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Arbuscular Mycorrhizal Fungal association with *Dicoma tomentosa* Cass. from Mahabubnagar District of Telangana state, India

Hari Prasad Kante*[1], Hindumathi Amballa[2], Bhadraiah Bheemanathni[2]
[1] Assistant Professor, Department of Botany, Government Degree College, Wanaparthy, Telangana, India
[2]Applied Mycology and Molecular Plant Pathology Lab, Department of Botany Osmania University, Hyderabad, India

ABSTRACT

The arbuscular mycorrhizal (AM) fungal association in the rhizosphere of *Dicoma tomentosa* Cass. species from 10 Mandals of Mahabubnagar District, Telangana state, India, were studied. The results showed 20 species of 5 genera of AM fungi were identified, of which 6 belonged to *Acaulospora*, 5 to *Glomus*, 5 to *Scutellospora*, 3 to *Gigaspora* and 1 to *Archaeospora*. *Acaulospora* was the dominant genera and *Acaulospora bireticulata, Acaulospora scrobiculata, Gigaspora rosea, Glomus aggregatum* and *Glomus multicaule* were the prevalent species. The highest root colonization 100% was recorded in Gopalpet sample. while The lowest root colonization 80 % was recorded in Pebbair sample. The AM fungi spore density ranged from 117 to 232 per 100gm soil (average 169.2), while the root colonization ranged from 80% to 100% (average 92.66). This study provides a valuable information for AM fungal association and AM fungal biotechnology on medicinal standardization planting.

Keywords: *Dicoma tomentosa*, Arbuscular Mycorrhizal fungi, AM fungal spores, Root colonization.

I. INTRODUCTION

Arbuscular Mycorrhizal fungi play a significant role in the Plant growth and metabolism. AM fungi have been associated with medicinal plants (Tejavathi and Jayashree, 2013; Tulshi Thapa et al, 2015). The study of rhizosphere microbes especially AM fungi from the important medicinal plants is very crucial, as they are well known to have impact on plant growth and also produce industrially important secondary metabolites and improve quality of medicinal product (Bafana and Lohiya, 2013). Originally medicinal plants in India were reported to be non-mycorrhizal due to the presence of various secondary metabolites. However, AM fungal colonization of medicinal plant roots are now reported (Mohan et al, 2005). The plant *Dicoma tomentosa* had a great medicinal importance in India. The whole plant is strongly bitter and is used as a febrifuge, particularly for children and for women after childbirth. The plant is applied as a dressing to septic wounds, and is used in a fumigation to relieve skin-itch. A roll of bruised leaves are inserted into the nostrils and left there for about an hour as a treatment for colds in the head. The leaves and fruit are burnt in a hole over which the patient squats when treating pain in the testicles (Burkill, 1985). The plant shows Anti-plasmodial activity, having urospermal A-15-O-

acetate as the main active compound (Olivia Jensen et al 2012).

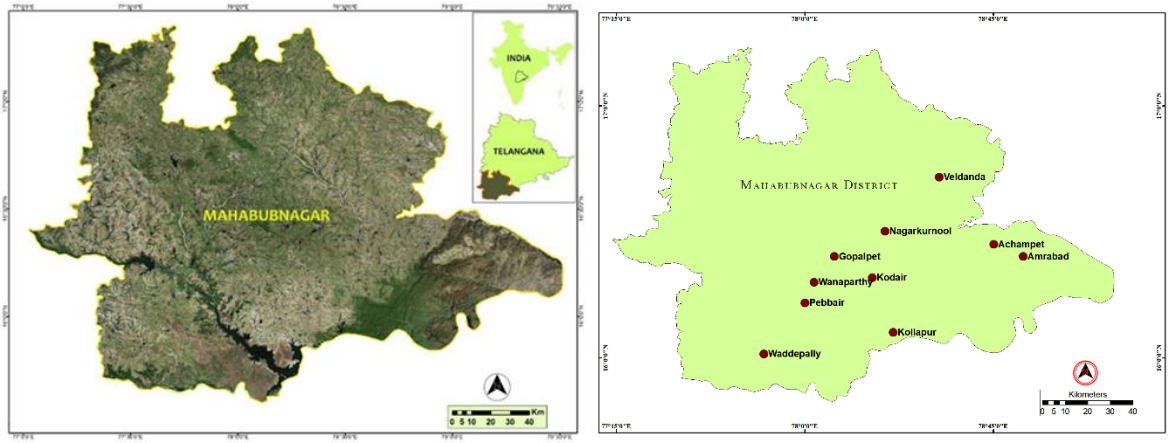
Cultivation of medicinal plants has a significant to study the commercial importance and their growth condition is gaining a lot of importance. In the present study *Dicoma tomentosa* medicinal plant and association of AM fungi harboring in their rhizospheres were collected in 10 Mandals of Mahabubnagar District.

