Revista Brasil. Bot., V.31, n.2, p.339-344, abr.-jun. 2008

Cryptophiale and *Cryptophialoidea* (Conidial fungi) from Brazil and keys to the genera

MARCOS FABIO OLIVEIRA MARQUES[1,3,4], ALISSON CARDOSO RODRIGUES DA CRUZ[1], FABIO FERNANDES BARBOSA[1,2] and LUÍS FERNANDO PASCHOLATI GUSMÃO[1]

(received: April 19, 2007; accepted: May 21, 2008)

ABSTRACT – (*Cryptophiale* and *Cryptophialoidea* (Conidial fungi) from Brazil and keys to the genera). During a survey of microfungi associated with dead leaves in the State of Bahia, Brazil, four species of *Cryptophiale* Piroz. and two species of *Cryptophialoidea* Kuthub. & Nawawi were found. *Cryptophiale guadalcanalensis* Matsush. and *Cryptophialoidea fasciculata* Kuthub. & Nawawi are new records for the neotropics, while *C. ramosa* Delg.-Rodr., J. Mena & Gené is a new record for South America. Descriptions, illustrations and geographical distribution of all the fungi are provided.

Key words - anamorphic fungi, biodiversity, Hyphomycetes, leaf litter

RESUMO – (*Cryptophiale* e *Cryptophialoidea* (Fungos Conidiais) no Brasil e chave para os gêneros). Durante a investigação de microfungos associados a folhas em decomposição no Estado da Bahia, quatro espécies de *Cryptophiale* Piroz. e duas de *Cryptophialoidea* Kuthub. & Nawawi foram encontradas. *Cryptophiale guadalcanalensis* Matsush. e *Cryptophialoidea fasciculata* Kuthub. & Nawawi constituem novos registros para o Neotrópico e *C. ramosa* Delg.-Rodr., J. Mena & Gené é um novo registro para a América do Sul. São apresentadas neste estudo, descrições, comentários, ilustrações e distribuição geográfica.

Pavavras-chave - biodiversidade, fungos anamorfos, Hyphomycetes, serapilheira

Introduction

The genus *Cryptophiale* was established by Pirozynski (1968) based on two foliicolous species, *C. kakombensis* Piroz. (type species) and *C. udagawae* Piroz. & Ichinoe. The genus has eighteen accepted species and is characterized by the presence of unbranched or dichotomously branched, setiform conidiophores, phialidic conidiogenous cells obscured by a shield of sterile cells located at the middle of setiform conidiophore and falcate to cylindrical, hyaline, 1-10-septate, conidia aggregated in slime mass (Pirozynski, 1968; Farr, 1980; Kuthubutheen 1987; Kuthubutheen & Sutton 1985; Goh & Hyde 1996; Mercado-Sierra *et al.* 1997; Umali *et al.* 1999; Delgado *et al*. 2005).

In a study of microfungi associated with palms plants, Hyde *et al.* (1999) established connections for *Cryptophiale kakombensis* and *C. udagawae* with their perithecial teleomorphs in Ascomycetes, *Chaetosphaeria saltuensis* K. D. Hyde, Goh, Joanne E. Taylor & J. Fröhl. and *C. hongkongensis* K. D. Hyde, Goh, Joanne E. Taylor & J. Fröhl., respectively.

Kuthubutheen & Nawawi (1987) proposed the segregation of *Cryptophiale secunda* Kuthub. & B. Sutton in a new genus, *Cryptophialoidea* Kuthub. & Nawawi. Five species are clustered in this genus, essentially distinguished by phialides without obscured by a shield of sterile cells and the conidiogenous apparatus located at the middle and disposed on only one side of the setiform conidiophores.

The species of both these genera are found associated with decaying leaves, wood, and roots of several plants in tropical and subtropical regions (Goh & Hyde 1996; Mercado-Sierra *et al.* 1997). Only one species, *Cryptophiale sphaerospora* Umali & D.Q. Zhou, was collected as parasite on synnemata of *Janetia synnematosa* Sivan. & Hsieh (Umali *et al.*1999). For Brazil, only three species of *Cryptophiale* have so far been collected, *C. minor* M.L. Farr (Farr 1980), *C. kakombensis* (Grandi & Attili 1996) and *C. udagawae* (Sutton & Hodges 1976) and one species of *Cryptophialoidea, C. manifesta*, (as *Cryptophiale manifesta*) (Sutton & Hodges 1976).

