Colletotrichum – names in current use

Hyde, K.D.[1,7*], Cai, L.[2], Cannon, P.F.[3], Crouch, J.A.[4], Crous, P.W.[5], Damm, U.[5], Goodwin, P.H.[6], Chen, H.[7], Johnston, P.R.[8], Jones, E.B.G.[9], Liu, Z.Y.[10], McKenzie, E.H.C.[8], Moriwaki, J.[11], Noireung, P.[1], Pennycook, S.R.[8], Pfenning, L.H.[12], Prihastuti, H.[1], Sato, T.[13], Shivas, R.G.[14], Tan, Y.P.[14], Taylor, P.W.J.[15], Weir, B.S.[8], Yang, Y.L.[10,16] and Zhang, J.Z.[17]

[1]School of Science, Mae Fah Luang University, Chaing Rai, Thailand
[2]Research & Development Centre, Novozymes, Beijing 100085, PR China
[3]CABI, Bakeham Lane, Egham, Surrey TW20 9TY, UK *and* Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, UK
[4]Cereal Disease Laboratory, U.S. Department of Agriculture, Agricultural Research Service, 1551 Lindig Street, St. Paul, MN 55108, USA
[5]CBS-KNAW Fungal Biodiversity Centre, Uppsalalaan 8, 3584 CT Utrecht, The Netherlands
[6]School of Environmental Sciences, University of Guelph, Guelph, Ontario, N1G 2W1, Canada
[7]International Fungal Research & Development Centre, The Research Institute of Resource Insects, Chinese Academy of Forestry, Bailongsi, Kunming 650224, PR China
[8]Landcare Research, Private Bag 92170, Auckland 1142, New Zealand
[9]BIOTEC Bioresources Technology Unit, National Center for Genetic Engineering and Biotechnology, NSTDA, 113 Thailand Science Park, Paholyothin Road, Khlong 1, Khlong Luang, Pathum Thani, 12120, Thailand
[10]Guizhou Academy of Agricultural Sciences, Guiyang, Guizhou 550006 PR China
[11]Hokuriku Research Center, National Agricultural Research Center, National Agriculture and Food Research Organization, Joetsu, Niigata 943-0193, Japan
[12]Departamento de Fitopatologia, Universidade Federal de Lavras UFLA, 37200-000 Lavras MG, Brazil
[13]National Institute of Agrobiological Sciences, 2-1-2 Kannondai, Tsukuba, Ibaraki 305-8602, Japan
[14]Plant Pathology Herbarium, Queensland Primary Industries and Fisheries, 80 Meiers Road, Indooroopilly, Queensland 4068, Australia
[15]BioMarka/Center for Plant Health, Melbourne School of Land and Environment, The University of Melbourne, Victoria 3010 Australia
[16]Department of Biology and Geography, Liupanshui Normal College. Shuicheng, Guizhou 553006, P.R. China
[17]Institute of Biotechnology, College of Agriculture & Biotechnology, Zhejiang University, Kaixuan Rd 258, Hangzhou 310029, PR China

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Filamentous fungi in the genus *Colletotrichum* are destructive pathogens that cause disease and crop losses in plants worldwide. Taxonomy and nomenclature in the group is confusing, even to scientists working in the field, and inaccurate diagnosis of species is not uncommon. In this review, we provide a overview of the 66 *Colletotrichum* names that are in common use, and the 19 recently used names which are regarded as doubtful. This paper represents the first comprehensive overview of the genus in 17 years, and is the first summary treatment of *Colletotrichum* to incorporate data generated through DNA analysis and phylogenetic systematics. Species are listed alphabetically and annotated with their taxonomic entry, teleomorph, hosts and disease, brief summaries of taxonomic and phylogenetic research, and outstanding issues for the genus that are neccesary to stabilize species names. Sequence data and type culture collection resources are also summarized. The paper serves to provide a new starting point for usage of current names in *Colletotrichum* and indicates future work needed.

Key words: anthracnose, molecular phylogeny, nomenclature, plant disease, plant pathogens, plant pathology, quarantine, taxonomy

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*Corresponding author: K.D. Hyde; e-mail: kdhyde2@gmail.com

Introduction

Colletotrichum is a taxonomically confused genus in urgent need of revision, especially as its members are important plant pathogens (Cannon *et al*., 2000; Johnston, 2000). Species estimates range from 11 in von Arx (1957), 22 in Sutton (1980), about 40 in Sutton (1992) and 60 in the *Dictionary of the Fungi* (Kirk *et al*., 2008), while there are 688 names in *Index Fungorum* (www.index fungorum.org; accessed 24 November 2009).

This paper uses Sutton (1980) as a starting point for names in the genus (updated in Sutton, 1992), with additional names from literature records since 1980. We have also accessed the USDA database (Farr and Rossman, 2009). There were 129 taxa of *Colletotrichum* recorded from North America alone, but on further checking many of these were excluded as they were pre-1980 records. Many of the recent compilations (e.g. *Index of Plant Diseases in Hawaii*, Alfieri *et al*., 1984; *Database of Plant Disease Names in Japan*, Sato *et al*., 2009, http://www.gene.affrc.go.jp/databases-micro_pl_diseases_en.php) use names from older checklists that are rarely used these days and are treated as uncertain. Notes for each accepted species are provided, including (putative) hosts, location and requirements for further research (e.g. need for epitypification, host-specificity pathogenicity testing). Forms and varieties are generally not listed as an understanding of species is prerequisite. The entries are made by authoritative mycologists in the field of *Colletotrichum* research in order to provide a comprehensive understanding of the needs for the genus.

Colletotrichum species are anamorphic *Glomerella* species (Sutton, 1992; Armstrong-Cho and Banniza, 2006; Pfenning *et al*., 2007) and names such as *Colletotrichum gloeosporioides* and *Glomerella cingulata* refer in the broad sense to the same biological organism, i.e. they are synonyms. However, the species concepts applied to anamorphs and teleomorphs do not always coincide, making simple one-to-one links difficult to achieve (Cannon *et al*., 2000). There is an imperative to classify fungi under one name, either the teleomorphic or anamorphic name, giving preference to the older generic name (Shenoy *et al*., 2007; Crous, 2009) as has been adopted in *Index Fungorum* (see entry under *Colletotrichum falcatum*). In order to follow this approach we need first to clarify the taxonomy of these important pathogens at the species level. Strains producing teleomorphs seem less often to cause serious disease of plants, but many species are heterothallic and have been recognized as holomorphic following laboratory mating experiments (e.g. Guerber and Correll, 2001; Armstrong-Cho and Banniza, 2006). Future revisions may need to adopt the generic name *Colletotrichum* for biological species.

Results and discussion

The *Colletotrichum* names in current use are listed alphabetically below with notes as follows.

- The species name is given with the authorities and publication details.
- Synonyms are not given as these can be searched in *Index Fungorum*. The main focus of *Index Fungorum* is, however, on name, and should not be relied upon in isolation to provide a complete synonymy. Furthermore, synonymies are generally based on subjective understanding based on morphology and are not the topic of this paper.
- The putative diseases caused and known hosts are listed. This is not a rigorous list as it is impossible to verify at this stage whether collections of each taxon on a host are correctly identified.
- Notes are provided on each species and include taxonomic and phylogenetic research needs.
- Recently used doubtful species are discussed at the end of this section.

Table 1 lists the species annotated below and the location of type and ex-type cultures, and genes presently sequenced.

Colletotrichum acutatum J.H. Simmonds ex J.H. Simmonds, Queensland Journal of Agricultural and Animal Science 25: 178A (1968).

Teleomorph: *Glomerella acutata* Guerber & J.C. Correll

Table 1. Species of *Colletotrichum* treated as currently used, and location of type specimens and their sequenced genes, if available.

Species	Type strain	ITS	Calmodulin	Actin	GAPDH	Tub2	GS	Mat1	Tub1	CHS-1	HIS3
C. acutatum	IMI 117617	AF411700	x	x	x	x	x	x	x	x	x
C. agaves	x	x	x	x	x	x	x	x	x	x	x
C. anthrisci	CBS 125334	GU227845	x	GU227943	GU228237	GU228139	x	x	x	GU228335	GU228041
C. asianum	MFU 090233	FJ 972612	FJ 917506	FJ 907424	FJ972576	FJ 907439	FJ 972595	x	x	x	x
C. axonopodi	IMI 279189	x	x	x	x	x	x	FJ377907	x	x	x
C. boninense	MAFF 305972	AB051400	x	x	GQ221769	x	x	x	x	x	x
C. capsici	CBS 120709	EF683603	x	x	x	EF683602	x	x	x	x	x
C. caudatum	MAFF 305700[1]	EU554110[1]	x	x	x	x	x	x	x	x	x
C. cereale	KS 20BIG	DQ126177	x	x	x	x	x	DQ131946	x	x	x
C. chlorophyti	IMI 103806	GU227894	x	GU227992	GU228286	GU228188	x	x	x	GU228384	GU228090
C. circinans	CBS 221.81	GU227855	x	GU227953	GU228247	GU228149	x	x	x	GU228345	GU228051
C. cliviae	CBS 125375	GQ485607	GQ849464	GQ856777	GQ856756	GQ849440	x	x	x	x	x
C. coccodes	x	x	x	x	x	x	x	x	x	x	x
C. crassipes	x	x	x	x	x	x	x	x	x	x	x
C. curcumae	IMI 288937	GU227893	x	GU227991	GU228285	GU228187	x	x	x	GU228383	GU228089
C. dematium	CBS 125.25	GU227819	x	GU227917	GU228211	GU228113	x	x	x	GU228309	GU228015
C. destructivum	x	x	x	x	x	x	x	x	x	x	x
C. dracaenophilum	x	x	x	x	x	x	x	x	x	x	x
C. echinochloae	MAFF 511473	AB439811	x	x	x	x	x	x	x	x	x
C. eleusines	MAFF 511155	EU554131	x	x	x	x	x	x	x	x	x
C. falcatum	x	x	x	x	x	x	x	x	x	x	x
C. fiorinae	EHS 58	EF464594	x	x	x	EF593325	x	x	x	x	x
C. fragariae	CBS 142.31	GU174546	x	x	GU174564	x	x	x	x	x	x
C. fructi	CBS 346.37 = CCT 4806	GU227844	x	GU227942	GU228236	GU228138	x	x	x	GU228334	GU228040
C. fructicola	MFU 090228	FJ972603	FJ917508	FJ907426	FJ972578	FJ907441	FJ972593	x	x	x	x

Table 1 (continued). Species treated as currently used in this paper and location of type specimens of *Colletotrichum* and their sequenced genes if available.

Species	Type strain	ITS	Calmodulin	Actin	GAPDH	Tub2	GS	Mat1	Tub1	CHS-1	HIS3
C. fuscum	x	x	x	x	x	x	x	x	x	x	x
C. gloeosporioides	IMI 356878 = CBS 953.97	EU371022, AY376532, FJ976209	FJ917512	FJ907430	FJ972582	FJ907445	FJ972589	x	x	x	x
C. gossypii	x	x	x	x	x	x	x	x	x	x	x
C. graminicola	M 1.001	DQ003110	x	x	x	x	x	FJ377994	x	x	x
C. hanaui	MAFF 305404	EU554101	x	x	x	x	x	FJ377922	x	x	x
C. higginsianum	x	x	x	x	x	x	x	x	x	x	x
C. hippeastri	CBS 125376	GQ485599	GQ849469	GQ856788	GQ856764	GQ849446	x	x	x	x	x
C. horii	ICMP 10492	GQ329690	x	x	GQ329681	x	x	x	x	x	x
C. hymenocallidis	CBS 125378	GQ485600	GQ849463	GQ856775	GQ856757	GQ849438	x	x	x	x	x
C. jacksonii	MAFF 305460	EU554108	x	x	x	x	x	x	x	x	x
C. kahawae	IMI 319418	GU174550	x	x	GU174562	x	x	x	x	x	x
C. lilii	x	x	x	x	x	x	x	x	x	x	x
C. lindemuthianum	x	x	x	x	x	x	x	x	x	x	x
C. lineola	CBS 125337	GU227829	x	GU227927	GU228221	GU228123	x	x	x	GU228319	GU228025
C. linicola	x	x	x	x	x	x	x	x	x	x	x
C. liriopes	CBS 119444	GU227804	x	GU227902	GU228196	GU228098	x	x	x	GU228294	GU228000
C. lupini	BBA 70884	x	x	x	x	x	x	DQ174704	AJ301948	x	x
C. lupini* var. *setosum	BBA 70352	x	x	x	x	x	x	DQ174702	AJ301923	x	x
C. malvarum	x	x	x	x	x	x	x	x	x	x	x
C. miscanthi	MAFF 510857	EU554121	x	x	x	x	x	EU365028	x	x	x
C. musae	x	x	x	x	x	x	x	x	x	x	x
C. navitas	CBS 125086	GQ919067	x	x	x	x	x	GQ919071	x	x	x
C. nicholsonii	MAFF 511115	EU554126	x	x	x	x	x	FJ377946	x	x	x

Table 1 (continued). Species treated as currently used in this paper and location of type specimens of *Colletotrichum* and their sequenced genes if available.

