CHAPTER VI

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The plants are of immense importance to the mankind. Human beings can not live if there are no plants. The dependence of man on plants has been of great importance since the human race began. Food, clothing and shelter are the three main necessities of life for man. To a great extent all these necessities are fulfilled by the plants. The plants are important to mankind in the following ways such as purification of air, useful effects of bacteria and fungi, fibers, foods, timbers, tanning materials, natural dyes, gums, fatty oils, medicines, beverages, rubber, sugar and miscellaneous product.

The living plant cells with their stocks of amino and fatty acids are equipped with the raw materials for building thousands of compounds that have medicinal properties, such as, glycosides, alkaloids, essential oils, proteins, tannins, flavonoids, carotenoids, vitamins and mineral elements. Plants thus act as nature's chemical industry for the production of vital medicinal compounds for commercial
The roots of nearly 80% of vascular plants are normally involved in symbiotic association with mycorrhiza, i.e. fungus-root association. There are two major mycorrhizal associations i.e. ectomycorrhizal and endomycorrhizal. Amongst the two main types of endomycorrhizae formed by septate and aseptate fungi, the one formed by aseptate fungi has been termed as "vesicular-arbuscular mycorrhiza." The vesicular-arbuscular mycorrhizal fungi has been placed in the class Zygomyctes order Glomales and Family Glomaceae. They produce two characteristic structures within the root viz., arbuscules and vesicules. Arbuscules are finely branched intracellular hyphae and are now known to be the major site for the nutrient exchange between the fungus and the host. Vesicles are globose to subglobose structure containing lipid globules and are understood to act as storage organs for food. The different genera forming VAM are Glomus, Acaulospora, Entrophospora, Gigaspora and Scutellospora, the latter two do not form intraradical vesicles.

VAM fungi have a broad ecological range and can be found in any ecosystem, but are more common in agricultural fields. They have also wide host range and thus form association with angiosperms, gymnosperms, pteridophytes, bryophytes and thallophytes.
They contribute to plant's functioning in natural environments, agriculture and reclamation. They help the host in increasing water and nutrient uptake, particularly of immobile ions, such as phosphates. They also increase tolerance to draught, high soil temperature, soil toxins and extreme pH, as well as protect against root and soil-borne pathogens.

In view of the importance of the economically plants the present study undertaken with the following objectives:

1. Collection of economically important plants for VA mycorrhizal infection from the agricultural fields and barren areas of District Azamgarh, Varanasi, Sonebhadra and Shankergarh (Allahabad).

2. Collection of rhizosphere soil samples for VAM spores from the same sites.

3. Taxonomical studies of the VAM spores.

4. Maintaining of VAM spores in pot culture conditions.

5. Effect of VAM inoculation on the growth and biomass of roots and shoots of certain economically important plants.

6. Evaluation of essential oils, alkaloids, protein and vitamin of certain VAM inoculated economically important plants.
Mycorrhizal Position of Economically Important Plants:

A survey was conducted for collecting economically important plants from Azamgarh, Varanasi, Sonebhadra and Shankergarh (Allahabad). In all 47 plants belonging to 25 families were collected. They were screened for mycorrhizal colonization.

It was observed that out of 47 medicinal plants, 45 plants were mycorrhizal and 2 plants were found to be non-mycorrhizal (Cassia obtusifolia L. and Launea asplenifolia (Roxb) Hook. f. of Caeasalpiniaceae and Asteraceae families respectively). The maximum infected families were Euphorbiaceae, Fabaceae and one member of Papilionaceae. In other families, such as, Malvaceae, Labiatae, Meliaceae, Poaceae, Solanaceae, Capparidaceae and Canabiacae the infection was high to medium.

In case of families Amaranthaceae and Chenopodiaceae the VAM association was found only in flowering stage of Amaranthus spinous L. and vegetative and fruiting stages of Chenopodium album L. although these families were earlier considered to be non-mycorrhizal. It was evident from the results that different plants of the same family varied in their mycorrhizal position.

In almost all the cases there was definite pattern of distribution of fungal mycelium within the root tissue, i.e. where the percentage of infection was high, the distribution of fungal mycelium,
was also dense and Vice Versa.

