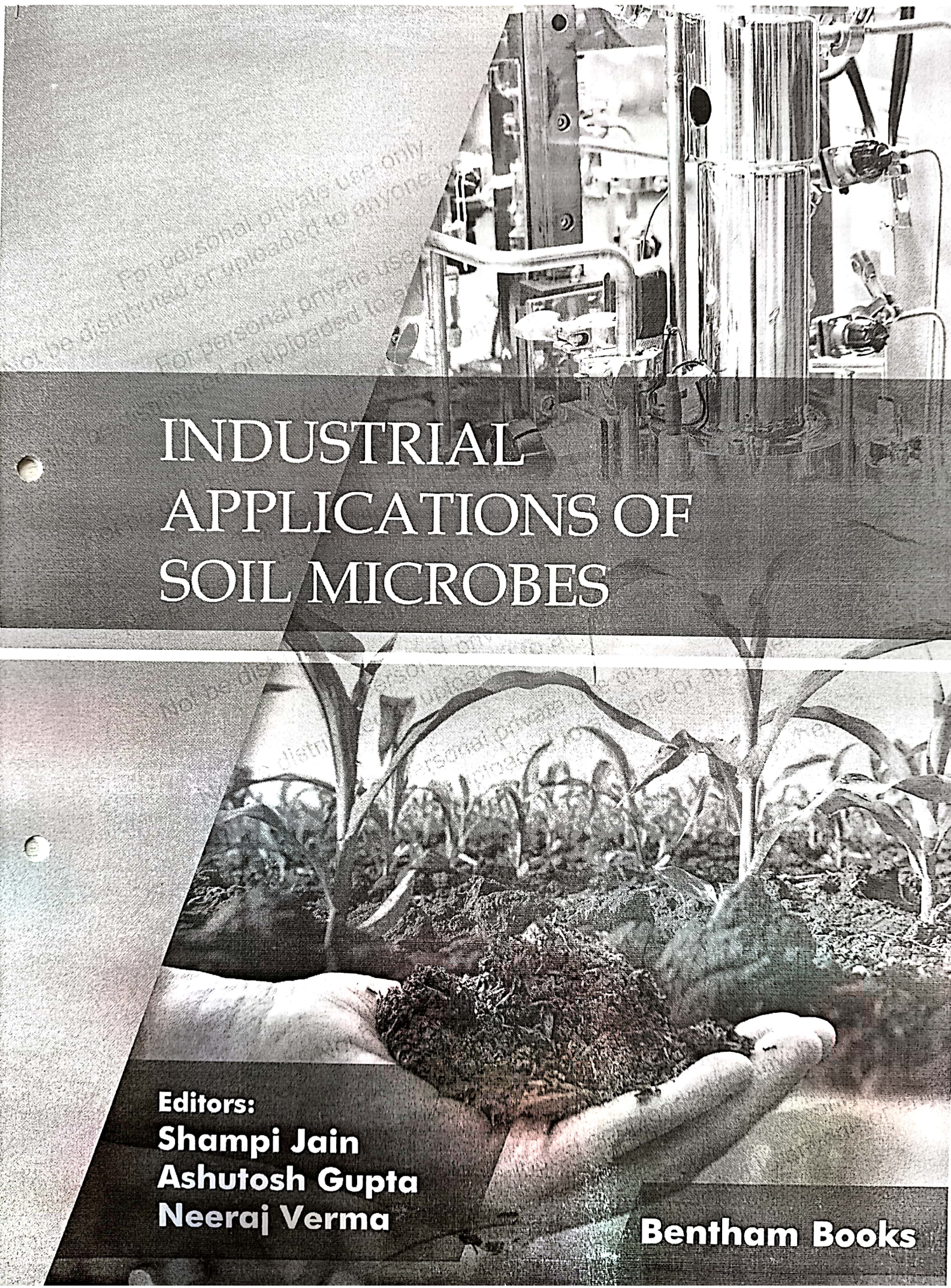

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CHAPTER 5

Agricultural Application of Mycorrhiza on Growth, Yield, and Quality of *Lycopersicon Esculentum* Mill-A Case Study

