

A new species of *Parapyricularia* from India and a key to all species

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Parapyricularia indica, sp. nov., on living leaves of *Gongronema hemsleyanum* (*Asclepiadaceae*) in subtropical forests of Uttar Pradesh, India, is described, illustrated and compared with other species of *Parapyricularia*. A key to species of *Parapyricularia* is provided. Description and nomenclatural details were deposited in MycoBank.

Keywords: biodiversity, phytopathogenic fungi, anamorph, taxonomy.

Parapyricularia, a genus of dematiaceous hyphomycetes (anamorphic fungi), was described by M. B. Ellis with the type species *Parapyricularia musae* Ellis & Peregrine (Ellis 1972). This genus can be distinguished from other dematiaceous hyphomycetes on the basis of the macronematous conidiophores, each composed of a mononematous stipe and a complex head of branches bearing conidia. The conidiogenous cells are polyblastic, integrated and terminal on the stipe, sympodial and denticulate. Conidia are mostly obturbinate or obclavate with a protuberant hilum. *Parapyricularia* shows similarity with *Pyricularia* Sacc. but the conidiophores of the latter genus are unbranched (Ellis 1972). The branched head of *Parapyricularia* also shows similarity with *Periconiella* Sacc., but the conidiogenous cells of *Periconiella* bear cicatrized scars (Ellis 1972).

Three species of *Parapyricularia* have been described: *P. brasiliensis* Silva *et al.* (Silva *et al.* 2005), *P. gymnematis* B. Rai & Kamal (Rai & Kamal 1985) and *P. musae* M. B. Ellis & Peregrine (Ellis 1972). Conidial (size, shape, shape of hilum and septation) and conidiophore characters (size of stipe, the proliferation of heads and size of primary branches) have been used to dis-

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tinguish species within the genus (Ellis 1972, 1976; Rai & Kamal 1985; Silva *et al.* 2005).

Materials and methods

Specimens with disease symptoms of fungi on living leaves were collected during the course of field trips. Microscopic characteristics were observed using leaf sections made with a razor blade. Detailed observations of morphological characters were carried out by means of an Olympus CX-31 light microscope using oil immersion (1000 \times). Morphological descriptions are based on slide preparations mounted in cotton-blue from infected area of leaves. Measurements were made of 20 conidia, hila, and conidiophores. Line drawings were prepared at a magnification of 1000 \times . The material examined is deposited in the Herbarium Cryptogamiae Indiae Orientalis (HCIO), Indian Agricultural Research Institute, New Delhi, India; and an isotype was retained in the herbarium of Department of Botany, D.D.U. Gorakhpur University (GPU).

Taxonomy

Parapyricularia indica R. Singh, Sham. Kumar, Archana Singh & K. Shukla, **sp. nov.** – Figs. 1–5
Mycobank no.: MB 519072

Maculae hypogaeae, irregulares, extensae per totum folii, brunneae vel atrobunneae. Caespituli in hypophyllo, effusi, brunnei. Mycelium partim superficiale ex hyphis ramosis, septatis, laevibus, brunneis, compositum. Conidiophora macronematosa, mononematosa, singularia infra et capitulo composita, recta vel flexuosa, cylindrica, ramosa vel non ramosa, crassitunicata, laevia, geniculata, brunnea, ad basim inflata, ad apicem curvata, 155–220 \times 4–10 μm , 4–7-septata. Cellulae conidiogaeae integratae vel discretatae, terminales, geniculatae, polyblasticae, cylindricae, cum cicatricibus incrassatis, 1.5–2 μm latis. Conidia acropleurogena, simplicia, solitaria, sicca, recta vel curvata, cylindrica vel obclavato-cylindrica, olivacea vel brunnea, 2–11-septata, 27–87 \times 3–8 μm , laevia, tenuitunicata, apicem obtusa, ad basim rotundata vel obconico-truncata, hilo incrassato, 1.5–2 μm lato.

Typus. – INDIA, U. P., Mahrajganj, Nichlaul Forest, July 2007, on living leaves of *Gongronema hemsleyanum* Warb., leg. Raghvendra Singh, (holotype – HCIO 30872, isotype Department of Botany, D. D. U. Gorakhpur University, GPU-KSR 394).

