

# New or critical Hyphomycetes from India

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## Summary

Thirty-two Hyphomycetes on rotten plant material collected at several localities at the Indian subcontinent are described and illustrated, mostly directly from the natural substrate, but occasionally also after pure cultures. Two new combinations are proposed in *Monodictys*; new species are described in *Brachydesmiella*, *Monotosporella*, *Dendryphiosphaera*, *Cheiromyces*, *Monodictys*, *Hematomyces*, *Leptodontidium*, *Ramichloridium*, *Spadicoides*, *Cordana*, *Exserticlava*, *Vermispora*, *Haplographium*, *Menisporopsis*, *Craspedodidymum*, *Bahusutrabeaja*, *Gyrothrix* and *Helminthosporium*. A new variety of *Brachydesmiella biseptata* is proposed. Preliminary keys are given to the hitherto known species of *Pithomyces* and *Monodictys*. A list of further Indian species found in the course of the study is provided.

## Introduction

Indian Hyphomycetes have been studied by several native and foreign mycologists, particularly by C.V. Subramanian, V. Agnihotru, P. Raghuveer Rao, and others. An attempt to present a systematic review of these fungi, expanding the lists published between 1918 and 1981 as "The Fungi of India", was made by Subramanian (1971). During the last decennia numerous tropical Hyphomycetes from other parts of the world have become known through the work of, for example, M.B. Ellis, S.J. Hughes, T. Matsushima, K.A. Pirozynski, B.C. Sutton, D. Lunghini and V. Holubová-Jechová.

The senior author has collected fungi on leaf litter and rotten wood for nearly twenty years; many of these appeared to be undescribed. A selection of material was studied during a three-month visit to the Centraalbureau voor Schimmelcultures in 1985/6. Most specimens originate from tropical forests in the states of Karnataka, Andhra Pradesh, Kerala, Maharashtra, Uttar Pradesh and Orissa (Fig. 1). [p. 2]

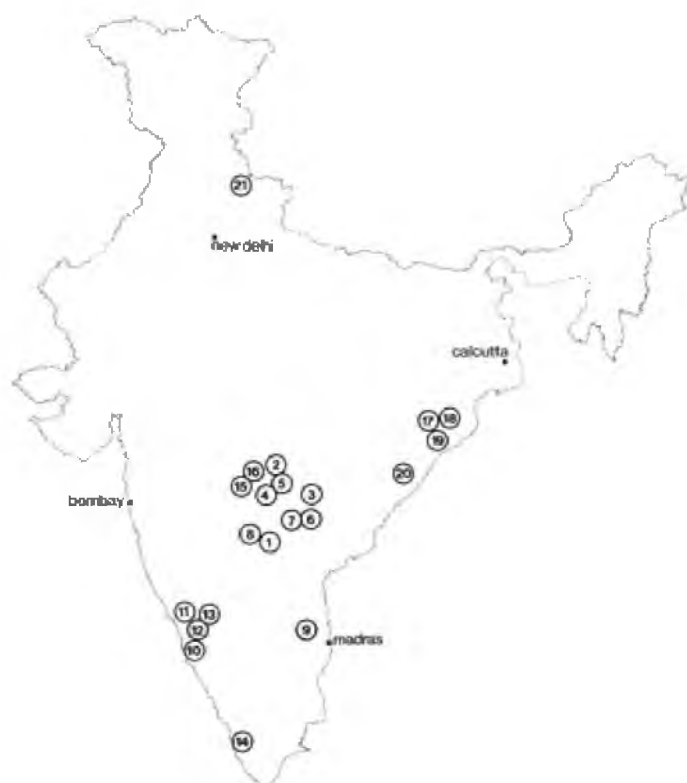


Fig. 1  
Collection sites in India. 1. Hyderabad; 2. Adilabad; 3. Mahadepur; 4. Narsapur; 5. Nirmal; 6. Pakhal; 7. Warangal; 8. Vikarabad; 9. Tirupati; 10. Agumbe; 11. Jog Falls; 12. Tirthahalli; 13. Sonda; 14. Cochin; 15. Tulajapur; 16. Ambajogai; 17. Balimeda; 18. Langigarah; 19. Sunki; 20. Ramagiri; 21. Dehra Dun.