Materials and methods:

Geographical details of the Study area:

The Mahabubnagar district is located between 15° 55′ and 17° 29′ N latitudes and between 77° 15′ and 79° 15′ E longitudes in Telangana state, India. To evaluate the diversity of AM fungi in rhizosphere soils and its association with roots of *Dicoma tomentosa*, the root samples and rhizosphere soils were collected from 10 different mandals (Achampet, Amrabad, Gopalpet, Kodair, Kollapur, Nagarkurnool, Pebbair, Veldanda, Waddepally and Wanaparthy). The soil type of this area is sandy loam soils and clay loam soils.

Map 1 & 2: Location of study sites



Collection of root and soil samples:

The mixtures of roots and rhizosphere soils of *Dicoma tomentosa* were collected from a depth of ca.5-10cm. Three healthy plants were selected from each field, root and soil samples were collected and subsequently placed in plastic bags and transferred to the laboratory. In the laboratory, the rhizosphere soil was air dried and stored in a refrigerator at 4^{o}C until processing. The root samples were washed with distilled water to removed attached soil particles, cut into 1 cm segments and fixed in FAA solution (formalin, acetic acid and alcohol).

Isolation, identification and quantification of AM Fungi spore:

Spores and sporocarps of AM fungi were isolated by using the wet sieving and decanting method described by Gerdemann and Nicolson (1963). AMF spore identification and their morphological characters were determined and analyzed qualitatively by using manual of Schenck and Perez (1990) and the website of the

International collection of vesicular and AM fungi (http://invam.wvu.edu/;http://www.zor .zut.edu.pl/ Glomeromycota/index.html). AM Fungi spore density was estimated as the mean number of spore per 100 gm soil (Stahl and Christensen, 1982).

Quantification of AM fungi root colonization:

The root samples were gently washed with distilled water to remove attached soil particles and free of FAA. The root samples cut into approximately 1 cm long segments, cleared by boiling in 10% KOH and the boiling time varied depending on the colour and thickness of the roots (Koske and Gemma, 1989). Cleared root segments were acidified with 5 N HCl and stained with 0.05% trypan blue in lactophenol (Phillips and Haymann, 1970). AM fungal colonization was quantified by the glass side method, in which 50 randomly selected 1 cm long root segments were examined microscopically (Giovannetti and Mosse, 1980).

Result and Discussion:

