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NEW CONIDIAL FUNGI FROM ANDAMAN ISLANDS, INDIA

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ABSTRACT

Four new species of litter-inhabiting Hyphomycetes are described from the forests of Middle Andaman Island, India. These are: (1) *Argopericonia indiraei* sp. nov, characterized by catenate, globose, hyaline blastic conidia developing on flexuous conidiophores with discrete conidiogenous cells; (2) *Virgatospora natarajensis* sp. nov. producing fusiform, non-septate, olive green to dark brown, phialidic conidia with longitudinal surface ridges on erect synnematous conidiomata, both isolated from decaying leaves of *Calamus thwaitesii*; (3) *Phialocephala vittalensis* sp. nov. with catenate, 1-septate, pale brown, phialidic conidia developing on apically branched conidiophores; and (4) *Stratiphoromyces raghukumarensis* sp. nov. producing fusiform, curved, 1-septate, phialidic conidia on percurrently regenerating conidiophores, isolated from fallen leaves of *Caryota urens*.

Key words: Biodiversity, Taxonomy, Hyphomycetes

INTRODUCTION

The Andamans, a string of about 350 islands in the Bay of Bengal, lying between 6° and 14°N, and 92° and 94° E, harbour dense evergreen tropical forests in their interiors while extensive mangrove swamps fringe their coastlines. The islands have a warm and humid climate with temperature ranging from 24°-36°C, relative humidity between 80-90% and rainfall of up to 450 cm per year. Geographic isolation and relative inaccessibility from the mainland have thus far contributed to preservation of the forests on the islands.

No authoritative reports have yet been published on the litter fungi of Andaman and Nicobar Islands, India, except that of Bhat & Kendrick (1993). During a floristic study of the fungi of the forests of the Andaman Islands and Western Ghats in southern India, Bhat and Kendrick (1993) described 9 new conidial fungi from the Andaman region. In the present study, an additional 4 novel taxa of hyphomycetes isolated from fallen and decaying leaves of *Calamus thwaitesii* Becc. and *Caryota urens* Linn. are described.

These hitherto unknown fungi are named in honour of four contemporary mycologists who have contributed significantly to the development of taxonomic mycology in India.

