RESEARCH ARTICLE

Comparitive study of *Arbuscular mycorrhizal* colonization between some Weeds and Ornamentals from Brahmala lake garden, Thane, MS, India

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ABSTRACT

Weeds are unavoidable in any cultivable patch and gardens are also not exceptional case. In absence of weeding as a horticultural practice, weeds can be a big problem which gets more troublesome in case of gardens, as weeds may superpose the beauty of that particular part of garden. Majority of weeds show presence of arbuscular mycorrhiza (AM) root colonization. This root colonization may be reached to 100 per cent in weeds like *Euphorbia hirta*. Similar way, many of the ornamentals used in gardens are also known to harbour AM. Thane city is one of the main hubs for Mumbai and Navi Mumbai which facilitates a good ambience for new comers in Mumbai. A number of lakes is one of the characters of Thane City (Maharashtra). Majority of them are in proper city and as a recreation, gardens are developed surrounding to these lakes. One of such garden is Brahmala Talao Udyan (Brahmala Lake Garden), which is under Thane Municipal Corporation. In present investigation, roots of some weeds like *Euphorbia hirta, Phyllanthus niruri, Physalis minima, Tridax procumbence, Heliotropium indicum* etc and of some ornamentals like *Pedilanthus sp, Rosa indica, Duranta racemosa, Cynadon dactylon, Acalypha indica* etc were screened for presence of AM fungi association. Care was taken that both the types of plants like weeds and ornamentals were collected on same day. Same time rhizospheric soil samples of respective plants were collected and analysed for physico-chemical properties like soil pH, organic matter, soil moisture etc. Same rhizospheric soil samples were screened for AMF spores (chlamydospores).

Key words – weeds, ornamentals, arbuscular mycorrhizal fungi colonization, rhizospheric soil, AMF spores

INTRODUCTION

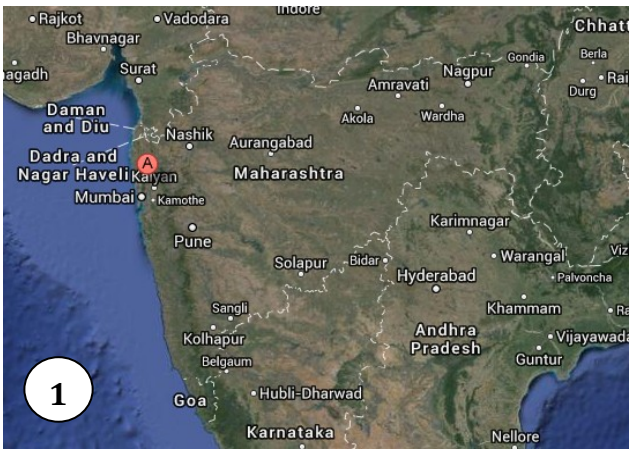
Thane is a city in Maharashtra, India, at the head of the Thane Creek. It is the administrative headquarters of Thane district. Thane covers an area of 147 km^2 and has a population of more than 1.8 million within its municipal limits, according to the 2011 census. Thane comes under Mumbai Metropolitan Region and also the proximity

with Mumbai has made it culturally a part of it. It is located to the northeast of Mumbai, partly on Salsette Island (it shares that island with the Mumbai City District, with Mumbai Suburban District and with Mira-Bhayandar Municipal Corporation), and partly on the mainland across Thane Creek. Spanning an area of about 147 km^2, the city is located at an elevation of 7 meters above sea level. It is surrounded by hills, including the hill of Yeoor and Parsik Hill.

Thane is also known as the City of Lakes. The city has around 35 lakes. The most beautiful of them is the Masunda Talao, also known as Talao Pali. Other lakes include Kachrali Lake, Pachpakhadi, Makhmali Lake, Ambe Ghonsali Lake, Siddheshwar Lake, Jail Lake, Upvan Lake, Bramhala-Kolbad Lake etc. Garden surrounding to Bramhala Kolbad lake was chosen for present investigation as it is one of the gardens which is most crowded.