During a study of microfungi associated with decaying leaves in Bahia State, some interesting species of these genera have been collected. They are described, illustrated and commented in this paper. A key is proposed to the known species of *Cryptophiale* and *Cryptophialoidea* after Goh & Hyde (1996) and Delgado *et al.* (2005).

1. Universidade Estadual de Feira de Santana, Dept. de Ciências Biológicas, Laboratório de Micologia, BR116 KM03, 44031-460 Feira de Santana, BA, Brazil.
2. Universidade Federal da Bahia, Instituto de Química, Laboratório de Biotecnologia e Química de Microrganismos, Rua Barão de Geremoabo, s/n, Campus de Ondina, 40170-290 Salvador, BA, Brazil.
3. Universidade do Estado da Bahia, Campus VII, Dept. de Educação, Laboratório de Microbiologia, Rodovia Lomanto Júnior, BR 407 KM 127, 48.970-000 Senhor do Bonfim, BA, Brazil.
4. Corresponding author: mfomarques@yahoo.com.br

Material and methods

Decaying leaves colonized by fungi were collected from various places such as Lençóis, Mucugê, Palmeiras, Rui Barbosa, Salvador and Santa Terezinha in Bahia State, during April 2000 to Nov. 2005. Following the leaf washing technique of Harley & Waid (1955), fragments of leaves were incubated in moist chambers at room temperature for development of fungal reproductive structures. Isolated fungi were identified from the slides prepared with PVL resin (Trappe & Schenck 1982). Permanent slides were deposited as herbarium specimens at "Herbário da Universidade Estadual de Feira de Santana" (HUEFS).

Results and discussion

Cryptophiale guadalcanalensis Matsush. [as '*guadalcanalense*'], Microfungi of the Solomon Islands and Papua-New Guinea:15. 1971.

Figura 1

Conidiophores setiform, straight or flexuous, septate, smooth, brown, 177-276 × 6-9 µm, 1-5 dichotomously branched at the apex, fertile from the middle up to branched apex 52.5-68 × 11.5-14.5 µm. Conidiogenous cells enteroblastic, phialidic, obscured by a shield of sterile cells. Conidia solitary, 1-septate, subulate, simple, smooth, produced in slimy masses, hyaline, 15.5-20 × 1.2 µm.

Material examined: BRAZIL. Bahia: Santa Terezinha, Serra da Jibóia, on dead leaves, 22-III-2005, *A.C.R. Cruz s.n.* (HUEFS97967).

Known distribution: Japan and Salomon Island (Matsushima 1975), India (Rao & De Hoog 1986).

The Brazilian specimen has smaller conidiophores and conidia and dichotomously branched conidiophores than the material described by Matsushima (1975). Three species, viz. *C. cucullata* Kuthub., *C. guadalcanalensis* and *C. udagawae*, have branched, setiform conidiophores. In *C. udagawae*, the conidiogenous apparatus is restricted to the unbranched part of setiform conidiophore (Pirozynski 1968; Kuthubutheen 1987). Whereas in *C. cucullata* and *C. guadalcanalensis*, the conidiogenous apparatus is extended within the branches. In *C. cucullata*, the conidiogenous apparatus extended up to the second dichotomy and the conidia are subulate with a distinct flexuous appendix (Kuthubutheen 1987).

Cryptophiale kakombensis Piroz., Can. J. Bot. 46: 1124. 1968.

Figura 2

Conidiophores setiform, simple, straight or flexuous, unbranched, septate, smooth, brown, 228-390 × 7.5-9 µm, fertile from the middle up to sub apex, 81-111 × 12-21 µm. Conidiogenous cells enteroblastic, phialidic, obscured by a shield of sterile cells. Conidia solitary, 1-septate, falciform, simple, smooth, produced in slimy masses, hyaline, 21-24 × 1.5 µm.

Material examined: BRAZIL. Bahia: Santa Terezinha, Serra da Jibóia, on decaying leaves, 22-III-2005, *A.C.R. Cruz s.n.* (HUEFS97968); Lençois, Fazenda Araruna, on decaying leaves, 9-VI-2003, *A.C.R. Cruz s.n.* (HUEFS56864); Palmeiras, Campo de São João, on decaying leaves, 12-XI-2003, *A.C.R. Cruz s.n.* (HUEFS56865).