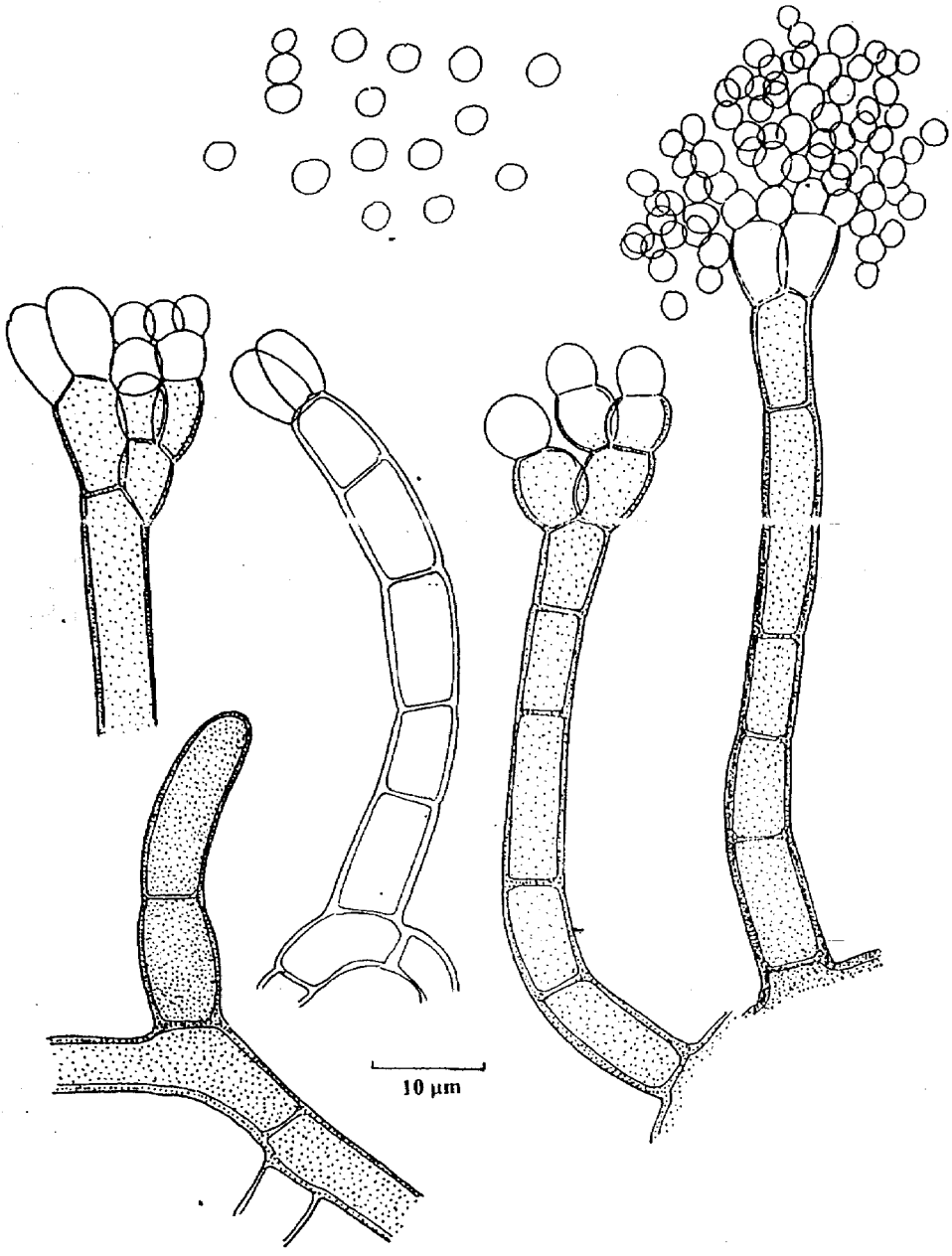

Fig.1. *Argopericonia indiraei:* a.Young conidiophore, b. Conidiophore with conidiogenous cells, c. Conidiophore with conidiogenous cells and catenate conidia.

MATERIALS AND METHODS

Fallen and decaying leaves of *Calamus thwaitesii* Becc. and *Caryota urens* Linn. were air-lifted to the mainland and incubated in sterile moist chambers for 7-14 days. The sporulating fungi were mounted in lactophenol and examined under the microscope.

Part of the leaf litter was cut into small bits and ground to fine particles in an electric blender. The particles were filtered through two superimposed metal sieves with mesh size of 250µm and 100 µm. The fine particles of between 100 and 250 µm size, trapped in the lower sieve, were repeatedly washed in sterile distilled water and plated on malt extract agar (MEA) medium containing a mixture of antibiotics (Bacitracin 0.02 g, Neomycin 0.02 g, Penicillin G 0.02g, Polymixin 0.02g, Streptomycin 0.02g and Terramycin 0.04g dissolved in 10 ml of distilled water and added to 1 L of MEA medium). Fungal hyphae arising from the particles were aseptically and individually transferred into fresh MEA slants. The fungi in culture sporulated after several weeks of incubation. These were examined under the microscope. Camera lucida drawings were made using a drawing tube attached to an Olympus microscope.

TAXONOMIC DESCRIPTION

Argopericonia indiraei **sp.nov.** (Fig. 1, a-d)
[Named in honour of Dr. Indira Kalyanasundaram, C.A.S.in Botany, University of Madras, Chennai, India]

Ad fungos conidiales, Hyphomycetes, pertinens. *Coloniae* in MEA regulares, tardus cresco, atro olivaceo viridis, ad marginiae rhizoidalis, usque ad 1 cm diam post 7 dies. *Mycelium* humiduin partim immersum, ex hyphis superficialis laevis, septatis, ramosis, tenui-tunicatis, pallide brunnis, 1.5-2 µm latis compositis. *Conidiophora* ex mycelii superficialis orienda, singula, discreta, erecta, recta, laevia, 3-7-septata, ramosa versus apicem, atrobrunnea, crassitunicata, 50-115 x 3-5 µm. *Cellulae conidiogenae* discretae, terminales, ellipsoideae, polyblasticae, cicatrices non incrassatae, laeviae, hyalinae, 4-5 x 2-3 µm. *Conidia* solitaria vel catenata, in catenis ramosis acropetalia; globosa, non-septata (amerosporia), laevia, hyalina, 2.5-4 µm diam, collapsis in mucosa massis.