Something about the Brahmala Lake Garden and its creation - Brahamala lake also known as Kolbad lake is situated in Uthalsar on Lal Bahadur Shastri Marg, Thane, Maharashtra (19°12'9"N 72°58'30"E). Thane Municipal Corporation (TMC) under its lake beautification programme to restore the glory of the 'City of Lakes', a group of Thaneites independently taken up the beautification of one of the lakes on priority basis in order to prevent encroachers from resurfacing on its periphery.

Exceptionally wide range of plants in different ecosystems shows association with AM fungi. The latter play a major role in better nutrition, species diversity and survival. Amongst the Angiosperms, about 90 per cent of the families develop AM association. The occurrence of AM fungi differs qualitatively and quantitatively with the change in edaphic factors and type of vegetation (Smith and Smith, 1996). Ecological factors which influence the colonization of AM fungi in the soil are soil pH, temperature, moisture, organic matter content in the soil and soil pollutants. Changes in the soil pH greatly affect the development and functioning of AM fungi. Different species of AM fungi show different responses to soil pH. Higher fungal spore density in acidic soil, while in alkaline soil the spore density is low has been reported (Dalal and Hippalgaonkar, 1995). Higher temperature results into high root colonization in temperate zone whereas it can be just a reverse in tropical region. AM fungi prefer optimum soil moisture for sporulation and growth. Because of it, during winter and summer spore density is low as compare to rainy season. Organic matter and soil fertility also play an important role in growth and sporulation of AM fungi. In low fertile soil, AM fungi spore density is higher to that of high fertile soil where it is quite low.



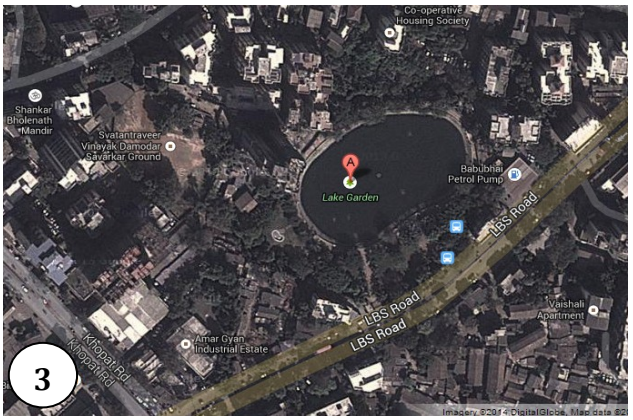


Plate 1, 2, 3: Showing location of Thane in Maharashtra, Thane City and Brahmala Lake Garden respectively (https://maps.google.co.in/maps?hl=en&tab=wl)

Changes in soil fertility due to amendments with mineral fertilizers or organic matter markedly affect the activity and survival of AM fungi. They can grow saprophytically around decaying root fragments and other organic matter (Hepper and Warner, 1983).

Many horticultural important ornamentals show presence of AM colonization. Kumar *et al* (2012) screened many numbers of ornamental flowering plants from Solan district, Himachal Pradesh and confirmed the biodiversity of AM association with different species. Klingeman *et al* (2002) from USA reported that the tree species of ornamentals also shows AM colonization. Similarly weeds show AM colonization is well accepted fact (Muthukumar and Prakash 2009, Sawarde *et al*, 2012, Kelkar *et al*, 2013). In present investigation, ornamental plants as well as weeds were collected over the period of 2008 - 2012 with roots and rhizospheric soil samples and were analysed for the presence of arbuscular mycorrhizal fungi association.

MATERIALS AND METHODS

During frequent visits to the area of collection, ornamental plants and weeds were collected and identified. The plants with root system along with rhizospheric soil were carefully collected in clean, unused plastic bags of suitable size. The rhizospheric soil samples were labelled showing the records like date of collection, time, location, name of the host plant etc and were brought in the laboratory. Then roots were carefully separated from entire plants, tapped gently to separate soil particles which were adhered to it (which were put in respective soil samples). The root samples were washed under tap water to clean and stored in 70 per cent of alcohol until further use. Soil samples were dried under sunlight and stored in labelled, sterilized plastic bags. Likewise the samples of weeds were collected from different locations of garden like lawns, on paths, sides of foot paths etc from the garden. Similar way different ornamentals were collected from their locations like lawn, edges, hedges etc.

