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Ramispinatispora gouthamkhaniensis sp. nov.: A NEW MEGASPORE FROM EARLY PERMIAN, BARAKAR FORMATION, GOUTHAM KHANI OPEN CAST MINE, KOTHAGUDEM AREA, TELANGANA, INDIA

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ABSTRACT
The paper records the occurrence of a new megaspore species namely *Ramispinatispora gouthamkhaniensis* sp. nov. recovered from the carbonaceous shale samples collected from the Barakar Formation, Early Permian, Goutham Khani Open Cast Mine, Kothagudem Area, Telangana. The megaspores are trilete, subcircular to circular, exosporium spinate, spines are densely distributed- single, bi and multifurcate uniformly distributed, straight to curve. The present find is significant as it represents the existence of lycopsids in the catchment area of Godavari Graben during its deposition. Hence, enlarge the phytogeographic distribution of this genus and widens the scope of use of this genus as one of the characteristic forms of Barakar Formation of Early Permian age.

KEY-WORDS: Barakar Formation, megaspores, Kothagudem Area, exosporium, lycopsids.

INTRODUCTION

Megaspores are the female gamete cells which give rise to the early land plants mainly the lycopsids. Their average size is about more than equal to 200 μm (Zerndt, 1934). Study of fossil megaspores is significant in the study of biostratigraphy and interpretation of source vegetation. The origin of heterospory started during Early Devonian (Scott & Hemsely, 1996). In the present communication a new species of Permian megaspore namely *Ramispinatispora gouthamkhaniensis* sp. nov. from the Barakar Formation, Early Permian of Goutham Khani Open Cast Mine, Kothagudem Area, Godavari Graben, Telangana has been described.

MATERIAL & METHOD

Megaspores were recovered from the carbonaceous shale samples collected from the Barakar Formation of Index Seam, Goutham Khani Open Cast Mine, Kothagudem Area, Telangana (Fig. 1). For the recovery of megaspores, the samples were processed with concentrate hydrofluoric acid for 5–7 days and washed thoroughly with water. Megaspores were picked individually and kept in conc. HNO_3 for 10–12 hours. A pinch of $KClO_3$ was added to catalyze the reaction. When the megaspores turned brown, they were thoroughly washed with water and then treated with 5% potassium hydroxide (KOH) solution which revealed the exosporium features like shape, nature of triradiate mark, contact ridges, ornamentation and the mesosporium. Megaspores were observed under low power binocular microscope Leica DFC 290.The slides have been deposited in the repository of BSIP Museum.

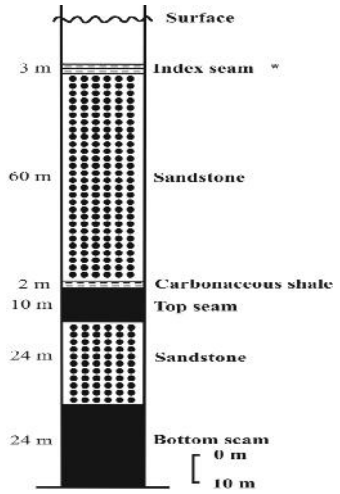

FIGURE 1- Litholog of Goutham Khani Open Cast Mine, Kothagudem Area (after SCCL, 2011). * = Megaspores.

SYSTEMATIC DESCRIPTION

Genus: ***Ramispinatispora*** Pant and Mishra, 1986

Type species: ***Ramispinatispora waltonii*** (Pant & Srivastava, 1962) Pant and Mishra, 1986

Ramispinatispora gouthamkhaniensis **sp. nov.** (Plate 1: Figs. 1-6)

Age: Barakar Formation, Early Permian, Goutham Khani Open Cast Mine, Godavari Graben, Telangana, India.

Etymology: After Goutham Khani Open Cast Mine.

Diagnosis: Megaspore trilete, azonate, circular to subcircular in shape, tri-radiate ridges wavy, ¾ spore radius long, exosporium spinate, spines simple, single, bifurcate and multifurcate, ornamentation dense, spines straight to curved, uniformly distributed; mesosporium indistinct, dark, apparently rounded and without cushions.

Description: There are two specimens, yet they are distinct enough for a new specific circumscription. The specimens are sub circular to circular in shape with prominent tri-radiate ridges. Arcuate ridges are not seen, exosporium spinate, spines densely distributed- single, bi and multifurcate uniformly distributed, straight to curved.

Dimensions: Overall size 641- 757µm, size of tri-radiate ridges 180 – 275 x 15- 60 µm, size of mesosporium 456 x 461µm, length of spines 53- 64 µm, width of spines at base 21- 26 µm, width of spines at apex 8 - 11 µm.

