MYCOTAXON

AN INTERNATIONAL JOURNAL FOR RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

Volume LXXIV, No. 2 April-June 2000

CONTENTS

ISSN 0093-4666 MYXNAE 74(2):257-546 (2000)

For subscription details, availability in microform, and
availability of articles as photocopies or tear sheets, see back cover.

[Contents continued from front cover]

MYCOTAXON offers Some of our Recent Books

prices include surface mail shipment

(for more books see also **www.mycotaxon.com/books.html**)

Fungi of China, by S. C. Teng. Mycotaxon, Ltd. 1996. Hardbound, xiv + 586 pp., 426 illustrations, map, portrait, index, 8-1/2x11 inches. $79.00. Airmail price varies by country: enquire. ISBN 0-930845-05-6.

• **Special for Mycotaxon subscribers: deduct $20.00 from regular price** •

Edited by Richard P. Korf, with a foreword by Teng's daughter, Rosaline Z. Deng.

What reviewers have to say about Teng's Fungi of China

"... one of the most valuable books on the fungi of China ever published in English." — *Mycologia* 90: 1091-1092, 1998.

"... a great big blue uncompromising brick of a book ... an instant classic. Anyone interested in identification of fungi, particularly in Asia, should get this book immediately. Mycology owes another debt to Dick Korf for his sympathetic and intelligent editing of this superb work." *Bibliography of Systematic Mycology* 10(6): xlviii-xlix. 1998.

"The publication of Teng's work now gives taxonomists easy access to the contributions of this remarkable scientist without having to undertake a fastidious searching in libraries." — *Sydowia* 48: 277-278. 1997.

"The book is important for any researcher interested in the systematic relationships, diversity, and distribution of fungi on a global scale." *New Zealand Journal of Botany* 35: 265-266. 1977.

"An extensive index to all taxa ... makes this book readily accessible to the user. It should be present in every public and private mycological library." *Persoonia* 16: 424. 1997.

Italians in the History of Mycology: *Proceedings of a symposium held in the Archivo Centrale dello Stato, Rome, 4-5 October 1995,* edited by Silvano Onofri, Antonio Graniti, & Laura Zucconi. Mycotaxon, Ltd. 1999. Softbound, 163 pp., illustrated, 16.5 x 23.5 cm. $35.00 plus postage. (Please ***order direct*** from Accademia Nazionale delle Scienze, detta dei XL, Villa Lontana, Via Cassia Antica 35, 00190 Roma, Italy, e-mail: acc.scienze@flashnet.it, fax: +39 06 3630057). ISBN 0-930845-09-0.

Twenty-one authors discuss contributions from Plinius the Elder onwards, specifically of Aldrovandi, Micheli, De Notaris, Inzenga, Carmignani, Arcangeli, Pellegrini, Saccardo, Bresadola, Tassi, Mattirolo, and Ciferri, and collections in herbaria in Rome and Genoa.

Lichenographia Thomsoniana: *North American Lichenology in honor of John W. Thomson,* edited by M. G. Glenn, R. C. Harris, R. Dirig & M. S. Cole. Mycotaxon, Ltd. 1998. Softbound, 448 pp., illustrated, 6x9 inches. $35.00. (Please ***order direct*** from Mariette Cole, 3010 West 112th St., Bloomington, MN 55431, U.S.A., e-mail: bcole@pclink.com). ISBN 0-930845-08-0.

A *Festschrift* of 30 papers honoring John W. Thomson.

Mycotaxon Cumulative Index for Volumes XLI-LX (1991-1996), by Karen D. Gettelman, Richard P. Korf, Susan C. Gruff, and Ian F. Korf. Mycotaxon, Ltd. 1998. Softbound, 296 pp., 6x9 inches. $35.00. Airmail, $55.00. ISBN 0-930845-07-2.

Author and taxon indexes to volumes 41-60 of Mycotaxon.

MYCOTAXON

AN INTERNATIONAL JOURNAL OF RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

VOLUME LXXIV, 2000

COMPLETE IN TWO QUARTERKY ISSUES
CONSISTING OF iv + 546 PAGES INCLUDING FIGURES

EDITOR-IN-CHIEF

ASSOCIATE EDITORS

EDITORIAL ADVISORY BOARD

Published by
MYCOTAXON, LTD., P. O. BOX 264
ITHACA, NY 14851-0264, USA

www.mycotaxon.com

Printed in the United States of America

TABLE OF CONTENTS, VOLUME SEVENTY-FOUR

No. 1, JANUARY-MARCH 2000

No. 2, APRIL-JUNE 2000

MYCOTAXON

Volume LXXIV(2), pp. 257-266 April-June 2000

STUDIES ON CERCOSPORA AND ALLIED GENERA IN CHINA I [1]

YING-LAN GUO YI JIANG

Systematic Mycology & Lichenology Laboratory
Institute of Microbiology, Academia Sinica, Beijing, 100080

Twenty seven species of *Cercospora,* 1 species of *Mycovellosiella* and 2 species of *Pseudocercospora* are reported. Of which, 4 are new species: *Cercospora acericola* Y. L. Guo & Y. Jiang on *Acer* sp., *C. euonymigena* Y. L. Guo & Y. Jiang on *Euonymus japonicus* L., *C. sambuci* Y. L. Guo & Y. Jiang on *Sambucus buergeriana* Blume, *Mycovellosiella rhoidis* Y. L. Guo on *Rhus* sp., and 6 are new records for China: *Cercospora asclepiadis* Ellis, *C. gomphrenae* Ray, *C. negundinis* Ellis & Everh., *C. siphocampyli* Chupp & Viegas, *Pseudocercospora asclepiadina* (Speg.) Deighton, *P. ubicola* (Yen) Deighton. Latin diagnoses, descriptions and illustrations of the new species are given. Specimens examined are deposited in HMAS.

Cercospora acericola Y. L. Guo & Y. Jiang. sp. nov. Fig.1

Maculae amphigenae, suborbiculares vel irregulares, 2-10 mm latae, pallide brunneae vel pallide rubro-brunneae. Caespituli amphigeni. Stromata nulla vel minutissima ex cellulis globosis brunneis composita. Conidiophora solitaria vel 2-11 fasciculata, modice brunnea vel brunnea, erecta vel curvata, non ramosa, 1-4 geniculata, 1-8 septata, 21.5-120.0(-194.0) × 6.5-8.6μm. Cicatrices conspicue incrassatae, 3.2-4.3μm latae. Conidia obclavata, hyalina, erecta vel curvata, ad apicem obtusa vel rotundata, ad basin obconico-truncata, indistincte 3-13 septata, 43.0-216.0 × 5.4-8.6(-10.3)μm.

Hab. in foliis vivis *Aceris* sp. (Aceraceae): Shennongjia, Hubei Provincia (HMAS 77309, Holotypus).

Leaf spots amphigenous, subcircular to irregular, 2-10 mm wide, often confluent, pale brown to pale reddish brown, with dark brown to dark reddish brown halo on the upper surface, yellowish brown to greyish brown on the lower surface. Fruiting amphigenous, chiefly hypogenous. Stromata none or only a few brown globose cells. Conidiophores solitary or 2-11 in a fascicle, moderately brown to brown, paler towards the apex, irregular in width, straight to curved, not branched, 1-4 geniculate, conically truncate to truncate at the apex, 1-8 septate, mostly 1-3 septate, 21.5-120.0(-194.0) ×

---

[1] Supported by the National Natural Science Foundation of China

6.5-8.6μm. Conidial scars conspicuously thickened, 3.2-4.3μm wide. Conidia obclavate, hyaline, straight to curved, apex obtuse to rounded, obconically truncate at the base, indistinctly 3-13 septate, 43.0-216.0 × 5.4-8.6(-10.3)μm.

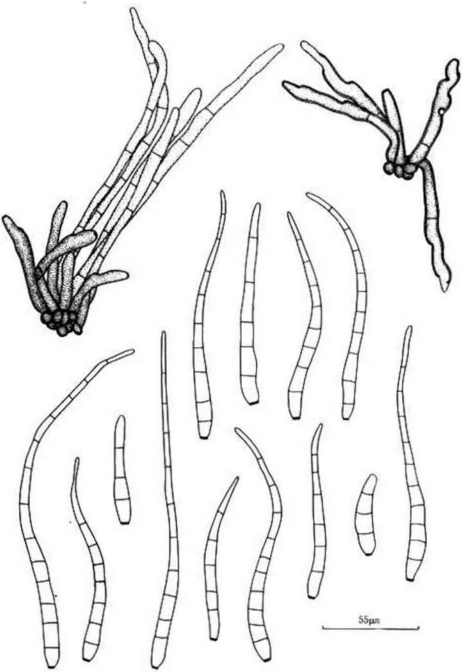


Fig.1 *Cercospora acericola* Y. L. Guo & Y. Jiang

Cercospora saccharini Lib. & Boewe (1960) on *Acer saccharinum* L. is similar to the new species. It differs from this fungus by its angular spots, larger stromata (30-45μm diam.), shorter conidiophores (22.0-54.0 × 5.0-7.0μm), and acicular to cylindrical, narrower conidia (38.0-124.0 × 3.0-3.5μm).

Cercospora achyranthina Thirum. & Chupp, Mycologia 40:352, 1948.

On *Achyranthes aspera* L.(Amaranthaceae): Yuanjiang, Yunnan Province (HMAS 77312).

On *Achyranthes bidentata* Bl.: Pengxian, Sichuan Province (HMAS 77313).

Cercospora alangii Y. L. Guo, Mycosystema 5:109, 1992.

On *Alangium chinensis* (Lour.) Harms (Alangiaceae): Shitai, Anhui Province (HMAS 62765, Type).

On *Alangium kurzii* Craib: Shangsi, Guangxi Province (HMAS 76355).

Cercospora alocasiae Sawada ex T. K. Goh & W. H. Hsieh, Trans. Mycol. Soc. R.O.C. 2:86, 1987.

Cercospora alocasiae Saw. Taiwan Agr. Rev. 38:693, 1942.

On *Alocasia macrorrhiza* (L.) Schott (Araceae): Taibei, Taiwan (NTU-PPE).

On *Pistia stratiotes* L.: Hainan Province (HMAS 77329).

Cercospora amorphophalli Henn., Hedwigia 41:147, 1902.

On *Amorphophallus rivieri* Durien (Araceae): Pingshan, Sichuan Province (HMAS 77330); Lunan, Yunnan Province (HMAS 12098).

On *Amorphophallus* sp.: Foping, Shaanxi Province (HMAS 77331).

Cercospora araliae-cordatae Hori, Chosen Sakumotsu Byogai Mokuroku (Nakata & Takimoto, A list of crop diseases in Korea) p.31, 1928.

On *Aralia* sp.(Araliaceae): Nanjing, Jiangsu Province (HMAS 77332).

Cercospora arisaemae F. L. Tai, Chinese Bot. Soc. Bul. 2:47, 1936.

On *Arisaema ambigum* Engl.(Araceae): Nanjing, Jiangsu Province (HMAS 06993, Type).

On *Typhoniun divaricatum* (L.) Decne.: Taizhong, Taiwan (NCHUPP-199).

Cercospora asclepiadis Ellis, Amer. Naturalist 16:810, 1882.

Cercospora maculans Pat., Expl. Scien. Tunisie impr. National, p.132, 1897.

On *Asclepias curassavica* L. (Asclepiadaceae): Hangzhou, Zhejiang Province (HMAS 77335).

Cercospora begoniae Hori, Shokubutsu Byogai Kowa, p.181.10th ed. 1916.

On *Begonia argenteo-guttata* Lemoine (Begoniaceae): Jilin, Jilin Province (HMAS 77340).

On *Begonia evansiana* Andr.: Jilin, Jilin Province (HMAS 77341).

On *Begonia* sp.: Nantou, Taiwan (NCHUPP-214); Chengdu, Sichuan Province

(HMAS 77342).

Cercospora bombacis T. K. Goh & W. H. Hsieh, Trans. Mycol. Soc. R.O.C. 2:87, 1987.

On *Bombax malabaricum* DC.(Bombacaceae): Zhanghua, Taiwan (NTU-PPE).

On *Ochroma lagopus* Swartz: Guangzhou, Guangdong Province (HMAS 77343).

Cercospora brachiata Ellis & Everh., Jour. Mycol. 4:5, 1888.
Cercospora amaranti Lobik, Bolezni Rast. (Morbi Plantarum) 17:193, 1928.

On *Amaranthus retroflexus* L.(Amaranthaceae): Beijing (HMAS 77314); Nanjing, Jiangsu Province (HMAS 77315); Shennongjia, Hubei Province (HMAS 47815).

On *Amaranthus tricolor* L.: Jilin, Jilin Province (HMAS 77316); Guangzhou, Guangdong Province (HMAS 12097).

On *Amaranthus* sp.: Beijing (HMAS 77317); Pengxian, Sichuan Province (HMAS 77318).

Cercospora caladii Cooke, Grevillea 8:95, 1879.

On *Colocasia esculenta* (L.) Schott (Araceae): Foping, Shaanxi Province (HMAS 69418).

Cercospora cannae J. K. Bai, X. J. Liu & Y. L. Guo, Acta Mycol. Sinica 3:102, 1984.

On *Canna indica* L.(Cannaceae): Jilin, Jilin Province (HMAS 43710, Type).

Cercospora catalpae Wint., Hedwigia 24:203, 1885, (same in Jour. Mycol. 1:124, 1885).

On *Catalpa ovata* Don. (Bignoniaceae): Nanjing, Jiangsu Province (HMAS 11873).

Cercospora celosiae Syd., Ann. Mycol. 27:430, 1929.

On *Celosia argentea* L. (Amaranthaceae): Yanglou, Hubei Province (HMAS 12104, Type); Hainan Province (HMAS 77319, 77320).

On *Celosia cristata* L.: Beijing (HMAS 11914); Jilin, Jilin Province (HMAS 77321); Zhenping, Henan Province (HMAS 12105); Taiwan (HMAS 04906); Chengdu, Sichuan Province (HMAS 77322).

Cercospora euonymigena Y. L. Guo & Y. Jiang. sp. nov. Fig.2

Maculae amphigenae, orbiculares vel suborbiculares, 1.5-5.5 mm diam., griseo-albae, pallide brunneae vel griseo-agrae. Caespituli amphigeni. Stromata nulla vel sarva, brunnea. Conidiophora solitaria vel 2-14 laxe fasciculata, pallide brunnea vel brunnea, 1-6 geniculata, 1-12 septata, 50.0-493.8 × 3.8-5.6μm. Cicatrices conspicue incrassatae, 2.5-4.0μm latae. Conidia acicularia, hyalina, erecta vel leviter curvata, ad apicem acutata, ad basin truncata, indistincte multiseptata, 52.5-350.0 × 3.1-5.6μm.

Hab. in foliis vivis *Euonymi japonici* L. (Celastraceae): Chengdu, Sichuan Provincia (HMAS 77350, Holotypus).

Leaf spots amphigenous, circular to subcircular, 1.5-5.5 mm wide, confluent, center greyish white, pale brown to greyish black, margin surrounded by a dark brown line on the upper surface, paler on the lower surface. Fruiting amphigenous. Stromata none or small, brown. Conidiophores solitary or 2-14 loosely fasciculate, pale brown to brown, paler towards the apex, irregular in width, straight to curved, rarely branched, 1-6 geniculate, subtruncate at the apex, 1-12 septate, 50.0-493.8 × 3.8-6.5μm. Conidial scars conspicuously thickened, 2.5-4.0μm wide. Conidia acicular, hyaline, straight to slightly curved, acute at the apex, truncate at the base, indistinctly multiseptate, 52.5-350.0 × 3.1-5.6μm.

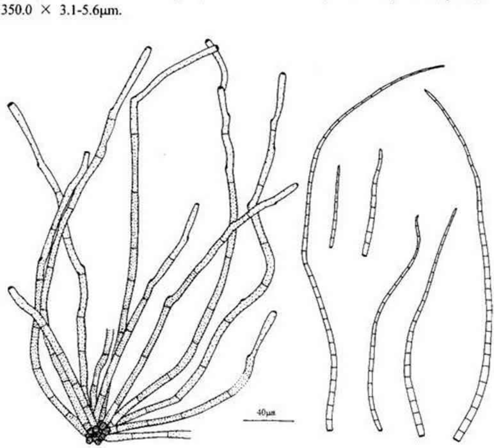


Fig.2 *Cercospora euonymigena* Y. L. Guo & Y. Jiang

Cercospora celastricola Govindu & Thirum. (1954) on *Celastrus paniculatus* Willd. is similar to the new species. It differs from this fungus in possessing larger stromata (30-90μm diam.), darker color (moderately brown to dark brown), shorter and narrower conidiophores (50.0-200.0 × 2.4-4.2μm), and cylindrical to obclavate, shorter and narrower conidia (83.0-116.0 × 2.4-4.2μm).

Cercospora fukushiana (Matsuura) Yamam., Jour. Plant Prot. 14:699, 1927.
Cercospora fukushiana Matsuura, Trans. Tattori Soc. Agr. Sci. Japan 1:83, 1928.

On *Impatiens balsamina* L. (Balsaminaceae): Beijing (HMAS 77336, 77337, 77338); Shenyang, Liaoning Province (HMAS 62018); Jilin, Jilin Province (HMAS 77339); Taibei, Taiwan (NTU-PPE).

On *Impatiens noli-tangere* L.: Foping, Shaanxi Province (HMAS 69429).

Cercospora gomphrenae Ray, Mycologia 36:172, 1944.

On *Gomphrena globosa* L. (Amaranthaceae): Beijing (HMAS 77323); Hankou, Hubei Province (HMAS 77324); Chengdu, Sichuan Province (HMAS 77325).

Cercospora justiciaecola F. L. Tai, Lloydia 11:47, 1948.

On *Justicia* sp. (Acanthaceae): Chengdu, Sichuan Province (HMAS 12127, Type).

Cercospora negundinis Ellis & Everh., Proc. Acad. Nat. Sci. Phila. Part I. 43:89, 1891.

On *Acer davidii* Franch. (Aceraceae): Changsha, Hunan Province (HMAS 77310).

Cercospora olivascens Sacc., Michelia 1:268, 1879.

On *Aristolochia debilis* Sieb. & Zucc.(Araliaceae): Hangzhou, Zhejiang Province (HMAS 77334).

On *Aristolochia* sp.: Shitai, Anhui Province (HMAS 61065).

Cercospora panacicola P. K. Chi & J. K. Pai, Acta Phytotax. Sinica, 10:110, 1965.

On *Panax ginseng* C. A. Mey. (Araliaceae) : Yongji, Jilin Province (HMAS 77333).

Cercospora papayae Hansf., Proc. Linn. Soc. London 1942-43:58, 1943.

On *Carica papaya* L. (Caricaceae): Cheli, Yunnan Province (HMAS 73958); Taizhong, Taiwan (NTUPP-255).

Cercospora sagittariae Ellis & Kell., Jour. Mycol. 2:1, 1886.

On *Sagittaria sagittifolia* L. (Alismataceae): Hangzhou, Zhejiang Province (HMAS 77311); Kaiyuan, Yunnan Province (HMAS 01956).

Cercospora sambuci Y. L. Guo & Y. Jiang sp. nov. Fig.3

Maculae amphigenae, orbiculares vel suborbiculares, 2-8 mm latae, certro griseo-albae, pallide flavo-brunneae vel brunneae, margine griseo-agrae. Caespituli amphigeni. Stromata nulla vel parva. Conidiophora solitaria vel 2-13 fasciculata, modice brunnea, erecta vel curvata, non ramosa, 1-6(-13) geniculata, multiseptata, 42.5-142.5(-400.0) × 3.5-6.3μm. Cicatrices conspicuae incrassatae, 2.5-3.8μm latae. Conidia acicularia, hyalina, erecta vel leviter curvata, ad apicem acutata vel subacuta, ad basim truncata, 5-multiseptata, 37.5-175.0 × 3.1-5.0μm.

Hab. in foliis vivis *Sambucis buergerianae* Blume. (Caprifoliaceae): Yongji, Jilin Provincia (HMAS 77346, Holotypus); *Sambucis javanicae* Reinw.: Hangzhou, Zhejiang Provincia (HMAS 77347).

Leaf spots amphigenous, circular to subcircular, 2-8 mm diam, pale yellowish brown to brown, center greyish white, margin surrounded by a greyish black line on the upper surface, pale yellowish brown to pale greyish brown on the lower surface. Fruiting amphigenous. Stromata none or only a few brown globose cells. Conidiophores solitary or 2-13 in a fascicle, moderately brown, paler and narrower towards the apex, irregular in width, often wide at the base, up to 8 μm wide, straight to curved, not branched, 1-6(-13) geniculate, multiseptate, 42.5-142.5(-400) ×3.5-6.3μm. Conidial scars conspicuously thickened, 2.5-3.8μm wide. Conidia acicular, hyaline, straight to slightly curved, acute to subacute at the apex, truncate at the base, 5-multiseptate, 37.5-175.0 × 3.1-5.0μm.

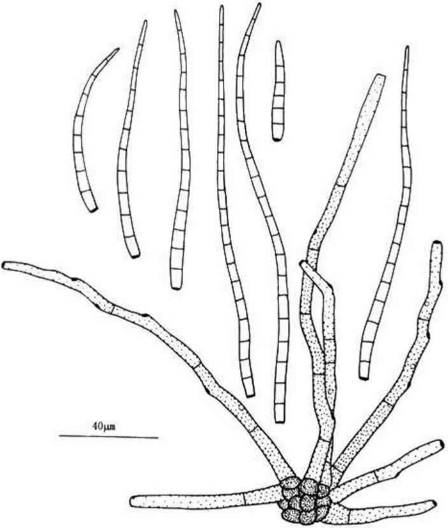


Fig.3 *Cercospora sambuci* Y. L. Guo & Y. Jiang

This fungus on *Sambucus javanica* Reinw., conidiosphores are longer (up to 400.0 μm long and with 13 geniculate) than on the *Sambucus buergeriana* Blume.

Cercospora depazeoides (Desm.) Sacc. (Nuov. Giorn. Bot. Ital. 8:187, 1876) on *Sambucus nigra* L. is similar to the new species. It differs from this fungus in having larger stromata (20-80μm diam.), obclavate to cylindrical-obclavate, pale olivaceous conidia.

This species is different from *Cercospora lateritia* Ellis & Halsted (1888) on *Sambucus pubens* Michx. by the later having effuse fruiting, larger stromata (up to 50 μm diam.), shorter conidiosphores (20-70 μm), and cylindrical to obclavate-cylindrical, hyaline to very pale reddish brown, shorter conidia (20-60 μm).

Cercospora siphocampyli Chupp & Viegas, Bol. Soc. Brasileira Agron. 7:367, 1944.
On *Adenophora* sp. (Campanulaceae): Beijing (HMAS 77344).

Cercospora viburnicola Ray, Mycologia 33:174, 1941.
On *Viburnum* sp. (Cappridiaceae) : Nanjing, Jiangsu Province (HMAS 77348); Liuba, Shaanxi Province (HMAS 69436); Jiangkou, Sichuan Province (HMAS 69437).

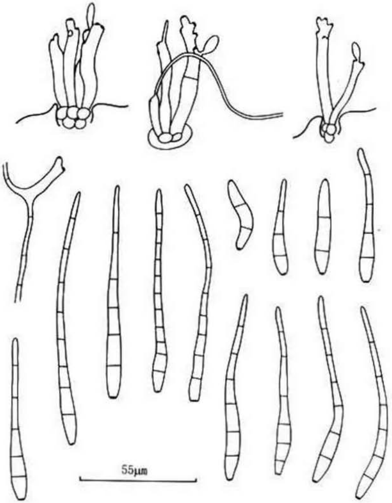


Fig.4 *Mycovellosiella rhoidis* Y. L. Guo

Mycovellosiella rhoidis Y. L. Guo, sp. nov. Fig.4
Maculae amphigenae, suborbiculares, angulares vel irregulares, 1-4 mm latae,

brunneae vel atro-brunneae. Caespituli hypogeni. Mycelium secundarium superficiale: hyphae subhyalinae, ramosae, septatae, 1.7-3.2μm latae. Stromata nulla. Conidiophora ex hyphis mycelii secundarii oriunda vel 2-8 fasciculata, hyalina vel dilutuissime olivacea, non ramosa, erecta vel leviter curvata, 0-1 geniculata, 0-1 septata, 13.0-65.0 × 4.0-7.5μm. Cicatrices conspicuae, 1.7-2.2μm latae. Conidia obclavata, hyalina, solitaria vel interdum catenata, erecta vel curvata, ad apicem acuta vel obtusa, ad basim obconico-truncata, 2-11 septata, 26.0-138.0 × 4.0-6.5μm.

Hab. in foliis vivis *Rhoidis* sp. (Anacardiaceae): Shennongjia, Hubei Provincia, 2 VIII 1984, leg. Y. L. Guo, no. 212 (HMAS 77433, Holotypus).

Leaf spots amphigenous, subcircular, angular to irregular, 1-4 mm diam., often confluent, center brown to dark brown, margin blackish brown on the upper surface, gray to pale grayish brown on the lower surface. Fruiting hypogenous. Secondary mycelium external: hyphae emerging through stomata or formed from the tip of conidiophores, subhyaline, branched, septate, 1.7-3.2μm wide. Stromata none. Conidiophores emerging through stomata, 2-8 fasciculate or borne terminally or laterally on external hyphae, hyaline to very pale olivaceous, not branched, irregular in width, straight to slightly curved, 0-1 geniculate, conical at the apex, 0-1 septate, 13.0-65.0 × 4.0-7.5μm. Conidial scars thickened, 1.7-2.2μm wide. Conidia obclavate, hyaline, solitary or occasionaly catenulate, straight to curved, apex subacute to obtuse, base obconically truncate, 2-11 septate, 26.0-138.0 × 4.0-6.5μm.

The new species differs from *Mycovellosiella rhois* (Sawada & S. Kats.) T. K. Goh & W. H. Hsieh (1987) on *Rhus semialata* Murr. var. *roxburghana* DC. by its indefinite spots, abundant external hyphae, larger stromata (up to 65μm diam.), pale olivaceous brown, branched, narrower conidiophores (70×4-5 μm), and cylindrical, catenulate, shorter and slightly narrower conidia (20-100×4-5 μm).

Pseudocercospora asclepiadina (Speg.) Deighton, Mycol. Pap. 140:22, 1976.
Napicladium asclepidinum Speg., An. Mus. Nat. Hist. nat. B. Aires 22:442, 1910.

On *Asclepias curassavica* L. (Asclepiadaceae): Hangzhou, Zhejiang Province (HMAS 76385).

Pseudocercospora ubicola (Yen) Deighton, Mycol. Pap. 140:155, 1976.
Cercospora ubicola J. M. Yen, Rew. de Mycol. 30:200, 1965.

On *Dioscorea subcalva* Praim & Burk (Dioscoreaceae): Kunming, Yunnan Province (HMAS 04518, 12230, 12231).

ACKNOWLEDGEMENTS

The authors are greatly indebted to Prof. Zhou GS for identification of host plants and to Ms. Zhu XF for inking the drawings.

REFERENCES

Chupp C (1954) A Monograph of the Fungus Genus *Cercospora*. Ithaca, New York

Deighton FC (1976) Studies on *Cercospora* and allied genera VI. *Pseudocercospoa* Speg., *Pantospora* Cif. and *Cercoseptoria* Petr. Mycol. Pap. No. 140

Ellis JB, Everhart BM (1888) Addition to *Ramularia* and *Cercospora*, Jour. Mycol. 4:1-7

Govindu HC, Thirumalachar MJ (1954) Notes on some Indian *Cercosporae*-IV. Sydowia 8:221-230

Goh TK, Hsieh WH (1987) Studies on *Cercospora* and allied genera of Taiwan V. Trans. Mycol. Soc. R.O.C. 2:125-148

Liberta E , Boewe GH (1960) A new species of *Cercospora* on *Acer saccharinum*. Mycologia 52:345-347

MYCOTAXON

Volume LXXIV(2), pp. 267-285 April-June 2000

MYXOMYCETES OF THE WINTER-COLD DESERT IN WESTERN KAZAKHSTAN

Martin Schnittler[1] & Yuri K. Novozhilov[2]
[1] Fairmont State College, Fairmont, West Virginia 26554, U.S.A.
(email: mschnittler@mail.fscwv.edu), and
[2] V.L. Komarov Botanical Institute of the Russian Academy of Sciences,
Prof. Popov St. 2, 197376 St. Petersburg, Russia
(email: mixus@YN1091.spb.edu)

Abstract: During a four-week expedition in April and May 1995, the winter-cold desert of the Mangyschlak Peninsula (52°13' E, 44°01' N) was surveyed for myxomycetes. From about 1,000 substratum samples, 146 moist chamber cultures were prepared. With the intention to check all suitable microhabitats, bark of all common desert shrubs, the rarely occurring accumulations of litter, and dung of various herbivorous animals were collected. For each culture, 5-10 individual samples of 2-3 pieces each were pooled from one microhabitat type. Although only two species with 10 collections were found in the field, the moist chamber cultures revealed a whole flora of desert myxomycetes. Twenty-seven species of myxomycetes, two members of the Protosteliales, and various Myxobacteria were recorded, often with exceedingly high levels of abundance. Among these are numerous species previously considered as rare, including *Echinostelium arboreum*, *E. colliculosum*, and *Macbrideola oblonga*. For rare or taxonomically difficult species, brief taxonomic descriptions are given. Compared with surveys from other geographic regions, the desert flora encountered is rather poor but one of the most distinctive among myxomycetes. In addition to obvious features such as absence of trees and succulent plants or the harsh, arid conditions, the high (7.5-8.0) pH of almost all of the substrata present seems to be a limiting factor.

Key words: biodiversity, desert, myxomycetes, Kazakhstan, microhabitats

INTRODUCTION

The life cycle of Myxomycetes (plasmodial slime moulds) involves two trophic stages, one consisting of uninucleate amoebae and the other represented by a distinctive multinucleate structure, the plasmodium, surrounded by the cell membrane and a slime sheath only. Both feed phagotrophically on bacteria, yeasts, spores of filamentous fungi, algae, and other protists (Stephenson and Stempen 1994). Since both trophic stages require moist, humid conditions, deserts would seem to present an extreme habitat for myxomycetes. Due to the apparent absence of fructifications in the field, desert myxomycetes are indeed poorly known. Nevertheless, some studies point towards a surprisingly rich and distinct myxomycete flora in arid regions (for example Arizona: Evenson 1961, Blackwell & Gilbertson 1980; Gobi desert: Novozhilov & Golubeva 1986).

The present study, made during a journey stretching about 1,500 km, adds a regional flora from one of the world's most extreme habitats - the winter-cold desert region east of the Caspian Sea. The region has a strong continental climate with extremely severe winters, and therefore even succulent plants are absent. Due to the rarity of myxomycete fructifications in the field, the survey presented herein focused almost exclusively on substratum sampling, including all frequently occurring substrata that appeared suitable for myxomycete growth. The region is seemingly not studied; a species account for Kazakhstan (Vasjagina et al. 1977) lists 111 species of myxomycetes, but these records are almost exclusively from montane areas of the country.

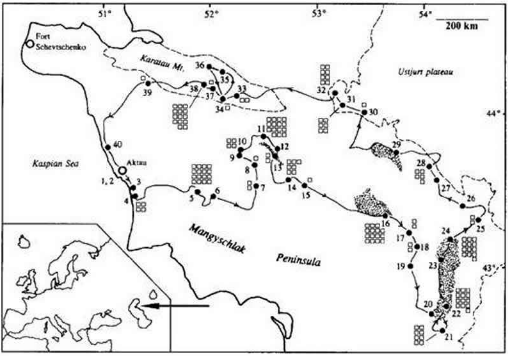


Fig. 1 Map of the Mangyschlak Peninsula, showing the journey (line with arrowheads) with collection points indicated. Dotted areas stand for larger sand dunes. Dotted lines mark the western boundary of the Ustjurt Plateau and the range of the Karatau Mountains. Numbers refer to the localities, with sets of quadrates indicating the number of collected substratum samples. Inset: Geographical position of the Mangyschlak region (arrow).

STUDY SITES

The Mangyschlak Peninsula, the area investigated, is naturally limited westwards by the shoreline of the Caspian Sea and eastward by the Ustjurt Plateau. In contrast to the very uniform sagebrush half desert of the Ustjurt Plateau, the desert of the Mangyschlak Peninsula is characterised by a more rugged relief, basically formed by a plateau furrowed by numerous deep depressions and canyons. Stony badlands dominate, harbouring a scanty vegetation of small shrubs and annual plants. With the exception of some planted individuals around artificial wells, larger trees are absent.

Our expedition was a four-week journey, describing a loop of about 1,500 km that began and ended at the town of Aktau (formerly named Schevtschenko). It extended from 51°18' E near Aktau in the west to 54°26' E in the east, touching the vegetation zones of southern feathergrass steppe in the Karatau Mountains, sagebrush desert in the central part, and southern desert dominated by *Chenopodiaceae* (Anonymous 1990). Fig. 1 shows the journey with the 40 localities investigated. The Mangyschlak Peninsula can be characterised as one of the harshest landscapes on Earth. Due to the extreme temperatures during the winter (up to -40 °C, with an average January temperature around -10 °C), no succulent or evergreen plants occur. The mean annual precipitation is 177 mm, with a monthly maximum of about 30 mm in August and September. Winter snowfalls are rare and are in some years absent. Considering the strong wind-chill, subterranean parts of wintering plants suffer from extremely low temperatures. Humid conditions with temperatures above 0 °C last for only about 1-2 weeks in spring and another 3-4 weeks in autumn. In spring, the temperature rises rapidly, soon changing into hot and very dry summer weather. Strong winds are typical, often producing dust storms at dawn, bringing hot air from Central Asia (Afghanistan). Remarkable were the high fluctuations in air humidity during our journey (which extended from the beginning to the end of spring), ranging from 100 % during nightly dew fall to less than 10 % around noon. In spite of the harsh conditions, the vascular plant flora is relatively rich (about 600 species). However, about 25 % of all plant species are annuals, living actively only during the short springtime (Safronova 1992). Only about 30 species of plants are higher shrubs (maximum height 1-2 m, in sand dune areas up to 3.5 m). The human influence on the vegetation is low, basically consisting of grazing by camels, horses and sheep. Small rodents occur with high population densities; among these are *Citellus citellus*, *C. fulvus* and mice of the genus *Meriones* (names after Gromova & Baranovoj [1981]). Due to hunting, the indigenous Saiga antelope (*Saiga tatarica*) is rare and often displaced by free roaming sheep.

Except for the Karatau Mountains, the whole region is derived from marine, basic sediment stones, mostly layers of dolomitic limestone, various kinds of calcareous marl, chalk and sandstone, often forming cliffs and rocky reefs. The soils are basic, with pH values mostly between 7.5 and 8.0. Huge areas are salt pans or are covered by sand dunes (Fig. 1). Only the Karatau Mountains are built from acidic slates. Due to the edaphic conditions often changing over short distances, various plant associations have been recognised (Safronova 1991a, b). As described below, five main habitats can be differentiated (nomenclature for vascular plants follows Czerepanov [1995]).

1. The **plateau**: The most uniform landscape, with elevations between 200 and 300 m. Loamy, very solidified soils support a poor vegetation of mainly sagebrush (*Artemisia* spp.), rarely intermixed with taller perennials such as *Rheum tataricum*. The investigated western part has slightly higher rainfall and harbours a flora richer in shrub-forming

species. Shrubs are up to 70 cm tall and usually have a deeply furrowed, or less commonly a peeling bark. Of interest as myxomycete substrata are a number of common *Chenopodiaceae* (*Salsola* spp., *Haloxylon aphyllum*) as well as *Atraphaxis replicata*, *Convolvulus fruticosus*, or *Astragalus karakugensis*, the latter remarkable by possessing a fibrous bark with high water retention.

2. **Cliffs, gorges and rocky reefs**: Gigantic dry depressions and canyons interrupt the plateau, often with scenic cliffs dropping off 100-200 m. The deepest of these depressions (Karagia) lies 132 m below sea level. Exposed to the fogs from the Caspian Sea, the cliff edges house plant communities significantly richer in species. Here *Rhamnus sintenisii*, an endemic of the region, can be found, forming taller shrubs up to 3 m height. This is the only common plant providing noticeable amounts of leafy litter. Other shrubs have mostly tiny to scale-like leaves and green, assimilating twigs. The soils are stony, calcareous and not too salty.

3. **Salt swamps and pans**: At the bottom of the depressions, gypsum or very salty soils dominate; frequently, salt pans (solontschaks) without any vegetation occur. The prevailing shrubs are various species of *Tamarix*, more rarely *Halostachys caspica*. Exceptional was the Ukere salt spring in the southern desert; at this site a short salty rivulet drains into a salt swamp.

4. **Sand dunes**: Smaller and larger sand dune areas with a very different vegetation are scattered throughout the region. Shrubs, such as *Haloxylon aphyllum* and various species of *Calligonum*, accompanied by two larger species of *Astragalus*, dominate. Very conspicuous are the big umbrellas of *Ferula foetida*, a giant member of the Apiaceae family with a life history similar to the century plants (*Agave*) found in New World deserts. In general, the vegetation on sandy soils is richer and more dense, locally providing thin mats of twiglet litter under the shrubs.

5. **Karatau Mountains**: Shallow hills with moderate elevations between 350 and 450 m are interrupted by deep-cut valleys. The soils are rocky to stony, often with rubblefields of acidic slate. Only here fresh water was present in small rivulets, usually framed by dense thickets of *Mentha longifolia*. The northern valley slopes bear feathergrass steppes poor in shrubs, with the southern counterparts being dominated by sagebrush. In the valleys, larger shrubs and *Crataegus ambigua*, the only naturally occurring tree, can be found.

MATERIALS AND METHODS

Substratum samples were collected systematically from all major shrub species, plant refuse and animal dung - all organic matter considered suitable for myxomycetes - at 40 locations during the journey. The field work was carried out in late April and early May of 1995, which represented the end of the short spring season. The first days were still cold and cloudy, with occasional brief rainfalls; the last days were already very hot, often with dust storms in early morning.

For substratum sampling, within a sample plot typically covering 500-1,000 square meters, the vegetation was recorded (abundance and coverage of the dominant vascular plants, vegetation structure, and soil features). Substrata were collected in 2-3 pieces from 5-10 plant individuals or points within the plot that shared the same microhabitat features. These were pooled, yielding a total sample of 15-35 g weight. Sampling included (i) for all larger shrubs or trees, the non-living outer part of the bark as scales of 1-2 cm size, (ii) thin mats of litter at the base of trees or tussock-forming plants, and (iii) droppings of

herbivorous animals, mostly rodents. For each sample, microclimatic conditions such as height, light, wind exposure as well as substratum features (texture, moisture, and degree of decay) were recorded for later ecological investigations (Schnittler, in prep.). A total of 146 samples was collected, including bark (81 samples), litter (35) and animal dung (30). The moist chamber cultures were prepared in the manner described by Härkönen (1977). For moist chambers, substratum pieces were placed on filter paper in Petri dishes, with the pieces touching but not overlapping each other and with the outer side of bark upside. Destilled water adjusted to pH 7.0 was added to each culture. All cultures were maintained 2 months under diffuse daylight and at room temperature (22-23 °C). On five occasions (days 2, 6, 11, 21 and 40 after start) the chambers were checked with a high-magnification dissecting microscope. Mature fructifications were mounted in small boxes, and sporocarps of minute species were immediately preserved in polyvinyl lactophenol or glycerol gelatine, when calcareous structures were present. From the 513 fructifications recorded, 169 specimens were collected and stored in the private collection of the first author at the Herbarium Haussknecht, Jena (JE). In addition, duplicates of some species were deposited at the Herbarium of the Komarov Botanical Institute, St. Petersburg (LE).
For comparison of myxomycete floras from different parts of the world, species lists of the respective papers were databased. From a synoptic table of all records, the coefficient of community indices (see Stephenson et al. 1993) were calculated. These have a value between 0 (nothing in common) and 1 (all species are members of both floras).

ANNOTATED SPECIES LIST

The following list includes all recorded species in alphabetical order. Nomenclature essentially follows Martin & Alexopoulos (1969), but for species not mentioned in this monograph, a reference to the protologue is given. Determinations considered as doubtful are given with the note 'cf.' (confer). Bold symbols in parentheses represent an abundance estimation of each species using the percentage scale of Stephenson et al. (1993), based on the proportion of a species in the total number of records (513): R - rare (≤0.5 %), recorded once or twice; O - occasional (0.5-1.5 %), 3-6 records; C - common (1.5-3 %), 7-11 records; A - abundant (>3 %), more than 11 records. After a comma, the number of collections follows, separated by a colon from the locality numbers as referred to in Fig. 1. Short comments on habitats and distribution are included; for rare and/or taxonomically difficult species, brief taxonomic descriptions are given. Colours are described as observed with a dissecting microscope and as seen by transmitted light. For the latter, the degree of transparency is described as: translucent - glass-clear; transparent - allowing milky light to come through, colours are visible; and opaque - impermeable to light, the structure appears black. Spore measurements are given for specimens mounted in polyvinyl lactophenol. Therefore, diameters can be slightly smaller (0-3 %) than for fresh material investigated in water. Terms for taxonomic descriptions are as used in Lado & Pando (1997), with colours described according to Kornerup & Wanscher (1981).
Although 40 localities where checked in the field for myxomycete fructifications, only for those mentioned in the following list were myxomycetes recorded. Except for the field collections obtained at localities 15 (*Physarum notabile*) and 33 (*Didymium squamulosum*), all records are from substratum samples cultivated in moist chambers. Locality numbers refer to Fig. 1.

4: sand dunes ca. 25 km SE Aktau, on the northern edge of the solontschak Karanol, near the Caspian Sea, 51°18'25" N 43°28'49" E ± 1 km

5: stony ground over limestone, near the upper edge of a cliff ca. 1 km NW of the well Sauttuy, E margin of the depression Karagije, elevation 110 ± 20 m, 51°52'37" N 43°31'23" E ± 1 km

7: sandy to loamy gypsum soils near the eastern margin of the depression Karagije, plateau on the NE edge of the depression Korganoi, 160 ± 20 m, 51°26'36" N 43°34'11" E ± 200 m

10: overgrazed and devastated sandy soil near the Karasasschokui Mt., next to the buildings of a Kazakh cemetery, 52°17'42" N 43°47'12" E ± 400 m

11: stony ground (limestone and chalk), plateau ca. 2 km N of the Baskuduk sand dunes, on the margin of giant chalk cliffs falling up to a depression, 52°28'51" N 43°52'39" E ± 200 m

13: loose, deep-grounded, sandy soil, at the NE margin of the Baskuduk sand dunes, 180 ± 20 m, 52°36'08" N 43°49'19" E ± 500 m

14: loose, deep-grounded, slightly overgrazed, sandy soil in a small valley between cliff edges, NW margin of the depression Usen, 240 ± 20 m, 52°44'09" N 43°33'46" E ± 600 m

15: stony soil between limestone plates, margin of the plateau to the depression Usen, NE-edge, 240 ± 20 m, 52°50'40" N 43°33'21" E ± 150 m

16: deep-grounded, loose soil, margin of the Tjuesu sand dunes, SE-edge, near the margin of a solontschak, ca. 2 km N of the well Besoktui, 80 ± 20 m, 52°36'53" N 43°21'07" E ± 500 m

17: solid, somewhat loamy soil between sandstone slates ca. 5 km N Mt. (cliffs) Kunabai, small sandstone hills, 120 ± 20 m, 52°48'49" N 43°13'53" E ± 100 m

18: solid, stony soil with marl, above limestone rocks, slightly overgrazed, ca. 10 km SSE Mt. Kunabai, on the plateau margin, 160 ± 20 m, 52°53'00" N 43°06'27" E ± 200 m

21: deep-grounded gypsum soil with earth lichens, small valley of the creek from the salt spring Ukere, SW-edge of the Ustjurt Plateau, 10 ± 20 m, 54°09'12" N 43°36'38" E ± 500 m

22: solid but sandy soil near a well, overgrazed, on the W margin of the Karünjarük sand dunes, SW-edge, ca. 5 km N of the well Seksorka, 90 ± 20 m, 54°08'50" N 43°46'25" E ± 5 km

24: loose sand dunes above red sandstone hills up to 50 m, Karaschek Mts. in the NW-part of the Karünjarük sand dunes, 140 ± 40 m, 54°11'23" N 43°10'37" E ± 1 km

25: solid, sandy soil on the bottom of a depression at the northernmost margin of the Karünjarük sand dunes under the cliffs to the plateau, 40 ± 20 m, 54°26'14" N 43°20'06" E ± 500 m

28: loose, sandy soil between sandstone boulders, terasses of a cliff slope forming the Kolbai Mts., W margin of the Ustjurt Plateau, 140 ± 40 m, 53°59'18" N 43°41'23" E ± 400 m

30: stony soils above chalk rocks, cliff valley in the Ustjurt Plateau at the NE edge of the Tusbair salt lake ca. 1 km SSE of the well Sandui, 53°27'39" N 44°01'22" E ± 600 m

31: stony soil above limestone rocks, near a cliff delimiting the Ustjurt Plateau, near the well Monata, 250 ± 20 m, 53°12'32" N 44°06'11" E ± 600 m

32: stony soil above limestone, cliffs delimiting the Ustjurt Plateau, falling down to the Kaidak salt lake, ca. 2 km NE of the spring Okbai, 240 ± 20 m, 53°3'35" N 44°10'25" E ± 1 km

33: stony soil above Devonian slate, ca. 12 km E Schetpe, hills on the N margin of the eastern Karatau Mts., 260 ± 40 m, 52°16'28" N 44°08'41" E ± 2 km

34: stony ground on the bottom of a deep-cut rivulet canyon ca. 4 km SW Scharmüsch, N margin of the eastern Karatau Mts., 160 ± 40 m, 52°25'19" N 44°07'59" E ± 1 km

37: sandy, overgrazed soil ca. 5.5 km NW Schetpe, foothills at the E margin of the Karatau Mts., near a well, 200 ± 50 m, 52°04'58" N 44°10'45" E ± 400 m

38: shallow, somewhat sandy soil above Devonian slate, deep-cut rivulet valley ca. 16 km NW Schetpe, western Karatau Mts., 180 ± 40 m, 51°57'31" N 44°14'20" E ± 1 km

39: stony soil between plates of limestone rocks, cliff edge ca. 7 km SW Danüspan Mt., southern foothills of the Karatau Mts., 160 ± 20 m, 51°21'57" N 44°15'19" E ± 100 m

Arcyria minuta Buchet (**R**, 1: loc. 4). Once on bark of *Tamarix*, sand dunes near the Caspian Sea.

Comatricha laxa Rostaf. (**O**, 4: loc. 4, 38). Four records, bark of *Tamarix* and *Crataegus* in areas with higher moisture (coast and Karatau Mountains).
Small groups of always single, scattered sporocarps (0.35)-0.5-0.8-(1) mm tall, relatively long stalked, stalks reaching one to one and a half times the sporotheca diameter. Sporotheca globose to weakly ovoid in larger sporocarps, (0.15)-0.2-0.3-(0.35) mm in diameter, dark blackish brown (6F8). Stalk fibrous, especially at the base, with an inconspicuous hypothallus lacking any reddish tints, under the microscope opaque, black, turning to olivaceous-yellow (4B6) at the base, (0.2)-0.3-0.5-(0.6) mm high, extending into a columella equalling one to two thirds of the height of the sporotheca. Capillitium stiff and coarse, branching from the whole length of the columella, dark black to brown (6F8-6D6), outer threads pale brown (6D6-6C5), forming in most except very small sporocarps an incomplete surface net with meshes of (6)-10-30-(50) μm, mostly between 10 and 15 μm diameter. Peridium absent, no conspicuous collar. Spores dull olivaceous brown (5E8) in mass, lacking reddish tints, globose, olivaceous brown (5D5) under transmitted light, with regularly arranged warts up to 0.2 mm high, (10)-11-12.7-(13) μm in diameter. Seemingly a common species in arid regions (unpublished observations from Big Bend, Texas, and the Caspian basin around Astrachan) with a habit as pictured in Mitchell (1999, specimens DWM 5423, Tanzania), whereas the drawing in Nannenga-Bremekamp (1991) seems to depict the wood-inhabiting form with larger, ovoid sporocarps and a more lax capillitium.

Comatricha pulchella (C. Bab.) Rostaf. (**C**, 6: loc. 4, 16, 21, 24, 34, 38). Preferentially on bark of *Tamarix* (3 of 6 records) but occasionally on litter; scattered over the whole area investigated.

Didymium anellus agg. (**A**, 25: loc. 4, 5, 7, 10, 11, 14, 16, 17, 21, 22, 24, 31, 32, 38). Common throughout the journey on all kinds of substrata, including the dung of various animals. All fructifications are sessile on a broad or constricted base, ranging from half-globose to flattened sporocarps and plasmodiocarps. Three forms, one regarded as an separate species, could be differentiated.
Didymium anellus Morgan, a form with small lime crystals. Small, scattered sporocarps of 0.25-0.4 mm diameter and up to 0.2 mm high, less commonly short plasmodiocarps, sessile on a dark, sharply constricted base, globose to depressed-globose. Hypothallus a small, brownish disk under the sporocarp, inconspicuous. Peridium black to dull brown (4F7) at the base, here often without lime, in the upper part densely sprinkled with isolated lime crystals, these easily differentiated under a dissecting microscope but relatively small, one half or equal the spore size. Peridium translucent, colourless to pale brownish (4A2-4B2) under transmitted light. Capillitium consisting of colourless to pale brownish (5A2-5D5) threads, 1-2-(2.5) μm wide, often branching and anastomosing to form an incomplete network, sometimes with flattened and darker coloured sections on the branches. Spores dull brown (5F6) in mass, under the microscope olive brown (7D4), globose, regularly covered with warts up to 0.5 μm high, (9.2)-9.6-10.5-(11.5) μm. This form best fits the description of *Didymium anellus*, except for the slightly larger spores (described as 7-10 μm in diameter).

Didymium anellus, a form with large lime crystals. Differing by the mostly short plasmodiocarps, sessile on a constricted base; lime crystals on the peridium very scattered, large and well developed, mostly 2-3 times larger than spores; the spores larger and slightly paler, (9.5)-10.5-11.5-(12.5) μm in diameter, warts smaller, and more densely arranged.

Didymium inconspicuum Nann.-Bremek. & D.W. Mitch. (Nannenga-Bremekamp, 1989). Small and inconspicuous, scattered sporocarps and short plasmodiocarps of 0.25-0.4 mm diameter, up to 0.1 mm high, less commonly short plasmodiocarps, flattened and sessile on a broad base. Hypothallus not detectable. Sporocarps grey to ochraceous (5B2-5B3), evenly sprinkled with very small, coalescing lime crystals, these much smaller than the spores, 3-6 μm in diameter and difficult to differentiate under a dissecting microscope, often forming a thin crust. Peridium translucent and pale colourless to yellowish-brown (4A2-4B3) under transmitted light. Capillitium formed by colourless to pale brown (5A2-5D5) threads, 1-2-(2.5) μm wide, often branching and anastomosing to an incomplete network, sometimes with flattened and darker coloured sections on the branches. Spores dull brown (5F6) in mass, under the microscope pale olive brown (7C3-7D4), globose, regularly covered with very fine and dense warts up to 0.3 μm high, (9.5)-10.5-11.5-(12.5) μm in diameter. As compared with isotype material (coll. Mitchell, DWM 4430), the Kazakh specimens seem to be identical with *D. inconspicuum*, described from one moist chamber culture prepared with bark from an unidentified desert shrub in Arizona.

Didymium annulisporum H.W. Keller & Schokn. 1989 (**R**, 1: loc. 24) Once on sheep dung, pH 8.2.

Very small, scattered globose sporocarps of (0.1)-0.15-0.2-(0.25) mm, sessile on a slightly constricted base. Hypothallus pale white to straw-coloured (4B4-4B7), limeless except for some lime granules in the centre. Sporothecae ash-grey (4B1) to white, densely covered with fine, star-like lime crystals touching each other with their tips. In contrast to *Didymium difforme*, individual lime crystals are still recognisable under a dissecting microscope; the crystals forming a brittle crust. Peridium colourless under transmitted light, smooth or minutely roughened. Capillitium consisting of colourless and slender threads arising from the base of the sporocarp, rarely branching and anastomosing, mostly with free ends, some reaching the peridium and connected with it, 1-1.2 μm wide. Spores dark brown (7F8 and darker) to almost black in mass, globose to slightly lemon-shaped under the microscope, pale violet grey (8D3) with conspicuous, scattered blunt and very dark spines up to 1.2 mm in length, with a darker, thin but conspicuous germination slit surrounding the spore like a belt, 12-13-(13.5) μm in diameter. Our specimen fits the excellent original description perfectly, except for the larger spores, which are described as 10-11 μm in size.

Didymium difforme (Pers.) S.F. Gray (**C**, 12: loc. 5, 7, 11, 14, 18, 22, 25, 28, 31, 32, 38). Surprising was the occurrence of this usually litter-inhabiting species on bark, especially *Rhamnus* (4 records). Localities are scattered over the whole region, except near the coast.

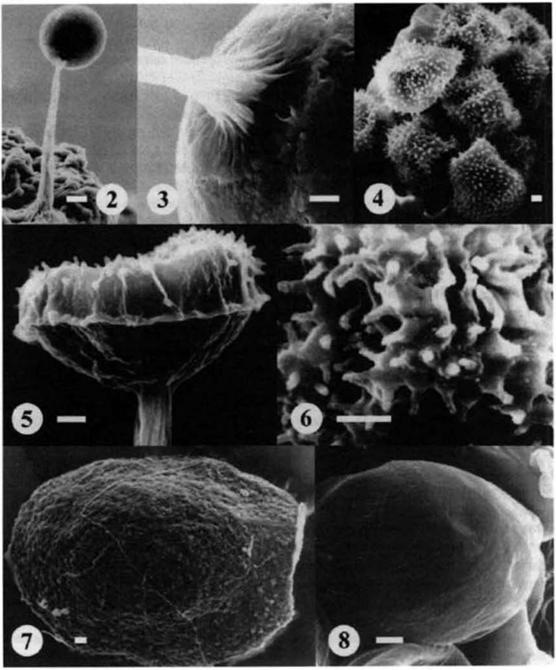
Didymium squamulosum (Alb. & Schwein.) Fr. (**R**, 3 + 8 field collections: loc. 25, 38). Except for two records on dung, the usually common species was found only in the Karatau Mountains within dense thickets of *Mentha longifolia* in a creek. Fresh sporocarps were abundant on dead stems protruding the water. Perhaps due to the extremely dry air, only a small zone of about 2 cm above the water surface was suitable for myxomycete growth. As indicated also by other findings (Kappel 1992), this species seems to be able to develop in water, thus not requiring extensive amounts of moist substratum.

Echinostelium arboreum H.W. Keller & T.E. Brooks, 1976 (**A**, 16: loc. 5, 11, 14, 16, 17, 22, 24, 32, 38)
Exclusively on the bark of various desert shrubs; throughout the region except near the coast.
Small to large colonies of single sporocarps, stout in habit, stalked, yellow-brown (4B4-4B5). Sporothecae urn-shaped, 30-50 µm in diameter. Stalk 120-150 µm long, in transmitted light yellow (4A4) to pale ochraceous (4B4) in the lower section, about two thirds of length filled with darker granules, diameter 10-15 µm on base, tapering to 2.5-3.5 µm on top. Peridium often persistent, smooth and colourless in transmitted light, leaving at least a conspicuous collar. No particular dehiscence lines were visible, but sutures during sporocarp development allowed the peridium, usually not connected with the capillitial threads, to fall away in mature sporocarps. Capillitium arising from one point at the centre of the sporotheca with a few perpendicular, stiff branches, these mostly dichotomous 1(-2) times more forked, at the ends about 1 µm in diameter. Spores in mass rose (4B4) to olivaceous (5B4) brown, very pale olivaceous (4A3) under the microscope, globose, ornamented with flat, patchy, slightly darker warts of 1-1.2 µm diameter, (5.5)-6.5-8-(9) µm in size.

Echinostelium colliculosum K.D. Whitney & H.W. Keller, 1980 (**A**, 45: loc. 4, 5, 10, 11, 13, 14, 16, 17, 18, 21, 22, 24, 28, 37, 38), Figs. 2-6. With high preference for bark, only exceptionally occurring on litter.
Large colonies of single but gregarious sporocarps, pink (7B2) to colourless, fresh shining like a small brilliant brooch, (50)-60-100 µm in height, each with 40-100 spores. Stalk white, colourless and translucent under the microscope, filled with a few dirt granules in the lower third, (40)-50-70 µm in height, diameter about 10 µm at the base, 2-2.5 µm on top. Peridium fugacious, collar absent. Columella consisting of a single, spore-like cell attached on the top of the stalk, with the same diameter and ornamentation as the spores. Spores white in mass, seldom very pale pink (7A2), colourless under the light microscope, globose, almost smooth but with large, thickened patches (articular surfaces) of unequal size, spore wall often shrinking on the smaller, thinner areas, (7)-8-9.5-(10.5) µm in size. Astonishingly, the spores appearing smooth under the compound microscope show small spines when viewed by SEM (Figs. 4, 6). The solid clusters of spores with not sharply separated articular surfaces very different in size within a spore as well as the longer stalks exclude the similar *E. coelocephalum* T.E. Brooks & H.W. Keller (Keller & Brooks 1976).

Echinostelium minutum de Bary (**O**, 3: loc. 4, 22, 38). Probably not belonging to the regular desert flora. The single record consisting of a large colony was from the bark of *Salix alba* planted around an artificial well.

Fuligo cinerea (Schwein.) Morgan (**R**, 2: loc. 5, 11).
Fructifications arranged in colonies of heaped plasmodiocarps, bent brain-like and coalescing into an aethalium of irregular shape and (3)-5-10 mm size, sessile on a broad



Figs. 2-8 SEM photographs of *Echinostelium colliculosum* (2-6, Schnittler 6791) and *Licea* spec. (7-8, 6856). 2 Developing sporocarp, still with a closed peridium; bar = 10 µm. 3 Detail of a later developmental phase, showing the columella as a ring differentiated from the still homogenous plasma mass. 4 Mature spores. 5 Tip of stalk with a spore-like columella; the horizontal ring marks the position of the peridium present in early development. 6 Detail of spore ornamentation; all bars = 1 µm. 7 Closed sporocarp of *Licea* spec.; the lines crossing the sporocarp are contaminant fungal hyphae; bar = 10 µm. 8 Completely smooth spore; bar = 1 µm. Photos Y. Novozhilov.

base and a white hypothallus containing lime granules. Peridium persistent, white to pale lilac (18A2-18A4) when fresh, densely covered with coalescing, thick lime patches, translucent and colourless under the microscope, smooth. Capillitium a network of translucent, colourless threads of 1-4 μm width, with irregular to elongate white lime nodes of 30-80(-100) μm size, filled with amorphous, conglomerated and colourless granula. Spores in mass dark-brown (7F8), ellipsoid to subglobose, pale brown (6C4-6D5) under transmitted light, ornamented with regular distributed to scattered spine-like warts up to 0.8 μm height, (10)-10.5-11.2-(12) μm. Our taxon is probably the small form with a gyrose cortex (approaching *Physarum gyrosum* Rostaf. in shape), as mentioned for 'warm regions' in Martin & Alexopoulos (1969: 264).

Licea biforis Morgan (**R**, 1: loc. 21). Occurring once on *Tamarix* bark from the southernmost locality of the journey.

Licea denudescens H.W. Keller & T.E. Brooks, 1977 (**R**, 2: loc. 13, 38). On leaves and twiglets of *Crataegus* and the bark of *Calligonum.*

Licea kleistobolus G.W. Martin (**A**, 21: loc. 4, 5, 10, 11, 14, 21, 22, 24, 32). The only abundant *Licea*, inhabiting bark of a wide range of desert scrubs.

Licea spec. (**R**, 1: loc. 24), Figs. 7-8. One specimen obtained in culture from rodent droppings (*Citellus* spec.).
Small, densely arranged fructifications of irregular shape, developing from the segregation of one larger plasmodium, of all sizes ranging from *Licea*-like sporocarps of 0.1 mm diameter to short, angular plasmodiocarps up to 0.5 mm size, flattened to half-ovoid, sessile on a broad base. Hypothallus separate for each fructification, slightly broader than these, with the same features as the peridium. Peridium olivaceous brown (5E6-5E7) due to the colour of spore mass, in transmitted light translucent to bright amber (4A6), densely encrusted with small granules and angular crystals of 2.5-5 μm length, densely and very fine warted. Capillitium absent, but very rare short, irregular winded golden yellow (4B8) threads were seen in the microscope, these 2.5-4 μm in diameter, 10-20 μm in length, free, evenly covered with fine warts. Spores in mass pale chestnut brown (5D6), amber (4A6-4B6) in transmitted light, smooth, globose, (9.2)-9.6-10-(10.5) μm, not conspicuous thick-walled.
Licea retiformis Nawawi (1973) fits our specimen except the presence of small capillitium pieces and the non-reticulate shape of the plasmodiocarps. *Perichaena brevifila* H.W. Keller & T.E. Brooks (1971) differs by having very large, conspicuously spiny spores. *Arcyodes luteola* (Kowalski) Nann.-Bremek. (1985) has similar, slightly larger spores, but is described as having a non-ornamented capillitium; *Arcyodes incarnata* (Alb. & Schwein.) Cooke usually has an abundant capillitium and forms crowded to heaped sporocarps without yellowish tints. *Perichaena liceoides* Rostaf., as redescribed in Gilert (1990), differs in having densely ornamented spores and smooth capillitium threads. From habit, *Licea tenera* Jahn (1919) comes closest to our specimen, but differs by having spinulose spores.

Macbrideola oblonga Pando & Lado, 1988 (**A**, 25: loc. 4, 5, 11, 16, 17, 18, 22, 24, 28, 32, 38). Found throughout the journey, occurring exclusively on bark.
Small groups of always single, scattered sporocarps, relatively short stalked, (0.4)-0.5-0.75-(1) mm tall, stalks reaching one fifth to one third the size of the reddish-brown, (8E7) ovoid, seldom globose sporotheca that is (0.35)-0.4.-0.65-(0.7) mm in height. Stalk hollow, not fibrous at the base, emerging from a membranous, discoid hypothallus, translucent pale to dull reddish brown (8C6-8E8) under the microscope, stalk itself dull reddish brown (8E8), transparent, (0.08)-0.1-0.12-(0.2) mm high, thick and stout, on the base 50-100 μm in diameter, often still 30 μm in the centre of the sporotheca. Capillitium stiff and coarse, main branches mostly perpendicular, arising over the whole length of columella, dull reddish brown (8E8), outer threads paler (8B5), branching especially near the surface and ending with pointed spines. Surface net absent. Peridium absent, also no conspicuous collar. Spores reddish brown (8E8) in mass, globose, pale reddish olivaceous brown (8D4) under transmitted light, with very fine, regularly arranged warts up to 0.2 μm high, (8.5)-9.2-10.5-(11.5) μm in diameter.
This taxon matches a description given by Nannenga-Bremekamp & Yamamoto (1983) for a *Macbrideola*, described also by Eliasson et al. (1988) as a *Comatricha*. Comparison with material obtained from Spain (D. Wrigley de Basanta, Madrid, DWB 1372) led to a clear assignment of the Kazakh specimens to *M. oblonga*, previously known only from the Mediterranean area.

Perichaena liceoides Rostaf. emend Gilert, 1990 (**R**, 1: loc. 16). One, larger collection from the bark of *Calligonum densum*, pH 7.6.
Very small, scattered sporocarps without a common hypothallus, globose in shape, (0.1)-0.2-0.4-(0.6) mm in size, sessile on a restricted base and without a visible hypothallus, up to 0.3 mm tall, always rounded in outline. Peridium yellow (4A8) to olivaceous (4B8), with irregularly distributed large black areas, dehiscence line invisible. The membranous layer under transmitted light pale yellow (4A5-4A6), almost smooth, sometimes with paler strips, the duller, opaque patches covered with dull-brown (4C7), rounded inclusions, these 2.5-4 μm in size and densely baked together. Capillitium absent except a few, short outgrowths from the peridium, these wrinkled, 2-3-(3.5) μm wide threads, irregular in shape, pale yellow (4A5) to ochraceous (4B5) and up to 25 μm long. Spores in mass bright golden yellow (4A8), pale yellow (4A5) to ochraceous (4B5) under the microscope, globose, ornamented with conspicuous, scattered and blunt to capitate conspicuous spines up to 1.5 μm in height, (10.5)-11-13.5-(16) μm in diameter. The small, yellow sporocarps lying on the substratum like small eggs are very distinctive.

Perichaena corticalis (Batsch) Rostaf. (**A**, 15: loc. 4, 5, 10, 16, 22, 24, 28, 31, 32, 38). Throughout the region on bark of various desert scrubs, only occasionally found on litter.

Perichaena depressa Libert (**C**, 6: loc. 11, 37, 38). Rarer than the previous species, only recorded from the Karatau Mountains and one locality nearby.

Perichaena vermicularis (Schwein.) Rostaf. (**A**, 42: loc. 4, 5, 10, 11, 13, 14, 15, 16, 17, 18, 21, 22, 24, 31, 32, 33, 38). In spite of the regular occurrence of this species on both bark and litter, only the litter form with a membranous, thin peridium and abundant capillitium was seen.

Physarum cinereum (Batsch) Pers. (**R**, 1: loc. 38). Only once in the Karatau Mountains, on litter of *Mentha longifolia.*

Physarum cf. *confertum* T. Macbr. (**C**, 6: loc. 5, 7, 18, 22). On the bark of various shrubs; found only in the southern part of the journey.
Fructifications in small colonies of scattered, short plasmodiocarps, sometimes coalescing, all sessile on a inconspicuous hypothallus. Plasmodiocarps worm-like, often forming annulate rings, globose in cross-section and ca. 0.3 mm high, ranging from small and round sporocarp-like fructifications up to plasmodiocarps of 3 mm length. Hypothallus inconspicuous, cream to straw-coloured (4B4-4B7), separate for each fructification. Peridium persistent, opening irregular, regularly sprinkled with separated, white patches of ash-grey (4B2) granular lime, these 30-50 μm in size, under the microscope translucent and colourless, with small warts and ridges to almost smooth. Capillitium a dense network of translucent, colourless threads 1-3 μm wide, bearing long and often confluent, sometimes branched nodes of granular lime, 50-100 μm, often attached to the peridium and of badhamioid habit. Spores in mass dark-brown (5F8 and darker) to black, globose, pale brown under transmitted light, ornamented with regular distributed, fine warts up to 0.3 μm in height, (10.5)-10.8-11.5-(12) μm.
With very small, distinct and never coalescing lime nodes, this taxon fits into the concept of *Physarum confertum.* However, the latter species is described as forming heaped fructifications with a peridium almost free of lime, and spores 10-14 μm in size.

Physarum decipiens M.A. Curtis (**R**, 2: loc. 38). Karatau Mountains, on bark of *Rhamnus.* All characters of our specimen are typical, with greenish-yellow plasmodiocarps during development as described by Jahn (1919) and the distinctive, rugulose surface. However, our collection differs by having curious spores (10.5)-11-12-(12.5) μm in diameter which are dark brown under transmitted light and ornamented with irregularly distributed, very conspicuous baculate spines up to 1.2 μm height, these often arranged in rows but leaving larger parts of the spore smooth.

Physarum didermoides (Pers.) Rostaf. (**R**, 1: loc. 18). Collected once from the bark of *Atraphaxis.*

Physarum notabile T. Macbr. (**A**, 82 + 2 field collections: loc. 4, 5, 7, 10, 11, 13, 14, 15, 16, 17, 18, 21, 22, 24, 28, 30, 31, 32, 33, 34, 37, 38) This species, usually regarded as rare in the Old World, was the most abundant myxomycete, inhabiting all types of substrata. Two destroyed and obviously wintered specimens were found in the field, both preserved in dense, up to 15 cm thick mats of the previous year stems of *Capparis spinosa.* Three forms, often with intermediate sporocarps in a given colony, could be recognised (Table 1). The most common form 1 fits best the description and the photograph given by Neubert et al. (1995: 283). However, spore colour is described as dark olive brown, more pronounced in Nannenga-Bremekamp (1991: 195) as very dark like in *P. didermoides.* Our form 1 differs in having pale spores like most of the *Physarum*-species, which is also the case in a specimen of Jaaps exsiccate series (No. 85). A specimen from Colorado (Larimer Co., cow dung, TRTC) determined by Sturgis is identical with form 2, whereas form 3 approaches somewhat *Physarum compressum* Alb. & Schwein. in habit.

Table 1. Morphological differentiation between forms of *Physarum notabile.*

character	form 1	form 2	form 3
sporotheca shape	globose-depressed to umbilicoid	globose	compressed to weakly reniform
diameter	0.5-0.7 mm	0.4-0.6 mm	0.2-0.3 x 0.5-0.8 mm
base	reddish (5B8-5D8)	dull grey (5D4-5B4)	reddish (5B8-5D8)
stalk	dark brown (5E8), solid	black	dirty brown (5F8) - black
lime nodes	40-80 µm, mostly separate	50-100 µm, sometimes coalescing	100 µm and more, coalescing to badhamioid
spore colour	violet brown (8C3-8E4) with a paler side, often a germination visible	dark violet brown (8E4) with a paler side	dark olive brown (5D4-5E5), no conspicuous paler area
diameter	(9.7)-10-10.8-(11.5) µm	(11)-11.6-12-(12.5) µm	(10.5)-11-11.5-(12) µm
ornamentation	warts < 0.4 µm high	spines 0.4-0.8 µm high	spines 0.8-1 µm high
habitat	litter and dung	preferentially dung	litter and dung

Protophysarum phloiogenum M. Blackw. & Alexop., 1975 (**O**, 3: loc. 16, 21, 24). This species was only found in the south-eastern loop of the journey, the true desert region. One of the Kazakh specimens is described and figured in Castillo et al. (1998).

Stemonitis virginiensis Rex (**R**, 1: loc. 38). Collected once on the bark of *Crataegus* from the Karatau Mountains. A small group of sporocarps matching the redescription of the species by Castillo et al. (1997) except for slightly larger spores (6.5-7.2 µm in diameter).

In addition, two forms of the Protosteliales and five forms of myxobacteria were common throughout the survey.

Protosteliales, sp. I (**A**, 42: loc. 4, 5, 10, 13, 14, 16, 17, 18, 21, 22, 24, 31, 32, 33, 37, 38). Very common on all kind of bark throughout the region, occurring rarely on litter.
Large colonies of gregarious, single, stalked but deciduous, globose, colourless and smooth spores (6.7-)7.2-8(-8.6) µm on slender, short stalks of one to two-fold spore diameter; very probably *Protostelium mycophaga* Olive & Stoianovitch.

Protosteliales, sp. II (**C**, 11: loc. 5, 11, 13, 24, 37, 38). As for the previous species, with a strong preference for bark.
An unidentified species with smaller colonies of scattered, single and stalked, deciduous thick-walled spores having a roughened surface, (7.8-)8.2-10.2(-10.8) µm in diameter, stalk not observed under the light microscope.

Myxobacterium div. spec. (**A**, 132: loc. 4, 5, 10, 11, 13, 14, 15, 16, 17, 18, 21, 22, 24, 25, 28, 31, 32, 33, 34, 38, 39). With 132 records, myxobacteria were exceedingly abundant on all substratum types throughout the region.

RESULTS AND DISCUSSION

The 146 moist chamber cultures yielded a total of 513 records, with 328 of these belonging to the myxomycetes. In the field, only 10 fructifications were collected, all under exceptional situations and representing only two species (*Didymium squamulosum* and *Physarum notabile*). Altogether, 27 species of myxomycetes, two members of the Protosteliales, and five forms of Myxobacteria (not differentiated) were registered. The average yield of the moist chambers was about 2.2 myxomycete species per culture. Only six of the cultures gave no results; fifteen others produced only myxobacteria.

It seems to be a common biological rule that extreme environments have impoverished floras, albeit with a few, extremely abundant species. The results of the study presented here confirm this. Compared with surveys from wooded areas (Stephenson et al. 1993, Schnittler & Novozhilov 1996), the desert investigated harbours a rather poor myxomycete flora. If only species regularly (more than two records) occurring in true desert habitats and outside the Karatau Mountains are regarded, the species list declines from 27 to 15, but these are species often found with exceedingly high frequencies (*Echinostelium colliculosum*: 43 of 81 cultures with bark; *Physarum notabile*: 82 of 146 cultures). These and other species previously regarded as rare (e.g. *Echinostelium arboreum* and *Macbrideola oblonga*) underline the distinctiveness of this desert myxomycete flora. From a number of substrata, especially bark of desert shrubs (e.g., *Atraphaxis replicata* and *Calligonum densum*), all cultures yielded myxomycetes. Under favourable weather conditions, literally each square centimetre of bark must be covered with myxomycetes.

Bark yielded most of the species, as well as most of the records, followed by litter and dung. Only two species occurred exclusively on animal droppings (*Didymium annulisporum* and *Licea* spec., both recorded only once), although dung is well known as an occasional substratum for many species (Eliasson & Lundquvist 1979). Of particular interest is the abundance of myxomycete taxa forms often regarded as ancient, such as *Echinostelium*, *Protophysarum* or the *Protosteliales* in comparison to the poor total myxomycete flora. The extremely high abundance of corticolous myxomycetes stands in contrast to the purity and scarcity of the epiphytic lichen flora (about 10 species only); 26 bark moist chambers were from taller shrubs almost free of epiphytic lichens, and 21 (81%) of these yielded myxomycetes. From the 46 moist chambers of shrubs with epiphytic lichen coverage exceeding 5%, 43 (93%) yielded myxomycetes.

What are the limiting factors for myxomycete diversity in such extreme environments? One obvious and striking factor is the very harsh climate, with only two short time windows (spring and autumn) available for myxomycete development. An indirect confirmation for this assumption is the appearance of additional species (*Perichaena depressa*, *Physarum cinereum*, *P. decipiens*, and *Stemonitis virginiensis*) in the Karatau Mountains, characterised by a more steppe-like vegetation and a slightly more humid climate. The extreme fluctuations in air humidity favour species with a short development time or those able to survive repeated desiccation during development. The rarity of decaying wood is a further limitation; dead branches remain over a long time on the shrubs, and those on the ground dry out quickly due to their small diameter. Due to the extremely cold winters, the region lacks any succulent plants, thus excluding species such as *Badhamia gracilis* (T. Macbr.) T. Macbr., known from arid regions but with a strong preference for decaying succulents (Blackwell & Gilbertson 1980, Eliasson 1991). Thin litter mats were observed only under the rare denser shrubs with well-developed foliage (e.g., *Rhamnus sintenisii*, *Ammodendron eichwaldii*) or as heaps of dead branches like in *Capparis spinosa*, thus limiting the number of litter species. A less obvious factor is the high pH of all substrata, usually ranging from 7.4-8.2. The reasons are the often salty soils as well as the actual plant substrata; especially the abundant *Chenopodiaceae* with high Na^+ and ash contents. These high pH values may be a reason for absence of most members of the Stemonitales, Liceales and Trichales except *Perichaena*. The only exception, bark of *Tamarix* (pH 4.6-7.2, n=5), harboured a different myxomycete flora (e.g., *Comatricha laxa*, *C. pulchella*, *Arcyria minuta*, and *Licea biforis*).

Table 2. Comparison of regional myxomycete floras with the results of the present survey. T - total number of species recorded, S - species shared, and CC - coefficient of community. For data sets from the boreal zone, compare Schnittler & Novozhilov (1996).

climate	T	S	CC	region and source
boreal	90	9	0.15	Russian Karelia (Schnittler & Novozhilov 1996)
boreal	125	10	0.13	boreal Finland (Härkönen 1979a, b, 1981, 1989)
boreal	101	8	0.12	boreal Sweden (Eliasson 1975, 1977, Eliasson & Lundqvist 1979, Eliasson & Strid 1976, Eliasson & Sunhede 1972, Fries 1899, 1906, 1910, 1912, Harling 1952, Santesson 1948, 1964)
temparate	106	5	0.07	(Stephenson et. al. 1993)
montane	56	-	0.00	(Stephenson et. al. 1993)
subtropical	77	7	0.13	(Stephenson et. al. 1993)
tropical	101	11	0.17	(Stephenson et. al. 1993)
tropical	94	10	0.16	Hawaii (Eliasson 1991)
medi-terranean	93	10	0.17	Israel (Ramon 1968, Binyamini 1986, 1987, 1991)
desert	39	9	0.27	Arizona (near Tucson, Chaparral and desert records only: Evenson 1961; Sonora: Blackwell & Gilbertson 1980)

Compared to surveys in temperate and tropical regions having a humid climate, the myxomycete species list obtained in the present study is short, but it comprises one of the most distinct myxomycete floras on Earth. Expressed in terms of similarity (coefficient of community, compare Stephenson et al. [1993]) the species inventory shows very low degrees of similarity (0.07-0.15) with all temperate regions and only slightly higher ones (0.13-0.17) with tropical and subtropical regions (Tab. 2). Surprisingly, the Mediterranean region also is very different (0.17 for myxomycetes from Israel). Only the flora of a hot desert (Arizona) shows a higher degree of similarity (0.27). Consequently, it can be expected that the most similar flora in the New World should occur in a winter-cold desert such as the Mojave region.

The area investigated in the present study is still too small to reveal differences in geographical distribution. Among the five main habitat types, sand dune areas showed the highest richness of species, correlating with a richer and more abundant shrub flora. Some shrubs, such as the *Calligonum* species, are limited to sand dunes. Obvious differences in the species inventory existed only for the Karatau Mountains, which have more rainfall, non-calcareous soils and with *Crataegus ambigua* the only true tree of the region. In terms of vegetation, this region can be regarded as the southernmost steppe peninsula.

At the present level of knowledge, further comparative investigations in other arid regions are necessary to explore the whole richness of desert myxomycetes and reveal their world-wide distribution patterns.

ACKNOWLEDGEMENTS

Field work of the first author was supported by a travel grant (40095/705.6.168) from the Stifterverband für die Deutsche Wissenschaft. For confirming determinations or loan of authentic or type material, we are indebted to D.W. Mitchell, G. Moreno, D. Wrigley de Basanta and Y. Yamamoto. Thanks are also due to D.W. Mitchell for revising the determination of *Comatricha laxa* and S.L. Stephenson for discussing and proof-reading the manuscript.

REFERENCES

Anonymous (1990) Vegetation map of the USSR. - Main administration for geography and map drawing, council of ministers of the USSR [In Russian]. - Moscow.

Binyamini, N. (1986) Myxomycetes from Israel I. - Nova Hedwigia **42**: 379-386.

Binyamini, N. (1987) Myxomycetes from Israel II. - Nova Hedwigia **44**: 351-364.

Binyamini, N. (1991) Myxomycetes from Israel III. - Trans. Mycol. Soc. Japan **32**: 485-493.

Blackwell, M. & Alexopoulos, C.J. (1975) Taxonomic studies in the Myxomycetes IV. *Protophysarum phloiogenum*, a new genus and species of Physaraceae. - Mycologia **67**: 32-37.

Blackwell, M. & Gilbertson, R.L. (1980) Sonoran Desert myxomycetes. - Mycotaxon **11**: 139-149.

Castillo, A.; Illana, C. & Moreno, G. (1998) *Protophysarum phloiogenum* and a new family in the Physarales. - Mycol. Res. **102**: 838-842.

Castillo, A., Moreno, G., Illana, C. & Lago, J. (1997) A critical study of some Stemonitales. - Mycol. Res. **101**: 1329-1340.

Czerepanov, S.K. (1995) Vascular plants of Russia and adjacent states (the former USSR). - Cambridge: Cambridge Univ. Press, 516 pp.

Eliasson, U. (1975) Myxomycetes in the nature reserve of the Gothenburg Botanical Garden. - Svensk Bot. Tidskr. **69**: 105-112.

Eliasson, U. (1977) Ecological notes on *Amaurochaete* Rost. (Myxomycetes). - Bot. Not. **129**: 419-425.

Eliasson, U. (1991) The myxomycete biota of the Hawaiian Islands. - Mycol. Res. **95**: 257-267.

Eliasson, U. & Lundqvist, N. (1979) Fimicolous myxomycetes. - Bot. Not. **132**: 551-568.

Eliasson, U., Keller, H.W. & Hutchinson, J.A. (1988) Myxomycetes from Arkansas. - Mycotaxon **32**: 375-398.

Eliasson, U. & Strid, A. (1976) Wood-inhabiting fungi of alder forests in North-Central Scandinavia. 3. Myxomycetes. - Bot. Not. **129**: 267-272.

Eliasson, U. & Sunhede, S. (1972) Some Swedish records of myxomycetes. - Svensk Bot. Tidskr. **66**: 18-24.

Evenson, A.E. (1961) A preliminary report of the myxomycetes of southern Arizona. - Mycologia **53**: 137-144.

Fries, R.E. (1899) Sveriges myxomyceter. - Kongl. Vetensk.-Acad. Förh. Öfvers. **56**: 215-246.

Fries, R.E. (1906) Myxomycetenfloran i de jämtlandska fjälltrakterna. - Arkiv Bot. **6**: 1-9.

Fries, R.E. (1910) Några ord om Myxomycetan floran i torne Lappmark. - Svensk Bot. Tidskr. **4**: 253-262.

Fries, R.E. (1912) Den Svenska Myxomycet-Floran. - Svensk Bot. Tidskr. **6**: 721-802.

Gilert, E. (1990) On the idendity of *Perichaena liceoides* (Myxomycetes). - Mycol. Res. **94**: 698-704.

Gromova, I.M. & Baranovoj, G.U. (eds., 1981) Catalogue of mammals of the Soviet Union (In Russian) - Leningrad: Nauka, 455 pp.

Härkönen, M. (1977) Corticolous myxomycetes in three different habitats in southern Finland. - Karstenia **17**: 19-32.

Härkönen, M. (1979a) Additions and corrections to the Finnish flora of myxomycetes. - Karstenia **19**: 1-7.

Härkönen, M. (1979b) A check-list of Finnish myxomycetes. - Karstenia **19**: 8-18.