Species	Type strain	ITS	Calmodulin	Actin	GAPDH	Tub2	GS	Mat1	Tub1	CHS-1	HIS3
C. nymphaeae	x	x	x	x	x	x	x	x	x	x	x
C. orbiculare	x	x	x	x	x	x	x	x	x	x	x
C. paspali	MAFF 305403	EU554100	x	x	x	x	x	FJ377921	x	x	x
C. phaseolorum	x	x	x	x	x	x	x	x	x	x	x
C. phormii	x	x	x	x	x	x	x	x	x	x	x
C. phyllachoroides	x	x	x	x	x	x	x	x	x	x	x
C. rusci	CBS 119206	GU227818	x	GU227916	GU228210	GU228112	x	x	x	GU228308	GU228014
C. sansevieriae	MAFF 239721	AB212991	x	x	x	x	x	x	x	x	x
C. siamense	MFU 090230	FJ972631	FJ917505	FJ907423	FJ972575	FJ907438	FJ972596	x	x	x	x
C. simmondsii	BRIP 28519	FJ972601	FJ917510	FJ907428	FJ972580	FJ907443	FJ972591	x	x	x	x
C. spaethianum	CBS 167.49 = BBA 4804	GU227807	x	GU227905	GU228199	GU228101	x	x	x	GU228297	GU228003
C. spinaciae	x	x	x	x	x	x	x	x	x	x	x
C. sublineola	S 3.001	DQ003114	x	x	x	x	x	FJ378029	x	x	x
C. tofieldiae	x	x	x	x	x	x	x	x	x	x	x
C. trichellum	x	x	x	x	x	x	x	x	x	x	x
C. trifolii	x	x	x	x	x	x	x	x	x	x	x
C. truncatum	CBS 151.35	GU227862	x	GU227960	GU228254	GU228156	x	x	x	GU228352	GU228058
C. verruculosum	IMI 45525	GU227806	x	GU227904	GU228198	GU228100	x	x	x	GU228296	GU228002
C. xanthorrhoeae	BRIP 45094	GU048667	x	x	GU174563	x	x	x	x	x	x
C. yunnanense	AS 3.9167	EF369490	x	x	x	x	x	x	x	x	x

[1]The *Colletotrichum caudatum* strain listed is provided as a representative of the species aggregate and is provided only for reference; it is not a type strain. The distinctive caudate condia of this isolate clearly identifies it as an authentic member of the species as currently described through morphology. See listing below for additional information.

Hosts and disease: Widely known as a fruit rot pathogen (both in the field and post-harvest), but also able to affect other parts of host plants causing symptoms such as blossom blight, crown rot, defoliation, fruit drop, leaf spot, leaf curl and root necrosis, generally described as anthracnose (Wharton and Diéguez-Uribeondo, 2004). Commercial crops with significant diseases reported to be caused by *C. acutatum* include almond (Förster and Adaskaveg, 1999), apple (Biggs and Miller, 2001), chilli (Than *et al*., 2008b), grape (Yamamoto *et al*., 1999; Whitelaw-Weckert *et al*., 2007), strawberry (Freeman *et al*., 2001a), olive (Talhinhas *et al*., 2005), and rubber (Fernando *et al*., 2000). *Colletotrichum acutatum* f. sp. *pineum* Dingley & J.W. Gilmour (1972) causes terminal crook disease of pine seedlings. *Colletotrichum acutatum* f. sp. *hakeae* Lubbe, Denman, P.F. Cannon, J.Z. Groenew., Lampr. & Crous was reported to be one of the most devastating fungal pathogens of *Proteaceae* in South Africa where it is used as a biological control agent of weedy *Hakea* (Lubbe *et al*., 2004). *Colletotrichum fioriniae* (as *C. acutatum* var. *fioriniae* Marcelino & Gouli was reported to be parasitic on a scale insect (Marcelino *et al*., 2008). Putative hosts include (from Walker *et al*., 1991; Johnston and Jones, 1997; Sreenivasaprasad and Talhinhas, 2005; Sato, 1997; The Phytopathological Society of Japan, 2000, 2009 [http://www.gene.affrc.go.jp/databases-micro_ pl_diseases_ en.php]) *Actinidiaceae* (*Actinidia*), *Adoxaceae* (*Sambucus*), *Amaryllidaceae* (*Crinum*, *Amacrinum*), *Anacardiaceae* (*Mangifera*, *Cotinus*), *Annonaceae* (*Annona*), *Apiaceae* (*Apium*), *Asteraceae* (*Calendula*, *Carthamus*, *Chrysanthemum*, *Cosmos*, *Xanthium*, *Zinnia*), *Balsaminaceae* (*Impatiens*) *Berberidaceae* (*Nandina*), *Bignoniaceae* (*Bignonia, Parmentiera*), *Caricaceae* (*Carica*), *Cucurbitaceae* (*Cucurbita*), *Cruciferae* (*Matthiola*), *Dryopteridaceae* (*Rumohra*), *Ebenaceae* (*Diospyros*), *Ericaceae* (*Rhododendron*, *Vaccinium*), *Euphorbiaceae* (*Hevea*), *Fabaceae* (*Lathyrus*, *Lupinus*, *Vigna*), *Fagaceae* (*Castanopsis*), *Gentianaceae* (*Eustoma*, *Gentiana*), *Juglandaceae* (*Carya*, *Juglans*), *Lardizabalaceae* (*Akebia*) *Lauraceae* (*Cinnamonium*, *Persea*), *Leguminosae* (*Lathyrus*), *Liliaceae* (*Tricyrtis*, *Tulipa*), *Magnoliaceae* (*Liriodendron*, *Magnolia*), *Moraceae* (*Ficus*, *Morus*), *Myrsinaceae* (*Cyclamen*), *Myrtaceae* (*Acca*), *Nelumbonaceae* (*Nelumbo*), *Oleaceae* (*Olea*), *Pinaceae* (*Pinus*, *Tsuga*), *Plumbaginaceae* (*Limonium*), *Polemoniaceae* (*Phlox*), *Primulaceae* (*Primula*), *Proteaceae* (*Hakea*, *Leucadendron*, *Leucospermum*, *Protea*), *Ranunculaceae* (*Anemone*, *Delphinium*, *Ranunculus*), *Rhamnaceae* (*Ceanothus*), *Rhodoraceae* (*Vaccinium*), *Rosaceae* (*Cydonia*, *Eriobotrya*, *Fragaria*, *Malus*, *Photonia*, *Prunus*, *Pyrus*, *Rubus*, *Sanguisorba*), *Rubiaceae* (*Coffea*), *Rutaceae* (*Casimiroa*, *Citrus*, *Flindersia*), *Salicaceae* (*Salix*), *Salvinaceae* (*Salvinia*), *Saxifragaceae* (*Bergenia*), *Simmondsiaceae* (*Simmondsia*), *Solanaceae* (*Capsicum*, *Cyphomandra*, *Lycopersicon*, *Physalis*, *Solanum*), *Theaceae* (*Camelia*, *Stewartia*), *Tiliaceae* (*Grewia*, *Corchorus*), *Umbelliferae* (*Apium*), *Urticaceae* (*Urtica*), *Verbenaceae* (*Verbena*, *Vitex*), *Vitaceae* (*Vitis*). There is also a record of *C. acutatum* causing lung and kidney infection in a sea turtle (Manire *et al*., 2002).

Notes: *Colletotrichum acutatum* is a heterogeneous species (Lardner *et al*., 1991; Sreenivasaprasad and Talhinhas, 2005), which is difficult to distinguish morphologically from *C. gloeosporioides* as both exhibit extensive cultural variability and have overlapping host ranges (Wharton and Diéguez-Uribeondo, 2004). Within *C. acutatum* various groups have been recognised based on physiology (*viz*. *C. acutatum* f.sp. *chromogenum* A.P. Baxter, Van der Westh. & Eicker (1983) was distinguished on the basis of red pigments produced in agar culture media), morphology (Lardner *et al*., 1999), vegetative compatibility analysis (Lardner *et al*., 1999), arbitrarily primed PCR (Freeman and Rodriguez, 1995; Lardner *et al*., 1999; Freeman *et al*., 2001b) and DNA sequence analysis (Johnston and Jones, 1997; Freeman *et al*., 2001b; Sreenivasaprasad and Talhinhas, 2005; Whitelaw-Weckert *et al*., 2007; Than *et al*., 2008a).

Simmonds (1968) designated a holotype (IMI 117617) and six paratypes from three hosts with variable morphological and molecular characteristics. The ex-paratype culture that Simmonds (coll. no. 16633D) sent to ICMP (1783), New Zealand and subsequently deposited in ATCC as ATCC 56816 (page 225, Guerber and Correll, 2001)

has an ITS sequence that differs from that of the holotype by one base pair (Vinnere *et al.*, 2002; Farr *et al.*, 2005).

Than *et al*. (2008a) designated an isolate of *C. acutatum* from *Carica papaya* in south-east Queensland, Australia as an epitype to help clarify Simmonds' species concept despite the fact that ITS sequences from the holotype (IMI 117617) and one of the paratypes (IMI 117619) (Vinnere *et al*., 2002) have been determined, and the ex-holotype culture is available in CBS. It is likely that some of the various morphological and molecular groups that have been recognised within *C. acutatum* represent discrete species, as have been found in some Australian isolates (Shivas and Tan, 2009).

Colletotrichum agaves Cavara, Fungi Longobardiae Exsiccati No 100 (1892).

Teleomorph: Unknown.

Hosts and disease: Leaf disease of *Agave, Furcraea*.

Notes: This taxon has been detected on dying *Agave* plants in greenhouses in Missouri Botanical Garden in St Louis (Farr *et al*., 2006). It has been considered to be a synonym of *C. gloeosporioides* (von Arx, 1957) and *C. coccodes* (Hughes, 1958), the latter presently being followed in *Index Fungorum*. Molecular data (combined ITS and LSU) show this taxon to be a distinct species which can easily be distinguished from other species on *Agavaceae* by the numerous black setae that develop throughout the conidiogenous region in acervuli (Farr *et al*., 2006).

Colletotrichum anthrisci Damm, P.F. Cannon & Crous, Fungal Diversity 39: 56 (2009).

Teleomorph: Unknown.

Host: *Anthriscus sylvestris*.

Notes: This species was described from dead stems of *Anthriscus* in the Netherlands, where it was found to be associated with stem lesions (Damm *et al*., 2009). The biology and life cycle of this fungus is still unknown.

Colletotrichum asianum Prihastuti, L. Cai & K.D. Hyde, Fungal Diversity 39: 96 (2009).

Teleomorph: Unknown.

Hosts and disease: Endophyte, epiphyte and pathogen of coffee berries (*Coffea* spp.), and anthracnose of chilli (*Capsicum*) and mango (*Mangifera*).

Notes: This taxon was introduced for *Colletotrichum* species from coffee in northern Thailand. Epiphytic and endophytic strains were isolated from apparently healthy berries, and it was also isolated as a pathogen. This species is similar in growth rate and colony colour to *Colletotrichum kahawae* but differs in conidial shape, straight in *C. kahawae* versus cylindrical with narrowed centre in *C. asianum*. They are also genetically distinct (Prihastuti *et al*., 2009). The isolates named as *C. gloeosporioides* which were shown to be the causal agents of chilli (*Capsicum annuum*) anthracnose in Thailand (Than *et al*., 2008b) also belong to this species (L. Cai, pers. comm.). The species appears to be widespread in Asia and occurs on several hosts and further research is required to establish its distribution, host range, biology and hosts it infects.

Colletotrichum axonopodi J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 727 (2009).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of *Axonopus affinis*, *A. compressus*.

Notes: *Colletotrichum axonopodi* is morphologically indistinguishable from the majority of falcate-spored species described from graminicolous hosts, and is diagnosed through molecular phylogenetics (Crouch *et al*., 2009a). Historically, *Axonopus* is not listed as a host to any pathogenic *Colletotrichum* species in the standard publication sources (*i.e.*, Sprague, 1950; Farr *et al*., 1989), but the taxon has been documented from the USA, Honduras and Australia as herbarium specimens (labelled as *C. graminicola* or *C. sublineola*) since the 1930s. Because the host plant is a cosmopolitan weed, the taxon is of no economic importance as a pathogen of agronomic crops.

Colletotrichum boninense Moriwaki, Toy. Sato & Tsukib., Mycoscience 44: 48 (2003).

Teleomorph: Unknown.

Hosts and disease: Leaf spots and endophytes of *Carapa*, *Catostemma*, *Cattleya, Clivia*, *Crinum*, *Cucumis*, *Cymbidium*, *Dendrobium*, *Dracaena, Eperua*, *Eucalyptus, Euony-*

mus, *Goupia, Leucospermum, Manilkara, Mora*, *Passiflora*, *Protea* and *Prunus*.

