DOUGLAS FERREIRA PARREIRA

MICOBIOTA FITOPATOGÊNICA ASSOCIADA À PLANTA INVASORA *Tibouchina herbacea*

Dissertação apresentada à Universidade Federal de Viçosa, como parte das exigências do Programa de Pós-Graduação em Fitopatologia, para obtenção do título de *Magister Scientiae.*

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Dr. Dartanha José Soares (Co-orientador)	Prof. Maria Catarina Megumi Kasuya
Prof. Leandro Grassi Freitas	Dr. Bruno Sérgio Vieira

Prof. Robert Weingart Barreto
(Orientador)

Aos meus pais, Cosme Damião e Maria Aparecida, minha base de apoio.

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BIOGRAFIA

Douglas Ferreira Parreira é filho de Cosme Damião Parreira e Maria Aparecida Ferreira Parreira, nascido em Três Pontas, MG.

Em marco de 2007 concluiu o curso de Agronomia pela Universidade Federal de Viçosa, em Viçosa, MG.

Nesse mesmo ano, ingressou no Programa de Pós-Graduação, em nível de Mestrado, em Fitopatologia da Universidade Federal de Viçosa, submetendo-se à defesa de tese em julho de 2008.

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As invasões causadas por plantas tanto em ambientes naturais como em ambientes modificados pela ação antrópica resultam em grandes perdas, de natureza econômica ou no desequilíbrio de ecossistemas. Alguns ecossistemas são mais suscetíveis a invasões biológicas, pois têm fauna e flora endêmicas desarmônicas (com nichos ecológicos vazios ou ocupados por espécies pouco adaptadas às funções ecológicas ali desempenhadas) devido ao seu surgimento em isolamento geográfico, como as ilhas oceânicas dos arquipélagos Havaiano, Polinésia Francesa, Fernando de Noronha e outros, ou à sua separação da massa continental no processo de deriva dos continentes em passado evolutivo remoto, como é o caso do Continente Australiano. Nesses locais a introdução de uma espécie exótica vegetal ou animal pode ser desastrosa para o ecossistema. Um exemplo é a introdução de *Tibouchina herbacea* no arquipélago Havaiano, que resultou em invasão de ecossistemas nativos. Esta planta pertencente à família Melastomataceae, e é nativa da América do Sul. Ela tem sido tratada como alvo de um programa de controle biológico utilizando-se insetos e fungos provenientes do seu centro de origem. Para este fim foi feito um levantamento da micodiversidade associada a *T. herbacea*. Deste levantamento resultaram 81 amostras, coletadas em três países: Brasil, República Dominicana e Costa Rica. No presente trabalho a ênfase foi dada ao esclarecimento da identidade dos fungos obtidos, como um primeiro passo para

uma futura utilização de fungos fitopatogênicos no controle de *T. herbacea*. 16 espécies de fungos foram obtidas, sendo: seis hifomicetos – *Cladosporium*, *Passalora*, *Cercospora apii* e três espécies do gênero *Pseudocercospora*; quatro coelomicetos – *Septoria*, *Hainesia*, *Chaetophiophoma* e *Pestalotiopsis*; e seis ascomicetos – *Asteridiella*, *Mollisia*, *Asterina*, *Perisporiopsis*, *Gnomonia*, *Leptosphaeria*. Foram reconhecidas como taxa novos para a ciência e são aqui descritos: *Cladosporium tibouchinensis*, *Mollisia tibouchinae*, *Passalora tibouchinae*, *Pseudocercospora subsinematosa*, *Pseudocercospora tibouchinensis*, *Pseudocercospora tibouchinicola* and *Septoria tibouchinensis*. Dentre as espécies de fungos encontradas no presente trabalho, três parecem ter potencial para uso em programas de controle biológico por causarem doenças severas em *T. herbacea*: *S. tibouchinensis*, *P. tibouchinae* e *M. tibouchinae*. Embora a especificidade destes fungos não tenha ainda sido testada, os dois primeiros fungos pertencem a gêneros que incluem espécies tidas como bastante específicas (pelo menos restritas a uma única família botânica).

ABSTRACT

PARREIRA, Douglas Ferreira, M.Sc., Universidade Federal de Viçosa, July, 2008. THE MYCOBIOTA OF THE INVASIVE WEED *Tibouchina herbacea.* Advisor: Robert Weingart Barreto. Co-advisors: Dartanhã José Soares and Olinto Liparini Ferreira.

Weed plant invasions, in natural as well as in anthropic modified environments, results in significant economical losses or ecosystem disequilibrium. Some ecosystems are more susceptible than others to biological invasions, once they have disharmonic fauna and flora (with empty ecological niches or niches occupied by low adapted species to the ecological functions required), due to its geographic isolation, as in oceanic islands (Hawaii, French Polynesia, Fernando de Noronha and other archipelagos), or due to its separation form the continental bulk during the process of continental derivation in a remote past, as in the case of Australian continent. In such places, the introduction of exotic vegetal or animal species may be a disaster for the ecosystem. A exemple is the introduction of *Tibouchina herbacea* in the Hawaiian archipelago resulted in environmental invasion. This plant belongs to the *Melastomataceae* family and it is native that South America. A biological program involving entomologists and plant pathologists on origin center of *T. herbacea* will be developing, searching natural enemies. With the purpose of future development of control programs using phytopathogenic fungi, the mycological diversity associated with this plant was assessed. A total of eighty one samples originated from Brazil, Dominican Republic and Costa Rica were analyzed in this study. This work was limited to the taxonomic treatment of the fungi obtained from samples and represents the first

step for the development of a future biological control program using phytopatogenic fungi to control the weed plant *Tibouchina herbacea*. In present work 16 fungi species were found: 6 Hyphomycetes – *Cladosporium*, Passalora, *Cercospora* and three *Pseudocercosporas*; 4 Coelomycetes – *Septoria*, *Hainesia*, *Chaetophiophoma*, *Pestalotiopsis* ;and 6 Ascomycetes – *Asteridiella*, *Mollisia*, *Asterina*, *Perisporiopsis, Gnomonia, Leptosphaeria*. There are recognized as new to science and described here: *Cladosporium tibouchinensis*, *Mollisia tibouchinae*, *Passalora tibouchinae*, *Pseudocercospora subsinematosa*, *Pseudocercospora tibouchinensis*, *Pseudocercospora tibouchinicola* and *Septoria tibouchinensis* Among the species of fungi founded in this study, three have potential for use in biological control programs causing severe disease in *T. herbacea*: *S. tibouchinensis*, *P. tibouchinae* and *M. tibouchinae*. Although the specificity of these fungi has not yet been tested, the first two genres belong to fungi that include species considered quite specific restricted to a single botanical family.

INTRODUÇÃO GERAL

As invasões causadas por plantas tanto em ambientes naturais como em ambientes modificados pela ação antrópica resultam em grandes perdas econômicas e no desequilíbrio de ecossistemas. Em ambientes de exploração agrícola plantas daninhas podem competir diretamente com a cultura, podem dificultar a colheita mecânica ou podem servir como hospedeiros alternativos de pragas e patógenos.

Alguns ecossistemas são mais suscetíveis a invasões biológicas, pois têm fauna e flora endêmicas desarmônicas (com nichos ecológicos vazios ou ocupados por espécies pouco adaptadas às funções ecológicas ali desempenhadas) devido ao seu surgimento em isolamento geográfico, como as ilhas oceânicas dos arquipélagos Havaiano, Polinésia Francesa, Fernando de Noronha e outros, ou à sua separação da massa continental no processo de deriva dos continentes em passado evolutivo remoto, como é o caso do Continente Australiano. Nesses locais a introdução de uma espécie exótica vegetal ou animal pode ser desastrosa para o ecossistema. Uma alternativa para a remediação nos casos de invasões causadas por plantas pode ser o controle biológico, que pode seguir duas estratégias diferentes, a clássica e a inundativa.

O controle biológico clássico ou estratégia inoculativa segue os princípios e métodos aplicados pelos entomologistas há cerca de um século (CATE, 1990). O uso de fitopatógenos neste caso é similar ao uso de insetos, envolvendo a importação de um agente de biocontrole para uma área onde populações da planta daninha existem livres de inimigos naturais, visando estabelecer um equilíbrio da população da planta alvo. No caso de utilização de fitopatógenos a preferência tem sido por fungos fitopatogênicos parasitas obrigatórios, provenientes do centro de origem da planta-alvo (MORTENSEN, 1986; ADAMS, 1988; TeBEEST, 1990). A razão para o uso da estratégia inoculativa

esta baseada na separação espacial da planta daninha e de seus inimigos naturais por um período de tempo, onde a planta tende a perder a resistência ao patógeno, tendendo a se tornarem mais vulnerável (CHARUDATTAN, 1990a; CHARUDATTAN, 1990b). O patógeno inoculado é meramente liberado em uma infestação da planta relativamente pequena quando comparada com a área total infestada. Dessa maneira uma pequena dose de inóculo inicial é utilizada para que, eventualmente, uma grande população da planta daninha seja afetada (CHARUDATTAN & DeLOACH, 1988; McRAE, 1988). Porém o processo pode ser lento, pois depende do aumento gradual da doença que pode levar alguns anos, mas que devido a seu baixo custo é apropriado para o controle de infestações em grandes áreas não manejadas ou com baixo valor econômico (ALTMAN et al, 1990; CHARUDATTAN, 1990b). O fungo fitopatogênico usado neste tipo de estratégia tem que ter alta capacidade de disseminação, de maneira que isso permita uma rápida dispersão na população alvo, sem que seja necessária a intervenção humana intensiva e repetida. Dessa forma, os tipos de infestação mais apropriados para o sucesso na aplicação da estratégia clássica de controle biológico são os que ocorrem em áreas com pouco ou nenhum distúrbio antrópico como por exemplo: áreas de vegetação natural, áreas de pastagens e cursos d'agua, dentre outros (MORTENSEN, 1986; ADAMS, 1988; CHARUDATTAN, 1985; CHARUDATTAN & DeLOACH, 1988). Outra característica importante para o fitopatógeno é a capacidade de se multiplicar e manter a epidemia, implicando na permanência de inóculo de um ano para outro. Comumente, aponta-se para as Uredinales, grupo de fungos que causa as doenças conhecidas como ferrugens como o mais adequado para o uso em programas de controle biológico clássico, devido à sua (comumente) elevada especificidade, fácil dispersão de propágulos pelo vento e desenvolviemento de endemias após a liberação inicial (MORTENSEN, 1986; TeBEEST et al, 1992). O controle biológico clássico é um sistema que possui mecanismos de auto regulação, onde os níveis de doença aumentam ou diminuem junto com a população da planta alvo (CHARUDATTAN, 1985; WATSON, 1992). Uma vez que o agente de controle biológico é liberado e se estabelece ele não pode ser mais contido, sendo necessário que ele tenha alta especificidade pela planta a ser controlada (WATSON, 1991; WAAGE, 1992). O exemplo mais amplamente conhecido de sucesso do controle biológico clássico utilizando um fitopatógeno foi obtido em *Chondrilla juncea* L na Austrália utilizando como agente a ferrugem *Puccinia chondrillina* Bubak & Sydenham (CULLEN *et al.,* 1973; CULLEN & HASAN, 1988; MORTENSEN, 1986). Em determinadas áreas

severamente infestadas, a população da planta foi reduzida, em menos de um ano e meio, em 99%.

A estratégia inundativa ou de bio-herbicida tipicamente envolve o uso de fungos fitopatogênicos endêmicos, já associados à planta alvo, que são produzidos em massa, formulados e aplicados de modo semelhante aos utilizados com herbicidas químicos onde a população da planta invasora encontra-se estabelecida. Consiste na produção de propágulos infectivos do organismo em larga escala, sendo aplicados na população alvo. Esse tipo de trabalho usualmente depende, para o seu sucesso, do desenvolvimento de formulações e técnicas apropriadas de aplicação para que um controle adequado seja obtido (TeBEEST *et al*, 1992). Existem diversos exemplos de produtos que se tornaram disponíveis comercialmente como resultado de estudos feitos nesta abordagem de biocontrole e que foram objeto de discussão em diversas revisões publicadas. Um exemplo é a publicação de EVANS *et al* (2001).

A primeira etapa de qualquer programa de controle biológico clássico, depois da escolha da espécie de organismo que se pretende controlar, é a busca no centro de origem do organismo por inimigos naturais. O Brasil é parte do centro de origem de muitas plantas invasoras importantes em escala mundial. Aproveitando esta localização privilegiada, diversos estudos prévios sobre a micobiota de plantas invasoras selecionadas têm sido feitos (BARRETO, 1991; BARRETO & EVANS, 1994; 1995a; 1995b; 1996b, 1998; BARRETO *et al.* 1995; POMELA & BARRETO, 1997; BARRETO *et al.* 1999; BARRETO & TORRES, 1999; BARRETO *et al.* 2000; PEREIRA & BARRETO, 2000; PEREIRA *et al.* 2003; PEREIRA & BARRETO, 2005; VIEIRA & BARRETO, 2005; PEREIRA & BARRETO, 2006; SOARES & BARRETO, 2006; POMELLA *et al,* 2007; PEREIRA *et al*, 2007; ROCHA *et al*, 2007; SEIXAS *et al*, 2007; SOARES & BARRETO, 2008)

A espécie de planta alvo deste trabalho, *Tibouchina herbacea* (DC.) Cogn. (Melastomataceae), foi introduzida no Havaí como ornamental e, devido à ausência de inimigos naturais e condições edafo-climáticas favoráveis se dispersou rapidamente pelas florestas nativas e regiões úmidas, sendo hoje encontrada nas ilhas Maui, Hawaii, Molokai, Oahu e Lanai (ALMASI, 2000). Nesses locais forma populações densas, sendo que o controle químico ou mecânico desta espécie são hoje considerados como economicamente inviáveis. O controle biológico já foi reconhecido como a única maneira de se mitigar este problema (WIKLER & SOUZA, 2005). Essa espécie quando em áreas abertas forma densos estandes, e sistematicamente invade locais de floresta

úmida, possui flores autógamas, não dependendo de polinizadores, e produz um grande número de sementes de tamanho diminuto dispersas facilmente pelo vento. Nas regiões de origem de *T. herbacea*, as plantas atingem no máximo 1,5 m de altura, sofrendo forte pressão de fitopatógenos e de insetos. No Havaí devido às condições edafoclimáticas favoráveis e a ausência de inimigos naturais pode atingir 4,0 m de altura (ALMASI, 2000). Nas ilhas havaianas não existe nenhuma espécie pertencente à família Melastomataceae. Todas as espécies desta família que ocorrem neste arquipélago , foram introduzidas pelo homem e se tornaram invasoras, sendo listadas como espécies nocivas. Sua venda e transporte sendo inclusive consideradas atividades ilegais (http://www.state.hi.us/dlnr/dofaw/hortweeds/species/tibher.htm). A espécie *T. herbacea*. é considerada como parte de um complexo altamente polimórfico, possuindo grande variação morfológica e genética, com ampla distribuição. Segundo uma das autoridades brasileiras nesta família (com. pessoal R. Goldemberg) há uma clara necessidade de uma revisão detalhada deste complexo para esclarecimento de sua taxonomia e delimitação clara de cada taxon que o compõe. Deve-se levar em consideração, as limitações impostas por este cenário imperfeito quanto à identidade das plantas hospedeiras para os fungos estudados neste trabalho quando da utilização da informação aqui gerada. Plantas herbáceas do gênero *Tibouchina*, com morfologia equivalente ou próxima da apresentada pelas plantas presentes como invasoras no Havaí, e que estivessem doentes foram coletadas e incorporadas neste estudo, mesmo quando alguma discrepância, por exemplo, número de pétalas nas flores, pilosidade nas hastes ou outro aspecto se apresentasse como discrepante do padrão usual fosse observado.

REFERÊNCIAS BIBLIOGRÁFICAS

ADAMS, E. B. Fungi in classical biocontrol of weeds. In Fungi in biological control systems, ed. M. N. Burge. Manchester University Press: Manchester 111-122. 1988.

ALMASI, K.N. A non-native perennial invades a native forest. Biological Invasions 2: 219-230. 2000.

ALTMAN, J., NEATE, S. & ROVIRA, A.D. Herbicide-pathogen interactions and mycoherbicides as alternative strategies for weed control. In Microbes and microbial products as herbicides, ed. R. E. Hoagland. American Chemical Society: Washington DC 240–259. 1990.