Härkönen, M. (1981) Ten myxomycete species new to Finland. - Karstenia **21**: 53-56.

Härkönen, M. (1989) Thirteen taxa of myxomycetes new to Finland. - Karstenia **28**: 93-99.

Harling, G. (1952) Notes on myxomycetes. I. *Physarum diderma* Rost. new to Sweden. - Svensk Bot. Tidskr. **46**: 47-52.

Jahn, E. (1919) Myxomycetenstudien. 9. Bemerkungen über einige seltene oder neue Arten. - Ber. Deutsch. Bot. Ges. **36**: 660-669.

Kappel, T. (1992) An aquarium myxomycete: *Didymium nigripes*. - Mycologist **6**(3): 106-107.

Keller, H.W. & Brooks, T.E. (1971) A new species of *Perichaena* on decaying leaves. - Mycologia **63**: 657-663.

Keller, H.W. & Brooks, T.E. (1976) Corticolous Myxomycetes V: Observations on the genus *Echinostelium*. - Mycologia **68**: 1204-1220.

Keller, H.W. & Brooks, T.E. (1977) Corticolous Myxomycetes VII: contribution toward a monograph of *Licea*, five new species. - Mycologia **69**: 667-684.

Keller, H.W. & Schoknecht, J.D. (1989) Life cycle of a new annulate-spored species of *Didymium*. - Mycologia **81**: 248-265.

Kornerup, A. & Wanscher, J.H. (1981) Methuen handbook of colour. 3. ed. - London: Methuen, 282 pp.

Lado, C. & Pando, F. (1997) Flora Mycologica Iberica, Vol. 2. Myxomycetes, I. Ceratiomyxales, Echinosteliales, Liceales, Trichales. 1. ed. - Madrid, Berlin, Stuttgart: J. Cramer, 323 pp.

Martin, G.W. & Alexopoulos, C.J. (1969) The Myxomycetes. - Iowa City: Iowa Univ. Press, 561 pp.

Mitchell, D.W. (1999) World inventory of myxomycete species. Descriptions and taxonomic references. - CD-ROM, distributed at the 3nd International Congress on the Systematics and Ecology of Myxomycetes, Beltsville, MD.

Nannenga-Bremekamp, N.E. (1985) Notes on Myxomycetes XXII. Three new species, two new families and four new combinations. - Proc. K. Ned. Akad. Wet. C **88**: 121-128.

Nannenga-Bremekamp, N.E. (1989) Notes on Myxomycetes XXIII. Seven new species of Myxomycetes. - Proc. K. Ned. Akad. Wet. C **92**: 505-515.

Nannenga-Bremekamp, N.E. (1991) A guide to the temperate myxomycetes. - Bristol: Biopress Ltd., 325 pp.

Nannenga-Bremekamp, N.E. & Yamamoto, Y. (1983) Additions to the Myxomycetes of Japan. I. - Proc. K. Ned. Akad. Wet. C **86:** 207-241.

Nawawi, A. (1973) A new species of *Licea* from Malaysia. - Trans. Br. Mycol. Soc. **60**: 153-154.

Neubert, H., Nowotny, W. & Baumann, K. (1995) Die Myxomyceten Deutschlands und des angrenzenden Alpenraumes unter besonderer Berücksichtigung Österreichs. Band 2. *Physarales*. - Gomaringen: Baumann Verl., 368 pp.

Novozhilov, Y.K. & Golubeva, O.G. (1986) Epiphytic myxomycetes from the Mongolian Altai and the Gobi desert. [In Russian]. - Mikologija i Fitopatologija **20**: 368-374.

Pando, F. & Lado, C. (1988) Two new species of corticolous Myxomycetes from Spain. - Mycotaxon **31**: 299-303.

Ramon, E. (1968) Myxomycetes of Israel. - Israel J. Bot. **17**: 207-211.

Safronova, I. N. (1991a) Vegetation of the Mangyschlak Peninsula. - Botanischeskij Zhurnal **76**: 205-216.

Safronova, I. N. (1991b) Geobotanical classification of the Mangyschlak Peninsula. - Botanischeskij Zhurnal **76**: 205-216.

Safronova, I. N. (1992) Checklist of the vascular plants ot the Mangyschlak Peninsula [In Russian]. - Botanischeskij Zhurnal **77**: 100-115.

Santesson, R. (1948) *Listerella paradoxa* Jahn och *Orcadella singularis* (Jahn) nov. comb., två für Sverige nya myxomyceter. - Svensk Bot. Tidskr. **42**: 42-50.

Santesson, R. (1964) Swedish myxomycetes. - Svensk Bot. Tidskr. **58**: 113-124.

Schnittler, M. & Novozhilov, Y.K., (1996) The Myxomycetes of Boreal woodlands in northern Karelia: A preliminary report. - Karstenia **36**: 19-40.

Stephenson, S.L., Kalyanasundaram, I. & Lakhanpal, T.N. (1993) A comparative biogeographical study of myxomycetes in the mid-Appalachians of eastern North America and two regions of India. - J. Biogeogr. **20**: 645-657.

Stephenson, S.L. & Stempen, H. (1994) Myxomycetes: a handbook of slime molds. - Portland, Oregon: Timber Press, 183 pp.

Vasjagina, M.P., Wujsova, S.M & Golovenko, I.N. (1977) Flora sporovykh rastenij Kazakhstana. Vol. 10. Phycomycetes et Myxomycetes. - Alma-Ata: Nauka, Kazakh branch, 348 pp.

Whitney, K.D. & Keller, H.W. (1980) A new species of *Echinostelium*. - Mycologia **72**(3): 640-643

MYCOTAXON

Volume LXXIV(2), pp. 287-300 April-June 2000

CONTRIBUTION OF ANDRÉ MAUBLANC TO MYCOLOGY.
I – ANNOTATED LIST OF PUBLICATIONS

Jean MOUCHACCA
Laboratoire de Cryptogamie, Muséum National d'Histoire Naturelle,
12, rue Buffon, F-75005 Paris, France
(E-mail: mouch@mnhn.fr; corresponding author)
&
Valérie SAINT-JORE
Lycée Agricole, Horticole et Forestier, F-76270 Mesnières-en-Bray, France

ABSTRACT: This note introduces the scientific contribution of André MAUBLANC (1880 - 1958) through a short biography and an annotated list of his writings. Over one hundred titles pertaining to the fields of phytopathology and mycology could be retreived. They focus on diseases of cultivated plants of temperate and tropical regions, on the taxonomy of their fungal agents and also on saprotrophs. Each title is provided with a concise note underlining the original approach of the research undertaken.

These publications apparently suffer from no longer being considered of interest although they deal with problems that even today have not been resolved.

KEY WORDS: fungi, phytopathology, biography, bibliography, taxonomy, crops, temperate zone, tropical regions.

INTRODUCTION

André (Pierre, Jules) MAUBLANC (1880-1958), remains the last French naturalist phytopathologist with a marked interest in fungal taxonomy. His notable achievements in both fields of research were undertaken throughout the first half of the twentieth century. Interestingly, however, his scientific contribution has never been considered on a global scale. Such concerns his numerous titles and new binomials he introduced mostly in the early decades of his career.

Maublanc graduated from the 'Paris Institut National Agronomique' at the turn of the twenty century. Soon after, he joined the recently organised 'Station

Centrale de Pathologie', which, at that time, was located a short distance from the Institute. There he was introduced to plant pathology and mycology by such eminent teachers as E. Prilleux, G. Delacroix and E. Griffon. After his engagement in the first world war, Maublanc was appointed at this Institute where he taught plant pathology and botany until his retirement in 1948. Maublanc was also involved in teaching both disciplines in two other institutes: 'Institut National d'Agronomie Coloniale' and 'Institut Technique de Pratique Agricole'. This longstanding career was, nonetheless, interrupted once by his 1912 - 1914 journey to Brazil being sent there to organize a phytopathological laboratory at the National Museum of Rio de Janeiro (Saint-Jore & Mouchacca, 1999).

Starting in 1903 and up to the first world war, Maublanc authored a large number of papers on plant diseases induced by fungi and on taxonomic mycology. These included the diagnoses of a fair number of new taxa developing on material collected in France and on specimens received at the Pathology Station either from local farmers or from overseas territories. Maublanc then also achieved the publication of two text books of plant pathology left incompleted by the death of G. Delacroix. After 1920, Maublanc pursued his investigations on microfungi inducing diseases of tropical and temperate plants and of material brought back from Brazil. But then he also developed an interest in higher fungi. This was rapidly materialized by a popular book on edible and poisonous mushrooms. The latter appeared in several editions between 1920 to 1940.

The study of basidiomycetes then became the dominant field of research pending his collaboration with the Swiss Paul Konrad. This association resulted in the preparation of the *Icones Selectae Fungorum* (1924 - 1937) and of two basic books on the systematics of higher fungi. In the same period, Maublanc issued the enlarged new version of his former popular book which was re-entitled 'Les Champignons de France'; the latter was also the subject of several new editions.

Besides his teaching commitments and research on fungi, Maublanc also accepted some side responsibilities. He was elected General Secretary of the French Mycological Society; a position he first occupied during the four years before his Brazilian trip and again for a very long period extending from 1920 to 1957. In this last year, he became President of the Society. Maublanc was also twice proposed as President of the French Society of Plant Pathology (1930 & 1939).

Maublanc's fields of interest extended beyond plant pathology and mycology. Indeed he soon became noted for his wide knowledge of other natural history disciplines such as entomology, geology, etc. This interest is behind his membership of other scientific and popular societies such as the French Entomological and Botanical Societies and the 'Société des Naturalistes Parisiens'. His implications in these domains culminated in his proposal as President of the French Entomological Society in 1942 and the French Botanical Society in 1945. In 1957, Maublanc assumed in addition the Presidency of the 'Société des Naturalistes Parisiens'.

Maublanc's notes on phytopathology on tropical and temperate plants were published mostly in journals which ceased to be published several decades ago. These publications apparently suffer from no longer being considered of interest although they deal with problems that even today have not been resolved.

The present note provides an annotated list of Maublanc's titles. The taxonomic status of names he introduced will be considered in a subsequent note.

ANNOTATED LIST OF PUBLICATIONS

ABBREVIATIONS: Journal titles were abbreviated following B-P-H/S (Botanico-Periodicum-Huntianum/Supplementum Hunt Institute for Botanical Documentation, Pittsburgh, 1991). Author's names are abbreviated following Brummit & Powell (1992).

1903

MAUBLANC A. Sur quelques espèces nouvelles de champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 19 : 291-296. Provides descriptions of 18 species new to science belonging to the Ascomycotina and the deuteromycotina and the new entomopathogenic form genus *Nomuraea*.

1904

MAUBLANC A. Espèces nouvelles de champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 20 : 70-74. Several new species and varieties of ascomycetes and deuteromycetes are proposed from material collected in France and Mexico.

MAUBLANC A. & LASNIER E. Sur une maladie des *Cattleya*. Bull. Trimestriel Soc. Mycol. France 20 : 167-192. Examination of infected leaves from plants of the genus *Cattleya* provided a pure strain of the causal agent; the latter proved to represent a new ascomycete, then proposed under the binomial *Physalospora cattleyae* Maubl. & Lasnier.

MAUBLANC A. Sur une maladie des olives due au *Macrophoma dalmatica* (Thüm.) Berl. & Vogl. Bull. Trimestriel Soc. Mycol. France 20 : 229-232. Features symptoms of a previously unknown olive disease with a description of the coelomycete causal agent.

MAUBLANC A. A propos du *Dasyscypha calyciformis* (Willd.). Bull. Trimestriel Soc. Mycol. France 20 : 233-235. A description of this discomycete is provided based on infected fir samples collected by G. Delacroix. Maublanc suggests the ascomycete, formerly observed on several conifers, is a saprophyte that develops at the periphery of the wounds or on the killed bark of the trees.

1905

MAUBLANC A. Travaux de la Station de Pathologie Végétale. Espèces nouvelles de champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 21: 87-94. In this paper, Maublanc introduced 15 new species of ascomycetes and deuteromycetes from material collected in France and overseas.

MAUBLANC A. Travaux de la Station de Pathologie Végétale. *Trichoseptoria fructigena*, nov. sp. Bull. Trimestriel Soc. Mycol. France 21 : 95-97. The new deuteromycete *Trichoseptoria fructigena* Maubl., developing on *Pyrus malus* and *Cydonia vulgaris* in France, is introduced.

1906

MAUBLANC A. Sur quelques espèces nouvelles ou peu connues de Champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 22 : 63-70. This paper considers species and varieties of ascomycetes and deuteromycetes yet unrecorded for the French, Spanish and Brazilian mycobiotas. New binomials established are: *Calospora tamaricis* and its var. *zignoelloides*, *Diplodiella tamaricis*, *Septoria azalae-indicae*, *S. phaseoli*, *Gloeosporium ricini*, *G. phaji*, *G. sobraliae*, *G. dendrobii*, *Marssonia obtusata*, *Ramularia ligustrina* and *Melanobasidium mali* gen. nov., sp. nov.

MAUBLANC A. Quelques champignons de l'est africain. Bull. Trimestriel Soc. Mycol. France 22 : 71-76. Reports on several rust and smut pathogens from plant material collected by G. Le Testu in Portuguese East Africa, now Moçambique. New binomials proposed are: *Puccinia Le Testui*, *Ravenelia Le Testui*, *Pleoravenelia deformans* and *Ustilago andropogonis-finitimi*.

1907

MAUBLANC A. Sur quelques champignons inférieurs nouveaux ou peu connus. Bull. Trimestriel Soc. Mycol. France 23 : 141-145. New taxonomic proposals are: *Physalospora populina*, *Sphaerella tabaci*, *Plowrightia agaves*, *Hysterostomella elaeicola*, *Phoma nicotianae*, *Cytosporina halimi* and *Camarosporium persicae*.

MAUBLANC A. *Ceratopycnidium*, genre nouveau de Sphéropsidées. Bull. Trimestriel Soc. Mycol. France 23 : 146-149. Introduces the new coelomycete genus *Ceratopycnidium* Maubl., type species *C. citricolum* Maubl.

MAUBLANC A. Sur une maladie des sapins produite par le *Fusicoccum abietinum*. Bull. Trimestriel Soc. Mycol. France 23 : 160-173. Reviews symptoms of the disease known as the red fir disease. In line with previous authors, Maublanc ascribes the causal agent to *Fusicoccum abietinum*, a description of which is also presented. A list of other fungi observed is also included. Some nomenclatural decisions are forwarded including two combinations: *Rhizosphaera pini* (Corda) Maubl. and *Toxosporium camptospermum* (Peck) Maubl.

PRILLEUX E. & MAUBLANC A. La maladie du sapin pectiné dans le Jura. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 145 : 699-701. Reports symptoms and origin of this fir disease. The authors advocate the establishment of a mixed vegetation of fir and beech trees up to 800 m altitude and a combination of fir-spruce at higher levels.

1908

GRIFFON E. & MAUBLANC A. Sur le blanc du chêne. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 147 : 437-439. An overview of the oak downy mildew in France.

GRIFFON E. & MAUBLANC A. Notes sur diverses maladies des branches du pommier. Bull. Soc. Nat. Hort. France, 8 p. A popular note on common twig diseases of apple trees.

1909

MAUBLANC A. Les maladies des pays chauds (1). Maladies du cacaoyer. I. La pourriture brune des cabosses. II. *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl. Agric. Prat. Pays Chauds 9 (79) : 314-324. This paper is the first of a series of notes on plant diseases in tropical regions. It considers a disease of cacao trees: the brown rot disease of pods with notes on the causal agent.

MAUBLANC A. Les maladies des pays chauds (2 - suite). Maladies du cacaoyer (suite). III. Le chancre du cacaoyer. IV. Les balais de sorcière du cacaoyer. V. Pourridié des racines du cacaoyer. Agric. Prat. Pays Chauds 9 (80) : 393-407. A survey of three fungal diseases of cacao trees.

MAUBLANC A. Rapport sur la session générale organisée à Paris en octobre 1908 par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 25, pp. XV-XXXIX. Report on the annual general session of the French Mycological Society presented by the General Secretary A. Maublanc. Included is a list of mushrooms collected during the October 1908 forays made in the forests of Saint-Germain and Compiègne and in localities around Versailles.

GRIFFON E. & MAUBLANC A. Le blanc du chêne. Bull. Trimestriel Soc. Mycol. France 25 : 37-50. An overview of the oak downy mildew in France and Europe, on susceptible host plants and on the origin of the disease.

GRIFFON E. & MAUBLANC A. Sur une maladie du Cacaoyer. Bull. Trimestriel Soc. Mycol. France 25 : 51-58. Reports on a root and twig disease of cacao trees grown in Africa (Gabon) evidenced by the development of small black pustules. An isolate of the causal agent matched the description of *Botryodiplodia theobromae* Pat., a polyphagous coelomycete then found to be best accomodated in the form genus *Lasiodiplodia* Ellis & Everh.

GRIFFON E. & MAUBLANC A. Notes de mycologie et de pathologie végétale. Bull. Trimestriel Soc. Mycol. France 25 : 59-63. The first part of this contribution groups the protologues of four new taxa: *Colletotrichum ixorae*, *Dichomera carpini*, *Naemaspora jasmini* and *Chaetophoma erysiphoides*. The second concerns the diseases and pathogens of the following pathologies submitted to the plant pathology laboratory: *Gloeosporium nervisequum* (Fuckel) Sacc. on platanus, *Cercospora microsora* Sacc. on lime-tree, *Urocystis cepulae* Frost a smut of onion and leek and *Phyllosticta brassicae* (Curr.) Westend. on cauliflower.

GRIFFON E. & MAUBLANC A. Observations sur quelques maladies de la betterave. Bull. Trimestriel Soc. Mycol. France 25 : 98-107. This first contribution on sugar-beet diseases reviews problems of heart decay, leaf diseases and formation of outgrowths or roots.

GRIFFON E. & MAUBLANC A. Sur une nouvelle rouille des Orchidées des serres. Bull. Trimestriel Soc. Mycol. France 25 : 135-139. Introduces the novel rust *Hemileia oncidii* Griffon & Maubl. observed on several Brazilian Orchids grown in greenhouses around Paris. According to the authors, the disease does not markedly affect the plants. To arrest its extension, the lower leaf surface should be washed with water supplemented with 'tobacco juice and black soap'.

GRIFFON E. & MAUBLANC A. Notes de pathologie végétale (mildiou, black-rot, rouilles). Observations sur quelques maladies de la vigne. Observations sur les rouilles des plantes cultivées en 1908. Bull. Trimestriel Soc. Mycol. France 25 : 140-146. This synthetic note conveys observations made at the Paris Plant Pathology Station in the year 1908 on some diseases of vine (powdery mildew and black-rot in the centre of France) and rusts of some cultivated plants such as cereals and some nursery trees and shrubs.

GRIFFON E. & MAUBLANC A. Sur quelques champignons parasites des plantes de serres. Bull. Trimestriel Soc. Mycol. France 25 : 238-242. Descriptions of fungi pathogenic to greenhouse plants of the genera *Clusiae*, *Dracaenae* and *Codiaeum*; two fungi are new proposals: *Pestalozzia clusiae* Griffon & Maubl. and *Phyllosticta dracaenae* Griffon & Maubl.

1910

MAUBLANC A. Rapport sur la session générale et les herborisations organisées aux environs de Dijon en octobre 1909 par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 26, pp. I-XXI & XXXI. A report on the plenary October 1909 session of the French Mycological Society. Includes the list of fungi from forays made around the cities of Autun, Epinac and Semur and in the woods of Gevrey-Saulun and Beaune.

MAUBLANC A. Les maladies des pays chauds (3 - suite). Maladies du cotonnier. I. Le chancre du collet du cotonnier. Agric. Prat. Pays Chauds 10 (83) : 105-111. After reviewing the diseases of cacao trees, those of cotton bushes are debated starting with that of the collar canker.

MAUBLANC A. Les maladies des pays chauds (4 - suite). Maladies du cotonnier (suite). II. Maladies de la mosaïque et maladies analogues. III. Antrachnose du coton.

Agric. Prat. Pays Chauds 10 (84) : 214-223. More diseases of cotton bushes are discussed.

MAUBLANC A. Les maladies des pays chauds (5 - suite). IV. Maladies diverses des racines. V. Maladies diverses des tiges. VI. Maladies des feuilles. VII. Maladies des fruits. Agric. Prat. Pays Chauds 10 (85) : 295-304. Descriptive cards of several common tropical diseases of roots, twigs, leaves and fruits of important crops.

MAUBLANC A. Les maladies des pays chauds (6 - suite). Maladies de la canne à sucre. Agric. Prat. Pays Chauds 10 (90) : 232-252. Descriptive cards of common diseases of sugar cane and their causal agents.

MAUBLANC A. Les maladies des pays chauds (7 - suite). Maladies de la canne à sucre. Agric. Prat. Pays Chauds 10 (91) : 312-320. Further information on diseases of sugar cane.

MAUBLANC A. Les maladies des pays chauds (8 - suite). Agric. Prat. Pays Chauds 10 (92) : 379-400. Reviews several diseases of tropical crops.

MAUBLANC A. Les maladies des pays chauds (9 - suite). Agric. Prat. Pays Chauds 10 (93) : 502-505. More information on tropical plant diseases of economic importance.

MAUBLANC A. Notes complémentaires (maladies du caféier, du théier, du cotonnier et du cacaoyer). Agric. Prat. Pays Chauds 10 (93) : 506-512. Unreported observations by the author on pathogens of diseases of coffee, tea, cotton and cacao trees.

GRIFFON E. & MAUBLANC A. Sur une maladie des perches de chataîgnier. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 151 : 1149-1151. A description is provided of the disease of chestnut-poles in the French Limousin region. Observed symptoms are believed to match a similar disease reported few years ago from Italy by Briosi & Farneti. The latter ascribed this ink disease of chestnut-trees to the widespread *Melanconis perniciosa* commonly detected only as its anamorphic form *Coryneum*. However, the French authors favour the hypothesis that the hyphomycete isolated by the Italians would rather be a synonym of *Melanconis modomia* Tul.

GRIFFON E. & MAUBLANC A. Nouvelles recherches sur la pourriture du coeur de la betterave. Bull. Trimestriel Soc. Mycol. France 26 : 126-131. By using pure cultures, the authors proved that the disease known as heart decay of sugar-beet corresponds, in fact, to two disorders: the true heart decay induced by *Phoma tabafica* and the drying of the heart leaves due to a species of *Cladosporium*. These results were in line with the field observations and the disease hypothesis formulated earlier by Krüger in 1894.

GRIFFON E. & MAUBLANC A. Le blanc du chêne et l'*Oïdium quercinum* Thümen. Bull. Trimestriel Soc. Mycol. France 26 : 132-137. A study of the widespread oak powdery mildew disease definitely distinct from *Oïdium quercinum*. Pending the discovery of the perfect state, the new provisional name *Oïdium alphitoïdes* Griffon & Maubl. was proposed.

GRIFFON E. & MAUBLANC A. Sur des espèces de *Sphaeropsis* et de *Diplodia* parasites du Poirier et du Pommier. Bull. Trimestriel Soc. Mycol. France 26 : 307-316. Observations confirmed that apple and pear trees were susceptible to attack by taxa of the genus *Sphaeropsis* as *S. malorum* Peck and *S. pseudodiplodia* (Fuckel) Delacr. Also by the morphologically similar genus *Diplodia*. However, developing taxa of the latter genus though morphologically distinctive were not identified to the species level. These coelomycetes though commonly reported as saprophytes, may sometimes act as wound parasites capable of killing a large area of the cortex.

GRIFFON E. & MAUBLANC A. Une Chytridinée nouvelle parasite d'un gazon de Ray-grass. Bull. Trimestriel Soc. Mycol. France 26 : 317-321. Examination of lawn samples of Ray-grass from Fontainebleau developing symptoms of 'yellowing' led to the isolation of a novel Chytrid described as *Cladochytrium caespitis* Griffon & Maubl.

GRIFFON E. & MAUBLANC A. Sur une maladie des perches du Chataîgnier. Bull. Trimestriel Soc. Mycol. France 26 : 371-381. A synthetic report on the Chestnut pole disease widespread in France, Italy and Portugal. The causal agent of the developing elongated spots is *Melanconis modomia* Tul. with the conidial state renamed *Coryneum modonium* (Tul.) Griffon & Maubl.

1911

GRIFFON E. & MAUBLANC A. Notes de pathologie végétale. I. Une maladie des feuilles de la rose de Noël. II. Une maladie de l'aubergine. III. Maladies des céréales (rouilles, piétin, noirs). IV. Maladies du cœur de la betterave. V. Maladies à sclérotes. VI. Maladies de la pomme de terre et de la tomate en 1910. VII. Le mildiou de la vigne en 1910. VIII. Le blanc de chêne en 1910. IX. Blanc de groseillier. X. Maladie verruqueuse de la pomme de terre. Bull. Trimestriel Soc. Mycol. France 27 : 47-67. Descriptions of fungi parasitising plants of economic importance in the domain of agricultural, horticultural and forestry. For some of the agents, an evaluation of losses is undertaken. Relevant measures of controls are also debated.

GRIFFON E. & MAUBLANC A. Deux moisissures thermophiles. Bull. Trimestriel Soc. Mycol. France 27 : 68-74. Protologues of two thermophilic hyphomycetes: *Penicillium dupontii* Griffon & Maubl. and *Sepedonium lanuginosum* (Miehe) Griffon & Maubl.

GRIFFON E. & MAUBLANC A. Notes de pathologie végétale et animale. I. Sur le *Plasmodiophora brassicae*. II. Sur un cas de décurtation des jeunes rameaux d'Epicéa. III. Sur une maladie des olives dans les Alpes-Maritimes. IV. Champignons nouveaux parasites des poires. V. Sur une maladie des poissons causés par une Saprolégniée. Bull. Trimestriel Soc. Mycol. France 27 : 469-475. Five particular pathologies are reviewed including a disease of young twigs of spruce trees, an olive disorder due to *Gloeosporium olivarum* Ver. d'Alm. in the region of the Alpes-Maritimes and finally a fish disease induced by one of the Saprolegniales. The chapter on pear diseases contains Latin descriptions of the new genus *Lasiostroma* and of *Phoma umbilicaris* (see also next paper).

GRIFFON E. & MAUBLANC A. Contribution à l'étude des maladies des pommes et des poires. Ann. Inst. Natl. Agron., Paris, 2ème série, t. 10, pp. 69-106. Conveys original information and drawings of several parasitic diseases of apples and peaches. The study was carried out at the plant pathology station and followed by a prospective research to define climatic and cultural conditions favouring each disease and to select appropriate field measures to limit losses. The new decay fungal agent of peaches *Lasiostroma pirorum* Maubl. gen. nov., sp. nov., is described in addition to *Phoma umbilicaris* (see also previous paper).

MAUBLANC A. Rapport sur la session générale organisée en septembre et octobre 1910 aux environs de Grenoble et d'Annecy par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 27, pp. I-XXX. This report comprises the list of fungi collected in the forays organised in the neighbourhood of Grenoble and Annecy during September and October 1910 by the French Mycological Society.

1912

GRIFFON E. & MAUBLANC A. Les *Microsphaera* des Chênes. I. Les *Microsphaera* américains des Chênes. II. Les *Microsphaera* européens des Chênes, Bull. Trimestriel Soc. Mycol. France 28 : 88-104. An overview of *Microsphaera* species on American and European oaks. The authors concluded that the *Microsphaera* responsible for the oak downy mildew is distinct from American species and from those reported earlier in Europe. The new taxon of unknown origin but most probably of recent introduction into Europe is proposed with the following binomial: *Microsphaera alphitoides* Griffon & Maubl.

MAUBLANC A. Rapport sur la session générale organisée en octobre 1911 aux environs de Paris par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 28, pp. I-XVI. List of mushrooms collected in the forests of Villers-Cotterêts, Saint Germain and Fontainebleau, situated around Paris, during the October 1911 forays organised by the French Mycological Society.

MAUBLANC A. Maladies du vanillier. Antrachnose du vanillier (*Calospora vanillae* Massee). Maladies des taches brunes des tiges (*Nectria vanillae* Zimm.). Agric. Prat. Pays Chauds 12 (108): 177-188. Diseaes of vanilla plants. Two diseases are reviewed.

MAUBLANC A. Maladies du vanillier (suite). Anthracnose du vanillier, suite (*Calospora vanillae* Massee). Maladies diverses du vanillier. Agric. Prat. Pays Chauds 12 (109) : 277-287. Further notes on diseases of vanilla plants.

1913

MAUBLANC A. Edouard Griffon (1869-1912). Bull. Trimestriel Soc. Mycol. France 29 : 197-205. A comprehensive obituary of the French phytopathologist.

GRIFFON E. & MAUBLANC A. Sur quelques champignons parasites des plantes tropicales. I. Une maladie de l'*Hevea brasiliensis*. II. Une maladie du Karité (*Butryospermum parkii*). Bull. Trimestriel Soc. Mycol. France 29 : 244-250. This note reports on the isolation of *Dothidiella ulei* Henn. from leaves of *Hevea brasiliensis* collected close to Balem (Para) at the mouth of the Amazon river. Two other pathogens of 'karité' plants grown in Africa (Haut Sénégal and Niger) are proposed as new taxa: *Fusicladium butyrospermi* Griffon & Maubl. and *Pestalozzia heterospora* Griffon & Maubl.

MAUBLANC A. Sur une maladie des feuilles du papayer (*Carica papaya*). Bull. Trimestriel Soc. Mycol. France 29 : 353-358. Note on a leaf disease. The morphology and taxonomy of the causal agent are discussed. To accomodate the fungus, the new genus *Asperisporium* is established with *A. caricae* (Speg.) Maubl. as type species. Three other taxa will also be transferred to *Asperisporium* Maubl.

MAUBLANC A. Rapport sur les maladies observées au Laboratoire de Phytopathologie du Musée National de Rio de Janeiro. Bulletin mensuel des renseignements agricoles et des maladies des plantes 4 (6) : 1-6. A report on most common pathogens of Brazilian crops and specifically of those grown in the southern states between Rio de Janeiro and Rio Grande; this area was the only part of the country for which the Laboratory of Phytopathololgy had collected substantial data. Crops investigated were the following: coffee, sugar cane, tobacco, corn, maté, rice, cotton, vine, wheat, fruit trees and some vegetable and ornamental plants.

MAUBLANC A. Bericht über die in dem phytopathologieschen Laboratorium des National-Museums in Rio de Janeiro beobachteten Pflanzenkrankheiten. Internationale Agrartechnische Rundschau 4 (1-2 : januar-februar 1913) : 717-720. A German version of the previous report on plant diseases observed at the Phytopathology Laboratory of the National Museum of Rio de Janeiro.

MAUBLANC A. & RANGEL E. Le *Stilbum flavidum* Cooke parasite du caféier et sa place dans la classification. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 157 : 858-860. A study of the polyphagous *Stilbum flavidum* was undertaken by incubating coffee leaves in humid chambers. The fungus proved to be the abortive sterile state of the new Basidiomycete *Omphalia flavida* Maubl. & Rangel.

1914

MAUBLANC A. & RANGEL E. Le *Stilbum flavidum* Cooke, forme avortée de l'*Omphalia flavida* n. sp. Bull. Trimestriel Soc. Mycol. France 30 : 41-47. Protologue of *Omphalia flavida* Maubl. & Rangel with details about conditions required for the development of its carpophores.

MAUBLANC A. L'*Ustulina pyrenocrata* Theissen, type du genre nouveau *Theissenia*. Bull. Trimestriel Soc. Mycol. France 30 : 48-53. From the cortex of a tree having the common name 'Minjoleiro' in the São Paulo area, Maublanc isolated a fungus matching the description of *Ustulina pyrenocrata* Theiss. A more elaborate study concluded the latter should be considered as the type species of the new genus *Theissenia* Maubl.

MAUBLANC A. Les genres *Drepanoconis* Schr. et Henn. et *Clinoconidium* Pat. : leur structure et leur place dans la classification Bull. Trimestriel Soc. Mycol. France 30 : 441-449. During his Brazilian stay, Maublanc was able to study both genera on undetermined plants of the family *Lauraceae*. He concluded that the genera *Clinoconidium*, *Drepanoconis* and *Coniodyctium* are distinguishable by conidial morphology and septation but interrelate by their structure and habit of life. These entities could thus be placed but provisionally in the Melanconiaceae.

1915

MAUBLANC A. & RANGEL E. Alguns fungos do Brasil, novos ou mal conhecidos. Bol. Agric. (São Paulo) 16 : 310-328. Provides a list of Basidiomycetes, Pyrenomycetes, Sphaeropsidales, Melanconiales and Hyphomycetes less common or yet unknown from Brazil. Establishment of new genera including *Chaetolentomita* Maubl.

MAUBLANC A. & RANGEL E. Über neue und wenig bekannte Pilze Brasiliens. Internationale Agrartechnische Rundschau 6 (7 : juli 1915) : 1210-1211. A list of 42 taxa belonging to the Ascomycotina and the deuteromycotina less common or yet unreported from Brazil. A condensed review of the previous note.

1920

MAUBLANC A. Contribution à l'étude de la flore mycologique brésilienne. Bull. Trimestriel Soc. Mycol. France 36 : 33-43. Reports the descriptions of several Brazilian fungi based on specimens collected by Maublanc. Proposal of some new taxa including the new ascomycetous genus *Uropolystigma* Maubl.

MAUBLANC A. & NAVEL H.C. Sur une maladie du palmier à huile (*Elaeis guineensis* Jacq.) aux îles San-Thomé et de Principe produite par un champignon (*Ganoderma applanatum* Pers.). Agron. Colon. 30 (mai-juin 1920) : 187-191. Describes symptoms of a new disease of oil palm trees. The authors insist on the need for a follow up of the plantations to assess the evolution of the disease which may prove to be highly destructive. They suggested to adapt local cultural methods and the application of simple prophylactic measures such as burning the attacked trees, wound disinfection with a ferric sulfate solution followed by application of tar, sealing of cavities with a solid material such as cement in order to increase trunk solidity and delay its rupture.

1922

MAUBLANC A. La pourriture brune du Cacaoyer. Agron. Colon., N.S., xi, 54, pp. 177-184. A survey of the history, distribution and symptoms of the brown decay disease of cacao trees. After providing a protologue for the novel causal agent

Phytophthora faberi Maubl., the author reviews the parameters of disease development and control measures.

1923

MAUBLANC A. Rapport sur la session générale organisée en octobre 1922, aux environs de Lyon par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 39, pp. IX-XXVIII. Report on the annual session of the French Mycological Society held in October 1922 with the list of taxa collected during the forays organised around the cities of Tarare, Saint Nonnet-le- Froid, Vienne and Charbonnières.

MAUBLANC A. La mosaïque de la canne à sucre. Agron. Colon., N.S., viii, 61, pp. 1-7. Reviews the history, distribution and losses due to the sugar cane mosaic. The causal agent could not be identified due to the absence in the diseased tissues of fungal or bacterial structures which could explain the symptoms. Based on published information, Maublanc favours the hypothesis of an infectious disease induced by a virus transmitted by greenflies. He then debates about the resistance and the varietal susceptibility to the disease.

1924

MAUBLANC A. Les maladies de l'Arachide. I. Maladie des tâches brunes des feuilles. II. Rouille de l'Arachide. III. Pourridié de l'Arachide. IV. Maladies à sclérotes de l'Arachide. V. Pourriture bactérienne de l'Arachide. VI. Maladies diverses ou peu connues. Agron. Colon., N.S., x, 73, pp. 1-12. A popular note on peanut disorders intended for farmers. Diseases covered are: brown leaf spots (*Cercospora personata* Ellis), rust (*Uredo arachidis* Lagerh.), rots (*Rhizoctonia*), sclerotial diseases (*Sclerotium rolfsii* Sacc.), bacterial decay (*Bacillus solanacearum* E. Smith) and other diseases of less known pathologies (mosaic, etc.). Information on prophylactic and chemical control measures are also provided.

MAUBLANC A. Compte rendu de la session générale tenue à Paris en octobre 1924 par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 40, pp. XLI-LIII. Report on the annual general meeting of the French Mycological Society with a list of mushrooms collected while foraying in the forests of Fontainebleau, Marly, Carnelle and Compiègne.

1925

MAUBLANC A. Conseils pour l'étude sur place des maladies cryptogamiques aux colonies et pour l'envoi d'échantillons d'étude. Agron. Colon., N.S., xiii, 92, pp. 57-64. This note is in relation with the author's side activities at the 'Institut National d'Agronomie Coloniale'. It conveys indications to be followed for correct handling and conditioning of infected material for examination by the phytopathology laboratory. Maublanc also stresses the type of information to be collected regarding disease evolution with a review of control measures to be applied locally.

MAUBLANC A. La maladie des tâches brunes de l'arachide en Afrique occidentale. Agron. Colon., N.S., xiii, 92, pp. 126-127. An overview of the report prepared by Mr Claveau, then Head of the Department of Agriculture, Forestry and Breeding of Sénégal and Mauritania. This document conveys data on the extension and losses induced by *Cercospora personata* Ellis, causal agent of brown leaf spot of peanuts in West Africa.

MAUBLANC A. Rapport sur la session générale tenue du 11 au 18 octobre 1925 à Bellême (Orne). Bull. Trimestriel Soc. Mycol. France, t. 42, pp. XXVI-XXXIX. Report on forays made in Saint Bomer and the forest of Bellême.

1928

MAUBLANC A. Rapport sur la session générale organisée en octobre 1927 aux environs de Paris, par la Société Mycologique de France. Bull. Trimestriel Soc. Mycol. France, t. 44, pp. IX-XXII. Collecting data from the October forays in Rambouillet and Armainvilliers.

MAUBLANC A. Observations sur quelques champignons du Brésil. I. Sur un parasite des feuilles de *Mikania*. Arch. Bot. (Paris). 2 (Bull. mens. No. 7) : 121-129. The debated pathogen is *Maireella bertioides* (Sacc. & Berl.) Maubl.

MAUBLANC A. & BARAT H. Une maladie nouvelle de la vanille. Agron. Colon., N.S., xvii, 123, pp. 77-82. Discuss symptoms of a new disease of vanilla plants developing at La Réunion island with the causal agent being a *Phytophthora*. Details of cultural and prophylactic control measures are forwarded.

1930

MAUBLANC A. & MALENCON G. Recherches sur le *Battarraea guicciardiana* Ces. Bull. Trimestriel Soc. Mycol. France 46 : 43-73. Data on the anatomy, distribution and phylogeny of the fungus are provided. It is distinguished from the closely related *Battarraea phalloïdes* by characteristics of the veil, habitat and geographic distribution.

MAUBLANC A. & MALENCON G. Sur la nature et l'organisation de la gleba du *Battarraea guicciardiana* Ces. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 190 : 510-512. A more elaborate description of this *Battarraea* species is provided.

1934

MAUBLANC A. & ROGER L. Une nouvelle rouille du caféier au Cameroun. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 198 : 1069-1070. Reports on a new disease of coffee trees in Cameroon induced by a rust.

MAUBLANC A. & ROGER L. Une nouvelle rouille du caféier au Cameroun : *Hemileia coffeicola*. Bull. Trimestriel Soc. Mycol. France 50 : 193-202. Description of a new rust species from infected coffee trees in Cameroon.

MAUBLANC A. & ROGER L. La phthiriose du caféier. Compt. Rend. Hebd. Séances Acad. Sci., Paris, 198 : 391-392. Considers symptoms and possible causes of this disease of coffee trees.

1935

MAUBLANC A. & ROGER L. La Phthiriose du caféier au Cameroun. Rev. Bot. Appl. Agric. Trop. 161 : 25-32. A study of the conidial state of *Polyporus coffeae* Wakef., infecting roots of African coffee trees. The authors note its similarity with *Bornetina corium* L.Mangin & Viala, agent of the vine phthiriose. On the basis of this assumption, the former conidial state is then considered to belong to this form genus and the disease named phthiriose of coffee trees. However, both conidial states are not considered as representing the same species.

MAUBLANC A. Rapport sur la session générale de la Société Mycologique de France tenue à Paris en octobre 1934. Bull. Trimestriel Soc. Mycol. France, t. 51, pp. III-XX. Details about forays undertaken in the forests of Villers-Cotterêts and Sénart and around the city of Beauvais.

1936

MAUBLANC A. Rapport sur la session générale de la Société Mycologique de France tenue à Barcelone du 19 au 27 octobre 1935. Bull. Trimestriel Soc. Mycol. France, t. 52 , pp. XVII-XXXII. Includes a list of mushrooms collected while foraying at the villages of Salut and Monserrat and the massif of Montseny.

1937

MAUBLANC A. Rapport sur la session générale de la Société Mycologique de France tenue à Aix-les-Bains du 20 au 27 septembre 1936. Bull. Trimestriel Soc. Mycol. France, t. 53, pp. XVII-XXVIII. List of mushrooms collected during the forays organised in the forests of Corsuet, Bouvillard and Sapenay and during the excursions at la Chartreuse de Saint Hugon and Mont Revard.

MAUBLANC A. Contribution à la connaissance de la flore mycologique du littoral atlantique. Rev. Pathol. Vég. Entomol. Agric. 24: 121-132. A list of interesting parasitic fungi belonging to the orders Peronosporales, Ustilaginales and Uredinales. Localities investigated were in the regions of Loire inférieure (Pornic and Croisic), Charente inférieure (Mechers and Oleron Island) and in Vendée (Island of Yeu).

MAUBLANC A. & VIENNOT-BOURGIN G. Tavelures des arbres fruitiers. Journées de la lutte chimique contre les ennemis des cultures, vol. 38, No. 4 bis, octobre 1937, 5 p. A popular document on the biology of agents inducing apple and peachs discolorations. A description of the apple blotch disease caused by *Gloeodes pomigera*, a relatively inocuous disease which, however, depresses the value of infected fruits; also provides a description of the *Diplodia* on apples. Notes on appropriate control measures.

1938

MAUBLANC A. & ROGER L. Sur deux espèces du genre *Cookeina* en Afrique. Bull. Trimestriel Soc. Mycol. France 54 : 111-114. A morphological study of *Cookeina sulcipes* (Berk.) Kuntze and *C. tricholoma* Mont. *Geopyxis striatospora* Maubl. & Roger is regarded as a synonym of the former.

MAUBLANC A. & Ed. d'ASTIS. *Tricholoma abbatum* (Quélet). Bull. Trimestriel Soc. Mycol. France 54 : 67-68. *Tricholoma abbatis* revisited. Twelve specimens were found in a mixed wood of pine and green-oaks growing on a calcareous soil at an altitude of 600 m on the north side of Mont Caume.

1939

MAUBLANC A. Rapport sur la session générale de la Société Mycologique de France tenue à Paris du 9 au 20 octobre 1937. Bull. Trimestriel Soc. Mycol. France, t. 55, pp. XIX-XXXII. Report on and list of mushrooms collected during forays in the forests of Orry-La-Ville, Villers-Cotterêts, Compiègne and Fontainebleau.

1944

MAUBLANC A. Les études mycologiques dans la région parisienne. Congrès naturaliste, Paris 1944, Commémoration du Quarantenaire des Naturalistes Parisiens, pp. 52-54. A review on the history of mycological forays in the Isle de France region presented at the meeting held to commemorate fourteen years of the ‘Association des Naturalistes Parisiens’.

MAUBLANC A. Contribution à l'étude de la flore cryptogamique de la région parisienne. Congrès naturaliste, Paris 1944, Commémoration du Quarantenaire des Naturalistes Parisiens, pp. 130-132. A list of interesting taxa collected in the zone extending up to 100 km around Paris and in the regions of Normandy and Loiret. These parasites of higher plants belong to the orders Peronosporales, Ustilaginales and Uredinales.

1951

MAUBLANC A. Paul Konrad (1877-1948). Bull. Trimestriel Soc. Mycol. France 67 : 329-335. Obituary.

1953

MAUBLANC A. A propos de quelques champignons printaniers. Bulletin des Naturalistes Parisiens, N.S., 8 : 3-6. A popular note on interesting finds of spring mushrooms made by the author.

BOOKS AUTHORED BY MAUBLANC

1909 - DELACROIX G. & MAUBLANC A. Maladies des plantes cultivées. II. Maladies parasitaires. Encyclopédie Agricole, J.B. Baillère (Ed.), Paris, 452 p., 83 pl. A comprehensive treatise on parasitic diseases of cultivated plants.

1911 - DELACROIX G. & MAUBLANC A. Maladies des plantes cultivées dans les pays chauds. Augustin Challamel (Ed.), Paris, 595 p., 70 pl. A well known general treatise of plant pathology of tropical plants.

1926 - Maladies des plantes cultivées. II. Maladies parasitaires. 2ème édition. Encyclopédie Agricole, J.B. Baillère (Ed.), Paris, 456 p., 89 pl. A revised edition of this textbook of plant pathology.

1921 - Les champignons comestibles et vénéneux. Paul Lechevallier (Ed.), Paris, 212 p., 140 figs., 96 pl. A popular treatise of edible and poisonous mushrooms. This book will be a piece of art for several decades.

1926 - Les champignons comestibles et vénéneux. 2ème édition.Tome 1. Paul Lechevallier (Ed.), Paris, 240 p., 96 pl. As the first edition proved to be very popular, Maublanc prepared an enlarged second edition that appeared in two volumes.

1928 - Les champignons comestibles et vénéneux. 2ème édition. Tome 2. Paul Lechevallier (Ed.), Paris, 240 p. The second part of the enlarged version of this popular book for mushroom collectors. The title of this book will undergo slight changes in subsequent editions.

1946 - Les champignons de France. 3ème édition, Paul Lechevalier (Ed.), Paris, cclxxvii, 2 vols., + 283 p., 240 pl. (224 col.), 57 figs. These two small volumes were aimed at being something more than merely popular books.

1952 - Les champignons de France. 4ème èdition, Paul Lechevalier (Ed.), Paris. Vols. I & II : 112 p. + 278 p. A renewed edition of this popular and highly praised book for mushroom hunters.

1959 - MAUBLANC A. & VIENNOT-BOURGIN G. Champignons de France. 5ème édition. Paul Lechevallier (Ed.), Paris., vol. I: i-iv + 305 p., portrait, 59 figs.; vol. II: Atlas, 283 p., 224 pl. (221 col.). The first volume comprises the following six chapters: introduction to fungi; classification of fungi; classification of Basidiomycetes; the Homobasidiomycetes; the Ascomycetes and finally edible and poisonous fungi.

1971 - Les champignons comestibles et vénéneux. 6ème èdition, Paul Lechevallier (Ed.), Paris. Additions to the previous editions: plates of *Cortinarius orellanus* and *Lepiota brunneo-incarnata* by G. Viennot-Bourgin. Vols. I & II : 308 p. + 285 pl.

1974 - Les champignons comestibles et vénéneux. 6ème édition, 2ème impression, Paul Lechevallier (Ed.), Paris. Vols. I & II: 308 p. + 285 pl.

1995 - Champignons comestibles et vénéneux. 7ème èdition, Paul Lechevallier (Ed.), Paris, 527 p., 230 col. pl. The latest edition of this popular book for mushroom collectors first written by A. Maublanc in 1921 was completely revised by J. PERREAU.

1924-1937 - KONRAD P. & MAUBLANC A. *Icones selectae fungorum*. Paul Lechevallier (Ed.), Paris, 6 vols. A total of 500 annotated plates and one volume with descriptions: vol. 6, 559 p. The well known *Icones selectae fungorum* were published serially in six volumes over a period of thirteen years:
Vol. 1 (1924-1930): plate Nos. 1 - 100; Vol. 2 (1930-1932): plate Nos. 101 - 199;
Vol. 3 (1932-1933): plate Nos. 200 - 299; Vol. 4 (1933-1934): plate Nos. 300 - 399;
Vol. 5 (1934-1935): plate Nos. 400 - 500; Vol. 6 (1935-1937): relevant text.

(1948) 1949 - KONRAD P. & MAUBLANC A. Les Agaricales. Classification, révision des espèces, iconographie, comestabilité. Agaricaceae. Encyclopédie Mycologique 14. Paul Lechevalier (Ed.), Paris, 469 p., 1 pl. A major taxonomic book on this large group of Basidiomycetes.

1952 - KONRAD P. & MAUBLANC A. Les Agaricales. Tome II. Russulacées, Hygrophoracées, Gomphidiacées, Paxillacées, Bolétacées. Encyclopédie Mycologique 20. Paul Lechevalier (Ed.), Paris, 220 p. The second part of a major taxonomic book on this large group of Basidiomycetes.

ACKNOWLEDGEMENTS

In tracing copies of hardly available literature the authors are much indebted to Drs. U. Braun, D. Minter and A.J.L. Phillips (Universidade do Minho) and Manuela Da Silva (Brazil). Dr. A.J.L. Phillips also seriously attempted to upgrade the English level of the text and has kindly accepted to act together with Dr. H. van der Aa as a presubmission reviewer for Mycotaxon.

REFERENCES

BRUMMIT R.K. & POWELL C.E. (Eds.), 1992. Authors of Plant Names. Royal Botanic Gardens, Kew.

SAINT-JORE V. & MOUCHACCA J., 1999. Travaux d'André AUBLANC, mycologue naturaliste français de la première moitiè du XXème siècle. Crypt., Mycol. (in press).

MYCOTAXON

Volume LXXIV(2), pp. 301-330 April-June 2000

CONTRIBUTION OF ANDRÉ MAUBLANC TO MYCOLOGY. II – TAXONOMIC STATUS OF INTRODUCED TAXA

Jean MOUCHACCA
Laboratoire de Cryptogamie, Muséum National d'Histoire Naturelle,
12, rue Buffon, F-75005 Paris, France (corresponding author)
&
Valérie SAINT-JORE
Lycée Agricole, Horticole et Forestier, 76270 Mesnières-en-Bray, France

ABSTRACT: This second contribution on A. Maublanc focuses on the status of the binomials he introduced. For each binomial, basic bibliographic information with characteristics of type material are given. An extensive search was undertaken to find authentic material in the few collections comprising specimens he examined. These collections, formerly dispersed in separate institutions, are now maintained together in the Paris Museum. Whenever possible individual positions were updated and studies were initiated to resolve a few cases.

More than one hundred new species were described by Maublanc from material originating from France, South America (mostly Brazil) and Africa. Taxonomic decisions were, however, commonly established on a plant-host basis. Over half the proposals represent deuteromycetes collected in France. The remaining comprise Ascomycetes and Basidiomycetes (11 species) on a 3:1 ratio. New Ascomycetes were generally based on the Brazilian specimens collected by Maublanc. Established Basidiomycetes are rusts and smuts with most being from Africa.

The following genera were established by Maublanc: *Asperisporium*, *Ceratopycnidium*, *Chaetolentomita*, *Lasiostroma*, *Melanobasidium*, *Nomuraea*, *Theissenia* and *Uropolystigma*. Some remain unispecific and unreported since their proposal.

The following new combinations are proposed by the present authors: *Marssonina obtusata* and *Stagonospora agaves*.

KEY-WORDS: Maublanc, fungi, biodiversity, taxonomy, phytopathogens, deuteromycetes, Ascomycetes, Basidiomycetes, new taxa, France, Brazil, Africa, documentation.

INTRODUCTION

The first part of this contribution on André Maublanc considered the scientific publications and writings by this eminent phytopathologist (Mouchacca & Saint-Jore, 2000). The present note focus on the taxonomic status of the names he introduced. Titles authored by him singly or with French and Brazilian colleagues were scanned for taxonomic decisions proposed therein. Similar decisions reported in the two text books on Basidiomycete systematics prepared with the Swiss mycologist P. Konrad, are not taken into account here.

For each taxon, basic bibliographic information with characteristics of type material are given. All efforts were undertaken to update individual taxonomic positions when changes were expected to occur in the light of present-day knowledge. For names not reassessed since they were proposed, information on the respective genera is provided instead. In a few cases, a collaborative taxonomic investigation was initiated to solve pending ones (Braun & Mouchacca, in press; Vanky & Mouchacca, in press).

An extensive search was undertaken to locate original specimens of taxa described by Maublanc. Indeed, the search was started several years ago. It rapidly confirmed that material studied by him has long suffered from being scattered in separate collections commonly inaccessible to the mycological community. Thus Maublanc's prime specimens of the Paris Pathology Station were moved, in the 1920's, to the new Versailles Centre; the long forgotten herbarium of the latter was recently transferred to the Paris Museum. A similar decision was taken a few years ago about the mycological collections of the Paris Institut National Agronomique. Authentic material of Maublanc was also filed in the general herbarium of the Paris Cryptogamic Museum (PC) pending his constant visits to consult specimens maintained there.

This dispersion of his authentic material accounts for the lack of modern taxonomic studies on the taxa he introduced. These taxa relate to fungi developing on plant material collected at the beginning of the twentieth century in Europe (mostly in France), Africa and South America; for the latter two continents, the available specimens are the only ones in existence.

Several authentic specimens could not, however, be located. Nonetheless, cases of failure should not altogether be considered definitive since the content of a small collection of Maublanc at PC awaits to be indexed. Also, a few Brazilian specimens unavailable in present collections at PC, are suspected to be located in the National Museum of Rio de Janeiro where Maublanc spent two years prior to the first world war. There he started, with E. Rangel, his series of exsiccata entitled 'Fungi Brasiliensis'. A complete set is expected to be housed in that institution. A similar set does not figure in PC since Maublanc distributed his South American specimens among material he collected elsewhere.

This note aims to stimulate interest in the names coined in the early decades of the twentieth century by Maublanc for a certain number of fungi. These binomials proved to be unreported since their introduction.

STATUS OF INTRODUCED TAXA

For names published before 1920, the volume (s) of Saccardo's *Sylloge Fungorum* are added under the heading literature. These are cited whenever the corresponding binomial could be traced following the relevant general index authored by Reed & Farr (1993). References are abbreviated according to B-P-H/S (Botanico-Periodicum-Huntianum/Supplementum Hunt Institute for Botanical Documentation, Pittsburgh, 1991). Author's names are abbreviated following Brummit & Powell (1992).

The following abbreviations were also introduced in the text:
Fungi Brasiliensis: FB; Herbier de l'Institut National Agronomique, Paris: Herb. INA; Herbier de la Station Centrale de Pathologie Végétale, Versailles (S.-&-O.), France (now Centre INRA Versailles): Herb. SCPV, and Paris Cryptogamie: PC.

Two genera were dedicated to Maublanc: *Maublancia* and *Maublancomyces*. *Maublancia myrtacearum* G.Arnaud, type species of *Maublancia* G.Arnaud (Arnaud, 1918) was established for a Brazilian ascomycete developing on living leaves of a plant family *Myrtaceae*. *Maublancomyces* was based by Herter (1950) on *Helvella gigas* Krombh. and described without knowledge of the earlier name *Neogyromitra* Imai. Eckblad (1968) provided evidence that *Maublancomyces* should be considered as a synonym of *Neogyromitra* which should in turn be regarded as congeneric with *Discina* (Fr.) Fr.

Individual entries are marked by arrows. Binomials introduced by Maublanc are printed in bold characters.

CHYTRIDIOMYCETES

⇒ **Cladochytrium (Physoderma) caespitis** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 26: 320. 1910; XXI: 847. Holotype: ? On roots of *Lolium perenne*, Fontainebleau, France (date & leg. not specified).

This species was overlooked by Sparrow (1960) in his generic treatment of *Cladochytrium* Nowak.

OOMYCETES

⇒ *Phytophthora palmivora* (E.J.Butler) E.J.Butler - Scient. Rep. Agric. Res. Inst. Pusa 1918-19: 82. 1919.
Basionym: *Pythium palmivorum* E.J.Butler - Mem. Dept. Agric. India, bot. ser., 1 (5): 82. 1907.
= **Phytophtora faberi** Maubl. - Agric. Prat. Pays Chauds 9 (79): 315. 1909; XXI: 860; XXIV: 35. Holotype: ? Parasitic on fruits of cacao trees in hot regions. Synonymy *fide* Waterhouse (1970).

The protologue provided by Maublanc was based on a full description of the black pod disease in the Cameroons given by von Faber in 'Die Krankheiten und Parasiten des Kakaobaumes [Arb. K. Biol. Anst. Land. Forst. 7 (2): 197. 1909]. Von Faber, however, did not name the fungus; the latter was then dedicated to him.

Following Waterhouse (1970) 'it is usually accepted that the fungus is the same as *Phytophthora palmivora*'.

ASCOMYCETES

⇒ **Anthostomella distachya** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 87. 1905; XIX: 77; XXII: 98. Holotype: PC ex Herb. INA, same material as for

Leptosphaeria ephedra Maubl. On dry branches of *Ephedra distachya*, in the dunes close to the river mouth, Le Cormeu (Loire-inférieure), France, IV 1904, leg. A. Maublanc.

This species has been overlooked in recent relevant partial revisions of the genus (Dulymamode *et al.*, 1998).

⇒ **Asterina maublancii** (G.Arnaud) Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 38. 1920; XXIV: 460.
Basionym: *Asterina melastomatis* Lév. var. *maublancii* G.Arnaud - Ann. Ecole Natl. Agric. Montpellier, N.S., 16: 169. 1918; XXIV: 460; *nom. ill.*, Art. 34.1b. Holotype: ? On living leaves of a plant family *Melastomataceae*, close to Boe Vista, Rio de Janeiro, Brazil (date ?), leg. A. Maublanc (FB No. 370).

The original specimen was tentatively identified as *Lembosia melastomatum* Mont. by Maublanc before its redisposition by G. Arnaud.

⇒ **Botryosphaeria abietina** (Prill. & Delacr.) Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 169. 1907; the synonymy is not mentioned in Reed & Farr (1993).
Basionym: *Physalospora abietina* Prill. & Delacr. - Bull. Trimestriel Soc. Mycol. France 6: 114. 1890; IX: 594; XII: 565; XX: 391. Holotype: ?

The fungus was encountered in the course of a study of a fir tree disease in the Jura mountains, France. It has also been observed in North America (Farr *et al.*, 1989).

⇒ **Calospora tamaricis** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 63. 1906; XXII: 395. Holotype: PC ex Herb. SCPV No. 1822 a; isotype PC ex Herb. INA. On dead branches of *Tamarix* sp., Pornic (Loire-Inférieure), France, IV 1905, leg. A. Maublanc. The original material was divided into two parts now maintained in separate collections.

A second collection is also available: Herb. SCPV No. 1822 C, collected at La Briochère close to Pornic, IV 1910, leg. A. Maublanc.

⇒ **Calospora tamaricis** var. **zignoelloides** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 63. 1906. Holotype: PC ex Herb. SCPV No. 1822 b; isotype PC ex Herb. INA, same material as *Diplodiella tamaricis* Maubl. [now *Microdiplodia depazeoides* (Durieu & Mont.) Zambett.]. On dead branches of *Tamarix* sp., Pornic (Loire-Inférieure), France, IV 1905, leg. A. Maublanc.

The original material was divided into two parts now maintained in separate collections.

⇒ *Chaetosphaeria brasiliensis* (Höhn.) E.Müller, in Müller & von Arx - Die Gattungen der didymosporen Pyrenomyceten. Beitr. Kryptogamenflora Schweiz 11 (2): 588. 1962.
Basionym: *Lentomita brasiliensis* Höhn. - Denkschr. K. Ak. Wiss. Wien, math.-nat. Kl. 83: 24. 1907.
= **Chaetolentomita lignorum** Maubl., in Maubl. & Rangel - Bol. Agric. (São Paulo) 16: 313. 1915; XXIV: 1072. Holotype: Herb. Museo Rio de Janeiro No. 1009. On decaying wood, Rio de Janeiro, Brazil, 22 XII 1912, leg. Maublanc & Rangel (Exsiccata Herb. Museo Rio de Janeiro No. 1009). Synonymy *fide* Müller & von Arx (1962).

The still unispecific genus *Chaetolentomita* Maubl., type species *C. lignorum* Maubl., was regarded as a synonym of *Chaetosphaeria* Tul. by Müller & von Arx (1962).

⇒ *Cookeina sulcipes* (Berk.) Kuntze - Rév. Gen. Pl. 2: 849. 1891; Denison - Mycologia 59: 312. 1967.
Basionym: *Peziza sulcipes* Berk. - London Jour. Bot. 1: 141. 1842.
= *Trichoscypha sulcipes* (Berk.) Sacc. - *Syll. Fung.* 8: 161. 1889.
= **Geopyxis striatospora** Maubl. & Roger, in Roger - Bull. Trimestriel Soc. Mycol. France 52: 83. 1936. Holotype: ? On leaves (host not specified), Ivory Coast (Africa), 1934, leg. A. Mallamaire. Synonymy *fide* Maublanc & Roger (1938).

The study of two additional African specimens (village of Yallinga, 1922, leg. G. Le Testu) led the French authors to conclude that the whole set of the then available specimens represent a single taxon.

This taxonomic decision was, however, not reported later by Denison (1967).

⇒ *Gibbera caespitosa* (Wint.) E.Müller, in Müller & von Arx - Die Gattungen der didymosporen Pyrenomyceten: 424. 1962.
Basionym: *Parodiella caespitosa* Wint. - Grevillea 15: 87. 1887.
= **Mairecella bertioïdes** (Sacc. & Berl.) Maubl. - Arch. Bot. (Paris) 2: 128. 1928.
Basionym: *Lizonia bertioides* Sacc. & Berl. - Rev. Mycol. (Toulouse) 7: 137. 1885. On living leaves of *Mikania* spp., Brazil (date & leg. not specified). No corresponding material could be located. Synonymy *fide* Müller & von Arx (1962).

⇒ *Gibbera melioloides* (Rehm) Theiss. - Sydowia 16: 188. 1918.
Basionym: *Guillaridella melioloides* Rehm - Hedwigia 40: 107. 1901.
= **Mairecella melioloides** (Rehm) Maubl. - Arch. Bot. (Paris) 2: 128. 1928. On living leaves of species of *Mikania* spp., Brazil; two collections are cited: from Rio de Janeiro, leg. E. Ule and from São Paulo, leg. A. Puttemans. Synonymy *fide* Müller & von Arx (1962).

⇒ **Gibberella longispora** Maubl. [as *Giberella*] - Bull. Trimestriel Soc. Mycol. France 36: 37. 1920; XXIV: 686. Holotype: PC ex Herb. INA as FB No. 135 (the packet bears the handwritten indication 'type'). On leaves of *Olyra* sp., pente des Corcovada, Rio de Janeiro, Brazil, 9 XI 1913, leg. A. Maublanc.

A second similar collection made on 15 V 1914 and numbered FB No. 221 is also available. Details of the *Fusarium* anamorph (unnamed) were also reported in the protologue.

⇒ *Lasiostemma melioloides* var. *caraçaense* (Maubl.) Farr - Mycologia 71: 252. 1979.
Basionym: **Dimeriella caraçaensis** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 34. 1920; XXIV: 247. Holotype: PC ex Herb. INA as FB No. 327. On living leaves of *Baccharidis* sp., Sierra de Caraça, State of Minas Gerais, 18 IX 1913, leg. A. Maublanc.

The material examined by Farr (1979) is located at FH on sheet No. 7607 of Patouillard's Herbarium. It is part of the original collection distributed by Maublanc in his series Fungi Brasiliensis. According to Farr (1979), the fungus is known only from the authentic collection.

⇒ **Hysterostomella elaeicola** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 143. 1908; XIX: 964; XXII: 556. Holotype: ? On leaves of *Elaeis guineensis*, Dahomey (date & leg. not specified).

⇒ **Laestadia multipunctata** (Went.) Maubl. - Bol. Agric. (São Paulo) 16: 312. 1915; not reported in Reed & Farr (1993).
Basionym: *Physalospora multipunctata* Went. - Grevillea 15: 88. 1886-7; IX: 596; XII: 566.

The fungus was observed developing on leaves of *Mikania* spp. No representative material could be located.

⇒ **Leptosphaeria alpiniae** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 89. 1905; XIX: 1095; XXII: 229. Holotype: PC ex Herb. SCPV No. 1580. On leaves of *Alpinis nutantis*, Botanical Garden, São Paulo, Brazil, leg. A. Puttemans (*sub* No. 466).

The fungus has apparently not been reassessed (Crane & Shearer, 1991).

⇒ **Leptosphaeria ephedra** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 88. 1905; XIX: 1101; XXII: 227. Holotype: PC ex Herb. INA, same material as for *Anthostomella distachya* Maubl. *loc. cit.*, but such is not mentioned on the packet. On dead branches of *Ephedra distachya*, in the sand dunes around the river mouth at Le Cormeu (Loire-Inférieure), France, IV 1904, leg. A. Maublanc.

The fungus has apparently not been reassessed (Crane & Shearer, 1991).

⇒ **Leptosphaeria lauri** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 89. 1905; XIX: 1105; XXII: 220. Holotype: PC ex Herb. SCPV No. 1709. On leaves of *Laurus nobilis*, département Seine-et-Marne, France (date ?), leg. A. Maublanc. According to Maublanc (1905), the fungus was accompanied by a *Phyllosticta* having oval spores, 6 x 3 µm, then believed to represent the anamorphic state.

This binomial was listed without any annotation by Crane & Shearer (1991).

⇒ **Leptosphaeria paraguayensis** Maubl. - Bol. Agric. (São Paulo) 16: 315. 1915; Bull. Trimestriel Soc. Mycol. France 36: 35. 1920; XXIV: 980. Holotype: PC ex Herb. Museo Rio de Janeiro No. 552 e, same material as for *Sphaerella ilicicola* Maubl. On leaves of *Ilex paraguayensis* near spots of *Cercospora ilicicola* (date & leg. not specified). The binomial was listed without any comment by Crane & Shearer (1991).

⇒ **Leptosphaeria puttemansii** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 88. 1905; XIX: 1110; XXII: 219. Holotype: PC ex Herb. SCPV No. 1598. On leaves of *Eriobotrya japonica*, Botanical Garden, São Paulo, Brazil, leg. A. Puttemans. On the packet, the following is mentioned: leg. A. Puttemans (Exsic. C. Roumeguère).

The name was listed without comment by Crane & Shearer (1991).

⇒ **Meliola lippiae** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 291. 1903; XVII: 546; XX: 62. Holotype: ? On the upper leaf surface of a *Lippa* sp., Dahomey, Africa (date ?), leg. G. Le Testu. The taxon was retained as valid by Hansford (1961).

⇒ *Melioliphila coralloides* (Maubl.) Rossman - Mycotaxon 8: 500. 1979; Mycol. Pap. 150: 95. 1983.

= *Paronectria coralloïdes* (Maubl.) Hansford - Mycol. Pap. 15: 130. 1946.
Basionym: **Calonectria coralloïdes** Maubl., in Maublanc & Rangel - Bol. Agric. (São Paulo) 16: 315. 1915; Bull. Trimestriel Soc. Mycol. France 36: 37. 1920; XXIV: 679. Lectotype: FH ex Herb. Museo Rio de Janeiro No. 640; isotype PC ex Herb. INA as FB No. 353. On immature ascomata of a *Meliola* sp. developing on leaves of a plant belonging to family *Melastomataceae*, *socio Trichothyrium fimbriatum* Speg. (?), Rio de Janeiro, Brazil, XII 1912, leg. A. Maublanc & E. Rangel.

The second specimen cited by Maublanc (1920) now filed in PC ex Herb. INA as FB No. 353 is labelled: On leaves of *Clidemia hirta*, developing over the mycelium of *Meliola melastomacearum*, in association with *Trichothyrium fimbriatum* Speg. (?), Rio de Janeiro, Brazil, 8 XII 1913, leg. A. Maublanc.

Rossman (1979) examined a duplicate of Herb. Museo Rio de Janeiro No. 640 found in Patouaillard's herbarium at FH and designated a lectotype.

⇒ **Metasphaeria stromaticola** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 34. 1920; XXIV: 959. Holotype: Herb. Museo Rio de Janeiro *sine num.* On leaf petioles of a plant belonging to the family *Sapindaceae* parasitising stromata of a *Phyllachora* sp. (? *P. duplex*), Jacarepanga, Rio de Janeiro, (date ?), leg. Dr. Britto.

⇒ **Microsphaera alphitoïdes** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 28: 100. 1912; Braun - The Powdery Mildews (Erysiphales) of Europe: 174. 1995; not reported in Reed & Farr (1993).
Anamorph: **Oidium alphitoides** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 26: 132. 1910; *nom. ill.*, Art. 34.1b. Holotype: ? On *Quercus ruber*, Gard, France, XII 1910.

For other synonyms of the anamorph, see Braun (1995).

⇒ **Morenoina inaequalis** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 40. 1920; XXIV: 430, then erroneously indicated as Maublanc & G.Arnaud.
Basionym: *Morenoina inaequalis* Maubl., in Arnaud - Ann. Ecole Natl. Agric. Montpellier, N.S., 16: 139. 1918; *nom. ill.* Art. 34.1b. Holotype: ?. On living leaves of a plant family *Myrtaceae*, pentes des Corcovado, Rio de Janeiro, 8 II 1914, leg. A. Maublanc (FB No. 296 but having the No. 295 in Maublanc, 1920).

⇒ *Mycosphaerella caricae* H. & P. Sydow - Sydowia 11: 403. 1903; Corlett - An annotated list of the published names in *Mycosphaerella* and *Sphaerella*: 59. 1991.
= *Mycosphaerella caricae* (Maubl.) Hansford - Proc. Linn. Soc. London 153: 22. 1941; *nom. ill.*, Art. 64.1.
Basionym: **Sphaerella caricae** Maubl. - Bull. Trimestriel Soc. Mycol. France 29: 358. 1913; XXIV: 855. Holotype: ? On living leaves of *Carica papaya* in Central and South America.

No particular specimen was specifically designated by the author. Also according to Maublanc (1913), *Asperisporium caricae* (Speg.) Maubl. is the corresponding anamorph.

Phoma caricae-papayae (Tarr) Punithalingam (Punithalingam, 1980) was proposed as a new name for *Phoma caricae* (Pat.) Punithalingam (CMI Description of Pathogenic Fungi and Bacteria, No. 634. 1980). However, it was not then indicated that the fungus is the anamorph of *Mycosphaerella caricae* H. & P. Sydow, the connection having not been proven experimentally. *Asperisporium caricae* (Speg.) Maubl. is also not discussed by Punithalingam (1980).

⇒ *Mycosphaerella ilicicola* (Maubl.) M.Morelet - Bull. Soc. Sci. Nat. Archéol. Toulon Var 176: 7. 1968; Corlett - An annotated list of the published names in *Mycosphaerella* and *Sphaerella*: 138. 1991; non *M. ilicicola* (Maubl.) Tomilin - Nov. Sist. Niz. Rast. 6: 120. 1969; a superfluous combination.
Basionym: **Sphaerella ilicicola** Maubl, in Maublanc & Rangel [as *illicicola*] - Bol. Agric. (São Paulo) 16: 313. 1915; Maublanc - Bull. Trimestriel Soc. Mycol. France 36: 34. 1920; XXIV: 850; XXIV: 850. Holotype: Herb. Museo Rio de Janeiro No. 552 c, *socio Cercospora ilicicola* Maubl. & *Leptosphaeria paraguayensis* Maubl, *fide* Maublanc & Rangel (1915). On white leaf spots of *Ilex paraguayensis*, southern Brazil, VII 1912 (leg. ?), Herb. Museo Rio de Janeiro No. 552 c.

⇒ *Mycosphaerella tabacii* (Maubl.) L.E.Miles [as *tabaci*] - Trans. Illinois State Acad. Sci. 10: 250. 1917; Corlett - An annotated list of the published names in *Mycosphaerella* and *Sphaerella*: 264. 1991; non *M. tabaci* (Maubl.) Tomilin - Nov. Sist. Niz. Rast. 8: 152. 1971, a superfluous combination, republished again in Oprodelitel'gribov roda *Mycosphaerella* Johans.: 256. 1979.
Basionym: **Sphaerella tabaci** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 142. 1908; XX: 828; XXII: 136, 883. Holotype: ?; same material as for *Phoma nicotiana* Maubl., also not available under this binomial. On twigs of *Nicotiana tabacum*, village of Razac (Dordogne), France (date ?), leg. A. Maublanc.

⇒ **Nectria badia** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 35. 1920; XXIV: 653. Holotype: ? On leaves of a plant of the family *Sapindaceae*, locality of Niteroy, Rio de Janeiro, State of Minas Gerais, Brazil (date ?), leg. A. Maublanc (FB No. 337).

⇒ **Phyllachora maydis** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 72. 1904; XVII: 838; XX: 374. Holotype: PC ex Herb. INA, same material as for *Coniothyrium phyllachora* Maubl. and filed under that name. On leaves of *Zea mays*, Mexico (date ?), leg. Dr. Bonnansea.

The species was retained as a valid taxon by Parberry (1967) who examined a type specimen annotated 'On *Zea mays* L., from Mexico, 70 (S)'. The fungus was also recorded from the Dominican Republic, Guatemala and Puerto Rico (Parberry *l. c.*).

⇒ **Physalospora cattleyae** Maubl. & Lasnier - Bull. Trimestriel Soc. Mycol. France 20: 171. 1904; XVII: 585; XVIII: 456; XX: 392. Holotype: PC ex Herb. INA. On dead leaves of *Cattleya mossia*, in greenhouses, close to Paris, France, 1904, leg. A. Maublanc.

The second available specimen is reported to have been collected in January 1905. Both packets are labelled: forme *gloeosporium G. macropus* Mangin (but should be read instead '*G. macropus* Sacc. *fide* Mangin').

In their publication, Maublanc & Lasnier (1904) stressed the accompanying *Gloeosporium* conidial state deviates from *G. macropus* Sacc. as suggested by Mangin (*l. c.*) but they refrained from naming the anamorph. However, according to von Arx (1970) and based on the type specimen, *Gloeosporium macropus* Sacc. represents the *Colletotrichum* conidial state of *Glomerella cingulata*.

⇒ **Physalospora populina** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 141. 1908; XX: 394; XXII: 86. Holotype: PC ex Herb. SCPV No. 1038 (labelled 'type') and PC ex Herb. INA, labelled *pars ex typo*. On dead branches of Caroline poplar (*Populus canadensis*), around Toulouse City, France, II 1906, leg. A. Maublanc (?).

⇒ **Pleospora evonymella** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 292. 1903; XVII: 749; XX: 437. Holotype: PC ex Herb. SCPV No. 2076; isotype PC ex Herb. INA. On living leaves of *Evonymus japonicus*, Pornic (Loire-Inférieure), France, IV 1903, leg. A. Maublanc.

The fungus was recognized as a valid taxon by Wehmeyer (1961) in his treatment of the genus *Pleospora* Rabenh. ex Ces. & De Not.

⇒ **Pleospora halimi** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 89. 1905; XX: 438; XXII: 269. Holotype: PC ex Herb. SCPV No. 2082; isotype PC ex Herb. INA. On branches of *Atriplex halimus*, Pornic (Loire-Inférieure), France, IV 1904, leg. A. Maublanc.

On packet No. 2082, the following has been added with a typewriter: leg. Exc. C. Roumeguère. Maublanc (1905) indicates having observed this ascomycete in association with *Coniothyrium halimi* Maubl. (then collected for the second time) which he considered to represent the relevant anamorph.

Regarding this *Pleospora*, Wehmeyer (1961) stressed the provided description rather recalls *P. pellita* (Fr.) Tul.

The fungus thus awaits to be reassessed.

⇒ **Pleospora kentiae** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 291. 1903; XVII: 754; XX: 440. Holotype: ?. On living leaves of a *Kentia* sp., Algeria, (date & leg. not specified).

Following the protologue, the relevant type material should also be the same as for *Ascochyta kentiae* Maubl. and *Stagonospora kentiae* Maubl. (PC ex Herb. SCPV No. 5811); but only the latter name is reproduced on the specimen of *Ascochyta kentiae*.

According to Wehmeyer (1961), Maublanc's description suggests an intermediate spore type placed in *Pleospora lactucicola*. Ellis & Everh.

⇒ **Pleospora polymorpha** Maubl. [as *polymorpka*, a typographic error] - Bull. Trimestriel Soc. Mycol. France 19: 291. 1903; XVII: 757; XX: 443. Holotype: Herb. SCPV No. 2144; isotype PC ex Herb. INA. In panicles of *Gynericum argenteum*, Pornic (Loire-Inférieure), France, IV 1903, leg. A. Maublanc.

According to Wehmeyer (1961), the description suggests a form of *Pleospora herbarum* (Pers.) Rabenh.

⇒ **Plowrightia agaves** (Maubl.) Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 143. 1907; XXII: 430.
Basionym: *Hypocrea agaves* Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 292. 1903; XVII: 802; XIX: 940. Holotype: PC ex Herb. SCPV No. 725. On leaves of an *Agave* sp, Mexico (date & leg. not specified).
= *Plowrightia williamsoniana* Kellerm. - Journal of Mycology 12 (85): 185. 1906. Synonymy *fide* Maublanc (1907).

⇒ **Schizoxylon yuccae** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 72. 1904; XVIII: 154; XX: 754. Holotype: ? On dead leaves of *Yucca gloriosa*, Pornic (Loire-Inférieure), France, 1903, leg. A. Maublanc.

The binomial was not considered by Sherwood (1977a & 1977 b) in her treatment of ostropâlean fungi.

⇒ **Sphaerostilbe polycephala** Maubl. & Roger, in Roger - Bull. Trimestriel Soc. Mycol. France 50: 330. 1934. Holotype: ? On bark of an unknown tree, around Douala, Cameroon, Africa (date ?), leg. Aubert (then Director of the Pathology Laboratory of Douala).

⇒ **Theissenia pyrenocrata** (Theiss.) Maubl. - Bull. Trimestriel Soc. Mycol. France 30: 52. 1914; XXIV: 1092.

Basionym: *Ustulina pyrenocrata* Theiss. - Sydowia 6: 347. 1908. XXII: 334.

The fungus developed on a specimen of a tree bark covered with a thick dark fungal crust at the School of Agriculture Luiz de Queiroz at Piracicaba, State of São Paulo, Brazil (date ?); material sent by G. Bondar. The tree is known locally by the common name 'Minjoleiro' (? *Enterolobium monjollo*). However, no corresponding material could be located.

To accomodate this species, the new genus *Theissenia* was proposed and named after the author of the basionym, F. Theissen, a German clergyman and amateur mycologist. This unispecific genus remains undocumented since its proposal (Hawksworth *et al.*, 1995).

⇒ **Uropolystigma atro-testaceum** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 36. 1920; XXIV: 644. Holotype: PC ex Herb. INA. On living leaves of a plant of the family *Malpighiaceae*, Ouro Preto (FB Nos. 181 & 321), Caraça (No. 342), State of Minas Gerais, Brazil (date ?), leg. A. Maublanc. .

This is the type species of the still unispecific and undocumented genus *Uropolystigma* Maubl. (Hawksworth *et al.*, 1995).

⇒ **Valsaria (Eu-Valsaria) spartii** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 88. 1905; XX: 1120; XXII: 391. Holotype: PC ex Herb. SCPV No. 1810; isotype PC ex Herb. INA. On branches of *Spartium junceum*, Pornic (Loire-Inférieure), France, IV 1904, leg. A. Maublanc.

⇒ ***Vizella hieronymi*** Wint. var. **coffeae** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 71. 1904; XVII: 861; XX: 1135. Holotype: ? On leaves of *Coffea* sp., Mexico (date ?)., leg. Herrera.

BASIDIOMYCETES

⇒ **Aecidium pergulariae** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 87. 1905; XXI: 776. Holotype: PC ex Herb. SCPV No. 3509. On leaves of *Pergularia africana*, Adja Ouéré, Dahomey, 28 III 1902, leg. G. Le Testu.

A more elaborate description was later provided by Viennot-Bourgin [(1958) 1959] from material developing on *Pergularia extensa* at Popué Boka, near the village of Annékrou, Ivory Coast; but then the original publication date was erroneously reported as 21: 87. 1906.

⇒ **Hemileia coffeicola** Maubl. & Roger - Bull. Trimestriel Soc. Mycol. France 50: 198. 1934; Laundon & Waterston - CMI Description of Pathogenic Fungi and Bacteria No. 2. 1964. Holotype: PC ex Herb. INA. On leaves of *Coffea arabica*, Dschang, Cameroon, X-XI 1933, leg. L. Gérin *via* Aubert (type).

= **Uredo coffeicola** Maubl. & Roger - Compt. Rend. Acad. Sci., Paris 198: 1069. 1934, proposed *ad interim*; *nom. ill.*, Art. 34.1b. The second available specimen also bears the same labelling.

The history and distribution of this rust on several *Coffea* species in Africa was reviewed by Laundon and Waterston (1964).

⇒ **Hemileia gardeniae-thunbergiae** Maubl. & Roger - Bull. Trimestriel Soc. Mycol. France 50: 202. 1934.
= *Uredo gardeniae-thunbergiae* Henn. - Bot. Ergebn. der kunene-Sambesi Exped.: 160. 1902; XVII: 440. Synonymy probably proposed without examination of authentic material.

The specimen examined by Maublanc & Roger (1934) was filed in PC under the binomial *Uredo gardeniae-thunbergiae*. It had the following characteristics: On leaves of *Gardenia thunbergia*, Tchibanga, Gabon, 1907, leg. G. Le Testu.

Unfortunately, this African specimen is no longer available in PC either under the generic epithet *Uredo* or *Hemileia*. It is possible the French authors did not examine authentic material of *Uredo gardeniae-thunbergiae*. Further as Hennings described only uredinia, his species cannot be considered as a basionym as suggested by Maublanc & Roger (1934).

⇒ **Hemileia pavetticola** Maubl. & Roger, in Roger - Bull. Trimestriel Soc. Mycol. France 54: 51. 1938. Holotype: ? On living leaves of *Pavetta ternifolia*, Kigali, Rwanda, 1936, leg. Molitor.

⇒ **Omphalia flavida** Maubl. & Rangel - Compt. Rend. Acad. Sci., Paris 157: 859. 1913; Bull. Trimestriel Soc. Mycol. France 30: 46. 1914; XXIII: 111. Holotype: ? On leaves of *Eriobotrya japonica* and on plants belonging to families *Melastomaceae*, *Compositae* and *Rubiaceae*, close to Rio de Janeiro, Brazil, (date ?), leg. E. Rangel; associated with *Stilbum flavidum* Cke, the abortive form.

