STUDIES ON THE GENUS *CERCOSPORA* AND ITS ALLIED GENERA IN THAILAND

タイ国産 *CERCOSPORA* 属とその関連属菌に関する研究

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ABSTRACT

The cercosporoid fungi are known as hyphomycetous and coelomycetous anamorphs of *Mycosphaerella*. Most of the taxa are known as plant pathogens causing leaf spots and are considered as the host specific. Specimens examined in this study were collected from seven provinces in Thailand from 2004 to 2008, namely Chiang Mai, Chiang Rai, Lampang, Lamphun, Payao, Phetchabun, and Uttradit province, respectively. Morphological examination and identification of species were based on the recent concepts in cercosporoid fungi anamorph.

In this study, 154 species of the cercosporoid fungi have been found associated with 148 genera of 62 plant families. The fungi consist of one *Asperisporium*, 73 *Cercospora*, one *Distocercospora*, 19 *Passalora*, and 60 *Pseudocercospora* species. Of them, nine novel species have been validly published. Sixty-six species are newly recorded to the mycoflora of Thailand, and 52 plants species are newly added as host of this group of fungi. The new species described in this study are listed below:

Genus *Cercospora*

C. arecacearum Hidayat & Meeboon, *C. neobougainvilleae* Meeboon, Hidayat, & C. Nakash., *C. habenariicola* Meeboon, Hidayat, & C. Nakash.

Genus *Passalora*

P. barleriigena Meeboon & Hidayat, *P. gmeliniicola* C. Nakash. & Meeboon, *P. sidae-mysorensis* Meeboon & Hidayat, *P. myricae* Meeboon, Hidayat and C. Nakash., *P. haldinae* C. Nakash. & Meeboon.

Genus *Pseudocercospora*

P. holmskioldiae C. Nakash. & Meeboon.

The investigation in Thailand reveals the existence of a large number of unknown species of the genus *Cercospora* and *Pseudocercospora*. Diversity of *Cercospora* and *Pseudocercospora* species in Thailand is higher than other countries in Indochinese region. In addition, species composition of these genera in this region is quite similar to that of Malesian region.

CHAPTER 1
INTRODUCTION

1.1. Research rationale

Cercospora Fresen. *sensu lato* (*s. lat.*) or cercosporoid fungi are the most important group of fungi in agricultural field. The fungi are destructive plant pathogens and major agent of crop losses throughout the world. This group is nearly universally observed on the major families of dicotyledonous and monocotyledonous plants, some gymnosperms and ferns (Pollack, 1987). The cercosporoid fungi are commonly associated with leaf spots, but can also cause necrotic lesions on flowers, fruits, bracts, seeds and pedicels of numerous hosts in most climatic regions (Agrios, 2005). Whereas these are important pathogens of major agricultural crops such as cereals, vegetables, ornamentals, forest trees, grasses, etc., the cercosporoid fungi are also known to be hyperparasites to other plant pathogenic fungi (Shin and Kim, 2001), and are employed as biocontrol agents of alien weeds (Morris and Crous, 1994; Pereira and Barreto, 2006).

In Thailand, some species of the cercosporoid fungi have been surveyed and reported. Sontirat et al. (1980) enumerated 22 species of *Cercospora*; Giatgong (1980) listed 47 identified and 13 unidentified species of the genus *Cercospora* in *The Host Index of Plant Diseases in Thailand*; and, Petcharat and Kanjanamaneesathian (1989) reported 49 species from various hosts. However, these reports were mainly based on the generic concepts introduced by Chupp (1954). Some additional reports of the cercosporoid fungi in Thailand were also published by Ellis (1976), Manoch et al. (1986), Pons and Sutton (1988), Barreto and Evans (1994), Crous (1998), Crous and Braun (2003), Braun et al. (2006) and Hunter et al. (2006).

However, the informations of the cercosporoid fungi in Thailand are scattered and quite limited beside the diversity of plants. Moreover those applicable generic and/or species concept are mingled archaic and current criteria. The studies on the diversity of plant pathogenic fungi are recognized as the importance. Therefore, the survey on the diversity of this group of fungi and those distributions in Thailand should be carried out to provide a comprehensive database base on the current generic and/or species.

1.2. Overview of cercosporoid genera treated in this study

The generic overviews of five genera observed in this study, which are *Asperisporium* Maubl., *Cercospora* Fr., *Distocercospora* N. Pons and B. Sutton, *Passalora* Fr., and *Pseudocercospora* Speg., are described below.

A. ***Asperisporium*** **Maubl.**, Bull. Soc. Mycol. Fr. 29: 357, 1913.

Sporodochia punctiform, pulvinate, brown, olivaceous brown or black. *Mycelium* immersed. Stromata usually well-developed, erumpent. Setae and hyphopodia absent. Conidiophores macronematous, mononematous, closely packed together forming sporodochia, usually rather short, unbranched or occasionally branched, straight or flexuous, hyaline to olivaceous brown, smooth. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical or clavate, cicatrized; scars prominent. Conidia solitary, dry, acropleurogenous, ellipsoidal, fusiform, obovoid, pyriform, clavate or obclavate, hyaline to brown or olivaceous brown, smooth or verrucose, with 0-3 transverse and sometimes 1 or more longitudinal or oblique septa.

The genus *Asperisporium* was introduced by Maublanc (1913), with *Asperisporium caricae* (Speg.) Maubl. as a type species. This genus was considered as an anamorph of *Sphaerella caricae* Maubl. (= *Mycosphaerella caricae* Syd. and P. Syd.), but has never been proven those relationship. Recently, 21 species has been recorded worldwide (Index Fungorum: http://www.indexfun gorum.org/Names /Names.asp). Morphologically, the genus *Asperisporium* is distinct from *Passalora* in having slightly geniculate conidiogenous cells, more or less terminal and lateral, flat, and little protruding scars and verrucose conidia (Ellis, 1971, 1976; Crous and Braun, 2003). However, the delimitation between the two genera based on these morphological characteristics seems to be doubtful (Crous and Braun, 2003). Therefore, the *Asperisporium* and *Passalora* are tentatively maintained as separate genera since molecular analysis has not been attempted to clarify the morphological elucidation between the two closely related genera (Crous et al., 2007a).

B. ***Cercospora*** **Fresen.**, Beitr. Mykol. 3: 91, 1863

Mycelium internal, rarely also external; hyphae colourless or almost so to pigmented, branched, septate, smooth to faintly rough-walled. Stromata lacking to well-developed, subhyaline to usually pigmented, substomatal to intraepidermal. Conidiophores mononematous, macronematous, solitary to fasciculate, arising from internal hyphae or stromata, emerging through stomata or erumpent, very rarely arising from superficial hyphae, erect, continuous to pluriseptate, subhyaline to pigmented, smooth to faintly rough-walled, thin to moderately thick-walled; conidiogenous cells integrated, terminal or intercalary or conidiophores reduced to conidiogenous cells, monoblastic, determinate to usually polyblastic, sympodial, rarely with a few enteroblastically percurrent proliferations which are not connected with conidiogenesis; conidiogenous loci (scars) conspicuous, thickened and darkened, planate. Conidia solitary, very

rarely catenate, scolecosporous, obclavate, cylindrical-filiform, acicular, hyaline or subhyaline (with a pale greenish tinge), mostly pluriseptate, euseptate, rarely with 0－1 or few septa, smooth or almost so, hila thickened and darkened, planate.

The genus *Cercospora*, established by Fresenius (1863), is one of the largest genera of Hyphomycetes (Crous and Braun, 2003). The type species is *C. penicillata* (Ces.) Fresen. The name *Cercospora*, which is derived from the combination of the Greek "*kerkok*" (tail) and "sporos" (seed), designates the filiform conidia of the fungus. The genus has been linked to the teleomorphic genus *Mycosphaerella* Johanson (Dothideomycetes, Capnodiales, Mycosphaerellaceae) that has been associated with at least 30 different Coelomycetes or Hyphomycetes anamorph genera (Crous and Braun, 2003; Crous et al., 2007b; Crous, 2009).

Saccardo considered *C. ferruginea* Fuckel which has pigmented conidia is a typical of *Cercospora* not with standing the type species which has hyaline conidia. Since then, two heterogeneous morphological characteristics are included within a genus, i.e., those species of the genus *Cercospora* have colored or hyaline conidia.

Spegazzini (1910) split the genus *Cercospora* and the genus *Cercosporina* Speg. for cercosporoid hyphomycetes with hyaline conidia. Saccardo (1913) accepted the genus *Cercosporina*, and transferred 89 species from *Cercospora* (including some species with colored conidia as well as with hyaline ones) to *Cercosporina.* Miura (1928) transferred *C. apii* to *Cercosporina*, and, proposed the genus *Cercosporiopsis* Miura to accommodate the *Cercospora*-like species with colored cylindric conidia but, this genus is superfluous and illegitimate name. Solheim (1930) proposed 21 sections of *Cercospora* considering the presence or absence of external mycelium, and prominent stromata, branching of conidiophores, as well as the shapes of conidia Later, Solheim and Stevens (1931) reconsidered their reclassification of *Cercospora* with the character of conidial scars, and divided the genus into 38 sections. And also they proposed the genus *Ragnhildiana* Solheim for the intermediate species between *Cladosporium* Link and *Cercospora.*

Chupp (1954), in the monograph of the genus *Cercospora* describe all *Cercospora* species published until 1954, made no attempt to subdivide the genus *Cercospora.* His generic concept was extensively accepted among the investigators at that time.

Deighton (1967, 1971, 1973, 1974, 1976, 1979, 1983, 1987) stressed the characteristic of the conidial scars is an important character in a series of the studies of the *Cercospora* and allied genera. And also, he redefined several genera of the cercosporoid fungi, and, newly proposed. From those results, cercosporoid genera were fallen into two distinct taxonomic categories, one was the genera of which the conidial scars were conspicuously thickened (appearing as black

rims observing under the light microscope) and the other is genera of which the conidial scars were unthickened. The hilum at the base of a conidium, which is thickened or unthickened, correspond to the scars left on the conidiogenous cell.

The character of conidial scars as an unambiguous taxonomic criterion stressed by Deighton have been adopted by investigators. The regional monograph based on this criterion have been published such as Pons and Sutton (1988), Braun (1988a, 1988b, 1989, 1990), Braun and Melnik (1997) from Circumboreal region; Guo (2001a, b; 2002a, b, c), Guo and Hsieh (1995), Guo and Jiang (2000a, b, c), Guo and Xu (2002a, b) in China; Shin and Kim (2001) from Korea; Goh and Hsieh (1987a, b, c), Hsieh and Goh (1990) from Taiwan; and Katsuki (1965), Katsuki and Kobayashi (1975), Kobayashi et al. (1998), Nakashima et al. (1999, 2002, 2004, 2006) from Japan; Thirumalachar and Misra (1953), Thirumalachar and Govindu (1953, 1956), Govindu and Thirumalachar (1955), Chona et al. (1959), Munjal et al. (1959), Vasudeva (1963), Bagyanarayana and Braun (1999), and Bhartiya et al. (2000) from India; Sontirat et al. (1980), Kanjanamaneesathian (1989), Nakashima et al. (2007), Meeboon et al. (2007a, b, c, d, e) from Thailand; and Thaung (1976) from Myanmar; Yen (1966, 1981, 1983), Yen and Lim (1969, 1973, 1980) from Singapore and Malaysia; and Boedijn (1961) from Indonesia; (1989, 1996) McKenzie and Jackson (1986, 1990, 1996), and Pennycook (1989) from New Zealand and Cook islands. Braun (1995) revised generic concepts of cercosporoid fungi based on the various characters including ontogeny, pigmentation, and ornamentation of conidia, conidiophores, and conidiomata. Pons and Sutton (1988) proposed the genus *Distocercospora* for *Cercospora*-like Hyphomycetes with distoseptate scolecospores conidia. Moreover, Braun (1993) made *Pseudocercospora*-like species with percurrent proliferating conidiogenous cells and *Mycosphaerella* teleomorph separate from *Stigmina*, and established the new genus *Cercostigmina* U. Braun. Although Deighton (1967) divided *Passalora* and *Cercosporidium* on the basis of the presence or absence of a substomatal stroma. Braun (1995a) concluded that these genera must be treated as one genus from results of the observation of the type specimen of *Passalora*. And also, the degree of the development of stroma-like hyphal aggregate in the substomatal cavities should not be used for generic differentiations among the *Cercospora* and its allied genera.

Crous and Braun (2003) re-examined and represented a compilation of more than 5,000 names that have been published or proposed in the genus *Cercospora*, and 550 names in the genus *Passalora*. Crous and Braun (2003) separated the cercosporoid genera mainly based on a combination of characters which are the structure of conidiogenous loci (scars) and conidial hila, the pigmentation of conidiophores and conidia. Based on these morphological criteria, Crous and

Braun (2003) recognized 659 species in the genus *Cercospora* including 281 species referred to *C. apii s. lat.*

C. *Distocercospora* N. Pons and B. Sutton, Mycol. Pap. 160: 60, 1988.

Mycelium internal. Stromata lacking or small. Conidiophores in small to moderately large, loose fascicles, arising from internal hyphae or stromata, emerging through stomata, erect, straight, subcylindrical-filiform, usually distinctly geniculate-sinuous, especially in the upper half, unbranched, septate throughout, wall somewhat thickened below, thin-walled towards the apex, pale to medium dark brown, olivaceous-brown, smooth. Conidiogenous cells integrated, terminal and intercalary, proliferation sympodial, occasionally percurrent, conidiogenous loci conspicuous, somewhat thickened and darkened. Conidia solitary, obclavate, distoseptate, pale olivaceous, almost smooth to distinctly verruculose, apex obtuse or subobtuse, base short obconically truncate, hila somewhat thickened and darkened.

Genus *Distocercospora* was established by Pons and Sutton (1988) to accommodate *Cercospora*-like species with distoseptate and pigmented conidia, and slightly thickened conidial scars. The type species is *D. pachyderma* (Syd. and P. Syd.) N. Pons and B. Sutton [= *Cercospora pachyderma* Syd. and P. Syd (1914)]. Crous and Braun (2003) noted that pigmentation of conidia and slightly thickened conidial scars resemble those of *Passalora* spp., and the frequently branched conidiophores in the type species seems to be allied to the genus *Mycovellosiella* Rangel and *Phaeoramularia* Munt.-Cvetk. According to the Index Fungorum online database (http://www.indexfungorum.org/Names/Names.asp), only three species of the genus *Distocercospora* has been recorded, viz, *D. africana* Crous and U. Braun, *D. livistonae* U. Braun and C. F. Hill, and *D. pachyderma* (Syd. and P. Syd.) N. Pons and B. Sutton. Due to the limitation of available culture and the lack of molecular phylogenetic data for *Distocercospora* species, Crous et al. (2007a) have reserved judgment of its taxonomic position. However, *Distocercospora* is acceptable as a genus of cercosporoid fungi in this thesis because there is no clear cut phylogenetic result that elucidating and separating the affinities of this genus with genus *Cercospora*.

D. *Passalora* Fr., *Summa veg. Scand.* (Stockholm): 500, 1849, *emend.* U. Braun (1995a).

= *Cercosporidium* Earle, Muhlenbergia 1: 16, 1901.

= *Vellosiella* Rangel, Bolm Agric. S. Paulo, Ser A, 2: 151, 1915, homonym.

≡ *Mycovellosiella* Rangel, Arch. Jard. Bot. Rio de Janeiro 2: 71, 1917.

= *Cercodeuterospora* Curzi, Boll Staz Patol Veg Roma, Ser 2, 12: 149, 1932.

= *Ragnhildiana* Solheim, Mycologia 23: 365, 1931.

= *Berteromyces* Cif., Sydowia 8: 167, 1954.

= *Fulvia* Cif., Atti Ist Bot Univ. Lab. Critt. Pavia, Ser. 5, 10: 245-246, 1954.

≡ *Mycovellosiellai* subgenus *Fulvia* (Cif.) U. Braun, A monograph of *Cercosporella, Ramularia*, and allied genera (phytopathogenic hyphomycetes), Vol. 1: 39, 1995b.

= *Oreophylla* Cif., Sydowia 8: 259, 1954.

= *Phaeoramularia* Munt.-Cvetk., Lilloa 30: 182, 1960.

= *Tandonella* S. S. Prasad and R. A. B. Verma, Indian Phytopathol. 23: 111, 1970.

Primary mycelium internal, secondary mycelium lacking to well-developed, external, superficial; hyphae branched, septate, smooth, hyaline to pigmented. Stromata absent to well-developed, substomatal to intraepidermal, rarely deeply immersed, subglobose to applanate, subhyaline to pigmented, composed of loosely to densely aggregated swollen hyphal cells. Conidiophores solitary, loosely to densely fasciculate or in sporodochial to synnematous conidiomata, arising from internal or superficial hyphae or substomatal to intraepidermal stromata, emerging through stomata, erumpent though the cuticle or arising from creeping hyphae, terminal or as lateral branches, conidiophores macronematous, unbranched or branched, continuous to pluriseptate, subhyaline to pigmented, smooth to finely verruculose; conidiogenous cells integrated, terminal, intercalary to pleurogenous or conidiophores reduced to conidiogenous cell, conidiogenous loci conspicuous, conidiogenous cells cicatrized, scars somewhat thickened and darkened-refractive, more or less planate. Conidia solitary to catenate, in simple or branched chains, amerosporous to scolecosporous, aseptate to pluriseptate, euseptate, rarely with a few additional distosepta, pale to distinctly pigmented (if subhyaline, conidia non-scolecosporous, broad, 4-15 μm diam., and with few septa, usually 0-4), smooth to finely verruculose, hila somewhat thickened and darkened-refractive, more or less truncate.

This genus is recognized as phytopathogenic fungi that usually inhabit living hosts and also, known as occasionally hyperparasitic or saprobic (Crous and Braun 2003). The type species is *Passalora baccilligera* (Mont. and Fr.) Mont. and Fr. (1849), and, this genus is one of synanamorphs of *Mycosphaerella* (Stewart et al., 1999; Crous and Braun, 2003, Crous et al., 2007a). This genus is characterized by having pigmented conidiophores, and ellispsoid to fusiform, obclavate to subcylindric, (0−)1(−3)-septate and pigmented conidia, formed singly. The genus was emended by Deighton (1967) who also discussed the generic history in detail. As a morphologically resemblant genus *Cercosporidium* Earle is well know.

Earle (1901) introduced the genus *Cercosporidium* [type species: *Scolecotrichum? euphorbiae* Tracy and Earle = *Cercosporidium chaetomium* (Cooke) Deighton), but one year

later, Earle (1902) reduced *Cercosporidium* to synonymy with *Passalora*. Deighton (1967) re-defined *Passalora* and re-introduced the genus *Cercosporidium* but failed to give clear cut morphological differences between the two genera. According to Deighton (1967), *Passalora* was distinguished from *Cercosporidium* on account of the presence well-developed stromata of the later genus. The characteristics of stromata, however, are useful specific features within the *Cercospora* complex, but unsuitable to discriminate genera (Braun, 1995a). Moreover, Arx (1983) confirmed that conspicuous stromata are often present in *P. bacilligera* (type species), treated *Cercosporidium* in synonymy with *Passalora*. And then, this concept of *Passalora* (incl. *Cercosporidium*) has been followed by Castañeda and Braun (1989), Deighton (1990), Braun (1992, 1995a), and Crous and Braun (2003).

Braun (1995a) discussed the difference between *Passalora* and *Cercospora s. str.*, and noted that the types of conidial scars combined with characteristics of conidia (shape, size, and color) warrant the clear separation of *Cercospora* and *Passalora*. Braun (1995a) emphasised that *Cercospora s. str.* are conspicuously thickened and darkened scars the size of which is variable and depends on the width of conidial hila (broad, dark, and very conspicuous, but fairly minute in some species with very narrow conidia). On the other hand, the scars of *Passalora* are conspicuous unthickened to slightly thickened. Braun (1995a) also noted the distinct characters of the conidia types (shape, size, color) of *Passalora* (ellipsoid-ovoid, broadly fusiform, clavate, obclavate, subcylindrical, usually fairly broad, colorless to pigmented, few septate) and *Cercospora* (*s. str.*) (long, narrow, acicular, narrowly cylindrical, filiform, hyaline or subhyaline, obscurely multiseptate, rarely 0—4-septate). On the basis of these characteristics, Braun (1995a) provided a re-description of *Passalora* emend.

Crous and Braun (2003) reduced *Phaeoramularia* to synonymy with *Passalora* that mainly differs from *Phaeoramularia* by forming solitary conidia. Furthermore, they emphasized that among cercosporoid hyphomycetes the mode of conidial formation, formed singly or in chain, was not tenable as distinguishing character at generic rank. For the same reason, the genus *Mycovellosiella* Rangel (1917), which has catenate conidia, superficial secondary mycelium, laterally branched conidiophores, and distinct conidial scars on the conidiogenous cells was also reduced to synomymy with *Passalora*. Besides, the present of secondary superficial mycelium had been considered as a valuable character for the separation of cercosporoid fungi. However, considering the development of superficial mycelium with solitary conidiophore is observed in several cercosporoid genera such as *Pseudocercospora*, *Cercosporella*, and *Ramularia* that it is not tenable for the separation of the cercosporoid genera (Crous and Braun, 2003). These treatments were also supported by the results of phylogenetic analyses using ITS and 5.8s rDNA,

in which *Passalora*, *Phaeoramularia*, and *Mycovellosiella* form mixed clusters (Crous et al., 2001a).

As mentioned above the genus *Passalora* including some of cercosporoid genera, and is massive taxon. Recently, Hernández-Guttiérrez and Dianese (2009) divided the genus *Passalora* into four morphological sections, viz, *Passalora*, *Phaeoramularia*, *Mycovellosiella*, and *Pseudophaeoisariopsis*. *Passalora* section *Mycovellosiella* has superficial mycelium, section *Phaeoramularia* has catenate conidia (in simple or branched chains), while section *Phaeoisariopsis* has synnematous synnemata conidiophores (Hernández-Guttiérrez and Dianese, 2009). The introduction of this formal and non-phylogenetic based division of *Passalora s. lat.* by Hernández-Guttiérrez and Dianese (2009) was purposed to simplify the taxonomy and determination of the *Passalora* complex. However, this thesis did not adopt this classification system as several characters proposed in each section are not significant with phylogenetic analysis such as superficial mycelium and catenate conidia (Crous and Braun, 2003), as well as synnematous conidiophores (Crous et al., 2006)

E. *Pseudocercospora* Speg., Anal. Mus. nac. Hist. nat. B. Aires 20: 438, 1910, *emend.* Deighton (1976). Crous and Braun (2006).

= *Phaeoisariopsis* Ferraris, Ann. Mycol.7: 280, 1909.

= *Cercosporiopsis* Miura, Flora of Manchuria and East Mongolia 3: 527, 1928 (*nom. illegit.*).

= *Cercoseptoria* Petr., Ann. Mycol. 23: 69, 1925.

= *Pantospora* Cif., Ann. Mycol. 36: 242, 1938.

= *Ancylospora* Sawada, Rep. Govt. Agric. Res. Inst. Taiwan 87: 78, 1944 (*nom. illegit.*).

= *Helicomina* L. S. Olive, Mycologia 40: 17, 1948.

= *Cercocladospora* G. P. Agarwal and S. M. Singh, Proc. Natl. Acad. Sci. India, B, 42: 439 (1972) 1974 *fide* Deighton (1976).

= *Paracercospora* Deighton, Mycol. Pap. 144: 47-48, 1979.

= *Cercostigmina* U. Braun, Cryptog. Bot. 4: 107, 1993.

= *Pseudophaeoramularia* U. Braun, Trudy Bot. Inst. Im. V. L. Komarova 20: 18, 1997.

Mycelium internal as well as external, superficial; hyphae branched, septate, hyaline to pigmented, smooth or almost so, thin-walled. Stromata lacking to well-developed, pigmented, substomatal or intraepidermal. Conidiophores solitary, arising from superficial hyphae, lateral or terminal, fasciculate, synnematous or forming distinct sporodochia, arising from internal hyphae or stromata, through stomata or erumpent, erect, minute, subcylindrical-conical to long and

filiform, aseptate to pluriseptate, subhualine to pigmented, pale olivaceous to medium dark brown, smooth to faintly rough-walled, thin-to moderately thick-walled; conidiogenous cells integrated, terminal or intercalary or conidiophores reduced to conidiogenous cells; conidiogenous loci inconspicuous, unthickened and not darkened, or loci subconspicuous, i.e., either more or less denticle-like and slightly darkened or refractive (but never thickened) or only the ultimate rim very slightly thickened and darkened-refractive (*Paracercospora* type). Conidia solitary or occasionally catenate, scolecosporous, rarely didymo- to phragmosporous, usually pluriseptate, rarely aseptate or only with few septa, euseptate, rarely with a few additional distosepta, rarely dictyosporous, usually pigmented, pale olivaceous to medium dark brown, rarely hyaline or subhyaline, thin-walled, wall rarely somewhat thickened, smooth to faintly rough-walled, hila unthickened, not darkened, occasionally somewhat refractive.

Pseudocercospora was introduced by Spegazzini (1910) with *Pseudocercospora vitis* (Lév.) Speg. as a type species. Deighton (1976) reintroduced this forgotten name and widened the concept of this genus considerably to include a wide range of cercosporoid taxa with inconspicuous scars. Deighton (1976) once distinguished *Cercoseptoria* Petr. from *Pseudocercospora* by having narrow, acicular conidia, but both genera could not be properly differentiated (Deighton, 1987; Braun, 1988b). Presently, *Cercoseptoria* is accepted as a synonym of *Pseudocercospora* (Hsieh and Goh, 1990; Crous and Braun, 1996; Braun and Melnik, 1997) which is also supported by molecular data of ITS and 5.8s rDNA sequence analysis published by Crous et al. (2000, 2001a).

Crous et al. (2001a) remarked that *Pseudocercospora* is morphologically highly variable, and accommodates a wide range a cercosporoid hyphomycetes with pigmented conidiophores and inconspicuous, unthickened, not darkened conidiogenous loci all others characters are variable and unsuitable for consideration at generic rank (Braun, 1995). Braun (1998) proposed a formal division of *Pseudocercospora* into five sections based on morphological features of conidiomata and conidia. However, he emphasized that these sections should only be regarded as morphological group (Braun, 1995). The molecular data published by Crous et al. (2000, 2001a) showed *Pseudocercospora* to be polyphyletic within *Mycosphaerella*. This genus, *Pseudocercospora*, includes species with solitary or catenulate conidia, having eu- or distosepta, and scars which are inconspicuous to denticles-like, unthickened.

Paracercospora Deighton (1979) which was introduced for cercosporoid hyphomycetes with subconspicuous conidial scars (thickened slightly along the rim) and known as the causal fungus of Sigatoka diseases on banana was also synomyzed with *Pseudocercospora* based on several molecular analyses (Stewart et al., 1999; Crous et al., 2000).

Cercostigmina U. Braun (1993) which was introduced for some *Stigmina*-like hyphomycetes are morphologically close to *Pseudocercospora* spp., but distinct by having percurrently proliferating conidiogenous cells (Braun, 1993). However the combination of sympodial and percurrent conidiogenous cells is not uncommon in *Pseudocercospora* (Crous et al, 2001). Furthermore, in molecular analysis of ITS rDNA, *Cercostigmina* species was nested on the same cluster with *Pseudocercospora* with 97% bootstrap support (Crous et al, 2001). Therefore, *Cercostigmina* was reduced to synonymy with *Pseudocercospora* (Crous et al., 2001b; Crous and Braun, 2003).

Xenostigmina Crous (1998), the type species is *X. zilleri* (A. Funk) Crous, is another genus segregated from *Stigmina*. This genus was proposed for the cercosporoid fungi consistently forming muriform conidial as well as the conidiogenous cells by percurrent, sympodial proliferation (Crous, 1998). However, Crous and Braun (2003) queried the separation of this genus, because the type of conidia and modes of proliferation observed on *Pseudocercospora*-like genera can also occur in *Pseudocercospora*. Then, Crous and Braun (2003) suggested that *Xenostigmina* should be a synonym of *Pseudocercospora*.

Pseudophaeoramularia U. Braun contained cercosporoid hyphomycetes intermediate between *Pseudocercospora* and *Phaeoramularia* was introduced by Braun and Melnik (1997). The type species of this genus, *Pseudophaeoramularia geranii* (W. B. Cook and C. G. Shaw) U. Braun, was originally placed in *Pseudocercospora* by Braun (1991). Crous et al. (2001a) concluded that this genus should be treated as the synonym of *Pseudocercospora* based on the analysis of ITS and 5.8S rDNA dataset, and emphasised that the separation of taxa with unthickened, non-pigmented scars and almost unthickened, slightly pigmented-refractive scars are not informative at the generic level. On the other hand, the other "type' of scar thickening (inconspicuous, planate, pileate, or protruding) could be more important.

Phaeoisariopsis Ferraris (1909) was established to accommodate *Isariopsis* species having pigmented conidiophores with almost unthickened and pigmented scars, and conidia. The separation of *Passalora* and *Phaeoisariopsis* is rather tenuous. Braun (1995a) accepted *Phaeoisariopsis* as the synnematous counterpart of *Passalora*. However, *Phaeoisariopsis* proved to be heterogenous genus which is composed of *Passalora*-like species with conspicuous, thickened, and darkened conidiogenous loci, and *Pseudocercospora*-like species with inconspicuous loci (Deighton 1990; Crous and Braun, 2003). Of them, most of *Passalora*-like species of this genus were already transferred to the genus *Passalora*. The formation of synnematous conidiophore was used as the feature for one of the generic delimitation in cercosporoid fungi. On the other hand, the close affinity of *Ph. griseola* and the type species of

Pseudocercospora (*P. vitis* (Lév) Speg., with synnematous conidiomata had been pointed out (Deighton, 1976). Crous et al. (2006) attempted to re-evaluate the taxonomic status of *Phaeoisariopsis griseola* by analysing virulence phenotypes, morphology and cultural characteristics as well as phylogenetic relatedness of *Phaeoisariopsis griseola* with closely related genera using DNA sequences of multiloci, and revealed that the type species of *Pseudocercospora* (*P. vitis*) located in the same clade with the type species of *Phaeoisariopsis* (*P. griseola*) and that of *Stigmina* Sacc. (*S. platani* (Fuckel) Sacc.). From the results of these experiments, the close affinity of these three genera underlines earlier suspicions of mycologists that criteria such as 1) slightly thickened conidial hila and scars, 2) synnematous to fasciculate to sporodochial conidiomata, 3) transverse to muriformly septate conidia, 4) euseptate to distoseptate conidia, 5) smooth percurrent proliferations and sympodial proliferation, versus irregular, rough percurrent proliferations on conidiogenous cells, are an insufficient basis to separate anamorph genera in *Mycosphaerella* (Crous et al. 2006). Then, *Phaeoisariopsis* was reduced to synonymy with *Pseudocercospora* (Crous et al., 2006).

Crous et al. (2001a) and Crous and Braun (2003) noted that *Denticularia* Deighton (1972) and *Semipseudocercospora* J. M. Yen (1983) with distinctly denticulate conidiogenous cells and non-scolecosporous conidia, seem to be closely allied to *Pseudocercospora*. Because some species of *Pseudocercospora* also form denticles (Crous, 1998).

1.3. Current progress in taxonomy of cercosporoid fungi including the teleomorph state, *Mycosphaerella s. lat.*

The cercosporoid fungi are mostly linked to *Mycosphaerella* Johanson as their teleomorph state (Crous and Braun, 2003). These anamorph genera have been separated by the combination of definite morphological characters such as conidiomatal structure, mycelium, conidiophore, conidiogenous cells and conidia (Crous and Braun, 2003).

Since the establishment of fungal ribosomal RNA genes amplification and direct sequencing technique by White et al. (1990), the progress in molecular phylogenetic study of Kingdom Fungi including *Cercospora* and allied genera has been accelerated rapidly. In the earliest study of molecular phylogenetic analyses for cercosporoid fungi using ITS1, 5.8s and ITS2 rDNA sequences data (Stewart et al., 1999), the distinct phylogenetic revealed the teleomorph genus *Mycosphaerella* is monophyletic with the exclusion of those species with *Cladosporium* anamorph; and beside 23 anamorph genera are linked to *Mycosphaerella* (Crous et al. 2000, 2001). That is, these genera were recognized as the true synanamorph of *Mycosphaerella*. Furthermore, morphological traits such as the presence or absence of superficial

mycelium, the formation of stromata, conidiomatal structure, conidial shape, sized and septation, as well as solitary vs. catenate conidia, saprobic, hyperparasitic and phytopathogenic habit, were rejected single characters at the generic level. Based on the results of these studies, many genera have been reduced being synonymous of other genera, e.g. *Paracercospora*, *Phaeoisariopsis*, and *Cercostigmina* were synonymyzed with *Pseudocercospora*; *Mycovellosiella* and *Phaeoramularia* were synonymyzed with *Passalora*, etc. (Crous and Braun, 2003).

The taxonomy and phylogeny of *Mycosphaerella* teleomorph, as the cercosporoid fungi, is also complicated (von Arx, 1983; Crous et al., 2000; Aptroot, 2006). According to the review of *Mycosphaerella* and its anamorphs (Crous, 2009), the first generic description for *Mycosphaerella* (1884) was that of *Sphaerella* (1882). The genus *Sphaerella* was, however, already in use for green algae, and thus all these taxa had to be placed in *Mycosphaerella* (Aptroot, 2006), which is based on *M. punctiformis* (Verkley et al., 2004). Despite the hyaline, 1-septate ascospores reported in the type by Persoon (1794), most investigators described as a *Sphaeria* or *Sphaerella* species, literally meant a 'spherical' fruiting body (Aptroot, 2006). In addition, the species criterion was unclear due to the lack of morphological features. Soon it became standard to also describe collections from different hosts as new species, which later led to many taxa being reduced to synonymy (Von Arx, 1949; Barr, 1972; Tomilin, 1979; Corlett, 1991; Aptroot, 2006); and thus the number of species of *Mycosphaerella* amount to 3,000 in the recent revision of that (Aptroot, 2006). Barr (1972) recognised two subgenera, *Eu-Mycosphaerella* and *Didymellina* (including the section *Cymadothea*), and 10 sections. The sub-genera were separated on the basis of the shape of their asci and anamorphs, and the sections based on ascospore shape, and/or parasitic or saprobic habit. Von Arx (1983) found the subdivision unsatisfactory, because the characters were inordinately divergent. In subsequent study based on the monographic revision, this separation was refined that it should be divided *Mycosphaerella s. lat.* into 7 sections (Crous et al., 2000, 2007; Aptroot, 2006; Crous, 2009).

As mentioned above, most cercosporoid genera were treated as a part of the synanamorph of the genus *Mycosphaerella* (Braun, 1995, 1998; Crous and Braun, 2003). *Mycosphaerella* was linked to 23 synanamorph genera which are composted monophyletic group respectively; and also, it was suggested that the genus was monophyletic (Stewart et al. 1999, Crous et al. 1999, 2000, 2001, Goodwin et al. 2001). Shortly afterwards, several anamorph genera including Coelomycetous fungi were introduced to accommodate *Mycosphaerella* anamorphs (Crous, 2009).

Thus, *Mycosphaerella* accommodate to several thousand species, and had more than 30 genera as synanamorph. The study of DNA phylogeny on *Mycosphaerella* and its anamorph are

still continued by Crous and his collaborators, wherein the anamorph concepts were re-evaluated. As the results, most genera were shown to represent well-defined clades within *Mycosphaerella* (Crous et al, 2000, 2001). Moreover, in multi-locus data analyses, *Mycosphaerella* was shown to be polyphyletic, and the well-defined anamorph genera were shown to have evolved in several clades (Hunter et al., 2006; Schoch et al., 2006; Crous et al., 2007; Arzaulou et al., 2007, Batzer et al, 2008). Based on these results, several genera were separated from *Mycosphaerealla*. These are *Davidiella* with *Cladosporium* anamorphs (Braun et al., 2003), *Schizothyrium* with *Zygophiala* anamorphs (Batzer et al., 2008), and *Teratosphaeria* with many anamorphs (Crous et al., 2007).

The latest studies based on the DNA sequence data derived from the LSU gene, Crous et al., (2009a,b) proposed that *Mycosphaerella s. str.* should best be limited to taxa with *Ramularia* anamorphs, with other well defined clades in the *Mycosphaerellaceae* representing *Cercospora*, *Cercosporella*, *Dothistroma*, *Lecanosticta*, *Phaeophleospora*, *Polythrincium*, *Pseudocercospora*, *Ramulispora*, *Septoria* and *Sonderhenia*. And also, a single generic name, based on priority but regardless of whether it is an anamorph or teleomorph generic name, was used for all ambiguous monophyletic lineages.

Crous (2009) redefined the genus *Mycosphaerella s. str.* as follows: *Ascomata* are submerged, separate, somewhat erumpent, small, simple, globose, black, with walls of 2–4 layers of textura angularis. *Ostioles* are central, frequently lined with periphyses. *Asci* are bitunicate, fasciculate, lacking hamathecial filaments. *Ascospores* are 1-septate, hyaline, lacking appendages and sheaths. *Anamorphs* are accommodated in *Ramularia*. Here after those concepts will be accepted by investigators.

1.4. Objectives of the study

The following two main objectives are designed in this thesis:

1. To grasp the diversity of cercosporoid fungi and their host plants in Thailand in order to provide a preliminary database and literature guide for the identification.
2. To analyse the species composition of *Cercospora* and *Pseudocercospora* in Thailand and other countries in Asia based on floristic regions in order to grasp a better understanding for the diversity and geographical distribution of the *Cercospora* and *Pseudocercospora* in Asian continent.

1.5. Outline of the thesis

This thesis is generally divided into five major chapters. In the first chapter, research rationale and objectives are described and elucidated. Especially, the current understanding of the cercosporoid fungi treated in this study including chronology and current status, are also reviewed in the first chapter. Materials and methods of this study are described in chapter 2. Enumeration and taxonomic description of species are provided and illustrated in chapter 3. In chapter 4 the diversity and composition of *Cercospora* and *Pseudocercospora* species in several floristic regions in Asia are disussed. In the final chapter, chapter 5, the general discussion and conclusions of the study are provided.

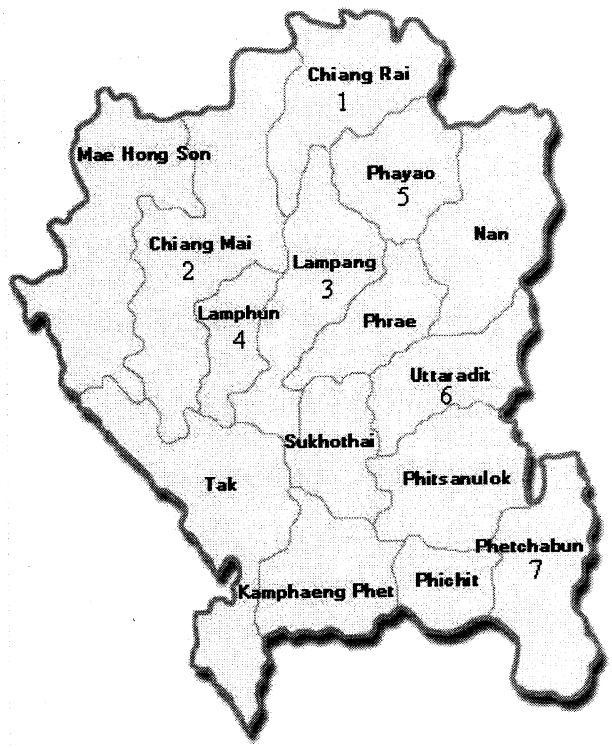
CHAPTER 2

MATERIALS AND METHODS

2.1. Collection and Examination of Specimens

The specimens examined in this thesis were generally collected from seven provinces in northern Thailand from 2004 to 2008 as follows:

1. Chiang Rai
2. Chiang Mai
3. Lampang
4. Lamphun
5. Payao
6. Uttradit
7. Phetchabun



Specimens were collected after observing symptoms of *Cercospora* and allied genera on leaves which are generally characterized by frog eye spots, stripes, shot-hole effect, discoloration, or necrosis. The specimens that showed the cercosporoid fungi symptoms were stored in the plastic bags. Collecting bags were sealed and labeled with some information including name of host plants, collecting site, collection date, and collector/s.

Specimens for microscopic observation were prepared by hand sectioning. Detailed observations of morphological characteristics were carried out by means of an Olympus BX51 (OLYMPUS®, Japan) light microscope using immersion objective and oil (1000×). Water and

Shear's solution were used as mounting media. Thirty conidia and those hila, conidiophores, conidiogenous loci, and 10 stromata were measured for each specimen. Line drawings were prepared at a magnification of 400×, and 1000× if necessary. Dried herbarium specimens have been deposited at CMU Herbarium (CMU), Biology Department, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand, and BIOTEC Herbarium (BBH), Bangkok, Thailand. Living cultures have been deposited at BIOTEC culture collection (BCC), Bangkok, Thailand, and Molecular of Plant Pathology Laboratory, Department of Entomology and Plant Pathology, Chiang Mai University, Chiang Mai, Thailand.

2.2. Single Spore Isolation

Single spore isolation of each fungus was attempted by the modification method proposed by Choi et al. (1999). A slide glass was sterilized with ethanol, and, wiped with a tissue paper. A sterilized pipette was then used in transferring 1−2 drops of sterilized water onto the glass slide. Flame sterilized fine forceps was used in picking up conidia from the specimen and suspend the conidia with sterilized water on the glass slide. Triangle line was marked on the bottom of the water agar plate. The spore suspension was then transferred, onto the surface of the water agar plate, and smeared along the drawn lines. The unsealed plate was incubated at room temperature for approximately 24 hours. The germination of conidia was checked within 24 hours. Once the conidium had germinated, a small piece of agar containing a germinated conidium was picked up with a sterilized glass needle. If the conidia do not germinate after 24 hours, the plate was sealed with PARAFILM "M"® (American National Can, Chicago, USA) and examined periodically. Approximately 10−20 germinated conidia were transferred onto two PDA plates and incubated at room temperature until the colony were grow to 1 to 2 cm indiameter. A small piece of mycelium with agar was transferred to another PDA plate and the culture was checked contamination after a few days.

2.3. Identification Procedures

Identification of species are mainly based on the protologues and publications of Chupp (1954), Deighton (1967, 1971, 1973, 1974, 1976, 1979, 1983, 1987), Ellis (1971, 1976), Pons and Sutton (1988), Braun (1988a, 1988b, 1989, 1990, 1993, 1994, 1995, 1996, 1998, 1999), Hsieh and Goh (1990), and Crous and Braun (2003). Sources are often suggested in the above references and the Dictionary of Fungi (Kirk et al., 2001), the 'searchable' data base such as "Index Fungorum" (http://www.indexfungorum.org/ Names/ Names.asp) and "Systematic Mycology and Microbiology Laboratory (SMML) USDA Fungus-Host Database" (http://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm).

2.4. Enumeration of results

The cercosporoid fungi collected in this study are provided in alphabetical order and separated according to plant families. All species are fully described. The following data are also provided:

Names of species with references

Synonym

Morphological description

Specimen examined

Habitat

Distribution with countries in alphabetical order

2.5. Data Analysis

A total number of species, number of fungi per region, and the number of fungi per country within region were recorded and calculated. A ratio of total species's number of *Cercospora* and *Pseudocercospora* in each country or region is analysed.

Similarities of the species composition of cercosporoid fungi among different regions was calculated by using Sørensen's index of similarity (QS) with values between 0 (no similarity) and 1 (absolute similarity) (Magurran, 1988).

Sorensen index of similarity= 2j/(a+b)

a = number of species presence in region a,

b = number of species presence in region b,

j = number of species presence in both regions.

(The higher of the Sørensen's index of similarity (QS) is, the more similar is the fungal communities between two regions compared).

Abbreviations and Acronyms

BBH	=	BIOTEC Herbarium (BBH), Bangkok, Thailand.
BCC	=	BIOTEC culture collection (BCC), Bangkok, Thailand,
CMU	=	Chiang Mai University Herbarium
sp.	=	species
sp. nov.	=	species nova
s. lat.	=	sensu lato
s. str.	=	sensu stricto

CHAPTER 3
TAXONOMY OF THE CERCOSPOROID FUNGI FROM THAILAND

In total, 154 species of the cercosporoid fungi associated with 62 families of plants have been examined and identified based on morphological characteristics. Sixteen specimens have only been successfully determined up to genus level. The identified taxa consist of one *Asperisporium*, 73 *Cercospora*, one *Distocercospora*, 19 *Passalora*, and 60 *Pseudocercospora* species. Nine novel species have been validly published. Of them, sixty-six species are new to Thailand, and 52 plants species are recognized as the new host of cercosporoid fungi. In addition, 35 species of genus *Cercospora* concluded as *C. apii s. lat.* all of these taxa are listed in table 3.1.

Table 3.1. List of the cercosporoid fungi recorded in this study.

Family	Fungus	Notes
Acanthaceae	*Cercospora andrographidicola*	
	Cercospora barleriicola	*C. apii s. lat.*
	Passalora barleriigena	New species
	Pseudocercospora justiciae	New record, new host
	Pseudocercospora rhinacanthi	
Adiantaceae	*Cercospora adiantigena*	New record, new host
Alangiaceae	*Pseudocercospora alangii*	New record
Amaranthaceae	*Cercospora canescens*	*C. apii s. lat.*, new host
	Cercospora celosiae	
	Cercospora ricinella	
Apocynaceae	*Cercospora peregrine*	*C. apii s. lat.*, new record, new host
	Pseudocercospora sp.	New host
	Pseudocercospora repens	New record
	Pseudocercospora plumeriae	New record, new host
Araceae	*Cercospora richardiicola*	*C. apii s. lat.*
Araliaceae	*Pseudocercospora panacis*	New record, new host
Arecaceae	*Cercospora arecacearum*	New species
	Distocercospora livistonae	New record
Aristolochiaceae	*Cercospora* sp.	New host
Asclepiadaceae	*Pseudocercospora marsdeniae*	New record, new host
Asteraceae	*Cercospora artemisiae*	New record, new host
	Cercospora bidentis	
	Cercospora chrysanthemi	*C. apii s. lat.*, new record
	Cercospora cynarae	New record

	Cercospora dahliicola	*C. apii s. lat,* new record
	Cercospora eupatorii	
	Cercospora gerberae	*C. apii s. lat.*
	Cercospora helianthicola	*C. apii s. lat.*
	Cercospora lactucae-sativae	New host
	Cercospora nilghirensis	New record
	Cercospora mikaniicola	
	Cercospora tagetis-erectae	
	Cercospora tridacis-procumbentis	*C. apii s. lat.*
	Cercospora zinniicola	New record
	Cercospora zinniae	*C. apii s. lat.,* new record, new host
	Passalora assamensis	
	Passalora tithonia	
	Pseudocercospora blumeae-balsamiferae	New record
	Pseudocercospora cosmicola	New record, new host
Balsaminaceae	*Cercospora balsaminiana*	New record, new host
	Cercospora fukushiana	*C. apii s. lat.*
Basellaceae	*Cercospora basellae-albae*	
Bignoniaceae	*Pseudocercospora jahnii*	New record
	Pseudocercospora oroxyli	
	Pseudocercospora tecomae-heterophyllae	
Brassicaceae	*Cercospora brassicicola*	New host
Buddlejaceae	*Pseudocercospora buddleiae*	
Caricaceae	*Asperisporium caricae*	
	Cercospora papayae	*C. apii s. lat.,* new record
	Cercospora sp.	
Caprifoliaceae	*Pseudocercospora* sp.	New host
Chenopodiaceae	*Cercospora beticola*	*C. apii s. lat.*
Combretaceae	*Pseudocercospara quisqualidis*	New record
Convolvulaceae	*Cercospora citrullina*	*C. apii s. lat,* new host
	Cercospora ipomoeae	*C. apii s. lat.*
	Cercospora operculinae	*C. apii s. lat.,* new record
Cucurbitaceae	*Cercospora citrullina*	*C. apii s. lat.,* new host
	Cercospora cocciniae	New record, new host
	Cercospora cucurbitacea	
Dioscoreaceae	*Passalora dioscoreae*	New record, new host
	Pseudocercospora carbonacea	
	Pseudocercospora contraria	
Dracaenaceae	*Pseudocercospora* sp.	New host

Ebenaceae	*Pseudocercospora diospyri-erianthae*	New record, new host
Elaeagnaceae	*Cercospora elaeagni*	
Elaeocarpaceae	*Pseudocercospora* sp.	New host
Euphorbiaceae	*Cercospora acalyphae*	
	Cercospora codiaei	*C. apii s. lat.*, new record, new host
	Cercospora jatrophigena	
	Cercospora phyllanthicola	*C. apii s. lat.*
Euphorbiaceae	*Cercospora ricinella*	
	Passalora atrides	
	Passalora henningsii	
	Passalora manihotis	New record
	Passalora sp.	New host
	Pseudocercospora eupatorii-formosani	New record, new host
	Pseudocercospora glochidionis	
	Pseudocercospora jatrophae	New record
	Pseudocercospora melanolepidis	
	Pseudocercospora euphorbiae-pubescentis	New record, new host
Fabaceae	*Cercospora canescens*	*C. apii s. lat.*
	Cercospora crotalariae	*C. apii s. lat.*, new record, new host
	Cercospora erythrinicola	*C. apii s. lat.*
	Cercospora kikuchii	*C. apii s. lat.*
	Cercospora leucaenae	
	Passalora aenea	
	Passalora arachidicola	
	Passalora buteae	New record, new host
	Passalora centrosematis	
	Passalora mucunicola	
	Pseudocercospora bauhiniae	
	Pseudocercospora centrosematicola	New record
	Pseudocercospora clitoriae	New record
	Pseudocercospora cruenta	New record
	Pseudocercospora dalbergiae	
	Pseudocercospora puerariae	New record
	Pseudocercospora stizolobii	
Flacourtiaceae	*Pseudocercospora dovyalidis*	New record, new host
Hamamelidaceae	*Pseudocercospora liquadambaricola*	New record
Hydrangeaceae	*Cercospora hydrangeae*	*C. apii s. lat.*

Lamiaceae	*Cercospora kabatiana*	*C. apii s. lat.*, new record, new host
	Cercospora physostegiae	New record, new host
	Cercospora volkameriae	*C. apii s. lat.*
	Passalora gmeliniicola	New species
Lomariopsidaceae	*Pseudocercospora phyllitidis*	
Lythraceae	*Cercospora* sp.	*C. apii s. lat.*, new host
	Pseudocercospora cupheae	
	Pseudocercospora lythracearum	New record
Malvaceae	*Cercospora althaeina*	New record
	Cercospora malayensis	*C. apii s. lat.*
	Passalora sidae-mysorensis	New species
	Pseudocercospora abelmoschi	
Meliaceae	*Pseudocercospora subsessilis*	
Menispermaceae	*Pseudocercospora* sp.	New host
Moraceae	*Cercospora broussonetiicola*	
	Cercospora ficina	New record
	Cercospora elasticae	*C. apii s. lat.*, new record
	Cercospora morina	*C. apii s. lat.*
	Pseudocercospora fici	
	Pseudocercospora fici-religiosae	New record
	Pseudocercospora mori	
	Pseudocercospora fici-caricae	New record
Musaceae	*Pseudocercospora musae*	
Myricaceae	*Passalora myricae*	New species
Myrtaceae	*Pseudocercospora paraguayensis*	
Nelumbonaceae	*Pseudocercospora nymphaeacea*	New record
Nyctaginaceae	*Cercospora neobougainvilleae*	New species
	Passalora bougainvilleae	
	Pseudocercospora bougainvilleae	New record
Nymphaeaceae	*Pseudocercospora nymphaeacea*	
Oleaceae	*Pseudocercospora butleri*	New record, new host
Onagraceae	*Cercospora fuchsiae*	*C. apii s. lat.*
Orchidaceae	*Cercospora habenariicola*	New species
Oxalidaceae	*Cercospora oxalidis*	New record, new host
	Pseudocercospora biophyti	New record, new host
Polypodiaceae	*Cercospora platycerii*	
	Pseudocercospora sp.	New host
Polygonaceae	*Pseudocercospora polygonigena*	New record, new host
Portulacaceae	*Cercospora talini*	*C. apii s. lat.*

Pteridaceae	*Cercospora cyclosori*	*C. apii s. lat.*, new record, new host
Rosaceae	*Cercospora scharifii*	New record, new host
	Pseudocercospora puderi	New record, new host
	Pseudocercospora prunicola	New record
Rubiaceae	*Cercospora coffeicola*	
	Passalora haldinae	New species
	Pseudocercospora gardeniae	New record
	Pseudocercospora sp.	New host
Rutaceae	*Pseudocercospora angolensis*	New record, new host
Saururaceae	*Cercospora houttuyniicola*	*C. apii s. lat.*
	Pseudocercospora houttuyniae	
Solanaceae	*Cercospora capsicigena*	*C. apii s. lat.*
	Cercospora physalidis	*C. apii s. lat.*
	Cercospora physalidis-angulatae	
	Cercospora puyana	New record, new host
	Cercospora sp.	New host
	Cercospora solanacea	New record, new host
	Passalora nattrassii	
	Passalora tarrii	New record
	Pseudocercospora daturina	New record
	Pseudocercospora egenula	New record, new host
	Pseudocercospora fuligena	
	Pseudocercospora solani-melongenicola	
Theaceae	*Pseudocercospora ocellata*	New record
Thelypteridaceae	*Cercospora* sp.	New host
Tiliaceae	*Cercospora* sp.	New host
Verbenaceae	*Cercospora* sp.	New host
	Cercospora sp.	New host
	Cercospora lantanae-indicae	
	Cercospora tectonae	*C. apii s. lat.*
	Pseudocercospora holmskioldiae	New species
	Pseudocercospora viticicola	
Zingiberaceae	*Cercospora alpiniicola*	New record, new host

Taxonomy

Family Acanthaceae

Cercospora andrographidicola S. Q. Chen & P. K. Chi, J. South China Agric. Univ. 11: 61, 1990.

Leaf spots 2−5 mm in diameter, amphigenous, subcircular to irregular, distinct on the upper surface, brown with dark margin, without definite margins on the lower surface. *Caespituli* amphigenous. *Stromata* often lacking, rudimentary to poorly developed, if present small, up to 29.5 µm in diameter, composed of a few subglobose and dark brown cells. *Conidiophores* (16) 23−60 (74) × 3−5 (6.5) µm, arranged in a loose fascicles, 1−9-septate, arising from stromata, straight or flexuous, simple, thick wall, brown to dark brown or paler towards the apex, geniculate near the apex. *Conidiogenous cells* integrated, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5−3 µm diameter, conspicuous, thickened, and darkened. *Conidia* (30.5) 49−86 (91) × (2) 2.5−3 (4) µm, obclavate to acicular, 3−15-septate, hyaline, straight to curved, truncate at the base with subacute apex, smooth, hila 1.5−2.5 µm diameter, with thickened. (Fig. 3.1)

Specimen examined: on *Andrographis paniculata* Nees, THAILAND, Uttradit Province, Sak Yai National Park, 25 November 2004, by Jamjan Meeboon (CMU 27924).

Host: *Andrographis paniculata* (Acanthaceae) (Meeboon et al., 2007c).

Distribution: China and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: This specimen is closed to *C. apii s.lat.* fide Crous and Braun (2003) due to its having small (often rudimentary) stromata, with loosely fasciculate conidiophores; and hyaline, acicular, and multiseptate (3−15-septate) conidia. Thus, further analysis is necessary to carry out in order to justify the status of this species. The first report of this species from Thailand was done by Meeboon et al. (2007c). *Andrographis paniculata* is a medicinal plant (especially leaves) native to India and Sri Lanka.

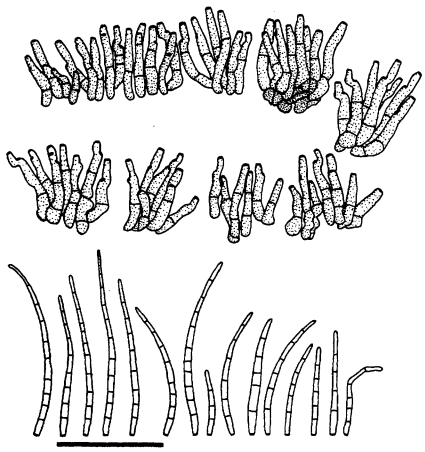


Fig. 3.1. Line drawings of *Cercospora andrographidicola* on *Andrographis paniculata*. Bar = 50 μm.

Cercospora barleriicola Payak & Thirum., Indian Phytopath. 2: 191, 1949.

= *Cercospora barleriae-cristatae* Govindu & Thirum., Sydowia 10: 273, 1957.

= ***C. apii s. lat.***

Leaf spots 5−8 mm diameter, amphigenous, dark to yellowish, only leaf decoloration on the host. *Caespituli* amphigenous. *Stromata* 20−24 μm diameter, small, substomatal, composed from few brown cells. *Conidiophores* 85−209 × 3−4 μm, 5−7 in a loose fascicles, 5−8-septate, arising from stromata, straight, unbranched, cylindrical, not geniculate, smooth, brown at the base, and paler toward the apex. *Conidiogenous cells* integrated, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 61−91 × 2−3 μm, solitary, acicular, straight, hyaline, 6−13-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1.5−2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.2)

Specimen examined: on *Barleria cristata* L., THAILAND, Chiang Mai Province, Chiang Dao District, Huay Luek Royal Project, 6 February 2008, Jamjan Meeboon (BBH 23592), Uttradit Province, Amphur Nam Pad, Sak Yai National Park, 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27885).

Host: *Barleria cristata* L. (Acanthaceae) (Meeboon et al., 2007b).

Distribution: India, Jamaica and Thailand (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: This species belongs to *C. apii s. lat.* fide Crous and Braun (2003) due to its long conidiophores (85−209 × 3−4 μm); and long (61−91 × 2−3 μm), acicular with many septate

(6－13-septate). The first report of this species from Thailand was carried out by Meeboon et al. (2007b). *Barleria cristata* is widely known as ornamentals, native to India and Myanmar.

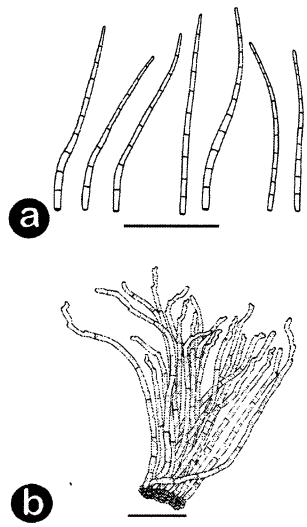


Fig. 3.2a-b. Line drawings of *Cercospora barleriicola* on *Barleria cristata*.
a. Conidia. b. Stroma and conidiophores. Bars: a, b = 25 μm.

Passalora barleriigena Meeboon & Hidayat, Mycotaxon 102: 140－141, 2007d.

MycoBank MB 510839

Maculae 1－14 mm diameter, amphigenae, subcirculares vel irregulares, pallidae vel pallide brunneae, margine primo indistincto, deinde fusco. Caespituli amphigeni. Stromata 7.5－20 μm diameter, parva, ex cellulis, globosis vel subglobosis, brunneis, 3－7, composita. Conidiophora 22－66 × 3.5－5 μm, brevia, 4－7, dense fasciculata, per stoma emergentia, 1－3－septata, nonramosa,1－2－geniculata, tenuitunicata, levia, basi atro－brunnea, apicem versus pallidiora. Cellulae conidiogenae integratae, terminales. Loci conidiogeni conspicui, incrassati, fuscati, 1－2 μm diameter Conidia 25－50 × 3.5－5 μm, solitaria, obclavata, rarissime oblonge cylindrici,recta (interdum curvata), basi leviter obconice truncata, apice rotundato, 1－3(－4)－septata, subhyalina vel pallide brunnea, hila incrassata et fuscata, 1－2 μm diameter.

Etymology: *barleriigena*, the epithet derived from the genus name of the host.

Leaf spots 1－14 mm in diameter, amphigenous, subcircular to irregular, pale to pale brown, margin at first indefinite in young spots, later conspicuous, dark. *Caespituli* amphigenous. *Stromata* 7.5－20 μm in diameter, small, composed of 3－7 globose to subglobose, brown cells. *Conidiophores* 22－66 × 3.5－5 μm, mostly short, 4－7 in a densely fasciculate, 1－3-septate,

emerging through the stomata, thin-walled, smooth, dark brown at the base, paler toward the apex, unbranched, 1−2−geniculate. *Conidiogenous cell*s integrated, terminal. *Conidiogenous loci* 1−2 μm in diameter, conspicuous, thickened and darkened. *Conidia* 25−50 × 3.5−5 μm, solitary, mostly obclavate, occasionally oblong-cylindrical, straight (occasionally curved), slightly obconically truncated at the base, mostly tapering toward a blunt, rounded apex, 1−4-septate, subhyaline to pale brown, hila 1−2 μm diameter, thickened and darkened. (Fig. 3.3)

Specimen examined: on *Barleria lupulina* Lindl., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 30 December 2005, Jamjan Meeboon (CMU 28212: **holotype**); 10 December 2006, Jamjan Meeboon and Ikumitsu Araki (CMU 28213); 19 September 2007, Jamjan Meeboon (BBH 23757).

Host: *Barleria lupulina* Lindl. (Acanthaceae).

Distribution: Thailand (known only from type locality).

Notes: Only one other species of *Passalora*, *P. acanthicola* (Hansf.) U. Braun & Crous has been recorded from Acanthaceae (on *Acanthus* spp.) (Crous & Braun, 2003). *Passalora barleriigena* is distinct from *P. acanthicola* in having unbranched and shorter conidiophores (22−66 × 3.5−5 μm vs 150−250 × 4−6 μm in *P. acanthicola*). The solitary conidia of *P. barleriigena* are also distinct from those of *P. acanthicola*, which are reported as sometimes being in branched chains (Chupp, 1954; Deighton, 1987). The conidia of *P. acanthicola* are cylindrical, rounded at both ends, and 20−95 × 4−6 um in size. The host plant, *Barleria lupulina*, is an ornamental plant native to India and Myanmar.

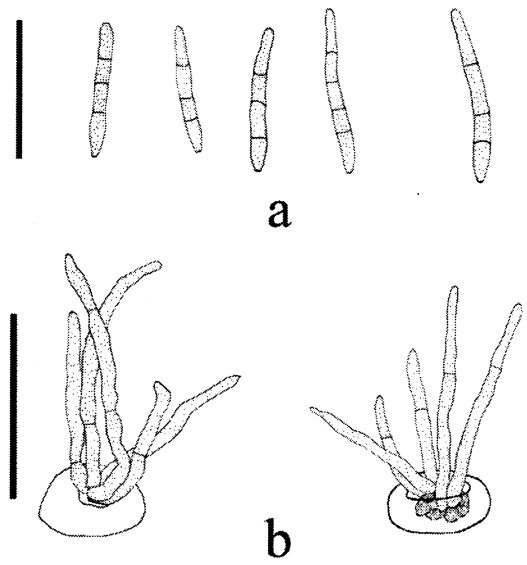


Fig. 3.3a-b. Line drawings of *Passalora barleriigena* on *Barleria lupulina* (from holotype). a. Conidia. b. Stromata and conidiophores. Bars: a, b = 25 μm.

Pseudocercospora justiciae (F. L. Tai) Y. L. Guo & X. J. Liu, Mycosystema 4: 103, 1991.

≡ *Cercospora justiciae* F. L. Tai, Lloydia 11: 47, 1948.

Leaf spots 2—13 mm diameter, distinct, amphigenous, irregular, scattered, brown, with blackish-brown margins. *Caespituli* amphigenous. *Stromata* 17—41 μm diameter, intraepidermal, well-developed, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* 23—58 × 2—4 μm, numerous in a dense fascicles, 1—3-septate, arising from the stromata, smooth, brown, simple, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 19—107 × 2—3.5 μm, solitary, acicular to obclavate, 3 — 10-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with subacute apex, hila unthickened and not darkened. (Fig. 3.4)

Specimen examined: on *Justicia betonica* L., THAILAND, Chiang Mai Province, Mae Fag, Sansai, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23710).

Host: *Justicia betonica* L. (Acanthaceae).

Distribution: China and USA (Crous & Braun, 2003).

Notes: This specimen is identified as *Pseudocercospora justiciae* due to long (19—107 × 2 — 3.5 μm) and multiseptate of conidia (3 — 10-septate) with conidiophores are slightly

geniculate at the apex nearly forming denticulates structure. This species is a newly added to Thailand's mycoflora, and *Justicia betonica* is reported here as a new host. *Justicia betonica* is ornamentals, native to tropical to warm temperate regions of the Americas, with two species occurring north into cooler temperate regions.

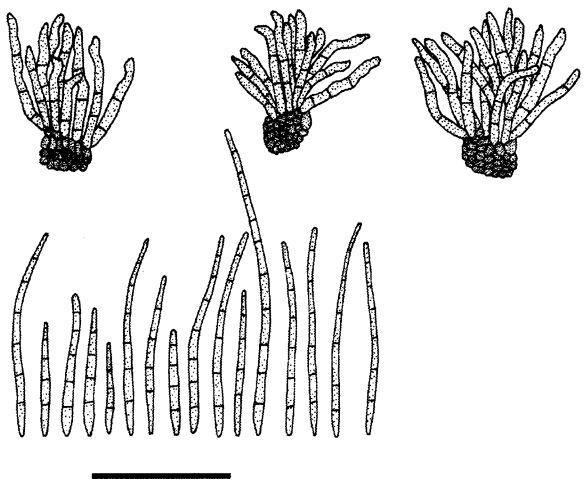


Fig. 3.4. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora justiciae* on *Justicia betonica*. Bar = 50 μm.