Notes: This taxon can be distinguished based on morphological characters (e.g. wide conidia with hilum-like base, l/b ratio: (1.8-)2-3(-3.3) and molecular data, as well as three isolates being slightly more susceptible to benomyl than a putative *C. gloeosporioides* isolate (Sato, 1997). This name was first used for isolates from eight plants on the Pacific Coast of Japan (Moriwaki *et al*., 2003). Later, this species was reported as an endophyte of several plants in Guyana (Lu *et al*., 2004) and in Australia and southern Africa (Lubbe *et al*., 2004), and causing anthracnose on *Dracaena sanderiana* and *Euonymus japonica* (Lee *et al*., 2005a,b; Farr *et al*., 2006). *Colletotrichum boninense* appears to be a distinct phytopathogen and endophyte on a number of hosts worldwide. The lifestyle should be carefully investigated. Cultures are available at MAFF and thus further sequences can be obtained if required. Johnston and Jones (1997, as *Colletotrichum* Group 1) and Johnston *et al.* (2005) reported several genetically and morphologically distinct groups within *C. boninense*, some of which are consistently associated with unnamed teleomorphs. Sequence data obtained from various isolates at CBS indicate that several undescribed species are presently included in *boninense* (Damm *et al*., unpublished).

Colletotrichum caudatum (Peck ex Sacc.) Peck, Bulletin of the New York State Museum 131: 81 (1909).

Teleomorph: Unknown.

Hosts and disease: Anthracnose and leaf spot of *Agropyron*, *Andropogon*, *Aristida*, *Bothriochloa*, *Cymbopogon*, *Eragrostis*, *Eremochloa*, *Eulaliopsis*, *Imperata*, *Roetboellia*, *Schizachyrium*, *Setaria*, *Sorghastrum*, *Sporobolus* and *Zoysia*.

Notes: This is one of the most distinctive of *Colletotrichum* species, as the falcate conidia have a cauda (appendage) at the apex. *Colletotrichum caudatum* was originally described as *Ellisiella caudata* (based on "*Colletotrichum caudatum* Peck", nom. nud.), by Saccardo (1880) from the foliage of *Sorghastrum nutans*. Later this name was recombined in *Colletotrichum* by Peck (1909). Von Arx (1957) included the taxon as a synonym of *C. graminicola*, but subsequent morphological examinations and multilocus sequence analysis upheld the distinctiveness of *C. caudatum* (Sutton, 1980, 1992; Crouch *et al*., 2009a,b). Although generally considered a single species with a broad range of warm-season grasses, the taxon appears to be an assemblage of host-specific phylogenetic species (Crouch *et al*., 2009b; Zeiders, 1987). Further sampling is needed to resolve this issue, and epitypification should stabilize the nomenclature. Potential epitype strains of *C. caudatum* are currently being evaluated alongside the 1880 type specimen (Crouch, unpubl. data).

Colletotrichum cereale Manns, Ohio Agricultural Experimental Station Bulletin 203: 207 (1909).

Teleomorph: Unknown.

Hosts and disease: Occurring as endophyte and causing leaf spots and stem rots on *Agrostis*, *Avena*, *Bromus*, *Calamagrostis*, *Dactylis, Elymus, Festuca*, *Hierochloe*, *Holcus*, *Hordeum*, *Lolium*, *Poa, Polypogon* and *Triticum*.

Notes: This taxon is widely distributed across temperate regions worldwide and inhabits numerous species of cool-season grasses of the subfamily Pooideae. *Colletotrichum cereale* can be found as either a plant pathogen or an endophyte, and host specialization is supported through phylogenetic studies (Crouch *et al*., 2009b). *Colletotrichum cereale* is a falcate-spored species first described by Selby and Manns (1909), but was synonymised with *C. graminicola* by Wilson just five years later. Wilson's treatment was upheld and expanded by von Arx (1957), but Sutton (1980, 1992), based on appressorial morphology, excluded from *C. graminicola* all but the fungus pathogenic to *Zea*. Wheat anthracnose outbreaks caused by *C. cereale* were problematic during the 1940s in the USA, but presently do not limit production of this crop, despite the fact that the fungus still inhabits wheat plants (see Crouch and Beirn, 2009 for review). Destructive disease outbreaks caused by this fungus on *Poa annua* and *Agrostis stolonifera* in golf course greens since the late 1990s highlighted the need to determine the

identity of this organism, which continued to be identified as *C. graminicola* even after Sutton's narrow circumscription. Multi-locus molecular phylogenetic study demonstrated the unique identity of this taxon and corresponded with the host range and morphology documented in the original *C. cereale* species description (Crouch *et al*., 2006). Epitype strains have been established for the major populations (Crouch *et al*., 2006).

Colletotrichum chlorophyti S. Chandra & Tandon [as '*chlorophytumi*'], Current Science 34: 565 (1965).

Teleomorph: Unknown.

Hosts and disease: Leaf spot of *Chlorophytum.* Also reported from *Stylosanthes hamata* (Damm *et al*., 2009).

Notes: Recent molecular analysis of the type strain confirmed *C. chlorophyti* to be a distinct species (Damm *et al*., 2009).

Colletotrichum circinans (Berk.) Voglino, Annali della Reale Accademia d'Agricoltura di Torino 49:175 (1907).

Teleomorph: Unknown. The report of a teleomorph for this species as *Cleistothecopsis circinans* F. Stevens & E.Y. True (Stevens and True, 1919) must be highly doubtful, because the fungus forms muriform septate ascospores and may be a synonym of *Pleospora* (*Dothideomycetes*).

Hosts and disease: Causes onion smudge of *Allium* species. The taxon has also been reported as pathogen of beet (*Beta vulgaris*), leaf spot on hairy violet (*Viola hirta*), on dead stem of wild chervil (*Anthriscus sylvestris*) (Damm *et al*., 2009) and from several other putative hosts (Farr *et al*., 2009) which require confirmation.

Notes: This taxon was considered as a form of *C. dematium* by von Arx (1957). Sutton (1980) maintained *C. circinans* as a distinct species specific to *Allium* spp., characterised by falcate, fusiform conidia that are gradually tapered at each end and 19–21 × 3.5 µm, which was confirmed by Damm *et al*. (2009) in a multi-gene analysis. In the same study, an epitype of this species was designated. Fagbola and Abang (2004), who suspected *C. circinans* and *C. coccodes* to be the same species, distinguished them based on DGGE analysis of PCR-amplified 18S rDNA fragments.

Colletotrichum cliviae Y.L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai, Fungi Diversity 39: 133 (2009)

Teleomorph: Unknown.

Hosts and disease: Leaf spots of *Clivia miniata*.

Notes: This species is similar to *Colletotrichum boninense* and *C. crassipes* in terms of conidial width. Shape is however, different, conidia of *C. crassipes* are truncate at the base, while those in *C. boninense* have a low hilum-like protuberance at the base (Sutton, 1980; Moriwaki *et al*., 2003). Although the conidial width in *C. cliviae*, *C. crassipes, C. orbiculare* and *C. boninense* overlap, *C. cliviae* grows faster than *C. orbiculare* and *C. boninense*. In addition, it is different from any similar taxa in nu-rDNA ITS, CAL, GDPH, actin, chitin synthase A and β-tubulin sequences (Yang *et al*., 2009).

Colletotrichum coccodes (Wallr.) S. Hughes, Canadian Journal of Botany 36: 754 (1958).

Teleomorph: Unknown.

Hosts and disease: The most important diseases are potato black dot (Lees and Hilton, 2003) and anthracnose of tomato (Ben-Daniel *et al*., 2009), but it has also been reported from chilli and mint (Nitzan *et al*., 2006b; Than *et al*., 2008c) as well as several rotation crops and *Curcurbitaceae* (Nitzan *et al*., 2006a; Tsror and Johnson, 2000).

Notes: This species was described from potato in Germany in 1833 as *Chaetomium coccodes* and is now regarded as a species of *Colletotrichum*. It has since been shown to cause disease in tomatoes and numerous other hosts and even human infection (Cano *et al*., 2004). It has several synonyms from a wide range of hosts. The conidia are similar to those of *C gloeosporioides* but are slightly constricted in the centre and taper abruptly at each end (Sutton, 1992). The taxon has been isolated as a common endophyte of root segments of transgenic potatoes (Götz *et al*., 2006). Vegetative compatibility groups have been reported for isolates from Israel and northern Europe (Shcolnick *et al*., 2007) and USA (Heilmann *et al*., 2006; Nitzan *et al*., 2002, 2006a,b). Several

recent papers deal with various aspects of the fungus and the diseases it causes (Sanogo *et al*., 2003; Costa *et al*., 2006; Aqeel *et al*., 2008; Minuto *et al*., 2008; Nitzan *et al*., 2008; Ben-Daniel *et al*., 2009). It has not been epitypified, which is necessary in order to establish whether this is a distinct species and stabilize the characters and name for future studies.

Colletotrichum crassipes (Speg.) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 77 (1957).

Teleomorph: Unknown.

Hosts: Grape anthracnose (*Vitis*).

Notes: This species was originally described from fruit of *Vitis vinifera* (grape) from Conegliano, Italy. The species was accepted by Sutton (1980, 1992) and is similar to *C. gloeosporioides*, but differs in its wider, generally longer conidia and deeply lobed appressoria. The name has rarely been used recently and the records from rattans (Mohanan, 2005) and jacaranda - *Dalbergia nigra* (Dhingra *et al*., 2003) need verification. It has also been putatively identified, mainly based on the morphology of the appressoria with crenate or deeply lobed margins and size of conidia, as causing human phaeohyphomycotic cysts (Castro *et al*., 2001). *Colletotrichum acutatum* is also known from grape (Melksham *et al*., 2002). Sutton (1992) suggested this taxon migh be composite and comprise several taxa. Fresh collections of this taxon are needed from grapes in Italy for molecular analysis.

Colletotrichum curcumae (Syd.) E.J. Butler & Bisby, The Fungi of India: 153 (1931).

Teleomorph: Unknown.

Hosts and disease: Leaf spot of turmeric (*Curcuma longa*) (Palarpawar and Ghurde, 1994).

Notes: In a multi-gene analysis, this taxon was shown to be a distinct species and epitypified (Damm *et al*., 2009).

Colletotrichum dematium (Pers.) Grove, Journal of Botany, British and Foreign, London 56: 341 (1918).

Teleomorph: Unknown.

Hosts and disease: Originally described on stem necroses on *Eryngium campestre*, and also reported as pathogenic on potato stems (*Solanum tuberosum*), from leaf spots of *Genista tinctoria*, as an endophyte in grapevine (*Vitis vinifera*), on dead stems of *Apiaceae* and on *Xanthium*. Other hosts need to be confirmed.

Notes: Many *Colletotrichum* species with curved conidia had been synonymised with *C. dematium* by von Arx (1957), who considered this taxon to be a common saprotroph on many herbaceous plants with several host-specific forms. Descriptions of *C. dematium* in the literature are very variable and confusing (von Arx, 1957; Sutton, 1980; Baxter, 1983). Therefore, this taxon has been epitypified and compared with other curved spored species from herbaceous hosts based on morphological and molecular data (Damm *et al.*, 2009). *Colletotrichum dematium* was confirmed to be plurivorous, probably having pathogenic, saprotrophic and endophytic lifestyles. However, since many strains originally identified as *C. dematium* proved to belong to different species, for example *C. lineola*, *C. spaethiana* and *C. truncatum*, host and biological information of this taxon in previous studies might be wrong. This includes the causal organisms of several economically important diseases, such as leaf blight of Japanese radish seedlings, anthracnose of mulberry, narukoyuri (*Polygonatum falcatum*) and statice (Yoshida and Shirata, 1999; Sato *et al*., 2005; Babu *et al*., 2008; Tomioka *et al*., 2008; Bobev *et al*., 2009), while the anthracnose pathogen of *Rhododendron* in Sweden (Vinnere *et al.*, 2002) does belong to *C. dematium* or the closely related *C. lineola* (Damm *et al.*, 2009).

Colletotrichum destructivum O'Gara, Mycologia 7: 38 (1915).

Teleomorph: *Glomerella glycines* Lehman & F.A. Wolf

Hosts and disease: Anthracnose in *Brassicaceae*, *Cuscutaceae*, *Leguminosae*, *Solanum, Perilla*.

Notes: This taxon causes anthracnose of soybean usually affecting aging plants at harvest or stubble (Manandhar *et al*., 1986) and of lucerne as a sole or secondary pathogen (Boland and Brochu, 1989). It was also found to cause anthracnose of perilla (Kawaradani *et al*., 2008). It is a hemibiotrophic species in *Medicago sativa, M. truncatula, Vigna ungui-*

culata, several *Nicotiana* species and *Arabidopsis thaliana* (Latunde-Dada *et al*., 1996, 1997; Shen *et al*., 2001; O'Connell *et al*., 2004) and produces large, prominently multi-lobed infection structures that are localized within the initially infected epidermal cells of the infected host. This feature is the same in *C. linicola* and *C. higginsianum,* and represents a key taxonomic character (Latunde-Dada and Lucas, 2007; O'Connell *et al*., 2004). A multilocus comparison approach is required to determine their relationships.

Colletotrichum dracaenophilum D.F. Farr & M.E. Palm, Mycological Research 110: 1401 (2006).

Teleomorph: Unknown.

Hosts and disease: Leaf anthracnose of *Dracaena*.