⇒ **Puccinia letestui** Maubl. [as *Le Testui*] - Bull. Trimestriel Soc. Mycol. France 22: 71. 1906; XX: 1294; XXI: 641. Holotype: PC ex Herb. SCPV No. 3393. On leaves of *Vernonia* sp., Marromen, Portuguese East Africa (Moçambique), 1 X 1904, leg. G. Le Testu.

⇒ *Puccinia oxalidis* Diet. & Ell. - Hedwigia 34: 291. 1895; XI: xv; XII: 638; XIV: 296; XX: 609.
= *Aecidium maublancii* Syd. - Sydowia 2: 351. 1904; XVII: 492, *nom. nov.*

Basionym: **Aecidium mexicanum** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 73. 1904; non *A. mexicanum* Diet. & Holw. - Bot. Gaz. 48: 36. 1897; XIV: 373. Holotype: ? On leaves of *Mahonia* sp., Mexico (date ?), leg. Dr. Bonnansea.

This aecial stage is now recognized as belonging to *Puccinia oxalidis* Diet. & Ellis.

⇒ *Ravenelia deformans* (Maubl.) Diet. - Beihefte Botan. Centralblatt. 20 (2): 404. 1906; Sydow P. & H. - Monographia Uredinearum III: 296. 1915.
Basionym: **Pleoravenelia deformans** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 73. 1906; XX: 1288; XXI: 745. Holotype: PC ex Herb. SCPV No. 3780. On twigs of *Acacia* sp. (? *A. arabica*), Mhalume, Portuguese East Africa (Moçambique), 11 X 1904, leg. G. Le Testu.

⇒ **Ravenelia letestui** Maubl. [as *Le Testui*] - Bull. Trimestriel Soc. Mycol. France 22: 72. 1906; XXI: 739; Sydow P. & H. - Monographia Uredinearum III: 267. 1915. Holotype: PC ex Herb. SCPV No. 3781. On living leaves of *Cassia* sp., Marral, Portuguese East Africa (Moçambique), 25 VIII 1904 (not 1905 as indicated in the publication), leg. G. Le Testu.

⇒ *Uredo behnickiana* Henn. - Hedwigia 44: 169. 1905; XXI: 803.
= **Hemileia oncidii** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 138. 1909; XX: 1249; XXI: 599. Holotype: ? On living leaves of several Brazilian orchids: *Oncidium marschallianum*, *O. crispum* and *O. varicosum* var. *rodgersii*, in greenhouses close to Paris, France, winter 1908-9, leg. A. Maublanc. Synonymy *fide* Sydow P. & H. (1915).

The original protologue only dealt with uredinia and thus the name *Hemileia oncidii* is invalid.

⇒ **Ustilago bouriquetii** Maubl. & Roger, in Roger [as *bouriqueti*] - Bull. Trimestriel Soc. Mycol. France 50: 327. 1934. Holotype: PC ex Herb. INA. On leaves of *Stenotaphrum* sp. (? *complanatum*), Nanisana, Madagascar, 1931, leg. Bouriquet, det. Mlle Camus.
= *Sphacelotheca mauritana* Zundel - Mycologia 36: 405. 1944. Synonymy *fide* Vanky (1996).
= *Sorosporium stenotaphri* G.Viennot-Bourgin - Ann. Inst. Natl. Agron., Paris 47: 43. 1963, *nomen novum superfluum pro Ustilago bouriquetii* (Vanky, 1996).

Two specimens are also filed in the same collection: Herb. Bouriquet. Sur *Stenotaphrum complanatum*, Station de Nahampoana (Fort Dauphin), 15 V 1947, leg. Mallamaire and Herb. A. Maublanc; sur *Stenotaphrum*, Madagascar, Bouriquet legit 1932, Typus, but following Vanky (1996) this specimen is not the type material.

This smut was not considered by Zundel (1953) in his book on Ustilaginales of the World. A modern description was recently provided by Vanky (1996).

⇒ **Ustilago andropogonis-finitimi** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 74-75. 1906; XXI: 507. Holotype: PC ex Herb. SCPV No. 4132. In ovaries of *Hyparrhenia finitimi* [= *Andropogonis* (*Cymbopogon*) *finitima*], Portuguese East Africa (Moçambique as Zambésie), 1905, leg. G. Le Testu.

The recent discovery of the relevant authentic material allowed us to disentangle the corresponding taxonomic imbroglio that prevailed since the introduction of this binomial (Vanky & Mouchacca, in press).

DEUTEROMYCETES

⇒ **Acladium candidum** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 295. 1903; XVIII: 522; XIX: 8. Holotype: ? Developed in a saline solution, Paris, France (date & leg. not specified). The original material is apparently a contaminant culture and as such should be considered as definitely lost.

Oospora albo-cinerascens Maubl. was also described from a saline solution.

⇒ **Ascochyta kentiae** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 293. 1903; XVIII: 350; XIX: 108. Holotype: PC ex Herb. SCPV No. 5811. On living leaves of *Kentia* sp., Alger, Algeria (date & leg. not specified).

The relevant handwriting of this specimen indicates it is the same material for *Stagonospora kentiae* Maubl.; but in the publication and under this binomial, it is specified such a specimen is also the authentic material of *Pleospora kentiae* Maubl.

⇒ **Asperisporium alstroemeriae** (Allesch.) Maubl. - Lavoura 16: 212. 1913; Bull. Trimestriel Soc. Mycol. France 29: 357. 1913; the synonymy is not reported in Reed & Farr (1993).
Basionym: *Scolecothrichum alstromeriae* Allesch., in P. Hennings - Hedwigia 34: 116. 1895; XI: 618; XII: 682.

Transferred to *Asperisporium* Maubl., type species *A. caricae* (Speg.) Maubl., on account of the verrucose conidia; see also under *A. caricae*.

⇒ **Asperisporium caricae** (Speg.) Maubl. - Lavoura 16: 212. 1913; Bull. Trimestriel Soc. Mycol. France 29: 357. 1913; XXIV: 855; Ellis - Dematiaceous Hyphomycetes: 274. 1971; Ellis & Holliday - CMI Description of Pathogenic Fungi & Bacteria No. 347. 1972.
Basionym: *Cercospora caricae* Speg. - Anal. Soc. Scient. Argentine 16: 168. 1883; Chupp - A monograph of the fungus genus *Cercospora*: 106. 1954.
= *Fusicladium caricae* (Speg.) Sacc. - Atti Congr. Bot. Palermo: 58. 1902; XVIII: 580.
For other synonyms, see Ellis & Holliday (1972).

Asperisporium Maubl. was established to accomodate *Cercospora caricae* Speg., a fungus then thought to be incorrectly placed in *Cercospora* Fresen. due to the verrucose conidia. Three other taxa were then transferred for the same reason. The type species induces black spot, blight or 'rust' of papaw (*Carica papaya*). The disease is now restricted to Central and South America, the West Indies and USA (Florida); it is presumably air dispersed but not yet sufficiently documented (Ellis & Holliday, 1972).

From infected leaves of papaw, Maublanc (1913) also described *Sphaerella caricae* Maubl. (now *Mycosphaerella caricae* H. & P. Sydow) which he believed to be the teleomorph.

The authentic material of *Cercospora caricae* Speg. is from Paraguay (B. Balansa No. 2739, February 1881).

⇒ **Asperisporium punctulatum** (Tracy & Earle) Maubl. - Lavoura 16: 212. 1913; Bull. Trimestriel Soc. Mycol. France 29: 357. 1913; the synonymy is not mentioned in Reed & Farr (1993).
Basionym: *Scolecotrichum punctulatum* Tracy & Earle - Bull. Torrey bot. club 25: 178. 1895; XIV: 1078.

Transferred to *Asperisporium* Maubl. on account of the verrucose conidia.

⇒ **Botryodiplodia digitata** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 294. 1903; XVIII: 334; XIX: 182; Zambettakis - Bull. Trimestriel Soc. Mycol. France 70: 311. 1954. Holotype: PC ex Herb. SCPV No. 6137. In pseudobulbs of *Cattleyae mossiae*, in a greenhouse close to Paris (Fontenay-aux-Roses), France (date and leg. not specified).

The species was retained as a valid taxon by Zambettakis (1954) upon examination of the exsiccata then maintained at the 'Station Centrale de Pathologie Végétale de Versailles'. No modern description of this species of *Botryodiplodia* (Sacc.) Sacc. could be traced.

⇒ **Camarosporium halimi** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 294. 1903; XVIII: 374; XIX: 218; XXVI: 398. Holotype: PC ex Herb. SCPV No. 6466, labelled *socio Coniothyrium atriplicis* Maubl. On twigs of *Atriplex halimum*, Pornic (Loire-Inférieure), France, IV 1903, leg. A. Maublanc. The original collection was divided into two parts filed under *Camarosporium halimi* and *Coniothyrium atriplicis*. Both parts are now maintained in PC as separate entities: Herb. SCPV & Herb. INA.

⇒ **Camarosporium persicae** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 144. 1907; XIX: 219; XXII: 1077. Holotype: PC ex Herb. SCPV No. 6472; isotype in PC ex Herb. INA. On dead twigs of *Persica vulgaris*, gardens of the Plant Pathology Station, Paris, France, 28 II 1906, leg. A. Maublanc. The original authentic material was divided into two parts; both are now housed in PC and maintained as separate collections.

⇒ **Camarosporium populinum** Maubl.- Bull. Trimestriel Soc. Mycol. France 21: 91. 1905; XVIII: 374; XIX: 219. Holotype: PC ex Herb. SCPV No. 6473; isotype PC ex Herb. INA. On twigs of *Populus alba*, Pornic (Loire-Inférieure), France, IV 1904, leg. A. Maublanc.

⇒ **Ceratopycnidium citricola** Maubl. [as *citricolum*] - Bull. Trimestriel Soc. Mycol. France 23: 148. 1907; XIX: 244 ; XXII: 1034. Holotype: ? Developed on the secretions of an insect present on both sides (but most often on the upper side) of leaves of tangerine (*Citrus reticulata*) at Brazzaville, Congo (date ?), leg. Ph. de Vilmorin.

Ceratopycnidium Maubl. was introduced to accommodate a single species. The genus was renamed *Ceratopycnium* by Clements & Shear (1931), a superfluous *nomen novum* (Sutton, 1977). The original African material is so far the only known record of the fungus (Bertoni & Cabral, 1991).

Recently a second species was introduced by Bertoni & Cabral (1991): *Ceratopycnidium baccharidicola*, on *Baccharis coridifolia* in Argentina. But these authors were unable to study the holotype 'since the author (Maublanc) indicated not where it was deposited'. Bertoni and Cabral then stressed the description and the original iconography provided are 'so detailed that it is possible to interpret conidiogenesis in the type species as being holoblastic with sympodial development of holoblastic conidiogenous cells'. Accordingly they proposed to emend the genus as having 'holoblastic conidia being hyaline, smooth, ellipsoid to cylindric, 0-3 euseptate, sometimes constricted at the septa'.

⇒ **Cercospora byrsonimatis** Maubl. - Bull. Trimestriel Soc. Mycol. France 36: 40. 1920; Chupp - A monograph of the fungus genus *Cercospora*: 365. 1954. Holotype: PC ex Herb. INA as FB No. 180.
= *Cercosporina byrsonimatis* (Maubl.) Sacc. - *Syll. Fung.* XXV: 910. 1931. On living leaves of *Byrsonema* sp., Belo Horizonte, State of Minas Gerais, Brazil, 8 IX 1913, leg. A. Maublanc.

Spegazzini (1910) introduced the genus *Cercosporina* to segregate species of *Cercospora* Fresen. with hyaline conidia. However as the type species of the latter genus possesses the same character, the new generic proposal is thus superfluous (Chupp, 1954). Transfers to *Cercosporina* subsequently made by Saccardo were accordingly not reported by Chupp (1954). Later, Sutton & Pons (1980) re-examined the lectotype species *Cercosporina asparagicola* Speg. and decided the fungus should better be retained in *Cercospora*, a decision in line with Chupp's proposal.

The recent discovery of authentic material initiated the preparation of a modern description of this Brazilian hyphomycete (Braun & Mouchacca, in press).

⇒ **Cercospora ilicicola** Maubl., in Maublanc & Rangel - Bol. Agr. (São Paulo) 16: 321-322. 1915; Bull. Trimestriel Soc. Mycol. France 36: 41. 1920; Chupp - A monograph of the fungus genus *Cercospora*: 52. 1954. Holotype: ?; probably in Herb. Museo Rio de Janeiro under No. 552; no specimen in PC. On living leaves of *Ilex paraguayensis*, Parana, Brazil, VII 1912, leg. E. Rangel No. 552.
= *Cercosporina ilicicola* (Maubl.) Sacc. - *Syll. Fung.* XXV: 896. 1931.

The transfer to *Cercosporina* Speg. was refuted by Chupp (1954).

⇒ *Cercospora traversiana* Sacc. - Sydowia 2: 18. 1904; Chupp - A monograph of the fungus genus *Cercospora*: 338. 1954.
= **Cercospora trigonellae** Maubl., in Maublanc & Rangel - Bol. Agric. (São Paulo) 16: 322. 1915; Maublanc - Bull. Trimestriel Soc. Mycol. France 36: 41. 1920. Holotype: ?; probably in Herb. Museo Rio de Janeiro; isotype PC (Herb. INA) as FB No. 325. On living leaves of *Trigonella foenum-graecum*, Pinheiro, Rio de Janeiro, Brazil, 1913, leg. E. Rangel No. 775. Synonymy *fide* Chupp (1954).
= *Cercosporina trigonellae* (Maubl.) Sacc. - *Syll. Fung.* XXV: 908. 1931.

In his second note on the same fungus, Maublanc (1920) refers to the exsiccata No. 325 of his series Fungi Brasiliensis: On living leaves of *Trigonella foenum-graecum*, Rio de Janeiro, Brazil, 18 VII 1912, leg. A. Maublanc.

⇒ *Chaetasbolisia erysiphoïdes* (Griffon & Maubl.) Speg. - Physis 4: 293. 1918; XXV: 179; Sutton - The Coelomycetes: 366. 1980.
Basionym: **Chaetophoma erysiphoïdes** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 60. 1909; XXII: 937. Holotype: ? On living leaves of *Quercus ilicis*, Cadillac (Gironde), France, (date ?), leg. Capus.

The specific epithet refers to the general appearance of the fungus recalling an Erysiphale. According to Sutton (1980), the type species of *Chaetasbolisia* Speg. was redescribed by Batista & Ciferri (1963) but not through an examination of authentic material.

⇒ *Colletotrichum gloeosporioides* Penz. - Fungi. Agrum. 2: 6. 1882; von Arx - Bibl. Mycol. 24: 59. 1970.

= **Gloeosporium dendrobii** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 68. 1906; XXII: 1192. Holotype: PC ex Herb. SCPV No. 7070. On leaves of *Dendrobium farneri*, in a greenhouse, close to Paris, France (date ?), leg. A. Maublanc. Synonymy *fide* von Arx (1970).

= **Gloeosporium hedericolum** Maubl. [as *hedericola*] - Bull. Trimestriel Soc. Mycol. France 20: 71. 1904; XVIII: 452; XIX: 772. Holotype: PC ex Herb. SCPV No. 7081. On living leaves of *Hedera helix*, Monfort-l'Amaury (close to Paris), France (date ?), leg. Mlle Belèze. Synonymy *fide* von Arx (1970).

= **Gloeosporium phaji** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 67. 1906; XXII: 1191. Holotype: PC ex Herb. SCPV No. 7104. On living leaves of *Phajum* sp., in a greenhouse, close to Paris, France, leg. A. Maublanc. Synonymy *fide* von Arx (1970).

= **Gloeosporium ricini** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 67. 1906; XXII: 1186. Holotype: PC ex Herb. SCPV No. 7112 as A. Puttemans - Fungi S. Paulensis No. 518. On senescent leaves of *Ricinus communis*, Botanical Garden, São Paulo, Brazil, I 1905, leg. A. Puttemans. Synonymy *fide* von Arx (1970).

= **Gloeosporium sobraliae** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 68. 1906; XXII: 1192. Holotype: PC ex Herb. SCPV No. 7114. On leaves of *Sobralia* sp., in a greenhouse, close to Paris , France (date ?), leg. A. Maublanc. Synonymy *fide* von Arx (1970).

Von Arx (1970) based his conclusions upon comparison of the provided protologues. Re-examination by the present authors of the discovered authentic material has confirmed the proposed synonymies.

⇒ **Coniothyrium atriplicis** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 293. 1903; XVIII: 305. XIX: 397. Holotype: PC ex Herb. INA, specimen labelled *socio Camarosporium halimi* Maubl. On twigs of *Atriplex halimi*, Pornic (Loire-Inférieure), France, IV 1903, leg. A. Maublanc. The original collection was divided into two parts filed under *Camarosporium halimi* and *Coniothyrium atriplicis*. Both parts are now maintained as separate collections in PC.

The species has apparently been overlooked since its description (Sutton, 1980).

⇒ **Coniothyrium phyllachorae** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 72. 1904; XVIII: 308; XIX: 400. Holotype: PC ex Herb. SCPV No. 6332; isotype PC ex

Herb. INA; same authentic material as for *Phyllachora maydis* Maubl. Observed developing on ascomata of *Phyllachora maydis* Maubl. growing on leaves of *Zea mays*, Mexico (date ?), leg. Dr. Bonnansea. The original collection was divided into several parts to represent authentic material of this fungus and that of *Phyllachorae maydis*. Parts are now maintained in separate collections at PC.

⇒ **Coryneum modonium** (Sacc.) Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 26: 379. 1910; Sutton - The Coelomycetes: 354. 1980; the synonymy is not reported in Reed & Farr (1993).
Basionym: *Stilbospora modonia* Sacc. - *Syll. Fung.* III: 772. 1884; XII: 764; XX: 1351.
Teleomorph: *Pseudovalsa modonia* (Tul.) Höhn. - Sydowia 16: 125. 1918.
Basionym: *Melanconis modonia* Tul. - Selecta Fungor. Carpol. 2, tab. 15, figs. 1-6, 1865; I: 603; XII: 416; XX: 43.
Examination of infected twigs of *Castanea* sp. in the Limousin area (France), led Griffon and Maublanc to transfer the anamorph of this fungus to *Coryneum* Nees. A modern description is provided by Sutton (1980).

⇒ **Cytospora unedonis** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 71. 1904; XVIII: 300; XIX: 532. Holotype: PC ex Herb. SCPV No. 5371; isotype PC ex Herb. INA. At the tip of dry leaves of *Arbutus unedo* (Arbousier), Pornic (Loire-Inférieure), France, IV 1903, leg. A. Maublanc.

⇒ **Cytosporina halimi** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 144. 1907; XXII: 1139. Holotype: PC ex Herb. SCPV No. 6488. On dead twigs of *Atriplex halimum*, Pornic (Loire-Inférieure), France, (date ?), leg. A. Maublanc.

⇒ **Dichomera carpinii** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 59-60. 1909; XXII: 1085. Holotype: PC ex Herb. SCPV No. 6480. On dead branches of *Carpinus betulus*, Bigny-sur-Arroux (Saône-et-Loire), 1908, leg. Flageolet.

⇒ *Diplodia inconspicua* Cooke - Grevillea 13: 96. 1885-6; IVA: 327; X: 284; XII: 210; Zambettakis - Bull. Trimestriel Soc. Mycol. France 70: 261. 1954 [as *inconspiqua*, a typographic error].
= **Diplodia abiegna** Maubl. - Bull. Trimestriel Soc. Mycol. France 15: 294. 1903. Holotype: PC ex Herb. SCPV No. 6144. On living leaves of *Abiei concolor*, close to Paris (Chatenay, Seine-et-Oise), France (date ?), leg. A. Maublanc. Synonymy *fide* Zambettakis (1954).
= *Microdiplodia abiegna* (Maubl.) Sacc. & D.Sacc. - *Syll. Fung.* XVIII: 327. 1906.

⇒ **Fusicladium butyrospermi** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 29: 249. 1913; XXV: 803. Holotype: ?; indicated as being the same material as for *Pestalozzia heterospora* Maubl., also not available under this name. On living leaves of *Butyrospermum parkii*, Koulikoro, Haut-Sénégal and Niger (date ?), leg. Vuillet.

⇒ **Helminthosporium lycopersici** Maubl. & Roger, in Roger - Bull. Trimestriel Soc. Mycol. France 52: 84. 1936; *nom. inval.*, Art. 36.1. Holotype: ? On living leaves of

Lycopersicon esculentum, La Mé, Ivory Coast (Africa), 26 IX 1932, leg. A. Mallamaire.

The species was proposed because no *Helminthosporium* had, at that time, been observed on tomato plants.

⇒ **Lasiodiplodia theobromae** (Pat.) Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 57. 1909; XXIV: 770; Punithalingam - CMI Description of Pathogenic Fungi & Bacteria No. 519. 1976 [as *Botryodiplodia theobromae* Pat.]; Sutton - The Coelomycetes: 191. 1980.
Basionym: *Botryodiplodia theobromae* Pat. - Bull. Trimestriel Soc. Mycol. France 8: 136. 1892; XI: 522; XII: 56; XXII: 1011. Holotype: FH No. 9410, collected in San Domingo de Colorado, Ecuador.
= **Chaetodiplodia arachidis** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 91. 1905; XVIII: 330; XIX: 261. Holotype: PC ex Herb. SCPV No. 6143. On stems of *Arachis hypogea* grown at the Plant Pathology Station, Versailles, France (date ?), leg. A. Maublanc. Synonymy *fide* Zambettakis (1954).

Teleomorph: *Botryosphaeria rhodina* (Berk. & Curtis) von Arx - The genera of fungi sporulating in pure culture (Lehre): 143. 1970.
Basionym: *Physalospora rhodina* Berk. & Curtis, in Cooke - Grevillea 17: 92. 1889.

This facultative wound pathogen induces numerous diseases either alone or in association with other primary invaders. Worldwide in distribution between latitudes 40° N & 40° S of the equator (Farr *et al.*, 1989).

In 1981, von Arx reconsidered his former opinion about the taxonomic position of the fungus which he relocated again in *Botryodiplodia* Sacc. But this disposition did not receive wide agreement (Farr *et al.*, 1989).

⇒ **Lasiostroma pirorum** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 27: 472. 1911 (not 1912 as indicated in Reed & Farr, 1993); Ann. Inst. Natl. Agron., Paris, sér. 2, 10: 100. 1911; XXV: 509. Holotype: ? On discolored fruits of *Pyrus communis* forming large necroses, Paris (date ?), leg. A. Maublanc.

According to Sutton (1977) in spite of the description which included '*Stromata...externe pilosa, pilis septatis, filiformibus*' it seems clear that the type and only species of *Lasiostroma* Griffon & Maubl. is a *Phomopsis*. The conidia were referred to as hyaline, continuous, ovoid or fusiform, both ends obtuse, biguttulate, 5 - 8 x 2 - 3 µm issuing in a cirrhus. Conidiophores were described as elongated, aciculate, 20 - 25 µm long. The stromatic tomentose fructifications and conidial and conidiophore features indicate *Phomopsis* to be the most likely genus. The absence of any illustration precludes a definite conclusion.

Sutton (1977) was apparently unaware of the second paper published on the same topic by Griffon and Maublanc (1911) and which contains three illustrations of the fungus (Figs. 8 - 10). Later, Sutton (1980) cited this form genus as a synonym of *Phomopsis* (Sacc.) Sacc. but still without debating the relevant type species.

⇒ *Macrophoma maublancii* Sacc. & D.Sacc. - *Syll. Fung.* XVIII: 273. 1906; *nom. nov.*
Basionym: **Macrophoma ulmicola** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 70-71. 1904; non *M. ulmicola* Dearn. - Mycologia 9: 353. 1917; XXV: 159. Holotype:

PC ex Herb. INA. On living leaves of probably *Ulmus campestris*, Le Croisic (Loire-Inférieure), France, VIII 1913, leg. A. Maublanc.

No modern description of this fungus is available (Sutton, 1980).

⇒ *Marssonina obtusata* (Maubl.) Mouch., comb. nov.
Basionym: **Marssonia obtusata** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 69. 1906; XX: 1269; XXII: 1211. Holotype: PC ex Herb. SCPV No. 7017. On living leaves of probably *Daphne laureola*, close to Alençon, France (date ?), leg. Lemée.

Marssonina Magnus has been conserved against *Marssonia* J.C. Fisch. but not all names of the latter were reassessed (Hawksworth *et al.*, 1995).

⇒ **Melanobasidium mali** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 70. 1906; XX: 1270; XXII: 1491. Holotype: ? On living leaves of *Pyrus malus*, Seville, Spain (date & leg. not specified). Type species of the unispecific genus *Melanobasidium* Maubl., a genus later renamed *Melanobasis* by Clements & Shear (1931: 370), a superfluous *nomen novum*. The genus awaits to be reassessed.

⇒ *Microdiplodia depazeoïdes* (Durieu & Mont.) Zambett. - Bull. Trimestriel Soc. Mycol. France 70: 248. 1954.
Basionym: *Diplodia depazeoïdes* Durieu & Mont. - Fl. Alg.: 575. 1849; Montagne - Syll. Crypt.: 266. 1856; III: 372.
= **Diplodiella tamaricis** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 66. 1906; XXII: 1006. Holotype: PC ex Herb. INA; same material as *Calospora tamaricis* var. *zignoellides* Maubl. On dead branches of a *Tamarix* sp., Pornic (Loire-Inférieure), France, IV 1905, leg. A. Maublanc. Synonymy *fide* Zambettakis (1954).

It is not clear whether Zambettakis (1954) examined authentic material.

⇒ *Monochaetia paeoniae* (Maubl.) Sacc. & D.Sacc. - Syll. Fung. XVIII: 485. 1906.
= **Pestalotia (Monochaetia) paeoniae** Maubl. [as *Pestalozzia*] - Bull. Trimestriel Soc. Mycol. France 21: 92. 1905; non *P. paeoniae* Servazzi - Boll. Lab. Sper. R. Osserv. Fitopat. Torino 16: 35. 1938. Holotype: ? On branches of *Paeonia arborea*, close to Paris, France (date & leg. not specified).

Following Nag Raj (1993), the original description and illustration suggest the fungus might be identical to *Seimatosporium grammitum* (Berk. & Curt.) Nag Raj, but a final decision can be reached only after re-examination of type material.

⇒ *Monochaetia pinicola* Dearness - Mycologia 20 : 224. 1928.
= **Toxosporium camptospermum** (Peck) Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 173. 1907; XXII: 1219. Synonymy *fide* Sutton (1975).
Basionym: *Pestalotia camptosperma* Peck - N. Y. St. Mus. Rep. 39: 48. 1886; X: 495; XII: 502.

This fungus was encountered in the course of a study of a disease of fir trees in the Jura mountains, France. The relevant taxonomic history was detailed by Sutton (1975).

⇒ **Naemospora jasmini** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 60. 1909; XX: 1276; XXII: 1196. Holotype: ? On dead twigs of *Jasmium officinale*, Rigny-sur-Arroux (Saône-et-Loire), France (date ?), leg. Flageolet.

The genus *Naemospora* Roth ex Kunze is regarded as a *nomen dubium* and could possibly represent a mitosporic fungus (Hawksworth *et al.*, 1995).

⇒ *Nomuraea rileyi* (Farlow) Samson, in Kish, Samson & Allen - J. Invertebr. Pathol. 24: 154. 1974; Samson - Stud. Mycol. 6: 81. 1974.
Basionym: *Botrytis rileyi* Farlow - Rep. U. S. Comm. Agri.: 121. 1883; not in Reed & Farr (1993).
= *Spicaria prasina* (Maubl.) Sawada - Cat. Formosan Fungi: 606. 1919.
Basionym: **Nomuraea prasina** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 296. 1903; XVIII: 533; XX: 201. Holotype: PC ex Herb. SCPV No. 7459. On larva of the insect *Pionaea forficalis* inhabiting *Brassica oleracea*, Tokyo, Japan, (date ?), leg. Nomura. Synonymy *fide* Kish *et al.* (1974).

The genus *Nomuraea* was established by Maublanc (1903) for the single entomophagous species *N. prasina* Maubl. Dedicated to Mr Nomura who had sent the original material to the Plant Pathology Station, Paris.

Kish *et al.* (1974) in the course of their study of entomophagous species of *Spicaria* Harting were unable to locate the type specimen of *Nomurea prasina*. But their examination of the protologue, representative available cultures and herbarium specimens confirmed the fungus is synonymous with *Botrytis rileyi*.

Re-examination of the disovered authentic material is in line with the relevant taxonomic conclusion formerly proposed.

⇒ **Oospora albo-cinerascens** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 295. 1903; XVIII: 498; XX: 231. Holotype: ? In a saline solution, Paris, France (date & leg. not specified). In the same publication, Maublanc also proposed the new *Acladium candidum* probably from the same saline solution. It is not clear whether both protologues were based on living cultures observed as contaminants of this solution.

⇒ **Penicillium dupontii** Griffon & Maubl. [as *duponti*]- Bull. Trimestriel Soc. Mycol. France 27: 73. 1911; XXV: 681; emend. Emerson, in Raper & Thom - A manual of the penicillia: 573. 1949; Pitt - The Genus *Penicillium* and its teleomorphic states *Eupenicillium* and *Talaromyces*: 515. 1980. Holotype: ? ; neotype CBS 236.58 (Pitt, 1980).
Teleomorph: *Talaromyces thermophilus* Stolk - Antonie van Leeuwenhoek J. Microbiol. Serol. 31: 268. 1965; Stolk & Samson - Stud. Mycol. 2: 55. 1972; Mouchacca - Crypt., Mycol. 18: 39. 1997.

The original cultures of this thermophilic hyphomycete were isolated from manure and damp hay by Mr Dupont, then Chief Chemist at the 'Ecole Nationale d'Agriculture de Grignon (France)'. The anamorph was described exclusive of the teleomorph. The history of this anamorph-teleomorph connection was recently reviewed by Mouchacca (1997).

⇒ *Pestalotiopsis ceratoniae* (Maubl.) Ribeiro de Souza - Rodriguésia 37 :22. 1985.
Basionym: **Pestalotia ceratoniae** Maubl. [as *Pestalozzia*] - Bull. Trimestriel Soc. Mycol. France 21: 92. 1905; XVIII: 480; XX: 302. Holotype: ? On living leaves of *Ceratonia siliqua*, Botanical Garden, São Paulo, Brazil, leg. A. Puttemans. Relevant authentic material might be present at the Herb. Museo Rio de Janeiro.

The transfer to *Pestalotiopsis* Steyaert was admitted by Nag Raj (1993).

⇒ **Pestalotia clusiae** Griffon et Maubl. [as *Pestalozzia*] - Bull. Trimestriel Soc. Mycol. France 25: 239. 1909; XX: 302; XXII: 1219; Guba - Monograph of *Monochaetia* and *Pestalotia*: 224. 1961. Holotype: ? On living leaves of *Clusia* sp., in a greenhouse, close to Paris, France, (date ?), leg. Jardin Colonial de Nogent-sur-Marne.

Considered as a valid taxon by Guba (1961) but regarded of uncertain status by Nag Raj (1993) because no authentic material was available to him for examination.

⇒ **Pestalotia heterospora** Griffon & Maubl. [as *Pestalozzia*] - Bull. Trimestriel Soc. Mycol. France 29: 249. 1913; XXV: 606; Guba - Monograph of *Monochaetia* and *Pestalotia*: 163. 1961. Holotype: ?; same specimen as for *Fusicladium butyrospermum* Griffon & Maubl. which also could not be located. On dry blackish patches on leaves of *Butryospermum parkii*, Koulikoro, Haut Sénégal and Niger, (date ?), leg. Vuillet.

Following Nag Raj (1993), the fungus awaits to be reassessed.

⇒ *Pestalotiopsis longi-aristata* (Maubl.) Kausar - Biologia 6: 239. 1960.
Basionym: **Pestalotia longi-aristata** Maubl. [as *Pestalozzia*] - Bull. Trimestriel Soc. Mycol. France 21: 92. 1905; XVIII: 479; XX: 304; Guba - Monograph of *Monochaetia* and *Pestalotia*: 243. 1961. Holotype: ? On living leaves of *Eriobotrya japonica*, Botanical Garden, São Paulo, Brazil, leg. A. Puttemans.
= *Pestalotiopsis longi-aristata* (Maubl.) Ribeiro de Souza - Rodriguésia 37(63): 24. 1985; a superfluous combination.

Authentic material might be present at the Herb. Museo Rio de Janeiro. The transfer to *Pestalatiopsis* Steyaert is not mentioned by Nag Raj (1993); he simply stated he had not examined relevant authentic material.

⇒ **Pestalotia paraguayensis** Maubl., in Maublanc & Rangel [as *Pestalozzia paraguariensis*] - Bol. Agric. (São Paulo) 16: 321. 1915; Maublanc - Bull. Trimestriel Soc. Mycol. France 36: 40. 1920; XXV: 599; Guba - Monograph of *Monochaetia* and *Pestalotia*: 243. 1961. Holotype: Herb. Museo Rio de Janeiro No. 552 a. On leaves of *Ilex paraguayensis*, Parana, Brazil, VII 1912.

Nag Raj (1993) did not speculate about the identity of the fungus because he could not locate any authentic material.

⇒ *Phoma anserina* El. Marchal - Champ. copr.: 11. 1891.
= **Phoma radicicola** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 90. 1905; XVIII: 250. Holotype: ? On dead roots of *Pelargonium roseum*, Philippeville, Algeria (date & leg. not specified). The fungus proposed by Maublanc matches the description of *Phoma anserina* (De Gruyter, pers. comm.).

⇒ **Phoma cytosporoides** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 70. 1904; XVIII: 255; XX: 352. Holotype: PC ex Herb. SCPV No. 5529; isotype PC ex Herb. INA. On dry twigs of *Eryngium campestre*, Pornic (Loire-Inférieure), France, 1903, leg. A. Maublanc. The original collection was divided into two parts now maintained in separate collections. Re-examination of authentic material proved that the fungus is a species of *Phomopsis* (Sacc.) Bubak. (De Gruyter, pers. comm.).

⇒ *Phoma draconis* (Berk. ex Cooke) Boerema - Versl. Meded. Plziektenk. Dienst Wageningen 159: 24. (Jaarb. 1982) 1983; De Gruyter *et al.* - Persoonia 16: 479. 1998.

Basionym: *Phyllosticta draconis* Berk.- Welw. Crypt. Lusit.: 51. 1853 (*nom. nud.*) ex Cooke - Grevillea 19: 8. 1891.
= **Phyllosticta dracaenae** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 25: 239. 1909; XX: 384; XXII: 860; non *Phyllosticta dracaenae* Henn. - Hedwigia 48: 111. 1908 (= *Asteromella* sp.). Holotype: PC ex Herb. SCPV No. 5997. On living leaves of *Dracaenae* sp., in greenhouses close to Paris (Villepreux, Seine-et-Oise), France, X 1909, leg. A. Maublanc. Synonymy *fide* Boerema (1983).

The fungus proposed by Maublanc is a later homonym of *Phyllosticta dracaenae* Henn. However, on the basis of the original description it was found to match *Phoma draconis* (Berk. ex Cooke) Boerema (Boerema, 1983). Re-examination of the discovered authentic material studied by Maublanc confirmed the conclusion forwarded by Boerema (van der Aa, pers. comm.).

⇒ **Phoma nicotianae** Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 144. 1907; XX: 357; XXII: 883. Holotype: ?; also type material of *Mycosphaerella* (*Sphaerella*) *tabaci* Maubl. but no specimen under this binomial could be located. On twigs of *Nicotiana tabacum*, village of Razac (Dordogne), France (date & leg. not specified).

The name possibly refers to the plurivorous *Phoma exigua* Desm. var. *exigua* (De Gruyter, pers. comm.).

⇒ **Phoma umbilicaris** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 27: 473. 1911; Ann. Inst. Natl. Agron., Paris, sér. 2, 10: 104. 1911; XXV: 110. Holotype: ? In the epicarps of fruits of common peach trees, France (date & leg. not specified).

An illustration of the fungus was later provided by Griffon & Maublanc (1911).

⇒ **Phoma unedonis** Maubl. - Bull. Trimestriel Soc. Mycol. France 20: 70. 1904; XVIII: 255; XX: 360. Holotype: PC ex Herb. INA. On dead twigs of *Arbutis unedonis* (Arbousier), Pornic (Loire-Inférieure), France, 1903, leg. A. Maublanc.

Re-examination of authentic material revealed the absence of a pycnidial fungus with the characters described by Maublanc (De Gruyter, pers. comm.).

⇒ **Phyllosticta agaves** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 293. 1903; XVIII: 243; XX: 380; XXVI: 926. Holotype: PC ex Herb. SCPV No. 6373, *sub Hendersonia agaves et Phyllosticta agaves*. On leaves of *Agave* sp., Algeria (date & leg. not specified).

On the holotype collection a pycnidial fungus with the characters described by Maublanc, *l.c.*, could not be found. Several old and empty fruitbodies can be observed with small conidia as described by Maublanc, close to the fruitbodies but growing on free *Aureobasidium*-like conidiogenous cells. On one spot, immature perithecia of a pyrenomycete are present. The fungus cannot be identified from the short description only (van der Aa, pers. comm.).

⇒ **Phyllosticta owariensis** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 292-293. 1903; XVIII: 232; XX: 387. Holotype: PC ex Herb. SCPV No. 6053. On living leaves of *Landolphiae owariensis*, Dahomey (Africa), 1901, leg. G. Le Testu.

According to van der Aa (pers. comm.), the fungus can provisionally be accepted in the genus *Phyllosticta*, *aff. P. minor* Ellis & Everh. but has to be re-examined from fresh material. On the holotype collection some important details of conidiogenesis and conidial morphology cannot be studied any more. Conidia are merely in very ripe condition, many of them germinating within the pycnidial cavities, then often with 1 - 3 septae. No appressoria are seen on the slender, hyaline branching germ tubes.

⇒ *Pollacia peucedani* (Ellis & Holway) Deighton, in Deighton & Pirozynski - Mycol. Pap. 101: 41. 1965; Ellis - More Dematiaceous Hyphomycetes: 110. 1976.
Basionym: *Fusicladium peucedani* Ellis & Holway - Bull. Labs nat. Hist. St. Univ. Ia. 3 (3): 42. 1895; XI: 618; XII: 262; non *F. peucedani* Syd. - Sydowia 5: 340. 1907; XXII: 1375.
= **Asperisporium peucedani** (Ellis & Holway) Maubl. - Lavoura 16: 207. 1913; Bull. Trimestriel Soc. Mycol. France 29: 357. 1913; the synonymy is not reported in Reed & Farr (1993).

The fungus develops on species of *Angelica, Cicuta, Lomatium* and *Sphenosciadum* in the United States (Ellis, 1976; Farr *et al.*, 1989).

⇒ *Ramularia didyma* Unger - Exanth. Pfl.: 49. 1833; Braun - A Monograph of *Cercosporella, Ramularia* and allied genera, vol. 2: 239. 1998.
= **Ramularia aequivoga** (Ces.) Sacc. var. **bulbosa** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 70. 1906; XXII: 1312. Holotype: ? On leaves of *Ranunculus repentis*, Pornic (Loire-Inférieure), France (date ?), leg. A. Maublanc. Synonymy *fide* Braun (1998).

⇒ **Ramularia ligustrina** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 70. 1906; XXII: 1325. Holotype: PC ex Herb. SCPV No. 7582. On living leaves of *Ligustrum* sp. (*sativum* ?), close to the city of Alençon, France (date ?), leg. Lemée.
Braun (1998) recently stressed that in the absence of authentic material, the status of the fungus could not be definitely reassesssed.

The discovery of the type specimen enabled a taxonomic revision (Braun & Mouchacca, in press).

⇒ **Rhizosphaera oudemansii** Maubl., *nom. nov.* - Bull. Trimestriel Soc. Mycol. France 23: 173. 1907; Sutton - The Coelomycetes: 371. 1980; the binomial is not reported in Reed & Farr (1993).
Basionym: *Sacidium abietis* Oudem. - Contr. Fl. Myc. Pays Bas 17: 333. 1900; non *R. abietis* L.Mangin & Hariot - Bull. Trimestriel Soc. Mycol. France 23: 56. 1907; Sutton - The Coelomycetes: 371. 1980.

The fungus commonly develops on needles of *Picea, Abies* and *Tsuga* species in Europe and North America; details of its taxonomic history and distribution were reported by Sutton (1980).

⇒ **Rhizosphaera pini** (Corda) Maubl. - Bull. Trimestriel Soc. Mycol. France 23: 171. 1907; XXII: 917; Sutton - The Coelomycetes: 371. 1980.
Basionym: *Coniothyrium pini* Corda - Icon. Fung. 4: 38. 1840.
= *Rhizosphaera abietis* L.Mangin & Hariot - Bull. Trimestriel Soc. Mycol. France 23: 56. 1907; Sutton - The Coelomycetes: 371. 1980. Synonymy *fide* Sutton (1980).

The fungus develops on needles of *Picea* sp. and *Abies pectinata* in Europe. The taxonomic history and the distribution of the fungus were detailed by Sutton (1980).

⇒ **Septoria azaleae-indicae** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 66. 1906; XXII: 1111. Holotype: ? On living leaves of *Azalea indica*, Botanical Garden, São Paulo, Brazil, leg. A. Puttemans. Authentic material might be available at the Herb. Museo Rio de Janeiro.

⇒ **Septoria ornithogali** Pass. var. **allii** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 295. 1903; XVIII: 393. Holotype: PC ex Herb. INA. On the leaf apex of *Allium vinealis*, Pornic (Loire-Inférieure), France, IV 1904, leg. A. Maublanc.

⇒ **Septoria phaseoli** Maubl. - Bull. Trimestriel Soc. Mycol. France 22: 66-67. 1906; XXII: 1095. Holotype: ? On living leaves of *Phaseolus* sp., Botanical Garden, São Paulo, Brazil, leg. A. Puttemans. Authentic material might be available at the Herb. Museo Rio de Janeiro.

⇒ *Stagonospora agaves* (Maubl.) Mouch., comb. nov.
= **Hendersonia agaves** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 294. 1903; XVIII: 367; XIX: 855. Holotype: PC ex Herb. SCPV No. 6373, same material as for *Phyllosticta agaves* Maubl. On leaves of *Agave* sp., Algeria (date & leg. not specified). *Hendersonia* Berk. has been rejected in favour of *Stagonospora* (Sacc.) Sacc. but no extended document exists for the latter (Sutton, 1980).

⇒ **Stagonospora kentiae** Maubl. - Bull. Trimestriel Soc. Mycol. France 19: 293. 1903; XVIII: 361; XX: 879. Holotype: PC ex Herb. SCPV No. 5811; same specimen as for *Ascochyta kentiae* Maubl. On living leaves of *Kentia* sp., Algeria (date & leg. not specified). The handwriting of packet No. 5811 clearly indicates the material is also the same only for *Stagonospora kentiae* Maubl. but not again for *Pleospora kentiae* Maubl. as mentioned in the relevant publication.

⇒ *Thermomyces lanuginosus* P. Tsiklinsky - Ann. Inst. Pasteur, Paris 13: 500. 1899; Mouchacca - Crypt., Mycol. 18: 49. 1997.
= **Sepedonium lanuginosum** Griffon & Maubl. - Bull. Trimestriel Soc. Mycol. France 27: 70. 1911; XXV: 703. Holotype: ?

The original culture of *Sepedonium lanuginosum* was isolated from fresh manure and damp hay incubated at 50°C by Mr Dupont then Chief Chemist at the 'Ecole Nationale d'Agriculture de Grignon'. The living material was unfortunately not maintained. The taxonomic history of this thermophilic hyphomycete was recently reviewed (Mouchacca, 1997).

⇒ *Tiarosporella phaseolina* (Tassi) van der Aa, in von Arx - Genera of fungi sporulating in pure culture, 3rd ed. (Lehre): 208. 1981.
Basionym: *Macrophoma phaseolina* Tassi - Boll. Lab. Orto bot. Sienna 4: 9. 1901.
= *Macrophomina phaseolina* (Tassi) Goidanich - Ann. sper. Agr. Roma, N. S., 1(3): 457. 1947.

=*Tiarosporella phaseoli* (Maubl.) van der Aa - Verh. Ned. Akad. Wetens. Afd. Naturk., Amsterdamn 2, 68: 4. 1977.
Basionym: **Macrophoma phaseoli** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 90. 1905; XVIII: 269; XX: 5. Holotype: PC ex Herb. INA, labelled *pars ex typo*. On dead stems of *Phaseolus vulgaris*, Tunis, 1904 (leg. ?).
= *Macrophomina phaseoli* (Maubl.) Ashby - Trans. Brit. Mycol. Soc. 12: 145. 1927. Synonymy *fide* Holliday & Punithalingam (1970).

= *Rhizoctonia bataticola* (Taubenh.) E.J.Butler, in Briton-Jones - Bull. Minist. Agric. Egypt 49, Bot. Sect., p. 65. 1925.
Basionym: *Sclerotium bataticola* Taubenh. - Phytopathology 3: 161. 1913. Synonymy *fide* Ashby (1927).
= *Sclerotium bataticola* Taubenh. ssp. *bataticola* Reichert & Hellinger - Palestine J. Bot., Rehovot Ser. 6: 137. 1947. Synonymy *fide* Mouchacca (1999).
= *Sclerotium bataticola* Taubenh. ssp. *intermedium* Reichert & Hellinger - Palestine J. Bot., Rehovot Ser. 6: 138. 1947. Synonymy *fide* Mouchacca (1999).
= *Sclerotium bataticola* Taubenh. ssp. *sesamicola* Reichert & Hellinger - Palestine J. Bot., Rehovot Ser. 6: 138. 1947. Synonymy *fide* Mouchacca (1999).

The following synonyms are also listed by Ashby (1927): *Macrophoma corchori* Saw., *M. cajani* Syd. & Butl., *M. sesami* Saw., *Macrophomina phillippinensis* Petr., *Dothiorella cajani* Syd. & Butl. and *Rhizoctonia lamellifera* Small.

⇒ **Trichoseptoria fructigena** Maubl. - Bull. Trimestriel Soc. Mycol. France 21: 95. 1905; XVIII: 403; XX: 1018. Holotype: ? On mature fruits of *Pyrus malus* and *Cydonia vulgaris*, close to Paris, France, (date ?), leg. A. Maublanc. The fungus is now reported to induce a fruit rot in the United States (Farr *et al.*, 1989). The genus has apparently not been reassessed (Sutton, 1977; Hawksworth *et al.*, 1995).

DISCUSSION

Over one hundred species new to science were introduced by Maublanc from material originating from three continents: Europe, South America and Africa. Prime collections were made in France, mostly by Maublanc himself. These account for almost half his introductions. The second half relates almost equally to Brazil and several African countries. Brazilian specimens were collected by Maublanc during his 1912 - 1914 stay in this country. African specimens were regularly received at the Paris Plant Pathology Station for examination.

On a chronological basis, almost all the proposed names (90,00 %) were introduced in the period starting from 1903 up to the end of the first world war; a very limited fraction was described partly in the 1920's and partly in the 1930's. A very low percentage of the early proposals were co-authored with E. Griffon while most of the later ones were achieved in collaboration with L. Roger. Interestingly only a single taxon is co-authored with the Brazilian E. Rangel. It follows, therefore, that Maublanc undertook alone most of his descriptive work in the early decades of his activities. It is also evident that he made no efforts to develop the study of plant pathogenic fungi on a large scale. Furthermore, this theme of research was relegated when Maublanc developed an interest in the Homobasidiomycetes. Both trends accounts for the non elaboration of a distinguished centre of taxonomic studies of plant related fungi in his lifetime.

Maublanc's descriptions were prepared from structures developing on plant material. The novel taxa were also generally proposed on a plant-host basis. No attempts were made to prepare corresponding living cultures even when this was possible. Only four taxa were reported from living strains received for examination. These were either culture contaminants or represent thermophilic hyphomycetes. It is thus obvious that the preparation and study of living material was not a trend favoured by Maublanc.

On a taxonomic basis, over half the proposals concern deuteromycetes. The remaining brings together Ascomycetes and Basidiomycetes on a 3:1 ratio. The established list also includes one Chytridiomycete and one Oomycete. The eleven new Basidiomycetes are rusts and smuts not originating from one particular continent, although most were parasitising African plants. These specialised forms belong to common genera such as *Aecidium*, *Uredo*, *Puccinia* and *Ustilago*. The latter genus comprises the long forgotten *Ustilago andropogonis-finitimi* unrecorded since its description in 1906 (Vanky & Mouchacca, in press).

New ascomycetous taxa have original localities situated in South America. These are based on Brazilian specimens brought back by Maublanc upon his return to Europe. The new Ascomycetes belong to 24 genera and for *Leptosphaeria*, *Pleospora*, *Sphaerella*, *Calospora* and *Physalospora* more than one new species was proposed. For this taxonomic group Maublanc established three new genera. *Chaetolentomita* is no longer retained as valid. *Theissenia* was introduced to accomodate a fungus described by the German amateur mycologist Theissen and *Uropolystigma* for a Brazilian collection. Both remain unispecific and undocumented since their introduction.

New deuteromycetes disclose the reverse trend with two thirds collected solely in France. Species were proposed in 35 genera. Plant associated forms with coelomycetous affinities outnumber hyphomycetes. Best represented genera of the former group are *Gloeosporium*, *Phoma*, *Phyllosticta*, *Camarosporium* and *Coniothyrium*. Three new genera were proposed. *Lasiostroma* Griffon & Maubl. is now accepted as being identical to *Phomopsis* (Sacc.) Sacc. but its only species awaits redisposal. The unispecific *Melanobasidium* Maubl., based on material collected in Spain, remains undocumented. *Ceratopycnidium* Maubl. was proposed for a single African species. Although the fungus was not documented again a second Brazilian species was recently added (Bertoni & Cabral, 1991). Its inclusion was based on speculations about the mode of conidiogenesis in the genus extracted from the orignal drawings provided by Maublanc.

Hyphomycetous genera as *Pestalotia*, *Septoria*, *Cercospora* and *Ramularia* are well represented in terms of species numbers. Two new genera are due to Maublanc: *Asperisporium* and *Nomuraea*. Both are still in use in the taxonomic literature. The first was introduced to accomodate a species of *Cercospora* on account of the verrucose conidia; two *Scolecothricum* taxa were also transferred to the new entity. *Nomuraea* was introduced for an entomophagous fungus collected in Japan; the type species is actually well documented with the correct name being *N. rileyi* (Farlow) Samson.

It is evident from the above considerations no overall policy for the study of parasitic fungi was elaborated by Maublanc. His prime French collections were apparently made in summer resort localities. Such was succeeded by his Brazilian interruption and the transfer of his interest to basidiomycetous fungi. The several popular accounts and the two text books he wrote about members of this group confirm the shift of Maublanc's major interest from phytopathology to mycology. Finally, a fair proportion of Maublanc's novel taxa have apparently remained undocumented since their introduction. Their status thus awaits to be re-evaluated in the light of modern taxonomic concepts.

It is our hope that the publication of this annotated list of taxa proposed by Maublanc should foster the attention of taxonomists on these long forgotten binomials.

ACKNOWLEDGEMENTS

Dr H.J. Gjaerum is once again credited for his invaluable assistance in updating the taxonomic status of some rust fungi. Drs. A.Y. Rossman, H. van der Aa and W. Gams have kindly given part of their time to review portions of this note. Requests for opinions on particular taxa resulted in joint collaborative works with Drs H. van der Aa, U. Braun, H. De Gruyer and K. Vanky. Dr. A.J.L. Phillips (Universidade do Minho, Portugal) together with Dr. H. van der Aa have willingly accepted to act as pre-submission reviewers. Finally, Dr Imre Végh and Alain Leberre (Centre INRA Versailles, France) are gratefully acknowledged for their help during the search for herbarium material.

REFERENCES

ARNAUD G., 1918. Les Astérinées. Ann. Ecole Natn. Agric. Montpellier, N.S., 16: 1-288.
ARX J.A. von, 1970. A revision of the fungi classified as *Gloeosporium*. Bibl. Mycol. 24: 1-203.
ARX J.A. von, 1981. The genera of fungi sporulating in pure culture. J. Cramer: 1-206.
ASHBY S.F., 1927. *Macrophomina phaseoli* (Maubl.) comb. nov. The pycnidial stage of *Rhizoctonia bataticola* (Taub.) Butl. Trans. Brit. Mycol. Soc. 12: 141-147.
BATISTA A.C. & CIFERRI R., 1963. The sooty molds of the family *Ascobolisiaceae*. Publ. Inst. Mic. Univ. Recife 163: 1-229.
BERTONI M.D. & CABRAL D., 1991. *Ceratopycnidium baccharidicola* sp. nov., from *Baccharis coridifolia* in Argentina. Mycol. Res. 95: 1014-1024.
BOEREMA G.H., 1983. Mycologisch-taxonomisch onderzoek. Versl. Meded. Pilziektenk. Dienst. Wageningen 159: 21-27. (Jaarb. 1982).
BRAUN U., 1995. The Powdery mildews (Erysiphales) of Europe. Gustav Fisher Verlag: 1-337.
BRAUN U., 1998. A monograph of *Cercosporella*, *Ramularia* and allied genera (Phytopathogenic Hyphomycetes). IHW-Verlag: 1-493.
BRAUN U. & MOUCHACCA J., 1999. Reassessments of *Cercospora byrsonimatis* and *Ramularia ligustrina*. Mycol. Res. (in press).
BRUMMIT R.K. & POWELL C.E. (Eds.), 1992. Authors of Plant Names. Royal Botanic Gardens. Kew: 1-732.
CHUPP C., 1954. A monograph of the fungus genus *Cercospora*. Cornell University Press, Ithaca, New York: 1-667.
CLEMENTS F.F. & SHEAR C.L., 1931. The genera of fungi. Hafner, New York.
CRANE J.L. & SHEARER C.A., 1991. A nomenclator of *Leptosphaeria* V. Cesati & G. de Notaris (Mycota-Ascomycotina-Loculoascomycetes). Edited by Illinois Natural History Survey.

DENISON W.C., 1967. Central American Pezizales. II. The genus *Cookeina*. Mycologia 59: 366-317.

DULYMAMODE R., CANNON P.F. & PEERALLY A., 1998. Fungi from Mauritius: *Anthostomella* species on Pandanus. Mycol. Res. 102: 1319-1324.

ECKBLAD F.-E., 1968. The genera of the operculate Discomycetes. A re-evaluation of their taxonomy, phylogeny and nomenclature. Nytt Magazin for Botanikk 15: 1-191.

ELLIS M.B., 1976. More Dematiaceous Hyphomycetes. CMI, Kew, Surrey, England: 1-507.

ELLIS M.B & HOLLIDAY P., 1972. *Asperisporium caricae*. CMI Description of Pathogenic Fungi & Bacteria No. 347. CMI, Kew, Surrey, England.

FARR M.L., 1979. The didymosporous dimeriaceous fungi described on *Asteraceae*. Mycologia 71: 243-271.

FARR D.F., BILLS G.F., CHAMURIS G.P. & ROSSMAN A.Y., 1989. Fungi on plants and plant products in the United States. Edited by the American Phytopathological Society: 1-1252.

GRIFFON E. & MAUBLANC A., 1911. Contribution à l'étude des maladies des pommes et des poires. Ann. Inst. Natl. Agron., Paris, sér. 2, tome 10, pp. 69-106.

GUBA E.F., 1961. Monograph of *Monochaetia* and *Pestalotia*. Harvard University Press, Cambridge, MA: 1-342.

HANSFORD C.G., 1961. The Meliolae, a monograph. Sydowia Beihefte 2: 1-806.

HAWKSWORTH D.L., KIRK P.M., SUTTON B.C. & PEGLER D.N., 1995. Dictionary of the fungi. Edited by the International Mycological Institute: 1-616.

HERTER W. G., 1950. Die Gattung der Riesenmorcheln, *Maublancomyces*. Rev. Sudam. Bot. 8: 159-162.

HOLLIDAY P. & PUNITHALINGAM E., 1970. *Macrophomina phaseolina*. CMI Description of Pathogenic Fungi & Bacteria No. 275. CMI, Kew, Surrey, England.

KISH L.P., SAMSON R.A. & ALLEN G.E., 1974. The genus *Nomuraea* Maublanc. J. Invert. Pathol. 19: 291-296.

LAUNDON G.F. & WATERSTON J.M.,1964. *Hemileia coffeicola*. CMI Description of Pathogenic Fungi & Bacteria No. 2. CMI, Kew, Surrey, England.

MAUBLANC A., 1903. Sur quelques espèces nouvelles de champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 29: 353-358.

MAUBLANC A., 1905. Espèces nouvelles de champignons inférieurs. Bull. Trimestriel Soc. Mycol. France 21: 87-94.

MAUBLANC A., 1907. Sur quelques champignons inférieurs nouveaux ou peu connus. Bull. Trimestriel Soc. Mycol. France 23: 141-145.

MAUBLANC A., 1913. Sur une maladie des feuilles de papayer (*Carica papaya*). Bull. Trimestriel Soc. Mycol. France 29: 353-358.

MAUBLANC A., 1920. Contribution à l'étude de la flors mycologique brésilienne. Bull. Trimestriel Soc. Mycol. France 36: 33-43.

MAUBLANC A. & LASNIER E., 1904. Sur une maladie des *Cattleya*. Bull. Trimestriel Soc. Mycol. France 20: 167-192.

MAUBLANC A. & ROGER L., 1934. Une nouvelle rouille du caféier au Cameroun : *Hemileia coffeicola*. Bull. Trimestriel Soc. Mycol. France 50: 193-202.

MAUBLANC A. & ROGER L., 1938. Sur deux espèces de *Cookeina* en Afrique. Bull. Trimestriel Soc. Mycol. France 54: 111-114.

MOUCHACCA J., 1997. Thermophilic fungi: Biodiversity and Taxonomic Status. Crypt., Mycol. 18: 19-69.

MOUCHACCA J., 1999. A list of novel fungi described from the Middle East, mostly from non-soil substrata. Nova Hedwigia 68: 149-174.

MOUCHACCA J. & SAINT-JORE V., 2000. Contribution of ANDRÉ MAUBLANC to mycology. I - Annotated list of publications. Mycotaxon (in press).

MÜLLER E. & ARX J.A. von, 1962. Die Gattungen der didymosporen pyrenomyceten. Beitr. Kryptogamenflora Schweiz 11 (2): 1-922.

NAG RAJ T.R., 1993. Coelomycetous anamorphs with appendage-bearing conidia. Mycologue Publications, Waterloo, Canada: 1-1101.

PARBERRY D.G., 1967. Studies on graminicolous species of *Phyllachora* Nke. in Fuckl. V. A taxonomic monograph. Aust. J. Bot. 15: 271-235.

PITT J., 1980. The genus *Penicillium* and its teleomorphic states *Eupenicillium* and *Talaromyces*. Academic Press, London: 1-634.

PUNITHALINGAM E., 1980. A combination in *Phoma* for *Ascochyta caricae-papayae*. Trans. Brit. Mycol. Soc. 75: 340-341.

REED C.F. & FARR D.F., 1993. Index to Saccardo's *Sylloge Fungorum* volumes I-XXVI in XXIX (1882-1972). Contr. 6, US Nat. Fungus Collections, Beltsville, Maryland, Rose Printing Inc. Tallahassee, Florida, USA.

ROSSMAN A.Y., 1979. A preliminary account of the taxa described in *Calonectria*. Mycotaxon 8: 485-558.

SHERWOOD M.A., 1977a. The Ostropalean fungi. Mycotaxon 5: 1-277.

SHERWOOD M.A., 1977b. The Ostropalean fungi II : *Schizoxylon*, with notes on *Stictis*, *Acarosporium*, *Coccopeziza* and *Carestiella*. Mycotaxon 6: 215-260.

SPARROW F.K., 1960. Aquatic Phycomycetes. 2nd rev. Edited by The University of Michigan Press, Ann Arbor, Michigan.

SPEGAZZINI C., 1910. Mycetes Argentinenses. Anal. Mus. Nac. B. Aires ser. 3, 20 : 329-467.

SUTTON B.C., 1975. Coelomycetes. V. *Coryneum*. Mycol. Pap. 138: 1-224.

SUTTON B.C., 1977. Coelomycetes VI. Nomenclature of generic names proposed for coelomycetes. Mycol. Pap. 141: 1-253.

SUTTON B.C., 1980. The Coelomycetes. Edited by CMI, Kew, Surrey, England: 1-696.

SUTTON B.C. & PONS N., 1980. Notes on the original species of *Cercosporina*. Mycotaxon 12: 201-218.

SYDOW P. & H., 1915. Monographia Uredinearum 3: 1-726.

VIENNOT-BOURGIN G., (1958) 1959. Urédinales d'Afrique (5e note). Urédinales de Côte d'Ivoire (4e note). *Uredineana*, 5 (Encyl. mycol., 31, 1958), pp. 137-248.

WATERHOUSE G.M., 1970. The genus *Phytophthora* De Bary. Mycol. Pap. 122: 1-59.

WEHMEYER L.E., 1961. A world monograph of the genus *Pleospora* and its segregates. Edited by the University of Michigan Press, Ann Arbor: 1-451.

VANKY K., 1996. Taxonomic studies on Ustilaginales. XIV. Mycotaxon 59: 89-113.

VANKY K. & MOUCHACCA J., 1999. The identity of *Ustilago andropogonis-finitimi*. Mycol. Res. (in press).

ZAMBETTAKIS Ch., 1954. Recherches sur la systématique des Sphaeropsidales-Phaeodidymées. Bull. Trimestriel Soc. Mycol. France 70: 219-350.

ZUNDEL G.L., 1953. The Ustilaginales of the world. Edited by the Pennsylvania State College School of Agriculture, Contrib. No. 6, 410 p.

INDEX OF NAME CHANGES

OOMYCETE *Phytophthora faberi* ⇒ *Phytophthora palmivora*

DEUTEROMYCETES

Cercospora trigonellae ⇒ *Cercospora traversiana*
Chaetophoma erysiphoïdes ⇒ *Chaetasbolisia erysiphoïdes*
Gloeosporium dendrobii ⇒ *Colletotrichum gloeosporioides*
Gloesporium hedericolum ⇒ *Colletotrichum gloeosporioides*
Gloeosporium phaji ⇒ *Colletotrichum gloeosporioides*
Gloeosporium ricini ⇒ *Colletotrichum gloeosporioides*
Gloeosporium sobraliae ⇒ *Colletotrichum gloeosporioides*
Diplodia abiegna ⇒ *Diplodia inconspicua*
Chaetodiplodia arachidis ⇒ *Lasiodiplodia theobromae*
Macrophoma ulmicola ⇒ *Macrophoma maublancii*
Diplodiella tamaricis ⇒ *Microdiplodia depazeoïdes*
Pestalotia paeoniae ⇒ *Monochaetia paeoniae*
Nomuraea prasina ⇒ *Nomuraea rileyi*
Pestalotia ceratoniae ⇒ *Pestalotiopsis ceratoniae*
Pestalotia longi-aristata ⇒ *Pestalotiopsis longi-aristata*
Phoma radicicola ⇒ *Phoma anserina*
Phoma cytosporoides ⇒ *Phomopsis* sp.
Phyllosticta dracaenae ⇒ *Phoma draconis*
Phyllosticta owariensis ⇒ *Phyllosticta* sp.
Ramularia aequivoga var. *bulbosa* ⇒ *Ramularia didyma*
Sepedonium lanuginosum ⇒ *Thermomyces lanuginosus*
Macrophoma phaseoli ⇒ *Tiarosporella phaseolina*
Hypocrea agaves ⇒ *Plowrightia agaves*
Sphaerella tabaci ⇒ *Mycosphaerella tabacii*
Sphaerella caricae ⇒ *Mycosphaerella caricae*
Chaetolentomita lignorum ⇒ *Chaetosphaeria brasiliensis*
Calonectria coralloïdes ⇒ *Melioliphila coralloïdes*
Sphaerella ilicola ⇒ *Mycosphaerella ilicicola*
Dimeriella caraçaensis ⇒ *Lasiostemma melioloides* var.
caraçaense

BASIDIOMYCETES

Aecidium mexicanum ⇒ *Aecidium maublancii*
Uredo coffeicola ⇒ *Hemileia coffeicola*
Pleoravenelia deformans ⇒ *Ravenelia deformans*

MYCOTAXON

Volume LXXIV(2), pp. 331-335 April-June 2000

A NEW SPECIES OF INONOTUS (BASIDIOMYCOTINA) FROM YUNNAN, SOUTHERN CHINA

YU-CHENG DAI
Botanical Museum, P.O. Box 47, FIN-00014 University of Helsinki, Finland

TONG-XIN ZHOU
Southwest Forestry College, Kunming 650224, Yunnan, China

ABSTRACT

A new polypore, *Inonotus indurescens* Y.C. Dai, collected from Yunnan in China, is described and illustrated. It is characterized by hard, effused-reflexed or pileate and imbricate basidiocarps, dark reddish brown to chestnut black upper surface, small pores, and the presence of both hyphoid and hymenial setae, while no setae are found in the context. Its hyphae are strongly agglutinated, and spores are yellow to rust brown, thick-walled and ellipsoid. Microscopically *I. indurescens* has similar spores and tramal hyphoid setae as those in *I. glomeratus* (Peck) Murrill, but the latter species has corky basidiocarps, yellowish brown upper surface and bigger pores, and hyphae are not agglutinated. In the context of *I. glomeratus* hyphoid setae are present. A discussion is given on the differences and similarities between the new species and those species of *Inonotus* which have hyphoid setae and thick-walled, coloured spores.

Key words: Basidiomycotina, China, *Inonotus*, *I. indurescens*, polypore

INTRODUCTION

Inonotus P. Karst is one of the well known genera in polypores, especially the species have been extensively studied in North America (Gilbertson & Ryvarden 1986) and Europe (Ryvarden & Gilbertson 1993). In Asia the species were investigated only locally. Indian species were published by Sharma (1995), and recently some new species were described from Northeast Asia (Hattori & Ryvarden 1993, Chang 1997, Chang & Chou 1998). The Chinese *Inonotus sensu lato* was summarized by Dai *et al.* (1997), and 15 species were reported in that paper. Because of the vast territory of China, extending from the boreal and temperate north, to the tropical vegetation in the south, it is evident that more species will be found especially in tropical areas.

During a study on the hymenochaetaceous fungi in China, many specimens were collected by T.X. Zhou and others from Yunnan Province in southern China, and these collections are now preserved in the herbarium of Southwest Forestry College in Kunming. In June of 1999 the senior author made a field trip to investigate wood-inhabiting fungi in Yunnan Province, and during the stay in Kunming some herbarium specimens were studied as well. Among this material, four recent collections of *Inonotus* P. Karst. were carefully studied in Helsinki, and they turned out to represent an undescribed species. In this paper the description is made.

METHODS

The measurements and drawings were made from slide preparations stained with Cotton Blue (CB). Spores were measured from sections cut from the tubes. IKI stands for Melzer's reagent and KOH for 5% potassium hydroxide; CB+ means cyanophilous. In presenting the variation in the size of the spores or other structures, 5% of the measurements were excluded from each end of the range, and are given in parentheses. In the text the following abbreviations are used: L= mean spore length (arithmetical mean of all spores, in µm), W= mean spore width (arithmetical mean of all spores, in µm), Q= quotient of the mean spore length and the mean spore width (L/W ratio), (n=x/y) x indicates measurements of spores (pores, hyphae, setae) from y specimens. The length of the setae was measured from the tip to its approximate base. Sections were studied at magnification up to x1250 by using a Leitz Diaplan microscope and phase contrast illumination. Drawings were made with the aid of a drawing tube.

DESCRIPTION

Inonotus indurescens Y.C. Dai, *spec. nova* (Fig. 1)
Carpophorum annuum, effus-reflexum vel pileatum; facies pororum atroumbrina, pori 5–7 per mm. Systema hypharum monomiticum, hyphae septatae, setae adsunt in trama vel hymenio. Sporae ellipsoideae, flavibrunneae, crassitunicatae, IKI–, CB (+), 4.3–5.7 × 3.2–4.1 µm.

Type: **China**. Yunnan Prov., Dali, Pianma, 10.III.1999 *Zhang 36* (H, holotype, isotypes in HMAS, SWFC).

Etymology. — *indurescens* (Lat., adj.): becoming hard.

Basidiocarps annual, effused-reflexed or pileate, imbricate, bone hard and light in weight when dry, pileus usually shelf-shaped and projecting up to 2 cm, 4 cm wide and 0.5 cm thick at base. Pileal surface dark reddish brown to chestnut black, concentrically zoned, glabrous, margin acute, more or less curving down when dry. Pore surface chestnut brown to black; pores angular, 5–7(–8) per mm (n=40/2), tube mouths irregularly lacerate. Context yellowish brown to dark brown, thin (not exceeding 2 mm), bone hard. Tubes dark brown, woody hard to bone hard, up to 3 mm long.

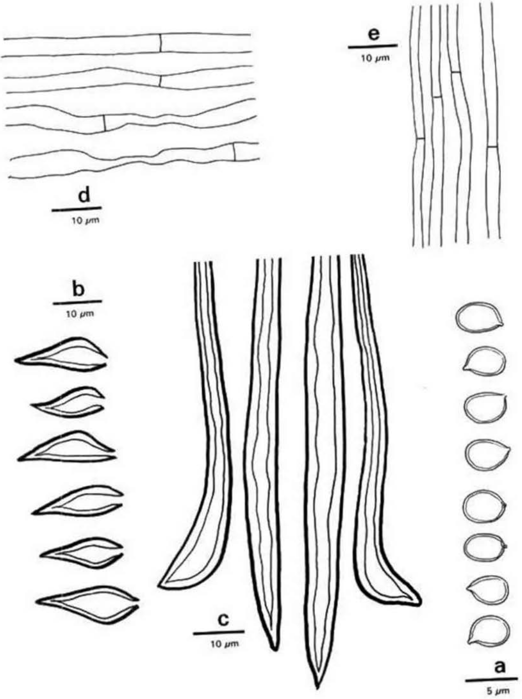


Fig. 1. Microscopic structures of *Inonotus indurescens* Y.C. Dai (drawn from holotype). —a) spores, —b) hymenial setae, —c) hyphoid setae, —d) contextual hyphae, —e) tramal hyphae.

Hyphal system monomitic; all septa without clamp connections; tissues darkening but otherwise unchanged in KOH.

Context. — Generative hyphae varying from hyaline and thin-walled to yellowish and fairly thick-walled, strongly agglutinated, frequently simple septate and rarely branched, often collapsed, (3.5–)4–6 (–7) µm in diam (n=30/1). No hyphoid setae.

Tubes. — Tramal hyphae varying from pale yellowish and thin-walled to rust brown and medium thick-walled, tightly agglutinated, frequently simple septate, occasionally branched, parallel along the tubes, (2.5–)2.8–4.3(–4.5) µm in diam (n=30/1). Hyphoid setae prominent but not dominant, dark brown, distinctly thick-walled with a narrow or wide lumen, embedded in trama or curved and penetrating into hymenium, apex sharp-pointed, up to 160 µm long and 8–12 µm in diam in the widest part. Hymenial setae abundant, subulate or ventricose, dark brown, thick-walled, sharp-pointed, (18–)21–32(–36) x (5–)6–9(–10) µm (n=30/2). Subhymenium indistinct; basidia clavate, with four sterigmata and a simple basal septum, 8–10 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller.

Spores. — Basidiospores ellipsoid, yellowish to rust brown, thick-walled, smooth, IKI–, CB+ when juvenile, (4–)4.3–5.7(–6) × (3.1–)3.2–4.1(–4.4) µm, L = 4.96 µm, W = 3.69 µm, Q = 1.31–1.38 (n=61/2).

Additional specimens examined (paratypes). — **China.** Yunnan Prov., Dali, Pianma, 10.III.1999 *Gao 35* (H, SWFC), 10.III.1999 *Zhang 38 & 51* (H, SWFC).

Inonotus indurescens is characterized by hard, effused-reflexed or pileate and imbricate basidiocarps, dark reddish brown to chestnut black upper surface, and small pores. Both tramal hyphoid setae and hymenial setae are found in its structure, and the hyphae are strongly agglutinated. Like in many other species of the genus, the spores are yellow, thick-walled and ellipsoid. Differences from the closely related species are discussed below.

The following species of the genus *Inonotus* have hyphoid setae and thick-walled, coloured spores: *I. glomeratus* (Peck) Murrill, *I. iliensis* Kravtzev, *I. micantissimus* (Rick) Rajchenberg, *I. nidus-pici* Pilát, *I. ochroporus* (van der Byl) Pegler, *I. patouillardii* (Rick) Imaz., *I. pegleri* Ryvarden, *I. pruinosus* Bondartsev, *I. quercustris* M. Blackwell & Gilb., *I. rickii* (Pat.) Reid, *I. rodwayi* Reid, and *I. ulmicola* Corfixen. Among these species *I. micantissimus, I. nidus-pici, I. pegleri, I. pruinosus* and *I. ulmicola* have resupinate basidiocarps and distinctly larger spores (spore length > 6 µm and width > 4.5 µm, Rajchenberg 1987, Ryvarden & Gilbertson 1993, Ryvarden & Johansen 1980, Dai *et al.* 1997). *Inonotus iliensis* was reported from Kazakhstan (Pegler 1964). It differs from *I. indurescens* by growing as resupinate in trunk cavities; its pores are bigger (3–4 per mm), it has no hymenial setae, and its spores are relatively larger (4–7.5 x 3.7–5.6 µm). *Inonotus ochroporus, I. patouillardii, I. quercustris, I. rickii* and *I. rodwayi* have pileate basidiocarps, but these species differ from *I. indurescens* by their larger pores (2–5 per mm) and in particular, bigger spores (spore length > 6 µm and width > 4.5 µm, Ryvarden & Johansen 1980, Gilbertson & Ryvarden 1986, Pegler 1964).

Inonotus indurescens is most closely related to *I. glomeratus*: the two share similar spores and hyphoid setae in trama. The latter species is widely distributed in North America and northern India. However, *I. glomeratus* has bigger pores (3–5 per mm), and its basidiocarps are corky. Its upper surface is yellowish brown, and therefore more light-coloured than in *I. indurescens*, and its pore surface is glancing. The contextual hyphae of *I. glomeratus* are neither agglutinated nor collapsed. In addition, *I. glomeratus* has prominent hyphoid setae in its context. In contrast, *I. indurescens* has small pores (5–7 per mm), and its basidiocarps harden upon drying. The reddish brown and chestnut tones of upper surface are very dark. No silky sheen is seen in its pore surface The hyphae of the context are often collapsed, and no hyphoid setae are found in its context.

Specimen of related species examined. — *Inonotus glomeratus*. **Canada**. Quebec, Gatineau, on log of *Fagus grandifolia*, 8.IX.1993 *Ginns 9982* (H ex DAOM 221572).

Acknowledgements. We are grateful to Dr. Tuomo Niemelä (Helsinki) for improving the manuscript, and to Prof. Teuvo Ahti (Helsinki) who helped in preparing the Latin description. Financial support to Yu-Cheng Dai from the Academy of Finland (Project No. 44173, 1998–2000) is gratefully acknowledged.

REFERENCES

Chang, T.T. 1997: Two new species of Hymenochaetaceae from Taiwan. — Mycol. Res. 101: 1003–1005.

Chang, T.T. & Chou, W.N. 1998: Two new species of Inonotus from Taiwan. — Mycol. Res. 102: 788–790.

Dai, Y.C., Niemelä, T. & Zang, M. 1997: Synopsis of the genus Inonotus (Basidiomycetes) sensu lato in China. — Mycotaxon 55: 273–283.

Gilbertson, R.L. & Ryvarden, L. 1986: North American polypores 1. Abortiporus – Lindtneria. — Fungiflora, Oslo. 433 pp.

Hattori, T. & Ryvarden, L. 1993: Polypores from Boin Is. (Japan) 1. A new species of Inonotus (Hymenochaetaceae, Basidiomycotina). — Mycotaxon 49: 209–215.

Pegler, D.N. 1964: A survey of the genus Inonotus (Polyporaceae). — Trans. British Mycol. Soc. 47: 175–195.

Rajchenberg, M. 1987: Type studies of Polyporaceae (Aphyllophorales) described by J. Rick. — Nordic J. Bot. 7: 553–568.

Ryvarden, L. & Gilbertson, R.L. 1993: European polypores 1. Abortiporus – Lindtneria. — Synopsis Fungorum 6: 1–387.

Ryvarden, L. & Johansen, I. 1980: A preliminary polypore flora of East Africa. — Fungiflora, Oslo. 636 pp.

Sharma, J.R. 1995: Hymenochaetaceae of India. — Botanical Survey of India, Calcutta. 219 pp.

MYCOTAXON

Volume LXXIV(2), pp. 337-342 April-June 2000

A NEW SPECIES OF SPOROCARPIC GLOMALES FROM SOUTH AFRICA

R.C. SINCLAIR, J.V. VAN GREUNING & ALBERT EICKER

Department of Botany, University of Pretoria, Pretoria 0002.
e-mail: sinclair@scientia.up.ac.za

Glomus avelingiae sp. nov. RC Sinclair is described and illustrated from collections made from the rhizosphere of an indigenous fruit-bearing tree, *Vangueria infausta* Burch. subsp. *infausta* near Cullinan, South Africa. Sporocarp morphology is presented as an important diagnostic feature.

Key words: Glomales, *Glomus*, sporocarp, arbuscular mycorrhizal fungi, South Africa.

Introduction

The order, Glomales was created to include all soil-borne fungi which form arbuscules in obligate mutualistic association with terrestrial plants (Morton and Benny, 1990). As an asexually reproducing species designated by morphology (form- or morph-species), a physiological prerequisite can create dilemma's, however sufficient morphological and habitat characteristics facilitate recognition of fungi from this order. Nonetheless, records of collections of arbuscular mycorrhizal (AM) fungi from South Africa are few. A collection of an *Endogone* Link:Fr species (Hattingh, 1972) was later identified as *Acaulospora laevis* Gerdemann & Trappe (Coetzee, 1982). Coetzee named a second collection of *A. laevis* from a different locality "with reservations" (pers. comm.) which is now deposited in the Pretoria Mycological Herbarium (PREM 45880). AM fungi have been collected from sand dunes in one of South Africa's neighboring countries, Namibia. These specimens have been sent to C. Walker in the UK for positive identification (K. Jacobson, pers. comm.). Some additional samples from Namibia are being pot cultured at the International Collection of Arbuscular and Vesicular-Arbuscular Mycorrhizal Fungi (INVAM) in West Virginia (Morton *et al.*, 1993) for study. Hoffman and Mitchell (1986) recognized four different "types" of AM fungi associated with *Acacia saligna* (Labill.) Wendl., an invader plant of the sensitive fynbos biome of the south-western Cape of South Africa but these fungi were not identified to species level. The present authors contributed to a recent report where some common AM fungi were identified (Gaur *et al.*, 1999) however, no taxonomic work, particularly from regionally important biomes in southern Africa, has been accomplished thus far.

Investigations begun at the University of Pretoria, have concentrated on the isolation and identification of indigenous species of AM fungi from the region. In this process, a new sporocarpic species in the sub-order Glomineae, family Glomaceae has been discovered. Spore size, color and in particular, wall layer characteristics are used to distinguish this taxon in the Glomaceae. Ontogenetic sequence in wall layer development has been investigated in several taxa in the genus *Glomus* (Stürmer and Morton, 1997), increasing the evidence of polyphyly in this apparently heterogenous taxon. Spore age·differences within the sporocarp in our collection has enabled investigation of spore ontogeny. Sporocarp morphology, known only in a few of the taxa in this family, is described here with an implication to the taxonomic usefulness of this characteristic.

Materials and Methods

Glomus avelingiae is described herein from a fresh, field-collected specimen. Microscopic investigations of sporocarp morphology and spore wall structure were done on specimens mounted in lactophenol, polyvinyl-lactic acid-glycerin and polyvinyl-lactic acid-glygerin with 1:1 (v/v) Meltzer's reagent. Thin sections (1.2 and 2 μm) were made of the sporocarp and studied with the transmission electron microscope. Light microscope examinations of the sectioned specimens were made with the aid of toluidine blue o staining. Color was determined with the use of the INVAM color chart (obtained from INVAM: 401 Brooks Hall, PO Box 6057, West Virginia University, Morganstown, WV, 26506-6057).

Taxonomic Part

Glomus avelingiae RC Sinclair, *sp. nov.* (Fig. 2 A-H)

[Etymology: this species is named in honour of its collector, Dr. Theresa Aveling.]

Sporocarpia epigaea, luteobrunnea vel pallide brunnea, iregulariter elliptica et modice convoluta, 1.0-1.2 X 1.8-2.2 mm, interdum materiam alienam aliquantum retinentia. Peridium nullum. Pagina sporocarpii crenulata ob chlamydosporas expositas. Chlamydosporae in sporocarpio contigue et fortuito dispositae, cum hyphis 8-10 μm crassis. Chlamydosporae maturae et immaturae valde approximatae repertae. Chlamydosporae maturae globosae vel subglobosae 64-80 μm, cum uno pariete quadristrato: strato intimo flexili, minus quam 0.5 μm crasso; strato medio laminato, pallide luteobrunneo, 1.6-2.4 μm crasso; duobus extimis subhyalinis, saepe ut videtur uno 0.6-0.8 μm crasso; immaturae bistratae. Hypha subtendens 8-10 μm lata, cylindrica, ad 5-7 μm angustata ad basin chlamydosporae, cum septo usque ad 1.5 μm crasso. Hoc septum interdum ad 4 μm infra basin sporae extensum, e strato medio laminato compositum. Chlamydosporae stratum medium deorsum extensum per 6-10 μm in hypha subtendenti.

Epigaeus sub *Vangueria infausta* subsp. *infausta* Burch., prope viae latus, circa 10 km ad septentrio-occidentem e pago Cullinan dicto, Gauteng Provincia, South Africa, 10 November 1994, T.A.S. Aveling, **PREM** 55918, holotypus.

