

Acaulospora paulinae, a new record of arbuscular mycorrhizal fungal species from Telangana state, India

K. Hari Prasad^{1*}, A. Hindumathi², B. Bhadraiah³

¹S.V. Government Arts & Science College, Palem, Telangana, India

^{2,3}Applied Mycology and Molecular Plant Pathology Lab, Department of Botany, Osmania University, Hyderabad, India

*Corresponding Author: hariprasad.telangana@gmail.com

Available online at: www.isroset.org

Received: 10/Oct/2019, Accepted: 20/Oct/2019, Online: 31/Oct/2019

Abstract: *Acaulospora paulinae* was isolated from the rhizosphere soils of *Setaria italica* (Poaceae), *Emilia sonchifolia* and *Vernonia cinerea* (Asteraceae) from Nagarkurnool and Wanaparthy Districts, Telangana, India. The spores are globose to subglobose, 60-95 µm in diameter. Sometimes ovoid 60-70 X 80-95 µm. Hyaline to sub hyaline or pale yellow. The spore wall composed of three layers. The surface of the middle layer is ornamented with evenly distributed pits 2.0-2.5 X 3.0-3.5 µm. *A. paulinae* spores were found in sandy loam soils with decreasing spore numbers. *A. paulinae* is a characteristic member of the arbuscular mycorrhizal fungal communities in soils with pH 5.3-8.5 in sandy loam soils of Nagarkurnool and Wanaparthy Districts, Telangana, India.

Keywords— *Acaulospora paulinae*, Arbuscular mycorrhizal fungi, Glomeromycota, Rhizosphere, Acaulosporaceae, Spore morphology, Taxonomy.

I. INTRODUCTION

The genus *Acaulospora* belongs to Acaulosporaceae family of Diversisporales order of Glomeromycota. As on today we know 37 *Acaulospora* species with smooth surfaces and also with ornamentation of the outer spore wall [1]. The genus *Acaulospora* was described [2] and they also presented the first key for two species. *Acaulospora laevis* and *Acaulospora elegans*, the former produce spores with smooth surface and the later produce spores with an ornamented surface. The genus *Acaulospora* spores produced singly in the soil and develop laterally from the neck of sporiferous saccule [3]. The mycorrhizae of *Acaulospora* spp. consist of arbuscules, irregular and knobby vesicles and straight and coiled intraradical hyphae [4]. Schenck *et al* [5] presented the key to the ornamented species of *Acaulospora*. Oehl *et al* [6] presented latest key to the species of *Acaulospora*. We conducted a field survey on arbuscular mycorrhizal fungal association with *Setaria italica* (Poaceae), *Emilia sonchifolia*, and *Vernonia cinerea* (Asteraceae). These three plants showed the association of *Acaulospora paulinae* from Nagarkurnool and Wanaparthy Districts, Telangana, India.

II. RELATED WORK

A. paulinae was reported in grasslands and arable lands of Poland [7]. *A. paulinae* reported frequently in grasslands and

arable lands of the upper Rhine lowland in France, Germany and Switzerland [8].

III. METHODOLOGY

Isolation and identification of AM Fungal spore:

Spores and sporocarps of AM fungi were isolated by using the wet sieving and decanting method [9]. AM fungal spore identification and their morphological characters were determined and analyzed qualitatively [10] and the websites of the International collection of vesicular and AM fungi (<http://invam.wvu.edu/>; <http://www.zor.zut.edu.pl/Glomeromycota>).

IV. RESULTS AND DISCUSSION

AM association and distribution: This study was conducted in two districts viz., Nagarkurnool (16019'47" N 78016'33" E) and Wanaparthy (16018'57" N 780 02'24" E) Districts of Telangana, India. *Acaulospora paulinae* has been recorded from these two districts. *A. paulinae* associated with *Setaria italica*, *Emilia sonchifolia* and *Vernonia cinerea*.

Morphological Analysis:

Acaulospora paulinae, Blaszk.

