderma* species opportunistic, avirulent plant symbionts. National Review of Microbiology 2004;2:43-56.
6. Ma J, Hill, CB, Hartman GL. Production of *Macrophomina phaseolina* conidia by multiple soybean isolates in culture. Plant disease 2010;94(9):1088-1092.
7. Mallesh SB, Narendrappa T, Ramanujam B. Evaluation of microbial antagonists and organic amendments on root rot of sage (*Salvia officinalis*) by *Fusarium solani* and *Rhizoctonia solani*. Karnataka Journal of Agricultural Sciences 2008;21(2):301-302.
8. McSorley R, Ozores-Hampton M, Stansly PA, Conner JM. Nematode management, soil fertility, and yield in organic vegetable production. Nematropica 1999;29(2):205-213.
9. Nayan Kishor Adhikary, Krishnendu Roy. Integrated management of foliar diseases of sesame (*Sesamum indicum* L.) in coastal Bengal. International Journal of

chemical studies 2019;7(3):417-419.
10. Papavizas GC, Lumsden RD. Biological control of soil-borne fungal propagules. Annual Review of Phytopathology 1980;18:389-413.
11. Pathak N, Rai AK, Ratna Kumari KV, Bhat. Value addition in sesame: A perspective on bioactive components for enhancing utility and profitability. Pharmacognosy Reviews 2014;8(16):147-155
12. Rafi HS, Dawar, Zaki MJ. Seed priming with extracts of *Acacia nilotica* (L.) wild. Exdelile and *Sapindus mukorossi* (L.) plant parts in the control of root rot fungi and growth of plants. Pakistan journal Botany 2015;47(3):1129-1135.
13. Rafi, HS, Dawar, Tariq M. Combined effect of soil amendment with oil cakes and seed priming in the control of root rot fungi of leguminous and non-leguminous crops. Pakistan. Journal Botany 2016;48(3):1305-131.
14. Reshma MV, Balachandran C, Arumughan C, Sunderasan A, Sukumaran D. Extraction, separation and characterisation of sesame oil lignan for nutraceutical applications. Food Chemistry. 2010; 120:1041-1046.
15. Ziedan EH, Elewa IS, Mostafa MH, Sahab AF. 2010. Application of mycorrhizae for controlling root diseases of sesame. First International Congress MCOMED. Moracoo, 11–13 October 2010, 97.