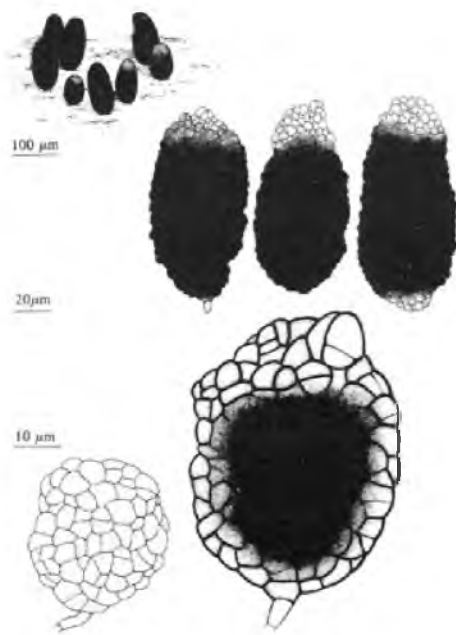


Fig. 14  
*Monodictys lepraria*, CBS-H 3905 on the natural substrate.

## Monodictys lepraria (Berk.) M.B. Ellis - Fig. 14

*Sporidesmium leprarium* Berk. - Kew J. Bot. 5: 43. 1853 = *Monodictys lepraria* (Berk.) M.B. Ellis - More demat. Hyphom. p. 44. 1976.

Colonies on rotten wood effuse, with irregular outline, farinose, blackish brown; under the stereo microscope individual conidia are visible, standing erect on the substratum, scattered or somewhat aggregated, jet black, glistening, [p. 26] somewhat immersed at early stages of development but soon superficial. Mycelium scanty, mostly immersed; hyphae (sub)hyaline, 2-3 µm wide. Conidia arising terminally from short, undifferentiated hyphal branches, formed as hyaline, globose blown-out ends which gradually become brownish and develop numerous septa by meristematic growth; conidia finally with thick cell walls, dark olivaceous brown to black; meristematic development then restricted to the apical zone, as a result the conidia becoming elongate, erect, with light apex. Mature conidia smooth-walled, ellipsoidal to ovoidal, muriform, constricted at the septa, 80-110 x 30-50 µm; conidial secession schizolytic.

### Material examined

CBS-H 3905, on rotten twigs, associated with *Sporoschisma mirabile* Berk. & Br. and *Kylindria excentrica* Bhat & Sutton, Agumbe, Karnataka, India, V. Rao, Oct. 1985; CBS-H 3943, on rotten wood, Jog Falls, Karnataka, V. Rao, Oct. 1985; CBS-H 3967, on rotten wood, Karimnagar, Andhra Pradesh, India, V. Rao, Oct. 1984.

### Discussion

Ellis (1976) listed *Monodictys cellulosa* Hughes (= *Sporidesmium cellulosum* Sacc.) as a synonym, but the authentic description and illustration given by Saccardo (1881a,b) clearly shows the presence of large, hyaline conidiophores in that species. The type material (PAD) showed brown, elongate, sometimes apparently catenulate conidia, distinct from those of *M. lepraria*.

Probably due to the slow development, conidia can be found in all stages of maturation, and consequently the species seems to be quite variable (Ellis, 1976). However, fully mature conidia in the collection from Agumbe were remarkably similar, all about 100 µm in length. Chouhan & Panwar (1980) reported the species from India, but apparently their specimen was immature, judging from the conidial dimensions given as 20-85 x 16-48 µm. The present collection exactly matches the description of the *Monodictys* anamorph of *Tubeufia amazonensis* Samuels et al. (1978).

## Monodictys abuensis (Chouhan & Panwar) Vasant Rao & de Hoog, comb. nov. - Fig. 15

*Berkleasium abuense* Chouhan & Panwar - Indian Phytopath. 33: 287. 1980 (basionym).

