Mycorrhizal fungi of *Artemisia japonica*

P.P. Rajeshkumar and V.B. Hosagoudar*

Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode- 695 562 Thiruvananthapuram, Kerala State, India.

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Abstract

Rhizosphere soil samples and terminal feeder roots of *Artemisia japonica* collected from the medicinal plants garden of Tropical Botanic Garden, Thiruvananthapuram, Kerala, India were mixed to form composite. Mycorrhizal colonization was estimated. Mycelium, vesicles, arbuscules of the mycorrhizal fungi was studied. Wet-sieving and decanting method used to isolate the arbuscular mycorrhizal spores. This study revealed the association of Acaulospora tuberculata, Glomus boreale, Glomus heterosporum, Glomus macrocarpum, Rhizophagus fasciculatus and Sclerocystis sinuosa.

Key words: Medicinal plant, Acaulospora, Glomus, Rhizophagus, Sclerocystis, Kerala

Introduction

The genus *Artemisia* L. belongs to the family Asteraceae (Compositae), represents about 400 species and of which 34 are in India (Santapau and Henry, 1984). Of these, *Artemisia japonica* Thumb. (A. parviflora Buch. Ham. ex D. Don), a shrubby perennial herb to India, Myanmar, Nepal, Bhutan, Japan, Pakistan, Afghanistan, occurs in Western Ghats (Maharashtra, Tamil Nadu, Karnataka and southern Kerala), is commonly known as Indian “warm wood, Fleabane, Davna Dauna, Nagdona, Nagadamani, Machipatri” (Nayar et al., 2006). This is a scented plant, occurs naturally in the high altitudinal grass lands, often along road sides in the Western Ghats (photo-a). The plant is scented, used in medicine and extracting essential oil, having anti-viral and anthelmentic properties. Such an interesting plant is being cultivated on the natural bed on the floor in the medicinal plants garden of Tropical Botanic Garden and Research Institute, Palode, became a subject for the study of its association with the mycorrhizal fungi.

Materials and Methods

Rhizosphere soil samples and terminal feeder roots of *A. japonica* were collected from the medicinal plant garden of Tropical Botanic Garden Thiruvananthapuram, Kerala, India. Four soil samples were collected from the corner regions of the nursery bed and mixed to form composite soil sample. The mycorrhizal colonization percentage in the root samples was estimated (Philips and Hayman, 1970). The roots were washed with running tap water, cut in to small pieces (1cm), cleared by boiling them in 10% KOH at 90°C for one hour, cooled to room temperature, washed thoroughly in distilled water, stained with lacto phenol-cotton-blue to study the presence of AM fungal structures. The collected air dried soil sample (100 gm) was directly used to estimate the AM fungal spores. Wet sieving and decanting method (Gerdemann and Nicolson, 1963) was followed to isolate the arbuscular mycorrhizal spores. The nature of vesicles, arbuscules and intercellular hyphae were studied. Fungal spores were identified on the basis of spore morphology (Schenk and Perez, 1990).

The percentage of mycorrhizal colonization was calculated as:

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\text{Percentage of root colonization} = \frac{\text{No. of mycorrhizal root segment}}{\text{Total No. of root segment}} \times 100
\]

*Corresponding author; Email address: vbhosagoudar@gmail.com.
Results

Root of *A. japonica* was colonized with mycorrhizal fungi. Thirty three percent of roots were colonized, the intraradical hyphae was ~9 µm broad, passed through inner and outer root of cortex and dichotomously branched at the entry point in to the root epidermis. Vesicles were present intercellularly or intracellularly with the diameter of 32 - 36 x 20 - 28 µm.

The spore numbers in the rhizosphere soil collected from the *A. japonica* was 260 spores/50 gm soils. The isolated species are *Acaulospora tuberculata*, *Glomus boreale*, *G. heterosporum*, *G. macrocarpum*, *Rhizophagus fasciculatus* and *Sclerocystis sinuosa*.

Description of the Species

*Acaulospora tuberculata* Janos & Trappe, Mycotaxon 15: 519, 1982. (Fig. 1C).

Azigosporos formed singly in soil, globose to subglobose, 260-265x 260-265 µm in diam., light yellowish brown to reddish brown; spore surface uniformly covered with tubercles. Spore wall three layered; outer layer yellow, up to 8 µm thick, tightly adherent to yellowish brown middle wall, up to 1µm thick and hyaline, inner wall thin, up to 1µm thick.

**Material Examined:** Isolated from rhizosphere soil of *Artemisia japonica* Thumb. Medicinal plants garden, JNTBGRI, Palode, January 1, 2011, P. P. Rajesh Kumar TBGT slide no. 999.