HOLOTYPUS: Cultura in MEA exiccata, extractis in putridinis foliis *Calamus thwaitesii*, Middle Andaman Islands, leg. Maria D'Souza, 31 Jan. 2000, IMI 386675

Conidial fungi, hyphomycetes. *Colonies* on MEA regular in outline, adpressed, flat, with rhizoidal margin, dark olive green, slow growing, attaining a diam of 1 cm after 7 days. *Mycelium* partly immersed, partly superficial, composed of smooth-walled, septate, branched, pale brown, hyphae 1.5-2 µm wide, often aggregated into superficial mycelial knots 10-20 µm diam. *Conidiophores* single, discrete, erect, straight or flexuous, smooth, thick-walled, 3-7-septate, 50-115 x 3-5 µm, dark brown in the lower half, branched and pale brown to colourless toward the tip, with rhizoid-like branches at the base, arising from superficial mycelium. *Conidiogenous cells* discrete, terminal, ellipsoidal, colourless, polyblastic, with unthickened scars, 4-5 x 2-3 µm. *Conidia* solitary to catenate, globose, nonseptate (amerosporous), smooth, hyaline, 2.5-4 µm diam, developing in branched, acropetal chains, often collapsing into slimy, globular mass.

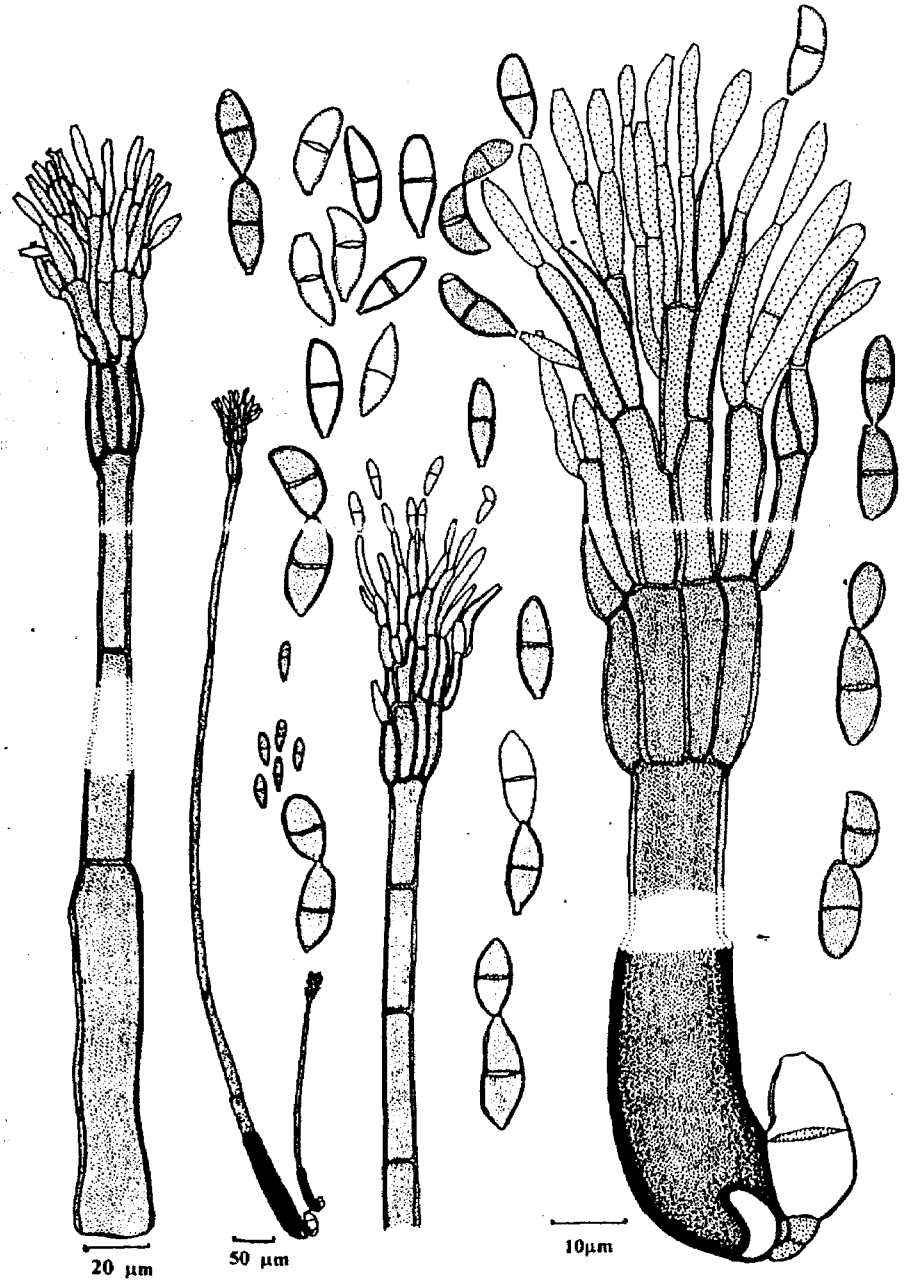

Fig.2. *Phialocephala vittalensis:* **a.** Mature conidiophores, **b.** Enlarged conidiophores, **c.** Conidia, **d.** Catenate conidia.

The previously monotypic genus *Argopericonia* B.Sutton & Pascoe (1987), typified by *A. elegans* B.Sutton & Pascoe, is characterized by production of solitary or shortly catenate, hyaline, ellipsoidal, smooth, polyblastic conidia on integrated hyaline, apical, cuneiform conidiogenous cells, and dark brown, single conidiophores. Conidiogenesis in *Argopericonia* is similar to that of *Periconia* Tode: Fr. Though similar to *Argopericonia elegans*, *A. indiraei* differs from the type by its (i) globose and smaller conidia (conidia in *A. elegans* are ellipsoidal, 11-12.5 x 7-8.5 µm) which develop in branched, acropetal chains and often collapse into slimy, globular masses, (ii) terminally branched conidiophores and (iii) conidiophores arising from rhizoid-like branches at the base.

Phialocephala vittalensis **sp. nov.** (Fig.2, a-d)
[Named in honour of Dr. B.P.R. Vittal, C.A.S. in Botany, University of Madras, Chennai, India)]

Ad fungos conidiales, Hyphomycetes, pertinens. *Coloniae* effusae, amphigenae. *Mycelium* partim immersum, ex hyphis superficialis septatis, laevis, ramosis, tenui-tunicatis, hyalinis, 2-3 µm latis, composito. *Conidiophora* singula, erecta, recta vel raro flexuosa, laevia, atrobrunnea, crassitunicata, 4-6-septata, 360-1200 x 10-20 µm, usque ad 25 µm lata ad basim,10-15 µm lata ad apicem, palliodora versus supra dimidiatum, septatum, ex stipite penicilliformi composita et ordenare in 3-5 serie metularum. *Cellulae conidiogenae* in conidiophoris incorporatae, terminales, monophialidicae, enteroblasticae, tenui-tunicatae, subhyalinae, hyalo non incrassato, 10-30 x 2.5-5 µm, experse collaretto, *Conidia* solitaria to catenata, in catenis subterminaliter formata, fusiforma vel ellipsoidea, recta vel curvata, basim attenuate truncata, apicem papillata vel rotundata, laevia, 1-septata, pelleda brunnea, 9-18 x 3-5 µm, omnia glutinata.

HOLOTYPUS: In foliis emortuis *Caryota urens*, Middle Andaman Island, leg. Rajiv Kumar, 15 Dec. 2000, IMI 386678.