Known distribution: Australia, India (Matsushima 1989), Brazil (Grandi 1999), Cuba (Mercado-Sierra *et al.* 1997), Equator (Matsushima 1993), Federative States of the Micronesia, Taiwan (Matsushima 1985), Ivory Coast, United States of America (Farr *et al*. 2007), Malaysia (Kuthubutheen & Sutton 1985), Mexico (Heredia-Abarca 1994), Seychelles (Hyde *et al.* 1999), Tanzania (Pirozynski 1968) and Venezuela (Castañeda-Ruiz *et al.* 2003).

This is a very common species of the genus occurring intermixed with *C. udagawae* on leaf litter and reported first from Ivory Coast by Rambelli *et al.* (2004). In Brazil, this species was first recorded from Juréia-Itatins Reserve, São Paulo State by Grandi & Attili (1996). Subsequently, it was found in the Bahia state, from Chapada Diamantina (Gusmão *et al.* 2005) and Pará state (Gutierrez A.H. unpublished data).

Cryptophiale minor M.L. Farr, Mycotaxon 11: 177. 1980.

Description and illustration of the species can be found in Farr (1980).

Conidiophores setiform, 120-200 × 6-8 µm, fertile region 30-50 µm long. Conidia 1-septate, 12-14(16) × 1.2 µm.

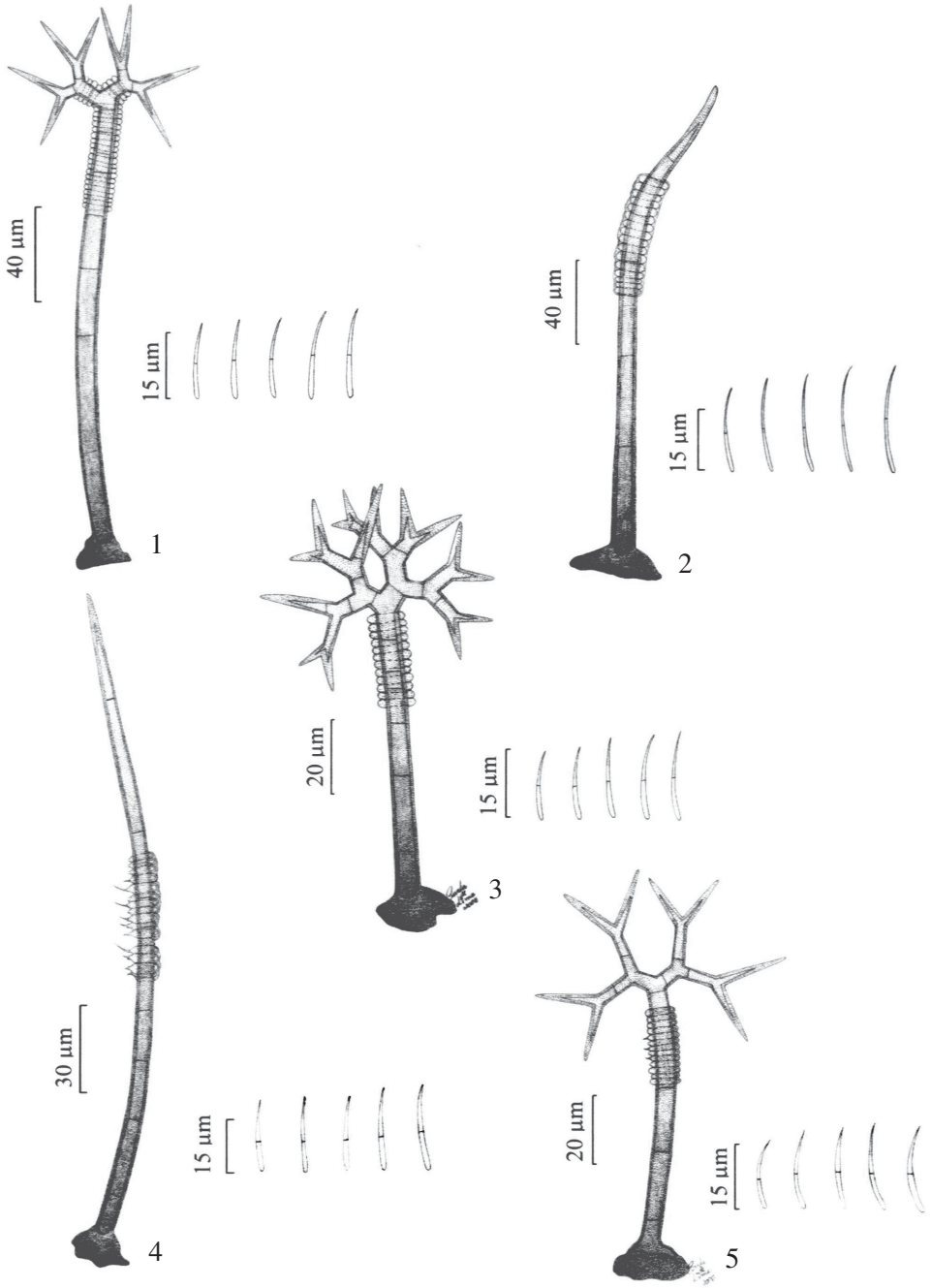
Know distribution: Brazil (Farr 1980), Cuba (unpublished data).

