International Conference on Frontiers in Life and Earth Science
© 2018 IJSRST | Volume 5 | Issue 1 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X

Management of Collar Rot of Groundnut (Arachis hypogaea L.) by biocontrol agents

Shaikh Ruhina Shaheen
Department of Botany, Nalanda Art's, Commerce and Science College, Satara (Khandoba), Aurangabad, Maharashtra, India

ABSTRACT

Groundnut is an economic important edible oilseed crop. Groundnut suffers seed, soil and foliar diseases. Among the groundnut diseases, collar rot is one of the economic important disease. Collar rot damaged regularly due to its seeds and soil borne nature. Collar rot of groundnut is caused by Aspergillus niger Van Tieghem. It is a soil-borne pathogen, usually the occurrence of collar rot disease during the early stages of crop growth and results in high seedling mortality. Collar rot disease of groundnut is one of the most serious, destructive diseases in and yield losses range from 13 to 52% and can be as high as 93.6% in some areas. Seven isolates of Trichoderma spp. belonging to viz., viren, viride, harzianum species groups were screened for their modes of biocontrol ability against Aspergillus niger van Teighem the causal agents of collar rot of groundnut. It was observed that T. viride 60 inhibited maximum (86.2%) growth of test fungus, followed by T. harzianum 2A (80.4%). However, filed evaluation of these isolates should be under taken to evaluate their efficiency against the soil borne pathogen of groundnut.

Keywords : Aspergillus Niger, Trichoderma Spp., Groundnut, Collar Rot

I. INTRODUCTION

Out of nine oilseed crops grown in India, groundnut accounts for 35% of the total area cropped under oilseed and 40% of the total oilseed production. Though, India is the largest producer of groundnut, its average productivity levels are very low as compared to USA and China. In India, the major groundnut growing states are Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu and Punjab [1]. A major limiting factor in profitable cultivation of this crop is the attack of several diseases mainly caused by fungi, which takes heavy loss of the crop at all the stages of growth right from sowing to harvest and storage. An important factor contributing to low yield are diseases [2]. Grover [3] listed more than 55 pathogens in groundnut crop. Only a few, such as early leaf spot (Phaeoisariopsis arichidicola) late leaf spot (Phaeoisariopsis personata), rust (Puccinia arichidis), collar rot (Aspergillus niger van Tieghem), stem rot (Sclerotium rolfsii Sacc.), root rot (Macrophomina phaseolina), and aflaroot (Aspergillus flavus) are economically important in India. Nematode diseases like root knot, and viral diseases like peanut bud and stem necrosis, groundnut mottle and clump [4] are major diseases that limit groundnut production and productivity. In addition, the pre- and post-harvest aflatoxin contamination in the kernels and meal also reduces groundnut quality as well as export value.

Economic importance and occurrence of disease

Collar rot disease in groundnut prominently is distributed in countries with tropical and sub-tropical climates where high temperature prevails during the rainy season. Collar rot disease of groundnut (Arachis hypogaea L.) caused by Aspergillus niger van Tiegham

is an important disease in several temperate countries [5]. However, in India, at Nagpur first reported the Aspergillus blight of groundnut caused by A. niger and worked out the morphology of the pathogen [6]. The primary source of the inoculum of collar rot pathogen has been shown to be mycelium and spores carried on the seeds and organic debris in the soil [7].

Figure 1. Groundnut plants showing typical collar rot symptom

Collar rot causes heavy losses in pod and fodder yield of groundnut. Most of the varieties of groundnut are susceptible to this disease. Many seed dressing fungicides are reported to be effective against collar rot of groundnut [8]. But limited work has been done on successful exploitation of bio-control agents, for the management of collar rot disease through induced resistance. The above method is very needed to keep the disease below the economic threshold level without damaging the agro-ecosystem in soil [9]. Trichoderma have been used as biological control agents against soil-borne plant pathological fungi [10]. The main objective of the present study was to find an, in vitro Trichoderma strain that will act as the best bio-control agent for effectively inhibiting the growth of A. niger (as all Trichoderma strains do not work equally against a specific disease).