Sporocarp epigeous, yellowish brown to pale brown, irregularly elliptical and moderately convoluted, 1.0-1.2 x 1.8-2.2 mm, sometimes retaining small amounts of foreign material. **Peridium** absent. **Sporocarp surface** crenulate due to exposed chlamydospores. Sporocarp hyphae 8-10 μm wide, bundled together, intertwined, coursing through the spore mass. Spores formed as determinate swellings of tips of sporogenous hyphae. **Chlamydospores** arranged in sporocarp adjacent to each other and random throughout. Mature and immature chlamydospores occurring in close proximity to each other. Mature chlamydospores globose to subglobose, 64-80 μm in diameter with one wall of four layers: innermost layer flexible, less than 0.5 μm thick; middle layer laminate, pale yellowish brown, 1.6-2.4 μm thick; outer bi-layer, subhyaline, 0.6-0.8 μm thick, often appearing as one layer. Juvenile chlamydospores have 2 layers. **Subtending hypha** 8-10 μm wide, 2-layered, cylindrical, narrow at the base of the chlamydospore to 5-7 μm, having a septum up to 1.5 μm thick. Septum in the subtending hypha composed of the middle laminate layer, sometimes extending 4 μm below the point of attachment at the spore base. Middle layer of the spore extending down the subtending hypha 6-10 μm.

In the rhizosphere near the soil surface beneath *Vangueria infausta* Burch. subsp. *infausta*; South Africa.

Collections examined: from the rhizosphere near the soil surface beneath *Vangueria infausta* Burch. subsp. *infausta*, near roadside approximately 10 km northwest of Cullinan, Gauteng Province, 10 November, 1994, T.A.S. Aveling, **PREM** 55918, holotype. An isotype has been sent to C.M.I., Kew for deposition.

Sporocarp color is 0-40-100-0 and chlamydospore color is 0-20-60-0 using the INVAM colour chart. There was no reaction by any of the spore wall layers or hyphae in the presence of Meltzer's reagent. The most commonly occurring mature spore size is 72 μm. A bar graph of the mature spore size range is provided (Fig. 1). A graphic presentation is made of some of the salient characteristics in this species (Fig. 2).

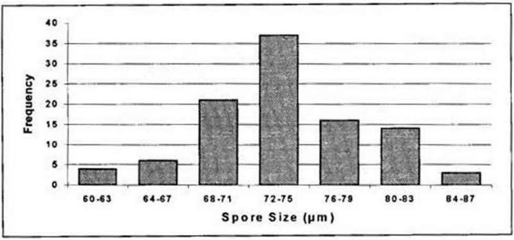


Fig. 1. Spore size range from a random selection of 100 mature spores.

Discussion

The most juvenile stage in *G. avelingiae* presented similarities to the second group described by Stürmer and Morton (1997) where the spore and hyphal wall are comprised of two layers i.e. a mucilaginous layer and a semiflexible hyaline layer. Differentiation proceeded by the appearance of a thin laminate layer and concurrent differentiation of two colorless laminae on the exterior and a thin flexible inner layer. Transmission electron microscopy provided less obvious differentiation of the layers in this species which further supports the conclusions of other authors (Maia *et al., 1993;* Morton, 1996) that the spore wall in the Glomales is a single structure. The spore wall is differentiated into regions of unequal density and composition that are often more easily distinguished with a light microscope.

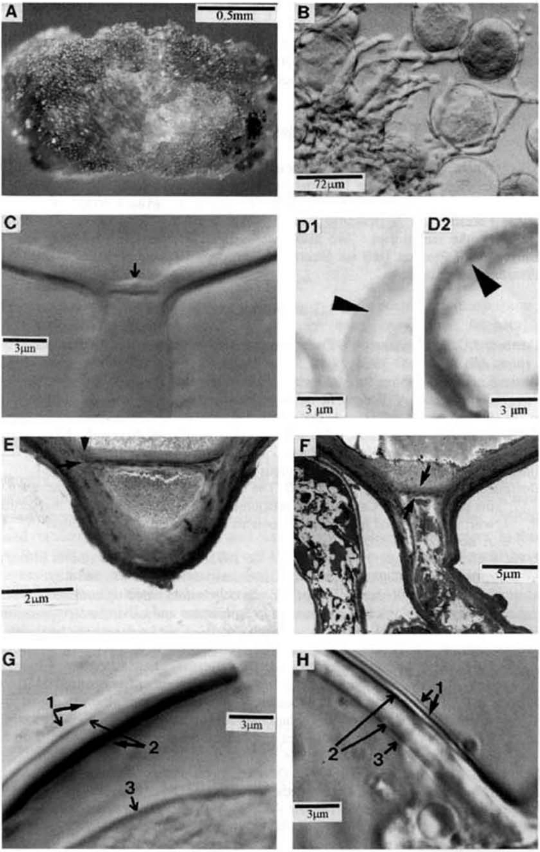
The main characteristics distinguishing *G. avelingiae* from other members in the genus *Glomus* is the spore size and wall structure and the true septum in the subtending hyphae formed from part of the laminated layer of the spore wall. The only other species with spores described having similar size range and wall layering is *Glomus fragile* (Berkeley & Broome) Trappe & Gerdemann. According to the description by Gerdemann and Trappe (1974) this species also has a septum at the hyphal attachment and is similar in spore shape, size, color and the configuration of the two relatively thin wall layers. However, no double layering of the outer layer is mentioned, nor is the thin inner flexible layer. Sporocarp formation has not been described in *G. fragile*. Material of *G. fragile*, known only from the type locality, was unavailable for examination. *G. avelingiae* is known only from the type locality.

The formation of the sporocarp in *G. avelingiae*, with bundled hyphae intertwining the spore mass, is distinct in its apparent randomness. This, as opposed to the orderly structure seen in other sporocarpic Glomales (Wu, 1993) from similar habitats suggests a genetic governance, contrary to the implication made by Morton (1988) that it is environmentally determined. We feel that sporocarp developmental morphology has taxonomic significance as does the ontogenetic sequence of chlamydospore morphology.

Asexuality in the Glomales is a cardinal genetic feature, as it is in the asexually reproducing Mitosporic fungi (formerly Deuteromycetes). Genetic isolation as a result of the loss of sexual recombination should be a factor in a low diversity which appears to be the case in the Glomales with so few taxa recognized. This is apparently not

---

Fig. 2 A-H. *Glomus avelingiae* A. Sporocarp; B. Chlamydospores surrounded by interwoven hyphae; C. Septum at subtending hyphal attachment; D1 & D2 . Juvenile stage of spore development indicating double layer; E & F. Transmission electron micrograph demonstrating contribution of laminate layer to subtending hyphal septum; F. Transmission electron micrograph depicting differentiated layers in spore wall and septum as oppossed to the less differentiated double layer in the distal portion of the subtending hyphal wall; G &H. Oil immersion light micrograph demonstrating multiple layers of the spore wall.


A
0.5mm
B
72μm
C
3μm
D1
3 μm
D2
3 μm
E
2μm
F
5μm
G
1
2
3
3μm
H
1
2
3
3μm

the case in the Mitosporic fungi which have perhaps the largest diversity of all the groups of fungi. In the Glomales the subterranean habit enforcing a low dispersal potential and the obligate dependence on a plant may have served to physically restrict gene flow moreso than in the Mitosporic fungi. However as evidence mounts, it is likely that even the most subtle morphological difference will define distinct lineages in this group of fungi.

Acknowledgements

Financial support from the National Research Foundation is acknowledged. We thank Dr. H.F. Glen of the National Botanical Herbarium of South Africa, N.B.I., Pretoria, for reviewing the latin diagnoses. We thank Prof Mike J Wingfield, Director of the Forestry and Agricultural Biotechnology Institute, University of Pretoria for reviewing the manuscript. We also thank Alan Hall and CF vd Merwe of the University of Pretoria Unit for Electron Microscopy for help with the transmission electron micrographs.

Literature Cited

Coetzee, J.C. 1982. A note on *Endogone* and *Acaulospora* in South Africa. *S. Afr. J. Bot.* **1**: 38-39.

Gaur, A., Van Greuning, J.V., Sinclair, R.C. & Eicker, A. 1999. Arbuscular mycorrhizas *of Vangueria infausta* Burch. subsp. *infausta* (Rubiaceae) from South Africa. *S. Afr. J. Bot.***65**(5): 1-3

Gerdemann, J. W. & Trappe, J.M. 1974. Endogonaceae in the Pacific Northwest. *Mycological Memoirs* **5**: 1-76.

Hattingh, M.J. 1972. A note on the fungus *Endogone*. *J. S.A. Bot.* **38**: 28-31.

Hoffman, M.T. & Mitchell, D.T. 1986. The root morphology of some legume spp. in the south-western Cape and the relationship of vesicular-arbuscular mycorrhizas with dry mass and phosphorous contents of *Acacia saligna* seedlings. *S. Afr. J. Bot.* **52**: 316-320.

Maia, L.C., Kimbrough, J.W. & Benny, G. 1993. Ultrastructural studies of the spore wall of *Gigaspora albida* (Glomales). *Mycologia* **85**: 883-889.

Morton, J.B. 1996. Redescription of *Glomus caledonium* based on correspondence of spore morphological characters in type specimens and a living reference culture. *Mycorrhiza* **6**: 161-166.

Morton, J.B. & Benny, G.L. 1990. Revised classification of arbuscular mycorrhizal fungi (Zygomycetes): a new order, Glomales, two new suborders, Glomineae and Gigasporineae, with an emendation of Glomaceae. *Mycotaxon* **37**: 471-491.

Morton, J.B., Bentivenga, S.P. & Wheeler, W.W. 1993. Germ plasm in the International Collection of Arbuscular and Vesicular-arbuscular Mycorrhizal Fungi (INVAM) and procedures for culture development, documentation and storage. *Mycotaxon* **48**: 491-528.

Stürmer, S.L. & Morton, J.B. 1997. Developmental patterns defining morphological characters in spores of four species in *Glomus*. *Mycologia* **89**: 72-81.

Wu, C.-G. 1993. Glomales of Taiwan: A comparative study of spore ontogeny in *Sclerocystis* (Glomaceae, Glomales). *Mycotaxon* **47**: 25-39.

MYCOTAXON

Volume LXXIV(2), pp. 343-356 April-June 2000

NEW TAXA OF USTILAGINOMYCETES

KÁLMÁN VÁNKY

Herbarium Ustilaginales Vánky (HUV)
Gabriel-Biel-Str. 5, D-72076 Tübingen, Germany

ABSTRACT

Proposed new taxa: Cintractiaceae K. Vánky (type *Cintractia*), *Restiosporium* K. Vánky (type *R. meneyae* K. Vánky, sp. nov., on *Lyginia barbata*), *Anthracoidea wakatipu* K. Vánky (type on *Carex wakatipu*). Three new combinations into the genus *Restiosporium*, and twenty-four into the genus *Moreaua* are proposed. *Tolyposporium* is considered a monospecific genus restricted to host plants in the Juncaceae. *Restiosporium* is restricted to host plants in the Restionaceae, and *Moreaua* to host plants in the Cyperaceae.

INTRODUCTION

Intensive study of smut fungi during the last three decades resulted not only in the description of new species and genera, but also in the elaboration of a new classificatory system (Bauer et al., 1997, Begerow et al., 1997, Vánky, 1999b) based on ultrastructural, molecular and classical morphological characters. In this new, but still not definite system, the c. 1450 known "classical" smut fungi (those possessing teliospores) are classified into 2 classes, 8 orders, 17 families, and 71 genera. The family Ustilaginaceae L.-R. & C. Tul., emend. R. Bauer & Oberw., possessing poreless septa, intracellular hyphae coated by an electron-opaque matrix, and phragmobasidia, represents a heterogeneous assemblage of 22 genera. Recently, based on the production of typical two-celled basidia, the genus *Anthracoidea* was separated from the Ustilaginaceae into the Anthracoideaceae Denchev (1997:413).

MATERIALS AND METHODS

For materials and methods see Vánky, 1994:8-9.

RESULTS AND DISCUSSION

Germination of several *Cintractia* species (*C. amazonica* H. & P. Sydow, *C. axicola* (Berk.) Cornu (including *C. peribebuyensis* (Speg.) Sawada), *C. limitata* Clinton, *C. mitchellii* K. Vánky, *C. taubertiana* (Henn.) Clinton) shows an unusual pattern (comp. Nene & Bhelwa, 1976, Ingold, 1995, 1999, Piepenbring, 1996, Piepenbring et al., 1999, Vánky, 1997a:164, Fig. 12). Namely, the cells of the four-celled basidium conjugate pairwise, and from each conjugated pair a relatively large blastoconidium is produced. This is probably dikaryotic and is borne on a well-defined sterigma. In connection with this unusual and striking pattern of teliospore germination in species of *Cintractia*, Ingold (1999:1072) wrote: "it is clear that the course of teliospore germination departs considerably from the standard *Ustilago* type". Based on these observations, and on a combination of other characters of *Cintractia* Cornu (type *C. axicola*), I am proposing a new family:

Cintractiaceae K. Vánky, **fam. nov.**

Membrum ordinis Ustilaginales G. P. Clinton, emend. R. Bauer & Oberw., subcl. Ustilaginomycetidae Jülich, emend. R. Bauer & Oberw., cl. Ustilaginomycetes R. Bauer, Oberw. & K. Vánky. Sori in superficie plantarum nutriciarum familiae Cyperaceae in statu juvenili plerumque mambrana fungali cooperti. Massa sporarum nigra, e sporis singulis, pigmentatis (rubro-brunneis) composita. Germinatio sporarum phragmobasidiis 4-cellularibus. Cellulae binae compatibiles basidii unitae blastoconidium unum magnum, verisimiliter dicaryoricum in sterigmate producentes; multo rarius etiam basidiosporas producentes. Interactio plantae et parasitae eius per hyphas intracellulares, matrice electronopaca circumdatas, septis evolutis sine poris. Genus typicum: *Cintractia* Cornu, Ann. Sci. Nat. Bot., Sér. 6, 15:279, 1883.

Member of the ord. Ustilaginales G. P. Clinton, emend. R. Bauer & Oberw., subcl. Ustilaginomycetidae Jülich, emend. R. Bauer & Oberw., cl. Ustilaginomycetes R. Bauer, Oberw. & K. Vánky. Sori on the surface of host plants belonging to the Cyperaceae family, when young usually covered by a fungal membrane. Spore mass black, composed of single, pigmented (reddish-brown) spores. Spore germination results in 4-celled phragmobasidia. Compatible basidial cells fuse two by two giving rise to a large, probably dikaryotic blastoconidium on a sterigma; more rarely also basidiospores are produced. Host-parasite interaction by intracellular hyphae coated by an electron-opaque matrix, mature septa are poreless. Type genus: *Cintractia* Cornu.

Tolyposporium Woronin ex Schröter (type: *T. junci*) also belongs to the Ustilaginaceae. In its present circumscription, *Tolyposporium* is still heterogenous (comp. Vánky, 1987:116), comprising spore-ball-forming smut fungi on host plants belonging to the families of Juncaceae, Cyperaceae and Restionaceae. Studying these smut fungi, I wrote (Vánky, 1998:521): "There is, however, some evidence that '*Tolyposporium*' species on these three host families are generically different, each genus being restricted to host plants of the same family". It is now appropriate to realize this idea, to describe *Restiosporium* for the smut fungi on Restionaceae, and place the "*Tolyposporium*" species on Cyperaceae into the genus *Moreaua* T. N. Liou & H. C. Cheng, available for them. *Tolyposporium* is considered to be a monospecific genus on host plants belonging to the Juncaceae.

In ***Tolyposporium junci*** (Schröter) Woronin ex Schröter, in Cohn (Aug. 27) 1887:276 (type on *Juncus bufonius* L.) the sori are external, naked, tumour-like, black, agglutinated, on the surface of the flowers, or part of them, around the axis of the spikelets, less often at the base of the floral stems and basal leaves. *Spore balls* are persistent, variable in shape and size, globose, subglobose, elongate or irregular, 16–50(–80) µm long, opaque, dark reddish-brown to blackish-brown, composed of 3–40 or more spores. The spore balls are formed in the central (basal) part of the sorus. From the mass of more or less radially arranged sporogenous hyphae growing out of the host tissue, thin-walled, colourless groups of irregular, often elongated spore initials appear. These increase in size, become rounded, and the dark outer wall appears, "cementing" the young spores together into spore balls. Older spore balls are successively pushed toward the periphery by newly-formed spore balls, but they remain in contact with the host through the elongated sporogenous hyphae, which disappear at maturity of the spores. The mature spore balls successively reach the surface of the naked sorus and become dispersed (comp. Vánky, 1994:276, Figs. A, B. C). *Spores* are subglobose to more or less angular, often subcuneiform and irregular, 6–13 x 8–17(–20) µm, dark yellowish-brown to blackish-brown, smooth on the contact surface and with irregular warts or tubercles on the free, slightly convex surface. The wall is unequally thickened (0.5–4 µm), two-layered. *Spore germination* (after a resting period, in water), usually results in four-celled basidia with basidiospores borne at the septa (Woronin, 1881(1882):575, Brefeld, 1895:150, Pl. IX, figs. 13–24). On Juncaceae: *Juncus bufonius* L. and *J. capitatus* Weigel, Europe, North America.

Typical for *Tolyposporium* are the sori on the surface of different organs of the host plant, the formation of the spore balls from a basal, hyaline mass of sporogenous hyphae, the permanent spore balls held together by a thick matrix, appearing electron-opaque in TEM, the coarsely ornamented free surface of the spores, and the spore germination.

The genus ***Heterotolyposporium*** K. Vánky, with two known species (type: *H. lepidospermae* K. Vánky), differs from the genus *Tolyposporium* in having concommitantly two different kinds of spores, mixed in the sori (Vánky, 1997b).

The smut fungi of Restionaceae.

On members of the Restionaceae family four smut fungi have been published: **1.** *Thecaphora leptocarpi* Berk. **2.** *Tolyposporium lepidoboli* McAlp., **3.** *T. restionum* (Nees) Websdane et al., and **4.** *Websdanea lyginiae* (Websdane, Shivasithamparam, Dixon & Pate) K. Vánky (based on *Ustilago lyginiae*).

All known smut fungi on Restionaceae form spore balls composed of pigmented spores only. For this reason they were placed into the genus *Thecaphora* Fingerh., or into the genus *Tolyposporium* Woronin ex Schröter. These two genera differ morphologically (comp. Vánky, 1987, 1998) and also in their molecular characters (comp. Begerow, et al., 1997). Furthermore, species of *Thecaphora* parasitise dicotyledonous host plants, those of *Tolyposporium* monocotyledonous ones. In the new classificatory system, *Thecaphora* belongs to the Glomosporiaceae Cif. emend. Begerow, R. Bauer & Oberw., *Tolyposporium* to the Ustilaginaceae L.-R. & C. Tul., emend. R. Bauer & Oberw.

The smut fungi of Restionaceae, except for *Websdanea lyginiae*, form their sori in the capsules, replacing the seeds by a black, granular powdery mass of spore balls. These are produced within a hyaline mass of sporogenous hyphae. The sori in *T. junci* and "*Tolyposporium*" species on Cyperaceae are external, on the surface of the host tissues. The morphology of the spore balls, spores and spore walls is also different in these groups of smut fungi (comp. Websdane, 1995:27, Fig. 2.1, Piepenbring et al., 1998, Figs. 62, 64). The spore balls in *T. junci* and "*Tolyposporium*" species on Cyperaceae are rather permanent and it is often difficult or impossible to separate them into spores. The spores are often wedge-shaped, with thick wall on the free surface. The spore balls of the smut fungi of Restionaceae are rather loose, easily separating, the spores are rounded or polyhedrally irregular, the spore wall is uniformly thick. In the only successful spore germination of a smut of Restionaceae (excepting *Websdanea*), the resulting basidia were four-celled. Compatible basidial cells fused pairwise by long copulation bridges. Such fusion of basidial cells is typical for *Cintractia* species, but was not observed in *T. junci* and "*Tolyposporium*" species on Cyperaceae. The few molecular data published (Piepenbring et al., 1999) show that *T. junci* and "*Tolyposporium*" *rhynchosporae-cephalotis* K. & T. Vánky are not related.

Based on the differences in sorus structure, development and morphology of spore balls and spores, and in spore germination of *Tolyposporium junci*, smut fungi of Restionaceae and species of "*Tolyposporium*" of Cyperaceae, I am proposing the recognition of three genera, each genus restricted to host plants in the same family. Actually, the smut fungi of Restionaceae cannot be included in any earlier known genus (comp. Vánky, 1987). Molecular data also support the splitting of *Tolyposporium* sensu lato. The following new taxa and recombinations are proposed:

Restiosporium K. Vánky, **gen. nov.**

Sori semina in fructibus plantarum familiae Restionaceae massa glomerulorum sporarum nigra, granuloso-pulverea, in massa hypharum sporogenearum differentiata substituentes. *Glomeruli sporarum* satis laxi, e sporis tantum compositi. Peridium, columella et cellulae steriles absentes. *Sporae* pigmentiferae. *Germinatio sporarum* (si nota) phragmobasidiis 4-cellularibus, quorum cellulae basidiales binatim fusae. Interactio inter matricem et parasitam per hyphas parasiticae intracellulares indumento electronopaco circumdatae. Septa matura sine poris. Plantae masculinae affectae gynoeceum simul cum soris producentes. Typus generis: *R. meneyae*.

Sori in the fruits of plants in the Restionaceae family, replacing the seeds by a black, granular powdery mass of spore balls differentiating within a mass of sporogenous hyphae. Spore balls rather loose, composed of spores only. Peridium, columella and sterile cells are lacking. Spores pigmented. Spore germination (where it is known) results in four-celled phragmobasidia in which basidial cells fuse pairwise. Parasitic hyphae intracellular coated by an electron-opaque matrix. Mature septa are poreless. Attacked male plants develop gynoecia with sori. Typus generis:

Restiosporium meneyae K. Vánky, **sp. nov.**

Typus in matrice *Lyginia barbata* (Labill.) R. Br., Australia, Western Australia, cca. 200 km N urbe Perth, Dandaragan Distr., Brand Hwy inter Cataby Roadhouse et Badgingarra, 30°33'27" S, 115°28'20" E, alt. cca. 200 m, 30.I.1996, leg. K. Websdane, C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 17938!), isotypi in PERTH et in Vánky, Ust. exs. No. 1075. Paratypi: idem, 25.II.1992, leg. K. Meney (UWA, HUV 17161!); WA, 19 km SE urbe Perth, 32°05'13" S, 115°58'40" E, XI.1992, leg. K. Meney (UWA, HUV 17162!); WA, Albany Distr., 15 km S urbe Albany, Torndirrup National Park, 35°06'30" S, 117°57' E, alt. 150 m, 11.II.1996, leg. C. et K. Vánky (PERTH, HUV 17940!).

Sori inconspicui, in capsulis, eas massa glomerulorum sporarum nigra, granuloso-pulverea implentes. Plantae infectae masculinae capsulas cum sporis producentes. Infectio systemica, flores omnes eiusdem plantae infectae. Capsulae infectae minores et plures quam illae plantarum salvarum feminearum. *Glomeruli sporarum* forma et magnitudine varii, ovoidei, elongati vel irregulares, 40–70(–80) x 50–100(–120) µm, atro-olivaceobrunnei, e multitudine magna (pluries decem usque pluries centum) sporarum faciliter sejunctarum compositi. Glomeruli sporarum ex cavitis hypharum sporogenearum in massa hyalina hypharum concentratis evoluti. *Sporae* forma et magnitudine variae, subglobosae, ovoideae, elongatae, plerumque subpolyhedriciter vel polyhedriciter irregulares, sub microscopio luce transeunte (LM) visu superficiali acies acutos sicut lineas in superficie sporarum ostendentes, sporae 7–10 x 9–14 µm, olivaceo-brunneae; pariete tenui, aequali (0,5–1 µm crasso), conspicue levi.

Sori (Fig. 1) inconspicuous, in the capsules filled with black, granular-powdery mass of spore balls. Infected male plants develop capsules with spores. Infection systemic, all flowers of a plant being infected. Infected capsules smaller and in greater number per culm than those of healthy female plants. *Spore balls* (Figs. 2, 3) variable in shape and size, ovoid, elongated or irregular, 40–70(–80) x 50–100(–120) µm, dark olivaceous-brown, composed of a great number (tens to hundreds) of easily separating spores. Spore balls develop (Fig. 4) from concentrated groups of sporogenous hyphae within a hyaline mass of hyphae. *Spores* (Figs. 2, 3) variable in shape and size, subglobose, ovoid, elongated, usually subpolyhedrally or polyhedrally irregular, in LM often with acute edges showing as lines on the spore surface when the spores are seen in surface view, spores 7–10 x 9–14 µm, olivaceous-brown; wall thin, even (0.5–1 µm thick), apparently smooth.

Etymology: *Restio-* from the host family Restionaceae, *-sporium* is the ending of many spore-ball-forming smut genera. *R. meneyae* is named after the excellent specialist of Restionaceae, Dr. Kathy Meney (Perth, Australia), who also collected many smut fungi, including, for the first time, this species.

1

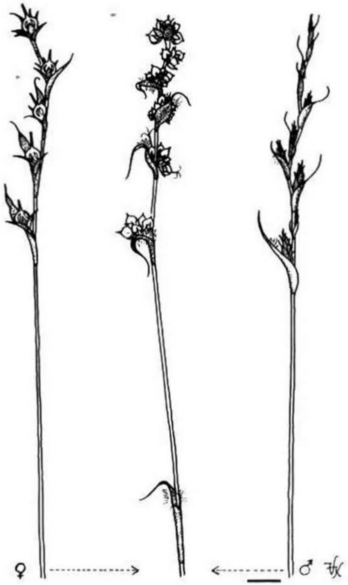


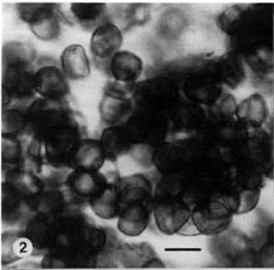
Fig. 1. Sori of *Restiosporium meneyae* K. Vánky in the capsules of *Lyginia barbata* (Labill.) R. Br. (type). To the left a healthy female plant, to the right a healthy male plant, in the middle an infected female or male plant. Bar = 1 cm.

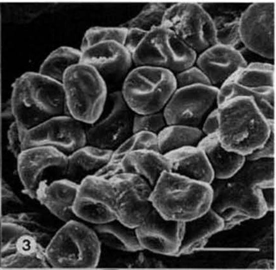
Figs. 2, 3. Spores of *Restiosporium meneyae* K. Vánky on *Lyginia barbata* (Labill.) R. Br. in LM and in SEM (type). Bars = 10 µm.

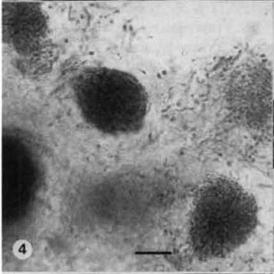
Fig. 4. Spore ball formation of *Restiosporium meneyae* (type). Bar = 10 µm.

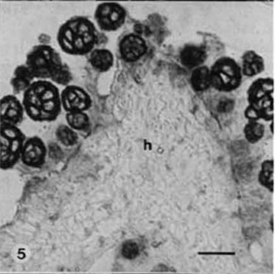
Fig. 5. Spore ball formation of *Moreaua aterrima* (L.-R. & C. Tul.) K. Vánky on *Carex caryophyllea* Latourr. (HUV 2044). h = host tissue. Bar = 25 µm.

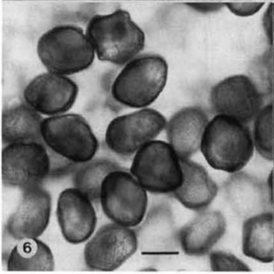
Figs. 6, 7. Spores of *Anthracoidea wakatipu* K. Vánky on *Carex wakatipu* Pertie, in LM and in SEM (type). Bars = 10 µm.

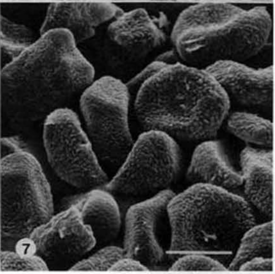

2


3


4


h
5


6

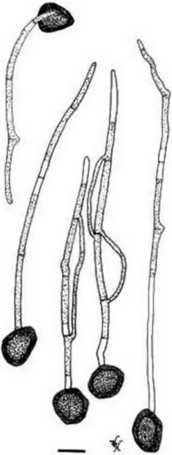

7

The following three species also belong to the genus *Restiosporium*:

Restiosporium lepidoboli (McAlpine) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium lepidoboli* McAlpine, Proc. Linn. Soc. New South Wales 29:127, 1904. – Type on *Lepidobolus drapetocoleus* F. Muell., Australia.

Restiosporium leptocarpi (Berkeley) K. Vánky, **comb. nov.**
Basionym: *Thecaphora leptocarpi* Berkeley, J. Linnean Soc. Bot 18:388, 1881. – Type on *Leptocarpus tenax* R. Br., Australia.

Restiosporium restionum (Nees) K. Vánky, **comb. nov.**
Basionym: *Uredo restionum* Nees, in Lehmann, Pl. Preiss. Enum. 2:59, 1846. – *Tolyposporium restionum* (Nees) Websdane, Sivasithamparam, Dixon & Meney, 1994:473. – Type on *Restio nitens* Nees (= *Alexgeorgea nitens* (Nees) L. Johnson & B. Briggs), Australia.



8

Fig. 8. Germinating spores of *Restiosporium* sp. on *Lepidobolus chaetocephalus* F. Mueller (on WA, at room temp., in 3 weeks; spores previously treated with Amisept; Dr. R. Bauer; HUV 17979) Bar = 10 µm

Tolyposporium being considered a monospecific genus, restricted to the Juncaceae, the spore ball forming smut fungi on Cyperaceae belong to another genus. For these smuts the genus *Moreaua* is available.

Moreaua T. N. Liou & H. C. Cheng, 1949:209, emend. K. Vánky.
Sori naked on the surface of inner floral organs of Cyperaceae, composed of black, granular-powdery mass of spore balls. Columella, peridium and sterile cells are lacking. *Spore balls* composed of rather firmly united spores. *Spores* usually wedge-shaped, pigmented (reddish- or blackish-brown), wall thick on the free surface. *Spore germination* results in four-celled phragmobasidia with sessile basidiospores. *Host-parasite interaction* by intracellular hyphae coated by an electron-opaque matrix. Mature *septa* are poreless. Typus generis: *Moreaua kungii* T. N. Liou & H. C. Cheng (= *Thecaphora aterrima*, = *Moreaua aterrima*).

Moreaua aterrima (L.-R. & C. Tulasne) K. Vánky, **comb. nov.**
Basionym: *Thecaphora aterrima* L.-R. & C. Tulasne, Ann. Sci. Nat. Bot., Sér. 3, 7:110, 1847. – *Tolyposporium aterrimum* (L.-R. & C. Tulasne) Dietel, in Engler & Prantl, 1897:14. – Lectotype (designated by Liro, 1938:310) on *Carex praecox* Jacq. [= *C. caryophyllea* Latourr.], France, Vienne Dépt., Pictavia [= Poitiers], coll. S. Delacroix.

Sorosporium atrum Peck, 1880:35. – Type on *Carex pennsylvanica* Lam., USA, Colorado, 6000 ft, VI, M. E. Jones.

Sorosporium flahaultii Boyer & Jaczewski, 1894:CCLXXVII. – Type on *Carex olbiensis* Jordan, France, Hérault Dépt., "Bois de Montarnaud" near Montpellier, Ch. Flahault.

Sorosporium caricis Ferraris, 1902:191. – Type on *Carex praecox* Schreb., Italy, Piemonte, Pinerolo, V.1861, A. Carestia.

Moreaua kungii T. N. Liou & H. C. Cheng, 1949:209. – Type on *Carex* sp., China, Shensi, Chow-chih-hsien, Low-kwan-tai, on river bank, 22.IV.1938, H. W. Kung (55). Isotype in HUV 11698!

Sori on filaments and the base of bracts of staminate flowers, only exceptionally on more or less aborted perigynia, as a black, granular-powdery mass of spore balls concealed by the bracts. Infection systemic. Infected female flowers are more or less completely transformed into male flowers. *Spore balls* globose, ovoid to irregular, 16–45 μm long, yellowish-brown to blackish-brown, persistent, composed of (1–)2–15(–more?) spores. *Spores* subglobose, semiglobose, subcuneiform, polyhedral to irregular, flattened and smooth on the contact sides, convex, thick-walled, finely and densely verruculose on the free surface, 7–14 x 10–16 μm in diameter, light yellowish-brown to dark olivaceous-brown. *Spore germination* results in phragmobasidia on which ovoid basidiospores are produced laterally or often terminally. Basidiospores germinate giving rise to chains or groups of yeast-like cells. After conjugation of basidial cells, or of basidiospores, hyphae may result (Cocconi, 1890:706, Pl. I(3), figs. 1–11; Liou & Cheng, 1949, Pls. IV-VI).

On Cyperaceae: at least on fifteen *Carex* spp. in Europe, Asia, North America.

Further smut fungi belonging to the genus *Moreaua* are:

Moreaua caustidis (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium caustidis* K. Vánky, in Vánky & Websdane, Mycotaxon 58:177, 1996. – Type on *Caustis blakei* Kük., Australia.

Moreaua cyathochaetae (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium cyathochaetae* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon 58:180, 1996. – Type on *Cyathochaeta avenacea* Benth., Australia.

Moreaua epischoeni (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium epischoeni* K. Vánky, Mycotaxon 70:20, 1999a. – Type on *Epischoenus gracilis* Levyns, South Africa.

Moreaua evandrae (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium evandrae* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon 58:175, 1996. – Type on *Evandra aristata* R. Br., Australia.

Moreaua fischeri (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium fischeri* K. Vánky, Mycotaxon 48:29, 1993. – Type on *Rhynchospora plumosa* Ell., USA.

Moreaua gahniae (K. & C. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium gahniae* K. & C. Vánky, in Vánky, Mycotaxon 62:154, 1997a. – Type on *Gahnia radula* (R. Br.) Benth., Australia.

Moreaua gymnoschoeni (K. & C. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium gymnoschoeni* K. & C. Vánky, in Vánky, Mycotaxon 62:163, 1997a. – Type on *Gymnoschoenus sphaerocephalus* (R. Br.) Hooker fil., Australia.

Moreaua kochiana (Gäumann) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium kochianum* Gäumann, Ber. Schweiz. Bot. Ges. 41:179, 1932. – Type on *Schoenus nigricans* L. x *ferrugineus* L., Switzerland.

Moreaua laevigata (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium laevigatum* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon, 56:224, 1995. – Type on *Schoenus laevigatus* W. Fritzg., Australia.

Moreaua lepidospermae (McAlpine) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium lepidospermae* McAlpine, The smuts of Australia, p. 188, 1910. – Type on *Lepidosperma angustatum* R. Br., Australia.

Moreaua littoralis (G. Cunningham) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium littorale* G. Cunningham, Trans. & Proc. New Zealand Inst. 56:77, 1926. – Type on *Cladium huttonii* Kirk. (= *Baumea arthrophylla* (Nees) Boeckeler), New Zealand.

Moreaua mauritiana (H. Sydow) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium mauritianum* H. Sydow, Ann. Mycol. 37:201, 1939. – Type on *Fimbristylis* sp., Mauritius.

Moreaua megaglomerulosa (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium megaglomerulosum* K. Vánky, Mycotaxon 65:147, 1997c. – Type on *Lepidosperma gunnii* Boeck, Australia.

Moreaua melanospora (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium melanosporum* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon 58:170, 1996. – Type on *Mesomelaena graciliceps* (C. B. Clarke) K. L. Wilson, Australia.

Moreaua mesomelaenae (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium mesomelaenae* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon 58:169, 1996. – Type on *Mesomelaena pseudostygia* (Kük.) K. L. Wilson, Australia.

Moreaua muelleriana (Thümen) K. Vánky, **comb. nov.**
Basionym: *Sorosporium muellerianum* Thümen, Flora 61:444, 1878. – Type on *Cladium filum* R. Br. (= *Gahnia trifida* Labill.), Australia.

Moreaua rhynchosporae (Hennings) K. Vánky, **comb. nov.**
Basionym: *Sorosporium rhynchosporae* Hennings, Hedwigia 35:222, 1896. – Type on *Rhynchospora glauca* Vahl (= *Rhynchospora rugosa* (Vahl) S. Gale), Brazil.

Moreaua rhynchosporae-cephalotis (K. & T. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium rhynchosporae-cephalotis* K. & T. Vánky, in Vánky, Mycotaxon 48:29, 1993. – Type on *Rhynchospora cephalotes* (L.) Vahl, Costa Rica.

Moreaua rodwayi (McAlpine) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium rodwayi* McAlpine, The smuts of Australia, p. 189, 1910. – Type on *Lepidosperma laterale* R. Br., Australia.

Moreaua schoeni (K. Vánky & McKenzie) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium schoeni* K. Vánky & McKenzie, in Vánky & Websdane, Mycotaxon 56:227, 1995. – Type on *Schoenus brevifolius* R. Br., New Zealand.

Moreaua tetrariae (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium tetrariae* K. Vánky, Mycotaxon 62:160, 1997a. – Type on *Tetraria capillaris* (F. Mueller) J. M. Black, Australia.

Moreaua tricostulariae (Websdane & K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium tricostulariae* Websdane & K. Vánky, in Vánky & Websdane, Mycotaxon 58:178, 1996. – Type on *Tricostularia neesii* Lehm., Australia.

Moreaua tristis (K. Vánky) K. Vánky, **comb. nov.**
Basionym: *Tolyposporium triste* K. Vánky, Mycotaxon 62:154, 1997a. – Type on *Gahnia tristis* Nees, China.

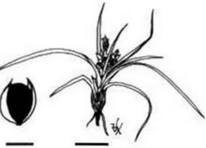
During work with the smut fungi of New Zealand, an *Anthracoidea* species was found on the endemic *Carex wakatipu* Petrie of the subgen. *Carex*, sect. *Echinolaenae*. No smut fungus has been reported on this sect. of *Carex*. It is described as:

Anthracoidea wakatipu K. Vánky, sp. nov.

Typus in matrice *Carex wakatipu* Petrie, New Zealand, South Island, Cardrona Valley, XI.1963, B. P. J. Molly. Holotypus in PDD 23213!, isotypus in Herbario Ustil. Vánky HUV 16724!

Sori in ovariis nonnullis inflorescentiae corpora nigra, dura, globosa, 1–1,5 mm diametro, circum nuces e sporis agglutinatis composita, superficie pulverea formantes. *Sporae* parvae, parum depressae, visu laterali 8–10 µm latae, in visu plano angulares-irregulares, polyangulares, elongatae, nonnunquam apicibus acutis, rarius rotundatae, saepe cum protuberantia una vel illis nonnullis, 10,5–16 x (12–)13,5–20(–24) µm, mediocriter rubrobrunneae; pariete inaequaliter incrassato, 1–2,5 µm, maxime incrassato ad angulos et protuberantias, saepe in area maxime incrassata locis luce refractivis, sine incrassationibus internis, superficie tenuiter, dense verruculosa; linea extrema sporae levis, usque valde tenuiter undulata.

Sori (Fig. 9) in some ovaries of the inflorescence forming black, hard, globose bodies around the nuts, 1–1.5 mm in diameter, composed of agglutinated spores, powdery on the surface. *Spores* (Figs. 6, 7) small, slightly flattened, in side view 8–10 µm wide, in plane view angular-irregular, polyangular, elongated, sometimes with acute tips, more rarely rounded, often with one or several protuberances, 10.5–16 x (12–)13.5–20(–24) µm, medium reddish-brown; wall unevenly thickened, 1–2.5 µm, thickest at the angles and protuberances, often with light-refractive spots in the thickest area, internal swellings lacking; surface finely, densely verruculose, spore profile smooth to very finely wavy.



9

Fig. 9. Sori of *Anthracoidea wakatipu* K. Vánky around the nuts of *Carex wakatipu* Petrie. Enlarged a sorus (type). Bars = 1 mm (left), 1 cm (right).

ACKNOWLEDGEMENTS

I am grateful to Dr. S. Tóth (Gödöllő, Hungary) for providing the Latin descriptions, to Dr. E. H. C. McKenzie (Auckland, New Zealand) for reading the manuscript and serving as pre-submission reviewer, to Dr. K. Websdane (Perth, Australia) for her help in collecting smutted Restionaceae, and to Dr. R. Bauer (Tübingen, Germany) for germination of a *Restiosporium* sp. Part of the work was carried out at the University of Tübingen, Institute of Special Botany and Mycology (director Prof. Dr. F. Oberwinkler).

LITERATURE CITED

Bauer, R., Oberwinkler, F. & Vánky, K. 1997. Ultrastructural markers and systematics in smut fungi and allied taxa. – Canad. J. Bot. 75:1273-1314.

Begerow, D., Bauer, R. & Oberwinkler, F. 1997. Phylogenetic studies on nuclear large subunit ribosomal DNA sequences of smut fungi and related taxa. – Canad. J. Bot. 75:2045-2056.

Berkeley, M. J. 1881. Australian fungi. II. Received principally from Baron F. von Mueller. – J. Linn. Soc. Bot. 18:383-389.

Boyer, G. & Jaczewski, A. 1894. Matériaux pour la flore mycologique des environs de Montpellier. – Bull. Soc. Bot. France 40:CCLX-CCXCVIII.

Brefeld, O. 1895. Untersuchungen aus dem Gesammtgebiete der Mykologie. XII. Hemibasidii. Brandpilze III. – Münster i. W., Commissions-Verlag v. H. Schöningh. IV + 99-236 pp. + Pls. VI-XII.

Cocconi, G. 1890. Sullo sviluppo della *Thecaphora aterrima* Tul., e dell *Urocystis primulicola* Magnus. – Mem. Reale Accad. Sci. Ist. Bologna, Ser. 4, 10:703-714 + Pls. I-II.

Cornu, M. 1883. Sur quelques Ustilaginées nouvelles ou peu connues. – Ann. Sci. Nat. Bot., Sér. 6, 15:269-296.

Cunningham, G. H. 1926. Third supplement to the Uredinaceae and Ustilaginaceae of New Zealand. – Trans. & Proc. New Zealand Inst. 56:74-80.

Denchev, C. M. 1997. Anthracoideaceae, a new family in the Ustilaginales. – Mycotaxon 65:411-417.

Dietel, P. 1897. Hemibasidii (Ustilagineae und Tilletiineae). In Engler & Prantl, Die Natürlichen Pflanzenfamilien. I(1)**:2-24.

Ferraris, T. 1902. Reliquie Cesatiane II. Primo elenco di funghi del Piemonte. – Annuario Reale Ist. Bot. Roma 9:187-220.

Gäumann, E. 1932. Ueber eine neue Ustilaginee. – Ber. Schweiz. Bot. Ges. 41:179.

Hennings, P. 1896. Beiträge zur Pilzflora Südamerikas I. Myxomycetes, Phycomycetes, Ustilagineae und Uredineae. – Hedwigia 35:207-262.

Ingold, C. T. 1995. Blastoconidium production from conjugated basidial cells in *Cintractia*. – Mycol. Res. 99:140-142.

— 1999. The *Cintractia* pattern of teliospore germination. – Mycol. Res. 103:1071-1072.

Liou, T. N. & Cheng, H. C. 1949. *Moreaua*, a new genus of Ustilaginaceae. – Contr. Inst. Bot., Natl. Acad. Peiping 6:209-217.

Liro, J. I. 1938. Die Ustilagineen Finnlands II. – Ann. Acad. Sci. Fenn., Ser. A, 42(1):1-720.

McAlpine, D. 1904. Australian fungi, new or unrecorded. Decades VII-VIII. – Proc. Linn. Soc. New South Wales 29:117-127.

— 1910. The Smuts of Australia, etc. – Melbourne, 285 pp.

Nees v. Esenbeck, C. G. 1846-1847. In Lehmann, C., Plantae preissianae, etc. Vol. II. – Hamburgii, Sumptibus Meissneri.

Nene, K. M. & Bhelwa, P. W. 1976. Morphological and cytological studies in *Cintractia axicola*. – Indian Phytopathol. 29:39-42.

Peck, H. C. 1880. New species of fungi. – Bot. Gaz. (Crawfordsville) 5:33-36.

Piepenbring, M. 1996. Smut fungi (Ustilaginales and Tilletiales) in Costa Rica. – Beih. Nova Hedwigia 113:1-155.

—, Bauer, R. & Oberwinkler, F. 1998. Teliospores of smut fungi. Teliospore walls and the development of ornamentation studied by electron microscopy. – Protoplasma 204:170-201.

—, Begerow, D. & Oberwinkler, F. 1999. Molecular sequence data assess the value of morphological characteristics for a phylogenetic classification of species of *Cintractia*. – Mycologia 91:485-498.

Schröter, J. 1887. Ustilaginei. In Cohn, Kryptogamen-Flora von Schlesien 3(1):261-291. J. U. Kerns Verlag, Breslau.

Sydow, H. 1939. Novae fungorum species. XXVII. – Ann. Mycol. 37:197-253.

Thümen von, F. 1878. Symbolae ad floram mycologicam Australiae. II. – Flora 61:440-444.

Tulasne, L.-R. & Tulasne, C. 1847. Mémoire sur les Ustilaginées comparées aux Urédinées. – Ann. Sci. Nat. Bot., Sér. 3, 7:12-127 + Pls. 2-7.

Vánky, K. 1987. Illustrated genera of smut fungi. – Cryptogamic Studies 1:1-159 (ed. W. Jülich). Gustav Fischer Verlag, Stuttgart/New York.

— 1993. Taxonomical studies on Ustilaginales. X. – Mycotaxon 48:27-44.

— 1994. European smut fungi. – Gustav Fischer Verlag, Stuttgart, Jena, New York, 570 pp.

— 1997a. New Ustilaginales from Australia. – Mycotaxon 62:151-174.

— 1997b. *Heterotolyposporium*, a new genus of Ustilaginales. – Mycotaxon 63:143-154.

— 1997c. Taxonomical studies on Ustilaginales. XVI. – Mycotaxon 65:133-158.

— 1998. A survey of the spore-ball-forming smut fungi. – Mycol. Res.102:513-526.

— 1999a. New smut fungi from South Africa. – Mycotaxon 70:17-34.

— 1999b. The new classificatory system for smut fungi, and two new genera. – Mycotaxon 70:35-49.

— & Websdane, K. 1995. Ustilaginales of *Schoenus* (Cyperaceae). – Mycotaxon 56:217-229.

— & — 1996. New Ustilaginales on Cyperaceae from Australia. – Mycotaxon 58:167-183.

Websdane, K. A. 1995. Smut fungi (Ustilaginales) infecting rushes (Restionaceae) and sedges (Cyperaceae) in Western Australia. – Doctoral Thesis. University of Western Australia, Dept. of Soil Science and Plant Nutrition, 173 pp.

—, Sivasithamparam, K., Dixon, K. W. & Meney, K. A. 1994. *Tolyposporium restionum* comb. nov. on *Alexgeorgea species* (Restionaceae) in Western Australia. – Mycotaxon 51:471-477.

Woronin, M. 1881(1882). Beitrag zur Kenntnis der Ustilagineen. – Abh. Senckenberg. Naturf. Ges. 12:559-591 + 4 Pls.

MYCOTAXON
Volume LXXIV(2), pp. 357-366 April-June 2000

FURTHER NOTES ON THE GENUS OUDEMANSIELLA FROM SOUTHWESTERN CHINA[1]

ZHU-LIANG YANG[2]

Kunming Institute of Botany, Academia Sinica, Kunming 650204,
P. R. China

Abstract

Two species of the genus *Oudemansiella* collected from southwestern China are described and illustrated in detail. One species, *O. orientalis*, is new to science, the other, *O. hongoi*, is a first record for China. Specimens studied are deposited in the cryptogamic herbarium of Kunming Institute of Botany (HKAS).

Key words: *Oudemansiella*, *O. orientalis*, *O. hongoi*, new species, new combination, China

A few of the species of *Oudemansiella* occurring in southwestern China were described and reported several years ago (Yang & Zang, 1993). Recently the author has collected another two noteworthy species of the genus from the region. They are reported herein.

1. *Oudemansiella orientalis* Z. L. Yang, *sp. nov.* Figs. 1-6

Pileus 1.5-8 cm latus, convexus vel subplanus, griseolus vel subfulvus, deinde albidus, albus vel cremeus, viscidus vel glutinosus, marginem versus substriatus. Caro tenuis, albida, inodora. Lamellae adnexae, albae vel cremeae, distantes vel subdistantes; lamellulae praesentes. Stipes 2-8 × 0.2-0.8 cm, subcylindricus, ad basim vix incrassatus, subfulvus vel fulvus, deinde albidus vel pallide fulvus, apicem versus pallidior, pubescens; exannulatus; pseudorrhiza absens. Sporae (10.5-)11.5-14.5(-16.5) × (9.0-)9.5-11.0(-12.0) µm, lato-ellipsoidea vel ellipsoidea, interdum lato-amygdaliformes. Basidia 45-60 × 12-15 µm,

---

[1] The project supported by a grant of the Foundation for Applied Basic Researches of Yunnan Province (no. 98C026Q) and in part by a grant for Systematic and Evolutionary Biology, Chinese Academy of Sciences.

[2] E-mail address: zlyang@public.km.yn.cn

clavata, 4-sporigera, raro 2-sporigera. Pleurocystidia 80-120 × 20-30 µm, fusoidea vel subfusoidea, saepe capitata vel subcapitata. Cheilocystidia 50-250 × 10-20 µm, subclavata, subcylindrica, fusoidea vel lanceolata. Epicutis pilei ex hyphis sphaeropedunculatis, latoclavatis vel clavatis erectis composita. Pileocystidia 45-160 × 10-20 µm, lanceolata, lageniformia vel subcylindrica. Fibulae praesentes. Holotypus: Z. L. Yang 2534 (HKAS 32127), 21. IX. 1998, Sanjiangkou Nat. Res., alt. 1800 m, Mugan, Yiliang, Yunnan, China. Ad lignum emortuum.

Etymology: *orientalis*, from the East.

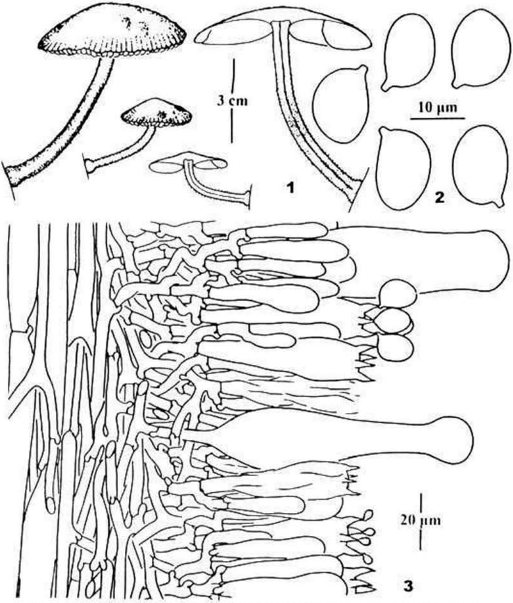
Basidiocarps (Fig. 1) small to medium-sized. Pileus 1.5-8 cm in diam., convex to almost applanate, greyish to brownish (5B2-5B3, Avellaneous, Wood Brown)[3], often becoming whitish to white or cream-coloured (3A2, Cream Color, Chamois) after rainfall, smooth, sometimes rugose in the centre, viscid to strongly glutinous, margin often with radially arranged translucent striations. Context of pileus white; taste mild. Lamellae adnexed, white to cream-coloured, distant to subdistant, with lamellulae. Stipe 2-8 × 0.2-0.8 cm, subcylindrical, brownish to definitely brown (5C6-6C5, Ochraceous-Tawny, Auburn), often becoming whitish, paler towards the apex, pubescent with whitish hairs, without annulus, base of stipe subdiscoid enlarged, without pseudorrhiza. Context of lower part of stipe brown to brownish, apical zone white, hardly fistulate.

Spores (Fig. 2) [140/6/2][4] (10.5-)11.5-14.5(-16.5) × (9.0-)9.5-11.0 (-12.0) µm [Q = (1.06-)1.17-1.39(-1.48), **Q** = 1.28 ± 0.08], broadly ellipsoid to ellipsoid, sometimes broadly amygdaliform, often with a subacute apex but also with an obtusely rounded apex, colourless, hyaline, inamyloid. Basidia (Fig. 3) 45-60 × 12-15 µm, clavate, 4-spored, rarely 2-spored; sterigmata 5-8 µm long; basal clamp connections common. Subhymenium (Fig. 3) not gelatinized, with frequently branching hyphal segments, 3-5 µm wide; clamp connections common. Hymenophoral trama (Fig. 3) consisting of parallel and interwoven hyphae, 3-30 µm wide; clamp connections common. Pleurocystidia (Fig. 3) scattered, 80-120 × 20-30 µm, fusiform to subfusiform, often capitate to subcapitate, hyaline, thin to slightly thick-walled, apex sometimes with hyaline incrustations. Cheilocystidia (Fig. 4) numerous, 50-250 ×

---

[3] Colour codes of the form e.g. 5B2 are from Kornerup & Wanscher (1981); Colour names with first letters capitalized (e.g. Wood Brown) are from Ridgway (1912).

[4] 140 spores from 6 basidiocarps of 2 collections measured in 5% KOH solution; Q is used to mean "length/width ration" of a spore; **Q** means average Q of all specimens ± sample standard deviation.



Figs. 1-3: *Oudemansiella orientalis* (HKAS 32127, holotype). 1. Basidiocarps; 2. Spores; 3. Hymenophoral trama, subhymenium, hymenium and pleurocystidia.

10-20 µm, subclavate, subcylindrical, fusiform or lanceolate, hyaline, thin-walled, sometimes slightly thick-walled, forming a sterile edge along the margin of lamellae. Pileipellis (Fig. 5) an epithelium made up of sphaeropedunculate, broadly clavate to clavate, thin-walled cells (20-50 × 5-30 µm) often with vacuolar brown pigment; clamp connections common. Pileocystidia (Fig. 5) scattered to fairly abundant, 45-160 × 10-20 µm, lanceolate, lageniform to subcylindrical, thin to slightly thick-

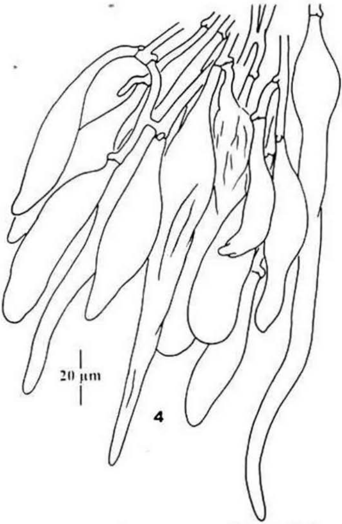


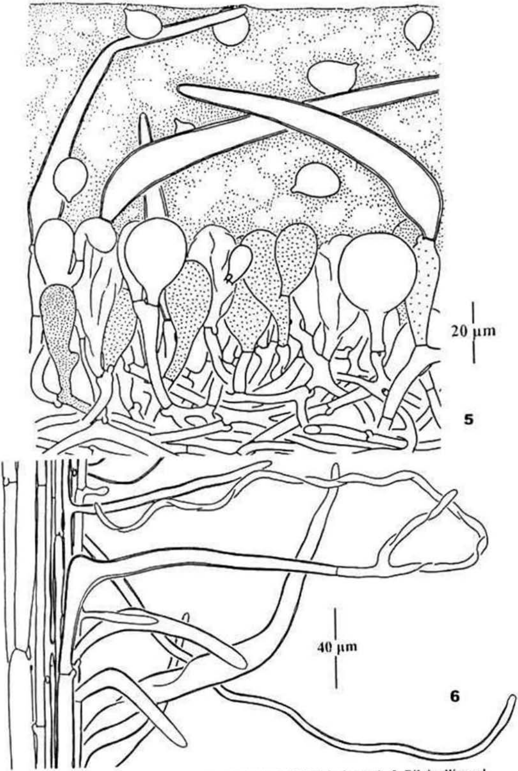
Fig. 4: *Oudemansiella orientalis* (HKAS 32127, holotype). Cheilocystidia.

walled (up to 1 µm thick), often attached on inflated hymeniodermic cells, but also penetrated into the base of epithelium and connected with cylindrical hyphae. Caulocystidia (Fig. 6) 60-450(-650) × 5-20 µm, lanceolate, subfusiform to subcylindrical, hyaline, thin to slightly thick-walled (up to 2 µm thick), sometimes branching, rarely septate. Trama of stipe (Fig. 6) made up of longitudinally arranged hyphae, 2-20 µm wide, thin to slightly thick-walled (up to 1.5 µm thick).

Habitat: On rotten trunk or stump of a broad-leaved tree, in subtropical evergreen broad-leaved forest.

Specimens examined: Yunnan Prov.: Yiliang County, Mugan Township, Sanjiangkou Nature Reserve, alt. 1800 m, 21. IX. 1998, Z. L. Yang 2534 (HKAS 32127, holotype), Z. L. Yang 2535 (HKAS 32021).

Distribution: Only known from the locality cited above.



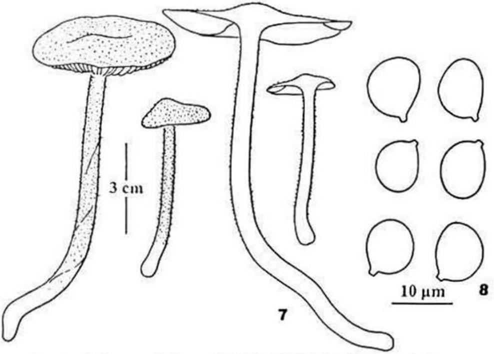
Figs.5-6: *Oudemansiella orientalis* (HKAS 32127, holotype). 5. Pileipellis and pileocystidia; 6. Trama of stipe and caulocystidia.

Note: *Oudemansiella orientalis*, being without a pseudorrhiza on the stipe base, is somewhat similar to species of the subgenus *Oudemansiella*, like *O. mucida* (Schrad.: Fr.) v. Höhn. and *O. canarii* (Jungh.) v. Höhn. However, it differs from the two species by its brownish to brown, slender stipe, ellipsoid, significantly smaller spores, and the presence of pileocystidia and caulocystidia. Furthermore, the basidiocarp development of *O. orientalis* appears to be gynmocarpous based upon observations made in the field. These facts suggest that *O. orientalis* should be put in the subgenus *Xerula*. However, it is not easy to place this taxon in the available sections as defined by Pegler & Young (1986). *Oudemansiella orientalis* posses hyaline caulocystidia and thin to slightly thick-walled pileocystidia, which might place it in section *Albotomentosae*, which, however, usually consists of taxa with dry pileus (Pegler & Young, 1986). In this section, *O. orientalis* is similar to *O. caussei* (Maire) Moser ex Clémençon, of which *O. renati* Clémençon and *O. nigra* Dörfelt are synonyms (Boekhout & Bas, 1986). But it differs from *O. caussei* in its viscid to glutinous, paler pileus, stipe without a pseudorrhiza, larger spores, and narrower pileocystidia (see Boekhout & Bas, 1986). Because of its slightly thick-walled pileocystidia, this species may be also put into the sect. *Xerula* (Pegler & Young, 1986), and it is somewhat similar to *O. americana* (Dörfelt) Pegler & Young and *O. hongoi* (Dörfelt) Z. L. Yang. *Oudemansiella orientalis* differs from the latter two species in its viscid to glutinous, paler pileus, and stipe without pseudorrhiza, in its larger spores, differently shaped pleurocystidia, and somewhat thinner-walled pileocystidia (Mitchel & Smith, 1978, Dörfelt, 1981; and see also descriptions of *O. hongoi* below).

2. *Oudemansiella hongoi* (Dörfelt) Z. L. Yang, *comb. nov.* Figs. 7-11
Basionym: *Xerula hongoi* Dörfelt, *Feddes Repert.* **97:** 401, Abb. 2., Taf. 28/Fig. 6 (1986).

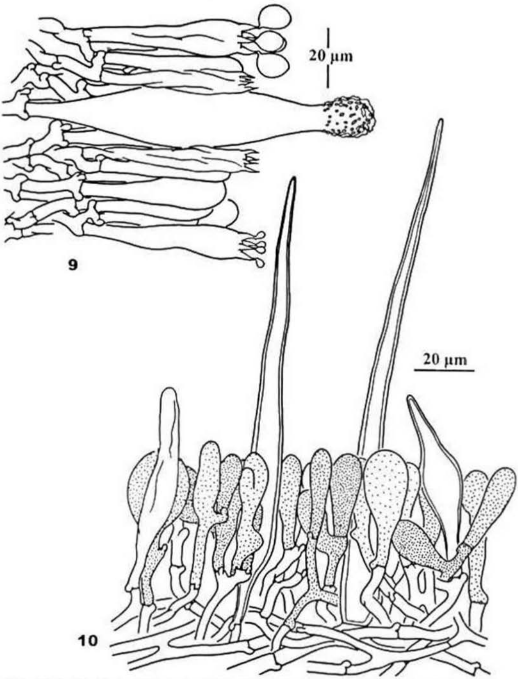
Basidiocarps (Fig. 7) small to medium-sized. Pileus 3-5 cm in diam., convex applanate, often with slightly umbonate centre, not viscid, at first dark grey to blackish, then brown to pale brown, pubescent with whitish hairs, glabrescent. Lamellae adnate, white, rather distant, with lamellulae. Stipe 6-11 × 0.3-0.7 cm, apex whitish, lower part brown, with whitish hairs, with a rudimental pseudorrhiza. Context white, taste mild.

Spores (Fig. 8) [75/3/1] (8.0-)8.5-10.5 × (7.0-)7.5-9.0(-9.5) µm [Q = (1.0-)1.06-1.26(-1.37), **Q** = 1.16 ± 0.06], subglobose to broadly ellipsoid, sometimes broadly amygdaliform, rarely globose, with a subacute or an obtusely rounded apex, colourless, hyaline, sometimes with vacuolar



Figs. 7-8: *Oudemansiella hongoi* (HKAS 32498). 7. Basidiocarps; 8. Spores.

brown pigment, inamyloid. Basidia (Fig. 9) 50 - 65 × 8 -14 µm, clavate, 4-spored; sterigmata 5-6 µm long; basal clamp connections common. Subhymenium (Fig. 9) with frequently branching hyphal segments, 3-5 µm wide; clamp connections common. Hymenophoral trama consisting of parallel and interwoven hyphae, 3-20 µm wide; clamp connections common. Pleurocystidia (Fig. 9) scattered, 65-120 × 15-25 µm, fusiform, usually capitate, often hyaline, sometimes with vacuolar brown pigment, thin to slightly thick-walled (ca. 0.5 µm thick), upper part, especially the apex often with incrustations. Cheilocystidia similar to pleurocystidia, abundant. Pileipellis (Fig. 10) a hymenioderm, made up of broadly clavate to clavate, thin- to slightly thick-walled cells (25-55 × 10-20 µm), most with vacuolar brown pigment; clamp connections common. Pileocystidia (setae) (Fig. 10) 55-150 × 10-15 µm, lanceolate to subfusiform, thin to thick-walled (up to 2.5 µm thick), hyaline or the cell wall of the lower part of pileocystidia becoming brownish pigmented with age. Caulocystidia (Fig. 11) 80-300 × 10-20 µm, often lanceolate, sometimes subfusiform to subcylindrical, hyaline, thin to slightly thick-walled (up to 2 µm thick), unbranching, often caespitose. Trama of stipe (Fig. 11) made up of longitudinally arranged hyphae, 2.5-20 µm wide, thin to slightly thick-walled (up to 1 µm thick), septum often with a clamp connection.



Figs. 9-10: *Oudemansiella hongoi* (HKAS 32498). 9. Hymenium, subhymenium and pleurocystidium; 10. Pileipellis and pileocystidia (setae).

Habitat: On rotten wood among mosses in forest of *Abies* and *Rhododendron*.

Specimen examined: Sichuan Prov.: Xiangcheng County, Daxueshan,

alt. 4100 m, 24. VII. 1998, Z. L. Yang 2415 (HKAS 32498).
Distribution: Japan; new to China.

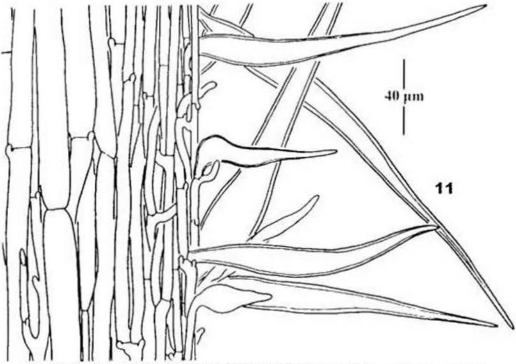


Fig. 11: *Oudemansiella hongoi* (HKAS 32498). Trama of stipe and caulocystidia.

Note: *Oudemansiella hongoi* is closely related to *O. americana* (Dörfelt) Pegler & Young. It differs from the latter in its broader and shorter spores according to the present knowledge. Whether they are conspecific or not, this question is still open. *Oudemansiella hongoi* is also similar to *O. caussei*. But it differs from the latter in its rounder (shorter and broader) spores, usually larger capitated pleurocystidia and cheilocystidia, and narrower pileocystidia with thicker wall (cf. Boekhout & Bas, 1986; Pegler & Young, 1986).

Acknowledgements

I am grateful to Prof. Dr. F. Oberwinkler (Tübingen, Germany) and Prof. M. Zang (Kunming, China) for their guidance. I thank Dr. S. A. Redhead (Ottawa, Canada) very much for serving as reviewer. Dr. M. Weiß (Tübingen, Germany) is acknowledged for correcting the Latin diagnosis.

References

Boekhout, T. & Bas, C. (1986). Notulae ad Floram Agaricinam Neerlandicam-XII. Some notes on the genera *Oudemansiella* and *Xerula*. *Persoonia* **13**, 45-56.

Dörfelt, H. (1981). Taxonomische Studien in der Gattung *Xerula* R. Mre. (IV). *Feddes Repert.* **92**, 255-291.

Dörfelt, H. (1986). Taxonomische Studien in der Gattung *Xerula* R. Mre. (XI). *Feddes Repert.* **97**, 397-404.

Kornerup, A. & Wanscher, J. H. (1981). Taschenlexikon der Farben. 3. Aufl. Muster-Schmidt Verlag: Göttingen, Germany.

Mitchel, D. H. & Smith, A. H. (1978). Notes on Colorado fungi III: new and interesting mushrooms from the aspen zone. *Mycologia* **70**, 1040-1063.

Pegler, D. N. & Young, T. W. K. (1986). Classification of *Oudemansiella* (Basidiomycota: Tricholomataceae), with special reference to spore structure. *Trans. Br. Mycol. Soc.* **87**, 583-602.

Ridgway, R. (1912). Color Standards and Nomenclature. Published by the author: Washington, D.C., USA.

Yang, Z. L. & Zang, M. (1993). Classification of the genus *Oudemansiella* Speg. in Southwest China. *Acta Mycol. Sinica* **12**, 16-27.

MYCOTAXON
Volume LXXIV(2), pp. 367-378 April-June 2000

COMPARATIVE STUDIES ON PUNCTELIA BORRERI, P. PERRETICULATA,AND P. SUBRUDECTA (PARMELIACEAE, LICHENIZED ASCOMYCOTINA) FROM THE IBERIAN PENINSULA

A. LONGÁN, M. BARBERO & A. GÓMEZ-BOLEA

Dep. Biologia Vegetal (U. Botànica). Fac. Biologia. Universitat de
Barcelona. Avda. Diagonal, 645. E-08028. Barcelona. Spain.
E-mail: agomez@porthos.bio.ub.es

Abstract

A comparative study on *Punctelia borreri*, *P. perreticulata* and *P. subrudecta* from the Iberian Peninsula has been carried out. New data are incorporated for the differentiation of the three species on the basis of medullary substances, lower cortex colour, thallus morphology and characters of pycnidia and conidia.

Key words: *Punctelia*, Iberian Peninsula.

Introduction

The genus *Punctelia* was segregated from *Parmelia* Ach. by Krog (1982) on the basis of the development of the pseudocyphellae, conidia morphology, chemistry and geographical distribution. As a result of the revision of this genus in the Iberian Peninsula at least three species have been reported: *Punctelia borreri* (Sm.) Krog, *Punctelia subrudecta* (Nyl.) Krog and *Punctelia perreticulata* (Räsänen) G. Wilh. & Ladd.

P. borreri and *P. subrudecta* have traditionally been differentiated by the colour of the lower cortex and the medullary substances: *P. borreri* with dark underside and gyrophoric acid, and *P. subrudecta* with pale underside and lecanoric acid (Hale, 1965 and 1984; Krog, 1982; Krog & Swinscow, 1977; Elix, 1994).

P. perreticulata is a closely related species. Hale (1965) differentiated it from *P. subrudecta* mainly on the basis of the marginal soredia, upper surface scrobiculation and narrower lobes. Wilhelm & Ladd (1987) studied material from the interior highlands of the United States and reported differences also in the ecology of the two species. However other authors have considered this taxon as a synonym of *P. subrudecta* (Krog, 1982; Nimis, 1993). Recently Adler & Ahti (1996) have given new data on the basis of overlooked conidial characters, and they recognise *P. perreticulata* as a distinct species. They noted that the morphological characters used by Hale (1965) are not reliable diagnostic characters for this species, and gave as the only consistent differential character the shape and length of conidia (longer in *P. perreticulata* than in *P. subrudecta*). These authors found differences in length of conidia of *P. perreticulata* between European (M = 7 µm), Australasian (M = 8-10 µm) and American (M = 9-11 µm) collections, and considered them as intraspecific geographical variation.

While revising the genus *Punctelia* in the Iberian Peninsula we realised that there is a great variability in the colour of the lower cortex of the specimens, and that lecanoric acid was present in specimens with a conspicuously dark underside. We also observed that specimens with long conidia, corresponding to *P. perreticulata*, seemed to be morphologically different from the close *P. subrudecta*. For this reason, we have done a comparative study on the chemistry, lower cortex colour, thallus morphology, pycnidia and conidial characters of the three species.

Material and Methods

A total of 63 samples from the Iberian Peninsula have been studied. Material from outside the Iberian Peninsula (included holotypes of *P. borreri* and *P. subrudecta*) has also been studied for comparison. The collections studied are housed at BCC, BM, H, MACB, US, and hb. J. Etayo.

The chemical study has been carried out with thin-layer chromatography using the standard method (Elix & Ernst-Russell, 1993). Chromatographies were done immediately after extraction (5 minutes in acetone), to avoid degradation of the lichen substances. The TLC plates were dried at 60° for 5 minutes before immersion in the solvents to avoid problems with humidity as much as possible.

The conidial length range was calculated from the study of all the Iberian samples with pycnidia: 7 of *P. subrudecta*, 5 of *P. borreri* and 3 of *P. perreticulata*. At least 10 conidia of each sample were first drawn at 1600x using a drawing tube, and then measured. In the expression of the length of conidia the range is given after elimination of the 10 % of the values at the extremes. Following Adler & Ahti (1996) we use the mode for comparisons between specimens.

Results

Chemical Substances: All the samples contained atranorin. *P. subrudecta* and *P. perreticulata* contained lecanoric acid and orsellinic acid (minor substance). *P. borreri* presented always lecanoric, gyrophoric, orcynil lecanorate and orsellinic acid (minor substance). Therefore, the presence of orcynil lecanorate and gyrophoric acid are diagnostic characters for *P. borreri*, while *P. subrudecta* and *P. perreticulata* cannot be differentiated by means of chemical substances. In case the lobes had a different lower cortex colour than the centre of the thallus, their chemical composition was studied independently, but no differences were observed in the chemistry of different parts of a same thallus. It is remarkable that lecanoric acid was present in all the samples.

Colour of the Lower Cortex: The colour of the lower surface of the different samples showed great variability from the lobes margins to the centre of the thallus. In *P. subrudecta* and *P. perreticulata*, the central lower cortex is always tan or light brown, whereas the lobes can vary from white to brown, dark brown or even black. In *P. borreri*, the lower cortex in the central part of the thallus is always black or at least dark brown, whereas the lobes can vary from black or dark brown to light brown or even white in some specimens. Although occasionally the same colours can be found on the underside of the three species, there is always a different colour gradient from the periphery to the centre of the thallus. In *P. borreri*, the underside darkens towards the centre. In *P. subrudecta* and *P. perreticulata* the underside is homogeneously pale or lighter towards the centre.

The different colour of the lobe underside in respect to the central surface can extend to a great proportion of the thallus. For this reason, a study of poor samples of thalli which consist mainly of lobes can induce mistakes.

Surface Morphology: The surface varied from smooth to scrobiculated and foveolated. Scrobiculation is often difficult to observe due to spread of soralia over big areas of the thallus. For this reason, the upper surface characters are best observed on the peripheral lobes. All the samples of *P. borreri* always present peripheral lobes with a smooth upper surface. *P. perreticulata* is characterised by a conspicuously scrobiculate to foveolate upper surface. *P. subrudecta* is the most variable species. It usually presents peripheral lobes with a smooth surface, but in some specimens some of the lobes present scrobiculation. Such lobes are usually truncate, and with abundant elevated pseudocyphellae. In fact, in *P. subrudecta* scrobiculation seems to be a consequence of the elevation of elongated pseudocyphellae, while in *P. perreticulata* the elevations of the upper cortex do not usually have pseudocyphellae. In any case, scrobiculation is a difficult character to use for distinction between *P. subrudecta* and *P. perreticulata*, although in the former it is present occasionally and in the latter it is a constant and conspicuous character.

The peripheral lobes of all the specimens of *P. borreri* and *P. perreticulata* are pruinose, while in the case of *P. subrudecta* the lobes are always epruinose. Pruina give the lobes a glaucous colour when fresh, and is usually abundant, although not always present in all the lobes of the same thallus.

The three species have laminar pseudocyphellae, which are orbicular or elongate. In *P. borreri* they are very abundant on the surface of peripheral lobes, where they are mainly orbicular, with a diameter up to 300 µm. In *P. subrudecta* orbicular pseudocyphellae has a diameter up to 100 µm, and soon developed into soralia near the lobe margins. Elevated pseudocyphellae are present in the ridges formed as a result of the occasional scrobiculation of some lobes. In *P. perreticulata*, pseudocyphellae were found to be very infrequent. The presence of a reticulum of pseudocyphellae (similar to that of *Rimelia reticulata*) is possible in the three species, but while in *P. subrudecta* and *P. borreri* it is present only at the lobe margins, it is more abundant all over the surface of some lobes of *P. perreticulata*.

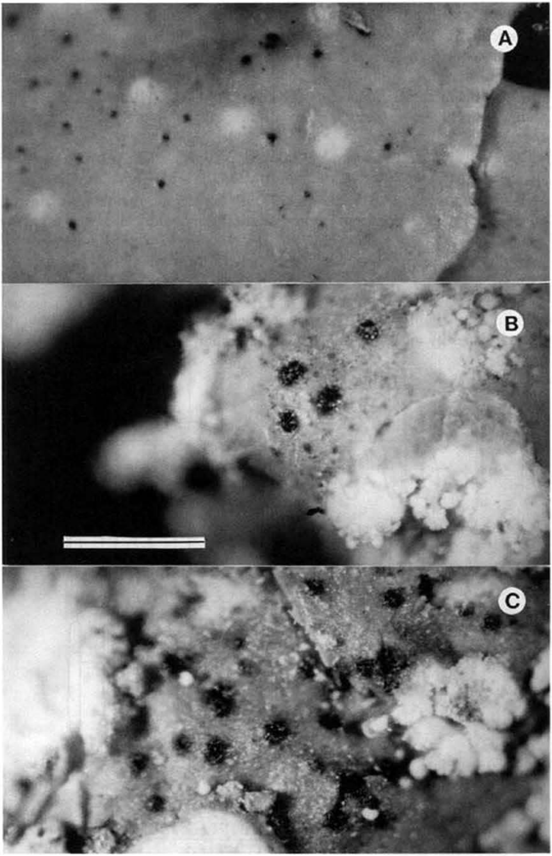
No differences between the species were found in the location of soralia, which are marginal and laminar. While some specimens showed discrete and well delimited soralia, some others had large areas of the thallus covered by coalescent soralia. Nevertheless, this variation occurred in all the three species. The soredia are farinose to coarsely granular, and can develop into pseudoisidia. Little lobes proliferating between these pseudoisidia in the central part of the thallus were observed in the three species.

Pycnidia: The pycnidia observed in these species seem to belong to the *Lobaria-Type*, described by Vobis (1980), especially for the presence of dark coloured cortical cells around the ostiole, which can clearly be differentiated from the rest of the cortex. Conidiophores of this type of pycnidia are expected to belong to the type VII, as mentioned by Vobis (op. cit.). However, the conidiophores observed in our samples, are more like in type VI, *sensu* Vobis (op. cit.).

From the samples examined, differences between two kinds of pycnidia were observed and described as follows:

-*Borreri-Type*: They correspond to the pycnidia of *P. borreri*. They were seen as punctiform black spots (25-55 µm) immersed in the thallus. Pycnidia wall dark coloured and with dark-brown cortical cells around the ostiole. They were mainly located in the peripheral lobes (Fig. 1A).

Fig. 1. Thallus surface showing the pycnidia of: A.- *Punctelia borreri*. B.- *P. perreticulata* and C.- *P. subrudecta*. Scale bar = 0,5 mm.


A
B
C

-*Subrudecta-Type*: They correspond to the pycnidia of *P. subrudecta* and *P. perreticulata*. They were seen as prominent black spots (90-125 µm). Pycnidia wall pale coloured and with brown-coloured cortical cells around the ostiol, that in this kind of pycnidia grow to form a clypeus, and appears for this reason as surrounded by a brown ring (Figs. 1B and 1C). Pycnidia aremainly situated in central parts of the thallus, where they are finally confluent.

Conidia (Fig. 2): There is a transition of conidial length between the three species. *P. subrudecta* has short unciform conidia with a length range of (3,6-)4,1-5(-6,8) µm, M = 4,5-5 µm (n = 128). *P. borreri* has mainly short filiform conidia, but with a certain proportion of unciform conidia also present, with a conidial length of (4,5-)5-6,8(-7,3) µm, M = 5-6,4 µm (n = 124). *P. perreticulata* has longer unciform to filiform conidia, (5,9-)6,4-8,2 (-9) µm, M = 6,4-7,3 µm (n = 50); (n = number of conidia measured).

From our results, the Iberian specimens of the three species can be differentiated by means of the chemical and morphological characters shown in Table 1.

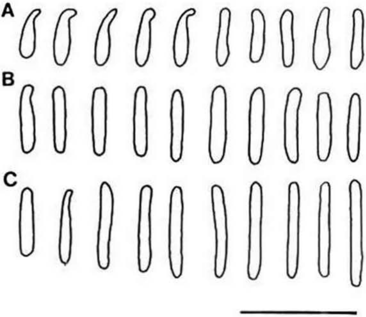


Fig. 2. Conidia of: A.- *Punctelia subrudecta*. B.- *P. borreri* and C.- *P. perreticulata*. Scale bar = 10 µm.

	P. borreri	*P. perreticulata*	*P. subrudecta*
Medullary Substances	Lecanoric, orsellinic and gyrophoric acids, and orcynil lecanorate	Lecanoric and orsellinic acids	Lecanoric and orsellinic acids
Lower Cortex Colour	Darkening towards the centre	Lighter towards the centre	Lighter towards the centre
Peripheral Lobes	Pruinose. Never scrobiculate, with abundant orbicular pseudocyphellae	Pruinose. Conspicuously scrobiculate to foveolate, pseudochypellae scarce	Epruinose. Only occasionally scrobiculate, and then when elevated pseudocyphellae
Pycnidia	Borreri-Type	Subrudecta-Type	Subrudecta-Type
Conidia	(4,5-) 5-6,8 (-7,3) µm M = 5-6,4 µm	(5,9-) 6,4-8,2 (-9) µm M = 6,4-7,3 µm	(3,6-) 4,1-5 (-6,8) µm M = 4,5-5 µm

TABLE 1. Main distinguishing characters of *Punctelia borreri*, *P. perreticulata* and *P. subrudecta*.

Discussion

Our chemical results, according with Spier (1994), confirm the presence of lecanoric acid in *P. borreri*. It is remarkable to note the constant presence of this substance in all the samples of this species, including the holotype specimen. In no case seemed lecanoric acid to be an artefact due to the TLC methodology, but another secondary metabolite. Lecanoric and gyrophoric acids are substances of the same metabolic pathway, so it is not improbable to find them together. Species with gyrophoric acid usually have also lecanoric and orsellinic acids (Kümmerling, 1991). On the contrary, species containing lecanoric acid always contain orsellinic acid, but gyrophoric acid is absent (Leuckert, 1985). Tønsberg (1992) noted that in species with gyrophoric acid as a major substance, lecanoric acid occurred as a constant satellite substance in trace amounts or in a concentration more or less equal to that of gyrophoric acid.

The lower cortex colour is normally used to differentiate *P. borreri* from *P. subrudecta*. However, Spier (1994), when dealing with Dutch specimens of *P. borreri*, found a great variation in the lower cortex colour and could not correlate it with the presence of lecanoric or gyrophoric acids. In our opinion, a good character to differentiate *P. borreri* from the other two species is the variation in colour intensity from the lobe margins to the centre of the thallus.

The apparent correlation between the presence of lecanoric acid and a pale underside (*P. subrudecta*) and that of gyrophoric acid and a dark underside (*P. borreri*) was noted by Hale in 1965, and since then it has been accepted by later authors. This correlation has been accepted as a general rule in the genus *Punctelia* (Hale, 1984 and Elix, 1996), although with some exceptions like *Punctelia novozelandica*, which has a black underside and produces lecanoric acid (Elix & Johnston, 1988). From our results, it seems that in these three species, the correlation would also not be true.

The dark colour of the underside of these species is due to a brown wall pigment, observed in the lower cortex in thin sections of the thallus. We do not know the chemical composition of this brown pigment, which is present in most of the samples at least in the edge of the lobes, but in the case of *Parmelia s. str.* it has been related to the presence of atranorin (Poelt & Leuckert, 1993), which would be substituted by this pigment. Spier & van Herk (1997) suggest that the colour of the underside in *P. borreri* may change with the age of the thalli, the old ones being dark coloured. This would explain that within a thallus of *P. borreri* the periphery was paler than the centre (which is older). In the case of *P. subrudecta* and *P. perreticulata* this explanation would not be valid, as these species tend to darken towards the periphery. We do not know the factors that determine the higher or lower concentration of the brown pigment, and its deposition in certain areas.