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Abstract: The present investigation deals with the effect of six different species of mycorrhizal inoculation on the germination and growth of *Lycopersicon esculentum* Mill (Tomato). This experiment was conducted to observe the efficient VAM inoculation that would be beneficial for plant growth. Tomato occupies a prominent position in vegetables and is a commercially exploited crop. The local variety of tomatoes (1057) was inoculated with six different AM fungal inoculums in the germinating media. The germination percentage and plant vigour were increased by different VA mycorrhizal fungi. The minimum number of days taken for germination was observed by *Glomus fasciculatum* (6 days) followed by *G. mosseae, G. monosporum, G. heterosporum, G. geosporum* and *G. multicaule* (7 days). The highest germination percent was recorded with *G. fasciculatum* (96%) followed by *G. geosporum* (94.12 per cent) when compared to the control. The highest shoot height, root length, fresh shoot weight and the highest fresh root weight were recorded with *Glomus fasciculatum* compared to the control and other VA fungal species. Hence, it is concluded that AM fungi help in better seed germination by mutualistic symbiosis.

Keywords: Germination, *Glomus* spp., Mycorrhiza, Mutualism, *Lycopersicon esculentum*.

INTRODUCTION

The present investigation deals with the effect of six various species of mycorrhizal inoculum on the germination and growth of *Lycopersicon esculentum* Mill. This study was conducted to observe the efficient mycorrhizal inoculation that would be beneficial for plant growth. *L. esculentum* occupies a prominent position in vegetables and is a commercially exploited crop. Mycorrhiza are symbiotic associations between plant roots and certain soil fungi that play a key

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soil of tomato using wet-sieving and decanting method [7].

Identification of the AM fungi was carried out using relevant literature [8, 9]. The inoculums were multiplied in a sterilized potting mixture using *Zea mays* as a host plant in the shade house in college. After the proper development of inoculums, 4 grams of inoculum treatment was given to all pots except the control.

RESULTS AND DISCUSSION

After a long experimental study, the finding of the present investigation brings out clearly indicated that *Lycopersicon esculentum* Mill responds well to mycorrhizal inoculation under pot culture. During the present finding seedling growth and vigor of tomatoes raised in pots were evaluated after inoculating nursery soil with six various cultures of mycorrhizal fungi. Six mycorrhizal fungi were tested for their ability to increase the growth, and biomass by the colonization of roots. Among the *Glomus fasciculatum*, *G. monosporum*, *G. mosseae*, *G. heterosporum*, *G. geosporum*, and *G. multicaule* mycorrhizal fungi. Among all, *G. fasciculatum* was the most effective in increasing the number of leaves, shoot and root growth, fresh weight, and % infection over control. The germination percentage and plant vigour were tested and it was increased by different VA mycorrhizal fungi. The minimum number of days taken for germination was observed by *G. fasciculatum* (6 days) followed by *G. mosseae*, *G. monosporum*, *G. heterosporum*, *G. multicaule* (7 days) and *G. geosporum* (8 days). The highest germination percent was recorded with *G. fasciculatum* (97%) followed by *G. geosporum* (94.12 per cent) when compared to the control. The highest number of leaves (15.28) compared with control (14.18), shoot height (22.38 cm), root length (13.78 cm), the highest fresh root weight (2 mg), and percent colonization (72%) were recorded with *G. fasciculatum* compared to the control *i.e.* fresh shoot weight (2.28 mg), shoot height (18.10 cm), root length (12.00 cm), fresh root weight (1.08 mg) and shoot weight (1.26 mg) and other VA fungal species. Hence mycorrhizal fungi help in better seed germination by mutualistic symbiosis.

Prasad and coworkers [10] observed the distribution of AM fungi in soybean. The treatment of GF showed a good effect on shoot and root lengths, compared to the control. This is because of the ability of mycorrhizal plants to utilize the available nutrients more efficiently than the non-mycorrhizal plants and mycorrhizal fungi are known to control the root topology in response to soil conditions [11].

A positive influence of VAM on vegetative and reproductive parameters of *Dolichos lablab* and positive response of VAM species on growth, yield and quality of two marigold varieties have been observed [12, 13]. Among the various 12 VAM culture *Gigaspora margarita* showed the most positive response in seed germination, highest shoot height, root length, highest number of roots, and

role in nutrient cycling in the ecosystem and also protect plants against environmental and cultural stress. Most of the major plant families are able to form mycorrhiza. The arbuscular mycorrhizal (AM) association is the commonest mycorrhizal type involved in agricultural systems.