*Glomus boreale* (Thaxt.) Trappe & Gerd.in Gerd. & Trappe, Mycol. Mem.5: 58, 1974 (borealis).

Endogone borealis Thaxt., Proc. Amer. Acad. Arts & Sci. 57: 318, 1922 (Fig. 1b).

Spore mass irregular, up to 6mm in diameter. Gleba with loosely woven hyphae, up to 10µm broad, contains foreign matter and many abortive spores. Spores borne on slender hyphae and subtended by the septum, reddish brown, broadly and symmetrically elliptical, 92-95x80-72 µm in diam., wall reddish brown, up to 8 µm thick.

**Material Examined:** Isolated from rhizosphere soil of *Artemisia japonica* Thumb. Medicinal plants garden, JNTBGRI, January 1, 2011, P. P. Rajesh Kumar TBGT slide no. 1000.

*Glomus heterosporum* Smith & Schenck, Mycologia 77: 567, 1985. (Fig. 1e).

Chlamydospores formed singly. Spores hyaline to light brown, globose to subglobose, 80 - 140x80-140µm in diam. Spores with three hyaline walls. Inner wall membranous, up to 4 µm thick, middle wall up to 7 µm thick and an outer wall less than 1µm thick. Hypha at point of attachment up 12 µm wide.

**Material Examined:** Isolated from rhizosphere soil of *Artemisia japonica* Thumb., Medicinal plants garden, JNTBGRI, January 1, 2011, P. P. Rajesh Kumar TBGT slide no. 1001.


Endogone macrocarpa (Tul.& C. Tul.) Tul.& C. Tul., Fungi Hypog. P., 182, 1851. (Fig. 1d)

Chlamydospores spore formed singly in soil, subglobose to subglobose, 124 - 130x124 -130 µm. Wall composed of two distinct layers, outer layers is thin up to 2 µm; inner wall layer is yellow up to 6µm thick with a serious of laminations. Spores taper to the point of attachment of the single persistent hypha. Subtending hyphae at the point of attachment up to 9µm wide. The pore to be closed by a septum that is thinner than the normal occcluding the wall thickening.

**Material Examined:** Isolated from rhizosphere soil of *Artemisia japonica* Thumb. Medicinal plants garden, JNTBGRI, January 1, 2011, P. P. Rajesh Kumar TBGT slide no. 1002.

*Rhizophagus fasciculatus* (Thaxt.) C. Walker & A. Schüßler, Gloucester p 19, 2010


(Fig 1f)
Figure 1: Mycorrhizal fungi of Artemisia japonica

Chlamydospores formed singly in soil, Globose to subobovate, 35-120 x 35-120 µm in diam., smooth to apparently roughened from adherent debris; wall 3-14µm thick, hyaline, light yellow to yellowish brown, the thicker walls often minutely perforate with thickened inward projections. Hyphal attachments 4-10 µm diam., occluded at maturity. Wall of attached hypha often thickened to 1-4 µm near the spore.

Material examined: Isolated from rhizosphere soil of Artemisia japonica Thumb., Medicinal plants garden, JNTBGRI, January 1, 2011, P. P. Rajesh Kumar TBGT slide no. 1003


Sclerocystis pakistanica S.H. Iqbal & Perveen, Trans. Mycol. Soc. Japan 21(1): 59, 1980. (Fig.1g)

Hyphae hyaline to brown, up to 6 µm broad, sporocarps brown, globose, subglobose to pulvinate, often tuberculate, 248-412 µm in diam., form protruding spores. Peridia 6-17 µm, tightly enclosing sporocarps, composed of thick walled sinuous hyphae. Chlamydospores obovate, elliptic, fusiform to clavate, 45-118 × 30-83 µm, radiating out in a single layer from a central plexus of hyphae. Chlamydospores wall brown, 1-4 µm thick, generally thickest near spore base.

Discussion

Wang and Qiu (2006) reviewed the occurrence of AM fungi associated with the species of Artemisia, namely, A. californica (Yoshida, 2001), A. campestri, A. maritime, A. vulgaris (Harley, 1987a; 1987b; Kasowska, 2002), A. codonocephala (Li, 2004), A. dracunculus (Camprubiet al., 1990), A. ludoviciana (Wilson, 2001), A. princeps (Yamato, 2004), A. tridentate (Duke, 1994), A. tridentate ssp. wyomingensis (Stahl, 1998), A. tridentata ssp. tridentata, A. tridentata ssp. vaseyana (Trent et al., 1994), A. umbelliformis (Harney, 1997). However, the association of AM fungi to Artemisia japonica in the present study is reported here for the first time.

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References


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