Pseudocercospora rhinacanthi (Höhn.) Deighton, Mycol. Pap. 140: 152, 1976.

≡ *Cercospora rhinacanthi* Höhn. "*rhynacanthi*". Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Wien. 121: 414, 1912.

≡ *Cercosporina rhinacanthi* (Höhn.) Sacc., Syll. Fung. 25: 917, 1931.

Leaf spots 5—25 mm diameter, amphigenous, solitary, distinct, visible on both upper and lower surfaces, circular-subcircular in shape, dark brown with whitish gray center surrounded by a raised yellowish-brown border line on the upper part, on the lower surface brown to yellowish with brown margin. *Caespituli* amphigenous, abundantly hypophyllous. *Stromata* 27—57 μm diameter, well-developed, substomatal, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (16.5) 23—34.5 (40) × 2.5—3.5 (4) μm, densely fasciculate, 1—2-septate, arising from stromata, straight to decumbent, smooth, brown, and paler towards the apex, unbranched, non-geniculate or slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (27) 42.5—64 (76.5) × 2.5—3.5 (4) μm, solitary, obclavate to cylindrical, 1—7-septate, straight to mildly curved, subhyaline, smooth, obtuse to subobtuse at

the apex, obconically truncate at the base, hila inconspicuous, unthickened, and not darkened. (Fig. 3.5)

Specimen examined: on *Rhinacanthus nasutus* Kuntze, THAILAND, Chiang Mai Province, Chiang Mai University, 25 November 2005, Jamjan Meeboon (CMU 27892); Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23742).

Host: *Rhinacanthus nasutus* Kuntze (Acanthaceae).

Distribution: China, Indonesia, Java, Philippines, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: The first record of this species from Thailand was done by Chandrasrikul (1962) as "*Cercospora rhinacanthi*" on *Rhinacanthus nasutus* in a preliminary host list of plant diseases in Thailand. Meeboon et al. (2007b) re-collected and reported the specimen as *P. rhinacanthi* because of its inconspicuous conidial scars and unthickened hila. The characters of leaf spot (dark brown with whitish gray center); and densely fasciculate and shost conidiophores [(16.5) 23−34.5 (40) × 2.5−3.5 (4) μm] of this specimen is also in concordance with *P. rhinacanthi* (formerly known as *C. rhinacanthi*) described by Chupp (1954). The host plant, *Rhinacanthus nasutus*, is ornamentals/wild plants, which its natural habitats are subtropical or tropical dry shrub-land and subtropical or tropical dry lowland grassland.

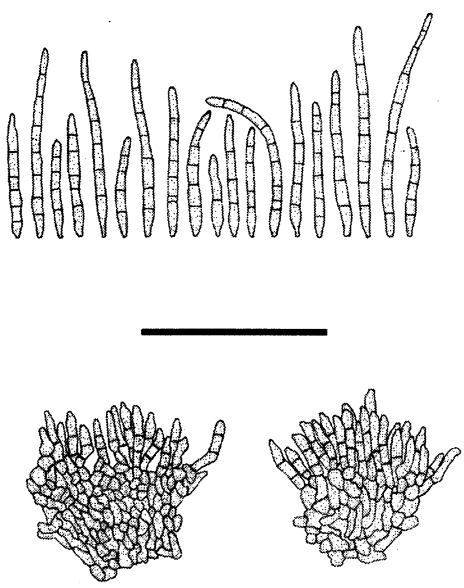


Fig. 3.5. Line drawings of *Pseudocercospora rhinacanthi* on *Rhinacanthus nasutus*. Bar = 50 μm.

Family Adiantaceae

Cercospora adiantigena U. Braun & Crous, CBC Biodiversity Series1: 44−45, 2003.

Leaf spots 5−15 mm diameter, amphigenous, solitary, circular, brown to dark brown, with dark margin and grey at the center. *Caespituli* amphigenous. *Stromata* 9−43 µm diameter, substomatal to intraepidermal, small, composed of few subglobose, brown to blackish-brown cells. *Conidiophores* 74−106 × 3−4 µm, 6−11 in a loose fascicles, 1−3-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, cylindrical, unbranched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5−2.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 53−60 × 2−3 µm, solitary, obclavate, straight, slightly curved, hyaline, 7−16-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1.5−2 µm diameter, thickened and darkened. (Fig. 3.6)

Specimen examined: on *Doryopteris ludens* J. Sm., THAILAND, Chiang Mai Province, Mae Rim, Nong Hoi Royal Project Foundation, 12 September 2007, Jamjan Meeboon (BBH 23634).

Host: *Doryopteris ludens* J. Sm. (Adiantaceae).

Distribution: Tanzania (Crous & Braun, 2003).

Notes: *Dorypoteris ludens* is an ornamentals fern belong to family Adiantaceae and origin from peninsular Malaysia. Three species of *Cercospora s. str.* have been reported from *Adiantum* spp., viz, *C. adianticola* R. K. Srivast., A. K. Srivast.& Kamal (*C. apii s. lat.*), *C. adiantigena* U. Braun & Crous, and *C. pteridigena* M. K. Khan, R. K. Verm & Kamal. *Cercospora pteridigena* is distinct from this specimen by having quite longer conidiophores, and large conidiogenous loci (4−5 µm diameter). This specimen is identified as *C. adiantigena* due to short and obclavate conidia (53−60 × 2−3 µm vs 40−90 × (4) 5−8 µm of *C. adiantigena*). This specimen is the new record of *C. adiantigena* from Thailand, and *D. ludens* is reported here as a new host of this fungus.

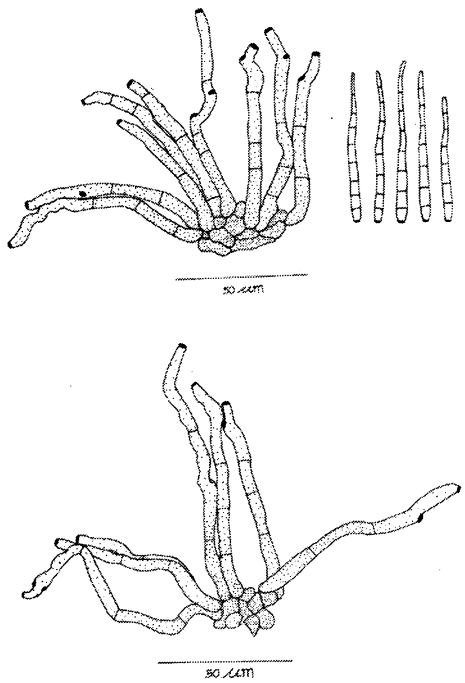


Fig. 3.6. Line drawings of conidia, conidiophores, and stromata of *Cercospora adiantigena* on *Doryopteris ludens*. Bar = 50 μm.

Family Alangiaceae

Pseudocercospora alangii Y. L. Guo & X. J. Liu, Mycosystema 2: 226, 1989.

= *Cercospora alangii* M. Mandal, Indian J. Mycol. Res. 16: 311, 1978.

Leaf spots 5 − 19 mm diameter, distinct, amphigenous, circular to irregular, scattered, grayish to brown, with dark margins. *Caespituli* hypophyllous. *Stromata* 23 − 40 μm, intraepidermal, well-developed, composed of brown to dark brown cells. *Conidiophores* 18−67.5 × 2−4.5 μm, numerous in a densely fasciculate, divergent, 1−3-septate, arising from the stromata, brown, smooth, simple, straight, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 14.5−89 × 2−4.5 μm, solitary, obclavate to long filiform, 2−8-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base with obtuse apex, hila unthickened and not darkened. (Fig. 3.7)

Specimen examined: on *Alangium salviifolium* Wang., THAILAND, Chiang Mai Province, Mae Fag, Sansai, Farming area, 3 August 2008, Jamjan Meeboon (BBH 23752).

Host: *Alangium salviifolium* Wang. (Alangiaceae).

Distribution: China and India (Crous & Braun, 2003).

Notes: Relatively short (18−67.5 × 2−4.5 μm), numerous in a divergent and densely fasciculate, with 1−3-septate of conidiophores; and obclavate conidia (14.5−89 × 2−4.5 μm) of this specimen is typical of *P. alangii* described by Guo and Liu (1989). This specimen is the first record of *P. alangii* from Thailand. The host, A*langium salviifolium*, is ornamental plant, native to western Africa, Madagascar, southern and eastern Asia (China, Malaysia, Indonesia, and the Philippines), tropical Australia, the western Pacific Ocean islands, and New Caledonia.

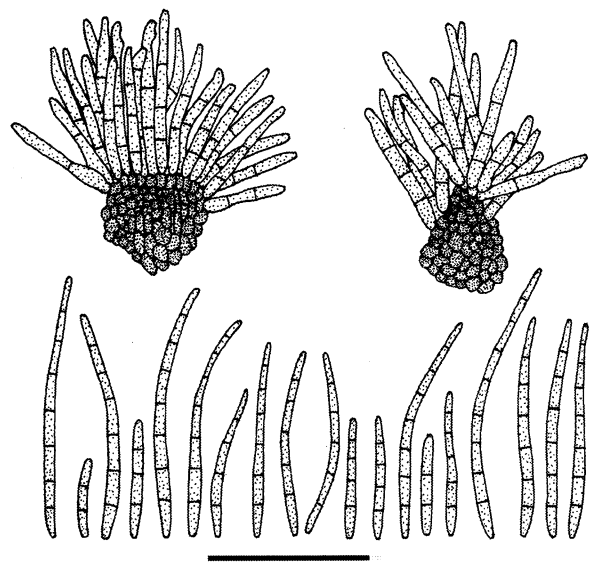


Fig. 3.7. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora alangii* on *Alangium salviifolium*. Bar = 50 μm.

Family Amaranthaceae

Cercospora canescens Ellis & G. Martin, Amer. Naturalist 16: 1003, 1882.

≡ *Cercosporiopsis canescens* (Ellis & G. Martin) Miura, Flora of Manchuria and East Mongolia 3: 529, 1928.

= *Cercospora vignicaulis* Tehon, Mycologia 29: 436, 1937.

= ***C. apii s. lat.***

Leaf spots 3−6 mm diameter, amphigenous, dark to yellowish, only leaf decoloration on the host. *Caespituli* hypophyllous. *Stromata* mostly lacking, if present small, up to 8 μm diameter, composed of 4−5 globose to subglobose, brown to dark brown cells. *Conidiophores* (90.5) 154 ± 29.5 (192) × (3) 3.5 ± 0.5 (4) μm, up to 5 in a loose fascicles, 3−7-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, geniculate. *Conidiogenous cells* integrated, holoblastic, polyblastic, sympodially

proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (82) 192 ± 57.4 (316) × (3) 3 ± 0.2 (4) µm, solitary, acicular, straight, hyaline, 10−22-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 2.5−3 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.8)

Specimen examined: on *Iresine herbstii* Hook., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, on leaves of *Celosia argentea* L., 14 August 2008, Jamjan Meeboon (BBH 23725); Chiang Rai Province, Mae Fah Luang, Mae Jan, Doi Tung Development, 16 August 2008, Jamjan Meeboon (BBH 23586).

Host: *Iresine herbstii* Hook. and *Celosia argentea* L. (Amaranthaceae).

Distribution: Worldwide, wherever the crop is cultivated, including Australia, Bangladesh, Barbados, Brazil, Bolivia, Brunei, Cambodia, China, Colombia, Costa Rica, Cuba, Dominican Republ., Ecuador, Fiji, Georgia, Ghana, Guyana, Haiti, Hong Kong, India, Indonesia, Iran, Japan, Kenya, Korea, Malawi, Malaysia, Malawi, Mauritus, Myanmar, Nepal, New Caledonia, New Zealand, Nigeria, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Puerto Rico, Russia, Senegal, Sierra Leone, Solomon Islands, Somalia, South Africa, Saint Vincent and the Grenadines, Sudan, Tadzhikistan, Taiwan, Tanzania, Trinidad and Tobago, Togo, Uganda, USA, Uzbekistan, Vanuatu, Venezuela,Virgin Islands, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This species was first reported from Thailand by Sontirat et al. (1980) who found *C. canescens* on *Vigna radiata*. Crous & Braun (2003) assigned this species to *C. apii s. lat.* In this study, *C. canescens* was found on *Celosia argentea*, (vegetables, distributed in Africa and Southeast Asia) and *Iresine herbstii* (an ornamental plant native to tropical America). *Iresine herbstii* is reported here as a new host of *C. canescens*.

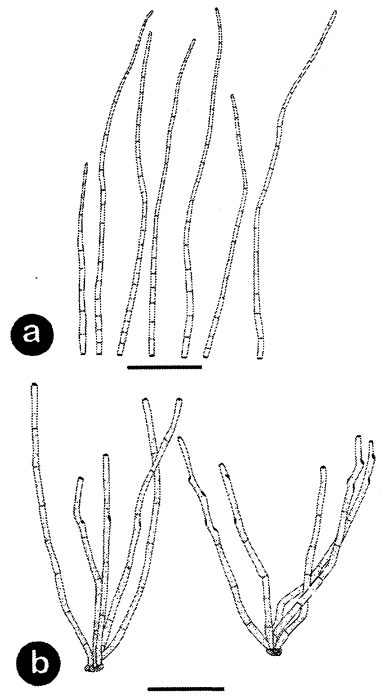


Fig. 3.8a-b. Line drawings of *Cercospora canescens* on *Iresine herbstii*.
a. Conidia. b. Conidiophores and stromata. Bars: a, b = 50 μm.

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

Leaf spots up to 3 mm in diameter, amphigenous, circular to subcircular, brown at central area (somewhat grey-brown in the centre of larger spots), with dark brown margin. *Caespituli* amphigenous, mostly hypophyllous. *Stromata* 19—29 μm in diameter, small, composed of a few globose to subglobose, dark brown cells. *Conidiophores* (34) 50—70 (85) × (2.5) 3—4 (5) μm, up to 13 in a moderately dense fascicles, 1—3-septate, straight to decumbent, light brown to brown, paler and narrower toward the apex, 1—5 geniculation near the apex. Conidiogenous cells integrated, terminal, holoblastic, polyblastic, sympdial proliferating. Conidiogenous loci conspicuous, thickened and darkened. *Conidia* (12) 27—47.5 (67) × 2.5—3.5 μm, 4—7-septate, hyaline, acicular, hyaline, obconically truncate at the base, with acute apex, hila 2—3 μm in diameter, thickened and darkened. (Fig. 3.9)

Specimen examined: on *Celosia argentea var. cristata* (L.) Kuntze, THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, on leaves of *Celosia argentea* L., 25 November 2005, Jamjan Meeboon (CMU 27902); the same locality, 25 November 2005, Jamjan Meeboon (CMU 27893).

Host: *Celosia argentea var. cristata* (L.) Kuntze and *Celosia argentea* L. (Amaranthaceae).

Distribution: Bangladesh, Brazil, Brunei, Cambodia, China, Cuba, India, Indonesia, Japan, Malaysia, Myanmar, Nigeria, Pakistan, Papua New Guinea, Sabah, Sri Lanka, Sudan, Taiwan, Thailand, Uganda, USA, and Venezuela (Crous & Braun, 2003).

Notes : This specimen is identified as *C. celosiae* due to having circular to subcircular and large leaf spot (up to 3 mm in diam.), long (34 − 85 × 2.5 − 5 μm) and geniculate conidiophores, with acicular conidia (Chupp, 1954). *Cercospora celosiae* on *C. argentea* and *C. argentea* var. *cristata* was previously reported from Thailand by Petcharat and Kanjanamaneesathian (1989) and Sontirat et al. (1980), respectively. *Celosia argentea* var. *cristata* is a common vegetables distributed in Africa and Southeast Asia.

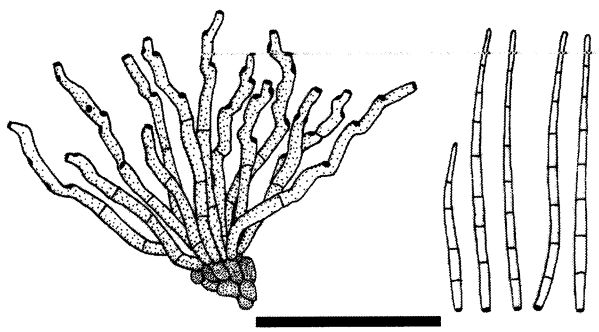


Fig. 3.9. Line drawings of *Cercospora celosiae* on *Celosia argentea.*

Cercospora ricinella Sacc. & Berl., Atti Reale 1st. Ven. Sci. Lett. Art. 6, Ser. 3: 721, 1885.

≡ *Cercosporina ricinella* (Sacc. & Berl.) Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 20: 429, 1910.

= *Cercospora albido-maculans* G. Winter, Hedwigia 24: 202, 1885; also in J. Mycol. 1: 124, 1885.

Leaf spots 2 − 9 mm diameter, distinct, amphigenous, circular or subcircular, grayish to brown, with reddish brown margins. *Caespituli* amphigenous. *Stromata* (12) 19 ± 6.1 (26) μm diameter, intraepidermal, small, composed of globular to angular, brown to blackish-brown cells. *Conidiophores* (47) 74 ± 16.8 (125) × (3) 4 ± 0.6 (5) μm, 5 − 9 in a loosely and divergent fasciculate, 1 − 4-septate, arising from stromata, erect to decumbent, smooth, pale yellow to pale brown, not branched, subcylindrical, strongly geniculate. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5 − 3 μm diameter, conspicuous, thickened, and darkened. *Conidia* (29) 53.5 ± 32.6 (168.5) × (2.5) 2.5 ± 0.4 (3.5) μm, solitary, narrowly obclavate to subacicular, 2 − 12-septate, straight to

curve, hyaline, smooth, base obconically truncate, with subacute apex, hila 2−2.5 μm diameter, thickened and darkened. (Fig. 3.10)

Specimen examined: on *Ricinus communis* L., THAILAND, Chiang Mai Province, Mae Fag, Amphur San Sai, 3 August 2008, Jamjan Meeboon (BBH 23755).

Host: *Ricinus communis* (Euphorbiaceae).

Distribution: Worldwide, including Angola, Argentina, Australia, Bangladesh, Barbados, Brazil, Bulgaria, Cambodia, China, Colombia, Cubda, Dominican Republic, Egypt, El-Salvador, Ethiopia, french Polynesia, Georgia, Ghana, Guatemala, Haiti, India, Indonesia, Iran, jamaica, Japan, Kazakhstan, Kenya, Korea, Malawi, Malaysia, Mauritius, Morocco, Mozambique, Myanmar, Nepal, New Caledonia, Nigeria, Pakistan, Panama, Philippines, Puerto Rico, Russia (European part), Sierra Leone, Somalia, South Africa, Sri Lanka, Sudan, Tahiti, Taiwan, Tanzania, Thailand, Togo, Trinida and Tobago, Uganda, Ukraine, USA, Vanuatu, Venezuela, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is identified as *C. ricinella* due to its type of leaf spot (2-9 mm diameter, distinct, amphigenous, circular or subcircular), densely fasciculate conidiophores, and acicular-filiform conidia with subtruncate basal end Chupp (1954). *Cercospora ricinella* was firstly reported from Thailand by Sontirat et al. (1980). Its host, *Ricinus communis*, is a source of castor oil/medicine, indigenous to the southeastern Mediterranean region, Eastern Africa, and India. Nowadays, *Ricinus communis* is widespread throughout tropical regions.

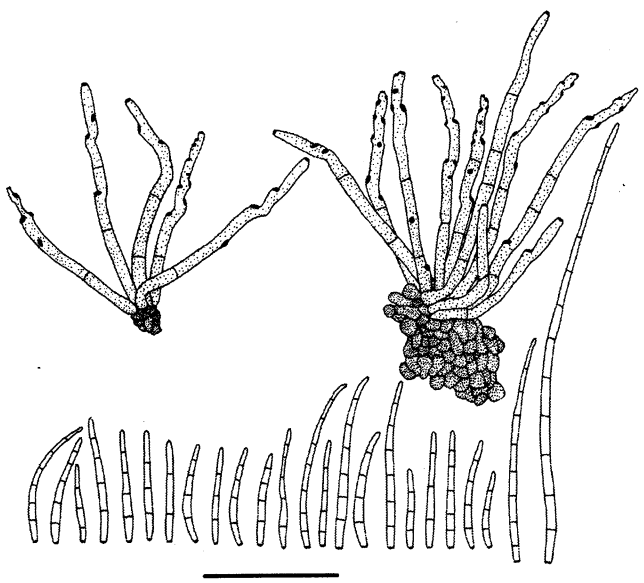


Fig. 3.10. Line drawingsof *Cercosporina ricinella* on *Ricinus communis*.

Family Apocynaceae

Cercospora peregrina Chupp, A monograph of the fungus genus *Cercospora*: 49, 1954.

= ***C. apii s. lat.***

Leaf spots 2−5 mm diameter, distinct, amphigenous, circular to subcircular, scattered, dull brown, often paler at the centre, with dark brown margins. *Caespituli* epiphyllous. *Stromata* 25−37 µm diameter, intraepidermal, well-developed, composed of globular to angular, brown to blackish-brown cells. *Conidiophores* 38−139 × 3−4.5 µm, 7−12 in a loosely to densely fasciculate, 2−4-septate, often divergent, arising from stromata, simple, erect to decumbent, smooth, pale brown to brown, not branched, subcylindrical, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 µm diameter, conspicuous, thickened, and darkened. *Conidia* 25−170 × 3−3.5 µm, solitary, narrowly obclavate to subacicular, 3−12-septate, straight, hyaline, smooth, base obconically truncate, with acute apex, hila 2−3 µm diameter, thickened and darkened. (Fig. 3.11)

Specimen examined: on *Pentalinon luteum* (L.) B. F. Hansen & Wunderlin, THAILAND, Chiang Mai Province, Royal Flora, 27 July 2008, Jamjan Meeboon (BBH 23762).

Host: *Pentalinon luteum* (L.) B. F. Hansen & Wunderlin (Apocynaceae).

Distribution: India, Mexico, Pakistan, and USA (Crous & Braun, 2003).

Notes: This specimen is a typical of *C. apii s. lat* fide Crous & Braun (2003) due to long and slightly geniculate of conidiophores, and long acicular conidia with truncate base and acute apex. *Cercospora peregrina* is the only species of *C. apii s. lat.* reported from plants family *Apocynaceae*. This specimen is the first record of *C. peregrina* from Thailand, and *Pentalinon luteum* is reported here as a new host of this fungus. *Pentalinon luteum* is ornamentals, naturally occurring in sunny locales throughout the coastal areas and rock pinelands of South Florida and the Caribbean area.

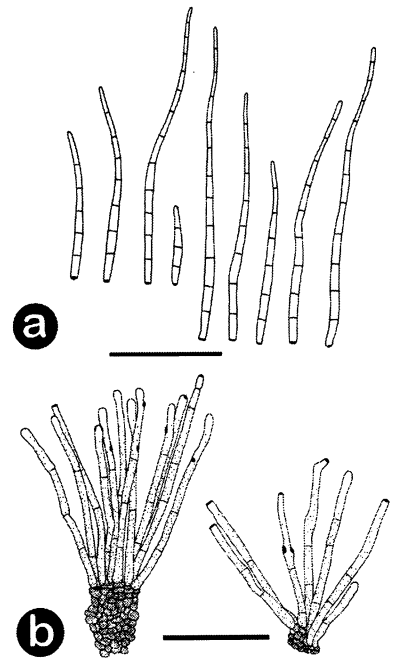


Fig. 3.11a-b. Line drawings of *Cercospora peregrina* on *Pentalinon luteum*.
a. Conidia, b. Conidiophore.

***Pseudocercospora* sp.**

Leaf spots 7—18 mm diameter, amphigenous, solitary, circular to subcircular, scattered, brown, with indistinct border. *Caespituli* amphigenous. *Stromata* 18 — 30 μm diameter, intraepidermal, well-developed, composed of brown to dark brown cells. *Conidiophores* 11—30.5 × 2—3 μm, numerous in a dense fascicles, 0—3-septate, arising from stromata, smooth, light brown to brown, simple, straight, not branched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 15 — 57 × 1.5 — 2.5 μm, solitary, subcylindric to obclavate, 4 — 9-septate, straight or slightly curved, smooth, hyaline to pale olivaceous, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.12)

Specimen examined: on *Kopsia fruticosa* (Roxb.) A.DC., THAILAND, Chiang Mai Province, Chiang Mai University, 12 August 2008, Jamjan Meeboon (BBH 23584: **holotype**).

Host: *Kopsia fruticosa* (Roxb.) A. DC. (Apocynaceae).

Distribution: Thailand.

Notes: Four *Pseudocercospora* species, viz, *P. byliana* (Syd.) J. M. Yen, *P. liebenbergii* (Syd.) Deighton, *P. tabernaemontanae* (Syd. & P. Syd.) Deighton, and *P. wrightiae* (Thirum. &

Chupp) Deighton, have been recorded as the species with amphigenous caespituli. This specimen is distinct from the four similar *Pseudocercospora* species in having distinctly geniculate conidiophores, and obclavate-filiform conidia with truncate base and conspicuous septation. Due to distinct morphological characteristics of this specimen to similar species; therefore, further examination using molecular phylogenetic analysis is necessary in order to clarify this specimen. *Kopsia fruticosa*, ornamental plant native to tropical and warm regions, is reported here as a new host of the genus *Pseudocercospora*.

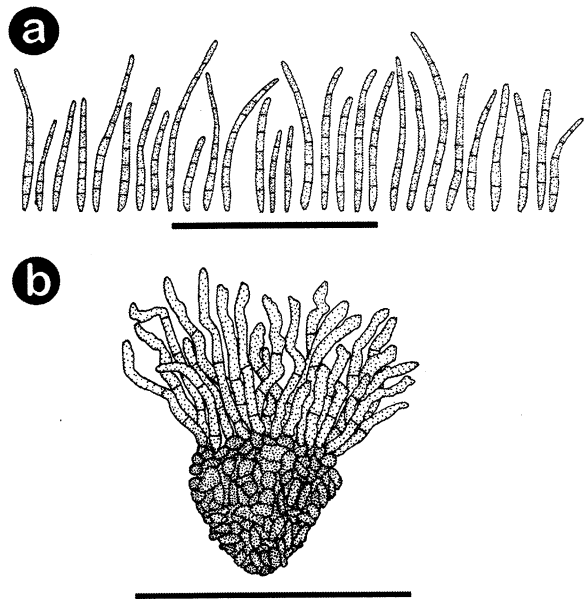


Fig. 3.12a-b. Line drawings of *Pseudocercospora* sp. on *Kopsia fruticosa*.
a. Conidia, b. Conidiophore. Bar = 50 μm.

Pseudocercospora repens (Ellis & Everh.) U. Braun, Trudy Bot. Inst. im. V.L. Komarova 20: 88, 1997.

≡ *Cercospora repens* Ellis & Everh., J. Mycol. 3: 14, 1887.

Leaf spots 3−6 mm diameter, amphigenous, circular to subcircular, darkened at the upper and lower surfaces, with indistinct margin, limited by the vein. *Caespituli* hypophyllous. *Stromata* lacking. *Conidiophores* 23−33 × 2.5−3 μm, non−fasciculate, 0−2-septate, arising from secondary mycelium, smooth, pale brown, paler toward the apex, straight to decumbent, branched, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 27−92 × 2−3.5 μm, solitary, subcylindrico-obclavate, straight to mildly curved,

subhyaline, 3−8-septate, smooth, truncate at the base, with subacute apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.13)

Specimen examined: on *Nerium oleander* L., THAILAND, Chiang Mai Province, Tumbol Mae Hea, Amphur Muang, 13 February 2008, Jamjan Meeboon (BBH 23739).

Host: *Nerium oleander* L. (Apocynaceae).

Distribution: China, Hong Kong, India, Japan, Korea, Mauritius, New Caledonia, New Zealand, Pakistan, Philippines, Taiwan, and USA (Crous & Braun, 2003).

Notes: Three species of *Pseudocercospora*, viz, *P. kurimensis* (Fukui) U. Braun, *P. neriella* (Sacc.) Deighton, and *P. repens* (Ellis & Everh.) U. Braun, have been reported associated with plant genus *Nerium*, ornamental plants widely distributed. This specimen is very close to *P. repens* in having hypophyllous caespituli, conidiophores arising from secondary mycelium, lacking of stromata, and conidia subcylindric-obclavate. This specimen is distinct from *P. kurimensis* due to amphigeous caespituli (abundantly epiphyllous), and divergent conidiophores of the later species; and also differs from *P. neriella* due to epiphyllous caespituli and well-developed stromata of the later species (Braun, 1996; Deighton, 1976; Braun & Melnik, 1997). This is the first report of *P. repens* on *Nerium oleander* from Thailand.

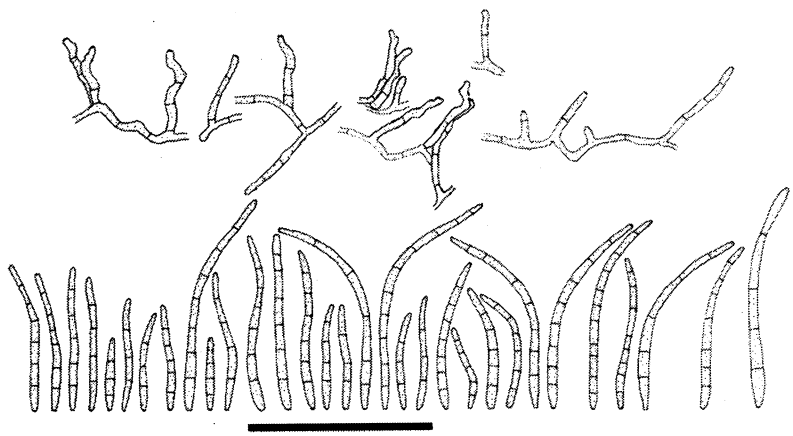


Fig. 3.13. Line drawings of conidia and conidiophores of *Pseudocercospora repens* on *Nerium oleander*. Bar = 50 µm.

Pseudocercospora plumeriae (Chupp.) Tak. Kobayashi., Nishijima, & C. Nakash., Mycoscience 39: 188, 1998.

≡ *Cercospora plumeriae* Chupp, A monograph of the fungus genus *Cercospora*: 49, 1954.

Leaf spots 2−6 mm diameter, distinct, amphigenous, circular to subcircular, scattered, yellowish to brown, often paler at the centre, with dark brown margins. *Caespituli* epiphyllous.

Stromata 21−25 μm diameter, intraepidermal, small, composed of globular to angular, brown to dark brown cells. *Conidiophores* 24−52 × 2.5−3 μm, arising from the stromata, pale to medium brown, numerous in a densely fasciculate, 1−3-septate, mostly not divergent, rarely divergent, simple, smooth, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 38−83 × 1.5−2.5 μm, solitary, filiform to long obclavate, 5−10-septate, straight or slightly curved, smooth, pale olivaceous, base truncate, with obtuse apex, hila unthickened and not darkened. (Fig. 3.14)

Specimen examined: on *Pentalinon luteum* (L.) B. F. Hansen & Wunderlin, THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Mae Hea, Royal Flora, 27 July 2008, Jamjan Meeboon (JM 103).

Host: *Pentalinon luteum* (L.) B. F. Hansen & Wunderlin (Apocynaceae).

Distribution: Bangladesh, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, and Trinidad and Tobago (Crous & Braun, 2003).

Notes: Three species of *Pseudocercospora* from plant family Apocynaceae, viz, *P. holarrhenae* (Thirum. & Chupp) Deighton, *P. neriella* (Sacc.) Deighton, *P. plumeriae* (Chupp) Tak. Kobay., Nishij., & C. Nakash., have been reported as species with epiphyllous caespituli. *Pseudocercospora holarrhenae* is distinct from this specimen due to pale conidiophores and obclavate conidia. On the other hand, *P. neriella* differs also from this specimen in having pale conidiophores with almost hyaline at the tip, with hyaline conidia. This specimen is much closed to *P. plumeriae* in having circular to subcircular symptoms, pale to medium brown conidiophores in fairly compact fascicles, and pale olivaceous conidia. This specimen is the first record of *P. plumeriae* from Thailand. *Pentalinon luteum*, ornamental plant that naturally occurring in sunny locales throughout the coastal areas and rock pinelands of South Florida and the Caribbean area, is reported here as a new host of this fungus.

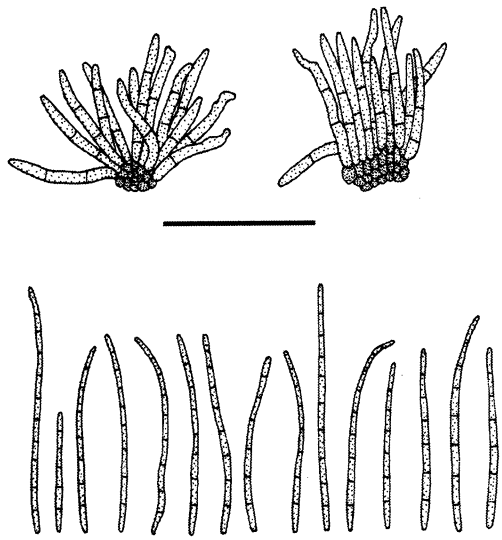


Fig. 3.14. Line drawings of conidia and conidiophores of *Pseudocercospora plumeriae* on *Pentalinon luteum*. Bar = 50 µm.

Family Araceae

Cercospora richardiicola G. F. Atk. 'richardiaecola', J. Elisha Mitchell Sci. Soc. 8: 19, 1892.

= ***C. apii s. lat.***

Leaf spots 2−15 mm diameter, distinct, amphigenous, circular to subcircular, brown or tan to gray, with narrow dark brown margins. *Caespituli* epiphyllous. *Stromata* a few brown cells. *Conidiophores* (50) 104.5 ± 70.5 (350) × (3.5) 3.6 ± 0.4 (5) µm, loosely to densely fasciculate, multiseptate, often divergent, arising from stromata, simple, erect to decumbent, smooth, pale olivaceous to brown, not branched, subcylindrical, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (40) 108.5 ± 66.5 (280) × (2.5) 3.3 ± 0.5 (4) µm, solitary, acicular, multiseptate, straight, hyaline, smooth, base obconically truncate, with acute apex, hila 2.5−3 µm diameter, thickened and darkened.

Specimen examined: on *Zantedeschia* sp., THAILAND, Phetchabun Province, Amphur Lom Sak, Num Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27966).

Host: *Zantedeschia* sp. (Araceae).

Distribution: Ethiopia, Guatemala, Hong Kong, Indonesia, Japan, Malaysia, Puerto Rico, Sierra Leone, South Africa, Thailand, USA, Virgin Islands, and Zimbabwe.

Notes: Large (2−15 mm diam.), distinct, amphigenous, and circular to subcircular leaf spot; long conidiophores (50−350 × 3.5−5 μm) and with acicular and hyaline conidia (40−280 × 2.5−4 μm) is typical of *C. richardiicola* (Chupp, 1954).it is belons to *C. apii s. lat.* due to its long conidiophores with acicular and hyaline conidia (Crous and Braun, 2003). Nakashima et al. (2007) were the first of reporting this species from Thailand. Its host, *Zantedeschia* sp., is an ornamental native to southern Africa from South Africa north to Malawi.

Family Araliaceae

Pseudocercospora panacis (Thirum. & Chupp) Y. L. Guo & X. J. Liu, Acta Mycol. Sin. 11: 297, 1992.

≡ *Cercospora panacis* Thirum. & Chupp, Mycologia 40: 358, 1948.

≡ *Passalora panacis* (Thirum. & Chupp) Crous & U. Braun, Mycotaxon 78: 336, 2001.

= *Pseudocercospora polysciatis-pinnatae* U. Braun & Mouch., N. Z. Jl. Bot. 37: 319, 1999.

Leaf spots 10−20 mm diameter, amphigenous, solitary, circular to subcircular, brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 20 − 50 μm diameter, well-developed, intraepidermal, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 27−43 × 2.5−5 μm, 8−12 in a densely fascicles, arising from stromata, straight to decumbent, 0−3-septate, smooth, brown and paler towards the apex, unbranched, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. Conidia 21.5−42 × 2−3 μm, solitary, obclavate, straight to mildly curved, hyaline to subhyaline, 2−3-septate, smooth, obconically truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.15)

Specimen examined: on *Polyscias scutellaria* (Burm. f.) Fosberg, THAILAND, Chiang Mai Province, Amphur Sarapee, Tumbol Khua Mung, Deu Ngok, 29 February 2008, Jamjan Meeboon (BBH 23589); Chiang Mai Province, Chiang Mai University, 12 June 2008, Jamjan Meeboon (BBH 23643).

Host: *Polyscias scutellaria* (Burm. f.) Fosberg, (Araliaceae).

Distribution: Australia, Brunei, Cambodia, India, Indonesia, Mauritius, New Caledonia, Papua New Guinea, and Sierra Leone (Crous & Braun, 2003).

Notes: An inconspicuous, unthickened, and not darkened conidiogenous locus of this specimen is typical of genus *Pseudocercospora* (Crous and Braun, 2003). This specimen is

identified as *P. panacis* due to the type of leaf spot (10−20 mm diam., amphigenous, circular to subcircular, brown with dark brown margin), well-developed stromata, short (27−43 × 2.5−5 µm) and densely fasciculates of conidiophores, with obclavate conidia (Guo and Liu, 1992) It is the first record of *P. panacis* from Thailand, and *Polyscias scutellaria*, an ornamental plant, is reported here as a new host of this fungus.

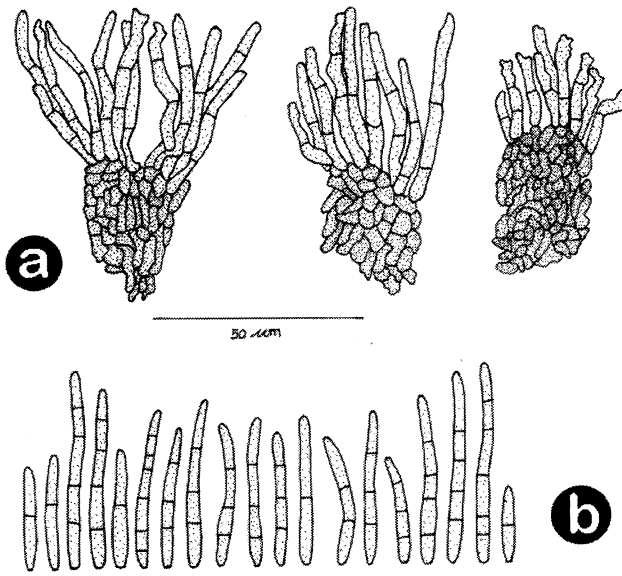


Fig. 3.15a-b. Line drawings of *Pseudocercospora panacis* on *Polyscias scutellaria*.
a. Stromata and conidiophores. b. Conidia. Bar = 50 µm.

Family Arecaceae

Cercospora arecacearum Hidayat & Meeboon, Mycol. Prog. 8: 115−121, 2009.

MycoBank No. MB 510616

Leaf spots 1−10 cm diameter, amphigenous, irregular, brownish, dull grayish to brown, finally pale grayish with a white center and dark margins, spots usually overlapping. *Caespituli* amphigenous, scattered, and dark-yellowish. *Stromata* 30−100 µm diameter, substomatal to intraepidermal, well-developed, subglobular, brown to blackish-brown. *Conidiophores* 68.5−310 × 4−5 µm, variable in length, in rich fascicles, 2−8-septate, dense, arising from stromata, smooth, pale yellowish to brownish throughout, sometimes paler at the apex, cylindrical, but narrowed towards the apex, straight, branched, strongly geniculate. *Conidiogenous cells* 24.5−67 × 4−5 µm, integrated, terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened and darkened. *Conidia* 140−320 × 4−5 µm, formed singly, acicular, straight, often

curved at the apex, hyaline, 9—25-septate, thin-walled, smooth, tapered towards a subacute apex, base truncate, hila 2.5—3 μm diam., thickened and darkened. (Fig. 3.16)

On potato dextrose agar medium: colony slowly growing, velvety, 3—4 cm after 30 days, tight to the agar, dark, covered by a grayish white aerial mycelium, reddish near the margin, with white margin, producing red pigmentation in the agar, no sporulation.

Specimen examined: on *Areca catechu* L., THAILAND, Chiang Mai Province, Amphur Mae Taeng, Tumbol Pa Pae, Mushroom Research Centre, 17 November 2006, Iman Hidayat (CMU 27946: **holotype**).

Host: *Areca catechu* (Arecaceae).

Distribution: Thailand (type locality).

Notes: According to Crous & Braun (2003), this species belongs to *Cercospora* Fresen. *s. str.*, which is characterized by having pigmented conidiophores, thickened and darkened conidiogenous loci, and hyaline scolecoid conidia. Furthermore, this fungus is distinct from the plurivorous *C. apii s. lat.* by having well-developed, large stromata, and strongly geniculate, branched conidiophores in rich fascicles (Crous & Braun 2003).

Currently, only three species on *Arecaceae*, viz, *Cercospora arecacearum* Hidayat & Meeboon, *C. palmae-amazonensis* Bat. & Cavalc. (Batista & Cavalcanti 1964) and *C. raphiae* Deighton (1985), have been maintained in *Cercospora* sensu str. (Crous & Braun 2003). Another species of *Cercospora sensu str., C. nucifera* R. K. Srivast., S. Narayan and A. K. Srivast. (1995), is now classified as *C. apii sensu lat.* (Crous & Braun 2003).

Cercospora arecacearum is distinct from *C. raphiae* by having amphigenous caespituli, branched and strongly geniculate conidiophores as well as much narrower acicular conidia. Deighton (1985) characterized *C. raphiae* by having hypophyllous caespituli, unbranched, non-geniculate conidiophores and obclavate-cylindrical conidia with slightly thickened hila. *Cercospora arecacearum* is also easily distinguishable from *C. palmae-amazonensis* by its large stromata, branched, and strongly geniculate conidiophores with hyaline acicular conidia. Its host, *Areca catechu*, is widely known as crops as well as ornamentals, native to tropical Pacific, Asia, and parts of east Africa.

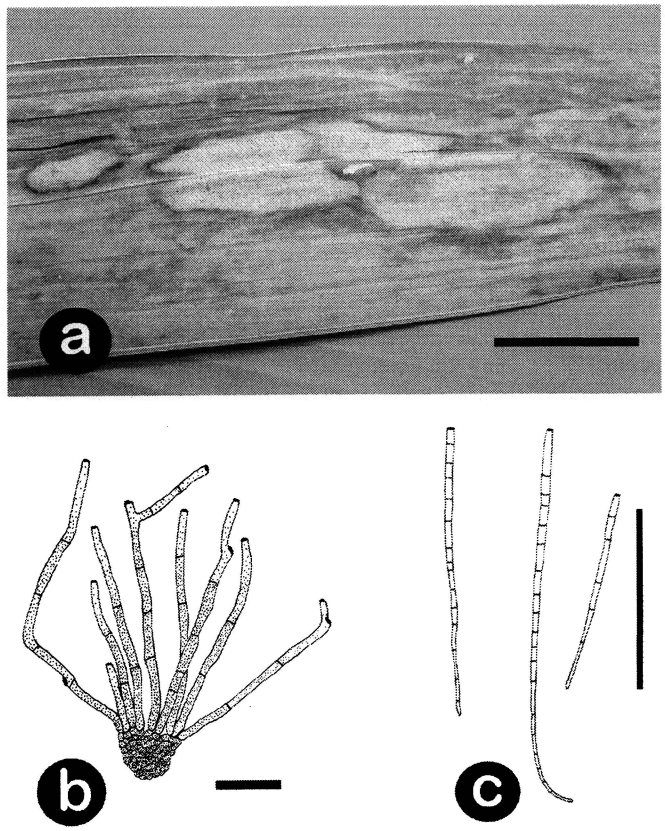


Fig. 3.16a-c. Symptoms, conidiophores, stroma, and conidia of *Cercospora arecacearum* (from holotype). a. Symptoms. b. Stroma and conidiophores. c. Conidia. Bars: a = 5 cm; b = 50 μm; c = 150 μm.

Distocercospora livistonae U. Braun & C. F. Hill, Fungal Diversity 22: 23−25, 2006.

Leaf spots amphigenous, subcircular to irregular, 2−15 mm wide, pale to dark brown, finally greyish brown to greyish white, margin indefinite or with a diffuse, irregular dark border. *Caespituli* hypophyllous, fine, punctiform, dark brown. Mycelium internal. Stromata lacking or small, (13) 19.3 ± 5.8 (28) μm diam., brown. *Conidiophores* in small to moderately large, loose fascicles, arising from internal hyphae or stromata, emerging through stomata, erect, straight, subcylindrical-filiform, usually distinctly geniculate-sinuous, especially in the upper half, unbranched, (34.5) 54.7 ± 9.3 (69) × (3) 3.8 ± 0.5 (5) μm,-septate throughout, wall somewhat thickened below, thin-walled towards the apex, pale to medium dark brown, olivaceous to brown, smooth. *Conidiogenous cells* integrated, terminal and intercalary, 10−30 μm long, proliferation sympodial, occasionally percurrent, conidiogenous loci conspicuous, somewhat thickened and darkened, 2−2.5 μm diam. *Conidia* solitary, obclavate, (23.5) 50.3 ± 12.8 (80.5) × (4) 5.3 ± 0.7 (7) μm, indistinctly 2−5 distoseptate, pale olivaceous, outer wall very thin, inner wall up to 2 μm

wide, almost smooth to distinctly verruculose, apex obtuse or subobtuse, base short obconically truncate, 2−3 μm wide, hila somewhat thickened and darkened. (Fig. 3.17)

Specimen examined: on *Livistona chinensis* R. Br., THAILAND, Chiang Mai Province, Chiang Mai University, Palm Garden, 6 March 2009, Jamjan Meeboon (JM 105).

Host: *Livistona chinensis* R. Br. (Arecaceae).

Distribution: New Zealand.

Notes: This specimen, *D. livistonae*, is the second record worldwide and the first record of from Thailand. Genus *Distocercospora* N. Pons & B. Sutton, the first on a host belonging to the *Arecaceae*. *Distocercospora africana* Crous & U. Braun (Crous & Braun, 1994), described from South Africa on *Dioscorea sylvatica* Eckl., is morphologically similar, but differs in having usually densely fasciculate, much shorter conidiophores, 15−80 × 3−10 μm, which are non-geniculate or only slightly so. The conidia are narrower, 35 μm. *Distocercospora pachyderma* (Syd. & P. Syd.) N. Pons & B. Sutton, the type species known from *Dioscorea* spp., is distinct by its strongly branched conidiophores. *Cercospora palmae-amazonensis* Bat. & Cavalc. (Batista & Cavalcanti, 1964), on an unidentified palm in Brazil, seems to be similar, but has non-geniculate, much shorter conidiophores. On account of pigmented conidia, this species has to be excluded from *Cercospora* Fresen., but its taxonomy is not yet clear. Type material has been re-examined, but no trace of fructification could be found (Crous & Braun, 2003: 304). *Passalora eitenii* Medeiros and Dianese (1994), known from Brazil on the palm *Syagrus comosa* (Mart.) Mart., seems also to be close to *Distocercospora livistonae*. Distoseptation of the conidia was not described in the original paper, but the illustrations indicate its possible occurrence (Medeiros& Dianese, 1994: 511, Pl. 1, Fig. H). Percurrent proliferation is also present in *P. eitenii* (Medeiros & Dianese, 1994: 511, Pl. 1, Fig. D−E), but this species differs from *D. livistonae* by its colourless, 1(−3)-septate conidia. Its host, *Livistona chinensis*, is a well-known ornamental palm, native to southern and southeastern Asia, Australasia, and the Northeast Africa.

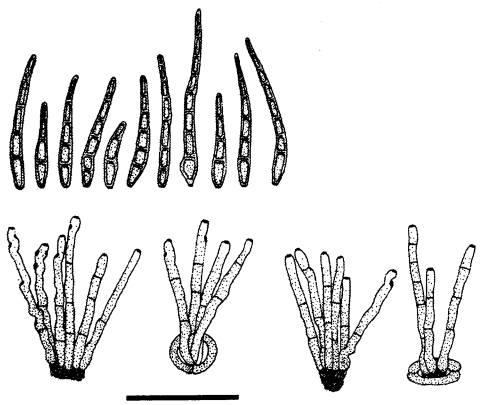


Fig. 3.17. Line drawings of *Distocercospora livistonae* on *Livistona chinensis* Bars = 50 μm.

Family Aristolochiaceae

***Cercospora* sp.**

Leaf spots 7—13 mm diameter, amphigenous, circular or irregular, brown to dark brown, with grayish to brown centre, surrounded by a dark margins. *Colonies* amphigenous. *Stromata* 12—33 μm diameter, intraepidermal, small to well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 25—329 × 2.5—6 μm, 10 to numerous in a loosely fasciculate, 1—2-septate, arising from stromata, erect to decumbent, simple, straight, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, ostly monoblastic, sympodially proliferating. *Conidiogenous loci* 2—3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 8—216 × 2.5—4 μm, solitary, narrowly obclavate to subacicular, 4—9-septate, straight, hyaline, smooth, base obconically truncate, with subacute apex, hila 2—2.5 μm diameter, thickened and darkened. (Fig. 3.18)

Specimen examined: on *Aristolochia tagala* Cham., THAILAND, Chiang Mai Province, Pang Da Royal Project, 5 August 2008, Jamjan Meeboon (BBH 23729).

Host: *Aristolochia tagala* Cham. (Aristolochiaceae).

Distribution: Thailand.

Notes: *Aristolochia tagala*, a medicinal plant distributed from the Himalaya to Sri Lanka through South East Asia (includes Myanmar, Indonesia, Indochina, and Thailand) and China, to Oceania (includes the whole of Malesia, the Solomon Islands and Queensland in Australia), is

reported here as a new host of genus *Cercospora*. The morphology characteristic of this specimen is closed to *C. apii s. lat.*, but further examination using molecular phylogenetic analysis is necessary in order to determine this specimen.

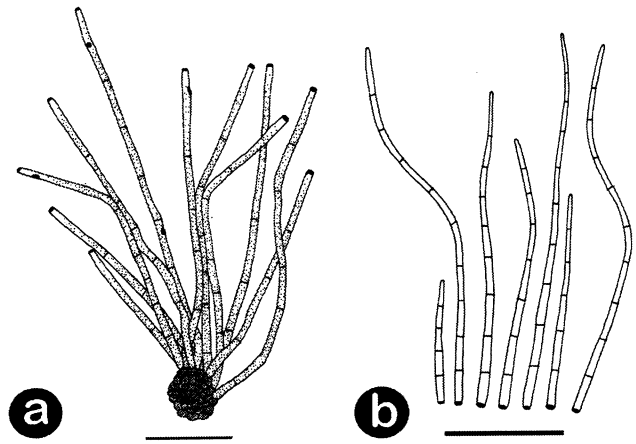


Fig. 3.18a-b. Line drawings of *Cercospora* sp. on *Aristolochia tagala*. a. Conidiophores and stroma. b. Conidia. Bars: a, b = 50 µm.

Family Asclepiadaceae

Pseudocercospora marsdeniae (Hansf.) Deighton, Mycol. Pap. 140: 147, 1976.

= *Cercospora marsdeniae* Hansf., Proc. Linn. Soc. London 158: 50, 1947.

Leaf spots 1−2 mm diameter, amphigenous, circular, angular to irregular, scattered, later coalescing to large spots, forming a 5−28 mm diameter size, grayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* amphigenous. *Stromata* 27.5−62 µm diameter, substomatal to intraepidermal, small to well-developed, composed of globose to subglobose, sometime angular, brown to dark brown cells. *Conidiophores* 9.5−29 × 2−3 µm, numerous in a densely fasciculate, 1−2-septate, arising from the upper part of stromata, pale olivaceous to brown, smooth, simple, straight or geniculate. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 26−78 × 2.5−4.5 µm, solitary, acicular to obclavate, 2−5-septate, straight or slightly curved, smooth, pale olivaceous, truncate basal end, with acute apex, hila unthickened and not darkened. (Fig. 3.19)

Specimen examined: on *Dregea volubilis* Benth. ex Hook. f., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, 1 August 2008, Jamjan Meeboon (BBH 23720).

Host: *Dregea volubilis* Benth. ex Hook. f. (Asclepiadaceae).

Distribution: Bulgaria, China, Ghana, Pakistan, and Uganda (Crous & Braun, 2003).

Notes: Inconspicuous, unthickened, not darkened of conidiogenous loci of this specimen is typical of genus *Pseudocercospora* (Crous & Braun, 2003) This specimen is identified as *P. marsdeniae* due to amphigenous caespituli, well-developed stroma (27.5—62 μm diam.), densely fasciculate and short conidiophores (9.5—29 × 2—3 μm), with cylindric-acicular conidia (Chupp, 1954; Deighton, 1976). It is the first record of *P. marsdeniae* from Thailand, and *Dregea volubilis*, ornamental plant that occurs widely throughout the hotter parts of India and South East Asia, is reported here as a new host of this fungus.

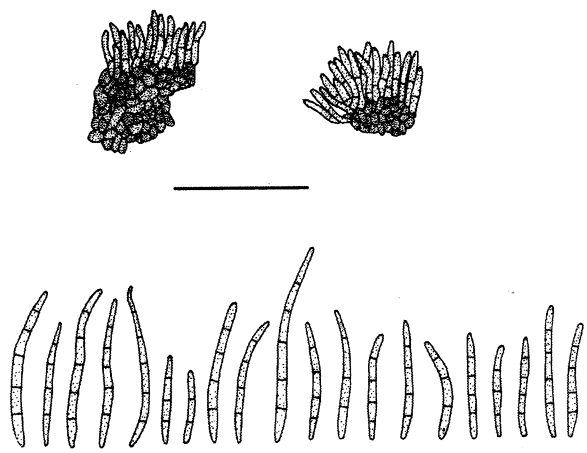


Fig. 3.19. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora marsdeniae* on *Dregea volubilis*. Bar = 50 μm.

Family Asteraceae

Cercospora artemisiae Y. L. Guo & Y. Jiang, Mycosystema 19: 445, 2000.

Leaf spots 15—30 mm diameter, amphigenous, circular to subcircular, at first pale greenish to ochraceous when the symptoms young, later become brown to dark brown, finally with grayish to brown at the centre, surrounded by a dark margin or brown halo. *Caespituli* hypophyllous, ochre yellow, velvety. *Stromata* 18 — 25 μm diameter, substomatal, well-developed, composed of a few globose to subglobose, brown to blackish-brown cells. *Conidiophores* 55—181 × 4—5.5 μm, 3—10 in a loosely fasciculate, 2—7-septate, arising from stromata, erect to decumbent, smooth, pale yellow to pale brown, simple, straight, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci*

conspicuous, thickened, darkened. *Conidia* 43.5—207.5 × 2—4 μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 4—17-septate, smooth, base obconically truncate, with subacute apex, hila 2—2.5 μm diameter, thickened and darkened. (Fig. 3.20)

Specimen examined: on *Artemisia indica* Willd., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, 14 August 2008, Jamjan Meeboon (BBH 23726).

Host: *Artemisia indica* Willd. (Asteraceae).

Distribution: China (Guo & Jiang, 2000).

Notes: Crous and Braun (2003) noted this species is probably a synonym of *C. apii s. lat.*, but further investigation is needed to justify this preliminary comment. This specimen shows some characteristics of *C. apii s. lat.* such as long conidiophores (55—181 × 4—5.5 μm), in a loosely fasciculate; and very long (43.5—207.5 × 2—4 μm), hyaline and acicular conidia. Thus, this result suggests placing this species as synonym of *C. apii s. lat.* It is the first record of *C. artemisiae* from Thailand, and *Artemisia indica* is reported here as a new host of this fungus. *Artemisia indica* is commonly recognized as ornamental and also medicinal plant, growth in temperate climates of the Northern Hemisphere and Southern Hemisphere, usually in dry or semi-dry habitats.

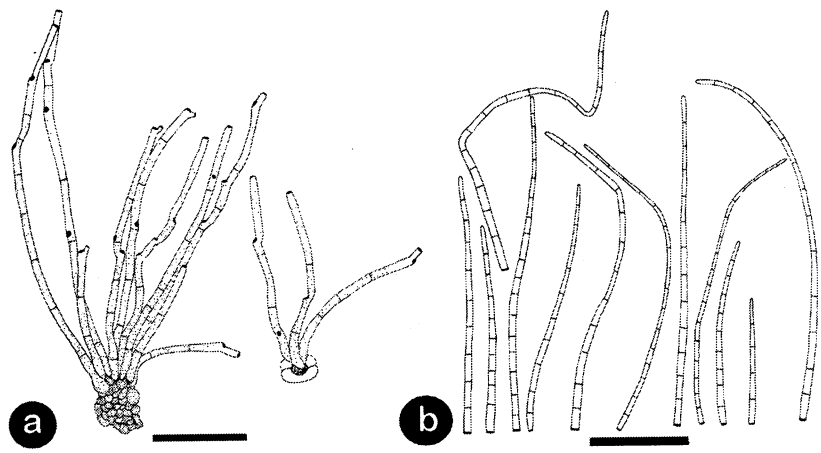


Fig. 3.20a-b. Line drawings of *Cercospora artemisiae* on *Artemisia indica*. a. Conidiophores and stromata. b. Conidia. Bars: a, b = 50 μm.

Cercospora bidentis Tharp, Mycologia 9: 108, 1917.

Leaf spots 2 − 7 mm in diameter, amphigenous, dark brown to black. *Caespituli* epiphyllous. *Stromata* lacking. *Conidiophores* (35) 75.5 ± 23.5 (123) × (3.5) 4.8 ± 0.4 (5.5) μm, loosely fasciculate, 3−12-septate, pale to medium olivaceous to brown, geniculate, not branched, subtruncate at the apex, conidial scars conspicuously thickened. *Conidiogenous cells* integrated, terminal, monoblastic, sympodially proliferating. *Conidia* (45) 98.7 ± 38.4 (185) × (2.5) 3.8 ± 1 (5) μm, solitary, acicular, slightly curved, hyaline, indistinctly multiseptate, smooth, subtruncate at the base, apex acute, with thickened, and darkened hila.

Specimen examined: on *Bidens pilosa* L., THAILAND, Phetchabun Province, Amphur Lom Sak, Num Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27963).

Host: *Bidens pilosa* L. (Asteraceae) (Meeboon et al., 2007c).

Distribution: Widespread in the tropics and subtropics, American Samoa, Brazil, China, Congo, Cuba, Ghana, India, Indonesia, Japan, Kenya, Malaysia, Malawi, Mauritius, Myanmar, Nepal, Nigeria, panama, Papua New Guinea, Solomon Islands, South Africa, Sudan, Taiwan, Tanzania, Tonga, Trinidad and Tobago, Venezuela, USA, Zimbabwe, and Thailand (Crous & Braun, 2003; Meeboon et al.,2007c).

Notes: Dark brown to black of leaf spot, epiphyllous caespituli, with long conidiophores (35−123 × 3.5−5.5 μm), and acicular conidia (45−185 × 2.5−5 μm) is typical of *C. bidentis* (Chupp, 1954). This species was firstly reported from Thailand by Meeboon et al. (2007c). Its host, *Bidens pilosa*, is common vegetables that also considered as a weed in some tropical habitats.

Cercospora chrysanthemi Heald & F. A. Wolf, Mycologia 3: 15, 1911.

= *Cercospora chrysanthemi* Puttemans, Bull. Soc. Roy. Bot. Belgique 48: 244, 912 (*nom.illeg.*), homonym *C. chrysanthemi* Heald & F. A. Wolf, 1911.

≡ *Cercosporina chrysanthemi* Sacc., Syll. Fung. 25: 898, 1931 (*nom. nov.*), as '(Puttemans) Sacc.'

= *Cercospora chrysanthemi-coronarii* Sawada, Rep. Dept. Agric. Gov. Res. Inst. Formosa 2: 147, 1922.

= ***C. apii s. lat.***

Leaf spots 5−25 mm diameter, amphigenous, irregular, greyish brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 34−40.5 μm diameter, well-developed, substomatal, small, composed of few subglobose, brown cells. *Conidiophores* 35−212 × 3−4.5 μm, 3−11 in

fascicles, 1—10-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, strongly geniculate. *Conidiogenous cells* integrated, holoblastic, polyblastic, sometimes monoblastic and terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* 23—190 × 2—4 μm, solitary, acicular, straight, hyaline, 3 — 10-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1.5—2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.21)

Specimen examined: on *Chrysanthemum* sp., THAILAND, Chiang Mai Province, Amphur Chiang Dao, Tumbol Huay Luek, Huay Luek Royal Project, 6 February 2008, Jamjan Meeboon (BBH 23577).

Host: *Chrysanthemum* sp. (Asteraceae).

Distribution: Bermuda, Brazil, China, Georgia, Hong Kong, India, Jamaica, Japan, Korea, Mauritius, Myanmar, New Zealand, Panama, Philippines, Taiwan, and USA (Crous & Braun, 2003).

Notes: This specimen is the first record of *C. chrysanthemi* from Thailand. Its host, *Chrysanthemum* sp., is ornamental plant native to Asia and northeastern Europe.

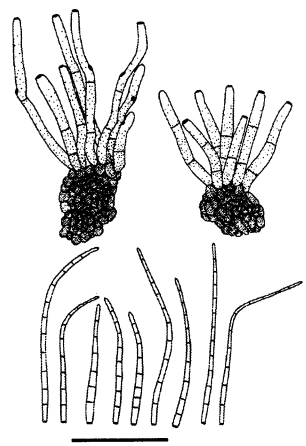


Fig. 3.21. Line drawings of conidia, conidiophores, and stromata of *Cercospora chrysanthemi* on *Chrysanthemum* sp. Bar = 50 μm.

Cercospora cynarae Y. L. Guo & Y. Jiang, Mycosystema 20: 26, 2001.

Leaf spots 2—10 mm in diameter, amphigenous, distinct, circular to subcircular, pale brown to tan, centre greyish brown to greyish white, with dark brown margins. *Caespituli* amphigenous. *Stromata* up to 28 μm in diameter, small sometimes lacking, if present composed of a few of globose, brown to dark brown cells. *Conidiophores* 32.5—220 × 3—5 μm, very

variable in length, loosely fasciculate, 3—12-septate, emerging from stromata through the cuticle or secondary mycelium, straight to slightly curved, pale brown or sometimes paler towards the apex, rarely geniculate. *Conidiogenous cells* integrated, terminal, often monoblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* 45—196 × 1.5—3 μm, solitary, acicular, curved, hyaline, 13—19-septate, smooth, truncate at the base, apex acute, with thickened, and darkened hila, ± 1 μm diameter. (Fig. 3.22)

Specimen examined: on *Cynara scolymus* L., THAILAND, Chiang Mai Province, Mae-jam Distric, Mae-hae Royal Project Area, 12 February 2008, Jamjan Meeboon BBH 23674).

Host: *Cynara scolymus* L. (Asteraceae).

Distribution: China (Jiang & Guo, 2001).

Notes: This specimen is the first record of *Cercospora cynarae* from Thailand. Its host, *Cynara scolymus*, is vegetables originating from southern Europe around the Mediterranean.

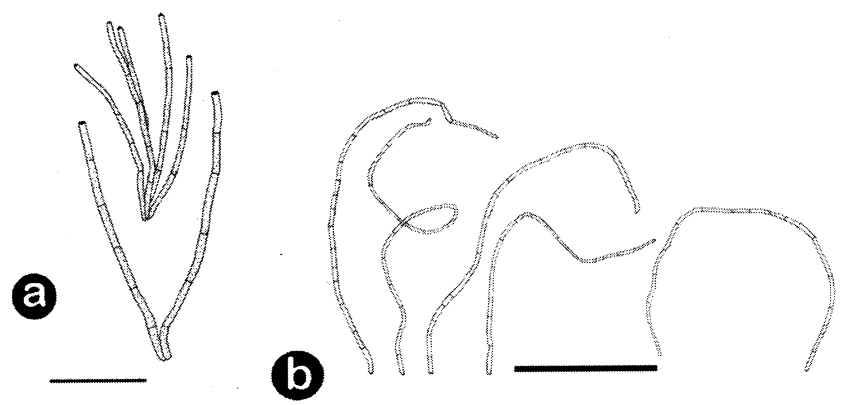


Fig. 3.22a-b. Line drawings of *Cercospora cynarae* on *Cynara scolymus*.
a. Conidiophores. b. Conidia. Bars: a. b = 50 μm.

Cercospora dahliicola M. A. Salam & P. N. Rao, J. Indian Bot. Soc. 36: 424, 1957.

= ***C. apii s. lat.***

Leaf spots 3—5 mm diameter, amphigenous, dark to yellowish, only leaf decoloration on the host. *Caespituli* hypophyllous. *Stromata* 19—21 μm, small, composed of a few globose to subglobose, brown to blackish-brown cells. *Conidiophores* 25—102 × 2.5—4 μm, 3—5 in a loosley and divergent fasciculate, 1—3-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, cylindrical, unbranched, not geniculate. *Conidiogenous cells* integrated, holoblastic, monoblastic, sympodially proliferating. *Conidiogenous loci* 2.5—3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 46—87 × 2.5—3 μm, solitary, acicular,

straight, hyaline, 7—10-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 2—2.5 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.23)

Specimen examined: on *Dahlia* sp., THAILAND, Chiang Rai Province, Mae Fah Luang, Mae Jan, Doi Tung Development, 16 August 2008, Jamjan Meeboon (BBH 23587).