Frank [1] described mycorrhiza as a mutualistic association of plant roots and fungi for which the term "Mycorrhiza" he has coined. The involvement in mineral uptake from the soil, they referred to as 'phosphorus gathering fungi'. Mycorrhizal fungi increase the surface absorbing area of roots, thereby greatly improving the ability of the plant to access various soil resources. Mycorrhizae are an essential part of a healthy soil microbiome and several miles of fungal filaments can be present in less than a thimbleful of soil is very significant.

L. esculentum Mill. is the edible, often red fruit/berry of a commonly known tomato plants all over the world. The species originated in the South American Andes. The tomato is useful in various ways, including raw, as an ingredient in many dishes, sauces, salads, drinks and vegetables. The fruit is rich in lycopene, which may have beneficial health effects. The tomato belongs to the family Solanaceae. The plants typically grow to 1–2.5 meters (3–9 ft) in height and have a weak stem that often sprawls over the ground and vines over other plants. It is a perennial in its native habitat, although often grown outdoors in temperate climates as annual.

Importance of the mycorrhizal fungi has received considerable attention in recent years owing to their beneficial response in improving crop productivity in agriculture and forestry. Mycorrhizal fungi increase nutrient uptake not only by increasing the surface absorbing area of the roots, but also release powerful organic compounds into the soil that help to solubilize hard-to- capture nutrients, such as organic nitrogen, phosphorus, iron and many other "tightly bound" soil nutrients. This extraction process is particularly important in plant nutrition and explains why non-mycorrhizal plants require high levels of fertilizers to maintain their health. Mycorrhizal fungi form an intricate web that captures and assimilates nutrients, conserving the nutrient capital in soils [2 - 6].

MATERIALS AND METHODS

The present investigation was carried out as a pot culture technique in Post Graduate Department of Botany, New Arts, Commerce and Science College, Parner, Maharashtra during the period 2012-20163. The local variety of tomato (1057) seeds used for the experiment was collected from the local market. The seeds were sown in plastic pots with six VAM species and a control. Cultures of six VAM fungi spores *i.e. Glomus fasciculatum*, *G. monosporum*, *G. mosseae*, *G. geosporum*, *G. heterosporum*, and *G. multicaule* were extracted from rhizospheric

highest fresh root weight, root – shoot ratio. Scientific studies clearly show that mycorrhizal populations are slow to recolonize naturally, therefore, reintroducing mycorrhizal fungi in agricultural areas where they have been lost can dramatically improve plant performance with less water and fertilizer and at a reduced cost. Effects of mycorrhizae and phosphorus on growth and nutrient uptake of millet, cowpea and sorghum on West African soil were observed in a study [14] and it correlates with this study Table **1**.

Table 1. Effect of mycorrhiza on *Lycopersicon esculentum* Mill.

Treatment	Days Taken for Germination	Germination %	% Root Infection	Shoot Length cm	Root Length cm	No. of Leaves	Fresh Shoot Weight mg	Fresh Root Weight mg
Control	7	88.2	22	18.10	12.00	14.18	1.26	1.08
G. fasciculatum	6	97	72	22.38	13.78	15.28	2.28	2.00
G. mosseae	7	94.12	62	21.4	13.00	14.12	1.98	1.60
G. monosporum	7	86.36	58	20.00	11.60	14.10	2.04	1.64
G. geosporum	8	82.88	64	20.88	11.82	14.38	2.10	1.74
G. multicaule	7	80.2	66	20.40	12.02	14.68	2.08	1.76
G. heterospora	7	81.32	66	19.88	17.92	14.54	2.10	1.64
S E ±0.1	-	0.28	0.78	1.88	1.24	1.02	0.22	0.16

CONCLUDING REMARKS

This scientific research study clearly indicates that mycorrhizal populations are slow to recolonize naturally, therefore, reintroducing mycorrhizal fungi in agricultural areas where they have been lost can dramatically improve plant performance with less water and fertilizers and at a reduced cost. Vesicular Arbuscular Mycorrhizal (VAM) is a fungus, which has the capability to dissolve the phosphates found in abundance in the soil. Apart from increasing the availability of phosphorus, VAM provides plants with the necessary strength to resist disease germs and unfavourable weather conditions. Moreover, VAM fungi play a major role in the soil aggregation process and stimulate microbial activity. They produce more vigorous and healthy plants.

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