BARRETO, R.W. & EVANS, H.C. Fungal biocontrol of weeds and its potential role in ecosystem sustainability. In: Chapela H. I. & M. E. Palm (eds). Mycology in Sustainable Development: Expanding Concepts and Vanishing Borders. Parkway Publishers Inc: Boone. 1996a.

BARRETO, R.W. & EVANS, H.C. Fungal pathogens of *Euphorbia heterophylla* and *E. hirta* in Brazil and their potential as weed biocontrol agents. Mycopathologia 141: 21–36. 1998.

BARRETO, R.W. & EVANS, H.C. Fungal pathogens of weeds collected in the Brazilian tropics and subtropics and their biocontrol potential. In: Delfosse, E.S. & R.R. Scott (eds). Proceedings of the Eighth International Symposium on Biological Control of Weeds. DSIR-CSIRO: Melbourne. 1996b.

BARRETO, R.W. & EVANS, H.C. Mycobiota of the weed *Cyperus rotundus* in the state of Rio de Janeiro, with an elucidation of its associated *Puccinia* complex. Mycological Research 99: 407–419. 1995a.

BARRETO, R.W. & EVANS, H.C. The mycobiota of the weed *Chromolaena odorata* in southern Brazil with particular reference to fungal pathogens for biological control. Mycological Research 98: 1107–1116. 1994.

BARRETO, R.W. & EVANS, H.C. The mycobiota of the weed *Mikania micrantha* in southern Brazil with particular reference to fungal pathogens for biological control. Mycological Research 99: 343–352. 1995b.

BARRETO, R.W. & TORRES, A.N.L. *Nimbya alternantherae* and *Cercospora alternantherae*: two new records of fungal pathogens on *Alternanthera philoxeroides* (alligatorweed) in Brazil. Australasian Plant Pathology 28: 103–107. 1999.

BARRETO, R.W. Studies on the Pathogenic Mycoflora of Selected Weeds from the State of Rio de Janeiro (Brazil). Tese de Ph.D.: University of Reading, Inglaterra. 1991.

BARRETO, R.W., CHARUDATTAN, R., POMELLA, A.W.V. & HANADA, R.E. Biological control of neotropical aquatic weeds with fungi. Crop Protection 19: 697–703. 2000.

BARRETO, R.W., EVANS, H.C. & ELLISON, C.A. The mycobiota of the weed *Lantana camara* in Brazil, with particular reference to biological control. Mycological Research 99: 769–782. 1995.

BARRETO, R.W., EVANS, H.C. & HANADA, R.E. First record of *Cercospora pistiae* causing leaf spot of water lettuce (*Pistia stratioites*) in Brazil, with particular reference to weed biocontrol. Mycopathologia 144: 81–85. 1999.

CATE, J.R. Biological control of pests and diseases: integrating a diverse heritage. In New directions in biological control: Alternatives for suppressing agricultural pests and disease, ed. R. R. Baker. Alan R Liss: New York 23–43. 1990.

CHARUDATTAN, R. & DeLOACH, C.J. Management of pathogens and Insects for weed control in agroecosystems. In Weed Management in agroecosystems: ecological approaches, eds M. A. 59 Altieri and M. Liebman. CRC press. Boca Raton: Florida 245–264. 1988.

CHARUDATTAN, R. Pathogens with potential for weed control. In Microbes and microbial products as herbicides, ed. R. E. Hoagland. American Chemical Society: Washington DC 132–154. 1990a.

CHARUDATTAN, R. Prospects for biological control of weeds by plant pathogens. Fitopatologia Brasileira 15(1): 13–19. 1990b.

CHARUDATTAN, R. The mycoherbicide approach with plant pathogens. In: TeBeest, D.O. (Ed.). Microbial control of weeds. New York, Chapman & Hall 24–57. 1991.

CHARUDATTAN, R. The use of genetically altered strains of pathogens for weed control. In Biological control in agricultural IPM systems, eds M. A. Hoy and D. C. Herzog. Academic Press: London 347–372. 1985.

CULLEN, J.M. & HASAN, S. Pathogens for the control of weeds. Philosophical Transactions of the Royal Society of London 318: 213–224. 1988.

CULLEN, J.M., KABLE, P.F. & CATT, M. Epidemic spread of a rust imported for biological control. Nature 244: 462–464. 1973.

DANIEL, J.T., TEMPLETON, G.E., SMITH, R.J. & FOX, W.T. Biological control of northern jointvech in rice with an endemic fungal disease. Weed Science 21: 303–307. 1973.

EVANS, H.C., GREAVES, M.P. & WATSON, A.K. Fungal biocontrol agents of weeds. In: T.M. Butt, C. Jackson & N. Magan (eds). Fungi as biocontrol agents: progress, problems and potential. Pp 169-192. CABI Publishing: Wallingford. 2001

McRAE, C.F. Classical and inundative approaches to biological weed control compared. Plant Protection Quarterly 3(3): 124–127. 1988.

MORTENSEN, K. Biological control of weeds with plant pathogens. Canadian Journal of Plant Pathology 8: 229–231. 1986.

PEREIRA, J.M. & BARRETO, R.W. Additions to the mycobiota of the weed *Lantana camara* (Verbenaceae) in Southeastern Brazil. Mycopathologia 151: 71–80. 2000.

PEREIRA, O.L. & BARRETO, R.W. *Pseudocercospora palicoureae* sp. nov. associated with the toxic rubiaceous weed *Palicourea marcgravii* in Brazil, with observations on its mycobiota. Fungal Diversity 23: 243–253. 2006.

PEREIRA, O.L. & BARRETO, R.W. The mycobiota of the weed *Mitracarpus hirtus* in Minas Gerais (Brazil), with particular reference to fungal pathogens for biological control. Australasian plant pathology 34(1): 41–50. 2005.

PEREIRA, O.L., BARRETO, R.W. & BEZERRA, J.L. *Cercospora talini* on *Talinum patens* in Brazil. Fitopatologia Brasileira, Brasília 28(2): 205–205. 2003.

PEREIRA, O.L., BARRETO, R.W., CAVALAZZI, J.R.P. & BRAUN, U. The mycobiota of the cactus weed *Pereskia aculeata* in Brazil, with comments on the life-cycle of *Uromyces pereskiae*. Fungal Diversity 25: 167–180. 2007.

POMELLA, A.W. & BARRETO, R.W. Leaf scorch of purple nutsedge (*Cyperus rotundus*) caused by *Ascochyta cyperiphthora*. Mycotaxon 65: 459–468. 1997.

POMELLA, A.W., BARRETO, R.W. & CHARUDATTAN, R. *Nimbya alternantherae* a potential biocontrol agent for alligatorweed, *Alternanthera philoxeroides*. BioControl (Dordrecht) 52: 271–288. 2007.

ROCHA, F.B., PEREIRA, O.L. & BARRETO, R.W. *Cercospora apii* causing leaf spots on two Brazilian toxic weeds: *Solanum glaucophyllum* and *Xanthium strumarium*. Brazilian Journal of Microbiology 38: 1–5. 2007.

SEIXAS, C.D.S., BARRETO, R.W. & KILLGORE, E. Fungal pathogens of *Miconia calvescens* (Melastomataceae) from Brazil, with reference to classical biological control. Mycologia 99: 99–111. 2007.

SOARES, D.J. & BARRETO, R.W. Additions to the Brazilian mycobiota of the grassy weed, *Hymenachne amplexicaulis* with a discussion on the taxonomic status of *Paraphaeosphaeria recurvifoliae*. Australasian Plant Pathology 35: 347–353. 2006.

SOARES, D.J. & BARRETO, R.W. Fungal survey of biocontrol agents of *Ipomoea carnea* from Brazil. In: XII International Symposium on Biological Control of Weeds, 2007, Mont Pellier. Proceedings of the XII International Symposium on Biological Control of Weeds, 2008 (no Prelo).

TeBEEST, D.O. & TEMPLETON, G.E. Mycoherbicide: progress in the biological control of weeds. Plant Disease., St. Paul 69(1): 6–10. 1985.

TeBEEST, D.O. Conflicts and strategies for future development of mycoherbicides. New directions in biological control: Alternatives for suppressing agricultural pests and disease, ed. R. R. Baker. Alan R Liss, Inc: New York 323–332. 1990.

TeBEEST, D.O. Status of research on bioherbicides. Plant Protection Quartely 7(4): 142. 1992.

TeBEEST, D.O., YANG, X.B. & CISAR, C.R. The status of biological control of weeds with fungal pathogens. Annual Review of Phytopathology 30: 637–657. 1992.

TEMPLETON, G.E. Biological control of weeds with fungal pathogens. Tropical Pest Management 30: 333–338. 1984.

VIEIRA, B.S. & BARRETO, R.W. *Lewia chlamidosporiformans* sp. nov. from *Euphorbia heterophylla*. Mycotaxon 94: 245–248. 2005.

WAAGE, J. Classical biological control In Proceeding of the first international weed control congress, J. H. Combellack, K. J. Levick, J. Parsons, and R. G. Richardson. Weed Science Society of Victoria: Melbourne 1: 240–249. 1992.

WATSON, A.K. Biological and other alternative control measures. Proceedings of the first international weed control congress, Weed Science Society of Victoria: Melbourne 1: 298–300. 1992.

WATSON, A.K. The classical approach with plant pathogens. In Microbial control of weeds, ed. O. T. TeBeest. Chapman & Hall: London 3–23. 1991.

WIKLER, C & SOUZA, P.G. Estudos Bioecológicos de *Syphraea uberabensis* (Coleoptera: Chrysomelidae) Bechyné 1956. Ambiência 1(1): 103–112. 2005.

The mycobiota of the invasive weed *Tibouchina herbacea*

Parreira D. F.[1]; Barreto R. W.[1*]; Soares D. J. [1]; and Pereira O. L.[1]

[1]Departamento de Fitopatologia, Universidade Federal de Viçosa, 36571-000, Viçosa, MG, Brazil.

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A survey of fungal pathogens associated with cane tibouchina - *Tibouchina herbacea* (Melastomataceae) - was conducted in the neotropics, concentrated in South and Southeastern Brazil but also including ad hoc collections in the Dominican Republic and Costa Rica, aiming at finding potential biological control agents for this herbaceous weed for introduction into Hawaii. Numerous fungal species were found, including six ascomycetes, six cercosporoid species and four coelomycete. Seven new taxa are described and illustrated herein: *Cladosporium tibouchinensis*, *Mollisia tibouchinae*, *Passalora tibouchinae*, *Pseudocercospora subsinematosa*, *Pseudocercospora tibouchinensis*, *Pseudocercospora tibouchinicola* and *Septoria tibouchinensis*. Additionally *Asteridiella mellastomacearum*, *Cercospora apii* and an undetermined species of *Perisporiopsis* ,are also reported for the first time on *T. herbacea*. Other fungi that were collected will be included in a separate publication. Among the species of fungi described in this study, three appear particularly promising for use in biological control programs because they were found to cause severe disease on *T. herbacea*: *Septoria tibouchinensis*, *Passalora tibouchinensis* and *Mollisia tibouchinae*. A series of additional tests, including a demonstration of host-specificity, will be required in order to cofirm this purported potential.

Key words:, biological control, fungal survey, *Mollisia*, neotropical fungi, *Passalora*, *Septoria*.

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*Corresponding author: R. W. Barreto; e-mail: rbarreto@ufv.br

Introduction

Tibouchina herbacea (DC.) Cogn. (Melastomataceae), known as cane tibouchina (local names in Brazil: quaresmeirinha, quaresmeira do brejo) is a herbaceous plant of humid habitats that is native from South America, namely Argentina, Paraguai, Uruguai and Brazil (Wagner *et al*. 1999). It was introduced in the Hawaiian Islands as an ornamental for its showy violet flowers and became a noxious invasive weed. It is presently found in Maui, Hawaii, Molokai, Oahu and Lanai (http://www.hear.org/starr/ hiplants/maps/tibouchina_herbacea.htm). There are no native Melastomataceae in Hawaii and all species in this family that have been introduced are noxious weeds, including some such as *Clidemia hirta* (L.) D. Don and *Miconia calvescens* D.C. which are ranked amongst the worst weeds in that archipelago(DeWalt et al., 2003). In natural areas *T. herbacea* reaches a maximum 1.5 m of height, whereas in Hawaiian it can reach up to 4 m, forming dense stands in pastures and disturbed areas (Almasi, 2000; Motooka *et al*. 2003). It is included in the State of Hawaii noxious weed list (http://hear.org/pier/species/

tibouchina_herbacea.htm). Its management has been made mainly through herbicide aplications, however, classical biological control has been recognized as the sole sustainable method of control for exotic weeds invading natural ecosystems, as is the case of the weedy melastomes in the Pacific (Wikler and Souza, 2005).

In the early 1990's contacts were established between Hawaii based scientists led by C. Smith (University of Hawaii) and Brazilian scientists with the purpose of initiating collaboration aimed at at classical biocontrol of several Hawaiian weeds native from Brazil and cooperative agreements between the Research Corporation of the University of Hawaii (RCUH) in the USA and Brazilian partners, including the Fundação Arthur Bernardes/Universidade Federal de Viçosa (FUNARBE/UFV) were established. At that time one of the main target-weeds was *T. herbacea* and preliminary surveys of fungal pathogens were initiated but the increasing threat represented by forest ecosystem invasion by *M. calvescens* led to a shift of priority and work was then concentrated on the study of pathogens attacking *M. calvescens* (Killgore *et al*. 1997; Culliney *et al*., 2003; Seixas *et al*., 2002; Seixas *et al*, 2007).

Recently, the work on *T. herbacea* was continued both involving Brazilian entomologists based at the state of Paraná and pathologists based at the state of Minas Gerais. Insect surveys performed by Charles Wikler yielded a series of potential biocontrol agents, but *Sypharea uberabensis* (Coleoptera: Chrysomelidae) was demonstrated to have the greatest potential (Wikler and Souza, 2005).

Works aiming at introducing this particular insect are well advanced. *Sypharea uberabensis* is now under quarantine in Hawaii for its final evaluation (T. Johnson, pers. comm.). Paralell to that, systematic field surveys of the mycobiota on *T. herbacea* was also conducted.

Several other studies of the mycobiota associated with weeds in Brazil have been published along the recent years to serve as the basis for future classical biological control programmes. Some recent examples are those on *Pereskia aculeata* (Pereira *et al*. 2007) and *Hedychium coronarium* (Soares and Barreto, 2008). This publication represents the first one concentrated on the mycobiota of *T. herbacea* in Brazil and is the first account of fungi associated to this plant species worldwide.

No records of fungi associated to *T. herbacea* were found in the literature and it was expected that a significant proportion of the fungi collected on this host might represent taxonomic novelties and that some might represent potential biocontrol agents that might be used against this host. Until now the surveys unraveled seventeen fungal species. This paper includes the description and discussion of ten selected species. The complementary list of fungal species will be covered in a separate publication.

Materials and methods

Prior to the field survey, a complete list of collecting localities from herbarium records of *T. herbacea* was compiled from the following Brazilian herbaria: Herb. IAC, Herbário Fanerogâmico e Criptogâmico do Instituto Agronômico; Herb. SP, Herbário Maria Eneyda P. K. Fidalgo; Herb. RB, Instituto de Pesquisas Jardim Botânico do Rio de Janeiro; Herb. R, Herbário do Museu Nacional do Rio de Janeiro; Herb. VIC, Universidade Federal de Viçosa; Herb. MBM, Museu Botânico Municipal; Herb. OUPR, Herbário José Badini. Selected sites in Southeartern and Southern Brazil were explored. Details of the survey methodology and the laboratory studies can be found in Barreto and Evans (1994). Freshly and dried samples were examined under a stereomicroscope. Hand free sections containing the fungal structures and fungal structures scraped with a scalpel from the plant surfaces were mounted in lactophenol.

Observations, measurements and line drawings were prepared using an Olympus BX 50 light microscope fitted with a drawing tube and a Olympus E330 camera. Photographs were used to illustrated some species. The collections examined were deposited in the herbarium of the Universidade Federal de Viçosa (VIC).

Results

Asteridiella melastomacearum (Speg.) Hansford., *The Meliolineae*. A Monograph. Sydowia Beih 2:154 (1961).