Characters of the upper surface have classically been used for differentiation of *P. subrudecta* and *P. perreticulata* (Hale, 1965, Wilhelm & Ladd, 1987). Adler & Ahti (1996) noted that scrobiculation and elevation of pseudocyphellae seemed to be consequences of environmental factors, particularly the type of substratum, and that it was not a taxonomically useful character to delimit *P. perreticulata*. They gave as the only consistent differential character between *P. perreticulata* and *P. subrudecta*, the shape and length of conidia. In the Iberian specimens examined, we observed morphological differences between the samples with short and unciform conidia (*P. subrudecta*) and the ones with long filiform conidia (*P. perreticulata*), which presented a much more foveolated or scrobiculated surface, and less pseudocyphellae. Scrobiculation was seen in epiphytes as well as in saxicolous specimens, so it doesn't seem to be directly correlated with the type of substratum. The Italian and French *P. perreticulata* examined for comparison had a conidial range identical to the ones of the Iberian samples, that correspond to the range given by Adler & Ahti (op. cit.) for European *P. perreticulata*. These samples were also morphologically identical to the Iberian ones, only differing in the presence of pruina, which in the specimens collected by Sbarbaro from Italy was only present at the margin of the lobes, while in the Spanish specimens it covered the lobes surface completely. Nevertheless, material labelled as *P. perreticulata* from America and New Zealand with filiform long conidia was heterogeneous, some samples being identical in morphological characters to the European *P. perreticulata*, and others very different in lobe morphology to our concept of this species, and more similar to the variable *P. subrudecta*. These last specimens had longer conidia than the European *P. perreticulata*, what is considered by Adler & Ahti (op. cit.) as intraspecific geographic variation. We are of the idea that more taxa might be involved in the samples with long conidia. Nevertheless, more studies with specimens with conidia are necessary to clarify the identity of *P. perreticulata* and *P. subrudecta* in terms of morphology in a world context.

Specimens examined:

***Punctelia borreri*: EUROPE: England**: Sussex (BM-holotypus). **Portugal**: Coimbra, Beira Litoral, on *Alnus cordata* at the Jardín Botánico, 1990 (MACB). **Spain**: Andalucía: Cádiz, Jerez de la Frontera, road C3331, km 41, 675 m, on *Crataegus monogyna*, 1994 (BCC-Lich.13186); Aragón: Zaragoza, Cariñena, Sierra de Algairon, Puerto de Codos, 850 m, on *Quercus ilex* subsp. *ballota*, 1992 (MACB 50679). Catalunya: Barcelona, El Bruc, 500 m, on *Quercus ilex*, 1978 (BCC-Lich.11653); on *Pinus halepensis*, 1980 (BCC-Lich.11656); Fogars de Montclús, road from Sant Celoni to Santa Fe del Montseny, on *Castanea sativa*, 1984 (BCC-Lich.11159); road to

Mosqueroles, on *Quercus suber*, 1985 (BCC-Lich.3810); Pantà de Foix, turó de la Picarola, 200 m, on *Quercus ilex*, 1997 (BCC-Lich.3190); Sant Llorenç del Munt, Cavall Bernat, 900 m, on *Quercus ilex*, 1997 (BCC-Lich.13192); Sant Bernat de Montseny, 700 m, on *Quercus ilex*, 1996 (BCC-Lich.13197); Sant Martí del Montnegre, saxicolous, 450 m, 1989 (herb. Barbero 480, 485, 487); Sant Martí de Montnegre, 500 m, on *Quercus ilex*, 1996 (BCC-Lich.13187); Orrius, Font de Sant Bartomeu, saxicolous, 1979 (BCC-Lich.1274); Girona, Albanyà, ermita de Sant Martí Corsavell, 600 m, on *Quercus ilex*, 1995 (BCC-Lich.13196); Castelló d'Empúries, Les Torroelles, 100 m, on *Ficus carica*, 1981 (BCC-Lich.8638); on *Olea europaea*, 1981 (BCC-Lich.8651); saxicolous, 1981 (BCC-Lich.8896); Montagut, Oix, 500 m, on *Quercus ilex*, 1981, BCC-Lich.10374; Pantà de Susqueda, Bosc del Cuminal, 700 m, on *Quercus ilex*, 1996 (BCC-Lich.13184); Tarragona, Poblet, La Pena, 700 m, on *Quercus ilex*, (BCC-Lich.3342). Galicia: A Coruña, Santiago de Compostela, Campus Universitario, 245 m, on *Robinia pseudoacacia*, 1984 (BCC-Lich.1829, MACB 16743). Navarra: Elzancha, on *Quercus robur* (hb. J. Etayo); Elzancha, on *Malus domestica* (hb. J. Etayo); Zugarramurdi, 209 m, on *Quercus robur* (hb. J. Etayo); Echauri, 960 m, on *Quercus coccifera* (hb. J. Etayo).

Punctelia perreticulata: **EUROPE: Spain**: Catalunya: Barcelona, Sant Climent, on *Ceratonia siliqua*, 1995 (hb. Valverde); Olesa de Montserrat, Bosc del Gavatx, saxicolous, 1984 (BCC-Lich); corticolous (BCC-Lich.); Tarragona, Paüls, Pla de la Mola, on *Pinus sylvestris*, 1990 (BCC-Lich.6173); Montsagre de Paüls, 950 m, on *Pinus sylvestris*, 1990 (BCC-Lich. 5832). **Italy:** Liguria, Spotorno, 1935 (H); on mosses, 1936 (BCC-Lich. 1700, H, US); on mosses, 1936 (H); on mosses, 1944 (H); saxicolous, 1951 (US); on *Frullania* sp., 1944 (US); saxicolous, 1952 (US). **France**: Hérault, 1964 (H; US). **NORTH AMERICA**: **USA**: California: Yosemite Valley (BM-herb. J. Stirton) Texas, Hamilton's Pool, 1976 (H); Crockett County, on *Juniper*, 1977 (H). **NEW ZEALAND**: Nelson, near Brightwater, on toatara and beech trees, 1954 (BM); Otago, Dunedin, near Flagstaff, Whare Flats, on old conifer stump, 1962 (BM); Canterbury, Timaru, Temuka, on *Nothofagus*, 1958 (BM).

Punctelia subrudecta: **AFRICA:** Isle St. Paul, 1874-75 (H-Nyl-Holotypus). **EUROPE: Spain:** Andalucía: Cádiz, Jerez de la Frontera, road from Alcalá de los Gazules to Puerto Galis km 16, Canuto del Caballo, 420 m, on *Erica*, 1994 (BCC-Lich.13185); on *Phillyrea media* (BCC-Lich.13189); road C3331 km 41, 675 m, on *Crataegus monogyna*, 1994 (BCC-Lich.13188). Cantabria: Santander, Comunidad de Campo de Cabuérnaga, Río Saja, Monte de la Canal del Infierno, 970 m, on *Fagus sylvatica*, 1994 (MACB 56249). Castilla

- La Mancha: Ciudad Real, Fuencaliente, Valle de Navalmanzano, 1000 m, on *Quercus ilex*, 1991 (MACB 43729). Catalunya: Barcelona, Llinars del Vallès, 250 m, saxicolous, 1981 (BCC-Lich.2286); Vilada, road to Borredà, 750 m, on *Pinus sylvestris*, 1981 (BCC-Lich.11458); Fogars de Montclús, road from Sant Celoni to Santa Fe del Montseny, on *Castanea sativa*, 1984 (BCC-Lich.11159); Dosrius, saxicolous, 1988 (herb. Barbero); Sant Llorenç del Munt, Cavall Bernat, 900 m, on *Quercus ilex*, 1997 (BCC-Lich 13193); Sant Pol de Mar, El Farrell, saxicolous, 1987 (hb. Barbero); Pantà de Foix, turó de la Picarola, 200 m, on *Quercus ilex*, 1997 (BCC-Lich. 13191); Girona, Albanyà, ermita de Sant Martí Corsavell, on *Quercus ilex*, 1995 (BCC-Lich.13194); Beuda, 500 m, on *Quercus ilex*, 1995 (BCC-Lich.13195); Roses, Sant Sebastià, 390 m, 1983 (BCC-Lich.11623, 11629); La Rejolera, on *Tamarix*, 1981 (BCC-Lich.11635); Tossa de Mar, Cala Bona, 10 m (BCC-Lich.11514); Cantallops, ermita de Santa Llúcia, 250 m, on *Quercus suber*, 1985 (BCC-Lich.3828, 3829); Tarragona, Punta de la Mora, 10 m, on *Pinus halepensis*, 1987 (BCC-Lich.4010); Pobla de Benifassà, 910 m, on *Quercus ilex*, 1990 (BCC-Lich.5825); Roquetes, Barranc del Farrubio, 150 m, on *Olea europaea*, 1987 (BCC-Lich.5870); Montsagre de Paüls, 950 m, on *Pinus sylvestris*, 1990 (BCC-Lich.5832bis). Navarra: Robledal de Orgui, Lizaso, 500 m (hb. J. Etayo); Landíbar, 100 m, on *Quercus robur* (hb. J. Etayo); Goizueta, 200 m, on *Quercus robur* (hb. J. Etayo); Monte del Setuain, 620 m (hb. J. Etayo); Elzancha, on *Quercus robur* (hb. J. Etayo).

Acknowledgements

We would like to acknowledge the keepers of the herbaria BCC, BM, H, MACB, US, and hb. J. Etayo for the loan of specimens. We are indebted to Dr J.A. Elix, who kindly sent us an extraction of orcinyl lecanorate. Financial support has been afforded by the *Comissionat per a Universitats i Recerca* (Catalan Goverment) and by the Spanish *Dirección General de Investigación Científica y Técnica*.

References

ADLER, M. T. & AHTI, T. (1996) The distinction of *Punctelia perreticulata* and *P. subrudecta* (Parmeliaceae, Lecanorales). *Lichenologist* **28(5):** 431-436.

ELIX, J. A. (1994) *Punctelia*. *Flora of Australia* **55:** 163-168.

ELIX, J. A. (1996) Biochemistry and secondary metabolites. In *Lichen Biology* (T. H. Nash, ed.): 154-180. Cambridge: University Press.

ELIX, J. A. & ERNST-RUSSELL, K. D. (1993) *A catalogue of standardized* *thin layer chromatographic data and biosynthetic relationships for lichen substances*. Canberra: Australian National University. 163 pp.

ELIX, J. A. & JOHNSTON, J. (1988) New species in the lichen family Parmeliaceae (Ascomycotina) from the Southern Hemisphere. *Mycotaxon* **31:** 491-510.

HALE, M. E. (1965) Studies on the *Parmelia borreri* group. *Svensk Botanisk Tidskrift* **5:** 37-48.

HALE, M. (1984) *Flavopunctelia*, a new genus in the Parmeliaceae (Ascomycotina). *Mycotaxon* **20:** 681-682.

KROG, H. (1982) *Punctelia*, a new lichen genus in the Parmeliaceae. *Nordic Journal of Botany* **2:** 287-292.

KROG, H. & SWINSCOW, T. D. (1977) The *Parmelia borreri* group in East Africa. *Norwegian Journal of Botany* **24:** 167-177.

KÜMMERLING, H. (1991) Zur kenntis der Flechtenflora an Hohen Meissner und in seinem Vorland (Hessen) unter besonderer Berüccksichtigung chemischer Merkmale. *Bibliotheca Lichenologica* **41:** 1-315.

LEUCKERT, C. (1985) Probleme der Flechten-Chemotaxonomie - Stoffkombinationen und ihre taxonomische Wertung. *Berichte der Deutsche Botanische Gesellschaft* **98:** 401-408.

NIMIS, P.L. (1993) *The lichens of Italy*. Torino: Museo Regionale di Scienzi Naturali. 897 pp.

POELT, J. & LEUCKERT, C. (1993) Substitution and Supplementary Addition of Secondary Products in the Evolution of Lichenized Ascomycotina. *Bibliotheca Lichenologica* **53**: 201-217.

SPIER, L. (1994) *Parmelia borreri* (Sm.) Turner in Nederland. Kritische kanttekeningen bij de recente vondsten. *Buxbaumiella* **35:** 16-22.

SPIER, L. & van HERK, C. M. (1997) Recent increase of *Parmelia borreri* in The Netherlands. *Lichenologist* **29** (4): 390-393.

TØNSBERG, T. (1992) The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* **14:** 1-331.

WILHELM, G. & LADD, D. (1987) *Punctelia perreticulata*, a distinct lichen species. *Mycotaxon* **28**: 249-250.

VOBIS, G. (1980) Bau und Entwicklung der Flechten-Pycnidien und ihrer Conidien. *Bibliotheca Lichenologica* **14**:1-141.

MYCOTAXON

Volume LXXIV(2), pp. 379-390 April-June 2000

SPECIES OF ANTHOSTOMELLA FROM PORTUGAL, INCLUDING A. CYPERACEICOLA SP. NOV. AND A. SCIRPI SP. NOV.

Bing-Sheng Lu & Kevin D. Hyde

Centre for Research in Fungal Diversity, Department of Ecology and Biodiversity, The University of Hong Kong, Pokfulam Road, Hong Kong

Abstract

Species of *Anthostomella* reported from Portugal have been re-examined. Two species have been transferred to other genera, and two species, one forma and one variety are synonymized. There are also five new records for Portugal identified from collections in herbaria. The new species *A. cyperaceicola* from *Cyperaceae* and *A. scirpi* from *Scirpus* are also described and illustrated. *Anthostomella* species known from Portugal are listed and a key to the known species of *Anthostomella* in Portugal is also provided.

Key words*:* *Anthostomella*, new records, new species, Portugal, Xylariaceae.

Introduction

Anthostomella Sacc. is placed in family Xylariaceae in order Xylariales, and comprises ca 300 species (Lu *et al.*, 1998). The genus has been partially monographed by Francis (1975) and Hyde (1996), however, no complete monograph exists (Lu & Hyde, 1998).

Over 2500 specimens borrowed from 30 herbaria have been examined, including 250 types of most described taxa and representatives of related genera. In this paper, the species of *Anthostomella* described or known from Portugal have been treated.
A list of the *Anthostomella* species known from Portugal is given in Table 1 and a key is also provided.

Material and Methodes

Specimens of *Anthostomella* known from Portugal were borrowed from IMI, K, LISE, NY, S and W. Examination was carried out by rehydrating dried materials in distilled water. Ascospores, asci and sections of ascomata were mounted in distilled water for observation, microphotography and measurement. Ascal apical rings were stained using Melzer's solution. Sections of ascomata were made on a cryotome and mounted with O. C. T. compound.

Taxonomy

Key to the species of *Anthostomella* known from Portugal

1. Ascospores with a dwarf cell..2
1. Ascospores lacking a dwarf cell..4

2. Ascospores longer than 20 µm, 22.5-30 x 7.5-11.5 µm, inequilaterally oblong-ellipsoidal...*A. appendiculosa*
2. Ascospores shorter than 20 µm..3

3. Ascospores 10.5-13 x 5-5.5 µm, ellipsoidal, lacking a germ slit...*A. clypeata*
3. Ascospores 12-17.5 x 5-8 µm, inequilaterally ellipsoidal, germ slit straight...*A. tomicoides*

4. Asci lacking an apical apparatus...5
4. Asci with a J+ subapical ring...7

5. Ascospores longer than 17 µm, 17.5-21.5 x 7.5-10.5 µm, broadly inequilaterally ellipsoidal, surrounded by a mucilaginous sheath which is wider in the middle...*A. smilacis*
5. Ascospores shorter than 17 µm...6

6. Ascospores 7.5-11 x 4-5 µm, ellipsoidal with two sides parallel, lacking a sheath...*A. sphaeroidea*
6. Ascospores 14-16.5 x 5-6.5 µm, ellipsoidal with one side flattened and tapering ends, surrounded by a mucilaginous sheath.......................*A. scirpi*

7. Asci with a wedge-shaped subapical ring, ascospores 13.5-18 x 7.5-11.5 x 4.5-6.5 µm, variable in shape, mostly ellipsoidal with one side flattened

to inequilaterally ellipsoidal...*A. cyperaceicola*
7. Asci with a discoid subapical ring..8

8. Ascospores thick-walled...9
8. Ascospores thin-walled..10

9. Ascospores 7.5-12.5 x 5-6.5 x 2.5-4 µm, ellipsoidal or oblong-ellipsoidal ....*A. tenacis*
9. Ascospores 17.5-21.5 x 8-9.5 µm, ellipsoidal.......................*A. delitescens*

10. Ascospores verrucose-walled, 12-17.5 x 5-10 µm, inequilaterally ellipsoidal ....*A. consanguinea*
10. Ascospores smooth-walled, 14-19 x 7.5-10 µm, ellipsoidal......*A. conorum*

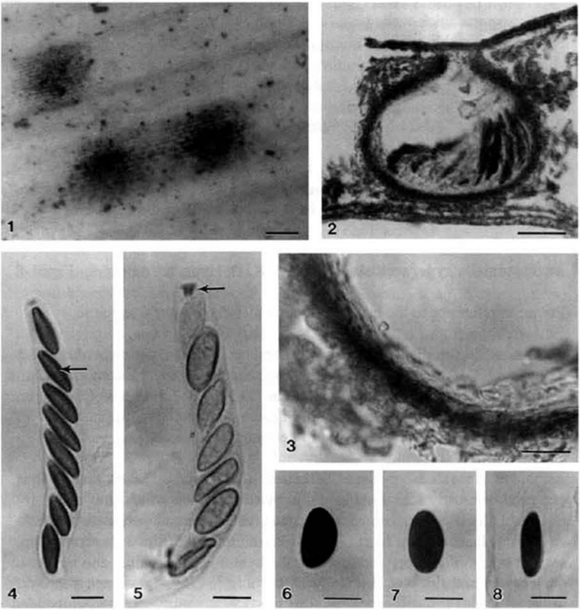
Anthostomella cyperaceicola B. S. Lu & K. D. Hyde, sp. nov. Figs 1-8

Etym.: in reference to the host family on which the fungus was found.

Ascomata 180 µm diam, 160 µm alta, immersa, globosa, ostiolata. Asci 87.5-112.5 x 11.5-12.5 µm, 8-spori, apparatu subapicale, J+, cuneato, 2-2.5 µm diam, 2.5-3 µm alto praediti. Ascosporae 13.5-18 x 7.5-11.5 x 4.5-6.5 µm, variabiles in figuro, late ellipsoideae unilateraliter applanatae vel inaequilateraliter ellipsoideae, fissuro germine praeditae.

Ascomata immersed, visible as darkened, slightly raised areas on the host, clustered or mostly solitary (Fig. 1); in vertical section ca 180 µm diam, 160 µm high, globose, dark brown, coriaceous, with a central periphysate ostiole, ca 20 µm diam, 30 µm high (Fig. 2). Peridium 10-15 µm wide, comprising several layers of compressed cells, walls hyaline at the inside, and brown to dark brown and thick-walled towards the outside (Fig. 3). Paraphyses 5-5.5 µm wide at the base, filamentous, flexuose, septate, numerous and embedded in a gelatinous matrix. Asci 87.5-112.5 x 11.5-12.5 µm ($\bar{x}$ = 101.3 x 12.1 µm, n = 10), 8-spored, broadly cylindrical, pedicellate, unitunicate, apically rounded, with a J+, wedge-shaped, subapical ring, 2-2.5 µm ($\bar{x}$ = 2.4 µm, n = 10) diam, 2.5-3 µm ($\bar{x}$ = 2.5 µm, n = 10) high (Figs 4, 5). Ascospores 13.5-18 x 7.5-11.5 x 4.5-6.5 µm ($\bar{x}$ = 16 x 9 x 5.8 µm, n = 25), overlapping uniseriate, shape variable, mostly broadly ellipsoidal with one-side flattened to inequilaterally ellipsoidal, brown, unicellular, smooth-walled, lacking a mucilaginous sheath, germ slit straight, ventral (Figs 6-8).

Holotype: Portugal, Estremadura, Cascais (Guineho) Province, on *Scirpus* sp.,



Figs 1-8. *Anthostomella cyperaceicola* (from holotype). 1. Appearance of ascomata on the host surface. 2. Section of ascoma. 3. Peridium. 4, 5. Asci with a J+, wedge-shaped, subapical ring (arrowed in 5). 6-8. Ascospores. Note the lack of a mucilaginous sheath, and straight germ slits (arrowed in 4). Scale bars: 1 = 500 μm, 2 = 50 μm, 3-8 = 10 μm.

27 Mar. 1963, M. S. Dias & M. T. Lucas 1765 (LISE 62896).

Other specimens examined: Portugal, Estremadura, Sintra, on unknown Cyperaceae, 17 Aug 1965, B. d'Oliveira S. (LISE 65641, deposited as *A. tomicum*); UK, Wales, Pembrokeshire, Freshwater Bay West, on *Phragmites communis*, 8 Aug 1928, P. G. M. Rhodes 3743 (W 20786, deposited as *A. tomicum*).

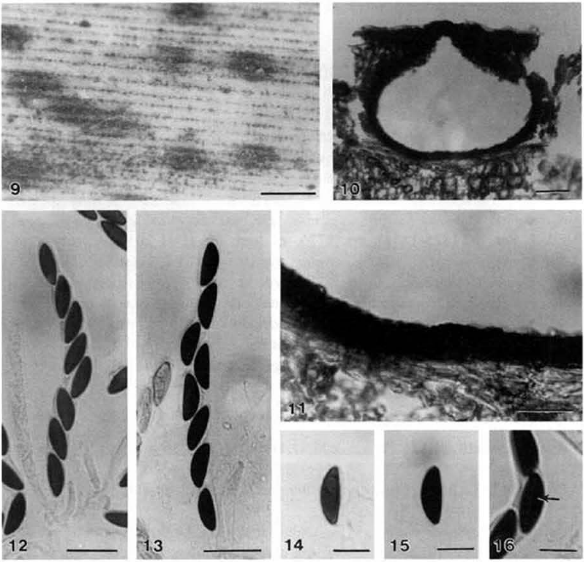
Anthostomella cyperaceicola differs from *A. tomicum* (Lév.) Sacc., as ascospores in *A. cyperaceicola* are variable in shape, mostly broadly ellipsoidal with one side flattened to inequilaterally ellipsoidal, and narrower ventrally, while those in *A. tomicum* are ellipsoidal. In addition, asci in *A. cyperaceicola* are shorter and wider (87.5-112.5 x 11.5-12.5 µm, $\overline{x}$ = 101.3 x 12.1 µm), while those in *A. tomicum* are longer and narrower (132.5-177.5 x 10-11.5 µm, $\overline{x}$ = 150.5 x 10.3 µm) [Material examined: On *Scirpusholoschoenus* (as *Juncus acutus*), Desmazières, *Plantes Crypt. France*, Ed. I. Ser. 1 (1825-1851), no. 1776, ex herb PC (IMI 205739, isotype of *Sphaeria tomicum*)]. *Anthostomella cyperaceicola* is distinct from *A. flagellariae* (Rehm) B. S. Lu & K. D. Hyde as ascospores in *A. cyperaceicola* are mostly broadly ellipsoidal with one side flattened to inequilaterally ellipsoidal, while those in *A. flagellariae* are broadly ellipsoidal with two sides somewhat parallel [Material examined: Philippines, Los Baños, Luzon, Laguna Province, on dead stem of *Flagellaria indica*, 14 Feb 1913, S. A. Reyes & C. F. Baker 1576b (S, holotype of *Anthostoma flagellariae*).

Anthostomella scirpi B. S. Lu & K. D. Hyde, sp. nov. Figs 9-16

Etym.: in reference to the host on which the fungus was found.

Ascomata 250 µm diam, 210 µm alta, immersa, globosa vel subglobosa, ostiolata. Asci 100-125 x 10-12.5 µm, sine apparatu apicale. Ascosporae 14-16.5 x 5-6.5 µm, ellipsoideae, unilateraliter applanatae et attenuata praeditae, fissuro germen dispando praeditae.

Ascomata immersed, visible as blackened, slightly raised areas, mostly clustered or solitary (Fig. 9); in vertical section ca 250 µm diam, 210 µm high, globose to subglobose, brown, coriaceous, with a central periphysate ostiolar canal (Fig. 10). Clypeus black, ca 300 µm diam, 40 µm high, comprising host cells and blackened intracellular hypha (Fig. 10). Peridium ca 15 µm wide, comprising brown, thick-walled, compressed cells (Fig. 11). Paraphyses 2.5-4 µm ($\overline{x}$ = 3.4 µm, n = 10) wide at the base, filamentous, flexuose, septate and embedded in a gelatinous matrix. Asci 100-125 x 10-12.5 µm ($\overline{x}$ = 112 x 11.6 µm, n = 20), 8-spored, broadly cylindrical,



Figs 9-16. *Anthostomella scirpi* (from holotype). 9. Appearance of ascomata on the host surface. 10. Section of ascoma. Note the blackened clypeus. 11. Peridium. 12, 13. Asci. Note the lack of an apical apparatus. 14-16. Ascospores. Note germ slit straight (arrowed in 16). Scale bars: 9 = 1000 µm, 10 = 50 µm, 11-13 = 20 µm, 14-16 = 10 µm.

pedicellate, unitunicate, apically rounded and lacking an apical apparatus (Figs 12, 13). Ascospores 14-16.5 x 5-6.5 µm ($\overline{x}$ = 15.5 x 5.5 µm, n = 25), overlapping uniseriate or partially biseriate, ellipsoidal with one side flattened and ends tapering, brown, unicellular, smooth-walled, surrounded by a thin mucilaginous sheath, 1-1.5 µm ($\bar{x}$ = 1.1 µm, n = 10), germ slit straight, ventral, indistinct (Figs 14-16).

Holotype: Portugal, Estremadura, Praia das Macas Province, on culm of *Scirpus*, 14 Apr. 1965, M. R. S. Dias & M. T. Lucas 1891 (LISE 65661).

Anthostomella scirpi has similar sized ascospores and lacks an ascal apparatus as in *A. palmicola* (Auersw.) Rabenh., *A. melanotes* (Berk. & Broome) Martin, and *A. eructans* Ellis & Everh. *Anthostomella scirpi* differs from *A. palmicola* (Auersw.) Rabenh. and *A. melanotes* (Berk. & Broome) Martin as ascospores in *A. scirpi* are ellipsoidal with one side flattened and ends tapering, while those in *A. palmicola* and *A. melanotes* are ellipsoidal with ends rounded [Material examined: Italy, Sardinia, Alghero, on leaf of *Chamaerops humilis*, Jun 1866, Marcucci, *Unio Itin. Crypt.* no. 58 (S, W 358240, 371572, isotype of *Sordaria palmicola*); USA, South Dakota, Northville, on branches of *Symphoricarpus occidentalis*, May 1929, J. F. Brenckle distributed in: *Sydow*, *Fungi Exotici Exsiccati* no. 947 (NY, K 56357, W, isotype of *Anthostoma melanotes*)]. *Anthostomella scirpi* differs from *A. eructans* as ascospores in *A. scirpi* are ellipsoidal with one side flattened and ends tapering, while those in *A. eructans* are ellipsoidal and ends rounded. A addition, ascospores in *A. scirpi* are relatively longer (14-16.5 µm, $\bar{x}$ = 15.5 µm), while those in *A. eructans* are shorter (11.5-14 µm, $\bar{x}$ = 12.5 µm) [Material examined: USA, New York, Lyndonville, on decorticated branch, May 1889, C. E. Fairman 42 (NY, holotype of *A. eructans*)].

Discussion

Twenty-one species of *Anthostomella* are now known from Portugal, including new records and two new species. The first species of *Anthostomella* to be described from Portugal was *Anthostomella yuccae* Thüm., but this is now regarded as a synonym of *A. sphaeroidea* Speg. (Francis 1975). Fabre (1883) later added *A. scopariae* Fabre from *Erica* sp., which is a synonym of *Anthostomella delitescens* (De Not.) Sacc. (this paper). The further 19 species of *Anthostomella* known from Portugal and the present status of these species are given in Table 1 and the formal synonymies are given below.

Anthostomella clypeata (De Not.) Sacc., *Sylloge Fungorum* **1**: 283 (1882).

≡ *Sordaria clypeata* De Not., *Sferiacei italici* **1**: 24 (1863).
= *Anthostomella appendiculosa* (Berk. & Broome) Sacc. var. *lusitanica* Da Camara, *Agronomia Lusitana* **11**: 44 (1949).
= *Anthostomella clypeata* (De Not.) Sacc. f. *rubi-ulmifolii* Gonz. Frag., *Broteria,* series Botany, **21**: 131 (1924).

Material examined: Portugal, near Povoa Lanhoso, S. Gens, on stems of *Rubus ulmifolius*, Aug. 1924, G. Sampaio, ex herb. MA 7062 (IMI 183753, holotype of *A. clypeata* f. *rubi-ulmifolii*); Portugal, Algarve, Caldas de Monchique Province, on *Rubus* sp., 9 Mar. 1948, M. R. de Sounsa Dias 409 (LISE 23954, holotype of *A. appendiculosa* var. *lusitanica*); *ibid.* (IMI 195466, isotype of *A. appendiculosa* var *lusitanica*).

Anthostomella delitescens (De Not.) Sacc., *Michelia* **1**: 328 (1878).

≡ *Sphaeria delitescens* De Not., *Micromycetes Italiana Novi vel Minus Cogniti*, Decas **8**: 124 (1854).
= *Anthostomella lavandulae* T. Lucas & S. Dias., *Agronomia Lusitana* **16**: 82 (1954).
= *Anthostomella scopariae* Fabre, *Annales des Sciences Naturelles*, A. Botanique, series 6, **15**: 38 (1883).

Material examined: Italy, Genua, on *Erica arborea*, 9 Mar. 1842 (RO, holotype of *Sphaeria delitescens*); Portugal, on *Lavandula stoechas*, 20 May 1953, M. T. Lucas 1296 (LISE 38787, holotype of *A. lavandulae*); Portugal, Gallia, on *Erica scoparia*, H. Fabre (S, type of *A. scopariae*).

Acknowledgements

Bing-Sheng Lu would like to thank The University of Hong Kong for the award of a Postgraduate Studentship. We are grateful to Dr A. Aptroot for valuable comments on the manuscript. Dr Edward C. Y. Liew is thanked for commenting on the draft manuscript. Ms Helen Liew is thanked for technical assistance. Thanks are extended to the curators of herbaria IMI, K, LISE, NY, S and W for the loan of material examined in this study.

Table 1. *Anthostomella* species recorded in Portugal

Species	Portugal hosts	Conclusions	References
A. appendiculosa (Berk. & Broome) Sacc.	*Rubus* (Rosaceae); *Smilax* (Smilacaceae)	New record in Portugal	This paper
A. appendiculosa var. *lusitanica* Da Camara	*Rubia* (Rubiaceae)	A synonym of *A. clypeata* (De Not.) Sacc.	Da Camara 1949a; this paper
A. clypeata (De Not.) Sacc.	*Rosa* (Rosaceae); *Rubus* (Rosaceae)	New record in Portugal	This paper
A. clypeata f. *rubi-ulmifolii* Gonz. Frag.	*Rubus* (Rosaceae)	A synonym of *A. clypeata* (De Not.) Sacc.	This paper
A. clypeata var. *macrospora* Da Camara	*Rubus* (Rosaceae)	A species of *Clypeosphaeria*	Da Camara 1949b; Francis 1975; this paper
A. clypeatula Da Camara	*Jasminum* (Oleaceae)	A synonym of *A. tomicoides* Sacc.	Da Camara 1949b; Francis 1975
A. conorum (Fuckel) Sacc.	*Coronilla* (Leguminosae-Papilionoideae); *Mesembryanthemum* (Aizoaceae)	New record in Portugal	This paper

Species	Portugal hosts	Conclusions	References
A. consanguinea (Ces.) Sacc.	*Chamaerops* (Palmae)	New record in Portugal	This paper
A. constipata (Mont.) Sacc.	*Smilax* (Smilacaceae)	Portugal collections are species of *A. smilacis* (Auersw.) Fabre	This paper
A. cyperaceicola B. S. Lu & K. D. Hyde	*Scirpus* (Cyperaceae)	A new species	This paper
A. hypsophila Ellis & Everh.	*Lonicera* (Caprifoliaceae)	The type specimen of this species and the Portugal collections are species of *Amphisphaerella*	This paper
A. lavandulae T. Lucas & S. Dias	*Crataegus* (Rosaceae); *Lavandula* (Labiatae)	A synonym of *Anthostomella delitescens* (De Not.) Sacc.	Lucas & Da Camara 1954; this paper
A. olearum Sacc. & Speg.	*Olea* (Oleaceae)	The type material of this species and the Portugal collection are species of *Rosellinia*	This paper
A. palmacea (Cooke) Sacc.	Palm (Palmae)	It was transferred to *Didymosphaeria* by Francis and to *Montagnula* by Aptroot; The Portugal collections are *Anthostomella tenacis* (Cooke) Sacc	Francis 1975; Aptroot 1995; this paper

Species	Portugal hosts	Conclusions	References
A. phoenicicola Speg.	*Asparagus* (Asparagaceae); *Chamaerops* (Palmae); Palm (Palmae)	The Portugal collections are *Anthostomella tenacis* (Cooke) Sacc	This paper
A. pisana Pass.	*Chamaerops* (Palmae)	The Portugal collections are *Anthostomella tenacis* (Cooke) Sacc	This paper
A. scirpi B. S. Lu & K. D. Hyde	*Scirpus* (Cyperaceae)	A new species	This paper
A. scopariae Fabre	*Crataegus* (Rosaceae); *Erica* (Ericaceae)	A synonym of *Anthostomella delitescens* (De Not.) Sacc.	Fabre 1883; this paper
A. smilacis (Auersw.) Fabre	*Arecastrum* (Palmae); *Smilax* (Smilacaceae)	New record in Portugal	Francis 1975; this paper
A. punicae Lucas & Da Camara	*Punica* (Lythraceae)	A species of *Clypeosphaeria*	Lucas & Da Camara 1952; Francis 1975
A. yuccae Thüm.	*Cordyline* (Agavaceae); *Dasylirion* (Dracaenaceae); *Yucca* (Agavaceae)	A synonym of *A. sphaeroidea* Speg.	Francis 1975

References

Aptroot, A. 1995. A monograph of *Didymosphaeria*. *Studies in Mycology* 37: 1-160.

Da Camara, E.S. 1949a. Mycetes aliquot Lusitaniae. IX. *Agronomia Lusitana* 11: 39-73.

Da Camara, E.S. 1949b. Mycetes aliquot Luisitaniae. X. *Agronomia Lusitana* 11: 165-189.

Fabre, J.H.C. 1883. Essai sur les Sphériacées du Department de Vaucluse. (Deuxième partie). *Annales des Sciences Naturelles*, Botanique. sér. 6, 15: 31-69.

Francis, S.M. 1975. *Anthostomella* Sacc. (Part I). *Mycological Papers* 139: 1-97.

Hyde, K.D. 1996. Fungi from palms. XXVI, the genus *Anthostomella*, with ten new species. *Nova Hedwigia* 62: 273--340.

Lu, B.S. & Hyde, K.D. 1998. Monographic studies on the genus *Anthostomella. Proceedings of the Asia-Pacific Mycological Conference on Biodiversity and Biotechnology*, 6-9 July 1998, Huahin, Thailand, p 260--263.

Lu, B.S., Hyde, K.D. & Ho, W.W.H. 1998. *Spirodecospora* gen. nov. (Xylariaceae, Ascomycotina) from bamboo in Hong Kong. *Fungal Diversity* 1:169--177.

Lucas, M.T. & Da Camara, E.S. 1952. Fungi Lusitaniae. II. *Agronomia Lusitana* 14: 193-227.

Lucas, M.T. & Da Camara, E.S. 1954. Fungi Lusitaniae. VIII. *Agronomia Lusitana* 16: 81-104.

MYCOTAXON

Volume LXXIV(2), pp. 391-394 April-June 2000

A NEW SPECIES OF CANOMACULINA (LICHENIZED ASCOMYCOTINA, PARMELIACEAE) FROM ARGENTINA

Lidia I. Ferraro

Universidad Nacional del Nordeste, Instituto de Botanica del Nordeste,
Sargento Cabral 2131, Casilla de Correo 209, 3400 Corrientes, Argentina

John A. Elix

Department of Chemistry, The Faculties, Australian National University,
Canberra, ACT 0200, Australia

ABSTRACT : The species *Canomaculina laciniella* Ferraro & Elix is described as new to science. It is quite widely distributed on trees in northern Argentina.

South America appears to be the major centre of speciation of the parmelioid genus, *Canomaculina* Elix & Hale (= *Rimeliella* Kurok.) (Elix 1994, 1997). As a result of more recent studies on the regional species of Parmeliaceae (Ferraro 1979, Ferraro & Elix 1993), we are describing a further new species in this genus. Chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson & Amman 1979; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix *et al.* 1989; Elix & Ernst-Russell 1993) and high performance liquid chromatography (Feige *et al.* 1993; Elix *et al.* 1997) and by comparison with authentic samples.

Canomaculina laciniella Ferraro & Elix, sp. nov. Figure 1

Differt a *Canomaculina uruguayensis* lobis laciniatibus, laciniis canaliculatibus et pagina inferiore nigra.

Type. Argentina. Corrientes Province. Depto. Monte Caseros, Timboy Stream along Route 122, 13 km W of Monte Caseros, on trees at the forest margin, *A. Schinini et al. 19705;* 10 Sept. 1979; CTES-holotype; US-isotype.

Figure 1. *Canomaculina laciniella* (holotype in CTES). Scale = 5 mm.

Thallus corticolous, loosely adnate, coriaceous, mineral grey, 4-10 cm wide. *Lobes* rotund, 3-10 mm wide, margins broadly crenate, ciliate, cilia abundant, very short, 0.2-0.5 mm long, rarely sparsely branched; lobes often becoming laciniate, laciniae 1.0-3.0 mm wide, 3-10 mm long, dichotomously to digitately branched, convex, lower surface canaliculate. *Upper surface* plane, shiny, strongly effigurate white-maculate, becoming cracked with age, lacking soredia and isidia. *Lower surface* black to the margins; rhizines dimorphous, short rhizinate or papillate to the margins, short rhizines simple to commonly branched and intertwined, dense, to 0.3 mm long, long rhizines sparse, coarse, simple or dichotomously branched, more than 1.0-2.0 mm long. *Apothecia* common, stipitate, 2-7 mm wide; disc perforate, thalline exciple smooth then rugulose, strongly white-maculate; spores 10-12 x 6-8 µm. *Pycnidia* common, conidia filiform, 10-14 x 1 µm.

Chemistry. Cortex K+ yellow; medulla K+ yellow turning red, C-, P+ orange; containing atranorin (minor), chloroatranorin (minor), salazinic acid (major), consalazinic acid (minor), protocetraric acid (trace), usnic acid (trace).

The following characters, present in this species, are characteristic of the genus *Canomaculina* Elix & Hale: effigurate-maculate upper surface, dimorphous rhizines, sparsely branched cilia and filiform conidia (Elix 1997; Kurokawa 1991). Morphologically *C. laciniella* resembles *C. uruguayensis* (Kremp.) Elix and *C. cristobalii* (Ferraro & Elix) Elix. Although *C. uruguayensis* has intricate short rhizines like *C. laciniella*, this species has a brown lower surface for the most part (only becoming black in the centre) and lacks laciniae. *Canomaculina laciniella* is clearly distinguished from *C. cristobalii* on the other hand, by the smaller spores (10-12 x 6-8 µm *cf.* 13-16 x 7-10 µm), the nature of the laciniae (flat in *C. cristobalii* - convex in *C. laciniella*) and medullary chemistry. Thus *C. laciniella* contains medullary salazinic and consalazinic acids whereas *C. cristobalii* contains additional loxodin and norlobaridone.

Specimens Examined

ARGENTINA. Corrientes Province. Depto. Gral. Paz, Lomas de Vallejos, *A. Schinini & C. Quarín 7834,* 29.viii.1973 (BG,CTES),*Schinini & C. Quarín 7856,* 29.viii.1973 (CTES, COLO, US). Depto. San Cosme, Puerto Gonzales, on twigs at forest margin, *L. Ferraro et al. 1845,* 21.v.1979 (CTES). Depto. San Luis del Palmar, Route 6, 16 km SE of San Luis del Palmar, in *Quebracho* forest, *C. L. Cristóbal 1689,* 24.x.1976 (CTES, COLO, US). Depto. San Martín, Arrocera Drews, 8 km N of Carlos Pellegrini, on *Quebracho* at margin of thick bush, *L. Ferraro & S. Tressens 799,* 16.ii.1976, *A. Krapovickas & C. L. Cristóbal 17.353,* 30.x.1971 (CTES, US). Depto. San Roque, Route 23 along left side of the Río Santa Lucía, *L. Ferraro et al. 2930,* 28.xii.1983 (CTES, US). Depto. Santa Tomé, Estancia Timbó, 28°21, 55°47'W, *A. Schinini 23349,* 2.ii.1983 (CTES).

ACKNOWLEDGEMENT

We thank Stuart Hay and Neal McCracken of the Photographic Unit, ANU, for preparing the photographs and Dr Alan Archer for helpful amendments to the draft manuscript.

LITERATURE CITED

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113-125.

Culberson, C. F. & Ammann, K. (1979). Standardmethode zur Dünnschicht- chromatographie von Flechtensubstanzen. *Herzogia*, **5**, 1-24.

Culberson, C. F. & Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *Journal of Chromatography* **238**: 483-487.

Culberson, C. F., Culberson, W. L. & Johnson, A. (1981). A standardized TLC analysis of β-orcinol depsidones. *Bryologist*, **84**, 16-29.

Elix, J. A. (1994). *Canomaculina* and *Rimeliella*. *Flora of Australia* **55**: 20-21; 188-192.

-

Elix, J. A. (1997). The lichen genera *Canomaculina* and *Rimeliella* (Ascomycotina, Parmeliaceae). *Mycotaxon* **65**: 475-479.

Elix, J. A., & Ernst-Russell, K. D. (1993). *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd Edn. (Australian National University, Canberra).

Elix, J. A., Johnston, J. & Parker, J. L. (1988). A computer program for the rapid identification of lichen substances. *Mycotaxon* **31**: 89-99.

Elix, J. A., Wardlaw, J. H., Archer, A. W., Lumbsch, H. T., & Plümper, M. (1997). Four new depsidones from *Pertusaria* and *Lecanora* lichens. *Australasian Lichenology* **41**: 22-27.

Feige, G. B., Lumbsch, H. T., Huneck, S. & Elix, J. A. (1993). The identification of lichen substances by a standardized high-performance liquid chromatographic method. *Journal of Chromatography* **646**: 417-427.

Ferraro, L. I. (1979). Una nueva especie de Parmeliaceae para el NE. Argentino. *Hickenia* **1**: 191-193.

Ferraro, L. I. & Elix, J. A. (1993). Two new species of Parmeliaceae (lichenized Ascomycotina) from South America. *Mycotaxon* **49**: 405-409.

Kurokawa, S. (1991). *Rimeliella*, a new lichen genus related to *Rimelia* of the Parmeliaceae. *Annals of the Tsukuba Botanical Garden* **10**: 1-14.

MYCOTAXON

Volume LXXIV(2), pp. 395-414 April-June 2000

MICROSCOPIC ASCOMYCETES ISOLATED FROM ROTTING WOOD IN THE BOREAL FOREST

T.C. LUMLEY[1], S.P. ABBOTT[1,2], and R.S. CURRAH[1]
[1]Department of Biological Sciences, University of Alberta,
Edmonton, AB, T6G 2E9, Canada
[2]University of Alberta Microfungus Collection and Herbarium,
Devonian Botanic Garden, Edmonton, AB, T6G 2E1, Canada

Abstract: During a survey of microfungi from rotting wood in northern Alberta forests, 49 species of ascomycetes, representing 24 genera, and 15 families in seven orders, were recovered. Twenty-eight species are new reports for Alberta, 15 of which are new for Canada, and seven are new for North America. Twenty species have not been reported previously from wood. The most frequently isolated species were *Microascus albonigrescens* and *Gelasinospora tetrasperma*. Diversity and abundance of ascomycete microfungi suggest that these fungi are a more significant component of wood decay fungus communities than previously recognized.

Keywords: biodiversity, decomposition, fungi, poplar, spruce, wood decay

Introduction

Woody material is a large reservoir of carbon in forest ecosystems, but relatively little is known about the communities of fungi that are responsible for the decomposition of this material. Most studies have concentrated on wood-decay basidiomycetes (e.g., Martin and Gilbertson 1978), or ascomycetes with superficial and macroscopic fruiting bodies (e.g., Abbott and Currah 1989), but the isolation of microscopic ascomycetes from wood has rarely been attempted. Studies of microfungi from wood have primarily reported hyphomycetes, and include only a few ascomycetes (e.g., Crawford et al. 1990; Duncan and Eslyn 1966).

During a survey of microfungi associated with decomposing wood in the boreal forest of Alberta, 298 fertile ascomycete cultures were recovered. Many of these are previously unknown from wood and some are known only from a few collections worldwide. It is our opinion that these hitherto overlooked organisms are not only playing an important role in the ecology of wood decay, but are important components of the biodiversity of boreal forest ecosystems. For these reasons, we provide an annotated list of ascomycetes recovered from rotting logs in undisturbed boreal forest of northern Alberta, as well as from logs of post-fire and post-harvest sites in the same region.

Materials and Methods

Study sites and sampling. Logs of diameter greater than 15 cm were sampled from undisturbed (1000 samples), post-fire (300 samples), and post-harvest (250 samples) sites in north-central and northeastern Alberta, Canada during the summers of 1995-1997. Most samples were taken from sites in Elk Island National Park (53°40'N, 112°48'W), Mariana Lakes area (56°16'N, 111°40'W), near Slave (55°35'N, 114°42'W) and Calling (55°26'N, 113°33W) Lakes, but some samples were taken from several other sites. Most samples were from white spruce (*Picea glauca*) and aspen (*Populus tremuloides*), but some were from other species (*Abies balsamea, Alnus tenuifolia, Betula papyrifera, Larix laricina, Picea mariana, Pinus banksiana, Populus balsamifera, Salix discolor*). Stage of decomposition was determined for each log. Gymnosperm logs were characterized according to Sollins (1982). Stage I logs were newly fallen and supported above the ground by branches; bark was intact. Stage II were losing small branches, but wood was hard. Stage III had lost most branches and bark and were in contact with the ground along the entire length; wood was soft. At stage IV, bark and branches were gone and the wood was broken into large chunks, and by stage V, wood was becoming humified and visible as a hummock on the forest floor. Angiosperm logs decompose more quickly and less uniformly, with fewer consistent external indicators. Consequently, only three decomposition stages were recognized: early stage (stage I) logs still had bark and branches attached, intermediate stage (stage II) logs were noticeably softer, and had most bark and branches gone, and late stage (stage III) logs were mostly humified and visible as hummocks.

Media and plating. Logs were sampled in one of two ways. Early stage logs, with wood intact, were sampled by cutting cross-sectional "cookies" with a bow-saw and extracting samples (approximately 1cm^3) using an ethanol-sterilized chisel. Late stage logs were sampled by extracting approximately 1 cm^3 of wood at various depths in the log. All samples were briefly flamed, and plated onto six media to encourage the growth of a broad spectrum of fungi. Media used were: tapwater agar (TWA, 1.5% agar w:v, which served primarily as a moist chamber), cornmeal agar (CMA, Difco, a non-specific medium), malt extract agar (MEA, 1.5% agar and malt extract w:v, a non-specific medium with a relatively high content of easily-assimilated carbon), MEA with benomyl (2 mg/L, primarily for the selection of resistant ascomycetes, such as Microascales), MEA with Rose Bengal (to retard the growth of all fungi, thus preventing rapid overgrowth and allowing isolation of slow-growing fungi), and Mycobiotic agar (MB, Difco, contains 400 mg/L cycloheximide which inhibits most fungi with the exception of certain ascomycetes, including some Onygenales and Microascales). Tetracycline (100 mg/L) was added to all media to inhibit the growth of bacteria.

Isolation and identification. Primary isolation plates were incubated at room temperature (19-24°C) and examined every 2-3 months, for 18-24 months. Species determinations were made either directly from primary isolation plates or from pure cultures grown on MEA, or on other diagnostic media, as required. Polyvinyl alcohol and lactofuchsin were used as mounting media (Sigler 1992). Ascospores were observed in squash mount preparations. Slide cultures used cereal agar (Sigler 1992). Representative isolates and specimens are maintained in the University of Alberta Microfungus Collection and Herbarium (UAMH).

Enzymatic abilities. Cellulolytic ability was determined for selected strains following the cellulose azure method of Smith (1977) using a basal salts medium. Molten basal salts medium (10 ml) was poured into 50 ml screw-cap test tubes and these were autoclaved for 12 minutes at 121°C. One millilitre of a molten 2% suspension (w:v) of cellulose azure (Difco) in basal salts medium was added to each of the cooled test tubes. Test tubes were inoculated with small (1 mm^3) cubes of agar taken from the perimeter of colonies on MEA, and incubated in the dark at room temperature for eight weeks.

Results

Twenty-four genera, 15 families, and seven orders are represented. Twenty-eight species are new records for Alberta, eight of these are new records for Canada, and seven for North America. Twenty species have not been reported previously from wood. Isolation numbers are summarized for the eight most common genera (Fig. 1).

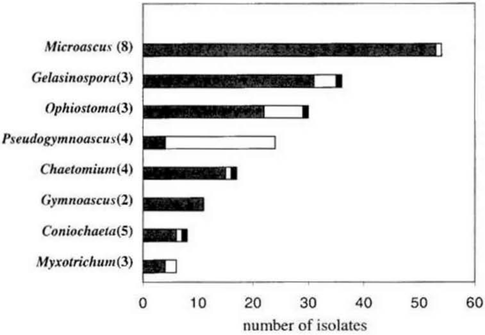


Figure 1. Number of isolates from the eight most common genera of ascomycetes isolated from rotting wood from undisturbed (gray), post-fire (white), and post-harvest (black) sites in the boreal forest of Alberta. Number of species is in parentheses.

Overall, *Microascus albonigrescens* was the most common (36 isolates), followed by *Gelasinospora tetrasperma* (32 isolates). *Pseudogymnoascus roseus* was also common (16 isolates) but was isolated almost exclusively from post-fire sites. Other examples of habitat specificity include *G. tetrasperma* almost exclusively from bark and *Gymnoascus uncinatus*, which was found only in Elk Island National Park. Only seven species were recovered from post-fire sites, including five from *Myxotrichaceae* (*Myxotrichum arcticum*, *Pseudogymnoascus alpinus*, *Pseudogymnoascus sp.*, *Pseudogymnoascus frigidus*, and *Pseudogymnoascus roseus*), and only four species were recovered from post-harvest sites (*Chaetomium funicola*, *Coniochaeta saccardoi*, *Gelasinospora tetrasperma*, and *Podospora tetraspora*).

Some species were strictly associated with one wood type. Twenty-one species were found only on gymnosperms and nine species were isolated exclusively from poplars. Species recovered from both log types were *Chaetomium funicola*, *Coniochaeta malacotricha*, *C. saccardoi*, *Emericella nidulans*, *Eupenicillium* *lapidosum, G. tetrasperma, Microascus* cf. *nidicola, M. singularis*, and *Ophiostoma piluliferum*.

Discussion

Overall, most isolates came from wood sampled in undisturbed sites, where most of the samples were taken. Species of *Gymnoascus* came only from the undisturbed site in Elk Island National Park, and all but one isolate of *Microascus* spp. also came from this site. There was evidence of a great deal of animal activity, especially by ungulates, whose dung may have contributed to the relatively large number of isolations of these fungi. Species of *Chaetomium, Coniochaeta, Ophiostoma*, and *Gelasinospora* were isolated from all site types, and *Pseudogymnoascus* and *Myxotrichum* spp. (Myxotrichaceae) were isolated from undisturbed and post-fire sites only.

Direct examination of logs, branches, and twigs for superficially fruiting ascomycetes has been the traditional method for wood surveys, but the ascomycete flora detected in this manner (e.g., Ellis and Ellis 1985) is quite different from those isolated from the interior of decayed logs by plating the wood directly. Soft-rot fungi, including many *Chaetomium* spp., are vigorously cellulolytic and prevalent in wood (Rayner and Boddy, 1988) but only observable after isolation. In addition to cellulose, other substrata are also available to microfungi in rotting wood. These include lignin, xylan, insect frass and carcasses, keratinous animal remains, and other residual proteinaceous material and organic compounds deposited by the action of other organisms. The diversity of additional substrates may help explain the diversity of ascomycete species that have not previously been reported from rotting wood. Some of these ascomycetes, while not strongly cellulolytic, are able to utilize other substrata and may be an integral part of the decay process.

The Microascaceae (teleomorphs and anamorphs) are commonly reported from urban and agricultural areas, and are reported only infrequently from nature, with even fewer reports from the boreal forest. Collections of this group come mainly from dung, litter, soil, or as airborne spores (e.g., Morton and Smith 1963; von Arx et al. 1988), but *Microascus* species were the most commonly isolated in this study, and the genus *Microascus* accounted for the greatest number of species (Fig. 1). Most microascaceous fungi are cellulolytic and proteolytic, and presumably their role in the communities of fungi on herbivore dung is the degradation of residual cellulose and proteins. Cellulose-rich woody debris on the forest floor has not been extensively sampled for these fungi. Cellulolytic abilities for five of the *Microascus* species recovered (*Microascus albonigrescens, M. longirostris, M. manginii, M.* cf. *nidicola, M. singularis*) were tested using cellulose azure and by cellophane membrane degradation (Abbott and Lumley unpublished results). All species were moderately or weakly cellulolytic: *M. albonigrescens* was best able to degrade cellulose, while *M. longirostris, M. manginii, M.* cf. *nidicola*, and *M. singularis* degraded cellulose only to a limited extent after prolonged incubation. Interestingly, *M. albonigrescens* was the most frequently isolated species of *Microascus* (36 isolates) and the other species of *Microascus* were comparatively rare (18 isolates in total). Many anamorphic taxa allied to the Microascaceae were also recovered from decayed wood, including species of *Scopulariopsis, Cephalotrichum* and *Wardomyces*.

Ophiostoma species and their anamorphs (e.g., *Leptographium* spp.) are a common cause of bluestain (Dowding 1970; Wingfield et al. 1993), and are frequently found associated with beetle galleries. These fungi are frequently isolated from lumber and logs, but very little is known about the ability of *Ophiostoma* species to compete with fungi during the latter stages of wood decomposition. Three species isolated produced perithecia in pure culture and, although anamorphic Ophiostomataceae were common during this study, teleomorphic strains were uncommon.

Chaetomium species are strongly cellulolytic, soft-rot fungi often isolated from soil (Gochenaur 1978), humus, litter, dung (Cain 1934), and wood (Duncan and Eslyn 1966). Many *Chaetomium* species are active at low water availability and their action can cause an accumulation of moisture. This is ecologically significant because it allows *Chaetomium* species to inhabit xeric environments where there is relatively little competition, but as water accumulates, they may be replaced by other, less xerotolerant, species. *Chaetomium* spp. were isolated from all site types and were among the few ascomycete species from post-harvest sites. These species were most frequent from early or intermediate stage logs, presumably correlated to low moisture levels.

The ecology of the Myxotrichaceae is virtually unknown, owing mainly to the inconspicuous nature of the ascomata and the relative difficulty with which they are cultured from natural substrata. Of the 16 accepted species, over half are known from three or fewer collections worldwide. Consequently, species distributions are uncertain and taxonomic circumscriptions at the species level are unreliable. Their ability to degrade cellulose is well-documented (Currah 1985) and, like *Microascus* species, were found to exhibit a broad range of cellulolytic abilities. ***Pseudogymnoascus roseus*** was the most efficient, followed by other *Pseudogymnoascus* species and *Myxotrichum arcticum*, which were only weakly cellulolytic, while isolates of *Myxotrichum ochraceum* and *Myxotrichum cancellatum* showed little or no cellulolytic ability. It is interesting that most isolates of *Pseudogymnoascus* spp. were recovered from post-fire sites, including from charred wood, although the reason for this is unknown.

Annotations

Species are listed alphabetically by genus and species with annotations concerning key diagnostic features and information on substrates and distribution. Annotations provide: Name and citation, taxonomic affiliation (Family, Order) following Eriksson and Hawksworth (1998), distinctive morphological features, taxonomic notes, substratum preference (stages I-V gymnosperm, stages I-III angiosperm) and any special adaptations (e.g., xerophily), and geographic distribution. "Collections examined" includes other specimens from Alberta and worldwide, including type material in some cases, used to confirm identity. Unless otherwise noted, material from Elk Island National Park, Mariana Lake, and Slave Lake was isolated by T. Lumley. To designate a taxon as a new record for Alberta, Canada, or North America, published works were searched, but herbarium records and unpublished lists were not.

Arthroderma curreyi Berkeley, 1860, Outlines of Brit. Fungology, p. 357.
(Arthrodermataceae, Onygenales)

Ascomata sterile; *Chrysosporium* anamorph distinguishes this species from other heterothallic *Arthroderma* species. Keratinolytic (Currah 1985), found on bark in one undisturbed site, possibly from bird activity (Pugh 1964). Widespread (e.g., Europe, Australia, USA). The specimen reported from Alberta in Currah (1985) proved to be *A. cuniculi*.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* bark, III, IV (UAMH 8728). **USA: Ohio:** soil, Kurup 1968 (UAMH 3171). **AUSTRALIA:** Melbourne: ex human arm (UAMH 7903).

Byssochlamys* cf. *fulva Oliver and Smith, 1933, J. Bot. Lond. 72: 197.
(Trichocomaceae, Eurotiales)

Cleistothecia pallid; ascospores hyaline, refractive, 6 x 4 µm; *Paecilomyces* state abundant. Several isolates were recovered on primary isolation plates after one-year incubation, but pure cultures were not obtained. Conidium size differed from the type of *B. fulva* (3-4.5 x 2-3 µm in UAMH 9624 versus 4.5-9 x 1.5-3.5 µm in UAMH 3094), and from the range reported in Stolk and Samson (1971)(4-8.5 x 1.5-5 µm) .

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* II, 2-year post-fire site (UAMH 9624); *Picea glauca* III; Elk Island National Park: *Populus tremuloides* II decomposition. **UK:** bottled fruit, Rendle 1933 (ex-type of *B. fulva*)(UAMH 3094).

Chaetomium funicola Cooke, 1873, Grevillea 1: 176.
(Chaetomiaceae, Sordariales)

Perithecia with distinctive two-tiered hairs, the first short, dichotomously-branched hairs, the second long and straight; ascospores limoniform, more acute at one end, 5.5-6.5 x 3.5-5.0 µm. Separated from the similar *C. dolichotrichum* Ames, which has dichotomously-branched hairs, by the presence of a second tier (Domsch et al. 1980), and from *C. elatum* Kunze : Fries by the smaller ascospores (10-13 x 8-10 µm in *C. elatum*). A cellulolytic, soft-rot fungus (Duncan and Eslyn 1966), possibly xerophilic. Worldwide, reported from pine litter (Hayes 1965), timber and paper, and forest soil (Hammill 1970). First report for Alberta.

Material examined: CANADA: Alberta: Elk Island National Park: *Populus tremuloides* II (UAMH 9370), *Picea glauca* I, IV; Slave Lake: 15-year post-harvest site, *Populus tremuloides* II. **USA:** Benjamin RSA 1683 (UAMH 3034). **COSTA RICA:** La Selva, Heredia Prov.: ex roots of epiphytic orchid *Pleurothallis* sp., Richardson 1991 (UAMH 7194).

Chaetomium globosum Kunze: Fries, 1829, Syst. Mycol. 3: 226.
(Chaetomiaceae, Sordariales)

Perithecia with wavy lateral hairs and undulate to loosely coiled terminal hairs; ascospores limoniform, 8.5-11.0 x 7.0-9.0 µm. Our isolates are probably var. *ochraceoides* Dreyfuss, because of the small ascospores and olive-green ascomata, but the delimitation among the five described varieties is not sharp (Dreyfuss 1976). *C. globosum* is common worldwide on most cellulosic substrata, including forest soil and litter (Hayes 1965), and wood (Mangenot 1952). Ascospores can survive drying for more than ten years (Page 1951). Reported from Alberta (Abbott et al. 1995; Sigler et al. 1996)

Material examined: CANADA: Alberta: Mariana Lake: *Populus tremuloides* I; Grimshaw: indoor air from *Apis mellifera* (honeybee) overwintering facility, Abbott 1994 (UAMH 7773); Devonian Botanic Garden near Devon: canvas in butterfly chrysalis incubation chamber, Abbott 1993 (UAMH 7407); Edmonton: indoor air, Sigler 1989 (UAMH 7142).

Chaetomium homopilatum Omrik, 1953, Mycologia 47: 749.
(Chaetomiaceae, Sordariales)

Perithecia elongate (subcylindric to ampulliform) with lateral and terminal, straight, unbranched hairs; ascospores limoniform with strongly apiculate apices, bilaterally flattened, 8.5-10 x 4.5 µm; *Botryotrichum* state present. First report from Canada.

Material examined: CANADA: Alberta: Elk Island National Park: *Populus tremuloides* II (UAMH 9453). **COSTA RICA: Heredia:** La Selva, roots of epiphytic orchid (*Dryadella pusiola*) Richardson 1991 (UAMH 7196).

Chaetomium piluliferum Daniels, 1961, Trans. Brit. Mycol. Soc. 44: 84.
(Chaetomiaceae, Sordariales)

Perithecia with uncinate hairs; ascospores ellipsoid, 13-16 x 7-8 µm; *Botryotrichum* state of large, globose, hyaline conidia from a hyaline, racemosely-branched conidiophore. Ascomata typically sterile, but two isolates examined from Alberta (UAMH 1086, 1387) form fertile ascomata in culture. *C. murorum* and *C. piluliferoides* are similar, but have narrower ascospores (Domsch et al. 1980). *Chaetomium piluliferum* is often found on dung, but also in soil and, less commonly, on wood. Cellulolytic (Daniels 1961), chitinolytic (Okafor 1967), and ligninolytic (Haider and Domsch 1969). Reported from Alberta by Sigler et al. (1996).

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II, V, *Populus tremuloides* II (UAMH 9371); Mariana Lake: *Picea glauca* II; Grimshaw: indoor air from honeybee (*Apis mellifera*) overwintering facility, Abbott 1994 (UAMH 7718); Edmonton: lungs ex Richardson's ground squirrel (*Spermophilus richardsonii*), Carmichael 1962 (UAMH 1387); spleen of rodent, Carmichael 1960 (UAMH 1086); coyote (*Canis latrans*) dung, Currah (UAMH 5589).

Coniochaeta ellipsoidea Udagawa, 1967, Trans. Mycol. Soc. Japan 8: 51.
(Coniochaetaceae, Sordariales)

Perithecia sparsely setose; ascospores asymmetrical, 20-25 x 10-11.5 µm. A single strain of this species produced confluent ascomata on the primary isolation plate, but subsequent subcultures were not viable. Previously reported from soil in Japan and Spain (Udagawa and Takada 1967; Checa et al. 1988). First record for North America and from wood.

Material examined: CANADA: Alberta: Slave Lake: 30-year post-fire site *Picea glauca* III (UAMH 9502).

Coniochaeta ligniaria (Greville) Massee, 1887, Grevillea 16: 37.
(Coniochaetaceae, Sordariales)

Perithecia setose, black; ascospores discoidal, with longitudinal germ slit, 11-13 x 8.5-9.5 µm; *Lecythophora* anamorph. Reported from wood of *Alnus, Fagus, Pinus, Quercus, Ulex,* and *Ulmus*, including some from western Canada (Ellis and Ellis 1985; Ginns 1986).

Material examined: CANADA: Alberta: Rocky-Clearwater Forest: rotted *Populus* wood, Sigler 1986 (UAMH 5533).

Coniochaeta malacotricha (Auserwald) Traverso, 1907, Flora Italica Cryptogama 1: 473.
(Coniochaetaceae, Sordariales)

Perithecia setose, black; ascospores asymmetrical, broadly ellipsoid in face view, 10-12.5 x 5.5-7 µm; *Lecythophora* anamorph. Fertile ascomata abundant on cellophane membrane (Carmichael 1963). Previous reports only from conifer wood (Mahoney and LaFavre 1981; Rogers and Grand 1971), including *Pinus* in Ontario (Ginns 1986). First report on poplar; first reports for Alberta.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* II (UAMH 9375); Elk Island National Park: *Populus tremuloides* II; Slave Lake; *Picea glauca* III (UAMH 9503).

Coniochaeta saccardoi (Marchal) Cain, 1968, Bibl. Mycol. 9: 65.
(Coniochaetaceae, Sordariales)

Perithecia densely setose, black; ascospores narrowly ellipsoid, 13-17 x 6-8 µm. Typically dung or soil inhabiting (Mahoney and LaFavre 1981), known previously in the boreal forest from rabbit dung in Saskatchewan (Cain 1934) and from caribou dung in arctic Alaska (Kobayasi et al. 1969). First report from wood and first report for Alberta.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV, V; Mariana Lake: *Populus tremuloides* III (UAMH 9504, 9505).

***Coniochaeta* sp.**

(Coniochaetaceae, Sordariales)

Perithecia pyriform to ovoid, black, moderately setose; asci cylindric with 8 uniseriate ascospores; ascospores black, smooth, with longitudinal germ slit, lacking gelatinous sheath, 11.5-14 x 4.5-5.5 µm; *Lecythophora* anamorph with allantoid conidia. Overlaps with *C. saccardoi*, but distinguished by consistently smaller ascospores and darker colonies. Possibly a new taxon.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* I (UAMH 9506).

Cryptendoxyla hypophloia Malloch and Cain, 1970, Can. J. Bot. 48: 1816.

(Pseudeurotiaceae, Eurotiales)

Ascomata black, non-ostiolate, peridium "cephalothecoid" (Malloch and Cain 1970); asci evanescent, pyriform, short-stipitate, 8-spored; ascospores dark-brown, long-cylindrical, 4.5-5.5 x 2-3 µm; *Chalara* anamorph common in most isolates, rarely sparse. Species originally described beneath the bark of standing, dead ("snag") deciduous trees (Malloch and Cain 1970). Our isolate came from an aspen snag and is the first record from outside Ontario. Possibly arthropod dispersed (Malloch and Cain 1970).

Material examined: CANADA: Alberta: Elk Island National Park: standing (snag) *Populus tremuloides* (UAMH 9468). **Ontario:** Ottawa: nails of human male, 1995 (UAMH 8816); ex human hand, 1991 (UAMH 7049).

Emericella nidulans (Eidam) Vuillemin, 1927, Compt. Rend. Hebd. Séances Acad. Sci., Paris 184: 137.

(Trichocomaceae, Eurotiales)

Cleistothecia reddish, surrounded by a layer of yellow hülle cells; ascospores with two ribbed equatorial crests, or "flanges", 4-6 x 3-4 µm; *Aspergillus* state (*A. nidulans* (Eidam) Winter), conidiophores pigmented, with biseriate aspergilla and rough-walled, globose conidia. Distinguished from the similar *Emericella rugulosa* by smooth, convex ascospore walls, and rapid growth rate (Klich and Pitt 1988). *E. nidulans* is most frequently isolated from soil in warm regions (Domsch et al. 1980), but reports also include Canada and Alberta (Bisby et al. 1935; Sigler et al. 1996). Cellulolytic (Marsh et al. 1949; Reese and Downing 1951; Reese and Levinson 1952) and possibly ligninolytic (Bull and Carter 1973). First report from wood.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV; Wagner Natural Area near Spruce Grove: *Populus balsamifera* II, Abbott 1996 (UAMH 9373), rotted wood of willow (*Salix discolor*), Abbott 1996 (SA-M280); Grimshaw: indoor air from *Apis mellifera* (honeybee) overwintering facility, Abbott 1994 (UAMH 7677).

Eremomyces bilateralis Malloch and Cain, 1971, Can. J. Bot. 49: 849-850.

(Eremomycetaceae, Dothideales)

Cleistothecia globose, black; ascospores hyaline, plano-convex, 3.5-5.5 x 2-3.5 µm; anamorph lacking. Although ascomata and ascospores are reminiscent of Microascaceae, this species is readily distinguished by cleistothecia that split at maturity to release a hyaline spore mass, and by the pseudoparenchymatous ascoma initials. Found previously on herbivore dung in North America and Africa (Malloch and Cain

1971a; Malloch and Sigler 1988). Our isolates are the most northerly collections known and the first report for Alberta and from wood.

Material examined: CANADA: Alberta: Elk Island National Park: *Populus tremuloides*, III (UAMH 8972, 8973). **USA: California:** Crystal Spring Reservoir, San Mateo Co.: pack rat dung, Malloch 1969 (paratype) (UAMH 5516).

Eupenicillium lapidosum Scott and Stolk, 1967, Antonie Leeuwenhoek J. Microbiol. 33: 298.
(Trichocomaceae, Eurotiales)

Cleistothecia with large refractive peridial cells; ascospores echinate, with 2 prominent, thin, equatorial crests; 6-6.5 x 4-4.5 µm; *Penicillium* anamorph. Uncommon, but primarily from soil. First report for Alberta and from wood.

Material examined: CANADA: Alberta: Red Earth: *Populus tremuloides* III, *Picea glauca* III; Mariana Lake: *Picea glauca* V, *Populus tremuloides* III (UAMH 9493).

Eurotium chevalieri Mangin, 1901, Ann. Sci. Nat. Botan., Ser. 9, 10: 361.
(Trichocomaceae, Eurotiales)

Cleistothecia bright yellow, subglobose; ascospores smooth, with 2 distinct equatorial flanges, mostly 4.5 µm diameter; anamorph in the *Aspergillus glaucus* group. Xerophilic, previously reported mainly as an airborne contaminant from Alberta (Sigler et al. 1996). First report from wood.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* V; Fairview: indoor air from *Apis mellifera* (honeybee) overwintering facility, Abbott 1994 (UAMH 7682). **USA:** ex coffee beans, Thom 1916 (authentic strain of *Eurotium chevalieri*) (UAMH 6583).

Gelasinospora endodonta (Malloch and Cain) von Arx, 1973, Kon. Ned. Akad. van Weten. Amsterdam Ser. C 76: 290.
(Sordariaceae, Sordariales)

Perithecia pyriform, ascospores broadly ellipsoid, black, surface with small, conical pits, 18.5-22 x 14.5-17 µm. Reported from soil in Australia (Malloch and Cain 1971b as *Anixiella endodonta*). First report for North America and from wood.

Material examined: CANADA: Alberta: Slave Lake: 15-year post-fire site *Picea glauca* III (UAMH 9501).

Gelasinospora retispora Cain, 1950, Can. J. Res. 28: 573.
(Sordariaceae, Sordariales)

Perithecia pyriform, black; asci 8-spored; ascospores, ellipsoid to broadly ellipsoid, with large, angular pits, 28-32 x 14-16 µm. Known from soil, litter, seeds, apple twigs and *Nothofagus* wood (Cain 1950; Domsch et al. 1980). Our single collection matches the ex-type culture (UAMH 484), and is the first report from Alberta.

Material examined: CANADA: Alberta: Slave Lake: *Picea glauca* V (UAMH 9495). **NETHERLANDS:** seeds of *Beta vulgaris*, 23 Dec 1955 (ex-type of *Gelasinospora retispora*) (UAMH 484).

Gelasinospora tetrasperma Dowding, 1933, Can. J. Res. 9: 294.
(Sordariaceae, Sordariales)

Perithecia pyriform, black; asci 4-spored; ascospores ellipsoid, surface finely pitted, 23-27 x 13-16 µm. Common from herbivore dung, especially in North America (Cain 1950; Kobyasi et al. 1969). Homothallic or secondarily homothallic (Sanni 1982). A first report from Alberta, but common from wood, especially burn sites in this study. Also reported from *Vaccinium* in Quebec (Ginns 1986). Ascospores may germinate

only after heating (Cain 1950). First report from wood.
Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* I-V, *Populus tremuloides* I- III, burned rotted (stage IV) wood of jack pine (*Pinus banksiana*) in 1-year-old fire site, Abbott 1996 (UAMH 9372); Elk Island National Park: *Picea glauca* IV, V. **Ontario:** Muskoka District: coniferous duff in mixed forest, Khan 1990 (UAMH 7729); from Cain to Keeping 1955 (authentic material) (UAMH 480).

Gymnoascus reessii Baranetzky, 1872, Botanische Zeitung 30:158.
(Gymnoascaceae, Onygenales)
Cleistothecia small, deep orange to dull rust, peridium of interwoven, modified hyphae with numerous bifurcate and trifurcate appendages; ascospores oblate, red-brown, smooth, 3.0-4.0 x 1.5-2.5 µm. *G. reessii* is common from soil (Wicklow and Wittingham 1974) and dung of herbivores (Currah 1985) and carnivores (Sigler and Flis, 1998). Neither keratinolytic nor cellulolytic. First report from wood.
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV (UAMH 8531), V; Lost River Canyon: coyote (*Canis latrans*) dung, Sigler 1983 (UAMH 4809); Red Deer: leg scrapings ex human female, Brown 1981 (UAMH 4416). **USA: California:** Coolinga, Fresno Co.: soil, Orr (UAMH 3158).

Gymnoascus uncinatus Eidam, 1880, Cohn Beitr. Biol. Pfl. 3:292.
(Gymnoascaceae, Onygenales)
Cleistothecia yellow-brown when mature, with long, uncinate peridial appendages; ascospores oblate, scattered pits barely visible under oil immersion, 4.5-5.5 x 1.5-3 µm; anamorph resembles *Chrysosporium merdarium*, with large yellow, asperulate conidia. *G. uncinatus* previously known only from dung (Samson 1972). Weakly cellulolytic, reports of keratinolytic ability (Currah 1985; von Arx 1987) not corroborated here. Previously reported from rotting wood in Alberta (Lumley and Currah 1995).
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II, IV, V (UAMH 8530, 9421). **USA: California:** dung, Benjamin (ex-type of *Gymnoascus uncinatus*) (UAMH 3913).

Gymnostellatospora frigida Uchiyama, Kamiya, and Udagawa, 1995, Mycoscience 36: 214.
(Myxotrichaceae, Onygenales)
Cleistothecia orange-brown, peridium of thin-walled, little-differentiated hyphae; ascospores with coarse, longitudinal ridges, some of which appear sigmoid under oil immersion, 4-5 x 3-4 µm. Type based on one isolate from forest soil in Japan (Uchiyama et al. 1995b). Differentiated from *Pseudogymnoascus japonicus*, which has ascospores with a more distinct sigmoid crest, and by the olive-green ascomata in *P. japonicus*. First report for North America and the first from wood.
Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* V (UAMH 9239), 2-year post-fire site, *Picea glauca* V (UAMH 9240).

Kernia retardata Udagawa and Muroi, 1981, Trans. Mycol. Soc. Japan 22: 18.
(Microascaceae, Microascales)
Cleistothecia black, globose; asci evanescent; ascospores ellipsoid, light red-brown, with a single germ pore, 6-8 x 4.5-5.5 µm; *Scopulariopsis* anamorph. Isolates from well rotted spruce wood were morphologically consistent with three other isolates from Alberta collected on decomposing leaves and dung. Many produced cleistothecia only on natural substrata and primary isolation plates, but also produced conidia sparsely in pure culture. Ascospore size varies more than described for the type specimen, both

within and among collections. Previously known only from the type from soil in Japan (Udagawa and Muroi 1981). First report for North America and from wood.

Material examined: CANADA: Alberta: Slave Lake: *Picea glauca* III, 30 year post-fire site (UAMH 9500); Elk Island National Park: *Picea glauca* IV, V (UAMH 9420, 9454), leaf litter under *Corylus cornuta* and *Populus tremuloides*, Abbott 1997 (UAMH 9455); Devonian Botanic Garden near Devon: leaves of aspen (*Populus tremuloides*) on lawn with snow mold, Abbott 1997 (UAMH 9026); south of Leduc: dung of skunk (*Mephitis mephitis*) on ground in farm yard, Abbott 1997 (UAMH 9027). **JAPAN:** Nishinasuno-machi, Nasu-gun, Tochigi: rice (*Oryza sativa*) field soil, Muroi 1978 (ex-type of *Kernia retardata*) (UAMH 9134).

Leptosphaerulina argentinensis (Spegazzini) Graham and Luttrell, 1961, Phytopathol. 51: 687.
(Pleosporaceae, Dothideales)

Pseudothecia black; ascospores muriform, typically with 5 longitudinal and 3 transverse septa, 34 x 12.5 µm. Known mainly as a leaf saprophyte. First report from rotting wood. Our isolates are the only reports for Canada, and are the most northerly collections known.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV (UAMH 9507); Edmonton: soil under coniferous tree, Carmichael 1962 (UAMH 1333).

Microascus albonigrescens (Sopp) Curzi, 1931, Boll. Staz. Patol. Veg. Roma 11: 60.
(Microascaceae, Microascales)

Ascocarps black, papillate to short-necked, ostiolate; asci evanescent; ascospores allantoid-reniform (concavo-convex), 4.5-5 x 3-3.5 µm, orange in mass, cirrhi especially well developed as medium dehydrates; *Scopulariopsis* anamorph, conidia narrowly ellipsoid or narrow ovoidal, with a truncate base, white in mass, abundant in some isolates. Originally described from Scandinavia (Sopp 1912), and reported from North America by Barron et al. (1961a). It has also been isolated from wood in Sweden (CBS catalogue) and litter in Japan (UAMH 8851). The most frequently isolated ascomycete during this study. Abundant in well-decayed conifer wood. First reports from Canada. Unlike other species of *Microascus*, which are common on dung and in soil, this species is found primarily on wood and litter.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II, IV, V (UAMH 8487, 8490, 9148), *Populus tremuloides* III; Slave Lake: 15-year post- fire site: *Populus tremuloides* III (UAMH 9529); North Buck Lake near Lac La Biche: debris of red squirrel (*Tamiasciurus hudsonicus*) midden under jack pine (*Pinus banksiana*), Abbott 1996 (UAMH 8753). **USA: Massachusetts:** R. Thaxter, Harvard University (UAMH 9322). **JAPAN:** litter, K. Tubaki 1968 (UAMH 8851).

Microascus brevicaulis S.P. Abbott, 1998, Mycologia 90: 298.
(Microascaceae, Microascales)

Perithecia subglobose, papillate, black; asci evanescent, ascospores broadly reniform, 5-6 x 3.5-4.5 µm; *Scopulariopsis brevicaulis* anamorph (Abbott et al. 1998). All fertile isolates described have come from Alberta. A single ascocarpic isolate came from well decayed spruce wood, but many anamorphic strains from rotted white spruce wood (UAMH 9145), burned wood of *Picea mariana* (UAMH 8628), aspen twigs (UAMH 9253), soil, litter, and dung in the boreal forest (e.g., UAMH 8746-8751) were collected.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* V (UAMH 9387); Scandia: indoor air from *Apis mellifera* (honeybee) overwintering facility, Abbott 1994 (holotype of *Microascus brevicaulis*) (UAMH 7770); Calgary: indoor air of basement of home, Abbott 1995 (UAMH 7880); Edmonton: straw ex birdhouse roosts, Carmichael 1961 (UAMH 1197); Barrhead: outside air ex RCS strip, Abbott 1996 (UAMH 8627); Lethbridge: dead housefly larva, Bell (UAMH 3753).

Microascus cinereus (Emile-Weil and Gaudin) Curzi, 1931, Boll. Staz. Patol. Veg. Roma 11: 60.
(Microascaceae, Microascales)

Perithecia papillate to short-necked; asci evanescent; ascospores narrowly reniform, typically 5.5 x 3 μm, orange in mass, forming a long cirrhus at maturity; dematiaceous *Scopulariopsis* anamorph. Widespread and common in soil and on dung, and from clinical sources (Barron et al. 1961a; Morton and Smith 1963). First reports for Canada and the first from wood.

Material examined: CANADA: Alberta: Muskeg Road SW of Boyle: wood from dead branches of *Salix discolor* II, Abbott 1996 (UAMH 9486); Maqua Lake near Fort McMurray: dung of grouse under black spruce (*Picea mariana*), Abbott 1996 (UAMH 9366); Edmonton: toe nail, 1993 (UAMH 8681). **USA: California:** lung of man, Orr (UAMH 9390). **England:** soil, Mendy 1958 (UAMH 8889).

Microascus longirostris Zukal, 1885, Verh. Zool.-Bot. Ges. Wien 35: 339.
(Microascaceae, Microascales)

Perithecia black, neck long; asci evanescent; ascospores reniform, 3-4 x 2.5 μm, orange in mass and forming a cirrhus. The type and most commonly reported species of *Microascus*. Originally from dung and wood in contact with dung (Barron et al. 1961a), it has been isolated from seeds, plant remains, and a wasp nest (Barron et al. 1961a; Morton and Smith 1963). A single isolate made from wood in this study.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* V, *Populus tremuloides* III (UAMH 9151); Slave Lake: dung of coyote (*Canis latrans*), Sigler 1983 (UAMH 4833); north of Lac La Biche: lung of northern flying squirrel (*Glaucomys sabrina*), Csotonyi 1997 (UAMH 9042). **Saskatchewan:** Prince Albert: indoor air of mill woodroom, Abbott 1995 (UAMH 8354). **USA: Maine:** Kittery Point: wasp nest, Harvard University (UAMH 9329).

Microascus manginii (Loubière) Curzi, 1931, Boll. Staz. Patol. Veg. Roma 11: 60.
(Microascaceae, Microascales)

Perithecia black, papillate; asci evanescent; ascospores broadly reniform, 4-6 x 5 μm, orange in mass; *Scopulariopsis candida* anamorph is often the only state present. Perithecia in some isolates (e.g., UAMH 9174) sterile, a feature common in isolates of *S. candida* (Abbott et al. 1998). Fertile isolates not previously reported from wood, although *Scopulariopsis candida* was isolated from a wooden cheese barrel (Morton and Smith 1963).