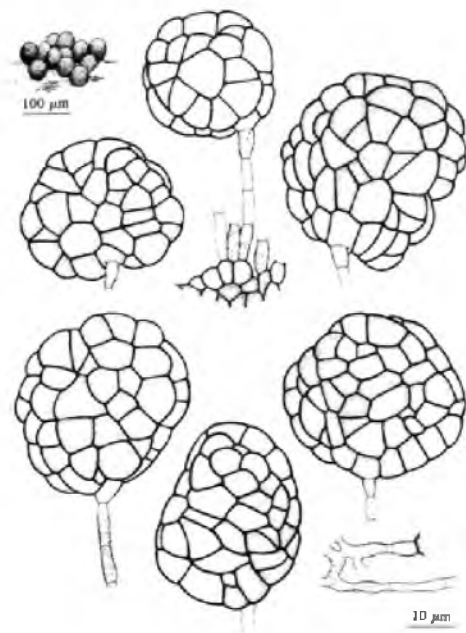


Fig. 15  
*Monodictys abuensis*, CBS-H 3904 on the natural substrate.

Colonies on rotten wood punctiform, black; under the stereo microscope circular, moriform patches are visible up to 100 µm diam, composed of densely aggregated conidia which are blackish and glistening; colonies partly immersed when young, later erumpent, with some superficial mycelium composed of irregularly branched hyphae. Hyphae subhyaline to pale [p. 27] olivaceous brown, 2-3 µm wide, with mostly verrucose walls of variable thickness and thin septa. Locally some immersed stroma is found composed of brown, thick-walled, (sub)globose cells about 3-5 µm diam. Conidia arising terminally from undifferentiated hyphae or short lateral branches, moderately thick-walled, smooth-walled or slightly verrucose, dull olivaceous brown, (sub)globose, 25-45 µm diam; conidia muriform, slightly constricted at the septa; conidial maturation by meristematic growth of the entire conidium; conidial secession possibly rhexolytic. [p. 28]

#### Material examined

CBS-H 3904 = VMRL 2555, on rotten bark, Nirmal, Andhra Pradesh, India, V. Rao & D.R. Kumar, Sept. 1984; CBS-H 3912, on rotten wood and bark, Narsapur forest, Andhra Pradesh, India, V. Rao, Oct. 1983.

#### Discussion

The fungus usually produces more or less circular, moriform colonies; only few conidia are formed solitarily. For this reason Chouhan & Panwar (1980) classified it in *Berkleasmiium*. However, real stromata are absent, at most some local stromatic cells being present at the centre of the colony. The further structure and development is sufficiently similar to other species of *Monodictys* to warrant its reclassification in that genus.

The conidia develop by meristematic growth, which takes place all over the conidial body. In this respect the present fungus is clearly different from *Pithomyces*, in spite of the fact that conidial secession is possibly rhexolytic.

The conidia are liberated rather easily. During maturation, the central conidia of the moriform clusters sometimes seem to be slightly lifted above the substrate. Locally intercalary, hyaline, thin-walled fragments of variable length are seen in hyphae that are otherwise brown. At the proximal insertion the outer cell wall seems to be discontinuous. This would point to some intercalary expansion growth of these hyphae. Whether or not this mechanism serves conidial secession, could not be ascertained.

*Monodictys abuensis* is very close to *M. nitens* (Schw.) Hughes, but this species has slightly smaller, broadly ellipsoidal conidia measuring 25-40 x 18-37 µm, rather than (sub)globose conidia. *M. abuensis* is also similar to *M. pandani* Mats. (Matsushima, 1985), but in that species the conidia are sessile on creeping, smooth-walled hyphae. Matsushima (1975) originally described this species under the name *M. ericoctona* (A. Braun & de Bary) Mats., but later (1985) corrected this conclusion. Indeed a figure of *Stemphylium ericoctonum* A. Braun & de Bary published in Lindau (1910) shows a fungus with clavate conidia lacking oblique septa. *M. putredinis* (Wallr.) Hughes is also similar, but has considerably darker conidia (Ellis, 1971a), while *M. paradoxa* (Corda) Hughes is smaller and should have markedly inflated conidiophore cells (Hughes, 1950). A further species close to *M. abuensis* is *Pithomyces cinnamomeus* Hol.-Jech. (Holubová-Jechová & Mercado, 1984). This species, however, has cinnamon brown conidia which are sessile on creeping hyphae and are liberated by rhexolytic secession.