Infection spots hypogenous, irregular, spreading on entire leaf surface, brown to dark brown. Colonies hypophyllous, effuse, brown. Mycelium external, superficial, branched, septate, smooth, brown. Stromata, setae, hyphopodia absent. Conidiophores macronematous, mononematous, complex head of branches bearing conidia, straight to flexuous, cylindrical, branched or unbranched, thick-walled, smooth, brown, dark at base becoming lighter towards the apex, base swollen, apex curved, scars thickened, 155–220 \times 4–10 μm , 4–7-septate, fertile head terverticillate, loose. Conidiogenous cells integrated, arising from 1 $^{\circ}$, 2 $^{\circ}$ and 3 $^{\circ}$ branches singly or in whorls of 2 or 3, terminal, geniculate, polyblastic, cylindrical, bearing thickened conidial scars, 1.5–2 μm wide. Conidia acropleurogenous, simple, solitary, dry, straight to curved, cylindrical to obclavate-cylindrical, olivaceous to medium brown,

2–11-septate, 27–87 × 3–8 mm, smooth, thin-walled, septa dark brown, apex obtuse, base rounded to obconico-truncate, hilum thickened, 1.5–2 mm wide.

E t y m o l o g y . – *indica*, referring to India, the country where the fungus was found.

H o s t p l a n t . – On living leaves of *Gongronema hemsleyanum* (*Asclepiadaceae*).

D i s t r i b u t i o n . – India, only known from the type collection.

Key to *Parapyricularia* species

We are providing a key to the genus *Parapyricularia*. The diagnostic morphological species differences are listed in Tab. 1.

1. Hilum protuberant..... 2
- 1*. Hilum not protuberant but thickened and darkened 3
2. Conidia 1–3-septate, up to 33 mm long; conidiophore stipe up to 1000 × 5–9 mm *P. musae*
- 2*. Conidia 1–8-septate, up to 66 mm long; conidiophore stipe 179–418 × 7–13 mm *P. brasiliensis*
3. Conidia 1–6-septate, mycelium internal, stromata present, conidiophores solitary to fasciculate, conidiophore stipe 64.5–195.5 × 5.7–6.8 mm *P. gymnematis*
- 3*. Conidia 2–11-septate, mycelium superficial, stromata absent, conidiophores solitary, conidiophore stipe 155–202 × 4–10 mm .. *P. indica*

Discussion

As it has been confirmed by molecular biology that presence and absence of thickened and darkened conidiogenous loci, slightly thickened and darkened or refractive scars (refractive nature indicates absence of scar), presence or absence of pigmentation in conidiophores and conidia and types of thickened and darkened conidiogenous loci (planate or pileate) are important features of taxonomic relevance (Crous 1999; Stewart *et al.* 1999; Crous *et al.* 2000, 2001 a, b; Untereiner 2000; Pretorius *et al.* 2003; Taylor *et al.* 2003), the new taxon is morphologically compared with other *Parapyricularia* species (Tab. 1).

The conidiophore stipe of *Parapyricularia indica* is shorter and conidia are longer and have more septa than those of *P. brasiliensis* and *P. musae*. The conidial base in *P. indica* is rounded to obconico-truncate whereas it is protuberant in both *P. brasiliensis* and *P. musae*.