Host: *Dahlia* sp. (Asteraceae).

Distribution: India (Salam & Rao, 1957).

Notes: This specimen is the first record of *C. dahliicola* from Thailand. Crous & Braun (2003) assigned this species as *C. apii s. lat.* Its host, *Dahlia* sp., is ornamental plant native to Mexico, Central America, and Colombia.

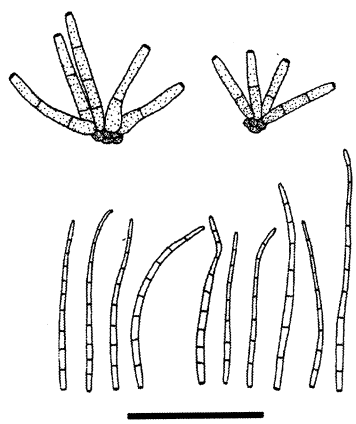


Fig. 3.23. Line drawings of conidia, conidiophores, and stromata of *Cercospora dahliicola* on *Dahlia* sp. Bar = 50 μm.

Cercospora eupatorii Sacc., Syll. Fung. 4: 449, 1886.

Leaf spots 2—5 mm in diameter, distinct, amphigenous, brown with indistinct black margins. *Caespituli* epiphyllous. *Stromata* small, composed of a few globose to subglobose, brown to blackish-brown cells. *Conidiophores* (15) 37.7 ± 19.7 (118) × (3.5) 4 ± 0.5 (5) μm, loosely and divergent fasciculate, 1—9-septate, arising from stromata, straight to decumbent, erect to decumbent, smooth, olivaceous to brown, not branched, subcylindrical, not geniculate. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (29) 44 ± 16 (215) × (1.5) 3.4 ± 0.5 (4) μm, solitary, narrowly obclavate to acicular, 3—12-

septate, straight to curve, hyaline, smooth, base subtruncate, with subacute apex, hilum 1.5−3 μm diameter, thickened and darkened.

Specimen examined: on *Eupatorium odoratum* L., THAILAND, Phetchabun Province, Amphur Lom sak, Nam Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27925); Chiang Mai Province, Queen Sirikit Botanical Garden, on *Eupatorium adenophorum* Spreng., 20 November 2004, Jamjan Meeboon (CMU 27880).

Host: *Eupatorium adenophorum* Spreng. and *E. odoratum* L., (Asteraceae).

Distribution: Nepal, USA, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Eupatorium adenophorum* and *Eupatorium odoratum* are widely known as weeds native to Mexico, but it is known in many other parts of the world as an introduced species and often a noxious weed.The first report of *Cercospora eupatorii* occurs on *Eupatorium adenophorum* and *Eupatorium odoratum* in Thailand was done by Meeboon *et* al. (2007c). The conidiophores of the specimen on *E. adenophorum* are straight, 2−8-septate, (117) 139−295 (332) × (2) 3.5−7 μm, with thickened conidiogenous loci. The conidia are pale olivaceous, obclavate, (14.5−) 22−39 (−51) × (2.5−) 4−5 (−7) μm, 2−12-septate, and have conspicuously thickened, darkened and non-protuberant of hila. On the other hand, the specimen on *E. odoratum* is characterized by having 1−9-septate conidiophores, 15−118 × 3.5−5 μm, and 3−12-septate conidia, 29−102.5 × 1.5−4 μm.

Cercospora gerberae Chupp & Viégas, Bol. Soc. Brasil. Agron. 8: 27, 1945.

= ***C. apii s. lat.***

Leaf spots 15−30 mm diameter, amphigenous, circular or subcircular, pale greenish to ochraceous at young symptoms, becoming brown to dark brown, with finally grayish to brown at the centre, surrounded by a dark margin. *Caespituli* amphigenous. *Stromata* (20.5) 33.5 ± 7.51 (39) μm diameter, well-developed, intraepidermal, composed of a few subglobose, brown to blackish-brown cells. *Conidiophores* (36) 88.5 ± 30 (163) × (3) 4.5 ± 0.6 (6) μm, loosely to densely fasciculate, 1−3-septate, numerous, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, polyblastic, sympodially proliferating. *Conidiogenous loci* thickened, darkened. *Conidia* (60) 113.38 ± 39.14 (198) × (2) 2.92 ± 0.78 (4) μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 5−12-septate, smooth, base obconically truncate, with subacute apex, hila 2−2.5 μm, thickened and darkened. (Fig. 3.24)

Specimen examined: on *Gerbera jamesonii* Adlam, THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 9 March 2005, Jamjan Meeboon (CMU 28219); Chiang Mai Province, Amphur Muang, Suthep, Chang Khian, 2 August 2008, Jamjan Meeboon (BBH 23690); Chiang Mai Province, Amphur Mae Jo, Tumbol San Sai, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23702).

Host: *Gerbera jamesonii* Adlam (Asteraceae).

Distribution: Australia, Bangladesh, Bermuda, Brazil, British Solomon Islands, Brunei, Cuba, Cambodia, Ghana, Hong Kong, India, Indonesia, Iran, Jamaica, Kenya, Malawi, Malaysia, Pakistan, Philippines, Puerto Rico, Sierra Leone, Singapore, Taiwan, Tanzania, Thailand, Uganda, USA and Virgin Islands (Crous & Braun, 2003).

Notes: This specimen is identified as *C. gerberae* due to its having large (15−30 mm diam.) and amphienous leaf spot; amphigenous caespituli with well-developed stromata; long (36−163 × 3−6 μm) and loosely fasciculate coniidophores; with long (39−198 × 2−4 μm), hyaline and acicular conidia. The conidiophores and conidia size and shape of this specimen are typical of *C. apii s. lat.* fide Crous and Braun (2003). *Gerbera jamesonii* is ornamental plant discovered in Barberton, Mpumalanga Province, South Africa. The first report of *Cercospora gerberae* occurs on *G. jamesonii* in Thailand was carried out by Sontirat et al. (1980).

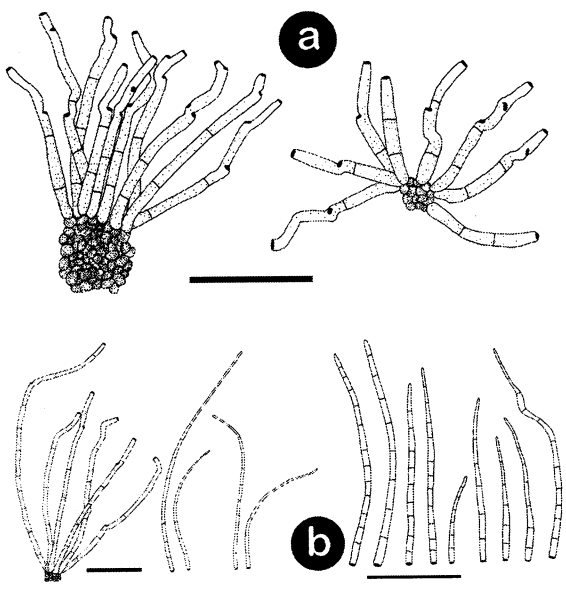


Fig. 3.24a-b. Line drawings of *Cercospora gerberae* on *Gerbera jamesonii*.
a. Stromata and conidiophores. b. Conidia. Bars: a, b = 50 μm.

Cercospora helianthicola Chupp & Viégas, Bol. Soc. Brasil. Agron. 8: 29, 1945.

= ***C. apii s. lat.***

Leaf spots 2−26 mm diameter, distinct, amphigenous, variable, from minute spot until large necrosis on the leaves, dar brown with indistinct margins. *Caespituli* hypophyllous. *Stromata* (12) 13.5 ± 1.3 (15) µm diameter, intraepidermal, small, composed of a few globose to subglobose, brown to blackish-brown cells. *Conidiophores* (79) 147.5 ± 35.7 (184) × (3) 4 ± 0.5 (5) µm, 3−6 in a loosely and divergent fasciculate, 2−4-septate, arising from stromata, straight to decumbent, erect to decumbent, smooth, pale yellow to pale brown, not branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5−3 µm diameter, conspicuous, thickened, and darkened. *Conidia* (120) 145.5 ± 39.9 (215) × (3) 3.5 ± 0.4 (4) µm, solitary, narrowly obclavate to acicular, 8−20-septate, straight to curve, hyaline, smooth, base obconically truncate, with subacute apex, hilum 1.5−3 µm diameter, thickened and darkened. (Fig. 3.25)

Specimen examined: on *Helianthus annuus* L., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 30 November 2004, Jamjan Meeboon (CMU 27879); Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 14 August 2008, Jamjan Meeboon (BBH 23610).

Host: *Helianthus annuus* L. (Asteraceae).

Distribution: Brazil, Cambodia, China, India, Mauritius, Pakistan, Panama, and Thailand (Crous & Braun, 2003).

Notes: In Thailand, this fungus was firstly reported by Petcharat and Kanjanamaneesathian (1989). Crous & Braun (2003) noted *C. helianthicola* as *C. apii s. lat.* Its host, *Helianthus annuus*, is commonly recognized as ornamentals, foods, and oil crops native to the Americas.

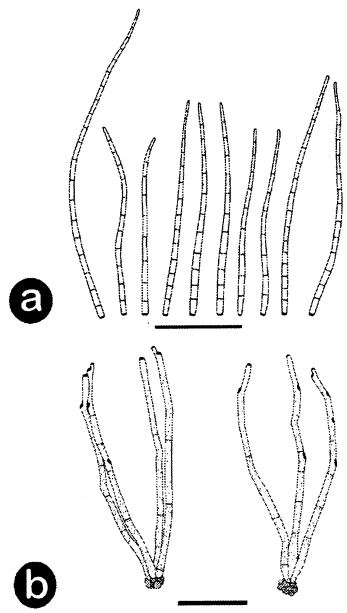


Fig. 3.25a-b. Line drawings of *Cercospora helianthicola* on *Helianthus annuus*.
a. Conidia. b. Stromata and conidiophores. Bars: a, b = 50 μm.

Cercospora lactucae-sativae Sawada, Report of the Department of Indutry, Government Research Institute, Formosa 85: 111, 1943.

= *Cercospora longispora* (Cugini) Trav., Malpighia 17: 217, 1902 (*nom.illeg.*), homonym of *C. longispora* Peck, 1884.

≡ *Cercospora longissima* Trav., Malpighia 17: correzione (correction slip) to p. 217, 1903 (*nom. illeg.*), homonym of *C. longissima* Cooke and Ellis, 1889.

≡ *Cercospora longisima* (Cugini) Sacc., Syll. Fung. 18: 607, 1906 (*nom.illeg.*), homonym of *C. longissima* Cooke and Ellis, 1889.

= *Cercospora lactucae* J. A. Stev., J. Dept. Agric. Puerto Rico 1: 105, 1917 (*nom.illeg.*), homonym of *C. lactucae* Henn., 1902.

= *Cercospora lactucae* Welles, Phytopathology 13: 289, 1923 (*nom.illeg.*), homonym of *C. lactucae* Henn., 1902.

= *Cercospora ixeridis-chinensis* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 86: 171, 1943 (*nom. inval.*).

= *Cercospora lactucae-indicae* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 86: 172, 1943 (*nom. inval.*).

Leaf spots 2－10 mm diameter, amphigenous, circular or subcircular, brown to dark brown, with grayish to brown at the centre, surrounded by a dark margin. *Caespituli*

amphigenous. *Stromata* 17−36 μm diameter, intraepidermal, moderately small, composed of subglobular, and brown to dark brown cells. *Conidiophores* 47−128 × 3−6.5 μm, 3−8 in a loose fascicles, 1−4-septate, arising through stomata, straight to decumbent, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, strongly geniculate near the apex. *Conidiogenous cells* 19−40 × 2−3.5 μm, integrated, terminal, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* 36−182 × 3−6.5 μm, solitary, acicular to narrowly obclavate, straight (occasionally curved), hyaline, 7−13-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1.5−3 μm diameter, thickened, and darkened.

Specimen examined: on *Lactuca sativa* cv. *butter head lettuce*, THAILAND, Chiang Mai Province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23572), on *L. sativa* cv. *red leaf lettuce*, Jamjan Meeboon (BBH 23573); and *L. sativa* cv. *green corol*, Jamjan Meeboon (BBH 23572), Amphur Sanpatong, Tambol Mae Win, Ban Mae Sapok, Mae Sapok Royal Project, 8 February 2008, *L. sativa* cv. *red corol*, Jamjan Meeboon (BBH 23569), on *L. sativa* cv. *red oak leaf*, Jamjan Meeboon (BBH 23570); on *L. sativa* cv. *ice berg*, Jamjan Meeboon (BBH 23633), on *L. sativa* cv. *lettuce green oak leaf*, Jamjan Meeboon (BBH 23597); on *L. sativa* cv. *lettuce sweet chart*, Jamjan Meeboon (BBH 23631).

Host: *Lactuca sativa* L. (Asteraceae) (Meeboon et al., 2007c).

Distribution: Worldwide, wherever the host plant is growing or cultivated, including China, Japan, Korea, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of this species from Thailand was done by Meeboon et al. (2007c). This report is the first report of *C. lactucae-sativae* on *Cichorium endivia*, and various cultivars of *L. sativa*, viz, cv. *butter head lettuce*, cv. *red leaf lettuce*, cv. *green corol*, cv. *red corol*, cv. *red oak leaf*, cv. *ice berg*, cv. *lettuce green oak leaf*, and cv. *lettuce sweet chart*, in Thailand.

Cercospora nilghirensis Govindu & Thirum., Sydowia 9: 224, 1955.

Leaf spots 2−5 mm diameter, amphigenous, distinct, circular to subcircular, pale to whitish at the center with dark margin. *Caespituli* amphigenous. *Stromata* up to 12 µm diameter, small, often lacking, intraepidermal, composed of a few globose to subglobose, brown cells. *Conidiophores* 88−118 × 4−6 µm, 4−9 in a loose to dense fascicles, 2−5-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, geniculate, mostly near the apex. *Conidiogenous cells* integrated, terminal or intercalary, frequently monoblastic, sometimes polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* 80 − 96 × 3.5 − 4 µm, solitary, obclavate, straight, slightly curved, hyaline, 6−12-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2−2.3 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.26)

Specimen examined: on *Conyza sumatrensis* (Retz.) E. Walker, THAILAND, Chiang Mai Province, Amphur Mae Jam, Mae Hae Royal Project, 12 February 2008, Jamjan Meeboon (BBH 23775).

Host: *Conyza sumatrensis* (Retz.) E. Walker (Asteraceae).

Distribution: India (Crous & Braun, 2003).

Notes: This specimen is quite closed to *C. nilghirensis* Govindu & Thirum. due to distinct and amphigenous leaf spot, amphigenous caespituli, stromata small to lacking, unbranched and geniculation of conidiophores near the apex, and conidia frequently obclavate. In *C. bidentis* Tharp, the leaf spot is indefinite at the lower surfaces and caespituli epiphyllous. This is the first record of *C. nilghirensis* from Thailand. Its host, *Conyza sumatrensis*, is weeds/annual herb native to North America but naturalized worldwide.

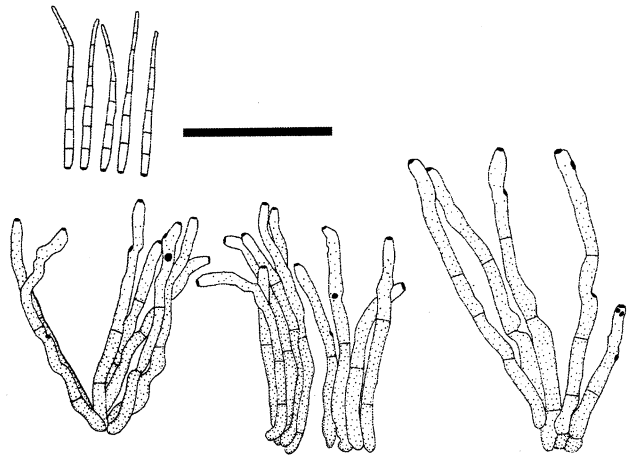


Fig. 3.26. Line drawings of conidia and conidiophores of *Cercospora nilghirensis* on *Conyza sumatrensis*. Bar = 50 μm.

Cercospora mikaniicola F. Stevens, Trans. Illinois Acad. Sci. 10: 213, 1917.

= *Cercospora mikaniae-cordatae* J. M. Yen, Rev. Mycol. 30: 183, 1965.

Leaf spots 1−5 mm diameter, amphigenous, circular or irregular circular, pale brown to brown, whitish at the centre, surrounded by brown margin. *Caespituli* amphigenous, but chiefly hypophyllous. *Stromata* lacking. *Conidiophores* (50) 68.7 ± 16.3 (108) × (5) 5.7 ± 0.8 (7) μm, 3−8 in a loose fascicles, 1−4-septate, arising through stromata, straight, cylindrical, smooth, olivaceous to brown, and paler toward the apex, unbranched, cylindrical, geniculate. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (83) 91.1 ± 11 (138) × (7) 7.5 ± 0.6 (10) μm, solitary, obclavate, straight or slightly curved, hyaline, 4−8-septate, smooth, attenuate and truncate at the base, obtuse apex, hila 4−7 μm diameter, thickened, and darkened.

Specimen examined: on *Mikania cordata* B. L. Rob., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 31 October 2004, Jamjan Meeboon (CMU 27934).

Host: *Mikania cordata* B. L. Rob. (Asteraceae) (Meeboon et al., 2008).

Distribution: American Samoa, Agrentina, Bangladesh, Brazil, Cuba, Colombia, Fiji, Guadalcanal, Hong Kong, India, Jamaica, Malaysia, Niue, Pakistan, Papua New Guinea, Puerto Rico, Samoa, Sierra Leone, Singapore, Solomon Islands, Thailand, Tuvalu, USA, Vanuatu (Crous & Braun, 2003: Meeboon et al., 2008).

Notes: The characters of conidiophores and conidia are typical of *C. apii s. lat*, but Crous and Braun (2003) still maintains it as separate species. Thus, further analysis is necessary to justify the status of this species. Its host, *Mikania cordata*, is tropical weeds originates from

South America. The first report of *Cercospora mikaniicola* occurs on *M. cordata* from Thailand was conducted by Meeboon et al. (2008).

Cercospora tagetis-erectae Thirum. & Govindu (*tagetes-erectae*), Sydowia 10: 262, 1956 [1957].

Leaf spots 1—4 mm diameter, amphigenous, irregular, brown, grayish white at the centre, surrounded by brown margin. *Caespituli* amphigenous, but chiefly hypophyllous. *Stromata* 30—55 µm in diameter, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (30) 58.5 ± 19.2 (120) × (2.5) 3.5 ± 0.7 (5.5) µm, 2—5-septate, arising through stromata, straight, cylindrical, smooth, olivaceous to brown, and paler toward the apex, unbranched, geniculate. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (50) 92.8 ± 30.5 (158) × (2.5) 3.3 ± 0.3 (4) µm, solitary, acicular, straight or slightly curved, hyaline, 3—13-septate, smooth, attenuate and truncate at the base, acute apex, hila 2—3 µm diameter, thickened, and darkened.

Specimen examined: on *Tagetes erecta* L., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 31 October 2004, Jamjan Meeboon (CMU 27939).

Host: *Tagetes erecta* L. (Asteraceae) (Meeboon et al., 2008).

Distribution: India and Thailand (Thirumalachar & Govindu, 1956; Meeboon et al., 2008).

Notes: This species is closed to *C. apii s. lat.* due to having long *res* (30—120 × 2.5—5.5 µm) and sinuous-geniculate conidiophores; with long (50—158 × 2.5—4 µm), hyaline and acicular conidia. However, Crous and Braun (2003) still placed this species as distinct species from *C. apii s. lat.* Thus, further analysis is necessary to carry out in order to justify the status of this species. *Tagetes erecta* is ornamental plant native to Mexico and Central America. The first report of *Cercospora tagetis-erectae* occurs on *T. erecta* in Thailand was carried out by Meeboon et al. (2008).

Cercospora tridacis-procumbentis Govindu & Thirum., Sydowia 7: 49, 1953.

= ***C. apii s. lat.***

Leaf spots 2—26 mm diameter, distinct, amphigenous, circular, dark brown, grayish-white at the centre, with indistinct margins. *Caespituli* hypophyllous. *Stromata* small, composed of a few brown cells. *Conidiophores* (40) 62 ± 11.2 (48) × (4) 4.3 ± 0.3 (5) µm, divergent fasciculate, 2—4-septate, arising from stromata, smooth, pale yellow to pale brown, unbranched,

subcylindrical, geniculate. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (20) 52.2 ± 15.2 (77) × (2.5) 3.2 ± 0.3 (4) μm, solitary, acicular, 5—15-septate, straight to curve, hyaline, smooth, base obconically truncate, with acute apex, hilum 2.5—3 μm diameter, thickened and darkened.

Specimen examined: on *Tridax procumbens* L., THAILAND, Chiang Mai Province, Chiang Mai University, 31 October 2004, Jamjan Meeboon (CMU 27918).

Host: *Tridax procumbens* L. (Asteraceae).

Distribution: Australia, Cuba, Ghana, Guinea, India, Kenya, Kiribati, Myanmar, Nauru, Nigeria, Papua New Guinea, Sierra Leone, Solomon Islands, South Africa, Tanzania, Thailand, Togo, and Tuvalu (Crous & Braun, 2003).

Notes: In Thailand, *C. tridacis-procumbentis* was reported by Sontirat et al. (1980). Crous and Braun (2003) noted *C. tridacis-procumbentis* as *C. apii s. lat.* Our observation also supports the placement of *C. tridacis-procumbentis* as synonym of *C. apii s. lat.* due to its having small stromata, subcylindric and loosely divergent fasciculate of conidiophores (40—48 × 4—5 μm); with hyaline, acicular conidia with acute apex (20—77 × 2.5—4 μm). Its host, *Tridax procumbens*, is weeds native to the tropical Americas, but it has been introduced to tropical, subtropical, and mild temperate regions worldwide.

Cercospora zinniicola A. Pande, Kavaka 3: 55, 1975.

Leaf spots 1—10 mm diameter, amphigenous, irregular, pale, with dark red margin, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* 32.5—46 μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 54—110 × 2.5—5 μm, 9—16 in a densely fasciculate, not divergent, 3—6-septate, arising from stromata, smooth, brown at the base, and paler toward the apex, straight to decumbent, unbranched, cylindrical, geniculate to sinuous, mostly near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* 2—2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 24.5—153.5 × 2.5—3.5 μm, solitary, filiform to narrowly obclavate, straight, hyaline, 7—18-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2—2.5 μm diameter, thickened, and darkened. (Fig. 3.27)

Specimen examined: on *Zinnia elegans* Jacq., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, Tumbol Wiang Ga Long, 31 July 2007, Jamjan Meeboon (BBH 23563);

Chiang Mai Province, Mae Rim, Queen Sirikit Botanical Garden, 5 August 2008, Jamjan Meeboon, (BBH 23731).

Host: *Zinnia elegans* Jacq. (Asteraceae).

Distribution: India (Crous & Braun, 2003).

Notes: Both of these specimens definitely distinct from *C. apii s. lat.* due to well-developed stromata, very densely fasciculate conidiophores, and obclavate conidia with obconically truncate base. Both of them are also characterized by having amphigenous caespituli. Both of the specimens having relatively short conidiophores (up to 100 µm long) as well as conidia, but the conidia spetation of the second specimen is a few (only up to 4-septate). Since these collections are not *C. apii s. lat.*; therefore, we assigned them to *C. zinniicola* due to the similarity of morphological characteristics, and being recorded from *Zinnia elegans*. These specimens are the first record of *C. zinniicola* from Thailand. Its host, *Zinnia elegans*, is ornamentals originally from scrub and dry grassland in an area stretching from the American Southwest to South America, but primarily Mexico.

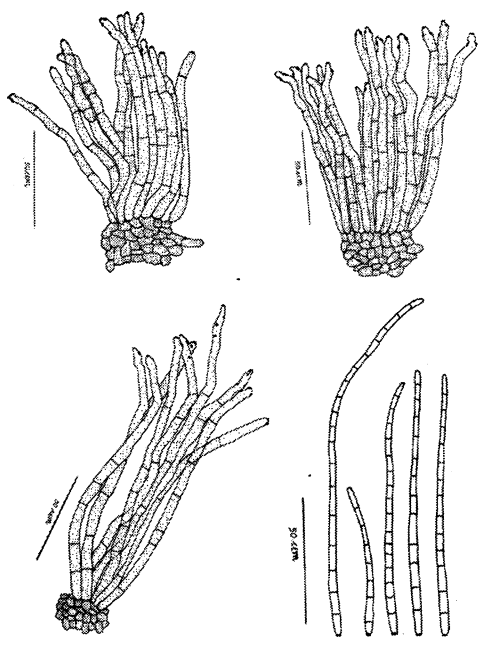


Fig. 3.27. Line drawings of conidia, conidiophores, and stromata of *Cercospora zinniicola* on *Zinnia elegans*. Bar = 50 µm.

Cercospora zinniae Ellis & G. Martin, J. Mycol. 1: 20, 1885.

= *Cercospora atricincta* Heald & F. A. Wolf, Mycologia 3: 14, 1911.

= *Cercospora zinniae* Takah. & Yosh., Pl. Protect. Tokyo 7: 17, 1953.

= ***C. apii s. lat.***

Leaf spots 15 – 30 mm diameter, amphigenous, circular or subcircular, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margins. *Caespituli* amphigenous, effuse. *Stromata* 17–25 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 40–152 × 3–5.5 µm, 9–13 in a densely fasciculate, often divergent, 1–4-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* 24 – 175 × 2 – 3.5 µm, solitary, narrowly obclavate to subacicular, straight, hyaline, 4–13-septate, smooth, obconically truncate at the base, with subacute apex, hila 1.5–2.5 µm diameter, thickened and darkened. (Fig. 3.28)

Specimen examined: on *Zinnia grandiflora* Nutt., THAILAND, Chiang Mai Province, Amphur Mae Rim, Queen Sirikit Botanical Garden, 5 August 2008, Jamjan Meeboon (BBH 23730).

Host: *Zinnia grandiflora* Nutt. (Asteraceae).

Distribution: American Samoa, Bangladesh, Bhutan Brazil, Brunei, China, Colombia, Cook Islands, Cuba, Dominican Republic, El-Salvador, Fiji, Ghana, Guam, Guatemala, Haiti, Hong Kong, India, Indonesia, Jamaica, Japan, Korea, Lithuania, Malawi, Malaysia, Mauritius, Mexico, Micronesia, Myanmar, Nepal, New Caledonia, Nigeria, Pakistan, Panama, Papua New Guinea, Philippines, Puerto Rico, Samoa, Singapore, Solomon Islands, South Africa, Sudan, Taiwan, Tanzania, Togo, Tonga, Trinidad and Tobago, Tuvalu, Uganda, USA, Vunatu, Venezuela, Virgin Islands, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is the first record of *C. zinniae* from Thailand, and *Zinnia grandiflora* is reported here as a new host of this fungus. *Zinnia grandiflora* is ornamentals originally from scrub and dry grassland in an area stretching from the American Southwest to South America, but primarily Mexico.

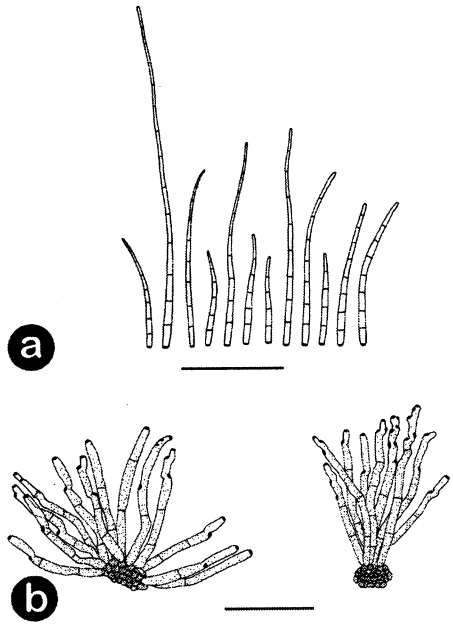


Fig. 28a-b. Line drawings of *Cercospora zinniae* on *Zinnia grandiflora*.
a. Conidia. b. Conidiophores and stromata. Bars a, b = 50 μm.

Passalora assamensis (S. Chowdhury) U. Braun & Crous, CBS Biodiversity Series 1: 69, 2003.

≡ *Cercospora assamensis* S. Chowdhury, Lloydia 20: 134, 1957.

= *Cercospora eupatorii-odorati* J. M. Yen, Bull. Trimest. Soc. Mycol. Fr. 84: 11, 1968.

≡ *Mycovellosiella eupatorii-odorati* (J. M. Yen) J. M. Yen, Bull. Trimest. Soc. Mycol. Fr. 97: 131, 1981.

≡ *Phaeoramularia eupatorii-odorati* (J. M. Yen) X. J. Liu & Y. L. Guo, *Acta Phytopath. Sinica* 12: 7, 1982.

= *Mycovellosiella eupatorii-odorati* var. *asteracearum* Bhalla, S. K. Singh, & A. K. Srivast., Aust. Syst. Bot. 12: 368, 1999.

Leaf spots 4−15 mm in diameter, amphigenous, subcircular, brown to grayish to brown at the center, with dark and narrow margins. *Caespituli* amphigenous. *Stromata* 24−44 μm diameter, intraepidermal, well-developed, and composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 28−53 × 3−5 μm, 7−13 in a loose to moderately dense fascicles, arising from stromata, 1−4-septate, erect, straight, smooth, pale brown to brown with lightly paler at the apex, unbranched, subcylindrical to moderately geniculate-sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monobalstic or ployblastic, sympodially

proliferating. *Conidiogenous loci* 1—1.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 13—54 × 2.5—5 μm, solitary, obclavate to subcylindrical, straight, subhyaline to light brown, 3—7-septate, smooth, obconically truncate at the base, with obtuse apex, hila 1—1.5 μm diameter, conspicuous, slightly thickened, and darkened. (Fig. 3.29)

Specimen examined: on *Eupatorium adenophorum* Spreng., THAILAND, Chiang Mai Province, Aumphur Mae Taeng, Tumbol Pa Pae, Bahn Phadeng, Mushroom Research Centre, 12 October 2006, Ikumitsu Araki (CMU 27916); Chiang Mai Province, Nong Hoy Royal Project, 27 July 2007, Jamjan Meeboon (BBH 23647).

.**Host**: on *Eupatorium adenophorum* Spreng., (Asteraceae) (Meeboon et al., 2007b).

Distribution: China, India, Malaysia, Nepal, New Zealand and Thailand (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: The first report of this species from Thailand was done by Meeboon et al. (2007b). Its host, *E. adenophorum*, is weeds native to Mexico, but it is known in many other parts of the world as an introduced species and often a noxious weed.

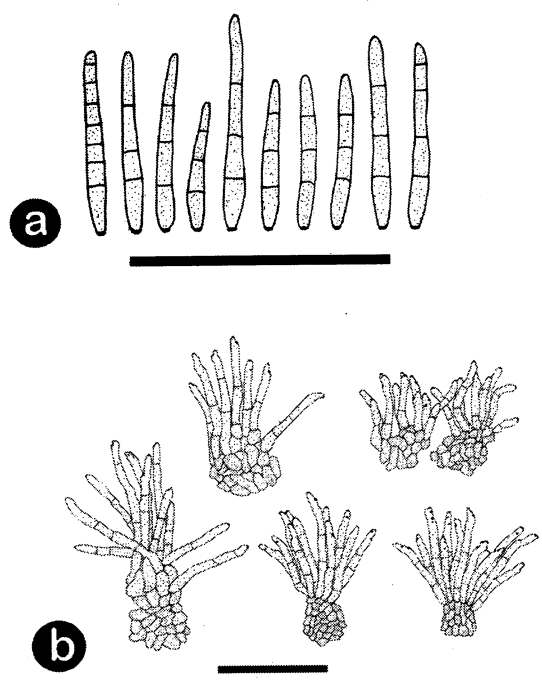


Fig. 3.29a-b. Line drawings of *Passalora assamensis* on *Eupatorium adenophorum*.
a. Conidia. b. Conidiophores and stromata. Bars a, b = 50 μm.

Passalora tithonia (R. E. D. Baker & W. T. Dale) U. Braun & Crous, CBS Biodiversity Series 1: 404−405, 2003.

≡ *Cercospora tithoniae* R. E. D. Baker & Dale, Mycol. Pap. 33: 106, 1951.

≡ *Phaeoramularia tithoniae* (R. E. D. Baker & W. T. Dale) Deighton, in Ellis, More Dematiaceous Hyphomycetes: 319, 1976.

= *Cercospora tithoniae* Chidd., Mycopathol. Mycol. Appl. 17: 80, 1962. (*nom. illeg.*) homonym of *C. tithoniae* R. E. D. Baker & W. T. Dale, 1951.

≡ *Cercospora tithonicola* J. M. Yen (tithonicola) Rev. Mycol. 31: 144, 1966 (*nom. nov.*).

Leaf spots 1−6 mm diameter, amphigenous, indistinct, subcircular to irregular, black, only leaf discoloration. *Caespituli* amphigenous. *Stromata* 20−67.5 µm diameter, substomatal, small, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (52−) 73−97 (−110) × (2.5−) 3−3.5 (−4.5) µm, in a dense fascicles, 2−6-septate, arising from stromata, straight to often incurved, smooth, pale brown, unbranched, slightly geniculate. *Conidiogenous cell*s integrated, holoblastic, monoblastic, sometimes polyblastic, terminal or intercalary, sympodial proliferating. *Conidiogenous loci* thickened and darkened. *Conidia* (20−) 22.5−56 (−89) × (2.5−) 3−4 (−4.5) µm, catenate, obclavate to cylindrical, straight, brown, 1−5-septate, smooth, obconically truncate at the base, with obtuse apex, hila 1−2 µm diameter, slightly thickened and darkened. (Fig. 3.30)

Specimen examined: on *Tithonia diversifolia* (Hemsl.) A. Gray, THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, Chiang Mai Province, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27957), 9 October 2005, Jamjan Meeboon (CMU 28052); Chiang Mai Province, Amphur Mae Jam, Mae-Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23601).

Host: *Tithonia diversifolia* (Hemsl.) A. Gray (Asteraceae) (Nakashima et al., 2007).

Distribution: Barbados, Cuba, Hong Kong, India, Ivory Coast, Mauritius, Singapore, Taiwan, Thailand, and Trinidad and Tobago (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: This species was identified as *P. tithoniae* due to small stromata, straight conidiophores, and obclavate and catenate conidia. The first record of this species from Thailand was done by Nakashima et al. (2007). Its host, *Tithonia diversifolia*, is ornamentals distributed in tropical and subtropical areas such as Central America, Southeast Asia and Africa.

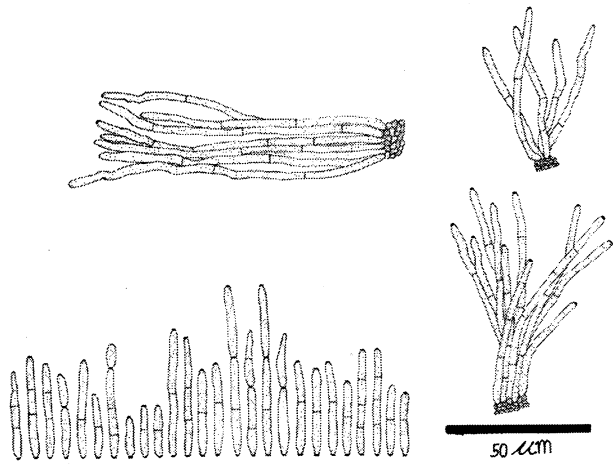


Fig. 3.30. Line drawings of *Passalora tithonia* on *Tithonia diversifolia*.

Pseudocercospora blumeae-balsamiferae Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 2: 128, 1987c.

≡ *Cercospora blumeae-balsamiferae* Sawada, Taiwan Agric. Res. Inst. Rept. 86: 166, 1943 (*nom. inval.*).

≡ *Pseudocercospora blumeae-balsamiferae* (Sawada) Y. L. Guo & X. J. Liu, Mycosystema 2: 229, 1989 (*nom. inval.*), homonym of *P. blumeae-balsamiferae* Goh & W. H. Hsieh, 1987.

Leaf spots 10—20 mm diameter, amphigenous, solitary, scattered on the host surface, circular to subcircular, brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 17—42 µm diameter, intraepidermal, well-developed, and composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 35—116 × 2.5—4 µm, 13—27, in a very densely fasciculate, 0—3-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler towards the apex, unbranched, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 78—102 × 3—4.5 µm, solitary, obclavate, straight to mildly curved, hyaline to subhyaline, 7—9-septate, smooth, obconically truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.31)

Specimen examined: on *Blumea balsamifera* DC., THAILAND, Chiang Mai Province, Chiang Mai University, Medicinal Plant Garden, 15 September 2007, Jamjan Meeboon (BBH 23688).

Host: *Blumea balsamifera* DC. (Asteraceae).

Distribution: Argentina, Brunei, China, India, yanmar, Philippines, and Taiwan (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. blumeae-balsamiferae* from Thailand. Its host, *Blumea balsamifera*, is medicinal plant distributed in tropical area especially Asia.

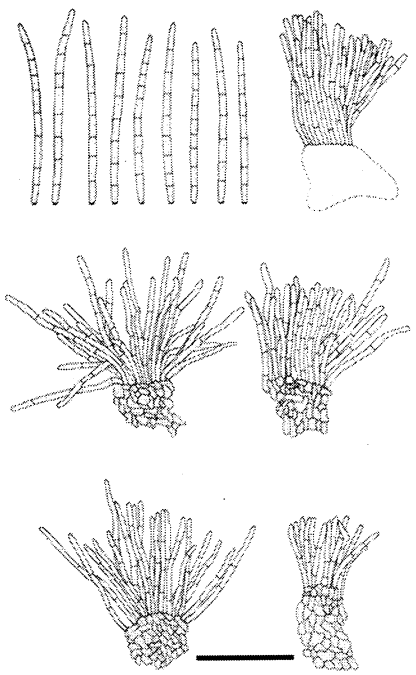


Fig. 3.31. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora blumeae-balsamiferae* on *Blumea balsamifera*. Bar = 50 µm.

Pseudocercospora cosmicola (A. K. Kar & M. Mandal) Deighton, Trans. Brit. Mycol. Soc. 88: 388, 1987.

≡ *Cercospora cosmicola* A. K. Kar & M. Mandal, Trans. Brit. Mycol. Soc. 53: 345, 1969.

Leaf spots 2−10 mm diameter, distinct, amphigenous, circular to irregular, scattered, brown, with dark brown margins. *Caespituli* hypophyllous. *Stromata* 30−40 µm diameter, intraepidermal, well-developed, composed of globular to angular, brown to dark brown cells. *Conidiophores* 13−18 × 2−2.5 µm, numerous in a densely fasciculate, 1−2-septate, not divergent, arising from stromata, brown, smooth, straight, simple, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 26−93 × 1.5−2.5 µm, solitary, long filiform to slightly obclavate, 4−8-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, obtuse apex, hila unthickened and not darkened. (Fig. 3.32)

Specimen examined: on *Cosmos sulphureus* Cav., THAILAND, Chiang Mai Province, Royal Flora, 27 July 2008, Jamjan Meeboon (BBH 23766).

Host: *Cosmos sulphureus* Cav. (Asteraceae).

Distribution: India (Deighton, 1987).

Notes: This specimen is the first record of *P. cosmicola* from Thailand. *Cosmos sulphureus*, usually weeds native to Central America, is reported here as a new host of this fungus.

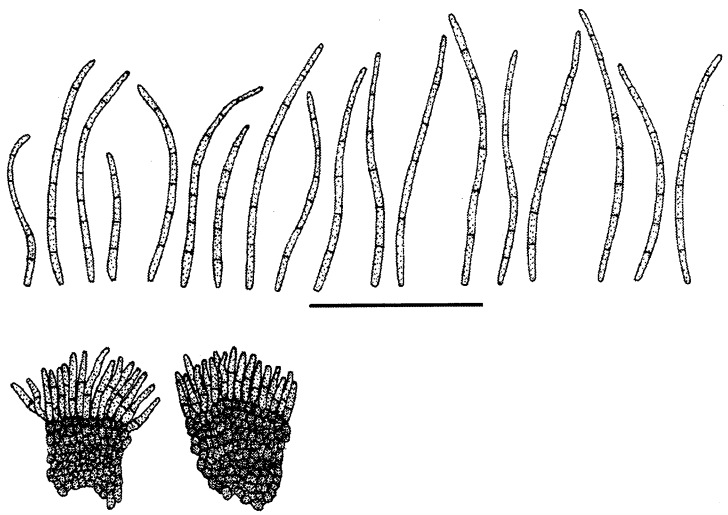


Fig. 3.32. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora cosmicola* on *Cosmos sulphureus*. Bar = 50 μm.

Family Balsaminaceae

Cercospora balsaminiana J. M. Yen & Lim, Cah. Pacifique 14: 91, 1970.

Leaf spots 3—10 mm diameter, amphigenous, circular to subcircular, brown to dark brown, with dark margin and pale at the center. *Caespituli* amphigenous. Stromata 10—15 μm diameter, substomatal to intraepidermal, small, composed of a few globose to subglobose, brown cells. *Conidiophores* 52—129 × 2—3.5 μm, 6—8 in a loose fascicles, 2—4-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, geniculate, mostly near the apex. *Conidiogenous cells* integrated, holoblastic, polyblastic, sometimes monoblastic, sympodially proliferating. *Conidiogenous loci* 1—2 μm, conspicuous, thickened, and darkened. *Conidia* 35—73 × 4—5 μm, solitary, obclavate to subacicular, straight, slightly curved, hyaline, 3—11-septate, smooth, obconically truncate at

the base, with tapering toward a subacute apex, hila, 1 – 2.3 μm diameter, thickened, and darkened. (Fig. 3.33)

Specimen examined: on *Impatiens walleriana* Hook. f., THAILAND, Chiang Mai Province, Amphur Mueang, Tumbol Sri Pum, Chiang Mai Public Garden, 15 August 2008, Jamjan Meeboon (BBH 23582).

Host: *Impatiens walleriana* Hook. f. (Balsaminaceae).

Distribution: Singapore (Yen & Lim, 1980).

Notes: The symptoms, stromata, and conidiophores of ths specimens are much closed to *C. apii s. lat.* fide Crous & Braun (2003), but the conidial shapes are obclavate with obconically truncate at the base which also distinct from *C. fukushiana* (Chupp, 1954; Yen & Lim, 1980). Therefore, we decide to assign this specimen to *C. balsaminiana*. This specimen is the first record of *C. balsaminiana* from Thailand. *Impatiens walleriana*, ornamental plant, native to eastern Africa from Kenya to Mozambique, is reported in this study as a new host of this fungus.

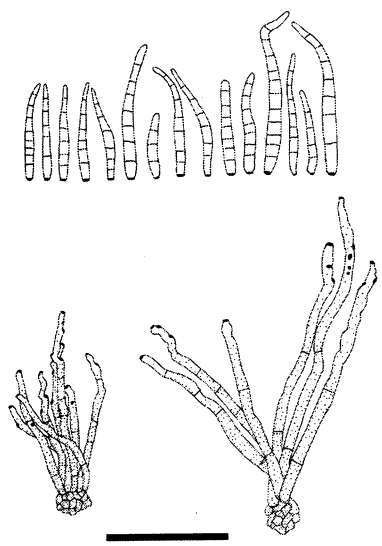


Fig. 3.33. Line drawings of conidia, conidiophores, and stromata of *Cercospora balsaminiana* on *Impatiens walleriana*. Bar = 50 μm.

Cercospora fukushiana (Matsuura) W. Yamam., J. Soc. Trop. Agric. 6: 601, 1934.

≡ *Cercospora fukushiana* Matsuura, J. Pl. Prot. 14: 699, 1927.

= *Cercospora balsaminae* Mend. Philipp. J. Sci. 75: 166, 1941.

= *Cercospora balsaminae* Kellerm. & Swingle, unknown fide Chupp, 1954.

= ***C. apii s. lat.***

Leaf spots 15 – 30 mm diameter, amphigenous, circular or subcircular, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre,

surrounded by a dark margin. *Caespituli* amphigenous, velvety. *Stromata* (25) 28.5 ± 2.5 (32) µm diameter, small, composed of globose to subglobse, brown to blackish-brown cells. *Conidiophores* (49) 83 ± 16.5 (112) × (4) 4.5 ± 0.9 (6.5) µm, 6—8 in a loosely to densely fasciculate, arising from stromata, simple, straight, 1—4-septate, erect to decumbent, smooth, subcylindrical, pale yellow to pale brown, rarely branched, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, darkened. *Conidia* (60) 86.5 ± 18 (120) × (2.5) 3.5 ± 1 (5) µm, solitary, narrowly obclavate to subacicular, 5—18-septate, straight, hyaline, smooth, base truncate to obconically truncate, with subacute apex, hila 1.5—2.5 µm diameter, thickened and darkened. (Fig. 3.34)

Specimen examined: on *Impatiens balsamina* L., THAILAND, Phetchabun Province, Nam Nao National Park, 24 November 2004, Jamjan Meeboon (CMU 27917); Chiang Mai Province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23616).

Host: *Impatiens balsamina* L. (Balsaminaceae) (Meeboon, 2006).

Distribution: Bangladesh, Bhutan Brazil, Brunei, China, Cuba, Estonia, Hong Kong, India, Indonesia, Iran, Japan, Korea, Lithuania, Korea, India, Indonesia, Malaysia, Mauritius, Myanmar, Nepal, New Caledonia, Papua New Guinea, Philippines, Sierra Leone, South Africa, Sudan, Taiwan, Tanzania, Thailand, and USA (Crous & Braun, 2003; Meeboon, 2006).

Notes: In Thailand, *C. fukushiana* on *I. balsamina* was first reported by Meeboon (2006). *Impatiens balsamina* is ornamentals native to southern Asia in India and Myanmar.

Literature: Chupp (1954, p. 78).

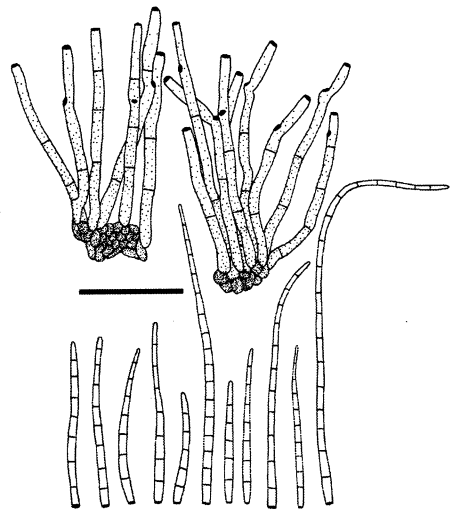


Fig. 3.34. Line drawings of *Cercospora fukushiana* on *Impatiens balsamina*.

Family Basellaceae

Cercospora basellae-albae R. K. Srivast., S. Narayan & A K. Srivast., Indian Phytopathol. 47: 229, 1994.

Leaf spots 2−8 mm in diameter, amphigenous, subcircular to irregular, pale brown to dingy grey in the center with reddish brown to purplish brown margin on the upper surface, pale brown to olivaceous to brown on the lower surface. *Caespituli* amphigenous. *Stromata* 13−53 μm in diameter, small, sometimes lacking, irregular, composed of a few globose to subglobose, dark brown cells. *Conidiophores* (25−) 31.5 − 60 (−70) × (3−) 4 − 5 (−6) μm, 10−15 in a divergent fascicles, 1−4-septate, emerging through stomata openings and the cuticle, light brown, paler towards the apex, straight to slightly curved, not branched, plainly geniculate near the apex. *Conidiogenous cells* integrated, terminal or intercalary, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 μm, conspicuous, thickened, and darkened. *Conidia* (17−) 26 − 52.5 (−93) × 3 −4 (−5) μm, solitary, acicular to obclavate, hyaline, 6−12-septate, non-constricted at the septa, acute to obtuse at the apex, truncate at the base, hila 1−3 μm in diameter, conspicuous, thickened, and darkened. (Fig. 3.35)

Specimen examined: on *Basella alba* L., THAILAND, Chiang Mai Province, Chiang Mai University, 27 November 2005, Jamjan Meeboon (CMU 28214).

Host: *Basella alba* L. (Basellaceae) (Meeboon et al., 2007d).

Distribution: India and Thailand (Srivastava et al., 1994; Meeboon et al., 2007d).

Notes: *Cercospora basellae-albae* on *Basella alba*, a well-known vegetable, has been previously recorded in India. The first report of this species from Thailand was done by Meeboon et al. (2007d). Crous & Braun (2003) noted that this species is a true *Cercospora s. str.*, but close to or identical with *C. apii s. lat.*

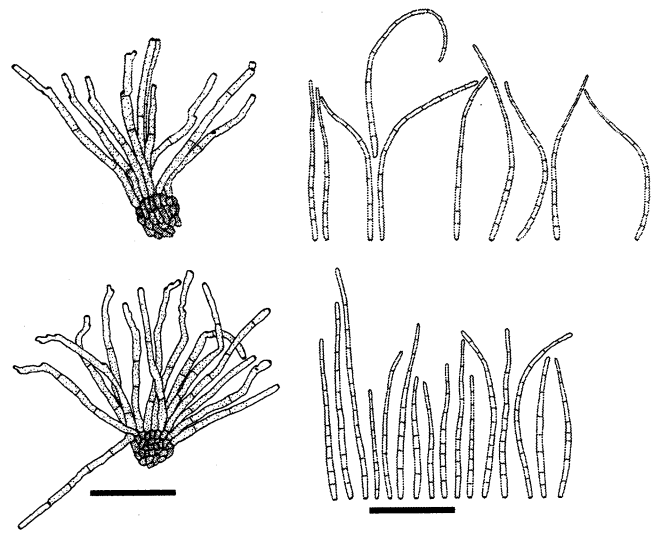


Fig. 3.35. Line drawings of *Cercospora basellae-albae* on *Basella alba.*

Family Bignoniaceae

Pseudocercospora jahnii (Syd.) U. Braun & Crous, CBS Biodeversity Series 1: 230−231, 2003.

≡ *Cercospora jahnii* Syd., Ann. Mycol. 28: 214, 1930.

Leaf spots 3−23 mm diameter, distinct, subcircular to circular, scattered, pale to grayish to brown at the centre, with blackish-brown margins. *Caespituli* hypophyllous. *Stromata* 28−58.5 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 22−71 × 2−4 µm, 1−3-septate, numerous in a densely fasciculate, arising from stromata, light brown to brown, simple, smooth, straight to decumbent, geniculate at the apex, branched. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 8.5−91 × 2−2.5 µm, solitary, acicular to obclavate, 5−10-septate, straight or slightly curved, smooth, pale olivaceous, catenate, truncate at the base, with subacute apex, hila unthickened and not darkened. (Fig. 3.36)

Specimen examined: on *Tabebuia* sp., THAILAND, Lamphun Province, Amphur Ban Hong, Tumbol Ban Hong, Farming area, 24 August 2008, Jamjan Meeboon (BBH 23695).

Host: *Tabebuia* sp. (Bignoniaceae).

Distribution: Cuba, India, Panama, Puerto Rico, Senegal, Trinidad and Tobago, USA, Venezuela, and Virgin Islands (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. jahnii* from Thailand. Its host, *Tabebuia* sp., is ornamentals or timber, distributed from northern Mexico and the Antilles south to northern Argentina and central Venezuela, including the Caribbean islands of Hispaniola (Dominican Republic and Haiti) and Cuba.

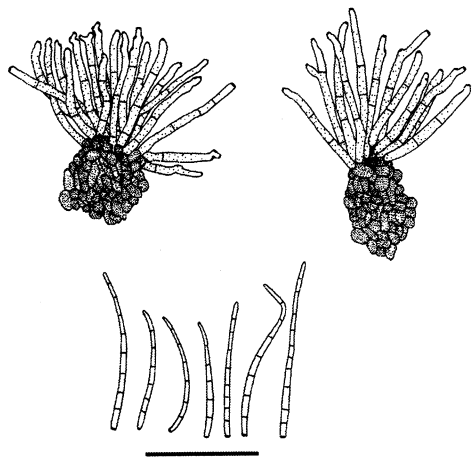


Fig. 3.36. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora jahnii* on *Tabebuia* sp. Bar = 50 µm.

Pseudocercospora oroxyli (A. K. Kar & M. Mandal) Deighton, Trans, Brit. Mycol. Soc. 88: 388, 1987.

≡ *Cercospora oroxyli* A. K. Kar & Mandal, Trans, Brit. Mycol. Soc. 53: 344, 1969.

Leaf spots 5 — 13 mm diameter, amphigenous, brown, with indistinct margin, often appears as a necrosis on the edge of the leaves. *Caespituli* hypophyllous. *Stromata* (19.5) 31 ± 5.6 (39) µm diameter, intraepidermal, well-developed, composed globose to subglobose, brown to dark brown cells. *Conidiophores* (8) 14 ± 4.6 (22.5) × (2) 3 ± 0.7 (4) µm, 9—10 to numerous in a dense fascicles, not divergent, 1—2-septate, arising from the stromata, brown, smooth, simple, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (23) 79 ± 42.2 (149) × (2) 2.5 ± 0.5 (3.5) µm, solitary, acicular to obclavate, 4—13-septate, straight or slightly curved, smooth, subhyaline to pale olivaceous, hila unthickened and not darkened. (Fig. 3.37)

Specimen examined: on *Oroxylum indicum* (L.) Benth. ex Kurz, THAILAND, Chiang Mai Province, Amphur Mae Rim, Tumbol Pa Pae, Mushroom Research Centre, 8 November 2006, Ikumitsu Araki (CMU 27908); Chiang Mai Province, Amphur Hang Dong, Tumbol Num Phrae, Farming area, 7 August 2008, Jamjan Meeboon (BBH 23590).

Host: *Oroxylum indicum* (L.) Benth. ex Kurz (Bignoniaceae) (Meeboon et al., 2007b).

Distribution: India, Myanmar, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: The first record of *P. oroxyli* on *O. indicum* from Thailand was reported by Meeboon et al. (2007b). Its host, *Oroxylum indicum*, is widely known as ornamental and medicinal plants, distributed throughout India and South East Asia.

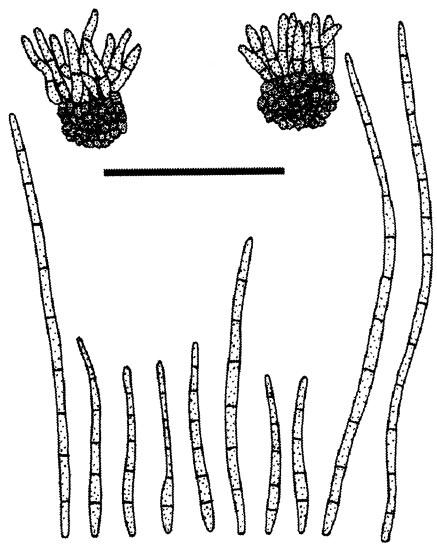


Fig. 3.37. Line drawings of *Pseudocercospora oroxyli* on *Oroxylum indicum*.

Pseudocercospora tecomae-heterophyllae (J. M. Yen) Y. L. Guo & X. J. Liu, Acta Mycol. Sinica 12: 30, 1993.

≡ *Cercospora tecomae-heterophyllae* J. M. Yen, Rev. Mycol. 31: 143, 1996.

≡ *Cercoseptoria tecomae-heterophyllae* (J. M. Yen) J. M. Yen, Gard. Bull., Singapore 33: 153, 1980.

Leaf spots 1—2.5 mm diameter, distinct, amphigenous, circular to irregular, pale to whitish, with brown margins. *Caespituli* amphigenous. *Stromata* 40—80 µm diameter, well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (25) 42 ± 8.5 (53) × (3) 3.6 ± 0.4 (4.5) µm, numerous in a dense fascicles, 1—3-septate, arising from

the stromata, straight to flexuous, smooth, brown, simple, not branched, slighly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (36) 55.2 ± 12.2 (72) × (2) 2.5 ± 0.1 (2.5) μm, solitary, filiform to acicular 3—6-septate, straight or slightly curved, smooth, pale olivaceous, attenuate and truncate at the base, with subacute to obtuse apex, hila unthickened and not darkened.

Specimen examined: on *Tecoma stans* (L.) Kunth, THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27961).

Host: *Tecoma stans* (L.) Kunth (Bignoniaceae) (Nakashima et al., 2007).

Distribution: China, India, Singapore, and Thailand (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: Nakashima et al. (2007) were the first of reporting this species from Thailand. Its host, *Tecoma stans*, is ornamental plant native to South and Central America, north to Mexico and the southwestern United States.

Family Brassicaceae

Cercospora brassicicola Henn., Bot. Jahrb. Syst. 37: 166, 1906.

= *Cercospora brassicae-campestris* Rangel, Arq. Mus. Nac., Rio de Janeiro 18: 163, 1917.

≡ *Cercosporina brassicae-campestris* (Rangel) Sacc., Syll. Fung. 25: 899, 1931.

= *Cercospora brassicae-juncea* Sawada (*brassicae-yunciae*), Special Publ. Coll. Agric. Natl. Taiwan Univ. 8: 212, 1959 (*nom. nud.*).

= *Cercospora bloxami auct. sensu* E. Young, Mycologia 8: 43, 1916.

Leaf spots 2—15 mm diameter, amphigenous, irregular, brown to dark brown, pale at the center, with dark margin, and limited by vein of the leaf. *Caespituli* amphigenous. Stromata 12.5 — 19.5 μm diameter, substomatal to intraepidermal, small, composed of a few globose to subglobose, brown cells. *Conidiophores* 24.5—64 × 3.5—5 μm, 6—11 in a loose to dense fascicules, 1 — 3-septate, arising from stromata, straight to decumbent, smooth, unbranched, cylindrical, geniculate near the apex, brown at the base, and paler toward the apex. *Conidiogenous cells* integrated, terminal or intercalary, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5—5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 54—103.5 × 2.5—5 μm, solitary, obclavate to subacicular, straight, slightly curved, hyaline, 7—16-

septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2.5−4.5 μm diameter, thickened and darkened. (Fig. 3.38)

Specimen examined: on *Brassica pekinensis* Skeels, THAILAND, Faculty of Agriculture, Chiang Mai University, Chiang Mai Province, 31 October 2004, Jamjan Meeboon (CMU 27891), on leaves of *B. campestris* L., 15 October 2004, Jamjan Meeboon (CMU 27887), on leaves of *B. rapa* L., 9 November 2005, Jamjan Meeboon (CMU 27905); Chiang Mai Province, Suthep-Pui National Park, on leaves of *B. juncea* (L.) Czern., 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27901); Chiang Rai Province, Amphur Wiang Pa Pao, on leaves of *B. oleracea* L., 19 October 2005, Jamjan Meeboon (CMU 28218); Chiang Mai Province, Amphur Mae Rim, Nong Hoi Royal Project, on leaves of *Raphanus sativus* L., 12 September 2007, Jamjan Meeboon (BBH 23639), on leaves of *Cichorium endivia* L., 6 June 2007, Jamjan Meeboon (JMC 29).

Host: *Brassica pekinensis* Skeels, *B. campestris* L., *B. juncea* (L.) Czern., *B. oleracea* L., *Raphanus sativus* L. (Brassicaceae) and *Cichorium endivia* L. (Asteraceae)

Distribution: Worldwide, including Angola, Armenia, Australia, Belarus, Brazil, China, Colombia, Cuba, Dominican Republic, Estonia, Great Britain, India, Indonesia, Jamaica, Japan, Kazakhstan, Kenya, Korea, Latvia, Lithuania, Malaysia, Malawi, Mauritius, Myanmar, Nigeria, Niue, Papua, New Guinea, Peru, Philippines, Puerto Rico, Russia, Sierra Leone, South Africa, Solomon Islands, Somalia, Sri Lanka, Sudan, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Togo, Uganda, Ukraine and USA (Crous & Braun, 2003).

Notes: *Brassica pekinensis, B. campestris, B. juncea, B. oleracea, Cichorium endivia,* and *Raphanus sativus* are common crops worldwide. Reports of *C. brassicicola* on plant genus *Brassica* from Thailand were published by Puckdeedindan (1966), and Petcharat and Kanjanamaneesathian (1989). In this study, *R. sativus* is reported as a new host of *C. brassicicola.*

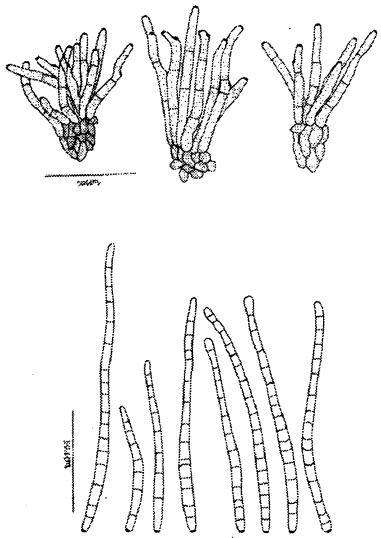


Fig. 3.38. Line drawings of *Cercospora brassicicola* on *Raphanus sativus*. Bars = 50 μm.

Family Buddlejaceae

Pseudocercospora buddleiae (W. Yamam.) Goh & W. H. Hsieh, Trans. Mycol. Soc. R.O.C. 2: 114, 1987b.

≡ *Cercospora buddleiae* W. Yamam., Trans. Nat. Hist. Soc. Formosa 26: 279, 1936.

≡ *Pseudocercospora buddleiae* (Yamam.) X. J. Liu & Y. L. Guo, Mycosystema 2: 230, 1989 (*comb. superfl.*).

Leaf spots 3—7 mm diameter, distinct, amphigenous, angular to irregular, vein-limited, yellowish-brown to brown, with dark margins, 1—4 mm diameter, brown, with indistinct margins. *Caespituli* hypophyllous. *Stromata* small, composed of few brown cells. *Conidiophores* (40) 82.7 ± 22.2 (130) × (4.4) 82.7 ± 22.2 (0.5) μm, loosely fascicles, 2—8-septate, straight to abruptly curved, smooth, olivaceous to brown, simple, branched, slighly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (25) 54.8 ± 13 (80) × (3.5) 4 ± 0.4 (5) μm, solitary, obclavate, 3—7-septate, straight or slightly curved, smooth, pale olivaceous, obconically truncate at the base, with subobtuse apex, hila unthickened and not darkened.

Specimen examined: on *Buddleja asiatica* Lour., THAILAND, Phetchabun Province, Amphur Lo Sak, Num Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27951).

Host: *Buddleja asiatica* Lour. (Buddlejaceae) (Nakashima et al., 2007).

Distribution: China, India, Japan, Philippines, Taiwan, and Thailand (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: The first report of this species in Thailand was done by Nakashima et al. (2007). Its host, *Buddleja asiatica*, is ornamentals distributed from tropical to warm areas worldwide.

Family Caricaceae

Asperisporium caricae (Speg.) Maubl. Lavoura 16: 207, 1913.

≡ *Cercospora caricae* Speg., Anal. Soc. cient. argent. 16: 168, 1883.

≡ *Fusicladium caricae* (Speg.) Sacc., Atti Congr. Bot. Palermo: 58, 1902.

≡ *Pucciniopsis caricae* (Speg.) Höhn. Seaver, Mycologia 16: 10, 1924; New York Acad. Sci. Ann. 3: 104, 1926.

= *Sphaerella caricae* Maubl., Bull. Soc. Mycol. Fr. 29: 358, 1913.

Teleo.: ?*Mycosphaerella caricae* Syd. & P. Syd., Ann. Mycol. 11: 403, 1913.

≡ *Mycosphaerella caricae* (Maubl.) Hansf., Proc. Linn. Soc. London 153: 22, 1941. (*nom. illeg.*, Art. 53.1), homonym of *M. caricae* Syd. & P. Syd., 1913.

Sporodochia hypophyllous, dark blackish-brown to black. Mycelium immersed. Stromata well-developed (54) 99 ± 39.3 (191) μm diameter. Conidiophores macronematous, mononematous, closely packed together forming sporodochia, unbranched, straight or flexuous, brown, (21) 34.3 ± 7.6 (45.5) × (4.5) 5.5 ± 0.6 (7) μm. Conidiogenous cells polyblastic, integrated, terminal, sympodial, cylindrical, scars prominent. Conidia solitary, ellipsoidal, pyriform, 0−2-septate, pale brown, verrucose, (10) 15.5 ± 2.8 (20.5) × (6.5) 8.9 ± 11 (11.5) μm. (Fig. 3. 39)

Specimen examined: on *Carica papaya* L., THAILAND, Chiang Mai Province, Mae Tang, Pa Pae, 5 March 2009, Jamjan Meeboon (JM103).

Host: *Carica papaya* L. (Caricaceae).

