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MYCORRHIZA IN JUTE PRODUCTION

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Abstract

Association of mycorrhiza with jute plants (*Corchorus* sp) is elucidated. A species of *Glomus* is considered forming mycorrhizal association with jute plants. The effect of mycorrhiza on the growth of jute plants and production of jute fibre is presented.

Introduction

Jute plants (*Corchorus* spp.) yield fibre of international importance and have multifarious uses. The cultivation of jute on commercial scale is restricted to a few countries in Asia on account of its requirement of special climatic conditions. The yield of fibre in countries growing jute plants is not the same quantitatively in different countries and is also not the same in a country of different edaphic conditions. The chemicals constituting a soil determine soil types and the fertility of a soil largely depends on microorganisms inhabiting the soil. Of the root-infecting fungi present in soil some form symbiotic association with plants known as mycorrhiza. Of these the vesicular-arbuscular mycorrhiza cause widespread root infection (Gerdemann, 1968). The works on mycorrhiza until 1968 were confined to the study of the occurrence of mycorrhiza in relation to various kinds of plants and in efforts made for culturing of these fungi. Subsequent reports dealing with the effects of mycorrhizal infection on plant growth increased the importance of the study of the subject. The beneficial interaction between vesicular-arbuscular fungi and their host plants with increased phosphate uptake in nutrient deficient soil is of great interest (Mosse & Hayman 1973; Gerdemann 1975; Mosse *et al.*, 1976).

Mycorrhizae occur in almost all tropical plants (Hayman, 1978) and have been shown to increase growth and phosphrous contents of plants in an Indian soil (Bagyaraj & Manjunath 1980). In recent years, there has been considerable interest on the interaction between the mycorrhizae and soil-borne plant pathogens attacking the roots of plants. The incidence of root disease was less in mycorrhizal plants and there was an improved nutrition of mycorrhizal plants in nutrient deficient soils (Schenk & Kellman, 1978; Shoenbeck & Dehne, 1981). This work deals with a survey of mycorrhizal association in jute plants in Sind and the effect of mycorrhizal association on the growth and yield of jute.

Materials and Methods

Jute, (*Corchorus capsularis*), was sown in 6 x 6 m plots in rows at the Karachi University Campus where soil was sandy loam, pH 7.5. Each plot was replicated three times with strips of 0.5 m fallow land in between. At intervals of 30 days, 50 g soil samples were collected from replicated plots. Soil was mixed in 200 ml of water in 500 ml beakers, placed on a magnetic strirrer for 5 min and then allowed to stand for 10 min for large soil particles to settle to the bottom. The supernatant was passed through a filter paper placed in a glass funnel. The mycorrhizal spores thus collected on the filter paper were counted under a stereoscopic microscope as described by Gerdemann & Nicolson (1963).

Plants at 4, 8, 12 and 16 months growth intervals alongwith roots and adhering soil from varying depths were recovered. Roots were gently washed under slow tap water, cut into 1 cm long segments, fixed in formalin acetic acid alcohol (FAA) cleared in 10% KOH and stained with 0.05% trypan blue as described by Phillips & Hayman (1970). The mycorrhizal formation was estimated by the percentage of the total root length colonized by vesicular – arbuscular mycorrhiza (Giovannetti & Mosse, 1980).

The effect of mycorrhizal inoculation on growth of jute was tested by inoculating mycorrhizal propagules collected from the rhizosphere region of 21 days old jute plants. Soils from the rhizosphere regions of the presown jute plots were suspended in distilled water and passed through 0.2 mm diameter sieve. Jute in a 6 x 6 m plot were inoculated with mycorrhizal propagules of *Glomus*, suspended in water (100 mycorrhizal propagules per 1000 ml of water) @ 1 litre of the suspension per square m of the plot. Plants not inoculated were left as control. In another experiment, 500 jute plant stems taken randomly from inoculated and uninoculated plots were decorticated by peeling in the form of green ribbons. The green ribbons were dried and weighed.

Results and Discussion

The soils of the plots of land planted with jute on sieving and examination of the sieved mass on filter papers showed the presence of chlamydospores (Fig. 1A) and zygospores (Fig. 1B) at regular intervals. The number of spores was highest after 4 weeks of planting (Table 1). Arbuscles (Fig. 1C) and vesicles (Fig. 1E) were present in the cortical regions of jute roots from seedling stage till harvest time. Mycorrhizal infection of jute roots varied at different stages of plant growth with maximum infection in 1-2 month old plants (Table 1). Infection of jute roots by the mycorrhizal hyphae penetrated the cortical cells and formed arbuscles inside the cells (Fig. 1D) and vesicles in the cortical region. (Fig. 1E).

