# *Thermomucor abortosporangium* sp. nov. (Fungi: Mucorales)

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ABSTRACT: *Thermomucor abortosporangium* A. Swathi Sri & A. Subrahm., *sp. nov.* is described as the second species of *Thermomucor*. It differs from the type species of *T. indicae-seudaticae* in the branching pattern of sporangiophores, size and shape of sporangiospores and production of abortosporangia. Zygospores are reddish brown, globose, psilate, isogamic and formed at low (37°C) temperature whilst the higher temperatures are prohibitive. The fungus grows well at 50°C on PDA, SMA and MEA.

KEY WORDS: Decaying leaf, India, new species, *Thermomucor*.

## INTRODUCTION

*Thermomucor* A. Subrahm., B.S. Mehrotra & Thirum. (Subrah[a]manyam *et al*., 1977) is a thermophilic, homothallic genus treated in Mucoraceae. It shows strong affinities with the recently constituted monogeneric Lichtheimiaceae Kerst. Hoffm., G. Walther & K. Voigt (Kirk, 2011; Subrahmanyam and Raju, 2011). So far, it is known only by the type species, *T. indicae-seudaticae* (Subrah[a]manyam *et al*., 1977). The genus is diagnosed by the production of globose, apophysate, columellate, multispored sporangia and smooth-walled, globose, reddish brown zygospores held in between the suspensors of equal size (isomorphic).

During the exploration of fungal flora of Meerut region, India, an isolate resembling *Thermomucor* in its basic characters was noticed at 50°C on synthetic mucor agar from a decaying leaf collected on Meerut Institute of Engineering & Technology (MIET) campus, Meerut, Uttar Pradesh. A critical study of monospore cultures revealed that the isolate differs from the type species in the branching pattern of sporangiophore, size and shape of sporangiospores and formation of abortive sporangia. Therefore, it is described as a new species of *Thermomucor*, under the name *T. abortosporangium.*

## TAXONOMIC TREATMENT

***Thermomucor abortosporangium*** A. Swathi Sri & A. Subrahm. *sp. nov.* Figs. 1 & 2

MycoBank no.: MB 563660.

*Sporangiae apophysates stipes, stipes laxus vel exitus; ut exitus 3 vel 4 stipes mauris in verticillatae, unus vel totus lemma gero abortivus sporangiae. Uber sporangiae globosae, teres columellate, multulorem ipsum, hyalinae brunneae ut stilus brunnea 52-102 µm priores. Columellae variabilis in vultusa funiculate hemiglobosae ut incomposite 28-45 × 39-69 µm. Sporangiosporea hyalinae stilus rutilus crocus in vulgus, teres vultus variabilis sphaerica 4-5 ovalis 5-7 × 3-6 vel irregularibus. Zygosporae puniceus frons spherical teres parietis tenuit de suspensors par amplitudo.*

Etymology: The species name refers to the formation of abortive sporangia.

Habitat: Senium foliatus material.

On synthetic mucor agar, the colonies grow rapidly at 50°C and cover 65 mm plate in 24 hr; thin and transparent initially but become thick and turn mouse grey at the end of 48 hr; sporulation abundant; zygospores not produced.

At 37°C on synthetic mucor agar, colonies spread and covered 65 mm plate in 72 hr; aerial mycelium wheat grey and well-developed; reverse colony dirty white; diffusible pigment none, sporulation abundant; zygospores profusely produced.

Mycelium hyaline, smooth, aseptate and branched; sporangiophores branched, developed from stolons, lateral in position, mostly aseptate, very rarely with one septum at the proximal end, each branch bears a fertile sporangium; occasionally 2-3 branches develop in a verticillate fashion, aseptate, one, a few or all of them bear abortive sporangia. Sporangia globose, multispored, smooth, columellate with deliquescent hyaline wall, 52-102 µm in diameter; columella