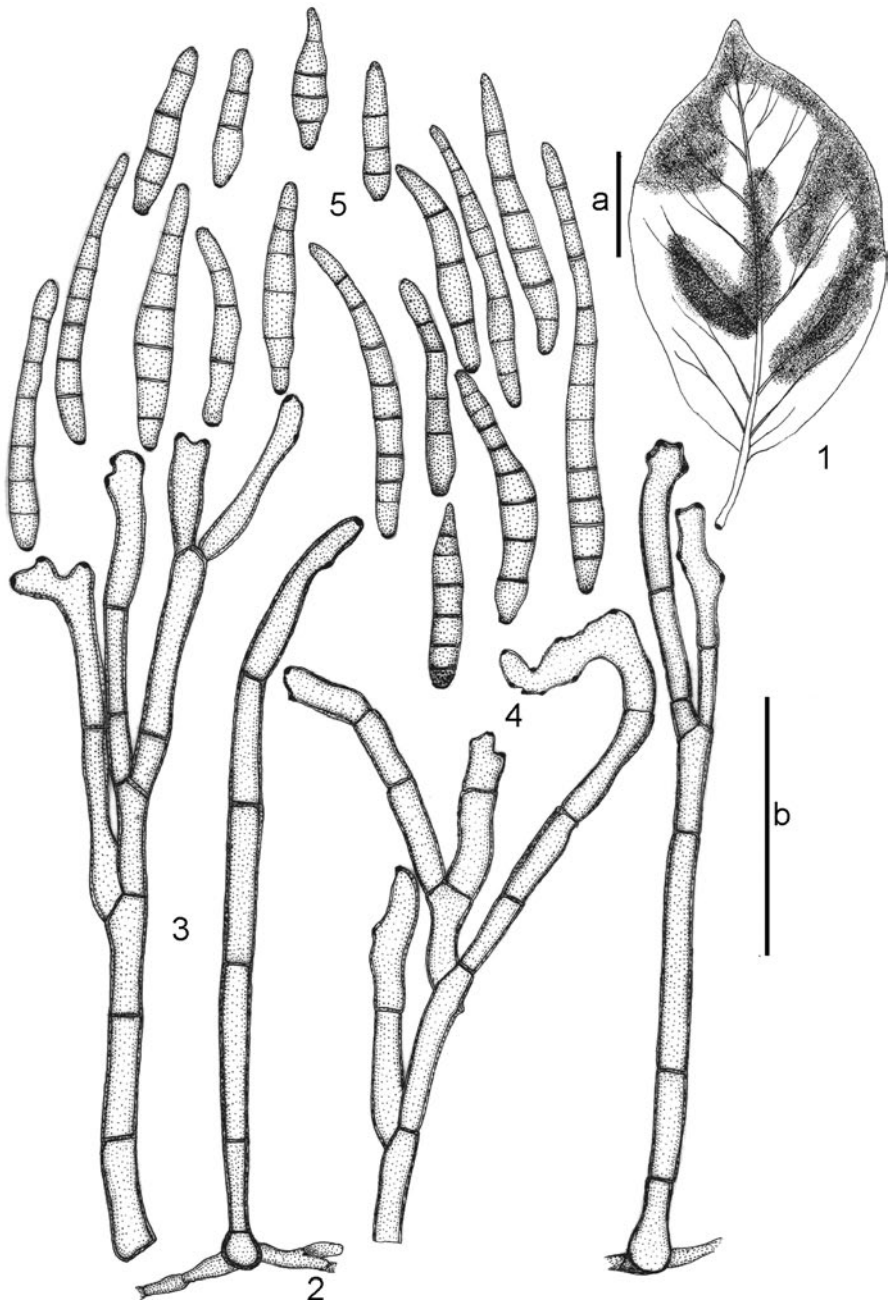
Parapyricularia indica shows similarity only with *P. gymnematis*. Conidia of both species have a non-protuberant hilum with slightly thickened and dark scars. Conidia of *P. indica* have more septa and conidiophore stipes are longer and thicker than those of *P. gymnematis*. Mycelium in *P. indica* is superficial and there are no stromata while in *P. gymnematis*, the mycelium is immersed and there are substomatal stromata from which fascicles of conidiophores develop.

Tab. 1. Comparative morphology of Parapyricularia spp.

| Species | M ¹ | S ² | Conidiophores | | | Conidia | | | Host |
|------------------------|----------------|----------------|-------------------------|---|-------------------|---------|---|--|------|
| | | | Conidiomata | Size (µm) | Size (µm) | Septa | Filum | Filum | |
| <i>P. brasiliensis</i> | S | A | solitary | stipe 179–418 × 7.0–13, primary branches 18.5–72 × 4.0–6.5 | 19.5–66 × 4.5–6 | 1–8 | protuberant and dark | <i>Gmelina arborea</i> (Lamiaceae) | |
| <i>P. gymnematis</i> | I | SS | solitary to fasciculate | stipe 64.5–195.5 × 5.7–6.8, primary branches 16–85 × 4.6–6.8 | 27.5–82.8 × 4–6.3 | 1–6 | not protuberant but slightly thickened and dark | <i>Gymnema tingens</i> (Asclepiadaceae) | |
| <i>P. indica</i> | S | A | solitary | stipe 155–220 × 4–10, primary branches (35–)56 (–75) × 4–6 | 27–87 × 3–8 | 2–11 | not protuberant but thickened and dark | <i>Gongronema hemsleyanum</i> (Asclepiadaceae) | |
| <i>P. musae</i> | S | A | solitary | stipe up to 1000 × 5–9, primary branches up to 120 × 4–6 | 27–33 × 7–10 | 1–3 | protuberant | <i>Musa</i> sp. (Musaceae) | |

¹ Mycelium (M), superficial (S), internal (I)

² Stromata (S), absent (A), substomatal (SS)



Figs. 1–5. *Parapyricularia indica* (HCIO 30872, holotype) on *Gongronema hemsleyanum*. 1. Symptoms on leaf. 2. External mycelium. 3. Stipes. 4. Conidiophores with complex head of branches. 5. Conidia. Bars: a 20 mm, b 50 μ m.

A cercosporoid species, *Stenella gongronematis* (J. M. Yen & Gilles) Deighton (Deighton 1979), has been also reported on the same host genus. However, this species possesses verruculose or rugulose conidia and conidiophores, with cicatrized, pileate conidiogenous loci.

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