II. METHODS AND MATERIAL

Isolation and maintenance of microbes

Groundnut seedlings which showed typical symptoms of collar rot, were cut into small bits using a sterilized blade. The pure pathogen culture (A. niger) was made by the hyphal tip isolation method [11] on the solidified PDA medium in petri plates. A typical black mycelium (conidia) growth of A. niger was observed after 72 h of incubation, at 28±2°C, in an incubator.

Three spp. of Trichoderma viz., T. virens, T. viride and T. harzianum were used in the present investigations. All the biocontrol agents were obtained from culture bank of Agharkar Research Institute, Pune (Maharashtra). Both the microbes were maintained throughout the study by periodical transfers on PDA media under aseptic conditions, to keep the culture fresh and viable.

Test of antagonistic potential:

Three spp. of Trichoderma viz., T. virens, T. viride and T. harzianum were used for antagonistic test by dual culture technique using 20 ml of Potato dextrose agar medium in 90 mm culture plates. Potato dextrose agar medium in the culture plates was seeded with the Trichoderma species and test pathogen (5 mm culture discs of three days old culture) opposite each other near the periphery of petri plates. The medium inoculated with the pathogen alone served as control. The experiment was conducted in four replications for each antagonist. All the inoculated plates were incubated at a temperature of 30±1°C. After six days, the plates were observed for growth of antagonist and test fungus. Index of antagonism as per cent growth inhibition of A. niger, was determined by following the method of Watanabe [12].

III. RESULTS AND DISCUSSION

In vitro antagonism between bio-agent Trichoderma and pathogen – A. niger

Growth inhibition of A. niger during in vitro interaction with bio-control agents Trichoderma, at 6 days after inoculation (DAI), was depicted in Fig. 2. Per cent growth inhibition of pathogen (A. niger) was significantly higher in T_3 (86.2%) antagonist, followed by T_5 (80.4%), T_1 (60.9%) and T_2 (50.6%) at 6 DAI. Non significant differences were observed between

antagonists T_6 (32.4%) and T_4 (28.8%). However, T_7 antagonists were recorded with a below 30% growth inhibition of fungal pathogen. Thus, it was observed that T_3 antagonist (i.e. interaction between Trichoderma viride 60 and pathogen (A. niger) have a better growth inhibition of test fungus A. niger, compared to the other bio-control agents.

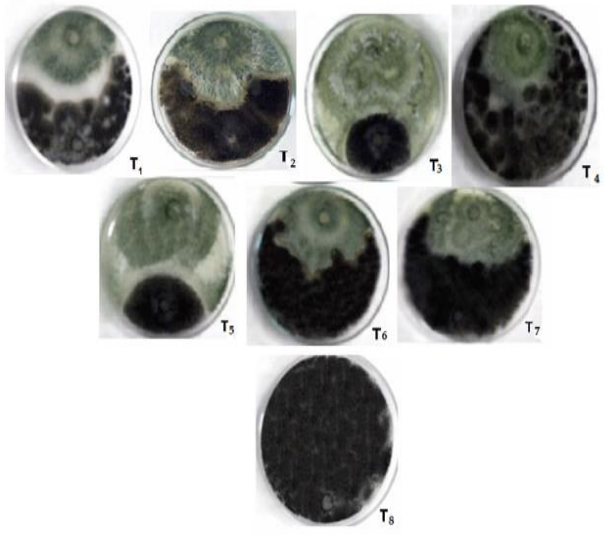

Figure 2. Antagonism between Trichoderma isolates and A. niger

T_1 – T. viren X AN; T_2 – T. viridie 54 X AN; T_3 – T. viridie 60 X AN; T_4 – T. viridie 62 X AN; T_5 – T. harzianum 2A X AN; T_6 – T. harzianum 4A X AN; T_7 – T. harzianum 5A X AN;T_8 - Control A. niger (AN).