It is apparent from the present survey that the maximum occurrence of VAM fungi was located in the samples of Azamgarh, followed by Varanasi, Sonebhadra and Shankergarh (Allahabad) samples. The high percentage of infection of VAM fungi in samples of Azamgarh and low at Sonebhadra and Shankergarh may be attributed to different factors, such as, soil, environment and host. Besides, different sites of collection may also contribute to the magnitude of infection.

**Survey of Spore Population in Rhizosphere Soil:**

Rhizosphere soil samples were collected from the same sites from where plants were selected.

All the rhizosphere soil samples contained the mycorrhizal spores. Maximum spore population was recorded in families Euphorbiaceae, Fabaceae and Papilionaceae. However, the lowest spore population was recorded in families Cactaceae.

Out of the 4 locations the spore population was good, i.e., 80% of rhizosphere samples of Azamgarh, 47% in Varanasi, 12.5% in Sonebhadra and 8.3% in Shankergarh.
Taxonomy of VAM Fungi:

The spores extracted from rhizosphere soil by wet-sieving method were taken in the present study. Pure cultures were obtained by single spore culture method. The morphological characters of the spores were studied and identified with the help of relevant literature.

Thirteen species of different mycorrhizal spores were encountered from the rhizosphere soil. Out of which seven species belonged to genus *Glomus*, four to *Gigaspora* and two to *Scutellospora*.

The most frequent species was found to be *Glomus mosseae* (Nicol. & Gerd.) Gerdemann & Trappe followed by *Gigaspora ramisporophora* Spain, Sieverding & Schenck, *Glomus fasiculatum* (Thaxter) Gerd. & Trappe emend. Walker & Koske and *G. aggregatum* (Schenck & Smith) Koske. However, some of the species were only infrequently found, such as, *Glomus tortuosum* Schenck & Smith, *Gigaspora gigantea* Nicol. & Gerd., *G. pellucida* Nicol. & Schenck, *Scutellospora fulgida* Koske & Walker, and *S. nigra* Schenck & Smith. It was observed that some of the species were new reports of VAM fungi from economically important plants, such as *Glomus dimorphicum* Boyetechko & Tiwari, *G. microcarpum* Tul. & Tul., *G. tortuosum*, *Gigaspora albida* Schenck & Smith, *G. pellucids*, *G. ramisporophora* and *Scutellospora fulgida*. 
Effect of inoculation with Vesicular-arbuscular mycorrhizal fungi in certain economically important plants:

Six economically important plants were selected to observe the effect of VAM inoculation on growth, root-shoot biomass and medicinal compounds. They are economically important because of their medicinal values. The plants were *Allium sativum* L., *Corriandum sativum* L., *Occimum basilicum* L. (essential oil), *Phaseolus radiatus* L. (protein), *Sesamum indicum* L. (essential oil and vitamin) and *Trigonella foenum-graceum* L. (alkaloid).

For VAM inoculation only two VAM fungi, viz., *Glomus fasciculatum* and *G. mosseae* which showed high colonization potential were included in this study.

(a) Effect on growth and Root-Shoot biomass:

The VAM fungi caused an improvement in the length, fresh and dry weight of the roots and shoots of the experimental plants.

In the present study *G. mosseae* did succeed in improving the growth and root-shoot biomass markedly in some of the plants (*A. sativum, S. indicum* and *T. foenum-graceum*). The findings were almost similar when *G. mosseae* was inoculated along with *G. fasciulatum* for the above mentioned plants. However, mixed inocula gave good results in either growth or biomass of some other plants as
well (*C. sativum, P. radiatus* and *O. basilicum*).

(b) Effect on Medicinal Compounds:

The results for the medicinal value of different economically important plants as indicated in the present study, were quite different in single inoculum and mixed inocula. The single inoculum with *G. mosseae* could improve the medicinal values, i.e., essential oil, alkaloid, vitamin, and protein contents only slightly from the control but the mixed inocula of *G. mosseae* and *G. fasciulatum* gave good increase to essential oil (*A. sativum, O. basilicum and S. indicum*) and protein (*P. radiatus*) contents from that of the control. However, the results for alkaloid and vitamin contents were same i.e., slight increase, as with single inoculum.

Strikingly there was no change in essential oil content in case of *C. sativum* when VAM fungi were supplemented either singly or in mixed inoculum.

Improvement in the growth, biomass and the medicinal value is noteworthy. The benefits of these treatments can be applied for large scale trials under field conditions.