Reprint **ISSN 1923-7766 (Web Version)**

International Journal of Experimental Agriculture

(Int. J. Expt. Agric.)

Volume: 7 **Issue: 3** **November 2017**

Int. J. Expt. Agric. 7(3): 9-13 (November 2017)

STUDY ON THE ASSOCIATION OF VAM FUNGI FROM RHIZOSPHERE SOIL OF DIFFERENT FRUIT PLANTS IN BANGLADESH

M. ARIFUNNAHAR, M.M. KARIM, M.N. ISLAM, R. MOMOTAZ AND R. ISLAM

An International Scientific Research Publisher

Green Global Foundation©

Web address: http://ggfjournals.com/e-journals archive
E-mails: editor@ggfjournals.com and editor.int.correspondence@ggfjournals.com

ISSN-1923-7766 (Online)
Int. J. Expt. Agric. 7(3):9-13(November 2017)

STUDY ON THE ASSOCIATION OF VAM FUNGI FROM RHIZOSPHERE SOIL OF DIFFERENT FRUIT PLANTS IN BANGLADESH

M. ARIFUNNAHAR[1*], M.M. KARIM[1], M.N. ISLAM[1], R. MOMOTAZ[1] AND R. ISLAM[2]

[1]Scientific Officer, [2]Senior Scientific Officer, Plant Pathology Division, BARI, Gazipur.

*Corresponding author & address: Most. Arifunnahar, E-mail: bonitaplpa@yahoo.com
Accepted for publication on 22 October 2017

ABSTRACT

Arifunnahar M, Karim MM, Islam MN, Momotaz R, Islam R (2017) Study on the association of VAM fungi from rhizosphere soil of different fruit plants in Bangladesh. *Int. J. Expt. Agric.* 7(3), 9-13.

Rhizosphere soil of several fruit plants from different regions of Bangladesh were collected for assessing Arbuscular Mycorrhizal (AM) spore population. Six areas of all over Bangladesh were surveyed and twenty three (23) of different fruit plants were collected for the present study. The AM spores were isolated by Wet Sieving and decanting method and 100 gm soil was used in each case. The spore numbers were varied from 831.25 (Sofeda) to 10831.25 (Litchi) at Gazipur, 1250 (Amra and Satkora) to 7287.5 (Litchi) at Rangpur, 831.25 (Kul) to 3956.25 (Litchu) at Tangail, 1037.5 (Applekul and Taikor) to 4581.25 (Batabilebu) at Jaintapur, Sylhet, 831.25 (Labu sample-4) to 3956 (Aam) at Srimangal and 0 (Kul) to 3125 (Litchu) at RARS, Ishurdi. A considerable variation was observed in different fruit plants at different locations in different times. Variation was also observed in same plant at different locations.

Key words: *VAM fungi, rhizosphere soil, fruit plant*

INTRODUCTION

"Mycorrhiza" the term used to describe the symbiotic association between a fungus and a root of higher plant (Frank 1985). It is known as a mutual sharing of life; whereby the fungus is the major partner of the plant that supply food, growth hormones and protection to plant roots from pathogens and the plant in return offers high energetic material to the fungus (Alizadeh 2011). The fungi form mutualistic association with majority of land plants and provide several advantages to host plants (Krishnakumar *et al*. 2013). Endomycorrhizal fungi, or vesicular- arbuscular mycorrhizae (VAM), are known to associate with a wide variety of plant species in a mutually beneficial manner. Both of the host plant and fungal member, benefited potentially from this association (Powell and Bagyaraj, 1984). There are almost seven types of Mycorrhizae (Reeves and Redente, 1991). They cannot be grown in laboratory conditions, but will grow with a wide variety of host plants. Near about 80% of all terrestrial plant species form endomcorrhiza i.e. Vesicular Arbuscular Mycorrhiza (VAM) or Arbuscular Mycorrhizal (AM) symbiosis (Smith and Read, 1997). Different AM fungi can simultaneously colonize a single root segment, and that the species are functionally diverse (Merryweather and Fitter, 1998). The fungi are obligate symbionts and non host specific (Bonfonte-Fasolo, 1987). Arbuscular mycorrhizal fungi that specifically colonize roots of a plant species are therefore likely to be of great relevance of function and their identification is important to understand the ecology of plant fungus interaction in natural ecosystems (Helgason *et al.* 2002). VAM fungi act as soil conditioner and play an important role in preventing rapid degradation of environment (Gosal *et al*. 2000). They have an important role in increasing plant uptake of P and other poorly mobile micronutrients particularly Zn and Cu (O'Keefe and Sylvia, 1991). It was also known that mycorrhizal plants are better able to withstand of drought than non-mycorrhizal plants. VAM fungi increase tolerance to heavy metals, salinity and drought (Henning 1993). Mycorrhizal plants are more resistant to survival and better performance after transplanting. Mycorrhizal plants are more resistant to soil borne pathogens, have altered production of plant hormones, and have more highly branched root systems than non-mycorrhizal plants. Out of the different types of mycorrhizae, the AM fungi are very important in relation to the improvement of agricultural and horticultural crops and forest trees in hilly areas (Mridha and Xu, 2001). They form three-way associations involving plants, fungi and soils. It seems that there is an important role of arbuscular mycorrhizal fungi in nutrient availability for different fruit plants. But few works has been done to assess the mycorrhizal association with different fruit plants. So the experiment was conducted to know the status of AM spores associated with different fruit crops at different location in Bangladesh.