Groundnut is an economically important crop but the collar rot disease was affecting its growth. The present experiment was initiated to study the comparative efficacy of the bio-control agents Trichoderma on different susceptibilities of groundnut varieties against A. niger causing collar rot at the pre emergence phase. An antagonistic effect of fungal bio-control agents against the test pathogen fungus (A. niger) was observed. T. viride 60 (T_3) showed maximum reduction in growth of test fungus showed maximum reduction in growth of test fungus followed by T. harzianum 2A (T_5). These results are in confirmation with the finding, who reported that the T. viride and T. harzianum were found to be effective in reducing the radial growth of A. niger in vitro [13]. The bio-control agent T. viride had a greater inhibition on A. niger than T. harzianum [14].

IV. CONCLUSION

Collar rot of groundnut caused by Aspergillus niger (Van Teighem) is one of economic important seed borne disease. The disease is expressing their symptoms in pre and post emergence phases. During experiment results of the present study, confirmed clearly that Trichoderma species inhibited the growth of pathogens remarkably well. The competence shown by Trichoderma species to inhibit the growth of the tested pathogens in vitro.

V. REFERENCES

[1] Kumari M, Singh M. Morphological and pathogenic vaiabilities among Aspergillus niger isolates associated with groundnut (Arachis htpogea. L.) Ann. Pl. Protec. Sci. 2016; 24(2):364-368.

[2] Subramanyam, P. and McDonald, D. 1983. Rust diseases of groundnut. Information Bulletin No. 13. Patancheru, A.P. India, ICRISAT.

[3] Grover R.K. 1981. Present state of research and future trends in controlling diseases of oilseeds and pulses. In: PAI National Seminar on Increasing of Pulses and Oilseeds Produc-tion Through Plant Protection. Vigyan Bhavan, New Delhi, 13–14 November, 1981, 315 pp.

[4] Ghewande M.P., Reddy P.S. 1986. Strategy for the management of major diseases of groundnut. Pesticides 20: 57–61.

[5] Carina M, Andrea A, Lorena P, Maria G, Stella C, Ana C. Ochratonin the occurrence of ochratoxin A producing black aspergilli in stored peanut seeds from Cordoba. Argentina J. Agro. Crop Sci. 2006; 86:2369-2373.

[6] Jain AC, Nema KG. Aspergillus blight of groundnut seedlings. Sci. Cult. 1952; 17:348.

[7] Nema KG, Jain AC, Asthana RP. Further studies on Aspergillus blight of groundnut seedlings and its control. Indian Phytopathology. 1955; 8:13-21.
[8] Gangopadhyay S., Bhatia J.V., Godara S.l. 1996. Evaluation of fungicides for the control of collar rot of groundnut. Indian J. Mycol. Plant Pathol. 26: 278–279.
[9] Papavizas G.C., Lewis I.A. 1988. The use of fungi in integrated control of plant disease. p. 235–253. In: "Fungi in Biocontrol Systems" (M.N. Burge, ed.). Manchester University Press, Manchester, UK, 945 pp.
[10] Kucuk C., Kivank M. 2003. Isolation of Trichoderma spp. and determination of their antifungal, biochemical and physiological features. Turk J. Biol. 27: 247–253.
[11] Sinclair J.B., Dhingra O.D. 1985. Basic Plant Pathology Method. CRC Press, Inc. Corporate Blud, M.W. Boca Rotam, Florida: 295–315.
[12] Watanabe N. 1984. Antagonism by various kind of Trichoderma fungi to soil born plant pathogen. Bull. Faculty of Agric., Maiji University, Japan 66: 45–50.
[13] Kishore G.K., Pande S., Rao J.N., Podile A.R. 2001. Biological control of crown rot groundnut by Trichoderma harzianum and T. viride. Int. Arachis Newsletter 21: 39–40.
[14] Prabhu K.S., Urs S.D. 1998. Efficacy of bio agents for management of collar rots of groundnut caused by Aspergillus niger. Current Res. Uni. Agric. Sci. Bangalore 27: 114–115.