## **Monodictys gemmipara** Vasant Rao & de Hoog, sp. nov. - Fig. 16

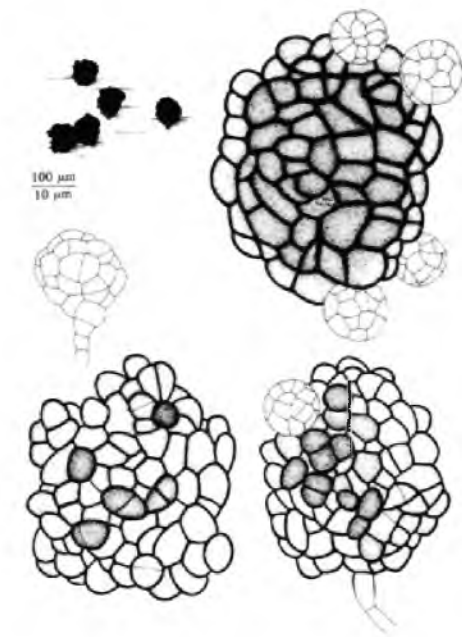


Fig. 16  
*Monodictys gemmipara*, CBS-H 3964 on the natural substrate.

Coloniae effusae, irregulariter circumscriptae, farinosae, subatrae; sub lente conidia globosa singula sparsa, atra visibilia. Mycelium sparsum, pro maxima parte submersum. Conidia terminalia e ramulis hyalinis indistinctis singula extruduntur, primum [p. 29] dilute brunnea, globosa, deinde paulatim fusciscentia, et progressionem meristemata multiseptata. Cellulae periphericae nonnumquam inflatae, formam irregularem conidiorum determinant; subinde nonnullae cellulae periphericae in conidia secundaria brunnea, levia et fere tenuitunicata, irregulariter septata, globosa, 12-14  $\mu\text{m}$  diam proliferantia. Conidia matura crassitunicata, obscure rubrobrunnea vel atra, levia, (sub)globosa, ad septa constricta, 50-70 x 45-50  $\mu\text{m}$ ; secessio schizolytica [p. 30] Holotypus CBS-H 3964, una cum *Sporidesmium globuliferum*, ad ramum decorticatum, prope Sonda, Karnataka in India lectus a S.S. Kulkarni et V. Rao, Dec. 1982.

Colonies on the natural substrate effuse, with irregular outline, farinose, blackish; under the stereo microscope individual scattered, superficial, dull black, globose conidia are visible. Mycelium scanty, mostly immersed. Conidia arising terminally from short, undifferentiated, hyaline hyphal branches, formed as pale brown, globose blown-out ends which gradually darken and develop numerous septa by meristematic growth. Peripheral cells swell locally and may extend considerably, the conidial outline consequently becoming irregular; in a later stage some peripheral cells may develop into brown, smooth- and moderately thin-walled, irregularly septate, globose secondary conidia, 12-14  $\mu\text{m}$  diam. Mature conidia with thick cell walls, dark reddish brown to black, smooth-walled, (sub)globose, constricted at the septa, 50-70 x 45-50  $\mu\text{m}$ ; conidial secession schizolytic.

#### Material examined

CBS-H 3964, holotype, associated with *Sporidesmium globuliferum* Berk. & Curt., on decorticated branch, Sonda, Karnataka, India, S.S. Kulkarni & V. Rao, Dec. 1982.

#### Discussion

The species is easily recognized by its large, more or less globose conidia with irregular outline, and by the production of globose, multi-septate secondary conidia.

## **Monodictys striata** (Petch) Vasant Rao & de Hoog, **comb. nov.** - Fig. 17

*Sporidesmium striatum* Petch - Ann. R. bot. Gard. Peradeniya 6: 249. 1917 (basionym) = *Piricauda striata* (Petch) R.T. Moore - Rhodora 61: 104. 1959.