Distribution: Argentina, Australia, Bermuda, Bolivia, Brazil, Chile, China, Colombia, Costa Rica, Cuba, Dominican Republ., Ecuador, El-Salvador, Ethiopia, Gabon,Ghana, Guatemala, Guatemala, Haiti, Honduras, India, Indonesia, Jamaica, Japan, Kenya, Malawi, Mexico, Mozambique, Nicaragua, Panama, Paraguay, Peru, Philippines, Puerto Rico, Solomon Islands, South Africa, Sri Lanka, St. Croix, St. Thomas, Taiwan, Thailand, Trinidad and Tobago, USA (FL, TX), Venezuela, Virgin Islands, Zimbabwe (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: The fungus was first described from Paraguay under the name *Cercospora caricae* Speg. (Pollack 1987; Saccardo 1892). It has been known from most nations of the Americas, namely the United States, Bermuda, Cuba, Costa Rica, Dominica, Jamaica, Nicaragua, Panama, Puerto Rico, Trinidad, Brazil, Columbia, Paraguay, and Venezuela (Cardin 1915; Ciferri 1961; Dennis 1970; Ellis 1971; Ellis & Holliday 1972; Farr et al. 1989; Kraisel 1971; Litzenberger and Stevenson 1957; Saccardo 1895, 1902a,b, 1906; Seaver & Chardon 1926; Stevens 1927; Uphof 1925). Since 1977, when Liu first recorded this papaya disease from Taiwan in Asia, it was recorded widely from other Southeast Asian countries, such as India, Indonesia, Philippines, Sri Lanka, and Taiwan (Adikaram & Wijepala 1995; Bilgrami et al. 1991; Huang 1987; Ilag 1991; Kobayashi 1994; Kobayashi & de Guzman 1986a,b, 1988; Tangonan & Quebral 1994; Tsai 1991; Ullasa et al. 1978). The disease caused by A. caricae was also recorded from Oceania, such as Hawaii and Solomon Islands (Mckenzie and Jackson 1986; Ogata and Heu 2001). In Japan, the disease was first found in 1992 on one tree in the southern part of Amami Oshima Island (Kobayashi et al. 1998a, 2001). The disease spread to the central to north part of the island in 1998. The first report of *Asperisporium caricae* from Thailand was done by Meeboon et al. (2007b) on *Carica papaya* which is common crops native to the tropics of the Americas.

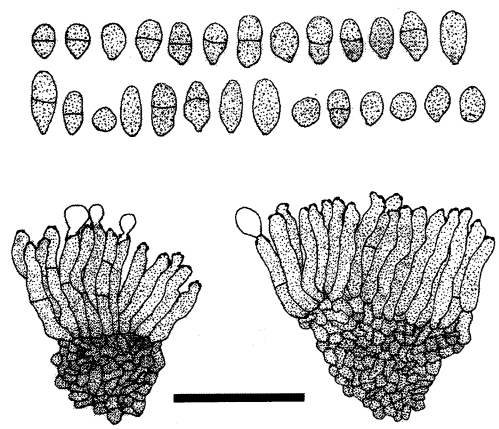


Fig. 3. 39. Line drawings of *Asperisporium caricae* on *Carica papaya.* Bars = 50 μm.

Cercospora papayae Hansf., Proc. Linn. Soc. London 155: 58, 1943.

= *Cercospora papayae* Chupp & Viégas, Arq. Mus. Nac. Rio de Janeiro 8: 42, 1945.

≡ *Cercospora mamaonis* Viégas & Chupp, Monograph of *Cercospora*: 107, 1954.

≡ *Pseudocercospora mamaonis* (Viégas & Chupp) Tak. Kobay. & Tokash., Ann. Phytopath. Soc. Japan 61: 51, 1995.

= ***C. apii s. lat.***

Leaf spots 2−5 mm in diameter, amphigenous, scattered to confluent, distinct, circular to subcircular, pale brown, centre greyish, with dark brown margins. *Caespituli* amphigenous. *Stromata* 12−34 µm in diameter, small, often rudimentary to poorly developed, intraepidermal, composed of a few sub-globular to irregular, brown cells. *Conidiophores* 46−202 × 3−5.5 µm, very variable in length, 4−13 in a divergent fascicles, 1−9-septate, emerging from stromata through the cuticle, pale olivaceous to brown or sometimes paler towards the apex, smooth, straight to slightly curved, mostly strong geniculate. *Conidiogenous cells* integrated, terminal, sympodially proliferating. *Conidiogenous loci* 2.5−3.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 81−201 × 3−4 µm, solitary, acicular, straight to mildly curved, hyaline, 14−36-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila, 1−2.5 µm diameter, thickened and darkened. (Fig. 3.40)

Specimen examined: on *Carica papaya* L., THAILAND, Chiang Mai Province, Amphur Sarapee, 12 September 2007, Jamjan Meeboon (BBH 23650).

Host: *Carica papaya* L. (Caricaceae).

Distribution: Barbados, Brazil, Cambodia, China, Cuba, Guatemala, India, Indonesia, Malawi, Mauritius, Myanmar, Nepal, Pakistan, Panama, Papua New Guinea, Philippines, Seychelles, Somalia, Sudan, Togo, Tonga, Uganda, USA, Venezuela, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is the first report of *C. papayae* from Thailand.

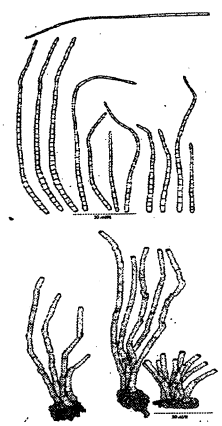


Fig. 3. 39. Fig. 3.40. Line drawings of conidia, conidiophores, and stromata of *Cercospora papayae* (*C. apii s. lat.*) on *Carica papaya*. Bar = 50 µm.

***Cercospora* sp.**

Leaf spots 2—5 mm in diameter, amphigenous, scattered to confluent, distinct, circular to subcircular, pale brown to tan, centre greyish brown to greyish white, with dark brown margins. *Caespituli* amphigenous. *Stromata* 15—40 μm in diameter, small, composed of globose to subglobose, brown cells. *Conidiophores* 38—165 × 3—5 μm, very variable in length, 5—25 in a dense and sometimes divergent fascicles, 1—5-septate, emerging from stromata, straight to slightly curved, subcylindrical, pale olivaceous to brown or sometimes paler towards the apex, thick walled, sometimes branched, strong geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2—2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 31—74 × 2—3.5 μm, solitary, obclavate, straight to mildly curved, hyaline, 3—6-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1—2.5 μm diameter, thickened and darkened. (Fig. 3.41)

Specimen examined: on *Carica papaya* L., THAILAND, Chiang Mai Province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23732).

Host: *Carica papaya* L. (Caricaceae).

Distribution: Thailand.

Notes: This specimen is distincts from the plurivorous *C. apii s. lat.* by having branched conidiophores, and obclavate conidia with obconically truncate at the base (hila 1—2.5 μm diameter). This specimen also differs from *Cercospora caricae-papayae* P. K. Rajak and S. P. Gautam in having conidiophores branched, shorter conidia (31—74 × 2—3.5 μm vs 80—330 × 3.5—6 μm of *C. caricae-papayae*), and being found on leaf spots (*C. caricae-papayae* found on petioles). Therefore, further examination is necessary in order to determine this specimen.

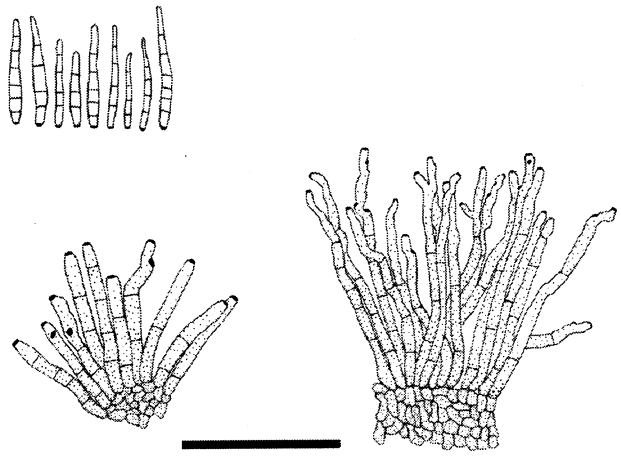


Fig. 3.41. Line drawings of conidia, conidiophores, and stromata of *Cercospora* sp. on *Carica papaya*. Bar = 50 μm.

Family Caprifoliaceae

***Pseudocercospora* sp.**

Leaf spots 3—7 mm diameter, distinct, amphigenous, circular to irregular, pale to whitish, with dark margins, scattered, sometimes forming necrosis at the edge of the leaves, 8—18 mm diameter, brown, with indistinct margins. *Caespituli* amphigenous. *Stromata* 17 — 22 μm diameter, intraepidermal, small to well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 10—16 × 2.5—3.5 μm, numerous in a dense fascicles, 1—2-septate, arising from the stromata, straight to decumbent, smooth, brown, simple, not branched, slighly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 24—61 × 3—3.5 μm, solitary, filiform-acicular to obclavate, 5—10-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.42)

Specimen examined: on *Sambucus simpsonii* Rehder, THAILAND, Chiang Mai Province, Amphur Muang, Chiang Mai Main Stadium, 24 August 2008, Jamjan Meeboon (BBH 23717).

Host: *Sambucus simpsonii* Rehder (Caprifoliaceae).

Distribution: Thailand

Notes: On plant genus *Sambucus* (Caprifoliaceae), *Pseudocercospora ebulicola* (M. Yamam.) Deighton has been recorded from Taiwan. However, this specimen is distincts from *P.*

ebulicola by having distinct symptoms, amphigenous caespituli, smal to well-developed stromata, shorter and not branched conidiophores (10−16 × 2.5−3.5 μm vs 40−150 × 4−5.5 μm of *P. ebulicola*), and shorter (24−61 × 3−3.5 μm vs 50−125 × 4−5.5 μm of *P. ebulicola*) and solitary conidia with truncate base.

Five other *Pseudocercospora* from family Caprifoliaceae, viz, *P. diervillae* (Ellis & Everh.) U. Braun, *P. varia* (Peck) J. K. Bai & Y. Cheng, *P. viburni-cylindrici* (F. L. Tai) U. Braun, *P. viburnigena* (U. Braun & Crous), and *P. weigeliae* (Ellis. & Everh.) Deighton, have been reporded in having amphigenous caespituli. However, this specimen differs with *P. diervillae* and *P. weigeliae* in having shorter conidiophores and conidia. This specimen is also distincts from *P. viburni-cylindrici* and *P. viburnigena* by having not branched conidiophores and shorter conidia. Morphologically, *P. varia* is the most closely related species due to the similarity in the sizes of condiophores and conidia, but this specimen differs with *P. varia* in having very short conidiophores, and solitary and pale olivaceous conidia with truncate base. Because of the distinctiveness of this specime with other similar taxa; therefore, futher investigation using molecular phylogenetic analysis is necessary in order to clarify this specimen. Its host, *Sambucus simpsonii* that native in temperate to subtropical regions, is reported here as a new host of genus *Pseudocercospora*.

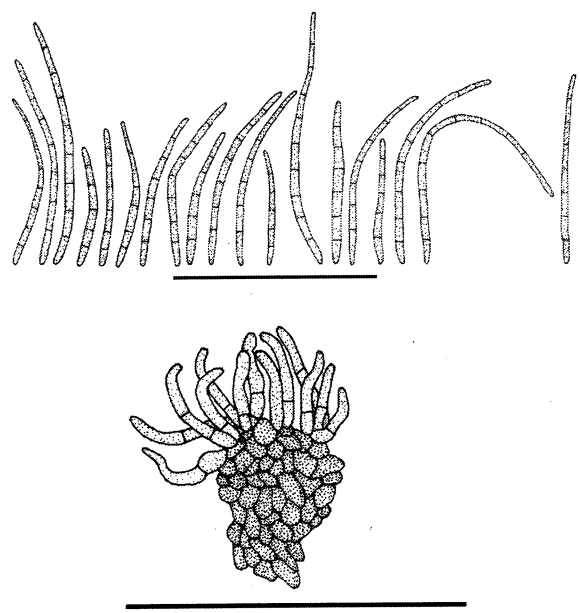


Fig. 3.42. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora* sp. on *Sambucus simpsonii*. Bars = 50 μm.

Family Chenopodiaceae

Cercospora beticola Sacc., Nuovo Giorn. Bot. Ital. 8: 189, 1876.

≡ *Cercosporina beticola* (Sacc.) K. Nakata, T. Nakajima & K. Katimoto, Rep. Agric. Korea 6, 1915.

= *Fusisporium betae* Desm., Ann. Sci. Net., Bot., 2 Ser., 19: 434, 1843.

= *Fusarium betae* (Desm.) Sacc., Michelia 2: 132, 1880.

= *PionNotes betae* (Desm.) Sacc., Syll. Fung. 4: 726, 1886.

= *Cercospora betae* (A. B. Frank) Sacc., Syll. Fung. 10: 637, 1892.

= *Cercospora longissima* Cooke & Ellis, Grevillea 17: 65, 1889.

= *Cercospora flagelliformis* Ellis & Halst., New Jersey Agric. Coll. Exp. Sta., Annual Rep. 11: 355, 1890.

= *Cercospora anthelmintica* G. F. Atk., J. Elisha Mitchell Sci. Soc. 8: 48, 1892.

= *Cercospora spinaciae* Oudem., Ned. Kruidk. Arch. III, 2: 324, 1900.

= *Cercospora chenopodiicola* Bres., Hedwigia 39: 328, 1900.

= *Cercosporina spinaciicola* Sacc., Nuovo Giorn. Bot. Ital., N. S., 22: 73, 1915.

= *Cercospora beticola* var. *poonensis* Chidd., Sydowia 13: 153, 1959 (*nom. inval.*).

= ***C. apii s. lat.***

Leaf spots 2−6 mm in diameter, amphigenous, distinct, circular to subcircular, brown, grey at the center, with dark brown margins. *Caespituli* amphigenous, chiefly epiphyllous. *Stromata* small, lacking to poorly developed, composed of a few globose to subglobose, dark brown cells. *Conidiophores* (22) 69.8 ± 21.2 (100) ×(3) 3.8 ± 0.5 (5) μm, fasciculate, pale brown, paler towards the apex, 1 − 4-septate, straight to slightly curved, geniculate, not branched. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5−3.5 μm diameter, conspicuous, thickened, and darkened. Conidia very variable in length, (40) 144.2 ± 88.6 (300) × (2.5) 3.9 ± 0.6 (4.5) μm, solitary, acicular to obclavate, straight to mildly curved, hyaline, 4−27-septate, smooth, subtruncate at the base, obtuse to subacute at the apex, hila 2.5−3.5 μm diameter, hila thickened and darkened.

Specimen examined: on *Beta vulgaris* L., THAILAND, Chiang Mai Province, Amphur Sansai, Mae Jo University, 19 August 2005, Jamjan Meeboon (CMU 28208); Chiang Mai Province, Doi Suthep-Pui National Park, on leaves of *Spinacia oleracea* L., 10 Oct 2005, Jamjan Meeboon (CMU 27931).

Host: *Beta vulgaris* L. and *Spinacia oleracea* L. (Chenopodiaceae) (Meeboon et al., 2007d, 2008).

Distribution: Worldwide where sugar beet and chard are cultivated, including China, Japan Korea, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007d, 2008).

Notes: The first report of *Cercospora beticola* from Thailand was done by Meeboon et al. (2007d) on *Beta vulgaris*, and on *Spinacea oleracea* (2008). *Beta vulgaris* is crops originated from Mediterranean, the Atlantic coast of Europe, the Near East, and India; meanwhile, *Spinacia oleracea* is crops native to central and southwestern Asia.

Family Combretaceae

Pseudocercospora quisqualidis (Narain & B. S. Mehrotra) Z. D. Jing & P. K. Chi, J. S. China Agr. Univ. 15: 19, 1994, and Fungal diseases of cultivated medicinal plants in Guangdong Province: 100, 1994.

≡ *Cercospora quisqualidis* Narain & B. S. Mehrotra, Sydowia 24: 327, 1971.

Leaf spots 8−20 mm diameter, amphigenous, distinct, appear as necrosis at the edge and tip of the leaves, pale, and blackish to dark brown, with brown margin. *Caespituli* amphigenous. *Stromata* 18−81 μm diameter, intraepidermal, well-developed, and composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 11−23.5 × 1.5−2 μm, densely fasciculate, 0−1-septate, arising from stromata, straight to decumbent, smooth, pale brown, paler toward the apex, unbranched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 31−62.5 × 1.5−2 μm, obclavate, tapering to the apex, base truncate, straight, subhyaline, 3−7-septate, hila indistinct, unthickened, and not darkened. (Fig. 3.43)

Specimen examined: on *Quisqualis indica* L., THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Mae Hea, Royal Flora, 13 February 2008, Jamjan Meeboon (BBH 23743).

Host: *Quisqualis indica* L. (Combretaceae).

Distribution: China and India (Crous & Braun, 2003).

Notes: *Quisqualis indica* is ornamentals found in Asia.This specimen is the first report of *P. quisqualidis* occurs on *Q. indica* in Thailand.

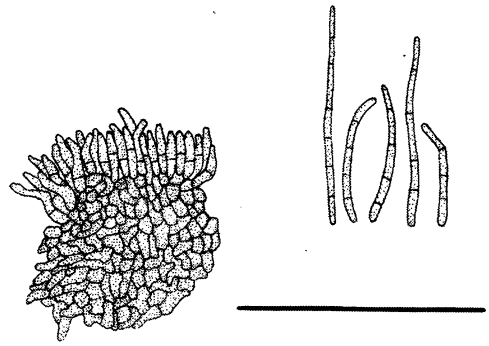


Fig. 3.43. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora quisqualidis* on *Quisqualis indica*. Bar = 50 μm.

Family Convolvulaceae

Cercospora ipomoeae G. Winter, Hedwigia 26: 34, 1887.

= *Cercospora dichondrae* Katsuki, Ann. Phytopathol. Soc. Japan 20: 72, 1955.

= ***C. apii s. lat.***

Leaf spots 15—30 mm diameter, amphigenous, circular or subcircular, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margin. *Colonies* amphigenous, ochre yellow, velvety. *Stromata* (24) 31 ± 5.3 (40) μm diameter, intraepidermal, well-developed, subglobose, brown to blackish-brown. *Conidiophores* (13.5) 59 ± 29.1 (134) × (3) 3.95 ± 0.75 (5) μm, in a loosely to densely fasciculate, 2—3-septate, numerous, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 2—3 μm diameter, conspicuous, thickened, darkened. *Conidia* (44.5) 78.5 ± 31.8 (143) × (3) 3.1 ± 0.2 (3.5) μm, solitary, narrowly obclavate to acicular conidia truncate, hila 2.0—2.5 μm diameter, hila thickened and darkened. (Fig. 3.44)

Specimen examined: on *Ipomoea aquatica* Forssk. and *Ipomoea nil* (L.) Roth, THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 9 March 2005, Jamjan Meeboon (CMU 28220 and CMU 28221); Chiang Mai Province, Amphur Pa Pae, Bahn Phadeng, Mushroom Research Centre, on *Argyreia henryi* Craib, 10 November 2006, Ikumitsu Araki (CMU 27911); Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, *Ipomoea obscura* (L.) Ker Gawl., 21 August 2008, Jamjan Meeboon (BBH 23558).

Host: *Ipomoea aquatica* Forssk., *Ipomoea nil* (L.) Roth, *Argyreia henryi* Craib and *Ipomoea obscura* (L.) Ker Gawl. (Convolvulaceae) (Meeboon et al., 2007c).

Distribution: Worldwide, including American Samoa, Antigua and Barbuda, Argentina, Australia, Barbados, Brazil, Brunei, China, Cook Islands, Costa Rica, Cuba, Fiji, Guam, Hong Kong, India, Indonesia, Italy, Ivory Coast, Jamaica, Japan, Kenya, Kiribati, Korea, Malaysia, Marshall Islands, Mauritius, Myanmar, New Caledonia, New Zealand, Pakistan, Panama, Papua New Guinea, Puerto Rico, Samoa, Sierra Leone, Solomon Island, Sudan, Venezuala, Taiwan, Tanzania, Thailand, USA, and Vanuatu (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of *C. ipomoeae* on *Argyreia henryi* from Thailand was done by Meeboon et al. (2007c). Crous & Braun (2003) assigned this species to *C. apii s.lat. Argyreia henryi* is ornamentals mainly in tropical Asia. In addition, *Ipomoea nil* and *Ipomoea obscura* are vegetables native to most of the tropical world and it has been introduced widely.

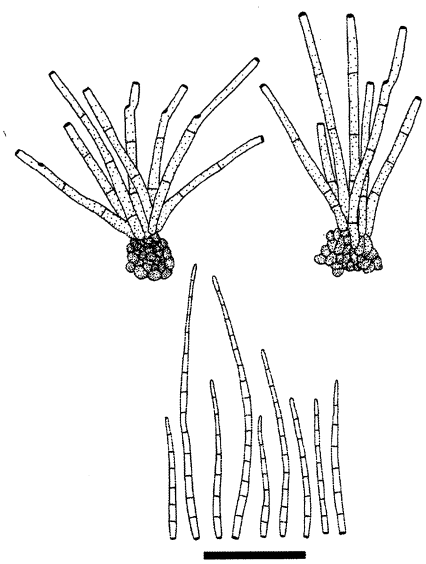


Fig. 3.44. Line drawings of *Cercospora ipomoeae* on *Ipomoea obscura*. a. Stroma and conidiophores. b. Conidia. Bar = 50 μm.

Cercospora operculinae Mendoza, Phiipp. J. Sci. 75: 174, 1941.

= *Cercospora operculinicola* Kamal, *in herb.* (IMI 367133).

= ***C. apii s. lat.***

Leaf spots 1—6 mm diameter, amphigenous, distinct, circular to subcircular, brown, with black margin. *Caespituli* amphigenous. *Stromata* 7 — 55 μm diameter, substomatal, small, composed of a few globose to subglobose, brown cells. *Conidiophores* 64—127.5 × 3—5 μm, 2—7 in a loose fascicles, 2—8-septate, arising from stromata, straight, unbranched, cylindrical, smooth, brown at the base, and paler toward the apex, plainly geniculate. *Conidiogenous cells*

integrated, holoblastic, polyblastic, rarely monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 1−2 µm diameter, conspicuous, thickened, and darkened. *Conidia* 22.5−96 × 3−3.5 µm, solitary, acicular, sometimes obclavate, straight, hyaline, 6−9-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1−2.3 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.45)

Specimen examined: on *Operculina turpethum* (L.) Silva Manso, THAILAND, Chiang Mai Province, Amphur Mae Taeng, 6 February 2008, Jamjan Meeboon (BBH 23768).

Host: *Operculina turpethum* (L.) Silva Manso (Convolvulaceae).

Distribution: India, Papua New Guinea, and Philippines (Crous & Braun, 2003).

Notes: This specimen is the first report of *C. operculinae* from Thailand. Crous & Braun (2003) assigned this species to *C. apii s.lat.* Its host, *Operculina turpethum*, is ornamentals distributed in tropics or warm areas.

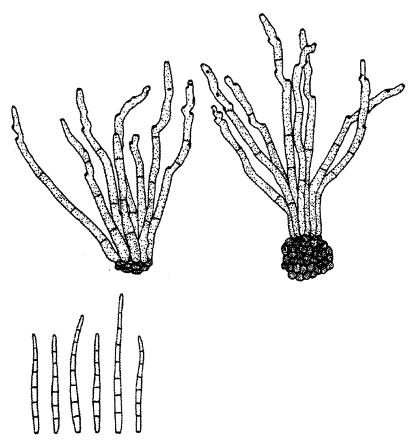


Fig. 3.45. Line drawings of conidia, conidiophores, and stromata of *Cercospora operculinae* on *Operculina turpethum*. Bars = 50 µm.

Family Cucurbitaceae

Cercospora citrullina Cooke Grevillea 12: 31, 1883.

= *Cercospora cucurbitae* Ellis & Everh., J. Mycol. 4: 3, 1883.

= *Cercospora sechii* J. A. Stev., Puerto Rico Agric. exp. Sta. Rep. 1917−1918: 137, 1919.

= *Cercospora momordicae* McRae, Ann. Cryptog. Exot. 2: 267, 1929.

= *Cercospora trichosanthis* McRae, Ann. Cryptig. Exot. 2: 270, 1929.

= *Cercospora luffae* Hara, Diseases of cultivated plants: 228, 1928.

= *Cercospora chardoniana* Chupp, Monogr. Univ. Puerto Rico, B, 2: 245, 1934.

= *Cercospora momordicae* Mend., Philipp. J. Sci. 75: 173, 1941. (*nom. illeg.*), homonym of *C. momordicae* McRae, 1929.

= *Cercospora momordicae* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 86: 173, 1943, (*nom. inval.*), homonym of *C. momordicae* McRae, 1929.

= ***C. apii s. lat.***

Leaf spots 5−25 mm diameter, amphigenous, irregular, greyish brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 14−30 µm diameter, substomatal, small, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* 52−106.5 × 2.5−5 µm, 6−11 in a loosely fasciculate, 2−5-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, not geniculate. *Conidiogenous cells* integrated, holoblastic, monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 1.5−2.5 µm diameter, refractive, conspicuous, thickened, and darkened. *Conidia* 63−296.5 × 2.5−4.5 µm, solitary, acicular, straight, hyaline, 8−26-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1.5−2 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.46, 3.47, 3.48, 3.49)

Specimen examined: on *Sechium edule* (Jacq.) Sw., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 19 December 2005, Jamjan Meeboon (CMU 28215); Chiang Mai Province, Faculty of Chiang Mai University, Multiple Cropping Centre, 1 August 2008, Jamjan Meeboon (BBH 23721), on leaves of *Coccinia grandis* (L.) Voigt, 19 January 2005, Jamjan Meeboon (CMU 27903); 12 June 2007, Jamjan Meeboon (BBH 23652); Chiang Rai Province, A.Wiang Pa Pao, T. Wiang Ga Long, Moo11, Bahn Tung Ruang Tong, on leaves of *Cucumis sativus* L., 30 July 2007, Jamjan Meeboon (BBH 23623); Chiang Mai Province, Amphur Hang Dong, Tumbol Num Phrae, Farming area, on leaves of *Lagenaria siceraria* (Molina) Standl., 7 August 2008, Jamjan Meeboon (BBH 23591); Chiang Mai Province, Sansai, Mae Fag, on leaves of *Momordica charantia* L., 3 August 2008, Jamjan Meeboon (BBH 23754); Chiang Mai Province, Mae Jo University, Farming area, on leaves of *Citrullus vulgaris* Schrad., 9 August 2008, Jamjan Meeboon (BBH 23703).

Host: *Coccinia grandis* (L.) Voigt *Sechium edule* (Jacq.) Sw., *Momordica charantia* L., *Cucumis sativus* L., *Citrullus vulgaris* Schrad., *Lagenaria siceraria* (Molina) Standl. (Cucurbitatceae).

Distribution: Wordwide, where the host plants are cultivated or growing, including American Samoa, Argentina, Austria, Banggladesh, Barbados, Belize, Bolivia, Brazil, Brunei, Bulgaria, Cambodia, Canada, Chile, China, Cook Island, Costa Rica, Cuba, Czech Republ.,

Denmark, Dominican Republic, El-Salvador, Ethiopia, Fiji, French Polynesia, Gabon, Georgia, Germany, Ghana, Great Britain, Greece, Guam, Hong Kong, India, Indonesia, Iran, Iraq, Ireland, Israel, Israel, Italy, Jamaica, Japan, Kenya, Korea, Laos, Malawi, Malaysia, Mauritius, Mexico, Morocco, Myanmar, Nepal, Netherlands, New Caledonia, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Pitcairn Island, Poland, Puerto Rico, Romania, Russia, Samoa, Saudi Arabia, Solomon Islands, Somalia, South Africa, Sri Lanka, Sweden, Switzerland, Sudan, Taiwan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Uganda, Ukraine, U.K, USA, Vanuatu, Venezuela, Virgin Islands, Zambia and Zimbabwe (Crous & Braun, 2003).

Notes: *Sechium edule* is reported here as a new host of *C. citrullina*. *Cercospora citrullina* was previously reported from Thailand by Petcharat and Kanjanamaneesathian (1989), and Meeboon et al. (2007b) on *Coccinia grandis*. Crous & Braun (2003) considered this species as *C. apii s. lat. Citrullus vulgaris*, *Coccinia grandis*, *Cucumis sativus*, *Momordica charantia*, and *Sechium edule* are common crops/vegetables in tropical and warm areas.

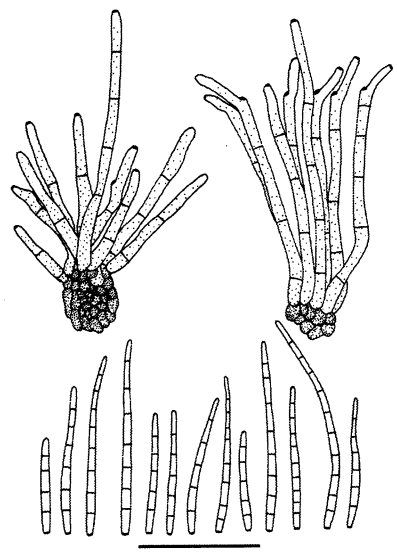


Fig. 3.46. Line drawings of *Cercospora citrullina* on *Citrullus vulgaris*. Bar = 50 µm.

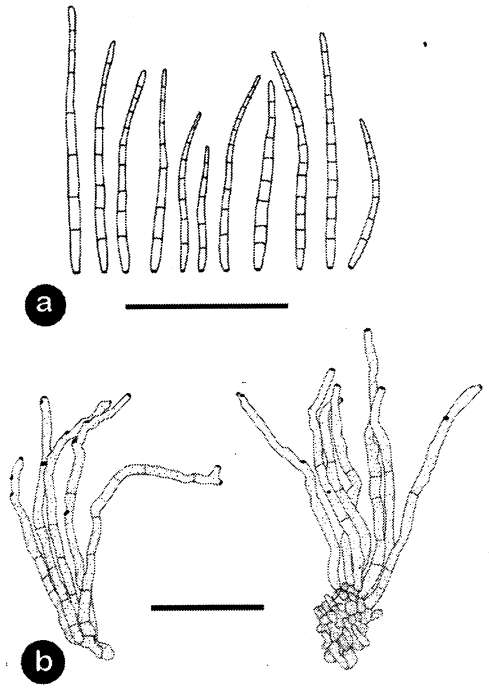


Fig. 3.48a-b. Line drawings of *Cercospora citrullina* on *Cucumis sativus*.
a. Condia. b. Conidiophores and stromata. Bars: a, b = 50 µm.

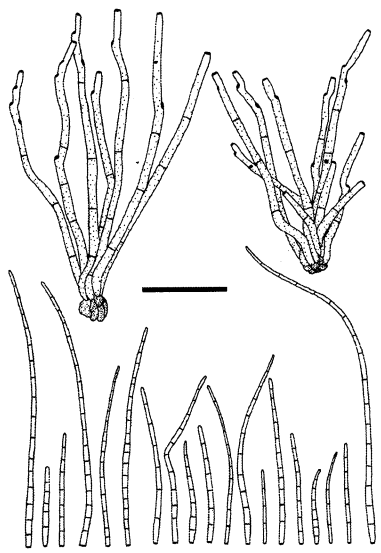


Fig. 3.47. Line drawings of *Cercospora citrullina* on *Momordica charanthia*. Bar = 50 µm.

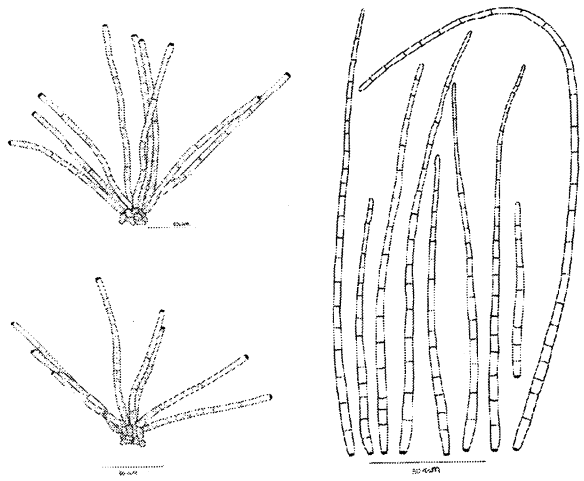


Fig. 3.49. Line drawings of *Cercospora citrullina* on *Sechium edule*. Bars = 50 μm.

Cercospora cocciniae Munjal, Lall, & Chona, Indian Phytopathol. 12: 86, 1959.

Leaf spots 1—5 mm diameter, amphigenous, scattered to confluent, distinct, circular to subcircular, pale to pale brown, greyish brown to greyish white at the center, with distinct, yellowish-brown to dark brown margins. *Caespituli* epiphyllous, rarely amphigenous. *Stromata* 18—29.5 μm diameter, small, sometimes rudimentary to poorly developed, composed of a few subglobular to irregular, brown to dark brown cells. *Conidiophores* 18—108.5 × 3—5.5 μm, very variable in length, 4—15 in a divergent fascicles, 1—9-septate, arising from stromata through the cuticle, pale olivaceous to brown, sometimes paler at the apex, straight to slightly curved, strongly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5—2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 41—102 × 2.5—5 μm, solitary, mostly obclavate-cylindric, sometimes acicular, straight to mildly curved, hyaline, 5—10-septate, very variable in length, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1.5—2.5 μm diameter, thickened, and darkened. (Fig. 3.50)

Specimen examined: on *Coccinia grandis* (L.) Voigt, THAILAND, Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 29 February 2008, Jamjan Meeboon (BBH 23564).

Host: *Coccinia grandis* (L.) Voigt (Cucurbitaceae).

Distribution: Brunei, India, and Pakistan (Crous & Braun, 2003).

Notes: This species is typical of *C. cocciniae* as having obclavate conidia. This specimen is the first record of *C. cocciniae* from Thailand, and *Coccinia grandis* is reported here as a new host of this fungus.

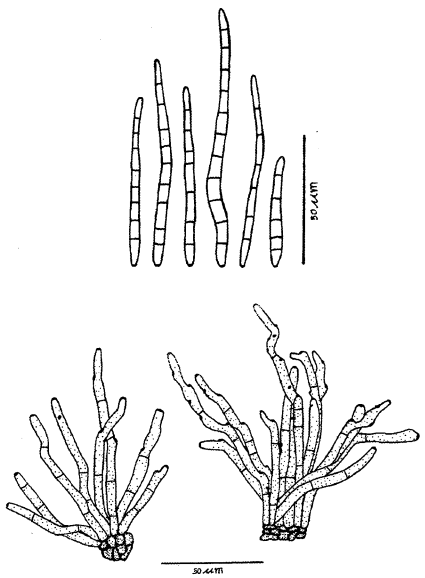


Fig. 3.50. Line drawings of conidia, conidiophores, and stromata of *Cercospora cocciniae* on *Coccinia grandis*. Bars = 50 μm.

Cercospora cucurbitacea Ellis & B. T. Galloway, U. S. D. A. Dept. Bull. 1366: 40, 1926 (*nom. nud.*).

Leaf spots 3—7 mm diameter, amphigenous, circular, pale brown, with raised grey-brown margins. *Caespituli* amphigenous. *Stromata* small, less than 20 μm, diameter, composed of a few subglobular brown cells. *Conidiophores* (40) 70.1 ± 18.5 (106) × (3) 3.7 ± 0.5 (5.5) μm, 4—16 in a divergent fascicles, 2—6-septate, arising from stromata through the cuticle, pale olivaceous to brown, sometimes paler at the apex, straight to slightly curved, strongly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (30) 96.2 ± 46.8 (175) × (3) 3.6 ± 0.7 (5) μm, solitary, mostly obclavate-cylindric, sometimes acicular, straight to mildly curved, hyaline, 2—16-septate, smooth, subtruncate to truncate at the base, obtuse to subobtuse at the apex, hila 2—2.5 μm diameter, thickened, and darkened.

Specimen examined: on *Cucurbita moschata* (Duchesne) Poir., THAILAND, Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 19 January 2005, Jamjan Meeboon (CMU 28216).

Host: *Cucurbita moschata* (Duchesne) Poir. (Cucurbitaceae) (Meeboon et al., 2007d).

Distribution: USA, Zimbabwe, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007d).

Notes: *Cucurbita moschata*, a crop widely cultivated in south and central America and Asia, was reported being as a host of *Cercospora cucurbitaceae* by Meeboon et al. (2007d).

Family Dioscoreaceae

Passalora dioscoreae (Ellis & G. Martin) U. Braun & Crous, CBS Biodiversity Series 1: 162, 2003.

≡ *Cercospora dioscoreae* Ellis & G. Martin, Amer. Naturalist 16: 1003, 1882.

≡ *Phaeoramularia dioscoreae* (Ellis & G. Martin) Deighton, More Dematiaceous Hyphomycetes: 319, 1976.

= *Cercospora nubilosa* Ellis & Everh., J. Mycol. 4: 115, 1888.

= *Cercospora tokoroi* Togashi, Bulletin Imper. Coll. Agric. and Forest. Morioka, Japan 22: 46, 1936.

Leaf spots 5−20 mm diameter, amphigenous, irregular, dark brown, limited by vein of a leaf. *Caespituli* amphigenous. *Stromata* 28.5−42 μm diameter, small, substomatal, composed of a few, globose to subglobose, brown cells. *Conidiophores* 17−50 × 2.5−3.5 μm, densely fasciculate, 1−3-septate, arising from stromata, straight, unbranched, cylindrical, smooth, brown at the base, and paler toward the apex, non-geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic, sympodially proliferating. *Conidiogenous loci* 2−2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 37−105.5 × 2.5−4.5 μm, obclavate, straight, subhyaline, 2−8-septate, truncate at the base, and tapering abruptly near the basal end, hila 1−2 μm diameter, conspicuous, and thickened. (Fig. 3.51)

Specimen examined: on *Dioscorea glabra* Roxb, THAILAND, Chiang Mai Province, Amphur Sanpatong, Tambol Mae Win, Bahn Mae Sapok, Mae Sapok Royal Project, 8 February 2008, Jamjan Meeboon (BBH 23682).

Host: *Dioscorea glabra* Roxb (Dioscoreaceae).

Distribution: Brazil Canada, China, Cuba, India, Indonesia, Italy, Japan, Panama, Philippines, Sri lanka, Taiwan, Togo, Trinidad and Tobago, Uganda, and USA (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. dioscoreae* on from Thailand, and *Dioscorea glabra* is also reported here as a new host to the pathogen.

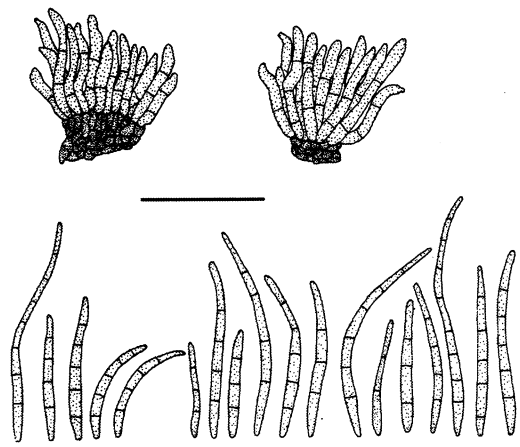


Fig. 3.51. Line drawings of conidia, conidiophores, and stromata of *Passalora dioscoreae* on *Dioscorea glabra*. Bars = 50 μm.

Pseudocercospora carbonacea (L. E. Miles) N. Pons & B. Sutton, Mycol. Pap. 160: 26, 1988.

≡ *Cercospora carbonacea* L. E. Miles, Trans. Illinois Acad. Sci. 10: 255, 1917.

Leaf spots 2−19 mm in diameter, amphigenous, on the surface scattered to confluent, distinct, angular, dark brown, without definite margins. *Caespituli* hypophyllous. *Stromata* 38.5 −93.5 μm in diameter, substomatal, well-developed, composed of globose to subglobose, dark brown-walled cells. *Conidiophores* (70−) 78.5−93.5 (−102) × 3−4 μm, numerous, in a rich and densely fasciculate, arising from the upper part of stromata, emerging through stomata or erumpent through the cuticle, 1−3-septate, subcylindrical, brown, slightly geniculation at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (45.5−) 72.5−103 (−125) × 4−4 (−5) μm, solitary, cylindric-obclavate, straight to mildly curved, hyaline to subhyaline, smooth, 4 − 12-septate, subtruncate or obconically truncate at the base, with obtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.52)

Specimen examined: on *Dioscorea glabra* Roxb. *var. glabra*, THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27958); Chiang Mai Province, Amphur Mae Taeng, Tumbol. Pa Pae, Bahn Phadeng, Mushroom Research Centre, *Dioscorea bulbifera* L., 8 November 2006, Ikumitsu Araki (CMU 27909).

Host *Dioscorea glabra* Roxb. *var. glabra* and *Dioscorea bulbifera* L. (Dioscoreaceae) (Nakashima et al., 2007).

Distribution: Barbados, Brabados, Brazil, Canada, Cuba, Dominican Republic, Ethiopia, French Antilles, Ghana, Grenada, Guinea, Haiti, India, Indonesia, Jamaica, Myanmar, Nigeria, Panama, Puerto Rico, Sierra Leone, Saint Lucia, Saint Vincent and the Grenadines, Tanzania, Thailand, Togo, Trinidad, Tobago, Venezuela, Virgin Islands (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: Nakashima *et* al. (2007) were the first of reporting this species from Thailand. Its hosts, *Dioscorea glabra var. glabra* and *Dioscorea bulbifera*, are vegetables native to south east Asia.

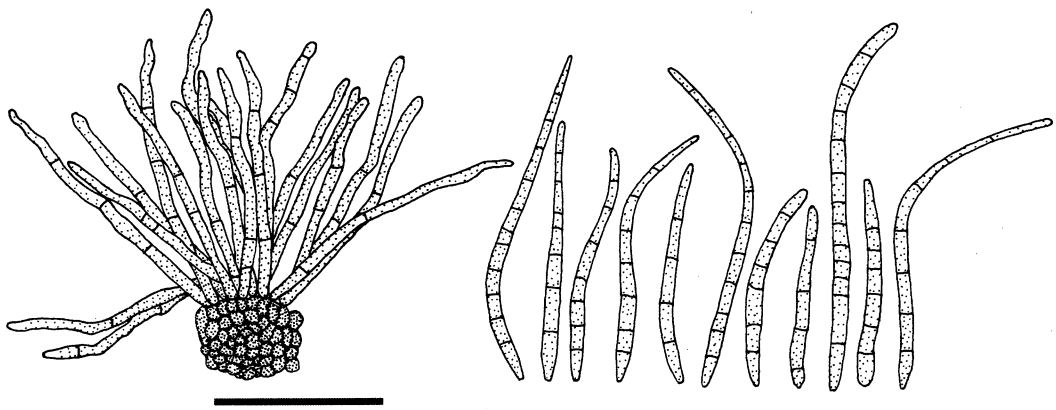


Fig. 3.52. Line drawings of *Pseudocercospora carbonacea* on *Dioscorea glabra*.
a. Stroma and conidiophores. b. Conidia. Bars = 50 μm.

Pseudocercospora contraria (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 30, 1976.

≡ *Cercospora contraria* Syd. & P. Syd., Ann. Mus. Congo, Bot., Ser. V, 3: 21, 1909.

= *Cercospora wildemanii* Syd. & P. Syd., Ann. Mus. Congo, Bot., Ser. V, 3: 21, 1909.

Leaf spots 2—9 in diameter, distinct, amphigenous, circular to subcircular, scattered, brown, greyish at the centre, with dark margin. *Caespituli* hypophyllous. *Stromata* (24.5) 37.5 ± 11.9 (57.5) μm diameter, substomatal, well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (18) 34.5 ± 11.6 (54) × (3) 4 ± 0.7 (5) μm, numerous in a dense fascicles, 1—2-septate, brown, simple, smooth, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (37) 57.5 ± 13.9 (80) × (3) 3.5 ± 0.5 (4.5) μm, solitary, long obclavate, 3—7-septate, straight or

slightly curved, smooth, pale olivaceous, truncate at the base, with subacute apex, hila unthickened and not darkened. (Fig. 3.53)

Specimen examined: on *Dioscorea alata* L., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 28 November 2005, Jamjan Meeboon (CMU 27943); Chiang Mai Province, Suthep-Pui National Park, on leaves of *Dioscorea glabra* Roxb., 25 July 2008, Jamjan Meeboon (BBH 23771).

Host: *Dioscorea alata* L. and *Dioscorea glabra* Roxb. (Dioscoreaceae) (Meeboon et al., 2008).

Distribution: Brazil, Cameroon, China, Congo, Ghana, Guinea, India, Indonesia, Japan, Java, Korea, Nigeria, Sierra Leone, Sudan, Tanzania, Thailand, Togo, and Uganda (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: This species was firstly reported from Thailand by Meeboon et al. (2008). Its host, *Dioscorea alata*, is common vegetables native to Southeast Asia.

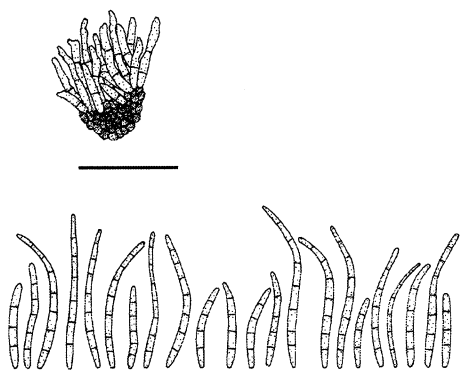


Fig. 3.53. Line drawings of *Pseudocercospora contraria* on *Dioscorea glabra*.
Bars = 50 μm.

Family Dracaenaceae

***Pseudocercospora* sp.**

Leaf spots 8−18 mm diameter, amphigenous, distinct, irregular, scattered, brown, with reddish brown margins. *Caespituli* hypophyllous. *Stromata* 13−25 μm diameter, intraepidermal, small to well-developed, composed of globose to subglobose, brown to dark brown cells, mycelium internal and external. *Conidiophores* 27−18.6 × 2−2.5 μm, numerous in a densely fasciculate, 1−3-septate, arising from the upper part of stromata as well as external mycelium, pale olivaceous to brown, simple, straight, smooth, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially

proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 57—139.5 × 1—2 μm, solitary, long filiform, 8—10-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.54)

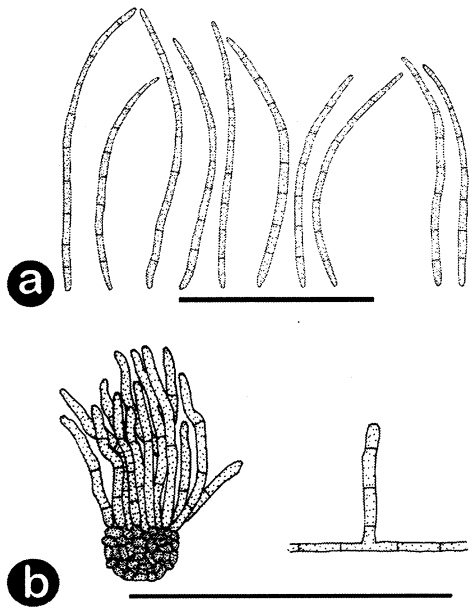


Fig. 3.54a-b. Line drawings of *Pseudocercospora* sp. on *Dracaena sanderiana*.
a. Condia. b. Conidiophores, stroma, and external mycelium. Bars: a, b = 50 μm.

Specimen examined: on *Dracaena sanderiana* Sander ex Mast., THAILAND, Chiang Mai Province, Amphur Muang, RAMA IX Garden, 26 August 2008, Jamjan Meeboon (BBH 23760).

Host: *Dracaena sanderiana* Sander ex Mast. (Dracaenaceae).

Distribution: Thailand.

Notes: *Dracaena sanderiana* is ornamentals native to Cameroon in tropical west Africa. This specimen is a new host species and also host family to the genus *Pseudocercospora*. Another cercosporoid fungus on family Dracaenaceae is *Stenella dracaenae* U. Braun and Crous (Crous & Braun, 2003). Molecular phylogentic investigation is needed in order to determine this specimen.

Family Ebenaceae

Pseudocercospora diospyri-erianthae Sawada ex Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 2: 90, 1987a.

≡ *Cercospora diospyri-erianthae* Sawada, Report of the Department of Indutry, Government Research Institute, Formosa 85: 103, 1943.

Leaf spots 2 − 11 mm diameter, solitary, amphigenous, subcircular to irregular, sometimes rectangular, pale olivaceous, with very dark and thick margin. *Caespituli* amphigenous, abundance at the upper surface. *Stromata* 16−53 μm diameter, well-developed, substomatal, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 13 −62 × 2.5−4 μm, densely fasciculate, 2−3-septate, arising from stromata, straight, branched, slightly geniculate, smooth, brown, and paler towards the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 21−54 × 2−3.5 μm, solitary, obclavate to cylindrical, straight to mildly curved, hyaline to subhyaline, 1−7-septate, smooth, obconically truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.55)

Specimen examined: on *Diospyros kaki* Thunb., THAILAND, Chiang Mai Province, Amphur Sanpatong, Tambol Mae Win, Bahn Mae Sapok, Mae Sapok Royal Project, 8 February 2008, Jamjan Meeboon (BBH 23746).

Host: on *Diospyros kaki* Thunb. (Ebenaceae).

Distribution: China and Taiwan (Crous & Braun, 2003).

Notes: This specimen is very similar to *Pseudocercospora diospyri-erianthae* in leaf spot characteristics and branched conidiophores. This is the first report of *P. diospyri-erianthae* from Thailand, and *D. kaki* is reported here as a new host of this fungus. *Diospyros kaki* is a timber plant, majority are native to the tropics, with only a few species extending into temperate regions.

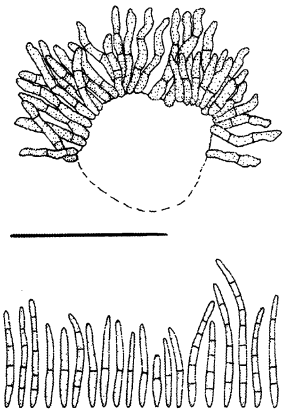


Fig. 3.55. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora diospyri-erianthae* on *Diospyros kaki*. Bar = 50 μm.

Family Elaeagnaceae

Cercospora elaeagni Heald & F. A. Wolf, Mycologia 3: 16, 1911.

≡ *Cercospora elaeagni* (Head & F. A. Wolf) Sacc., Syll. Fung. 25: 901, 1931.

Leaf spots 2—5 mm diameter, amphigenous, circular, grey with dark brown margins. *Caespituli* amphigenous. *Stromata* small, composed of a few subglobular brown cells. *Conidiophores* (42) 68.2 ± 16.7 (105) × (3) 3.6 ± 2.7 (4) μm, pale olivaceous to brown, straight to slightly curved, abruptly geniculate. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (30) 87.2 ± 40.2 (150) × (2.5) 3.2 ± 0.3 (4) μm, solitary, acicular, straight to mildly curved, hyaline, indistinctly multiseptate, smooth, truncate at the base, acute at the apex, hila 2—2.5 μm diameter, thickened, and darkened. (Fig. 3.56)

Specimen examined: on *Elaeagnus conferta* Roxb., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 11 November 2005, Jamjan Meeboon (CMU 28210).

Host: *Elaeagnus conferta* Roxb. (Elaeagnaceae) (Meeboon et al., 2007d).

Distribution: The first report of *C. elaeagni* on *E. latifolia* from Thailand was done by Meeboon et al. (2007d). Its host, *Elaeagnus conferta*, is ornamentals which are mainly native to temperate and subtropical regions of Asia.

Notes: The first report of *C. elaeagni* on *E. latifolia* from Thailand was done by Meeboon et al. (2007d). Its host, Elaeagnus conferta, is ornamentals which are mainly native to temperate and subtropical regions of Asia.

Family Elaeocarpaceae

***Pseudocercospora* sp.**

Leaf spots 7—16 mm diameter, distinct, amphigenous, circular, angular to irregular, sometimes limited by vein, scattered, pale to grayish, with reddish brown margin. *Caespituli* hypophyllous. *Stromata* 23 — 30 μm diameter, intraepidermal, small to well-developed, composed of globular to angular, brown to dark brown cells. *Conidiophores* 13.5—19 × 2—3.5 μm, numerous in a dense fascicles, 1—2-septate, not divergent to slightly divergent, arising from the stromata, pale olivaceous to brown, smooth, simple, straight, not branched, sometimes slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 45—79.5 × 2—3 μm, solitary, filiform to subacicular, 5—10-septate, straight or slightly curved, smooth, pale olivaceous, base truncate, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.57)

Specimen examined: on *Elaeocarpus grandiflorus* J. E. Smith., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 25 July 2008, Jamjan Meeboon (BBH 23772).

Host: *Elaeocarpus grandiflorus* J. E. Smith. (Elaeocarpaceae).

Distribution: Thailand.

Notes: *Pseudocercospora aristoteliae* is the only cercosporoid fungi recorded from plant family Elaeocarpaceae. However, this specimen is distincts from *P. aristoteliae* by having hypophyllous caespituli, very short conidiophores (13.5—19 × 2—3.5 μm vs 10—40 × 4—5 μm) in a densely fasciculate, and filiform conidia with truncate at the basal end. Further examination using molecular phylogenetic analysis is necessary in order to clarify this specimen. *Elaeocarpus grandiflorus* is reported here as a new host of genus *Pseudocercospora*. In addition, *E. grandiflorus* is a wild plant or ornamentals, distributed from Madagascar in the west through India, Southeast Asia, Malaysia, southern China, and Japan, through Australia to New Zealand, Fiji, and Hawaii in the east.

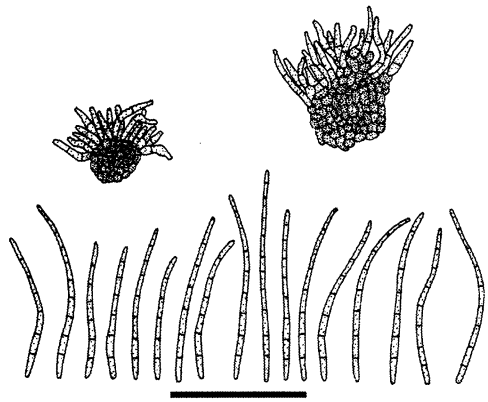


Fig. 3.57. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora* sp. on *Elaeocarpus grandiflorus*. Bar = 50.

Family Euphorbiaceae

Cercospora acalyphae Peck, Rep. (Annual) New York State Mus. Nat. Hist. 34: 48, 1881.

= *Cercospora acalypharum* Tharp, Mycologia 9: 106, 1917.

≡ *Cercosporina acalypharum* (Tharp) Sacc., Syll. Fung. 25: 902, 1931.

Leaf spots 15—30 mm diameter, amphigenous, circular or subcircular, symptoms at first pale greenish to ochraceous when young, later brown to dark brown, finally with grayish to brown at the centre, surrounded by a dark margin. *Colonies* amphigenous, ochre yellow, velvety. *Stromata* (25) 39 ± 8.2 (47) μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells, *Conidiophores* (48.5) 63.5 ± 8.6 (83.5) × (4) 5 ± 0.5 (6) μm, 2—8 in a loosely fasciculate, 1—3-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sometimes polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5—3.5 μm diameter, conspicuous, thickened, darkened. *Conidia* (44) 165.5 ± 74.62 (256) × (1.5) 2.56 ± 0.56 (3) μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 4 — 18-septate, smooth, base obconically truncate, with subacute apex, hila 2—3 μm diameter, thickened and darkened. (Fig. 3.58)

Specimen examined: on *Acalypha wilkesiana* Mull. Arg., THAILAND, Phetchabun Province, Amphur Nam Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27898); Chiang Mai Province, A. Mae Jo, Sansai, Farming area, 31 July 2008, Jamjan Meeboon (BBH 23694).

Host: *Acalypha wilkesiana* Mull. Arg. (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: Brazil, China, Cuba, India, Jamaica, Japan, Solomon Islands, Thailand, USA, and Venezuela (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: Meeboon et al. (2007c) were the first of reporting this species from Thailand. Its host, *Acalypha wilkesiana*, is ornamentals distributed from southern United States to Uruguay and northern Argentina.

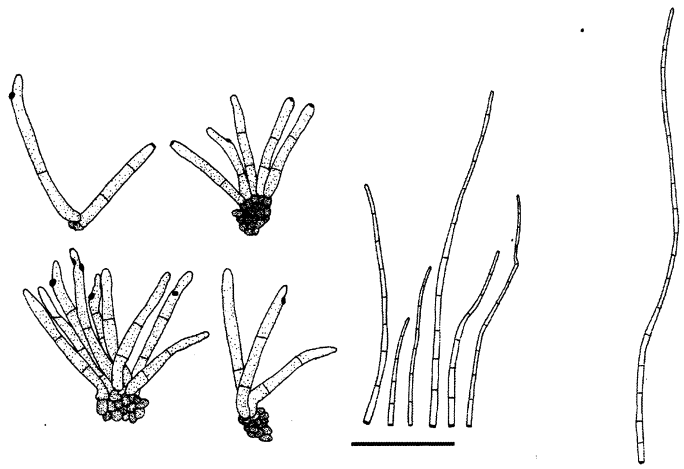


Fig. 3.58. Line drawings of *Cercospora acalyphae* on *Acalypha wilkesiana*. Bar = 50 μm.

Cercospora codiaei Gonz. Frag. & Cif., Boln de la Real Soc. Españ. Hist. Nat., Madrid 26: 199, 1926.

= ***C. apii s. lat.***

Leaf spots 2−15 mm diameter, amphigenous, subcircular, solitary, pale brown, with reddish brown margin. *Caespituli* amphigenous. *Stromata* 38 − 44 μm diameter, small, substomatal, composed of a few globose, dark brown cells. *Conidiophores* 56−213 × 4−5.5 μm, 5−16 in a loose fascicles, 4−7-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, slightly geniculate. *Conidiogenous cells* integrated, holoblastic, polyblastic, sometimes monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 2−3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 29−160 × 3−4.5 μm, solitary, acicular, rarely obclavate, straight, hyaline, 3−10-septate, smooth, truncate at the base, with tapering toward a subacute apex, hila 1.5−2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.59)

Specimen examined: on *Codiaeum variegatum* (L.) A. Juss., THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Suthep, Suthep-Pui National Park, Medicinal Plant Garden, 25 July 2008, Jamjan Meeboon (BBH 23666).

Host: *Codiaeum variegatum* (L.) A. Juss. (Euphorbiaceae).

Distribution: Cuba, Dominican Republic, and Nigeria (Crous & Braun, 2003).

Notes: This is the first record of *Cercospora codiaei* and from Thailand, and *Codiaeum variegatum* is reported here as a new host of this fungus. *Codiaeum variegatum* is ornamentals, occurs naturally in southern Asia, Indonesia and other Eastern Pacific islands.

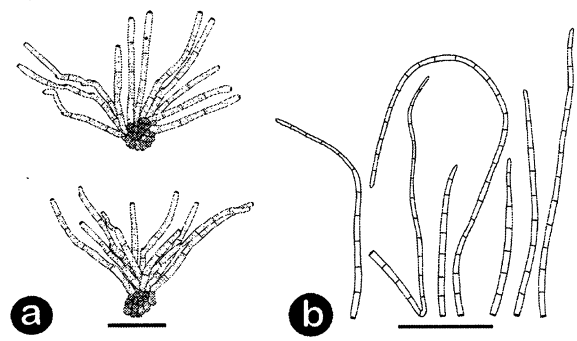


Fig. 3.59a-b. Line drawings of conidia, conidiophores, and stromata of *Cercospora codiaei* on *Codiaeum variegatum*. Bars: a, b = 50 μm.

Cercospora jatrophigena U. Braun, Fungal Diversity 8: 51, 2001.

Leaf spots amphigenous, irregular, large, 4−16 mm diameter, brown, grayish to brown, margin indefinite or with a narrow dark border. *Caespituli* hypophyllous, thin, subeffuse to dense, very dense colonies. *Stromata* lacking or small, 10−40 μm diameter, brown, substomatal to intraepidermal. *Conidiophores* in small to moderately large fascicles, divergent, arising from internal hyphae or stromata, through stomata or erumpent, erect, straight, stiff to flexuous, neither sinuous nor conspicuously geniculate, unbranched, (125.5) 208.2 ± 72.8 (400) × (4) 4.5 ± 0.5 (5) μm, pluriseptate throughout, olivaceous to medium brown throughout or tips paler, smooth; conidiogenous cells integrated, terminal or intercalary, conidiogenous loci thickened and darkened, 2.5−4 μm diameter. *Conidia* solitary, acicular-filiform, (93) 171.2 ± 65.7 (322) × (3) 3.7 ± 0.7 (5) μm, pluriseptate, distance between septa 5−15 μm, hyaline, smooth, apex subacute, base truncate or subtruncate, hila 2−3.5 μm diam., thickened and darkened.

Specimen examined: on *Jatropha curcas* L., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 3 November 2005, Jamjan Meeboon (CMU 27933).

Host: *Jatropha curcas* L. (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: India and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Cercospora jatrophigena* was firstly reported from Thailand by Meeboon et al. (2007c). *Cercospora jatrophigena* differs from *C. jatrophicola* in having distinct leaf spots, very long, non-geniculate conidiophores and much longer acicular-filiform conidia. The features of the lesion and the size of the conidiophores and conidia also discriminate this species from *C. apii s. lat.* Its host, *Jatropha curcas*, is ornamentals, originating in Central America, whereas it has been spread to other tropical and subtropical countries as well and is mainly grown in Asia and in Africa.

Cercospora phyllanthicola S. A. Khan & Kamal, Indian Phytopathol. 15: 296, 1962 [1963].

= ***C. apii s. lat.***

Leaf spots 2−5 mm diameter, amphigenous, irregular, brown to dark brown, pale at the center, with dark margin, and limited by vein of the leaf. *Caespituli* amphigenous. *Stromata* 15 − 32 µm diameter, small, substomatal to intraepidermal, composed of a few globose to subglobose, dark brown cells. *Conidiophores* (36−) 42−59 (−66) × (3−) 3.5−4.5 (−5) µm, 8−13 in a loose to dense fascicles, 1−3-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, cylindrical, sometime constrict at the-septate, rough wall, unbranched, geniculate, mostly near the apex. *Conidiogenous cells* integrated, terminal or intercalary, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 µm diameter, conspicuous, thickened, and darkened. *Conidia* 51−60.5 (−133) × 3−4 (−4.5) µm, solitary, obclavate to acicular, straight, slightly curved, hyaline, 5−11-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1−2.3 µm diameter, thickened, and darkened. (Fig. 3.60)

Specimen examined: on *Phyllanthus* sp., THAILAND, Uttradit Province, Amphur Muang, Sak Yai National Park, 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27876); Chiang Rai Province, Wiang Pa Pao, on leaves of *Phyllanthus acidus* (L.) Skeels, 15 February 2008, Jamjan Meeboon (BBH 23670).

Host: *Phyllanthus* sp. and *Phyllanthus acidus* (L.) Skeels (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: Brunei, India, Malaysia, Myanmar, Pakistan, Singapore, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: Three species of *Cercospora s. str.*, viz, *C. kirganeliicola* R. K. Srivast., S. Narayan, & A. K. Srivast. (*C. apii s. lat.*), *C. phyllanthicola* (*C. apii s. lat.*), and *C. tarii Deighton* have been recorded associated with plant genus *Phyllanthus*. This specimen is most similar to *C. phyllanthicola* by having simple conidiophores and acicular conidia. The first report of *C. phyllanthicola* from Thailand was carried out by Meeboon et al. (2007c). Crous & Braun (2003) assigned this species to *C. apii s.lat.* Its host, *Phyllanthus acidus*, is ornamentals as well as edible fruits from south Asia.

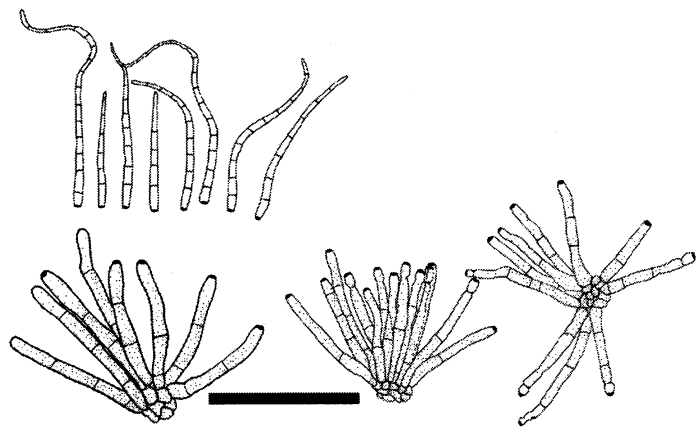


Fig. 3.60. Line drawingsof *Cercospora phyllanthicola* on *Phyllanthus acidus*. Bars = 50 μm.

Cercospora ricinella Sacc. & Berl., Atti Reale Ist. Ven. Sci. Lett. Art., 6, Ser. 3: 721, 1885.

≡ *Cercosporina ricinella* (Sacc. & Berl.) Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 20: 429, 1910.

= *Cercospora albido-maculans* G. Winter, Hedwigia 24: 202, 1885; also in *J.* Mycol. 1: 124, 1885.

= *Cercospora ricini* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires Ser. 2, 3: 343, 1899.