Notes: This species was recently described and ex-type cultures and sequences are available. The taxon is known only from China and can be distinguished from other taxa on *Agavaceae* by its long conidia (averaging more than 28 µm long). Molecular data support the uniqueness of this species (Farr *et al*., 2006; L. Cai, pers. comm.). Other taxa from *Dracaena* have been discussed by Farr *et al*. (2006).

Colletotrichum echinochloae Moriwaki & Tsukib., Mycoscience 50: 275 (2009).

Teleomorph: Unknown.

Hosts and disease: Leaf blight and greyish-white lesions with brown margins on leaves of *Echinochloa esculenta*.

Notes: This taxon was previously identified as *C. graminicola* but differs from this species in its falcate and short conidia, 18-22.2 µm in length, cultural characteristics, and specific pathogenicity to *Echinochloa esculenta*. Molecular phylogenetic analyses using rDNA-ITS, HMG, and *Sod2* sequences also show this species to be unique (Moriwaki and Tsukiboshi, 2009). *C. echinochloae* originates from the same host plant as *C. jacksonii*, and while the two species are clearly sister taxa, the type strains of *C. echinochloa* and *C. jacksonii* fall into two distinct phylogenetic lineages (Crouch *et al*., 2009a; Moriwaki and Tsukiboshi, 2009).

Colletotrichum eleusines Pavgi & U.P. Singh [as '*eleusinis*'], Mycopathologia et Mycologia Applicata 27: 85 (1965).

Teleomorph: Unknown.

Hosts: Anthracnose of *Eleusine indica*.

Notes: Wilson (1914) included isolates of *Colletotrichum* from *Eleusine* in his description of *C. graminicola*. *Colletotrichum eleusines* was first introduced in 1965, but the taxon was not accepted by Sutton (1980, 1992) in any of his subsequent treatments. Crouch *et al*. (2009a) reintroduced *C. eleusines* based on molecular phylogenetic data. The taxon is morphologically indistinguishable from many closely related falcate-spored *Colletotrichum* species associated with grasses and is diagnosed using molecular analysis.

Colletotrichum falcatum Went, Archives Java Suikerindustrie 1: 265 (1893).

Teleomorph: *Glomerella tucumanensis* (Speg.) Arx & E. Müll.

Hosts and disease: Red rot and red streak of *Saccharum* (sugarcane).

Notes: Red rot can infect mature stalks of sugarcane, leaf mid ribs and cause rot of planting material which results in substantial losses in crop yield and sugar quality (Rao *et al*., 2004). This fungus was isolated in 1892 from a sugarcane field at Tjomal, Java, Indonesia but the type material could not be located in any herbaria. Remarkably the same sugarcane field still exists and it is possible to designate an epitype in order to stabilize the taxonomic position. The taxon was recently isolated from the same original site and host species allowing it to be epitypified (Prihastuti *et al*., unpublished).

Colletotrichum fioriniae (Marcelino & Gouli) R.G. Shivas & Y.P. Tan, Fungal Diversity 39: 117 (2009).

Teleomorph: *Glomerella acutata* var. *fioriniae* J.A.P. Marcelino & S. Gouli

Hosts and disease: Leaf and stem blight of *Acacia acuminata*, fruit rot of *Persea americana*, endophyte in *Mangifera indica* and 28 other species of plants, apparently entomopathogenic on elongate hemlock scale (*Fiorinia externa*).

Notes: Originally established to accommodate entomopathogenic forms of *C. acuta-*

tum associated with an epizoote of scale insects in eastern USA, where it also occurred as an endophyte in 28 species of plants (Marcelino *et al*., 2008). Differs culturally from *Colletotrichum acutatum* Simmonds by having colonies on PDA that are grey cottony with aerial mycelium in compact tufts, and in reverse pale brownish-pink with dark flecking, as well as by its ITS and β-tubulin sequences. *Colletotrichum fioriniae* accommodates *C. acutatum* group C according to Lardner *et al*. (1999) or *C. acutatum* group A3 according to Sreenivasaprasad and Talhinhas (2005).

Colletotrichum fragariae A.N. Brooks, Phytopathology 21: 113 (1931)**.**

Teleomorph: Unknown.

Hosts and disease: Crown rot, stolon lesions and fruit rot of *Fragaria* × *ananassa* (strawberry).

Notes: This species is one of the causal agents of strawberry anthracnose, which is usually caused by three species (including *C. acutatum* and *C. gloeosporioides*). Each of these species produces similar symptoms on strawberry which include crown rot, fruit rot and stolon lesions. It has been regarded as a synonym of *C. gloeosporioides* by von Arx (1957) but then as specific to *Fragaria* (von Arx, 1981; Sutton, 1992). It is recognized as a distinct species differentiated from *C. gloeosporioides* and *C. acutatum* by both conidia and setae on a strawberry leaf agar medium (Gunnell *et al.*, 1992), but its status as a distinct species is under review (Martínez-Culebras *et al.*, 2003). Molecular data based on the rDNA ITS sequences has shown that the divergences between this taxon and a putative *C. gloeosporioides* strain were too low to distinguish them as separate species (Sreenivasaprasad *et al*., 1996; Buddie *et al*., 1999; Martínez-Culebras *et al.*, 2003), but it can be discriminated from other members of the *C. gloeosporioides* aggregate isolated from strawberry by an *MvnI* restriction site within the ITS1 region (Martínez-Culebras *et al*., 2000, 2003). Recent phylogenetic research using a wider range of genes (Johnston, in litt.) supports the work of MacKenzie *et al*. (2007) indicating that *C. fragariae* is distinguishable from the rest of the *C. gloeosporioides* aggregate, but that it is not restricted to strawberry.

Colletotrichum fructi (F. Stevens & J.G. Hall) Sacc. [as '*fructus*'], Sylloge Fungorum (Abellini) 22: 1201 (1913).

Teleomorph: Unknown.

Hosts and disease: Fruit rot of apple (*Malus domestica*). Also reported on pear (*Pyrus communis*) and walnut (*Juglans regia*) (Farr *et al.,* 2009), which needs to be confirmed.

Notes: This taxon has been revealed to be a distinct species based on multi-gene analyses and an epitype has been designated (Damm *et al*., 2009).

Colletotrichum fructicola Prihastuti, L. Cai & K.D. Hyde, Fungal Diversity 39: 96.

Teleomorph: *Glomerella* sp.

Hosts and disease: Endophyte, epiphyte and pathogen isolated from coffee berries (*Coffea* sp.) and leaf spots of peanut (*Arachis*).

Notes: This species was first reported from coffee berries in Thailand, isolated as epiphytes, endophytes and pathogens. Conidia of this species are similar to *C. kahawae* which has been reported associated with coffee berry disease, but they can be distinguished by biochemical tests (Prihastuti *et al*., 2009). The taxon was introduced as a new species based on molecular data. Subsequent collections in Thailand have shown this species to have a wide host range (L. Cai, pers. comm.).

Colletotrichum fuscum Laubert, Gartenwelt 31: 675 (1927).

Teleomorph: Unknown.

Hosts and disease: Leaf spots on *Scrophulariaceae sensu lato* (*Antirrhinum majus*, *Digitalis* spp., *Linaria maroccana*, *Nemesia strumosa*).

Notes: Laubert described *C. fuscum* from diseased leaves of *Digitalis purpurea* in 1927 from Germany. A similar disease on *Digitalis* and related plants is common in New Zealand (Sutton 1980; Anon., 2001–2009) and Japan (e.g. Tomioka *et al*., 2001). This fungus is genetically distinct from *C. gloeosporioides*, based on sequences from the ITS region (Moriwaki *et al*., 2003, Cannon *et al*., 2008) and GPDH intron 2 (Weir, unpubl. data). Both Moriwaki *et al*. (2002) and Cannon *et al*. (2008) recognized that *C. fuscum* was closely related to isolates referred variously to *C. destructivum*,

C. higginsianum, and *C. linicola* on the basis of ITS sequences. Each of these names is used for fungi causing leaf-spotting diseases of *Scrophulariaceae*, legumes, crucifers, and *Linum* respectively. A comparison of published descriptions shows that there are morphological as well as genetic similarities between isolates given these names. For example, all have distinctively-shaped conidia with a slight curve and tapering to narrowly rounded ends (e.g. Spilsbury, 1953; von Arx, 1970; Sutton, 1980; Tomioka *et al*., 2001). There has been no modern study of the type specimens of these taxa and whether or not they are genetically and biologically distinct remains unresolved.

Colletotrichum gloeosporioides (Penz.) Penz. & Sacc., Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti, Serie 6, 2: 670 (1884).
Teleomorph: *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk

Hosts and disease: *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. is one of the most common and widely distributed plant pathogens in the world (Sutton, 1992; Cannon *et al*., 2000). Since its original description (as *Vermicularia gloeosporioides* Penz.) it has been associated with at least 470 different host genera (Sutton 1980), either as a primary disease-causing organism, or isolated from deteriorated plant parts. It is especially prevalent in the tropics, but has been recorded also from a wide range of temperate and subtropical habitats. The species is well known as a latent pathogen causing post-harvest problems (Prusky and Plumbley, 1992), endophytic strains are commonly isolated from symptomless plant parts (Cannon and Simmons, 2002; Lu *et al*., 2004; Photita *et al*., 2004, 2005), and reduced-pathogenicity mutants have been explored as control mechanisms for virulent strains (Yakoby *et al*., 2002). Some strains are highly host-specific, and are used or planned for use as bioherbicides in several parts of the world (e.g. Watson *et al*., 2000; Goodwin, 2001; Kaewchai *et al*., 2009).

Colletotrichum gloeosporioides has been implicated as an economically important pathogen of a wide range of plants, including *Agavaceae* (Farr *et al*., 2006), apple (Carvalho *et al*., 2000), avocado (Mills *et al*., 1992; Freeman *et al*., 2000), citrus (Adaskaveg and Förster, 2000; Timmer and Brown, 2000; Ramos *et al*., 2006), coffee (Waller and Bridge, 2000), mango (Mills *et al*., 1992; Afanador Kafuri *et al*., 2003), olive (Martin and Garcia Figueres, 1999), papaya (Mills *et al*., 1992), passion fruit (Afanador Kafuri *et al*., 2003), proteas (Lubbe *et al*., 2004), stylosanthes (Manners and He, 1997; Munaut *et al*., 2002), strawberry (Buddie *et al*., 1999; Smith and Black, 1990; Xiao *et al*., 2004) and yam (Abang *et al*., 2002; Mignouna *et al*., 2002).

Notes: *Colletotrichum gloeosporioides* as currently circumscribed is a polymorphic species aggregate containing a number of subgroups which show varying degrees of pathogenicity, host-specificity and genetic homogeneity. It was first recognized as an aggregate taxon by von Arx (1957) who placed at least 600 taxa into synonymy (the precise number is difficult to determine due to the high level of homonymy and complications due to teleomorph/anamorph links). Some of these (e.g. *C. higginsianum*, *C. phormii*) are now recognized as belonging to separate species, but the vast majority have never been re-evaluated. In the absence of living cultures of type specimens with extractable DNA, there are strong practical arguments against their resurrection.

The *Colletotrichum gloeosporioides* aggregate has been defined using morphological methods by e.g. Sutton (1980) and Baxter *et al.* (1983), primarily using characteristics of the conidia – they were considered to be cylindrical with rounded ends and less than 4.5 µm in diameter. Such features are not considered to be reliable; ,specially as *Colletotrichum* species in culture frequently produce secondary conidia that are highly variable in size and shape. The aggregate is now more objectively defined using molecular methods, and sequences including rDNA-ITS, β-tubulin, *MAT1-2* and GDPH (Morikawi *et al*., 2002; Du *et al*., 2005; Gonzalez *et al*., 2006; Cannon *et al.*, 2008; Than *et al*., 2008a) may be used to assign strains to *C. gloeosporioides* in its currently defined sense.

Some recently accepted taxa are now known to belong within the *C. gloeosporioides* aggregate. The best studied of these is *C. kahawae* (Waller *et al*., 1993), described for the important African pathogen of *Coffea*

known to pathologists as coffee berry disease. Although its recognition as a distinct taxonomic unit is very important in the applied sciences, it is now believed to be an almost clonal entity that can only be reliably distinguished from other taxa within the *C. gloeosporioides* aggregate using biochemical tests. *Colletotrichum fragariae* (Brooks, 1931) constitutes a further subgroup within the *C. gloeosporioides* aggregate, but this exhibits substantially more genetic polymorphism compared with *C. kahawae*. Recent studies (Weir and Johnston, *in litt*.) suggest that it can be recognized as a distinct taxonomic entity within the aggregate, but is not specific to strawberry.

ITS analysis has not proved informative in distinguishing subgroups within the *C. gloeosporioides* aggregate, although there are suggestions that a sequence dichotomy exists that is reflected in the gene's secondary structure (Bridge *et al*., 2008b). The aggregate is currently the subject of intensive phylogenetic research using multiple genes, and it is likely that a series of well-supported monophyletic (though not host-specific) clades will be identified.

Colletotrichum gossypii Southw., Journal of Mycology 6: 100 (1890).