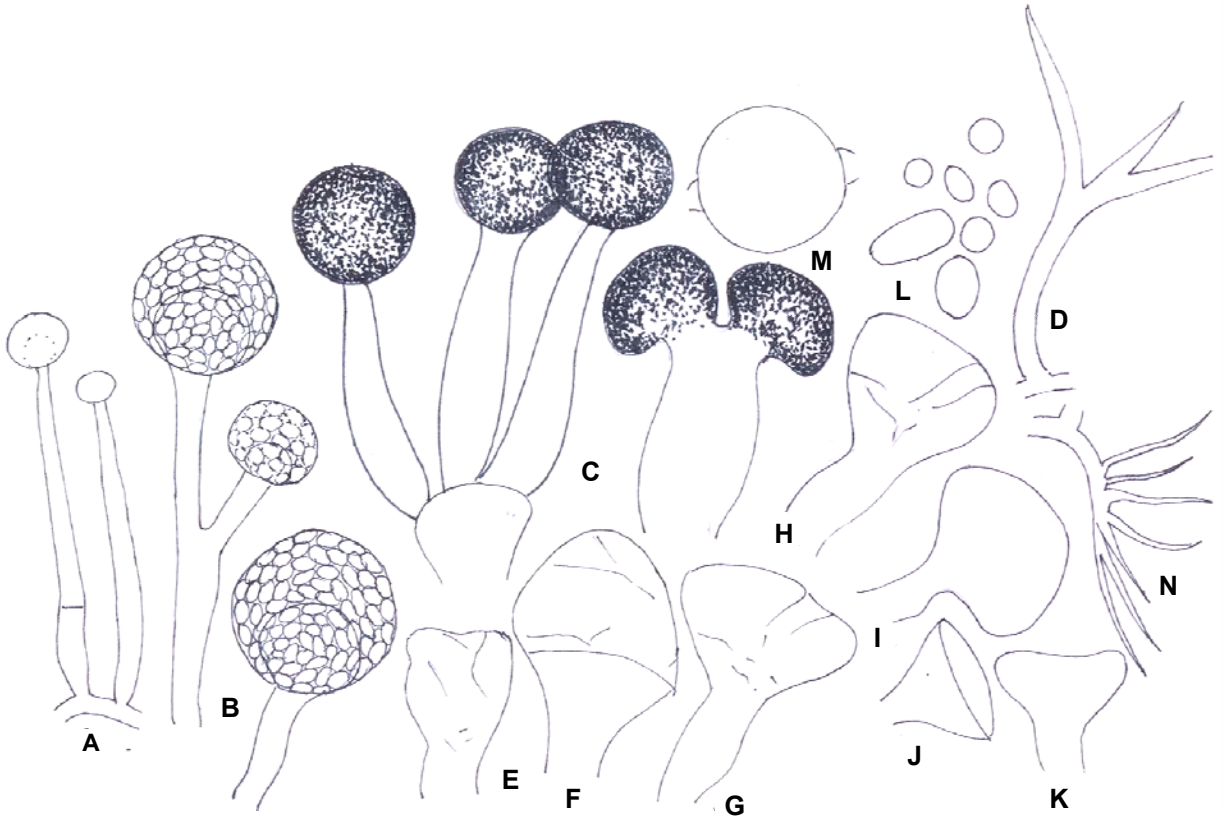


**Fig. 1. *Thermomucor abortosporangium,* sp. nov. A: Sporangiophores bearing immature sporangia (10 × 10x). B: Fertile sporangia (40 × 10x). C: Verticillate sporangiophores, each bearing an abortive sporangium (40 × 10x). D: Forked sporangiophore (one branch shows further dichotomy), with no sporangia developed (10 × 10x). E-K: Polymorphic columella (40 × 10x). L: Mature sporangiospores (15 × 40x). M: Mature psilate zygospore (10 × 40x). N: Branched rhizoids (10 × 10x).**

variable in shape, globose, dome-shaped, funnel-like to irregular, 28-45 × 39-69 μm; sporangiospores hyaline, smooth, pale golden yellow in mass, globose (4-5 μm), ovoid (5-7 × 3-6 μm) to irregular, released by dissolution of sporangial wall. Rhizoids often branched, never produced opposite to sporangiophores, 35-82 × 3-5 μm. Zygospores smooth, reddish brown, 28-34 μm, produced at 37°C. Suspensors holding zygospores equal in size (isogamic).