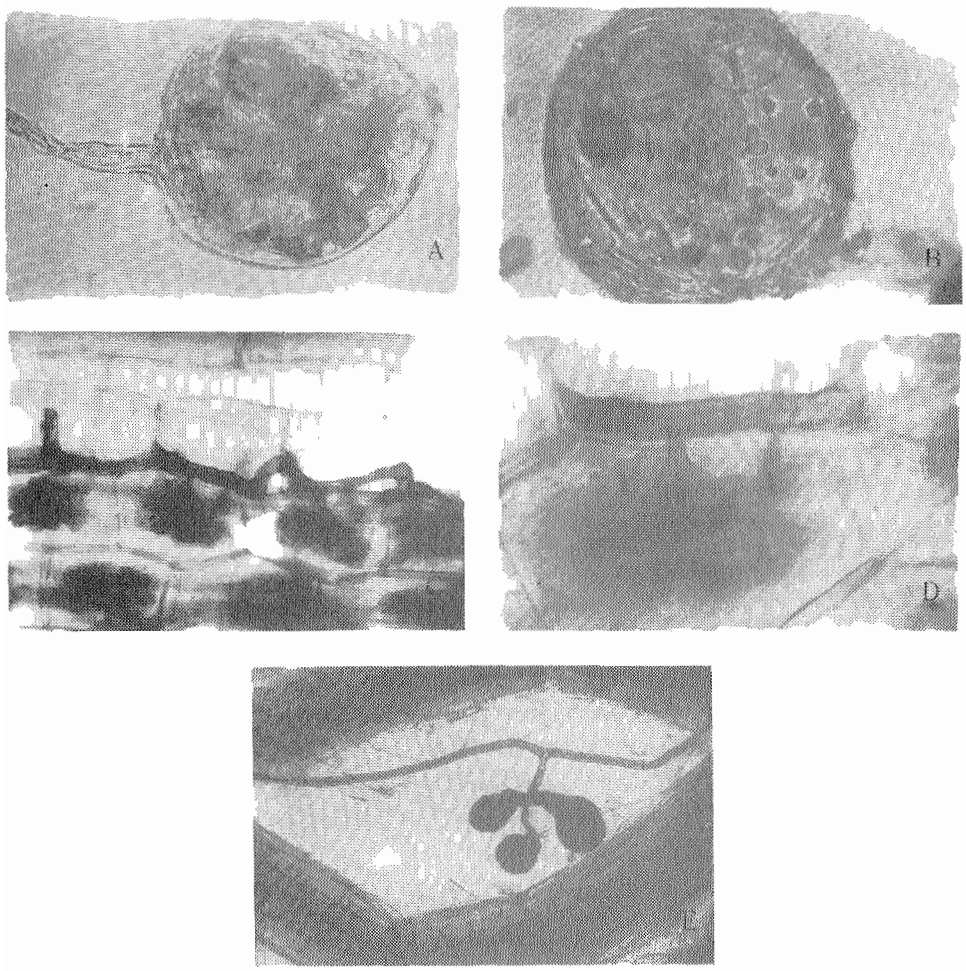

Fig. 1. A: A mycorrhizal spore x 400. B: A mycorrhizal zygospore x 400. C: Mycorrhizal aubuscles in cortical cells of root of a jute plant x 400. D: A mycorrhizal arbuscle in the cortical cell of root of a jute plant x 1000. E: Mycorrhizal vesicles in the cortical region of root segment of a jute plant x 100.

Inoculation with mycorrhizal propagules in the soil of jute plots after sowing jute seeds resulted in an increase in length of jute stem and weight of jute bark (Table 2) with a resultant increase in the production of jute fibre. Such increase in yield due to increase in phosphorus uptake has been reported by Mosse & Hayman (1973), Gerdemann (1975), Moose *et al.*, (1976) and Hayman (1978). Mycorrhizal association with jute and other crop plants has been reported by Ferraz (1979) in a survey work of Amazonian crops in which the spores of a mycorrhizal fungus, *Acaulospora*, was predominant.

Table 1. Mycorrhiza in soil of jute fields and in association with roots of jute plants.

Month	No. of mycorrhizal propagules in soil of jute fields	Per cent of jute roots infected with mycorrhiza
July	207	27
August	173	55
September	136	41
October	84	35
Average	150 per g	50.7

The vesicular-arbuscular mycorrhizal fungi present difficult taxonomic problems in identification owing to the fact that it cannot be cultivated in culture media. The morphology of the spores and sporocarps extracted from the soil, mycelial structure of the fungus on the root and the nature of vesicles and arbuscles formed inside jute root and the nature of vesicles and arbuscles formed inside jute root tissues by the endophyte were taken into consideration for the identification of mycorrhizal fungus. Following the key for the identification of vesicular-arbuscular mycorrhizae (Gerdemann & Trappe 1974; Harley & Smith, 1983) the mycorrhizal fungus has been identified as a species of *Glomus*.

The findings of this work would suggest that the inoculation of jute-field soil with mycorrhizal propagules holds promise of increasing jute fibre production especially in phosphorus deficient soils

Table 2. Effect of mycorrhizal inoculation on the length and weight of jute plants.

	Length of stems (m)		weight of dried bark of Jute plants (g)	
	Inoculated	Control	Inoculated	Control
Average	2.4	2.25	15	11.5

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