The staining procedure to detect the presence of arbuscular mycorrhizal colonization from roots of collected plants if any was carried out by the standard procedure (Koske , 1989) Carol and Stribley (1991). The per cent root colonization was calculated by following formula (Nicolson, 1955).

$$\text{Per cent root colonization} = \frac{\text{No. of root pieces showing infection}}{\text{Total no. of root pieces observed}} \text{ X } 100$$

Isolation and quantification of AM spores (chlamydospores) from rhizospheric soils of ornamentals and weeds was carried out by wet sieving and decanting method (Gerdeman and Nicolson, 1963). Different spores were examined for their taxonomic status by using standard key (Schenk and Perez, 1989).

Rhizospheric soil samples were analyzed for its various physico – chemical properties like soil pH, organic matter content were estimated. Soil pH was determined by using pH meter model number EQ 614. Organic matter content was estimated by Blackman and Walky (1935) titration method. Soil moisture was determined by gravimetric technique (Schemugge *et al.*, 1980)

RESULTS AND DISCUSSION

During present investigation number of weeds as well as ornamentals were collected and identified. A list of both the types of plants is given in Table 1. Rhizospheric soil samples were examined for physico-chemical properties. (Table 2) All plants collected were screened for root colonization by AM fungi. Likewise samples were collected in the period of 2008 -2012.

Table 1: List of Ornamentals and weeds from Brahmala Lake Garden, Thane

ORNAMENTAL PLANTS		WEEDS	
Plant Name	Family	Plant Name	Family
Pedilanthus sp	Euphorbiaceae	*Euphorbia hirta*	Euphorbiaceae
Rosa indica	Rosaceae	*Phyllanthus niruri*	Euphorbiaceae
Duranta racemosa	Verbenaceae	*Physalis minima*	Solanaceae
Cynadon dactylon	Poaceae	*Tridax procumbence*	Ateraceae
Acalypha indica	Euphorbiaceae	*Heliotropium indicum*	Boraginaceae

Table 2: Physico-chemical properties of rhizospheric soil of ornamentals and weeds from Brahmala Lake Garden, Thane.

Parameters	Range
Soil pH	6.2 – 7.4
Soil Moisture	75 – 95 %
Soil organic matter	1.01 – 1.89 %

Table 3: Spore density and % root colonization for collected plants from Brahmala Lake Garden.

Plant Name	% Root Colonization	Spore Density
ORNAMENTALS		
Pedilanthus sp	32.6	86
Rosa indica	37.6	97
Duranta racemosa	29.8	75
Cynadon dactylon	62.8	77
Acalypha indica	19.8	99
Average	36.52 (35 %)	86.8 (49%)
WEEDS		
Euphorbia hirta	87.5	87
Phyllanthus niruri	88.9	82
Physalis minima	79.9	98
Tridax procumbence	89.9	108
Heliotropium indicum	0.0	76
Average	69.24 (65%)	90.2 (51%)

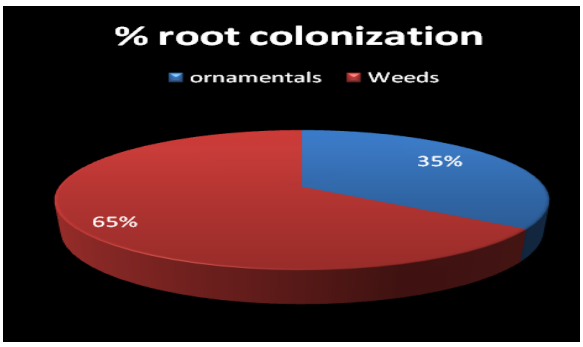


Figure 1: Comparison of % root colonization in Ornamentals and Weeds as a group.