Conidial fungi, hyphomycetes. *Colonies* effuse, amphigenous. *Mycelium* partly immersed, composed of septate, branched, smooth hyphae 2-3 µm wide. *Conidiophores* solitary, erect, straight to rarely flexuous, smooth-walled, dark brown, thick-walled, 4-6-septate, 360-1200 x 10-20 µm, up to 25 µm wide at the base, slightly paler and penicillately branched in the apical region, with 3-5 series of metulae bearing an apical cluster of phialides. *Conidiogenous cells* terminal, discrete, monophialidic, enteroblastic, thin-walled, subhyaline, 10-30 x 2.5-5 µm, without collarette. *Conidia* solitary to shortly-catenate, in subterminally attached chains, fusiform to ellipsoidal, slightly curved, base narrowly truncate, papillate to rounded at the tip, smooth, 1-septate (didymosporous), mid brown, 9-18 x 3-5 µm, produced in slimy masses.

The genus *Phialocephala* W.B.Kendr. (Kendrick, 1961), with *P. dimorphospora* W.B.Kendr. as type species, presently accommodates 21 species reported from all over the world (Crane, 1971; Jong & Davis, 1972; Kendrick, 1963a,b; Kendrick, 1964; Kowalski & Kehr, 1995; Kirschner & Oberwinkler, 1998; Maggi & Persiani, 1984; Matsushima, 1989; Onofri & Zucconi, 1984; Onofri et al., 1994; Shearer et al., 1976; Siegfried et al., 1992; Sutton, 1975; Sivasithamparam, 1975; Wingfield, 1985; Wang & Wilcox, 1985; Wingfield et al., 1987; Vujanovic et al., 2000). According to Onofri & Zucconi (1984) and Vujanovic et al. (2000), who provided taxonomic keys, the species of *Phialocephala* can be segregated into two groups, those with well-defined and conspicuous collarettes on the phialides and those without well-defined collarettes. *P. vittalensis* falls into the latter