Remarks: *Ramispinatispora gouthamkhaniensis* sp. nov. differs from all the known species of the genus *Ramispinatispora*, viz., *R. indica* (sexine of contact areas with greatly reduced ornamentation or almost reduced; Pant & Mishra, 1986, Pl. 9, Figs. 60, 61, Text- Figs. 13, A-F), *R. nautiyalii* (sexine covered with stout multiple branched spinulose appendages; Pant & Mishra, 1986, Pl. 9, Figs. 62-64, Text-Figs. 14, A-E) and *R. waltonii* (distinct contact areas and arcuate ridges; Pant & Mishra, 1986). *Ramispinatispora mahanadiensis* (Tewari et al., 2009) has been merged in *Singhisporites mahanadiensis* (Slater et al., 2011). Joshi and Tewari (2015) described the megaspores under the genus *Singhisporites* (Pl. 3; Figs. 5, 6; Pl. 4, Figs. 1, 2). Based on present description, diagnosis and dimensions they are retained in the genus *Ramispinatispora viz. R. gouthamkhaniensis* sp. nov.

Holotype: BSIP Slide No. 15444.

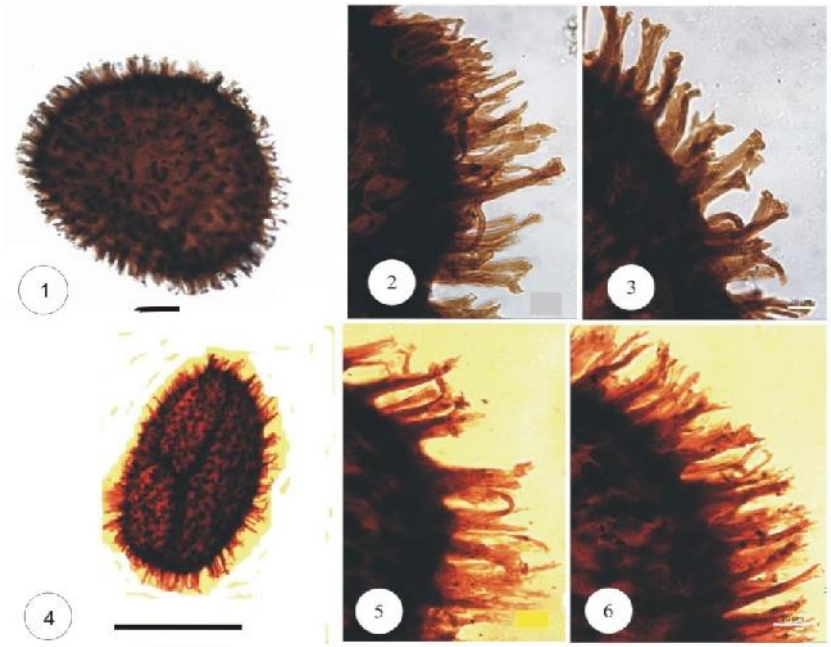

PLATE 1: Scale bar = 100 µm. **1.** *Ramispinatispora gouthamkhaniensis*, BSIP Slide No. 15444. **2 & 3**. A portion of megaspore in 1 enlarges (× 3.5) to show ornamentation. **4.** *R. gouthamkhaniensis*, BSIP Slide No. 15445. **5 & 6**. A portion of megaspore in 3 enlarges (× 3.5) to show ornamentation.

DISCUSSION & CONCLUSION

Permian megaspores from Godavari Graben have been reported from Ramagundem, Chelpur (Jha & Srivastava 1984), Rampuram (Patil & Premchand, 2001), Mailaram (Jha & Tewari, 2003), Gundala (Jha et al., 2006), Kachinapalli (Tewari et al., 2007) Kothagudem (Joshi & Tewari, 2015) areas. The spines indicate aquatic fresh water palaeo-environmental conditions. Since spines have been known to facilitate fertilization, their sturdy nature and close proximity might have been responsible for providing better chances for fusion of gametes resulting in increased reproduction and eventually in their copious population indicating presence of diverse lycopsids which, however, are not recorded in the Godavari Graben (Joshi, 2016). The occurrence of megaspores is also significant since it indicates presence of cryptogams (lycopsids, sphenopsids) in the area. Presence of new species *viz. Ramispinatispora gouthamkhaniensis* adds to the existing knowledge of megaspores in the Godavari Graben. More efforts are required for the recovery of megaspores in the area for better understanding of their vertical distribution and diversity.

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