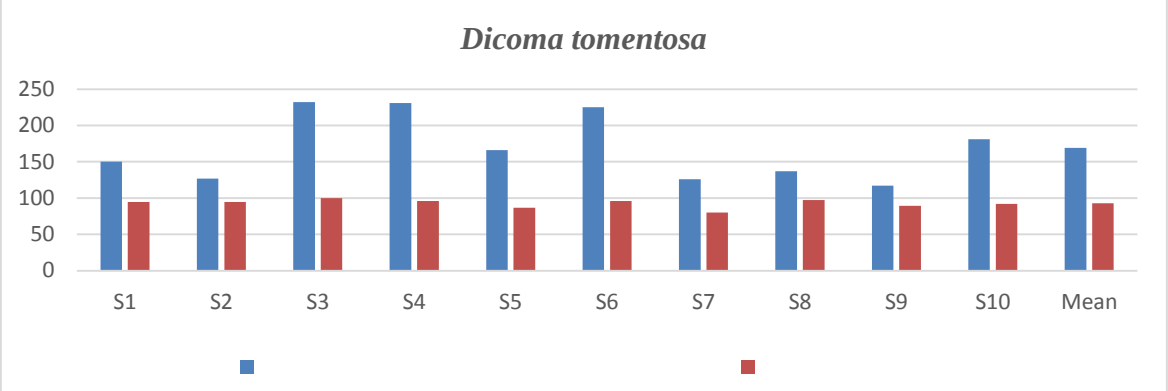
In the present study reveals that, *Dicoma tomentosa* associated with 20 AM fungal species belonging to 5 genera viz., *Acaulospora, Archaeospora, Gigaspora, Glomus* and *Scutellospora*. Of which 6 belonged to *Acaulospora,* 5 to *Glomus*, 5 to *Scutellospora*, 3 to *Gigaspora* and 1 to *Archaeospora*. The highest AM fungal spore count per 100gm of rhizosphere soil was recorded (Table 1) in Gopalpet with 232 AM fungal spores with 100 % root colonization followed by Kodair with 231 AM fungal spores with 96 % root colonization and Nagarkurnool with 225 AM fungal spores with 96 %root colonization. The lowest AM fungal spore count per 100gm of rhizosphere soil was recorded in Veldanda with 117 AM fungal spores with 89.33 % root colonization. The lowest root colonization 80 % was recorded in Pebbair. The average AM fungal spore count was recorded as 169.20 and percentage of root colonization was recorded as 92.66%. *Acaulospora* was the dominant genera and *Acaulospora bireticulata, Acaulospora scrobiculata, Gigaspora rosea, Glomus aggregatum* and *Glomus multicaule* were the prevalent species (Table 2).

The AM spore number of *Dicoma tomentosa* was higher in Gopalpet, Kodair and Nagarkurnool samples compared to that of Waddepally sample which might be due to the presence of sandy loam soil in Gopalpet, Kodair and Nagarkurnool and clay loam soil in the Waddepally. Rachel et al (1993) reported more AM fungal infection in sandy loam soil followed by other soil types.

The AM fungal association with *Dicoma tomentosa* in 10 Mandals of Mahabubnagar District investigated in the present study. From the research, we could conclude that the biodiversity of AM fungi was abundant, though *Acaulospora* was the dominant genus. The AM fungal spore density and root colonization varied markedly among 10 Mandals. Considering the potential application of AM fungi on *Dicoma tomentosa*, it seems that more attention should be paid to the predominant AM fungi during the process of their cultivation, especially mycorrhizal performance i.e., improving growth, increasing secondary metabolite production.

Table 1: AM fungal spore count and root colonization percentages in *Dicoma tomentosa* from 10 mandals of Mahabubnagar District.

Sample No.	Name of the sample	No. of AMF spores / per 100gm soil	Percentage of Root colonization
1	Achampet	150	94.67
2	Amrabad	127	94.67
3	Gopalpet	232	100
4	Kodair	231	96
5	Kollapur	166	86.66
6	Nagarkurnool	225	96
7	Pebbair	126	80
8	Veldanda	137	97.33
9	Waddepally	117	89.33
10	Wanaparthy	181	92
	Mean	169.2	92.66



Graph.1: Graph shows that AM fungal spore count and root colonization percentages in *Dicoma tomentosa* from 10 mandals of Mahabubnagar District.