Leaf spots amphigenous, circular to angular, 1—12 mm diameter, dark brown, grayish white at the centre, reddish brown border. *Caespituli* amphigenous, chiefly hypophyllous. *Stromata* lacking or small, 20—40 μm diameter, composed of a few swollen hyphal cells. *Conidiophores* densely fasciculate, erect, straight to slightly curved, geniculate, unbranched, (18) 55.7 ± 24.6 (110) × (4) 4.6 ± 0.5 (6) μm, 2—5-septate, olivaceous to medium brown throughout or tips paler, smooth; conidiogenous cells integrated, terminal or intercalary, conidiogenous loci thickened and darkened, 2.5—3.5 μm diameter. *Conidia* solitary, acicular-filiform to obclavate, (15) 70.4 ± 34.2 (175) × (2.5) 3.6 ± 0.5 (5) μm, indistinctly pluriseptate, hyaline, smooth, apex

subacute to subobtuse, base truncate or subtruncate, hila 2－3.5 μm diam., thickened and darkened.

Specimen examined: on *Ricinus communis* L., THAILAND, Chiang Mai Province, Inthanon National Park, 22 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27897).

Host: *Ricinus communis* L. (Euphorbiaceae).

Distribution: Worldwide, including Angola, Argentina, Australia, Bangladesh, Barbados, Brazil, Bulgaria, Cambodia, China, Colombia, Cuba, Dominican Republic, Egypt., El-Salvador, Ethiopia, French Polynesia, Georgia, Ghana, Guatemala, Haiti, India, Indonesia, Iraq, Jamaica, Japan, Kazakhstan, Kenya, Korea, Malawi, Malaysia, Mauritius, Morocco, Mozambique, Myanmar, Nepal, New Caledonia, Nigeria, Pakistan, Panama, Philippines, Puerto Rico, Russia (European part), Sierra Leone, Somalia, South Africa, Sri Lanka, Sudan, Tahiti, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, Ukrain, USA, Vanuatu, Venezuela and Zimbabwe (Crous & Braun, 2003).

Notes: The first report of this species from Thailand was done by Petcharat and Kanjanamaneesathian (1989). Its host, *Ricinus communis*, is castor oil/medicinal plant, indigenous to the southeastern Mediterranean region, Eastern Africa, and India.

Passalora atrides (Syd. & P. Syd.) Y. L. Guo, Fung. Sci. 17: 27, 2002.

≡ *Cercospora atrides* Syd. & P. Syd., Ann. Mycol. 20: 65, 1922.

≡ *Cercosporidium atrides* (Syd. & P. Syd.) Goh & W. H. Hsieh, *Cercospora* and similar fungi from Taiwan: 115, 1990.

≡ *Passalora atrides* (Syd. & P. Syd.) Poonam Srivast., J. Living World 1: 112, 1994 (*nom. inval.*).

Leaf spots 2－12 mm in diameter, amphigenous, subcircular, greyish brown, with dark brown margin. *Caespituli* amphigenous, chiefly hypophyllous. *Stromata* 45－85 μm diameter, well-developed, intraepidermal, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (20) 39 ± 11.2 (56) × (5) 5.8 ± 0.5 (7) μm, densely fasciculate, 1－3-septate, arising from stromata, erect, straight to slightly curved, smooth, dark olivaceous to brown, unbranched, subcylindric, rarely geniculate. *Conidiogenous cells* holoblastic, mostly monoblastic, integrated, terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (21) 42.2 ± 9.8 (55) × (6) 6.7 ± 0.4 (8) μm, solitary, ellipsoid-ovoid to obclavate, straight, subhyaline, 3－7-septate, slightly constricted at the septa, smooth, base

obconically truncate, with obtuse apex, hila 1—1.5 μm diameter, conspicuous, slightly thickened and darkened.

Specimen examined: on *Bridelia ovata* Decne., THAILAND, Chiang Mai Province, Queen Sirikit Botanic Garden, 18 November 2005, Jamjan Meeboon (CMU MH 054).

Host: *Bridelia ovata* Decne. (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: China, Sierra Leone, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Passalora atrides* and *Pseudocercospora aberrans* (Petr.) Deighton (Deighton, 1987) are the only cercosporoid fungi species recorded on *Bridelia* spp. However, the present specimen was identified as *Passalora atrides* based on pigmented, ellipsoid-ovoid conidia and conspicuous, thickened, darkened conidiogenous loci. This species was reported for the first time from Thailand by Meeboon et al. (2007c). Its host, *Bridelia ovata*, is a wild plant found from Africa to Asia.

Passalora henningsii (Allesch.) R. F. Castañeda & U. Braun, Cryptog. Bot. 1: 46, 1989.

≡ *Cercospora henningsii* Allesch., Die Pflanzenwelt Ost. Afrikas & der Nachbargebiete, Teil C: 35, 1895.

≡ *Cercosporidium henningsii* (Allesch.) Deighton, More Dematiaceous Hyphomycetes: 295, 1976.

≡ *Passalora henningsii* (Allesch.) Poonam Srivast., Journal of Living World 1: 116, 1994.

= *Cercospora manihotis* Henn., Hedwigia 41: 18, 1902.

= *Cercospora cearae* Petch, Ann. Roy. Bot. Gard. Peradeniya 3: 10, 1910.

= *Septogleum manihotis* Zimm., Centralbl. Bakteriol., Abt. 2, 8: 218, 1902.

= *Helminthsoporium manihotis* Rangel, Arch. Jard. Bot. Rio de Janeiro 2: 71, 1902.

≡ *Mycosphaerella manihotis* Ghesq. & Henrard, Rev. Zool. Afr. Suppl. Bot. 12: 1, 1924 (*nom. illeg.*), homonym of *M. manihotis* Syd. & P. Syd, 1901.

Leaf spots 3—12 mm in diameter, amphigenous, subcircular, brown grayish to brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 20—52.5 μm diameter, composed of globose drak brown cells. *Conidiophores* (15) 41 ± 12.2 (62) × (3.5) 4.1 ± 0.4 (5) μm, densely fasciculate, 1—3-septate, arising from stromata, straight to slightly curved, smooth, pale brown, unbranched, moderately geniculate, bluntly rounded at the apex. *Conidiogenous cells* holoblastic, mostly monoblastic, integrated, terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (25) 38.2 ± 8 (50) × (4) 4.8 ± 0.4 (6) μm, solitary,

obclavate to subcylindrical, straight, subhyaline, 3－6-septate, smooth, base obconically truncate, with obtuse apex, hila 1－2 μm diameter, conspicuous, slightly thickened, and darkened.

Specimen examined: on *Manihot esculenta* Crantz, THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 18 November 2005, Jamjan Meeboon (CMU 27920).

Host: *Manihot esculenta* Crantz (Euphorbiaceae).

Distribution: Angola, Antigua and Barbuda, Australia, Barbados, Brazil Brunei, Cambodia, China, Colombia, Congo, Costa Rica, Cuba, Dominican Replubic, Fiji, El-Salvador, French Polynesia, Gabon, Ghana, Haiti, India, Indonesia, Ivory Coast, Jamaica, Kenya, Madagascar, Malawi, Malaysia, Mauritius, New Caledonia, Nigeria, Palau, Panama, Peru, Philippines, Puerto Rico, Sierra Leone, Singapore, Somalia, Solomon Islands, South Africa, Sri Lanka, Sudan, Suriname, Taiwan, Tanzania, Thailand, Timor, Togo, Trinidad and Tobago, Uganda, USA, Vanuatu, Venezuela, Virgin Islands, Wallis and Futuna Islands, and Zimbabwe (Crous & Braun, 2003).

Notes: In Thailand, this species was first reported by Chandrasrikul (1962) who published it as *C. cassavae* Ellis & Everh.; however, *C. cassavae* is now considered a synonym of *Passalora henningsii* (Crous & Braun, 2003). The present specimen is close to *P. henningsii* rather than *P. manihotis* (F. Stevens & Solheim) U. Braun and Crous due to amphigenous colonies and conidiophores shorter than 100 μm in size [(34－) 46.5－85 (－136.5) × (3.5－) 4.5－4.5 (－7) μm]. *Passalora manihotis* is characterized by having hypophyllous colonies and conidiophores longer than 100 μm in size (50－200 × 3.5－5 μm) (Chupp, 1954). Its host, *Manihot esculenta*, is common annual crops in tropical and subtropical regions.

Passalora manihotis (F. Stevens & Solheim) U. Braun & Crous, CBS Biodiversity Series 1: 266, 2003.

≡ *Ragnhildiana manihotis* F. Stevens & Solheim, Mycologia 23: 404, 1931.

≡ *Cercospora caribaea* Cif., in Muller & Chupp, Arq. Inst. Biol. Veget. Rio de Janeiro 1: 215, 1935 (*nom. nov.*), non *Cercospora manihotis* Henn., 1902.

≡ *Phaeoramularia manihotis* (F. Stevens & Solheim) M. B. Ellis, More Dematiaceous Hyphomycetes: 321, 1976.

Leaf spots 4－15 mm in diameter, amphigenous, subcircular, brown grayish to brown, with dark margin. *Caespituli* amphigenous. *Stromata* 20－50.5 μm diameter, well-developed, intraepidermal, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 23 － 63 × 3.5 － 5.5 μm, in small to moderately large fascicles, loose to

moderately dense, 2－4-septate, arising from stromata, erect, straight, smooth, pale brown, unbranched, subcylindrical to moderately geniculate-sinuous. *Conidiogenous cells* holoblastic, mostly monoblastic, integrated, terminal, sympodially proliferating. *Conidiogenous loci* 1－1.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 32－77 × 3－6 μm, solitary, obclavate to subcylindrical, straight, subhyaline, 3－8-septate, smooth, often verruculose, base obconically truncate, with obtuse apex, hila 1－1.5 μm diameter, conspicuous, slightly thickened, and darkened. (Fig. 3.61)

Specimen examined: on *Manihot esculenta* Crantz, THAILAND, Chiang Mai Province, Amphur Muang, Ban Umong, Water Reservoir, 24 August 2007, Jamjan Meeboon (BBH 23651).

Host: *Manihot esculenta* Crantz (Euphorbiaceae).

Distribution: Australia, Barbados, Brazil, Cameroon, Colombia, Congo, Cuba, Dominican Republic, Ghana, Guinea, Guyana, Haiti, India, Indonesia, Ivory Coast, Jamaica, Liberia, Malaysia, Netherlands Antilles, New Caledonia, Nigeria, Panama, peru, Philippines, Puerto Rico, Senegal, Sierra Leone, Somalia, Sri Lanka, Tanzania, Togo, Trinidad and Tobago, USA, Venezuela, and Virgin Islands (Crous & Braun, 2003).

Notes: This is the first report of *P. manihotis* from Thailand.

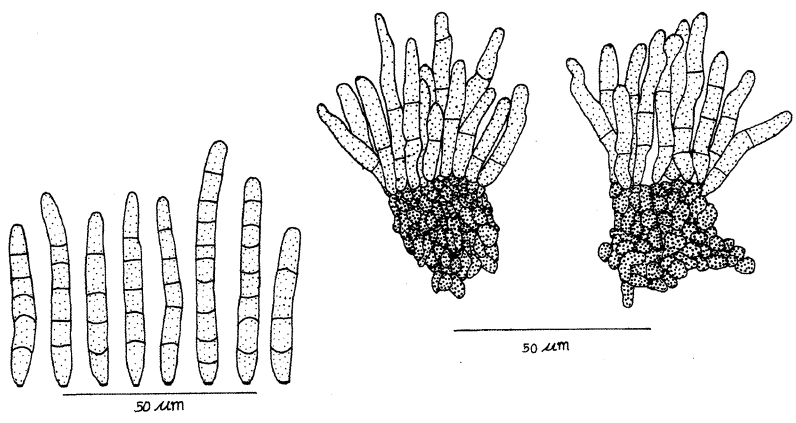


Fig. 3.61. Line drawings of conidia, conidiophores, and stromata of *Passalora manihotis* on *Manihot esculenta*. Bars = 50 μm.

***Passalora* sp.**

Leaf spots 5－15 mm diameter, amphigenous, circular, greyish brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 22.5 － 38.5 μm diameter, small, substomatal, composed of a few, globose to subglobose, brown to dark brown cells. *Conidiophores* 43－58 × 4－4.5 μm, 5－15 in a loose fascicles, 1－3-septate, arising from stromata and secondary

mycelium, straight, thick wall, smooth, brown at the base, and paler toward the apex, sometimes branched, cylindrical, geniculate. *Conidiogenous cells* integrated, holoblastic, mostly monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 2 – 2.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 42 – 96 × 6.5 – 9.5 µm, solitary, obclavate, straight to curve, light brown to medium brown, 3 – 10-septate, smooth, truncate at the base, with tapering toward a subacute apex, hila 1.5 – 2 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.62)

Specimen examined: on *Codiaeum variegatum* (L.) A. Juss., THAILAND, Chiang Mai Province, Amphur Mae Taeng, 6 February 2008, Jamjan Meeboon (BBH 23578).

Host: *Codiaeum variegatum* (L.) A. Juss. (Euphorbiaceae).

Distribution: Thailand.

Notes: Six species of *Passalora* with amphigenous caespituli, viz, *P. crotonifolia* (Cooke) Crous, U. Braun, and Alfenas, *P. crotoniphila* (Speg.) Crous, *P. crotonis* (Ellis & Everh.) Crous & U. Braun, *P. henningsii* (Allesch.) R. F. Castañeda & U. Braun, *P. maritima* (Tracy and Earle) Crous & U. Braun, and *P. securidacae* U. Braun & Crous, have been reported associated with plant family Euphorbiaceae. The conidiophores of this species sometimes branched, and only *P. maritima* and *P. securidacae* are characterized by having branched conidiophores (Chupp, 1954; Crous & Braun, 2003). Very wide conidia (6.5 – 9.8 µm) with light brown to medium brown color are the major morphological characteristic of this specimen which makes it differs with other *Passalora* species in Euphorbiaceae. Due to distinctiveness morphology characteristics of this specimen with other closely taxa; therefore, further investigation by using molecular phylogenetic approach is necessary in order to determine this specimen. *Codiaeum variegatum*, an ornamentals plant occurs naturally in southern Asia, Indonesia and other Eastern Pacific islands, is reported here as a new host of the genus *Passalora*.

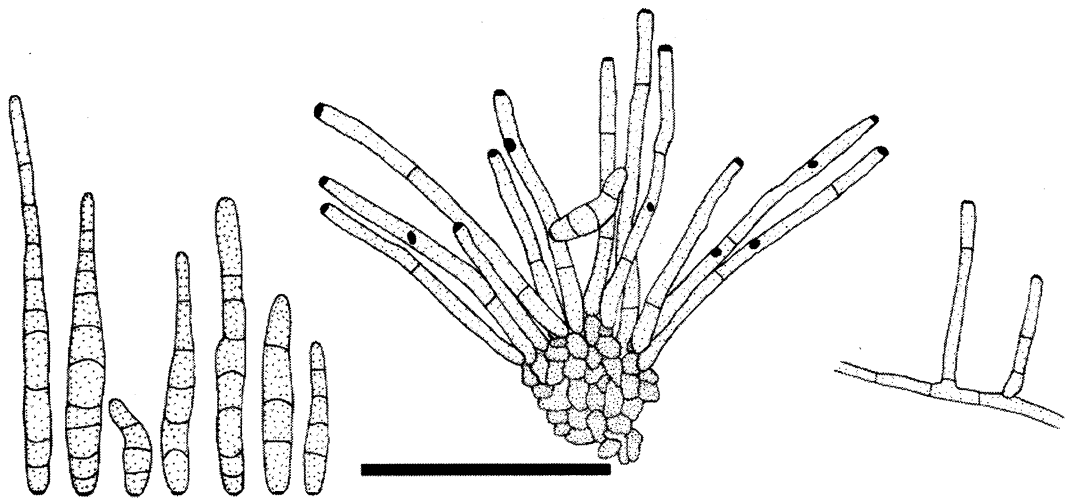


Fig. 3.62. Line drawings of conidia, conidiophores, and stromata of *Passalora* sp. on *Codiaeum variegatum*. Bar = 50 μm.

Pseudocercospora eupatorii-formosani U. Braun & Bagyan, (as '*eupatorii-formosani*'), Sydowia 51: 8, 1999.

≡ *Cercospora eupatori-formosani* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 86: 169, 1943 (*nom. inval.*).

≡ *Pseudocercospora eupatori-formosani* (Sawada) J. M. Yen, Gard. Bull. Singapore 33: 175, 1980 (comb. inval.).

≡ *Pseudocercospora eupatorii-formosani* (Sawada ex Y. L. Guo & W. H. Hsieh) J. M. Yen, ex Y. L. Guo & W. H. Hsieh, The genus *Pseudocercospora* in China: 67, 1995 (*nom. inval.*).

Leaf spots 1—2 mm diameter, amphigenous, circular, angular to irregular, scattered, later coalescing to large spots, 3—23 mm diameter, grayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* hypophyllous. *Stromata* 20—40 μm diameter, substomatal to intraepidermal, small to well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 11—25 × 2.5—3 μm, 5 to numerous in a densely fasciculate, 0—1-septate, arising from the upper part of stromata, pale olivaceous to brown, simple, smooth, straight or slightly geniculate at the apex. *Conidiogenous cells* integrated, holoblastic, mostly monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 33.5—107 × 2.5—3 μm, solitary, acicular to obclavate, 3—6-septate, straight or slightly curved, smooth,

pale olivaceous, truncate at the basal end, with acute apex, hila unthickened, and not darkened. (Fig. 3.63)

Specimen examined: on *Euphorbia cotinifolia* L., THAILAND, Chiang Mai Province, Amphur Sansai, Tumbol Mae Fag, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23705).

Host: *Euphorbia cotinifolia* L. (Euphorbiaceae).

Distribution: Australia, Brazil, Brunei, Cambodia, China, Cuba, India, Indonesia, Ivory Coast, Nepal, New Zealand, Malaysia, Taiwan (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. eupatorii-formosani* from Thailand, and *Euphorbia cotinifolia*, an ornamental plant widely distributed in Central America, is reported here as a new host of this fungus.

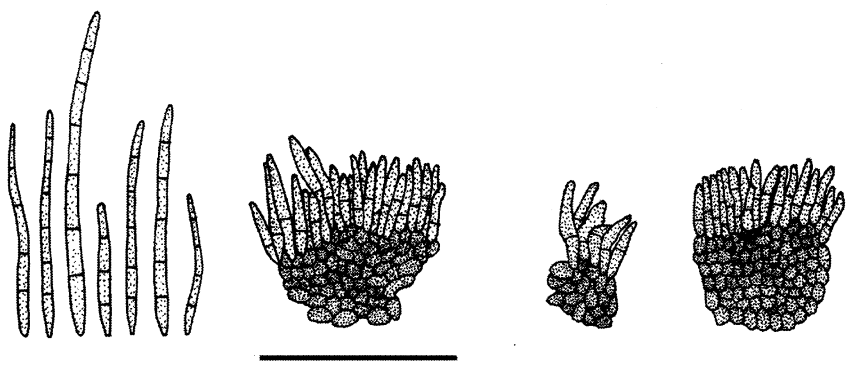


Fig. 3.63. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora eupatorii-formosani* on *Euphorbia cotinifolia*. Bar = 50 µm.

Pseudocercospora glochidionis (Sawada) Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 2: 136, 1987c.

≡ *Cercospora glochidionis* Sawada, Trans, Nat. hist. Soc. Taiwan 24, 1919.

Leaf spots 3—15 mm diameter, amphigenous, circular to irregular, pale brown to brown, center grayish white to grey, margin dark brown. *Caespituli* amphigenous. *Stromata* well-developed, subglobose, 30—85 µm diameter, globose to subglobose, brown to dark brown cells. *Conidiophores* (12) 32.9 ± 11.9 (51) × (3) 3.8 ± 0.4 (4.5) µm, loosely to densely fasciculate, 0—3-septate, arising from stromata, straight to curved, smooth, pale olivaceous to brown, paler towards the apex, cylindrical, unbranched, rarely geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (15) 39.9 ± 17 (80) × (2.5) 3.6 ± 0.4 (4) µm, solitary, obclavate to cylindric-obclavate, 2 — 8-septate, straight to slightly curved,

subhyaline, smooth, obconically truncate at the base, obtuse at the apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Glochidion sphaerogynum* Kurz, THAILAND, Chiang Mai Province, Amphur Mae Taeng, Tumbol Pa Pae, Bahn Phadeng, Mushroom Research Centre, 7 November 2006, Jamjan Meeboon (CMU 27913).

Host: *Glochidion sphaerogynum* Kurz (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: China, India, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: This specimen is a new record of *P. jatrophae* from Thailand. Its host, *Jatropha curcas*, is ornamental plant originating in Central America, but mainly grown in Asia and in Africa.

Pseudocercospora jatrophae (G. F. Atk.) A. K. Das & Chattopadh., J. Mycopathol. Res. 28: 1990.

≡ *Cercospora jatrophae* G. F. Atk., J. Elisha Mitchell Sci. Soc. 8: 64, 1892.

Leaf spots 1 − 8 mm diameter, amphigenous, angular, dark brown, only leaf decolorization, limited by vein of the leaf, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* 9−27 µm diameter, intraepidermal, small, composed of a few, globose to subglobose, brown to dark brown-walled cells. *Conidiophores* 11.5−23 × 2−3 µm, 3−11 in a loose fascicles, 1−3-septate, arising from stromata, straight to decumbent, smooth, pale brown, cylindrical, unbranched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 20.5 − 34 × 2 − 2.5 µm, solitary, obclavate to cylindrical, 3 − 6-septate, straight, hyaline to subhyaline, smooth, obconically truncate at the base, tapering toward a subacute apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.64)

Specimen examined: on *Jatropha curcas* L., THAILAND, Chiang Mai Province, T. Suthep, Amphur Sarapee, Tumbol Deu Ngok, Farming Area, 7 March 2008, Jamjan Meeboon (BBH 23736).

Host: *Jatropha curcas* L. (Euphorbiaceae).

Distribution: American Samoa, China, India, Martinique, Tonga, and USA (Crous & Braun, 2003).

Notes: This specimen is a new record of *P. jatrophae* from Thailand. Its host, *Jatropha curcas*, is ornamental plant originating in Central America, but mainly grown in Asia and in Africa.

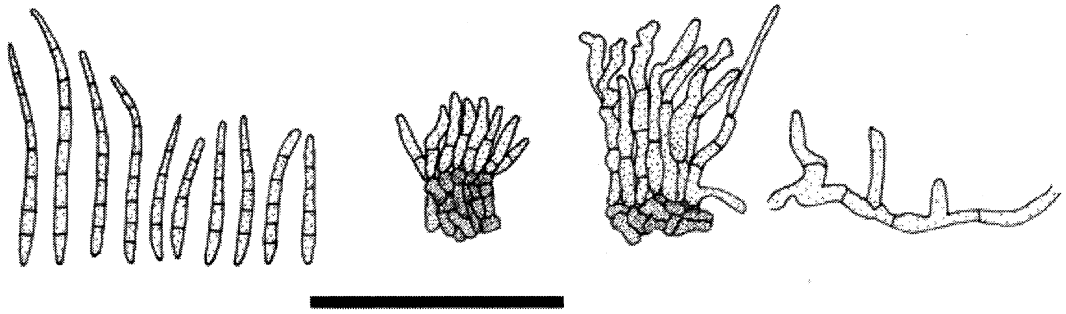


Fig. 3.64. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora jatrophae* on *Jatropha curcas*. Bar = 50 μm.

Pseudocercospora melanolepidis Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 2: 132, 1987c.

≡ *Cercospora melanolepidis* Sawada, Taiwan Agric. Rep. 38: 698, 1942 (*nom. inval.*).

Leaf spots 1−3 mm diameter, amphigenous, subcircular, angular or irregular, dark brown, grayish white at the center with yellowish-brown margin. *Caespituli* hypophyllous. *Stromata* lacking, composed of a few brown cells. *Conidiophores* (22) 42.5 ± 12.5 (65) × (3) 3.7 ± 0.3 (4) μm, loosely fasciculate, 0−2-septate, arising from the secondary mycelial hyphae, smooth, pale olivaceous to brown, paler towards the apex, straight, unbranched, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (25) 66.8 ± 30.5 (125) × (2) 3.1 ± 0.4 (4) μm, solitary, obclavate to cylindrical, 2−11-septate, straight to mildly curved, subhyaline, smooth, subtruncate to obconically truncate at the base, obtuse at the apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Mallotus pierrei* (Gagnep.) Airy Shaw, THAILAND, Uttradit Province, Amphur Muang, Sak Yai National Park, 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27899).

Host: *Mallotus pierrei* (Gagnep.) Airy Shaw (Euphorbiaceae) (Meeboon et al., 2007c).

Distribution: China, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of *P. melanolepidis* on *M. pierrei* from Thailand was carried out by Meeboon et al. (2007c). *Pseudocercospora melanolepidis* was previous recorded on *M. moluccanus* and *M. multiglandulosa* by Crous & Braun (2003). *Mallotus pierrei* is a wild plant mainly used for timber, found in tropical Africa and Madagascar.

Pseudocercospora euphorbiae-pubescentis (Unamuno) U. Braun & Crous, CBS Biodiversity Series 1: 180, 2003.

≡ *Cercospora euphorbiae-pubescentis* Unamuno, Bol. Soc. Esp. Hist. Nat. 35: 435, 1935.

= *Cercospora euphorbiae* Pat, Bull. Soc. Mycol.France 9: 160, 1893.

Leaf spots 1−2 mm diameter, circular, angular to irregular, scattered, later coalescing to large spots, grayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* hypophyllous. *Stromata* 13−22 μm diameter, substomatal to intraepidermal, small, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 14−26 × 2.5 μm, numerous in a densely fasciculate, 1−2-septate, arising from the stromata, pale olivaceous to brown, smooth, simple, straight to slightly geniculate near the apex. *Conidiogenous cells* integrated, holoblastic, mostly monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 28−56 × 2−2.5 μm, solitary, filiform to long obclavate, 5−9-septate, straight or slightly curved, smooth, pale olivaceous, subtruncate to truncate at the basal end, with obtuse apex, hila unthickened, not darkened. (Fig. 3.65)

Specimen examined: on *Euphorbia milii* Des Moul., THAILAND, Chiang Mai Province, Amphur Hang Dong, Tumbol Num Phrae, Farming area, 7 August 2008, Jamjan Meeboon (BBH 23588).

Host: *Euphorbia milii* Des Moul. (Euphorbiaceae).

Distribution: Brazil, Ecuador, Libya, and Spain (Crous & Braun, 2003).

Notes: Two species of *Pseudocercospora*, viz, *P.euphorbiae-pubescentis* (Unamuno) U. Braun and Crous, and *P. euphorbiicola* (G. F. Atk.) U. Braun and Crous, have been recorded associated with plant genus *Euphorbia* (Crous & Braun, 2003). Of them, only *P. euphorbiae-pubescentis* has very similar morphological characteristics by short conidiophores with almost straigth to slight geniculation at the apex, and filiform-long obclavate conidia with subtruncate base. This specimen is the first record of *P. euphorbiae-pubescentis* from Thailand. *Euphorbia milii*, an ornamental plant native to Madagascar, is reported here as a new host of this fungus.

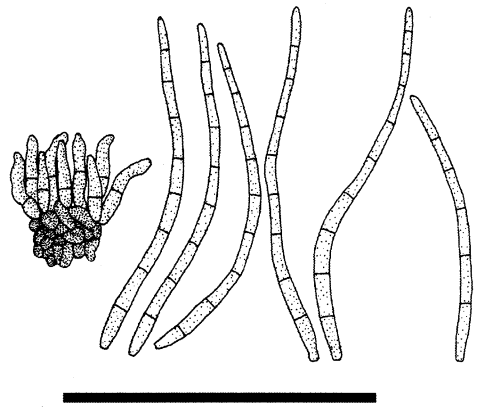


Fig. 3.65. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora euphorbiae-pubescentis* on *Euphorbia milii*. Bar = 50 μm.

Family Fabaceae

Cercospora canescens Ellis & G. Martin, Amer. Naturalist 16: 1003, 1882.

≡ *Cercosporiopsis canescens* (Ellis & G. Martin) Miura, Flora of Manchuria and East Mongolia 3: 529, 1928.

= *Cercospora vignicaulis* Tehon, Mycologia 29: 436, 1937.

= ***C. apii s. lat.***

Leaf spots 3—20 mm diameter, amphigenous, irregular, brown to dark brown, limited by vein of the leaf. *Caespituli* amphigenous. *Stromata* 26.5—67 μm diameter, well-developed, intraepidermal, and composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 60.5—118 × 3—5 μm, 12—20 in a loose to dense fascicles, 1—3-septate, arising from stromata, straight to decumbent, cylindrical, smooth, brown at the base, and paler toward the apex unbranched, geniculate to sinuous. *Conidiogenous cells* 12 — 35.5 × 3 — 5 μm, integrated, terminal, holoblastic, polyblastic, sometimes monoblastic, sympodially proliferating. *Conidiogenous loci* 1.5—3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 56—113.5 × 3—4.5 μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 3—9-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2 — 3 μm diameter, thickened, and darkened. (Figs. 3.66, 3.67, 3.68, 3.69).

Specimen examined: on *Vigna radiata* (L.) R.Wilczek, THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, Tumbol Wiang Ga Long, 25 October 2005, Jamjan Meeboon (CMU 27888), on leaves of *Vigna unguiculata* var. *sesquipedalis* Bertoni, 18 November 2005,

Jamjan Meeboon (CMU 27894), on leaves of *Lablab purpureus* (L.) Sweet, 16 July 2007, Jamjan Meeboon (BBH 23624); Chiang Mai Province, San Sai, Mae Fag, 3 August 2008, Jamjan Meeboon (BBH 23749); on leaves of *Psophocarpus tetragonolobus* DC., 31 July 2007, Jamjan Meeboon (JM 104), on leaves of *Dolichos lablab* L., 25 July 2008, Jamjan Meeboon (BBH 23773); Chiang Mai Province, Amphur Mae Rim, Nong Hoi Royal Project, on leaves of *Vigna unguiculata* (L.) Walp., 27 September 2007, Jamjan Meeboon (BBH 23678); Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, on leaves of *Vigna unguiculata* (L.) Walp., 1 August 2008, Jamjan Meeboon (BBH 23722).

Host: *Dolichos lablab* L., *Lablab purpureus* L., *Psophocarpus tetragonolobus* DC., *Vigna radiate* (L.) R.Wilczek, *V. unguiculata* (L.) Walp., *V. unguiculata* var. *sesquipedalis* Bertoni (Fabaceae).

Distribution: Worldwide, wherever the crop is cultivated, including Australia, Bangladesh, Barbados, Brazil, Bolivia, Brunei, Cambodia, China, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Fiji, Georgia, Ghana, Guyana, Haiti, Hong Kong, India, Indonesia, Iran, Japan, Kenya, Korea, Malawi, Malaysia, Malawi, Mauritus, Myanmar, Nepal, New Caledonia, New Zealand, Nigeria, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Puerto Rico, Russia, Senegal, Sierra Leone, Solomon Islands, Somalia, South Africa, Saint Vincent and the Grenadines, Sudan, Tadzhikistan, Taiwan, Tanzania, Trinidad and Tobago, Togo, Uganda, USA, Uzbekistan, Vanuatu, Venezuela, Virgin Islands, Zambia and Zimbabwe (Crous & Braun, 2003).

Notes This species was first reported from Thailand by Sontirat et al. (1980) who found *C. canescens* on *V. radiata*. Crous & Braun (2003) assigned this species to *C. apii s. lat.* Its hosts, *Dolichos lablab*crops, *Glycine max*, *Lablab purpureus*, *Psophocarpus tetragonolobus*, *Raphanus sativus*, *V. radiata*, *V. unguiculata*, and *V. unguiculata* var. *sesquipedalis*, are common crops/legume crops in Asia, Africa, southern Europe and Central and South America. *Glycine max*, crops, native to East Asia. *Lablab purpureus*, crops throughout the tropics, especially in Africa, India and Indonesia. *Psophocarpus tetragonolobus*, important crops, native to Papua New Guinea. *Raphanus sativus*, crops, domesticated in Europe in pre-Roman times, they are grown and consumed throughout the world. *Vigna radiate*, Crops, native to Pakistan and India. *Vigna unguiculata*, crops, legume crops in the semi-arid tropics covering Asia, Africa, southern Europe and Central and South America.

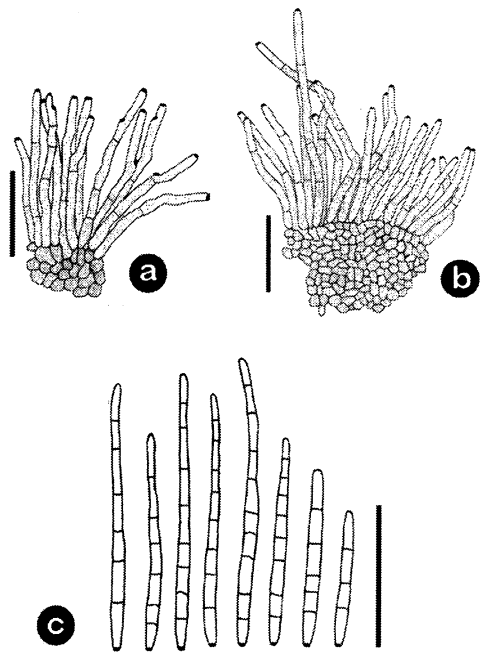


Fig. 3.66a-c. Line drawings of *Cercospora canescens* on *Vigna unguiculata*. a-b. Conidiophores and stromata. c. Conidia. Bars: a, b, c = 50 µm.

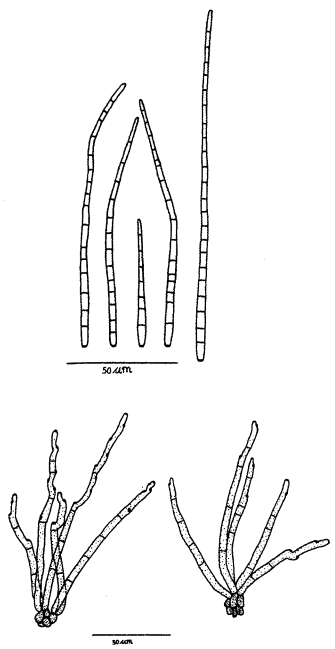


Fig. 3.67. Line drawings of *Cercospora canescens* on *Psophocarpus tetragonolobus*. Bar = 50 µm.

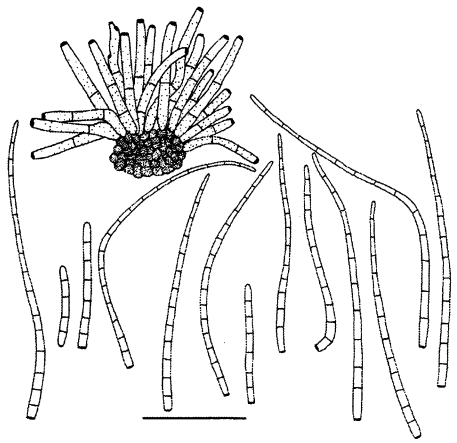


Fig. 3.68. Line drawings of *Cercospora canescens* on *Dolichos lablab*. Bar = 50 μm.

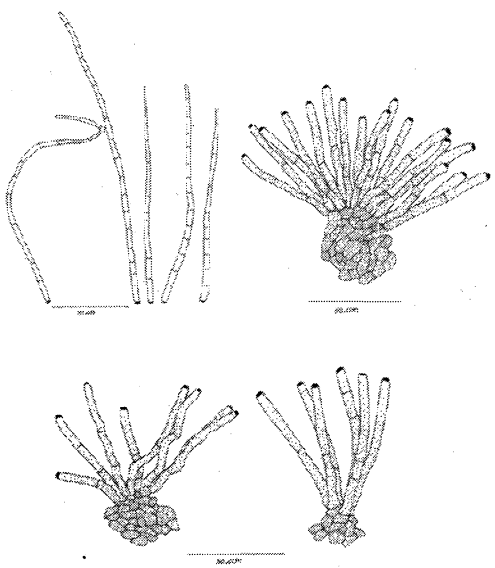


Fig. 3.69. Line drawings of *Cercospora canescens* on *Lablab purpureus*. Bar = 50 μm.

Cercospora crotalariae Sacc., Syll. Fung. 22: 129, 1913.

= *Cercsospora crotalariae-junceae* Sawada, J. Taihoku Soc. Agric. 7: 27, 1942 (*nom. inval.*).

= ***C. apii s. lat.***

*Leaf spot*s 1—9 mm diameter, amphigenous, scattered to confluent, subcircular to angular, pale brown at the young symptoms, later becoming greyish brown, greyish to pale at the centre, with reddish brown or purplish brown margins. *Caespituli* amphigenous. *Stromata* 25—30.5 μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 35—231 × 3.5—5.5 μm, numerous in a densely fasciculate, 2—6-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to

pale brown, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5 — 3.5 µm diameter, conspicuous, thickened, darkened. *Conidia* 39—206 × 2—4 µm, solitary, narrowly obclavate to subacicular, straight, hyaline, 5 — 17-septate, smooth, base obconically truncate, with subacute apex, hila 2.5—3.5 µm diameter, thickened and darkened. (Fig. 3.70)

Specimen examined: on *Crotalaria montana* Heyne ex Roth. THAILAND, Chiang Mai Province, Amphur Sansai, Mae Jo University, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23708).

Host: *Crotalaria montana* Heyne ex Roth (Fabaceae).

Distribution: Bangladesh, China, Cuba, Ethiopia, India, Indonesia, Pakistan, Papua New Guinea, Puerto Rico, Sri Lanka, Taiwan, venequela, and Thailand (Crous & Braun, 2003).

Notes: This specimen is a new record of *C. crotalariae* from Thailand, and *Crotalaria-Montana* is reported here as a new host of this fungus. Crous & Braun (2003) assigned this species as *C. apii s. lat. Crotalaria montana* is ornamentals mostly distributed in the tropics.

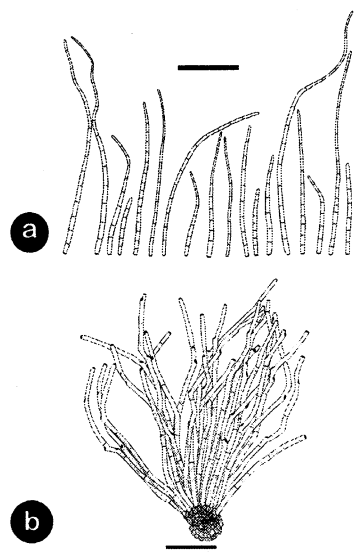


Fig. 3.70a-b. Line drawings of *Cercospora crotalariae* on *Crotalaria montana*.
a. Conidia. b. Conidiophores and stroma. Bars: a = 40 µm, b = 50 µm.

Cercospora erythrinicola Tharp, Mycologia 9: 109, 1917.

≡ *Cercospora erythrinicola* (Tharp.) Sacc., Syll. Fung. 25: 907, 1917.

= *Cercospora erythrinigena* Kamal, ined., *in herb.* (IMI 375847).

= ***C. apii s. lat.***

Leaf spots 3—9 mm diameter, amphigenous, subcircular to irregular, greyish brown at the centre, with yellowish-brown margins. *Caespituli* amphigenous. *Stromata* lacking. *Conidiophores* (16) 34.1 ± 10.8 (54) × (3.5) 3.8 ± 0.3 (4.5) μm, arising from exernal hyphae, simple, straight, erect, smooth, pale olivaceous to brown, subcylindrical, rarely geniculate, unbranched, 1 — 2-septate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, darkened. *Conidia* (35) 46.3 ± 6.9 (60) × (3) 3.5 ± 0.3 (4.5) μm, solitary, narrowly obclavate to acicular, straightly curved, hyaline, 2—6-septate, smooth, base truncate, acute apex, hila 2.5—3.5 μm diameter, thickened and darkened.

Specimen examined: on *Erythrina* sp., THAILAND, Chiang Mai Province, Amphur Mae Teang, Tumbol Pa Pae, Bahn Phadeng, Mushroom Research Centre, 12 November 2006, Ikumitsu Araki (CMU 27914).

Host: *Erythrina* sp. (Fabaceae) (Meeboon et al., 2007c).

Distribution: Brazil, Cuba, India, Pakistan, Taiwan, Thailand, and USA (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Cercospora erythrinicola* was firstly reported from Thailand by Meeboon et al. (2007c). Its host, *Erythrina* sp., is ornamental plant distributed in tropical and subtropical regions worldwide.

Cercospora kikuchii T. Matsumoto & Tomoy., Ann. Phytopathol. Soc. Japan 1: 1, 1925.

≡ *Cercospora kikuchii* T. Matsumoto & Tomoy., *l.c.*: 10.

≡ *Cercospora kikuchii* (T. Matsumoto & Tomoy.) M. W. Gardner, Proc. Indian Acad. Sci. 36: 12, 1927 (*comb. superfl.*).

= ***C. apii s. lat.***

Leaf spots 1—9 mm diameter, amphigenous, scattered to confluent, subcircular to angular, initially appearing pale brown, later becoming tan to to dingy grey, greyish white at the centre, with reddish brown or purplish brown margins. *Caespituli* hypophyllous. *Stromata* (26) 32 ± 6.1 (39) μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (76) 108 ± 14.3 (129) × (3.5) 4 ± 0.4 (5) μm, 9 to numerous in a densely and divergent fasciculate, 2—4-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 2—3 μm diameter, conspicuous, thickened, darkened. *Conidia* (80) 115.11 ± 31.6 (132) × (3) 3.5 ± 0.2 (3.5) μm, solitary,

narrowly obclavate to subacicular, straight, hyaline, 6—11-septate, smooth, base obconically truncate, with subacute apex, hila 2—2.5 μm diameter, thickened and darkened. (Fig. 3.71)

Specimen examined: on *Glycine max* Merr., THAILAND, Chiang Mai Province, Chiang Mai University, 21 November 2004, Jamjan Meeboon (CMU 27878); Chiang Mai Province, Mae Jo University, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23707).

Host: *Glycine max* Merr. (Fabaceae).

Distribution: Worldwide where the host is cultivated, including Argentina, bangladesh, Bolivia, Brazil Brunei, Burkina Faso, Cameroon, Canada, China, Colombia, Cuba, Egypt, Ethiopia, Fiji, France, Gabon, Ghana, Guinea, India, Indonesia, Iran, Jamaica, Japan, Korea, Liberia, Malaysia, Mexico, Mozambique, Nepal, New Caledonia, Nigeria, Pakistan, Panama, Papua New Guinea, Peru, Puerto Rico, Russia, Sierra Leone, Somalia, South Africa, Sri Lanka, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, Zambia and Zimbabwe (Crous & Braun, 2003).

Notes: The first record of this species from Thailand was listed in Sontirat et al. (1980). Crous & Braun (2003) assigned this species to *C. apii s.lat.*

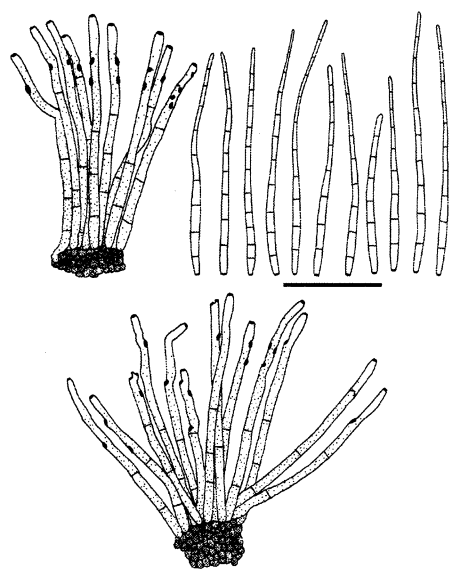


Fig. 3.71. Line drawings of *Cercospora kikuchii* on *Glycine max*. Bar = 50 μm.

Cercospora leucaenae A. N. Shukla & Sarmah, Indian Forester 110: 1066, 1984.

Leaf spots 1—8 mm diameter, amphigenous, solitary, sometimes clustered to form larger spots, circular to subcircular, sometimes irregular, greyish brown, with dark brown margin, limited by leaf veins. *Caespituli* amphigenous. *Stromata* 15 — 30 μm diameter, small,

substomatal, composed of a few globose to subglobose, brown-walled cells. *Conidiophores* (50) 81 ± 19.9 (115) × (3.5) 3.8 ± 0.2 (4) μm, 5−12 in a loose fascicles, 2−4-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, often not geniculate, very rarely geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (57) 84.8 ± 21.4 (130) × (3) 3.4 ± 0.2 (3.5) μm, solitary, acicular, straight, hyaline, 5−12-septate, smooth, truncate at the base, subacute apex, hila 2−2.5 μm diameter, conspicuous, thickened, and darkened.

Specimen examined: on *Leucaena leucocephala* (Lam.) de Wit, THAILAND, Chiang Rai Province, A. Wiang Pa Pao, 11 November 2005, Jamjan Meeboon (CMU 28217).

Host: *Leucaena leucocephala* (Lam.) de Wit (Fabaceae) (Meeboon et al., 2007d).

Distribution: India and Thailand (Crous & Braun, 2003; Meeboon et al., 2007d).

Notes: The first report of *C. leucanae* was done by Meeboon et al. (2007d). A true *Cercospora s. str.* close to or identical with *C. apii s.lat.* Its host, *Leucaena leucocephala*, is usually used for firewood, fiber, and livestock feed. It is also known as weeds in Taiwan, the Hawaiian islands and Fiji.

Passalora aenea (Cif.) U. Braun & Crous, CBS Biodiversity Series 1: 46−47, 2003.

≡ *Berteromyces aeneus* Cif., Sydowia 8: 267, 1954.

= *Cercospora cassiae* Henn., Bull. Herb. Boissier 1: 121, 1893, non *Passalora cassiae* Syd., 1939.

≡ *Cercosporidium cassiae* (Henn.) Deighton, Mycol. Pap. 112: 66, 1967.

≡ *Phaeoisariopsis cassiae* (Henn). Arx, Proc. K. Ned. Akad. Wet., C 86: 43, 1983.

≡ *Passalora cassiae* (Henn.) Poonam Srivast., J. Living World 1: 114, 1994 (*nom. inval. et. illeg.*), homonym of *Passalora cassiae* Syd., 1939.

≡ *Passalora cassiae* (Henn.) U. Braun, Mikol. Fitopatol. 30: 6, 1996 (*nom. illeg.*), homonym of *Passalora cassiae* Syd., 1939.

= *Cercospora cassiicola* Roum. (*cassiaecola*), Fungi sel. exs., No. 4486, 1888 (*nom. nud.*).

Leaf spots 1−5 mm diameter, amphigenous, subcircular to irregular, blackish to dark brown, limited by the veinlets of the leaf. *Caespituli* amphigenous. *Stromata* 45 − 80 μm diameter, substomatal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (55) 79.3 ± 15.2 (118) × (3.5) 3.9 ± 0.3 (5) μm, in large densely fascicles, 1−3-septate, arising from stromata, straight to often incurved, smooth, pale olivaceous to brown, with paler at the apex, unbranched, subcylindrical, geniculate-sinuous. *Conidiogenous*

cells integrated, holoblastic, terminal, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (25) 44.3 ± 13.1 (67) × (5) 6.2 ± 1.2 (10) μm, solitary, broadly obclavate, straight or slightly curved, base obconically truncate, slightly curved toward the obtuse apex, brown, 0—5-septate, smooth, hila 2—2.5 μm diameter, thickened and darkened.

Specimen examined: on *Cassia agnes* (de Wit) Brenan, THAILAND, Chiang Mai Province, Suthep-Pui National Park, 10 December 2006, Jamjan Meeboon and Ikumitsu Araki (CMU 27910).

Host: *Cassia agnes* (de Wit) Brenan (Fabaceae) (Meeboon et al., 2007c).

Distribution: Brazil, Barbados, Colombia, Ethiopia, India, Jamaica, Tanzania, Thailand, Uganda, USA, and Zambia (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *P. aenea* on *C. agnes* was firstly reported from Thailand by Meeboon et al. (2007c). This species was previous reported on several hosts of the genus *Cassia*, viz., *C. fistula, C. goratensis, C. grandis, C. javanica, C. leptocarpa,* and *C. marylandica* by Crous & Braun (2003). *Cassia agnes* is ornamental plant widely distributed in tropical area.

Passalora arachidicola (Hori) U. Braun, New Zealand J. Bot. 37: 303, 1999.

≡ *Cercospora arachidicola* Hori, Nishigahara Agric. Expt. Stat. Tokyo: 26, 1917.

= *Cercospora arachidis* var.*macrospora* Maffei, Riv. Pat. Veget. 12: 7, 1992.

Leaf spots 1—7 mm diameter, amphigenous, subcircular to irregular, blackish to dark brown, surrounded by yellowish of leaf decolorization. *Caespituli* amphigenous. *Stromata* 81—104 μm diameter, substomatal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 34—88 × 4—5 μm, in large densely fascicles, 1—4-septate, arising from stromata, straight to often incurved, smooth, pale brown, with paler at the apex, unbranched, subcylindrical, geniculate-sinuous. *Conidiogenous cells* integrated, holoblastic, terminal, polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5 — 3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 29—85 × 3.5—6.5 μm, solitary, obclavate, straight, base obconically truncate, slightly curved toward the obtuse apex, brown, 3—5-septate, smooth, hila 1—2.5 μm diameter, thickened and darkened. (Fig. 3.72)

Specimen examined: on *Arachis hypogaea* L., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Jamjan Meeboon (CMU 27890); Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 15 March 2007, Jamjan Meeboon (BBH 23691).

Host: *Arachis hypogaea* (Fabaceae).

Distribution: Widely distributed with host, including Afghanistan, Angola, Argentina, Australia, Bangladesh, Benin, Bolivia, Brazil, Brunei, Burkina Faso. China, Cuba, Cameroon, Colombia, Comoros, Congo, Cuba, Dominican Republic, El-Salvador, Fiji, Gabon, Gambia, Ghana, Guatemala, Guinea, Guyana, Hong Kong, India, Indonesia, Ivory Coast, Jamaica, Japan, Kenya, Korea, Laos, Lebanon, Libya, Madagascar, Malawi, Malaysia, Mali, Mauritius, Mexico, Mozambique, Myanmar, Nepal, New Caledonia, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Philippines, Puerto Rico, Sabah, Senegal, Sierra Leone, Solomon Islands, Somalia, South Africa, Sudan, Suriname, Taiwan, Tanzania, Thailand, Togo, Uganda, USA, Uruguay, Venezuela, Vietnam, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This species was firstly reported from Thailand by Sontirat (1980) as *Cercospora arachidicola* Hori. Its host, *Arachis hypogaea*, is crops native to South America, Mexico and Central America.

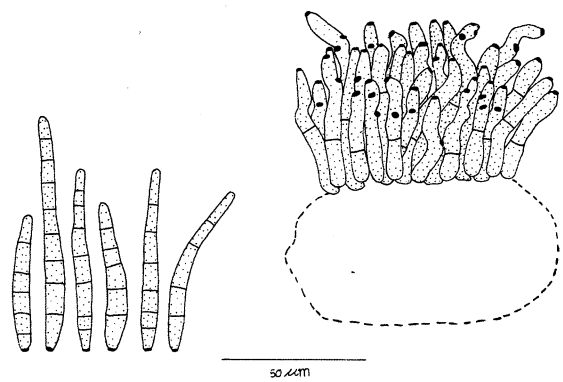


Fig. 3.72. Line drawings of *Passalora arachidicola* on *Arachis hypogaea*. Bar = 50 µm.

Passalora buteae (Kamal, B. K. Gupta, & C. Gupta) U. Braun & Crous, CBS Biodiversity Series 1: 444, 2003.

≡ *Phaeoramularia buteae* Kamal, B. K. Gupta & C. Gupta, Indian Phytopath. 43: 144, 1990.

Leaf spots 4−35 mm in diameter, amphigenous, irregular, brown to grayish to brown, with red margin. *Caespituli* hypophyllous. *Stromata* 22 − 47 µm diameter, well-developed, intraepidermal, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 52−86 × 2−5 µm, loose to moderately dense fascicles, 1−3-septate, arising from stromata, erect, straight, smooth, pale brown, branched, subcylindrical to moderately geniculate-sinuous. *Conidiogenous cells* integrated, terminal or intercalasry, holoblastic, often

polyblastic, sympodially proliferating. *Conidiogenous loci* 1—1.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 7.5—44 × 2—3 µm, catenate, clavate to subcylindrical, straight, subhyaline, 0—4-septate, smooth, sometimes verruculose, obconically truncate at the base, with obtuse apex, hila 0.5—1 µm diameter, conspicuous, slightly thickened, and darkened. (Fig. 3.73)

Specimen examined: on *Butea monosperma* Kuntze, THAILAND, Chiang Mai Province, A. Mae Taeng, 6 February 2008, Jamjan Meeboon (BBH 23758).

Host: *Butea monosperma* Kuntze (Fabaceae).

Distribution: India (Crous & Braun, 2003).

Notes: This is the first record of *P. buteae* from Thailand, and *B. monosperma* is reported here as a new host of this fungus. The host, *Butea monosperma*, is timber or medicinal plant, native to tropical southern Asia, from Pakistan, India, Nepal, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, and western Indonesia.

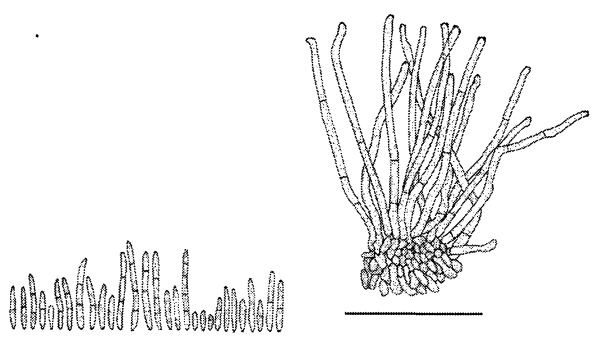


Fig. 3.73. Line drawings of conidia, conidiophores, and stroma of *Passalora buteae* on *Butea monosperma*. Bar = 50 µm.

Passalora centrosematis N. Pons, U. Braun & Crous, CBS Biodiversity Series 1: 114, 2003.

≡ *Cercospora centrosematis* Chupp & A.S. Mull. (*centrosemae*), Bol. Soc. Venez. Ci. Nat. 8: 40, 1942 (*nom. inval.*).

Leaf spots indistinct, dark brown to black patches on lower leaf surface. *Caespituli* hypophyllous. *Stromata* lacking or composed of the bases of the conidiophore packed in the stomatal openings. *Conidiophores* (35) 110.4 ± 44.5 (180) × (3) 4.5 ± 0.7 (6) µm, in large densely fascicles, 1—4-septate, smooth, dark brown, uniform in color, branched, subcylindrical, geniculate-sinuous. *Conidiogenous cells* integrated, holoblastic, terminal, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia*

(25) 52.2 ± 12.2 (70) × (3) 5 ± 0.7 (6) μm, solitary, obclavate-cylindrical, straight, base long obconically truncate, slightly curved, obtuse apex, brown, 3—5-septate, smooth, hila 1.5—2 μm diameter, thickened and darkened.

Specimen examined: on *Centrosema pubescens* Benth., THAILAND, Chiang Mai Province, Queen Sirikit Botanic Garden, 21 November 2004, Jamjan Meeboon (CMU MH 065).

Host: *Centrosema pubescens* Benth. (Fabaceae) (Meeboon et al., 2007c).

Distribution: Philippines, Puerto Rico, Thailand, and Venezuela (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of this species from Thailand was reported by Meeboon et al. (2007c). Its host, *Centrosema pubescens*, is ornamental plant origin from tropical American.

Passalora mucunicola Crous, U. Braun & Alfenas, Mycotaxon 72: 181, 1999.

Leaf spots 1—6 mm diameter, amphigenous, subcircular to irregular, brown, surrounded by dark brown border. *Caespituli* amphigenous. *Stromata* 35—70 μm diameter, substomatal, well-developed, composed of globose to subglobose, brown brown cells. *Conidiophores* (30) 49.1 ± 9.9 (65) × (4) 4.8 ± 0.3 (5.5) μm, loosely fascicles, 1—3-septate, arising from stromata, straight to slightly curved, smooth, pale brown, with paler at the apex, unbranched, subcylindrical, rarely geniculate. *Conidiogenous cells* terminal. *Conidiogenous loci* conspicuous, refractive conidial scars, thickened, and darkened. *Conidia* (30) 85.1 ± 33.7 (148) × (3) 4.2 ± 0.4 (5) μm, solitary, subcylindrical, straight to curved, base obconically truncate, obtuse apex, brown, 4—8-septate, smooth, hila 2.5—3.5 μm diameter, thickened and darkened.

Specimen examined: on *Mucuna bracteata* DC., THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27954).

Host: *Mucuna bracteata* DC. (Fabaceae) (Meeboon et al., 2007c).

Distribution: Brazil and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of this species from Thailand was done by Meeboon et al. (2007c). A few *Passalora* species are known from *Mucuna,* namely *P. mucunae* (Syd. & P. Syd.) U. Braun & Mouch., *P. mucunae var. denticulata* U. Braun & Mouch. & *P. sojina* (Hara) H.D. Shin & U. Braun. *P. mucunicola* is distinct from *P. mucunae* by having short, 1 — 3-septate conidiophores, whereas those of *P. mucunae* are pluriseptate, up to 500 μm long. It is furthermore distinguished from P. *sojina* (conidia 20—80 × 4—8 μm, conidiophores 40 — 200 ×

4 — 6.5 μm) by its longer conidia, and shorter conidiophores. Its host, *Mucuna bracteata*, is common ornamental plant found in the woodlands of tropical areas.

Pseudocercospora bauhiniae (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 140, 1976.

≡ *Cercospora bauhiniae* Syd. & P. Syd., Ann. Mycol. 12: 202, 1914.

= *Cercospora latimaculans* Wakef., Bull. Misc. Inform. 1918: 210, 1918.

Leaf spots 2—10 mm diameter, amphigenous, circular to angular, grayish to brown to pale brown, with dark brown margin. *Caespituli* amphigenous but chiefly hypophyllous. *Stromata* 20—40 μm diameter, intraepidermal, and composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (18) 28.7 ± 6.7 (42) × (3) 3.75 ± 0.3 (4.5) μm, 0—1-septate, arising from stromata, straight to mildly curved, smooth, medium brown, and paler towards the apex, unbranched, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (35) 67.3 ± 23.5 (120) × (2.5) 3.2 ± 0.4 (5) μm, solitary, obclavate, straight to mildly curved, subhyaline to pale olivaceous to brown, 4—9-septate, smooth, obconically truncate at the base, with subobtuse apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Bauhinia racemosa* Lam., THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27956).

Host: *Bauhinia racemosa* Lam. (Fabaceae) (Meeboon et al., 2007c).

Distribution: Brazil, Colombia, Ethiopia, Ghana, India, Philippines, Singapore, South Africa, Thailand, USA, and Venezuela (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: Meeboon et al. (2007c) were the first of reporting *Pseudocercospora bauhiniae* from Thailand. Its host, *Bauhinia racemosa*, is ornamentals, many species are widely planted in the tropics as "orchid trees", particularly in northern India, Vietnam and southeastern China.

Pseudocercospora centrosematicola (J. M. Yen & G. Lim) J. M. Yen, Gard. Bull., Singapore 33: 171, 1980.

≡ *Cercospora centrosematicola* J. M. Yen & G. Lim, Cah. Pacifique 17: 102, 1973.

Leaf spots 10—20 mm diameter, amphigenous, solitary, circular to subcircular, brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 10 — 38 μm diameter, well-developed, intraepidermal, and composed of globose to subglobose, brown to dark brown cells.

Conidiophores 26—45 × 2—5 μm, 6—10 in a dense fascicles, 1—3-septate, arising from stromata, straight to decumbent, smooth, brown, and paler towards the apex, unbranched, plainly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 48—95 × 2.5—4 μm, solitary, obclavate, straight to mildly curved, hyaline to subhyaline, 4—7-septate, smooth, obconically truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.74).

Specimen examined: on *Centrosema pubescens* Benth, THAILAND, Chiang Mai Province, Amphur Sarapee, 12 September 2007, Jamjan Meeboon (BBH 23692); 9 August 2008, Jamjan Meeboon (BBH 32487).

Host: *Centrosema pubescens* Benth (Fabaceae).

Distribution: Ivory Coast, Malaysia, and Singapore (Crous & Braun, 2003).

Notes: This specimen is the first record of *Pseudocercospora centrosematicola* from Thailand. Its host, *Centrosema pubescens*, is ornamental plant origin from tropical American.

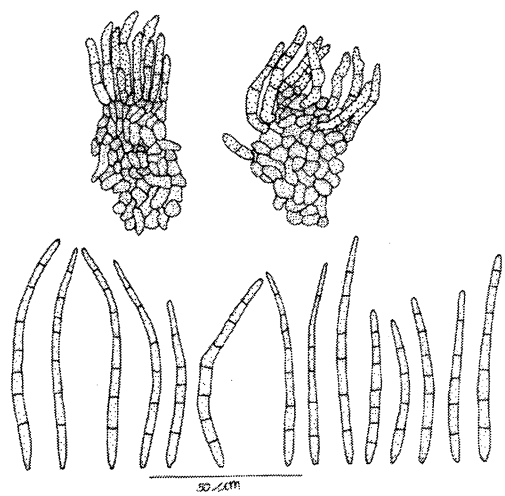


Fig. 3.74. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora centrosematicola* on *Centrosema pubescens*. Bar = 50 μm.

Pseudocercospora clitoriae (G. F. Atk.) Deighton, Mycol. Pap. 140: 51, 1976.

≡ *Cercospora clitoriae* G. F. Atk., J. Elisha Mitchell Sci. Soc. 8: 62, 1892.

Leaf spots 1—4 mm diameter, distinct, solitary or clustered, amphigenous, subcircular to irregular, sometimes rectangular, pale to light brown, with dark brown or reddish-brown margin, limited by the leaf vein. *Caespituli* amphigenous, but abundance at the lower surface of the leaf. *Stromata* 21 — 38.5 μm diameter, substomatal, well-developed, composed of globose to

subglobose, brown to dark brown cells. *Conidiophores* 14.5−40.5 × 2.5−3.5 μm, densely fasciculate, not divergent, 1−3-septate, arising from stromata, straight, simple, smooth, brown, and paler towards the apex, unbranched, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sometimes monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 16.5−37 × 2.7−4 μm, solitary, obclavate, smooth, straight to mildly curved near the apex, hyaline to pale olivaceous, 0−5-septate, with tapering gradually to the apical end to form conically apex, and abruptly tapering near the basal end to form obconically truncate base, hila inconspicuous, unthickened, and not darkened. (Fig. 3.75)

Specimen examined: on *Clitoria ternatea* L., THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Mae Hea, Royal Flora, 13 February 2008, Jamjan Meeboon (BBH23765).

Host: *Clitoria ternatea* L. (Fabaceae).

Distribution: Australia, Bangladesh, India, Panama, Sudan, USA, and Venezuela (Crous & Braun, 2003).

Notes: This specimen is identified as *P. clitoriae* due to short (14.5−40.5 × 2.5−3.5 μm) and unbranched condiophores, with short and obclavate conidia (16.5−37 × 2.7−4 μm). This specimen differs from *P, cruenta* as the later species having branched and relatively longer conidiophores (10−75 × 2.5−5 μm) (Chupp, 1954; Deighton, 1976). This is the first record of *P. clitoriae* from Thailand. Its host, *Clitoria ternatea*, is common ornamentals, native to tropical and equatorial Asia, but has been introduced to Africa, Australia and Europe.

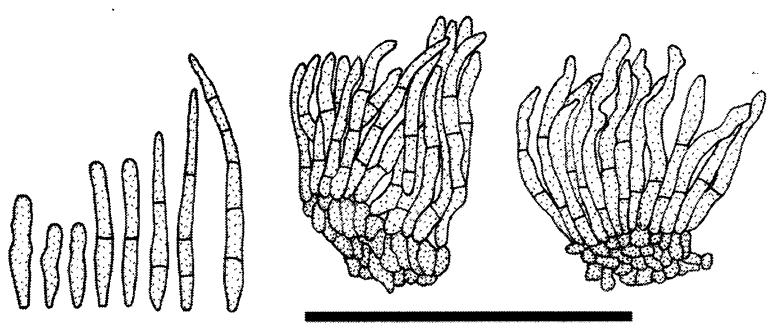


Fig. 3.75. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora clitoriae* on *Clitoria ternatea*. Bar = 50 μm.

Pseudocercospora cruenta (Sacc.) Deighton, Mycol. Pap. 140: 142, 1976.

≡ *Cercospora cruenta* Sacc., Michelia 2: 149, 1880.

= *Cercospora phaseolorum* Cooke, Grevillea 12: 30, 1883.

= *Cercospora vignae* Ellis & Everh., J. Mycol. 3: 19, 1887.

= *Cercospora dolichi* Ellis & Everh., J. Mycol. 5: 71, 1889.

≡ *Pseudocercospora dolichi* (Ellis & Everh.) J.M. Yen, Bull. Trimest. Soc. Mycol. Fr. 97: 152, 1981.

= *Cercospora vignae* Racib., *Z. Pflanzenkr.* 8: 66, 1898 (*nom. illeg.*), homonym of *C. vignae* Ellis & Everh., 1887.

= *Cercospora raciborskii* Matsumoto & Nagaoka, J. Plant Protect. 18: 714, 1931.