Colonies on rotten bark expanding, farinose, black; under the stereo microscope scarce individual, ellipsoidal, erumpent sporodochia are visible, which are composed of densely aggregated, blackish conidia. Mycelium scanty, composed of moderately thin-walled, smooth-walled, pale olivaceous brown hyphae. Stromata absent. Conidiophores arising in dense groups from undifferentiated hyphae, short, composed of 1-3 rectangular cells. Conidia arising as terminal blown-out ends of conidiophores, initially broadly ellipsoidal, pale olivaceous with thin septa; conidial maturation by meristematic growth of the entire conidium; mature conidia golden brown, smooth-walled, moderately thick-walled, broadly ellipsoidal, broader than long, mostly asymmetrically inserted, 27-35 x 16-22  $\mu\text{m}$ ; conidia muriform, slightly constricted at the septa, often the median septum forms a [p. 31] rather straight, somewhat darkened line; conidial secession probably schizolytic.

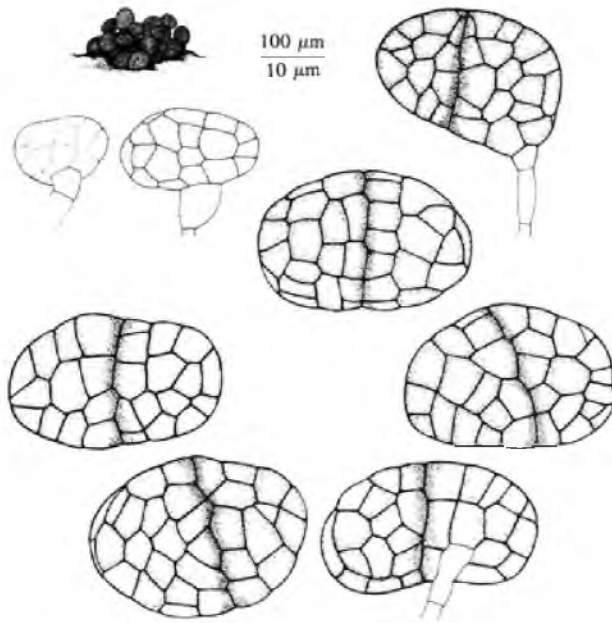


Fig. 17  
*Monodictys striata*, CBS-H 3959 on the natural substrate.

#### Material examined

CBS-H 3959, on inner side of rotten bark, associated with *Gonatobotryum fuscum* (Sacc.) Sacc. and *Phaeoisaria clematidis* (Fuckel) Hughes, Nirmal, Andhra Pradesh, India, V. Rao, Sept. 1984.

#### Discussion

*Monodictys striata* is close to *M. abuensis* and *M. putredinis* (Walk.) Hughes; these species together compose a group of more or less sporodochial taxa with evenly medium brown, rounded conidia with relatively thin cell walls. *M. striata* is recognized by the conidia that are asymmetrically inserted and are wider than long. Its sporodochia are not stromatic, as in *M. abuensis*.

Apparently the difference between species with scattered conidia, with sporodochia and with small stromata is gradational. As a consequence, the [p. 32] borderline between *Monodictys* Hughes and *Berkleasmium* Zobel should be reconsidered.

Another genus close to *Monodictys* is *Pithomyces* Berk. & Br. This genus is distinguished from *Monodictys* by rhexolytic conidium secession. In addition, in a number of species a difference in conidial expansion is apparent. In numerous *Pithomyces* species the conidium initial reaches its ultimate length in an early stage of development, while the conidial body later enlarges laterally to attain its full width. In *Monodictys*, however, the conidial body enlarges by multilateral meristematic growth, the young conidium often having about the same shape as the mature conidium. Often, however, the mentioned developmental characters and the characters of conidial secession are recognized with difficulty, particularly in species with large, strongly pigmented conidia. At present the taxonomic borderline between *Monodictys* and *Pithomyces* needs critical reexamination.

*Monodictys* is delimited from *Epicoccum* Link:Fr. by lacking sporodochia (Ellis, 1976), but this difference is gradational from species to species. Particularly *M. bogoriensis* (Penz. & Sacc.) Hughes has stromatic sporodochia, short-cylindrical, brownish conidiophores and rough-walled conidia. It is possibly better classified in *Epicoccum*.