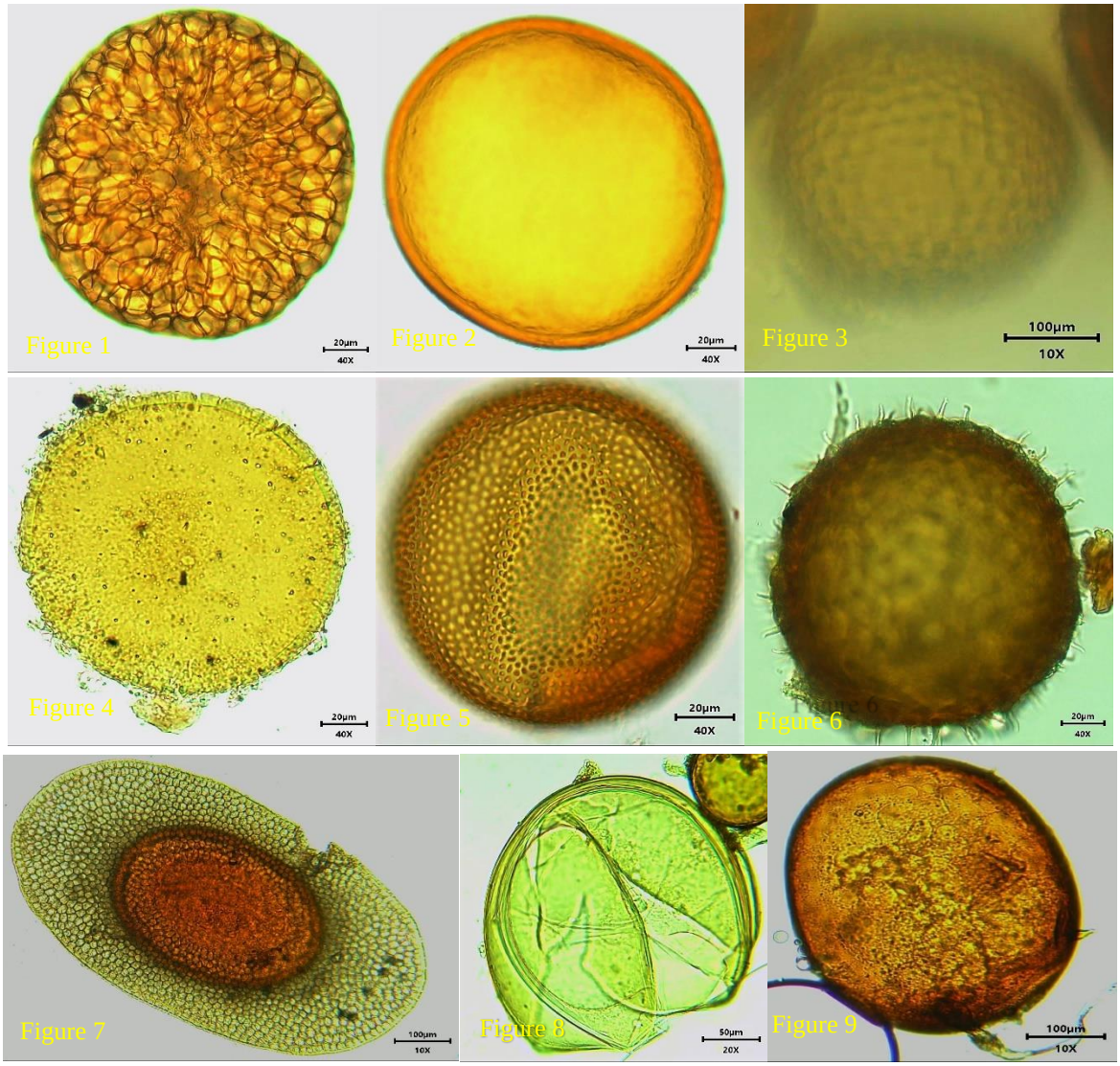
S1= Achampet, S2= Amrabad, S3= Gopalpet, S4= Kodair, S5= Kollapur, S6= Nagarkurnool, S7= Pebbair S8= Veldanda, S9= Waddepally, S10= Wanaparthy.

Table 2: The AM fungal association with Dicoma tomentosa in 10 mandals from Mahabubnagar District.

S. No.	AM fungal species	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	*Acaulospora bireticulata*	+	+	+	+	+	+	-	+	+	+
2	*Acaulospora delicata*	-	+	-	+	+	-	+	-	-	-
3	*Acaulospora foveata*	+	-	-	+	-	-	-	+	-	-
4	*Acaulospora laevis*	-	+	+	-	-	-	-	-	-	-
5	*Acaulospora scrobiculata*	+	-	+	+	+	+	+	-	-	+
6	*Acaulospora spinosa*	-	-	-	-	-	+	-	+	-	-
7	*Archaeospora Schenckii*	+	-	+	+	-	-	-	+	+	-
8	*Gigaspora albida*	-	+	-	-	+	-	+	-	-	+