This fungus was isolated from large zonate spots from dead leaves of *Astrocaryum* G. Mey (Arecaceae) along the Rio Negro, Amazonas State. According to Farr (1980), the species appears to be close to *C. iriomoteana* Matsush., but the conidia of the latter are consistently subulate and strongly curved, sometimes even hook-like at the apex. The variability of conidial shape in C. *minor* is an unusual feature since the conidial shape appears to be uniform in other species of the genus *Cryptophiale*.

Cryptophiale udagawae Piroz. & Ichinoe, Can. J. Bot. 46: 1126. 1968.

Figura 3

Conidiophores setiform, straight or flexuous, septate, smooth, brown, with 3-4 branches at the apex, 97.5-150



Figures 1-5. 1. *Cryptophiale guadacanalensis*, conidiophores setiform, branched, fertile region with conidiogenous cells up to first dichotomy branches, and conidia. 2. *Cryptophiale kakombensis*, conidiophores setiform, fertile region with conidiogenous cells, and conidia. 3. *Cryptophiale udagawae*, conidiophores setiform, branched, fertile region with conidiogenous cells up to dichotomy branches, and conidia. 4. *Cryptophialoidea fasciculata*, conidiophores setiform, bundles of conidiogenous cells, and conidia. 5. *Cryptophialoidea ramosa*, conidiophores setiform, branched, bundle of conidiogenous cells, and conidia.

× 4.5-9 µm, fertile from middle up to first dichotomy branch at the apex 22.5-51 × 9-13.5 µm. Conidiogenous cells enteroblastic, phialidic, obscured by a shield of sterile cells. Conidia solitary, 1-septate, falcate, simple, smooth, hyaline, produced in slimy masses, 15.5-20 × 1.2 µm.

Material examined: BRAZIL. Bahia: Santa Terezinha, Serra da Jibóia, on decaying leaves, 24-X-2005, *M.F.O. Marques s.n.* (HUEFS98034).

Known distribution: Australia (Matsushima 1989), Brazil (Grandi 1999), China, Japan, Ivory Coast, New

Guinea, New Zealand, United States of America (Farr *et al.* 2007), Cuba (Mercado-Sierra *et al.* 1997), Equator (Matsushima 1993), Malaysia (Kuthubutheen & Sutton 1985), Mexico (Heredia-Abarca 1994), Taiwan (Matsushima 1980) and Venezuela (Castañeda-Ruiz *et al.* 2003).

The conidiophores, fertile zone and conidia from the present collection were smaller than described by Pirozynski (1968) and Kuthubutheen & Sutton (1985). This species presents variable number of branches in the conidiophore, *i.e.* from 1 to 3 by Pirozynski (1968) and Kuthubutheen & Sutton (1985), 3 by Matsushima (1971) and 5 to 8 by Mercado-Sierra *et al.* (1997). In Brazil, it was collected in the States of Espírito Santo (Sutton & Hodges 1976) and São Paulo (Grandi & Attili 1996). This is the first record of the fungus from Bahia state.

Cryptophialoidea fasciculata Kuthub. & Nawawi, Mycol. Res. 98: 686. 1994.