Spore description: Spores single in the soil and develop laterally on the neck of a sporiferous saccule, hyaline to pale

yellow, globose to sub globose, 60-95µm in diam. Sometimes ovoid 60-70 X 80-95 µm.

Spore wall: Spore wall composed of three layers (Sw1-3). L1 evanescent, hyaline 0.5-0.8 µm thick. L2 laminate, hyaline to pale yellow 1.5-2.5 µm thick, ornamented with evenly distributed pits 2.0-2.5 X 3.0-3.5 µm diam. L3 flexible, hyaline <0.5 µm thick, tightly adherent to L2.

Germination wall: Germination wall two layers (Gw1, Gw2). Gw1 flexible, hyaline, bi layered (Gw1L1, Gw1L2). Gw2 plastic, hyaline, bi layered (Gw2L1, Gw2L2). Sporiferous saccule hyaline, globose to sub globose, collapsing at maturity and leaving a cicatrix, 6-9 µm diam. at the point of spore attachment.

Key to *Acaulospora* spp. with ornamented outer spore wall: Below we present Oehl *et al* (2006) key, to help to distinguish the spores with depressions (pits) or cerebriform folds of *Acaulospora* spp.

1. Spores with depressions (pits) or cerebriform folds
 - 1a. Spores with pits.....2
 - 1b. Spores with cerebriform folds -*A. rehmi*
 2. Spores formed singly in soil, not in sporocarps...3
 - 3a. Pits of regular round shape.....4
 - 3b. Pits of irregular shape - *A. scrobiculata*, *A. lacunosa*.
 - 4a. Spores with regular round pits, spores regularly <100 µm diam.....5
 - 4b. Spores with regular round pits, spores regularly >100 µm diam- *A. foveata*.
 - 5a. Spores hyaline, sub hyaline.....6
 - 5b. Spores yellow to Orange brown- *A. alpina*.

- 6a. Spore hyaline to sub hyaline, concave round pits of widest diameter < 3.5 µm- *A. Pauline*
- 6b. Spore hyaline to sub hyaline, concave round pits of widest diameter > 3.5 µm- *A. undulata*

V. CONCLUSION

Acaulospora paulinae spores were identified in the rhizosphere soils of *Setaria italica*, *Emilia sonchifolia*, and *Vernonia cinerea* collected from Nagarkurnool (site 1) and Wanaparthy (Site 2). Site 1(Nagarkurnool) identified spore has shown (Fig. 1 and 2) sub hyaline, ovoid shape 89.53 µm diam. spore wall (L2) ornamented with evenly distributed pits 3.15-3.35 µm diam. Site 2 (Wanaparthy) identified spore has shown (Fig. 3 and 4) pale yellow, globose to sub globose shape 92.90 µm diam. spore wall (L2) ornamented with evenly distributed pits 2.69-3.09 µm diam. All the morphological characters of the *A. paulinae* were well fitted according to Oehl *et al* keys for the identification of the spore. In the present study, *A. paulinae* spores were found in sandy loam soils with fewer spore numbers. *A. paulinae* and *A. undulata* spores are similar in size and colour. Examination of spores of these fungi under compound microscope readily separate them. *A. paulinae* has three layered spore wall and two layered germination walls, whereas the spore of *A. undulata* consists of only a two layered spore wall and one layered germination wall [11].

ACKNOWLEDGMENT

I would like to thank Southern Eastern Regional Office, Hyderabad for sanctioning minor research project, which has helped me complete the research work and also strengthen lab facilities in Government degree college.

