ASSESSMENT OF BENEFICIAL MICROORGANISMS IN THE RHIZOSPHERE SOIL OF BLACK NIGHTSHADE (*SOLANUM NIGRUM* L.) IN NATURAL VEGETATION IN SEMIARID ZONE OF TAMILNADU

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Abstract : *Solanum nigrum* (L.) is commonly called as Black Nightshade and it belongs to the family solanaceae. The sustainable cultivation techniques using bioinoculants not only improve the production but also maintain the soil fertility status and protect the agro ecosystem from degradation. Various types of beneficial microorganisms inhabited in the rhizosphere, which influence either directly or indirectly the growth and development of plants. Hence, Plant specific micro flora in the rhizosphere to be identify for the large scale application of bio inoculants for sustainable cultivation of *Solanum nigrum*. The present investigation focuses on the microbial interaction and rhizosphere ecology of existing wild plant of *Solanum nigrum* in semi-arid zone of Southern Tamil Nadu. The rhizosphere soil analysis showed the AM fungal spore (67/ 100 g soil) was recorded and *Glomus* as the dominant genus of AM fungi was found and 87% of AM fungal root colonization was also recorded in plants grown in sandy clay soil with a pH of 8.6. Among the fungi, the six dominant fungal species isolated and identified were *Aspergillus* sp., *Penicillium* sp., *Fusarium* sp., *Rhizopus*., *Tricoderma* sp., and *Curvularia* sp. *Solanum nigrum* are highly mycorrhizal dependent in this agro climatic region. Beneficial bacteria such as *Azospirillum*, *Pseudomonas* and *Azotobacter* were recorded. The above microorganisms may play a role in nutrient management and act as bio control for sustainable cultivation of *Solanum nigrum*.

Keywords: Bio-fertilizer, Rhizosphere flora and *Solanum nigrum*

INTRODUCTION

One of the important milestones of biological research in the last millennium is the understanding that soil microorganisms play a vital role in agriculture. The nature and activity of micro flora in rhizosphere influences the growth and yield of plants significantly. The complexity of soil system is determined by the numerous and diverse interactions among its physical, chemical, and biological components as modulated by the prevalent environmental conditions [3]. Various types of beneficial microorganisms inhabit the rhizosphere, which influence either directly, or indirectly the growth and development of plants. Many microbial interactions, which are regulated by specific molecules/ signals [10], are responsible for key environmental processes, such as the bio-geo chemical cycling of nutrients, matter, and maintenance of plant health and soil quality [2]. Carbon fluxes are crucial determinants of rhizosphere function [16]. Their role in agriculture is vital for nitrogen fixation, phosphate solubilization, and mobilization of nutrients. Such beneficial microbes are called bio fertilizers. Nitrogen is an important constituent of amino acids, protein and protoplast, directly influence the plant growth and development in terms of both morphological and biochemical characteristics. Since, nitrogen management is one of the major factors to attain higher productivity, particularly under limited water supply, where the use of higher dose of inorganic fertilizers is restricted, demands the integration of various sources of nitrogenous fertilizers in a more appropriate way because this not only reduces the use of inorganic fertilizers but also makes the environment eco-friendly. Knowledge on the role of microorganisms in plant life would serve as a guide for the judicial use to regulate fertilizers and manure application to the field crops. So that the yield can be maximized and cost of cultivation minimized.

The influence of the rhizosphere flora over plant growth, the present investigation was carried out to the assessment of microbial diversity and population in rhizosphere soil of *Solanum nigrum* in semi-arid region of Tamil Nadu.

MATERIAL AND METHOD

Rhizosphere soil samples were collected from *Solanum nigrum* in semi-arid zone (Sivagangai District) of Tamil Nadu. The soil pH was determined in soil water suspension (1:2.5) using a pH meter [5], nitrogen by kjeldahl method using Kjeltech autoanalyser 1030 [12] and phosphorus by calorimetrically employing vanado-molybdate method. Potassium was estimated by using flame photometer with determined with neutral normal ammonium acetate solution [15].

Dilution plating method was employed for the enumeration of microbial population of total bacteria [1] and total fungi [9] in the soil samples. Pikovskayas medium was used for *Azotobacter* and Kings B medium for *Pseudomonas*. AM Spore density was measured by a modified wet sieving and decanting method [4] and identified based on their spore morphology and hyphal attachment[14]. Mycorrhizal association with plant root was determined by Lacto phenol tryphan blue staining method [11] and the root colonization percentage was estimated [7].

RESULT AND DISCUSSION

The rhizosphere population of microorganisms is dynamic and governed by several factors [6]. Factors such as soil nutrient status and organic matter content often affect the rhizosphere population. The result revealed that pH of the soil is alkaline in nature (Table: 1). The present investigation of the analysis of rhizosphere soil samples showed that, the microbial population such as bacteria, fungi and AM fungal spore density.

The bacterial population was recorded in the rhizosphere of *solanum nigrum*. The beneficial bacteria such as *Azospirillum*, *Pseudomoans*, and *Azotobacter* were recorded as $5x10^8$; $6x10^8$ and $7x10^8$ g / of dry soil (Table:2). Rangaswamy & Sadasivm [13] reported the presence of *Azotobacter* Sp in some soil types of India, where as Lakshmi *et al.*, [14] reported the presence of *Azospirillum Spp.* in the roots of several Indian plants.

