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Abradeosporangium, a new genus of Mucorales (Fungi: Zygomycetes) from India

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Abstract: *Abradeosporangium*, a new genus of Mucorales with its type species *A. variosporum,* is described from India. The new genus is distinct in producing dimorphic sporangia and multispored, acolumellate and globose macrosporangia with persistent, thin peridium. Sparingly, portions of the sporangial wall at the top and bottom of the sporangia are dissolved at maturity to release the sporangiospores whilst, in its close ally *Gilbertella*, the sporangium breaks open via a longitudinal suture. Further, the smaller sporangia (microsporangia) are without a longitudinal suture and produce variable number of spores. The sporangiospores are pale brown, longitudinally striated without any appendages. Besides, the new genus produces neither rhizoids nor zygospores.

Keywords: *Abradeosporangium*, Mucorales, Mycota, new genus, Zygomycetes.

During the course of exploration of fungi of Meerut district, Uttar Pradesh, India, an interesting isolate bearing dimorphic sporangia on distinct sporangiophores was discovered from the rat excreta and decomposing *Hibiscus* flowers gathered from the campus of Meerut Institute of Engineering and Technology (MIET). Some of the macrosporangia dehisce along a longitudinal suture as in *Blakeslea* and *Gilbertella* (Binny 1991). However, the present isolate differs from both these genera in several diagnostic characters. Hence, it is warranted to accommodate the present isolate in a new genus of Mucorales.

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Abradeosporangium Subrahm. et A. Swathi Sri, gen. nov.

(Mucorales, Zygomycetes) (Image 1; Figs. 1-5)

Material examined: Holotype: 08.x.2008, Anamorph, soil and decomposing Hibiscus flowers, MIET Campus, Meerut, India, coll. A. Swathi Sri (MIET Culture Bank: Fungi 126) (MycoBank # 518785).

Sporangia dimorpha; macrosporangia globosa, atrobrunnea, columella nulla, multispora, parietus tenues, ad apicem et basim dissolutus ad maturitatus et sporae liberatus, aliquot sporangia dehisce longitudinalis. Microsporangia plus minus globosa, dilutus brunnea, multisporata, parietus glabrus, persistens et sutura longitudinalis nulla. Sporangiosporae globosae, variabilis, dilute brunneae vel brunneae, striatus longitudinalis minutus, plerumque ovalis, sporae globosae, raro fucus et dumbelliformes. Zygosporae nullae.

Sporangia dimorphic; macrosporangia globose, dark brown, acolumellate, multispored with smooth, thin-walled (peridium) which at maturity dissolves at the top and bottom to release the spores. Some of the sporangia split open along the longitudinal suture as in *Blakeslea* (Ho & Chang 2003) and *Gilbertella* (Hesseltine 1960; Mehrotra & Mehrotra 1963). Microsporangia nearly globose, pale brown, with variable number of sporangiospores; peridium smooth, persistent and without any longitudinal suture. Sporangiospores variable in shape, pale brown to brown, finely longitudinally striated, usually oval or globose, occasionally fusiform to dumbbell shaped. Zygospores absent.

Etymology: The generic name refers to breakage or dissolution of sporangium; L: *abrādō*: damage; sporangium.

Type species: *Abradeosporangium variosporum*, sp. nov.

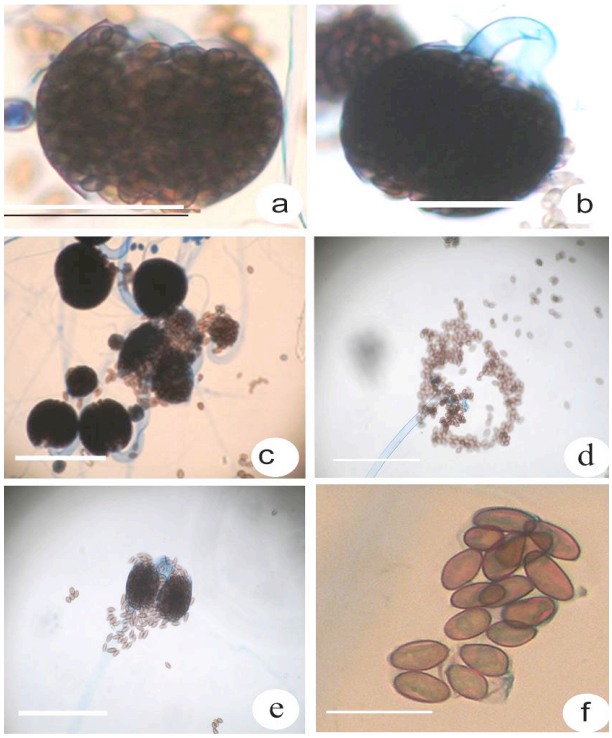

Image 1. *Abradeosporangium variosporum* gen. et sp. nov.
a, b – Mature macrosporangia with goose-necked sporangiophores; c – Macro- and microsporangia;
d – Distal part of sporangiophore after dehiscence of the macro-sporangium, without columella;
e – Macrosporangium dehisced along the longitudinal suture;
f – Sporangiospores without appendages.