(FIGS 1, 9-11)

Colonies on living leaves, predominantly hypophyllous. *Hyphae* sinuous, slightly undulate, branching alternate or opposite, cells 5–9 µm diam. *Appressoria* alternate to unilateral, brown to dark brown, straight to slightly curved, 13.5–21 µm long, *stalk cells* cylindrical, 3–9 x 5–9.5 µm, head cells subglobose to ovate, sometimes angulose, 9.5–15 x 10–14 µm. *Phialides* separate, opposite or alternate, brown, ampuliform, 13–20.5 x 6.5–10 µm. *Perithecia* black, scattered, globose, with crenate to crenulate surface, 43.5–173.5 µm diam. *Asci* evanescent. *Ascospores* brown, oblong, obtuse, 4-septate, slightly constricted at septae, 32.5–40 x 11–15 µm, smooth.

Habitat: on living leaves of *Tibouchina herbacea*.

Known distribution: Minas Gerais and Rio de Janeiro (Brazil).

Material examined: BRAZIL, Minas Gerais, Alvorada de Minas, on living leaves of *T. herbacea*, 19 April 2008, R. W. Barreto (VIC 30690); BRAZIL, Minas Gerais, Poços de Caldas, Cascata Véu de Noiva, on living leaves of *T. herbacea*, 8 June 2001, R. W. Barreto (VIC 30639); BRAZIL, Minas Gerais, Ponte Nova, on living leaves of *T. herbacea*, 10 November 1995, R. W. Barreto (VIC 30651); BRAZIL, Minas Gerais, Jequiri, on living leaves of *T. herbacea*, 21 April 1996, R. W. Barreto (VIC 30668); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 20 October 1996, R. W. Barreto (VIC 30675)

Cercospora apii Fresen. *sensu lato*, emend. Crous and Braun., Mycosphaerella *and its anamorphs: 1. Names published in* Cercospora *and* Passalora CBS Biodiversity Ser. 1: 33-36 (2003)

(FIGS 2, 12-13)

Lesions on living leaves, necrotic, initially circular to ellipsoid, later coalescing to form large spots, 3.5–42 x 3–25 mm, with indistinct margins, brow. *Internal hyphae* 1.5–8 µm diam, branched, septate, brown. *External hyphae* not observed. *Stromata* reduced to few cells on substomatal cavity. Conidiophores hypophylous arising through stomata, fasciculate, erect, straight, subcylindrical, 48–175 x 4–5.5 µm, 2–5-septate, unbranched, brown paler at apices, thin-walled, smooth. *Conidiogenous cells* terminal, integrated, proliferating simpodially, 23.5–73 x 3.5–5 µm, light brown. *Conidiogenous loci* conspicuous, 1-3 per cell, 2.5–4 µm diam, thickened, darkened. *Conidia* solitary, ranging from obclavate-cylindrical to (mostly) acicular-filiform, straight to curved, 30–115 x 2–5 µm, apex subacute, base truncate, 2–7-septate, guttulate, hyaline, thin walled, smooth, hila thickened and darkened.

Teleomorph: not seen.

Habitat: on living leaves of *Tibouchina herbacea*.

Known distribution: Espirito Santo (Brazil), Minas Gerais (Brazil), Paraná (Brazil) and Rio Grande do Sul (Brazil).

Material examined: BRAZIL, Minas Gerais Viçosa, on living leaves of *T. herbacea*, 02 February 2001, R. W. Barreto (VIC 30569). BRAZIL, Parana, Curitiba, on living leaves of *T. herbacea*, 30 March 1998, R. W. Barreto (VIC 30620). BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 18 January 2001, R. W. Barreto (VIC 30695). BRAZIL, Rio Grande do Sul, Nova Petrópolis,

on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30696). BRAZIL, Minas Gerais, Viçosa, road to Cajuri on living leaves of *T. herbacea*, 16 March 1996, R. W. Barreto (VIC 30660). BRAZIL, Minas Gerais, Jequeri on living leaves of *T. herbacea*, 21 April 1996, R. W. Barreto (VIC 30668). BRAZIL, Minas Gerais, Juiz de Fora, on living leaves of *T. herbacea*, 06 November 1998, R. W. Barreto (VIC 30673). BRAZIL, Espirito Santo, Venda Nova do Imigrante, entrance of Parque Estadual da Pedra Azul on living leaves of *T. herbacea*, 09 December 2004, O. L. Pereira (VIC 30682).

Cladosporium tibouchinensis D.F. Parreira & R.W. Barreto **sp. nov.**

(FIGS 14-15)

Mycobank 512067.

Etymology: named in reference to the host genus.

Differt a *Cladosporium hypophyllum* conidiophoris longioribus, 15–160.5 x 3.0–5.0 µm, 0–3 septata, conidiis longioribus 4.5–49.5 x 2–5 µm, 0–3 septata.

Colonies formed at the apex of trichomes, partly or completely covering its inflated heads, giving the appearance of burned matches to the trichomes (under the dissecting microscope), connected to neighboring trichomes by external hyphae. *Internal hyphae* indistinct. *External hyphae* wrapping the trichomes, 2–3 µm diam, branched, septate, double layered and smooth walled, brown. *Conidiophores* hypophyllous, in loose groups or solitary emerging from external hyphae, cylindrical, straight or flexuous, sometimes branched, 15–160.5 x 3–5 µm, 1–7-septate, double layered, dark brown. *Conidiogenous cells* terminal, integrated, cylindrical, with simpodial proliferation, 7.5–43.5 x 3–5 µm, brown. *Conidiogenous loci* conspicuous, 1–9 per cell, on small lateral shoulders, 1–2(3) µm diam, thickened, darkened. *Conidia* solitary or catenulate,(in short branched chains), variable in shape, narrowly to broadly ellipsoid, subcylindrical to cylindrical-oblong, subglobose, obovoid or limoniform, straight to slightly curved, curved, 4.5–49.5 x 2–5 µm, 0–3 septate, gutulate, ligth brown, thin-walled, smooth, hila thickened and darkened.

Teleomorph: not seen.

Known distribution: Minas Gerais (Brazil), Paraná (Brazil), Rio Grande do Sul (Brazil) and Santa Catarina (Brazil).

Material examined: BRAZIL, Santa Catarina, Lajes, on living leaves of *T. herbacea*, 16 January 2001, R. W. Barreto (VIC 30567; **holotype**). BRAZIL, Minas Gerais, Alvorada de Minas, on living leaves of *T. herbacea*, 19 April 2008, R. W. Barreto (VIC 30690). BRAZIL, Minas Gerais, Carrancas, on living leaves of *T. herbacea*, 16 May 2004, O. L. Pereira (VIC 30676). BRAZIL, Minas Gerais, Tiradentes, on living leaves of *T. herbacea*, 15 May 2004, O. L. Pereira (VIC 30678). BRAZIL, Minas Gerais, Carrancas, on living leaves of *T. herbacea*, 16 May 2004, O. L. Pereira (VIC 30679). BRAZIL, Paraná, Curutiba, on living leaves of *T. herbacea*, 31 March 1998, R. W. Barreto (VIC 30619). BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30696).

Mollisia tibouchinae D.F. Parreira & R.W. Barreto **sp. nov.**

(FIGS 3, 16-18)

Mycobank XXXXX.

Etymology: named in reference to the host genus.

Differt a *Mollisia parasitica* asci minoribus, 52–69 x 6–9 µm, ascosporae minoribus 8.5–12 x 3.5–4 µm.

Spots on stems and leaves; on leaves amphigenous, circular to ellipsoid, initially as small brown spots, becoming large, surrounded by an inner brown and an outer reddish margin, brow in center, 0.9–3 mm diam, sometimes leading to the necrosis of extensive areas of the leaves or stems. *Internal hyphae* indistinct. *External hyphae* absent. *Apothecia* cupulate to flat, short-stalked, 90–232.5 x 116.5–750 µm, textura globulosa-angularis, peripheral cells baloon-shaped, becoming broadly claviform towards the margin. *Paraphyses* cylindrical, apex clavate, 2–3 µm diam, septate, hyaline. *Asci* parallel, unitunicate, clavate, pedicellate, straight to slightly curved, 52–

69 x 6–9 µm, 8-spored,. *Ascospores* oval to ellipsoid, 8.5–12 x 3.5–4 µm, hyaline, 0-septate, smooth, guttulate.

Anamorph: not observed.

Habitat: on living leaves of *Tibouchina herbacea*.

Known distribution: Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, São Paulo, (Brazil).

Material examined: BRAZIL, Minas Gerais, Barbacena, on living leaves of *T. herbacea*, 14 May 2004, O. L. Pereira (VIC 30677, **holotype**); BRAZIL, Minas Gerais, Tiradentes, on living leaves of *T. herbacea,* 15 May 2004, O. L. Pereira (VIC 30678); BRAZIL, Minas Gerais, Carrancas, on living leaves of *T. herbacea*, 16 May 2004, O. L. Pereira (VIC 30679); BRAZIL, Minas Gerais, Lambari, Parque Nova Baden, on living leaves of *T. herbacea*, 25 November 1998, R. W. Barreto (VIC 30630); BRAZIL, Minas Gerais, Borda da Mata, on living leaves of *T. herbacea*, 25 November 1998, R. W. Barreto (VIC 30631); BRAZIL, Minas Gerais, Poços de Caldas, Cascata Véu de Noiva, on living leaves of *T. herbacea*, 8 June 2001, R. W. Barreto (VIC 30639); BRAZIL, Minas Gerais, Poços de Caldas, Cascata Véu de Noiva, on living leaves of *T. herbacea*, 5 June 2001, R. W. Barreto (VIC 30640); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 19 February 2006, R. W. Barreto (VIC 30642); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 2 May 2008, R. W. Barreto (VIC 30644); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 08 June 1995, R. W. Barreto (VIC 30645); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 08 June 1995, R. W. Barreto (VIC 30646); BRAZIL, Rio de Janeiro, Teresópolis, on living leaves of *T. herbacea*, 13 October 1995, R. W. Barreto (VIC 30648); BRAZIL, Rio de Janeiro, Petrópolis, Fazenda Inglesa, on living leaves of *T. herbacea*, 15 October 1995, R. W. Barreto (VIC 30649); BRAZIL, Minas Gerais, Itabirito, on living leaves of *T. herbacea*, 9 November 1995, R. W. Barreto (VIC 30650); BRAZIL, Rio de Janeiro, Petrópolis, Araras, on living leaves of *T. herbacea*, 19 December 1995, R. W. Barreto (VIC 30652); BRAZIL, São Paulo, Bananal, Serra da Bocaina,on living leaves of *T. herbacea,* 28 December 1995, R. W. Barreto (VIC 30654); BRAZIL, São Paulo, Bananal, Serra da Bocaina, on living leaves of *T. herbacea,* 28 December 1995, R. W. Barreto (VIC 30655); BRAZIL, Minas Gerais, Barão de Cocais, Santuário do Caraça, on living leaves of *T. herbacea*, 3 May 1996, R. W. Barreto (VIC 30667); BRAZIL, Rio de Janeiro, Nova Friburgo, Alto do Michelis, on living leaves of *T. herbacea*, 4 April 2000, R. W. Barreto (VIC 30669); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea,* 5 April 2000, R. W. Barreto (VIC 30670); BRAZIL, Rio de Janeiro, Nova Friburgo, Alto do Michelis, on living leaves of *T. herbacea*, 20 October 1996, R. W. Barreto (VIC 30672); BRAZIL, Santa Catarina, São Joaquim, on living leaves of *T. herbacea,*11 June1997, R. W. Barreto (VIC 30674); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 20 October 1996, R. W. Barreto (VIC 30675).

Passalora tibouchinae D.F. Parreira & O.L. Pereira **sp. nov.**

(FIGS 4, 19-20)

Mycobank 512080.

Etymology: named in reference to the host genus.

Maculis in foliis vivis, circularibus, cinereo-brunneis vel atro-brunneis, 1.5-6 mm diam. *Stromatibus* amphigenis, parvis vel bene evolutis, atro-brunneis, 6.5–32.5 × 7.5–45 µm. *Conidiophoris* fasciculatis, atro-brunneis, apicem versus pallide brunneis, 15.0–76.0 × 2–5 µm, 0–6-septatis. *Conidiis* solitariis, acicularibus vel obclavatis, rectis vel leniter curvatis, 30–115 × 2–5 µm, 2–7-septatis, ad apicem acutis, ad basim truncatis, pallide brunneis, levis.

Leaf spots initially as small brown spots, becoming circular, brown with an outer reddish margin, light brow centraly, 1.5–6 mm diam. *Internal hyphae* 1.5–8 µm diam, branched, septate, ligth brown. *External hyphae* absent. *Stromata* either reduced to few cells filling the substomatal cavity or well developed, 6.5–32.5 x 7.5–45 µm, composed of dark brown *textura angularis*. *Conidiophores* anphigenous arising through stomata, fasciculate, erect, straight to slightly curved or sinuose, subcylindrical, 15–76 x 2–5 µm, 0–6 septate, unbranched, brown becoming pale at apices, thin-walled, smooth. *Conidiogenous cells* terminal, integrated, proliferating simpodially, 5–41 x 2.5–5 µm, light brown. *Conidiogenous loci* conspicuous, 1-5 per cell, 1–2 µm diam, thickened and darkened. *Conidia* solitary, cylindrical to nearly acicular, straight to curved, 30–115 x 2–5.0 µm, apex obtuse or subacute, base truncate, 2–7 septate , guttulate, ligth brown, thin-walled, smooth, hila thickened and darkened.

Teleomorph: not seen.

Known distribution: Espirito Santo (Brazil), Minas Gerais (Brazil), Paraná (Brazil), Rio de Janeiro (Brazil), Rio Grande do Sul (Brasil) and São Paulo (Brazil).

Material examined: BRAZIL, Espirito Santo, Ibatiba, on living leaves of *T. herbacea*, 09 December 2004, O. L. Pereira (VIC 30568; **holotype**). BRAZIL, Espirito Santo, Venda Nova do Imigrante, entrance of Parque Estadual da Pedra Azul on living leaves of *T. herbacea*, 09 December 2004, O. L. Pereira (VIC 30680). BRAZIL, Espirito Santo, Venda Nova do Imigrante, entrance of Parque Estadual da Pedra Azul on living leaves of *T. herbacea*, 09 December 2004, O. L. Pereira (VIC 30681). BRAZIL, Minas Gerais, Lagoa da Prata, on living leaves of *T. herbacea*, 05 February 2005, O. L. Pereira (VIC 30683). BRAZIL, Paraná, Curitiba, Road Curitiba-Paranaguá Km 51 on living leaves of *T. herbacea,* 31 March 1998, R. W. Barreto (VIC 30619). BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 24 february 1998, R. W. Barreto (VIC 30621). BRAZIL, Rio de Janeiro, Vila do Grama, on living leaves of *T. herbacea*, 24 february 1998, R. W. Barreto (VIC 30625). BRAZIL, Minas Gerais, Rio Pomba, on living leaves of *T. herbacea*, 19 october 1998, R. W. Barreto (VIC 30628). BRAZIL, Minas Gerais, Santa Barbara do Tugúrio, on living leaves of *T. herbacea*, 21 november 1998, R. W. Barreto (VIC 30629). BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30696). BRAZIL, Minas Gerais, Coronel Pacheco, on living leaves of *T. herbacea*, 13 March 2002, R. W. Barreto (VIC 30641). BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 06 April 2008, R. W. Barreto (VIC 30643). BRAZIL, São Paulo, Bananal, Serra da Bocaina (top) on living leaves of *T. herbacea*, 28 December 1995, R. W. Barreto (VIC 30656). BRAZIL, Minas Gerais, Araponga, Cachoeira do Estouro on living leaves of *T. herbacea*, 09 March 1996, R. W. Barreto (VIC 30659). BRAZIL, Minas Gerais, Alto Caparaó, near Hotel Caparaó, river margin on living leaves of *T. herbacea*, 31 March 1996, R. W. Barreto (VIC 30665). BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 19 October 1996, R. W. Barreto (VIC 30671).

Perisporiopsis sp.

(FIGS 21-23)

Leaf spots absent, pseudothecia randomly distributed on leave surface.. *Internal hyphae* not observed. *External hyphae* 3–5 µm diam, branched, septate, brown, smooth. *Pseudothecia* superficial, epigenous, isolate, unilocular, globose to subglobose, 83.5–170 x 72.5–160 µm, walls of *textura angularis*, brown, ornamented with dark brow erect setae on upper half. *Hamathecial tissue* absent. *Asci* bitunicate, fasciculate, obclavate to cylindrical, sessile to short pedicellate, straight to slightly curved, 37.5–76 x 14–29.55 µm, 8-spored. *Ascospores* fusiform, 17.5–28.5 x 5.5–8.5 µm, hyaline, 3-septate, guttulate, smooth.

Anamorph: not observed.