Figura 4

Conidiophores setiform, simple, straight or flexuous, unbranched, septate, smooth, brown at the base, dark brown at apex, 220-262 × 5-6 µm, fertile from the middle up to sub apex, 27-70 µm. Conidiogenous cells enteroblastic, monophialidic, discrete, determinate, lageniform, 11.5-15 × 2-3.5 µm, with inconspicuous collarettes. Conidia solitary, 1-septate, falcate, hyaline, simple, smooth, produced in slimy masses, 20-24.5 × 1.5-2 µm.

Material examined: BRAZIL, Bahia: Mucugê, on dead leaves of *Chamaecrista cytizoides* var. *blanchet* (Benth.) H. S. Irwin & R. C. Barneby (Caesalpiniaceae), 23-I-2000, *L.F.P. Gusmão s.n*. (HUEFS42710); Rui Barbosa, Serra do Orobó, on dead leaves of *Gaylussacia brasiliensis* Meissn. (Vacciniaceae), 16-IV-2000, *L.F.P. Gusmão s.n*. (HUEFS42779); Lençóis, on dead leaves of *Clusia nemorosa* G.F.W. Mey (Guttiferae), 25-IV-2000, *L.F.P. Gusmão s.n*. (HUEFS56615); Salvador, APA das Lagoas e Dunas do Abaeté, on dead leaves of *Manilkara salzmanii* (DC.) H.J. Lam. (Sapotaceae), 24-VIII-2005, *F.F. Barbosa s.n*. (HUEFS98055).

Known distribution: Malaysia (Kuthubutheen & Nawawi 1994).

The conidia are shorter in the material studied compared to the original description (Kuthubutheen & Nawawi, 1994). This is the second record of *C. fasciculata.*

Cryptophialoidea ramosa Delgado, J. Mena & Gené, Fung. Divers. 20: 31. 2005.

Figura 5

Conidiophores setiform, straight or flexuous, septate, smooth, brown, 115.5-141 × 6-7.5 µm, dichotomously branched 2-3 times at the apex, fertile from the middle to the first dichotomy branch (not included it), 24-39 × 12-16.5 µm. Conidiogenous cells enteroblastic, monophialidic, discrete, determinate, lageniform, with inconspicuous collarettes. Conidia solitary, 1-septate, falcate, slightly curved, simple, smooth, produced in slimy masses, hyaline, 16-20.5 × 1-1.2 µm.

Materials examined: BRAZIL, Bahia: Santa Terezinha, Serra da Jibóia, on decaying leaves, 09-XI-2005, *M.F.O. Marques s.n*. (HUEFS98035); Salvador, APA das Lagoas e Dunas do Abaeté, on dead leaves of *Anacardium occidentalis* L. (Anacardiaceae), 29-VIII-2005, *F.F. Barbosa s.n*., (HUEFS98056).

Known distribution: Cuba (Delgado *et al.* 2005).

The specimens collected are compatible with the original description (Delgado *et al.* 2005). These are distinguished from the original description, by the presence of dichotomous branches at the apex of conidiophores and slightly smaller conidial dimensions. The species with dichotomous branches in the conidiophores such as *Cryptophiale udagawae*, *C. guadalcanalensis* and *C. cucullata* could be confused with *Cryptophialoidea ramosa*, although they are clearly distinguishable when observed through the conidiogenous apparatus, phialides without collarettes and obscured by a shield of sterile cells on each side of the conidiophores (Delgado *et al.* 2005). The Brazilian collection constitutes the second record of the species.

Key to species of *Cryptophiale* and *Cryptophialoidea* [After Goh & Hyde (1996) and Delgado *et al.* (2005)].

1. Fertile region of conidiophore lacking shield of sterile cell or rudimentary on the base of phialide bundles
   2. Setiform conidiophores dichotomously branched ..... *Cryptophialoidea ramosa*
   2. Setiform conidiophores unbranched
      3. Conidiogenous cells predominant polyphialidic ..... *Cryptophialoidea manifesta*
      3. Conidiogenous cells monophialidic
         4. Conidia falcate
         4. Conidia uncinate ..... *Cryptophialoidea uncispora*
            5. Phialides arranged in discrete bundles ..... *Cryptophialoidea fasciculata*