= *Cercospora vignae-sinensis* F. L. Tai & C. T. Wei, Sinensia 4: 126, 1933.

= *Cercospora neovignae* W. Yamam., Trans. Sapporo Nat. Hist. Soc. 13: 142, 1934.

= *Cercospora vignae-sinensis* Sawada, Report of the Department of Industry, Government Research Institute, Formosa 85: 125, 1943.

Leaf spots 5—10 mm diameter, amphigenous, subcircular to irregular, brown, grayish to brown at the center, with slightly dark margin. *Caespituli* amphigenous. *Stromata* 24—41 μm diameter, small to well-developed, intraepidermal, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 29—53 × 3—4 μm, 5—21 in a dense and divergent fascicles, 1—3-septate, arising from stromata, erect, straight to decumbent, smooth, brown and becoming pale brown toward the apex, unbranched, cylindrical, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 38—58 × 2—3 μm, solitary, cylindrical, straight, hyaline to subhyaline, 1—3-septate, smooth, narrow and obconically truncate at the base, broader to the middle and narrowing towards the obtuse apex, with unthickened, and not darkened hila. (Fig. 3.76)

Specimen examined: on *Pueraria phaseoloides* Benth., THAILAND, Krabi Province, Sa Morokot Wildlife Sanctuary, 8 August 2006, Jamjan Meeboon (BBH 23628).

Host: *Pueraria phaseoloides* Benth. (Fabaceae).

Distribution: Worldwide, including Afghanistan, Angola, Argentina, Australia, Azerbaijan, Bangladesh, Barbados, Bolivia, Brazil, Brunei, Cambodia, Canada, China, Colombia, Cuba, Dominican Republic, Egypt, El-Salvador, Ethiopia, Fiji, Georgia, Ghana, Grenada, Guatemala, Guyana, Haiti, Honduras, Hong Kong, India, Indonesia, Iran, Iraq, Italy, Jamaica, Japan, Korea, Liberia, Malawi, Malaysia, Mauritius, Mexico, Mosambique, Myanmaar, Nepal, New Caledonia, Niger, Nigeria, Pakistan, Panama, papua New Guinea, Peru, Philippines, Puerto Rico, Russia, Rwanda, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Senegal, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, Sri Lanka, Sudan,

Suriname, Taiwan, Tanzania, Togo, Tonga, Trinidad and Tobago, Uganda, USA, Venezuela, Virgin Islands, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is much closed to *P. cruenta* due to the type of leaf spot, amphigenous caespituli, slightly geniculate and dense fascicle of condiiophores and obclavate conidia. This specimen is distincts from *P. puerariicola* due to by geniculation of conidiophores, and shorter conidiophores than *P. puerariae* (up to 350 μm long). This is the fisrt report of *P. cruenta* from Thailand. Its host, *Pueraria phaseoloides*, is commonly recognized as weeds, widely distributed in tropical areas.

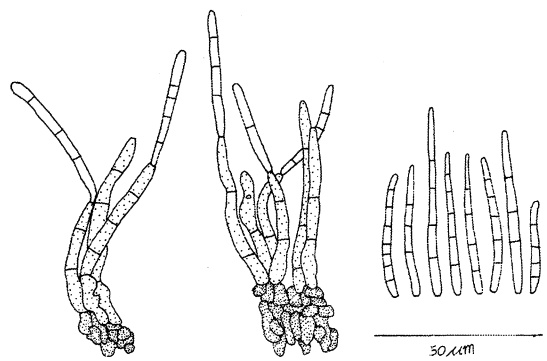


Fig. 3.76. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora cruenta* on *Pueraria phaseoloides*. Bar = 50 μm.

Pseudocercospora dalbergiae (S. H. Sun) J. M. Yen, Bull. Trimest. Soc. Mycol. Fr. 94: 386, 1978 [1979].

≡ *Cercospora dalbergiae* S. H. Sun, J. Agric. Forest. Taiwan 4: 179, 1955.

≡ *Cercoseptoria dalbergiae* (S. H. Sun) J. M. Yen, Bull Soc. Mycol. France 97: 91, 1981.

Leaf spots 1—3 mm diameter, amphigenous, circular to subcircular, grayish to brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 30—55 μm diameter, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (15) 31.4 ± 9 (45) × (2.5) 3.4 ± 0.3 (4) μm, densely fasciculate, 0—4-septate, arising from stromata, straight to curved, smooth, olivaceous to pale olivaceous to brown, unbranched, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (25) 47.8 ± 15 (73) × (2) 2.9 ± 0.5 (4) μm, solitary, cylindrical to narrowly obclavate, straight to curved, hyaline to subhyaline, 4—7-septate, smooth, obconically truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Dalbergia stipulacea* Roxb., THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27960); Chiang Mai Province, Amphur Mae Taeng, Tummbol Pa Pae, Bahn Phadeng, Mushroom Research Centre, on leaves of *Dalbergia cultrata* Graham, 13 November 2006, Ikumitsu Araki (CMU 27969).

Host: *Dalbergia stipulacea* Roxb. and *Dalbergia cultrata* Graham (Fabaceae) (Meeboon et al., 2007c).

Distribution: China, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of *P. dalbergiae* on *D. cultrata* from Thailand was carried out by Meeboon et al. (2007c). *Pseudocercospora dalbergiae* was previously recorded on *D. sissoo* (Crous & Braun, 2003). Its hosts, *Dalbergia cultrate* and *Dalbergia stipulacea*, are timber crops, native to the tropical regions of Central and South America, Africa, Madagascar, and southern Asia.

Pseudocercospora puerariae (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 64, 1976.

≡ *Cercospora puerariae* Syd. & P. Syd., Ann. Mycol. 12: 204, 1914.

Leaf spots 5 − 10 mm diameter, amphigenous, subcircular to irregular, brown, with grayish to brown at center without definite margin. *Caespituli* amphigenous. *Stromata* 18−26 µm diameter, small, immersed, intraepidermal, composed of a few globose to subglobose, brown-walled cells. *Conidiophores* 100−240 × 2−4 µm, up to 15 in a dense fascicles, not divergent, 3−5-septate, arising from stromata, straight to decumbent, with 1−2-geniculation at the apex, unbranched, cylindrical, smooth, dark brown and paler near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 88 − 110 × 3.5 − 5.5 µm, solitary, obclavate, curve from the middle to the apex, pale brown, 6−13-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila unthickened, and not darkened. (Fig. 3.77)

Specimen examined: on *Pueraria phaseoloides* Benth., THAILAND, Krabi Province, Sa Morokot Wildlife Sanctuary, 8 August 2006, Jamjan Meeboon (BBH 23628).

Host: *Pueraria phaseoloides* Benth. (Fabaceae).

Distribution: Brazil China, Colombia, Cost Rica, Ecuador, India, Malaysia, Panama, Peru, and Philippines (Crous & Braun, 2003).

Notes: This specimen is much closed to *P. puerariae* particularly due to long and not divergent conidiophores. Other conidiophores characters are also similar in having dark brown color, dense, and slightly geniculation at the apex. This is the first record of *P. puerariae* from Thailand. Its host, *Pueraria phaseoloides*, is weeds widely distributed in tropical areas.

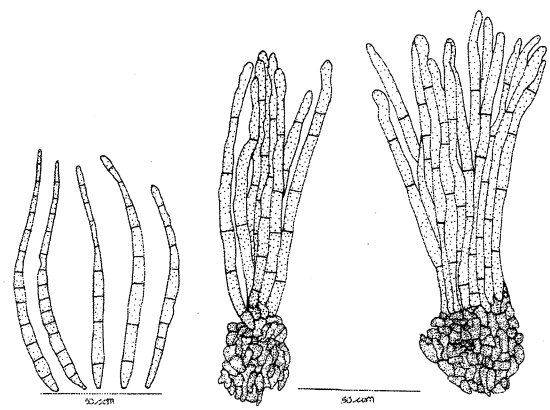


Fig. 3.77. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora puerariae* on *Pueraria phaseoloides*. Bars = 50 µm.

Pseudocercospora stizolobii (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 153 1976.

≡ *Cercospora stizolobii* Syd. & P. Syd., Ann. Mycol. 11: 270, 1913.

= *Cercospora lussoniensis* Sacc., Ann. Mycol. 12: 314, 1914.

= *Cercospora mucunae-capitatae* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 85: 116, 1943 (*nom. inval.*).

Leaf spots 1−5 mm diameter, amphigenous, circular to irregular, tan with dark grayish to brown center, surrounded by a define dark reddish raised border. *Caespituli* amphigenous but chiefly hypophyllous. *Stromata* 20−55 µm diameter, well-developed, subepidermal, globular, brown to dark brown. *Conidiophores* (25) 46.5 ± 14.3 (70) × (3) 3.5 ± 0.2 (4) µm, densely fasciculate, pale olivaceous to brown, uniform in color 0−3-septate, straight to curved, rarely branched, geniculate near the apex. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (15) 59.8 ± 17.6 (85) × (2.5) 3.7 ± 0.5 (5) µm, obclavate to obclavate-cylindrical, straight to mildly curved, subhyaline, 2−8-septate, smooth, obconically truncate at the base, with obtuse apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Mucuna bracteata* DC., THAILAND, Chiang Mai Province, Queen Sirikit Botanical Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27967).

Host: *Mucuna bracteata* DC. (Fabaceae) (Meeboon et al., 2007c).

Distribution: Widespread, including Australia, Barbados, Brazil, Cambodia, China, Colombia,Cuba, Fiji, Gabon, Ghana, Guatemala, Guyana, Haiti, Hong Kong, India, Jamaica, Japan, Java, Malawi, Nigeria, Nepal, Panama, Papua New Guinea, Philippines, Puerto Rico, Sierra Leone, South Africa, Saint Vincent and the Grenadines, Taiwan, Thailand, Togo, Trinidad, Tobago, USA, Venezula, Virgin Islands, Zambia, and Zimbabwe (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Cercospora stizolobii*, which is a synonym of *P. stizolobii*, was already recorded on *Stizolbium deeringianum* Bort, (Florida Velvet Bean) from Thailand (Sontirat et al., 1994). Furthermore, the collection on *Mucuna bracteata* represents a new host record from Thailand was also reported by Meeboon et al. (2007c).

Family Flacourtiaceae

Pseudocercospora dovyalidis (Chupp & Doidge) Deighton, Mycol. Pap. 140: 143, 1976.

≡ *Cercospora dovyalidis* Chupp & Doidge (*doryalidis*), Bothalia 4: 885, 1948.

= *Pseudocercosporella dovyalidis* (Chupp & Doidge) B. Sutton, Mycol. Pap. 138: 99, 1975.

Leaf spots 5−12 mm diameter, amphigenous, circular to irregular, scattered, brown, grayish at the centre, with dark brown margins. *Caespituli* hypophyllous. *Stromata* 45.5−95 µm diameter, intraepidermal, well-developed, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* 20−70 × 3−5.5 µm, numerous in a dense fascicles, 1−3-septate, arising from the stromata, pale olivaceous to brown, smooth, simple, straight, sometimes branched, geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 8−49.5 × 2.5−5 µm, solitary, obclavate to subcylindric, 0−5-septate, straight or slightly curved, smooth, pale olivaceous, catenate, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.78)

Specimen examined: on *Flacourtia jangomas* (Lour.) Ransch, THAILAND, Lamphun Province, Amphur Ban Hong, Farming area, 24 August 2008, Jamjan Meeboon (BBH 23698).

Host: *Flacourtia jangomas* (Lour.) Ransch (Flacourtiaceae).

Distribution: China, Cuba, India, Kenya, and South Africa (Crous & Braun, 2003).

Notes: This specimen is a new record of *P. dovyalidis* from Thailand. *Flacourtia jangomas*, an ornamental plant widely cultivated in Southeast and East Asia, is reported here as a new host of this pathogen.

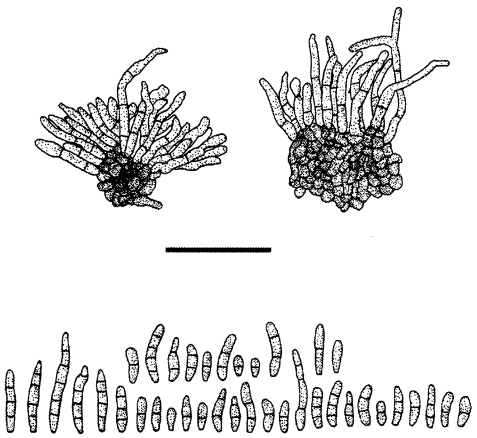


Fig. 3.78. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora dovyalidis* on *Flacourtia jangomas*. Bar = 50 μm.

Family Hamamelidaceae

Pseudocercospora liquadambaricola (J. M. Yen) U. Braun, Schlechtendalia 5: 44, 2000.

≡ *Cercospora liquidambaricola* J. M. Yen, *Bull.* Trimest. Soc. Mycol. France 94: 52, 1978.

≡ *Cercoseptoria liquidambaricola* (J. M. Yen) J. M. Yen, Bull. Trimest. Soc. Mycol. France 97: 92. 1981.

= *Cercospora liquidambaris* (Cooke & Ellis) G. F. Atk, J. Elisha Mitchell Sci. Soc. 8: 48, 1892 (*nom. confus.*), *fide* Chupp (1954), non *Pseudocercospora liquidambaris* Goh & W. H. Hsieh, 1990.

≡ *Pseudocercospora neoliquidambaris* C. Nakash. & Tak. Kobay., Mycoscience 43: 224, 2002 (*nom.superfl.*).

= *Cercospora liquidambaris* Sawada, Rep. Gov. Agric. Res. Inst., Taiwan 85: 112, 1943 (*nom. inval.*), homonym of *C. liquidambaris* (Cook & Ellis) G. F. Atk., 1892.

≡ *Pseudocercospora liquidambaris* (Sawada) Goh & W. H. Hsieh, *Cercospora* and Similar Fungi from Taiwan: 150, 1990.

Leaf spots 1−5 mm diameter, amphigenous, subcircular to irregular, dark brown, with pale olivaceous at the center, limited by the leaf vein, sometimes only decoloration on the leaves. *Caespituli* amphigenous, mostly hypophyllous. *Stromata* 29−63 μm diameter, substomatal, well-developed, and composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 15−21 × 2−4.5 μm, densely fasciculate, 0−2-septate, straight, smooth, pale brown, paler toward the apex, unbranched, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci*

inconspicuous, unthickened, and not darkened. *Conidia* 26−54 × 2−3.5 µm, solitary, acicular to obclavate, straight to mildly curved, subhyaline, 3−6-septate, smooth, truncate at the base, with acute apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.79)

Specimen examined: on *Liquidambar formosana* Hance, THAILAND, Chiang Mai Province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (JM 105).

Host: *Liquidambar formosana* Hance (Hamamelidaceae).

Distribution: China, Hong Kong, Japan, Mexico, Taiwan, and USA (Crous & Braun, 2003).

Note: This specimen is the first record of *P. liquadambaricola* from Thailand. Its host, *Liquidambar formosana,* is ornamentals as well as timber crops, distributed in east Asia to Europe.

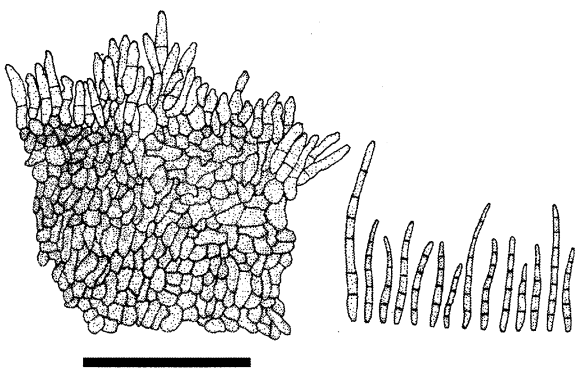


Fig. 3.79. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora liquidambaricola* on *Liquidambar formosana*. Bar = 50 µm.

Family Hydrangeaceae

Cercospora hydrangeae Ellis & Everh., J. Elisha Mitch. Sci. Soc. 8: 52, 1892.

= *Cercosporina hydrangeicola* Speg., Anales Mus. Nac. Buenos Aires 20: 426, 1910.

≡ *Cercospora hydrangeicola* (Speg.) Vassiljevsky, in Vassiljevsky & Karakulin, Fungi imperfecti parasitici 1. Hyphomycetes: 339, 1937.

= *Cercospora hydrangeana* Tharp, Mycologia 9: 110, 1917.

≡ *Cercosporina hydrangeana* (Tharp) Sacc., Syll. Fung. 25: 915, 1931.

= *Cercospora arborscentis* Tehon & E. Daniels, Mycologia 17: 246, 1925.

= ***C. apii s. lat.***

Leaf spots 5—20 mm diameter, amphigenous, circular or subcircular, brown to dingy grey, with dark reddish brown margin. *Caespituli* amphigenous but chiefly epiphyllous. *Stromata* small, consist of a few brown cells. *Conidiophores* (35) 80 ± 25 (122) × (4) 4.4 ± 0.3 (5) μm, numerous in a loosely fasciculate, 2—5-septate, straight to slightly curved, smooth, pale yellow to pale brown, not branched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (48) 84.4 ± 20.8 (116) × (3) 4.2 ± 0.4 (5) μm, solitary, acicular, straight to mildly curved, hyaline, indistinctly multiseptate, smooth, base truncate, with subacute to obtuse apex, hila 2—2.5 μm diameter, thickened and darkened.

Specimen examined: on *Hydrangea macrophylla* (Thunb.) Ser., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Jamjan Meeboon (CMU 27921); Chiang Mai Province, Sanpatong District, Mae Wang Sub-district, Tambol Mae Win, Bahn Mae Sapok, Mae Sapok Royal Project, 8 February 2008, Jamjan Meeboon (BBH 23567).

Host: *Hydrangea macrophylla* (Thunb.) Ser.(Hydrangeaceae).

Distribution: Argentina, Borneo, Brazil, Brunei, China, Hong Kong, India, Iran, Japan, Korea, Malawi, Malaysia, Myanmar, Nigeria, Philippines, Puerto Rico, Romania, Russia (Asian part), Sabah, Sierra, Leone, Singapore, Taiwan, Thailand, USA, Virgin Islands, and Zimbabwe (Crous & Braun, 2003).

Notes: The first record of this species from Thailand was published by Petcharat and Kanjanamaneesathian (1989), but they did not give any detailed morphological description and illustration for this fungus. Braun (2000) assigned this species to *C. apii s.lat.* Its host, *Hydrangea macrophylla*, is ornamentals native to Japan.

Family Lamiaceae

Cercospora kabatiana Allesch. ex Lindau, Rabenh. Krypt.- Fl. ed. 2, 9: 130, 1910.

≡ *Cercospora kabatiana* (Allesch. ex Lindau) Moescz, Magyar Biol. Kutatóint. Munkái 3: 115, 1930.

= ***C. apii s. lat.***

Leaf spots 15—30 mm diameter, amphigenous, circular or subcircular, at first pale greenish to ochraceous, later become dull brown, finally with pale to grayish white at the centre, surrounded by a dark margin. *Caespituli* amphigenous. *Stromata* lacking. *Conidiophores* 78—185 × 3—5 μm, numerous in a loosely fasciculate, 2—5-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical,

geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5−3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 95−144 × 2.5−4 μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 7−12-septate, smooth, base truncate, with subacute apex, hila 2−2.5 μm diameter, thickened and darkened. (Fig. 3.80)

Specimen examined: on *Solenostemon scutellarioides* (L.) Codd, THAILAND, Chiang Mai Province, Chiang Mai University, 1 August 2008, Jamjan Meeboon (BBH 23583).

Host: *Solenostemon scutellarioides* (L.) Codd (Lamiaceae).

Distribution: Armenia, Austria, Czech Republic, Lesotho, and USA (Crous & Braun, 2003).

Notes: This specimen is a typical of *C. apii s. lat.* by having slight or lacking stromata, long conidiophores, and hyaline and long acicular conidia, with truncate base. *Cercospora kabatiana* was assigned to *C. apii s. lat.* by Crous & Braun (2003). This specimen is the first record of *C. kabatiana* from Thailand, and *Solenostemon scutellarioides* is reported here as a new host of this fungus. *Solenostemon scutellarioides* is ornamental plant originating from Southeast Asia and Malaysia

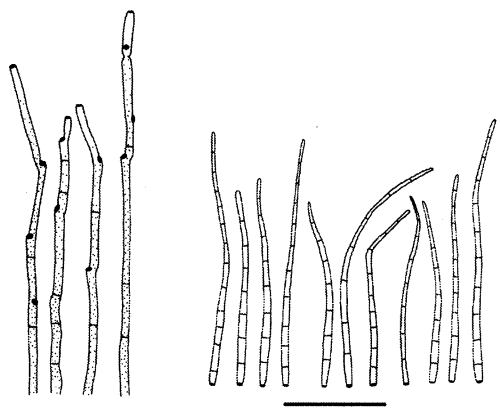


Fig. 3.80. Line drawings of conidia, conidiophores, and conidiogenous cells of *Cercospora kabatiana* (*C. apii s. lat.*) on *Solenostemon scutellarioides*. Bar = 50 μm.

Cercospora physostegiae Jenkins, Phytopathology 35: 329, 1945.

Leaf spots 1 − 8 mm diameter, amphigenous, solitary, sometimes clustered to form larger spots, circular to subcircular, sometimes irregular, greyish brown, with dark brown margin, limited by leaf veins. *Caespituli* amphigenous. *Stromata* 14 − 30 μm diameter, small, substomatal, composed of a few globose to subglobose, brown-walled cells. *Conidiophores* 20−70 × 3−6 μm, 6−14 in a loose fascicles, 1−3-septate, arising from stromata, straight, smooth,

brown at the base, and paler toward the apex, unbranched, cylindrical, often not geniculate, very rarely geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* 2 − 3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 20 − 129 × 2 − 4 μm, solitary, obclavato − filiform to acicular, straight, hyaline, 12 − 19-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1.5 − 2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.81)

Specimen examined: on *Clerodendrum paniculatum* L., THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Mae Hea, Royal Flora, 13 February 2008, Jamjan Meeboon (BBH 23579).

Host: *Clerodendrum paniculatum* L. (Lamiaceae).

Distribution: USA (Chupp, 1954).

Notes: Four species of the genus *Cercospora* non *C. apii s. lat.* have been reported from the plant family Lamiaceae, viz, *C. isanthi* Ellis and Kellerm., *C. physostegiae, C. scorodoniae* Unamuno, and *C. teucrii* Ellis and kellerm. All of these species are characterized by relatively short conidiophores and amphigenous caespituli (Chupp, 1954). This species is much closed to *C. physostegiae* due to conidiophores often not geniculate and obclavate conidia with obconically truncate base. Another three species are characterized by acicular conidia and geniculate conidiophores. This specimen is the first record of *C. physostegiae* from Thailand, and *Clerodendrum paniculatum* is reported here as a new host of this fungus. In addition, *Clerodendrum paniculatum* is ornamental plant native to tropical and warm temperate regions of the world, with most of the species occurring in tropical Africa and southern Asia.

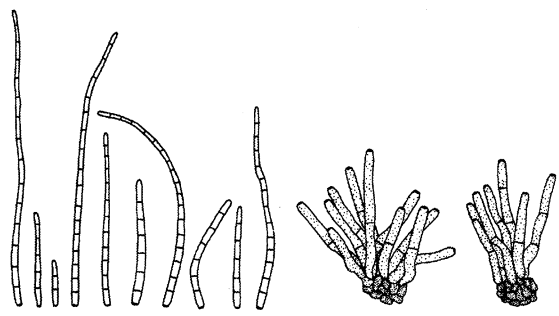


Fig. 3.81. Line drawings of conidia, conidiophores, and stromata of *Cercospora physostegiae* on *Clerodendrum paniculatum*. Bar = 50 μm.

Cercospora volkameriae Speg., Revista del Museo de La Plata 15: 47, 1908.

= ***C. apii s. lat.***

Leaf spots 2－5 mm diameter, amphigenous, circular or subcircular, limited by vein, often greyish at the centre, brown with a dark rddish margins. *Caespituli* epiphyllous. *Stromata* (12) 23 ± 8.9 (32) μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (36) 67 ± 22.1 (127.5) × (2.5) 3 ± 0.5 (4) μm, 8－10 in a loosely and divergent fasciculate, 2－4-septate, arising from stromata, erect to decumbent, smooth, pale yellow to pale brown, straight, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5－3 μm diameter, conspicuous, thickened, and darkened. *Conidia* (40) 60 ± 20.7 (87) × (2) 2.5 ± 0.4 (3) μm, solitary, narrowly obclavate to subacicular, 3－10-septate, straight, hyaline, smooth, base obconically truncate, with subacute apex, hila 2－2.5 μm diameter, thickened and darkened.

Specimen examined: on *Clerodendrum fragrans* Willd., THAILAND, Chiang Mai Province, Royal Flora, 27 July 2008, Jamjan Meeboon (BBH 23763).

Host: *Clerodendrum fragrans* Willd. (Meeboon et al., 2007c).

Distribution: Barbados, Brazil, Brunei, Cuba, Ghana, Guinea, India, Indonesia, Jamaica, Korea, Malawi, Malaysia, Nepal, Nigeria, Sierra Leone, Singapore, Sudan, Taiwan, Tanzania, Thailand, and Togo (Crous & Braun, 2003: Meeboon et al., 2007c).

Notes: The morphological characteristicss of this specimen are much closed to *C. volkameriae.* The first record of *C. volkameriae* from Thailand was done by Meeboon et al. (2007c). Crous & Braun (2003) considered this species as *C. apii s.lat.* Its host, *Clerodendrum fragrans*, is ornamental plant native to tropical and warm temperate regions of the world, with most of the species occurring in tropical Africa and southern Asia.

Passalora gmeliniicola C. Nakash. & Meeboon, Fungal Diversity 26: 260－261 (2007).

MycoBank: 510509

Maculis in foliis vivis dispersis, irregularibus vel angularibus, per venas limitatis, atro-brunneis, centro pallide brunneis, 1－9 mm diameter, ultimo confluentibus, griseo-albidis; stromatibus epiphyllis, substmaicis vel intraepidermicis, bene evolutis, brunneis vel atrobrunneis, 25－57.5 μm diameter Conidiophoris dense fasciculatis, atro-brunneis, pachydermis, apicem versus pallide brunneis, asperulatis, prolificationibus percurrentibus, geniculatis, 39－45 × 3－3.7 μm, 1－5-septatis. Locis conidiogenis parvis, distinctis, incrassatis, 0.9－1.7 μm diameter Conidiis solitariis, raro catenatis, brunneis, cylindricis vel obclavatis, pachydermis, rectis vel

paulo curvatis, asperulatis, ad apicem obtusis vel subobtuse, ad basim obconice truncatis et leviter incrassatis, 3 – 16-septatis, raro pauci-distoseptatis, 16 – 80 × 5.6 – 7.8 µm.

Etymology: gmeliniicola, derived from the genus name of the host plant.

Leaf spots scattered, distinct, irregular to angular, vein-limited, dark brown, centre pale brown, 1 – 9 mm wide, later coalescing to large spots, grayish white. *Stromata* epiphyllous, substomatal to intraepidermal, well-developed, composed of swollen brown to dark brown hyphal cells, 25 – 57.5 µm diameter *Conidiophores* 39 – 45 × 3 – 3.7 µm, densely fasciculate, 1 – 5-septate, thick-walled, dark brown, paler toward the apex, geniculate. *Conidiogenous cells* integrated, terminal, sympodially proliferating. *Conidiogenous loci* 1 – 2 µm diameter, distinct, darkened and thickened. *Conidia* solitary, brown, occasionally catenulate, cylindro-obclavate to obclavate, thick-walled, straight to mildly curved, asperulate, 16 – 80 × 5.6 – 7.8 µm, 3 – 16-euseptate, rarely with a few additional distosepta, obtuse to subobtuse at the apex, obconically truncate and slightly thickened at the base. (Fig. 3.82)

Specimen examined: on *Gmelina arborea* Roxb., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27953; **holotype**); **Paratype:** 10 December 2006, Ikumitsu Araki and Jamjan Meeboon (CMU 28047).

Host: *Gmelina arborea* (Lamiaceae).

Distribution: Thailand (type locality).

Notes: *Passalora gmelinae-arboreae* (A. K. Sarbhoy, Hosag. & N. Ahmad) U. Braun and Crous (Sarbhoy et al., 1985; Crous & Braun, 2003) which was previously belonging to *Mycovellosiella* Rangel, is different from the present new species by having superficial mycelium with solitary conidiophores, longer and wider, branched conidiophores and lacking stromata. *Gmelina arborea* is commonly known as ornamentals, timber crops, as well as medicinal plant, occurring naturally throughout greater part of India at altitudes up to 1500 meters, and also in Myanmar, Thailand, Laos, Cambodia, Vietnam, and in southern provinces of China.

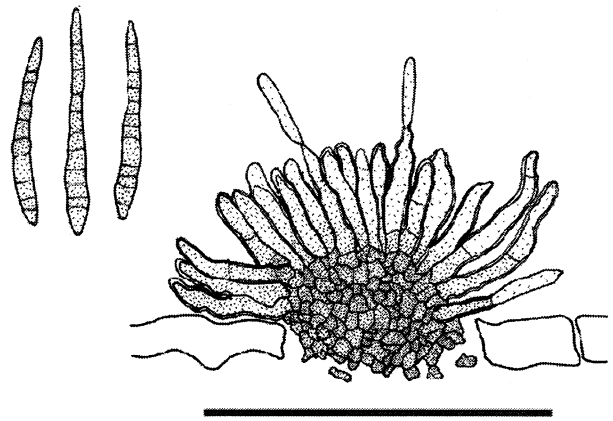


Fig. 3.82. Line drawings of conidia, conidiophores, and stromata of *Passalora gmeliniicola* on *Gmelina arborea* (from holotype). Bar = 100 μm.

Family Lomariopsidaceae

Pseudocercospora phyllitidis (H. H. Hume) U. Braun & Crous, CBS Biodiversity Series 1: 321, 2003.

≡ *Cercospora phyllitidis* H. H. Hume, Bull. Torrey Bot. Club 27: 577, 1900.

Leaf spots 1—4 mm diameter, amphigenous, subcircular to irregular, usually vein-limited, pale brown to brown, with pale yellowish halo. *Caespituli* epiphyllous. *Stromata* 24—74 μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown-walled cells. *Conidiophores* 4—34 × 2—3 μm, densely fasciculate or sometimes solitary, 1—2-septate, arising from stromata and external hyphae, straight, pale brown, geniculate to slightly curved, wall somewhat thickened, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* indistinct, unthickened and not darkened, non refractive. *Conidia* 36—118 × 1.8—3.7 μm, solitary, acicular to obclavate, 2—10-septate, subhyaline to pale olivaceous to brown, straight to mildly curved, smooth, tip acute, base truncate, hila unthickened and not darkened. (Fig. 3.83)

Specimen examined: on *Nephrolepis biserrata* (Sw.) Schott (Lomariopsidaceae), THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27962); 10 December 2006, Ikumitsu Araki and Jamjan Meeboon (CMU 28058); Chiang Mai Province, Suthep-Pui National Park, on leaves of *Nephrolepis cordifolia* (L.) C. Presl (Lomariopsidaceae), 10 December 2006, Jamjan Meeboon

and Ikumitsu Araki (CMU 27912); Chiang Mai Province, A. Sansai, Mae Jo, 9 August 2008, Jamjan Meeboon (BBH 23700).

Host: *Nephrolepis biserrata* and *N. cordifolia* (Lomariopsidaceae).

Distribution: Canada, Great Britain, India, Puerto Rico, Thailand, USA, and Virgin Islands (Crous & Braun, 2003; Nakashima et al, 2007).

Notes: This species was described on a wide range of ornamental ferns, including *Nephrolepis exaltata* (Crous & Braun, 2003). Nakashima et al. (2007) were the first of reporting this species on *Nephrolepis biserrata* from Thailand. In this study, *Nephrolepis cordifolia* is reported as a new host of *P. phyllitidis*.

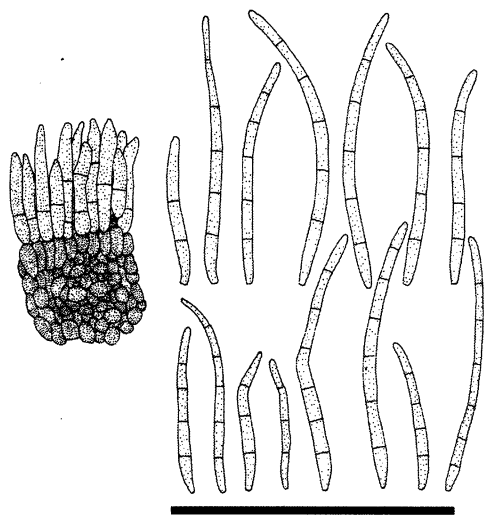


Fig. 3.83. Line drawings of *Pseudocercospora phyllitidis* on *Nephrolepis cordifolia*. Bar = 50 μm.

Family Lythraceae

***Cercospora* sp.**

= ***C. apii s. lat.***

Leaf spots 1−5 mm diameter, amphigenous, subcircular, black, with dark brown margin, and surrounding by yellow discoloration around the margin. *Caespituli* amphigenous. *Stromata* up to 10 μm diameter, small, mostly lacking, intraepidermal, composed of few, globose to subglobose, brown-walled cells. *Conidiophores* 66−204 × 3−6 μm, 3−6 in a loose fascicles, straight, 3−9-septate, unbranched, cylindrical, geniculate to strongly geniculate, thick wall, smooth, brown at the base, and paler toward the apex. *Conidiogenous cells* integrated, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5−3 μm diameter,

conspicuous, thickened, and darkened. *Conidia* 44.5—140 × 2.5—4 μm, acicular, hyaline, 5—7-septate, solitary, base truncate, with slightly curved at the apex, hila 2 — 3 um diameter, conspicuous, thickened, and darkened. (Fig. 3.84)

Specimen examined: on *Punica granatum* L., THAILAND, Chiang Mai province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23596).

Host: *Punica granatum* L. (Lythraceae).

Distribution: Thailand.

Notes: The morphological characteristics of this specimen are much closed to *C. apii s. lat.* fide Crous & Braun (2003) due to stromata small to lacking, conidiophores not in a dense fascicles and relatively long with geniculation near the apex, and long acicular conidia with truncate base. In this report, *Punica granatum* is reported as a new host. *Punica granatum* is an ornamental plant native to the region from Iran to the Himalayas in northern India, and has been cultivated and naturalized over the whole Mediterranean region and the Caucasus since ancient times.

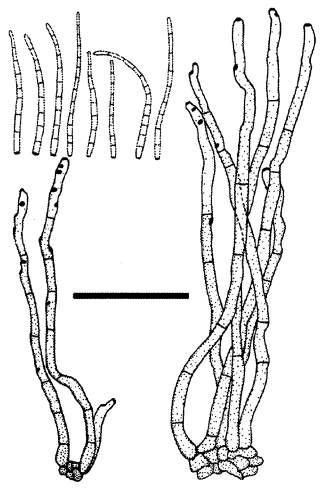


Fig. 3.84. Line drawings of conidia, conidiophores, and stromata of *Cercospora* sp. (*C. apii s. lat.*) on *Punica granatum*. Bar = 50 μm.

Pseudocercospora cupheae (Syd.) U. Braun, Schlechtendalia 2: 14, 1999.

≡ *Cercospora cupheae* Syd., Ann. Mycol. 37: 428, 1939.

Leaf spots 9 — 25, amphigenous, irregular, brown with indistinct border. *Caespituli* amphigenous, chiefly hypophyllous. *Stromata* 25—55 μm diameter. *Conidiophores* (12) 19.6 ± 3.7 (27) × (2) 2.5 ± 3.7 (0.3) μm, densely fasciculate, light brown to brown, smooth, straight, not geniculate, not branched. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (48) 65.6 ±

12.1 (90) × (3) 3.2 ± 0.3 (4.5) μm, solitary, obclavate, 2−8-septate, straight or slightly curved, smooth, subhyaline to pale olivaceous, turncate at the base, with subacute to obtuse apex, hila unthickened and not darkened.

Specimen examined: on *Cuphea hyssopifolia* Kunth, THAILAND, Chiang Mai Province, Queen Sirikit Botanic Garden, 21 November 2004, Jamjan Meeboon (CMU MH 074).

Host: *Cuphea hyssopifolia* Kunth (Meeboon et al., 2007c).

Distribution: Dominican Republic, Ecuador, Mexico, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of this species from Thailand was published by Meeboon et al. (2007c). Its host, *Cuphea hyssopifolia*, is ornamental plant native to Mexico, Guatemala, and Honduras.

Pseudocercospora lythracearum (Heald & F. A. Wolf) X. J. Liu & Y. L. Guo, Acta Mycol. Sin. 11: 294, 1992.

≡ *Cercospora lythracearum* Heald & F. A. Wolf, Mycologia 3: 18, 1911.

≡ *Cercospora lythracearum* (Heald & F. A. Wolf) Sacc., Syll. Fung. 25: 909, 1931.

= *Cercospora lagerstroemiae* Syd. & P. Syd., Ann. Mycol. 12: 203, 1914.

= *Cercospora lagerstroemiae-subcostatae* Sawada, Taiwan Agric. Res. Inst. Rept. 51: 129, 1931.

≡ *Cercospora lagerstroemiae-subcostatae* (Sawada) Goh & W. H. Hsieh, *Cercospora* and similar fungi from Taiwan: 212, 1990.

= *Cercospora lagerstroemiicola* Sawada, Taiwan Agric. Res. Inst. Rept. 85: 112, 1943.

Leaf spots 9−25, amphigenous, irregular, scattered, often as necrosis at the edge of the leaves, brown with indistinct border. *Caespituli* mostly hypophyllous. *Stromata* 16−20 μm diameter, intraepidermal, well-developed, composed of a few globular to angular, brown to dark brown cells. *Conidiophores* 16−25.5 × 2−2.5 μm, 6 to umerous in a loose to dense fascicles, mostly not divergent, 1−2-septate, arising from stromata, light brown to brown, smooth, simple, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 33−64 × 2 μm, solitary, long cylindrical to obclavate, 2−8-septate, straight or slightly curved, smooth, subhyaline to pale olivaceous, turncate at the base, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.85)

Specimen examined: on *Lagerstroemia speciosa* (L.) Pers., THAILAND, Chiang Mai Province, Tumbol Mae Fag, Sansai, Farming area, Thailand, 9 August 2008, Jamjan Meeboon (BBH 23706).

Host: *Lagerstroemia speciosa* (L.) Pers. (Lythraceae).

Distribution: Brunei, Bulgaria, China, Dominican Republic, Hong Kong, India, Japan, Korea, Mauritius, Myanmar, Panama, Papua New Guinea, Philippines, Puerto Rico, Taiwan, Trinidad and Tobago, Uganda, USA, and Vrigin Islands (Crous & Braun, 2003).

Notes: This specimen is a new record of *P. lythracearum* from Thailand. Its host, *Lagerstroemia speciosa*, is ornamental plant native to tropical southern Asia.

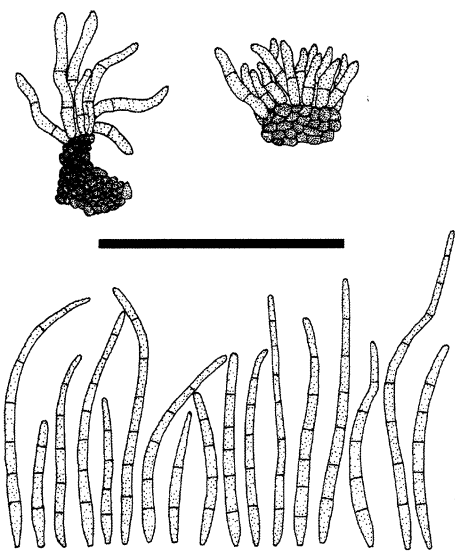


Fig. 3.85. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora lythracearum* on *Lagerstroemia speciosa*. Bar = 50 μm.

Family Malvaceae

Cercospora althaeina Sacc. Michelia 1: 269, 1878.

= *Cercospora kellermanii* Bubák, J. Mycol. 9: 3, 1903.

= *Cercospora ramularia* Siemaszko, Izv. Kavkazsk. Muz. 12: 28, 1919 and *Arch.* Nauk Biol. Towarz. Nauk. Warszawsk. 1: 49, 1923.

≡ *Cercopsorina ramularia* (Siemaszko) Sacc., Syll. Fung. 25: 910, 1931.

= *Cercospora altheina* var. *praecincta* Davis, Trans. WisconsinAcad. Sci. 18: 260, 1915.

≡ *Cercospora praecincta* (Davis) Chupp, A monograph of the fungus genus *Cercospora*: 376, 1954.

= *Cercospora althaeina* var. *althaeae-officinalis* Săvul. & Sandu, Hedwigia 73: 127, 1933.

= *Cercospora althaeicola* J. M. Yen & S. K. Sun, Cryptog. Mycol. 4: 189, 1983.

Leaf spots 1−5 mm diameter, amphigenous, dark to yellowish, only leaf decoloration on the host. *Caespituli* amphigenous. *Stromata* 12−36 μm diameter, substomatal, small, composed of a few globose to subglobose, brown to blackis brown cells. *Conidiophores* 41−186 × 3−5 μm, up to 8 in a densely fasciculate, 3−7-septate, arising from stromata, straight, sometime slightly constricted at the-septate, smooth, brown at the base, and paler toward the apex, cylindrical, unbranched, not geniculate. *Conidiogenous cells* integrated, holoblastic, often monoblastic, sometimes polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 57−316 × 2−4 μm, solitary, acicular, straight, hyaline, 14−25-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 2−2.5 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.86)

Specimen examined: on *Alcea rosea* L., THAILAND, Chiang Rai Province, Amphur Mae Jan, Tumbol Mae Fah Luang, Doi Tung Development, 16 August 2008, Jamjan Meeboon (BBH 23585).

Host: *Alcea rosea* L. (Malvaceae).

Distribution: Worlwide, Argentina, Armenia, Australia, Azerbaijan, Bangladesh, Brazil, Bulgaria, Canada, China, Cuba, Georgia, Germany, Guatemala, India, Iran, Italy, Jamaica, japan, Kazakhstan, Kenya, Kirghizia, Korea, Lithuania, Malawi, Malaysia, Mauritius, Moldoza, Myanmar, New Zealand, Pakistan, Romania, Russia (Eurpoean part), Tadzhikistan, Taiwan, Ukraine, USA, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is the first record of *C. althaeina* from Thailand. Its host, *Alcea rosea*, is ornamental plant native to southwest and central Asia.

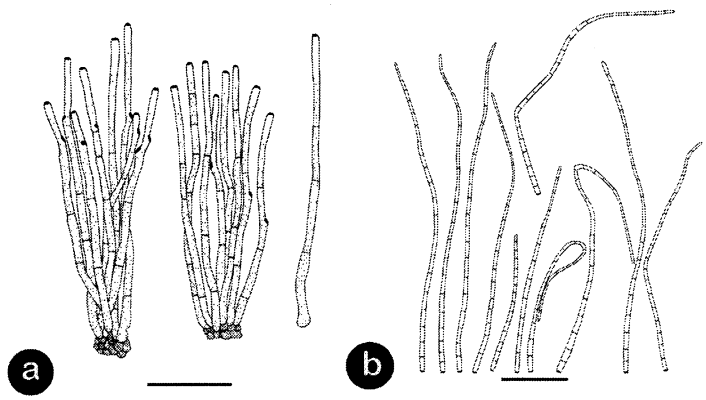


Fig. 3.86a-b. Line drawings of *Cercospora althaeina* on *Alcea rosea*. a. Conidiophores and stromata. b. Conidia. Bars: a, b = 50 µm.

Cercospora malayensis F. Stevens & Solheim, Mycologia 23: 394, 1931.

= *Cercospora hibisci-esculenti* Sawada (*nom. nud.) fide* Hsieh & Goh: 219, 1990.

= *Cercospora hibisci-sabdariffae* Sawada, Special Publ. Coll. Agric. Natl. Taiwan Univ. 8: 220, 1959 (*nom. nud.*).

= ***C. apii s. lat.***

Leaf spots 1−8 mm diameter, amphigenous, subcircular to irregular, tan to dingy grey, dark brown margin. *Caespituli* amphigenous. *Stromata* 10−50 µm diameter. *Conidiophores* (40) 99.2 ± 49 (192) × (3) 3.9 ± 0.5 (5) µm, loosely fasciculate, straight, multiseptate, unbranched, cylindrical, geniculate to strongly geniculate, smooth, brown at the base, and paler toward the apex. *Conidiogenous cells* integrated, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (30) 121.7 ± 47.7 (220) × (2) 3.2 ± 0.8 (5) µm, acicular, hyaline, straight to curved, 4−13-septate, solitary, base truncate to subtruncate, subobtuse at the apex, hila 2−3 um diameter, conspicuous, thickened, and darkened.

Specimen examined: on *Hibiscus rosa-sinensis* L., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 3 November 2005, Jamjan Meeboon (CMU 27936).

Host: *Hibiscus rosa-sinensis* L. (Malvaceae) (Meeboon et al., 2008).

Distribution: Brazil, Brunei, Cambodia, China, Cuba, El-Salvador, Ethiopia, Fiji, Ghana, India, Indonesia, Iran, Jamaica, Japan, Korea, Malaysia, Mauritius, Nepal, New Caledonia, Nigeria, Niue, Pakistan, Papua New Guinea, Philippines, Senegal, Sierra Leone, Singapore, Solomon Islands, South Africa. Sudan, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, USA, Venezuela, Zambia, Zimbabwe (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: The first record of this species was published by Meeboon et al. (2008). Its host, *Hibiscus rosa-sinensis*, is ornamental plant native to East Asia.

Passalora sidae-mysorensis Meeboon & Hidayat, Mycotaxon 102: 142—143, 2007.

Mycobank MB 510840

Maculae amphigenae, subcirculares, centro pallide brunneo, deinde atro-brunneo, margine indistincto, 3—13 mm diameter Caespituli amphigeni. Stromata nulla vel parva, ad 9.5 µm diameter, ex cellulis globosis vel subglobosis, 2—4, composita. Conidiophora 5—12, laxe vel dense fasciculata, 2—4-septata, ramosa, 2—3—geniculata, 83—112 × 5—6.5 µm, basi brunnea, apicem versus pallidiora, tenuitunicata vel leviter crassitunicata, levia. Cellulae conidiogenae integratae, terminales, sympodiales. Loci conidiogeni cospicui, leviter incassati et fuscati, 1—2.5 µm diameter Conidia catenata, interdum ramicatenata, cylindrica vel breve clavata, basi obconice truncata, apicem versus saepe latiora, 14—40 × 6—9 µm, 0—3-septata, subhyalina vel pallidus-brunneus, levia, tenuitunicata, hila incrassata et fuscata, 1—2.5 µm diameter

Etymology: the epithet refers to the name of the host.

Leaf spots amphigenous, subcircular, center pale brown, darker towards the periphery with inconspicuous margin, 3—13 mm in diameter. *Caespituli* amphigenous. *Stromata* lacking to small, if present up to 9.5 µm in diameter, composed of 2 — 4 globose to subglobose, brown cells. *Conidiophores* 83 — 112 × 5 — 6.5 µm, 5 — 12 in a loosely to densely fasciculate, 2 — 4-septate, arising from stromata, thin-walled to slightly thickened, smooth, brown at the base and paler towards the apex, branched, strongly geniculate 2 — 3 times near the tip. *Conidiogenous cells* integrated, terminal, sympodially proliferating. *Conidiogenous loci* 1 — 2.5 µm in diameter, conspicuous, slightly thickened and darkened. *Conidia* 14 — 40 × 6 — 9 µm, catenate, sometimes in branched chains, cylindrical to short clavate, at base obconically truncate and narrow at the base, broader towards the apex, 0 — 3-septate, subhyaline to pale brown, thin-walled, smooth, hila 1 — 2.5 µm diameter, thickened and darkened. (Fig. 3.87)

Specimen examined: on *Sida mysorensis* Wight & Arn., THAILAND, Chiang Mai Province, Chiang Mai University, 15 November 2005, Jamjan Meeboon (CMU 28207: **holotype**). **Paratype**: 2 October 2006, Jamjan Meeboon (CMU 28206).

Host: *Sida mysorensis* Wight & Arn. (Malvaceae).

Distribution: Thailand (type locality).

Notes: Seven species of *Passalora* are hitherto known associated with *Malvaceae,* viz, *P. althaeigena* (J. M. Yen & S. K. Sun) U. Braun and Crous, *P. bastardiae* (Petr. & Cif.) U. Braun and Crous, *P. hughesii* (Munt.-Cvetk.) U. Braun and Crous, *P. malvacearum* (B. Rai and Kamal) U. Braun and Crous, *P. pavoniicola* U. Braun and Freire, *P. sidarum* (Petr. & Cif.) U. Braun and Crous and *P. sidae-cordifoliae* Crous et al. These species, except for *P. althaeigena* and *P. sidaecordifoliae*, are former *Mycovellosiella* species, i.e., they are distinguished from *P. sidae-mysorensis* by having superficial mycelium with solitary conidiophores (Braun and Freire, 2004; Chupp, 1954; Muntañola, 1960; Petrak & Ciferri, 1932; Rai & Kamal, 1985). *Passalora althaeigena* is also characterized by having amphigenous leaf spots and colonies, as well as fasciculate conidiophores (Hsieh & Goh 1990, Crous & Braun 2003), but it is distinct from *P. sidae-mysorensis* by its much longer, pluriseptate conidia, formed singly. Two species of *Passalora* have been described from *Sida* spp., viz, *P. sidae-cordifoliae* and *P. sidarum*. The latter species, previously assigned to *Mycovellosiella*, has superficial mycelium with solitary conidiophores, and *P. sidae-cordifoliae* is distinguished from *P. sidae-mysorensis* by solitary, much longer, pluriseptate conidia (Crous et al., 1999). Its host, *Sida mysorensis*, is recognized as ornamental plant mostly found in the tropics and subtropics, although some species extend into temperate regions.

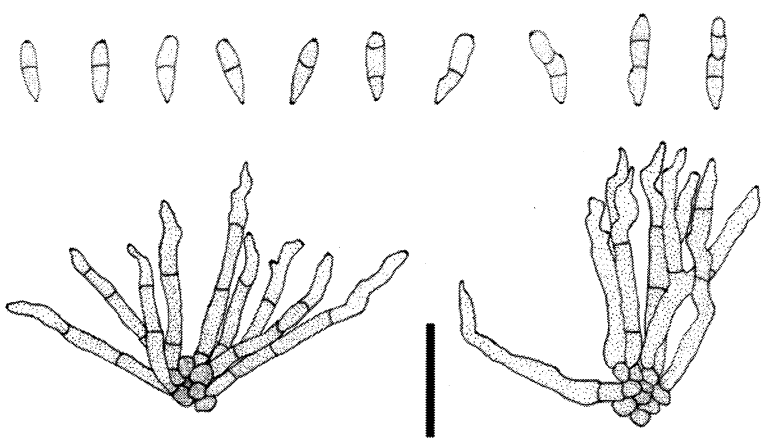


Fig. 3.87. Line drawings of conidia, conidiophores, and stromata of *Passalora sidae-mysorensis* on *Sida mysorensis* (from holotype). Bar = 50 μm.

Pseudocercospora abelmoschi (Ellis & Everh.) Deighton, Mycol. Pap. 140: 138, 1976.

≡ *Cercospora abelmoschi* Ellis & Everh., J. Inst. Jamaica 1: 347, 1893.

= *Cercospora hibisci* Tracy & Earle, Bull. Torrey Bot. Club 22: 179, 1895.

= *Cercospora hibisci-manihotis* Henn., Hedwigia 43: 146, 1904.

Leaf spots 6−20 mm diameter, amhigenous, circular to irregular, scattered, brown, with blackish-brown margins. *Caespituli* hypophyllous. *Stromata* (24) 48 ± 23.3 (79) µm diameter, intraepidermal, well-developed, composed of globose and subglobose, brown to dark brown cells. *Conidiophores* (10) 15.5 ± 3.6 (22.5) × (2) 2.5 ± 0.4 (3) µm, numerous in a densely fasciculate, 0 − 1-septate, arising from the stromata, straight, pale olivaceous to brown, smooth, simple, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal holoblastic, monoblastic, symprodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (10) 20.5 ± 5.8 (28) × (2.5) 2.5 ± 0.5 (3) µm, solitary, obclavate to subcylindric, 1−5-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.87)

Specimen examined: on *Hibiscus* sp., THAILAND, Chiang Mai Province, Queen Sirikit Botanic Garden, 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27922); Chiang Mai Province, Tumbol Mae Fag, Sansai, Farming area, on leaves of *Hibiscus sabdariffa* L., 9 August 2008, Jamjan Meeboon (BBH 23709).

Host: *Hibiscus* sp. and *Hibiscus sabdariffa* L. (Malvaceae).

Distribution: American Samoa, Antigua and Barbuda, Australia, Bangladesh, Barbados, Bermuda, Brazil Brunei, China, Cuba, Dominican Republic, Fiji, French Antilles, gabon, Georgia, Ghana, Grenada, Guinea, India, Indonesia, Iran, Jamaica, Japan, Kenya, Korea, Malawi, Malaysia, Mauritius, Myanmar, Nepal, Nigeria, Pakistan, Palau, Panama, Philippines, Puerto Rico, Samoa, Sarawak, Saint Vincent and the Grenadines, Singapore, Sri Lanka, Sudan, Taiwan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Uganda, USA, Vanuatu, Venezuela, Virgin Islands, Yemen, and Zimbabwe (Crous & Braun, 2003).

Notes: Petcharat and Kanjanamanseethian (1989) reported this species as '*C. abelmoschi* Ellis and Everh.' on *A. esculentus*. However, Deighton (1976) transferred *C. abelmoschi* to *Pseudocercospora*. The present specimen is a true *Pseudocercospora* due to unthickened conidiogenous loci and hila. The leaf spots of this specimen are amphigenous and have small stromata (12−27 µm in diameter). The conidiophores are brown or pale brown, straight and (12) 20−46.5 (56.5) × 2.5−5 µm. The conidia are obclavate and (17) 22−61.5 (66) × 3.5−5 µm, with 4 − 6-septate. Its host, *Hibiscus sabdariffa*, is common ornamental plant native to Europeans, Asians, and Africans.

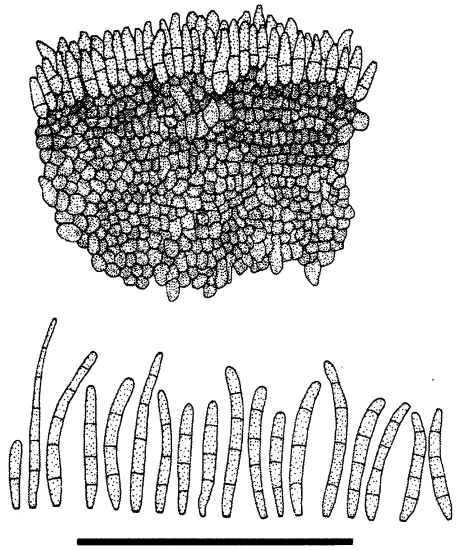


Fig. 3.87. Line drawings of *Pseudocercospora abelmoschi* on *Hibiscus sabdariffa*. a. Stroma and conidiophores. b. Conidia. Bar = 50 μm.

Family Meliaceae

Pseudocercospora subsessilis (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 154, 1976.

≡ *Cercospora subsessilis* Syd. & P. Syd, Ann. Mycol. 11: 329, 1913.

≡ *Cercosporina subsessilis* (Syd. & P. Syd.) Sacc. Syll. Fung. 25: 911, 1931.

= *Cercospetoria domingensis* Cif., Ann. Mycol. 36: 231, 1938.

= *Pseudocercospora meliae* A. N. Rai & Kamal, Curr. Sci. 51: 287, 1982.

= *Cercospora subsessilisi* var. *azadirachtae* R. Srivast. (*acadirachtii*), Zentralbl. Bakteriol. Parasitenk. Infektionskrankheiten Hyg., 2. Abt., Allg. Landwirtschaftliche techn. Mikrobiol. 135: 559, 1980.

= *Pseudocercospora meliae* S. R. Chowdhury & Chandal, Proc. Natl. Acad. Sci. India, Sect. B, 56: 83, 1986.

= *Pseudocercosporella indica* A. N. Rai, B. Rai, & Kamal, Mycol. Res. 97: 29, 1993.

Leaf spots 1−10 mm diameter, amhigenous, circular to subcircular, tan to grey, margin surrounded by a dark brown rised line. *Caespituli* amhigenous, chiefly hypophyllous. *Stromata* 45−60 μm diameter, globular, dark brown to dark brown. *Conidiophores* (13) 24.5 ± 9.7 (45) × (2) 2.8 ± 0.4 (4) μm, densely fasciculate, 0−2-septate, straight to slightly curved, not branched, pale olivaceous, uniform in color, smooth, slightly geniculate. *Conidiogenous cells* integrated, terminal holoblastic, monoblastic, symprodially proliferating. *Conidiogenous loci* inconspicuous,

unthickened, and not darkened. *Conidia* (15) 47.3 ± 25 (95) × (2) 3 ± 0.4 (4) μm, solitary, narrowly obclavate to cylindrical, 3—11-septate, straight to curved, smooth, subhyaline to pale olivaceous, obconically truncate at the base, subacute to obtuse apex, hila unthickened and not darkened.

Specimen examined: on *Melia azedarach* L., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 10 December 2006, Jamjan Meeboon and Ikumitsu Araki (CMU 27915).

Host: *Melia azedarach* L. (Meliaceae) (Meeboon et al., 2007c).

Distribution: Barbados, China, Cuba, Dominican Republic, Ecudaro, Hong Kong, India, Jamaica, Japan, Myanmar, Nepal, Pakistan, Palestine, Peru, Philippines, Puerto Rico, Sierra Leone, Somalia, Sri Lanka, Sudan, Taiwan, Thailand, USA, Venezuela, and Virgin Islands (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Pseudocercospora subsessilis* was firstly reported on *M. azedarach* from Thailand by Meeboon et al. (2007c). Its host, *Melia azedarach*, is timber crops native to India, southern China, and Australia.

Family Menispermaceae

***Pseudocercospora* sp.**

Leaf spots 10—20 mm diameter, amphigenous, solitary, scattered through the host surface, circular to subcircular, brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 22—53 μm diameter, intraepidermal, well-developed, and composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 84—207 × 3—4 μm, 13—25 in a very dense fascicles, not divergent, 2—6-septate, arising from stromata, smooth, brown, and paler towards the apex, straight to decumbent, sometimes branched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 27—116 × 3—4 μm, solitary, obclavate to filiform, straight to mildly curved, hyaline to subhyaline, 6—8-septate, smooth, truncate at the base, with obtuse to subobtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.88)

Specimen examined: on *Pericampylus glaucus* Merr., THAILAND, Chiang Mai Province, Amphur Mae Taeng, T. Pa Pae, Bahn Phadeng, Pathumikaram Temple, 9 September 2007, Nilam Wulandari (JM 106).

Host: *Pericampylus glaucus* (Menispermaceae).

Distribution: Thailand.

Notes: Four species of *Pseudocercospora,* viz, *P. cocculi* (Syd.) Deighton, *P. cocculicola* (W. W. Ray) U. Braun & Crous, *P. pareirae* (Speg.) Crous & U. Braun, and *P. triloba* (Chupp) U. Braun & Crous, have been recorded from plant family Menispermaceae. This specimen is ditincts from other similar species by having very long conidiophores (84—207 × 3—4 μm) in a very densely fasciculate but not divergent, and long conidia with truncate base. Further investigation using molecular phylogenetic approach is necessary in order to clarify this specimen. *Pericampylus glaucus* is reported here as a new host of the genus *Pseudocercospora. Pericampylus glaucus* is also recognized as ornamental and medicinal plants, distributed in Philippines and Southeast Asia.

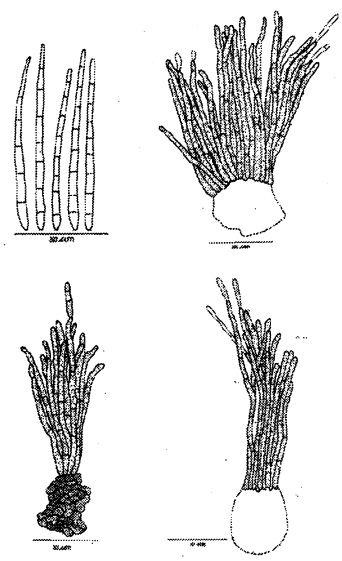


Fig. 3.88. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora* sp. on *Pericampylus glaucus*.

Family Moraceae

Cercospora broussonetiicola Y. L. Guo & L. Xu, Mycosystema 21: 181, 2002.

*Leaf spot*s amphigenous, circular, subcircular, angular, oval to irregular, 1 — 5 mm diameter, punctiform, brown, center grayish white or tan, surrounded by a dark brown margin. *Caespituli* amphigenous. *Stromata* small, only a few brown globose cell, sometime absent. *Conidiophores* loosely to densely fasciculate, moderately brown to brown, paler towards the apex, straight to curved, rarely branched, (20) 152 ± 89.8 (300) × (4.5) 4.5 ± 0.1 (5) μm, conically truncate to subtruncate at the apex, 2 — 5-septate. *Conidiogenous cell* integrated,

terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, darkened. *Conidia* solitary, acicular, straight or curved, (40) 198 ± 82 (285) × (3) 4.5 ± 0.3 (5) μm, hyaline, indistinctly multiseptate, smooth, apex acute, base truncate, hilum thickened and darkened.

Specimen examined: on *Broussonetia papyrifera* Vent., THAILAND, Chiang Mai Province, Mae Jo University, 19 August 2005, Jamjan Meeboon (CMU 28209).

Host: *Broussonetia kaempferi* Vent. (Moraceae) (Meeboon et al., 2007d).

Distribution: China and Thailand (Guo & Xu, 2002; Meeboon et al., 2007d).

Notes: *Cercospora broussonetiicola* has only been reported on *Broussonetia kaempferi* Siebold (Crous & Braun, 2003). This species was firstly reported occurred on *B. papyrifera* from Thailand by Meeboon et al. (2007d). The bark of *Broussonetia papyrifera* can be used for making high quality paper, native to eastern Asia.

Cercospora ficina Tharp, Mycologia 9: 109, 1917.

≡ *Cercospora ficina* (Tharp) Sacc., Syll. Fung. 25: 911, 1931.

*Leaf spot*s amphigenous, circular or subcircular, 15－30 mm diameter, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margin or brown halo. Colonies hypophyllous, ochre yellow, velvety. *Stromata* intraepidermal, well-developed, subglobose, brown to blackish-brown, 17－38 μm diameter *Conidiophores* loosely to densely fasciculate, numerous, arising from stromata, simple, straight, branched, subcylindrical, geniculate to sinuous, erect to decumbent, 42－229 × 3－6 μm, smooth, pale yellow to pale brown, 2－9-septate. *Conidiogenous cell* integrated, terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, darkened. *Conidia* solitary, narrowly obclavate to subacicular, straight, 42.5－161 × 2－4.5 μm, hyaline, 7－14-septate, smooth, apex subacute, base obconically truncate, hilum thickened and darkened. (Fig. 3.89)

Specimen examined: on *Ficus religiosa* L., THAILAND, Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 18 August 2008, Jamjan Meeboon (BBH 23557).

Host: *Ficus religiosa* L. (Moraceae).

Distribution: India, Indonesia, Nigeria, Pakistan, Sudan, Uganda, and USA (Crous & Braun, 2003).

Notes: This specimen is a new record of *C. ficina* from Thailand. Its host, *Ficus religiosa,* is ornamentals plant native to India, Nepal, Sri Lanka, southwest China, and Indochina east to Vietnam.

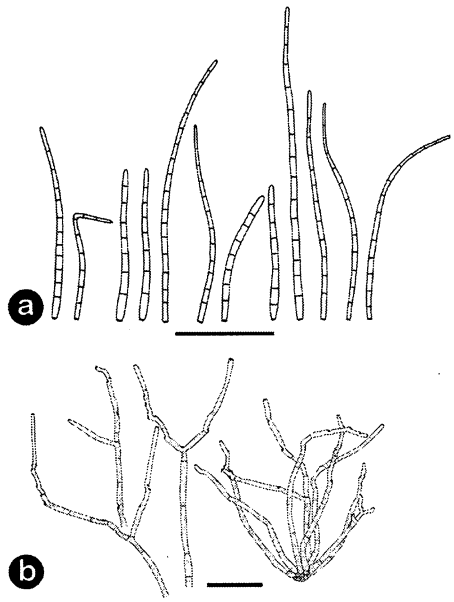


Fig. 3.89a-b. Line drawings of *Cercospora ficina* on *Ficus religiosa*.
a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 μm.

Cercospora elasticae A. Zimm., Bull. Inst. Bot. Buitenzorg 10: 17, 1901.

= ***C. apii s. lat.***

Leaf spots 5—8 mm diameter, distinct, amphigenous, sacttered, circular or subcircular to angular, sometimes forming large symptoms, up to 30 mm diameter, greyish brown, with dark marigns. *Caespituli* epipyllous. *Stromata* 18—24 μm diameter, intraepidermal, small, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 63—139 × 3—4 μm, 5—8 in a loosely and divergent fasciculate, 2—4-septate, arising from stromata, erect to decumbent, smooth, pale yellow to pale brown, not branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* 2—3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 120—160 × 3 μm, solitary, acicular, 8—13-septate, hyaline, smooth, truncate at the base, with acute to subacute apex, hila 2—2.5 μm diameter, thickened and darkened. (Fig. 3.90)

Specimen examined: on *Ficus carica* L., THAILAND, Chiang Mai Province, Amphur Samoeng, Pang Da Royal project, 5 August 2008, Jamjan Meeboon (BBH 23728).