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II (UAMH 9147, 9174), IV; Red Deer: outside air, Abbott 1995 (UAMH 7921). **USA: Arizona:** dung, Orr 1958 (UAMH 8977). **FRANCE:** Mangin, (ex-type of *Microascus manginii*) (UAMH 9135). **UK:** buckwheat chaff, Donnelly 1974 (UAMH 8797).

Microascus* cf. *nidicola Massee and Salmon, 1901, Ann. Bot. 15: 313-357.
(Microascaceae, Microascales)

Perithecia black, papillate; asci evanescent; ascospores narrow falcate-reniform, 7-8 x 2 μm, cirrhi inconspicuous or absent; *Scopulariopsis* anamorph. Ascospores consistent with the extralimital specimens, but colonial morphology and the *Scopulariopsis* anamorph are unique. Few reports since the original collection on dung (Massee and Salmon 1901). Barron et al. (1961a), Morton and Smith (1963), and von Arx et al. (1988) base their descriptions on material from desert regions of the USA (UAMH 8979, 8980). Only a few of our isolates produce fertile ascocarps (e.g., UAMH 9169), but several others produce sterile sclerotium-like structures (e.g., UAMH 9168) (see notes under *Microascus manginii*)(Abbott et al. 1998).

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II (UAMH 9167, 9168), *Populus tremuloides* III (UAMH 9169). **USA: Utah:** kangaroo rat (*Dipodomys merriami*), Emmons Oct 1956 (UAMH 8979), soil, Emmons Oct 1956 (UAMH 8980).

Microascus singularis (Saccardo) Malloch and Cain, 1971, Can. J. Bot. 49: 859.
(Microascaceae, Microascales)

Perithecia black, often covered with flexuous hairs, short-necked; asci evanescent; ascospores broadly reniform to heart-shaped, 3-4.5 x 2-3 µm, orange in mass; anamorph *Wardomycopsis*, conidia dark brown, ellipsoid, truncate at base, with germ slit, conidiophores compact and branched. The conidial state is the most prominent feature in some isolates, but sparsely produced in others. Ascomata mature slowly (8 weeks to 6 months) and are sparse in most isolates. Widely distributed, but infrequent. First reports for Canada.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* II (UAMH 8618, 9152), *Populus tremuloides* III (UAMH 9175). **USA: Massachusetts:** Cambridge: barrel bottom, Thaxter 1904 (UAMH 2637). **JAPAN:** Tokyo: laboratory contaminant, Udagawa 1962 (UAMH 9330).

Myxotrichum arcticum Udagawa, Uchiyama and Kamiya, 1994, Mycotaxon 52: 197-205.
(Myxotrichaceae, Onygenales)

Cleistothecia black with short, curved appendages; ascospores fusiform, with longitudinal ridges, 4-6 x 1.5-2.0 µm; *Oidiodendron* anamorph, some parts of conidiophores geniculate, giving rise to short, fertile branches which develop into conidia that appear blastic, otherwise resembling *Oidiodendron griseum*. The peridial cells resemble *Myxotrichum bicolor*. This is the second report of this species, and the first report for Canada and from wood.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* III (UAMH 9243), 2-year post-fire site, *Picea glauca* III (UAMH 9244); Slave Lake: 29-year post-fire site, *Picea glauca* V (UAMH 9337). **USA: Alaska:** Willow north of Wasilla: forest soil, Udagawa 1992 (ex-type of *Myxotrichum arcticum*) (UAMH 7565).

Myxotrichum cancellatum Phillips, 1884, Grevillea 13: 51.
(Myxotrichaceae, Onygenales)

Cleistothecia black, confluent in a dense mat, appendages long and spine-like; ascospores fusiform, smooth, 3-4 x 1-2 µm; anamorph reported as an *Oidiodendron*-state (Orr and Kuehn 1964a), our isolate *Geomyces*-like. Ascomata larger than type (200-500 µm vs. 100-250 µm), and appendages longer (100-500 µm vs. 50-300 µm). *M. cancellatum* has been found on dead *Fraxinus* branches, frozen blueberry pastries, a pineapple pericarp stored at 5°C, and soil (Orr and Kuehn 1964). The first isolation in Canada, and the first from wood. Enzymatic abilities unknown; our cellulose assay was negative.

Material examined: CANADA: British Columbia: near Mount Robson: well-rotted conifer wood under orchid (*Calypso bulbosa*), Lumley 1996 (UAMH 8727). **USA: New Jersey:** Camden: frozen blueberry pastry, Kuehn 1961 (UAMH 1911). **JAPAN:** Tokyo: soil, Udagawa 1959 (UAMH 1996).

Myxotrichum ochraceum Berkeley and Broome, 1875, Ann. Nat. Hist. IV. 15: 37.
(Myxotrichaceae, Onygenales)

Cleistothecia black, interspersed among bright yellow mycelium, peridial appendages long (up to 150 µm) and straight, with reflexed branching in the lower half; ascospores fusiform, with longitudinal ridges, 3.5-5 x 1.5-3 µm; *Malbranchea*-like anamorph. Differed in several respects from the type: appendages occurring at one level (vs. two,

Apinis 1964; Currah 1985) and pale yellow centrum (vs. bright orange-yellow, Apinis 1964). *M. ochraceum* has been isolated from wood shavings, twine and straw (Orr et al. 1963), rotten wood, bark, and cardboard (Currah 1985). *Myxotrichum ochraceum* var. *frigidum*, from forest soil in Japan, grows better at 15°C (Uchiyama et al. 1995a).
Material examined: CANADA: Alberta: Elk Island National Park: *Populus tremuloides* II (UAMH 8532). **ENGLAND:** rotten cardboard (UAMH 1904).

Ophiostoma piliferum (Fries) H. and P. Sydow, 1919, Ann. Mycol. 17: 43.
(Ophiostomataceae, Ophiostomatales)
Perithecia black, long-necked, ostiolate; asci evanescent; ascospores hyaline, allantoid to falcate (concavo-convex), 3-4.5 x 1.5-2 µm; *Sporothrix* anamorph (see Benade et al. 1998). Widely distributed in North America; including from aspen wood in Alberta and British Columbia (UAMH 7233, 7459) and white spruce in Manitoba (Olchowecki and Reid 1974). Frequent on *Pinus*, but also on *Abies*, *Betula*, *Picea*, *Populus*, *Quercus*, *Thuja*, *Liquidambar* and *Platanus* (Olchowecki and Reid 1974; Ginns 1986; Griffin 1968; Upadhyay 1981, as *Ceratocystis pilifera*).
Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* II (UAMH 9374); Whitecourt: *Populus tremuloides* wood, Crane 1989 (UAMH 7233). **British Columbia:** Fort Nelson: *Populus tremuloides* wood, Hutchison 1991 (UAMH 7459).

Ophiostoma stenoceras (Robak) C. Moreau, 1952, Rev. Mycol. (Paris) Suppl. Colon. 17: 22.
(Ophiostomataceae, Ophiostomatales)
Perithecia black, long-necked, ostiolar hairs pointed and divergent; ascospores hyaline, reniform or orange-section shaped, concavo-convex, 2-4 x 1-1.5 µm, forming a droplet at ostiole; *Sporothrix* anamorph (see Upadhyay 1981). Perithecia abundantly produced on OAT. Widely distributed in North America, reported from *Pinus* and *Picea* in Ontario (Ginns 1986 as *Ceratocystis stenoceras*) and from air in Alberta (Sigler et al. 1996).
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* I (UAMH 9530); St. Lina: indoor air of honeybee (*Apis mellifera*) overwintering facility, Abbott 1995 (UAMH 7953). **British Columbia:** Lynn Creek Road: bark of *Pinus contorta* attacked by *Dendroctonus* beetles, Sigler 1982 (UAMH 4590).

***Ophiostoma* sp.**
(Ophiostomataceae, Ophiostomatales)
Perithecia black, long-necked, ostiolar hairs pointed and divergent; ascospores ellipsoid, 2 x 1.5 µm, forming a clear droplet at the ostiole; synanamorphs *Sporothrix*, conidia 3.5-4 x 1.5 µm, consistent in all collections, and *Leptographium*, conidiophores 45-65 x 3 µm, conidia 3 x 1.5 µm. Slow growing, fertile perithecia forming on primary isolation plates after 1 year, but not in axenic culture. This was the most abundant *Ophiostoma* species and was found exclusively on intermediate to late stage decay spruce logs in undisturbed sites.
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* III, V (UAMH 9531); Mariana Lake : *Picea glauca* II, III, IV.

Petriella sordida (Zukal) Barron and Gilman, 1961, Can. J. Bot. 39: 839.
(Microascaceae, Microascales)
Perithecia black, subglobose with distinct neck; asci evanescent; ascospores red-brown, asymmetrically ellipsoid to fusoid (plano-convex), smooth, 9-10 x 5 µm; synanamorphs

Graphium and *Scedosporium*. Known from soil, plant debris, and dung (Barron et al. 1961b). First report for Alberta.

Material examined: CANADA: Alberta: Wizard Lake near Calmar: wood of *Populus* II, Abbott 1997 (UAMH). **Nova Scotia:** Kentville: twigs of apple (*Malus* sp.) wood, Gourley (UAMH 8695). **Ontario:** Algonquin Provincial Park: porcupine (*Erythizon dorsatum*) dung, Scott 1991 (UAMH 7493). **ITALY:** dry branch of pear (*Pyrus communis*), Curzi (ex-type of *Petriella asymmetrica*)(UAMH 3983); Cyprus: bark of poplar (*Populus nigra*), Nattrass (ex-type of *Petriella asymmetrica* var. *cypria*)(UAMH 8893).

Podospora tetraspora (Winter) Cain, 1962, Can. J. Bot. 40: 460.
(Sordariaceae, Sordariales)

Perithecia with small tufts of agglutinated hairs; asci 4-spored; ascospores black, ellipsoid, with cylindrical apical appendage, approximately 10 µm long. Typically found on dung (Mirza and Cain 1969), not previously reported from rotting wood. Widespread, known from Ontario and Quebec (Mirza and Cain 1969) and Alaska (Kobayasi et al. 1969). First report for Alberta.

Material examined: CANADA: Alberta: Calling Lake: *Populus tremuloides* I (UAMH 9496), 15-year post-harvest site.

Pseudogymnoascus alpinus Müller and von Arx, 1982, Sydowia 35: 135.
(Myxotrichaceae, Onygenales)

Cleistothecia often confluent, white or bright yellow, without distinct peridial hyphae; ascospores fusoid, with a longitudinal ridge or ridges, 3-5 x 3-4 µm. Previously known only from the type, from the rhizosphere of *Erica carnea* (Müller and von Arx 1982). Our isolates differ from the type in having large, yellow ascomata, while those of the type are small and white or brownish. First report for North America and from wood.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* III (UAMH 9242), V (UAMH 9241). **SWITZERLAND:** Graubünden: rhizosphere of *Erica carnea*, Müller 1978 (UAMH 9430) (ex-type of *P. alpinus*).

***Pseudogymnoascus* sp.**
(Myxotrichaceae, Onygenales)

Cleistothecia yellow when young, olive-green when mature, with thin-walled, asperulate, clavate appendages; ascospores fusoid, with a longitudinal, sigmoid crest, 4-5 x 3-4 µm; *Ovadendron*-like anamorph resembles the *Geomyces* anamorph of *Pseudogymnoascus roseus* and the arthroconidial anamorph of *Pseudogymnoascus dendroideus* Locquin-Linard. Probably a new species. Weakly cellulolytic.

Material examined: CANADA: Alberta: Mariana Lake: *Picea glauca* V (UAMH 9238), 25-year post-fire site, *Picea glauca* III with some charring (UAMH 8899).

Pseudogymnoascus roseus Raillo, 1929, Zentralbl. Bakteriol. Parasitenkde Infektionskr Abt. 1 78:515.
(Myxotrichaceae, Onygenales)

Cleistothecia red-brown, peridium of loosely interwoven, thick-walled hyphae, appendages short (up to 20 µm long), straight, thin-walled, and asperulate; ascospores fusoid, smooth, 3-4.5 x 2-2.5 µm; *Geomyces* anamorph. *Geomyces* state and red-brown ascomata set this species apart from others in the genus. Worldwide distribution (Domsch et al. 1980). Isolated mainly from soil, including alpine and boreal forest soil in Alberta (Bissett and Parkinson 1979), forest and grassland soil (Morrall and Vanterpool 1968; Samson 1972; Orr 1979), and wood (Currah 1985). Most frequent from wood in post-fire sites. Vigorously cellulolytic.

Material examined: CANADA: Alberta: Mariana Lake: *Populus tremuloides* III, 30-year post-fire site, *Picea glauca* V (UAMH 9222); F951-03, F953-02, 2-year post-fire site *Picea glauca* V, 2-year post-fire site *Populus tremuloides* III; Slave Lake: 15-year post-fire site *Populus tremuloides* III; Gregoire Lake Provincial Park: soil, aspen (*Populus tremuloides*) forest under alder (*Alnus crispa*), Abbott 1996 (UAMH 8835); Kananaskis: soil under *Pinus contorta*, Widden 1967 (UAMH 2879); Cadomin: mycorrhizal roots of *Abies lasiocarpa*, Fernando (UAMH 9163). **Saskatchewan**: Grasslands National Park: bottom layer of ungrazed grassland soil, Abbott 1996 (UAMH 8834); Morrall (UAMH 3002). **ITALY:** Torino: wood of larch (*Larix decidua*), Dal Vesco (UAMH 1644).

Rosellinia aquila (Fries) de Notaris, 1844, Giorn. Bot. Ital. 1: 334.
(Xylariaceae, Xylariales)

Perithecia black, papillate, discrete and subglobose; ascospores inequilateral-ellipsoid to bean-shaped, with germ slit and small, hyaline appendages at the apices, 17-20 x 7-8 µm; *Geniculosporium* anamorph. Common on angiosperm wood (Ellis and Ellis 1988). Widely distributed (Dennis 1977; Martin 1967; Dargan and Thind 1979). First report for Canada.

Material examined: CANADA: Alberta: Sherwood Natural Area near Sherwood Park: standing *Populus tremuloides*, II, Abbott 1996 (UAMH 9465); **USA: New York:** Nyack Village, Rockland Co.: Martin 1963 (UAMH 1832). **MEXICO:** San Cristobal, Chiapes: cow dung, Martin 1962 (UAMH 2164).

Sordaria fimicola (Roberge) Cesati and De Notaris, 1863, Comm. Soc. Crit. Ital. 1: 226.
(Sordariaceae, Sordariales)

Perithecia pyriform, black; ascospores ellipsoid, smooth, black, with a narrow gelatinous sheath and a single prominent germ pore, 23-25 x 11-15 µm. Previously isolated from dung, herbaceous plants and seeds in Canada (Cain 1934; Cain and Groves 1948; Ginns 1986). Our isolates are the first known from wood and the first reports for Alberta.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* V (UAMH 9497); Lesser Slave Lake: carnivore dung, Sigler 1982 (UAMH 4575); Perryvale: living sphagnum moss (*Sphagnum fuscum*), Thormann 1997 (UAMH 9475).

Sphaerodes fimicola (Hansen) D. Hawksworth, 1982, Bot. J. Linn. Soc. 84: 146.
(Melanosporaceae, Sordariales)

Perithecia pyriform, with a translucent peridium; ascospores dark, limoniform, reticulate, 16-18 x 11-14 µm. Typically coprophilous, this is the first report from rotted wood and the first reports for Alberta.

Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV (UAMH 9369); ex roots of orchid (*Platanthera hyperborea*), Zelmer 1994 (UAMH 7777).

Strattonia carbonaria (Phillips and Plowright) Lundquist, 1972, Symb. Bot. Upsal. 20: 269.
(Lasiosphaeriaceae, Sordariales)

Perithecia ovoid; ascospores with a hyaline, triangular, apical appendage and appearing two-celled, 18-23 x 9-10 µm. It is generally found on burnt ground or charcoal (Dennis 1977; Ellis and Ellis 1988), and was found only once from a post-fire site in the boreal forest. First report for North America.

Material examined: CANADA: Alberta: F681-03, *Picea glauca* V, 30-year post-fire site (UAMH 9498).

Talaromyces retardatus Udagawa, Kamiya, and Osada, 1993, Trans. Mycol. Soc. Japan 34: 9.
(Trichocomaceae, Eurotiales)
Cleistothecia yellow to pink; ascospores ellipsoid, covered with blunt warts, pallid yellowish, 3.5-4.5 x 2.5-3 µm; *Penicillium* subgenus *Biverticillium* anamorph, well developed biverticillate conidiophores up to 300 µm long, conidia smooth to finely roughened, 3 x 2 µm; mycelium white to yellow, slow growing (8 mm in 7 days), producing a red diffusing pigment. Isolates produced ascomata after one year on primary isolation plates. These isolates faster growing than the ex-type culture (Udagawa et al. 1993), but slower than other species in *Talaromyces* section *Lutei* (Pitt 1979). Type material from decaying wood in Japan (Udagawa et al. 1993). First report for North America.
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV, V (UAMH 9494); Mariana Lake: *Picea glauca* III.

Talaromyces udagawae Stolk and Samson, 1972, Stud. Mycol. 2: 36.
(Trichocomaceae, Eurotiales)
Cleistothecia large (often over 1 mm on MEA after 6 months), bright yellow, peridium of loosely-interwoven, occasionally encrusted hyphae, including some radiating elements; ascospores with distinct lateral or spiral bands or crests, 3-4.5 x 2-3 µm; biverticillate *Penicillium* anamorph often sparse. Similar to *Talaromyces luteus* (Zukal) C.R. Benjamin, considered distinct by Stolk and Samson (1972) on the basis of larger ascospores and spiral ornamentation. *T. udagawae* was previously known only from the type, from soil, Misugimura, Japan. First report for North America and from wood.
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* V (UAMH 9338).

Thielavia terrestris (Apinis) Malloch and Cain, 1972, Can. J. Bot. 50: 61.
(Chaetomiaceae, Sordariales)
Perithecia black, non-ostiolate, smooth or with hypha-like setoid appendages, 100-200 µm diameter; ascospores ovoid, dark brown, 4-6 x 3-4 µm; *Acremonium* anamorph, conidia borne in short chains or in slimy heads. Heterothallic; most isolates produce only the conidial state and sterile ascomata in culture. Previously isolated from soil and plant debris, including wood (von Arx 1975; Wacha and Tiffany 1979). First report for Alberta.
Material examined: CANADA: Alberta: Elk Island National Park: *Picea glauca* IV, V, *Populus tremuloides* III (UAMH 8975); Edmonton: soil by hair bait, Blondell-Hill 1990 (UAMH 6818); human toe nail, Sand 1995 (UAMH 8112). **British Columbia:** Vancouver: spruce and pine wood, Forest Products Lab (UAMH 3264-3268). **ENGLAND:** pasture soil, Apinis (ex-type of *Allescheria terrestris*)(UAMH 3988).

Acknowledgments

Comments on an earlier version of the manuscript by Drs. B. Callan and A. Weir are greatly appreciated. This work was supported by the Challenge Grants in Biodiversity Program, Department of Biological Sciences, University of Alberta, and the Alberta Conservation Association (TCL, SPA). Funds from Sustainable Forest Management Network and Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship (SPA), Izaac Walton Killam Memorial Scholarship (SPA), and NSERC research grants (RSC) are gratefully acknowledged.

Literature cited

Abbott, S.P. and R.S. Currah. 1989. *The larger cup fungi and other ascomycetes of Alberta*. University of Alberta Devonian Botanic Garden, Edmonton. 96 pp.

Abbott, S.P., L. Sigler, and R.S. Currah. 1998. *Microascus brevicaulis* sp. nov., the teleomorph of *Scopulariopsis brevicaulis*, supports placement of *Scopulariopsis* within the Microascaceae. Mycologia 90: 297-302.

Abbott, S.P., L. Sigler, R. McAleer, D.A. McGough, M.G. Rinaldi, and G. Mizell. 1995. Fatal cerebral mycoses caused by the ascomycete *Chaetomium strumarium*. J. Clin. Microbiol. 33: 2692-2698.

Apinis, E.A. 1964. Revision of British Gymnoascaceae. Mycol. Pap. 96: 1-56.

Barron, G.L., R.F. Cain, and J.C. Gilman. 1961a. The genus *Microascus*. Can. J. Bot. 39: 1609-1631.

Barron, G.L., R.F. Cain, and J.C. Gilman. 1961b. A revision of the genus *Petriella*. Can. J. Bot. 39: 837-845.

Benade, E., M.J. Wingfield, and P.S. Van Wyk. 1998. Conidium development in *Hyalodendron* and *Allescheriella* anamorphs of *Ophiostoma* and *Ceratocystiopsis*. Mycotaxon 68: 251-263.

Bisby, G.R., M.I. Timonin, and M. James. 1935. Fungi isolated from soil profiles in Manitoba. Can. J. Res., Sect. C, 13: 47-65.

Bissett, J. and D. Parkinson. 1979. The distribution of fungi in some alpine soils. Can. J. Bot. 57: 1609-1629.

Bull, A.T. and B.L.A. Carter. 1973. The isolation of tyrosinase from *Aspergillus nidulans*, its kinetic and molecular properties, and some consideration of its activity *in vivo*. J. Gen. Microbiol. 75: 61-73.

Cain, R.F. 1934. Studies of coprophilous Sphaeriales in Ontario. Biblio. Mycol. 9: 1-126.

Cain, R.F. 1950. Studies of coprophilous ascomycetes. I. *Gelasinospora*. Can. J. Res. 28: 566-576.

Cain, R.F. and J.W. Groves. 1948. Notes on seed-borne fungi VI. *Sordaria*. Can. J. Res. 26: 486-495.

Carmichael, J.W. 1963. Dried mold colonies on cellophane. Mycologia 55: 283-288.

Checa, J., J.M. Barrasa, G. Moreno, F. Fort, and J. Guarro. 1988. The genus *Coniochaeta* (Sacc.) Cooke (Coniochaetaceae, Ascomycotina) in Spain. Cryptogam. Mycol. 9: 1-34.

Crawford, R.H., S.E. Carpenter, and M.E. Harmon. 1990. Communities of filamentous fungi and yeasts in decomposing logs of *Pseudotsuga menziesii*. Mycologia 82: 759-765.

Currah, R.S. 1985. Taxonomy of the Onygenales: Arthrodermataceae, Gymnoascaceae, Myxotrichaceae, and Onygenaceae. Mycotaxon 24: 1-216.

Daniels, J. 1961. *Chaetomium piluliferum* sp. nov., the perfect state of *Botryotrichum piluliferum*. Trans. Brit. Mycol. Soc. 44: 79-86.

Dargan, J.S. and K.S. Thind. 1979. Xylariaceae of India - VII. The genus *Rosellinia* in the northwest Himalayas. Mycologia 71: 1010-1023.

Dennis, R.W.G. 1977. *British Ascomycetes*. Gantner-Verlag, Vaduz. 585 pp.

Domsch, K.H. , W. Gams, and T.-H. Anderson. 1980. *Compendium of soil fungi*. Vol. 1. Academic Press, London. 859 pp.

Dowding, P. 1970. Colonization of freshly-bared pine sapwood surfaces by staining fungi. Trans. Brit. Mycol. Soc. 5: 399-412.

Dreyfuss, M. 1976. Taxonomische untersuchungen Innerhalb der Gattung *Chaetomium*. Sydowia 28: 50-132.

Duncan, C.G. and W.E. Eslyn. 1966. Wood-decaying ascomycetes and Fungi Imperfecti. Mycologia 58: 642-645.

Ellis, M.B. and J.P. Ellis. 1985. *Microfungi on land plants*. Macmillan Publishing Company, New York. 818 pp.

Ellis, M.B. and J.P. Ellis. 1988. *Microfungi on miscellaneous substances*. Timber Press, Portland. 244 pp.

Eriksson, O.E. and D.L. Hawksworth. 1998. Outline of the ascomycetes - 1998. Syst. Ascomycetum 16: 83-302.

Ginns, J.H. 1986. *Compendium of plant disease and decay fungi in Canada 1960-1980*. Agriculture Canada, Ottawa. 416 pp.

Gochenaur, S.E. 1978. Fungi of a Long Island oak-birch forest. I. community organization and seasonal occurrence of the opportunistic decomposers of the A Horizon. Mycologia 70: 975-994.

Griffin, H.D. 1968. The genus *Ceratocystis* in Ontario. Can. J. Bot. 46: 689-718.

Haider, K. and K.H. Domsch. 1969. Abbau und Umsetzung von lignifiziertem Pflanzenmaterial durch mikroskopische Bodenpilze. Arch. Microbiol. 64: 338-348.

Hammill, T.M. 1970. *Paecilomyces clavisporis* sp. nov., *Trichoderma saturnisporum* sp. nov., and other noteworthy soil fungi from Georgia. Mycologia 62: 107-122.

Hayes, A.J. 1965. Some microfungi from scots pine litter. Trans. Brit. Mycol. Soc. 48: 179-185.

Klich, M.A. and J.I. Pitt. 1988. *A laboratory guide to common* Aspergillus *species and their teleomorphs.* CSIRO, Division of Food Processing. 116 pp.

Kobayasi, Y., N. Hiratsuka, Y. Otani, K. Tubaki, S. Udagawa, and M. Soneda. 1969. The second report on the mycological flora of the Alaskan arctic. Bull. Nat. Sci. Mus. 12: 311-430.

Lumley, T.C. and R.S. Currah. 1995. A preliminary account of some unusual onygenalean fungi from rotting wood. Rep. Tottori Mycol. Inst. 33: 7-13.

Mahoney, D.P. and J.S. LaFavre. 1981. *Coniochaeta extramundana*, with a species synopsis of other *Coniochaeta* species. Mycologia 75: 931-952.

Malloch, D. and R.F. Cain. 1970. Five new genera in the family Pseudeurotiaceae. Can. J. Bot. 48: 1815-1825.

Malloch, D. and R.F. Cain. 1971a. Four new genera of cleistothecial Ascomycetes with hyaline ascospores. Can. J. Bot. 49: 847-854.

Malloch, D. and R.F. Cain. 1971b. New cleistothecial Sordariaceae and a new family, Coniochaetaceae. Can. J. Bot. 49: 869-880.

Malloch, D. and L. Sigler. 1988. The Eremomycetaceae (Ascomycotina). Can. J. Bot. 66: 1929-1932.

Mangenot, F. 1952. Recherches methodiques sur les champignons de certains bois en decomposition. Revue Gen. Bot. 59: 115.

Marsh, P.B., K. Bollenbacher, M.L. Butler, and K.B. Raper. 1949. The fungi concerned in fibre deterioration. 2. Their ability to decompose cellulose. Text. Res. J. 19: 462-484.

Martin, P. 1967. Studies in the Xylariaceae II. *Rosellinia* and the *Primocinerea* section of *Hypoxylon*. J. S. Afr. Bot. 33: 315-328.

Martin, K.J. and R.L. Gilbertson. 1978. Synopsis of wood rotting fungi on spruce in North America: II. Mycotaxon 7: 337-356.

Massee, G. and E.S. Salmon. 1901. Researches on coprophilous fungi. Ann. Bot. 15: 313-357.

Mirza, J.H. and R.F. Cain. 1969. Revision of the genus *Podospora*. Can. J. Bot. 47: 1999-2048.

Morrall, R.A.A. and T.C. Vanterpool. 1968. The soil microfungi of upland boreal forest at Candle Lake, Saskatchewan. Mycologia 60: 642-654.

Morton, F.J. and G. Smith. 1963. The genera *Scopulariopsis* Bainier, *Microascus* Zukal, and *Doratomyces* Corda. Mycol. Pap. 86: 1-96.

Müller, E. and J.A. von Arx. 1982. *Pseudogymnoascus alpinus*, nov. spec. Sydowia 35: 135-137.

Okafor, N. 1967. Decomposition of chitin by microorganisms isolated from a temperate and a tropical soil. Nova Hedwig. 13: 209-226.

Olchowecki, A. and J. Reid. 1974. Taxonomy of the genus *Ceratocystis* in Manitoba. Can. J. Bot. 52: 1675-1711.

Orr, G.F. 1979. The genus *Pseudogymnoascus*. Mycotaxon 8: 165-173.

Orr, G.F. and H.H. Kuehn. 1964. A re-evaluation of *Myxotrichum spinosum* and *M. cancellatum*. Mycologia 55: 473-481.

Orr, G.F., H.H. Kuehn, and O.A. Plunkett. 1963. The genus *Myxotrichum* Kunze. Can. J. Bot. 41: 1457-1480.

Page, W.M. 1951. Variability of spores of some coprophilous species of *Sordaria* and *Chaetomium*. Trans. Brit. Mycol. Soc. 34: 539.

Pitt, J.I. 1979. *The genus* Penicillium *and its teleomorphic states* Eupenicillium *and* Talaromyces. Academic Press, New York. 634 pp.

Pugh, G.J.F. 1964. Dispersal of *Arthroderma curreyi* by birds and its role in the soil. Sabouraudia 3: 275-278.

Rayner, A.D.M. and L. Boddy. 1988. *Fungal decomposition of wood: its biology and ecology*. John Wiley and Sons, Chichester. 587 pp.

Reese, E.T. and M.H. Downing. 1951. Activity of the Aspergilli on cellulose, cellulose derivatives, and wool. Mycologia 43: 16-28.

Reese, E.T. and H.S. Levinson. 1952. A comparative study of the breakdown of cellulose by microorganisms. Physiol. Plant. 5: 345-366.

Rogers, J.D. and L.F. Grand. 1971. *Coniochaeta malacotricha*: anomalous asci and the conidial state. Can. J. Bot. 49: 2239-2240.

Samson, R.A. 1972. Notes on *Pseudogymnoascus*, *Gymnoascus*, and related genera. Acta Bot. Neerl. 21: 517-527.

Sanni, M.O. 1982. Perithecium development in *Gelasinospora tetrasperma*. Mycologia 74: 320-324.

Sigler, L. 1992. Preparing and mounting slide cultures. In: *Clinical microbiology procedures manual* (H.D. Isenberg, Ed.), American Society for Microbiology, Washington, D.C., Pp. 6.12.1-6.12.4.

Sigler, L. and A. Flis. 1998. *University of Alberta microfungus collection and herbarium catalogue of strains*. UAMH, Edmonton. 213 pp.

Sigler, L., S.P. Abbott, and H. Gauvreau. 1996. Assessment of worker exposure to airborne molds in honeybee overwintering facilities. Amer. Ind. Hyg. Assoc. J. 57: 484-490.

Smith, R.E. 1977. Rapid tube test for detecting fungal cellulase production. Appl. Env. Microbiol. 33: 980-981.

Sollins, P. 1982. Input and decay of coarse woody debris in coniferous stands in western Oregon and Washington. Can. J. For. Res. 12: 18-28.

Sopp, O.J. 1912. Monographie der Pilzgruppe *Penicillium* mit besonderer Berücksichtigung der in Norwegen gefunden Arten. Videnskapsselskapets Skrifter. 1. Mat.-Naturv. Klasse 11: 1-207.

Stolk, A.C. and R.A. Samson. 1971. Studies on *Talaromyces* and related genera I. *Hamigera* gen. Nov. and *Byssochlamys*. Persoonia 6: 341-357.

Stolk, A.C. and R.A. Samson. 1972. The genus *Talaromyces*: studies on *Talaromyces* and related genera II. Stud. Mycol. 2: 1-65.

Uchiyama, S., S. Kamiya, and S. Udagawa. 1995a. A new variety of *Myxotrichum ochraceum* from Japanese soil. Mycoscience 36: 289-292.

Uchiyama, S., S. Kamiya, and S. Udagawa. 1995b. Five onygenalean fungi from Japan. Mycoscience 36: 211-220.

Udagawa, S. and T. Muroi. 1981. Notes on some Japanese Ascomycetes XVI. Trans. Mycol. Soc. Japan 22: 11-26.

Udagawa, S. and M. Takada. 1967. Notes on some Japanese Ascomycetes V. Trans. Mycol. Soc. Japan 8: 50-53.

Udagawa, S., S. Kamiya, and K. Osada. 1993. *Talaromyces retardatus*, a new species isolated from decaying woody material. Trans. Mycol. Soc. Japan. 34: 9-13

Upadhyay, H.P. 1981. *A monograph of* Ceratocystis *and* Ceratocystiopsis. University of Georgia Press, Athens. 176 pp.

von Arx, J.A. 1975. On *Thielavia* and some similar genera of ascomycetes. Stud. Mycol. 8: 1-29.

von Arx, J.A. 1987. A re-evaluation of the Eurotiales. Persoonia 13: 273-300.

von Arx, J.A., M.J. Figueras, and J. Guarro. 1988. Sordariaceous ascomycetes without ascospore ejaculation. Nova Hedwig. 94: 1-104.

Wacha, A.G. and L.H. Tiffany. 1979. Soil fungi isolated from fields under different tillage and weed-control regimes. Mycologia 71: 1215-1226.

Wicklow, D.T. and W.F. Whittingham. 1974. Soil microfungal changes among the profiles of disturbed conifer-hardwood forests. Ecology 55: 3-16.

Wingfield, M.J., K.A. Seifert, and J.F. Webber (eds.). 1993. Ceratocystis *and* Ophiostoma: *taxonomy, ecology, and pathogenicity*. APS Press, St. Paul. 293 pp.

MYCOTAXON

Volume LXXIV(2), pp. 415-422 April-June 2000

CRYPTOPORUS SINENSIS SP. NOV., A NEW POLYPORE FOUND IN CHINA

Sheng-Hua Wu[1] and Mu Zang[2]

[1]Department of Botany, National Museum of Natural Science, Taichung, Taiwan, Republic of China

[2]Kunming Institute of Botany, Academia Sinica, Kunming 650204, Yunnan, China

ABSTRACT

The polypore *Cryptoporus sinensis* Sheng H. Wu & M. Zang is described as new and separated from *C. volvatus* by smaller spores. Earlier, *Cryptoporus* was recognized as a monotypic genus, with the generic type *C. volvatus*. The new species is close to *C. volvatus*, but has smaller basidiospores. *Cryptoporus volvatus* is known from North America and East Asia. *Cryptoporus sinensis* is hitherto known only from central and southern provinces of China.

Key words: China, *Cryptoporus sinensis, C. volvatus,* new species, polypore.

INTRODUCTION

Cryptoporus (Peck) Shear is generally regarded by mycologists as a member of the Polyporaceae (Basidiomycotina). This genus is distinct from other genera of polypores by the peculiar morphology of the basidioma. The pileus margin of *Cryptoporus* extends over most of the hymenial surface, and the latter is exposed only near the pileus base by an opening in the covering layer. This feature explains the origin of the generic name. In Greek, "crypto-" means covered or hidden. In Latin, "porus" means pore. *Cryptoporus* has long been known as a monotypic genus, with the generic type of *C. volvatus* (Peck) Shear. *Cryptoporus volvatus* is widely distributed in North America and East Asia. According to Gilbertson and Ryvarden (1986), this species is saprobic on various coniferous trees, mainly *Pinus* spp. In this study, *C. sinensis* is described as new from central and southern China.

According to the book "Icones of Medicinal Fungi from China" (Ying et al., 1987), *C. volvatus* has been recorded in many provinces in northern and southern China. The medicinal value of this fungus was described in this book as follows: " To be taken after decoction, it cures bronchitis and asthma, with anti-inflammatory effect. In addition, this fungus contains fragrant substances, and on sucking, it tastes bitter at first, gradually becoming fragrant. People living in the Lijiang district of Yunnan use this fungus orally for infants in order to wean them from breast feeding. In the northwest part of Yunnan, decoction of this fungus with water is popularly used for treating bronchitis and asthma". It would be interesting to compare the medicinal value of *C. volvatus* and *C. sinensis*.

DESCRIPTION OF SPECIES

Cryptoporus sinensis Sheng H. Wu & M. Zang, sp. nov. (Figures 1A-C, 2, 3A-F)

Fructificatio pileata, mediocriter dura, ungulata, dimidiato-orbiculata. Pileus cremeus, flavus, brunneus vel alutaceus. Pori rotundi, 4-5 per mm. Systema hypharum dimiticum. Hyphis generativis fibulatis. Hyphae skeletales ramosae, 1-6 μm diam. Cystidia destituta. Basidia clavata, 15-25 × 7-9 μm, 4-sterigmatibus. Basidiosporae cylindrico-naviculares, laeve, 7.5-10 × 4-5 μm, IKI-, CB-.

Basidiomata fairly tough, solitary or rarely imbricate, sessile, laterally attached by a reduced base, ungulate, surface view dimidiate-circular, up to 3 cm diam., up to 2 cm thick, upper surface variable in color, e.g. cream-colored, yellow, yellowish brown, or tan, usually azonate, glabrous, slightly glossy, occasionally wrinkled; margin cream-colored, obtuse. Pileus margin extends over most of pore surface, with a small opening at the base. The covering of lower surface ivory-colored, up to 1 mm thick. Tube layer wood-colored, up to 4 mm thick. Context whitish, up to 6 mm thick, separated from the tube layer by a thin dark zone. Cuticle thin, fairly hard. Pore surface brown; pores circular, 4-5 per mm.

Hyphal system dimitic; generative hyphae nodose-septate. Contextual skeletal hyphae dominant, colorless, branched, with narrow lumen, 1-6 μm diam.; contextual generative hyphae colorless, 1.5-6 μm diam., thin-walled. Tramal skeletal hyphae similar to those in context, arboriform towards hymenium, much-branched in the hymenial layer; becoming brown towards pore surface. Cystidia lacking. Cystidioles fusoid, 15-25 × 6-11 μm, thin-walled. Basidia clavate, 15-25 × 7-9 μm, 4-sterigmate. Basidiospores cylindrical-navicular, smooth, with 0.3-0.6 μm thick walls, 7.5-10 × 4-5 μm, colorless, IKI-, CB-.

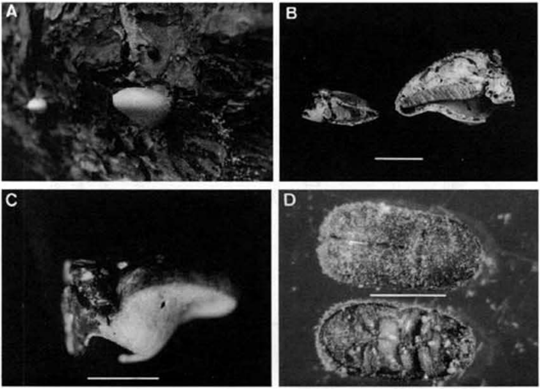


Figure 1. A, Basidiomata of *Cryptoporus sinensis* (*in situ*); B, Lateral sections of basidiomata of *C. sinensis* (left: *Wu 9708-158*; right: holotype), showing the cuticle, context (noting the beetle galleries), tube layer, pore surface, and the covering below pore surface; C, Lateral view of *C. sinensis* (holotype); D, Ciidae species from the basidiomata of *Cryptoporus sinensis* (*Wu 9708-158*). Scale bars = 1 cm (B, C); = 1 mm (D).

Etymology: From sinensis (= China), referring to the country where this new species was found.

Holotype: CHINA. YUNNAN. XISHUANGBANNA: Tatukang, Sawmill, 22.22N, 100.56E, alt. 1 350 m, on trunk of *Pinus khasya*, 15 Aug 1997, *Wu 9708-157* (TNM *M7825*).

Additional specimens examined: CHINA. YUNNAN. XISHUANGBANNA: Tatukang, Sawmill, 22.22N, 100.56E, alt. 1 350 m, on trunk of *Pinus khasya*, 15 Aug 1997, *Wu 9708-158* (TNM *M7826*); KUNMING: 25.04N, 102.42E, on fallen wood, Aug 1990, X.L. Mao *s.n.* (HMAS *70222*(s)). XICHUAN. KANGTING: Shate, alt. 3 400 m, on *Pinus densata*, 31 Jul 1997, P.C. Sun (*2805*) (HKAS *31204).* JIANGXI: Jinggangshan, 26.34N, 114.10E, on fallen wood, 15 Jul 1985, Q.X. Wu (*136*) (HMAS *57538* (s)). FUJIAN. QINGLIU: 26.10N, 116.48E, 30 Jul 1974, Q.M. Ma (*500*) (HMAS *42173* (s)); SANMING: 26.13N, 117.36E, 23 Jul 1974, Q.M. Ma (*84*) (HMAS *41197*(s)). HUBEI. WUHAN: 30.35N, 114.17E, on rotten wood, Aug 1965, S.C. Teng *s.n.* (HMAS *34729* (s)).

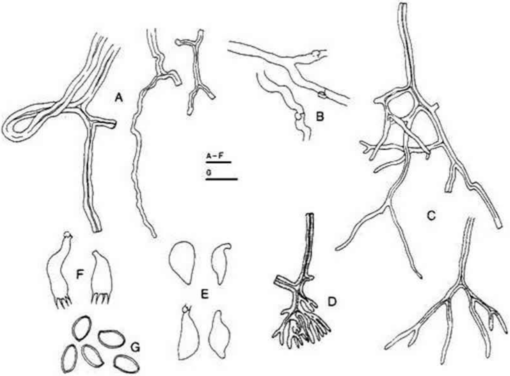


Figure 2. *Cryptoporus sinensis* (holotype). A, Contextual skeletal hyphae; B, Contextual generative hyphae; C, Tramal skeletal hyphae; D, Much-branched skeletal hyphal terminals near pore surface; E, Cystidioles; F, Basidia ; G, Basidiospores. Scale bars = 10 μm.

Distribution: Known from central and southern China.

Cryptoporus volvatus (Peck) Shear, Bull. Torrey Bot. Club. 29: 450. 1902. (Figures 3G-L)

Basionym: *Polyporus volvatus* Peck, N.Y. State Mus. Ann. Rept. 27: 98. 1877.

A description, line drawing, and discussion of this species have been comprehensively provided by Gilbertson and Ryvarden (1986).

Specimens examined: USA. NEW YORK: Adirondacks Forest, Indian Lake, leg. C.H. ck, VII-1873 (holotype, NYS). CALIFORNIA. ALAMEDA CO.: Berkeley, University of California Campus, West across creek from Life Sciences, in open grove of *Pinus* and *Quercus agrifolia*, on log of *Pinus radiata*, appearing the year after tree was cut, Feb 1978, Isabelle Tavares (*2530*) (H, K, ex UC). OHIO. ROSS CO.: Scioto Trails State Park, on *Pinus resinosa*, 27 Apr 1975, W.B & V.G. Cooke (*49671*) (K(mycological collections) *56027*); MARYLAND: Sligo, on *Pinus* sp., 8

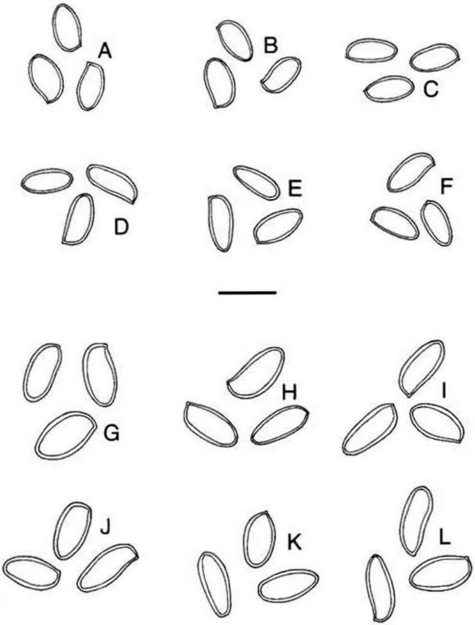


Figure 3. A-F: Basidiospores of *Cryptoporus sinensis*. A, China: Yunnan (*Wu 9708-157*, holotype); B, China: Yunnan (*Wu 9708-158*); C, China: Yunnan (HMAS *70222*(s)); D, China: Hubei (HMAS *34729* (s)). E, China: Jiangxi (HMAS *57538* (s)); F, China: Fujiang (HMAS *41197*(s)). G-L: Basidiospores of *Cryptoporus volvatus*. G, USA: New York (holotype); H, Canada: British Columbia (*Kennedy 403*); I, Russia: Primorsk (TAA *105311*); J, Japan: Ehime (TMI *2974*); K, China: Hainan (BPI *US0235707*); L, Vietnam: Tonkin (*LBA 133*). Scale bar = 10 μm.

May 1904, C.L. Shear *s.n.* (BPI *US0235706*). VIRGINIA: Camp Humphreys, on *Pinus* sp., 11 May1930, Nellie W. Nance *s.n.* (BPI *US0235709*). CANADA. BRITISH COLUMBIA: Victoria, on spruce wood, 15 May 1947, L.L. Kennedy (*403*) (H, ex ALTA); Vancouver Island, Cordova Bay, dead wind fallen *Abies grandis*, 22 Sep 1968, W.G. Ziller *s.n.* (K(mycological collections) *56028*). RUSSIA. PRIMORSK: USSURIJSK: Ussurijsk Nature Reserve, on *Pinus koraiensis*, 22 May 1983, E. Parmasto *s.n.* (O, ex TAA *105311*). JAPAN. EHIME. OZU CITY: Mt. Higashiu, on *Pinus* sp., 6 May 1963, K. Tashise *s.n.* (TMI *2974*); NAGASAKI: Shimoagata-gun, Izuhara-machi, on *Pinus thunbergii*, 24 Jul 1973, I. Ohira *s.n.* (TMI *2975*); TOTTORI. TOTTORI CITY: Kokoge, 27 May 1979, E. Nagasawa *s.n.* (TMI *16739*); CHUGOKU. FUSUTA. HIROSHIMA: On living trunk of *Pinus* sp., 5 May 1944 (Hongo herb. No. *618*, K(mycological collections) *56029*). CHINA. HAINAN. TAN HSIEN: On pine, 6 Oct 1934, S.T. Teng *s.n.* (BPI *US0235707*). VIETNAM. TONKIN: Eberhadt, *LBA 133* (O, ex FH).

Distribution: North America and East Asia.

DISCUSSION

Cryptoporus sinensis has smaller basidiospores (7.5-10 × 4-5 μm) than *C. volvatus* ((9-)10-12.5 (-13.5) × (4.5-) 5-6 (-7) μm). The spore size difference is the only morphological difference detected between these two species. *Cryptoporus volvatus* has a widespread distribution in North America and East Asia, but is mostly recorded in temperate regions. *Cryptoporus sinensis* is so far known from central and southern provinces of China. The possibility that *C. sinensis* represents a small-spored form of *C. volvatus* originating from regions with warmer climate has been excluded, because specimens from more southern areas (Hainan of China and Vietnam) also bear large spores typical of *C. volvatus*. *Cryptoporus sinensis* may have evolved from *C. volvatus* in central and southern China.

Measurements of spores from Chinese specimens of *C. volvatus* by mycologists seem to include elements of this species and *C. sinensis* (e.g., 8.5-13 × 3.9-6.2 μm by Ying et al., 1987). Teng's (1939, 1996) spore measurements (10-13 × 4.5-6 μm) from Chinese specimens only represent the spore range of *C. volvatus*. Zhao and Zhang (1992) noted the differences in spore sizes between their measurements (7.5-10.5 × 4-5 μm) and Teng's measurement. Zhao and Zhang's measurement reflects the spore size of *C. sinensis*.

Ryvarden (1991) suggested a close relationship between *Cryptoporus* and *Trametes* Fr., due to the trimitic hyphal system and cylindrical spores. Hibbett and Donoghue (1995) have inferred that *Cryptoporus* and *Trametes* belong to one of their seven studied groups, based on a phylogenetic classification of the Polyporaceae through parsimony analysis of mitochondrial ribosomal DNA sequences. Moreover, *Ganoderma* P. Karst. is the closest genus to *Cryptoporus* among the genera that they studied.

Both *C. volvatus* and *C. sinensis* do have branched skeletal hyphae of the "arboriform" type which is uniformly present in *Ganoderma* spp. This type of skeletal hypha has not previously been noted in the genus *Cryptoporus*. *Cryptoporus* also resembles *Ganoderma* in having thick-walled basidiospores, but they are smooth and not with intra-wall pillars as in *Ganoderma*. The glossy and brown pileus surface of *Cryptoporus* is similar to that of many species of *Ganoderma*. *Cryptoporus* was described as trimitic (Gilbertson and Ryvarden, 1986) with branched skeletal hyphae and binding hyphae. In this study, we did not find binding hyphae in basidiomata of either *C. sinensis* or *C. volvatus*. The hyphal system of *Cryptoporus* should be further studied.

One small insect species of the family Ciidae (tree-fungus beetles) was usually found in basidiomata of *C. sinensis* collected by the authors from Yunnan (Figure 1D). Small holes present in the context of these basidiomata were indicative of these insects. A collection was even completely eaten by this insect species during storage. Similarly, basidiomata of *C. volvatus* are likely to be eaten by certain insect species (E. Parmasto, pers. comm.).

ACKNOWLEDGMENTS

The authors are indebted to the curators of BPI, H, HMAS, K, NYS, O, and TMI for arranging loans of specimens for this study, and to Miss M.L. Chan for help in identifying the insects in basidiomata of *C. sinensis*. We are obliged to Dr. L. Ryvarden for reviewing the manuscript. We are also grateful to Ms. Cheryl Robbins for revising the English.

LITERATURE CITED

Gilbertson, R.L. and L. Ryvarden. 1986. North American polypores. Vol. 1. *Abortiporus - Lindtneria*. Fungiflora, Oslo, Pp. 1-433.

Hibbett, D.S. and M.J. Donoghue. 1995. Progress toward a phylogenetic classification of the Polyporaceae through parsimony analysis of mitochondrial ribosomal DNA sequences. Can. J. Bot. 73: 853-861.

Ryvarden, L. 1991. Genera of polypores. Nomenclature and taxonomy. Synopsis Fung. 5: 1-363.

Teng, S.C. 1939. A contribution to our knowledge of the higher fungi of China. Academia Sinica, 614 pp.

Teng, S.C. 1996. Fungi of China. Mycotaxon Ltd., Ithaca, 586 pp.

Ying, J.Z., X.L. Mao, et al. 1987. Icones of medicinal fungi from China. Science Press, Beijing, 579 pp.

Zhao, J.D. and X.Q. Zhang. 1992. The polypores of China. Biblioth. Mycol. 145: 1-524.

中華隱孔菌 (CRYPTOPORUS SINENSIS)，發現於中國的新種多孔菌

吳聲華[1]　臧穆[2]

[1]國立自然科學博物館植物學組，臺灣
[2]中國科學院昆明植物研究所

中華隱孔菌 (*Cryptoporus sinensis* Sheng H. Wu & M. Zang) 於本文中發表為多孔菌新種。過去隱孔菌屬 (*Cryptoporus*) 被視為單種屬，其模式種為 *C. volvatus* (Peck) Shear。中華隱孔菌近似 *C. volvatus*，唯擔孢子較小。*Cryptoporus volvatus* 分佈於北美及東亞，而 *C. sinensis* 則僅知於華中及華南。*Cryptoporus volvatus* 在中國為傳統醫用真菌。*Cryptoporus sinensis* 及 *C. volvatus* 的成員過去在中國均被處理為後者之名。

關鍵詞：中國，中華隱孔菌 (*Cryptoporus sinensis*)，隱孔菌 (*C. volvatus*)，新種，多孔菌。

MYCOTAXON

Volume LXXIV(2), pp. 423-427 April-June 2000

NOTES ON GOMPHALES: RAMARIA RIELII

P.P.Daniëls & M.T.Tellería

Real Jardín Botánico; C.S.I.C., Plaza de Murillo 2, 28014 Madrid. Spain.

Abstract: Identity of *Ramaria rielii* Boud. is discussed on the basis of the find and study of its type. This is a distinct species from *R. botrytis* (Pers.:Fr.) Bourdot, with which it has been long confused.

Keywords: Gomphales, *Ramariaceae*, *Ramaria rielii*, taxonomy.

Resumen: Se discute la identidad de *Ramaria rielii* Boud. a partir del estudio del material tipo, localizado en el herbario PC. Se trata de una especie independiente y que hasta el momento se la relacionaba con *R.botrytis* (Pers.:Fr.) Bourdot. Se incluye una tabla comparativa con las especies mas próximas.

Palabras clave: Gomphales, *Ramariaceae*, *Ramaria rielii*, taxonomía.

Introduction

Boudier (1897a:13) described a new species of *Ramaria* from Grande-Chartreuse (Isère, France) which was dedicated to Dr. Riel, who collected it. Boudier stated that "Cette (...) espèce a la couleur et la taille du *Ramaria formosa*, mais s'en distingue bien à ses rameaux bien moins divisés, presque simples, bien plus épais et obtus au sommet et par ses spores plus grandes de 16 à 18μ de longueur tandis que celles de formosa n'atteignent que 12. (...). Le sommet des rameaux est toujours obtus, (...) et jaune citron quand il est érodé. Les stries (...) sont longitudinales, plus ou moins ondulées et en occupent toute la longueur. La chair est fine et douce et formée d'hyphes allongées, septées, d'environ 10μ de diamètre".

Maire (1911:449) when arguing about the deterioration of *Clavaria botrytis* discussed that "Nous avons trouvé des spécimens dans cet état à la Grande-Chartreuse. Ces spécimens ressemblent extraordinairement au *Ramaria Rielii* Boud. (...) qui n'en differe guère que par sa chair jeune sous l'hymenium. Comme le *R. Rielii* a des spores très grandes (...) et comme provient justement de la Grande-Chartreuse, où nous n'avons rencontré que *C. Botrytis*, on peut se demander si le champignon de Boudier n'est pas (...) un trognon de *Clavaria Botrytis*."

Except Bourdot & Galzin (1927:94), subsequent authors have considered *R. rielii* as a strange form of other species of *Ramaria* or, generally, they have accepted Maire's suggestion of an old and deteriorated specimen of *R. botrytis*.

Coker (1923:149) suggested that *R. rielii* and *Clavaria strasseri* Bres. [≡*Ramaria strasseri* (Bres.) Corner] were the same species. If so, it should be named *R. rielii* Boud. since this name has nomenclatural preference (*R. rielii* Boud.1897 and *C. strasseri* Bres. in Strasser

1900:296). Cotton & Wakefield (1919:172) and Corner in his Monograph (1950:560) accepted Maire's judgement. Thus *R. rielii* has remained a synonym of *R. botrytis* and it has scarcely been mentioned later (McAfee & Grund 1981:36, Jülich 1989:107).

Material and Methods

During a stay in the Muséum National d'Histoire Naturelle, Paris, the type of *R. rielii* was located in the Boudier herbarium (PC). The type consists of a pressed specimen sectioned into 2 pieces.

Other samples examined were: Representative specimen of *C. botrytis* Pers.:Fr. at UPS (cf Petersen 1971:372); Holotype of *R. claviramulata* Marr & D.E.Stuntz at SUCO; Holotype of *R. sardiniensis* Schild & Ricci at ZT. For *R. strasseri* (Bres.) Corner, measurements were taken from Christan 1994:63.

Color references and fresh measurements are those taken from the author's illustrations (Boudier 1896 and 1897b) which were drawn at natural size. Color designation when dry are those of ISCC-NBS (1964).

All microscopic measurements were made into 3% KOH; spore measurements do not include apiculus nor ornamentation (L=spore length, W=spore width, E=L/W; Lm=mean L, Wm=mean W, Em=mean E, measures=50).

Ramaria rielii Boud., *Bull. Soc. Mycol. France* 13:13. 1897.

Typus: PC, Herb. Boudier. Grande-Chartreuse (Isère), in fagetis et abiegnis mixtis. Septembre 1896, legit doct. Riel.(!).

Macroscopy:

Basidiome fasciculate, 12 x 5 cm., scarcely ramified with thick and densely packed branches forming an obovoid compact mass.

Base white to cream, 2.5 x 3 cm. (Boudier 1897a), glabrous, strong and subbulbous. Whitish to ochre (about 70.l.OY) when dry.

Branch ramification (axils) acute, into 1-2(3) ranks, polychotomous. Primary branches common, 1-1.5 cm thick (Boudier 1897a), cylindrical to claviform, almost single, somewhat fused below. Branches sometimes flattened (Boudier 1896). Outer surface longitudinally grooved, somewhat winding, 0.5-1.3 mm wide and locally labyrinthiform when fused together. Grooves of orange salmon color and disappearing toward the base. Orange-brown color (77.m.yBr) when dried. Internodes up to 3 cm length.

Hymenophore amphigenous, with spore accumulation into grooves and points of branching. Spores yellowish orange (71.m.OY, 72.d.OY) in mass.

Apex obtuse, blunted, strong (up to 1.5 cm wide), not ramified nor well defined; with a labyrinthiform design because of the confluence of surface grooves there; of the same color as branches or lemon yellow when eroded.

Flesh white, yellow near hymenium; taste mild, not bitter (teste Boudier). Inner flesh spongy when dried, softer towards the base.

Microscopy:

Monomitic, tramal hyphae without clamps, 3.5-6(13) µm wide, somewhat wider at the base, (5.7)9.5-13(15.3) µm, strangulated at the septa. Wall up to 0.5 µm wide, hyaline. Ampulliform septa up to 16 µm wide, clearly ornamentated with short tips. Hyphae parallel to subparallel on the border and interwoven inwards, not congested. Secretory hyphae not seen.

Subhymenial hyphae about 2 µm wide, hyaline, with a thin wall, not clamped and interwoven.

Basidia 70-80 x 10 µm (teste Boudier), claviform, unclamped, hyaline but commonly guttulate, sterigmata 4, about 6 µm long. They are in bad condition and break or collapse easily.

Spores yellowish, subcylindrical, sometimes sigmoid, (15)16.6-18.8(22,3) x (4)4.7-5.8(7) µm, Lm=17.69, Wm=5.25, E=(2.54)3.10-3.73 (5.58), Em=3.41 (16-18 x 5-7 according to Boudier), cyanophilous.

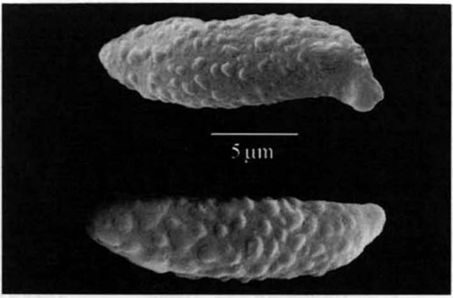


Fig.1. Spores of *R. rielii.*

Spore wall up to 0.4 µm thick. Ornamentation conspicuous all over the surface, warty without particular orientation or somewhat longitudinally arranged but not grooved (see fig.1). Homogeneous or with a yellow, refringent guttule inside, rarely multiguttulate. Apiculus prominent, up to 1.5 µm length.

Ecology: On mixed woods with fir (*Abies/Picea*) and beech (*Fagus sylvatica*).

Observations: Boudier (1897a,b) pointed out the presence of cystidia on the hymenium. No cystidia on the type have been located by us.

Conclusions

In view of the characters described, the studied exsiccata can not be *R. botrytis* nor *R. strasseri* because both species have spores with oblique striae, clamped hyphae and well-defined apices which are clearly ramified. On the other side, *R. rielii* has verrucose spores, unclamped hyphae and a non-ramified apex (see table 1); moreover, Lm value is up to 4µm higher.

	Clamped hyphae	Spore ornamentation	Lm	Em	Definite apex
R. botrytis	Yes	striae	13.90	2.91	Yes
R. rielii	**No**	**warts**	**17.69**	**3.41**	**No**
R. strasseri	Yes	striae	13.70	2.59	Yes

Table 1.

Thus, *R. rielii* belongs to subgenus *Laeticolora*. There are scarcely any species without clamps and with a grooved hymenium known in this subgenus. Even if its original colors when fresh are those offered by Boudier (1896, 1897b) or they are the result of a rufescent reaction (which might explain the yellow shades on the subhymenium), this species can be related with *R. claviramulata* Marr & D.E.Stuntz or with *R. sardiniensis* Schild & Ricci. A comparative table is the following:

	Lm	Spore ornamentation	Hymenium	Apex
R.claviramulata	10.42	warts forming pseudostriae or single	Subrugose	Blunted, some ramified
R.rielii	**17.69**	**single warts**	**Longitudinally grooved**	**Blunted**
R.sardiniensis	9.23	warts forming pseudostriae or single	Subrugose to slightly grooved	Blunted and fused or scarcely separate

Table 2.

R. sardiniensis is a recently described species (Schild 1998) which differs by its Lm value and by the higher ramification rank. Also by its branch thickness, which is from 2.3 to 6 mm at the base in *R. sardiniensis* and from 10 to 15 mm at the branch apices in *R. rielii*. It shows a color change towards blackish on the base, which is not referred to by Boudier.

R. claviramulata is also somewhat close to *R. rielii* but Lm value is up to 7µm longer in the latter and spore ornamentation is different too (see table 2).

Acknowledgements:

We would like to thank to the DGES on its Flora Micológica Ibérica project (PB96-0129) under which this work was completed. Also to the Muséum National d'Histoire Naturelle, Paris (PC) specially to Dr.Buyck, Dr.Couté and Dr.Mascarell for their help during the stay of one of us (P.P.D.). To M.Jerez for his help with the S.E.M. To the following herbaria for loaning type specimens: Uppsala (UPS), Oneonta (SUCO) and Zurich (ZT). In the same way to F.Pando for his assistance and management.

Bibliography

Boudier,E. (1896): Cahiers manuscrits, vol.3:104., Ms 209, Herbier PC.

Boudier,E. (1897a): Nouvelles espèces ou varietés de Champignons de France. *Bull. Soc. Mycol. France* 13:11-18.

Boudier,E. (1897b): *Bull. Soc. Mycol. France* 13:Planche II.

Bourdot,H. & Galzin,A. (1927): Hymenomycètes de France. *Biblioth. Mycol.* 23:764pp. (Reprint 1969).

Christan,J. (1994): Pilzneufunde in Nordwestoberfranken 1992, IV. Teil Ramaria. *Pilzf. Nordwestoberfrankens* 16-17:61-64.

Coker,W.C. (1923): *The club and coral mushrooms (Clavarias) of the United States and Canada*. Univ. North Carolina Press. Chapel Hill. 209pp.

Corner,E.J.H. (1950): A Monograph of Clavaria and allied genera. *Ann. Bot. Mem.* 1:740pp.

Cotton,A.D. & Wakefield,E.M. (1919): Revision of the British Clavariae *Trans. Brit. Mycol. Soc.* 6:164-198.

ISCC-NBS (1964): *Centroid Color Charts*, U.S. Department of Commerce. National Bureau of Standards, Washington D.C.

Jülich,W. (1989): *Guida alla determinazione dei funghi, vol.2°, Aphyllophorales, Heterobasidiomycetes, Gasteromycetes*. Arti Grafiche Saturnia, Trento, 597pp.

Maire,R. (1911): Notes critiques sur quelques Champignons récoltés pendant la session de Grenoble-Annecy de la Societé Mycologique de France (Septembre - Octobre 1910). *Bull. Soc. Mycol. France*. 27:403-452.

McAfee,B.J. & Grund,D.W. (1981): The clavarioid fungi of Nova Scotia. *Proc. Nova Scotian Inst. Sci.* 32:1-73

Petersen,R.H. (1971): Type studies in clavarioid fungi IV. Specimens from Herbarium Fries at Uppsala, with notes on cantharelloid species. *Friesia* 9(4-5):369-388.

Schild,E. (1998): Il genere Ramaria: Cinque nuovi taxa dall'Italia mediterranea. *Rivista Micol.* 2:119-140.

Strasser,P. (1900): Pilzflora des Sonntagberges (N.-Oe.), II. *Verh. K. K. Zool.-Bot. Ges. Wien* 50:293-301.

MYCOTAXON

Volume LXXIV(2), pp. 429-445 April-June 2000

A COMPARISON AMONG THE LICHEN FLORAS OF THREE CLIMATICALLY DIFFERENT LOCALITIES IN SOUTH WEST GREENLAND

Eric Steen Hansen

Botanical Museum, University of Copenhagen
Gothersgade 130, DK-1123 Copenhagen K, Denmark
Erich@bot.ku.dk

ABSTRACT

A total of 229 taxa of lichens including a few lichenicolous fungi are reported from Qeqertarsuatsiaat/Fiskenæsset, Qussuk and Sangujaarssuit situated in the Nuuk District, South West Greenland. Dominant species were recorded by estimating the cover percentage of all taxa in the different plant communities. The following habitat factors were estimated: rock type and texture, occurrence of limonite crusts and guano, and moisture conditions. The lichen flora of the three localities, which differ from each other climatically, is compared.

The coastal locality, Qeqertarsuatsiaat, is characterised by its conspicuous ornithocoprophilous lichen vegetation consisting of species such as *Aspicilia caesiocinerea*, *Physcia caesia*, *Protoparmelia badia* and *Xanthoria elegans* and a particular community of lichens tolerant of high concentrations of iron, for example, *Acarospora smaragdula*, *A. sinopica* and *Tremolecia atrata*. Well developed snowbeds dominated by *Salix herbacea*, *Cladonia ecmocyna*, *Peltigera scabrosa and Solorina crocea* are of great importance on the Qeqertarsuatsiaq island. *Empetrum hermaphroditum-Vaccinium uliginosum* heaths rich in "fell-field lichens" such as *Alectoria ochroleuca*, *Bryocaulon divergens* and *Flavocetraria nivalis* also occur in many places on this island. Epiphytic lichens are of minor importance at Qeqertarsuatsiaat.

The comparatively varm summers at Qussuk favours the development of scrub vegetation. Accordingly the epiphytic lichen flora, represented by species such as *Cetraria sepincola*, *Lecanora fuscescens*, *Parmeliopsis ambigua* and *Varicellaria rhodocarpa*, is more rich at this locality than at Qeqertarsuatsiaat. Mixed dwarf shrub heaths dominated by *Betula nana*, *Empetrum hermaphroditum*, *Ledum groenlandicum* and *L. palustre*, *Vaccinium uliginosum* and rich in macrolichens such as *Cladonia stellaris*, *C. stygia*, *C. mitis* and *Stereocaulon paschale* are widely distributed at Qussuk. The lichens form almost pure lichen heaths in the area. More dry heaths and fell-fields with *Flavocetraria nivalis*. *Sphaerophorus globosus* and species of *Alectoria* occur on hills and in other less protected places. Seepage rocks support lichens such as *Ephebe hispidula*, *Massalongia carnosa*, *Polychidium muscicola* and *Vestergrenopsis isidiata*. Contrary to lichens associated with iron-containing crusts ornithocoprophilous lichens and lichens occurring on dry, gneissic rocks without guano are of great importance at Qussuk.

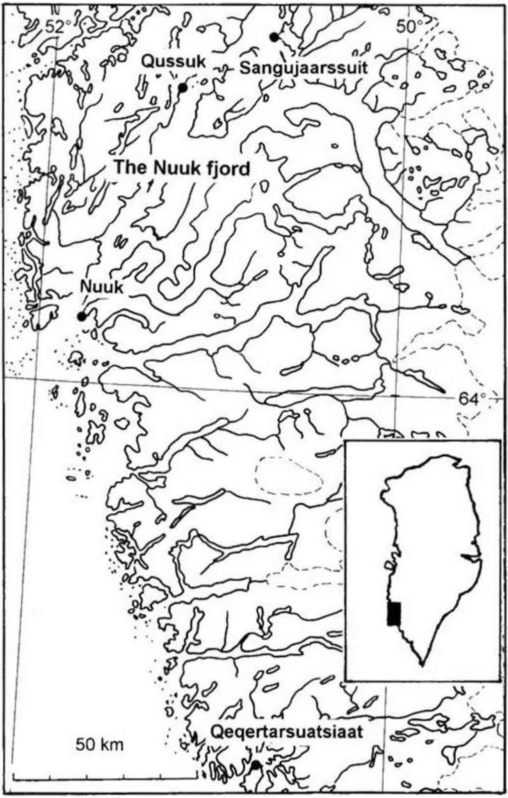
The richest epiphytic lichen flora was found on *Alnus crispa* and *Betula nana* near the head of Sangujaarssuit. The two shrub species have many lichens in common, for example, *Arthopyrenia punctiformis*, *Lecanora fuscescens*, *Melanelia septentrionalis* and *Parmeliopsis ambigua*. *Phaeocalicium compressulum* is a typical epiphyte on *Alnus*. Normal terricolous lichens such as *Caloplaca ammiospila*, *Cladonia cyanipes* and *Psoroma hypnorum* often colonize the basal parts of the shrubs. Many *Peltigeras*, for example, *Peltigera kristinssonii* and *P. leucophlebia*, grow among mosses such as *Hylocomium splendens* and *Pleurozium schreberi* in open scrubs composed of *Alnus crispa* or *Salix glauca*. Heath mosaics composed of *Betula nana*, *Empetrum hermaphroditum*, *Ledum groenlandicum*, *Salix glauca* and *Vaccinium uliginosum* are rich in lichens such as *Buellia papillata* and *Nephroma expallidum*. A *Salix herbacea-Sibbaldia procumbens* snowbed appears to be rich in lichens characterised by a mainly coastal distribution in Greenland (for example, *Pertusaria oculata* and *Solorina crocea*). The saxicolous lichen flora of the Sangujaarssuit area contains a southern inland-element represented by, for example, *Lasallia pensylvanica*, *Lobaria scrobiculata* and *Nephroma bellum*. Ornithocoprophilous lichens are common in the area.

KEY WORDS: Lichen flora, Greenland.

INTRODUCTION

Dahl (1950) and Hansen (1993) have given an account of the previous research on lichens in the Nuuk District. It shows that the collecting activity has varied rather much from area to area within the district. Thus localities such as Nuuk, Qornoq, Kapisillit and the Ameralik fjord must be considered to be fairly well investigated lichenologically, while, for example, Qeqertarsuatsiaat and the greater part of the Nuuk fjord, have an incompletely known lichen flora (Fig. 1).

Fig. 1: The Nuuk fjord area and the Qeqertarsuatsiaat/Fiskenæs area showing the three collection localities, Qeqertarsuatsiaat/Fiskenæsset, Qussuk and area near the head of Sangujaarssuit. The small map to the right shows the location of the investigation area in Greenland.


52°
50°
Qussuk
Sangujaarssuit
The Nuuk fjord
Nuuk
64°
Qeqertarsuatsiaat
50 km

The author investigated the lichen flora of the surroundings of Qeqertarsuatsiaat in the summer of 1993. In the summer of 1997 the author explored the lichen flora of Qussuk and an area near the head of Sangujaarssuit in collaboration with members of the staff of the Greenland Institute of Natural Resources and the National Environmental Reseach Institute, Department of Arctic Environment, respectively. Qeqertarsuatsiaat (63°06'N, 50°40'W) is situated at the northernmost corner of Qeqertarsuatsiaq island (max. alt. 220 m a.s.l.; Fig. 1). The town is facing Fiskenæsfjorden, which extends to the outer coast. It is located c. 150 km to the south of Nuuk, the capital of Greenland. Qussuk (64°43'N, 51°18'W) is situated on the northern extension of Nordlandet/Akia characterised by its many lakes and up to 200 m high hills. The locality faces Qugssuk, a northern branch of the Nuuk fjord. The distance between Qussuk and Nuuk is c. 65 km.

The third locality is an area situated near the head of Sangujaarssuit (64°52'N, 50°47'W), which is a western branch of the fjord, Ilulialik, a northern extension of the Nuuk fjord. A 570 meter high mountain partly shelters the area. The vegetation is best developed on southeast-facing slopes and at the foot of the mountain. Archaean granodioritic gneisses predominate in the investigation areas (Escher & Stuart Watt, 1976; Kalsbeek & Garde, 1989). The gneisses contain layers of amphibolite and anorthosite (Qeqertarsuatsiaat) and are cut by swarms of mafic dykes of early Proterozoic age. Unfortunately, only a sparse meteorological information is available from the three localities. However, the climate of Qeqertarsuatsiaat is comparable with that of Nuuk, which falls within the low arctic, oceanic regime (Dahl, 1950; Böcher, 1954). According to measurements made by ASIAQ/Grønlands Forundersøgelser the mean temperature of July is c. 7°C at Nuuk. The mean temperature of the coldest month, February, is -7.5°C. The normal annual precipitation at Nuuk is 756 mm (1993-1997) at Nuuk. The Nuuk fjord area is characterised by an oceanic-continental gradient (Hansen, 1993; Heide-Jørgensen & Johnsen, 1997), which implies that inland summer temperatures are higher than coastal summer temperatures, and that precipitation is higher at the coast than at inland localities. In accordance with this climatic pattern Qussuk has a low arctic, suboceanic climate, whereas that of the Sangujaarssuit area is low arctic and subcontinental (-continental).

MATERIAL AND METHODS

Lichens were collected at more than 100 sample plots situated at Qeqertarsuatsiaat, Qussuk and near the head of Sangujaarssuit. Moisture conditions, rock type and texture and occurrence of limonite crusts and guano were recorded at the different lichen habitats. Dominant species were recorded by estimating the cover percentage of all taxa in all plant communities rich in lichens. The surface examined in analysis of terricolous communities is one square metre (all localities, but primarily Qeqertarsuatsiaat) or 71x71 cm (Qussuk, Sangujaarssuit), while it is 10x10 cm in analysis of saxicolous communities (all localities). Numerous random samples of lichens were collected for a complete investigation of the different vegetation types. Dominant epiphytic lichens were recorded by an evaluation of the most prevalent species on selected branches and twigs. The collected material, a total of 911 lichen specimens, is deposited at the Botanical Museum, University of Copenhagen (C). A study collection of lichens from Qussuk, Sangujaarssuit and Nuuk is kept at the Greenland Institute of National Resources. The classification of vegetation types and plant communities is in accordance with that previously used by Hansen (1993, 1997). Within each of the three main types of flora (corticolous, terricolous and saxicolous flora) the different plant communities occurring at the three localities are described and discussed.

RESULTS AND DISCUSSION

The present study shows that the composition of the lichen flora and vegetation varies to some extent with the distance between the locality and the outer coast. The largest number of lichen taxa was found at the coastal locality, Qeqertarsuatsiaat (totally 161; Table I). The Sangujaarssuit area is also comparatively rich in lichen taxa (151), while only 138 taxa were recorded at Qussuk. This locality contains, however, the largest growths of terricolous lichens apart from some *Peltigeras* and species such as *Icmadophila ericetorum*, which are best developed on mossy ground in open scrubs at the inland locality. Outer coast localities are often poorer in lichen species than localities situated in the inland because of more severe climatic conditions. This is well illustrated by an example from the Julianehåb district, where Akia and Harefjeld, both characterised by low summer temperatures and much fog, contain only half as many lichen species as Narssarssuaq (Hansen, 1978a). An account of the lichen vegetation of Qeqertarsuatsiaat, Qussuk and the investigated area at Sangujaarssuit is provided below.

Table I

	I	II	III
Corticolous lichens	2	5	12
Terricolous lichens	75	69	69
Saxicolous lichens	84	64	70
Total number of lichens	161	138	151

Table I: The total number of corticolous -, terricolous - and saxicolous lichens occurring at the three collection localities (see Fig. 1).

A. Corticolous flora

Nuuk and Qeqertarsuatsiaat are very poor in epiphytic lichens owing to the comparatively cold summer climate (Hansen, 1993). *Lecanora fuscescens* was found growing together with *Biatora vernalis* on prostrate branches of *Salix glauca* south of the town. The last-mentioned lichen usually occurs on plant remains in this area. No corticolous lichens were found on the scattered shrubs of *Betula nana* occurring on Qeqertarsuatsiaq island.

With its more favourable climate Qussuk has many scrubs and, therefore, also a comparatively rich epiphytic lichen flora (Table I). *Cetraria sepincola*, *Lecanora fuscescens*, *Parmeliopsis ambigua* and *Varicellaria rhodocarpa* grow on up to 2 cm thick branches of *Betula nana*. Basal branches of this shrub appear to be a suitable substrate for the terricolous lichens, *Cetraria islandica* and *Ochrolechia frigida* (!). Two normally epilithic lichens, viz. *Parmelia saxatilis* and *Pseudephebe pubescens*, occur very rarely on such branches at Qussuk. One obligate epiphytic lichen, *Cetraria sepincola*, and two lichens usually occurring on rocks, viz. *Cetraria hepatizon* and *Pseudephebe minuscula*, were found growing on a 3 cm thick branch of *Salix glauca*. *Bryonora castanea, Buellia papillata* and *Psoroma hypnorum* occur on dead branches of *Salix*.

Alnus crispa forms extensive and up to almost three metre high thickets on the southeast-facing side of the mountain near the head of Sangujaarssuit. More open scrubs occur in the lowland below this mountain. A fairly rich flora of epiphytic lichens was found on up to three cm thick branches of *Alnus*. It consists of the following twelve species: *Arthopyrenia punctiformis*, *Caloplaca holocarpa*, *Cetraria sepincola*, *Lecanora fuscescens*, *L. symmicta*, *Melanelia septentrionalis* (dominant), *Parmeliopsis ambigua*, *P. hyperopta*, *Pertusaria carneopallida*, *Phaeocalicium compressulum, Rinodina lecideoides* and *Varicellaria rhodocarpa* (Table I). *Parmeliopsis ambigua* and *P. hyperopta* occur most abundantly on the thickest branches, while other species, for example, *Cetraria sepincola*, most frequently occur on thin branches and twigs. Thus it appears that the investigated locality has many corticolous lichens in common with, for example, Kapisillit (Hansen, 1993). However, terricolous lichens such as *Caloplaca ammiospila*, *Cladonia chlorophaea*, *C. cyanipes*, *Cladonia deformis* and *Psoroma hypnorum* which were found growing on the lowest part of the *Alnus* shrubs, are more common at Sangujaarssuit than at Kapisillit. *Parmelia saxatilis*, which usually grows on rocks in Greenland, rarely colonizes the bark of *Alnus* in the Nuuk fjord area. It is also able to colonize the branches of, for example, *Betula pubescens, Juniperus communis* and *Sorbus groenlandica* (Alstrup, 1982).

Betula nana also appears to be rich in corticolous lichens in the Sangujaarssuit area. *Arthopyrenia punctiformis, Cetraria sepincola, Lecanora fuscescens*, *L. symmicta*, *Melanelia septentrionalis*, *Parmeliopsis ambigua* (occasionally lignicolous) and *Varicellaria rhodocarpa* are obligate epiphytic lichens, whereas the following species have a lower substrate specificity: *Cetraria hepatizon*, *Cladonia amaurocraea*, *C. chlorophaea*, *C. cornuta*, *C. deformis, Hypogymnia austerodes*, *Parmelia saxatilis*, *P. sulcata*, *Rinodina turfacea* and *Xanthoria borealis* (frequently saxicolous). *Cladonia amaurocraea* are restricted to the basal part of the *Betula nana* shrubs. Normally terricolous lichens are also commonly found on the lowest twigs of *Betula nana* at Qasigiannguit in the Disko Bugt area, but in the last case fell-field species such as *Alectoria nigricans* and *A. ochroleuca* replace the *Cladonia* species (Hansen, 1997).

B. Terricolous flora

1. Qeqertarsuatsiaat/Fiskenæsset

The epigaeic lichen flora of Qeqertarsuatsiaat is richer in species than that of Qussuk and the area at Sangujaarssuit (Table I). The lichen vegetation includes three different plant communities, viz. snowbeds (including snowbed heaths), dwarf shrub heaths and fell-fields.

Snowbeds dominated by *Salix herbacea* are best developed on northward-facing slopes and occur in many places on the Qeqertarsuatsiaq island. They are generally poor in lichen species, although some species, for example, *Cladonia ecmocyna* and *Solorina crocea*, often cover large areas along the border of the snow-patches (Hansen, 1971). A snowbed heath of particular interest occurs on strongly sloping ground below a rock wall just south of Qeqertarsuatsiaat. It is rich in mosses, for example, *Hylocomium splendens* and *Pleurozium schreberi*, and contains numerous lichens, in particular *Cladonias* and *Peltigeras*. Species such as *Cladonia arbuscula*, *C. crispata*, *C. mitis*, *C. phyllophora*, *C. stygia*, *C. uncialis*, *Flavocetraria nivalis*, *Peltigera canina*, *P. leucophlebia*, *P. malacea*, *P. rufescens*, *P. scabrosa* (dominant) and *Stereocaulon alpinum* indicate the heath character of this community, but the previously mentioned "snowbed-lichens" are also of great importance in this vegetation mosaic. *Ochrolechia frigida*, *O. lapuënsis* and *Pertusaria geminipara* cover dead mosses and other plant fragments. *Baeomyces rufus*, *Cladonia bellidiflora*, *C. pleurota and C. squamosa* were often found growing on bare soil.

Dwarf shrub heaths dominated by *Empetrum hermaphroditum* and *Vaccinium uliginosum* occur in many places on the Qeqertarsuatsiaq island. They are especially rich in lichens on the top of hills and on plateaus. *Flavocetraria nivalis* is dominant at these sites with *Alectoria nigricans*, *A. ochroleuca*, *A. sarmentosa* ssp. *vexillifera*, *Bryocaulon divergens*, *Cetraria muricata*, *Sphaerophorus globosus* and *Thamnolia vermicularis* (v. *subuliformis*) as important additional lichens. However, dwarf shrubs are of minor importance in areas, which are particularly exposed to strong winds. True fell-field vegetation composed of the lichens just mentioned is usually developed in such areas. Moist *Vaccinium* heaths are restricted to depressions in the terrain. They often appear to be rich in lichens such as *Cetrariella delisei*, *Cladonia mitis* and *C. stricta* and *Arctocetraria andrejevii* with *Cladonia cornuta*, *C. cyanipes*, *C. pleurota* and *C. sulphurina* growing on the top of tussocks (Hansen, 1971). *Cladonia stellaris* preferably occurs along the border of stands of *Vaccinium uliginosum*. At some distance from the sea *C. stellaris* forms a very conspicuous association together with *Flavocetraria nivalis*, but although it is rather common on the island, it cannot be compared with the large growths occurring at Qussuk. *Cladonia floerkeana*, which has a somewhat scattered distribution in South West Greenland (Hansen, 1995a), was found growing in a single place close to the sea.

2. Qussuk

This locality is primarily characterised by its often rather complex types of dwarf shrub heaths, most of which contain many lichens. However, bogs and fell-fields are additional plant communities more or less rich in lichens. Dahl's statement - that lichen heaths are most luxuriantly developed in the middle of the South West Greenland fjords (Dahl, 1950) - applies perfectly to those occurring at Qussuk. Snowbeds are of minor importance, only.

