J Indian bot Soc Vol 77 (1998) 201-203

COLONIZATION BY ARBUSCULAR MYCORRHIZAL AND MYCOPHYLLOUS FUNGI IN ROOTS AND SCALE LEAVES OF GARLIC

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(Accepted December, 1998)

Garlic is an important bulb crop widely used as spice/condiment. Its medicinal, insecticidal, fungicidal and bactericidal properties are well known. Arbuscular mycorrhizal fungi form obligate symbiotic association with plants and enhance plant growth and biomass. There ia no report on the natural colonization of roots and scale leaves of garlic by arbuscular mycorrhizal/mycopyllous fungi (AM/MF), hence reported. Roots and scale leaves were colonized by the extracellular, intracellular and intercellular hyphae, arbuscules and vesicles of AM/MF. Extraradical and intraradical spores were observed only in the roots.

Key Words: Arbuscular mycorrhiza, garlic, vesicles, roots, scale leaves.

Garlic (*Allium sativum* L.) is an important bulb crop widely used as a spice/condiment. Medicinally it is used as a gastric stimulant, for reducing cholestrol levels in the blood, in pulmonary tuberculosis, rheumatism, cough and red eyes etc. Apart from medicinal importance garlic has insecticidal, fungicidal and bactericidal properties also.

Arbuscular mycorrhizal fungi (AMF) are ubiquitous in soil deficient in phosphorous and form obligate symbiotic association with most of the plants. Their great potential to enhance plant growth and biomass is well known. Most of the studies are on the colonzation of roots by AMF. Natural colonization of ginger (Taber and Trappe, 1982; Mago *et al.*, 1993), turmeric (iqbal and Nasim, 1991; Sampath and Sullia, 1992), colocasia (Mago *et al* 1993; Bhat and Kaveriappa, 1997) and onion (Martub and Birchfield, 1972) has been reported earlier. Survey of literature revealed that there is no report on the natural colonization of roots and scale leaves of garlic by arbuscular mycorrhizal/mycopyllous fungi, hence reported.

MATERIALS AND METHODS

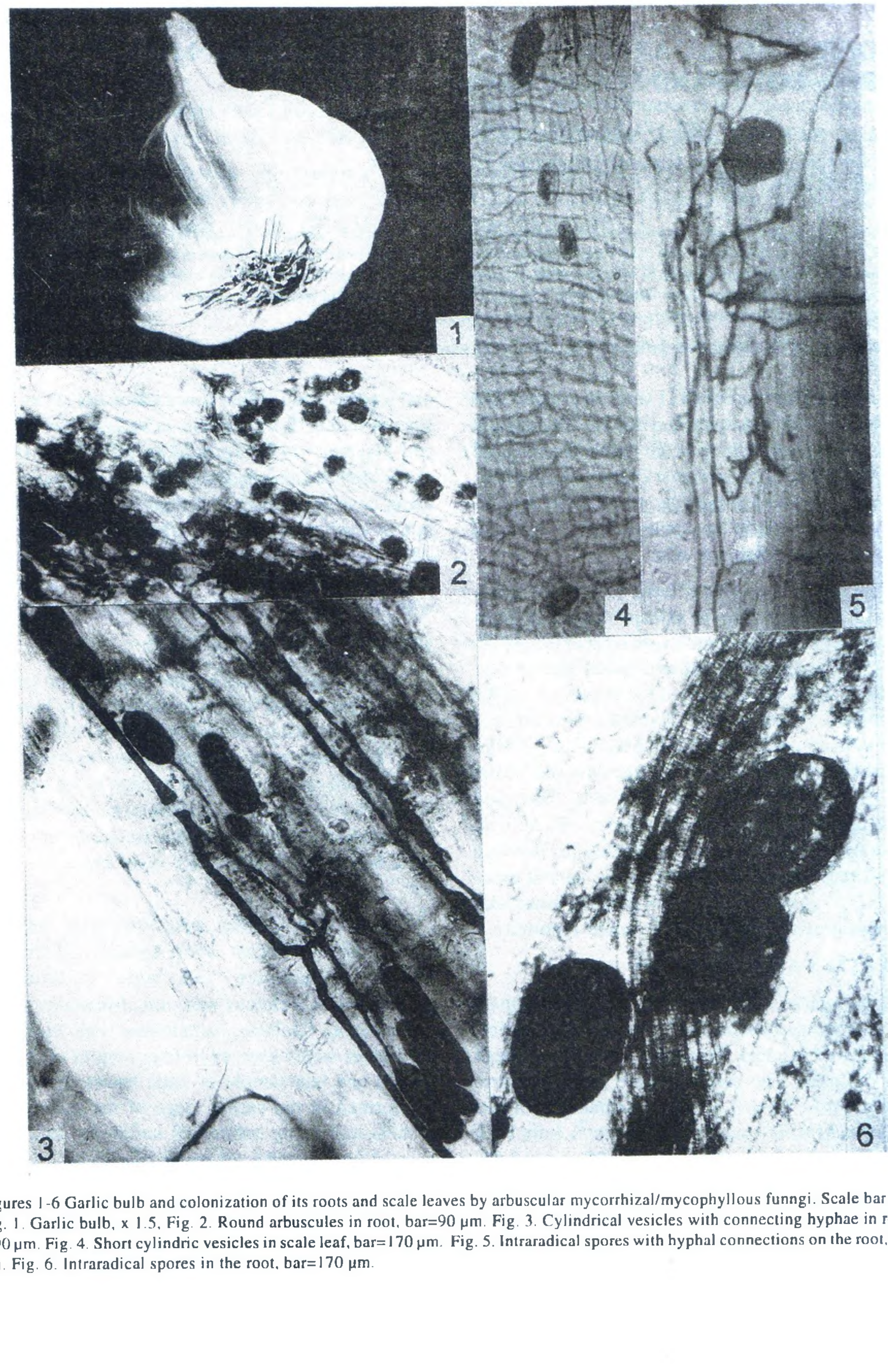
Mature garlic bulbs were collected from farmers fields, kitchen gardens and markets located at different places of Andhra Pradesh and Utter Pradesh States of India. The samples were fixed and preserved in FAA. Twenty five representative root bits (100mm) and scalee leaves bits ($10mm^2$) from each sample were cleared in 10% KOH for 20 min at 80°C washed with several changes of ater, kept in .5N HCL for five to ten minutes to neutralise the alkali and washed three to four times water and cleared bits stained in 0.05% trypan blue in lactophenol (Philips and Hayman, 1970) (procedure modified). Before observation the mounted root bits were gently squashed under coverslip. Absence and presencee of colonization by the hyphae, vesicles arbuscules and spores of AMF in each segment of root and scale leaf was expressed as percentage of colonization in according with slide method of Giovannetii and Mosse (1980).