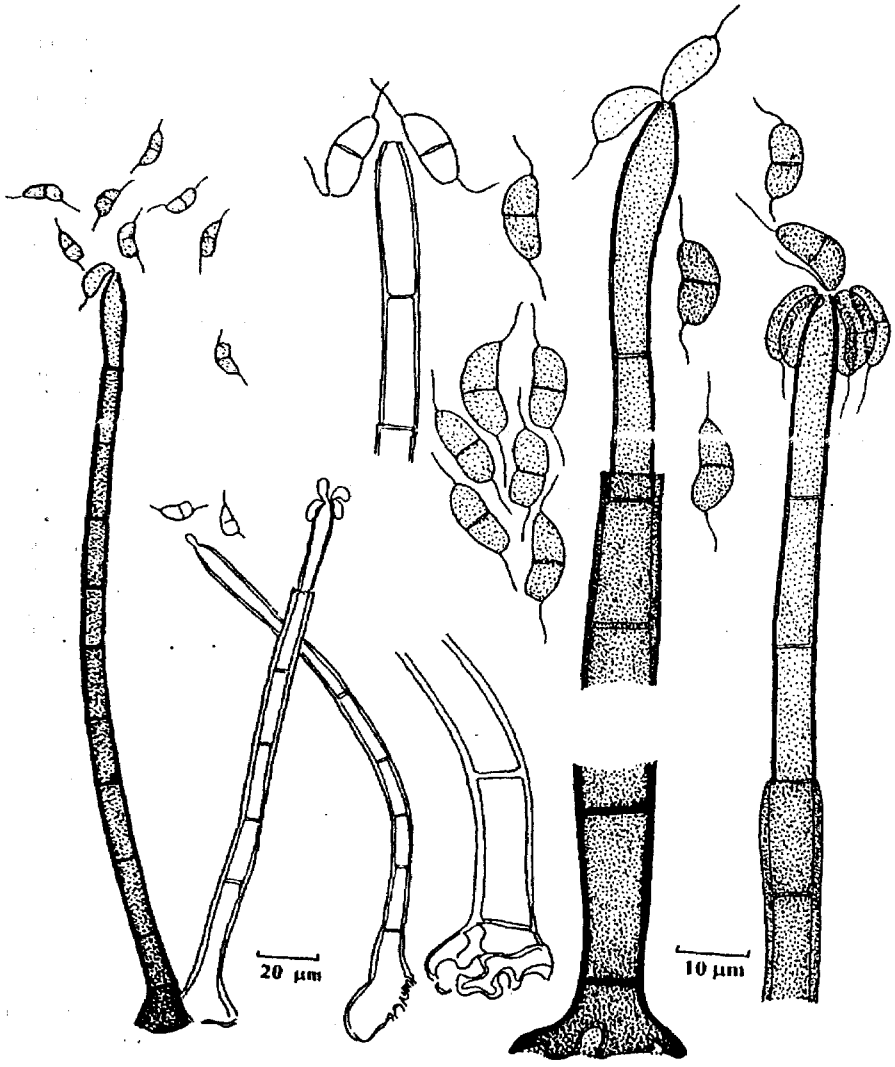

Fig. 3. *Stratiphoromyces raghukumarensis:* **a.** Mature conidiophores, **b.** Portion of conidiophores and conidiogenous cells, **c.** Conidia.

category. Further, among the species without conspicuous collarettes, *P. vittalensis* can be compared only with *P. ivoriensis* Zucconi & Onofri, in which the conidia are catenate, terminally attached to each other in the chain, subcylindrical, non-septate, pale brown and 4.5-5.4 x 1.8-2.2 µm. *P. vittalensis* differs in its fusiform, apically papillate, curved, 1-septate (didymosporous), mid brown conidia, 9-18 x 3-5 µm, arranged in subterminally attached chains.

Stratiphoromyces raghukumarensis **sp. nov.** (Fig.3, a-c)
[Named in honour of Dr. S. Raghukumar, National Institute of Oceanography, Goa, India]

Ad fungos conidiales, Hyphomycetes, pertinens. *Coloniae* in substrato naturali effusae, atrobrunneae. *Mycelium* partim immersum, ex hyphis superficialis septatis, laevis, ramosis, tenui-tunicatis, hyalinis vel pallide brunneis, 2-2.5 µm latis, composito. *Conidiophora* singula, erecta, recta vel flexuosa, multiseptata, non-ramosa, crassitunicata, atrobrunnea ad basim, luteobrunnea vel fere hyalinae ad apicem, regeneratione percurrenti, 120-250 x 9-15 µm. *Cellulae conidiogenae* monophialidicae, incorporatae terminales, lageniformes, supra medium ad crassa, apicem versus deminutae crassae, successione conidiorum planum eundem producentes proliferatione enteroblastica, 30-40 x 5-8 µm, experse collaretto. *Conidia* solitaria, ellipsoidea, curvata, laevia, 1-septata, nonconstricta ad septa, ex cellula distalis triangularia, cellula proximitatis rhomboidea cum hilo inflato praedita, laevia, 10-15 x 3-5 µm; una setula ad apicem et una ad basim, flexuosa, usque ad 8 µm longa.

HOLOTYPUS: In foliis emortuis *Caryota urens*, Middle Andaman Island, leg. Rajiv Kumar, 15 Dec. 2000, IMI 386679.

Conidial fungi, hyphomycetes. *Colonies* on natural substrate effuse, confined to the edges of leaf substrate, dark brown. *Mycelium* partly immersed, composed of septate, branched, hyaline to pale brown, smooth hyphae 2-2.5 µm wide. *Conidiophores* single, erect, straight to flexuous, multiseptate, unbranched, thick-walled, dark brown in the lower half, light brown at the apex, percurrently regenerating from broken ends, 120-250 x 9-15 µm. *Conidiogenous cells* monophialidic, integrated, terminal, spathulate to lageniform, broadest above the middle, narrower at the apex, without a collarette, 30-40 x 5-8 µm, with simultaneously developing enteroblastic conidia. *Conidia* solitary, ellipsoidal, slightly curved, 1-septate, not constricted at the septum, with distal cell triangular and proximal cell rhomboidal, without a protuberant hilum, rounded at the tip, smooth-walled, 10-15 x 3-5 µm, with a single, flexuous setula up to 8 µm long at each end.