5. Phialides not arranged in bundles ..... *Cryptophialoidea secunda*

1. Fertile region of conidiophore with shield of sterile cell covering the phialides
   6. Conidiophore apex branched
      7. Fertile region of conidiophore at middle ..... *Cryptophiale udagawae*
      7. Fertile region of conidiophore apical or subapical
         8. Conidial apex appendiculate ..... *Cryptophiale cucullata*
         8. Conidial apex not appendiculate ..... *Cryptophiale guadalcanalensis*
   6. Conidiophore apex unbranched
      9. Conidia 3-10 septate
         10. Conidial apex appendiculate ..... *Cryptophiale enormis*
         10. Conidial apex not appendiculate
            11. Conidia 72-95 × 2.5-3 µm ..... *Cryptophiale pandanicola*
            11. Conidia 30-62 × 2.5-4 µm ..... *Cryptophiale multiseptata*
      9. Conidia 0-1 septate
         12. Conidia lacking septum
            13. Conidiophore with setiform lateral branches
               14. Setiform branches distinctly verruculose ..... *Cryptophiale verrucosa*
               14. Setiform branches not verruculose ..... *Cryptophiale apicalis*
            13. Conidiophore lacking setiform lateral branches
               15. Conidia spherical to subspherical ..... *Cryptophiale sphaerospora*
               15. Conidia with others forms
                  16. Conidia 20-28 × 4-4.5 µm, apex appendiculate ..... *Cryptophiale caudata*
                  16. Conidia 5.5-12 × 0.5 µm, apex not appendiculate ..... *Cryptophiale pusilla*
         12. Conidia with a single median septum
            17. Length of conidiophores never more than 350 µm
               18. Conidia narrowly obclavate, apex distinctly uncinate ..... *Cryptophiale iriomoteanum*
               18. Conidia falcate or fusiform, apex not uncinate
                  19. Fertile region of conidiophore apical, up to 110 µm; conidia 22-30 µm long ..... *Cryptophiale kakombensis*
                  19. Fertile region of conidiophore median, 30-50 µm long; conidia 12-14 µm long ..... *Cryptophiale minor*
            17. Length of conidiophores up to 410 µm or longer
               20. Fertile region of conidiophore basal ..... *Cryptophiale insularis*
               20. Fertile region of conidiophore apical or subapical
                  21. Fertile region of conidiophore subapical, conidia cylindrical or obclavate ..... *Cryptophiale orthospora*
                  21. Fertile region of conidiophore apical, conidia fusiform or subulate
                     22. Conidia 23-27 µm long, apex appendiculate ..... *Cryptophiale aristata*
                     22. Conidia 9.5-18 µm long, apex not apendiculate ..... *Cryptophiale novae-caledoniae*

Acknowledgement – We are grateful to Prof. D.J. Bhat (Department of Botany, Goa University, India) for kindly reviewing the manuscript. Marcos Fabio Oliveira Marques and Alisson Cardoso Rodrigues da Cruz wish to acknowledge CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) and CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico), respectively, for providing grants. The authors are grateful to "Programa Flora da Bahia" for facilities during expeditions in the "Campo rupestre" vegetation and CNPq (Proc. 471619/04-3) for the financial support to Serra da Jibóia project.

References

CASTAÑEDA-RUIZ, R.F., ITURRIAGA, T., MINTER, D.W., SAIKAWA, M., VIDAL, G. & VELÁZQUEZ-NOA, S. 2003. Microfungi from Venezuela, a new species of *Brachydesmiella*, a new combination, and new records. Mycotaxon 85:211-229.

DELGADO, G., MENA-PORTALES, J., GENÉ, J. & GUARRO, J. 2005. New species of *Cryptophialoidea* and *Hughesinia* (Hyphomycetes, anamorphic fungi) from Cuba. Fungal Diversity 20:31-38.

FARR, M.L. 1980. A new species of *Cryptophiale* from Amazonas. Mycotaxon 11:177-181.

FARR, D.F., ROSSMAN, AY., PALM, M.E. & MCCRAY, E.B. 2007. Fungal Databases, systematic Botany & Mycology Laboratory, ARS, USDA. http://nt.ars-grin.gov/fungaldatabases/ (acesso em 14/01/2007)

GOH, T.K. & HYDE, K.D. 1996. *Cryptophiale multiseptata*, sp. nov. from submerged wood in Australia, and keys to the genus. Mycological Research 100:999-1104.