Teleomorph: *Glomerella gossypii* Edgerton

Hosts and disease: Anthracnose, pink boll rot or seedling blight of cotton (*Gossypium*).

Notes: The name *C. gossypii* has been frequently used in the literature (e.g. Silva-Mann *et al*., 2007; Alves and Pozza, 2009; Chitarra *et al*., 2009). It was suggested that the two varieties can be differentiated by AFLP, but this observation was based on only ten strains (Silva-Mann *et al*., 2005). *Colletotrichum gossypii* var. *gossypii* supposedly causes anthracnose, mostly resulting in seedling dieback, while *C. gossypii* var. *cephalosporioides* is proposed to be the causal agent of ramulose of cotton (Mathieson and Mangano, 1985; Chitarra *et al*., 2009; Monteiro *et al*., 2009). There is no consistent report about morphological or molecular markers to differentiate the two varieties. Many authors have considered *C. gossypii* to be a synonym of *C. gloeosporioides* and the taxon was not accepted in Sutton (1992). *Colletotrichum gossypii* has quarantine significance (EPPO, 2009), particularly as it is seed dispersed. Fresh collections are needed to establish if this is a distinct species and for epitypification.

Colletotrichum graminicola (Ces.) G.W. Wilson [as '*graminicolum*'], Phytopathology 4: 110 (1914)

Teleomorph: *Glomerella graminicola* D.J. Politis

Hosts and disease: Anthracnose of *Zea mays* (corn).

Notes: *Colletotrichum graminicola* was introduced in 1914, combining several morphologically similar taxa from *Colletotrichum, Dicladium*, *Colletotrichopsis*, and *Steirochaete*, including *C. cereale* and what would later be described as *C. eleusines*, *C. jacksonii*, *C. miscanthi*, *C. navitas*, *C. nicholsonii* and *C. paspali* (Crouch *et al*., 2009a,c). The taxon has been the subject of much controversy over the past 50 years, beginning with the work of von Arx (1957). In order to connect the conidial state of the graminicolous species with a newly introduced sexual morph, *Glomerella tucumanensis* (von Arx and Müller, 1954), von Arx synonymized all *Colletotrichum* associated with grasses under the name *C. graminicola*, including the previously distinct taxa *C. sublineola*, *C. falcatum* and *C. caudatum*. *Colletotrichum graminicola sensu lato* Arx was considered by most researchers as a group species and in subsequent years the taxon was increasingly subdivided, eventually into 12 species. The identification of a unique teleomorph associated with *C. graminicola* from *Zea mays* (Politis, 1975) and subsequent morphological studies by Sutton (1966, 1968) resulted in *C. graminicola* being established as a taxon limited to this host plant, and *C. sublineola*, *C. falcatum* and *C. caudatum* were re-established as discrete species. Molecular phylogenetic studies confirmed the distinction of *C. graminicola sensu stricto* (Du *et al*., 2005; Crouch *et al*., 2006, 2009a,b, 2010). Although this fungus emerged as an important pathogen of corn crops during the 1970s and 1980s, anthracnose caused by *C. graminicola* no longer impacts crop production in most developed areas due to the deployment of

resistant cultivars. *Colletotrichum graminicola* is the first *Colletotrichum* species to have its entire genome sequenced (Lisa Vaillancourt, pers. comm.) and is a well established model for fungus-plant interactions, pathogen biology and hemibiotrophic infection (reviewed in Crouch and Beirn, 2009). An epitype strain (M1.001) has been established (Crouch *et al*., 2006); this is the same strain sequenced through the Broad Institute's Fungal Genome Initiative (http://www.broad.mit.edu/science/ projects/fun gal-genome-initiative/current-fgi-sequence-projects).

Colletotrichum hanaui J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 728 (2009).

Teleomorph: Unknown.

Hosts: Anthracnose of *Digitaria* (crabgrass).

Notes: *Colletotrichum* associated with crabgrass has traditionally been referred to as *C. graminicola*, although Wilson (1914) did not include isolates of *Colletotrichum* from crabgrass in his treatment of the species, and Sutton (1980, 1992) limited *C. graminicola* to the fungus pathogenic to *Zea mays*. Systematic studies of this morphologically cryptic phylogenetic species were first performed in 2009, when it was described as a distinct taxon based upon multilocus molecular data (Crouch *et al*., 2009a).

Colletotrichum higginsianum Sacc., Journal of Agricultural Research, Washington 10: 161 (1917).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of *Brassicaceae*.

Notes: This taxon causes anthracnose leaf spot disease on a wide range of cruciferous plants (*Brassicaceae*) in South Atlantic and Gulf states of the United States, the West Indies, Japan, and Southeast Asia (Higgins, 1917; Scheffer, 1950; Sutton, 1980; Moriwaki *et al*., 1997). It was regarded as a synonym of *C. gloeosporioides* by von Arx (1957), but subsequently has been recognized as a distinct species on the basis of its conidial morphology and consistent association with cruciferous hosts (Sutton, 1980, 1992). It has however, been considered as a synonym of *C. destructivum* based on morphology of conidia and appressoria. The infection process closely resembled that of *C. destructivum* on other hosts (e.g. alfalfa, cowpea, and tobacco) and rDNA sequences are similar to *C. destructivum* (O'Connell *et al*., 2004). More recently, its host range was also considered an unambiguous criterion of delimitation of two species (Sun and Zhang, 2009). Molecular data analysis based on a multilocus comparison is needed before the status of the two taxa can be resolved.

Colletotrichum hippeastri Y.L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai, Fungal Diversity 39: 133 (2009)

Teleomorph: Unknown.

Hosts and disease: Anthracnose of *Hippeastrum vittatum.*

Notes: The conidia of this taxon are distinct in being usually narrower near the ends or at centre and germinating conidia form 2-4 cells. This character is distinct from other species of *Colletotrichum*. In addition, *C. hippeastri* clustered separately from any morphologically similar species (e.g. *C. dracaenophilum*, *C. sansevieriae* and *C. nupharicola* (Farr *et al*., 2006; Johnson *et al*., 1997; Nakamura *et al*., 2006) in phylograms inferred from nu-rDNA ITS, calmodulin, β-tubulin, GDPH, actin, chitin synthase A and/or, six combined genes datasets (Yang *et al*., 2009).

Colletotrichum horii B. Weir & P.R. Johnst., Mycotaxon (in press).

Teleomorph: Unknown.

Hosts and disease: Associated with lesions on unripe fruit, young stems and twigs of persimmon (*Diospyros kaki*).

Notes: An anthracnose disease of persimmon fruits was described in a Japanese language article by Shotaro Hori in 1910 as *Gloeosporium kaki*. The next year Seiya Ito (1911), probably unaware of the earlier work, described a pathogen from persimmon fruits and twigs which he also named *Gloeosporium kaki*, although based on different specimens. This has led to some confusion as the authority has variably been cited as either Ito or Hori. Maffei (1921) described a leaf spot pathogen of persimmon from a specimen collected in Italy as *Colletotrichum kaki*. Von Arx (1957, 1970)

considered the fungi described by Hori and Maffei to be the same, and synonymous with *Colletotrichum gloeosporioides*. However, on the basis of biological and morphological differences, Weir and Johnston (in press) concluded that the two species were distinct. They examined specimens from China, Japan and New Zealand, neotypified *Gloeosporium kaki* Hori and, based on molecular and morphological evidence, renamed the persimmon pathogen *Colletotrichum horii,* a member of the *C. gloeosporioides sensu lato* species complex.

Colletotrichum hymenocallidis Y.L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai, Fungal Diversity 39: 138 (2009)**.**

Teleomorph: Unknown.

Hosts and disease: leaf spot of *Hymenocallis americana*.

Notes: The conidial dimensions and shapes of *Colletotrichum hymenocallidis* are close to *C. siamense*, whereas their colony characters differ. Colonies of *C. siamense* are yellowish-white in reverse versus greenish-black in *C. hymenocallidis*; the mean size of conidia, conidial and mycelial appressorium in *C. hymenocallidis* are also larger than that of *C. siamense* (Prihastuti *et al*., 2009; Yang *et al*., 2009). Phylogenetic analysis using chitin synthase A gene region and multiple gene loci showed that *C. hymenocallidis* is a distinct species (Yang *et al*., 2009).

Colletotrichum jacksonii J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 729 (2009).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of *Echinochloa* (barnyard grass).

Notes: As with many *Colletotrichum* species associated with grass hosts, this organism is referred to in the literature as *C. graminicola*. Lectotype material for *C. graminicola* (as *Dicladium graminicola*; Cesati, 1852) was present on both *Echinochloa* and *Zea* host substrates, but Sutton (1965, 1980, 1992) constrained *C. graminicola* to *Colletotrichum* pathogenic on *Zea mays*. As described by Crouch *et al*. (2009a), *C. jacksonii* is a falcate-spored phylogenetic species morphologically indistinguishable from several closely related graminicolous inhabiting species; it is diagnosable through molecular characters. Although closely related to *C. echinochloae*, a taxon also described from *Echinochloa*, the type of *C. jacksonii* is part of a phylogenetic lineage distinct from *C. echinichloae* (Crouch *et al*., 2009a; Moriwaki and Tsukiboshi, 2009).

Colletotrichum kahawae J.M. Waller & Bridge, Mycological Research 97: 993 (1993).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of coffee berry (*Coffea arabica*).

Notes: The name *C. coffeanum* was applied to *Colletotrichum* species found on coffee in Brazil by F. Noack at the end of the 19th century, where coffee berry disease (CBD) is not present, and is now considered as a poorly defined host-linked group within the *C. gloeosporioides* aggregate. Therefore, the use of *C. coffeanum* for the CBD pathogen was a misapplication (Sutton, 1992). Waller *et al*. (1993) renamed the highly pathogenic strain causing coffee berry disease in Africa as *C. kahawae* based on differences in growth rate and ability to utilize carbon sources. Correll *et al*. (2000) used SSREP and ALFP techniques to show that *C. kahawae* is a clonal population and similar results were found by Varzea *et al.* (2002) using VCG. Its status as a distinct species or infraspecific taxon is discussed in detail by Cannon *et al*. (2000). The name has continued to be used (see Bridge *et al*., 2008a; Gichuru *et al*., 2008; Durand *et al*., 2009; Van Der Vossen and Walyaro, 2009; Zeru *et al*., 2009). Data presented by Cai *et al*. (2009) and Prihastiti *et al.* (2009) in this issue may indicate that this is a distinct species. In Brazil, different populations of *C. gloeosporioides* are quite common as endophytes of the coffee tree, an observation already made by Rayner (1948). Others are considered the etiologic agent of a foliar disease known as "mancha mantecosa" or blister spot, described first in Costa Rica (Vargas and Gonzales 1972; Ferreira *et al.*, 2009; Pereira *et al.*, 2009). Nevertheless, conclusive pathogenicity tests or phylogenetic analyses have still to be conducted. *C. coffeanum* could be a suitable name for this fungus.

Colletotrichum lilii Plakidas ex Boerema & Hamers, Netherlands Journal of Plant Pathology 94(suppl. 1): 12 (1988).

Teleomorph: Unknown.

Hosts and disease: Black scale disease of lily bulbs (*Lilium longiflorum*). Also reported on other *Lilium* spp. and on *Hemerocallis* sp. (Farr *et al.,* 2009), which however needs to be confirmed.

Notes: In a molecular study of curved spored species from herbaceous hosts, this taxon has been shown to be a distinct species (Damm *et al*., 2009).

Colletotrichum lindemuthianum (Sacc. & Magnus) Briosi & Cavara, I Funghi Parassiti delle Piante Coltivate ed Utili Essicati, Delineati e Descriti, Fasc. 2: no. 50 (1889).

Teleomorph: *Glomerella lindemuthiana* Shear

Hosts and Disease: Primarily observed on *Phaseolus* and *Vigna* species (*Fabaceae*), causing anthracnose of leaves, stems and fruits (pods). Also reported from a wide range of other leguminous plants, including species of *Cassia*, *Dolichos*, *Glycine*, *Lablab*, *Medicago* and *Mucuna* (Sutton, 1980). Biological control of the fungus using *Pseudomonas* species has been investigated (Bardas *et al*., 2009a,b).

Notes: *Colletotrichum lindemuthianum* as widely circumscribed has notably short, slightly ovoid conidia (9.5-11.5 × 3.5-4.5 µm; Sutton, 1992) that do not become septate before germination (Sherriff *et al*., 1994). It has been accepted as part of the *C. orbiculare* aggregate based on both morphological and molecular evidence (Sherriff *et al*., 1994; Sreenivasaprasad *et al*., 1996), and Liu *et al*. (2007) considered that there was a good argument for combining the complex into a single species. Mating types were investigated by Rodríguez-Guerra *et al.* (2005) and García-Serrano *et al*. (2008), who found that all strains investigated were heterothallic. Several studies on its population biology have been published (e.g. Balardin *et al*., 1997; Bardas *et al*., 2009b; Fabre *et al*., 1995; González *et al*., 1998; Sicard *et al*., 1997).