Mixed dwarf shrub-lichen heaths are widely distributed in the Qussuk area. *Betula nana*, *Empetrum hermaphroditum*, *Ledum palustre*, *L. groenlandicum* and *Vaccinium uliginosum* often are the dominant dwarf shrubs, although their individual importance in the heaths varies to some extent. *Cladonia stellaris* is usually the dominant lichen, but species such as *Cladonia mitis*, *C. stygia*, *Flavocetraria nivalis*, *Nephroma arcticum*, *Peltigera aphthosa*, *Stereocaulon alpinum* and *S. paschale* also cover comparatively large areas. The rather frequent occurrence of *Arctocetraria andrejevii*, *Cetrariella delisei*, *Cladonia ecmocyna*, *C. crispata* and *C. stricta* in these heath patches distinctly shows their semi-moist character. *Cetraria islandica*, *Cladonia bellidiflora*, *C. chlorophaea*, *C. cornuta*, *C. cyanipes* and *Flavocetraria cucullata* preferably grow in more dry places in the heaths. It is a remarkable feature of the vegetation pattern of Qussuk that part of the above-mentioned lichens - and in particular *Cladonia stellaris* - forms almost pure lichen heaths covering up to fifty square metre! - *Cladonia stygia* often covers comparatively large areas in moist *Betula nana* heaths bordering bogs dominated by, for example, *Salix arctophila*. Transitions between these two communities contain lichens such as *Cladonia macrophyllodes*, *C. mitis*, *C. stygia* and *Peltigera malacea*.

Betula nana-Empetrum-Vaccinium-Ledum palustre heaths developed on more dry ground on hills differ considerably from the above-mentioned heath types as regards their content of lichens. *Flavocetraria nivalis* often is dominant, while the following lichens occur less abundantly: *Alectoria nigricans*, *A. ochroleuca*, *Bryocaulon divergens*, *Cetraria islandica*, *C. muricata*, *C. nigricans*, *Cladonia borealis*, *C. gracilis*, *C. mitis*, *Ochrolechia frigida*, *Pertusaria dactylina*, *Sphaerophorus globosus*, *Stereocaulon alpinum* and *Thamnolia vermicularis* (v. *subuliformis*). Relatively small fell-field patches with few and scattered dwarf shrubs, but abundant occurrences of the above-mentioned lichens can be found in windswept areas around Qussuk. Species such as *Cladonia stellaris* and *C. stygia* avoid places exposed to strong desiccation caused by wind (Hansen, 1971).

3. Sangujaarssuit

At the head of this fjord terricolous lichens appear to be of great importance in the following plant communities: open thickets composed of *Alnus crispa* or *Salix glauca*, dwarf shrub heaths, fell-fields and snowbeds. The first two communities are best developed in the lowland, while the last-mentioned communities preferably occurs at higher elevations.

The bottom layer in the scrubs is rich in mosses, for example, *Hylocomium splendens* and *Pleurozium schreberi*. A number of lichens are, however, favoured by the somewhat shady and moist conditions prevailing in this biotope, for example, *Nephroma arcticum*, *N. expallidum*, *Peltigera canina*, *P. didactyla*, *P. kristinssonii*,. *P. leucophlebia* and *P. malacea*. Occasionally, *Icmadophila ericetorum* and *Omphalina hudsoniana* are found growing over mosses on boggy ground together with Equisetum sylvaticum along the border of the scrubs.

Together with *Betula nana*, *Empetrum*, *Ledum groenlandicum*, *Salix glauca* and *Vaccinium* form heath mosaics, which generally are higher (> 50 cm) than those occurring at Qussuk. They also differ to some extent with regard to the lichen flora. *Cladonia mitis*, *C. stellaris* and *C. stygia* occur more rarely, whereas lichens such as *Buellia papillata* and *Nephroma expallidum* are relatively common in the heaths at Sangujaarssuit. Clayey frost boils occur abundantly at this locality. They are colonised by the following lichens: *Cladonia chlorophaea*, *C. mitis*, *C. phyllophora*, *C. pyxidata*, *Ochrolechia frigida*, *Peltigera didactyla*, *P. rufescens*, *Psoroma hypnorum* and *Stereocaulon alpinum*,.

An interesting *Salix herbacea-Sibbaldia procumbens* snowbed rich in lichens was found at c. 400 m a.s.l. on the mountain at the head of the fjord. Here the following lichens were noted: *Cetraria islandica*, *Cetrariella delisei*, *C. bellidiflora*, *C. borealis*, *C. crispata*, *C. ecmocyna*, *C. mitis*, *C. pleurota*, *C. sulphurina*, *Lepraria neglecta*, *Peltigera malacea*, *Pertusaria oculata*, *Solorina crocea*, *Stereocaulon alpinum* (dominant) and *S. paschale*. Large growths of *Solorina crocea* occur in similar north-facing places on this mountain.

C. Saxicolous flora

1. Qeqertarsuatsiaat

Nitrophilous lichen vegetation is widely distributed at Qeqertarsuatsiaat, but different lichen communities occurring on rocks without visible influence of guano or other nitrogenous matters are also of great importance. An iron-containing rock situated to the south of the town has a very characteristic lichen flora. The lichen vegetation on wind-swept boulders differ markedly from that associated with more protected boulders. The total number of epilithic lichens is larger at Qeqertarsuatsiaat than at the two other localities investigated (Table I).

A north-facing, vertical and strongly weathered siliceous rock situated on the southern outskirts of the town appears to be particular rich in saxicolous lichens. Part of the rock is distinctly influenced by guano of ravens and gulls. These patches support a number of ornithocoprophilous lichens such as *Aspicilia caesiocinerea*, *Candelariella vitellina*, *Diploschistes scruposus*, *Phaeophyscia sciastra*, *Physcia caesia*, *P. dubia*, *Protoparmelia badia*, *Rhizocarpon geminatum* and *Xanthoria elegans* (dominant). *Lecanora intricata*, *L. polytropa* and *Lecidea lapicida* v. *pantherina* are more or less common, too. Moist faces are covered by *Bellemerea cinereorufescens*, *Caloplaca nivalis*, *Cystocoleus ebeneus*, *Lecanora chloroleprosa*, *Placynthium asperellum*, *Rhizocarpon badioatrum*, *R. lavatum*, *Umbilicaria vellea* (dominant), *U. virginis* and *Xanthoria sorediata*. *Bellemerea cinereorufescens*, which is often found growing on metalliferous rocks (Wirth, 1995), forms an association with *Acarospora sinopica*, *A. smaragdula* *Lecidea lapicida*, *Porpidia melinodes* and *Tremolecia atrata* on rocks composed of amphibolite. Three different ecotypes of *A. smaragdula* occur at Qeqertarsuatsiaat, viz. the normal ecotype with pale brown thallus, a rust-stained ecotype and a green, possibly Cu-rich ecotype (Purvis & Halls, 1996). The occurrence of *Lecanora marginata* on the investigated rocks indicates presence of Ca (Hansen, 1995b).

Gneissic boulders occurring along the shore often have a bright yellow colour due to the dominant lichen *Candelariella arctica*. *Acarospora molybdina*, *Amandinea coniops*, *Caloplaca alcarum*, *C. fraudans*, *Lecanora contractula*, *L. straminea* and *Physcia tenella* v. *marina* are additional members of this community, which is favoured by guano of, for example, gulls, and by fish offal, too. *Candelariella arctica* is also common on blocks, which occur scattered in the town. *Verrucaria degelii* was found growing on gneissic rocks in the littoral zone along the coast at the northwestern part of Qeqertarsuatsiaat.

Blocks exposed to strong winds support lichens such as *Ophioparma ventosa, Tephromela aglaea* and *T. armeniaca*. They usually form a characteristic association together with *Aspicilia mastoidea* (sometimes replacing Orphniospora as the dominant lichen), *Orphniospora moriopsis* (often dominant), *Rhizocarpon inarense* and different species of *Umbilicaria*, for example, *U. hyperborea* and *U. torrefacta. Umbilicaria cinereorufescens* and *U. polyphylla*, both of which have a particular preference for inland areas (Hansen, 1971), were found growing on a strongly weathered, gneissic in a sheltered area southwest of Qeqertarsuatsiaat.

2. Qussuk

The following three types of epilithic lichen vegetation are of primary importance in the Qussuk area: lichen vegetation on dry, gneissic rocks without influence of nitrogenous matters, ornithocoprophilous lichen vegetation and lichen associations on rocks temporarily moistened by seeping water. Rust-stained lichens are, however, comparatively rare at Qussuk.

Orphniospora moriopsis is the dominant epilithic lichen some distance away from the coast. The species forms characteristic mosaics together with numerous macro- and microlichens. *Arctoparmelia centrifuga, A. incurva, Cetraria hepatizon, Parmelia saxatilis, Pseudephebe minuscula, P. pubescens, Sphaerophorus fragilis, Umbilicaria havaasii, U. hyperborea, U. proboscidea* and *U. torrefacta* are the most important macrolichens, and *Rhizocarpon geographicum, R. inarense, R. praebadium* and *R. rittokense* appear to be the most essential microlichens. The community, which is best developed on horizontal and slightly sloping surfaces of rocks and boulders, is widely distributed in Greenland (Hansen, 1978a, 1997). *Rhizocarpon eupetraeum*, which has a scattered occurrence at Qussuk, also belongs to this community. It has previously been reported from Narssaarssuaq and has a distinctly southern distribution in Greenland (Hansen, 1978b).

Exposed siliceous boulders near the coast and on the top of hills are often covered by a conspicuous ornithocoprohilous vegetation composed of the following species: *Candelariella vitellina, Melanelia disjuncta, Parmelia sulcata, Phaeophyscia sciastra, Physcia caesia*, P. dubia, *Umbilicaria arctica* (dominant), *Xanthoria borealis* and *X. elegans. Candelariella arctica* is dominant on seashore rocks manured by birds (Hansen, 1993).

Seepage rocks occur scattered in the lowland at Qussuk. They support lichens such as *Ephebe hispidula, Leprocaulon subalbicans, Massalongia carnosa, Polychidium muscicola, Umbilicaria deusta* and *Vestergrenopsis isidiata*. The three last-mentioned lichens usually grow on mosses, for example, *Andraea*, on such rocks (Hansen, Poelt & Søchting, 1987). *Caloplaca castellana* and *Placynthium asperellum* grow on sligtly manured, moist rocks. *Hymenelia lacustris* is restricted to rocks bordering glacial streams. Although a few rust-stained lichens, for example, *Acarospora sinopica, Miriquidica atrofulva* and *Tremolecia atrata*, were noted, this group of lichens is generally weakly represented at Qussuk.

3. Sangujaarssuit

The saxicolous lichen flora of the Sangujaarssuit area differs from that of Qeqertarsuatsiaat and Qussuk by the presence of a distinct southern inland-element represented by species such as *Lasallia pensylvanica, Lobaria scrobiculata* and *Nephroma bellum* (Hansen, 1995a) and by the lack of lichens occurring on seashore rocks. Otherwise, the lichen vegetation comprises of the same communities as those reported from Qeqertarsuatsiaat and Qussuk.

Vertical, mossy surfaces of small gneissic boulders situated in open *Salix glauca* scrubs are colonized by *Nephroma bellum* (dominant), *N. parile*, *Peltigera collina*, *Phaeophyscia endococcina* and *Psoroma hypnorum*. The last-mentioned species is usually found growing on rocks and boulders near watercourses and on seepage surfaces (Moberg & Hansen, 1986). Together with *Cetraria hepatizon*, *Lasallia pensylvanica* forms large growths on the top of big boulders in these lowland scrubs. L. pensylvanica also occurs abundantly on exposed rocks on the basal part of the mountains. Here it forms a characteristic association with *Arctoparmelia centrifuga*, *A. incurva*, *Orphniospora moriopsis*. *Umbilicaria cinereorufescens*, *U. cylindrica*, *U. havaasii*, *U. hyperborea* and *U. torrefacta*. *Aspicilia mastrucata*, *Pseudephebe minuscula*, *Rhizocarpon eupetraeum*, *R. grande*, *R. praebadium*, *R. rittokense* are additional important lichens on projecting rocks. Rocks exposed to strong winds support lichens such as *Ophioparma ventosa*, *Tephromela aglaea* and *T. armeniaca*. Moist rocks are covered by lichens such as *Amygdalaria panaeola*, *Lecanora chloroleprosa*, *Miriquidica atrofulva*, *Porpidia flavicunda*, *Rhizocarpon badioatrum*, *Tremolecia atrata Umbilicaria deusta* and *U. vellea*,.

A comparatively rich lichen flora is found on rocks manured by birds. *Xanthoria elegans*, *X. borealis*, *Physcia dubia*, *Parmelia sulcata*, *Hypogymnia austerodes*, *H. subobscura* and *Bryoria chalybeiformis* are more or less common macrolichens on such rocks, while *Protoparmelia badia*, *Aspicilia caesiocinerea*, *Dimelaena oreina*, *Rhizocarpon geminatum* and *R. bolanderi* appear to be the most important microlichens. *Xanthoria elegans* also grows on old bones, sometimes together with *Caloplaca cerina*, *C. tiroliensis* and *Lecanora behringii*. *Leptogium saturninum*, *Lobaria scrobiculata* and *Physconia detersa* were found growing in a fissure in a rock influenced by guano.

List of lichens and lichenicolous fungi

The lichens and lichenicolous fungi represented by the author's collections are listed alphabetically. The list shows the locality for each of the 229 taxa collected (Fig. 1). Nomenclature follows mainly Santesson (1993). Information about the ecology of the lichens is also collocated in the list. The following abbreviations are used: ap = apothecia present; pe = perithecia present; st = sterile specimen; + = present; c = corticolous; t = terricolous; s = saxicolous; I = Qeqertarsuatsiaat/Fiskenæsset; II = Qussuk; III = area near the head of Sangujaarssuit; E = ecology.

Thirty-six numbers of lichens from the three localities have been distributed previously from herb C as part of "Lichenes Groenlandici Exsiccati", edited by the present author. The relevant numbers are stated in the following list.

	I	II	III	E
Acarospora molybdina (Wahlenb.) A. Massal.	ap			s
Acarospora peliscypha Th. Fr.	ap	ap		s
Acarospora rhizobola (Nyl.) Alstrup	st			t
Acarospora sinopica (Wahlenb.) Körb.	ap	st		s
Acarospora smaragdula (Wahlenb.) A. Massal.	ap			s
Alectoria nigricans (Ach.) Nyl.	st	st	st	t
Alectoria ochroleuca (Hoffm.) A. Massal.	st 556	st	st	t
Alectoria sarmentosa (Ach.) Ach. ssp. vexillifera (Nyl.) D. Hawksw.	st			t
Allantoparmelia alpicola (Th. Fr.) Essl.	ap	ap		s
Amandinea coniops (Wahlenb.) Scheid.	ap			s
Amygdalaria panaeola (Ach.) Hertel & Brodo		st	st	s
Arctocetraria andrejevii (Oxner) Kärnefelt & Thell	st	st 669		t
Arctoparmelia centrifuga (L.) Hale	ap	ap	ap	s
Arctoparmelia incurva (Pers.) Hale	st	st	st	s
Arthopyrenia punctiformis (Pers.) A. Massal.			ap	c
Arthrorhaphis alpina (Schaer.) R. Sant.	ap		st	t
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold	ap	ap	ap	s
Aspicilia mastrucata (Wahlenb.) Th. Fr.	ap	ap	ap	s
Baeomyces placophyllus Ach.	st			t
Baeomyces rufus (Huds.) Rebent.	ap	ap	ap	t
Bellemerea cinereorufescens (Ach.) Clauzade & Cl. Roux	ap			s
Biatora vernalis (L.) Fr.	ap		ap	t
Brodoa oroarctica (Krog) Goward	ap	ap	st	s
Bryocaulon divergens (Ach.) Kärnefelt	st	st 673	st	t
Bryonora castanea (Hepp) Poelt		ap		t
Bryonora curvescens (Mudd) Poelt	ap			t
Bryoria chalybeiformis (L.) Brodo & D. Hawksw.	st	st	st	t
Bryoria nitidula (Th. Fr.) Brodo & D. Hawksw.		st	st	t
Buellia papillata (Sommerf.) Tuck.		ap	ap	t
Caloplaca alcarum Poelt	ap			s
Caloplaca ammiospila (Wahlenb.) H. Olivier	ap			t
Caloplaca castellana (Räsänen) Poelt		ap	ap	s
Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr.		ap	ap	-
Caloplaca fraudans (Th. Fr.) H. Olivier	ap			s
Caloplaca holocarpa (Hoffm. ex Ach.) A. E. Wade			ap	c
Caloplaca nivalis (Körb.) Fr.	ap			s
Caloplaca tiroliensis Zahlbr.			ap	t
Candelariella arctica (Körb.) R. Sant.	ap			s
Candelariella aurella (Hoffm.) Zahlbr.		ap		s
Candelariella placodizans (Nyl.) H. Magn.	st	st	st	t
Catapyrenium lachneum (Ach.) R. Sant.		pe		t
Cetraria commixta (Nyl.) Th. Fr.			ap	s
Cetraria hepatizon (Ach.) Vain.	ap 546	st	ap	s
Cetraria islandica (L.) Ach.	st 547	st	st	t
Cetraria muricata (Ach.) Eckfeldt	st	st	st	t
Cetraria nigricans Nyl.	st	ap	st	t
Cetraria sepincola (Ehrh.) Ach.		ap	ap	c
Cetrariella delisei (Bory ex Schaer.) Kärnefelt & Thell	ap	ap	st	t

Cladonia amaurocraea (Flörke) Schaer.	st	st	st	t
Cladonia arbuscula (Wallr.) Flot.	st			t
Cladonia bellidiflora (Ach.) Schaer.	ap	ap	st	t
Cladonia borealis S. Stenroos	ap	ap	ap	t
Cladonia cariosa (Ach.) Spreng.			ap	t
Cladonia carneola (Fr.) Fr.	ap	st		t
Cladonia cervicornis (Ach.) Flot. ssp. verticillata (Hoffm.) Ahti		st		t
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.	st	st	ap	t
Cladonia cornuta (L.) Hoffm.	ap	st 654	st	t
Cladonia crispata (Ach.) Flot.	st	ap 655		t
Cladonia cyanipes (Sommerf.) Nyl.	st	st	st	t
Cladonia deformis (L.) Hoffm.		st	st	t
Cladonia ecmocyna Leight.	ap	ap 656	st	t
Cladonia fimbriata (L.) Fr.		st		t
Cladonia floerkeana (Fr.) Flörke	ap			t
Cladonia gracilis (L.) Willd.	ap	ap	st	t
Cladonia luteoalba Wheldon & A. Wilson		st		t
Cladonia macrophylla (Schaer.) Stenh.		ap	st	t
Cladonia macrophyllodes Nyl.	ap			t
Cladonia mitis Sandst.	ap	st 677	st	t
Cladonia phyllophora Hoffm.	st	ap	ap	t
Cladonia pleurota (Flörke) Schaer.	ap	ap	st	t
Cladonia pocillum (Ach.) Grognot	st			t
Cladonia pyxidata (L.) Hoffm.	st 554	st	ap 667	t
Cladonia squamosa Hoffm.	st	st	st	t
Cladonia stellaris (Opiz) Pouzar & Vezda	st	st 652	st	t
Cladonia stricta (Nyl.) Nyl.		ap 658		t
Cladonia stygia (Fr.) Ruoss	st	st 653	st	t
Cladonia subfurcata (Nyl.) Arnold		ap		t
Cladonia sulphurina (Michx.) Fr.	st	st	st	t
Cladonia uncialis (L.) Weber ex F. H. Wigg.	st	ap		t
Cystocoleus ebeneus (Dillwyn) Thwaites	st			s
Dibaes baeomyces (L. f.) Rambold & Hertel			st	t
Dimelaena oreina (Ach.) Norman			ap	s
Diploschistes scruposus (Schreb.) Norman	ap			s
Ephebe hispidula (Ach.) Horw.	st	st		s
Epilichen scabrosus (Ach.) Clem.	ap		ap	-
Euopsis pulvinata (Schaer.) Vain.		ap		s
Flavocetraria cucullata (Bellardi) Kärnefelt & Thell	st	st	st	t
Flavocetraria nivalis (L.) Kärnefelt & Thell	ap	ap	st	t
Graphium aphthosae Alstrup & D. Hawksw.			+	-
Hymenelia lacustris (With.) M. Choisy	ap	ap		s
Hypogymnia austerodes (Nyl.) Räsänen			st	s
Hypogymnia physodes (L.) Nyl.	st			s
Hypogymnia subobscura (Vain.) Poelt			st	s
Icmadophila ericetorum (L.) Zahlbr.			ap 662	t
Lasallia pennsylvanica (Hoffm.) Llano			ap 668	s
Lecanora atrosulphurea (Wahlenb.) Ach.	ap	ap		s
Lecanora behringii Nyl.			ap	-
Lecanora chloroleprosa (Vain.) H. Magn.	st	st	st	s
Lecanora contractula Nyl.	ap			s
Lecanora fuscescens (Sommerf.) Nyl.	ap	ap	ap	c
Lecanora intricata (Ach.) Ach.	ap	ap		s
Lecanora leucococca Sommerf.			ap	-
Lecanora marginata (Schaer.) Hertel & Rambold	ap			s
Lecanora polytropa (Ehrh. ex Hoffm.) Rabenh.	ap	ap	ap	s

Lecanora straminea Ach.	st			s
Lecanora symmicta (Ach.) Ach.			ap	c
Lecidea auriculata Th. Fr.		ap		s
Lecidea caesioatra Schaer.	ap			s
Lecidea lapicida (Ach.) Ach. v. lapicida	ap	ap	ap	s
Lecidea lapicida (Ach.) Ach. v. pantherina Ach.	ap			s
Lecidoma demissum (Rutstr.) Gotth. Schneid. & Hertel		ap	ap	t
Lepraria neglecta (Nyl.) Lettau	+	+	+	t
Leprocaulon subalbicans (I. M. Lamb) I. M. Lamb & A.M.Ward	+	+	+	t
Leproloma vouauxii (Hue) J. R. Laundon	+			s
Leptogium lichenoides (L.) Zahlbr.	st		st	t
Leptogium saturninum (Dicks.) Nyl.			st	s
Lobaria scrobiculata (Scop.) DC.			st	s
Massalongia carnosa (Dicks.) Körb.	st	st	st 665	s
Melanelia disjuncta (Erichsen) Essl.	st	st	st	s
Melanelia infumata (Nyl.) Essl.	st		st	s
Melanelia septentrionalis (Lynge) Essl.			ap 660	c
Miriquidica atrofulva (Sommerf.) A. J. Schwab & Rambold	st	st	st	s
Miriquidica nigroleprosa (Vain.) Hertel & Rambold		ap		s
Mycobilimbia lobulata (Sommerf.) Hafellner		ap	ap	t
Nephroma arcticum (L.) Torss.	st	st	st 664	t
Nephroma bellum (Spreng.) Tuck.			ap 661	s
Nephroma expallidum (Nyl.) Nyl.			st	t
Nephroma isidiosum (Nyl.) Gyeln.		st		s
Nephroma parile (Ach.) Ach.			st	s
Ochrolechia frigida (Sw.) Lynge	ap	ap	ap	t
Ochrolechia grimmiae Lynge	ap	ap	st	t
Ochrolechia lapuënsis (Räsänen) Räsänen	ap	ap	st	t
Ochrolechia tartarea (L.) A. Massal.	ap		st	s
Omphalina hudsoniana (H. S. Jenn.) H. E. Bigelow	+	+	+	t
Ophioparma ventosa (L.) Norman	ap	ap	ap	s
Orphniospora moriopsis (A. Massal.) D. Hawksw.	ap	ap	ap	s
Pannaria pezizoides (Weber) Trevis.	ap			t
Parmelia omphalodes (L.) Ach.	st	st	st	s
Parmelia saxatilis (L.) Ach.	ap	st 672	ap	s
Parmelia sulcata Taylor	st	st	st	s
Parmeliopsis ambigua (Wulfen) Nyl.		st	st	c
Parmeliopsis hyperopta (Ach.) Arnold		st	st	c
Peltigera aphthosa (L.) Willd.	ap	st	ap 659	t
Peltigera canina (L.) Willd.	ap		st	t
Peltigera collina (Ach.) Schrad.			st	s
Peltigera didactyla (With.) J. R. Laundon	st	st	st	t
Peltigera kristinssonii Vitik.			ap	t
Peltigera leucophlebia (Nyl.) Gyeln.	ap	st	ap	t
Peltigera malacea (Ach.) Funck	ap	st	ap	t
Peltigera rufescens (Weiss) Humb.	st		st	t
Peltigera scabrosa Th. Fr.	ap 548	ap		t
Pertusaria carneopallida (Nyl.) Anzi			ap	c
Pertusaria coriacea (Th. Fr.) Th. Fr.	ap			t
Pertusaria dactylina (Ach.) Nyl.		st	st	t
Pertusaria geminipara (Th. Fr.) C. Knight ex Brodo	st	st	st	t
Pertusaria glomerata (Ach.) Schaer.		ap		t
Pertusaria oculata (Dicks.) Th. Fr.	st	st	st	t
Pertusaria panyrga (Ach.) A. Massal.		ap	ap	t
Phaeocalicium compressulum (Szatala) Alb. Schmidt			ap	c
Phaeophyscia endococcina (Körb.) Moberg			ap	s

Phaeophyscia sciastra (Ach.) Moberg	st	ap	st	s
Phylliscum demangeonii (Moug. & Mont.) Nyl.		ap		s
Physcia caesia (Hoffm.) Fürnr.	ap	st	st	s
Physcia dubia (Hoffm.) Lettau	st	st 671	st	s
Physcia tenella (Scop.) DC. v. marina (A. Nyl.) Lynge	st			s
Physconia detersa (Nyl.) Poelt			st	s
Physconia muscigena (Ach.) Poelt	st			t
Placopsis gelida (L.) Linds.	st		st	s
Placynthium asperellum (Ach.) Trevis.	st	ap	st	s
Polychidium muscicola (Sw.) Gray		ap 674	st	s
Porpidia crustulata (Ach.) Hertel & Knoph			ap	s
Porpidia flavicunda (Ach.) Gowan	ap		ap	s
Porpidia melinodes (Körb.) Gowan & Ahti	st 550	st 670		s
Protoparmelia badia (Hoffm.) Hafellner	ap	ap	ap	s
Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw.	ap	st	st	s
Pseudephebe pubescens (L.) M. Choisy	st	st 676	st	s
Psora rubiformis (Ach.) Hook.	ap			t
Psoroma hypnorum (Vahl) Gray	ap	ap	ap	t
Rhagadostoma lichenicola (De Not.) Keissl.		pe	pe	-
Rhizocarpon badioatrum (Flörke ex Spreng.) Th. Fr.	ap		ap	s
Rhizocarpon bolanderi (Tuck.) Herre			ap	s
Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg.	ap			s
Rhizocarpon eupetraeum (Nyl.) Arnold		ap	ap	s
Rhizocarpon geminatum Körb.	ap	ap	ap	s
Rhizocarpon geographicum (L.) DC.	ap	ap	ap	s
Rhizocarpon grande (Flörke) Arnold		ap	ap	s
Rhizocarpon inarense (Vain.) Vain.	ap			s
Rhizocarpon lavatum (Fr.) Hazsl.	ap			s
Rhizocarpon leptolepis Anzi			ap	s
Rhizocarpon praebadium (Nyl.) Zahlbr.	ap	ap	ap	s
Rhizocarpon rittokense (Hellb.) Th. Fr.		ap	ap	s
Rinodina cacuminum (Th. Fr.) Malme	ap	ap		s
Rinodina lecideoides (Nyl.) Kernst.			ap	c
Rinodina turfacea (Wahlenb.) Körb.	ap		ap	t
Solorina crocea (L.) Ach.	ap	ap	ap 663	t
Sphaerophorus fragilis (L.) Pers.	st	st	st	s
Sphaerophorus globosus (Huds.) Vain.	st	st	st	t
Stereocaulon alpinum Laurer	st	st	st	t
Stereocaulon arenarium (Savicz) I. M. Lamb	st			t
Stereocaulon botryosum Ach.	st	st	st	s
Stereocaulon glareosum (Savicz) H. Magn.	st			t
Stereocaulon paschale (L.) Hoffm.	st	st 657	st	t
Stereocaulon rivulorum H. Magn.	ap		st	t
Stereocaulon spathuliferum Vain.			st	s
Stereocaulon vesuvianum Pers.	st	st 678		s
Tephromela aglaea (Sommerf.) Hertel & Rambold	ap 555			s
Tephromela armeniaca (DC.) Hertel & Rambold	st		ap	s
Thamnolia vermicularis (Sw.) Schaer.	+	+	+	t
Toninia cumulata (Sommerf.) Th. Fr.	ap			t
Trapeliopsis granulosa (Hoffm.) Lumbsch		st	ap 666	t
Tremolecia atrata (Ach.) Hertel	ap	ap		s
Umbilicaria arctica (Ach.) Nyl.	ap	ap	ap	s
Umbilicaria cinereorufescens (Schaer.) Frey	st 549		st	s
Umbilicaria cylindrica (L.) Delise ex Duby	ap	ap	ap	s
Umbilicaria deusta (L.) Baumg.	st 553	st	st	s
Umbilicaria havaasii Llano	ap	ap 679	ap	s

Umbilicaria hyperborea (Ach.) Hoffm.	ap	ap	ap	s
Umbilicaria polyphylla (L.) Baumg.	st			s
Umbilicaria proboscidea (L.) Schrad.	ap	ap	ap	s
Umbilicaria rigida (Du Rietz) Frey	ap			s
Umbilicaria torrefacta (Lightf.) Schrad.	ap	ap	ap	s
Umbilicaria vellea (L.) Hoffm.	st	st	st	s
Umbilicaria virginis Schaer.	ap	ap		s
Varicellaria rhodocarpa (Körb.) Fr.		ap	ap	c
Verrucaria degelii R. Sant.	pe			s
Vestergrenopsis isidiata (Degel.) E. Dahl		st	st	s
Xanthoria borealis R. Sant. & Poelt	ap	ap	ap	s
Xanthoria elegans (Link) Th. Fr.	ap	ap	ap	s
Xanthoria sorediata (Vain.) Poelt	st			s

ACKNOWLEDGEMENTS

The author wish to thank the staff of the Greenland Institute of Natural Resources - in particular its director, Klaus Nygaard - and Mikkel Tamstorf, the National Environmental Research Institute, Department of Arctic Environment, for great help, hospitality and good company. I also wish to thank my other friends in Nuuk and Qussuk for their support in many ways. A grant from the Commision for Scientific Research in Greenland (KVUG) is gratefully acknowledged. Pipaluk Møller Lund and Arild Landa, the Greenland Institute of Natural Resources, Nuuk, and Ingvar Kärnefelt, Botanical Museum, Lund, kindly read and corrected the manuscript.

REFERENCES

Alstrup, V. 1982. The Epiphytic Lichens of Greenland. *The Bryologist* 85(1): 64-73.

Böcher, T. W. 1954. Oceanic and Continental Vegetational Complexes in Southwest Greenland. *Meddelelser om Grønland* 148(1) :1-336.

Dahl, E. 1950. Studies in the Macrolichen Flora of South West Greenland. *Meddelelser om Grønland* 150(2): 1-176.

Escher, A. & Stuart Watt, W: 1976. Geology of Greenland. *The Geological Survey of Greenland*, Copenhagen.

Hansen, E. S. 1978a. A comparison between the lichen flora of coastal and inland areas in the Julianehåb District. *Meddelelser om Grønland* 204(3): 1-31.

Hansen, E. S. 1978b. Notes on occurrence and distribution of lichens in South East Greenland. - *Meddelelser om Grønland* 204(4): 1-71.

Hansen, E. S. 1993. The lichen flora of coastal and inland areas in the Godthåb fjord and the Ameraik fjord, southwestern Greenland. *Mycotaxon* 48: 249-269.

Hansen, E. S. 1995a Greenland Lichens. Rhodos and Danish Polar Center, Copenhagen.

Hansen, E. S. 1995b. The lichen flora near Ittoqqortoormiit/Scoresbysund in Central East Greenland. *Herzogia* 11: 197-206.

Hansen, E. S. 1997. Studies of the lichen flora of coastal areas in Central West Greenland. *Nova Hedwigia* 64 (3-4): 505-523.

Hansen, E. S., Poelt, J. & Søchting, U. 1987. Die Flechtengattung Caloplaca in Grönland. *Meddelelser om Grønland. Bioscience* 25: 1-52.

Hansen, K. 1971. Lichens in South Greenland, distribution and ecology. *Meddelelser om Grønland* 178(6): 1-84.

Heide-Jørgensen, H. & Johnsen, I. 1997. Ecosystem Vulnerability to Climate Change in Greenland and the Faroe Islands. Ministry of Environment and Energy, Copenhagen.

Kalsbeek, F. & Garde, A. A. 1989. Descriptive text to 1:500 000 sheet 2, Frederikshåb Isblink Søndre Strømfjord. - *The Geological Survey of Greenland*, Copenhagen.

Moberg, R. & Hansen, E. S. 1986. The lichen genus Physcia and allied genera in Greenland. *Meddelelser om Grønland. Bioscience* 22: 1-32.

Purvis, O. W. & Halls, C. 1996. A review of lichens in metal-enriched environments. *Lichenologist* 28(6): 571-601.

Santesson, R. 1993. The lichens and lichenicolous fungi of Sweden and Norway. SBT-förlaget, Lund.

Wirth, V. 1995. Die Flecten Baden-Württembergs. 2. ed. Eugen Ulmer, Stuttgart.

MYCOTAXON

Volume LXXIV(2), pp. 447-462 April-June 2000

ISOZYME ANALYSIS OF DIFFERENT SPECIES OF THE GENUS SACCOBOLUS (ASCOMYCETES, PEZIZALES)

ARACELI MARCELA RAMOS, MARIA ESTHER RANALLI, FLAVIA FORCHIASSIN AND BEATRIZ O. SAIDMAN.

Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires. Ciudad Universitaria, C1428BGA, Buenos Aires, Argentina. E-mail: araceli @bg.fcen.uba.ar

ABSTRACT

In this work we accomplished the isozyme analysis of monosporic strains of ten species of the genus ***Saccobolus***, with the aim of establishing: the precise identification of some especies among which, the continuous variation of some characters poses doubts about their delimitation, interspecific relationships within the genus and evaluate possible intraspecific variations. No differences were observed in the state of the characters between the monosporic strains of each geographical isolate. Esterases was the only system in which differences between some geographical isolates were observed within the same species, resulting in a total of 15 band patterns. The phenogram obtained from grouping analysis (UPGMA) showed two groups of species, corresponding to the two sections of the genus. The isozyme analysis shows a very close degree of association within the members of the genus ***Saccobolus***, this agrees with the morphological and physiological observations of the group, in which the species are regarded as a continuum. In the species studied of the genus ***Saccobolus*** the scarce intraspecific variation (due probably to the type of sexual reproduction) allows to emphasise the interspecific differences and clearly separate the different species These scarce isoenzimatic variability, could reflect a real genetic homogeneity. The results of this research support the use of isozyme patterns of enzymes tested for the delimitation of species in the genus. This analysis warrants the existence of the ten species as taxonomically independent units.

Key words: isozymes, Ascobolaceae, taxonomy, fungi, ***Saccobolus***.

INTRODUCTION

The genus ***Saccobolus*** (Pezizales, Ascobolaceae) was established by Boudier (1869) and characterised by the presence of a mucilaginous hyaline sheath surrounding the ascospores which are grouped forming a pack inside the ascus. The genus is divided in two sections: ***Saccobolus*** and ***Eriobolus***. In the first we find species with yellow, yellowish amber receptacles (lateral and exterior part of the apotecium, excluding the hymenium), and yellow-citrine, yellowish orange or orange yellowish content of the paraphyses. There is no amorphous intercellular pigment and the ascospore packing follows pattern I (van Brumelen, 1967). In the section ***Eriobolus*** we find species with white, violated pale or violated brown receptacles and hialine paraphyses. Usually an amorphous intercellular pigment is present in the end of the paraphysis and the ascospore packing follows pattern II and IV (van Brumelen, 1967).

We have found considerable coincidences in morphological, microscopic, cytological and developmental characters from the study of numerous isolates and cultures belonging to ascospores of different species of the genus ***Saccobolus***. Such coincidences have led us, in certain instances, to doubt in the delimitation of some species. Even though characteristics such as structure and asci dimensions, type of dehiscence, spores ornamentation and general pattern of ascocarp development have a clear importance in the classification of the species in the genus. In many cases, these have led to uncertainty in the identification of certain species, within which we observe a continuous variation of many characters.

Different authors have contributed to widen the knowlodge of the genus, van Brummelen (op. cit.), Carrol (1967), Gamundi and Ranalli (1969), Ranalli and Gamundi (1975), Ranalli and Forchiassin (1976), Mercuri and Forchiassin (1978), Forchiassin and Dokmetzian (1982), Forchiassin (1983), Galvagno et al. (1984), Dokmetzian et al. (1986), Mouso and Ranalli (1986), Ranalli and Gonzalez Castelain (1994), Ranalli et al. (1994), Ramos (1994), Ramos and Forchiassin (1996, a y b), Ranalli and Mercuri (1995), Zelada et al. (1994).

With the problem outlined and in order to clarify doubts, this work presents the isozyme analysis of 114 strains belonging to ten species of the ***Saccobolus***. The aim of the analysis is to establish the precise identification of the species, interspecific relationships within the genus and evaluate possible intraspecific variations.

MATERIALS AND METHODS

Organisms: Monosporic strains were used and kept in PF medium (Gamundi and Ranalli, 1964) at 5°C, BAFC: Buenos Aires Facultad de Ciencias Table 1

Table 1. List of strains

KEY	STRAINS	LOCATION	SUBSTRATE	DATE	BAFC #
CitER 1	***S. citrinus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Jan-88	2838
CitER 2	***S. citrinus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Jan-88	2839
CitER 3	***S. citrinus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Jan-88	2840
CitER 4	***S. citrinus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Jan-88	2841
CitER 5	***S. citrinus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Jan-88	2842
CitII 1	***S. citrinus*** **II**	Campana, PBA, Arg	cow dung	Apr-94	2826
CitII 3	***S. citrinus*** **II**	Campana, PBA, Arg	cow dung	Apr-94	2843
CitII 5	***S. citrinus*** **II**	Campana, PBA, Arg	cow dung	Apr-94	2844
CitFAC 1	***S. citrinus*** **FAC**	Ciudad Universitaria, BA, Arg	cow dung	Apr-94	2827
CitFAC 3	***S. citrinus*** **FAC**	Ciudad Universitaria, BA, Arg	cow dung	Apr-94	2845
CitFAC 5	***S. citrinus*** **FAC**	Ciudad Universitaria, BA, Arg	cow dung	Apr-94	2846
Long 0	***S. longevisporus*** **PD**	Puerto Deseado, SC, Arg	cow dung	Nov-83	2847
Long 1	***S. longevisporus*** **PD**	Puerto Deseado, SC, Arg	cow dung	Nov-83	2848
Long 2	***S. longevisporus*** **PD**	Puerto Deseado, SC, Arg	cow dung	Nov-83	2849
Long 3	***S. longevisporus*** **PD**	Puerto Deseado, SC, Arg	cow dung	Nov-83	2850
Long 4	***S. longevisporus*** **PD**	Puerto Deseado, SC, Arg	cow dung	Nov-83	2851
PlatAg 0	***S. platensis*** **AG**	Agronomía, BA, Arg	cow dung	Jul-92	2852
PlatAg 2	***S. platensis*** **AG**	Agronomía, BA, Arg	cow dung	Jul-92	2853
PlatAg 3	***S. platensis*** **AG**	Agronomía, BA, Arg	cow dung	Jul-92	2854
PlatAg 5	***S. platensis*** **AG**	Agronomía, BA, Arg	cow dung	Jul-92	2855
PlatSM 1	***S. platensis*** **SM**	San Martín , N.Arg	horse dung	Jan-96	2856
PlatSM 2	***S. platensis*** **SM**	San Martín , N.Arg	horse dung	Jan-96	2857
PlatSM 3	***S. platensis*** **SM**	San Martín , N.Arg	horse dung	Jan-96	2858
PlatSM 4	***S. platensis*** **SM**	San Martín , N.Arg	horse dung	Jan-96	2859
PlatSM 5	***S. platensis*** **SM**	San Martín , N.Arg	horse dung	Jan-96	2860
PlatSP 0	***S. platensis*** **SP**	San Pedro, PBA, Arg	cow dung	May-91	2861
PlatSP 1	***S. platensis*** **SP**	San Pedro, PBA, Arg	cow dung	May-91	2862
PlatSP 2	***S. platensis*** **SP**	San Pedro, PBA, Arg	cow dung	May-91	2863
PlatSP 3	***S. platensis*** **SP**	San Pedro, PBA, Arg	cow dung	May-91	2864
PlatSP 5	***S. platensis*** **SP**	San Pedro, PBA, Arg	cow dung	May-91	2865

Table 1. List of strains

KEY	STRAINS	LOCATION	SUBSTRATE	DATE	BAFC #
SaccBC 2	***S.saccoboloides*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-87	2596
SaccBC 3	***S.saccoboloides*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-87	2866
SaccBC 6	***S.saccoboloides*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-87	2867
SaccBC 7	***S.saccoboloides*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-87	2868
SaccBC 8	***S.saccoboloides*** **BC**	Villa La Angostura, N, Arg	cow dung	Sep-88	2869
SaccT 3	***S.saccoboloides*** **TAFI**	Tafi del Valle, T, Arg	cow dung	Sep-88	2822
SaccT 4	***S.saccoboloides*** **TAFI**	Tafi del Valle, T, Arg	cow dung	Sep-88	2870
SaccT 6	***S.saccoboloides*** **TAFI**	Tafi del Valle, T, Arg	cow dung	Sep-88	2871
Sacc Ez 9	***S.saccoboloides*** **EZ**	Ezeiza, PBA, Arg	horse dung	Mar-94	2872
Sacc Ez 10	***S.saccoboloides*** **EZ**	Ezeiza, PBA, Arg	horse dung	Mar-94	2873
Sacc Ez 11	***S.saccoboloides*** **EZ**	Ezeiza, PBA, Arg	horse dung	Mar-94	2874
Sacc Ez 12	***S.saccoboloides*** **EZ**	Ezeiza, PBA, Arg	horse dung	Mar-94	2875
Sacc Ez 13	***S.saccoboloides*** **EZ**	Ezeiza, PBA, Arg	horse dung	Mar-94	2876
SuccSM 0	***S. succineus*** **SM**	San Martin , RN.Arg	horse dung	Jan-96	2877
SuccSM 4	***S. succineus*** **SM**	San Martin , RN.Arg	horse dung	Jan-96	2878
SuccSM 5	***S. succineus*** **SM**	San Martin , RN.Arg	horse dung	Jan-96	2879
SuccSM 6	***S. succineus*** **SM**	San Martin , RN.Arg	horse dung	Jan-96	2880
SuccSM 8	***S. succineus*** **SM**	San Martin , RN.Arg	horse dung	Jan-96	2881
SuccV 0	***S. succineus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Apr-89	2882
SuccV 1	***S. succineus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Apr-89	2883
SuccV 2	***S. succineus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Apr-89	2884
SuccV 3	***S. succineus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Apr-89	2885
SuccV 4	***S. succineus*** **ER**	Gualeguaychú, ER,Arg	cow dung	Apr-89	2886
TruncBC 2	***S. truncatus*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-97	2595
TruncBC 3	***S. truncatus*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-97	2887
TruncBC 4	***S. truncatus*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-97	2888
TruncBC 5	***S. truncatus*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-97	2889
TruncBC 6	***S. truncatus*** **BC**	Villa La Angostura, N, Arg	cow dung	Jan-97	2890
TruncT 0	***S. truncatus*** **T**	Tandil, PBA, Arg	horse dung	Jan-92	2821
TruncT 1	***S. truncatus*** **T**	Tandil, PBA, Arg	horse dung	Jan-92	2891
TruncT 2	***S. truncatus*** **T**	Tandil, PBA, Arg	horse dung	Jan-92	2892
TruncT 3	***S. truncatus*** **T**	Tandil, PBA, Arg	horse dung	Jan-92	2893
TruncT 4	***S. truncatus*** **T**	Tandil, PBA, Arg	horse dung	Jan-92	2894

Table 1. List of strains

KEY	STRAINS	LOCATION	SUBSTRATE	DATE	BAFC #
DepF 1	*S. depauperatus* **FAC**	Ciudad Universitaria, BA, Arg	horse dung	Sep-94	2895
DepF 3	*S. depauperatus* **FAC**	Ciudad Universitaria, BA, Arg	horse dung	Sep-94	2896
DepF 4	*S. depauperatus* **FAC**	Ciudad Universitaria, BA, Arg	horse dung	Sep-94	2897
DepF 4'	*S. depauperatus* **FAC**	Ciudad Universitaria, BA, Arg	horse dung	Sep-94	2898
Dep I 1	*S. depauperatus* **II**	Campana, PBA, Arg	cow dung	Ago-94	2833
Dep I 2	*S. depauperatus* **II**	Campana, PBA, Arg	cow dung	Ago-94	2811
Dep I 3	*S. depauperatus* **II**	Campana, PBA, Arg	cow dung	Ago-94	2812
In AD 1	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2831
In AD 2	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2899
In AD 3	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2900
In AD 4	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2901
In AD 5	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2902
In AD 6	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2903
In AD 7	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2904
In AD 8	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2905
In AD 9	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2906
In AD 10	*S. infestans* **AD**	Adrogué, PBA,Arg.	horse dung	Mar-91	2908
In PA 13	*S. infestans* **PA**	Porto Alegre, Brasil	cow dung	May-91	2832
In PA 14	*S. infestans* **PA**	Porto Alegre, Brasil	cow dung	May-91	2909
In PA 15	*S. infestans* **PA**	Porto Alegre, Brasil	cow dung	May-91	2910
In PA 16	*S. infestans* **PA**	Porto Alegre, Brasil	cow dung	May-91	2911
In PA 17	*S. infestans* **PA**	Porto Alegre, Brasil	cow dung	May-91	2912
Seu I 2	*S.seudodepauperatus* **I I**	Campana, PBA, Arg	cow dung	Aug. 94	2913
Seu I 3	*S.seudodepauperatus* **I I**	Campana, PBA, Arg	cow dung	Aug. 94	2914
Seu I 4	*S.seudodepauperatus* **I I**	Campana, PBA, Arg	cow dung	Aug. 94	2915
Seu I 6	*S.seudodepauperatus* **I I**	Campana, PBA, Arg	cow dung	Aug. 94	2916
Seu I 8	*S.seudodepauperatus* **I I**	Campana, PBA, Arg	cow dung	Aug. 94	2917

Table 1. List of strains

KEY	STRAINS	LOCATION	SUBSTRATE	DATE	BAFC #
Seu V 2	***S.seudodepauperatus* IV**	Campana, PBA, Arg	horse dung	Aug. 94	2828
Seu V 3	***S.seudodepauperatus* IV**	Campana, PBA, Arg	horse dung	Aug. 94	2919
Seu V 4	***S.seudodepauperatus* IV**	Campana, PBA, Arg	horse dung	Aug. 94	2920
Seu V 5	***S.seudodepauperatus* IV**	Campana, PBA, Arg	horse dung	Aug. 94	2921
Seu V 6	***S.seudodepauperatus* IV**	Campana, PBA, Arg	horse dung	Aug. 94	2922
Seu EZ 1	***S.seudodepauperatus* EZ**	Ezeiza, PBA, Arg	horse dung	Jun-91	2829
Seu EZ 2	***S.seudodepauperatus* EZ**	Ezeiza, PBA, Arg	horse dung	Jun-91	2923
Seu EZ 3	***S.seudodepauperatus* EZ**	Ezeiza, PBA, Arg	horse dung	Jun-91	2924
Seu EZ 4	***S.seudodepauperatus* EZ**	Ezeiza, PBA, Arg	horse dung	Jun-91	2925
Ver GC 0	***S.verrucisporus* GC**	Gob.Castro,PBA, Arg	horse dung	Jun-83	2823
Ver GC 1	***S.verrucisporus* GC**	Gob.Castro, PBA, Arg	horse dung	Jun-83	2926
Ver GC 2	***S.verrucisporus* GC**	Gob.Castro, PBA, Arg	horse dung	Jun-83	2927
Ver GC 3	***S.verrucisporus* GC**	Gob.Castro, PBA, Arg	horse dung	Jun-83	2928
Ver GC 4	***S.verrucisporus* GC**	Gob.Castro, PBA, Arg	horse dung	Jun-83	2929
Ver GC 5	***S.verrucisporus* GC**	Gob.Castro, PBA, Arg	horse dung	Jun-83	2930
Ver G 1	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2931
Ver G 2	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2932
Ver G 3	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2933
Ver G 4	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2934
Ver G 5	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2935
Ver G 6	***S.verrucisporus* G**	Gualeguaychú, ER, Arg	cow dung	Apr-89	2936
Ver II 6	***S.verrucisporus* II**	Campana, PBA, Arg	cow dung	Aug. 94	2937
Ver II 7	***S.verrucisporus* II**	Campana, PBA, Arg	cow dung	Aug. 94	2938
Ver II 8	***S.verrucisporus* II**	Campana, PBA, Arg	cow dung	Aug. 94	2939

shows the location (place, province) (BA: Buenos Aires, PBA: province of Buenos Aires, SC province of Santa Cruz, ER province of Entre Ríos, N: province of Neuquén, RN: province of Río Negro, T: province of Tucumán), substrate (dung), date of collection and strain number (BAFC #) for all the isolates.

Growth medium: $SO_4Mg.7H_2O$, 0,5g; PO_4H_2K, 0,5g; PO_4HK_2, 0,6g; $CuSO_4.5H_2O$, 0,4mg; $MnCl_2.4H_2O$ 0,09mg; H_3BO_3, 0,07mg; $Na_2MoO_4.2H_2O$, 0,02mg; $FeCl_3$, 1mg; $ZnCl_2$, 10mg; biotine 5µg; thiamine-HCL 0.1 mg., glucose 15 g., asparagine 4 g, distilled water to complete 1 litre.

Growth medium was sterilized at 121°C and 1.2 atm. for 20 minutes.

Erlenmeyer flasks containing 50 ml of fresh medium were inoculated by transferring a 5 mm disk cut out from the margin of a 5 day-old colony growing on 2% Bactoagar. Incubation was carried out at 24°C under continuous and orbital shaking at 125 r.p.m. in an New Brunswick G 27 incubator chamber.

Mycelium was harvested, vacuum filtered in a Buchner funnel through filter paper and dried at 90 °C to obtain dry weight values as a growth variable in time. For the samples used in the electrophoretic analysis, the mycelium was harvested the day of maximum growth (which was established for each species from growth curves) rinsed three times with bidistilled water, fractionated and kept at -70 °C until used. The mycelium was milled with extraction buffer (100mM Buffer Tris-HCl, pH 7,5, 0,1% v/v 2-mercaptoetanol, 1mM EDTA, 10mM ClK, 10mM $Cl_2Mg.6H_2O$, 10% PVP 10000) (Soltis et al., 1983), separated in aliquots and kept at -70°C until used.

Polyacrylamide gels and enzymatic dying: The horizontal gel technique was used, using gel concentrations of 7% polyacrylamide (Saidman, 1985). Buffer solutions for gel preparation varied according to the different isozyme system analysed. Thirteen enzymatic systems were analysed. The enzimatic system were clasified in:

Enzymes with good resolution for all isolates ACP (acid phosphatase) EC: 3.1.3.2, G6PD (glucose-6-phosphate dehydrogenase) EC: 1.1.1.49, IDH (isocitrate dehydrogenase) EC: 1.1.1.42, EST (esterase) EC: 3.1.1..., GOT (glutamic oxaloacetic transaminase) EC: 2.6.1.1, SOD (superoxide dismutase) EC: 1.15.1.1. Enzymes with good resolution for only some isolates AK (alkaline phosphatase) EC: 3.1.3.1, GDH (NADP) (glutamate dehydrogenase) EC: 1.4.1.3, MDH(NADP) (malate dehydrogenase (NADP)) EC: 1.1.1.40, MDH(NAD) (malate dehydrogenase (NAD)) EC: 1.1.1.37. Enzymes with poor or no resolution ADH (alcohol dehydrogenase) EC: 1.1.1.1, CAT (catalase) EC: 1.11.1.6, PER (peroxidase) EC: 1.11.1.7.

Different systems of gel buffer (A) and electrode gel (a) for each enzyme were used:

(A) Lithium borate, pH 8 / (a) Lithium borate, pH 8,2 (Scandalios, 1969; modified); ADH, CAT, EST, GOT, MDH(NADP), MDH(NAD), SOD, PER.

(A) Tris-citrate, pH 6,5 / (a) Tris citrate, pH 7 (Selander et al., 1971; modified); ACP, AK, IDH, GDH (NADP).

(A)/(a) Tris citrate, pH 8 (Soltis et al., op. cit.); G6PD.

Dying techniques for AAT were performed according to Vallejos, (1983); for ACP, G6PD, AK, IDH, GDH (NADP), ADH, CAT, PER, were performed according to Manchenko (1994); and for EST, GOT, MDH(NADP), MDH(NAD), SOD according to Wendel and Weeden (1989). The six systems wich showed the best resolution for all the isolates were selected for the subsequent analysis.

The extracts were absorbed in Whatman 3 MM paper rectangles (2mm x 4mm), which were introduced in the grooves made in the gel.

They were then covered with a solution of bromophenol blue (which marked the front of the electrophoretic run).Electrophoresis was carried out at constant temperature, 4°C; using a potential difference of 120 volts. during 5 hours, after which we proceeded to reveal the different bands of enzymatic activity.

The distance for each band from the origin was measured in every enzymatic system. Rf was determined as the ratio between the migration distance of each band of enzymatic activity with respect to the bromophenol blue front.

Numerical methods: The 24 geographical isolates of the ten species of *Saccobolus* constituted the operative taxonomic units (OTU).

The characters used, each represented by a band of enzymatic activity, were obtained from studying the material detailed in table 1. Forty eight characters were used and entered in a phenetic matrix as binary data which were coded as presence (1) or absence (0) for all the monosporic isolates consigned in table 1. No differences were observed between the different monosporic strains from each geographical area, therefore we determined that each one was one operative taxonomic unit.

Grouping analysis: From the basic matrix the coefficient of similarity of Gower (Sneath and Sokal, 1973) was calculated for each possible OTU pair. The resulting matrix was analysed by the unweighted pair-group method using arithmetic averages (UPGMA) (Sneath and Sokal, op. cit..). The Multivariate Statistical Package (MVSP) programme (Kovack, 1993) was used in the analysis. The distortion produced during the grouping analysis was calculated using the coefficient of phenetic correlation, (Sokal and Rohlf, 1962) using the

NTSYS-PC (Rolf, 1993) programme.

RESULTS AND DISCUSSION

Figure 1 shows the diagrams of the zymograms for the six isozyme systems 44 electromophs were detected.

Acid phosphatase showed six different band patterns for both sections. Figure 1 (1-A-F).

The only system that showed some differences between the different geographical isolates for the same species was esterases figure 1 (2.A-O) showing a total of 15 band patterns. Among the species of the section ***Saccobolus***, ***S. longevisporus*** 2-C, ***S. platensis*** 2-D and ***S. truncatus*** 2-I did not show differences between different geographical isolates, whilst ***S. citrinus*** 2-A and B, ***S. saccoboloides*** 2-E and F and ***S. succineus*** 2-G and H did.

The section *Eriobolus* showed six band patterns for esterases (J-O). ***S depauperatus*** (2-J) and ***S. infestans*** (2-K) did not show differences between different isolates, while some isolates of ***S. seudodepauperatus*** (2-L y M) and ***S. verrucisporus*** (2-N y O) differed from the rest.

Glucose-6phosphate dehydrogenase figure 1 (3.A-E) showed three electromorphs, with one band each, for the section ***Saccobolus*** (3.A-C). and two for the section ***Eriobolus*** (3.D-E). Glutamic oxaloacetic transaminase figure 1 (4.A-F) showed only two electromorphs with one band for the section ***Saccobolus*** (4.A-B). The section ***Eriobolus*** showed one band pattern for each species (4.C-F).

Isocitrate dehydrogenase figure 1 (5.A-D) showed 4 electromorphs with two bands each. Two electromorphs for the section ***Saccobolus*** (5.A-B). and two for the section ***Eriobolus*** (5.C-D). Superoxide dismutase figure 1 (6.A-H) showed five band patterns for the species of the section ***Saccobolus*** (6-A a E), and three for the section ***Eriobolus*** (6-F a H).

Among the six isoenzimatic system studied, only the glucose-6-phosphate dehydrogenase showed one band for all the strains analysed, in concordance with haploid state of vegetative mycelium. The presence of simple bands due to the expression of simple alleles could be expected. The existance of multiple band patterns for some of the system investigated, suggests the existence of secondary enzymes, resulting from post-transductional processes, or expression of alleles of different loci. (Harris and Hopkinson, 1978; Micales, 1992)

The phenogram obtained from the grouping analysis (UPGMA) figure 2, shows that the two sections in which the genus is divided are clearly separated

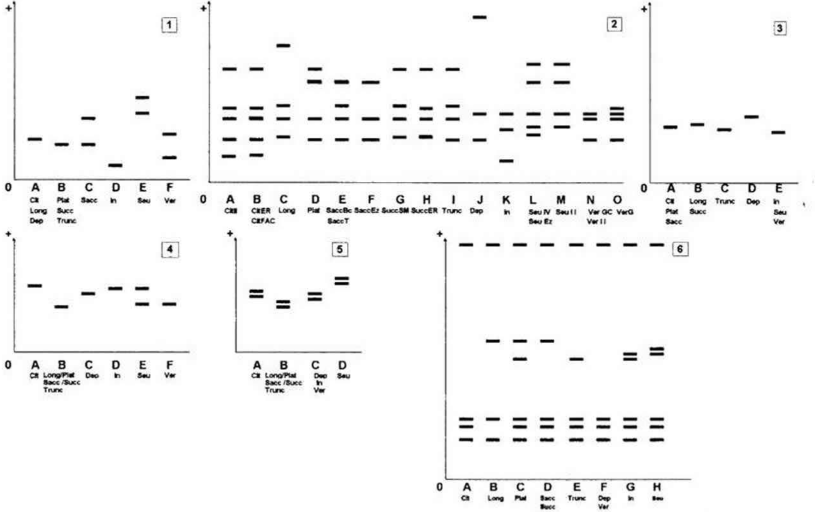


Figure 1. Diagram of electromorphs (A - O) identified for each system: (1) ACP, (2)EST, (3) G6PDH, (4) AAT, (5) IDH, (6) SOD.

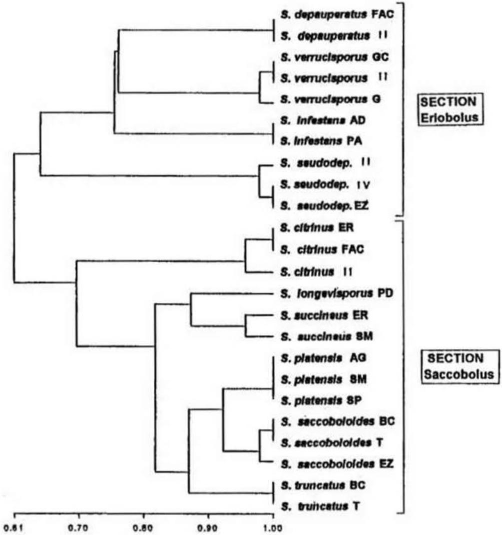


Figure 2. Phenogram based on Gower coefficient. UPGMA Cluster analysis.

in two groups of species. Each of these groups comprises the geographic isolates of the species previously included in each section. The core that contains the species of the section ***Eriobolus*** shows a subgroup of three species, ***S. depauperatus***, ***S. infestans*** and ***S. verrucisporus*** and one OTU, separated from the rest, represented by ***S. seudodepauperatus***. The other group, which includes an the species of the section ***Saccobolus,*** shows a group formed by five species: ***S. longevisporus***, ***S. succineus***, ***S. platensis***, ***S. saccoboloides*** and ***S. truncatus***; and another isolated from the rest formed by the populations of ***S. citrinus***. In the first group two smaller groups are formed, one constituted by ***S. platensis S. saccoboloides*** and ***S.truncatus,*** and another one formed by ***S. longevisporus*** and ***S. succineus***.

The two groups which correspond to both sections, are associated with a degree of similarity greater then 60 %. The species showed scarce differences among the populations of the same species, with degree of similarity of around 100%, indicating that their phenotipes are almost identical. The differences of some bands for esterses cause the slight differences in the degree of similarity among the strains of different populations of the same species. The rest of the enzymes did not show differences among geographic isolates.

The coefficient of phenetic correlation was of 0,94 indicating hardly any distortion in the grouping analysis.

When numerous isolates of different species of the genus ***Saccobolus*** were studied, the coincidences observed in morphological, citological and developmental charaters poses doubts on their clear delimitation. On the other hand the growth media and culture conditions caused variations in the morphology of the apotecia and their distribution on the substrate, these changes can be observed not only in the laboratory but also in natural populations.

The isoenzymatic techniques utilized in this work clearly delimited the species of the genus. Each species showed characteristic band patterns for the majority of the isoenzymatic systems analyzed.

When comparing the results obtained from isoenzymatic analysis with previous morphological and physiological studies, we can observe that the higher degree of similarity between pairs of species is in concordance with greater similarities in morphological characters and physiological characteristics.

S. saccoboloides and ***S. platensis*** which showed the highest degree of similarity, are also species tightly tied when culture and morphological characters are analyzed (Ranalli y Mercuri, op. cit.).

S. citrinus, a species that clearly differs from the core or group that includes the rest of the species in the section ***Saccobolus*** in the isoenzymatic phenogram, presents a physiological and culture behaviour that differs notoriously from the rest, although such differences are not expressed in its morphology.

In the section ***Eriobolus*** the species are better morphologically delimited and this fact is reflected in the isoenzymatic analysis. ***S. seudodepauperatus*** was the species that showed the lowest degree of similarity. Ranalli y Gamundi, op. cit., analyzed culture and morphological characters to compare ***S. seudodepauperatus*** and ***S. depauperatus***. This study showed a clear difference between both species, as well as among ***S. seudodepauperatus*** and the rest of the species in the section.

With respect to the scarce variability that exists within of the species of this genus, it can be related to their type of sexual reproduction. All the species of the genus are homothallic; this means that they are able to complete their life cycle starting from a monosporic strain. It has been proposed that the degree of variation is in direct relationship with the degree of sexual reproduction in the population or species. In populations of ***Phakopsora pachyrhizi*** (Bonde et al., 1988) and ***Puccinia striiformis*** (Newton et al., 1985), pathogens which do not reproduce sexually, low levels of enzyme diversity were reported. Previously Burdon et al. (1983) reported that there was no genetic variation in the collections of ***Puccinia graminis f. sp. tritici*** from Australia when the fungi were forced to reproduce asexually. Harrington et al, op. cit., correlated the enzymatic variability with the type of reproduction in ***Ceratocystis***. In this genus, a scarce or null isoenzymatic variability in the homotallic species could be observed also in one species that only has asexual reproduction, while heterothallic species showed greater variability.

The scarce isoenzimatic variability, observed within the species of the genus ***Saccobolus***, could reflect a real genetic homogeneity. Other authors wich studied the genus ***Saccobolus***, observed low or null intraspecific variability for other phenotipic characteristics such as morphology and culture, (Mercuri and Ranalli, op. cit.), and growth, (Ramos and Forchiassin, 1998), and for other physiological characteristics tested among them enzymatic productivity, (Ramos and Forchiassin, op. cit.). These finding support the exixtence of genetic homogeneity.

Isozyme analysis is frequently used to solve taxonomic problems, particularly when the morphological characteristics are overlapped or are plastic within the genus or species as happens in ***Saccobolus***. In this genus the species form a continuum, making it often a difficult task, to separate some species with certainty because, many morphological characteristics show hardly any variation between species. Isozyme analysis allows to identify clearly different species of the genus as totally identifiable entities. The ability of these techniques in identifying species rely furthermore, on the degree of genetic variation within the population. In the species studied of the genus

Saccobolus the scarce intraspecific variation (due probably to the type of sexual reproduction) allows to emphasise the interspecific differences and clearly separate the different species. On the other hand, in groups with high genetic variability diagnostic markers are hardly obtained and intraspecific variation may be similar to that observed among species, hindering the clear separation of species within the genus.

As a rule a high degree of association is observed among the ten species of genus ***Saccobolus*** which form one group when the isozyme analysis is taken into account. This agrees with previous morphological and physiological studies, which also show that these species form a continuum difficult to delimit in some cases, due to the high homogeneity in the morphological characters.

Analysis of the isozyme patterns provides an invaluable piece of information about differences and similarities between the species of the genus, indicating that the ten species which were studied constitute independent taxonomic entities, supporting what was already established on the basis of morphology and physiology (Ranalli and Forchiassin, op. cit., Mouso and Ranalli, op. cit., Ranalli and Gonzalez Castelain, op. cit., Ranalli et al., op. cit., Ranalli and Mercuri, op. cit.).

ACKNOWLEDGEMENTS

This work was supported by a grant from the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and University of Buenos Aires, Argentina.

REFERENCES

BOUDIER E. (1869). Mémoire sur les Ascobolés. Ann. Sci. Nat. Bot. Ser. 10: 191-268

BONDE M. R., G. L. PETERSON & W. M. DOWLER (1988). A comparison of isozymes of ***Phakopsora pachyrhizi*** from the eastern hemisphere and the new world. Phytopathology. 78:1491-1494.

BRUMMELEN J. VAN (1967). A world monograph of the genera ***Ascobolus*** and ***Saccobolus*** (Ascomycetes, Pezizales). Persoonia suppl 1: 1-260.

BURDON J. J., N. H. LUIG & D. R. MARSHALL (1983). Isozyme uniformity and virulence in ***Puccinia graminis*** f. sp. tritici and ***P. recondita*** f. sp. tritici in Australia. Aust. J. Biol. Sci. 36:403-410.

CARROLL, G. C. (1967). The ultrastructure of ascospore delimitation in ***Saccobolus kerverni***. J. Cell Biol. 33: 218-224.

DOKMETZIAN D. A.., F. FORCHIASSIN & M. E. RANALLI (1986). Estudio sistemático y biológico de las Ascoboláceas de Argentina X. Physis, secc. C 44: 29-38.

FORCHIASSIN F. & D. A. DOKMETZIAN (1982). Estudios citológicos en ***Saccobolus succineus***. Physis, secc. C 40: 47-52.

FORCHIASSIN F. (1983). Effect of light the development of ***Saccobolus platensis***. Rev. Arg. Microb. 15: 213-218.

GALVAGNO M. A., F. FORCHIASSIN, M. L. CANTORE & S. PASSERON (1984). The effect of light and cyclic AMP metabolism on fruiting body formation in ***Saccobolus platensis***. Exper. Mycol. 8: 334-341.

GAMUNDI I. J. & M. E. RANALLI (1964). Estudio sistemático y biológico de las Ascoboláceas de Argentina. I. Nova Hedwigia 7: 517-533.

GAMUNDI I. J. & M. E. RANALLI (1969). Estudio sistemático y biológico de las Ascoboláceas de Argentina. III. Nova Hedwigia 17: 383-407.

HARRINGTON T. C., J. P. STEIMEL, M. J. WINGFIELD & G. A. KILE (1996). Isozyme variation and species delimitation in the ***Ceratocystis coerulescens*** complex. Mycologia 88:104-113.

HARRIS, H. & D. A. HOPKINSON (1978). Handbook of enzyme electrophoresis in human genetics. North-Holland Biomedical Press, Amsterdam.

KOVACH W. L. (1993). MVSP-A multivariate statistical package for IBM-PCs, versión 2.1. Kovach Computing Services, Pentraeth , Wales, UK.

MANCHENKO P. (1994). Handbook of detection of enzymes on electrophoretic gels. CRC Press, Inc, Boca Raton, Florida, USA.

MERCURI, O. A. & F. FORCHIASSIN (1978). Fotobiología de ***Saccobolus citrinus***. Physis, secc. C. 38: 69-82.

MICALES J. A., M. R. BONDE & G. L. PETTERSON. (1992). Isozyme analysis in fungal taxonomy and molecular genetics. In: Handbook of Applied Mycology. Vol. 4, Fungal Biotechnology . Arora, D. K. & Mukerji, K. (eds.). M. Dekker, New York, USA. p. 57-79.

MOUSO DE CACHI N. & M. E. RANALLI. (1986). Estudio sistemático y biológico de las Ascoboláceas de Argentina. XI. Citología y desarrollo de ***Sacccobolus platensis*** . Physis, secc. C. 44:83-91

NEWTON A. C., C. E CATEN. & R. JOHNSON.(1985). Variation for isozymes and double-stranded RNA among isolates of ***Puccinia striiformis*** and two other cereal rusts. Plant Pathol. 34: 235-247.

RAMOS A. M. (1994). Desarrollo de ***Saccobolus longevisporus*** (Fungi, Ascomycetes) con distintas fuentes de nitrógeno. Bol. Soc. Arg. Bot. 30: 71-76.

RAMOS A. M. & F. FORCHIASSIN (1996 a). Amilasas en cuatro especies del género ***Saccobolus,*** (Fungi, Ascomycetes). Bol. Soc. Arg. Bot. 31: 217-220.

RAMOS, A. M. & F. FORCHIASSIN (1996 b). Producción de endoglucanasa en cuatro especies del género ***Saccobolus***. Rev. Arg. Microbiol. 28: 55-62.

RAMOS, A. M. & F. FORCHIASSIN (1998). Análisis comparativo de los patrones isoenzimáticos de ß-1,4 endoglucanasa en especies del género ***Saccobolus*** (Ascobolaceae-Pezizales). Rev. Arg. Microbiol. 30: 130-137.

RANALLI M. E. & I. GAMUNDI (1975). Estudio sistemático y biológico de las Ascoboláceas de Argentina. VI. Morfología y desarrollo de ***Sacccobolus pseudodepauperatus*** sp. Nov. Citología del asco. Nova Hedwigia. 26: 737-763.

RANALLI M. E. & F. FORCHIASSIN. (1976). Estudio sistemático y biológico de las Ascoboláceas de Argentina. VII. Desarrollo y Citología de ***Sacccobolus citrinus***. Bol. Soc. Argent. de Bot. 17: 262-279.

RANALLI M. E. & R. J. GONZALEZ CASTELAIN (1994). Estudio sistemático y biológico de las Ascoboláceas de Argentina. XIII. Una nueva especie de ***Sacccobolus*** (Ascomycetes-Pezizales) Physis, secc. C. 49: 11-17.

RANALLI M. E., R. J. GONZALEZ CASTELAIN & F. FORCHIASSIN (1994). Estudio sistemático y biológico de las Ascoboláceas de Argentina. XIV. Desarrollo del apotecio y del sistema ascógeno de ***Sacccobolus longevisporus*** . Physis, secc. C. 49: 51-59.

RANALLI M. E. & O. A. MERCURI (1995). Taxonomy of some Argentine species of ***Saccobolus***. Mycotaxon. 54: 325-327.

ROLF J. F. (1993). NTSYS-PC. Numerical Taxonomy and Multivariate Analysis System. Version 1.8 Exeter Software Applied Biostatistics Inc., N.Y.

SAIDMAN B. O. (1985). Estudio de la variación alozímica en el género ***Prosopis*** . Doctoral Thesis. Facultad de Ciencias Exactas y Naturales. Universidad de Buenos Aires.

SELANDER R. K., M. H. SMITH., S.Y. , YANG, W. E. JOHNSON & J.B. GENTRY (1971). IV. Biochemical polymorphism and systematics in the genus ***Peromyscus***. I. Variation in the old-field mouse (***Peromyscus polionotus***). Univ. Texas Publ. 103: 49-90.

SNEATH P. H. & R. R. SOKAL (1973). Numerical Taxonomy. The principles and practice of numerical classification.. W. H. Freeman & Co, San Francisco, USA.

SOKAL R.R. & F. J. ROHLF (1962). The comparison of dendrograma by objetive methods. Taxon. 11: 33-40..

SOLTIS D. E., C. H. HAUFLER, D. C. DARROW & G. J. GASTONY (1983). Starch gel electrophoresis of Ferns A compilation of grinding buffers, gel and electrode buffers, and staining schedules. Am. Fern J. 73: 9-27.

VALLEJOS, C. E. (1983). Enzyme activity staining. In: Isoenzymes in Plant genetics and Breeding. Eds. S. D. Tanksley and T. J. Orton. A: Amsterdam, Elsevier. p. 469-516.

WENDEL J. F. & N. F. WEEDEN (1989).Vizualization and interpretation of plants isozymes. Isozyme in Plant Biology. In: D.E. Soltis and P.S. Soltis (eds.). Chapter 1: 5-45.

ZELADA A. M., A. SAMELA, S. PASSERON & M. L. CANTORE (1994). Occurrence of GTP-binding proteins in the Ascomycete ***Saccobolus platensis***. Exper. Mycol. 18: 330-337.

Gemma J. N., Koske R. E. 1988. Seasonal variation in spore abundance and dormancy of *Gigaspora gigantea* and in mycorrhizal inoculum potential of a dune soil. Mycologia 80: 211-216.

Gemma J. N., Koske R. E., 1989. Field inoculation of American beachgrass (*Ammophila breviligulata*) with V-A mycorrhizal fungi. J. Environm. Manag. 29: 173-182.

Gemma J. N., Koske R. E., Carreiro M. 1989. Seasonal dynamics of selected species of VA mycorrhizal fungi in a sand dune. Mycol. Res. 92: 317-321.

Gerdemann J. W. 1968. Vesicular-arbuscular mycorrhiza and plant growth. Annu. Rev. Phytopath. 6: 397-418.

Gerdemann J. W., Nicolson T. H. 1963. Spores of mycorrhizal *Endogone* species extracted from soil by wet sieving and decanting. Trans. Br. Mycol. Soc. 46: 235-244.

Gianinazzi S., Gianinazzi-Pearson V. 1986. Progress and headaches in endomycorrhiza biotechnology. Symbiosis 2: 139-149.

Giovannetti M., Nicolson T. H. 1983. Vesicular-arbuscular mycorrhizas in Italian sand dunes. Trans. Br. Mycol. Soc. 80: 552-557.

Halvorson W. L., Koske R. E. 1987. Mycorrhizae associated with an invasion of *Erechtites glomerata* (Asteraceae) on San Miguel Island, California. Madrono 34: 260-268.

Harley J. L., Harley E. L. 1987a. A check-list of mycorrhiza in the British flora. New Phytol. 105: 1-102.

Harley J. L., Harley E. L. 1990a. A check-list of mycorrhiza in the British flora – addenda, errata and index. New Phytol. 107: 741-749.

Harley J. L., Harley E. L. 1990b. A check-list of mycorrhiza in the British flora - second addenda and errata. New Phytol. 115: 699-711.

Harley J. L., Smith S. E. 1983. Mycorrhizal Symbiosis. Academic Press, London.

Hueck K. 1932. Erlaterung zur vegetationskundlichen Karte der Lebanehrung (Ostpommern). Beitr. zur Naturdenkmalpflege 15: 100-133.

Khan A. G. 1974. The occurrence of mycorrhizas in halophytes, hydrophytes and xerophytes, and of *Endogone* spores in adjacent soils. J. Gen. Microbiol. 81: 7-14.

Koske R. E. 1975. *Endogone* spores in Australian sand dunes. Can J Bot 53: 668-672.

Koske R. E. 1985. *Glomus aggregatum* emended: A distinct taxon in the *Glomus fasciculatum* complex. Mycologia 77: 619-630.

Koske R. E. 1987. Distribution of VA mycorrhizal fungi along a latitudinal temperature gradient. Mycologia 79: 55-68.

Koske R. E. 1988. Vesicular-arbuscular mycorrhizae of some Hawaiian dune plants. Pacific Sci. 42: 217-229.

Koske R. E., Friese C., Walker C., Dalpé Y. 1986. *Glomus pustulatum*: A new species in the Endogonaceae. Mycotaxon 26: 143-149.

Koske R. E., Gemma J. N. 1990. VA mycorrhizae in vegetation of the Hawaii: evidence for codispersal of plants and fungi. Am. J. Bot. 77: 466-474.

Koske R. E., Gemma J. N. 1996. Arbuscular mycorrhizal fungi in Hawaiian sand dunes: Island of Kaua'i. Pacific Sci. 50: 36-45.

Koske R. E., Gemma J. N. 1997). Mycorrhizae and succession in plantings of beachgrass in sand dunes. Amer. J. Bot. 84: 118-130.

Koske R. E., Gemma J. N. 1997. Mycorrhizae and succession in plantings of beachgrass in sand dunes. Amer J Bot 84: 118-130.

Koske R. E., Gemma J. N., Flynn T. 1992. Mycorrhizae in Hawaiian angiosperms: a survey with implications for the origin of the native flora. Am. J. Bot. 79: 853-862.

Koske R. E., Gemma J. N., Jackson N. 1997. Mycorrhizal fungi associated with three species of turfgrass. Can. J. Bot. 75: 320-332.

Koske R. E., Halvorson W. L. 1981. Ecological studies of vesicular-arbuscular mycorrhizae in a barrier sand dune. Can. J. Bot. 59: 1413-1422.

Koske R. E., Halvorson W. L. 1989. Mycorrhizal associations of selected plant species from San Miguel Island, Channel Islands National Park, California. Pacific Sci. 43: 32-40.

Koske R. E., Halvorson W. L. 1989. *Scutellospora arenicola* and *Glomus trimurales*: two new species in the Endogonaceae. Mycologia 81: 927-933.

Koske R. E., Sutton J. C., Sheppard B. R. 1975. Ecology of *Endogone* in Lake Huron sand dunes. Can. J. Bot. 53: 87-93.

Koske R. E., Tews L. L. 1987. Vesicular-arbuscular mycorrhizal fungi of Wisconsin sandy soils. Mycologia 79: 901-905.

Koske R. E., Walker C. 1985. Species of *Gigaspora* (Endogonaceae) with roughened outer walls. Mycologia 77: 702-720.

Lee P-J., Koske R. E. 1994. *Gigaspora gigantea*: parasitism of spores by fungi and actinomycetes. Mycol. Res. 98: 458-466.

Lisiewska M. 1983. Udzial macromycetes w zbiorowiskach roślinnych na wydmach i w borach nadmorskich w Słowińskim Parku Narodowym. Bad. Fizjogr. nad Polską Zach. 34: 23-45.

Logan V. S., Clarke P. J., Allaway W. G. 1989. Mycorrhizas and root attributes of plants of coastal sand-dunes of New South Wales. Aust. J. Plant Physiol. 16: 141-146.

McGonigle T. P., Miller M. H., Evans D. G., Fairchild C. L., Swan J. A. 1990. A new method which gives an objective measure of colonization of roots by vesicular-arbuscular mycorrhizal fungi. New Phytol. 115: 495-501.

Mohankumar V., Ragupathy S., Nirmala C. B., Mohadevan A. 1988. Distribution of vesicular-arbuscular mycorrhizae (VAM) in the sandy beach soils of Madras coast. Cur. Sci. 57: 367-368.

Morton J. B. 1986. Three new species of *Acaulospora* (Endogonaceae) from high aluminum, low pH soils in West Virginia. Mycologia 78: 641-648.

Morton J. B. 1995. Taxonomic and phylogenetic divergence among five *Scutellospora* species based on comparative developmental sequences. Mycologia 87: 127-137.

Morton J. B., Benny G. L. 1990. Revised classification of arbuscular mycorrhizal fungi (Zygomycetes): a new order, Glomales, two new suborders, Glomineae and Gigasporineae, and two new families, Acaulosporaceae and Gigasporaceae, with an emendation of Glomaceae. Mycotaxon 37: 471-491.

Nicolson T. H. 1960. Mycorrhiza in Gramineae. II. Development in different habits, particularly sand dunes. Trans. Br. Mycol. Soc. 43: 132-145.

Nicolson T. H., Johnston C. 1979. Mycorrhiza in Gramineae. III. *Glomus fasciculatum* as the endophyte of pioneer grasses in maritime sand dunes. Trans. Br. Mycol. Soc. 72: 261-268.

Ostrowski M., Symonides E. 1994. Słowiński National Park. SCI & ART. Warsaw.

Pawlowska T. E., Blaszkowski J., Rühling A. 1996. The mycorrhizal status of plants colonizing a calamine spoil mound in southern Poland. Mycorrhiza 6: 499-505.

Phillips J. M., Hayman D. S. 1970. Improved procedures for clearing roots and staining parasitic and vesicular-arbuscular mycorrhizal fungi for rapid assessment of infection. Trans. Br. Mycol. Soc. 55: 158-161.

Piotrowska H. 1991. The development of the vegetation in the active deflation hollows of the Łeba Bar (N Poland). Fragm. Flor. et Geobot. 35: 173-215.

Puppi G., Riess S. 1987. Role and ecology of VA mycorrhizae in sand dunes. Angew. Botanik 61: 115-126.

Read D. J. 1989. Mycorrhizas and nutrient cycling in sand dune ecosystems. Proc. Royal Soc. Edinburg 96B: 89-110.

Rose S. L. 1980. Mycorrhizal associations of some actinomycete nodulated nitrogen-fixing plants. Can. J. Bot. 58: 1449-1454.

Rose S. L. 1988. Above and belowground community development in a maritime sand dune ecosystem. Plant and Soil 109: 215-226.

Schenck N. C., Pérez Y. 1990. Manual for the identification of VA mycorrhizal fungi. Plant Pathology Department, Institute of Food and Agricultural Sciences, University of Florida, INVAM. Gainesville.

Schenck N. C., Smith G. S. 1982. Additional new and unreported species of mycorrhizal fungi (Endogonaceae) from Florida. Mycologia 74: 77-92.

St John T. V., Koske R. E. 1988. Statistical treatment of endogonaceous spore counts. Trans. Br. Mycol. Soc. 91: 117-121.