Habitat: on living leaves of *Tibouchina herbacea*.

Known distribution: Espirito Santo, Minas Gerais, Rio de Janeiro, Rio Grande do Sul (Brazil).

Material examined: BRAZIL, Espirito Santo, Venda Nova do Imigrante, Parque Estadual da Pedra Azul, on living leaves of *T. herbacea*, 09 December 2004, O. L. Pereira (VIC 30682; **holotype**); BRAZIL, Minas Gerais, Barbacena, on living leaves of *T. herbacea*, 14 May 2004 O. L. Pereira (VIC 30677); BRAZIL, Minas Gerais, Santa Barbara do Tugúrio, on living leaves of *T. herbacea*, 27 November 1998, R. W. Barreto (VIC 30629); BRAZIL, Minas Gerais, Lambari, Parque Nova Baden, on living leaves of *T. herbacea*, 25 November 1998, R. W. Barreto (VIC 30630); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 18 January 2001, R. W. Barreto (VIC 30636); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30637); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30696); BRAZIL, Rio Grande do Sul, Road Nova Petrópolçis-Caxias do Sul Km 179, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30638); BRAZIL, Rio de Janeiro, Nova Friburgo, road Rio de Janeiro-Nova Friburgo Km 60, on living leaves of *T. herbacea*, 2 May 2008, R. W. Barreto (VIC 30644); BRAZIL, Rio de Janeiro, Petrópolis, Araras, on living leaves of *T. herbacea*, 19 December 1995, R. W. Barreto (VIC 30652).

Pseudocercospora subsinematosa D.F. Parreira & D.J. Soares **sp. nov.**

(FIGS 5, 24-26)

Mycobank 512071.

Etymology: named in reference to the conidiophores aggregated in short synemata-like structures.

Differt a *Pseudocercospora tibouchinae* conidiophoris longioribus, 21–76 µm longis, 0–5 septata, conidiis 54–145.5 µm longis, 4–15 septata.

Leaf spots circular to elliptic, 2–7 mm, initially as small spots surrounded by a reddish-brown margin, later developing into a large spot, light brown in center, with a reddish-brown margin, vein-delimited. *Internal hyphae* thin-walled, 1.5–3.5 µm diam., branched, septate, ligth brown. *External hyphae* absent. *Stromata* epiphyllous, well-developed, immersed to erumpent, 21–55 x 16–50 µm, composed of dark brown *textura angularis*. *Conidiophores* epigenous, aggregated in dense fascicles, as short synnemata-like structures, erect, straight to slightly sinuose, subcylindrical, 21–76 x 3–5 µm, 1–5 septate, unbranched, brown becoming paler at apice, thin-walled, smooth. *Conidiogenous cells* terminal, integrated, cylindrical, 8.0–28.5 x 2.5–5.0 µm, light brown, smooth. *Conidiogenous loci* protruding, 1-2 per cell, 1.5–3 µm diam, unthickened, not darkened. *Conidia* solitary, obclavate-cylindrical to subcylindrical attenuating gradually towards the apex, straight to slightly curved, 45–145.5 x 2–4 µm, apex subacute to occasionally obtuse, base subtruncate or sometimes endend in a strongly protruding hilum, 4–15-septate, guttulate, pale olivaceous to pale brown, smooth, thin-walled, hila unthickened, not darkened.

Teleomorph: not seen.

Known distribution: Minas Gerais (Brazil).

Material examined: BRAZIL, Minas Gerais, Tabuleiro, on living leaves of *T. herbacea*, 15 October 2007, D. F. Parreira and D.J. Soares (VIC 30565; **holotype**). BRAZIL, Minas Gerais, Tabuleiro, on living leaves of *T. herbacea*, 15 October 2007, D.F. Parreira and D.J. Soares (VIC 30687).

Pseudocercospora tibouchinensis D.F. Parreira & R.W. Barreto **sp. nov.**

(FIGS 6, 27-28)

Mycobank 512076.

Etymology: named in reference to the host genus.

Differt a *Pseudocercospora tamoneae*, conidiis ad 202.0 µm longis, 3–12 septata.

Leaf spot very similar to those caused by *P. subsinematosa*, but larger in size 1.5–19 mm diam. *Internal hyphae* indistinct. *External hyphae* absent. *Stromata* subglobose to irregular, well-developed, sub-immersed to erumpent, 17.5–45 x 20–62.5 µm, composed of dark brown, *textura angularis*. *Conidiophores* aggregated in sporodochia, erect, straight to slightly curved, subcylindrical, 8.5–40.5 x 2–4.5 µm, 0–4 septate, unbranched, light brown, thin-walled, smooth. *Conidiogenous cells* terminal, integrated, 5.5–20 x 2–3 µm, light brown. *Conidiogenous loci* inconspicuous, 1–2 per cell, 1–3 µm diam, unthickened, not darkened. *Conidia* solitary, cylindrical to acicular, straight to slightly curved, sometimes geniculate, 55–202 x 2–3 µm, apex obtuse or subacute, base truncate, 3–11 septate, guttulate, pale olivaceous, thin-walled, smooth, hila unthickened and not darkened.

Teleomorph: not seen.

Known distribution: Cordillera Oriental (Dominican Republic), Minas Gerais (Brazil), Paraná (Brazil), Rio de Janeiro (Brazil) and Rio Grande do Sul (Brazil).

Material examined: BRAZIL, Rio de Janeiro, Itatiaia, Parque Nacional do Itatiaia, on living leaves of *T. herbacea*, 27 December 1995, R. W. Barreto (VIC 30653; **holotype**). BRAZIL, Paraná, Curitiba, on living leaves of *T. herbacea*, 30 Mach 1998, R. W. Barreto (VIC 30618). BRAZIL, Minas Gerais, Rio Pomba, on living leaves of *T. herbacea*, 19 October 1998, R. W. Barreto (VIC 30628). BRAZIL, Minas Gerais, Ouro Preto, Reserva Biológica do Tripuí on living leaves of *T. herbacea*, 01 August 1998, R. W. Barreto (VIC 30566). BRAZIL, Minas Gerais, Viçosa, on living leaves of *T.*

herbacea, 04 December 1998, R. W. Barreto (VIC 30632). DOMINICAN REPUBLIC, Cordillera Oriental, Miches, on living leaves of *T. herbacea*, 27 December 1998, R. W. Barreto (VIC 30633). BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 18 January 2001, R. W. Barreto (VIC 30636). BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 19 February 2006, R. W. Barreto (VIC 30642). BRAZIL, Minas Gerais, Manhuaçu, road Belo Horizonte-Vitória on living leaves of *T. herbacea*, 30 March 1996, R. W. Barreto (VIC 30661). BRAZIL, Minas Gerais, Manhuaçu, road Belo Horizonte-Vitória (between Realeza and Manhuaçu) on living leaves of *T. herbacea*, 30 March 1996, R. W. Barreto (VIC 30662). BRAZIL, Minas Gerais, Alto do Caparaó, boundary Alto Jequitibá on living leaves of *T. herbacea*. 31 March 1996, R. W. Barreto (VIC 30663). BRAZIL, Minas Gerais, Alto do Caparaó, near the entrance park on living leaves of *T. herbacea*, 31 March 1996 R. W. Barreto (VIC 30664). BRAZIL, Minas Gerais, Caeté, Serra da Piedade on living leaves of *T. herbacea*, 03 May 1996, R. W. Barreto (VIC 30697). BRAZIL, Minas Gerais, Barão de Cocais, Santuário do Caraça on living leaves of *T. herbacea*, 03 May 1996, R. W. Barreto (VIC 30667). BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 05 April 2000, R. W. Barreto (VIC 30670).

Pseudocercospora tibouchinicola D.F. Parreira & D.J. Soares **sp. nov.**

(FIGS 7, 29-30)

Mycobank 512079.

Etymology: named in reference to the host genus.

Differt a *Pseudocercospora tibouchinae* stromatibus nullis, conidiophoris longioribus, 11.0-53.0 µm, conidiis 16.5-195.0 µm longis, 1–16 septata.

Colonies on living leaves, not forming conspicuous leaf spots, growing mainly abaxially forming a dense olivaceous mat of conidia and conidiophorores, colonies somewhat vein-delimited abaxially; adaxially colonies are sparse and less commonly formed;, on senescent leaves green islands formed at colonized areas whereas the rest of the lamina becomes red or brow. *Internal hyphae* 1.5–3 µm diam., branched, septate, hyaline, thin-walled. *External hyphae* absent. *Stromata* absent. *Conidiophores* arising from stomata, sparsely fascitulate, erect, straight, subcylindrical, 11–53 x 3–5 µm, 1–4-septate, mostly unbranched, ligth-brow, thin-walled, smooth. *Conidiogenous cells* terminal, integrated, 5–22.5 x 3–5 µm, pale olivaceous, smooth. *Conidiogenous loci* protruding, 1–2 per cell, 1–2 µm diam, unthickened, not darkened. *Conidia* solitary, obclavate-cylindrical to subcylindrical, straight to curved, sometimes geniculate, 16.5–195 x 2.0–3.5 µm, apex subacute, occasionally obtuse, base endend in a strongly protruding hilum, 1–16-septate, guttulate, pale olivaceous, thin-walled, smooth, hila unthickened not darkened.

Teleomorph: not seen.

Known distribution: Minas Gerais (Brazil).

Material examined: BRAZIL, Minas Gerais, Tabuleiro, on living leaves of *T. herbacea*, 15 October 2007, D. F. Parreira and D.J. Soares (VIC 30564; **holotype**).

Septoria tibouchinensis D.F. Parreira & R.W. Barreto **sp. nov.**

(FIGS 8, 31-33)

Mycobank XXXXX.

Etymology: named in reference to the host genus.

Differt a *Septoria melastomatis*, conidia longioribus, 44.5–101.5 × 1.5–2 µm, 2–4 septata.

Leaf spots, initially puctiform, isolate to abundant coalescing to cover large areas or whole leaves that become redish brown to brown with whitish dots corresponding to areas with accumulation of sporulation. *External hyphae* absent. *Internal hyphae* indistinct. *Conidiomata* pycnidial, unilocular, globose, the upper half of the conidiomata usually breaking off at maturity leaving only the lower half inbedded in the leaf tissue, 72-226 x 66-177 µm, thin walled 5–6 µm, medium brown, *textura angularis*. *Dehiscence* apical ostiolate 20–31.5 µm diam.*Conidiophores* mostly reduced to the conidiogenous cell, occasionally developing,rarely branched, lining the inner part

of the conidiomata, 0–1-septate, hyaline, smooth, subcylindrical, 6–18 × 2–3.5 µm. *Conidiogenous cells* holoblastic, terminal, hyaline, smooth, 6–14 × 2–3.5 µm. *Conidia* solitary, cylindrical, straight to sinuous, 44.5–101.5 × 1.5–2 µm, 2–4-septate, hyaline, smooth, strongly guttulate.

Habitat: on living leaves of *Tibouchina herbacea*.

Known distribution: Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, São Paulo (Brazil).

Material examined: BRAZIL, Minas Gerais, Alvorada de Minas, on living leaves of *T. herbacea*, 19 April 2008, R.W. Barreto. (VIC 30690; **holotipe**); BRAZIL, Minas Gerais, Tiradentes, on living leaves of *T. herbacea,* 15 May 2004, O L. Pereira (VIC 30678); BRAZIL, Minas Gerais, Carrancas, on living leaves of *T. herbacea*, 16 May 2004, O. L. Pereira (VIC 30679); BRAZIL, Minas Gerais, São Roque de Minas, on living leaves of *T. herbacea,* 7 April 2004, O. L. Pereira (VIC 30684); BRAZIL, São Paulo, Eldorado Paulista, Parque Estadual de Jacupiranga, Caverna do Diabo, on living leaves of *T. herbacea*, 16 April 2005, O. L. Pereira (VIC 30685); BRAZIL, Minas Gerais, Borda da Mata, on living leaves of *T. herbacea*, 25 November 1998, R. W. Barreto (VIC 30631); BRAZIL, Rio de Janeiro, Parati, on living leaves of *T. herbacea*, 16 January 2001, R. W. Barreto (VIC 30635); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 18 January 2001, R. W. Barreto (VIC 30636); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30637); BRAZIL, Rio Grande do Sul, Nova Petrópolis, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30696); BRAZIL, Rio Grande do Sul, Road Nova Petrópolçis-Caxias do Sul Km 179, on living leaves of *T. herbacea*, 19 January 2001, R. W. Barreto (VIC 30638); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea*, 19 February 2006, R. W. Barreto (VIC 30642); BRAZIL, Rio de Janeiro, Nova Friburgo, road Rio de Janeiro-Nova Friburgo Km 60, on living leaves of *T. herbacea*, 2 May 2008, R. W. Barreto (VIC 30644); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea,* 8 June 1995, R. W. Barreto (VIC 30646); BRAZIL, Minas Gerais, Viçosa, on living leaves of *T. herbacea,* 24 September 1995, R. W. Barreto (VIC 30647); BRAZIL, São Paulo, Bananal, Serra da Bocaina, on living leaves of *T. herbacea,* 28 December 1995, R. W. Barreto (VIC 30654); BRAZIL, São Paulo, Bananal, Serra da Bocaina, on living leaves of *T. herbacea,* 28 December 1995, R. W. Barreto (VIC 30655); BRAZIL, São Paulo, Bananal, Serra da Bocaina, on living leaves of *T. herbacea,* 28 December 1995, R. W. Barreto (VIC 30656); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea,* 05 February 1996, R. W. Barreto (VIC 30657); BRAZIL, Minas Gerais, Araponga, Estevão Araújo, on living leaves of *T. herbacea,* 9 March 1996, R. W. Barreto (VIC 30658); BRAZIL, Minas Gerais, Alto Caparaó, on living leaves of *T. herbacea,* 31 March 1996, R. W. Barreto (VIC 30663); BRAZIL, Minas Gerais, Alto Caparaó, on living leaves of *T. herbacea,* 31 March 1996, R. W. Barreto (VIC 30644); BRAZIL, Minas Gerais, Alto Caparaó, on living leaves of *T. herbacea,* 31 March 1996, R. W. Barreto (VIC 30665); BRAZIL, Minas Gerais, Caeté, on living leaves of *T. herbacea,* 3 May 1996, R. W. Barreto (VIC 30666); BRAZIL, Rio de Janeiro, Nova Friburgo, on living leaves of *T. herbacea,* 5 April 2000, R. W. Barreto (VIC 30670); BRAZIL, Minas Gerais, Juiz de Fora, on living leaves of *T. herbacea,* 6 December 1998, R. W. Barreto (VIC 30673); BRAZIL, Santa Catarina, São Joaquim, on living leaves of *T. herbacea,*11 June1997, R. W. Barreto (VIC 30674).

Discussion

Asteridiella melastomacearum is the only species in the group of fungi collected on *T. herbacea* and studied in the present publication that was readily recognized as previously known taxon. It was originally described from *Tibouchina longifolia* (Vahl) Baill. ex Cogn. by Hansford (1961). *Tibouchina herbacea* is the third host in genus *Tibouchina*, found for this fungal species.

The cercosporoid fungi are among the most common of all plant pathogens (Crous and Braun, 2003) and several papers were already published dealing on this fungus group from Brazil (Braun and Freire, 2006; Dornello-Silva *et al*. 2007; Rocha *et al*. 2008). The *Cercospora* on *T. herbacea* fits well within *Cercospora apii sensu lato* - including species that are morphologically indistinguishable from *C. apii*. Many species of *Cercospora* that were distinguished from *C. apii* solely based on host-association were reduced to synonymy of the later species (Crous and Braum, 2003). There are still

many unresolved issues regarding taxonomic delimitation at the species or infra-specific level within the *C. apii* complex as revealed by later studies (Groenewald *et al.* 2006). Under the new concept for this group of species *T. herbacea* appears to represent a new host for *C. apii.* This represents the first report of *C. apii* on a member of the Melastomataceae.

Cladosporium tibouchinensis had conidiophores pigmented and well differenciated, conidia euseptate and conidiogenus loci coronated, therefore it is a typical *Cladosporium s. str.* (Crous *et al*, 2007). In the key to biotrophic *Cladosporium* species provided by Shubert (2005), *C. tibouchinensis* appears as similar to *C. hypophyllum* Fuckel, differing from that species by having conidiophores and conidia of a different size. Additionally *Cladosporium tibouchinensis* was only found growing on the apex of trichomes, differently from *C. hypophyllum*. It was, therefore recognized and described as a new species.