Host: *Ficus carica* L. (Moraceae).

Distribution This specimen is a new record of *C. elasticae* from Thailand. Its host, *Ficus carica*, has edible fruit native to southwest Asia and the eastern Mediterranean region (from Greece to Pakistan).

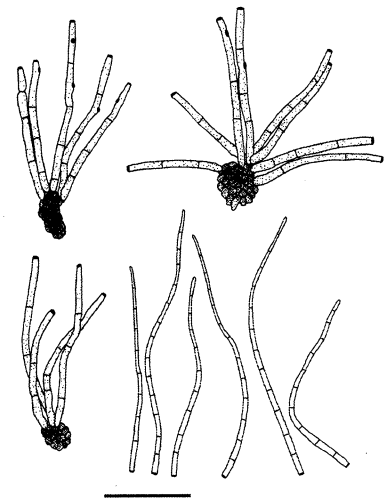


Fig. 3.90. Line drawings of conidia, conidiophores, and stromata of *Cercospora elasticae* on *Ficus carica*. Bar = 50 µm.

Cercospora morina Chupp, A monograph of the genus *Cercospora*: 400, 1954.

= ***C. apii s. lat***

Leaf spots 8—20 mm diameter, amphigenous, irregular, greyish brown to dingy gray, with dark brown marigns. *Caespituli* amphigenous, but chiefly epipyllous. *Stromata* 15—30 µm diameter, intraepidermal, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* (60) 103.5 ± 40.1 (200) × (5) 5.2 ± 0.3 (6.5) µm, 5—8 in a loosely and divergent fasciculate, 3—8-septate, arising from stromata, straight to curved, smooth, dark brown, not branched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (60) 132.7 ± 55.6 (230) × (2.5) 3.4 ± 0.3 (0.6) µm, solitary, acicular, indistinctly multiseptate, hyaline, smooth, truncate at the base, with acute to subacute apex, hila 2—3 µm diameter, thickened and darkened.

Specimen examined: on *Morus alba* L., THAILAND, Chiang Mai Province, Chiang Mai University, 3 December 2005, Jamjan Meeboon (CMU 27926).

Host: *Morus alba* L. (Moraceae) (Meeboon et al., 2007b).

Distribution: Brazil, Estonia, Latvia, Russia (Europian part), and Thailand (Crous & Braun, 2003; Meeboon et al., 2007b).

Notes: The first report of *C. morina* on this plant in Thailand was done by Chandrasrikul (1962). Meeboon et al. (2007b) re-collected and illustrated this species. Its host, *Morus alba*, is recognized as medicinal plant native to northern China.

Pseudocercospora fici (Heald & F. A. Wolf) X. J. Liu & Y. L. Guo, Mycosystema 4: 100, 1991.

≡ *Cercospora fici* Head & F. A. Wolf, Mycologia 3: 16, 1911.

= *Cercospora ficicola* Bond. -Mont., Trudy Bot. Inst. Akad. Nauk SSR, Ser. 2, 3: 755, 1936.

Leaf spots 1−2 mm diameter, circular, angular to irregular, scattered, later coalescing to large spots, 3−23 mm diameter, grayish to brown, with blackish-brown border on the upper leaf surface, pale greenish with indistinct border on the lower leaf surface. *Caespituli* amphigenous. *Stromata* (21) 34.5 ± 11 (54) µm diameter, intraepidermal, small to well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* (36.5) 50.5 ± 10.2 (70) × (2.5) 3 ± 0.2 (3) µm, numerous in a dense fascicles, 1−4-septate, arising from the stromata, pale olivaceous to brown, smooth, simple, geniculate near the apex.. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (44) 77.5 ± 19.3 (100) × (2.5) 2.5 ± 0.3 (3.5) µm, solitary, acicular to obclavate, 6−10-septate, straight or slightly curved, smooth, pale olivaceous, truncate at basal end, with acute apex, hila unthickened and not darkened. (Fig. 3.91)

Specimen examined: on *Ficus rumphii* Blume, THAILAND, Chiang Mai Province, Chiang Mai University, 3 December 2005, Jamjan Meeboon (CMU 27923); Chiang Mai Province, Amphur Muang, Tumbol Sri Pum, Chiang Mai Park, on leaves of *Ficus punctata* Thunb., 15 August 2008, Jamjan Meeboon (BBH 23581).

Host: *Ficus rumphii* Blume and *Ficus punctata* Thunb. (Moraceae) (Meeboon et al., 2007c).

Distribution: Australia, Azerbaijan, China, Georgia, India, Iran, Japan, Madagascar, Nigeria, Russia (European part), Taiwan, Thailand, USA, Uganda, and Vanuatu (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first report of *P. fici* from Thailand was done by Meeboon *et* al. (2007c), including *Ficus rumphii* as a new host. Previously recorded hosts of this species are *Ficus bengalensis, F. carica, F. coronata, F. chartacea, F. cunia, F. elastica, F. fistulosa, F. hispida, F. orthoneurea, F. pumila, F. radicans, F. religiosa, F. repens, F. scandens, F. sycomorus, F.*

uliginosa, and *F. urceolaris* (Crous & Braun, 2003). *Ficus punctata* has edible fruit native to southwest Asia and the eastern Mediterranean region (from Greece to Pakistan), and *F. rumphii* is ornamental plant native throughout the tropics with a few species extending into the semi-warm temperate zone.

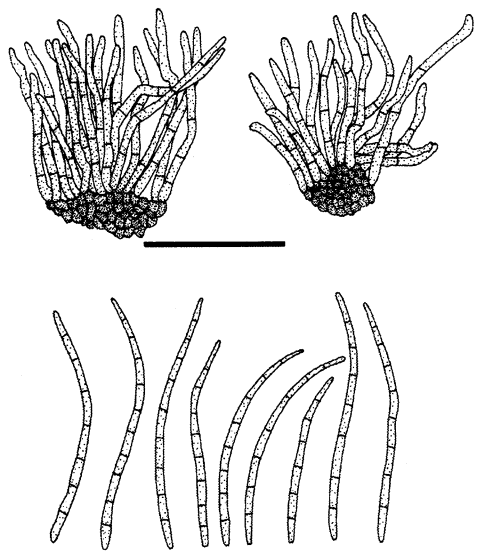


Fig. 3.91. Line drawings of *Pseudocercospora fici* on *Ficus punctata*. Bar = 50 μm.

Pseudocercospora fici-religiosae (Chidd.) U. Braun, Bagyan., and Jagad, Int. J. Mycol. Lichenol. 4: 366, 1992.

≡ *Cercospora fici-religiosae* Chidd., Sydowia 13: 161, 1959.

Leaf spots 3—23 mm diameter, amphigenous, circular, circular to irregular, sometimes angular, scattered, grayish to brown, with dark brown margin. *Caespituli* hypophyllous. *Stromata* 40—53 μm diameter, intraepidermal, well-developed, composed of brown and dark brown cells. *Conidiophores* 24—60 × 2—3.5 μm, numerous in a densely fasciculate, 1—3-septate, arising from the stromata, straight, pale olivaceous to brown, smooth, simple, geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sumpodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 25—88.5 × 1.5—2.5 μm, solitary, acicular to obclavate, 4—10-septate, straight or slightly curved, smooth, pale olivaceous, truncated at the base, with acute apex, hila unthickened and not darkened. (Fig. 3.92)

Specimen examined: on *Ficus religiosa* L., THAILAND, Chiang Mai Province, Chiang Mai University, Faculty of Agriculture, 18 August 2008, Jamjan Meeboon (BBH 23557).

Host: *Ficus religiosa* L. (Moraceae).

Distribution: India (Crous & Braun, 2003).

Notes: This specimen is a new record of *P. fici-religiosae* from Thailand. *Ficus religiosa*, ornamentals, native to India, Nepal, Sri Lanka, southwest China and Indochina east toVietnam.

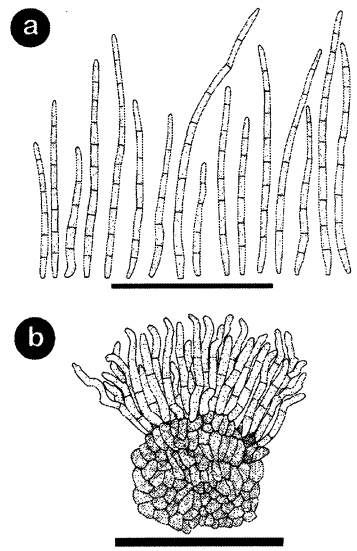


Fig. 3.92a-b. Line drawings of *Pseudocercospora fici-religiosae* on *Ficus religiosa*. a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 μm.

Pseudocercospora mori (Hara) Deighton, Mycol. Pap. 140: 148, 1976.

≡ *Cercospora mori* Hara, J. Sericult. Assoc. Japan 27: 227, 1918.

= *Cercospora mori* Marchal & Steyaert, Bull. Soc. Roy. Bot. Belgique 61: 166, 1929 (*nom. illeg.*), homonym of *C. Mori* Hara, 1918.

Leaf spots amphigenous, but almost indistinct, only leaf decoloration. *Caespituli* hypophyllous. *Stromata* (24) 29.5 ± 6.2 (38) μm diameter, small, substomatal to intraepidermal, composed of globose to subglobose, brown to dark brown cells, mycelium internal and external also present. *Conidiophores* (19) 23 ± 4.3 (31) × (2) 2.5 ± 0.4 (3) μm, 6—10 in a dense fascicles, 1—2-septate, not divergent, arising from the upper part of stromata as well as external hyphae and stoma, smooth, pale olivaceous to brown, simple, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monblastic, sometimes polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (23) 32.5 ± 10.2 (54) × (2) 2 ± 0.3 (3) μm, solitary, mostly obclavate, sometimes long cylindric to slightly acicular, 3—5-septate, straight or slightly curved, smooth, pale olivaceous, base obconically truncate, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.93)

Specimen examined: on *Morus* sp., THAILAND, Chiang Mai Province, Tumbol Mae Fag, Sansai, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23711).

Host: *Morus* sp. (Moraceae).

Distribution: Bangladesh, Belgium, China, Congo, Georgia, India, Japan, Lebanon, Myanmar, Pakistan, Singapore, Taiwan, Thailand, and USA (Crous & Braun, 2003).

Notes: The first report of *P. mori* in Thailand was done by Sontirat et al. (1980) as '*Cercospora mori*' on *Morus alba* L. *Morus* sp.

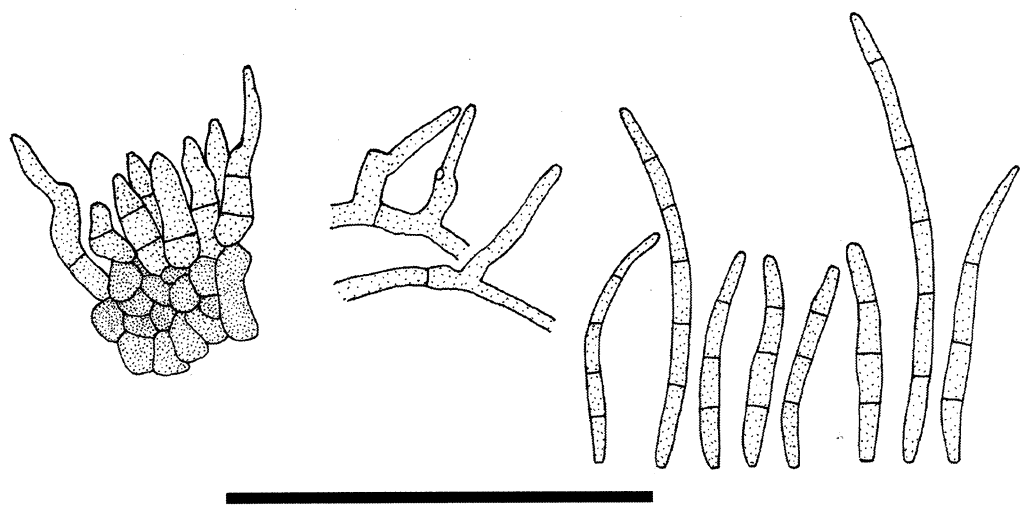


Fig. 3.93. Line drawings of *Pseudocercospora mori* on *Morus* sp. Bar = 50 μm.

Pseudocercospora fici-caricae (Sawada) Goh & W. H. Hsieh, *Cercospora and similar* Fungi from Taiwan: 237 (1990).

≡ *Cercospora fici-caricae* Sawada, Rep.Dept. Agric. Gov. Res. Inst. Formosa 2: 151, 1922.

Leaf spots 2−11 mm diameter, amphigenous, distinct, angular to irregular, scattered, grayish to brown with pale at the centre, with dark brown margin, sometimes limited by vein. *Caespituli* epipyllous. *Stromata* 14−24.5 μm diameter, intraepidermal, small, composed of globular to angular, brown to blackish-brown cells. *Conidiophores* 10−25 × 3−4 μm, numerous in a dense fascicles, 2−4-septate, not divergent, arising from the stromata, brown, smooth, simple, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 12.5−80 × 2.5−3 μm, solitary, filiform-obclavate, 1−3-septate, straight or curved, smooth, pale olivaceous, truncate at the base, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.94)

Specimen examined: on *Ficus carica* L., THAILAND, Chiang Mai Province, Pang Da Royal Project, 5 August 2008, Jamjan Meeboon (BBH 23728).

Host: *Ficus carica* (Moraceae).

Distribution: Korea and Taiwan (Crous & Braun, 2003).

Notes: Eight species of *Pseudocercospora*, viz, *P. angulomaculae* (A. K. Kar and M. Mandal) U. Braun and Crous, *P. caudata* (J. Kranz) U. Braun, *P. cladophora* Sawada ex Goh & W. H. Hsieh, *P. fici* (Heald & F. A. Wolf) X. J. Liu & Y. L. Guo, *P. fici-caricae* (Sawada) Goh & W. H. Hsieh, *P. fici-chartaceae* (J. M. yen & Lim) J. M. Yen, *P. fici-religiosae* (Chidd.) U. Braun, Bagyan., and Jagad., and *P. fici-septicae* Goh & W. H. Hsieh, have been recorded associated with plant genus *Ficus*. This specimen is much closed to *P. fici-caricae* in having epiphyllous caespituli, small stromata, and short conidiophores in a densely fasciculate, and filiform-obclavate conidia. This specimen is a new record of *P. fici-caricae* from Thailand.

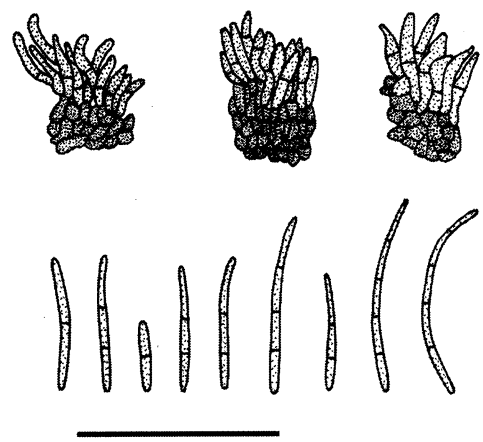


Fig. 3.94. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora fici-caricae* on *Ficus carica*. Bar = 50 μm.

Family Musaceae

Pseudocercospora musae (Zimm.) Deighton, Mycol. Pap. 140: 148, 1976.

≡ *Cercospora musae* Zimm., Centralbl. Bakteriol., Abt. 2, 8: 219, 1902.

= *Cercospora musae* Massee, Bull. Misc. Inform. 28: 159, 1914.

≡ *Mycosphaerella musicola* R. Leach, Trop. Agric. 18: 92, 1941 (*nom. nud.*).

Leaf spots 2−15 mm diameter, amphigenous, center grayish white, pale brown, grayish to brown to black, margin dark purplish brown to blackish, with a yellowish-brown to pale

brown halo, often confluent into larger patches. *Caespituli* amphigenous, chiefly hypopyllous. *Stromata* 15−45 μm diameter, substomatal, subglobular, dark brown. *Conidiophores* (10) 30.8 ± 10.4 (46) × (2.5) 2.9 ± 0.3 (4) μm, densely fasciculate, pale olivaceous to olivaceous braown, paler and narrower towards the apex, straight to moderately curved, not branched, not geniculate. 0−2-septate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (30) 53.1 ± 14.1 (80) × (2.5) 3 ± 0.2 (4) μm, solitary, obclavate-cylindrical, 1−3-septate, straight to slightly curved, smooth, pale olivaceous, obconically truncate at the base, with subacute to obtuse apex, hila unthickened and not darkened.

Specimen examined: on *Musa acuminata* Colla, THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 3 November 2005, Jamjan Meeboon (CMU 27945).

Host: *Musa acuminata* Colla (Musaceae) (Meeboon et al., 2008).

Distribution: Widely distributed, including American Samoa, Angola, Antigua and Barbuda, Argentina, Australia, Bahamas, Barbados, Belau, Belau, Belize, Bolivia, Brazil, Brunei, Bhutan, Cambodia, Cameroon, Cape Verde, Cayman Islands, China, Colombia, Congo, Cook Islands, Costa Rica, Cuba, Dominican Republ., Ecuador, Egypt, El Salvador, Ethiopia, Fiji, France, Guiana, French Polynesia, Guiana, French Polynesia, Gabon, Ghana, Grenada, Guadeloupe, Guam, Guatemala, Guinea, Guinea-Bisiau, Guyana, Haiti, Honduras, Hong Kong, India, Indonesia, Ivory Coast, Jamaica, Kenva, Kiribati, Laos,Madagascar, Malawi, Malaysia, Martinique, Mauritius, Mexico, Micronesia,-Montserrat, Mozambique, Nepal, New Caledonia, Nicaragua, Nigeria, Niue, Norfolk Island, Panama, Papua New Guinea, Peru, Philippines, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, São Toné e Príncipe, Sierra Leone, Solomon Islands, Somalia, South Africa, Sri Lanka, Suriname, Taiwan, Tanzania, Togo, Tonga, Trinidad and Tobago, Tuvalu, Uganda, USA, Vanuatu, Venezuela, Vietnam, Wallis and Futuna Islands,Yemen, Zambia, and Zimbabwe (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: Meeboon et al. (2008) were the first of reporting this species from Thailand. Its host, *Musa acuminate*, is common crops native to northern Australia.

Family Myricaceae

Passalora myricae Meeboon, Hidayat & C. Nakash., Sydowia 60: 256−257, 2008

MycoBank No. MB 510476

Maculae amphigenae, orbiculares, centro pallide brunneae vel fumosae, margine fuscae, 0.5 — 5 mm diameter Caespituli amphigeni. Stromata intraepidermalia, parva, 0.5 — 26.5 μm diameter, ex cellulis, globosis vel subglobosis, brunneis vel atro-brunneis. Conidiophora 2 — 14-fasciculata, per stroma emergentia, cylindrica, 0 — 1-septata, non-ramosa, recta, ad apicem leviter truncata, tenuitunicata, levia, 8 — 36 × 2 — 6 μm, basi brunnea, apicem versus pallidiora. Cellulae conidiogenae 6 — 9 × 2 — 6 μm, integratae, terminales, monoblastic, sympodiales. Loci conidiogeni conspicui, incrassati et fuscati, 1 — 2 μm diameter Conidia solitaria, obclavata, recta vel leviter curvata, basi truncata, apicem acuta vel subacuta, protuberantia, 14 — 67 × 2 — 6 μm, 4 — 5-septata, pallide brunneae, tenuitunicata, levia, hila incrassata et fuscata, 1 — 2 μm diameter

Etymology: the epithet refers to the genus name of the host.

Leaf spots 0.5 — 5 mm diameter, amphigenous, orbicular, pale brown to dingy gray at center, with a darker margin. *Caespituli* amphigenous. *Stromata* 0.5 — 26.5 μm diameter, intraepidermal, small, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 8 — 36 × 2 — 6 μm, 2 — 14 in a divergent fasciculate, 0 — 1-septate, arising from stromata, cylindrical, thin-walled, smooth, brown at the base and paler towards to the apex, unbranched, straight, slightly truncated at the apex. *Conidiogenous cells* 6 — 9 × 2 — 6 μm, integrated, terminal, monoblastic, sympodial proliferation. *Conidiogenous loci* 1 — 2 μm diameter, conspicuous, thickened, and darkened. *Conidia* 14 — 67 × 2 — 6 μm, solitary, obclavate, straight to slightly curved, truncate at the base, acute to subacute at the apex, protuberant, 4 — 5-septate, pale brown, thin-walled, smooth, hila 1 — 2 μm diameter, thickened and darkened. (Fig. 3.95)

Specimen examined: on *Myrica esculenta* (Buch. -Ham) D. Don., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 2 November 2004, Jamjan Meeboon (CMU 27932: **holotype**).

Host: *Myrica esculenta* (Myricaceae).

Distribution: Thailand (type locality).

Notes: *Pseudocercospora penicillus* (Ellis & Everh.) U. Braun and Crous (synonym: *Cercospora penicillus* Ellis & Everhart), is the only species of cercosporoid fungi recorded from Myricaceae (Crous & Braun 2003). In the previous publication, Chupp (1954) placed *C. dispersa* Ellis and Everhart and *C. myricae* Tracy and Earle as synonyms of *C. penicillus,* the latter being

characterized by stromata lacking or up to 50 μm in diameter; non fasciculate conidiophores (50 −150 × 4−5.5 μm) and obclavate to cylindro-obclavate conidia with pale olivaceous in colour (30−125 × 3−5.5 μm). Crous & Braun (2003) noted that the morphological characteristics of *C. penicillus* are typical of *Pseudocercospora* Speg. by having inconspicuous conidiogenous loci, and unthickened, non-pigmented conidial hila, with long conidiophores arising from external hyphae or stromata. The specimen examined here is a typical member of the genus *Passalora* Fr. due to conspicuous, darkened, and thickened scars and hila, with pigmented conidia. Therefore, we propose *P. myricae* as a new species. *Myrica esculenta*, ornamentals, has a wide distribution, including Africa, Asia, Europe, North America and South America, and missing only from Australasia. Its host, *Myrica esculenta*, is ornamental plant distributed in Africa, Asia, Europe, North America, and South America.

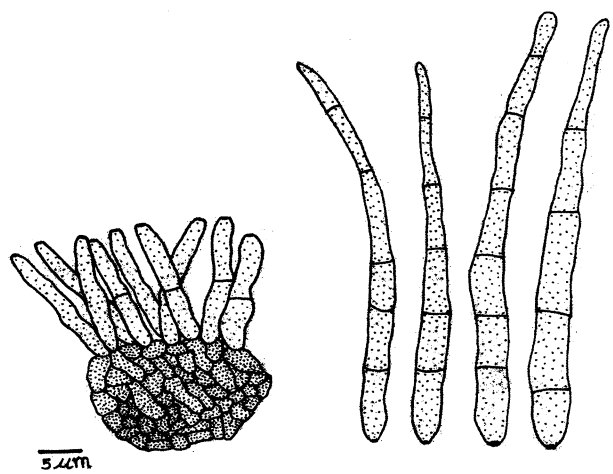


Fig. 3.95. Conidia, conidiophores, and stroma of *Passalora myricae* on *Myrica esculenta* (from holotype). Bar = 5 μm.

Family Myrtaceae

Pseudocercospora paraguayensis (Tak. Kobay.) Crous, Mycotaxon 57: 270, 1996.

≡ *Cercospora paraguayensis* Tak. Kobay., Trans. Mycol. Soc. Japan 25: 263, 1984.

= *Pseudocercospora eucalypti* Goh & Hsieh, *Cercospora* and Similar Fungi from Taiwan: 244, 1990.

Leaf spots 3−15 mm diameter, amphigenous, irregular, brown, only leaf decolorization, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* 11−69.5 μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 27−43 × 2.5−5 μm, 12−20 in a densely fasciculate, 1−

4-septate, arising from stromata, straight to decumbent, smooth, pale brown, cylindrical, unbranched, non-geniculate. *Conidiogenous cells* 4 – 6 × 2 – 4 µm, integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* unconspicuous, non-thickened, and not darkened. *Conidia* 31.5–60 × 2–4 µm, solitary, obclavate to cylindrical, straight, hyaline, 6–16-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila unconspicuous, non-thickened, and not darkened. (Fig. 3.96).

Specimen examined: on *Eucalyptus* sp., THAILAND, Chiang Mai Province, Amphur Doi Lo, 15 August 2006, Jamjan Meeboon (CMU 27906).

Host: *Eucalyptus* sp. (Myrtaceae) (Meeboon et al., 2007c).

Distribution: Brazil, China, Israel, Paraguay, Taiwan, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: *Pseudocercospora paraguayensis* was firstly reported from Thailand by Meeboon et al. (2007c). Its host, *Eucalyptus* sp., is common crops native to Australia.

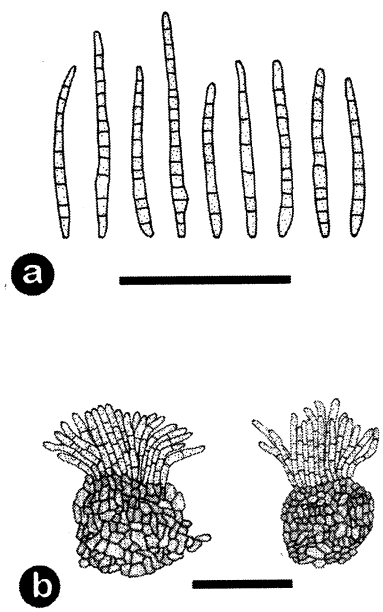


Fig. 3.96a-b. Line drawings of *Pseudocercospora paraguayensis* on *Eucalyptus* sp. a. Conidia. b. Conidiophores and stromata. Bars: a, b = 50 µm.

Family Nelumbonaceae

Pseudocercospora nymphaeacea (Cooke & Ellis) Deighton, Trans. Brit. Mycol. Soc. 88: 390, 1987.

≡ *Cercospora nymphaeacea* Cooke & Ellis

≡ *Cercoseptoria nymphaeacea* (Cooke & Ellis) Deighton, Mycol. Pap. 140: 165, 1976.

= *Cercospora exotica* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 45: 463, 1893.

= *Cercospora nelumbinis* Tharp, Mycologia 9: 111, 1917.

≡ *Cercosporina nelumbinis* (Tharp) Sacc., Syll. Fung. 25: 912, 1931.

Leaf spots 3−7 mm diameter, amphigenous, circular to subcircular, brown, blacish to dark brown margin. *Caespituli* amphigenous. *Stromata* 11−29 μm diameter, intraepidermal, well-developed, and composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 20−46 × 1.5−2 μm, 7−15 to numerous in a dense fascicles, not divergent, 0−2-septate, arising from stromata, straight to decumbent, smooth, pale brown, paler toward the apex, unbranched, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblstic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 34−54 × 1.5−2 μm, solitary, obclavate to cylindric, 2−4-septate, straight to mildly curved, subhyaline to pale, smooth, obconically truncate at the base, with obtuse to subobtuse at the apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.97)

Specimen examined on *Nelumbo nucifera* Gaertn., THAILAND, Chiang Mai Province, Chiang Mai University, 9 July 2007, Jamjan Meeboon (BBH 23738).

Host: *Nelumbo nucifera* Gaertn. (Nelumbonaceae).

Distribution: Brazil, China, Colombia, Dominican Republic, India, Jamaica, Japan, Kenya, Mauritius, Panama, and USA (Crous & Braun, 2003.

Notes: This specimen is the first report of *Pseudocercospora nymphaeacea* from Thailand. Its host, *Nelumbo nucifera*, is ornamental plant native to India and commonly cultivated in water gardens. The lotus is the national flower of India and Vietnam.

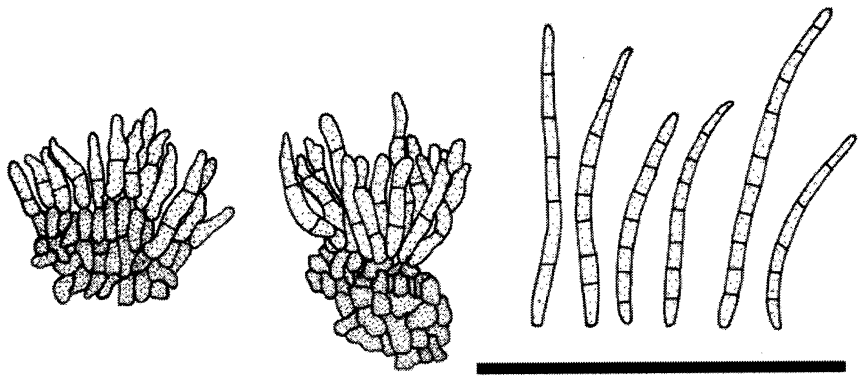


Fig. 3.97. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora nymphaeacea* on *Nelumbo nucifera*. Bar = 50 µm.

Family Nyctaginaceae

Cercospora neobougainvilleae Meeboon, Hidayat & C. Nakash., Sydowia 60: 254 – 256, 2008.

MycoBank No. MB 510475

Maculae amphigenae, orbiculares, centro pallide brunneo, margine atro-brunneae, 2 – 8 mm diameter Caespituli epiphylli. Stromata intraepidermalia, bene evolutis, 11.5 – 71.5 µm diameter, ex cellulis, globosis vel subglobosis, atro-brunneis. Conidiophora 4 – 20, laxe vel dense fasciculata, per stroma emergentia, 1 – 3-septata, apicem versus coangusto, non-ramosa, 1 – 2-geniculata, tenuitunicata vel leviter crassitunicata, 14 – 165 × 1 – 9 µm, basi brunnea, apicem versus pallidiora. Cellulae conidiogenae 2 – 30.2 × 1 – 9 µm, integratae, terminales, sympodiales. Loci conidiogeni conspicui, incrassati et fuscati, 1 – 3 µm diameter Conidia solitaria, obclavata, recta vel leviter curvata, basi truncata vel obconica truncata, apicem acuta vel subobtusa, 4 – 112 × 4 – 8 µm, 4 – 5-septata, hyalina, tenuitunicata, levia, hila incrassata et fuscata, 1 – 4 µm diameter

Etymology: The epithet refers to the genus name of the host.

Leaf spots 2 – 8 mm diameter, amphigenous, orbicular, center pale brown, with dark brown margin. *Caespituli* epiphyllous. *Stromata* 11.5 – 71.5 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, dark brown cells. *Conidiophores* 14 – 165 × 1 – 9 µm, 4 –20 in a loosely to densely fasciculate, 1 –3-septate, arising from stromata,

narrower toward the apex, unbranched, geniculate 1 — 2 times near the apex, thin-walled to slightly thickened, smooth, brown at the base and paler towards the apex. *Conidiogenous cells* 2 — 30 × 1 — 9 μm, integrated, terminal, sympodial proliferation. *Conidiogenous loci* 1 — 3 μm diameter, conspicuous, thickened, darkened. *Conidia* 4 — 112 × 4 — 8 μm, solitary, obclavate, straight to mildly curve, truncate to obconically truncate at base, acute to subobtuse at the apex, 4 — 5-septate, hyaline, thin-walled, smooth, hila 1 — 4 μm diameter, thickened and darkened. (Fig. 3.98)

Specimen examined: on *Bougainvillea spectabilis* Willd., THAILAND, Chiang Mai Province, Chiang Mai University, 30 November 2005, Jamjan Meeboon (CMU 27930: **holotype**); Chiang Mai Province, A. Muang, RAMA IX Garden, 26 August 2008, Jamjan Meeboon (BBH 23759).

Host: *Bougainvillea spectabilis* (Nyctaginaceae).

Distribution: Thailand (type locality).

Notes: Four species of genus *Cercospora* are hitherto known associated with Nyctaginaceae, viz, *Cercospora canescens* Ellis & G. Martin, *C. furfurella* Speg., *C. mirabilis* Tharp, and *C. salpianthi* Chupp and A. S. Mull. (Crous & Braun 2003). Two species, *C. canescens* and *C. salpianthi* belong to the species complex *C. apii s. lat.* (Crous & Braun, 2003). *Cercospora neobougainvilleae* differs from the plurivorous *C. apii s. lat.* by having obclavate conidia and well-developed stromata (11.5—71.5 μm diameter).

Cercospora neobougainvilleae sp. nov. differs from *C. furfurella* in leaf spots appearances, stromata, and septation characteristics. The symptoms of *C. neobougainvilleae* are pale at the center with dark brown margin, but *C. furfurella* symptoms are almost lacking or dark purple to almost black with gray center. The stromata of *C. neobougainvilleae* are well-developed but *C. furfurella* stromata are small or sometimes lacking. The conidia septation in *C. neobougainvilleae* are distinct with 3—6-septa, but *C. furfurella* is characterized by 4—5-indistinct septa. Moreover, the conidia sizes of *C. neobougainvilleae* are different (4—112 × 4—8 μm vs 30—120 × 2—4.5 μm of *C. furfurella*).

Cercospora mirabilis Tharp, described from *Mirabilis jalapa*, is characterized by having amphigenous caespituli, small or lacking stromata, short branches conidiophores, and acicular conidia with indistinct septation (Chupp 1954). *Cercospora neobougainvilleae* differs from *C. mirabilis* by having epiphyllous caespituli, well-developed stromata, unbranched conidiophores, and obclavate conidia with distinct septation.

As the result of our comparative study, *C. neobougainvilleae* is recognized as an independent species from other *Cercospora* species associated with plants from Nyctaginaceae. Therefore, this study propose *C. neobougainvilleae* as a new species. Its host, *Bougainvillea spectabilis*, is common ornamental plant native to South America from Brazil west to Peru and south to southern Argentina.

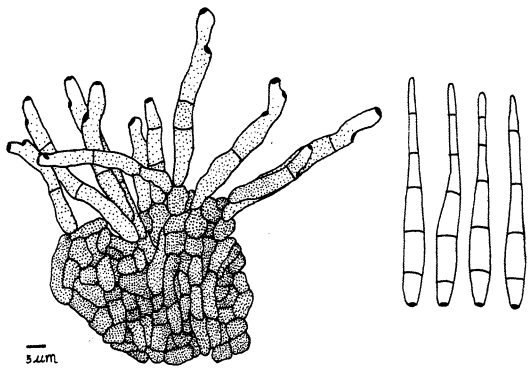


Fig. 3.98. Line drawings of conidia, conidiophores, and stroma of *Cercospora neobougainvilleae* on *Bougainvillea spectabilis* (from holotype).

Passalora bougainvilleae (Munt.-Cvetk...) R. F. Castañeda & U. Braun, Cryptog. Bot. 2: 291, 1991.

≡ *Cercospora bougainvilleae* Munt.-Cvetk.., Revista Argent. Agron. 24: 84, 1957.

≡ *Cercosporidium bougainvilleae* (Munt.-Cvetk.) Sobers & C. P. Seymour, Proc. Florida State Hort. Soc. 81:398, 1969.

Leaf spots 1−3 mm in diameter, amphigenous, circular to subcircular, pale brown to brown in the center, with dark brown margins. *Caespituli* amphigenous. *Stromata* 27−57 µm diameter, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* (26−) 44−93 (−126) × 3−4 (−5) µm, numerous in a densely fasiculate, 1−4-septate, arising from stromata, straight to curve, uniformly pale brown to brown, branched, plainly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly ploblastic, sympodial proliferating. *Conidiogenous loci* 2−3 µm diameter, conspicuous, thickened, darkened. *Conidia* (31−) 35.5 −63 (−67) × 4 (−4.5) −6 µm, ovoid to obclavate, 1−8-septate, brown, straight to mildly curve, base obconically truncate with obtuse apex, hila 1.5−2 µm diameter, thickened and darkened. (Fig 3.99)

Specimen examined: on *Bougainvillea spectabilis* Willd., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan

Meeboon (CMU 27955); Chiang Mai University, Chiang Mai Province, 1 November 2006, Jamjan Meeboon (CMU 28048); 6 December 2006, Ikumitsu Araki (CMU 28049), 10 December 2006, Ikumitsu Araki and Jamjan Meeboon (CMU 28050).

Host: *Bougainvillea spectabilis* Willd. (Nyctaginaceae) (Nakashima et al., 2007).

Distribution: Argentina, Brazil, Brunei, China, Cuba, El-Salvador, India, Indonesia, Jamaica, Japan, Thailand, USA, and Venezuela (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: *Passalora bougainvilleae* was firstly reported from Thailand by Nakashima et al. (2007).

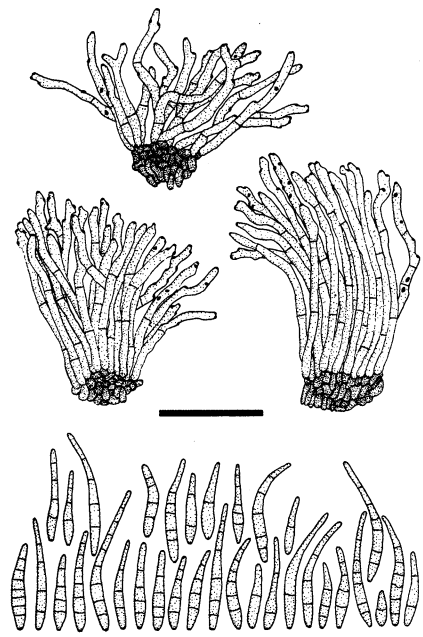


Fig. 3.99. Line drawings of *Passalora bougainvilleae* on *Bougainvillea spectabilis*. Bar = 50 μm.

Pseudocercospora bougainvilleae Y. L. Guo, Mycotaxon 72: 351, 1999.

≡ *Cercospora bougainvilleae* P. N. Rao, Indian Phytopathol. 15: 113, 1962 (*nom. illeg.*), homonym of *C. bougainvilleae* Munt.-Cvetk.., 1957.

Leaf spots 3 − 13 mm diameter, distinct, aphigenous, circular, angular to irregular, scattered, light brown, with blackish-brown margins. *Caespituli* hypophyllous. *Stromata* 36−76 μm diameter, intraepidermal, well-developed, composed of globular to angular, brown to dark brown cells. *Conidiophores* 9−28.5 × 1.5−2 μm, 11 to numerous in a densely fasciculate, 1−2-septate, not divergent, arising from stromata, smooth, brown, straight, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 20−67 × 1.5−2.5 μm, solitary,

obclavate to long filiform, 4−6-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.100)

Specimen examined: on *Bougainvillea spectabilis* Willd., THAILAND, Chiang Mai Province, A. Muang, RAMA IX Garden, 26 August 2008, Jamjan Meeboon (BBH 23759).

Host: *Bougainvillea spectabilis* Willd. (Nyctaginaceae).

Distribution: Argentina, Brazil, Brunei, China, Cuba, El-Salvador, India, Indonesia, Jamaica, Japan, USA, and Venezuela (Crous & Braun, 2003).

Notes: This specimen is a new record of *Pseudocercospora bougainvilleae* from Thailand.

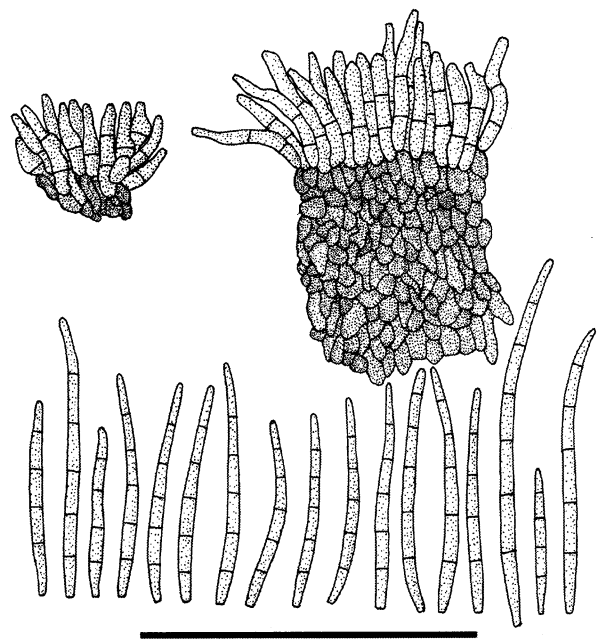


Fig. 3.100. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora bougainvilleae* on *Bougainvillea spectabilis*. Bar = 50 µm.

Family Nymphaeaceae

Pseudocercospora nymphaeacea (Cooke & Ellis) Deighton, Trans. Brit. Mycol. Soc. 88: 390, 1987.

≡ *Cercospora nymphaeacea* Cooke & Ellis

≡ *Cercoseptoria nymphaeacea* (Cooke & Ellis) Deighton, Mycol. Pap. 140: 165, 1976.

= *Cercospora exotica* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 45: 463, 1893.

= *Cercospora nelumbinis* Tharp, Mycologia 9: 111, 1917.

≡ *Cercosporina nelumbinis* (Tharp) Sacc., Syll. Fung. 25: 912, 1931.

Leaf spots 3−6 mm diameter, amphigenous, circular to subcircular, brown, with dark brown margin. *Caespituli* amphigenous. *Stromata* 11−29 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 20−46 × 1.5−2 µm, 7−15 in a densely fasciculate, 0−2-septate, arising from stromata, straight to decumbent, smooth, pale brown, paler toward the apex, unbranched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 34−54 × 1.5−2 µm, solitary, obclavate to cylindric, straight to mildly curved, subhyaline, 2−4-septate, smooth, obtuse to subobtuse at the apex, obconically truncate at the base, hila inconspicuous, unthickened, and not darkened. (Fig. 3.101)

Specimen examined: on *Nymphaea stellata* Willd., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 20 November 2005. Jamjan Meeboon (CMU 27944).

Host: *Nymphaea stellata* Willd. (Nymphaeaceae) (Meeboon et al., 2008).

Distribution: Brazil, China, Colombia, Dominican Republic, India, Jamaica, Japan, Kenya, Mauritius, Panama, Thailand, USA (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: The first report of *P. nymphaeacea* on *Nymphaea stellata* from Thailand was done by Meeboon et al. (2008). *Nymphaea stellata* is ornamental plant found almost anywhere around the world.

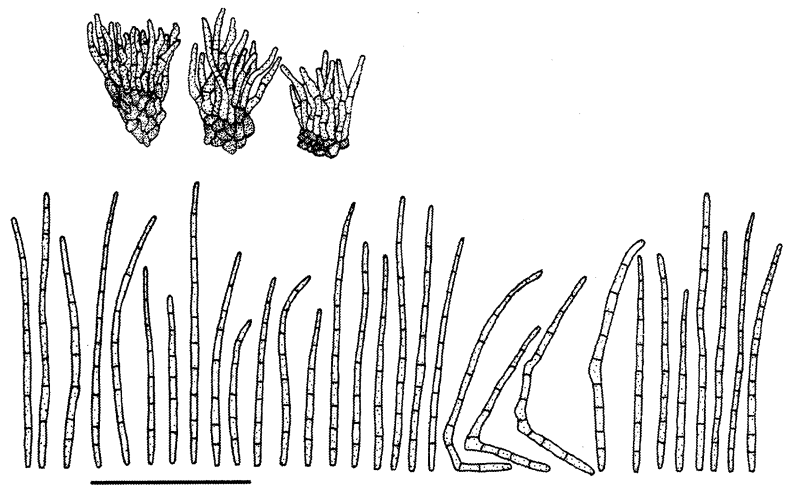


Fig. 3.101. Line drawings of *Pseudocercospora nymphaeacea* on *Nymphaea stellata*. Bar = 50 µm.

Family Oleaceae

Pseudocercospora butleri (Syd.) U. Braun, Schlechtendalia 5: 42, 2000.

≡ *Fusicladium butleri* Syd., Ann. Mycol. 14: 260, 1916.

= *Cercospora jasminicola* A. S. Mull. & Chupp, Arq. Inst. Biol. Veg. Rio de Jainero 3: 93, 1936 (*nom. inval.*).

≡ *Pseudocercospora jasminicola* (A. S. Mull. & Chupp) Deighton, Mycol. Pap. 140: 74, 1976.

= *Cercospora jasmini* Sawada, J. Taihoku Soc. Agric. 7: 119, 1942.

= *Cercospora odoratissimi* Sawada, Report of the Department of Indutry, Government Research Institute, Formosa 85: 110, 1943.

= *Cercospora jasminicola* var. *khandalensis* Chidd., Mycopathologia 17: 1, 1962.

Leaf spots 2—9 mm diameter, amphigenous, solitary, scattered on the host surface, subcircular to irregular,pale to white, with reddish-brown margin. *Caespituli* amphigenous. *Stromata* 16—53 μm diameter, small to well-developed, substomatal, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 17.5 — 42 × 2 — 3.5 μm, densely fasciculate, not divergent, 1—2-septate, arising from stromata, mostly straight, smooth, brown, and paler towards the apex, branched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 16—75 × 2—3 μm, solitary, obclavate to cylindrical, straight to mildly curved, hyaline to subhyaline, 3—11-septate, smooth, obconically truncate at the base, tapering towards the apex, with obtuse to subobtuse at the apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.102)

Specimen examined: on *Jasminum sambac* Soland., THAILAND, Chiang Mai province, Royal Flora, 12 February 2008, Jamjan Meeboon (BBH 23744); Chiang Mai Province, Royal Flora, on leaves of *Jasminum nobile* C. B. Clarke (Oleaceae), 27 July 2008, Jamjan Meeboon, RF4 (BBH 23767).

Host: *Jasminum sambac* Soland. (Oleaceae)

Distribution: Brazil, Brunei, China, Cuba, El-Salvador, Guatemala, Hong Kong, India, Indonesia, Jamaica, Myanmar, Philippines, Salvador, Singapore, Taiwan, Uganda, USA, and Venezuela (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. butleri* from Thailand, and *J. nobile* is reported here as a new host of this fungus. Its host, *Jasminum nobile*, is ornamentals native to tropical and warm temperate regions of the Old World (Europe); meanwhile. *Jasminum sambac* is native to southern Asia, in India, Philippines, Myanmar, and Sri Lanka.

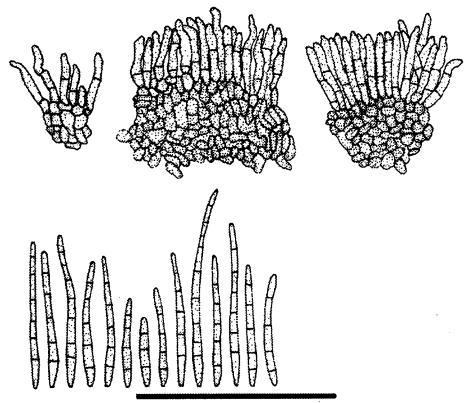


Fig. 3.102. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora butleri* on *Jasminum sambac*. Bar = 50 µm.

Cercospora fuchsiae Chupp & A. S. Mull., Bol. Soc. Venez. Ci. Nat. 8: 45, 1942.

= ***C. apii s. lat.***

Leaf spots 8—20 mm diameter, amphigenous, circular to irregular, greyish brown, with a pale center, concentric rings and dark line margin. *Caespituli* amphigenous, but chiefly epipyllous. *Stromata* 15—30 µm diameter, intraepidermal, composed of a few brown cells. *Conidiophores* (40) 71.2 ± 20.7 (120) × (4) 4.3 ± 0.3 (5) µm, loosely fasciculate, multiseptate, arising from stromata, straight to curved, smooth, dark brown, slightly branched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (25) 55.5 ± 17.5 (85) × (2.5) 2.8 ± 0.3 (3.5) µm, solitary, acicular to obclavate, indistinctly multiseptate, hyaline, smooth, truncate to long obconically at the base, with subacute to subobtuse apex, hila 2—3 µm diameter, thickened and darkened.

Specimen examined: on *Fuchsia* sp., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 3 Nov 2005, Jamjan Meeboon (CMU 27935).

Host: *Fuchsia* sp. (Onagraceae) (Meeboon et al., 2008).

Distribution: Brazil Guatemala, Thailand, USA, Venezuela, and Zimbabwe (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: The first report of *C. fuchsiae* from Thailand was done by Meeboon et al. (2008). Crous & Braun (2003) assigned this species to *C. apii s. lat.* Its host, *Fuchsia* sp., is ornamental plant native to South America, but with a few occurring north through Central America to Mexico, and also several from New Zealand, and Tahiti.

Literature: Chupp (1954, p. 420).

Family Orchidaceae

Cercospora habenariicola Meeboon, Hidayat & C. Nakash., Mycotaxon 99: 118 – 119, 2007a.

MycoBank No. MB 510367

Maculae amphigenae, circulares vel subcirculares, 15 — 30 mm diameter, primo pallide viridulae, ochraceae, deinde brunneae vel atro-brunneae, ultimo centro griseo-brunneo, margine fusco vel brunno cinctae. Coloniae amphigenae, ochraceae, velutinae. Stromata substomatalia vel intraepidermalia, subglobosa, 25 — 75 μm diameter, brunnea vel atro-brunnea. Conidiophora laxe vel dense fasciculata, numerosa, simplicia, raro ramosa, recta, subcylindrica, geniculata vel sinuosa, erecta vel decumbentia, 50 — 285 × 7.3 — 7.5 μm, interdum ad 952 μm longa, laevia, pallide olivacea vel pallide brunnea, 2 — 9-septata. Cellulae conidiogenae integratae, terminales, sympodiales. Loci conidiogeni conspicui, incrassati, fuscati, 2.4 — 3.6 μm diameter Conidia solitaria, obclavata vel subaciculares, recta, 75 — 110 × 4.9 — 5 μm, hyalina, 6 — 10-septata, laevia, apice subacuto, basi obconice truncata, hila incrassata et fuscata, 1.2 — 2.9 μm diameter.

Etymology: *habenariicola*, from the genus name of the host plant.

Leaf spots 15 — 30 mm diameter, amphigenous, circular or subcircular, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margin or brown halo. *Caespituli* amphigenous, ochre yellow, velvety. *Stromata* 25 — 75 μm diameter, intraepidermal, well-developed, subglobose, brown to blackish-brown. *Conidiophores* 50 — 285 × 7.3 — 7.5 μm, occasionally up to 952 μm long, loosely to densely fasciculate, 2 — 9-septate, numerous, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, sympodially proliferating. *Conidiogenous loci* 2.4 — 3.6 μm diameter, conspicuous, thickened, darkened. *Conidia* 75 — 110 × 4.9 — 5 μm, solitary, narrowly obclavate to subacicular, straight, hyaline, 6 — 10-septate, smooth, apex subacute, base obconically truncate, hila 1.2 — 2.9 μm diameter, thickened and darkened. (Fig.3.103).

Specimen examined: on *Habenaria susannae* (L.) R. Br., THAILAND, Chiang Mai Province, Queen Sirikit Botanic Garden, 14 July 2006, Jamjan Meeboon (CMUMH 155: **holotype**).

Host: *Habenaria susannae* (L.) R. Br. (Orchidaceae).

Distribution: Thailand (type locality).

Notes: Because of pigmented conidiophores, thickened and darkened conidiogenous loci, hyaline scolecoid conidia, the new species on *Habenaria susannae* belongs to *Cercospora s. str.* (Crous & Braun, 2003). It is easily distinguishable from the plurivorous *C. apii s. lat.* by having well-developed stromata and obclavate conidia with obconically truncate bases (Crous & Braun, 2003).

On orchids numerous species of *Cercospora s. lat.* are known, including *C. cypripedii* Ellis & Dearn., *C. dendrobii* H.C. Burnett, *C. odontoglossii* Prill. & Delacr. and *C. peristeriae* H.C.Burnett, which have been excluded and reallocated to the genus *Pseudocercospora* Speg. (Crous & Braun, 2003). *Cercospora angraeci* Feuilleaub. & Roum., described from orchids, is an insufficiently known species of unclear generic affinity (Crous & Braun, 2003), but based on the original description *C. habenariicola* differs from *C. angraeci* in having much longer, occasionally branched conidiophores (Chupp, 1954). *Cercospora cephalantherae* Ondřej & Zavřel (‘*cephalentherae*’; Ondřej & Zavřel, 1971), a genuine species of *Cercospora s. str.*, is characterized by having very short, narrow conidiophores (10—25 × 3.5 μm) and relatively short, narrow conidia [40 — 80 (100) × 2 — 3 (3.5) μm] (Ondřej & Zavřel, 1971). *Cercospora habenariicola* is morphologically fairly very close to *C. epipactidis* C.Massal. However, the latter species has consistently unbranched, small conidiophores (10—45 × 4—6 μm), and short, narrow conidia [30—130 × 3.5—5 μm] (Chupp, 1954). *Cercospora eulophiae* M.S.Patil (Patil, 1978) is another cercosporoid fungus on an orchid (*Eulophia* sp.), but this species was described having straight to flexuous, smaller condiophores, and pigmented conidia [75—250 × 3.2—4 μm] (Patil, 1978). Its host, *Habenaria susannae*, is ornamentals widely distributed in both tropical and temperate zones.

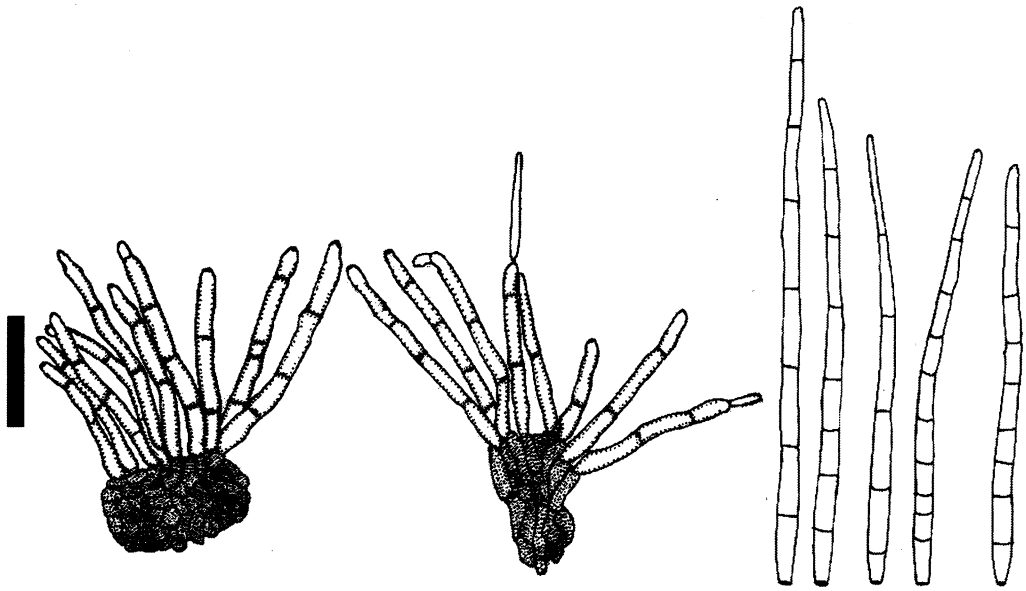


Fig 3.104. Line drawings of conidia, conidiophores, and stromata of *Cercospora habenariicola* on *Habenaria susannae* (from holotype). Bar = 40 μm.

Family Oxalidaceae

Cercospora oxalidis (A. S. Mull. & Chupp) U. Braun & Crous, CBS Biodiversity Series 1: 300, 2003.

≡ *Cercospora oxalidis* A. S. Mull. & Chupp, Arq. Inst. Biol. Veget. Rio de Janeiro 1: 218, 1935 (*nom. inval.*).

Leaf spots 1—5 mm in diameter, amphigenous, scattered to confluent, distinct, circular to subcircular, pale brown to tan, centre greyish brown to greyish white, dark brown margin. *Caespituli* amphigenous. *Stromata* 14—41 μm in diameter, small, often rudimentary to poorly developed, brown to dark brown, irregular, composed of a few brown hyphal cells. *Conidiophores* 14—122 × 2.5—4.5 μm, loosely fasciculate, 1—4-septate, emerging through the cuticle, or sometimes from stromata, straight to slightly curved, pale olivaceous to brown or sometimes paler towards the apex, geniculate. *Conidiogenous cells* integrated, terminal or intercalary, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5—3.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 57—91 × 1—2.4 μm, solitary, acicular, straight to mildly curved, hyaline, 5—10-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila ± 1 μm diameter, thickened, and darkened. (Fig. 3.105)

Specimen examined: on *Oxalis* sp., THAILAND, Chiang Mai province, Amphur Mae Jam, Mae Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23595).

Host: *Oxalis* sp. (Oxalidaceae).

Distribution: Brazil and USA (Crous & Braun, 2003).

Notes: This is the first record of *C. oxalidis* from Thailand.

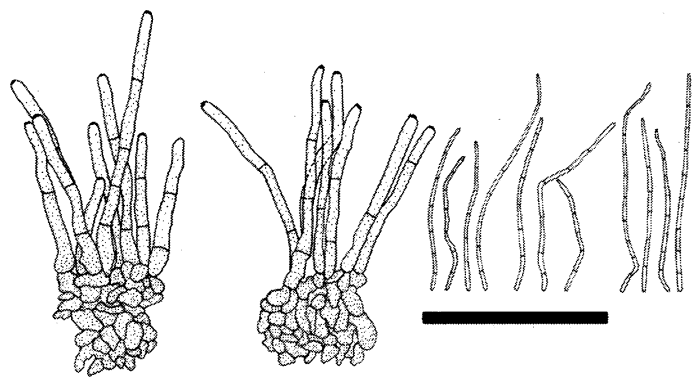


Fig. 3.105. Line drawings of conidia, conidiophores, and stromata of *Cercospora oxalidis* on *Oxalis debilis*. Bar = 50 µm.

Pseudocercospora biophyti (Syd. & P. Syd.) Deighton, Mycol. Pap. 140: 140, 1976.

≡ *Cercospora biophyti* Syd. & P. Syd., Philipp. J. Sci. (Bot.) 8: 284, 1913.

Leaf spots 2 − 11 mm diameter, solitary, amphigenous, subcircular to irregular, sometimes rectangular, pale olivaceous, with very dark and thick margin. *Caespituli* amphigenous, abundance at the upper surface. *Stromata* 5 − 15 µm diameter, substomatal, well-developed, and composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 15 − 40 × 2.5 − 4.5 µm, loosely fasciculate, 1 − 2-septate, arising from stromata, straight, smooth, brown, paler towards the apex, unbranched, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 30 − 110 × 2 − 2.5 µm, solitary, obclavate to cylindrical, straight to mildly curved, hyaline to subhyaline, 3 − 14-septate, smooth, obtuse to subobtuse at the apex, obconically truncate at the base, hila inconspicuous, unthickened, and not darkened. (Fig. 3.106)

Specimen examined: on *Oxalis debilis* Kunth *var. corymbosa* (DC.) Lourteig, THAILAND, Chiang Mai province, Amphur Mae Jam, Mae Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23595).

Host: *Oxalis debilis* Kunth *var. corymbosa* (DC.) Lourteig (Oxalidaceae).

Distribution: India, and Philippines (Crous & Braun, 2003).

Notes: This is the first record of *P. biophyti* from Thailand, and *Oxalis debilis* is reported here as a new host of this fungus.

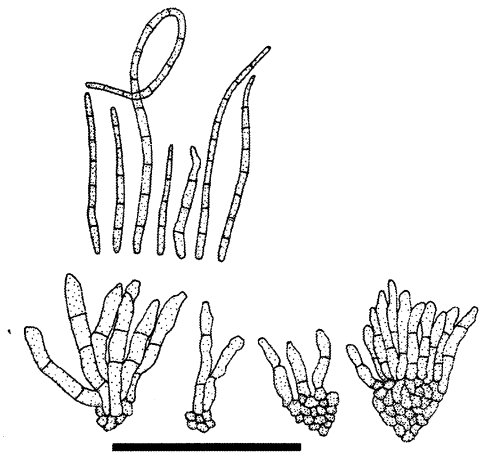


Fig. 3.106. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora biophyti* on *Oxalis debilis*. Bar = 50 μm.

Family Polypodiaceae

Cercospora platycerii Chupp, Monograph of *Cercospora*: 456, 1954.

Leaf spots 5—30 mm diameter, amphigenous, subcircular to irregular, grey to pale brown, with dark brown margin, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* 16 — 58 μm diameter, small to well-developed, substomatal and composed of globose to subglobose, brown to blackish few brown cells. *Conidiophores* 61—200 × 3—5.5 μm, densely fasciculate, 3—10-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, geniculate-sinuous at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2—3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 25—280 × 1—3 μm, solitary, obclavate to acicular, straight, hyaline, 5—24-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 0.5—2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.107)

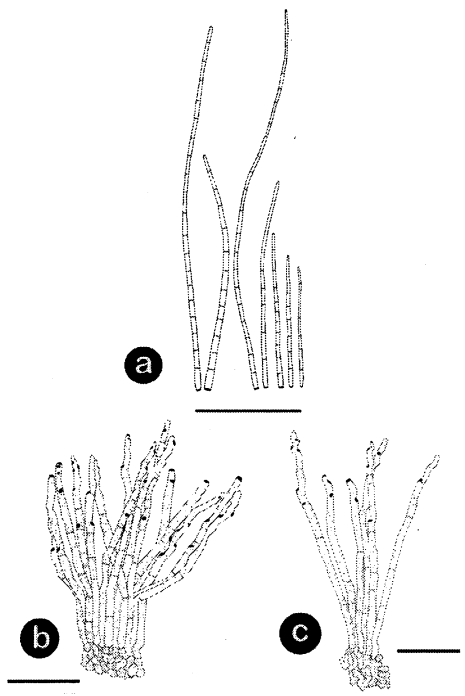
Specimen examined: on *Platycerium bifurcatum* (Cav.) C. Chr., THAILAND, Chiang Mai Province, Amphur Doisaket 5 July 2006, Jamjan Meeboon (CMU 27904); Chiang Mai Province, Tumbol Sansai, on leaves of *Platycerium wallichii* Hook., 12 September 2007, Parin

Noiruang (BBH 23741); Chiang Mai Province, Pang Da Royal Project, 5 August 2008, Jamjan Meeboon (BBH 23733).

Host: *Platycerium bifurcatum* (Cav.) C. Chr. and *Platycerium wallichii* Hook. (Polypodiaceae) (Crous & Braun, 2003; Meeboon et al., 2007b, c).

Distribution: Thailand and USA (Crous & Braun, 2003; Meeboon et al., 2007b, c).

Notes: The first record of *C. platycerii* from Thailand was done by Meeboon et al. (2007b, c) on *P. wallichii* and *P. bifurcatum*. *Platycerium bifurcatum* is ornamentals native to tropical areas of South America, Africa, Southeast Asia, Australia and New Guinea.



Figs. 3.107a-c. Line drawings of *Cercospora platycerii* on *Platycerium wallichii*. a. Conidia. b-c. Conidiophores and stromata. Bars: a, b, c = 50 μm.

***Pseudocercospora* sp.**

Leaf spots 2−7 mm diameter, distinct, amphigenous, angular to irregular, scattered, often at the edge of the leaves, brown, with dark brown margins, whitish at the centre. *Caespituli* epipyllous. *Stromata* 36 − 75 μm diameter, intraepidermal, well-developed, composed of globualr to angular, brown to dark brown cells. *Conidiophores* 12−39 × 2−3 μm, numerous in densely fasciculate, 1−2-septate, arising from the upper part of stromata, brown, smooth, paler towards the apex, simple, straight, mostly not geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 24−64 × 2 μm, solitary, filiform to subacicular, 4−6-

septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with obtuse apex, hila unthickened and not darkened. (Fig. 3.108)

Specimen examined: on *Platycerium wallichii* Hook., THAILAND, Chiang Mai Province, Pang Da Royal Project, 5 August 2008, Jamjan Meeboon (BBH 23735).

Host: *Platycerium wallichii* Hook. (Polypodiaceae).

Distribution: Thailand.

Notes: Two species, *Pseudocercospora abacopteridicola* (J. M. Yen & Lim) J. M. Yen and *P. phyllitidis* (H. H. Hume) U. Braun and Crous, have been recorded from ferns. This specimen differs from *P. abacopteridicola* due to epiphyllous caespituli, well-developed stromata, and conidiophores arising from stromata. Comparing to *P. phyllitidis*, this specimen also differs in having epiphyllous caespituli and base truncate of conidia. Due to distinctiveness of mosphological characteristics of this specimen with closely related taxa; therefore, further investigation is necessary in order to clarify this specimen. *Platycerium wallichii*, an ornamental plant native to tropical areas of South America, Africa, Southeast Asia, Australia, and New Guinea, is reported here a new host of the genus *Pseudocercospora*.

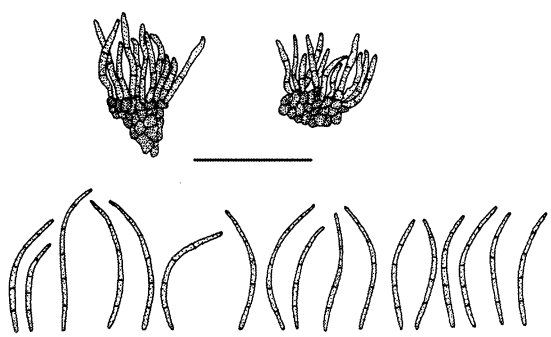


Fig. 3.109. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora* sp. on *Platycerium wallichii*. Bar = 50 μm.