Colletotrichum gloeosporioides occurs commonly on legumes, and some descriptions (e.g. Mordue, 1971) appear to be composites of the two species. The name has been used frequently in the literature (see Bardas *et al*., 2009a,b; Campa *et al*., 2009; Davide and de Souza, 2009; Munda *et al*., 2009) and thus typification of *C. lindemuthianum* needs to be addressed, with conservation if necessary to preserve the wider application of the name.

Colletotrichum lineola Corda, in Sturm, Deutschlands Flora (Nürnberg) 3: 41 (1831).

Teleomorph: Unknown.

Hosts: Primarily observed on a dead stem of an unknown species in *Apiaceae*. Also reported on dead stems of *Anthriscus* sp., *Heracleum* sp. and *Allium giganteum*, on petioles of *Fragaria* sp., rotten fruit of *Prunus domestica*, as pathogenic on *Clarkia elegans*, from leaf spot of *Trillium* sp., on *Astrantia major*, *Tussilago farfara*, *Euphorbia egula*, *Lupinis polyphyllus*, and *Symplocarpus foetidus* (Damm *et al*., 2009).

Notes: This is the type species of the genus but has rarely been mentioned in recent literature. The species was not recognised by von Arx (1957) and Sutton (1980, 1992) regarded it as a synonym of *C. dematium*. The epitype however, was isolated from a plant belonging to the *Apiaceae* collected near the location of the original specimen described from Prague, Czech Republic, and the species has been confirmed to be distinct from *C. dematium* and other species with curved conidia from herbaceous hosts (Damm *et al*., 2009). *Colletotrichum lineola* had been considered as occuring on *Dactylis glomerata* and other grass species (Grove, 1937; Farr *et al*., 2009), which is doubtful, because of the separate host spectrum of *Colletotrichum* species with curved conidia on graminicolous and herbaceous hosts (Crouch *et al*., 2009a, Damm *et al*., 2009). This was recently confirmed for the anthracnose pathogen of switchgrass that was recognised as a new species, *C. navitas* (Crouch *et al*. 2010). While many disease reports might have been confused *C. lineola* with other species with curved conidia, the species was confirmed to be plurivorous having pathogenic and saprotrophic livestyles (Damm *et al*., 2009).

Colletotrichum linicola Pethybr. & Laff. Scientific Proceedings of the Royal Dublin Society, N.S. 15(no. 30): 368 (1918).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of flax (*Linum*). It has also been reported from field bindweed (*Convolvulus arvensis*) in Turkey as *C.* cf. *linicola* (Tunali *et al*., 2008) and may be a potential biocontrol agent.

Notes: Sutton (1980) listed this species under the name *C. lini* (Westerd.) Tochinai, but later (Sutton, 1992) referred to Dickson's (1956) opinion that the basionym, *Gloeosporium lini* Westerd. was probably synonymous with *Polyspora lini* Laff. And not with *Colletotrichum linicola*. The names *Gloeosporium lini* Westerd. and *Colletotrichum lini* (Westerd.) Tochinai should be treated as of uncertain application, and deleted from the synonymy of *C. linicola.* The species was described from flax (*Linum*) and appears to occur mainly on this host (http://www.ismpminet.org/Resources/common/names/flax.asp). This name has been used in the literature as a distinct species (e.g. Sreenivasaprasad *et al*., 1996; Latunde-Dada and Lucas, 2007; Liu *et al*., 2007; Diederichsen *et al*., 2008), although it is not clear whether this is a unique species from flax. Fresh collections are needed to establish if this is a distinct species by molecular data analysis and epitypification is necessary.

Colletotrichum liriopes Damm, P.F. Cannon & Crous, Fungal Diversity 39: 71 (2009).

Teleomorph: Unknown.

Hosts: Lilyturf (*Liriope muscari*).

Notes: This species was described on *Liriope muscari* from Mexico (Damm *et al*., 2009). This taxon might be identical with the cause of anthracnose of *Liriope platyphylla* in Korea (Lee 1997), but this needs to be verified.

Colletotrichum lupini (Bondar) Nirenberg, Feiler & Hagedorn, Mycologia 94: 309 (2002).

Teleomorph: Unknown.

Hosts and disease: Anthracnose lesions of lupin (*Lupinus*). The most distinctive symptom is the bending and twisting of stems.

Notes: This taxon was first introduced as *Gloeosporium lupini* by Bondar (1912) from Brazil. Nirenberg *et al*. (2002) accepted this species and formally transferred it to *Colletotrichum*. They designated a neotype with living cultures and also introduced a variety *setosum*. It is difficult to distinguish this species from other *Colletotrichum* species with cylindrical conidia, such as *C. gloeosporioides* and *C. fragariae*. This species has been recognised by RAPD banding patterns, nu-rDNA, ITS1 and ITS2 sequence data (Nirenberg *et al*., 2002; Lotter and Berger, 2005). *Colletotrichum lupini* strains form a homogeneous group supported by a high bootstrap value of 96% based on DNA sequence data. This species causes a devastating disease on lupins worldwide (Lotter and Berger, 2005) and interaction of infection between the species and host have been studied (Bonivento *et al*., 2007; Oelofse *et al*., 2009). The name has been extensively used in the recent literature (e.g. Thomas *et al*., 2008; Adhikari *et al*., 2009; Muth *et al*., 2009).

Colletotrichum malvarum (A. Braun & Casp.) Southw., Journal of Mycology 6: 116 (1891).

Teleomorph: Unknown.

Hosts and disease: Leaf spot on *Althaea, Lavatera, Malva, Sida*.

Notes: This species was originally described from *Malva* in Europe as *Steirochaete malvarum* A. Braun & Casp. and was reported to have very small conidia (8-9 × 3-4 μm). It was later reported from hollyhock and *Sida*, but with larger conidia (11-28 × 5 μm) and *Althaea* (Tosi *et al*., 2004). It has also been reported from Chinese mallow (*Malva*) in Korea (Kim *et al*., 2008). *Colletotrichum malvarum* was proposed to be a synonym of *C. orbiculare* based on conidial morphology, affinity for the *Bauhinia purpurea* agglutinin (BPA) lectin and a monoclonal antibody (UB 20), infection hyphae and analysis of rDNA sequence data (Bailey *et al*., 1996). Liu *et al*. (2007) showed the isolates from *Sida spinosa* differed from *C. orbiculare* and several other closely related species based on distinct RFLPs. The species has also been proposed for use as a biological control agent to control prickly sida (Kirkpatrick *et al*., 1982). There is obvious confusion surrounding this species which may be specific to *Malvaceae* or even to genera within this family. New collections from hosts in this family are needed to establish whether this is a known species such as *C. orbiculare*, a distinct species in its own right or even a complex of species.

Colletotrichum miscanthi J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 729 (2009).

Teleomorph: Unknown.

Host and disease: Anthracnose of *Miscanthus*.

Notes: Wilson (1914) included *Colletotrichum* strains associated with *Miscanthus* in his broad interpretation of *C. graminicola*, but Sutton limited this species to *Zea* pathogens (1980; 1992). *Colletotrichum miscanthi* was introduced in 2009 based on molecular phylogeny.

Colletotrichum musae (Berk. & M.A. Curtis) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 107 (1957).

Telemorph: *Glomerella musarum* Petch

Hosts and disease: Endophyte, anthracnose, blossom end rot, crown rot and tip rot diseases of banana (*Musa* spp.).

Notes: Von Arx (1981) included this under *C. gloeosporioides* as specific to *Musa,* while Sutton (1980, 1982) accepted this as a distinct species, which is supported by recent molecular work (L. Cai, pers. comm.). This taxon has been reported as the major causal organism of anthracnose and is also responsible for causing crown rot, blossom end rot and tip rot of banana (Nazriya *et al.*, 2007). This taxon has been found on *Musa balbisiana, M. cavendishii*, *M. paradisiaca*, and *M. sapientum* throughout the world (Sutton, 1980), and also has been found on *M. acuminata* from Jordan (Israeli and Temkin-Gorodeiski, 1977), West Indies (Chillet *et al*., 2006) and Thailand (Nuangmek *et al*., 2008). In Sri Lanka, *C. musae* causes post-harvest disease of many varieties of banana (Antony *et al.*, 2004; Nazriya *et al*., 2007). This taxon can be isolated from healthy leaves and roots of *M. acuminata* as an endophyte (Pereira *et al.*, 1999; Photita *et al*., 2001, 2005; Alvindia and Natsuaki, 2008). Recently, Mahadtanapuk *et al.* (2007) found *C. musae* was a pathogen causing anthracnose on curcuma flowers (*Curcuma alismatifolia* Gagnep.). However, identification of *C. musae* was not based on molecular data. *Colletotrichum musae* has been used frequently in the literature (e.g. Daundasekera *et al*., 2008; Da Silva *et al*., 2008; Demerutis *et al*., 2008; Niroshini Gunasinghe and Karunaratne, 2009) and appears to be a distinct species that needs to be epitypified.

Colletotrichum navitas J.A. Crouch, Mycological Research 113: 1417 (2009).

Teleomorph: Unknown.

Host and disease: Anthracnose of *Panicum virgatum*.

Notes: *Colletotrichum* pathogenic to *P. virgatum* (switchgrass) has been observed from the native range of the grass across the USA since the late 1880s. Prior to the description of *C. navitas* by Crouch *et al*. (2009c), the fungus was referred to as either *C. lineola* (before 1914; the type species for the genus) or *C. graminicola* (post-1914). Wilson (1914) included a specimen of *Colletotrichum* from switchgrass in his description of *C. graminicola*, but Sutton (1980) excluded all but isolates from *Zea* in his treatment of the species. Unlike most *Colletotrichum* species described from grass hosts, *C. navitas* is distinguished by relatively large conidia (34.2-40.5 µm long) with a distinct hockey-stick shape. *Colletotrichum navitas* is the sister taxa to *C. graminicola*, and may be uniquely diagnosed through its distinct multilocus phylogenetic signature (Crouch *et al*., 2009c).

Colletotrichum nicholsonii J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 730 (2009).

Teleomorph: Unknown.

Host and disease: Anthracnose of *Paspalum dilatatum*.

Notes: Prior to its introduction in 2009 as a morphologically cryptic phylogenetic species, *Colletotrichum* associated with *Paspalum* hosts were referred to as *C. graminicola*. Neither Wilson (1914), von Arx (1957) nor Sutton (1980, 1992) included *Paspalum* strains in their treatments of *C. graminicola*, but the name was applied because the host was a graminicolous plant (*sensu* von Arx) rather than as a result of systematic study. It is one of two cryptic species that have been described from *Paspalum* (see also *C. paspali*), and is identified through molecular phylogenetics.

Colletotrichum nymphaeae (Pass.) Aa, Netherlands Journal of Plant Pathology 84: 110 (1978).

Teleomorph: Unknown.

Host and disease: Leaf spots arranged in two lines, almost parallel to the midrib of *Nymphaea* and *Nuphar*.

Notes: This taxon was considered restricted to *Nymphaeaceae* by Aa *et al*. (1978; 1990). It causes anthracnose on water-lilies leaves in the Netherlands and other European countries (Aa *et al*., 1978). The taxonomic novelty of this species is inconclusive. Although this species is thought to be specific to *Nymphaeaceae* and morphologically different from *C. gloeosporioides.* Conidia of *C. nymphaeae* are ellipsoidal or cylindrical, straight or slightly curved, rounded at the apex, somewhat attenuated, occasionally truncate at the base, whereas conidia of *C. gloeosporioides* are straight, cylindrical, apex obtuse, tapered towards the truncate base. Aa *et al*. (1990) considered these criteria were inadequate to conclude this is a distinct species. Johnson *et al*. (1997) observed this species on *Nymphaeceae* and compared it with *C. nupharicola* using morphological and molecular (RAPD and RFLP-ITS) sequence data. Both appressoria and conidia of *C. nymphaea**e*** were wider than *C. nupharicola*. Digestion of the PCR-ITS products with four enzymes produced distinct restriction digest phenotypes, combining other characters, *C. nupharicola* was introduced as a new species. *C. nymphaea**e*** requires further work using ITS and other genes, since only 28s rDNA sequences from only one strain are available.

Colletotrichum orbiculare (Berk. & Mont.) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 112 (1957).

Teleomorph: *Glomerella lagenaria* F. Stevens

Hosts and *Disease*: Anthracnose of *Cucurbitaceae*, especially melons (*Cucumis*), watermelon (*Citrullus*) and cucumber (*Cucurbita*); see e.g. Correll *et al* (1993). Walker *et al*. (1991) showed that strains from cucurbits could infect a wide range of plants, and morphologically similar strains from *Xanthium* (cocklebur, *Asteraceae*) could infect cucurbits.