Mollisia tibouchinae belongs to a genus containing a majority of saprophytic species. *Mollisia parasitica* (G. Winter) Sacc. is an exception. This species is a known parasite a member of Melastomataceae which has been recorded on *Tibouchina pulchra* Cogn. (Viégas, 1961). *Mollisia tibouchinae* can be readily separated from *M. parasitica* by ascus and ascospore sizes: asci are 52–69 x 6–9 µm, and ascospore 8.5–12 x 3.5–4 µm in *M. tibouchinae* whereas in *M. parasitica* asci are 75-78 × 16 µm and ascospores are 14-7 µm.

There is no previous report of a fungus in the genus *Passalora* on a member of the Melastomataceae. *Passalora tibouchinae* is clearly a new species.

The fungus identified herein as *Perisporiopsis* sp. has bitunicate asci, pragmospores that are constricted at septae and fits well within the genus *Perisporiopsis* (Sivanesan, 1984). Nevertheless, for a complete description allowing for a comparison with other fungi in this genus it is still necessary to find the anamorphic stage of this species, which was apparently absent from all specimens that were collected in this study. For the moment we preferred to keep it identified only at the generic level.

There are at least 14 *Pseudocercospora* species recorded on members of the Melastomataceae, but only one (*P. tibouchinae*) is known in association with plants in the genus *Tibouchina*. All the three new species of *Pseudocercospora* introduced here have clear morphological differences that allow its distinction to all *Pseudocercopora* previously described on this host family (Table 1). *Pseudocercospora tibouchinicola* is similar to *P. dissotidis* having no stromata and forming indistinct leaf spots. All other *Pseudocercospora* species on family Melastomataceae are associated to leaf spots. Conidiophores of *P. tibouchinicola* are smaller and conidia are longer and narrower than those of *P. dissotidis*. *Pseudocercospora subsinematosa* is similar to *P. leandrae* in stromata, conidiophores and conidia size, but the new species is easily distinguished from *P. leandrae* as well as all other *Pseudocercospora* on Melastomatace by its conidiophore arrangment in loosely synnemata. *Pseudocercospora tibouchinensis* is the sole species of *Pseudocercospora* previously described in association with the genus *Tibouchina.* Although it causes leave spots that are similar to those formed by *P. subsinematosa*, conidiophores and conidia which have a similar size to those of *P.tibouchinicola,* it differs from all new species described in this publication by having conidia with a truncate base whereas *P. subsinematosa* had conidia with somewhat conical base and *P. tibouchinicola* has conidia that are ended in a strongly protruding hilum.

Septoria tibouchinae differs from *Septoria melastomatis* Patouillard and *Septoria miconiae* Garman in conidial size - narrower in the new species than in *S. melastomatis* (which is 5 µm wide as compared to 1.5-2 µm wide in *S. tibouchinae*) and

longer than in *S. miconiae* (which is up to 26 µm long as compared to 44.5–101.5 µm long in *S. tibouchinae*). The literature contains yet another species of *Septoria* associated to a member of the Melastomataceae, wich is *Septoria melastomatum* (Lév.) Berl. & Voglino (Saccardo, 1892). Nevertheless, this is an obscure species for which no adequate description was found in the literature that might allow for a proper comparison with the new species proposed herein.

Among the species of fungi described in this study, three appear to have potential for use as biological control agents to be used against *T. herbaceae* because of being associated to severe disease symptoms. These are: *Septoria tibouchinensis*, *Passalora tibouchinensis* and *Mollisia tibouchinae*. Although the specificity of these fungi has not been tested yet, *S. tibouchinensis* and *P. tibouchinensis* belong to genera that include species regardes as being rather specific. *Asteridiella melastomacaerum* has no potential as a biological control agent, as it causes only minor damage to the infected foliage. *Cercospora apii* is regarded as a polyphagous pathogen, with a broad host range, although some host-specific populations are known to occur. It is difficult to evaluate its potential at this stage. *Cladosporium tibouchinensis* and *Perisporiopsis* sp. are of dubious pathogenic status and, in case they are capable of infecting healthy tissue they are only weak pathogens of no relevance for biological control. Although clearly pathogenic to *T. herbacea* the three new species of *Pseudocercospora* should be given a lower priority in investigations for biocontrol as the level of damage to the host, as observed in the field was always lower than that observed for *S. tibouchinensis*, *P. tibouchinensis* and *M. tibouchinae*.

Other fungi that were found associated to *T. herbacea* were preliminarly identified as: *Asterina*, *Chaetophiophoma*, *Gnomonia*, *Hainesia*, *Leptosphaeria*, *Pestalotiopsis*. They will be described and discussed in a separate publication.

The significant number of 16 fungal species, including seven new taxa, found associated with *T. herbacea* during the surveys follows the pattern observed during surveys of fungi on other native Brazilian weeds such as *Chromolaena odorata* (L.) R.M.King & H.Rob (Barreto and Evans, 1994). *Lantana camara* L. (Barreto *et al.* 1995; Pereira and Barreto, 2000), *Miconia calvescens* DC (Seixas *et al.* 2007) and *Mitracarpus hirtus* (L.) DC (Pereira & Barreto, 2005). These other surveys also yielded a plethora of fungi, including records of novel fungal-host associations and also new fungal taxa. It is likely that an expansion of the survey to other areas of within the wide range of native distribution of *T. herbacea* and related species occurrence will expand the list of fungi associated with this species even further.

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References

Almasi, K.N. (2000). A non-native perennial invades a native forest. Biological Invasions 2: 219-230.

Barr, M.E. (1978). The Diaporthales in North America with Emphasis on Gnomonia and its Segregates. Mycologia Memoir 7: 15-62.

Barreto, R.W. and Evans, H.C. (1994). The mycobiota of the weed *Chromolaena odorata* in southern Brazil with particular reference to fungal pathogens for biological control. Mycological Research 98: 1107-1116.

Barreto, R.W., Evans, H.C. and Ellison, C. (1995). The mycobiota of the weed *Lantana camara* in Brazil, with particular reference to biological control. Mycological Research 99: 407-409.

Braun, U. (1999). Taxonomic notes on some species of the Cercospora complex. Schlechtendalia 2:1-28.

Braun, U. and Hill, C.F. (2002). Some new micromycetes from New Zealand. Mycological Progress 1:19-20.

Braun, U., Crous, P.W. and Pons, N. (2002). Annotated list of Cercospora species (epithets a-b) described by C. Chupp. Feddes Repertorium Specierum Novarum Regni Vegetabilis 113:112-127

Braun, U., David, J. and Freire F.d.C.O. (1999).Some cercosporoid hyphomycetes from Brazil. Cryptogamie Mycologie 20(2): 95-106.

Chupp, C. (1954). A monograph of the fungus genus *Cercospora*. Published by the author, Ithaca.

Cronk, Q.C.B. and Fuller, J.L. (1995). Plant Invaders: the Threat to Natural Ecosystems. Chapman & Hall, New York.

Crous, P.W. and Braun, U. (1996). Cercosporoid fungi from South Africa. Mycotaxon 57:233-321.

Crous, P.W. and Braun, U. (2003). Mycosphaerella *and its anamorphs: 1. Names published in* Cercospora *and* Passalora. CBS Biodiversity Ser.

Crous, P.W., Alfenas, A.C. and Barreto, R.W. (1997). Cercosporoid fungi from Brazil. Mycotaxon 64: 405-430.

Crous, P.W., Braun, U., Schubert, K. and Groenewald, J.Z. (2007). The genus *Cladosporium* and similar dematiaceous hyphomycetes. Studies in Mycology 58:51-55.

Culliney, T.W., Nagamine, W.T. and Teramoto, K.K. (2003). Introductions for Biological Control in Hawaii 1997–2001. Proceedings Hawaiian Entomological Society 36: 145-153.

Culliney, T.W., Nagamine, W.T. and Teramoto, K.K. (2003). Introductions for Biological Control in Hawaii 1997–2001. Proceedings Hawaiian Entomological Society 36: 145-153.

Deighton, F.C. (1987). New species of *Pseudocercospora* and *Mycovellosiella*, and new combinations into *Pseudocercospora* and *Phaeoramularia*. Transactions of the British Mycological Society 88: 365-391.

DeWalt, J.S., Denslow, J.S. and Ickes, K. (2003). Natural-enemy release facilitates habitat expansion of the invasive tropical shrub *Clidemia hirta*. Ecology 85: 471-483.

Dornelo-Silva, D., Pereira-Carvalho, R.C., Dianese, J.C. (2007). New *Stenella* and *Parastenella* species from the Brazilian Cerrado. Mycologia 99: 753-764.

Groenewald, M., Groenewald, J.Z., Braun, U. and Crous, P.W. (2006). Host range of *Cercospora apii* and *C. beticola* and description of *C. apiicola*, a novel species from cerely. Mycologia 98: 275-285.

Hansford, C.G. (1961). The Meliolineae. A Monograph. Sydowia Beih 2: 1-806.

Julien, M.H. and Griffiths, M.W. (1998). Biological Control of Weeds: AWorld Catalogue of Agents and Their Target Weeds. 4th edition. CABI Publishing, Wallingford, Oxon., U.K.

Kamal, M.K., Khan. and Verma, R.K. (1990). New species and combinations in *Pseudocercospora* from India. Mycological Research 94: 240-242.

Killgore, E.M., Sugyama, L.S. and Barreto, R.W. (1997). Prospective biological control of *Miconia calvescens* in Hawai'i with a non-indigenous fungus *Colletotrichum gloeosporioides* (Penz.) Sacc. f.sp. *miconiae*. Proceedings of the First Conference on Miconia Control.

Motooka, P., Castro, L., Nelson, D., Nagay, G. and Ching, L (2003). Weeds of Hawai'i's Pastures and Natural Areas An Identification and Management Guide. CTAHR Publication, 184 pp.

Pereira, J.M. and Barreto, R.W. (2000). Additions to the mycobiota of the weed *Lantanacamara* (Verbenaceae) in Southeastern Brazil.Mycophatologia 151: 71-80.

Pereira, O.L., Barreto, R.W., Cavalazzi, J.R.P. and Braun, U. (2007). The micobiota of the cactus weed *Pereskia aculeata* in Brazil, with comments on the life-cicle of *Uromyces perskiae*. Fungal Diversity 25: 167-180.

Pereira, O.L. and Barreto, R.W. (2005). The mycobiota of the weed *Mitracarpus hirtus* in Minas Gerais (Brazil), with particular reference to fungal pathogens for biological control. Australasian plant pathology 34: 41-50.

Rocha, F.B., Soares, D.J. and Barreto R.W. (2008) *Pseudocercospora* species on Piperaceae from Viçosa, Minas Gerais, Brazil. Mycological Progress. doi10.1007/s11557-008-0566-0.

Saccardo, P.A. (1889). *Sylloge Fungorum* 8: 329

Saccardo, P.A. (1892). *Sylloge Fungorum*. 10: 355.

Schubert, K. (2005). *Morphotaxonomic revision of foliicolus* Cladosporium *species (hyphomycetes).* Ph D. Thesis. Martin-Luther-University Halle, Germany.

Seixas, C.D.S., Barreto, R.W. and Killgore E. (2007). Fungal pathogens of *Miconia calvescens* (Melastomataceae) from Brazil, with reference to classical biological control. Mycologia 99: 99-111.

Seixas, C.D.S., Barreto, R.W., Freitas, L.G., Maffia, L.A. and Monteiro, F.T. (2004). *Ditylenchus drepanocercus* (Nematoda), a potential biological control agent for *Miconia calvescens* (Melastomataceae): host-specificity and epidemiology. Biological Control 31: 29-37.

Sivanesan, A. (1984). *The Bitunicate Ascomycetes and Their Anamorphs*. J. Cramer, Vaduz, Germany.

Soares, D.J. and Barreto, R.W. (2008). Fungal pathogens of the invasive riparian weed *Hedychium coronarium* from Brazil and their potential for biological control. Fungal Diversity 28: 85-96.

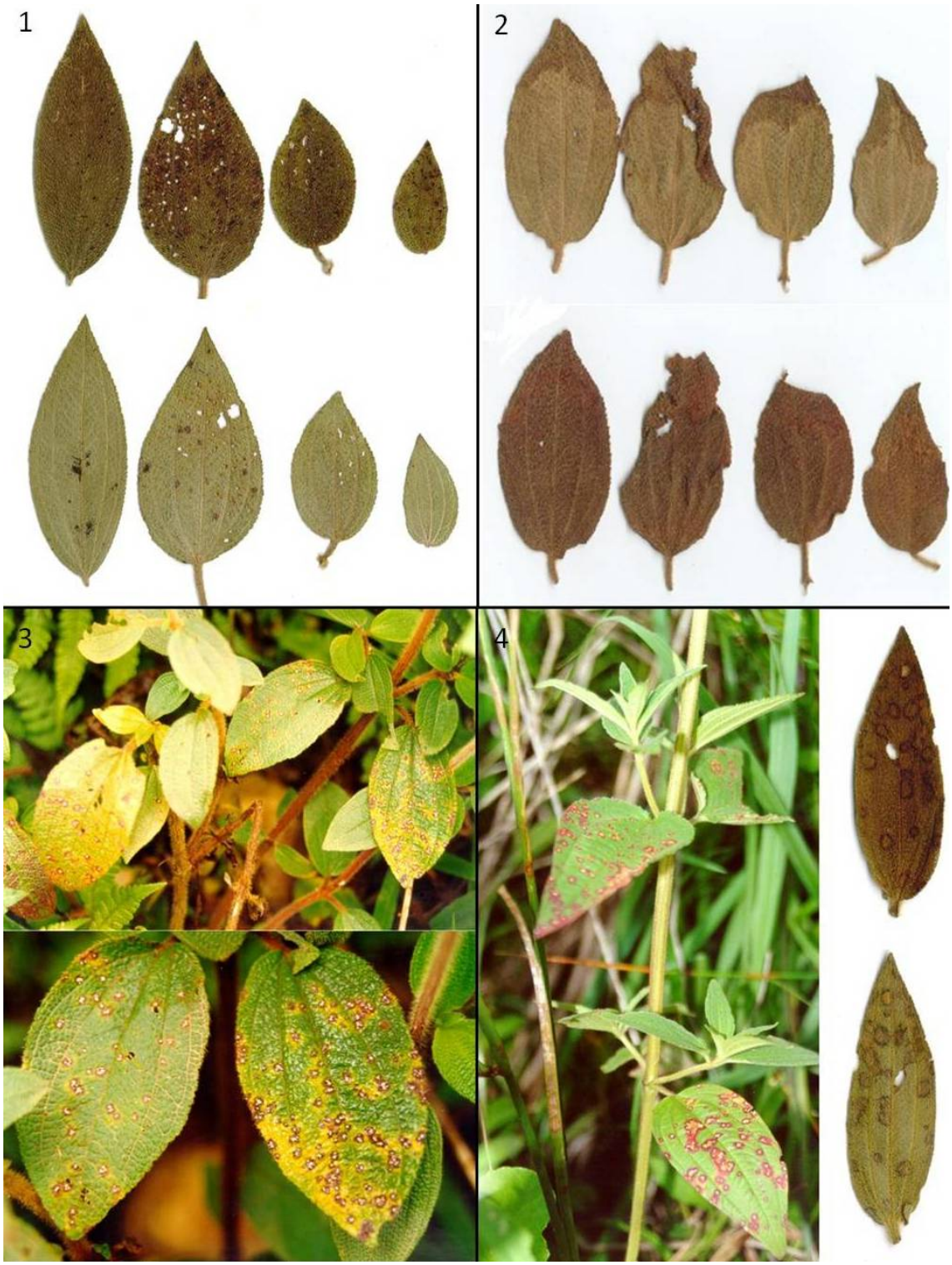
Viégas, A.P. (1961). Índice de fungos da América do Sul. IAC, Campinas.

Wagner, W.L., Herbst, D.R. and Sohmer, S.H. (1999). Manual of the flowering plants of Hawaii. Revised edition. Bernice P. Bishop Museum special publication. University of Hawai'i Press/Bishop Museum Press, Honolulu.