MATERIALS AND METHODS

Selection of area

Six areas of all over Bangladesh were surveyed to collect the samples. The areas were

Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Gazipur; Regional Agricultural Research Station (RARS), Rangpur; Along, Tangail; Citrus Research Centre, Jaintapur, Sylhet; Farmers field, Srimangal and Regional Agricultural Research Station (RARS), Ishurdi, Pabna.

Selection of plant

Twenty three (23) different types of fruit plants were selected for the present study which was collected from different locations with different period of time. These were as follows-

Table 1. List of different fruit plants which had been collected from different locations of Bangladesh

Sl. No.	Local Name	English Name	Scientific Name	Family
01	Golapjam	Rose apple	*Syzygium jambos*	Myrtaceae
02	Payara/ Cheri Payara	Guava	*Psidium guajava*	Myrtaceae
03	Cherifal	Cherry	*Prunus avium*	Rosaseae
04	Litchi	Litchi	*Litchi chinensis*	Sapindaceae
05	Kul/Boroi	Ber	*Zizyphus jujuba*	Rhamnaceae
06	Lebu	Lemon	*Citrus limon*	Rutaceae
07	Payara	Guava	*Psidium guajava*	Myrtaceae
08	Kamranga	Carambola	*Averrhoa carambola*	Averrhoaceae
09	Bilimbi	Bilimbi	*Averrhoea bilimbi*	Averrhoeaceae
10	Sofeda	Sapota	*Manilkara achras*	Sapotaceae
11	Jamrul	Wax jambu	*Syzygium samarangense*	Myrtaceae
12	Atafol	Bullock's heart	*Annona reticulata*	Annonaceae
13	Amloki	Amla	*Phyllanthus emblica*	Euphorbiaceae
14	Amra	Hog plum	*Spondias mangifera*	Anacardiaceae
15	Aam	Mango	*Mangifera indica*	Anacardiaceae
16	Malta	Sweet orange	*Citrus sinensis*	Rutaceae
17	Tetul	Tamarind	*Tamarindus indica*	Trapaceae
18	Taikor	-	-	-
19	Batabilebu	Shaddock	*Citrus grandis*	Rutaceae
20	Satkara	Satkara	*Citrus macroptera*	Rutaceae
21	Kamala	Mandarin	*Citrus reticulata*	Rutaceae
22	Passion fruit	Passion fruit	*Passiflora edulis*	Passifloraceae
23	Jam	Jamun	*Syzygium cumini*	Myrtaceae

Collection of soil samples

100 gm of soil sample were collected from the vicinity of the root region of each of the plant species and collected in polythene bags, labeled then refrigerated at 4^0C for further use.

Collection of AMF spores from soil samples

Wet sieving and decanting method was followed for the isolation of spores for which 100 gm of soil was homogenized with 1-2 liters of water mixing in a bucket. The bucket was left for an hour and when the soil particles settled down the top water was sieved through a sieving set having pore size marked as BS-60, BS-80, BS-100, BS-150, BS-170 and BS-200 piled one above another. The size of the pores were fine enough to remove the larger particles of organic matter, but coarse enough to allow the desired spores to pass through. From each tier the spores was collected with a fine brush and suspended in sterile water on a petriplate, the heavier particles were allowed to settle for a few seconds and the excess water decanted through the sieve and spores were collected with fine brush. With the help of a microscope (4X) parasitized spores, plant debris etc. were separated.

Spore count

AMF spores were isolated from 100 gm of soil by wet sieving and decanting method (Gerdemann and Nicolson, 1963). The collected spores were spread on filter paper placed in a petriplate and counted under microscope and expressed under 100 gm of dry soil.

