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"EFFECT OF ARBUSCULAR MYCORRHIZAL FUNGUS, *ACAULOSPORA LACUNOSA* ON GROWTH OF GROUNDNUT DISEASE CAUSED BY *CERCOSPORA ARACHIDICOLA*"

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ABSTRACT

Efficacy of arbuscular mycorrhizal fungus (AMF), *Acaulospora lacunosa* was evaluated for the biological control of soil-borne plant pathogen *Cercospora arachidicola* in groundnut plant. For this investigation pot culture technique was followed. Soil based mixture of AMF, *Acaulospora lacunosa* was inoculated onto the root of groundnut plant. In results the colonization by AMF significantly resulted into decreased incidence of disease caused by *Cercospora arachidicola.* The growth of groundnut showed marked increase in the shoot and root length, fresh and dry weight due to AMF colonization.

KEYWORDS: Arbuscular Mycorrhiza, Tikka Disease, Groundnut, *Cercospora arachidicola, Acaulospora lacunosa*

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the important oil seed crops of India, growing in the semi-arid tropics. It is valuable cash crop planted by millions of small farmers because of its economic and nutritional value. A variety of fungi are known to cause important plant diseases, resulting in a significant loss in agricultural crops. The plant diseases need to be controlled to maintain the level of yield both quantitatively and qualitatively. Biological control of soil borne pathogens by introduced microorganisms has been studied over 80 years, but most of the time it has not been considered commercially feasible. Microorganisms that can grow in the rhizosphere are ideal to be used as bio-control agents, since the rhizosphere provides the front- line defense for root against pathogens. At present, foliar disease management in groundnut often involves indiscriminate use of fungicides.

However, it has been reported that fungicides are not eco-friendly as they are supposed to harm other useful micro flora in soil and they also pose many health problems in addition to their adverse effect on quality. Tikka spots caused by *Cercospora arachidicola* is the most common and serious disease of groundnut. The incidence and severity of disease varies between localities and seasons. Small chlorotic spots appear on leaflets 10 days after infection. The spots then develop in about 5 days into mature, sporulating lesions. The spots are reddish brown to black on upper surface, while on lower surface; these are light brown in colour. Disease of groundnut reduces yield and quality and increase the cost of production wherever the crop is grown (Jyothsna, 2004).

The AMF are the symbiotic fungi that predominate in the roots and soils of agricultural crops. The AMF play an important role in the reduction of plant pathogens, such as *Rhizoctonia solani* and *Phytophthora* sp. (Trotta *et al*., 1996, Cordier *et al*., 1996). The antagonistic interaction between AMF with various soil borne pathogens is the reason for their use as bio-control agents.

MATERIALS AND METHODS

Preparation of Soil Mixture

The potting mixture was prepared with a mixture of red soil and sand in the ratio 3:1. The soil was sterilized and filled in Polyvinyl Chloride pots.

Source of Inoculum

Isolation of AM Fungi

The AMF, *Acaulospora lacunosa* was isolated from soil by wet sieving and decanting method and were maintained in ragi seedlings.

Isolation of the Pathogen *Cercospora arachidicola*

The pathogen, *Cercospora arachidicola* which causes tikka disease of groundnut was isolated from infected groundnut leaves. Pure culture was made and maintained in Potato dextrose agar in the laboratory under aseptic condition.

Inoculation of AM Fungi and Pathogen to Pots

The seeds of groundnut were added in pots at the rate of 4 seeds. The AMF, *Acaulospora lacunosa* was applied 2-3 cm below the soil surface by layering method. The spore suspension of pathogen was added to the pots. The pot without AMF and pathogen serves as control. All the treatments were maintained in triplicates. The pots thus prepared were regularly watered and all the nursery precautions were taken to maintain aseptic conditions. At the end of three months, the test plants were carefully separated from the pots and root length, shoot length, wet weight and dry weight of the plants were recorded. The plants also observed for the presence of disease spots. The nutrient content of the seeds were analysed. The nutrient analysis was carried out in CFTRI, Mysore.