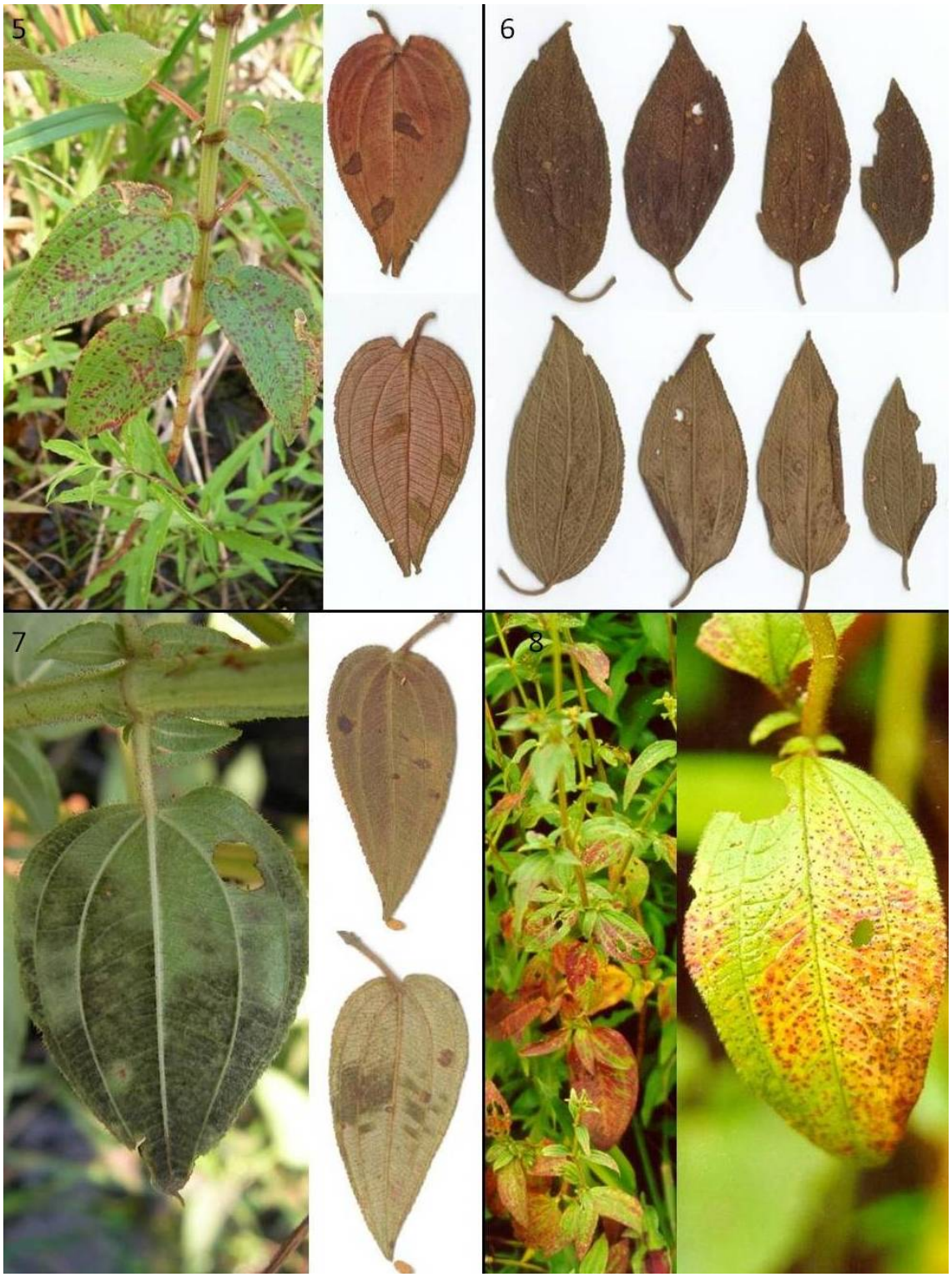
Wikler, C. and Souza, P.G. (2005) Estudos Bioecológicos de *Syphrea uberabensis* (Coleoptera: Chrysomelidae) Bechyné 1956. Ambiência 1: 103-112.

Table 1. Morphology of *Pseudocercospora* species recorded on the Melastomataceae.

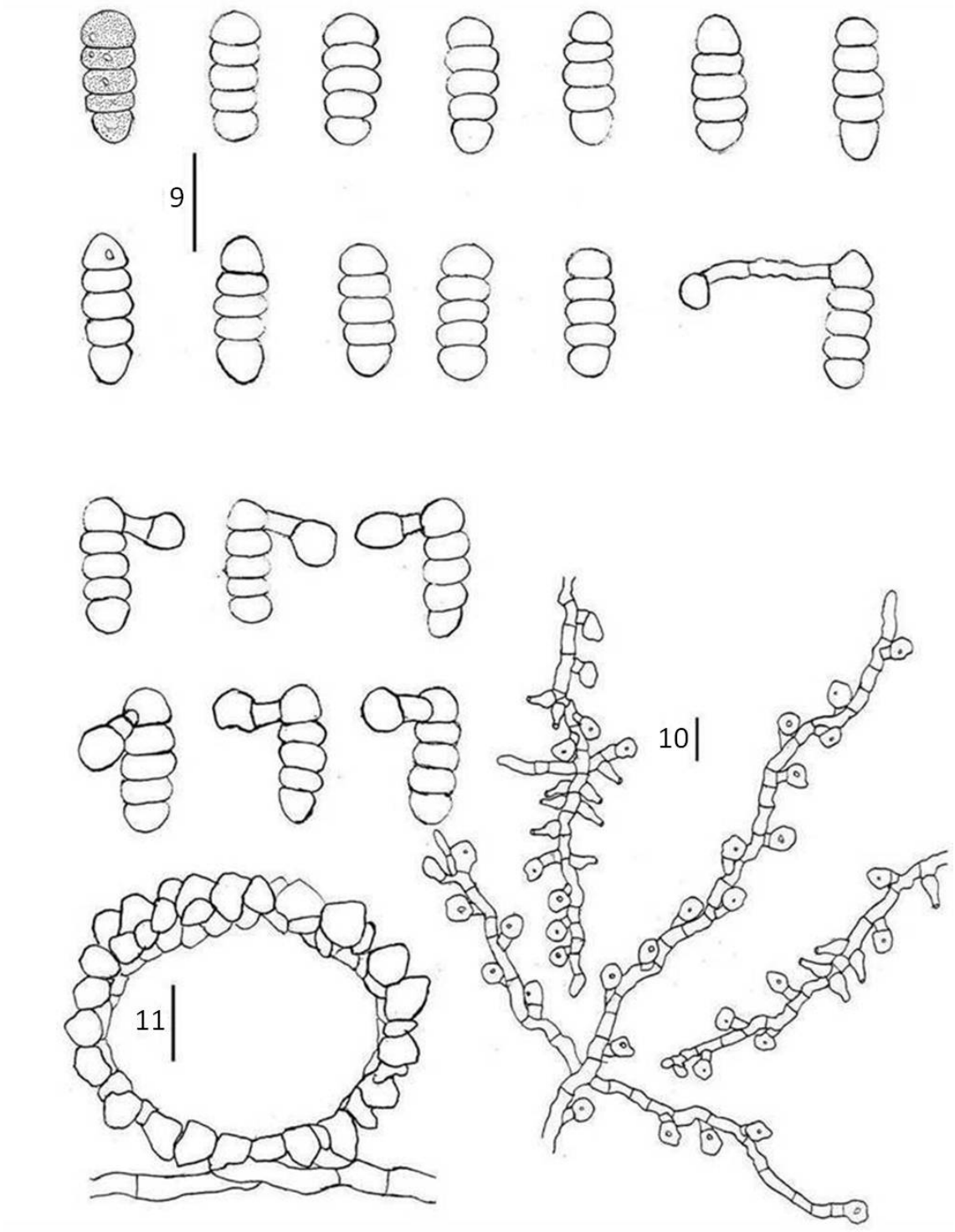
Species	Stromata	Conidiophores		Conidia	References
	size (µm)	size (µm)	septation	size (µm)	
P. aciotidis (Chupp) U. Braun & Crous	reduced to few cells	20–85 x 4–5.5	3–6	20–95 x 3.5–5	Chupp, 1954
P. curta (Syd.) U. Braun & Crous	60–80 diam.	10–20 x 3.5–5	absent	60–85 x 5–7	Chupp, 1954
P. dissotidis (Chupp & Doidge) Crous & U. Braun	absent	10–150 x 4–6	multiseptate	20–65 x 4.5–6	Chupp, 1954
P. erythrogena (G. F. Atk.) U. Braun	absent or reduced to few cells	10–70 x 2.5–4	septate	30–100 x 2.5–4	Chupp, 1954
P. leandrae (Syd.) U. Braun	35–50 diam.	30–70 x 3.5–4.5	0–2	45–140 x 3–5	Chupp, 1954
P. melastomobia (W. Yamam.) Deighton	22–33 x 29–42	10–50 x 3.5–6	septate	80–150 x 2.5–4	Chupp, 1954
P. miconiae (Gonz. Frag. & Cif.) U. Braun & Crous	absent or reduced to few cells	20–100 x 3.5–6	multiseptate	40–100 x 3–5.5	Chupp, 1954
P. miconiicola (Chupp) U. Braun & Crous	20–35 diam.	50–130 x 3.5–5	1–5	25–45 x 4–8	Chupp, 1954
P. mirandensis (Chupp) R.F. Castañeda & U. Braun	30–75 diam.	5–25 x 2–3.5	rarely	20–90 x 2–3.5	Chupp, 1954
P. monochaeticola (Chupp) U. Braun & Crous	20–60 diam.	10–55 x 1.5–3	rarely	30–85 x 1.5–3	Chupp, 1954
P. osbeckiae (Chona, Lall & Munjal) Kamal, M.K. Khan & R.K. Verma	18–26 x 15–20 or lacking	10-80 x 3-4.5	septate	40–90 x 3–5	Kamal et al, 1990
P. oxysporae (A.K. Kar & M. Mandal) Deighton	10–42.2 diam.	10–83.5 x 3–5	0–6	30–88.5 x 3–4.5	Deighton, 1987
P.subsinematosa D.F. Parreira & D.J. Soares	21–55 x 16–50	21–76 x 3–5	1–5	45–145.5 x 2–4	present work
P. tamoneae (Chupp) U. Braun & R.F. Castañeda	absent or reduced to few cells	10–40 x 2–4.5	septate	25–100 x 2–4.5	Chupp, 1954
P. tibouchinae (Viégas) Deighton	30–35 x 50–70	15–20 x 2–3	0–1	40–120 x 2–3	Crous et al, 1996
P. tibouchinicola D.F. Parreira & D.J. Soares	absent	11–53 x 3–5	0–4	16.5–195 x 2–3.5	present work
P. tibouchinensis D.F. Parreira & R.W. Barreto	17.5–45 x 20–62.5	8.5–40.5 x 2–4.5	0–4	55–202 x 2–3	present work



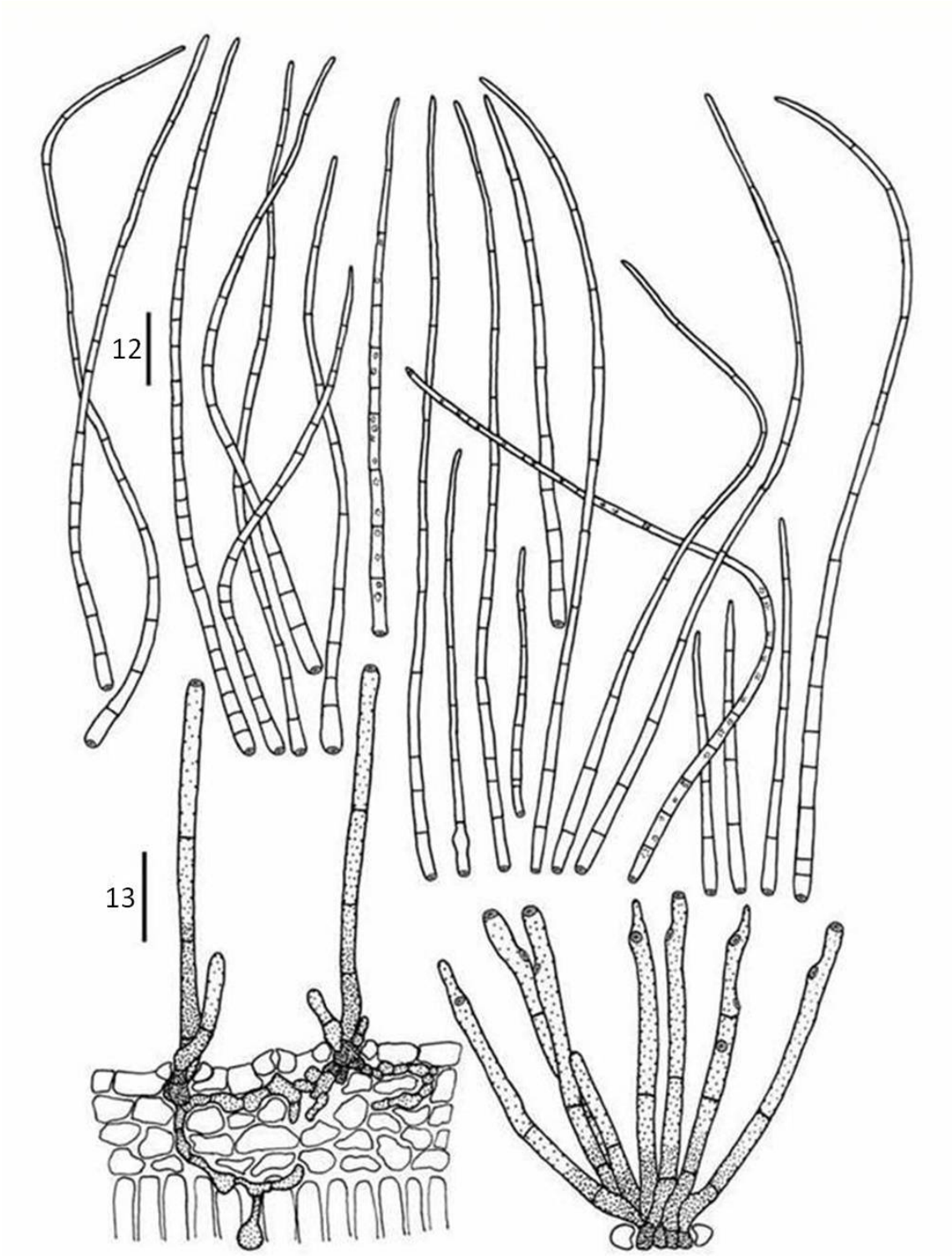
Figs 1-4 Selected disease symptoms to which fungi collected in the survey were associated: 1- black mildew - *Asteridiella melastomacearum*; **2**- leaf spots - *Cercospora apii*; **3**- leaf spots - *Mollisia tibouchinae*; **4**- leaf spots - *Passalora tibouchinae*.