RESULTS AND DISCUSSION

RESULTS

Spore population of AM fungi

The rhizosphere soils of all these fruit plants were supported by a good number of VAMF spores. At HRC, Gazipur, the highest number of spores (10831.25 per 100 gm soil) was obtained from the rhizosphere soil of Litchi (10-15 years old) and the lowest number of spores (831.25 per 100 gm soil) was recorded from Cherry and Sofeda. Most of the fruit plants like Malta, Payara, Kamranga, Litchi (2-3 years old) and Jamrul, more than 4000 spores per 100 gm rhizosphere soli were recorded during March, 2011 (Table 2).

During March, 2011, the highest number of spores (7287.5 per 100 gm soil) was observed from the rhizosphere soil of Litchi and the lowest spores (1250 per 100 gm soil) from Amra and Satkara, but more than 5000 spores per 100 gm soil were recorded from Malta, Lebu, Sofeda Jamrul and Passion fruit at Rangpur (Table 3).

At Tangail, the highest number of spores (3956.25 per 100 gm soil) was recorded from the rhizosphere soil of Litchi which was followed by Jamrul and Aam and the lowest number of spores (831.25 per 100 gm soil) from Kul during April, 2011 (Table 4).

During May, 2011, the highest number of spores (5000 per 100 gm soil) was observed from the rhizosphere soil of Batabilabu (10-15 years old) and the lowest spores (1250 per 100 gm soil) were recorded from Applekul, Taikor, Satkora and Kamranga at Jaintapur, Sylhet. Most of plants like Aam, Litchi, Jamrul, Malta, Kamala and Payara were recorded more than 2000 spore per 100 gm soil (Table 5).

At Srimangal, the highest number of spores (2912.5 per 100 gm soil) was obtained from the rhizosphere soil of Aam and the lowest number of spore (1456.25 per 100 gm soil) was observed from Lebu-4 during May, 2011(Table 6).

At, RARS, Ishurdi, the highest spore population (3125 per 100 gm soil) was recorded in the rhizosphere soil of Litchi. No spore (0 per 100 gm soil) was found in Kul. More than 1000 spores per 100 gm of soil were obtained from Sofeda, Batabi lebu and Payara during May, 2011 (Table 7).

Table 2. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at HRC, Gazipur

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Golapjam	2500
02	Cheri Payara	1456.25
03	Cherry	831.25
04	Litchi (2-3years)	4581.25
05	Litchi (0-15 years)	10831.25
06	Boroi	1037.5
07	Lebu	2706.25
08	Payara	5831.25
09	Kamranga	4787.5
10	Bilimbi	2500
11	Sofeda	831.25
12	Jamrul	4162.5
13	Ataful	3750
14	Amloki	2287.5
15	Amra	2081.25
16	Aam	3856.25
17	Malta	6250
18	Tetul	1456.25

Table 3. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at ARS, Rangpur

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Naspati	5000
02	Aamra	1250
03	Taikor	2081.25
04	Batabilebu	416.5
05	Satkara	1250
06	Kamla	3537.5
07	Malta	5831.25
08	Lebu	5206.25
09	Safeda	5206.25
10	Payara	3750
11	Litchi	7287.5
12	Aam	4581.25
13	Passion fruit	5000
14	Jamrul	2500
15	Kul	2706.25

Table 4. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at Alenga, Tangail

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Litchi	3956.25
02	Kul	831.25
03	Aam	2287.5
04	Payara	2081.25
05	Safeda	1037.5
06	Jamrul	2500

Table 5. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at Citrus Research Centre, Jaintapur, Sylhet

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Payara	2287.5
02	Apple kul	1037.5
03	Taikor	1037.5
04	Jamrul	2912.5
05	Satkara	1456.25
06	Batabilabu	4581.25
07	Kamranga	1456.25
08	Kamla	2287.5
09	Malta	2331
10	Safeda	1875
11	Kamala	1875
12	Aam	3962
13	Litchu	3750

Table 6. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at Srimangal

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Lebu-1	2287.5
02	Lebu-2	1875
03	Lebu-3	1662.5
04	Aam	2912.5
05	Payara	1662.5
06	Lebu-4	1456.25

Table 7. Spore population of arbuscular mycorrhizae in rhizosphere soil of different fruit plants at RARS, Ishurdi

Sl. No.	Name of Fruit plants	No. of spore/100 gm soil
01	Jam	831.25
02	Safeda	1875
03	Aam	412.5
04	Litchi	3125
05	Aamra	625
06	Batabilebu	1875
07	Kul	0
08	Jamrul	625
09	Payara	1250