Below a preliminary key to the described *Monodictys* species and some related taxa is given:

- |  |  |    |
|--|--|----|
| 1a. Conidia large, black, intercalary in undifferentiated hyphae       | <i>Intercalarispora nigra</i> Crane & Schoknecht<br>(Schoknecht & Crane, 1983) |    |
| 1b. Conidia, if black, not intercalary                                 |  | 2  |
| 2a. Conidiogenous cells or conidiophores differentiated                |  | 3  |
| 2b. Conidiogenous cells and conidiophores undifferentiated             |  | 5  |
| 3a. Conidiogenous cells sympodial                                      | <i>Parapithomyces brideliae</i> Thaug (1976)                                   |    |
| 3b. Conidiogenous cells monoblastic                                    |  | 4  |
| 4a. Conidiogenous cells acicular, with markedly thickened apical scars | <i>Pseudochuppia sarcinisporea</i> Kamal et al. (1985)                         |    |
| 4b. Conidiogenous cells ampulliform, with unthickened apical scars     | <i>Chuppia sarcinifera</i> Deighton (1965)                                     |    |
| 5a. Conidia consisting of 4-5 or less cells                            |  | 6  |
| 5b. Conidia multi-celled   |  | 12 |

6a.	Conidia globose, cruciately septate	<i>M. cruciseptata</i> Schoknecht & Crane (1983)	
6b.	Conidia of other shape, constricted at the septa		7
7a.	Conidia rough-walled when mature		8
7b.	Conidia remaining smooth-walled		10
8a.	Conidia with transverse septa only	<i>M. aspera</i> (Corda) Hughes (1958)	
8b.	Conidia with transverse and longitudinal septa [p. 33]		9
9a.	Lichenicolous species	<i>M. anaptychia</i> (Lindau) D. Hawksworth (1975)	
9b.	On other substrates	<i>M. asperospora</i> (Cooke & Masee) M. B. Ellis (1971b, 1976)	
10a.	Conidia irregular, 1-5-celled	<i>M. ucrainica</i> (Kirilenko) de Hoog & Grinbergs (1975; Kirilenko, 1967)	
10b.	Conidia more regularly (3-)4(-5)-celled		11
11a.	Conidia 7-14 x 5-10 µm	<i>M. glauca</i> (Cooke & Harkn.) Hughes (Ellis, 1971a)	
11b.	Conidia 17-30 x 15-19 µm	<i>M. nigrosperma</i> (Schw.) W. Gams (1971, = <i>M. levis</i> (Wiltshire) Hughes; Wiltshire, 1938; Domsch & Gams, 1970; Matsushima, 1971)	
12a.	Conidia hyaline	<i>M.-synanam.</i> of <i>Verticillium chlamyosporium</i> Goddard and <i>V. catenulatum</i> (Kamyschko ex Barron) W. Gams (1971; Barron & Onions, 1966)	
12b.	Conidia brown to black		13
13a.	Conidia elongate, flexuous, <i>Cirrenalia</i> -like	<i>M. austrina</i> Tubaki (Tubaki & Asano, 1965)	
13b.	Conidia of other shape, not flexuous		14
14a.	Conidia sarcinoid, with markedly echinulate to spinose outer walls	<i>M. namataniensis</i> Mats. (Kobayasi, 1971; Matsushima, 1971)	
14b.	Conidia star-shaped due to conical peripheral cells	<i>M. asterospora</i> Sutton & Alcorn (1984)	
14c.	Conidia of other shape, smooth- or irregularly rough-walled		15
15a.	Conidia with a single, hyaline, often inflated basal cell		16
15b.	Basal cell of conidia, if hyaline, not markedly different from adjacent cells		17
16a.	Hyaline basal cell mostly much smaller than conidial body	<i>M. paradoxa</i> (Corda) Hughes (Ellis, 1971a; Hughes, 1950; Matsushima, 1975)	
16b.	Hyaline basal cell reaching up to about 1/3 of the conidial body	<i>Bahugada sundara</i> K.A.N. Reddy & V. Rao (1984)	
17a.	Proximal half of conidia considerably lighter than distal half	<i>M. melanopa</i> (Acharius) M. B. Ellis (1976)	
17b.	Both conidial halves with about the same pigmentation, though apex may be somewhat lighter		18
18a.	Mature conidia with globose secondary conidia	<i>M. gemmipara</i>	
18b.	Mature conidia without secondary conidia		19
19a.	Mature conidia with short, blunt spines in the apical region	<i>Sporidesmium stygium</i> Berk. & Curt., anam. of <i>Glonium clavispurum</i> Seay. (Lohman, 1937)	
19b.	Mature conidia without spines, occasionally rough-walled to verrucose		20
20a.	Conidia (sub)globose to broadly obovoidal, brown to black		21
20b.	Conidia broadly ellipsoidal to elongate, medium brown if obovoidal		26
21a.	Mature conidia becoming rough-walled	<i>M. castanaea</i> (Walk.) Hughes (Ellis, 1971a)	
21b.	Conidia remaining smooth-walled [p. 34]		22
22a.	Conidia medium brown		23
22b.	Conidia dark brown to black		24