Habitat: Decaying leaf material, MIET campus, Meerut, India. Isolation number MIET F326. *A. Swathi Sri, IMI, UK 398507* (Type); NFCCI, Pune India, 2112 (Isotype) and IMTECH, Chandigarh, India (Isotype).

The present isolate resembles *Thermomucor indicae-seudaticae* in bearing apophysate, multispored columellate fertile sporangia born on lateral branches of sporangiophores originated from stolons, besides the psilate, reddish brown zygospores held in between suspensors of equal size and optimum growth temperatures. But, it differs from the type in presence of verticillate sporangiophores bearing abortive sporangia, variation in the shape and size of columella and sporangiospores, and smaller size of zygospores (Table 1). Zygospores are produced only at lower temperatures (37ºC) while in the type species they are known to develop at 37-60ºC. In the initial isolation at 50ºC on PDA and SMA, a large number of clavate, aseptate chlamydospores developed (Fig. 2B) but this ability was lost completely on subsequent transfers.

## DISCUSSION

The genus *Thermomucor* was described in 1977 with type species *T. indicae-seudaticae* (Subrah[a]manyam *et al*., 1977) isolated from compost in Pimpri, Poona, India with both anamorph and teleomorph stages produced at 37-60º C. In contrast, *T. abortosporangium* sp. nov. was isolated at 50ºC from decaying leaf and it produced zygospores only at 37ºC; it failed to produce them even at 50ºC despite induction by growing on PDA with six drops of 50% lactic acid per litre (Tuite, 1969). Furthermore, the variations in size and shape of