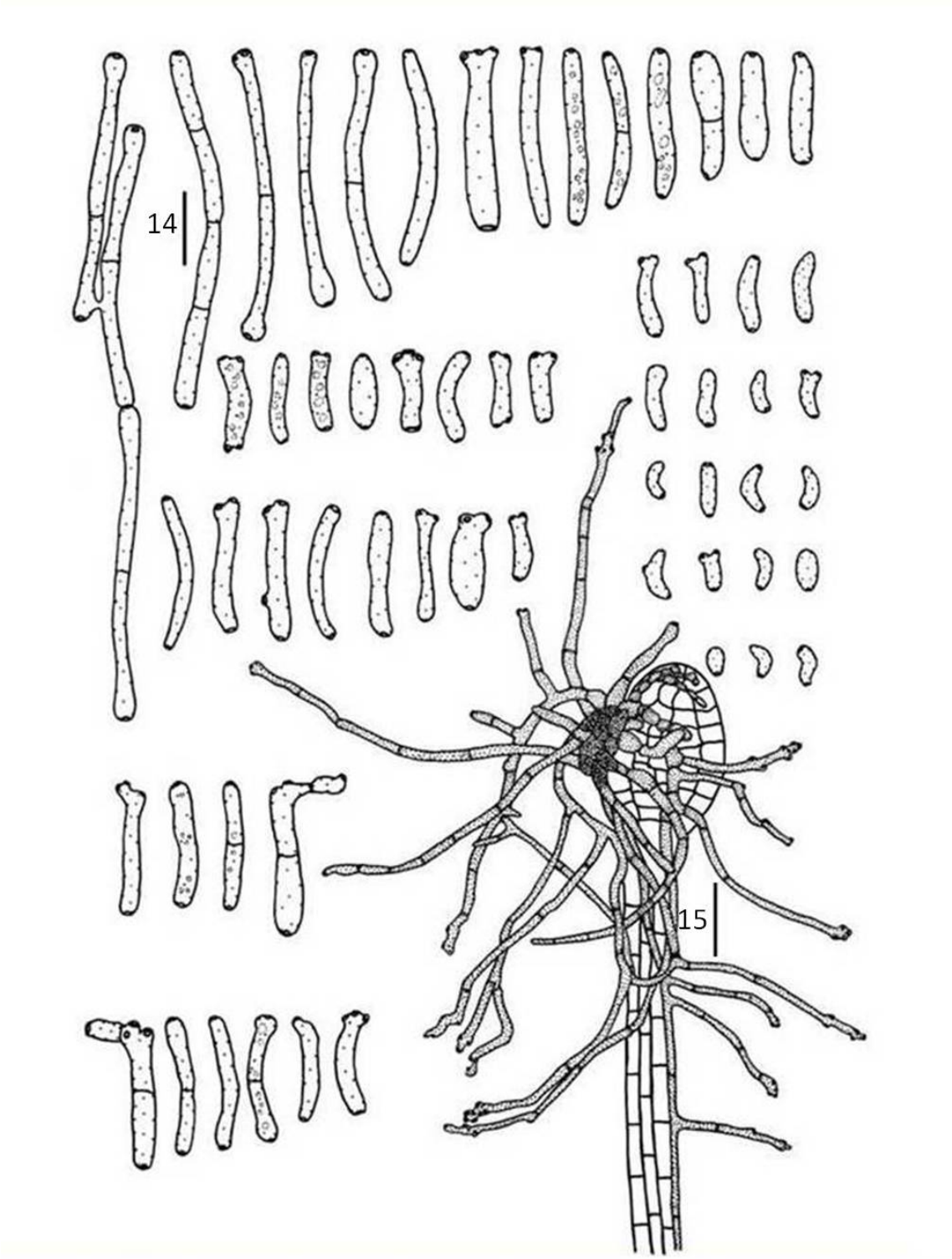
Figs 5-8. Selected disease symptoms to which fungi collected in the survey were associated: 5- leaf spots - *Pseudocercospora subsinematosa*; **6**- leaf spots - *Pseudocercosora tibouchinensis*; **7**- sooty mold and leaf spots - *Pseudocercospora tibouchinicola*; **8**- leaf spots and blight - *Septoria tibouchinae*.



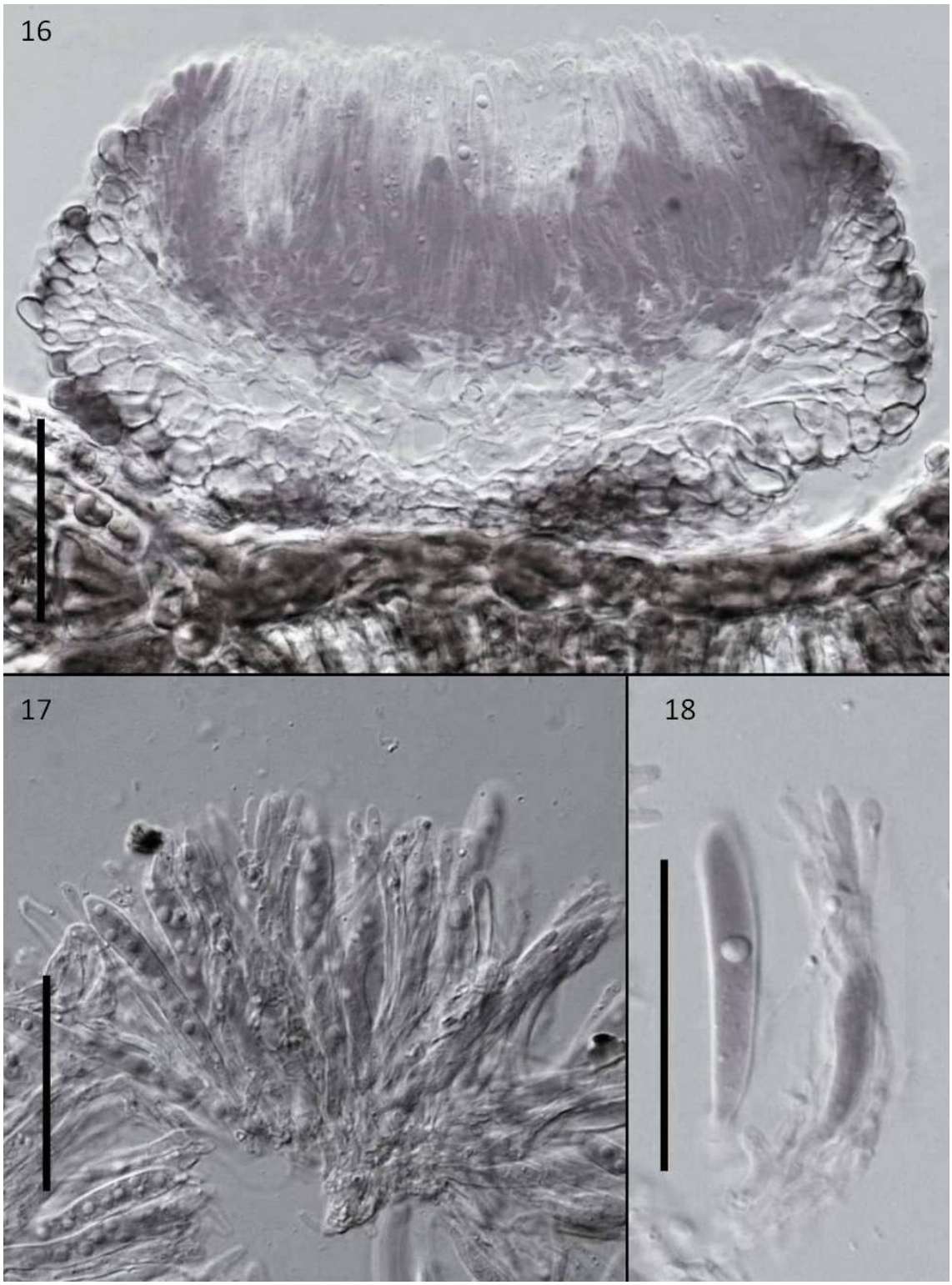
Figs 9-11. *Asteridiella melastomacearum* (VIC 30690) **9** Ascospores. **10** External hypha with appressoria and phialides. **11** Secton through perithecium showing its crenate external surface. Bars =25 µm



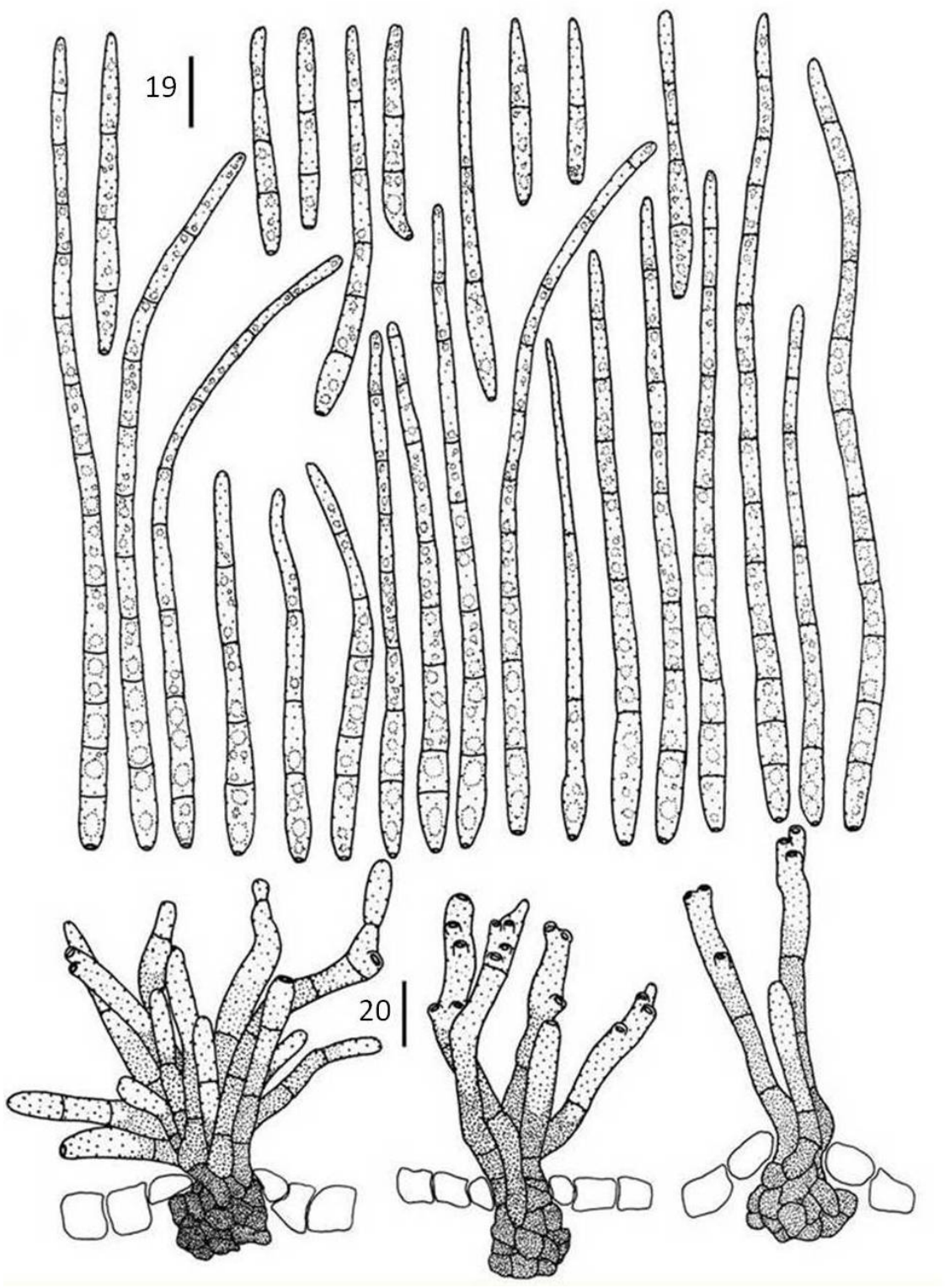
Figs 12-13. *Cercospora apii* (VIC 30569) **12.** Acicular conidia. **13.** Conidiophores arising through stomata either, solitary or fasciculate, brown. Bar = 10 µm.



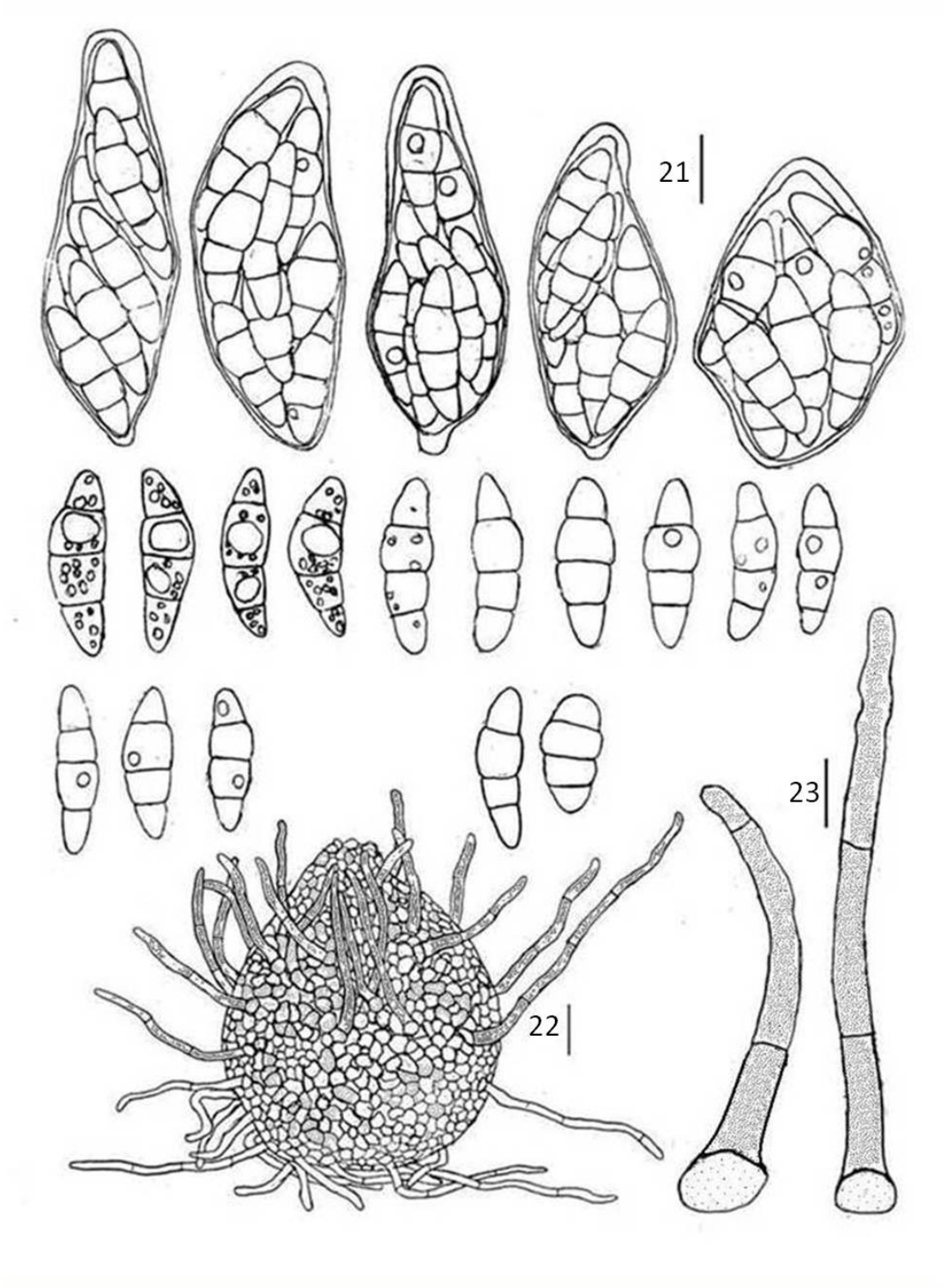
Figs 14-15. *Cladosporium tibouchinensis* (VIC 30567). **14.** Conidia (note the wide range of shapes: irregular, ellipsoid, allantoid, cylindrical; note narrowing in the middle, particularly for longer conidia). Bar=10 µm **15.** Conidiophores arising from external mycelium on trichomes. Bar = 80 µm



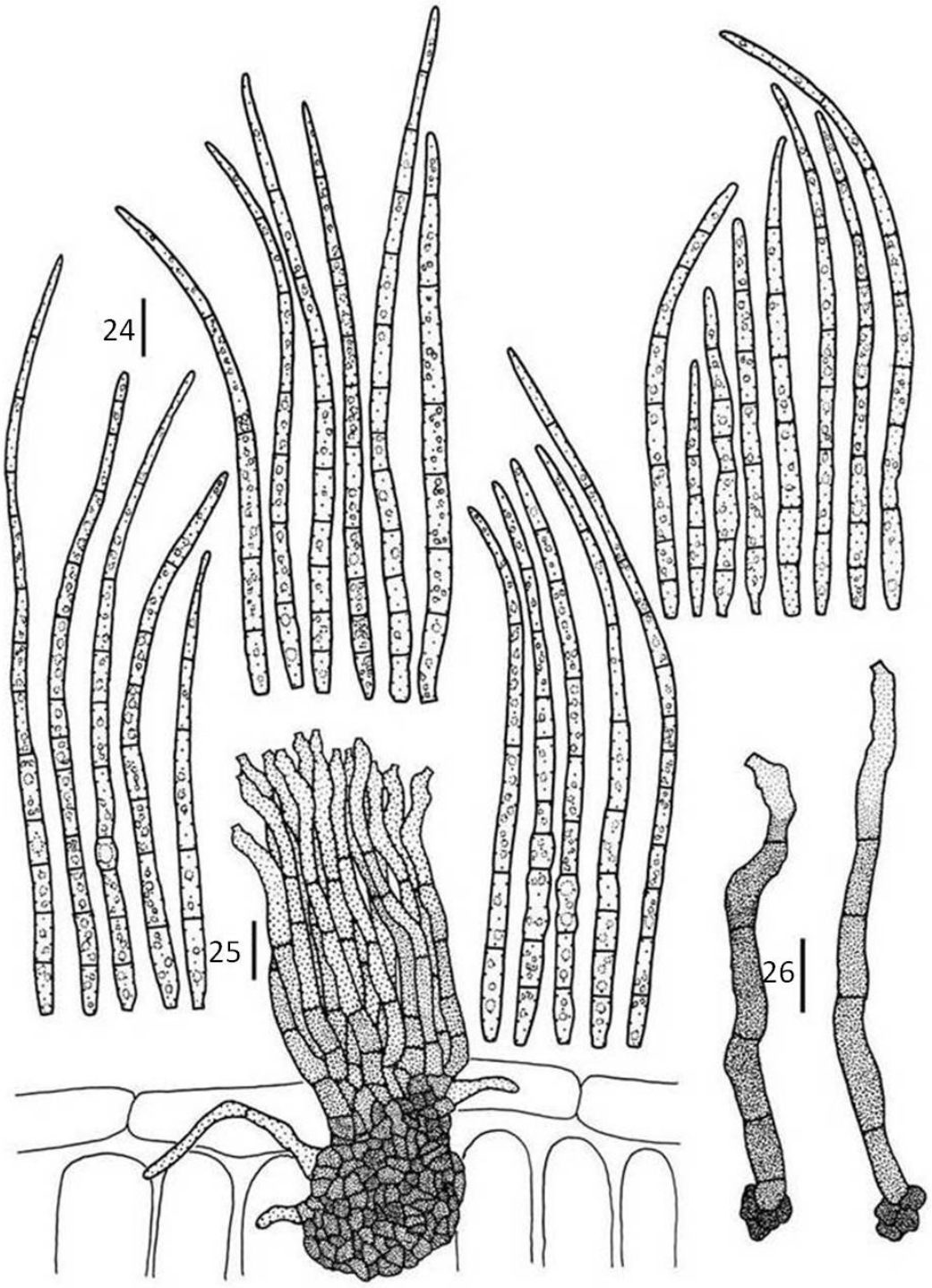
Figs 16-18. *Mollisia tibouchinae* (VIC 30667) **16** Apothecium. Bar=50 µm. **17** Asci and ascospores. Bar=10 µm. **18** Paraphises. Bar=10 µm.