RESULTS AND DISCUSSION

Colonization by the hyphae, arbuscules, vesicles and spores of AMF in the roots and scale leaves of garlic (Fig.1) are presented in Table-1. All the samples screened were colonized by extracellular, intracellular and intercellular hyphae to the extent of 76-100% root bits and 52-100% scale leaf samples. Coenocytic intercellular hyphae were common in the scale leaves and intermediate layer of the root cortex.

Intracellular hyphae were usually in the outer cortical layers of roots. Some hyphae had irregular knobby appearance and were occasionally pseudoseptate. Pelotons were not observed in any of the sample. Globose, subglobose and elongated arbuscules were observed in five samples of the root (Fig.2) and one sample of scale leaves. Arbuscules are formed in the earlier stage of the colonization process and being ephemeral structures their presence in the root and scale leaves of mature and stored bulbs of garlic is interesting. Mago *et al* (1993) surveyed only the scale leaves of ginger *(Zingiber*

Received February, 1998



Figures 1-6 Garlic bulb and colonization of its roots and scale leaves by arbuscular mycorrhizal/mycophyllous funngi. Scale bar ——— Fig. 1. Garlic bulb, x 1.5, Fig. 2. Round arbuscules in root, bar=90 µm. Fig. 3. Cylindrical vesicles with connecting hyphae in root, bar = 90 µm. Fig. 4. Short cylindric vesicles in scale leaf, bar=170 µm. Fig. 5. Intraradical spores with hyphal connections on the root, bar=90 µm. Fig. 6. Intraradical spores in the root, bar=170 µm.

Table 1. Colonization (%) by the arbuscular mycorrhizal fungi in the roots and arbuscular mycophyllous fungi in the scale leaves of garlic.