Stürmer S. L., Bellei M. M. 1994. Composition and seasonal variation of spore populations of arbuscular mycorrhizal fungi in dune soils on the island of Santa Catarina, Brazil. Can. J. Bot. 72: 359-363.

Stürmer S. L., Morton J. B. 1997. Developmental patterns defining morphological characters in spores of four species in *Glomus*. Mycologia 89: 72-81.

Sylvia D. M. 1986. Spatial and temporal distribution of vesicular-arbuscular mycorrhizal fungi associated with *Uniola paniculata* in Florida foredunes. Mycologia 78: 728-734.

Sylvia D. M., Will M. E. 1988. Establishment of vesicular-arbuscular mycorrhizal fungi and other microorganisms on a beach replenishment site in Florida. Appl. Environm. Microbiol. 54: 348-352.

Walker C., Trappe J. M. 1993. Names and epithets in the Glomales and Endogonales. Mycol. Res. 97: 339-344.

Will M. E., Sylvia D. M. 1990. Interaction of rhizosphere bacteria, fertilizer, and vesicular-arbuscular mycorrhizal fungi with sea oats. Appl. Environm. Microbiol. 56: 2073-2079.

MYCOTAXON

Volume LXXIV(2), pp. 483 April-June 2000

NOTES ON MYXOMYCETES FROM CHINA: TWO NEW NAMES

CHAO-HSUAN CHUNG and SHENG-SHUNG TZEAN
Department of Plant Pathology, National Taiwan University, Taipei, TAIWAN
E-mail: sst@ccms.ntu.edu.tw

ABSTRACT: *Trichia huizhongii* and *Physarum caesiellum nom. nov.* are proposed for the Myxomycetes *T. ramosa* Yu Li & H.Z.Li 1992 (*non* (Pers.) Mérat. 1821) and *P. caesium* Shuang L.Chen & Yu Li 1998 (*non* (Pers.) Mérat. 1829), respectively.

KEYWORDS: China, Myxomycetes, Myxomycota, nomenclature, slime molds

The names used to describe two Myxomycetes from China are found to be later homonyms; therefore, we propose the following new names.

Trichia huizhongii Chao-H.Chung & Tzean, ***nom. nov.***
Trichia ramosa Yu Li & H.Z.Li, Mycosystema 5: 175. 1992, *non Trichia ramosa* (Pers.) Mérat, Fl. Par. 2 ed., 1: 117. 1821 (≡ *Diderma ramosum* Pers. 1801 = *Reticularia stipitata* Bull.).
Notes: The species epithet is in memory of Hui-zhong Li (Institute of Microbiology, Chinese Academy of Sciences, Beijing), who found this species. Martin & Alexopoulos (1969) have proposed that *Reticularia stipitata* Bull. is probably a *Badhamia*.

Physarum caesiellum Chao-H.Chung & Tzean, ***nom. nov.***
Physarum caesium Shuang L.Chen & Yu Li, Mycosystema 17: 289. 1998, *non Physarum caesium* (Schumach.) Fr., Syst. Mycol. 3: 147. 1829 (≡ *Licea caesia* Schumach. 1803 = *Didymium difforme* (Pers.) Gray).
Notes: *Didymium difforme* is a plasmodiocarpous, sessile species, and thus is quite different from *Physarum caesiellum*.

LITERATURE CITED

Chen S.-L. & Li Y. 1998. Taxonomic studies on *Physarum* from China I. Three new species from northeastern China. Mycosystema 17:289-293.

Fries, E. M. 1829. Systema mycologicum, sistens fungorum ordines, genera et species, hucusque cognitas, quas ad normam methodi naturalis determinavit, disposuit atque descripsit. vol. 3. Lundae: ex officina Berlingiana.

Li Y., Li H.-z. & Chen S.-L. 1992. Myxomycetes from China IX: A new species of *Trichia*. Mycosystema 5:175-178.

Martin, G. W. & C. J. Alexopoulos. 1969. The Myxomycetes. Univ. Iowa Press, Iowa City.

Persoon, C. H. 1801. Synopsis methodica fungorum. Gottingae: Apud Henricum Dieterich.

MYCOTAXON

Volume LXXIV(2), pp. 485-494 April-June 2000

NOTES ON HYPHOMYCETES. LXXVI.
XYLOHYPHOPSIS AND WEBSTEROMYCES, TWO NEW DEMATIACEOUS, ACROPETALLY CATENATE GENERA

E. CHRISTOPHER PARTRIDGE, WILLIAM A. BAKER,
AND GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture,
Auburn University, Alabama 36849

ABSTRACT

Two new genera, *Xylohyphopsis* Baker & Partridge and *Websteromyces* Baker & Partridge, are established. The former is typified by the anamorphic fungus previously known as *Xylohypha curta* (Corda) S. Hughes [*Torula curta* Corda], while the latter accommodates a hithertofore undescribed species, *W. verruculosum*. *Xylohypha lignicola* Sutton is considered to be congeneric with *X. curta* and is, accordingly, also classified in *Xylohyphopsis*. All three occur on decorticated wood.

INTRODUCTION

Ongoing studies of dematiaceous Hyphomycetes occurring on woody substrates in southern Africa have led to the discovery of a number of novel taxa and some previously described but whose classification has been found to be in need of revision (Morgan-Jones, 1982; Morgan-Jones *et al.*, 1983; 1987a; 1987b; Sinclair *et al.*, 1987; Partridge *et al.*, 1999). Among those collected during the course of the last decade are two catenate entities, one originally described as *Torula curta* Corda, and another which we believe to be undescribed. We consider their respective uniqueness sufficient to warrant the naming of two new genera in which to classify them. Both are described and illustrated in this publication.

In reclassifying *T. curta* in the genus *Xylohypha* (Fr.) Mason, Hughes and Sugiyama (1972) recognized its similarity, in terms of some key hallmark characteristics, to the type species, *X. nigrescens* (Pers.) Mason. However, these authors (Hughes & Sugiyama, loc. cit.) noted the presence of apparently septate conidia following somewhat irregular chain disarticulation, leading to the qualifying statement being made that, notwithstanding this feature, the taxon "seems more suitably classified in *Xylohypha* than elsewhere". We are in agreement with what is presumably inferred; that is, *T. curta* is not entirely satisfactorily classified in *Xylohypha*. In addition to the matter of conidial septation certain other distinguishing characteristics clearly separate this species from *X. nigrescens*. These will be discussed in detail following the description provided below. Since there is no alternative genus available in which to classify this anamorph such is established herein.

TAXONOMIC PART

Xylohyphopsis Baker et Partridge, gen. nov.

Coloniae effusae, nigrae. Mycelium plerumque in substrato immersum, ex hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus compositum. Conidiophora micronemata, singula vel saepe caespitosa, cylindrica, pallide brunnea, laevia, adscendentia vel semiprostrata. Conidia sicca, in catenis simplicibus vel ramosis, acropetis formata, acropleurogena, doliiformia, aseptata vel septata, pallide vel medio brunnea, laevia, ad extremis truncatis.

Xylohyphopsis Baker & Partridge, gen. nov.

Colonies effuse, spreading widely or concentrated and localized, powdery with abundant conidial formation, dark brown to black. Mycelium mostly immersed in the substratum, composed of branched, septate, pale brown to brown, smooth hyphae. Conidiophores micronematous, essentially unmodified, emergent hyphae, single or in loose caespitose clusters, mostly flexuous, cylindrical or with individual cells slightly inflated, pale brown, smooth, ascending and more or less erect or semi-prostrate. Conidia dry, formed acropetally in simple or branched chains, acropleurogenous, barrel-shaped to ellipsoidal, aseptate or septate, where multicellular constricted at the septa, pale to mid brown, smooth, distinctly truncate at both ends upon disarticulation or obtuse at one end if terminal, tending to round off following detachment. Conidia seceding by either schizolytic splits occurring at septa or occasionally conidial units abstricting completely with no discernible transverse septum involved.

Etymology: *Xylohypha* et Gr. *opsis*, aspect.

Xylohyphopsis curta (Corda) comb. nov. (Figure 1)

≡ *Torula curta* Corda, Icon. Fung. 6: 5, 1854.

≡ *Xylohypha curta* (Corda) S. Hughes apud Deighton, Mycol. Pap. 78: 43, 1960.

= *Torula olivacea* Corda subsp. *inops* Karst., Hedwigia 29: 272, 1890.

Colonies effuse, spreading widely and thin or concentrated and localized forming a somewhat dense substratum, powdery with abundant conidial formation, dark brown to black. Mycelium mostly immersed in the substratum, composed of branched, septate, pale brown to brown, smooth, 2-5µm wide hyphae. Occasional hyphal cells slightly inflated. Conidiophores micronematous, essentially unmodified, emergent hyphae, merging gradually and subtly into conidial chains, single or in loose caespitose clusters, mostly flexuous, cylindrical or with individual cells slightly inflated, pale brown, smooth, ascending and more or less erect or semi-prostrate. Conidial chains often arising as lateral outgrowths of repent hyphae in close proximity to one another and frequently from adjacent hyphal cells. Conidia dry, formed acropetally in long, simple or, more rarely, branched chains, acropleurogenous, barrel-shaped to ellipsoidal, aseptate or septate, where multicellular constricted at the septa, pale to mid brown, smooth, distinctly truncate at both ends upon disarticulation or obtuse at one end if terminal, tending to round off following detachment, becoming uniformly somewhat thicker-walled with maturity and very slightly roughened. Conidial size varying depending upon number of unit cells; when unicellular 6.5-8 x 5-6.5µm. Chains breaking up readily into zero to four, or more, septate conidia. At the time of secession polar truncation broad, flat, 3-4µm wide. Conidia seceding by either schizolytic splits occurring at septa or occasionally conidial units abstricting completely with no discernible transverse septum involved.

On decaying wood, Mont-Aux-Sources, Royal Natal National Park, Republic of South Africa, 16 January 1992, G. Morgan-Jones, AUA.

The decision to establish a new generic name for this taxon is based upon the presence of several fundamental differences between it and *Xylohypha* sensu stricto. In *X. nigrescens* and such other species as *X. ferruginosa* (Corda) S. Hughes, *X. novae-zelandiae* S. Hughes & Sugiyama, and *X. palmicola* S. Hughes & Sugiyama, the units of the moniliform conidial chains are invariably connected by only a very narrow isthmus, there being no broad transverse septum involved in the compartmentalization process. Each successive conidium arises as a bud which originates at a minute terminal conidiogenous locus on the preceeding unit, and is ultimately pinched off in essentially a yeast-like manner. As a result, the constriction between each conidium is extremely accentuated and the chains consistently fall apart as single-celled units. As *Xylohypha* conidia mature, their walls thicken differentially, the small connective zone between each conidium remaining rather thinner than the periclinal circumference area. In contrast, the conidial units of *Xylohyphopsis curta* are separated by broad transverse septa which thicken equivalently relative to the lateral walls. In the process of disarticulation the distinct, wide septa cleave schizolytically.

Xylohyphopsis curta appears to be cosmopolitan in distribution and somewhat varied in its substrate association. In addition to the collection from South Africa reported herein, this species has been encountered in Canada on unidentified rotten wood (Hughes and Sugiyama, loc. cit.). The name *Torula olivacea* Corda subsp. *inops* was based on a specimen of this fungus found on pine wood in Finland and the Corda type material extant in the Prague herbarium (PR) is on wood of *Quercus* (Hughes and Sugiyama, loc. cit.).

Sutton (1973) named and described *Xylohypha lignicola* Sutton, a fungus which appears to be closely similar to *X. curta*. It produces comparable chains of conidia, each unit being separated by a broad transverse septum. However, Sutton (loc. cit.) noted that the chains do not readily break up, and when they do each resulting conidium is invariably unicellular. At the time of detachment the conidia were described as being truncate at each end but later becoming subglobose to globose. Although of a similar size to those of *X. curta*, the conidia of *X. lignicola* are dark brown, thick-walled, and verrucose at maturity. Notwithstanding these small differences, we believe *X. lignicola* to be congeneric with *X. curta* and therefore the following new combination is proposed: *Xylohyphopsis lignicola* (Sutton) Baker & Partridge, comb. nov. [basionym: *Xylohypha lignicola* Sutton, Mycol. Pap. 132: 126, 1973].

Websteromyces Baker et Partridge, gen. nov.

Coloniae extense effusae, atrobrunneae vel nigrae, densae, pulveraceae. Mycelium in substrato immersum, ex hyphis ramosis, brunneis, septatis, laevibus compositum. Conidiophora semi-macronemata, singula vel

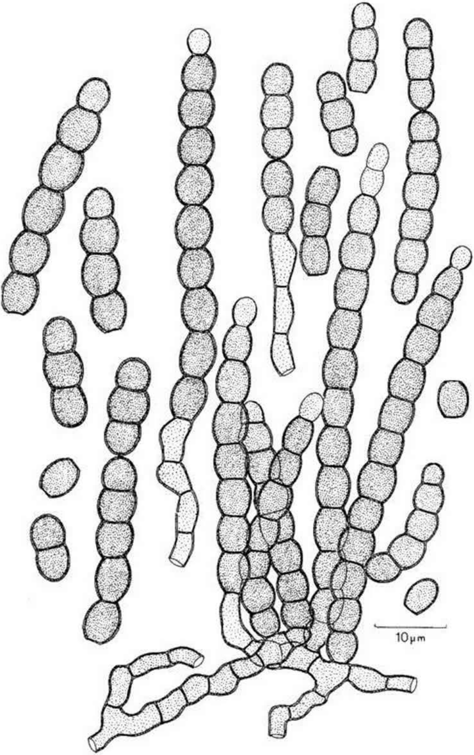


FIGURE 1. *Xylohyphopsis curta*. Conidiophores and conidia.

plerumque caespitosa, adscendentia, erecta vel flexuosa, simplicia vel interdum ramosa, cylindrica, pallide brunnea vel brunnea, laevia, apicem versus verruculosa. Conidia sicca, in catenis simplicibus vel ramosis, acropetis formata, acropleurogena, ellipsoidea vel leniter clavata, aseptata vel 1-2-septata, brunnea, dense verruculosa.

Websteromyces Baker & Partridge, gen. nov.

Colonies extensively effuse, spreading as irregular tufts, at first more or less orbicular, later becoming confluent, dark brown to black, dense, appearing when fully developed as powdery, sooty patches. Mycelium mostly immersed in the substrate, composed of branched, brown, septate, smooth hyphae. Conidiophores semi-macronematous, little modified from the hyphae, broader and somewhat verruculose distally, otherwise smooth, solitary or, more frequently, densely caespitose, ascending, more or less straight or slightly flexuous, simple or sometimes bearing short lateral branches, cylindrical, pale brown to brown. Conidia dry, in simple or branched chains, forming acropetally, acropleurogenous, ellipsoid to somewhat clavate, unicellular or 1-2-septate, brown, densely verruculose.

Etymology: this genus is named in honor of Professor John Webster, University of Exeter, England, who collected the type specimen, in respectful recognition of his many distinguished contributions to mycology.

Websteromyces verruculosum Baker et Partridge, sp. nov.

Coloniae extense effusae, atrobrunneae vel nigrae, densae, velutinae, pulveraceae, discretae vel interdum coalescentes, orbiculares vel irregulares. Mycelium in substrato immersum, ex hyphis ramosis, brunneis, septatis, laevibus vel verruculosis, 2.5-4µm crassis compositum. Conidiophora semi-macronemata, singula vel plerumque caespitosa, adscendentia, erecta vel flexuosa, simplicia vel interdum ramosa, cylindrica, pallide brunnea vel brunnea, laevia, apicem versus verruculosa, usque ad 90µm longa, 3.5-5µm crassa. Conidia sicca, in catenis simplicibus vel ramosis, acropetis formata, acropleurogena, ellipsoidea vel leniter clavata, aseptata vel 1-2-septata, brunnea, dense verruculosa, 6-10µm longa, 4-5µm crassa.

In ligno emortuo, Mankwe Dam, Pilansberg Nature Reserve, Bophuthatswana, Republic of South Africa, 11 July 1991, J. Webster, AUA, holotypus.

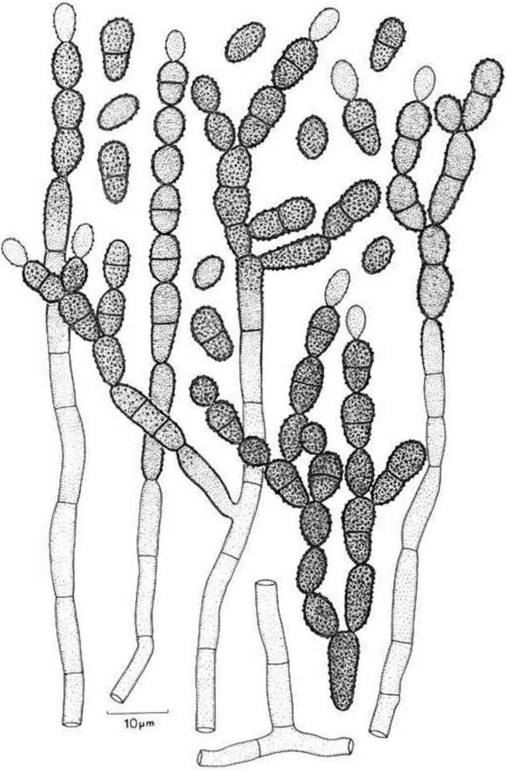


FIGURE 2. *Websteromyces verruculosum*. Conidiophores and conidia.

Websteromyces verruculosum Baker & Partridge sp. nov. (Figure 2)

Colonies extensively effuse, spreading as irregular tufts, at first more or less orbicular, later becoming confluent, dark brown to black, dense, velvety, appearing when fully developed following conidiation as powdery, sooty patches. Mycelium mostly immersed in the substrate, composed of branched, very pale brown to brown, septate, smooth or occasionally finely verruculose, 2.5-4µm wide hyphae. Conidiophores semi-macronematous, little modified from the hyphae, broader and somewhat verruculose distally, otherwise smooth, or verruculose over much of their length, solitary or, more frequently, crowded and densely fasciculate, ascending, more or less straight or slightly flexuous, simple or sometimes bearing short lateral branches, cylindrical, pale brown to brown, up to 90µm long, 3.5-5µm wide. Conidia dry, in simple or branched chains, forming acropetally, acropleurogenous, ellipsoid to somewhat clavate, unicellular or frequently bicellular, rarely 2-septate, where 1-septate with the distal cell often slightly larger than the other, brown, densely verruculose, becoming relatively thick-walled at maturity, 6-10µm long, 4-5µm wide.

On dead, decorticated, submerged branch of unidentified tree, Mankwe Dam, Pilansberg Nature Reserve, Bophuthatswana, Republic of South Africa, 11 July 1991, J. Webster, AUA, holotype.

Although a number of genera having acropetally catenate conidia of morphologically similar aspect have been recognized, such as *Cladosporium* Link, *Websteromyces* is distinct in a number of respects. The absence of any cicatrization, the degree of abstriction between each conidial unit, and conidium ornamentation are among characteristics which make this genus singularly unique.

The fungus *Alysidium minus* (Castañeda) Castañeda & Kendrick, originally named *Cladosporium minus* Castañeda, has a broadly similar morphology, but it is uncertain whether this taxon, because of the presence of what appear to be distinct conidiogenous denticles, is closely related to *W. verruculosum.* It is conceivable, however, that it might be appropriately transferred to *Websteromyces*. It seems very doubtful that *A. minus* is satisfactorily classified in the genus *Alysidium* Kunze, not only on account of this name being now considered a synonym of *Haplotrichum* Link. A reevaluation of its classification and that of several other species currently placed in *Alysidium* is needed. Among these are *A. guttulatum* Castañeda, *A. pinarense* Castañeda & Kendrick, and *A. resinae* (Fr.) M.B. Ellis, including *A. resinae* var. *microsporum* Sutton. Such taxa are doubtfully related to species of *Haplotrichum*, a genus based on the anamorphs of *Botryobasidium* Donk, which produce hyaline or straw-colored conidia and will, therefore, need to be transferred elsewhere, possibly to one or more additional new genera. The type species of *Alysidium* is the anamorph of *Botryobasidium aureum* Parmasto and a number of binomials have, historically, been applied to it, including *A. fulvum* Kunze, *A. dubium* (Pers.) M.B. Ellis [*Trichoderma dubium* Pers.], and *Haplotrichum aureum* (Pers.) Hol.-Jech. [*Acrosporium aureum* Pers.]. In a revision of *Haplotrichum*, Holubová-Jechová (1980) adopted the name *H. aureum* but *T. dubium* is the first binomial applied to this species. The same author (Holubová-Jechová, 1976) had taken up the genus *Haplotrichum* Link for anamorphs of *Botryobasidium* on the basis of the fungal nomenclature starting-point date provisions of the International Rules of Botanical Nomenclature existing at that time. Following the enactment of changes in the ICBN made in 1981, however, the generic name *Acladium* Link [Mag. Ges. naturf. Freunde, Berlin, 3: 11, 1809] takes priority precedence over *Haplotrichum* and the valid name for the anamorph on which the generic name *Alysidium* is based is thus now *Acladium dubium* (Pers.) S. Hughes. In order to appropriately revise the nomenclature of these anamorphs, other taxa transferred by Holubová-Jechová (1976) will probably need to be reassigned to *Acladium*. Relative to *A. pinarense*, Castañeda & Kendrick (1990) offer the observation that darkly pigmented species of *Alysidium* and *Alysidiopsis* Sutton may eventually be redisposed in *Cladosporium*. We consider this to be highly unlikely, however, because of the absence of distinctly thickened conidial scars in the former genera. On the contrary, *Alysidiopsis* appears to be a perfectly good genus. These taxa clearly do not belong in *Cladosporium*.

ACKNOWLEDGMENTS

One of us (G.M.-J.) acknowledges with gratitude the opportunity to collect microfungi in South Africa afforded through the good offices of Professor Albert Eicker, Department of Botany, University of Pretoria. We appreciate being allowed the privilege of studying the collection made by Professor John Webster. We thank Dr. J. Leland Crane, Illinois Natural History Survey, Champaign, for reviewing the manuscript.

LITERATURE CITED

CASTAÑEDA RUIZ, R.F. and B. KENDRICK. 1990. Conidial Fungi from Cuba. I. *Univ. Waterloo Biol. Ser.* 32: 1-53.
HOLUBOVÁ-JECHOVÁ, V. 1976. *Haplotrichum* Link instead of *Oidium* Link, a necessary nomenclatural change. *Česká Mykol.* 30: 3-4.

HOLUBOVÁ-JECHOVÁ, V. 1980. Revision and subdivision of *Haplotrichum* - anamorphs of *Botryobasidium*. *Mycotaxon* 12: 122-130.

HUGHES, S.J. and J. SUGIYAMA. 1972. New Zealand Fungi 18. *Xylohypha* (Fr.) Mason. *N. Z. J. Bot.* 10: 447-460.

MORGAN-JONES, G. 1982. Notes on Hyphomycetes. XLII. New species of *Acrodictys* and *Pseudospiropes* from South Africa. *Mycotaxon* 16: 187-191.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1983. Notes on Hyphomycetes. XLIV. New and rare dematiaceous species from the Transvaal. *Mycotaxon* 17: 301-316.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1987a. Notes on Hyphomycetes. LIII. *Monotretomyces*, a new dematiaceous, catenate genus. *Mycotaxon* 29: 353-358.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1987b. Notes on Hyphomycetes. LV. *Craneomyces verrucosus* gen. nov., and *Trichobotrys effusa*. *Mycotaxon* 30: 345-350.

PARTRIDGE, E.C., W.A. BAKER, G. MORGAN-JONES, and A. EICKER. 1999. Notes on Hyphomycetes. LXXV. New species of *Brachysporiella* and of the previously monotypic genus *Ityorhoptrum* on decorticated wood in southern Africa. *Mycotaxon* 73: (in press).

SINCLAIR, R.C., A. EICKER and G. MORGAN-JONES. 1987. Notes on Hyphomycetes. LVI. *Ceratosporella cheiroidea*, a new species. *Mycotaxon* 30: 351-358.

SUTTON, B.C. 1973. Hyphomycetes from Manitoba and Saskatchewan, Canada. *Mycol. Pap.* 132: 1-143.

MYCOTAXON
Volume LXXIV(2), pp. 495-498 April-June 2000

ON THE SPORE WALL OF ECHINOSTELIUM ELACHISTON (MYXOMYCETES)

FRANCISCO PANDO[1] & MIGUEL OLTRA[2]

[1] Real Jardín Botánico (CSIC), Plaza de Murillo, 2. 28014 Madrid. Spain
[2] Departamento de Biología Vegetal, Universidad de Alcalá de Henares 28871 Alcalá de Henares (Madrid). Spain

Summary

Spores of *E. elachiston* are warted; warts usually grouped in clusters, then giving the impression of thickening pads by transmitted light. These clusters of warts might be the precursors of the typical thickened pads found in some species of the genus.

Echinostelium elachiston Alexop. is a scarcely a collected species. It is only known from a few localities in Greece (Alexopoulos, 1958), USA (Martin & Alexopulos, 1968; Whitney, 1980), Britain (Ing, 1999), France (Mitchel & al., 1984), Turkey (Härkönen) and Spain (Champion, 1983; Oltra & Pando, 1998; Pando, 1997).

Spore wall structure is a character of taxonomic and phylogenetic relevance. It splits the genus in two groups, one with spore wall of uniform thickness and the other with thickened articular surfaces (sometimes referred as "thickened pads") on the spore wall. The elucidation of the actual structure of the spore wall in *E. elachiston* is especially important since because of its simplicity, it occupies a basal position in the evolution of the group and its good characterization is essential for a reliable interpretation of the evolution of the group.

The question of whether the spores of *E. elachiston* have thickened articular surfaces or not has remained open until today. Alexopoulos (1958: 52) in the protologue states that spore are "globose, typically golden yellow, smooth but with well-marked thin places on the wall," and later (Martin & Alexopoulos, 1968: 98), as "smooth, but with well-marked circular areas on the wall". On the other hand, Whitney (1980: 967) describes its spores as "minutely roughened, lacking articular surfaces." The available illustrations, provided in the cited works (Alexopoulos, 1958: 53; Martin & Alexopoulos, 1968: plate VI fig. 58; Whitney, 1980: 968 figs. 19-27), are equally non-conclusive.

Some of the specimens recently found in Spain held numerous well-mature sporocarps. This allowed us to prepare some samples for S.E.M.

observation using the "criticaL point" technique. What the S.E.M. pictures revealed was that the spores surface are covered by warts irregular in shape and size which, in some cases, appear in clusters (Fig.1, 2), giving so the impression that they are thickened pads. To set our observations of a firm ground we studied almost all the available specimens collected worldwide. We found that some specimens identified as *E. elachiston* belonged in fact to other species (UTMC-1346, GR-228 —cited in the protologue). In other cases, immature specimens might lead to the impression that *E. elachiston* shows smooth spores. Spores of immature specimens characteristically remain firmly attached to sporocarps. That was the case of specimens GR-9-60, TEB #2602, TEB #2640, GR-64-1. It is possible that these specimens even belong to *E. colliculosum* K.D. Whitney & H.W. Keller or *E. coelocephalum* T.E. Brooks & H.W. Keller. Preparation of additional microscope slides, and S.E.M. samples would be needed to secure the identification, but this would compromise the integrity of the herbarium specimens.

We conclude that the spores of *E. elachiston* are warted, in some specimens coarsely warted; warts regularly distributed or more characteristically grouped in clusters, then giving the impression of forming pads by transmitted light. These clusters of warts might be the precursors of the typical thickened pads found in some species of the genus. In the case of immature sporocarps, the wide collar (9-20 µm vs. less than 8 µm in diam) and the thick stalk (4-5 µm vs. 1.5-3 µm in diam) are useful character to separate this species from the close *E. colliculosum and E. coelocephalum.*

Acknowledgements

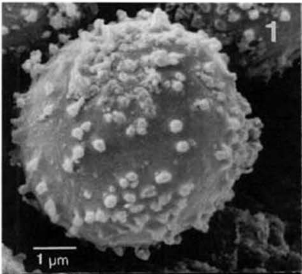
We thank the BPI curators for lending specimens of *E. elachiston*. We also appreciate the kindness of Mr. David. K. Mitchell for allowing to study his collection. This paper is partially supported by the Spanish government through the DGES grant (PB95-0129-C03-01) to the *Flora Mycologica Iberica* project.

Collections examined:

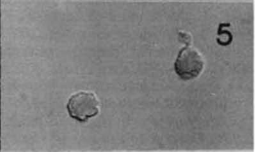
Echinostelium coelocephalum T.E. Brooks & H.W. Keller
USA: Colorado: Boulder, On bark of Ulmus in moist chamber, UTMC-1346, BPI 819092 [as *Echinostelium elachiston* Alexop.].

Figs. 1-6. *E. elachiston*. 1-2. Spores with critical point method by SEM; some warts are grouped in clusters. 3. Top of sporocarp by SEM: spores, collar and tip of stalk. 4-5. Spores by transmitted light (Oltra 1813, MA-Fungi 38578). 6. Spores by transmitted light (GR-194 BPI 819066; Holotypus). 7. *E. coelocephalum*. Spores by transmitted light (UTMC-1346, BPI 819092). 8. *E. collicolosum*. Spores by transmitted light (GR 228, BPI 819076).

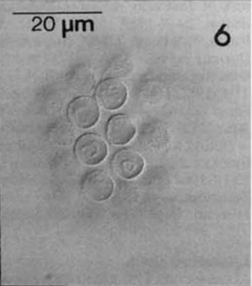
–For comparison , figs. 1-2 are at the same scales, as well as figs. 4-8.

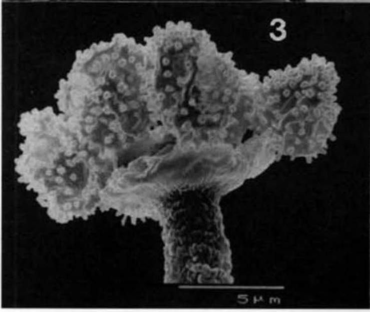

1
1 μm

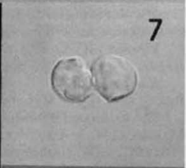

4

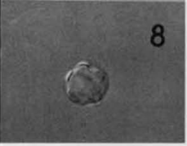

5


2


20 μm
6


3
5 μm


7


8

Echinostelium colliculosum K.D. Whitney & H.W. Keller

GREECE: Marathon, Attica, bark of *Cupressus sempervirens* in moist chamber, 19-III-1955, GR-228, BPI 819076 [as *Echinostelium elachiston* Alexop.].

Echinostelium elachiston Alexop.

FRANCE: Dordogue, Abre de la Liberté, en Tilia bark, 3-VIII-1981, DWM 3734.

GREECE: Astypalaia island, *Juniperus phoenicia*, I-1955, GR-213, BPI 805663 [probably, *E. coelocephalum*; small collar]. Knossos, Creta, On bark of *Cupressus sempervirens* in moist chamber, 25-VI-1964, UTMC-243, BPI 819079 [immadure]. Olimpia, Elis, moist chamber, bark of *Acer*, 15-IV-1955, GR-229, BPI 819091. Tempe-Stomion rd. Thessaly, moist chamber, bark of *Platanus orientalis*, 13-X-1954, GR-194, BPI 819066 [Typus]. Kaisarioni, Attica, developed in moist chamber on bark of *Robinia pseudoacacia* (?), 4-VIII-1960, GR-9-60, BPI 819086 [immature].

SPAIN: Guadalajara; Anquela del Ducado, 30TWL7337, 1200 m, corteza de *Quercus faginea* developed in moist chamber, 16-X-1987, 551 Pando, MA-Fungi 22536. Orea, junto a la ctra. de Orea a Orihuela del Tremedal, 30TXK1990, 1600 m, bark of *Juniperus sabina* in moist chamber, 21-X-1987, 557-1 Pando, MA-Fungi; *ibidem*, 24-X-1987, 557-2 Pando, MA-Fungi 225422; *ibidem*, 15-X-1987, 555 Pando, MA-Fungi 22540. Anquela del Ducado, 30TWL7337, 1200 m, On bark of *Quercus faginea*, 16-X-1987, Pando 551, MA-Fungi 22536. Orea, near road from Orea to Orihuela del Tremedal, 30TXK1990, 1600 m, On bark of *Juniperus sabina*, 21-X-1987, Pando 557-1, MA-Fungi 22542; *ibidem*, 24-X-1987, Pando 557-2, MA-Fungi 22542. Valencia; Gandía, Playa del Grao de Gandía, paseo marítimo, 30SYJ4521, 1 m, on *Phoenix canariensis*, 4-X-1996, 1813. Oltra, MA-Fungi 38578.

USA: Kansas; Johnson Co., on peach bark in moist chamber, 25-XI-1963, T.E. Brooks #2602, BPI 819073 [immature]; *ibidem*, en On elm in bark in moist chamber, 13-IV-1964, T.E. Brooks 2640 [immature], BPI 819070; *ibidem*, en On bark of living *Juniperus virginiana* in moist chamber, 15-IX-1964, TEB 2683, BPI 819081. Missouri: Cape Girardeau, On sweetgum bark in moist chamber, 20-III-1968, TEB 3381, BPI 819089.

Literature cited

ALEXOPOULOS, C.J. (1958). Three new species of Myxomycetes from Greece. *Mycologia* 50(1): 52-56.

CHAMPION, C.L. (1983). Algunos Mixomicetos colectados en las Islas Canarias. *Vieraea* 12(1-2): 295-304.

HÄRKÖNEN, M. (1988). Some additions to the knowledge of Turkish Myxomycetes, *Karstenia* 27:1-7

ING, B. (1999). *The Myxomycetes at Britain and Ireland. An Identifiaction handbook*. The Richmond Publishing. London.

MARTIN, G.W. & ALEXOPOULOS, C.J. (1969). *The Myxomycetes*. Univ.Iowa. Iowa.

MITCHELL, D.W.,NANNENGA-BREMEKAMP, N.E.,CHAMPION, C.L. & CLARK, M.C. (1984). Myxomycota ramassés en France et conservés dans nos collections privées. *Doc. Mycol.* 14(54-55): 51-60.

OLTRA, M., PANDO, F. & CALONGE, F.D. (1998). Aportaciones al catálogo micológico de la Comunidad Valenciana. *Bol. Soc. Micol. Madrid.* 23: 187-194.

PANDO, F., (1997). Bases Corológicas de Flora Micológica Ibérica. Cuad. Trab. Fl. Micol. Ibér. 12: 23-36, 111-112. [51 entries].

WHITNEY, K.D. (1980). The Myxomycete genus *Echinostelium*. *Mycologia* 72(5): 950-987.

MYCOTAXON

Volume LXXIV(2), pp. 499-503 April-June 2000

TWO NEW SPECIES OF XANTHOPARMELIA (LICHENIZED ASCOMYCOTINA, PARMELIACEAE) FROM AUSTRALIA CONTAINING NORLOBARIDONE

JOHN A. ELIX & SIMONE H. J. J. LOUWHOFF

Department of Chemistry, The Faculties, Australian National University, Canberra, ACT 0200, Australia

MARIA del CARMEN MOLINA

Departamento de Biología Vegetal II, Facultad de Farmacia, Universidad Complutense de Madrid, 28040 Madrid, Spain

ABSTRACT: *Xanthoparmelia crespoae* Elix, Louwhoff & Molina and *X. microphyllizans* Elix are described as new to science.

Introduction

As a result of a continuing study of the lichen genus *Xanthoparmelia* in Australia (Elix 1994, 1999; Elix & Kantvilas 1999), we are describing a further two new species. Throughout the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson & Johnson 1982; Elix & Ernst-Russell 1993), high performance liquid chromatography (Elix *et al.* 1997; Feige *et al.* 1993) and comparison with authentic samples.

Xanthoparmelia crespoae Elix, Louwhoff & Molina, sp. nov. Fig. 1

Thallus ut in *Xanthoparmelia incrustata* sed superfice superiore effigurato-maculata differt.

Type: Australia. New South Wales, Shoalhaven River, Warri Bridge, *ca.* 15 km NW of Braidwood, 35°21'S, 149°44'E, 600 m, on granite rocks in *Leptospermum-Acacia* dominated scrub, *J. A. Elix 30295*, 22 Sep. 1999; holo: CANB; iso: HO, MEL.

Thallus foliose, moderately adnate to adnate, forming extended colonies to 20 cm wide. *Lobes* densely imbricate, ±forming a rather thick, dense mat, sublinear to subirregular, subdichotomous to subirregularly branched, 1.0-1.2 mm wide; developing narrower (0.2-1.0 mm), sublinear-elongate, subdichotomous to trichotomously branched, ±clustered, torulose to subterete laciniae. *Upper surface* yellow green, mostly flat, dull, distinctly to effigurately maculate, smooth or rarely cracked, lacking isidia and soredia. *Medulla* white. *Lower surface* ivory to pale brown, often darkening towards the lobe apices; some laciniae canaliculate; rhizines sparse, simple, concolorous. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K-, medulla K-, C-, KC+ orange-pink, P-; containing usnic acid (major), norlobaridone (major), loxodin (minor).

This species is characterized by the moderately adnate, foliose thallus which forms extended, dense mats, the narrow, imbricate lobes with a distinctly to effigurately maculate upper surface, a pale lower surface, the absence of isidia and the presence of loxodin and norlobaridone in the medulla. In overall morphology this species resembles *Xanthoparmelia incrustata* (Kurok. & Filson) Elix & J.Johnst., but the latter species is more tightly adnate, often becomes areolate in the centre, has an emaculate upper surface and develops convex marginal lobes as well as laciniae with a canaliculate lower surface. *Xanthoparmelia crespoae* could be confused with the chemically identical, maculate species *Xanthoparmelia metamorphosa* (Gyeln.) Hale, but the latter species is distinguished by having a loosely adnate thallus, much narrower (0.2-0.6 mm cf. 1-1.2 mm wide), dichotomously branched, divaricate lobes (not dense and mat forming) with a weakly white-maculate upper surface. At present this species is known only from the type locality where it is quite common. This species is named in honour of the noted Spanish lichenologist, Professor Ana Crespo.

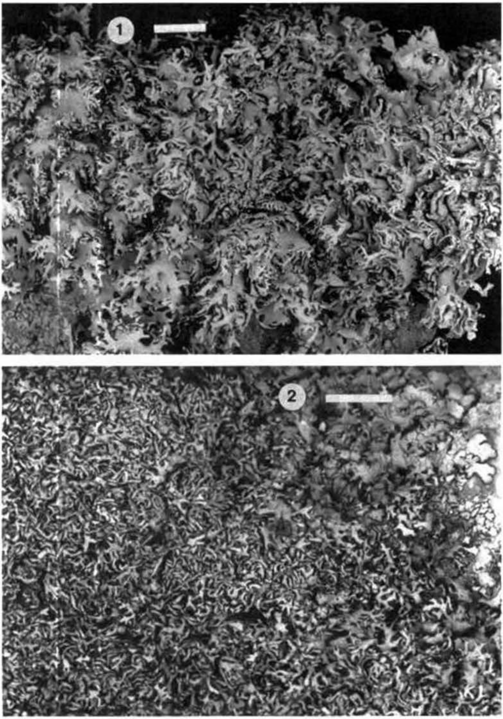
Paratype Specimens Examined

AUSTRALIA. New South Wales, type locality, *J. A. Elix 42680*, 17.i.1998 (CANB); Shoalhaven River, 100-200 m downsteam from Warri Bridge, *ca.* 15 km NW of Braidwood, 35°21'S, 149°44'E, 600 m, on granite rocks in *Leptospermum-Acacia* dominated scrub, *J. A. Elix 30299*, 22.ix.1999 (CANB); *S. H. J. J. Louwhoff 1110, 1114, J. A. Elix & M. C. Molina*, 22.ix.1999 (CANB), *S. H. J. J. Louwhoff, M. C. Molina 67, 86, 103 & J. A. Elix*, 22.ix.1999 (MD).

Xanthoparmelia microphyllizans Elix, sp. nov. Fig. 2

Thallus ut in *Xanthoparmelia filarszkyana* sed lobis laciniatibus vel lobulatibus differt.

Type: Australia. Tasmania: Deal Island, Kents Group, Bass Strait, summit, *ca.* 500 m NE of Lighthouse Hill, 195 m, on exposed granite rocks, *John Whinray 2741*, 6 Nov. 1992; holo: MEL; iso: CANB.



Figures 1-2. New species of *Xanthoparmelia*: 1, *X. crespoae* (holotype in CANB); 2, *X. microphyllizans* (holotype in MEL). Scale bar = 5 mm.

Thallus foliose, tightly adnate, to 15 cm wide. *Lobes* imbricate, flat, sublinear to irregular, irregularly branched, 1-3 mm wide; apices of the marginal lobes subrotund; margins ±laciniate-dissected; at the centre developing densely imbricate, mat-forming, sublinear-elongate, microphylline laciniae, 0.1-0.5 mm wide. *Upper surface* yellow-green, darkening with age, dull in centre but shiny at lobe apices, emaculate, margins blackened, without isidia or soredia. *Medulla* white. *Lower surface* flat, smooth, ivory to brown, darkening at the lobe apices; rhizines sparse, simple, short, coarse, dark brown or black. *Apothecia* not seen. *Pycnidia* common, immersed. *Conidia* bifusiform, 6-7 x 0.7-1 µm.

Chemistry. Cortex K-, medulla K-, C-, KC+ orange-pink, P-; containing usnic acid (major), norlobaridone (major), loxodin (minor).

This species is characterized by the tightly adnate foliose thallus, the densely imbricate, microphylline laciniae, the pale lower surface, the absence of isidia, and the presence of loxodin and norlobaridone in the medulla. The primary lobes of *X. microphyllizans* resemble those of *X. filarszkyana* (Gyeln.) Hale as both have marginal lobes with subrotund apices, lack isidia, have a pale lower surface and identical chemistry. However, *X. filarszkyana* lacks laciniae whereas *X. microphyllizans* is densely laciniate. *Xanthoparmelia microphyllizans* could also be confused with the chemically identical species, *X. flavescentireagens* (Gyeln.) D. J. Galloway, but the latter species is distinguished by having a loosely to moderately adnate thallus which lacks microphylline laciniae. When laciniate, *X. flavescentireagens* develops much broader (0.8-1.5 mm wide), sublinear-elongate, ±weakly canaliculate laciniae. At present this species is known only from the type locality where it is apparently quite common.

ACKNOWLEDGEMENTS

We wish to thank the Australian Research Council for financial support of this project, Mr Stuart Hay and Mr Neal McCracken of the Photographic Unit, ANU, for preparing the photographs. This research was made possible by a Postdoctoral Fellowship (to MCM) from the Comunidad Autonoma de Madrid (BOCM, 27 January, 1999).

LITERATURE CITED

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113-125.

Culberson, C. F. & Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *Journal of Chromatography* **238**: 483-487.

Elix, J. A. (1994). *Xanthoparmelia*. *Flora of Australia* **55**: 201-308.

Elix, J. A. (1999). Eight new species of *Xanthoparmelia* (lichenized Ascomycotina, Parmeliaceae) from Australia. *Mycotaxon* **73** (in press).

Elix, J. A., and Ernst-Russell, K. D. (1993). *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd Edn. (Australian National University, Canberra).

Elix, J. A., & Kantvilas, G. (1999). Two new species of *Xanthoparmelia* from Australasia (Ascomycotina, Parmeliaceae). *Mycotaxon* **71**: 89-93.

Elix, J. A., Wardlaw, J. H., Archer, A. W., Lumbsch, H. T., and Plümper, M. (1997). Four new depsidones from *Pertusaria* and *Lecanora* lichens. *Australasian Lichenology* **41**: 22- 27.

Feige, G. B., Lumbsch, H. T., Huneck, S. & Elix, J. A. (1993) The identification of lichen substances by a standardized high-performance liquid chromatographic method. *Journal of Chromatography* **646**: 417-427.

MYCOTAXON

Volume LXXIV(2), pp. 505-506 April-June 2000

FIRST REPORT OF ANTHOSTOMELLA PEDEMONTANA FROM NORTH AMERICA

Jeffrey K. Stone and Melodie L. Putnam
Department of Botany and Plant Pathology, Oregon State University,
Corvallis, OR 97331

Abstract

Anthostomella pedemontana is reported from pine foliage in Oregon.

Discolored foliage of *Pinus sylvestris* L. grown for Christmas trees in a plantation in Southwest Oregon was referred to the Oregon State University Plant Clinic for examination and diagnosis in late March 1996. Attached, browned needles mainly bearing immature *Lophodermium pinastri* (Hook.) Chev. were observed. An inconspicuous fungus with immersed perithecia, associated with pale bands in the needles was also present. This fungus proved to be a species of *Anthostomella* Sacc., and was apparent only from a slight deformation of the needle surface where a slightly protruding papilla emerged, often surrounded by a halo of expelled brown ascospores.

The specimen agreed in all respects with the description of *A. pedemontana* Ferr. & Sacc. provided in Francis (1975). In particular, this species is distinguished by having asci lacking an apical ring and unicellular, oval to ellipsoidal ascospores with a symmetrical hyaline sheath and prominent, central, straight germ slit only about one-half the length of the spore.

This fungus has previously been recorded from the same host in Italy and from *P. wallichiana* A.B. Jackson from Pakistan (Francis 1975). To our knowledge this is the first report of its occurrence in the United States or North America. One other species of *Anthostomella*, *A. formosa* var. *abietis* J. D. Rogers et al. also has been reported from conifer foliage (*Abies procera* Rehd.) grown for Christmas trees in Oregon (Rogers et al. 1994). The other records of *A. pedemontana* are from apparently naturally abscised needles.

Ascospores of *A. pedemontana* germinated on malt and potato dextrose agar, and produced a white, cottony culture on both media. At 25 C, growth was relatively rapid, 7.5 cm in seven da. No conidial anamorph was produced in cultures after several months. A culture of *A. pedemontana* from germinated ascospores has been deposited with ATCC (ATCC 200583) and a specimen was deposited in the Oregon State University Herbarium (OSC 67860).

Literature cited

Francis, S. M. 1975. *Anthostomella* Sacc. (Part I). Mycological papers 139. CMI, Kew, UK. 97 p.

Rogers, J. D., J. K. Stone, and Y.-M. Ju. 1994. *Anthostomella formosa* var. *abietis* var. nov. and notes on *Apiorhychostoma*. Mycologia 86: 700 – 703.

MYCOTAXON

Volume LXXIV(2), pp. 507-514 April-June 2000

BOOK REVIEWS AND NOTICES[1]

Compiled by

David L. HAWKSWORTH

MycoNova, 114 Finchley Lane, Hendon,
London NW4 1DG, UK

In taking on the responsibility for this section of *Mycotaxon*, my aim is to provide systematic mycologists with prompt information of new titles that may be of interest to them. In order to achieve this goal, and recognizing that some works will be of wider interest than others, the section will comprise a mixture of detailed reviews and shorter notices arranged under series of broad headings. These will include not only items sent submitted by publishers and authors for this purpose, but further other works that come to my attention. In general, only titles published within the previous twelve months will be included. The value of the series will depend on publishers, editors, and authors submitting material promptly on publication. If you have generated a work that you would like to see covered in these pages, ensure a copy is dispatched to my office as soon as possible. Also, if you would like to review a book not yet featured here do let me know, even if it has not been submitted by the publisher for that purpose. I am anxious that works of value in systematic mycology in the broadest sense from societies, small publishers, and in serial publications are not overlooked.

I also wish to acknowledge and thank my predecessor in this role, Eric McKenzie, first on behalf of all *Mycotaxon* readers for his period of stewardship, and second personally for effecting a smooth hand-over of responsibilities.

GENERAL

Italians in the History of Mycology. Edited by Silvano Onofri, Antonio Graniti & Laura Zucconi. 1999. Mycotaxon, P. O. Box 264, Ithaca, NY 14851-0264, USA. Pp. 163. ISBN 0 930845 09 9. Price not indicated.

The proceedings of a symposium held in Rome on 4-5 October 1995 held under the auspices of the Società Botanica Italiana, paying tribute to the enormous contributions Italians have made to mycology from the sixteenth century onwards, but with some references going back to the sixth century. The fourteen chapters cover pioneers such as Micheli, De Notaris, Saccardo, Bresadola, Tassi, Mattirolo, and Ciferri. Attention is also given to internationally lesser known Italian mycologists such as Inzenga, Carmignani, Archangeli, and Pellegrini. In addition there are accounts of the mycological collections in Rome and Genoa.

---

[1] Books for consideration for inclusion in this column should be sent to the Book Review Editor in the first instance: David L. Hawksworth, MycoNova, 114 Finchley Lane, Hendon, London NW4 1DG, UK; tel/fax [+44] (0) 20 8203 4282; e-mail myconova@btinternet.com. Unsigned reviews and notices are by the Book Review Editor.

An enjoyable, fascinating, and beautifully illustrated book with copies of illustrations, many in colour, and also of manuscripts, specimens, and labels as well as portraits. The illustrations include one of *Elaphomyces granulatus*, dated to 512 AD based on Dioscorides' *De Natura Medica* of the first century; Dioscorides was Greek but a physician to Nero's Asiatic legions. Some early illustrations were somewhat imaginative in part, for example that of Aldovandi's sixteenth century plate of *Phallus impudicus*, and Dodoens' 1616 portrayal of the same fungus, but others were faithfully executed, as that of a truffle in Cesi's late sixteenth century *Codex*.

In a volume of its size, it was inevitable that full recognition of all Italian workers could not be given. Personally, I would have liked to see even more attention given to work by Micheli, De Notaris and Saccardo, including their impacts on the systems for lichen-forming fungi. For example, Micheli's first illustration of asci ever (in *Pertusaria*) and how Linnaeus' work took lichenology backwards how: De Notaris' recognition of the importance of spore types stimulated the work of the Italians Massalongo and Trevisan in revising generic concepts in the 1850s-1870s; and Saccardo's mechanistic system permeated the work of Nylander and Zahlbruckner and eclipsed work whose rediscovery had to await the 1970s-1980s.

What is especially gratifying is the interest and respect that Italian mycologists have in their history. There have been separate symposia devoted to the achievements of Saccardo and Ciferri held in 1995 and 1997 respectively, the first published in 1998 and part of the second in 1999. In addition, there have been Italian reprints of selected works by De Notaris issued in 1990, by Massalongo in 1991, and of Trevisan in 1994. It is to be hoped that more of Micheli's unpublished work will also eventually become available - as alluded to in this volume.

Scientists always sit on the shoulders of their forebears, and this is especially true for systematists. Personally, I continue to be amazed at what has been observed and the insights that can be obtained from reading work from the past. Volumes such as this provide an *entrée* into a body of knowledge that is in danger of being lost at a time when researchers are increasingly reliant on what is available through electronic databases. It is great that Mycotaxon Ltd has decided to make the proceedings of this symposium more widely available. If you can obtain a copy I am confident you will enjoy it as much as I did.

Russian Arctic Fungi. By I. V. Karatygin, E. L. Nezdoimingo, Y. K. Novozhilov & M. P. Zhurbenko. 1999. Komarov Botanical Institute, St Petersburg. Pp. 212. [In Russian with English alternative title page and Preface.] ISBN 5 8085 0058 3. Price not indicated.

A summary of the fungi known from the Russian arctic. The 1750 species treated cover slime-moulds, oomycetes, macromycetes, ascomycetes, and mitosporic conidial fungi. Lichenicolous fungi are included, but not lichens, soil fungi and yeasts; this somewhat eclectic approach will have to be borne in mind when using this as a checklist or for comparative studies with different regions. The taxa are arranged by the 8th edition of *Ainsworth & Bisby's Dictionary of the Fungi*, and records, according to 13 geographic regions, and with references either to collections in LE or to published reports. Notes on the occurrence of treated species in other arctic regions (e.g. Alaska, Canada, Fennoscandia, Greenland, Spitsbergen) are appended. The work comes with a "health warning" that many identifications may be wrong. Such checklists are a key step in getting to grips with the mycobiota of an area, and I am sure the compilation will be of value to all trying to identify fungi from the Russian arctic.

TECHNIQUES

Molecular Fungal Biology. Edited by R. P. Oliver & M. Schweizer. 1999. Cambridge University Press, Cambridge CB2 2RU, UK. Pp. x + 388. ISBN 0 521 451167, Hardback, Price: £57.50. ISBN 0 521 56784X, Paperback, Price: £21.95.

Molecular biology pervades increasingly diverse aspects of mycology. This book endeavours to provide an introduction to its multifarious applications. The topics covered range from phylogeny to results from yeast genome sequencing, and sexual development to lignocellulose breakdown, phytopathology and biotechnology. The authors are generally well-known in their fields, but for a work advertised as 'written for advanced undergraduates taking courses in mycology, applied biology, biotechnology, fungal biology and fungal genetics' I would have expected more explanatory introductory matter to ease such undergraduates into this arena. As is common with so many multi-authored volumes, the whole lacks the cohesion one might expect from a work under single or joint authorship. Should an undergraduate be contemplating a project or a postgraduate study in fungal phylogeny, for example, Berbee & Taylor's contribution is a most useful supplement to other general texts on molecular phylogenetics as applied to the fungi, and also a bridge to more specialized works such as that edited by Bridge *et al.* Discussed below. This will be a useful volume for a mycological department's library, but at such a price the main usage is likely to be by recommendation to particular chapters rather than encouraging students to buy personal copies.

Applications of PCR in Mycology. Edited by P. D. Bridge, D. K. Arora, C. A. Reddy & R. P. Elander. 1998. CAB International, Wallingford, Oxon OX10 8DE, UK. Pp. 15 + 357. ISBN 0 85199 233 1. Price: £60.00, $110.00 (USA).

The first book devoted entirely to PCR applications in mycology. With the methodology now featuring in so many aspects of mycology this is most timely. Further, many of the contributors are well-known active researchers in the field and based on their personal experiences. An introductory overview of the methodology is followed by chapters focusing on: gene cloning, screening for gene expression, species definition, use in lichen-forming fungi, mycorrhizal fungi, fungal phylogeny, entomopathogenic fungi, biotechnology, lignocellulose degradation, mycotoxin production, medical mycology, fungal-plant interactions, and seed-borne diseases. Future directions are also highlighted, including diagnostics, genome mapping and expression, and detection. This is a must for molecular mycologists, but for the systematist I would have liked to see more basic material included on the interpretation of sequence data, for example sequence alignment, secondary structure, and molecular trees.

Managing the Modern Herbarium. An interdisciplinary approach. Edited by Deborah A. Metsger & Sheila C. Byers. 1999. Society for the Preservation of Natural History Collections, Washington, DC. [Available through Elton-Wolf Publishing, Suite 212 - 1656 Duranleau Street, Granville Island, Vancouver, BC V6H 3S4, Canada.] Pp. xxii + 384. ISBN 0 9635476 2 3. Price: CAN $ 39.95 (US $ 29.95).

A multiauthored volume on herbarium management, arising from a project between The Society for the Preservation of Natural History Collections and the Royal Ontario Museum. A chanterelle dominates the front cover suggesting that they have a high profile in the book. In fact there are two specifically contributions amongst the 29 included: on destructive sampling of fungal specimens for molecular work (G. M. Mueller) and freeze-drying and storing entire fruit bodies of larger fungi (S. Moore). At first that might seem disappointing, and there are only passing mentions in others chapters. The importance of this book for the curators of dried mycological reference collections is the information that applies to dried collections of any kind: pest control, herbarium design, environmental control, paper type and conservation, adhesives, bar codes, record keeping, and especially recommendations agreed on destructive sampling for molecular work. A valuable adjunct to *The Herbarium Handbook* (L. Forman & D. Bridson, eds, Royal Botanic Gardens, Kew, 1989 and later editions) which has a more hands-on presentation and emphasises the practice at Kew.

ASCOMYCETES

***Mycosphaerella* spp. and their Anamorphs associated with leaf Spot Diseases of *Eucalyptus*.** By Pedro W. Crous. 1998. APS Press, 3340 Pilot Knob Road, St Paul, Minnesota 55121-2097, USA. [Mycologia Memoir No. 21.] Pp. 170, 140 figs. ISBN 0 89054 190 6. Price: US $ 46.

This complex of fungi provides one of the largest challenges in the systematics of fungi of phytopathological importance at this time. In view of the scale of the problem, a host-oriented approach is a pragmatic approach. A remarkable 57 species are treated, including six new in *Mycosphaerella* (28 species in total), and further new species in the anamorph genera *Cercospora, Lecanostictopsis, Mycovellosiella, Passalora, Phaeoramularia, Pseudocercospora, Pseudocercopsorella*, and *Stigmina*. The new genus *Xenostigmina* is introduced for the fungus previously called *Stigmina zilleri* on *Acer*. The line drawings are first-rate, and both dichotomous and synoptic keys are provided. Practical guides of how to study and isolate these fungi are included. A major contribution to our knowledge of these fungi based on the author's long experience of this group.

LICHEN-FORMING FUNGI

Swedish Lichenology. Dedicated to Roland Moberg. Edited by Jan-Eric Mattsson, Mats Wedin & Inga Hedberg. 1999. Almqvist & Wiksell International, Stockholm, Sweden. [Symbolae Botanicae Upsalienses, No. 32(2).] Pp. 211. ISBN 91 554 4452 0, ISSN 0082-0644. Price not indicated.

A collection of eight papers prepared to mark the 60th birthday of Roland Moberg, Director of the Botanical Museum of the University of Uppsala since 1976, the leading international authority on the taxonomy of *Physcia* and related genera, and author or coeditor of several influential works on the identification and conservation of lichens in Sweden.

Unlike so many "Festschrift" works, this is not just a series of papers thrown together, but a collection with a focus on the history of lichenology. Sweden has always had a special place in lichenology since Acharius, the last pupil of Linnaeus to defend his thesis before Linnaeus, laid the foundations of many aspects of their study and described many common genera for the first time. P. M. Jørgensen covers Linnaeus and his pupils; L. Arvidsson lichenology in Sweden in the 19th century, and L. Tibell Swedish collections abroad. B. Johnsell and U.-M. Hultgård cover the development of Swedish herbaria over four centuries, and there are special features on the Uppsala School of Lichen Chemistry (J. A. Elix) and the writings of Gunnar Degelius (L. Ardvidsson & D. J. Galloway).

Of especial and wide interest is G. Rambold and D. Triebel's account of generic concepts in lichenized and lichenicolous fungi since 1950 - period in which 330 new generic names has been introduced in these groups. The period covers the integration of lichen-forming with other fungi, chemotaxonomy, the advent of scanning electron and transmission microscopy, new attention to ascus structure and ontogeny, and latterly molecular approaches. At the end of each section, there are worked synopses of pertinent examples arising from concepts then in vogue are provided. It is a salutary reminder that what is state of the art now may not been seen in quite the same light even 10-15 years on. This chapter should be compulsory reading for any ascomycetologist considering describing a new genus !

Understanding Lichens. By George Baron. December 1999. Richmond Publishing, P. O. Box 963, Slough SL2 3RS, UK. Pp. iv + 92, figs 49, col. plates 4. ISBN 0 85546 252 3. Price: £ 9.95.

Lichenology is desperately short of introductory texts on aspects such as nature, biology, ecology and uses to bridge the gap between identification manuals and more specialised works. George Baron, a former Professor of Educational Administration in the University of London, enthusiastically embraced lichenology as a hobby after he retired in 1978. He also wrote a regular column on lichens for naturalists in *British Wildlife* from 1990-97, and has now put his considerable educational skills even more into disseminating basic information about his chosen "pets". Published in conjunction with the independent South London Botanical Institute, the book ranges from chapters such as: What is a Lichen ?, Lichens and the Environment, and the Classification of Lichens, to the Uses of Lichens and The Amateur Study of Lichens. The chapter on Classification even includes three pages on the principles of nomenclature, but in stressing the modern integrative classification with other fungi a phylogenetic presentation of the place of lichen-forming families would have been a bonus.

In general the work is authoritative, and the photographs (including 24 in colour) are first-rate. However, some of the drawings would have benefited from the help of a professional artist, and the Literature on Lichenology section could have included some more recent reviews and multiauthored texts; these aspects merit attention in any future edition.

Although written primarily for a UK audience, the principles covered transcend national boundaries and the book can be expected to become widely used in field courses and by students embarking on sixth-form or undergraduate projects. With so much lichenological recording now being the provenance of the amateur, the need for such a book had become increasingly clear, and it is gratifying that Professor Baron has helped plug this hole in lichen literature.

Proceedings of the Symposium "Taxonomy, Evolution and Classification of Lichens and related Fungi, London 10-11 January 1998. Edited by M. Wedin, T. Tønsberg & D. H. Brown. 1998. Academic Press Ltd, 24-28 Oval Road, London NW1 7DX, UK. [Reprinted from The Lichenologist 30(4 & 5).] 209 pp. ISSN 0024-2829. Price not indicated.

A separately issued reprint of 15 papers presented at an international symposium sponsored by the British Lichen Society, Linnean Society of London, and Systematics Association. It is good to see these papers issued as a group in a refereed journal rather than as an independent book. Too much work is hidden in conference proceedings volumes that are difficult to locate or prohibitively expensive and I congratulate the editors on selecting this route. The focus is on molecular approaches, but controversial issues such as the naming of photobiont morphs, chemotypes, generic concepts in macrolichens, are also addressed. The field is rapidly developing, and although now a little old, there is much of lasting value here that all lichenologists will find of interest.

The Macrolichens in West Virginia. By Don G. Flenniken. 1999. Published by the author, 2273 Blachleyville Road, Wooster, Ohio 44691, USA. Pp. 231, 26 coloured plates. ISBN not indicated. Price not indicated.

A regional manual, the production of which was partly supported by grants from the West Virginia Division of Natural Resources. Keys and descriptions of all species are included, and maps showing occurrences on a county basis in the state. Particularly informative are notes on the ecology and status of the species which show that the author has a deep rapport with the macrolichens of the state. References to modern accounts and revisions are included where these exist. Especially valuable are the coloured plates covering some 275 species, and the results of microcrystal tests - something not used today as widely as they merit for those without access to thin-layer chromatographic facilities. The work includes a checklist, and a comparison of the current nomenclature with species reported in the last survey of lichens in the state by Sheldon in 1939, and also Hale's *How to Know the Lichens* (1979). It is great to see such a detailed work from a clearly most experienced and careful 'amateur' who has worked as a teacher and park naturalist. With current trends in North America, such detailed lichen recording and manuals are increasingly likely to rely on such dedicated persons.

BASIDIOMYCETES

Atlante fotografico dei Funghi d'Italia. Edited by Carlo Papetti, Giovanni Consiglio & Giampaola Simonini. Vol. 1. July 1999. Fondazione Centro Studi Micologici dell' Asociazione Micologica Bresadola, P. O. Box 296, 36100 Vicenza, Italy. Pp. cxviii + 512, numerous coloured plates. ISBN not indicated. Price not indicated.

Another splendidly illustrated field guide to Italian macromycetes. The comprehensive introduction includes a detailed account of characters used in identification, observations on ecology, and also keys to the genera. Each species has a page of its own, and this includes a detailed description and also drawings of spores - something sadly omitted in many field guides - and a note on edibility. The Association that prepared this book is well-known for the high quality of its work and this new title lives up their established reputation. A valuable addition to the growing number of European field guides.

CONIDIAL FUNGI

Illustrated Genera of Imperfect Fungi. By H. L. Barnett & Barry B. Hunter. 1998. Fourth edition.. APS Press, 3340 Pilot Knob Road, St Paul, Minnesota 55121-2097, USA. Pp. xxii + 218. Spiral bound. ISBN 0 89054 192 2. Price: US $ 43.

A new edition of this familiar work. The Saccardoan classification is still followed, although it is recognized in the Introduction that the orders and families used are not phylogenetic but 'only to facilitate their identification'. Innovations for this edition include a general introduction, a simplified key to some commonly isolated genera, and a series of fine scanning electron micrographs illustrating conidiogenesis types according to the Hughesian system. No updating according to the Hennebert & Sutton coding system was attempted and certainly should be considered for any future edition. Surprisingly 52 genera 'infrequently isolated and of little economic importance have been omitted'. Some taxonomy would have benefited from updating (e.g. *Cephalosporium* is still accepted and there is no reference to *Acremonium*). An indication of the species numbers in the treated genera would also have been helpful. Especially welcome is a series of 15 experiments to illustrate various biological aspects of these fungi which will be of value to those wishing to extend their use in practical classes. A downside of trying to illustrate so many genera is the small size of the drawings; those in Ellis & Ellis' *Microfungi on Land Plants* (1985; not cited in the Bibliography) show what can be achieved in this regard. In summary, a work to be used with caution until a more through revision is available.

YEASTS AND YEAST-LIKE FUNGI

Ecology and Evolution of Black Yeasts and their Relatives. Edited by G. S. De Hoog. 31 May 1999. [Studies in Mycology No. 43.] Centraalbureau voor Schimmelcultures, Baarn, P. O. Box 273, NL-3740 AG Baarn, The Netherlands. Pp. 208. ISBN 90 70351 39 0; ISSN 0166-0616. Price: Eu 48.00.

What are the black yeasts? If you have ever pondered this question, you definitely need to buy this book. The book itself is a compilation of 21 papers (17 research papers, 3 short communications and 1 review). The *Studies in Mycology* series has entered a new era with a much friendlier A4 format, and an excellent reproduction of line drawings, as well as half-tone and colour photographic plates, printed on good quality paper. One of the primary aims of this book has undoubtedly been to establish a solid molecular base for this pleomorphic group of fungi. Of the papers that are presented, wide ranging issues such as evolution, ecology, taxonomy and phylogeny are addressed. Nearly all the acknowledged researchers in the field have participated in some or other aspect of this book. I found all the papers well-illustrated, and also incorporating a variety of techniques to address specific, well-defined questions. Several of the chapters will be of interest to a wider mycological and plant pathological audience other than those focused on the black yeasts *per se*. I found the chapters dealing with the dothideaceous black yeasts of particular interest. Many epilithic and halotolerant black yeasts are related to the *Dothideales*, including *Aurobasidium*, *Discosphaeria*, *Hormonema*, etc., that are able to convert to meristematic growth under stress. I found the choice of isolates relevant and the eventual phylogenies presented extremely exciting. For instance, *Trimmatostroma* clustered close to *Cladosporium* and *Stenella*, which suggests that it could have a *Mycosphaerella*-like teleomorph. A cultural link has recently been proven for *Trimmatostroma* in *Teratosphaeria*. What then is the relationship of the latter genus to *Mycosphaerella*? Strains of *Stenella araguata* (from human and plant hosts) also clustered separately, once again questioning if *Stenella* should be used to accommodate human pathogens. This is also somewhat reminiscent of the *Cladophialophora*/*Pseudocladosporium* situation, where saprophytic strains from plant material cluster in the latter. Several chapters are dedicated to resolving species complexes within *Cladophialophora*. A significant body of information is presented on species of *Trimmatostroma* throughout this book, and it appears that the *Trimmatostroma*-like morphology has evolved more than once, and that several anamorph genera may have to be introduced to suitably characterize this variation. *Aurobasidium*, *Kabatiella* and *Hormonema* are also related to the *Dothideales*. Most of us know these genera as endophytes that usually turn up on diverse hosts, and sometimes, as in the case of *Kabatiella*, as pathogens. Results of some of the work presented here support the separation of *Kabatiella* (plant pathogen) from *Aurobasidium* (saprophyte), which will make sense to most phytomycologists that have dealt with these organisms. *Kabatiella zeae* clustered outside the *Aurobasidium*/*Hormonema* complex, and could possibly belong to the *Pleosporales*, suggesting that the nomenclature of this pathogen needs to be revised. I also found the chapter by De Hoog *et al.* dealing with the taxonomy of the *Phialophora verrucosa* complex of interest. The name *Phialophora* (*Herpotrichiellaceae*; teleomorph *Capronia*) has been applied to a diversity of pigmented fungi with aseptate, slimy conidia borne on phialides with clearly defined cup-shaped collarettes. Research on this group has led to the identification of several generic entities such as *Phialomonium*, *Phaeoacremonium* and *Phaeomoniella* to name but a few. Of particular interest is the differentiation of collarette types in *Phialophora*, which should provide a valuable additional morphological criterion. Related genera such as *Exophiala* are also shown to be polyphyletic, though those with annellidic proliferation of conidiogenous cells were shown to be monophyletic. In summary, many species are newly described or redisposed to other genera based on a wealth of newly generated sequence data. I would, however, have liked to have the accession numbers clearly indicated in the respective chapters to all these novel sequences. Although I could find this information for most, it was definitely not present for all the data presented. A general index for those of us who quickly want to locate data on a specific fungus or technique would also have made this book much more user friendly. That said, however, I can still easily recommend this book based on the quality of the work, and the bulk of novel information presented. *PEDRO W. CROUS, University of Stellenbosch, Matieland, South Africa*

SLIME MOULDS

The Myxomycetes of Britain and Ireland. An identification handbook. By Bruce Ing. September 1999. Richmond Publishing, P. O. Box 963, Slough SL2 3RS, UK. Pp. iii + 374, figs 357. ISBN 0 85546 251 5. Price: £ 35 (+ postage and packing £ 3).

This book is the distillation of some four decades of experience of the identification and ecology of myxomycetes in Great Britain and Ireland by one of the world's leading authorities on the group. Aspects covered in the introductory chapters cover phylogeny, life-histories, ecology, distribution, collection, culture, and preservation. Keys to orders and families are followed by systematically arranged accounts, with keys to genera and species. Each species account includes a references to the place of publication of the name, description, references to illustrations in other works, information on the habitat and distribution inside the British Isles and world-wide, and generally extremely helpful and often perceptive 'notes'. Line-drawings of the species are provided, emphasizing diagnostic features. An appendix gives the derivation of names, and there is also a glossary, annotated bibliography, and list of useful addresses. As so many myxomycetes are widely distributed, this will be a 'must' for the myxomycologist's wants list.

MISCELLANEOUS

A Beginner's Guide to Secondhand Bookdealing. By Stuart A. Baldwin. September 1999. Baldwin's Scientific Books, Fossil Hall, Boars Tye Road, Silver End, Witham, Essex CM8 3QA, UK. Pp. ix + 214, 5 pl., 2 figs. ISBN 0 9508063 5 8. Price: £ 24.

As a result of delving into the history of names, taxonomists inevitably develop an interest if not a passion for long out of print or antiquarian texts; mycologists are no exception to this general rule. This means becoming a purchaser and often a vendor of such works. But how does the mysterious world of second-hand bookselling operate ? What do all the often abbreviated terms in booksellers' catalogues mean ? How are books priced ? What if books are stamped or written on ? Here a successful natural history bookseller specialising in palaeontology and evolutionary topics, and who also has had experience in establishing new businesses for the London Enterprise Agency opens Pandora's box. The style is light-hearted in part, but includes much background information that a mycologist, finding he or she was moving into this area, even if not planning to start a business, could profit from.

Sustainable Use of Genetic Resources under the Convention on Biological Diversity.. By W. H. Lesser. 1998. CAB International, Wallingford, Oxon OX10 8DE, UK. Pp. 240. ISBN 0 85199 197 1. Price: £ 35.00, US $ 65.00.

How to manage the collection and transfer of specimens and cultures of fungi in the post-Convention environment period is a matter of increasing concern to mycologists. Although not focusing on microbiological issues, this book covers legal and economic issues. Especially relevant are summaries of the laws and other regulations in place in particular countries. This will not provide all the answers to every situation, but will give a better understanding of the issues and ways of complying with them.

Author Index, Volume Seventy-Four

SPECIAL PRICE FOR MYCOTAXON SUBSCRIBERS

Effective 14 February 2000, subscribers to Mycotaxon are now offered a $20.00 reduction in the price of S. C. Teng's Fungi of China, acclaimed by reviewers as "an instant classic" and as "one of the most valuable books on the fungi of China ever published in English." It will be shipped to current subscribers at a price of $59.00 postpaid (by surface mail), except for delivery to Canada, where the price for surface delivery is $64.00. Airmail delivery differs by country; please ask for the airmail price to your country. The dimensions of this hardcover book are 8-1/2 x 11 inches; it has 600 pages, 426 illustrations, and it weighs over 4 pounds.

The reduced price is possible through the generosity of Rosaline Deng, Teng's daughter, who not only translated the original text from English to Chinese but also contributed the foreword to the English version of Teng's book, finally published by Mycotaxon, Ltd. in 1996. Subscribers are free to purchase several copies at this reduced price, and are free to give such copies to their institutional libraries or friends. Ms. Deng does this as a token of appreciation to Mycotaxon, Ltd. for its assistance in publishing the book, and to offer the supporters of the journal, its subscribers, an opportunity to purchase the book at a very reasonable price. You can find out more about the book by visiting our website, <www.mycotaxon.com/books.html>. To order one or more copies, please either (i) write to Mycotaxon, Ltd., Order Department, P. O. Box 264, Ithaca, NY 14851-0264 or, perhaps much easier, (ii) just visit our website at <www.mycotaxon.com/order.html>. There you can either arrange to have an e-mail order form sent to you, or you can download an order form for mailing or faxing your order. Another possibility is (iii) to send an e-mail message to the Order Department at <rkorf@att.net> asking for a books order form to be sent to you by e-mail.

NOMENCLATURAL NOVELTIES PROPOSED IN VOLUME 74

Anthostomella cyperaceicola B. S. Lu & K. D. Hyde, p. 381
Anthostomella scirpi B. S. Lu & K. D. Hyde, p. 383
Anthracoides wakatipu Vánky, p. 354
Biscogniauxia nawawii M. A. Whalley, Y. M. Ju, J. D. Rogers, & Whalley, p. 135
Canomaculina laciniella L. I. Ferraro & Elix, p. 391
Cercospora acericola Y. L.Guo & Y. Jiang, p. 257
Cercospora euonymigena Y. L.Guo & Y. Jiang, p. 260
Cercospora sambuci Y. L.Guo & Y. Jiang, p. 262
Cercosporella cimicifugae H. D. Shin & U. Braun, p. 107
Cintractiaceae Vánky, p. 344
Cortinarius atrochalybaeus Ammirati & M. M. Moser, p. 19
Cortinarius cacodes M.M. Moser & Ammirati, p. 6
Cortinarius fraudulosus Britzelm. var. *patrickensis* M. M. Moser, p. 10
Cortinarius glaucocephalus M. M. Moser, Ammirati, & Halling, p. 12
Cortinarius lilacinocolossus M. M. Moser, p. 15
Cortinarius oliveopetasatus M. M. Moser, p.29
Cortinarius subpurpureophyllus A. H. Sm. var. *sulphureovelatus* M. M. Moser, p. 25
Cryptoporus sinensis Sheng-H. Wu & M. Zang, p. 416
Diplomitoporus hondurensis (Murrill) Ryvarden, p. 121
Diplomitoporus incisus Ryvarden, p. 122
Entyloma arctotis Vánky, p. 210
Glomus avelingiae R. C. Sinclair, p. 338
Hypochniciellum luteolum Hjortstam & Ryvarden, p. 247
Hypoxylon gombakense M. A. Whalley, Y. M. Ju, J. D. Rogers, & Whalley, p. 137
Inonotus indurescens Y. C. Dai, p. 332
Macalpinomyces simplex Vánky, p. 202
Marssonia obtusata (Maubl.) Mouch., p. 319
Moreaua aterrima (Tul. &. C. Tul.) Vánky p. 351
Moreaua caustidis (Vánky) Vánky, p. 352
Moreaua cyathochaetae (Vánky) Vánky, p. 352
Moreaua epischoeni (Vánky) Vánky, p. 352
Moreaua evandrae (Websdane & Vánky) Vánky, p. 352
Moreaua fischeri (Vánky) Vánky, p. 352
Moreaua gahniae (Vánky & C. Vánky) Vánky, p. 352
Moreaua gymnoschoeni (Vánky & C. Vánky) Vánky, p. 352
Moreaua kochiana (Gäum.) Vánky, p. 352
Moreaua laevigata (Websdane & Vánky) Vánky, p. 352
Moreaua lepidospermae (McAlpine) Vánky, p. 352
Moreaua littoralis (G. Cunn.) Vánky, p. 352
Moreaua mauritiana (Syd.) Vánky, p. 552
Moreaua megaglomerulosa (Vánky) Vánky, p. 353
Moreaua melanospora (Websdane & Vánky) Vánky, p. 353

ERRATA

VOLUME SEVENTY-ONE

Page 113, line 7	for	*30°41'S, 30°16'E*	read	*14°11'N, 101°11'E*
Page 113, lines 36-37	for	*30°41'S, 30°16'E*	read	*16°53'N, 104°25'E*
Page 115, line 34	for	*30°41'S, 30°16'E*	read	*14°11'N, 101°11'E*

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME SEVENTY-FOUR

This index includes names of genera, infrageneric taxa, species, and infraspecific taxa, as well as new names of suprageneric taxa. All new names are in CAPITALS. The page number on which a new name is proposed is followed by an asterisk (*).

Reviewers, Volume Seventy-Four

The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume.

H. van der Aa
T. Ahti
A. Aptroot
A. W. Archer
J.-K. Bai
R. Berndt
B. Callan
A. Castillo
J. L. Crane
P. W. Crous
F. Dugan
I. J. Gamundí
D. A. Glawe
R. E. Halling
M. Härkönen
S. Helfer
S. Hodges
E. Horak
R. E. Koske
C. Lado
A. Landa
E. Langer
C. Illana
D. J. Lodge
E. H. C. McKenzie
I. Melo
H. Osorio
G. Pacioni
A. J. L. Phillips
S. A. Redhead
P. Roberts
J. D. Rogers
L. Ryvarden
E. C. Setliff
S. L. Stephenson
G. C. A. van der Westhouizen
M. J. Wingfield
T.-Y. Zhang

Publication Date for Volume Seventy-Four, No. 1

MYCOTAXON for January-March, volume 73(1): 1-256
was issued on March 10, 2000.

MYCOTAXON is published quarterly during the periods of January–March, April–June, July–September, and October–December by Mycotaxon, Ltd., 316 Richard Pl., Ithaca, NY 14850–0264. Periodical postage paid at Ithaca, NY, and at additional mailing offices. Subscription rates (year 2000 only): In U. S. and possessions, one year, $201.00; reduced rate for personal subscribers, one year, $96.00. Foreign subscriptions, add $6 for surface mail, or add $30 for ISAL air mail.

POSTMASTER: Send address changes to Mycotaxon, Ltd., P.O. Box 264, Ithaca, NY 14851-0264.

EDITORS OF MYCOTAXON

MYCOTAXON is a quarterly peer-reviewed journal devoted to all phases of mycological taxonomy and nomenclature. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in English or in French. Summaries in those or any additional languages desired by the authors are given for longer articles. Printing is on high quality, acid-free book paper. Authors prepare their own *camera-ready* copy after having received critical comments from pre-submission reviewers. *Instructions to Authors* appeared in Mycotaxon 68: 1-7. 1988, updated on out website at <www.mycotaxon.com/instructions.html>, and *Guidelines for Reviewers* appeared in Mycotaxon 68: 9-10. 1998, updated on our website at <www.mycotaxon.com/reviewers.html>.

SUBSCRIPTION INFORMATION

Current volumes contain at least 512 pages. All subscriptions are on an annual basis, with four quarterly issues each year. Personal subscriptions are available at a substantially reduced rate for individuals who agree not to deposit their copies in another library than their personal one within 3 years of receipt. Do not address any orders to the Editors, but instead to the Mycotaxon Order Department, P.O. Box 264, Ithaca, NY 14851-0264 USA, or your agent. Prices and availability of back volumes will be sent upon request to that Department, but are also posted on-line at <www.mycotaxon.com>, or can be provided in an E-mail version on request to <rkorf@att.net>. Mycotaxon may also be obtained on a journal-exchange basis. Proposals for such exchanges from journals, institutions, or individuals with difficulty in obtaining foreign currency should be addressed to the Order Department.

The annual subscription rate for year 2000 (three volumes) are:

	USA	Foreign (surface mail)	Foreign (ISAL airmail)
REGULAR (multi-user)	$201	$207	$231
PERSONAL (individual)	$96	$102	$126

(Most back volumes—except vols. 1, 38, 39, 43, and 46—are still available at $35 each by surface mail, $55 each by air mail; all are available in photocopy and 34-ff in microfilm.)

CUMULATIVE INDICES

Printed versions of the *Mycotaxon Cumulative Indices* for Volumes 1-20 (ISBN 0-930845-00-5), Volumes 21-40 (ISBN 0-930845-01-03), and Volumes 41-60 (ISBN 0-930845-07-02) are available (see descriptions at <www.mycotaxon.com/books.html> and order there or through your local bookstore's listings under "Books in Print"). An online *Cumulative Index to Taxa in Volumes 61-ff* and the *Cumulative Author Index to Volumes 61-ff* are posted at <www.mycotaxon.com>.

AVAILABILITY IN MICROFILM, PHOTOCOPY, & ELECTRONIC VERSIONS

MYCOTAXON is also available in *microfilm* from Bell & Howell Information and Learning, P. O. Box 1346, Ann Arbor, MI 48106-1346, U.S.A., through their Microfilm Catalog <www.umi.com/sim>. *Tear sheets* or *photocopies* of individual articles may be obtained through The Genuine Article™, I.S.I., 3501 Market Street, Philadelphia, PA 19104, U.S.A., or through their website, <www.isinet.com>. *Photocopies* or *electronic versions* of individual articles are available from Infotrieve, 1066 Le Conte Ave., Los Angeles, CA 90024, U.S.A. or through their website, <www.infotrieve.com>.

CONTACTING MYCOTAXON'S EDITOR-IN-CHIEF BY E-MAIL OR FAX

To reach the Editor-in-Chief regarding manuscripts, you may E-Mail to <mycotaxon.editor@lizon.com> or you may FAX to Pavel Lizoň at (421-7) 5477-1948.

CONTACTING MYCOTAXON'S ORDER DEPARTMENT BY E-MAIL OR FAX

To reach the Order Department for information or placing orders, you may E-Mail to <rkorf@att.net> or you may FAX to Orders, Mycotaxon, Ltd., May–October at (607) 273-4357, and November–April at (727) 321-1460.

***VISIT MYCOTAXON ON THE WORLD WIDE WEB AT* <www.mycotaxon.com>**