With its spathulate to lageniform, phialidic conidiogenous cells and setulate, ellipsoidal, curved, moderately brown didymoconidia, this fungus shows some similarity to *Kylindria excentrica* Bhat & B.Sutton (1985) and *Stratiphoromyces brunneisporus* Goh & Hyde (1998). The genus *Kylindria* DiCosmo, Berch & W.B.Kendr. (DoCosmo & al., 1983), with *K. triseptata* (Matsush.) DiCosmo et al. as type, is characterized by production of one- to several-septate, colourless conidia from monophialidic conidiogenous cells with narrow apertures, borne on setiform, dark conidiophores, whereas in the monotypic genus *Stratiphoromyces* Goh & K.D.Hyde (1998), typified by *S. brunneisporus* Goh & K.D.Hyde, the conidiophores are stout, erect, mononematous and percurrently regenerating, and the conidiogenous cells repeatedly proliferate to produce a crop of solitary, rhexolytically

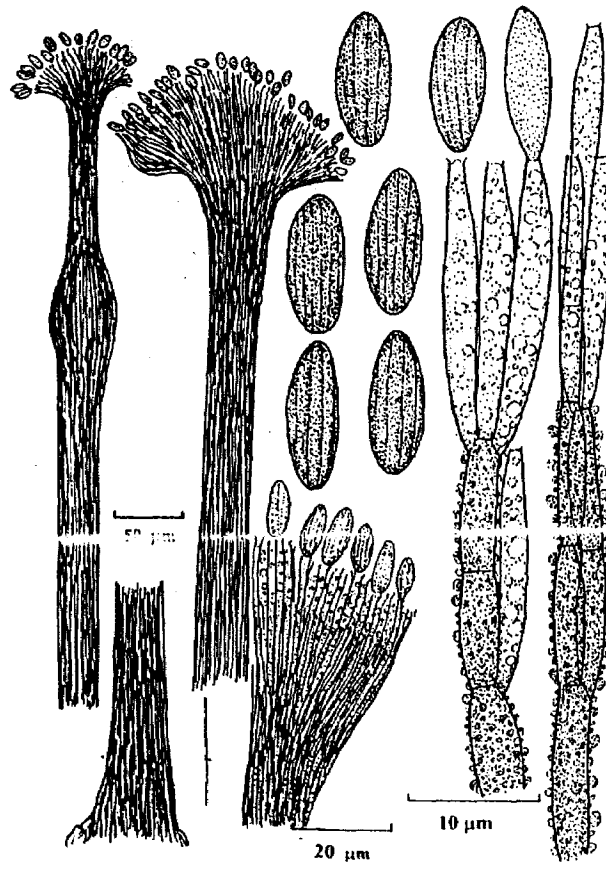

Fig. 4. *Virgatospora natarajanii*: **a.** Synnema, **b.** Portion of synnema, **c.** Conidiogenous cells (phialides), **d.** Conidia.

seceding, brown, 1-septate, curved, setulate conidia with a triangular distal cell and a rhomboidal proximal cell with a conspicuously protruding hilum.

In our opinion, conidiogenesis in *Stratiphoromyces* is phialidic and similar to that in *Kylindria*. The illustration in Fig. 20 of *Stratiphoromyces brunneisporus* (p. 1151, Goh & Hyde, 1998), clearly shows a conidiogenous cell with narrow apical aperture and phialidic conidiogenesis. There is a need for reexamination of the type of *S. brunneisporus* and redescription of the genus *Stratiphoromyces*.

However, the moderately brown, setulate, 1-septate, curved conidia with distal triangular cell and proximal rhomboidal cell of *Stratiphoromyces* significantly differ from those of *Kylindria*. Our fungus is similar to *Stratiphoromyces* in its conidial morphology and is therefore described as a new species, *S. raghukumarensis*, which differs from the type species in having occasionally proliferating conidiophores and the absence of a protruding hilum from the rhomboidal proximal cell of the conidium.