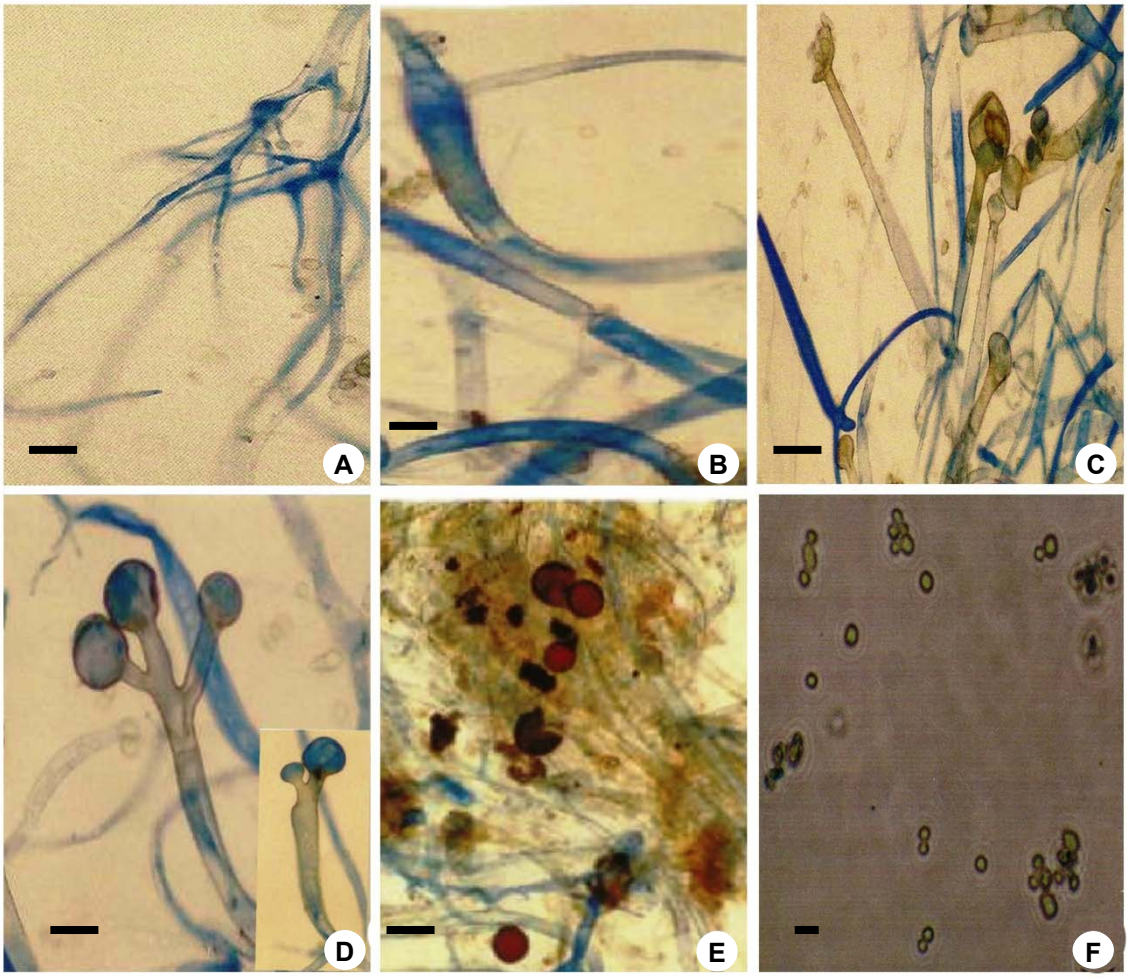


**Fig. 2. *Thermomucor abortosporangium* sp. nov. A: Branched rhizoids. B: Chlamydospores. C: Chlamydospores and dehisced sporangia. D: Verticillately arranged sporangiophores with abortive sporangia. E: Psilate zygospores. F: Sporangiospores. Bar = 30µm.**

**Table 1. Distinction between the two species of *Thermomucor*.**

| | Trait | *T. indicae-seudaticae* | *T. abortosporangium* sp.nov. |
|---|---|---|---|
| 1 | **Sporangiophores:** | Verticillate sporangiophores absent. | Branches (2-3) develop in a verticillate fashion on a clavate flat tip; one or all the branches bear abortive sporangia. |
| 2 | **Sporangia:** | Brown, globose, spore diam. 175 µm; wall ruptures at maturity to release spores. | Hyaline to pale golden yellow; spore diam. 52-102 µm; wall dissolves at maturity. |
| 3 | **Columellae:** | Hemi-globose; 85-150 µm. | Globose, saucer- or funnel-like, conical, hemi-globose to irregular; 28-45 × 39-69 µm. |
| 4 | **Sporangiospores:** | Hemi-globose, psilate, hyaline, 3.5-6 µm; pale brown in mass. | Shape variable, globose (4-5 µm), ovoid (5-7 × 3-6 µm) or irregular; pale golden yellow in mass. |
| 5 | **Zygospores:** | 56-50 µm. | 28-34 µm. |

columellae and sporangiospores are unknown in *T. indicae-seudaticae*.

The production of abortive sporangia is thus far not known for any of thermophilic mucoralian taxa though mesophilic species like *Amylomyces rouxii*, particularly the strains designated NRRL 3139, NRRL 3160 are reported to produce abundant abortive sporangia on PDA, SMA and MEA (Ellis *et al.*, 1976). In these cases,

abortive sporangiospores were restricted only to the upper hemisphere of the sporangia and none attained maturity.

Regardless of the growth medium and temperature of incubation, abortive sporangia developed in the present isolate only on verticillate sporangiophores and sporogenesis never occurred in these sporangia whilst the sporangia formed on lateral sporangiophores were always fertile.

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*Orthographic variant; the name of the author A. Subrahmanyam was wrongly spelled in the original publication as 'A. Subrahamanyam' when the genus *Thermomucor* was described in 1977. It is to be corrected as A. Subrahmanyam, as has been done in Index Fungorum.

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# 新種 *Thermomucor abortosporangium*（真菌：毛黴目）

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摘要：本文描述新種 *Thermomucor abortosporangium* A. Swathi Sri & A. Subrahm.。此新種為 *Thermomucor* 屬的第二個物種。它的不同於在孢子囊枝的分枝格局，孢子囊枝及產生的 abortosporangia 的大小和形狀。其接合孢子為紅褐色、球形、平滑、同形接合，形成於低溫（37°C）中的，而溫度較高時則遭抑制。這種真菌在 50°C 的 PDA、SMA 和 MEA 培養基中生長良好。

關鍵詞：腐爛葉、印度、新物種、*Thermomucor*。