DISCUSSION

For more than one location the maximum numbers of spores per 100 gm of soil were recorded in Litchi (*Litchi chinensis*) which was followed by Malta (*Citrus sinensis*), Payara (*Psidium guajava*), Kamranga (*Averrhoa carambola*), Lebu (*Citrus limon*), Sofeda (*Manilkara indica*), Jamrul (*Syzygium samarangense*) and Passion fruit (*Passiflora edulis*) and the minimum spore population was recorded from Kul (*Zizyphus jujuba*), Cherry (*Prunus avium*), Taikor, Satkora (*Citrus macroptera*) and sometime there was no spore found in Kul (*Zizyphus jujube*) plant which was collected from Regional Agricultural Research Station (RARS), Ishurdi during May, 2011. The results are corroborative with the findings of Setua *et al*. (2001) who observed maximum number of AM spores in Mulberry during summer than winter. In case of time and location, the population of spores varied from plant to plant. There were wide variations in shape, size and color of spores. Different shape and size of

spores like round, oval and spherical were observed in different fruit plants. In case of color, like deep brown, light brown, radish and black spores were recorded in rhizosphere soil of fruit plants. The results of this study show that biodiversity of arbuscular mycorrhizal fungi differ in different plants. It has been observed that the host plants controls the diversity of arbuscular mycorrhizal populations through the difference in the effects on the hyphal growth and sporulation. The diversity of AMF found in this study can be further utilized to evaluate their activity in the enhancement of growth of the fruit plants. As a wide range of host, fungal and environmental factors are known to influence subsequent spore production.

CONCLUSION

It is concluded from this study that Spore density varied from plant to plant, plant species to species, season to season and also affected by host plant growth stages (vegetative-fruiting). Little work has been done regarding the distribution, diversity and association of Vesicular Arbusculr Mycorrhiza with fruit plants in Bangladesh. This association is important for exchanging some immobile nutrient with different fruit plants. It helps to increase plant growth and biomass and also reduce soil borne diseases. The association has positive effect with host plants by sharing the elements. So a vast research on this filed is necessary for a better tomorrow.

REFERENCES

Alizadeh O (2011) Mycorrhizal symbiosis. Adv. Stud. Biol., 3: 273-281.

Bonfonte-Fasolo P (1987) Vasicular arbuscular mycorrhizae fungus plant interaction at the cellular level. Symbiosis. 3(2), 249-254.

Frank AB (1985) "Uber die auf Wurzelsymbiose beruhende Ernahrung grewisser Baume durch unterirdische Pilze". Ber. Deutsch Bot. Gesells 3: 128-145.

Gerdemann JW, Nicolson TH (1963) Spores of mycorrhizal Endogone species extracted from soil by wet sieving and decanting. Trans. Br. Mycol. Soc., 46: 235-244.

Gosal SK, Gupta RR, Gosal SS (2000) Vesicular arbuscular mycorrhiza: In vitro multiplication and its application to micropropagated plants. In. Plant Biotechnology Recent advances in Biotechnology. Edited by P.C. Trivedi, (Panima Publishers), New Delhi: 435-450.

Helgason T, Merry weather JW, Denison J, Wilson P, Younf JPW, Fitter AH (2002) Selectivity and functional diversity on arbuscular mycorrhizas of co-occuring fungi and plants from a temperate deciduous woodland. *Journal of Ecology* 90: 371-384.

Henning K (1993) Response of roots to heavy metal toxicity. Eniv. Exploratory Bot., 33:99-119.

Krishnakumar S, Balakrishnan N, Muthukrishnan R, Kumar SR (2013) Myth and mystery of soil mycorrhiza: A review. *Afr. J. Agric. Res*., 8: 4706-4717.

Merryweather J, Fitter A (1998) The Arbuscular mycorrhizal fungi of Hyacinthoides nonscripta: I. Diversity of fungal taxa. *New Phytol* 138: 117-129.

Mridha MAU, Xu HL (2001) Nature Farming with Vesicular arbuscular mycorrhizae in Bangladesh. *Bangladesh. J. Crop Prod*. 3: 303-312.

O'Keefe DM, Sylvia DM (1991) Mechanisms of the vesicular arbuscular mycorrhizal plant growth response. In: Handbook of Applied Mycology. D.K. Arora (ed.). Marcel Dekker, New Phytol. 77: 641-653.

Powell CL, Bagyaraj DJ (1984) VA- Mycorrhiza. CRC press. Boca Raton. Florida.234pp

Reeves FB, Redente EF (1991) The importance of mutualism in succession Pp. 423. 441. In: Semiarid lands and deserts. E.d., Skujins, *J., Dekker Marcel, Inc*., New York.

Setua GC, Ghosh JK, Das NK, Saratchandra B (2001) Response of direct inoculation of VAM on growth, leaf yield and phosphorus uptake in Mulberry (*Morus alba*). *Indiand J. Agric. Sci.* 69: 444-448.

Smith SE, Read DJ (1997) Mycorrhizal Symbiosis. Academic Press, San Diego, USA.