# STUDIES ON THE VESICULAR ARBUSCULAR MYCORRHIZA OF PADDY IN MEGHALAYA

**Ajay Kumar Singh**

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DEPARTMENT OF BOTANY
SCHOOL OF LIFE SCIENCES
NORTH-EASTERN HILL UNIVERSITY
SHILLONG - 793014
INDIA

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Grams : NEHU

Phone : Off 23390

North - Eastern Hill University

PROFESSOR R. R. MISHRA
M. Sc., Ph. D., F. N. A. Sc., F. N. I. E.

DEPARTMENT OF BOTANY
SCHOOL OF LIFE SCIENCES
SHILLONG - 793014

I certify that the thesis entitled "Studies on the Vesicular- arbuscular mycorrhiza of paddy in Meghalaya", submitted by Ajay Kumar Singh, for the degree of Doctor of Philosophy, embodies the record of original investigation carried out by him under my supervision. He has been duly registered and the thesis presented is worthy of being considered for the award of the Ph.D. degree. This work has not been submitted for any degree of any other University.

R.R. Mishra
21.2.90

( R.R.MISHRA)
Signature of the Supervisor

Date :
Place : Shillong

Forwarded
Y. S. Chaturvedi
21.2.90
Head
Department of Botany
School of Life Sciences
N.E.H.U., Shillong-793014

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# INTRODUCTION

Paddy is the most important staple crop of Meghalaya. Due to high rainfall during kharif season, in addition to transplanted lowland paddy cultivation, the direct sown upland paddy cultivation is also widely practiced by the farmers.

The importance of vesicular-arbuscular (VA) mycorrhiza in agricultural crops is widely recognised (Mosse, 1973; Gerdemann, 1975; Mishra and Verma, 1982). Paddy has been reported to be infected by VA mycorrhizal fungi under field conditions (Iqbal et al., 1975; Manjunath et al., 1981b). Bhattarai (1983) observed high VA mycorrhizal infection in different paddy varieties under upland cultivation practice. Growth response of paddy plants to VA mycorrhizal infection was found by Iqbal et al., (1978a). Still, however, detailed study on the role of VA mycorrhiza in paddy is awaited.

Phosphorus is by far considered as the most important nutrient concerned in growth responses of plants to VA mycorrhiza (Mosse, 1973; Krishna and Bagyaraj, 1982). The improved phosphorus nutrition of VA mycorrhizal plants results from an increased efficiency in phosphorus uptake from the soil (Sanders and Tinker, 1971; Powell, 1975a; Gianinazzi Pearson et al., 1981). There is now substantial evidence (Rhodes and Gerdemann, 1975; Owusu Bennoah and Wild, 1979; Graham et al., 1982b) to show that increased phosphorus uptake is possible because of the capacity of the external

hyphae of VA mycorrhizal fungi to absorb phosphate from the soil and translocate it into the host root. This enables the plants to have a longer, better distributed surface for absorption. Besides P, the VA mycorrhizal fungi also enhance uptake of micro-elements (Rhodes and Gerdemann, 1978; Zaag et al., 1979; Bagyaraj and Manjunath, 1980; Jensen, 1982).

Different strains of VA mycorrhizal fungi vary in their efficiency for nutrient uptake (Jensen, 1982; Davis and Young, 1985). This difference is thought to be due to the difference in ability of extension of hyphal distances travelled from the root surface (Abbott and Robson, 1985b). The cultivars of the same species have also been reported to vary in their ability to form mycorrhiza (Azcon and Ocampo, 1981; Manjunath et al., 1981b; Gueye, 1983).

VA mycorrhizal infection and endogonaceous spore population were found to be reduced by addition of soluble phosphate (Abbott and Robson, 1977; Asimi et al., 1980; Jensen and Jakobsen, 1980). Menge et al., (1978) proved that concentration of phosphorus within the plant root and not the soil phosphate status was the regulatory factor in determining colonization, infection and spore production by VA mycorrhizal fungi. Addition of nitrogen fertilizer in soil was also reported to decrease spore production and VA mycorrhizal infection (Hayman, 1970; Chambers et al., 1980), though

application of increasing amounts of nitrogen in soil was also found to increase VA mycorrhizal infection (Hepper, 1983).

Moisture level of soil and frequency of irrigation affect VA mycorrhizal status in host root (Levy et al., 1983; Anderson et al., 1986). VA mycorrhizal fungi were reported to impart resistance to the host against drought stress (Levy and Krikun, 1980; Hardie and Leyton, 1981), though there are some reports which do not agree with this hypothesis (Hetrick et al., 1984). Most reports now accept that the growth response of plants to VA mycorrhiza under drought stress is due to improved P nutrition and more extensive soil water extraction (Allen, 1982; Busse and Ellis, 1985).

Rhizospheric micro-organisms were found to interact with VA mycorrhizal fungi. Bagyaraj and Menge (1978) observed an increased population of bacteria and actinomycetes in the rhizosphere of tomato inoculated with Glomus fasciculatum. A beneficial effect on plant growth was achieved by Manjunath et al., (1981a) when Glomus fasciculatum was inoculated in combination with Aspergillus niger. Verma (1982) also reported increased growth in Eupatorium adenophorum when Glomus tenue was inoculated in combination with Trichoderma viridae. T. viridae also increased mycorrhizal infection. As far as soil borne fungal pathogens are concerned, variable reports are available. Davis et al., (1978) observed more