

Vesicular-arbuscular mycorrhiza in rape seed plant.

K.G. MUKERJI and BHUPINDER KOCHAR - Mycology Lab.,
Botany Department, University of Delhi, DELHI -110007, INDIA.

ABSTRACT

Rapeseed plants were grown and observed for vesicular-arbuscular mycorrhizal (VAM) infection. They showed extensive invasion into the root tissue by VAM mycelium both superficially as well as internally. The percentage of infection was observed to increase with the increase in age of the plant. The fungus causing infection was identified as Glomus fasciculatus.

INTRODUCTION

In nature, the roots of both cultivated and uncultivated plants are usually infected with mycorrhizal fungi. VAM is reported to be associated with the roots of most of the angiosperms except a few families including the Cruciferae (Gerdemann, 1968). However, some others have seen VAM in roots of the some of these families though lacking arbuscules (Kruckelmann, 1975; Williams et al 1974).

The present paper describes the development of true endomycorrhiza in rape plant, earlier believed to be a non-host plant for the endomycorrhizal infection. The mycorrhiza was formed by Glomus fasciculatus (Thax.) Gerdemann & Trappe.

These investigations are important as VAM association with rape root is necessary in relation to increasing its yield especially in soils of low fertility.

MATERIALS AND METHODS

Rapeseed plants (Brassica napus subsp. oleifera var. annua) were grown under natural conditions and their roots collected and observed for VA mycorrhizal infection at different time intervals. The roots were cleared and stained by a method of King et al (1981), modified from Phillips and Hayman (1970). Intact root segments were removed carefully from the soil, washed gently in water and kept in 10% KOH at root temperature for 48 hours. After the roots were cleared, the KOH was replaced by 0.1% trypan blue in lactophenol and left overnight. The stained root segments were mounted in lactophenol and examined under the microscope for VA mycorrhizal infection.

RESULTS AND DISCUSSION

Microscopic examinations revealed the presence of true vesicular-arbuscular mycorrhiza in the rape roots. Young roots showed extensive growth of superficial fungal mycelium (Fig. 1). The germinating spores were identified as those of Glomus fasciculatus. There were distinct thin-walled (3-5 μm) and thick-walled hyphae (6.5 - 8 μm), the latter invading the root tissue. This superficial mycelium showed ill-defined appressoria at some of its entry points into the root tissue (Fig. 2). The number of entry points/appressorium per mm root ranged from 2-4, being more at the junctions where lateral roots were initiated. The amount of mycelium around the roots varied with different samples. The hyphae on penetrating the external cell layers spread inter-and intracellularly in the cortex forming arbuscules and vesicles, thus causing the internal infection (Fig. 3). The apical meristems were free of hyphae.

The arbuscules appeared very soon during the infection process. These developed on the side branches of distributive hyphae (Fig. 9). Some of the cells were completely filled by the arbuscules.

The vesicles could be observed in various stages of their development in the cortical region (Fig. 4). They were always terminal on simple or funnel shaped subtending hyphae (Figs. 6 & 8). During the later stages of infection, some of the root samples showed the infection of the stelar system as well (Figs. 5 & 7).

The percentage of infection was seen to increase with the increase in age of the plant, becoming more or less constant after flowering of the plant. However, the amount of root infection varied with different samples.

Earlier investigators found poor VA mycorrhizal infection in rape seed plants. And this was observed only when these non-host plants were growing with mycorrhizal companion plants (Hirrel et al 1978; Ocampo et al 1980). The infection was restricted to only intercellular hyphae and vesicles. No arbuscules were observed.

In our observations, we have seen the formation of both the arbuscules and the vesicles by the VA mycorrhiza in rape roots and hence, the development of true VAM infection, in the absence of any mycorrhizal companion plant.

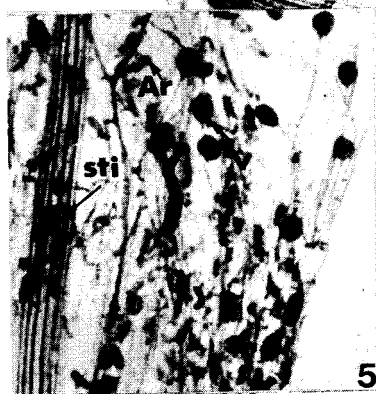
This is the first report of true VA mycorrhizal fungi in rape and this opens a new chapter on the prospects of improving growth and yield of rape on a large scale through inoculation with VAM.

The authors are thankful to Dr. Rani Gupta for her constant help.

REFERENCES

- GERDEMANN, J. W. (1968). Vesicular-arbuscular mycorrhiza and plant growth. *Annual Review of Phytopathology*, 6, 397-418.
- HIRREL, M. C., MEHRAVARAN, H. & GERDEMANN, J. W. (1978). Vesicular-arbuscular mycorrhizae in the Chenopodiaceae and Cruciferae: Do they occur? *Canadian Journal of Botany*, 56, 2813-2817.

- KING, E. J., SCHUBERT, T.S. & BROWN, M.F. (1981) (Abstr.)
Proceedings and Abstracts of fifth North American
Conference on Mycorrhizae, pp. 46. Quebec.
- KRUCKELMANN, H.W. (1975). Effects of fertilizers, soils,
soil-tillage, and plant species on the frequency of
Endogone chlamydospores and mycorrhizal infection in
arabic soils. In Endomycorrhizas (Ed. by F.E. Sanders,
Barbara Mosse & P.B. Tinker), pp. 511-525. Academic
Press, New York and London.
- OCAMPO, J.A., MARTIN, J. & HAYMAN, D.S. (1980).
Influence of plant interactions on vesicular-arbuscular
mycorrhizal infections. I. Host and non-host plants
grown together. *New Phytologist*, 84, 27-35.
- WILLIAMS, S.E., WOLLUM, A.G. & ALDON, E.F. (1974).
Growth of Atriplex canescens (Pursh) Nutt. improved by
formation of vesicular-arbuscular mycorrhizae, *Soil
Science Society of America Proceedings*, 38, 962-965.





Figs. 1-9. Rape roots infected with Glomus fasciculatus :
 Fig. 1. External hyphae (eh) attached to root x 65. Fig. 2. Thick walled external mycelium showing the entry points (ep) x 165. Fig. 3. Internal infection (Ii) of root tissue showing internal hyphae and the arbuscules (Ar) x 165. Fig. 4. Vesicles (V) in the root cortex x 100. Fig. 5. Cleared root showing stelar infection (Sti) x 100. Fig. 6. Vesicles associated with the root x 370. Fig. 7. Vesicles in the stelar system of the root x 370. Fig. 8. Vesicle showing funnel shaped subtending hypha x 370. Fig. 9. Isolated internal hypha with arbuscules (Ar) x 540.