Sample	Tissue	Hyphae	Arbus-cules	Vesi-cles	Spores
GKV	Roots	80	12	72	-
	Scale leaves	76	-	56	-
GHB	Rootts	100	-	64	-
	Scale leaves	52	-	-	-
GGP	Roots	100	-	52	16
	Scale leaves	84	-	20	-
GBP	Roots	92	8	36	8
	Scale leaves	72	-	-	-
GDP	Roots	100	16	28	-
	Scale leaves	100	-	-	-
GJP	Roots	100	16	68	-
	Scale leaves	68	12	-	-
GBE	Rootts	100	16	64	-
	Scale leaves	76	-	-	-

officinale), arum *(Colocasia esculenta)* and zimikand *(Amorphophallus campanulatus)* but they did not observe arbuscules in the scale leaves though hyphae and vesicles were recorded from ginger and arum. Similar was the observation of Taber and Trappe (1982). According to Mago *et al* (1993) the complete absence of arbuscules in the scale leaves can raise certain doubts as to whether the infection observed in them was superficial, but the presence of intercellular hyphae and vesicles indicate a deep seated infection. This is the first report on the presence of arbuscules in the scales leaves.

Broadly cylindrical to oval vesicles with hyphal connection were recorded in all the samples of the root (Fig.3) and three samples of scale leaves (Fig-4). There was great variation in the size of the vesicles. The cylindrical vesicles ranged from 27.7-90.0 x 11.9-27.7 µm and oval ones from 155.70-179 x 96.90-107.2 µm. This indicates that size and shape of the vesicle may depend on the colonizing fungus. Colonization by the vesicles was to the extent of 28-72% of the root bits and 16-56% of the scale leaf bits.

Colonization by spores was very infrequent in roots and absent in scale leaves. Globose and short cylindric extraradical (Fig.5) and intraradical (Fig.6) spores were observed in only two of the root samples. The subtending hyphae were simple. Colonization by spores was 8 and 16% in root bits. Interaction of arbuscular mycorrhiza in garlic by artificial inoculation under glass house condition is reported earlier (Fogher *et al.*, 1986 and Firdaus *et al.*, 1988). Garlic plantlets were regenerated from callus by Fogher *et al.* (1986) and the effect of inoculated *Glomus mosseae* was observed on the rooting of the plantlets. Firdaus *et al.* (1988) studied the effect of AMF on IAA induced roots of garlic. This is the first report on the naturally occurring colonization of the root and scale leaves of garlic by arbuscular mycorrhizal/ mycophyllous fungi.

I.K.Kunwar is grateful o UGC for financial assistance.

REFERENCES

Bhat R P & K M Kaveriappa 1997 Occurrence of vesicular-arbuscular mycorrhizal fungi in the tubers of *Colocasia esculenta* (L.) Schott. *Mycorrhiza News* **9** 12-13.

Firdaus E B, S H Iqbal & A Zain-ul 1988 Effect of IAA treatment of roots of vesicular-arbuscular mycorrhizal infections at various developmental stages of *Allium sativum* L. *Biologia* (Pakistan) **34** 193-202.

Fogher C, L Maggioni & C Corti 1986 [Effect of inoculation with *Glomus mosseae* on rooting of plantlets of garlic (*Allium sativum* L) regenerated from callus] Effettti dell' inocula con *Glomus mosseae* sulla radicazione di piantie di aglio (*Allium sativum* L) rigenerate da callo. Annnnali della Facolta di Agraria Univ Caltolica del Sacro Cuore Milano **26** 9-14.

Giovannetii M & B Mosse 1980 An evaluation of techniques for measuring vesicular-arbuscular mycorrhizal infection in roots. *New Phytol* **64** 489-500.

Iqbal S M & G Nasim 1991 Are underground non-root portions of tropical plants vesicular-arbuscular mycorrhizal? *Trans mycol Soc Japan* **32** 467-476.

Mago P, P Pasricha & K G Mukerji 1993 Survey of vesicular-arbuscular mycorrhizal fungi in scale leaves of modified stems. *Phytomorphology* **43** 81-85.

Martin M J & W Birchfield 1972 *Endogone* sp. in roots of sweet potato and soyabean in Lousiana. *Pl Dis Reptr* **56** 58.

Philips J M & D S Hayman 1970 Improved procedure for clearing roots and staining parasitic and vesicular- arbuscular mycorrhizal fungi for rapid assessment of infection. *Trans Br mycol Soc* **55** 158-161.

Sampath P & S B Sullia 1992 The occurrence of VAM fungi in the scale leaves of turmeric. *Mycorrhiza News* **4** 5.

Taber R A & J M Trappe 1982 Vesicular arbuscular mycorrhiza in rhizomes scale-like leaves roots and xylem of ginger. *Mycologia* **74** 158-161.