Virgatospora natarajanensis **sp.nov.** (Fig.4, a-d)
[Named in honour of Dr. K. Natarajan, C.A.S. in Botany, University of Madras, Chennai, India]

Ad fungos conidiales, hyphomycetes, pertinens. *Coloniae* effusae, olivaceae melano, ex synnematis numeroso irregulariter interspersus, rectus, de leuco vel griseus, viridulus mucosus capitatus, compositum. *Mycelium* plerumque in substrato immersum, ex hyphis crassitunicatis, septatis, ramosis, hyalinis, 2-4 µm lat. composito. *Conidiomata* synnematosa, *conidiophoris* crassitunicatis, septatis, ramosis, laevis inter basilaris partis, distinctae echinulatus inter apicalis fertilis regionis, subhyaliniš; synnemata usque ad 680 µm longa, in basim usque ad 90 µm, in medio 25-35 µm lat., apice in capitulum fertile expanso usque ad 170 µm lat. *Cellulae conidiogenae* monophialidicae, discretae, plerumque terminales, interdum subterminales, elongatae, subcylindricae, recte vel subcurvatae, 18-25 µm longae, in basim usque ad 2-2.5 µm lat., in medio 2-3.5 µm lat, usque ad 1.5 µm lat. in apicem, cum collarulo distincto apicali 2.5 µm lat. *Conidia* solitaria, ellipsoidea vel fusiformia, aseptata, olivea viridis vel brunneis, cum costatis distinctis longitudinalis in superficie, 10-13.5 µm longa, 3.5-4.5 µm lat. in medio, rotundata ambi terminalis, crassitunicata, aggregatae in capitatis mucosis ad apicem synnemata.

HOLOTYPUS: In foliis emortuis *Calamus thwaitesii*, Middle Andaman Island, leg. Rajiv Kumar, 15 Dec.2000, IMI 386680.

Conidial fungi, hyphomycetes. *Colonies* effuse, olivaceous black, composed of a number of irregularly scattered erect, off-white to greyish, synnematal conidiomata with greenish slimy heads. *Mycelium* partly immersed, composed of smooth, septate, and branched, hyaline, thin-walled, hyphae 2-3 µm wide. *Conidiomata* synnematous, *conidiophores* thick-walled, septate, branched, smooth below, distinctly echinulate toward the apex, subhyaline, synnemata up to 680 µm long, up to 90 µm thick at the base, 25-35 µm thick in the middle, up to 170 µm thick at the flared apex. *Conidiogenous cells* monophialidic, discrete, mostly terminal, sometimes subterminal, elongate, subcylindrical, straight or slightly curved, smooth, 18-25 µm long, 2-2.5 µm wide at the base, 2-3.5 µm wide in the middle, up to 1.5 µm wide at the tip, with a distinct collarette 2.5 µm wide at the apex. *Conidia* solitary, ellipsoidal to fusiform, non-septate (amerosporous), pale olive green to brown, with distinct longitudinal ridges on the surface, 10-13.5 µm long, 3.5-4.5 µm wide in the middle, rounded at both ends, thick-walled, aggregated in large slimy heads at the tips of synnemata.

The monotypic genus *Virgatospora* Finley (1967), with *V. echinofibrosa* Finley as type species, was described for synnematous fungi producing slimy, septate, phialidic conidia with distinct longitudinal ridges, on the surface on echinulate conidiophores (Bills et al., 1994). *V. natarajanensis* differs from the type by its fusiform, non-septate, smaller conidia. The conidia in *V. echinofibrosa* are ellipsoidal to limoniform, papillate at both ends, curved, 3-septate (phragmosporous), grey to dark brown, 38-45 x 12-15 µm, whereas in *V. natarajensis* the conidia are fusiform, non-septate (amerosporous), rounded at both ends and 10-13.5 x 3.5-4.5 µm.

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