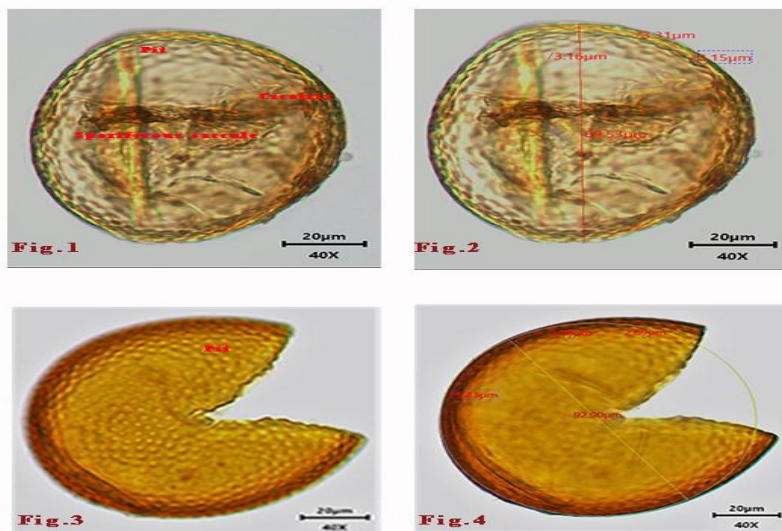


Fig. 1 and 2 are showing ovoid *Acaulospora paulinae* spore in *Vernonia cinerea*.
Fig. 3 and 4 are showing globose *Acaulospora paulinae* spore in *Emilia sonchifolia* and *Setaria italica*.

REFERENCES

- [1]. A. Schüßler and C. Walker, "*The Glomeromycota: A Species List with New Families and New Genera*". Schüßler, A., Walker, C., Gloucester, published in libraries at Royal Botanic Garden Edinburgh, Kew, Botanische Staatssammlung Munich, and Oregon State University, **2010**.
- [2]. J.W. Gerdemann and J.M. Trappe, "*The Endogonaceae in the Pacific Northwest*." Mycologia Memoir No.5. **76pp. 1974**.
- [3]. J. B. Morton and G. L. Benny, "*Revised classification of arbuscular mycorrhizal fungi (Zygomycetes): a new order, Glomales, two new suborders, Glomineae and Gigasporineae, and two new families, Acaulosporaceae and Gigasporaceae, with an emendation of Glomaceae*". Mycotaxon **37**, pp. **471-491, 1990**.
- [4]. J. B. Morton, "*International Culture Collection of Arbuscular and Vesicular-Arbuscular Mycorrhizal Fungi*. West Virginia University." **2000**.
- [5]. N.C. Schenck, J.L. Spain, E. Sieverding and R.H. Howler, "*Several new and unreported vesicular arbuscular mycorrhizal fungi (Endogonaceae) from Colombia*." Mycologia **76**, pp. **685-699, 1984**.
- [6]. F. Oehl, Z. Sýkorová, D. Redecker and A. Wiemken, "*Acaulospora alpina, a new arbuscular mycorrhizal fungal species characteristic for high mountainous and alpine regions of the Swiss Alps*." Mycologia **98**, pp. **286-294, 2006**.
- [7]. J. Blaszkowski, "*The occurrence of arbuscular fungi and mycorrhizae (Glomales) in plant communities of maritime dunes and shores of Poland*." Bull. Pol. Ac. Sci. Biol. Sci. **41**, **377-392, 1993a**.
- [8]. F. Oehl, E. Sieverding, P. Mader, D. Dubois, K. Ineichen, T. Boller and A. Wiemken, "*Impact of long-term conventional and organic farming on the diversity of arbuscular mycorrhizal fungi*." Oecologia. **138**, pp. **574-583, 2004**.
- [9]. J. W. Gerdemann and T. H. Nicolson, "*Spores of mycorrhizal Endogone extracted from soil by wet sieving and decanting*." Trans. Brit. Mycol. Soc. **46**, pp. **235-244, 1963**.
- [10]. N.C. Schenck and Y. Perez, "*Manual for the Identification of VA Mycorrhizal Fungi*." Synergistic Publications, Gainesville, Florida, USA. pp **283, 1990**.
- [11]. E. Sieverding, "*Two new species of vesicular arbuscular mycorrhizal fungi in the Endogonaceae from tropical high lands of Africa*." Angew. Bot. **62**, pp. **373-380, 1988**.