9	*Gigaspora gigantea*	-	-	+	-	-	-	-	-	+	-
10	*Gigaspora rosea*	+	-	-	+	+	+	-	+	+	-
11	*Glomus aggregatum*	+	+	-	+	+	-	+	+	+	+
12	*Glomus constrictum*	-	-	+	+	+	-	+	-	-	-
13	*Glomus mossae*	+	-	+	+	-	+	+	-	-	-
14	*Glomus multicaule*	+	-	+	+	-	-	-	+	+	+
15	*Glomus multisubtensum*	+	+	+	-	-	-	-	+	-	+
16	*Scutellospora gregaria*	-	-	+	-	-	+	+	-	-	-
17	*Scutellospora heterogama*	-	-	-	-	+	-	-	-	-	+
18	*Scutellospora pellucida*	-	-	-	+	-	-	-	+	-	-
19	*Scutellospora straita*	+	-	-	-	-	-	+	-	-	-
20	*Scutellospora tricalyptra*	+	-	-	-	+	-	-	-	+	-

S1= Achampet, S2= Amrabad, S3= Gopalpet, S4= Kodair, S5= Kollapur, S6= Nagarkurnool, S7= Pebbair
S8= Veldanda, S9= Waddepally, S10= Wanaparthy



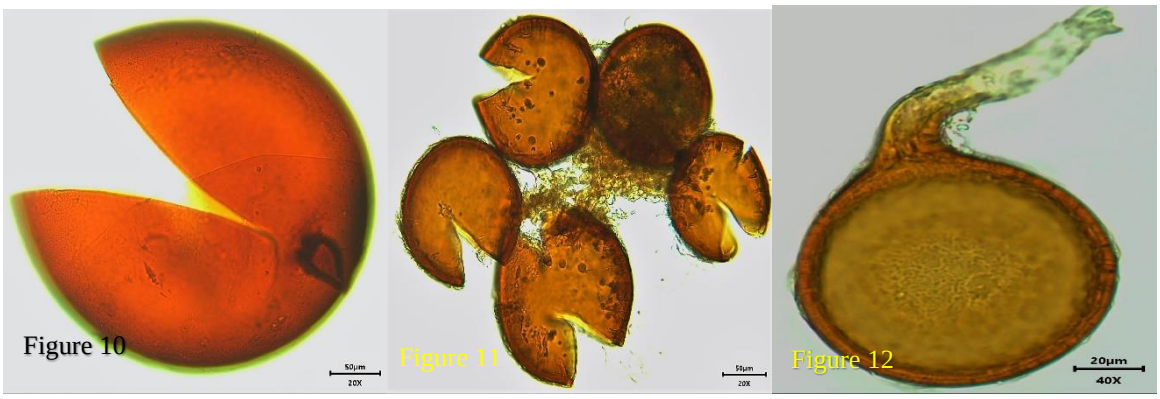
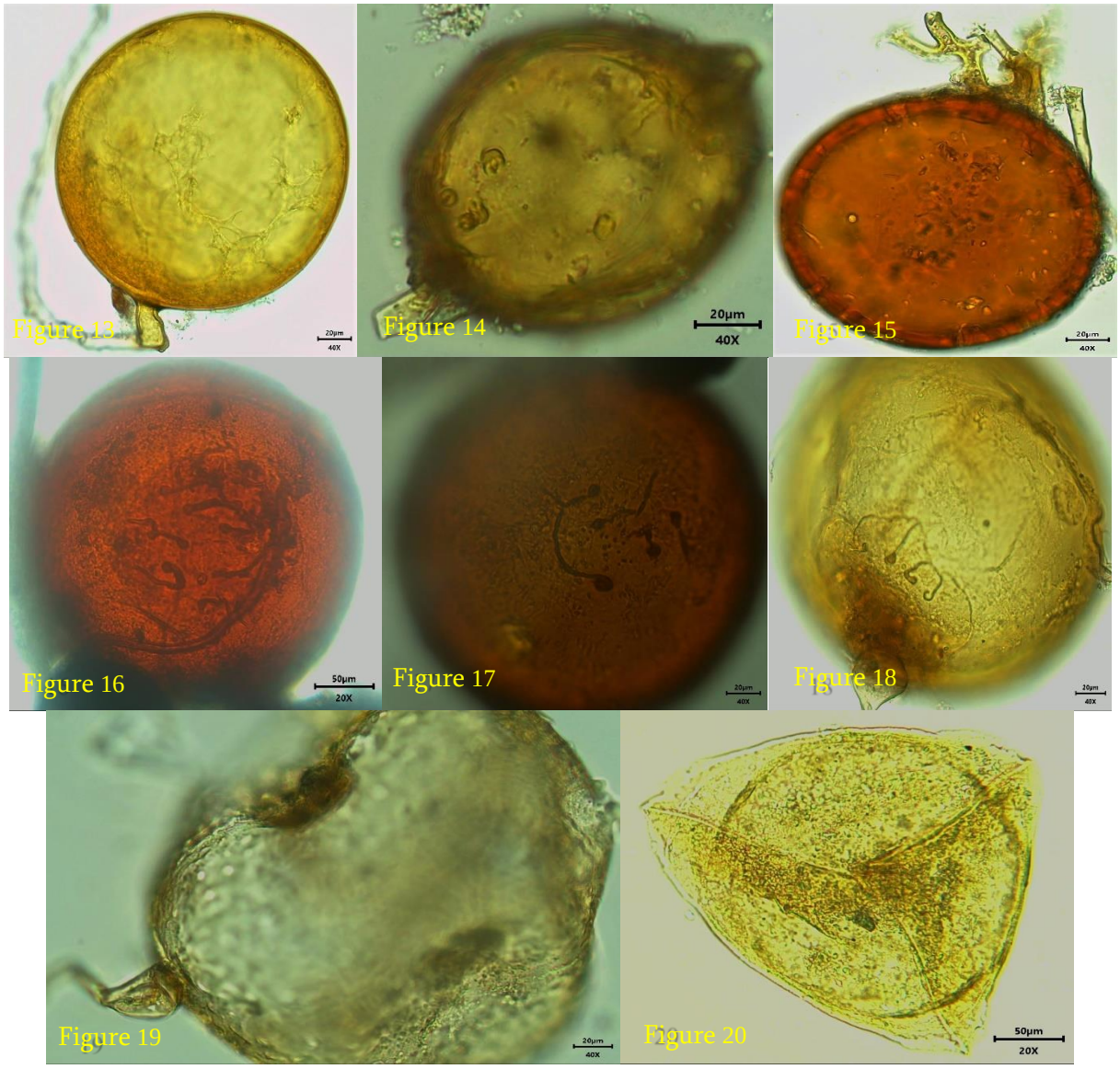
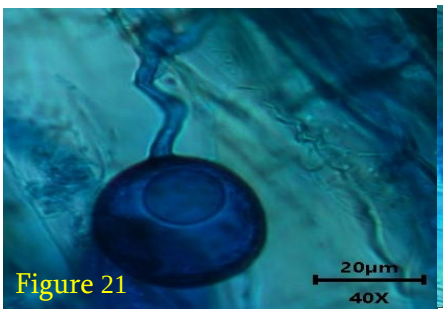