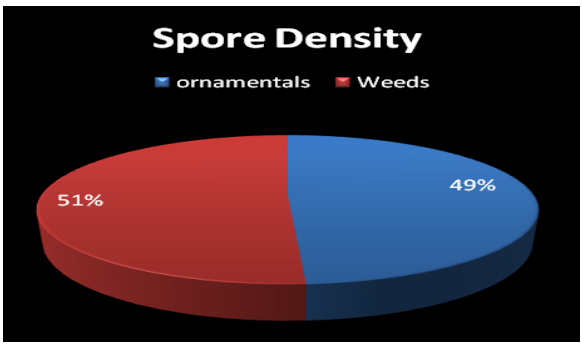


Figure 2: Comparison of Spore Density in Ornamentals and Weeds as a group.

Plate 4: Showing relative position of ornamentals (*Cynadon dactylon*) and weed (*Euphorbia hirta*) from Brahmala Lake Garden

Plate 5: Showing relative position of ornamentals (*Cynadon dactylon*) and weed (*Phyllanthus niruri*) from Brahmala Lake Garden.

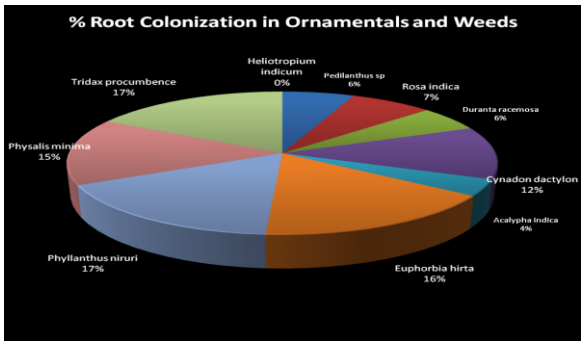


Figure 3: Comparison of % root colonization of all plants studied (ornamentals and weeds)

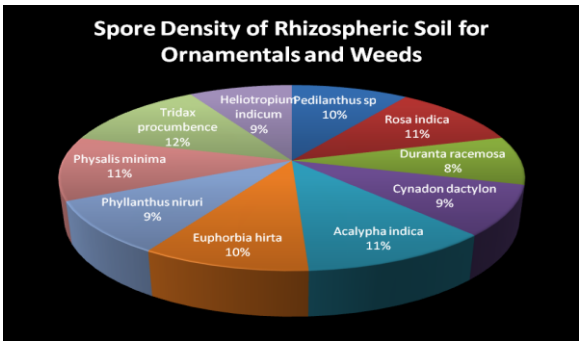


Figure 4: Comparison of spore density of rhizospheric soil for all plants studied (ornamentals and weeds)

Spore density (No. Of spore per 100 g of oven dry rhizospheric soil) and % root colonization for collected plants are shown in Table 3. All the four major genera, *Glomus, Gigaspora, Aculospora* and *Scutellospora* of AM fungi were observed in association with roots of ornamentals and weeds from collection areas. Out of which *Glomus mosseae* was the most frequently occurring AM fungal species. Along with it other species of *Glomus like G. faciculatum, G. multicaule, G. microcarpum, G. aggregatum* were also observed. Other AM fungal genera are *Gigaspora, Acaulospora mellea,* and *Scutellospora* which are recorded in descending order of its occurrence. Variation in spore density has been observed. Most important reason for it is variation in physical parameters of soil like soil moisture and organic matter. Most probable reason for the variation might be because of amendment of soil with fertilizers. As with many references it has been observed that when organic matter in rhizospheric soil is high, spore density is low.

One of other aspects of this investigation is variation in per cent root colonization in ornamentals and weeds. By considering the plants as individuals the per cent root colonization ranges from 0 to 89.9. But by considering these plants in two different groups as ornamentals and weeds this aspect gets a good turn. It has been observed that on average per cent root colonization in ornamentals is only up to 35 % whereas at the same time weeds are showing same results as 65%. On other hand spore density for individual plants range from 8 – 12 %, which is in turn as group become 49% for ornamentals and with 51% weeds. It indicates that number of spores in rhizospheric soil varies in a narrow range whereas per cent root colonization in weeds is on upper hand to that of ornamentals. This might be one of the important reasons of sustainability of weeds, which may contribute to the success rate of growth of weeds

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