Notes: *Colletotrichum orbiculare* (also widely referred to in the older literature as *C. lagenarium*) is traditionally separated from the *C. gloeosporioides* aggregate in morphological terms by its conidia, which tend to have a smaller length/breadth ratio and which do not become septate at germination. However, the difference is not absolute and von Arx (1957) considered the species to be a divergent ('abweichend') form of *C. gloeosporioides*. Several molecular studies using ribosomal DNA (Sherriff *et al*., 1994; Bailey *et al*., 1996; Sreenivasaprasad *et al*., 1996, Johnston and Jones, 1997) have shown that *C. orbiculare* is distinct from the *C. gloeosporioides* aggregate, and belongs to its own aggregate taxon that also include *C. lindemuthianum*, *C. malvarum* and *C. trifolii*. Phylogenetic analysis using multiple genes has not yet been completed for this complex, but a preliminary study (Liu *et al*., 2007) suggested that the complex should be regarded as a single operational species with a number of host-specific subunits, and strains of *C. orbiculare* from *Xanthium* represented a separate infraspecific taxon. Studies are required using strains from a wider range of hosts and geographical origin before the systematic arrangement proposed by Liu and colleagues can be confirmed. As this name is commonly used in the literature (e.g. Asakura *et al*., 2009; Shimizu *et al*., 2009; Zhang *et al*., 2009), research on typification and designation of epitype cultures is urgently needed.

The teleomorph of *Colletotrichum orbiculare* was described from UV-irradiated cultures of the anamorph by Stevens (1931) under the name *Glomerella lagenaria*, and also superfluously by Watanabe and Tamura (1952).

Colletotrichum paspali J.A. Crouch, B.B. Clarke, J.F. White & B.I. Hillman, Mycologia 101: 730 (2009).

Teleomorph: Unknown.

Host and disease: Anthracnose of *Paspalum notatum*.

Notes: This is one of two morphologically cryptic taxa described from *Paspalum*; see *Colletotrichum nicholsonii*.

Colletotrichum phaseolorum S. Takim., Annals of the Phytopathological Society of Japan 5: 21 (1934).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of Azuki bean (*Vigna angularis* syn. *Phaseolus radiatus* var. *aurea*) and cowpea (*Vigna unguiculata* subsp. *cylindrica*, syn. *Vigna catiang* var. *sinensis*).

Notes: According to a molecular study, the taxon is distinct from other species with curved conidia (Damm *et al*., 2009). However, while strains from Azuki bean and cowpea were regarded as belonging to the same species in the original description (Takimoto 1934), they differ in DNA sequence data from each other (Damm *et al*., 2009).

Colletotrichum phormii (Henn.) D.F. Farr & Rossman, Mycological Research 110: 1403 (2006).

Teleomorph: *Glomerella phormii* (J. Schröt.) D.F. Farr & Rossman.

Hosts and disease: Causing leaf lesions in *Phormium*.

Notes: This species was revisited by Farr *et al*. (2006) who provided a detailed account of the nomenclature of this species and its synonyms following examination of the holotype. Their illustrations and the cultures used in barcoding are derived from recent collections or cultures ex Kinghorn (1936) and there is no ex-type isolate. Based on ITS and LSU data *C. phormii* is a unique species. The taxon is only known from *Phormium* species (New Zealand flax), is the slowest growing species on *Agavaceae* and is differentiated from other similar species by longer, wider conidia (Farr *et al*., 2006). All 14 *C. phormii* sequences in NCBI, are named as *Fusarium phormii*, but are clearly *C. phormii* (accession numbers DQ286134 to DQ286147, accessed 21 April 2009). An epitype should be designated.

Colletotrichum phyllachoroides (Ellis & Everh.) Arx, Verh Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 119 (1957).

Teleomorph: Unknown.

Hosts and Disease: Necrotic leaf spot of *Artemisia* species (*Asteraceae*; von Arx, 1957; Sutton, 1980), the conidiomata occupying most of the lesions. Records on tomato (*Lycopersicon*, *Solanaceae*) in BPI and on *Suaeda fruticosa* (*Chenopodiaceae*; see below) need confirmation.

Notes: This is a poorly known species that is not definitely known from culture, recognized by its distinctive black conidiomata and its rather large, wide, falcate conidia. The only definitively identified collections are from California, USA.

Fisher and Petrini (1987) reported *Colletotrichum phyllachoroides* as a semi-dominant endophyte in leaves of *Suaeda fruticosa* from Dorset, UK. The cultures were presumably identified using morphological features, but apparently none was preserved in either living or dried condition, so the identification must be regarded as tentative. This taxon needs recollecting and DNA sequencing to establish if it is a unique species.

Colletotrichum rusci Damm, P.F. Cannon & Crous, Fungal Diversity 39: 72 (2009).

Teleomorph: Unknown.

Hosts: *Ruscus.*

Notes: This species was described on *Ruscus* from Italy (Damm *et al*., 2009). The biology and life cycle of this fungus is still unknown.

Colletotrichum sansevieriae M. Nakamura & M. Ohzono, Journal of General Plant Pathology 72: 253 (2006).

Host and disease: Causing water-soaked lesions on leaves of *Sansevieria*.

Notes: This species cannot be distinguished from *C. boninense*, *C. gloeosporioides*, and other *Colletotrichum* species with broad and cylindrical conidia, as their conidia sizes and shape overlap. This species shows high specificity to *Sansevieria* (*Agavaceae*) causing leaf anthracnose; pathogenicity testing showed that it does not cause disease on selected plant species belonging to 11 families (Nakamura *et al*., 2006). It can also be distinguished from other similar species based on ITS sequences.

Colletotrichum siamense Prihastuti, L. Cai & K.D. Hyde, Fungal Diversity 39: 98 (2009).

Teleomorph: Unknown.

Hosts and disease: Endophyte, epiphyte and pathogen isolated from coffee berries (*Coffea* sp.).

Notes: This taxon comprises epiphytes, endophytes and pathogens from coffee and was described based on morphology and multigene sequence data. It resembles *C. acutatum* in cultural characters and conidial shape, however *C. siamense* conidia are fusiform with obtuse slightly rounded ends versus fusiform in *C. acutatum* (Prihastuti *et al*., 2009). Subsequent collections in Thailand have shown this species to have a narrow host range (L. Cai, pers. comm.).

Colletotrichum simmondsii R.G. Shivas & Y.P. Tan, Fungal Diversity 39:119 (2009)

Teleomorph: Unknown.

Hosts and disease: Endophyte in *Actinidia chinensis*, fruit rot of *Capsicum frutescens*, *Carica papaya*, *Cyphomandra*, *Fragaria x ananassa*, *Litchi chinensis*, *Lycopersicon esculentum*, *Mangifera indica*, *Nephelium lappaceum*, *Persea americana*, *Vaccinium corym-bosum*.

Notes: Morphologically similar to *Colletotrichum acutatum* Simmonds but differs culturally by having colonies on PDA that are grey cottony and in reverse pale grey to pale orange sometimes with dark flecking, as well as by its ITS and β-tubulin sequences. *Colletotrichum simmondsii* accommodates *C. acutatum* group D according to Lardner *et al*. (1999) or *C. acutatum* group A2 according to Sreenivasaprasad and Talhinhas (2005).

Colletotrichum spaethianum (Allesch.) Damm, P.F. Cannon & Crous, Fungal Diversity 39: 74 (2009).

Teleomorph: Unknown.

Hosts: *Hosta sieboldiana*, *Lilium* sp., *Hemerocallis* sp.

Notes: Originally described on *Funkia univittata* (= *Hosta sieboldiana*) in Germany, this taxon was combined in the genus *Colletotrichum*, epitypified and confirmed as a discrete species. The taxon is closely related or identical with the causal agents of anthracnose of Japanese radish (*Raphanus sativus* var. *hortensis*) and narukoyuri (*Polygonatum falcatum*) (Damm *et al*., 2009) that were recently reported from Japan (Sato *et al.*, 2005; Tomioka *et al.,* 2008). However, further molecular studies are necessary to confirm the identity of these pathogens and to study the possible synonymy of the taxon with *C. liliacearum*.

Colletotrichum spinaciae Ellis & Halst., Journal of Mycology 6: 34 (1890).

Teleomorph: Unknown.

Hosts and disease: Leaf spots and anthracnose of spinach (*Spinacea oleracea*). Also reported on white goosefoot (*Chenopodium album)*, purslane (*Portulaca oleracea*) and alfalfa (*Medicago sativa*) (Damm *et al*., 2009).

Notes: Regarded as *C. dematium* forma *spinaciae* by von Arx (1957), but confirmed as a discrete species in a molecular study (Damm *et al*., 2009). According to von Arx (1957), the species develops only weak symptoms on hosts other than spinach.

Colletotrichum sublineola Henn. ex Sacc. & Trotter, [‘as *sublineolum*’] Sylloge Fungorum 22: 1206 (1913).

Teleomorph: Currently undescribed; but see notes below.

Hosts and disease: Anthracnose of *Sorghum bicolor*, *S. halepense*, *Eremochloa ophiuroides*.

Notes: Von Arx (1957) considered this taxon, along with *C. falcatum* and *C. caudatum*, as synonyms of *C. graminicola*, but Sutton (1980) re-established these species as distinct taxa based on appressorial characters. Molecular fingerprinting and phylogenetic analysis supports *C. sublineola* as a distinct taxon (for review, see Crouch *et al*., 2006), and an epitype strain has been established (S3001). Due to the taxonomic changes associated with this and other graminicolous *Colletotrichum*, the host range of *C. sublineola* is poorly defined, with only *Sorghum bicolor*, *S. halepense*, and *Eremochloa ophiuroides* (centipedegrass) confirmed as hosts through molecular analysis (Crouch, unpubl. data). Historical observations of *C. sublineola* from other host plants based upon morphology may be erroneous, as the fungus is morphologically indistinguishable from several other graminicolous *Colletotrichum* species (Crouch *et al*., 2009a). The teleomorph of this fungus has been identified (Vaillancourt and Hanau, 1992), but not yet formally described or named.

Colletotrichum tofieldiae (Pat.) Damm, P.F. Cannon & Crous, Fungal Diversity 39: 77 (2009).

Teleomorph: Unknown.

Hosts: *Tofieldia calyculata,* lupin (*Lupinus polyphyllus*), *Dianthus* sp.

Notes: This species, originally described on *Tofieldia* sp. from Sichuan, was combined in the genus *Colletotrichum* and confirmed as a discrete species (Damm *et al*., 2009). The taxon is closely related or identical with the causal agent of anthracnose of statice (*Goniolimon tataricum*) (Damm *et al*., 2009) that was recently reported from Bulgaria (Bobev *et al.,* 2009). However, further molecular studies are necessary to confirm the identity of this pathogen.

Colletotrichum trichellum (Fr.) Duke, Transactions of the British Mycological Society 13: 173 (1928).

Teleomorph: Unknown.

Host and disease: leaf spots of Ivy (*Hedera* spp.).

Notes: Von Arx (1957) included this species as a facultative synonym of *C. dematium*. Sutton (1962) noted significant morphological differences between the two species with *C. trichellum* showing thinly developed acervuli, and *C. dematium* showing extensive and dark-walled acervuli. The conidia of *C. trichellum* were found to be less falcate and tapered abruptly at each end as opposed to those of *C. dematium* which are strongly falcate with long acute apices. The most marked morphological difference between the two species is the appearance of the appressoria. Those of *C. trichellum* are relatively darker with irregular, crenate edges while those of *C. dematium* are cinnamon buff and rarely develop complex edges (Sutton, 1962). Based on these observations, Sutton (1962) regarded them as separate species and von Arx (1981) also accepted *C. trichellum* as a distinct taxon, which was confirmed in a molecular study (Damm *et al*., 2009).

The taxon causes leaf spots on species of *Hedera* (ivy) worldwide, especially *H. helix*. Additional species of *Colletotrichu*m have also been observed from ivy, including *C. dematium* (Sutton, 1962) and a new collection of an unnamed *Colletotrichum* species from ivy plants in Thailand (Hyde, unpubl. data). The *Colletotrichum* species occurring on ivy as well as the identity of *C. trichellum* require further research.

The type specimen for *C. trichellum* is old (pre-1817) and in poor condition; thus there is a need of epitypification. Since it is unlikely that DNA can be extracted from the type, an epitype from a living culture originating from the UK has been identified (Crouch and Hyde, unpubl. data).

Colletotrichum trifolii Bain, Journal of Mycology 12: 193 (1906).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of flower heads and petioles and rarely leaves of *Medicago* (alfalfa), *Trifolium* (red clover).

Notes: This species was described from Tennessee and West Virginia in 1906 causing devastating disease of red clover (Bain and Essary, 1906). The conidia were reported as 11-13 × 3-4 μm and straight with rounded ends as in the present day "*acutatum*" type. The protein and gene levels of this species and signalling pathways during infection as well as genes for host resistance have been recently studied (Warwar and Dickman, 1996; Yang and Dickman, 1999; Chen and Dickman, 2004; Armour *et al*., 2008; Yang *et al*., 2009). *C. trifolii* was erected more than a hundred years ago and its status cannot clearly be determined; thus there is a need for epitypification.

Colletotrichum truncatum (Schwein.) Andrus & W.D. Moore, Phytopathology 25: 122 (1935).

Teleomorph: Unknown. The teleomorph of the anthracnose pathogen of lentil named as *Glomerella truncata* C.L. Armstr. & Banniza is not related to *C. truncatum*, but to the *C. destructivum* aggregate (Latunde-Dada and Lucas 2007, Damm *et al*., 2009).