Abradeosporangium variosporum
Subrahm. et A. Swathi Sri, sp. nov.
(Image 1; Figs. 1-5)

Mycelium aseptatus, hyalinus, glabrus, ramosus; sporangiophorae hyalinae, lateralis, non-ramosus, aseptatae, statim inferne sporangiorum curvatae, producentes sporangia ad terminalis; sporangia dimorpha, producentes sporangiophores separatis. Macrosporangia magna, spherica, atrobrunnea, acolumellata, multispora, 101-109 µm diam.; parietus sporangiorum hyalinus, glabrus, persistentes; parietus inferne et ad apicem dissolutus et sporangiosporae liberatae; saepe sporangia dehiscentes longitudinalis. Microsporangia numerosa, producentes pedicellae lateraliter, dilute brunneae, sutura longitudinalis nulla, 12-42 µm diam.; sporangiosporae dilute brunneae vel brunneae, appendices nullae, striatus longitudinalis minutae, plerumque ovoideae, 7-10 x 3-5 µm, sporae globosae, ad 10µm diam., saepe dumbelliformes vel fusiformes; chlamydosporae intercalares vel termilnalis, glabrae, cylindraceae, solitariae, dilute brunneae, 6-8 x 1-2 µm; zygosporae nullae.

Mycelium aseptate, hyaline, smooth, branched; sporangiophores hyaline, lateral, unbranched, aseptate and curved proximate to the sporangium even at maturity, bear a single sporangium distally; sporangia dimorphic, born on separate sporangiophores. Macrosporangia large, spherical, dark brown, acolumellate, multispored, 101-109 µm in diam.; peridium smooth, persistent; but

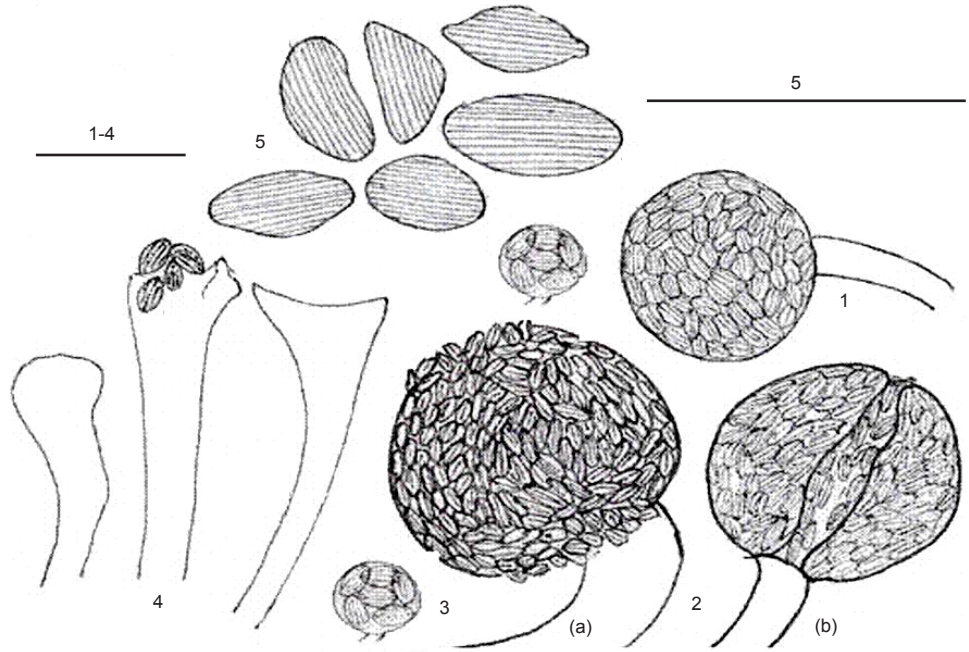

Figure 1-5. *Abradeosporangium variosporum* gen. et sp. nov.
1 – Macrosporangium (10 x 40X); 2 – Mature sporangia showing (a) dissolution of sporangial wall; (b) breaking of sporangial wall along the longitudinal suture (10 x 40X); 3 – Microsporangia (10 x 40X); 4 – Distal parts of sporangiophores after the dispersal of spores (10 x 40X), note the absence of columella; 5 – Sporangiospores (10 x 40X).

Table 1. Comparison of diagnostic characters of *Blakeslea, Gilbertella* and *Abradeosporangium* gen. nov.