Fungal population was recorded in the rhizosphere soil of *solanum nigrum.* Among the fungal species, the six dominant fungal species isolated and identified were *Aspergillus sp*., *Penicilium* sp., *Fusarium* sp., *Rhizopus* sp., *Trichoderma sp* and *curvularia* sp.

Identification of AM fungal spores isolated from the rhizosphere soil of *solanum nigrum*. AM fungal spores (67/100g soil) were recorded and *Glomus* as the dominant genus of AM fungi was found and 87% of AM fungal root colonization was recorded (Table: 3).

The influence of plant growth promoting microorganisms can be studied by subjecting the plants to inoculation with the above microorganisms alone and in combination. Such pot culture and field studies may help us to understand the influence of the microorganisms play a major role in nutrient management and act as bio-control for sustainable cultivation of *Solanum nigrum.*

Table 1: Edaphic factors of Rhizosphere soil of *solanum nigrum*

S. No.	Characteristics	Rhizosphere soil
1	pH	8.6
2	Available Nitrogen (mg/100g soil)	84
3	Available Phosphorous(mg/100g soil)	11.3
4	Available Potassium(mg/100g soil)	190

Table 2 : Microbial populations in the rhizosphere soil of *Solanum nigrum*

S. No	Microorganisms	Population CFU / g soil
1	*Azospirillum*	$5x10^8$
2	*Azotobacter*	$7x10^8$
3	*Pseudomonas*	$6x10^8$
4	*Aspergillus* sp	$21x10^4$
5	*Trichoderma* sp	$15x10^4$
6	*Penicillium* sp	$20x10^4$
7	*Curvularia* sp	$8x10^8$
8	*Fusarium* sp	$12x10^8$
9	*Rhizopus* sp	$18x10^4$

Table 3 : AM Fungal spores & colonization percentage in the rhizosphere soil of *solanum nigrum*

S.No	AM Fungal spore	Colonization percentage
1.	*Glomus fasiculatum*	87
2.	*Acaulospora spinosa*	50
3.	*Scutellospor*a sp	20

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REFERENCES

Allen, O. N. (1957). Experiments in soil Bacteriology. Burgees Publishing Co., Minneapolis, Minn., U.S.A. 117 pp.

Barea, J.M., Aczon, R., Azcon-Aguilar C. (2004). Mycorrhizal fungi and plant growth promoting rhizobacteria. In: Varma A, Abbott L, Werner D, Hampp R, eds. Plant surface microbiology. Heidelberg, Germany: Springer-Verlag, 351-371.

Buscot, F. (2005). What are soils. In: Buscot F, Varma S, eds. *Microorganisms in soils: roies in genesis and functions.* Heidelberg, Germany: Spinger-Verlag, 3-18.

Gerdmann, J. M., Nicolson, T.H. (1963). Spores of mycorrhizal endosome species extracted from soil by Wet Sieving and Decanting, *Trans. Br. Mycol.Soc*., **46**:235-244.

Jackson, M. L. (1973). Soil Chemical Analysis. Prentice Hall of India (pvt) Ltd., New Delhi.

Katznelson, H. (1965). Nature and importance of the rhizosphere. In: Ecology of soil-borne plant pathogens (eds.) K.F.Baker and W. C. Snyder. Univ. Calif. Press, Berkeley. Pp. 187-209.

Krishna, K. R., Dart, P. J. (1984). Effect of mycorrhizal inoculation and soluble phosphorus fertilizer on growth and phosphorus uptake of pearl millet. *Pl. Soil.*, **81**: 247-256.

Lakshmi, V., Sathyanarayana Rao, A., Vijayalakshmi, K., Lakshmi-Kumari, M.,Tilak, K. V. B. R., Subba Rao, N. S. (1977). Establishment & Survival of *Azospirillum lipoferum*. *Proc. Indian Acad. Sci.,* **86**(6): 397-404.

Martin, J. P. (1950). Use of acid, rose bengal and streptomycin in the plate method for estimating soil fungi. *Soil Sci*., **69**: 215-233.

Pace, N.R. (1997). A molecular view of microbial diversity in the biosphere. *Science*.,**276**: 734-740.

Philips, J. F., Hayman, D. S. (1970). Improved procedure for clearing root Parasitic & staining VAM Fungi for rapid assessment of infection, *Trans. Br. Mycol. Soc.*, **55**:158-160.

Piper, C. S. (1966). Soil and Plant Analysis. Hans Publications, Bombay.

Rangaswamy, G., Sadasivam K. V. (1964). Studies on occurrence of *Azotobacter* in some soil types. *J. Indian Soc. Soil. Sci.,* **12**(1): 43-49.

Schenck, Perez Y. (1988). In: Manual for the identification of VAM Fungi. Second edition, Synergistic publications.

Stanford, S., English, L. (1949). Use of flame photometer in rapid soil tests of K and *Ca. Agron.*, **41**: 446-447.

Toal, M.E., Yeomans, C., Killham, K., Meharg, A.A. (2000). A review of rhizosphere carbon flow modeling. *Plant and Soil.,* **222**: 263-281.