23a. Conidia (sub)globose, 25-45 µm diam	<i>M. abuensis</i>	
23b. Conidia broadly ellipsoidal, 25-40 x 18-37 µm	<i>M. nitens</i> (Schw.) Hughes (Moore, 1959)	
24a. Conidia obovoidal	<i>M. pelagica</i> (Johnson) Jones (1963; Kohlmeyer, 1960; Kumar, 1973; Booth, 1981)	
24b. Conidia globose		<b>25</b>
25a. Conidia 15-23 µm diam	<i>Sporidesmium globigerum</i> Hino & Katumoto (Hino, 1961)	
25b. Conidia 30-40 µm diam	<i>Sporidesmium globiferum</i> Berk. & Curt. (Moore, 1959)	
26a. Conidia erect, elongate to short-cylindrical, usually over 70 µm long		<b>27</b>
26b. Not combining above characters		<b>30</b>
27a. Conidia up to 4 cells (about 25 µm) wide	<i>M. antiqua</i> (Corda) Hughes (Ellis, 1976; Rao & Reddy, 1978a)	
27b. Conidia 5-10 cells wide		<b>28</b>
28a. Conidia black	<i>M. lepraria</i>	
28b. Conidia dark brown		<b>29</b>
29a. Conidia ovoidal	<i>M. sessilis</i> Hol.-Jech. (Holobová-Jechová & Mercado, 1986)	
29b. Conidia elongate	<i>M. cellulosa</i> Hughes (1958)	
30a. Mature conidia rough-walled	<i>M. fluctuata</i> (Tandon & Bilgrami) M. B. Ellis (1971a,b)	
30b. Mature conidia remaining smooth-walled		<b>31</b>
31a. Sporodochia present	<i>M. bogoriensis</i> Penz. & Sacc. (Penzig & Saccardo, 1901)	
31b. Sporodochia absent		<b>32</b>
32a. Conidia sessile	<i>M. pandani</i> Mats. (Matsushima, 1985; = <i>M. ericoctona</i> (A. Braun & de Bary) Mats. <i>sensu</i> Matsushima, 1975)	
32b. Conidia with some hyaline or pale brown supporting cells		<b>33</b>
33a. Conidia dark brown to black, with lighter basal cells		<b>34</b>
33b. Conidia evenly mid brown to blackish brown		<b>35</b>
34a. Mature conidia dark brown, obovoidal, 33-45 x 20-27 µm	<i>M. monilicellularis</i> Matsushima (1975)	
34b. Mature conidia black, broadly obovoidal, 20-37 x 15-23 µm	<i>M. nigra</i> Matsushima (1975)	
35a. Mature conidia often with straight median septum; conidia laterally inserted	<i>M. striata</i>	
35b. Mature conidia with irregular septation; conidia proximally inserted [p. 35]	<i>M. putredinis</i> (Wally.) Hughes, anam. of <i>Ohleria brasiliensis</i> Starbäck (Samuels, 1980; Ellis, 1971a; Seman & Davydkina, 1982; Matsushima, 1975)	