GRANDI, R.A.P. & ATTILI, D.S. 1996. Hyphomycetes on *Alchornea triplinervia* (Spreng.) Müell. Arg. leaf litter from the Ecological Reserve Juréia-Itatins, State of São Paulo, Brazil. Mycotaxon 60:373-386.

GRANDI, R.A.P. 1999. Hifomicetos decompositores do folhedo de *Euterpe edulis* Mart. Hoehnea 26:87-101.

GUSMÃO, L.F.P., GÓES-NETO, A. & CRUZ, A.C.R. 2005. Fungos. *In* Biodiversidade e Conservação da Chapada Diamantina (F.A. Juncá, L. Funch & W. Rocha orgs.) Brasília, Ministério do Meio Ambiente. p.225-240.

HARLEY, J.L. & WAID, J.S. 1955. A method of studing active mycelia on living roots and other surfaces in the soil. Transactions of the British Mycological Society 38:104-118.

HEREDIA-ABARCA, G. 1994. Hifomicetes dematiaceos em Bosque mesofilo de montana. Registros nuevos para México. Acta Botánica Mexicana 27:15-32.

HYDE, K.D., GOH, T.K., TAYLOR, J.E. & FROHLICH, J. 1999. *Byssosphaeria, Chaetosphaeria, Niesslia* and *Ornatispora* gen. nov., from palms. Mycological Research 103:1423-1439.

KUTHUBUTHEEN, A.J. 1987. Another new species of *Cryptophiale* from Malaysia. Transactions of the British Mycological Society 89:274-278.

KUTHUBUTHEEN, A.J. & NAWAWI, A. 1987. *Cryptophialoidea* gen. nov. on decaying leaves from Malaysia. Transactions of the British Mycological Society 89:581-583.

KUTHUBUTHEEN, A.J. & NAWAWI, A. 1994. *Cryptophialoidea fasciculata* sp. nov. and *C. manifesta* comb. nov. from Malaysia. Mycological Research 98:686-688.

KUTHUBUTHEEN, A.J. & SUTTON, B.C. 1985. *Cryptophiale* from Malaysia. Transactions of the British Mycological Society 84:303-306.

MATSUSHIMA, T. 1971. Microfungi of the Solomon Islands and Papua-New Guinea. Published by the author, Kobe.

MATSUSHIMA, T. 1975. Icones Microfungorum a Matsushima Lectorum. Published by the author, Kobe.

MATSUSHIMA, T. 1980. Matsushima Mycological Memoirs n. 1. Published by the author, Kobe.

MATSUSHIMA, T. 1985. Matsushima Mycological Memoirs n. 4. Published by the author, Kobe.

MATSUSHIMA, T. 1989. Matsushima Mycological Memoirs n. 6. Published by the author, Kobe.

MATSUSHIMA, T. 1993. Matsushima Mycological Memoirs n. 7. Published by the author, Kobe.

MERCADO-SIERRA, A., HOLUBOVÁ-JECHOVÁ, V. & MENA-PORTALES, J. 1997. Hifomicetos demaciáceos de Cuba. Enteroblásticos. Museo Regionale di Scienze Naturali, Monografie XIII. Torino, Italia.

PIROZYNSKI, K.A. 1968. *Cryptophiale*, a new genus of Hyphomycetes. Canadian Journal of Botany 46:1123-1127.

RAMBELLI, A., MULAS, B.E & PASQUALETTI, M. 2004. Comparative studies on microfungi in tropical ecosystems in Ivory Coast forest litter: behavior on different substrata. Mycological Research. 108:325-336.

RAO, V. & DE HOOG, G.S. 1986. New or critical Hyphomycetes from India. Studies in Mycology 28:1-84

SUTTON, B.C. & HODGES, C.S. 1976. *Eucalyptus* microfungi: some setose Hyphomycetes with phialides. Nova Hedwigia 27:343-352.

TRAPE, J.M. & SCHENCK, N.C. 1982. Taxonomy of fungi forming endomycorrhizae.. *In* Methods and Principles of mycorrizal research (N.C. Schenck ed.). The American Phytopathological Society. St. Paul, p.1-9.

UMALI, T.E., ZHOU, D., GOH, T.K. & HYDE, K.D. 1999. *Cryptophiale sphaerospora* sp. nov. occurring on *Janetia synnematosa*. Mycoscience 40:189-192.