Hosts and disease: Anthracnose on legume crops such as bean (*Phaseolus lunatus, P. vulgaris*), soybean (*Glycine max*), peanut (*Arachis hypogea*), and lucerne (*Medicago sativa*), anthracnose of chilli pepper (*Capsicum annuum, C. frutescens*), peppers (*Capsicum anuum*), and several other hosts in a wide range of plant families (Pring *et al*., 1995; Shenoy *et al*., 2007; Damm *et al.,* 2009; Farr *et al*., 2009),

of which many need to be confirmed. Associated with symptoms of leaf tip die-back, foliar blight, leaf spot, leaf lesions and boll rot of various plants (Shenoy *et al*., 2007). The taxon was also identified from a corneal ulcer of human eye (Damm *et al*., 2009).

Notes: The taxon, originally described on *Phaseolus lunatus*, was epitypified and recognised as distinct (Damm *et al*., 2009). The major pathogen of the anthracnose disease complex of chilli pepper, known as *C. capsici* The causal organism of lentil anthracnose referred to *C. truncatum* by Ford *et al*. (2004) does not belong to this species. Latunde-Dada and Lucas (2007) showed that *C. truncatum* isolates from lentil, peas and cowpeas had similar phylogeny based on ITS sequences to *C. destructivum* isolated from faba beans and lucerne, and *C. linicola* isolates from flax. Further research is required to clarify the identity of these anthracnose pathogens. The species has a great deal of intraspecific variability and a wide host range (Damm *et al*., 2009).

Colletotrichum verruculosum Damm, P.F. Cannon & Crous, Fungal Diversity 39: 81 (2009).

Teleomorph: Unknown.

Hosts: *Crotalaria juncea*.

Notes: This species was described on *Crotalaria juncea* from Zimbabwe (Damm *et al*., 2009). The biology and life cycle of this fungus is still unknown.

Colletotrichum xanthorrhoeae R.G. Shivas, Bathgate & Podger, Mycological Research 102: 280 (1998).

Teleomorph: Unknown.

Hosts and disease: Leaf spots of *Xanthorrhoea*.

Notes: The pathogenicity of this species was demonstrated on young leaves of seedling plants (Shivas *et al*., 1998). Cannon *et al*. (2008) considered this species a segregate within the *C. gloeosporioides* aggregate that remained to be further characterized using molecular techniques (Table 1).

Colletotrichum yunnanense Xiao Ying Liu & W.P. Wu, Mycotaxon 100: 139 (2007).

Teleomorph: Unknown.

Host: *Buxus* sp.

Notes: This recently reported species is only known as an endophyte from *Buxus* sp. Since other known endophytic species, such as *C. acutatum, C. asianum, C. boninense, C. fructicola, C. gloeosporioides* and *C. siamense* are also well known plant pathogens (Lu *et al*., 2004; Prihastuti *et al*., 2009), it is highly likely that *C. yunnanense* has other life styles. The biology and life cycle of this fungus needs further investigation. Phylogenetically and morphologically this fungus is most closely related to *C. dracaenophilum*, but it produces smaller conidia and has a faster growth rate in culture.

Recently used doubtful species

Colletotrichum aquatile R. Sprague [as '*aquatilis*'], Mycologia 49: 838 (1958) [1957].

Hosts: *Catabrosa*, *Puccinellia*.

Notes: Based upon the host range (cool-season grasses) and morphology, this taxon is likely to be *C. cereale*. This species was not accepted by Sutton (1980, 1992). Fresh collections are required before this taxon can be established as distinct from *C. cereale*.

Colletotrichum araliae Kamal & R.P. Singh, Indian Phytopathology 33: 594 (1981) [1980].

Hosts: *Aralia*.

Notes: This taxon is the second species described from *Aralia*, and is poorly justified. The conidia are falcate and fresh collections are needed to establish whether it is a distinct species.

Colletotrichum artocarpi Delacr. ex Sacc. & D. Sacc., Sylloge Fungorum 18: 466 (1906).

Teleomorph: *Glomerella artocarpi* Delacr.

Host and disease: Leaf spots of *Artocarpus* spp. (jackfruit).

Notes: This name was recently used for a fungus causing leaf spots of *Artocarpus heterophyllus* Lam. in Thailand (Sanyong and Amarakul, 2001). Dieback of the same host was also reported to be caused by *C. gloeosporioides*. It is also reported as a pathogen in Hawaii (http://www.extento. hawaii.edu/Kbase /Crop/Type/col_prim.htm), Guam (http://www. prevalentfungi.org/subject. cfm?id=56164) and

French Polynesia (http://www.agriculture.gov.pf/UserFiles/organismes%20nuisibles%20PF.pdf). Otherwise the name has been little used. The taxon needs re-evaluation following fresh collection, morphological examination and sequence data analysis.

Colletotrichum atramentarium (Berk. & Broome) Taubenh., Memoirs of the New York Botanical Garden 6: 549 (1916).

Hosts and disease: reported to cause anthracnose of several solanaceous hosts (Farr *et al*., 2009).

Notes: This species is listed as a synonym of *C. coccodes* in *Index Fungorum*. The name has been used occasionally in some recent non-taxonomic publications (e.g. Miyazawa *et al*., 2000; Carpinella *et al*., 2003), but does not appear to represent a distinct species.

"Colletotrichum bromeliacearum" Birge, USDA Bureau of Plant Industry Bulletin 226: 14 (1912), nom. nud.

Hosts: *Billbergia, Tillandsia recurvata*.

Disease: Anthracnose on stems.

Notes: This name is used in Farr *et al*. (1989), but is not listed in *Index Fungorum*. It needs to be established whether the *Colletotrichum* species on *Bromeliaceae* are distinct species.

Colletotrichum capsici (Syd.) E.J. Butler & Bisby, The Fungi of India, Imperial Council of Agricultural Research Scientific Monograph 1: 152 (1931).

Teleomorph: Unknown.

Hosts and disease: Anthracnose of chilli pepper (*Capsicum annuum, C. frutescens*) and has been reported to have a wide putative host range (121 genera in 45 plant families, Shenoy *et al*., 2007). The taxon has been reported to cause anthracnose on cotton, peppers, tomatoes and a wide range of legume species (Pring *et al*., 1995). It has also been reported to infect and survive in weed and flower hosts such as hibiscus and chrysanthemum (Roberts *et al*., 2001) and associated with symptoms of leaf tip die-back, foliar blight, leaf spot, leaf lesions and boll rot of various plants (Shenoy *et al*., 2007).

Notes: Because of its importance as a plant pathogen *C. capsici* has been well-studied and epitypification by Shenoy *et al*. (2007) established a connection between the original morphological species concept and DNA-sequence based assessments. Subsequent research on multi-locus phylogenies and morphology of the curved spore *Colletotrichum* species, which includes *C. capsici*, synonymised this taxon with *C. truncatum* (Damm *et al*., 2009), along with *C. curvatum*. Not all researchers are, however, in agreement with the synonomy proposed by Damm *et al*. (2009).

Colletotrichum caricae F. Stevens & G.J. Hall, Zeitschrift für Pflanzenkrankheiten 19: 68 (1909).

Host: *Ficus carica*.

This species was listed in Sutton (1992) although there is no modern description. Von Arx (1957) had reduced it to synonymy with *C. gloeosporioides* but later (von Arx, 1981) accepted it as a species specific to *Ficus* (as *Carica*). This species therefore needs to be recollected from *Ficus* and sequenced to establish whether it is distinct.

Colletotrichum corchori Pavgi & U.P. Singh, Mycopathologia et Mycologia Applicata 27: 84 (1965).

Teleomorph: Unknown.

Hosts and disease: Anthracnose spots on leaves of *Corchorus* (jute).

Notes: This taxon has been introduced twice from jute plants, firstly for a species of *Colletotrichum* occurring on *Corchorus capsularis* in Japan (Ikata and Yoshida, 1940) and then on *C. aestruans* (= *C. acutangulus*) (jute) in India (Pavgi and Singh, 1965). There have been a few subsequent studies on this species (e.g. Khan and Strange, 1975, 1976; Rahman and Junaid, 2008), one showing it comprises at least six races (Choudhury and Ahmed, 1969). Sutton (1980) accepted this as a distinct species and its current name is listed as *C. corchori* Pavgi & U.P. Singh in *Index Fungorum*. In a multigene analysis, a strain from *Corchorus capsularis* from Bangladesh, originally identified as *C. corchori*, proved to be *C. truncatum* (Damm *et al*., 2009). The collection from *Zea* in Brazil (Mendes *et al*., 1998) is doubtful. Fresh collections of this species are needed to establish whether this is a distinct species.

Colletotrichum curvatum Briant & E.B. Martyn, Tropical Agriculture 6: 258 (1929).

Host: *Crotalaria*.

Notes: There is no modern description for this taxon and Sutton (1992) and von Arx (1957) considered it a synonym of *C. dematium*. However, Damm *et al.* (2009) showed the taxon to be a synonym of *C. truncatum*.

Colletotrichum fusarioides (Ellis & Kellerm.) O'Gara, Mycologia 16: 169 (1924).

Teleomorph: *Glomerella fusarioides* Edgerton

Host: *Asclepias*.

Notes: This species was mentioned in Sutton (1992) but has been little used otherwise since its introduction.

Colletotrichum gnaphalii Syd., Annales Mycologici 37: 419 (1939).

Host: *Gnaphalium*.

Notes: This species has rarely been mentioned other than in Sutton (1992). It has small conidia (8-15 × 4-6 μm) and very little is known about it. Fresh collections are needed.

Colletotrichum helichrysi (G. Winter) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 92 (1957).

Host: *Helichrysum*.

Notes: This species was accepted by von Arx (1957), excluded in Sutton (1980), but discussed in Sutton (1992). Very little is known about this species and it must be considered doubtful until fresh collections are made.

Colletotrichum liliacearum Ferraris, Malpighia 16: 35 (1902).

Hosts: *Hemerocallis* (daylily).

Notes: Sutton (1992) considered *C. lilii* Plakidas ex Boerema & Hamers (from *Lilium longiflorum*) a synonym of *C. liliacearum*. It was suggested by Sobers and Plakidas (1962) that *C. liliacearum* should be used for non-pathogenic forms and *C. lilii* for pathogenic forms. These taxa require fresh collections for further work. Damm *et al.* (2009) found two distinct species occuring on *Lilium*, *C. lilii* and *C. spaethianum*. More collections from *Hemerocallis* and *Lilium* are needed to establish whether this taxon is a distinct species or a synonym of *C. spaethianum*.

Colletotrichum neriicola Hüseyın & Selçuk [as '*neriicolum*'], Lidia 5: 149 (2001)

Host and disease: On leaves of cultivated *Nerium oleander*.

Notes: This species has not been mentioned since it was introduced. Fresh collections and isolates are needed to establish if it is a distinct species.

Colletotrichum nigrum Ellis & Halst., Bulletin of the Torrey Botanical Club 18:15 (1891).

Host: *Capsicum annuum*.

Notes: This species has been placed in synonymy with *C. gloeosporioides* (von Arx, 1957) and later maintained as a species restricted to *Capsicum* (von Arx, 1981). The name has rarely been used and should be considered doubtful.

Colletotrichum nupharicola D.A. Johnson, Carris & J.D. Rogers, Mycological Research 101: 647 (1997).

Hosts: *Nuphar, Nymphaea*.

Notes: This species falls into *C. gloeosporioides sensu lato* based on ITS and GPDH sequences (Weir, unpubl. data) and may not represent a unique species. Cultures are available so further analysis is needed using multigenes to establish its status.

Colletotrichum paludosum (Ellis & Galloway) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51(3): 115 (1957).

Host: *Peltandra*.

Notes: Von Arx (1957) considered this species to be close to *C. crassipes*. The name has not been used in recent literature.

Colletotrichum psoraleae (Peck) Arx, Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, tweede sect. 51: 125 (1957).

Host: *Psoralea.*

Notes: This species is mentioned in Sutton (1992) but has not been referred to in the recent literature.

Colletotrichum taiwanense Sivan. & W.H. Hsieh, Mycological Research 97: 1525 (1993). *Teleomorph*: *Glomerella septospora* Sivan. & W.H. Hsieh

Host: *Styrax formosanus*.

Notes: This is a very unusual species and is unlikely to be *Glomerella / Colletotrichum*. The *Glomerella*-like teleomorph has ascomata with a well-develop wall or even stroma, asci lack an apical ring and ascospores are 3-septate and relatively massive (60-95(-100) µm long). Asci with *Glomerella*-like ascospores were found mixed with asci containing 3-septate ascospores in the same perithecium (Sivanesan and Hsieh, 1993). The anamorphic state also has unusual conidiogeneous cells for the genus and conidia are also relatively large, 22-35(45) × 5-8 µm in 0-3-septate conidia and (50-58 × 5-8 µm) in 4-5-septate conidia. Confirmation that this is a *Glomerella* species with a *Colletotrichum* anamorph is required.

Colletotrichum typhae H.C. Greene, Transactions of the Wisconsin Academy of Science and Arts, Letters 44: 41 (1956) [1955].

Host: *Typha latifolia*

Notes: The species was mentioned in Sutton (1992) but has not otherwise been mentioned recently in the literature.

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