Figure 1= *Acaulospora bireticulata*, Figure 2= *Acaulospora delicata*, Figure 3= *Acaulospora foveata,* Figure 4= *Acaulospora laevis*, Figure 5= *Acaulospora scrobiculata*, Figure 6=*Acaulospora spinosa,* Figure 7= *Archaeospora Schenckii*, Figure 8= *Gigaspora albida*, Figure 9= *Gigaspora gigantea,* Figure 10= *Gigaspora rosea*, Figure 11= *Glomus aggregatum*, Figure 12= *Glomus constrictum.*





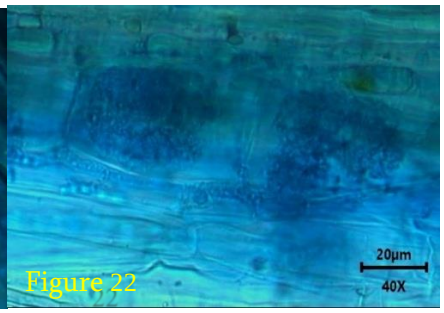


Figure 13= *Glomus mossae*, Figure 14= *Glomus multicaule*, Figure 15= *Glomus multisubtensum*
Figure 16= *Scutellospora gregaria*, Figure 17= *Scutellospora heterogama*, Figure 18= *Scutellospora pellucida,* Figure 19= *Scutellospora straita,* Figure 20= *Scutellospora tricalyptra,* Figure 21= Root cortical cell showing Vesicle, Figure 22= Root cortical cell showing Arbuscules.

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