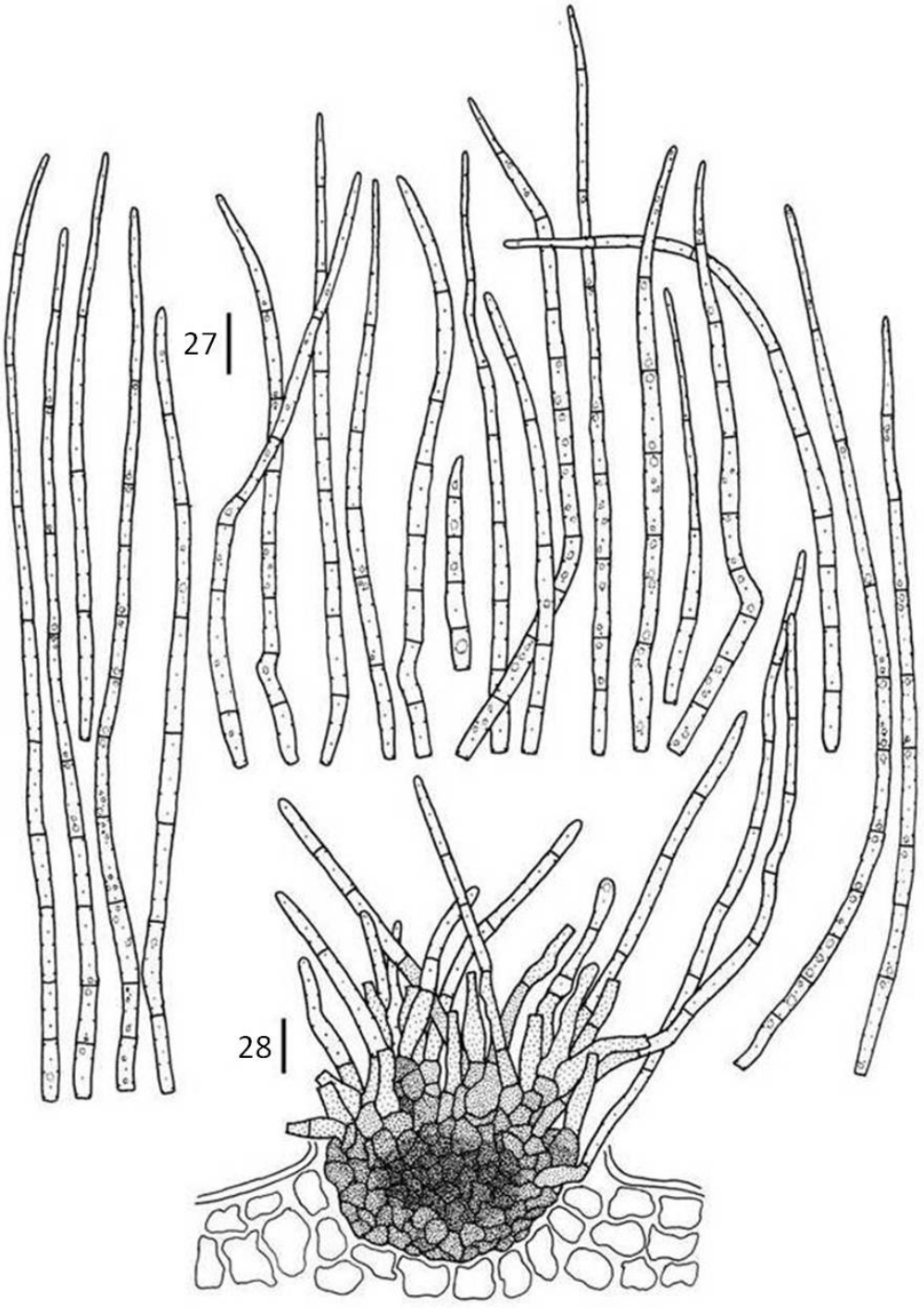
Figs 19-20. *Passalora tibouchinae* (VIC 30568).**19.** Conidia. **20.** Conidiophore fascicles arising through stomata. Bars = 10 µm.



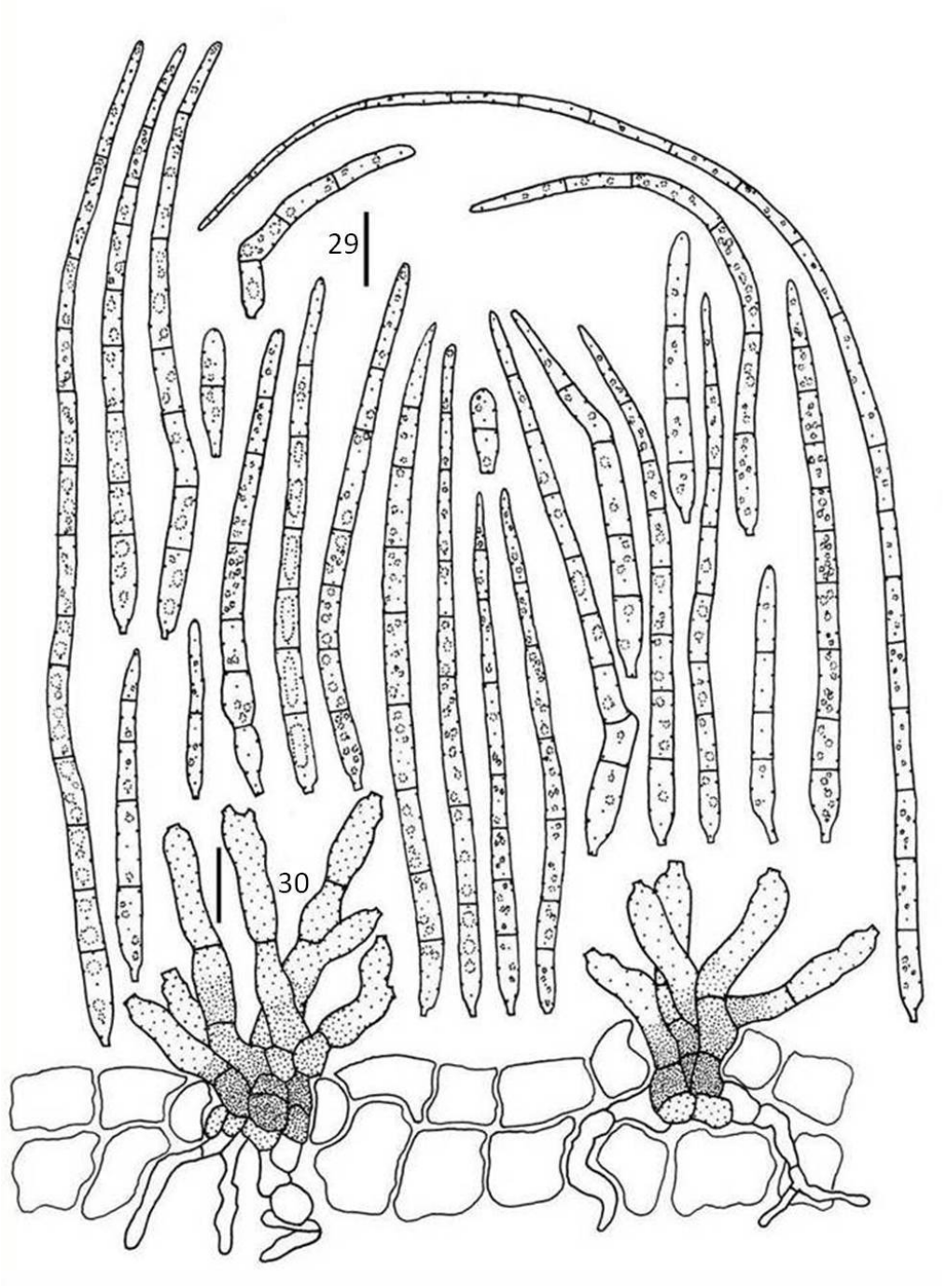
Figs 21-23. *Perisporiopsis* sp (VIC 30682) **21** Asci and ascospores. Bar=10 µm. **22** Pseudothecium. Bar=25 µm. **23** Pseudothecial ornamentations. Bar=10 µm



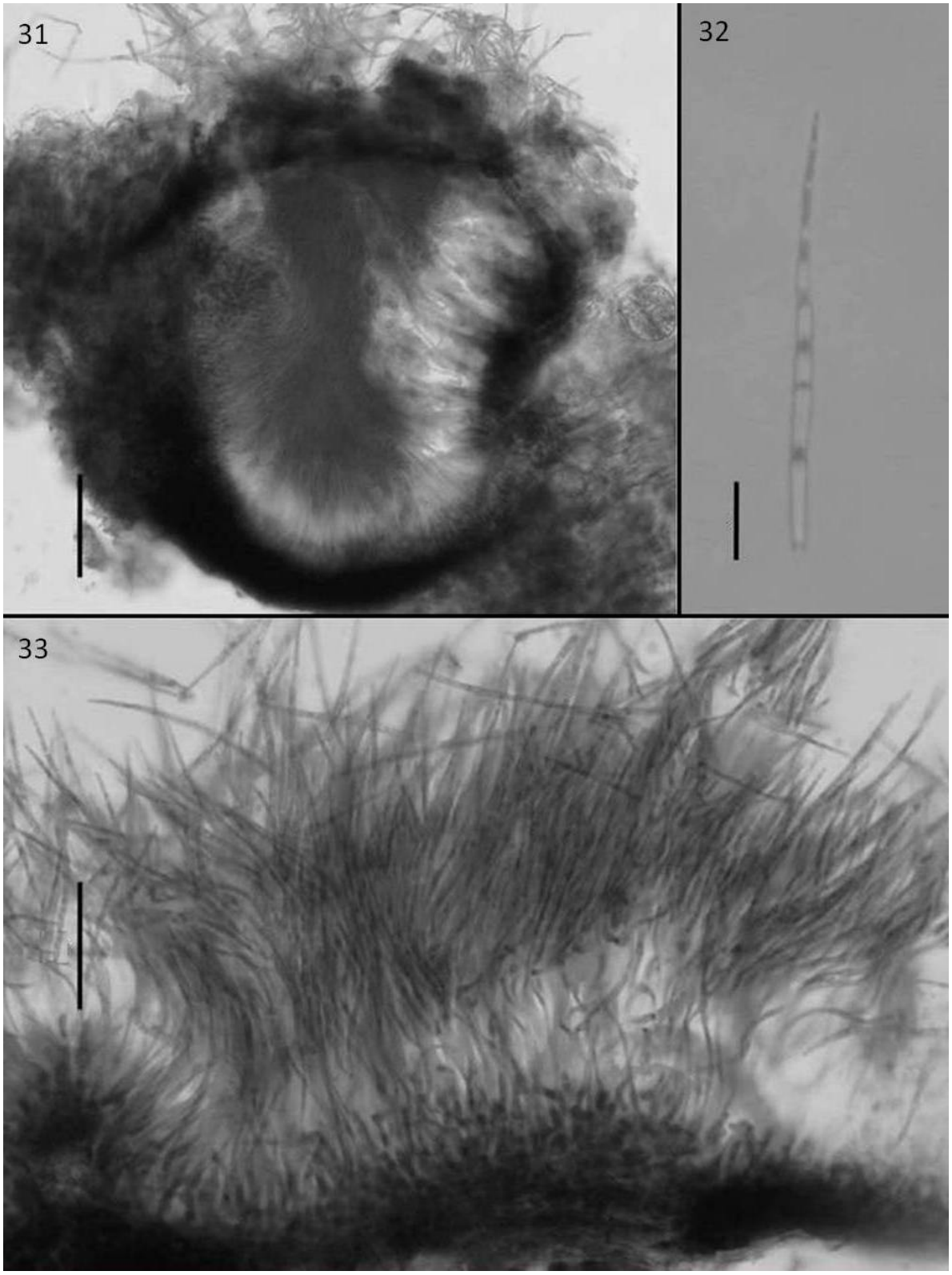
Figs 24-26. *Pseudocercospora subsinematosa* (VIC 30565). **24.** Conidia (note hila varying from subtruncate to protuberant). **25.** Conidiophores aggregated in dense, subsynnematose fascicle. **26.** Close-up of conidiophores. Bars = 10 µm.



Figs 27-28. *Pseudocercospora tibouchinensis* (VIC 30566).**27.** Conidia. **28.** Conidiophores on a dense imersed stroma. Bars = 10 µm.



Figs 29-30. *Pseudocercospora tibouchinicola* (VIC 30564). **29.** Conidia (note geniculation on some conidia, wide range of sizes and shapes and protuberant hila). **30.** Conidiophores arising from stomata. Bars = 10 μm..



Figs 31-33. *Septoria tibouchinae* (VIC 30690) **31** Pycnidium imersed in host tissue. Bar=50 µm. **32** Septate and guttulate conidium. Bar=10 µm. **33** Conidia and conidiogenous cells. Bar=30 µm.

CONCLUSÃO GERAL

Como resultado da análise de um total de 81 amostras de fungos associados a *T. herbacea* que foram coletadas foram identificadas 16 espécies diferentes, sendo que 7 foram consideradas novas para a ciência. Esta é mais uma evidência tanto da lacuna de conhecimento existente sobre a biodiversidade fúngica no Brasil como do valor da abordagem do estudo sistemático dos fungos associados a uma planta hospedeira como fonte de novidades micológicas em regiões tropicais. A expansão dos levantamentos para outras áreas de ocorrência de *T. herbacea* deverá ampliar ainda mais a lista de fungos associados a esta espécie.

Dentre as espécies de fungos encontradas no presente trabalho, três parecem ter potencial para uso em programas de controle biológico por causarem doenças severas em *T. herbacea*: *Septoria tibouchinensis*, *Passalora tibouchinae* e *Mollisia tibouchinae.* Embora a especificidade destes fungos não tenha ainda sido testada, os dois primeiros fungos pertencem a gêneros que incluem espécies tidas como bastante específicas (pelo menos restritas a uma única família botânica). Além disso, crescem em cultura pura, o que facilitaria a execução dos testes de patogenicidade, especificidade e outros. Sobre *M. tibouchinae* há ainda pouca informação. Aparentemente há apenas uma outra espécie no gênero que é parasita de plantas (*M. parasítica*), coincidentemente também atacando plantas do gênero *Tibouchina.* Os isolados obtidos a partir do levantamento foram depositados na coleção micológica da Clinica de Doenças de Plantas, do DFP, o que possibilitará o seu uso, em fase posterior do trabalho, numa avaliação objetiva dos fungos obtidos como agentes de controle biológico de *T. herbacea.*