RESULTS

Inoculation of *Acaulospora lacunosa* increased the growth of groundnut plant and decreased the infection of *Cercospora arachidicola but* few chlorotic spots were seen in the plants inoculated with *Cercospora arachidicola.* There was no much difference in root and shoot length in the plants inoculated with *Acaulospora lacunosa* compared to control (Table 1). The wet weight and dry weight were comparatively more in plants inoculated with *Acaulospora lacunosa* than control (Table 2). But the protein and fat content of groundnut seeds was less than control (Table 3).

Table 1: Effect of AM Fungi on Shoot and Root Growth of Groundnut Plant

Sl. No.	Treatment	Root Length in cm Mean ± SD*	Shoot Length in cm Mean ± SD*
1	*Acaulospora lacunosa*	9.4 ± 2.7	21.75 ± 4.5
2	*Acaulospora lacunosa* + Pathogen	6 ± 0	24 ± 0
3	Control	7.5 ± 2	30.8 ± 3.7

*± SD- Standard deviation where n-12

Table 2: Effect of AM Fungi on Wet Weight and Dry Weight of Groundnut Plant

Sl. No.	Treatment	Wet Weight in g Mean ± SD*	Dry Weight in g Mean ± SD*
1	*Acaulospora lacunosa*	9.1 ± 1.2	7.6 ± 1.3
2	*Acaulospora lacunosa* + Pathogen	10.4 ± 0.1	6.4 ± 0
3	Control	10 ± 0.2	6 ± 0.1

*± SD- Standard deviation where n-12

Table 3: Nutrient Analysis of Groundnut Seeds

Sl. No.	Parameter	Treatment		
		Acaulospora lacunosa	*Acaulospora lacunosa*+ Pathogen	Control
1	Moisture (% by wt.)	32.4	37.5	25.9
2	Total Ash (% by wt.)	1.94	1.76	2.1
3	Fat (% by wt.)	28.9	28.7	33.4
4	Protein (% by wt.)	16.8	17.7	18.7
5	Crude fibre (% by dry wt.)	2.87	2.82	2.36
6	Carbohydrates (% by wt.)	17.1	11.5	17.5
7	Calorific value (k cal / 100g)	396	375	445

*Results were obtained from CFTRI, Mysore

DISCUSSIONS

The present work shows that *Acaulospora lacunosa* can be used as a bio-control agent against tikka disease of groundnut. It was found that the presence of AMF increase the tolerance of some plants to nematodes and other plant pathogens (Mehrotra 2007). Similar results were found by Veerbhadraswamy and Rajkumar (2011) in which *Glomus fasciculatum*, *Glomus mossae* and *Acaulospora laevis* can be used as bio-control agent against black bundle disease of maize caused by *Cephalosporium acremonium*. Namdas *et al*., 2010 noted that percent frequency of occurrence of pathogenic fungi decreased with increasing age of plant associated with *Glomus fasciculatum.* In the present work AMF has decreased the incidence of disease as well as increased the growth of the plant. Aneesa Rani *et al*. (2010) found that combined application of *Azospirillum*, Phosphobacteria and *Glomus* sp. enhance the growth of Cashew rootstocks. Pindi *et al*. (2010) found that *Glomus fasciculatum* formed better colonization and increased the growth of *Sesbania grandiflora* and *Pongamia pinnata*. Hema shenpagam *et al*. (2010) found that inoculating *Glomus aggregatum* along with PGPR's encourages the ability of *Glomus aggregatum* and enhances the growth, biomass, nutrients and content of secondary metabolites of *Solanum xanthocarpum*. Singh *et al*. (2007) found that AMF increase the growth and yield of Papaya.

CONCLUSIONS

Acaulospora lacunosa can be isolated from majority of the host plant and can be mass produced in the laboratory. It is cheaper than chemical fertilizer and also ecofriendly. So the use of VAM fungi is being encouraged in agriculture. Since groundnut is a cash crop farmer can protect the crop from seed borne pathogen by inoculating VAM fungi other than any expensive fertilizer.

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