Taxon / Trait	***Blakeslea*** Thaxt., 1914 (*B. monospora* B.S. Mehrotra & Baijal, 1968)	***Gilbertella*** Hesselt., 1960 (*G. persicaria* (E.D. Eddy) Hesselt., 1960)	***Abradeosporangium*** Subrahm. et A. Swathi Sri, gen. nov. (*A. variosporum* Subrahm. et A. Swathi Sri, sp. nov.)
Sporangiophores	Erect, ascending, branched, irregularly constricted.	Simple, rarely branched; curved immediately below the sporangium but straightens at maturity.	Simple, goose-necked even at maturity.
Macrosporangia	Globose, yellowish-brown to black, multispored, 45-170 µm; wall persistent covered with crystalline spines; breaks into two equal halves through a longitudinal suture with a drop of sporangial content.	As in *Blakeslea monosperma*.	Globose, dark brown, multispored, thin-walled, smooth. In some sporangia, part of the wall at top and bottom get dissolved to release sporangiospores. In others, the sporangium breaks along a longitudinal suture as in *Gilbertella* or *Blakeslea* but without a droplet of sporangial contents.
Microsporangia	1-8 spored, borne on barrel-shaped pedicles that cover the globose vesicles; open by a longitudinal suture.	None.	Present on simple short stalks; longitudinal suture absent; bear variable number of spores.
Columella	Present.	Present.	Absent.
Sporangiospores	Fusiform, pigmented, striate and bear a group of long, fine, hyaline appendages at each pole.	Globose, broadly fusiform or ellipsoid to ovoid or irregular 7.6-11.4 x 6.4-8.9 µm, smooth; bear long, slender appendages at the poles.	Pale brown to brown, finely striated, oval, 7-10 x 3-5 µm, globose, 10µm dumbbell or spindle-shaped spores occasionally formed; appendages absent at the poles.
Chlamydospores		Ovoid, doliform, cylindrical or irregular, 11.32 x 10-16 µm, light brown, smooth.	Oval, barrel-shaped, single, intercalary, pale brown, smooth, 6-8 x 2 µm.
Zygospores (telomorph)	Present.	Present.	Absent.

(After Thaxter 1914; Hesseltine 1960; Mehrotra & Baijal 1968; Kirk 1984; Benny 1991; present study)

at maturity, part of the wall at the top and bottom gets dissolved to release the sporangiospores; a few sporangia split open along the longitudinal suture as in *Blakeslea* and *Gilbertella* (Table 1). Microsporangia numerous, born on small lateral stalks, pale brown with variable number of spores without longitudinal suture, 12-42 *µ*m in diam.; sporangiospores lack appendages, pale brown to brown, smooth, finely longitudinally striated, shape variable, most commonly ovoid, 7-10 x 3-5 *µ*m or globose, up to 10 *µ*m in diam., occasionally dumbbell or fusiform shaped spores also formed; chlamydospores intercalary or terminal; smooth, barrel-shaped, single, pale brown, 6-8 x 1-2 *µ*m; zygospores absent.

Culture characterization: The fungus grows on most of the common media like potato dextrose agar, 2% malt extract agar, oatmeal agar, YpSs agar and also on synthetic mucor agar.

(i) On oatmeal agar: Growth profuse; colonies at room temperature white to pale yellow, fast growing, cover 80mm plate in 72h. Aerial mycelium well-developed, appear granular with the development of sporangia; sporangia pale brown, turn black on maturation. Sporulation characteristically begins from periphery of the colony; reverse colony colourless; diffusible pigment absent.

(ii) On potato dextrose agar: Growth profuse; colonies at room temperature fast growing, cover 80mm plate in 72h. Mycelium dull-white, raised, zonate, crest and trough-like with depressed area at the centre. Sporulation characteristically begins from periphery of the colony in the aerial mycelium. It appears granular with the initiation of pale brown sporangia which turn black on maturation; reverse colony pale woody yellow; sporulation abundant.

On almost all media, the mycelial growth is zonate, crest-like and trough type; sporulation always begins from the periphery of the colony.

Discussion

Abradeosporangium gen. nov. is a saprophytic mucoralian genus producing acolumellate dimorphic sporangia. On most of the mycological media, it produces crest and trough type growth. Sporulation characteristically begins from the periphery of the colony. It produces multispored, psilate macrosporangia. The sporangiophores are goose-necked even at maturity (dehiscence time). The release of sporangiospores is either through a longitudinal suture as in *Gilbertella* and *Blakeslea*, or by dissolving a part of the sporangial wall (peridium) at the top and bottom. The latter trait makes *Abradeosporangium* gen. nov. distinct. While *Gilbertella* and *Blakeslea* produce columellate sporangia (Table 1), the sporangia are acolumellate in the present isolate (Image 1; Fig. 1).

Furthermore, the microsporangia, unlike *Blakeslea* (Kirk 1984), are produced distally on simple sporangiophores and not on barrel-shaped pedicles covering the surface of globose vesicles. The suture present in the microsporangial wall of *Blakeslea* is wanted in *Abradeosprongium* gen. nov. Moreover, the sporangiospores are simple, longitudinally striated, ovoid or globose and do not bear hyaline appendages at the poles as in *Blakeslea* and *Gilbertella*. Besides, zygospores and rhizoids are wanted. Another interesting feature of the present isolate is that it fails to sporulate on slants.

Other distinct features of the new genus: Growth on most of the media is characteristically crest and trough type; sporulation always begins from the periphery of the colony. It sporulates freely in a plate but not in a tube. Several combinations like PDA + 2 % cow dung extract; soil extract + SMA agar; soil extract + cow dung extract, PDA + SMA - all of them incubated at 18^0, 24^0, 28^0 and 37^0 C but sporulation could not be induced in tube culture.

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