Family Polygonaceae

Pseudocercospora polygonigena (J. M. Yen) U. Braun & Crous, CBS Biodiversity Series 1: 332, 2003.

≡ *Cercospora polygonigena* J. M. Yen, Rev. Mycol. 42: 143, 1978.

≡ *Cercoseptoria polygonigena* (J. M. Yen) J. M. Yen, Gard. Bull. Singapore 33: 152, 1980, also in Cryptog. Mycol. 1: 253, 1980.

Leaf spots 3—5 mm diameter, distinct, circular, angular to irregular, scattered, grayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* amphigenous. *Stromata* 12—75 μm diameter, substomatal to intraepidermal, small to well-developed, composed of globular to angular, brown to blackish-brown cells. *Conidiophores* 14—77.5 × 2—4 μm, numerous in a densely fasciculate, 2—3-septate, arising from the stromata, smooth, medium brown to brown, simple, straight to decumbent, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 45.5—89 × 2—4 μm, solitary, filiform-slightly acicular to obclavate, 5—10-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base, with acute apex, hila unthickened and not darkened. (Fig. 3.110)

Specimen examined: on *Triplaris surinamensis* Cham., Thailand, Chiang Mai Province, Suthep-Pui National Park, 10 December 2006, Jamjan Meeboon (JM 107).

Host: *Triplaris surinamensis* Cham. (Polygonaceae).

Distribution: Singapore (Yen & Lim, 1980).

Notes: Four species of *Pseudocercospora,* viz, *P. persicariae* (W. Yamam.) Deighton, *P. platensis* (Speg.) U. Braun, *P. polygonicola* (A.K. Kar & M. Mandal) Deighton (1987), and *P. polygonigena* (J.M. Yen) U. Braun & Crous (2003) Yen & Lim (1980, p. 154), have been recorded from plant family *Polygonaceae*.This specimen differs from *P. persicariae*, *P. platensis*, and *P. polygonicola* in having amphigenous caespituli, short and not branched conidiophores in a dense fascicles, and acicular conidia with truncate base. *Pseudocercospora polygonigena* is the most similar species due to amphigenous caespituli, relatively well-developed stromata, short conidiophores in a densely fasciculate, and conidia truncate at the base (Yen & Lim, 1980). This specimen is the first record of *P. polygonigena* from Thailand, and *Triplaris surinamensisi* is reported here as a new host of this fungus. The host, *Triplaris surinamensis*, is ornamental plant distributed in the Americas.

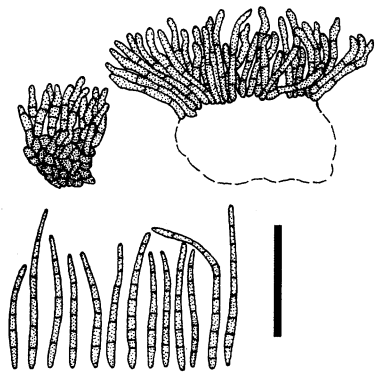


Fig. 3.110. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora polygonigena* on *Triplaris surinamensis*. Bar = 50 µm.

Family Portulacaceae

Cercospora talini Syd. & P. Syd., Mém. Herb. Boissier 8: 2, 1900.

= ***C. apii s. lat.***

Leaf spots 2−7 mm diameter, amphigenous, circular to irregular, dark brown, white to pale at the center, pale brown margin. *Caespituli* amphigenous, chiefly epiphyllous. *Stromata* 25 −45 µm diameter, substomatal, small, composed of a few brown cells. *Conidiophores* (40) 102.6 ± 58 (250) × (4) 4.2 ± 0.5 (4.5) µm, loosely fasciculate, multiseptate, straight, smooth, brown at the base, and paler toward the apex, unbranched, geniculate. *Conidiogenous cells* integrated, holoblastic, monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (40) 84.3 ± 32.5 (144) × (2) 2.9 ± 0.3 (3) µm, solitary, acicular, straight to curved, hyaline, indistinctly multiseptate, smooth, truncate at the base, acute apex, hila 2−2.5 µm diameter, conspicuous, thickened, and darkened.

Specimen examined: on *Talinum triangulare* Willd., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27968).

Host: *Talinum patens* Willd. (Portulacaceae) (Nakashima et al., 2007).

Distribution: Argentina, Thailand, and Venezuela (Crous & Braun, 2003; Nakashima et al., 2007).

Notes: The first report of *C. talini* from Thailand was done by Nakashima et al. (2007). Its host, *Talinum triangulare*, is vegetables grown in West Africa, South Asia, Southeast Asia, and warmer parts of North America and South America.

Family Pteridaceae

Cercospora cyclosori Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 4: 26, 1989.

≡ *Cercospora cyclosori* Sarbajna & Chattopadh., J. Mycopathol. Res. 28: 14, 1990 (*nom. illeg.*), homonym of *C. cyclosori* Goh & W. H. Hsieh, 1989.

= ***C. apii s. lat.***

Leaf spots 2−8 mm diameter, amphigenous, irregular, white to pale at the center, with brown margin, sometimes limited by vein. *Caespituli* amphigenous. *Stromata* 23 − 55 μm diameter, substomatal, small, composed of a few subglobose, brown-walled cells. *Conidiophores* 111 − 190 × 3 − 5 μm, 9 − 17 in a loosely fasciculate, 5 − 7-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, not geniculate. *Conidiogenous cells* integrated, holoblastic, monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 2 − 3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 179−283 × 2.5−3.5 μm, solitary, acicular, straight, hyaline, 14−25-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 1.5−2 μm diameter, conspicuous, thickened, and darkened. (Fig. 3.111)

Specimen examined: on *Pteris biaurita* L., THAILAND, Chiang Mai Province, Amphur Mae Jam, Mae-Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23617).

Host: *Pteris biaurita* L. (Pteridaceae).

Distribution: India, and Taiwan (Crous & Braun, 2003).

Notes: This specimen is much closed to *C. cyclosori* in having dark brown symptoms, amhigenous caespituli, conidiophores in a divergent fascicles, and long acicular conidia with truncate base (Hsieh & Goh, 1990). Crous & Braun (2003) assigned this species to *C. apii s. lat.* This specimen is the first record from Thailand, and *Pteris biaurita* is reported here as a new host of this fungus. The host, *Pteris biaurita*, is ornamentals native to tropical and subtropical regions of the world.

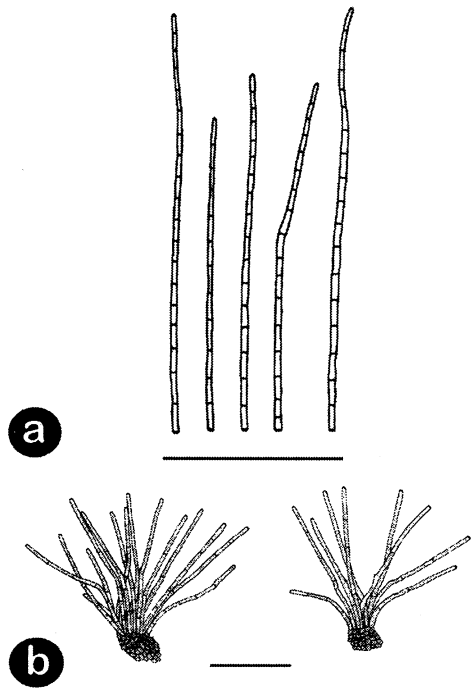


Fig. 3.111a-b. Line drawings of *Cercospora cyclosori* (*C. apii s. lat.*) on *Pteris biaurita*. a. Conidia. b. Conidiophores and stromata. Bars: a, b = 50 μm.

Family Rosaceae

Cercospora scharifii Petr., Sydowia 10: 14, 1957 [1956].

Leaf spots 3−8 mm diameter, amphigenous, circular to subcircular, brown, with dark brown to blackish margin. *Caespituli* amphigenous. *Stromata* lacking. *Conidiophores* 30.5−141 × 3−5 μm, 4−9 in a loosely fasciculate, 1−6-septate, arising from stromata, straight to decumbent, unbranched, cylindrical, smooth, brown at the base, and paler toward the apex, geniculate, mostly near the apex. *Conidiogenous cells* integrated, terminal or intercalary, sympodially proliferating. *Conidiogenous loci* 1.5−2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 25−38.5 × 3.5 μm, solitary, obclavate, straight, hyaline, 4−5-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1.5−2 μm diameter, thickened, and darkened. (Fig. 3.112)

Specimen examined: on *Rosa hybrida* E. H. L. Krause, THAILAND, Chiang Mai Province, Amphur Mae Jam, Mae Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23671).

Host: *Rosa hybrida* E. H. L. Krause (Rosaceae).

Distribution: Iran (Crous & Braun, 2003).

Notes: This specimen is the first record of *C. scharifii* from Thailand, and *R. hybrida* is reported in this study as a new host of this fungus. The host, *Rosa hybrid*, is ornamentals mainly native to Asia, with smaller numbers of species native to Europe, North America, and northwest Africa.

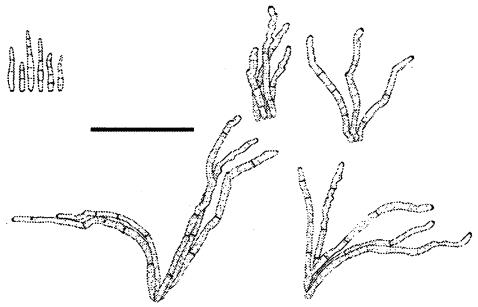


Fig. 3.112. Line drawings of conidia and conidiophores of *Cercospora scharifii* on *Rosa hybrida*. Bar = 50 μm.

Pseudocercospora puderi Deighton, Mycol. Pap. 140: 90, 1976.

≡ *Cercospora puderii* B.H. Davis (*puderii*), Mycologia 30: 291, 1938 (*nom. inval.*).

Leaf spots 3—8 mm diameter, amphigenous, circular to subcircular, pale to brown, with dark margin. *Caespituli* amphigenous. *Stromata* 30 — 46 μm diameter, substomatal to intraepidermal, composed of a few globose to subglobose, brown to dark brown-walled cells. *Conidiophores* 36—40 × 2—2.5 μm, densely fasciculate, 0—2-septate, straight, unbranched, smooth, pale brown, paler toward the apex, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 36—72 × 2—3 μm, solitary, acicular to obclavate, straight to mildly curved, subhyaline, 4 — 7-septate, smooth, truncate at the base, with subacute apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.113)

Specimen examined: on *Rosa hybrida* E. H. L.Krause, THALAND, Chiang Mai Province, Amphur Mae Jam, Mae Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23671).

Host: *Rosa hybrida* E. H. L.Krause (Rosaceae).

Distribution: Cambodia, China, Cuba, Cyprus, Dominican Republic, Haiti, Hong Kong, India, Jamaica, Korea, Malaysia, Mauritius, Malaysia, Mexico, Netherlands, Papua New Guinea, Philippines, Sabah, Sierra Leone, USA, and Venezuela (Crous & Braun, 2003).

Notes: This is the first record of *P. puderi* from Thailand, and *R. hybrida* is reported here as a new host of this fungus.

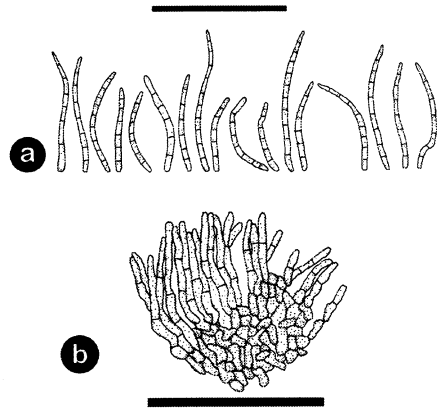


Fig. 3.113a-b. Line drawings of *Pseudocercospora puderi* on *Rosa hybrida*. a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 μm.

Pseudocercospora prunicola (Ellis & Everh.) U. Braun, Trudy Bot. Inst. im V. L. Komarova 20: 82, 1997.

≡ *Cercospora prunicola* Ellis & Everh., J. Mycol. 3: 17, 1887.

≡ *Cercoseptoria prunicola* (Ellis & Everh.) J. M. Yen, Bull. Soc. Mycol. France 97: 92, 1981.

= *Cercospora pruni-yedoensis* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 85: 120, 1943 (*nom. inval.*).

≡ *Pseudocercospora pruni-yedoensis* Goh & W. H. Hsieh, *Cercospora* and similar Fungi from Taiwan: 282, 1990.

= *Cercospora pruni-persicae* J. M. Yen, Bull. Soc. Mycol. France 94: 61, 1978, also in Rev, Mycol. 42: 59, 1978.

≡ *Cercospetoria pruni-persicae* (J. M. Yen) J. M. Yen (*pruni-perciae*), Bull. Soc. Mycol. France 97: 92, 1981.

Leaf spots 5 — 16 mm diameter, distinct, amphigenous, angular to irregular, reddish brown, with dark margin, sometimes limited by vein. *Caespituli* amphigenous. *Stromata* 39.5 — 42 μm diameter, intraepidermal, well-developed, composed of globular to angular, brown to dark brown cells. *Conidiophores* 13.5 — 39 × 2 — 2.5 μm, 0 — 2-septate, numerous in a densely fasciculate, arising from the stromata, brown, simple, straight, smooth, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci*

inconspicuous, unthickened, and not darkened. *Conidia* 13.5−40.5 × 1.5−2.5 μm, solitary, filiform to obclavate, 1−5-septate, straight or slightly curved, smooth, pale olivaceous, base truncate, with subacute to obtuse apex, hila unthickened and not darkened. (Fig. 3.114)

Specimen examined: on *Prunus persica* (L.) Batsch, THAILAND, Chiang Mai Province, Pang Da Royal Project, 5 August 2008, Jamjan Meeboon (BBH 23727).

Host: *Prunus persica* (L.) Batsch (Rosaceae).

Distribution: China, Hong Kong, India, Japan, Kirghizia, Korea, Myanmar, Russia (Asian and European part), Taiwan, USA, and Vanuatu (Crous & Braun, 2003).

Notes: Two *Pseudocercospora* species, viz, *P. graphioides* U. Braun and *P. prunicola* (Ellis and Everh.) U. Braun, have been recorded associated with palnt genus *Prunus*. This specimen differs from *P. graphioides* in having shorter (13.5−39 × 2−2.5 μm vs 30−130 × 4 −6 μm) and not geniculate conidiophores, and shorter conidia ((13.5−40.5 × 1.5−2.5 μm vs 30−100 × 4.5−8 μm) with truncate base. This specimen is much similar to *P. prunicola* by having short and not geniculate conidiophores, and obclavate and short conidia. This specimen is a new record of *P. prunicola* from Thailand. Its host, *Prunus persica*, is recognized as crops native to China.

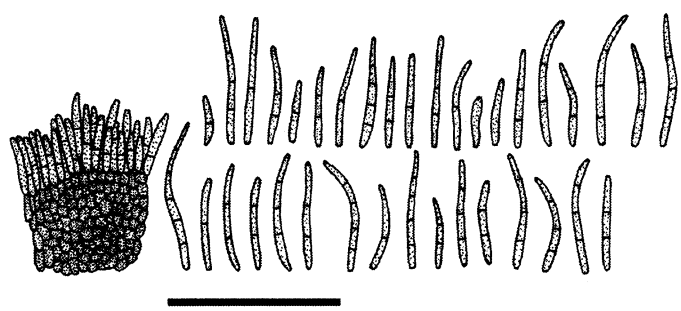


Fig. 3.114. Line drawings of conidia, conidiophores, and stroma of *Pseudocercospora prunicola* on *Prunus persica*. Bar = 50 μm.

Family Rubiaceae

Cercospora coffeicola Berk. & M. A. Curtis, Grevillea 9: 99, 1881.

= *Cercospora coffeae* Zimm., Ber. Land-Forstw. Deutch-Oatafr. 2: 35, 1904.

= *Cercospora herrerana* Farneti, Atti Ist. Bot. Univ. Pavia, Ser. 2, 9: 37, 1911.

Leaf spots 5－8 mm diameter, amphigenous, circular, to subcircular brown to dark brown, pale at the center, with dark margin. *Caespituli* amphigenous. *Stromata* 16.5－31 μm diameter, substomatal to intraepidermal, small, composed of a few globose and brown-walled cells. *Conidiophores* (20－) 22－86 (－140) × (2.5－) 3.5－4 (5) μm, 9－23 in a loosely to densely fasciculate, divergent, 2－7-septate, arising from stromata, straight, mostly near the apex, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, geniculate. *Conidiogenous cells* integrated, holoblastic, polyblastic, sometimes monoblastic, terminal or intercalary, sympodially proliferating. *Conidiogenous loci* 2－2.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* (35－) 99－178 × 3－4 μm, solitary, obclavate, straight, slightly curved, hyaline, 4－21-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2－2.3 μm diameter, thickened, and darkened.

Specimen examined: on *Coffea arabica* L., THAILAND, Chiang Mai Province, Amphur Mae Jam, Mae Hae Royal Project Area, 12 February 2008, Jamjan Meeboon (BBH 23600).

Host: *Coffea arabica* L. (Rubiaceae).

Distribution: Widely distributed, including American Samoa, Angola, Australia, Brazil, Brunei, Cambodia, China, Colombia, Congo, Costa Rica, Cuba, Dominican Republ., E1 Salvador, Ethiopia, Fiji, French Guiana, French Polynesia, Guiana, French Polynesia, Gabon, Ghana, Guadeloupe, Guatemala, Guyana, Haiti, India, Indonesia, Ivory Coast, Jamaica, Japan, Kenya, Laos,n Madagascar, Malawi, Martinique, Mauritius, Micronesia, Mosambique, Myanmar, Nepal, New Caledonia, Nigeria, Panama, Papua New Guinea, Peru, Philippines, Puerto Rico, Samoa, Sierra Leone, Somalia, South Africa, Sudan, Suriname, Taiwan, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, USA, Vanuatu, Venezuela, Yemen, and Zimbabwe (Crous & Braun, 2003).

Notes: *Cercospora coffeicola* was firstly reported from Thailand by Sontirat et al. (1980). Its host, *Coffea arabica*, is common crops indigenous to Ethiopia and Yemen.

Passalora haldinae C. Nakash. & Meeboon [as '*haldiniae*'], Fungal Diversity 26: 259－260, 2007. MycoBank: 510508

Maculis in foliis vivis subcirculibus vel irregularibus, pallide brunneis vel atro-brunneis, margine indefinitis, 1－14 mm diameter; caespitulis praecipue epiphyllis. Stromatibus praecipue epiphyllis, parvis vel bene evolutis, intraepidermicis, usque 67 μm diameter, brunneis, subglobosis vel globosis. Conidiophoris laxe vel dense fasciculatis, erumpentibus, brunneis, valde 1－10-geniculatis, 15－63 × 2.8－3.6 μm, 2－7-septatis, raro ramosis; locis conidiogenis

parvis, distinctis, leviter incrassatis, 0.8 —1.3 μm diameter Conidiis solitariis, cylindricis vel obclavatis, rectis, laevibus, ad apicem obtusis, ad basim obconice truncates, leviter incrassatis, brunneis, 1 —7-septatis, 24 —80 × 2.7 —5 μm.

Etymology: haldinae, derived from the genus name of the host plant.

Leaf spots 1 —14 mm diameter, subcircular to irregular, pale brown to dark brown, with indefinite margins. *Caespituli* mainly epiphyllous. *Stromata* up to 67 μm diameter, small or well-developed, intraepidermal, subglobular to globular, brown. *Conidiophores* 15 —63 × 2.8 —3.6 μm, loosely to densely fasciculate, 2 —7-septate, erumpent through the cuticle, brown, strongly 1 —10-geniculate, occasionally branched. *Conidogenous cells* integrated, intercalary or terminal, proliferating sympodially. *Conidiogenous loci* 1 —1.5 μm diameter, small, distinct and slightly thickened. *Conidia* 24 —80 × 2.7 —5 μm, solitary, cylindrical to obclavate, 1 —7-septate, brown, straight, smooth, apex obtuse, base obconically truncated, with a slightly thickened hila. (Fig. 3.115)

Specimen examined: on *Haldina cordifolia* (Roxb.) Rids., THAILAND, Uttradit Province, Amphur Muang, Sak Yai National Park, 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27886: **holotype**).

Host: *Haldina cordifolia* (Rubiaceae).

Distribution: Thailand (type locality).

Notes: The species of *Cercospora* and allied genera on hosts of the genus *Haldina* are not yet known. Six species of *Passalora* have been recorded on other hosts belonging to the Rubiaceae, viz. *Passalora cephalanti* (Ellis & Kellerm.) U. Braun and Crous (Crous & Braun, 2003), *P. diodiae* (Cooke) Crous, U. Braun and Alfenas (Crous et al., 1999), *P. mitracari-hirti* O.L. Pereira and R.W. Barreto (Pereira & Barreto, 2005), *P. okinawaensis* (Tak. Kobay. & T. Nishijima) U. Braun (Crous & Braun, 2003), *P. pseudocapnodioides* O.L. Pereira and R.W. Barreto (Pereira & Barreto, 2005), and *P. ubatubensis* (Chupp & Viégas) Crous, Alfenas and R. W. Barreto (Crous et al., 1997). Compared with the morphological characteristics of these species, *Passalora haldiniae* is distinguished by having strongly geniculate, occasionally branched conidiophores (conidiogenous cells), and conidia formed singly. Its host, *Haldina cordifolia*, is recognized as ornamental plant native to southern Asia, from India east to southern China and Vietnam.

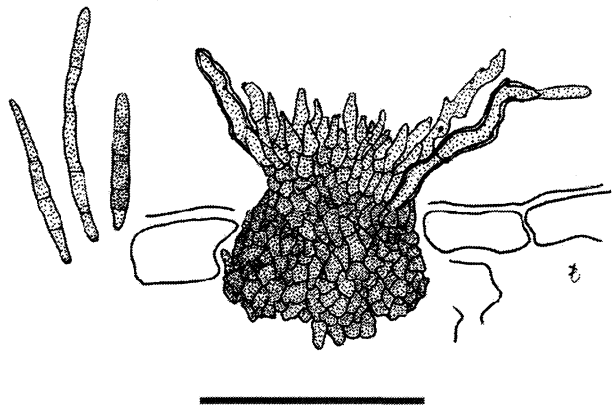


Fig. 3.115. Line drawings of conidia, conidiophores, and stroma of *Passalora haldinae* on *Haldina cordifolia* (from holotpe). Bars = 50 μm.

Pseudocercospora gardeniae (Boedijn) Deighton, Mycol. Pap. 140: 144, 1976.

≡ *Cercospora gardeniae* Boedijn, Nova Hedwigia 3: 427, 1961.

Leaf spots 2−7 mm diameter, amphigenous, distinct, circular to subcircular, brown, pale at the center, with dark brown margin. *Caespituli* amphigenous. *Stromata* 15−27.5 μm diameter, small, intraepidermal, composed of a few globose to subglobose, dark brown-walled cells. *Conidiophores* 7.5−25 × 2−3.5 μm, 5−16 in a densely fasciculate, curved, 1−3-septate, smooth, pale brown, paler toward the apex, unbranched, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal to intercalary, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 10−75 × 1.5−3 μm, solitary, mostly obclavate, sometimes acicular to cylindric, straight to mildly curved, subhyaline, 3−8-septate, smooth, truncate at the base, with obtuse apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.116)

Specimen examined: on *Gardenia jasminoides* Ellis, THAILAND, Chiang Mai Province, Amphur Muang, Tumbol Mae Hea, Royal Flora, 13 February 2008, Jamjan Meeboon (BBH 23747).

Host: *Gardenia jasminoides* Ellis (Rubiaceae).

Distribution: Indonesia and Philippines (Crous & Braun, 2003).

Notes: This specimen is the first report of *P. gardeniae* from Thailand. Its host, *Gardenia jasminoides*, is common ornamental plant originated in Asia, and is most commonly found growing in Vietnam, Southern China, Taiwan, and Japan.

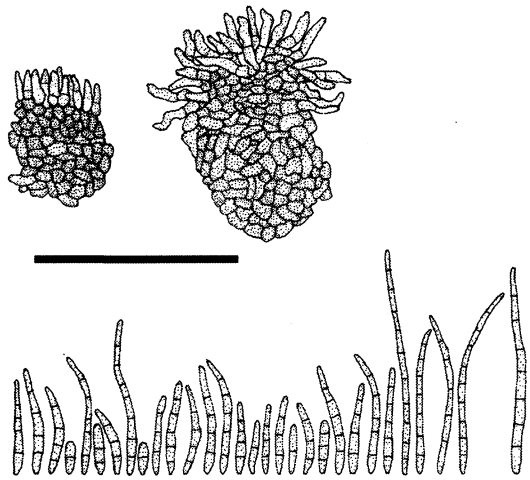


Fig. 3.116. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora gardeniae* on *Gardenia jasminoides*. Bars = 50 μm.

***Pseudocercospora* sp.**

Leaf spots 5−20 mm diameter, distinct, amphigenous, angular to irregular, scattered, dull brown, with dark margins, often limited by vein. *Caespituli* epipyllous, effuse. *Stromata* 31−35.5 μm diameter, intraepidermal, small to well-developed, composed of globular to angular, brown to dark brown cells, mycelium internal and external. *Conidiophores* 20.5−54 × 3−5 μm, 8 to numerous in a loosely to densely fasciculate, 2−4-septate, arising from the upper part of stromata as well as external mycelium, pale yellowish-brown, straight, smooth, branched, slightly geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 55−163 × 2−4 μm, solitary, filiform to long obclavate, 4−11-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the base with obtuse apex, hila unthickened and not darkened. (Fig. 3.117)

Specimen examined: on *Mitracarpus villosus* Cham. & Schltdl., THAILAND, Chiang Mai Province, Amphur San Sai, Tumbol Tumbol Mae Fag, 3 August 2008, Jamjan Meeboon (BBH 23748).

Host: *Mitracarpus villosus* Cham. & Schltdl. (Rubiaceae).

Distribution: Thailand.

Notes: Two *Pseudocercospora* species, viz, *P. borreriae* (Ellis & Everh.) Deighton and *P. mitracarpicola* (J. M. Yen & Gilles) U. Braun and Crous, have been recorded associated with plant genus *Mitracarpus*. Crous & Braun (2003) noted that *P. mitracarpicola* has a slightly

conspicuous conidiogenous loci, and slightly thickened and darkened hila. This specimen is much closed to *P. borreriae* due to branched conidiophores, but differs in having epiphyllous caespituli, shorter conidiophores (20.5−54 × 3−5 μm vs 35−220 × 3−5.5 μm of *P. borreriae*), and longer conidia (55−163 × 2−4 μm vs 30−90 × 2.5−5 μm of *P. borreriae*) with truncate base. Further examination is needed in order to determine this specimen. *Mitracarpus villosus*, commonly known as ornamentals and medicinal plants in tropical and warm areas, is reported here as a new host to the genus *Pseudocercospora*.

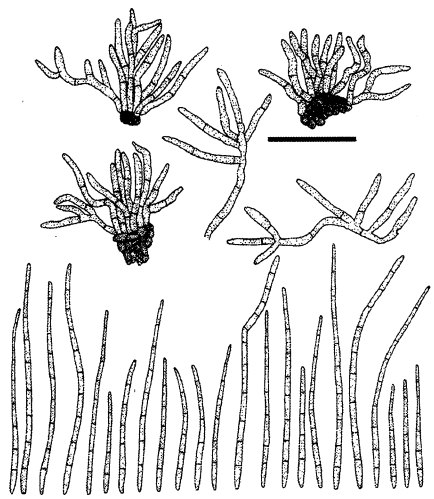


Fig. 3.117. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora* sp. on *Mitracarpus villosus*. Bars = 50 μm.

Family Rutaceae

Pseudocercospora angolensis (T. Carvalho & O. Mendes) Crous & U. Braun, Sydowia 55: 301, 2003.

≡ *Cercospora angolensis* T. Carvalho & O. Mendes, Bolm Soc. broteriana 27: 201, 1953.

≡ *Phaeoramularia angolensis* (T. Carvalho & O. Mendes) P. M. Kirk, Mycopathologia 94: 177, 1986.

≡ *Pseudophaeoramularia angolensis* (T. Carvalho & O. Mendes) U. Braun, Cryptog. Mycol. 20: 171, 1999.

Leaf spots 1−2 mm diameter, amphigenous, circular, angular to irregular, scattered, later coalescing to large spots, grayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* hypophyllous. *Stromata* 15−60 μm diameter, substomatal to intraepidermal, distinct, small to well-developed, composed

of dark brown. *Conidiophores* 40—80 × 2.5—3.5 μm, 5 to numerous in a densely and divergent fasciculate, 1—4-septate, arising from the upper part of stromata, smooth, brown, simple, straight, slightly geniculate near the apex. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 17—75 × 2—3 μm, solitary, acicular to obclavate, 3—7-septate, straight or slightly curved, smooth, pale olivaceous, truncate at the basal end, with acute apex, hila unthickened and not darkened. (Fig. 3.118)

Specimen examined: on *Citrus reticulata* Blanco, THAILAND, Chiang Mai Province, Amphur Sarapee, Tumbol Khua Mung, Farming area, 1 March 2008, Jamjan Meeboon (BBH 23605).

Host: *Citrus reticulata* Blanco (Rutaceae).

Distribution: Angola, Burndi, Cameroon, Central African Republic, Comoros, Congo, Ethiopia, Gabon, Gambia, Guinea, Ivory Coast, Kenya, Mozambique, Nigeria, Tanzania, Togo, Uganda, Yemen, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. angolensis* from Thailand, and *C. reticulata* is reported here as a new host. *Citrus reticulate* is common crops that commonly cultivated in tropical and subtropical areas.

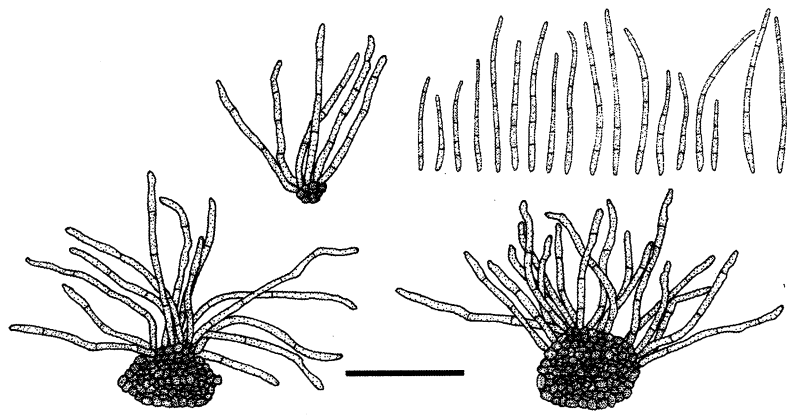


Fig. 3.118. Line drawings of conidia, conidiophores, and stromata of *Pseudocercospora angolensis* on *Citrus reticulata*. Bar = 50 μm.

Family Sauruaceae

Cercospora houttuyniicola Goh & W. H. Hsieh, Bot. Bull. Acad. Sin. Taipei 30: 118, 1989.

= ***C. apii s. lat.***

Leaf spots 5—25 mm diameter, amphigenous, clustered, irregular, dark brown to blackish, with dark reddish margin. *Caespituli* amphigenous. *Stromata* 13—43 μm diameter, substomatal,

small, and composed of 5 − 6, globose to subglobose, brown to blackish-brown cells. *Conidiophores* 47.5−176 × 3−4.5 μm, 5−11 in a loosely fasciculate, 1−3-septate, arising through stomata, straight, cylindrical, smooth, brown at the base, and paler toward the apex, unbranched, mostly not geniculate, sometimes slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic, sympodially proliferating. *Conidiogenous loci* 2−3.5 μm diameter, conspicuous, thickened, and darkened. *Conidia* 27−99 × 2−5 μm, solitary, acicular, straight to curve at the apex, hyaline, 7−12-septate, smooth, obconically truncate at the base, tapering toward a acute apex, hila 2−3 μm diameter, thickened, and darkened. (Fig. 3.119)

Specimen examined: on *Houttuynia cordata* Thunb., THAILAND, Chiang Mai Province, Chiang Mai University, 6 December 2006, Ikumitsu Araki (CMU 27907); 19 July 2007, Jamjan Meeboon (BBH 23737).

Host: *Houttuynia cordata* Thunb. (Saururaceae) (Meeboon et al., 2007c).

Distribution: Taiwan and Thailand (Goh & Hsieh, 1989; Meeboon et al., 2007c).

Notes: The first report of *C. houttuyniicola* from Thailand was done by Meeboon et al. (2007c). Its host, *Houttuynia cordata*, is common vegetables native to Japan, Korea, southern China, and Southeast Asia.

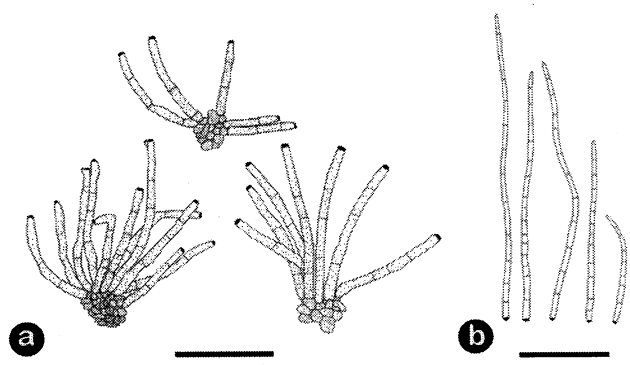


Fig. 3.119a-b. Line drawings of *Cercospora houttuyniicola* on *Houttuynia cordata*.
a. Conidiophores and stromata. b. Conidia. Bars: a, b = 50 μm.

Pseudocercospora houttuyniae (Togashi & Katsuki) Y. L. Guo & W. X. Zhao, Acta Mycol. Sinica 8: 118, 1989.

≡ *Cercospora houttuyniae* Togashi & Katsuki, Bot. Mag. Tokyo 65: 21, 1952.

Leaf spots 5−20 mm diameter, amphigenous, solitary, distinct, subcircular, visible on both upper and lower surfaces, greyish brown, with pale yellowish-brown to pale brown, dark

reddish brown margin. *Caespituli* amphigenous, abundantly hypophyllous. *Stromata* 20 – 30 µm diameter, substomatal. *Conidiophores* (42) 67.5 ± 18 (97) × (3) 3.7 ± 0.3 (4.5) µm, densely fasciculate, 1 – 5-septate, straight to curved, smooth, pale olivaceous to brown, uniform in color, slightly attenuated towards the apex, branched, slightly geniculate or slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (37) 80.1 ± 27.5 (133) × (3) 3.7 ± 0.3 (4) µm, solitary, obclavate, 4 – 11-septate, straight to mildly curved, subhyaline, smooth, subacute to obtuse at the apex, obconically truncate at the base, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Houttuynia cordata* Thunb., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27959).

Host: *Houttuynia cordata* Thunb. (Saururaceae) (Meeboon et al., 2007c).

Distribution: China, Japan, Taiwan, and Thailand (Guo & Zhao, 1989; Meeboon et al., 2007c).

Notes: The first report of *P. houttuyniae* from Thailand was done by Meeboon et al. (2007c).

Literature: Guo et al. (1998, p. 318).

Family Solanaceae

Cercospora capsicigena Bhartiya, R. Dubey & S. K. Singh, Indian Phytopathol. 53: 149, 2000.

= ***C. apii s. lat.***

Leaf spots 2 – 15 mm diameter, amphigenous, circular to subcircular, brown to yellowish-brown concentric lesions, cemtre whitish grey surrounded by raised blackish-brown border line. *Caespituli* amphigenous. *Stromata* lacking to rudimentary, composed of a few swollen brown hyphal cells. *Conidiophores* (32) 74 ± 32.4 (128) × (3) 4.1 ± 0.4 (5.5) µm, 3 – 12 in a loosely fasciculate, 1 – 5-septate, straight to slightly curved, smooth, olivaceous to brown, paler upward, unbranched, geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (60) 91.3 ± 29.2 (158) × (4) 4.6 ± 0.2 (5) µm, solitary, acicular to filiform, straight to mildly curved, hyaline, 5 – 12-septate, smooth, obconically truncate at the base, subacute apex, hila 2 – 3 µm diameter, thickened, and darkened.

Specimen examined: on *Capsicum annuum* var. *acuminatum* Fingerh., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Jamjan Meeboon (CMU 27889).

Host: *Capsicum annuum* var. *acuminatum* Fingerh. (Solanaceae).

Distribution: India and Thailand (Crous & Braun, 2003).

Notes: From Thailand, Sontirat et al. (1980) reported *C. capsici* which is recently known as *C. physalidis* fide Crous & Braun (2003). This record is the first report of *C. capsicigena* from Thailand. Crous & Braun (2003) considered this species as *C. apii s. lat.* its host, *Capsicum annuum*, is common crops distributed worldwide.

Cercospora physalidis Ellis, Amer. Naturalist 16: 810, 1882, *emend.* Braun & Melnik, Trudy Bot. Inst. im V. L. Komarova 20: 79, 1997.

≡ *Cercosporina physalidis* (Ellis) Miura, South Manch. Railway Co. Agric. Rept. 27: 525, 1928.

= *Cercospora solanicola* G. F. Atk., J. Elisha Mitchell Sci. Soc. 8: 53, 1892.

= *Cercospora nicotianae* Ellis & Everh., Proc. Acad. Sci. Philadelphia 45: 170, 1893.

= *Cercospora phyalidicola* Ellis & Barthol., Erythea 4: 28, 1896.

= *Cercospora physalidicola* Speg., Anales Mus. Nac. Buenos Aires 3: 342, 1899. (*nom. illeg.*).

= *Cercospora raciborskii* Sacc. & Syd., Syll. Fung. 16: 1070, 1902.

= *Cercosporina physalidicola* Speg. Anales Mus. Nac. Hist. Nat. Buenos Aires 20: 426, 1910.

= *Cercosporina daturicola* Speg. Anales Mus. Nac. Hist. Nat. Buenos Aires 20: 425, 1910.

≡ *Cercospora daturicola* (Speg.) Vassiljevsky, *Fungi* imperfecti parasitici 1. Hyphomycetes: 247, 1937.

≡ *Cercospora daturicola* (Speg.) W. W. Ray, Mycologia 36: 175, 1944.

= *Cercospora capsici* Heald & W. A. Wolf, Mycologia 3: 15, 1911.

= *Cercospora abchasica* Siemaszko, Izv. Severo-Kavkazsk. Muz. 12: 26, 1919.

= *Cercospora melongenae* Welles, Phytopathology 12: 63, 1922.

= *Cercospora atropae* Kvashn., Izv. Severo-Kavkazsk. Kraev. Stantsii Zashch. Rast. 4: 37, 1928.

= *Cercosporina petuniae* Saito, Trans. Tottori Soc. Agric. Sci. 3: 271, 1931.

≡ *Cercospora petuniae* (Saito) Chupp & A. S. Mull., Ceiba 1: 176, 1950 (*nom. illeg.*).

= *Cercospora petuniae* A. S. Mull. & Chupp, Arq. Inst. Biol. Veg. Rio de Janeiro 3: 96, 1936 (*nom. inval.*).

= *Cercospora petuniae* Sandu & Sarea, Lucr. Sti. Inst. Agron. 1962: 94, 1962 (*nom. illeg.*).

= *Cercospora petuniae* var. *brevipedicellata* Chidd., Indian Phytopathol. 12: 120, 1960 (*nom. inval.*).

= ***C. apii s. lat.***

Leaf spots 2 – 15 mm diameter, amphigenous, irregular, brown to dark brown, pale at the center, with dark margin, limited by leaves vein. *Caespituli* amphigenous. *Stromata* 10.5 – 19 µm diameter, substomatal to intraepidermal, small, composed of few globose to subglobose, brown-walled cells. *Conidiophores* 27.5 – 54 × 2.5 – 5.5 µm, 3 – 8 in a loosely to densely fasciculate, 1 – 3-septate, arising from stromata, straight to decumbent, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, strongly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 1.5 – 2.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 46.5 – 160 × 2 – 4 µm, solitary, obclavate to acicular, straight, slightly curved, hyaline, 7 – 15-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1 – 2.3 µm diameter, thickened, and darkened. (Figs. 3.120, 3.121, 3.122).

Specimen examined: on *Capsicum frutescens* L., THAILAND, Phetchabun Province, Amphur Lom Sak, Num Nao National Park, 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27965); Chiang Mai Province, Amphur Sarapee, 28 November 2006, Jamjan Meeboon (CMU 28065); Chiang Mai Province, Doi Suthep-Pui National Park, on leaves of *Capsicum annuum* L., 2 October 2005, Jamjan Meeboon (CMU 27938); Chiang Rai Province, Amphur Wiang Pa Pao, on leaves of *Capsicum annuum* var. *acuminatum* Fingerh, 2 February 2008, Jamjan Meeboon (BBH 23602); Chiang Mai Province, Amphur Mae Taeng, on leaves of *Nicotiana tabacum* L., 6 February 2008, Jamjan Meeboon (BBH 23668); Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, on leaves of *Solanum nigrum* L., 1 August 2008, Jamjan Meeboon (BBH 23612); Chiang Mai Province, Suthep-Pui National Park, on leaves of *Solanum verbascifolium* L., 25 July 2008, Jamjan Meeboon (BBH 23769).

Host: *Capsicum annuum* L., *C. annuum* var. *acuminatum* Fingerh, *C. frutescens* L., *Nicotiana tabacum* L., *Solanum nigrum* L., *S. verbascifolium* L. (Solanaceae).

Distribution: Worldwide where the host is cultivated, including including Afghanistan, American Samoa, Argentina, Armenia, Australia, Bangladesh, Barbados, Bhutan, Bolivia, Brazil, Brunei, Bulgaria, Cambodia, China, Colombia, Congo, Cuba, Cyprus, Dominican Republic,

Egypt., El-Salvador, Ethiopia, Fiji, French Antilles, Gabon, Gambia, Georgia, Germany Ghana, Guam, Guatemala, Guinea, Guayana, Haiti, Hong Kong, India, Indonesia, Iraq, Jamaica, Japan, Jordan, Kenya, Korea, Laos, Libya, Malawi, Malaysia, Mauritius, Mexico, Micronesia, Morocco, Myanmar, Nepal, New Caledonia, Nigeria, New Zealand, Pakistan, Palau, Panama, Papua New Guinea, Philippines, Puerto Rico, Romania, Russia (European part), Samoa, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Taiwan, Tanzania, Thailand, Tonga, Trinidad and Tobago, Uganda, Ukraine, USA, Vanuatu, Venezuela, Virgin Islands,Wallis and Futuna Islands, Yemen, Zambia, and Zimbabwe (Crous & Braun, 2003).

Notes: The first record of this species from Thailand was done by Sontirat et al. (1980) as '*C. capsici* Heald & F. A. Wolf'. Crous & Braun (2003) considered this species as *C. apii s.lat.* *Capsicum frutescens* (bird chili) is an important crop in Thailand, and its 'leaf spot disease' caused by *C. capsici* is recognized as an important disease in Thailand. *Solanum verbascifolium* is reported here as a new host of this pathogen. *Solanum verbascifolium* is weeds, naturalized in Australia and New Zealand. Other hosts, such as *Capsicum* spp., *Nicotiana tabacum*, and *Solanum nigrum* are common crops in tropical areas.

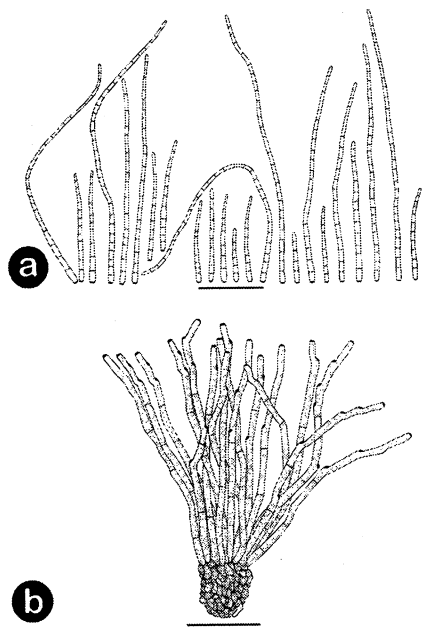


Fig. 3.120. Line drawings of *Cercospora physalidis* on *Nicotiana tabacum*. a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 µm.

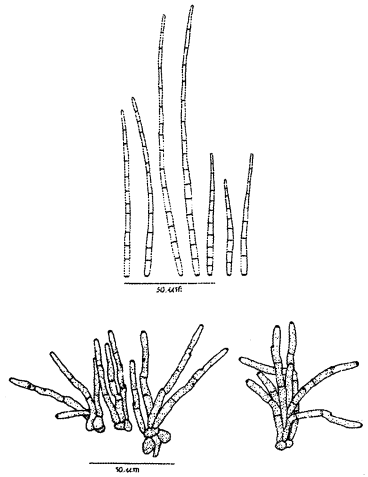


Fig. 3.121. Line drawings of *Cercospora physalidis* on *Capsicum annuum*. a. Stroma and conidiophores. b. Conidia. Bar=50 µm.

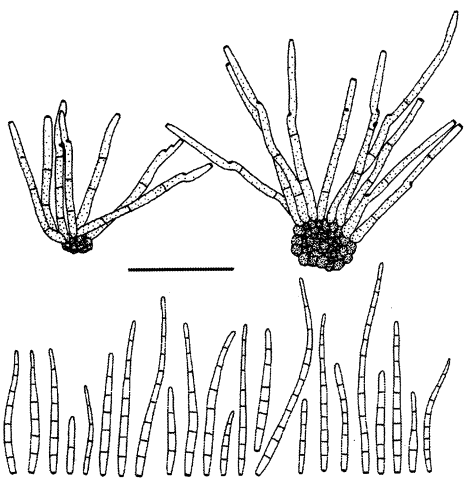


Fig. 3.122. Line drawings of *Cercospora physalidis* on *Solanum nigrum*. a. Stroma and conidiophores. b. Conidia. Bar = 50 µm.

Cercospora physalidis-angulatae J. M. Yen, Cah. Maboké 9: 112, 1971.

Leaf spots 2 – 15 mm diameter, amphigenous, subcircular to irregular, pale to yellowish-brown with dark brown border line. *Caespituli* amphigenous but chiefly hypophyllous. *Stromata* 15 – 40 µm diameter. *Conidiophores* (52) 103.3 ± 46.5 (179) × (4) 4.2 ± 0.3 (5) µm, loosely to densely fasciculate, 1 – 4-septate, straight to mildly curved, smooth, olivaceous to brown to brown, uniform in colour, unbranched, strongly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (47) 92.4 ± 34.5 (185) × (3) 3.8 ± 0.3 (5) µm, solitary,

obclavate-cylindric, straight to slightly curved, hyaline, 3 − 14-septate, smooth, subtruncate to subobtuse at the base, obtuse to subacute apex, hila 1 − 2.3 μm diameter, thickened, and darkened.

Specimen examined: on *Physalis angulata* L., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 2 October 2005, Jamjan Meeboon (CMU 27937).

Host: *Physalis angulata* L. (Solanaceae) (Meeboon et al., 2008).

Distribution: Gabon and Thailand (Crous & Braun, 2003; Meeboon et al., 2008).

Notes: *Cercospora physalidis-angulatae* was firstly reported from Thailand by Meeboon et al. (2008). Its host, *Physalis angulata*, is ornamental plant naturalized in Australia.

Cercospora puyana Sydow., Ann. Mycol.37: 431, 1939.

Leaf spots 1 − 9 mm diameter, amphigenous, scattered to confluent, subcircular to angular, initially appearing pale brown, later becoming greyish at the centre, with reddish brown or purplish brown margins. *Caespituli* amphigenois, chiefly hypophyllous. *Stromata* 24−40.5 μm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 39.5−127 × 3−4 μm, numerous in a densely fasciculate, slightly divergent, arising from stromata, 1−3-septate, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, branched, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2−3 μm diameter, conspicuous, thickened, darkened. *Conidia* 64−165 × 2 −5 μm, solitary, long obclavate to subacicular, 6−19-septate, straight, hyaline, smooth, base obconically truncate, with subacute apex, hila 2.5−3 × 2−3 μm diameter, thickened and darkened. (Fig. 3.123).

Specimen examined: on *Solanum indicum* L., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, 1 August 2008, Jamjan Meeboon (JM 108).

Host: *Solanum indicum* L. (Solanaceae).

Distribution: Ecuador (Chupp, 1954).

Notes: This species is distinct from plurivorous *C. apii s. lat.* in having well-developed stromata, branched conidiophores, and obconically truncate at the base of conidia (Chupp, 1954). Recently, about 10 species of *Cercospora* species non *C. apii s. lat.* have been recorded on plant genus *Solanum*, viz, *C. lanugiflori* Chupp & A. S. Mull., *C. nigri* var. *microsporae* L. N. Bhardwaj & Y. S. Paul, *C. puyana, C. sciadophila* (Speg.) Chupp, *C. solanacea* Sacc. & Berl., *C. solani* Thüm., *C. solanigena* Bhartiya, R. Dubey & S.K. Singh (as "*solenigena*"), *C. solani-nigri*

Chidd., *C. solani-tuberosi* Thirum., *C. venezuelae* var. *indica* Govindu & Thirum. (Crous & Braun, 2003). This specimen is much similar to *C. puyana* in having amphigenous caespituli, branched conidiophores, and long obclavate conidia with obconically base truncate. This specimen is the first record of *C. puyana* from Thailand, and *Solanum indicum* is reported here as a new host of this fungus. Its hosts, *Solanum indicum* and *Solanum melongena*, are common crops native to India and Sri Lanka.

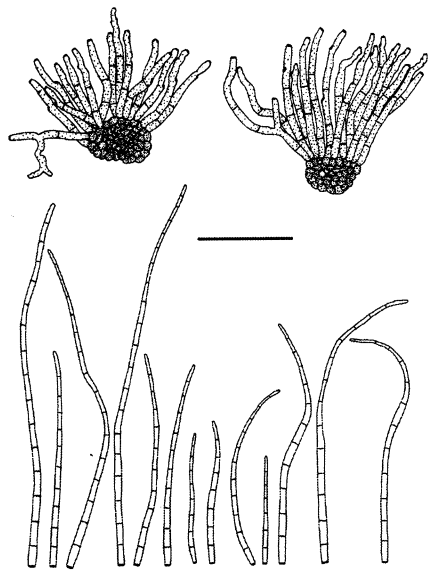


Fig. 3.123. Line drawings of conidia, conidiophores, and stroma of *Cercospora puyana* on *Solanum indicum*. Bar = 50 μm.

***Cercospora* sp.**

Leaf spots 2 − 7 mm diameter, amphigenous, distinct, circular to angular, brown, sometimes forming larger symptoms, with indistinct margins. *Caespituli* epiphyllous. *Stromata* 32−68 μm diameter, intraepidermal, well-developed, composed of globular to angular, brown to blackish-brown cells. *Conidiophores* 34−151 × 2.5−5.5 μm, numerous in a densely fasciculate, 2−5-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, rarely branched, subcylindrical, strongly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, monoblastic to polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5−3 μm diameter, conspicuous, thickened, and darkened. *Conidia* 45−72 × 2.5−3 μm, solitary, filiform-narrowly obclavate, 4−8-septate, straight, hyaline, smooth, base obconically truncate, with subacute apex, hila 2−2.5 μm diameter, thickened and darkened. (Fig. 3.124)

Specimen examined: on *Brunfelsia hopeana* Benth., THAILAND, Chiang Mai Province, Royal Flora, 27 July 2008, Jamjan Meeboon (BBH 23764).

Host: *Brunfelsia hopeana* Benth. (Solanaceae).

Distribution: Thailand.

Notes: *Brunfelsia hopeana* is the tropical plant contains various alkaloids including hopeanin, an active alkaloid compound with medicinal properties. Morphologically, this specimen differs from the plurivorous *C. apii s. lat.* in having well-developed stromata, numerous conidiophores in densely fasciculate and strongly geniculate, and filiform-narrowly obclavate conidia with only a few-septate with obconically truncate base. This species is distincts from other closely related *Cercospora* species in family Solanaceae, viz, *C. lanugiflori* Chupp and A. S. Mull., *C. nigri* var. *microsporae* L. N. Bhardwaj and Y. S. Paul, *C. puyana* Syd., *C. sciadophila* (Speg.) Chupp, *C. solanacea* Sacc. and Berl., *C. solani* Thüm., *C. solanigena* Bhartiya, R. Dubey, S. K. Singh, *C. solani-nigri* Chidd, *C. solani-tuberosi* Thirum., and *C. venezuelae* var. *indica* Govindu & Thirum., due to having longer conidiophores with strong geniculation, and filiform-narrowly obclavate conidia with a few-septate. Based on morphology characteristics of conidia, this species is much closed to *C. solanigena*, but Crous & Braun (2003) noted the later species as uncertain due to young conidia assumption in the original dscription. *C. venezuelae* var. *indica* is another uncertain species within this group. Further investigation is necessary in order to determine this specimen. *Brunfelsia hopeana* is reported here as a new host of the genus *Cercospora*. *Brunfelsia hopeana* is ornamentals origin from South and Central America, the Mexican lowlands, the Caribbean islands, and southern Florida.

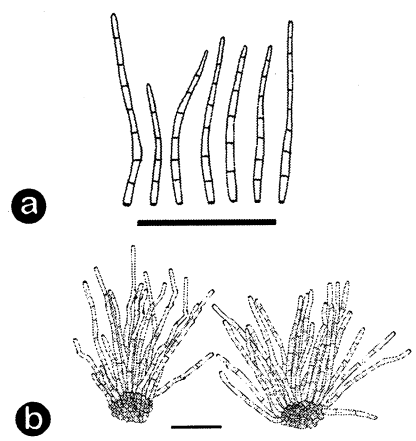


Fig. 3.124a-b. Line drawings of conidia (a), conidiophores, and stroma (b) of *Cercospora* sp. on *Brunfelsia hopeana*. Bar = 50 µm.

Cercospora solanacea Sacc. & Berl., Atti Reale Ist. Veneto Sci. Lett. Arti VI, 3: 721, 1885.

Leaf spots 15 − 30 mm diameter, amphigenous, angular, at first pale greenish to ochraceous, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margin. *Caespituli* epiphyllous, ochre yellow, velvety. *Stromata* 19−24 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 27−79.5 × 2−4.5 µm, 5−7 in a densely fasciculate, 1−3-septate, arising from stromata, simple, straight, erect to decumbent, smooth, pale yellow to pale brown, not branched, subcylindrical, not geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic. *Conidiogenous loci* 2 − 3 µm diameter, conspicuous, thickened, and darkened. *Conidia* 30−71.5 × 3−3.5 µm, solitary, narrowly obclavate, 3−6-septate, straight, hyaline, smooth, base obconically truncate, with subacute apex, hila 2−2.5 × 2−3 µm diameter, thickened and darkened. (Fig. 3.125)

Specimen examined: on *Solanum torvum* Sw., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, 1 August 2008, Jamjan Meeboon (BBH 23719).

Host: *Solanum torvum* Sw. (Solanaceae).

Distribution: Australia, China, India, Taiwan, and Venezuela (Crous & Braun, 2003).

Notes: This specimen is much closed to *C. lanugiflori* and *C. solanacea* based on epiphyllour caespituli, relatively short and not geniculate conidiophores, and cylindric and short conidia with a few-septate Chupp (1954). However, due to the status of *C. lanugiflori* is unclear (Crous & Braun, 2003); therefore, this specimen is assigned to *C. solanacea*. This specimen is the first record of *C. solanacea* from Thailand, and *Solanum torvum* is reported here as a new host of this fungus. The host, *Solanum torvum*, is common crops in tropical and warm regions.

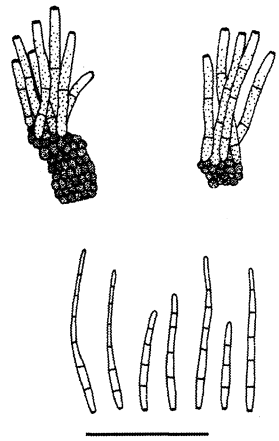


Fig. 3.125. Line drawings of conidia, conidiophores, and stroma of *Cercospora solanacea* on *Solanum torvum*. Bar = 50 μm.

Passalora nattrassii (Deighton) Crous & Braun, CBS Biodiversity Research Series 1: 461, 2003.

≡ *Mycovellosiella nattrassii* Deighton, Mycol. Pap. 137: 17, 1974.

Leaf spots 3 – 10 mm diameter, amphigenous, scattered to confluent, subcircular to irregular darkish brown, chlorotic discolorations. *Caespituli* amphigenous. *Stromata* lacking. *Conidiophores* 5 – 25 × 3.5 – 7.5 μm, borne singly as lateral branches from the superficial secondary mycelium, 0 – 2-septate, straight to slightly curved, pale olivaceous to olivaceous brawn, slightly geniculate near the apex. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* 1 – 1.5 μm diameter, minute, conspicuous, thickened, and darkened. *Conidia* 10 – 70 × 4.5 – 7.5 μm, solitary to catenate, cylindric-obclavate to slightly obclavate, straight to substraight, pale olivaceous brawn, slightly attenuated towards the apex, 1 – 6-septate, often mildly to constricted at the septa, hila 1 – 1.5 μm diameter, thickened, darkened, and slightly protuberant. (Fig. 3.126)

Specimen examined: on *Solanum melongena* L. cultivar egg plant long-shaped, THAILAND, Chiang Mai Province, Amphur Chiang Dao, Huay Luek Royal Project, 6 February 2008, Jamjan Meeboon (BBH 23666), on *Solanum melongena* L. cultivar egg plant pear-shaped, Jamjan Meeboon (BBH 23665); Chiang Mai Province, Suthep-Pui National Park, on leaves of *Solanum trilobatum* L., 21 November 2004, Jamjan Meeboon (CMU 27919).

Host: *Solanum melongena* L. cultivar egg plant long-shaped, *S melongena* L. cultivar egg plant pear-shaped, *S. trilobatum* L. (Solanaceae) (Meeboon et al., 2007c).

Distribution: China, Japan, Kenya, Korea, Nepal, Sabah, and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of *P. nattrassii* from Thailand was done by Meeboon et al. (2007c). Its host, *Solanum trilobatum*, is common crops native to South Asia.

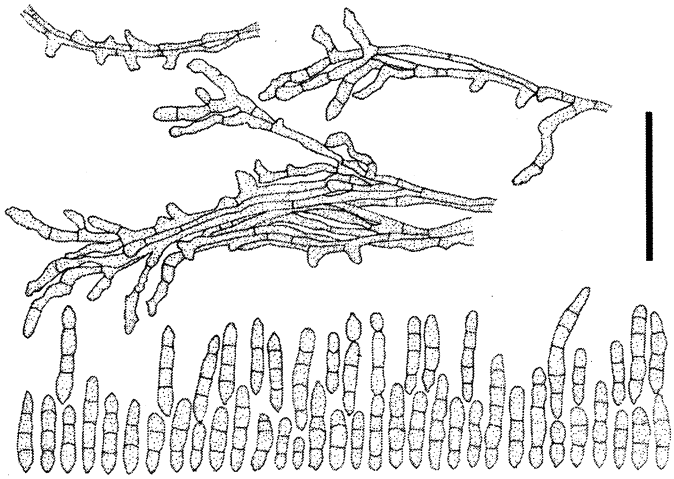


Fig. 3.126. Line drawings of *Passalora nattrassii* on *Solanum melongena*. Bar = 50 μm.

Passalora tarrii (Deighton) U. Braun & Crous, CBS Biodiversity Series 1: 397, 2003.

≡ *Mycovellosiella tarrii* Deighton, Mycol. Pap. 137: 20, 1974.

≡ *Cercospora deightonii* Chupp, Monograph of *Cercospora*: 538, 1954.

Leaf spots 5 – 20 mm diameter, amphigenous, irregular, pale brown, only leaf decolorization, with dark green margin, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* lacking. *Conidiophores* 10 – 70 × 3.5 – 5 μm, non fasciculate, 0 – 2-septate, arising from secondary mycelium, straight, smooth, brown, and paler towards the apex, unbranched, cylindrical, slightly geniculate. *Conidiogenous cells* integrated, holoblastic, often monoblastic, terminal, sympodially proliferating. *Conidiogenous loci* 1.5 – 2 μm diameter, conspicuous, thickened, and mildly darkened. *Conidia* 157 – 591 × 3 – 7 μm, solitary, obclavate to long cylindrical, straight, hyaline to subhyaline, multiseptate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1 – 1.5 μm diameter, conspicuous, thickened, and slightly darkened. (Fig. 3.127)

Specimen examined: on *Solanum melongena* L., THAILAND, Chiang Mai Province, Amphur Sarapee, 12 September 2007, Jamjan Meeboon (BBH 23593).

Host: *Solanum melongena* L. (Solanaceae).

Distribution: India, Japan, Philippines, Sierra Leone, Sudan, Taiwan, and Togo (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. tarrii* from Thailand.

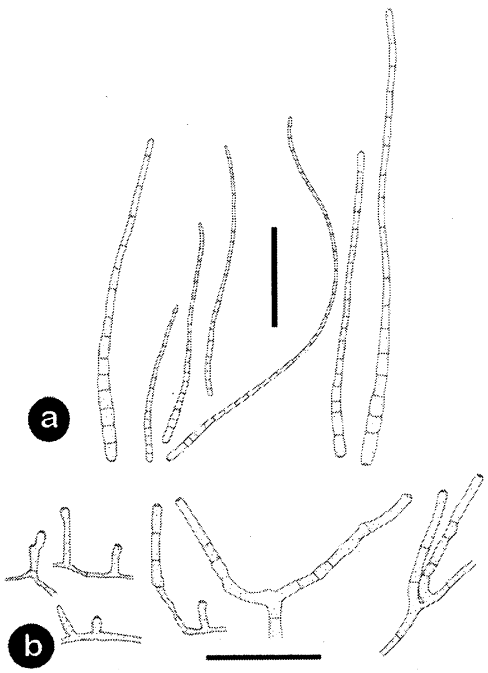


Fig. 3.127a-b. Line drawings of *Passalora tarrii* on *Solanum melongena*. a. Conidia. b. Conidiophores and superficial mycelium. Bars: a, b = 50 µm.

Pseudocercospora daturina (J. M. Yen) Deighton, Mycol. Pap. 140: 143, 1976.

≡ *Cercospora daturina* J. M. Yen, Rev. Mycol. 30: 169, 1965.

Leaf spots 10 – 20 mm diameter, amphigenous, solitary, scattered through the host surface, circular to subcircular, brown, sometimes paler at the center, with dark brown margins. *Caespituli* amphigenous. *Stromata* 18 – 30 µm diameter, intraepidermal, well-developed, composed of globose to subglobose, brown to dark brown cells. *Conidiophores* 21 – 78 × 2 – 4 µm, 7 – 12 in a dense fascicles, 1 – 4-septate, arising from stromata, straight to decumbent, smooth, brown, and paler towards the apex, branched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 33 – 135 × 2.5 – 4 µm, solitary, obclavate to filiform, straight to mildly curved, hyaline to subhyaline, 6 – 14-septate, smooth, obconically truncate at the base, with obtuse to subobtuse at the apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.128)

Specimen examined: on *Datura alba* Nees, THAILAND, Chiang Mai Province, Suthep-Pui National Park, 26 July 2007, Jamjan Meeboon (BBH 23645).

Host: *Datura alba* Nees (Solanaceae).

Distribution: India and Singapore (Crous & Braun, 2003).

Notes: Two species of *Pseudocercospora*, viz, *P. daturina* (J. M. Yen) Deighton and *P. jamaicensis* (Chupp) Deighton, have been recorded on plant genus *Datura*. Since the conidiophores of this specimen are branched; therefore, this specimen is not likely related to *P. jamaicensis* which is characterized by unbranched conidiophores. On the other hand, *P. daturina* was described by Yen (1980) by having branched conidiophores. Therefore, we assigned this specimen to *P. daturina*. This specimen is the first record of *P. daturina* from Thailand, *Datura alba*, is common weeds, dangerous for human or animals. Exact natural distribution is uncertain, due to extensive cultivation and naturalization throughout the temperate and tropical regions of the globe, but is most likely restricted to the Americas, from the United States south through Mexico, where the highest species diversity occurs.

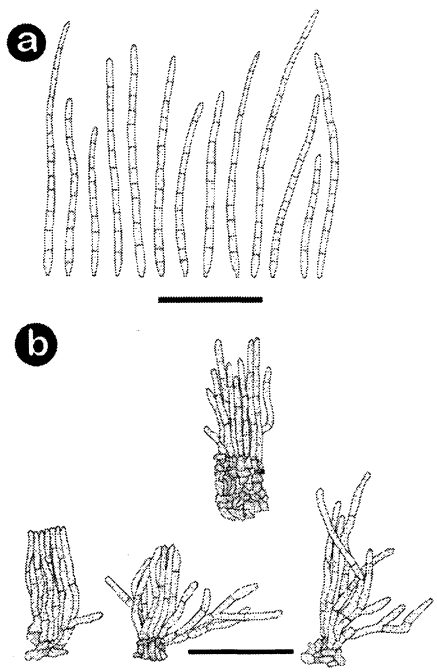


Fig. 3.128a-b. Line drawings of *Pseudocercospora daturina* on *Datura alba*.
a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 µm.

Pseudocercospora egenula (Syd.) U. Braun & Crous, CBS Diversity Series 1: 171, 2003.

≡ *Cercoseptoria egenula* Syd., Ann. Mycol. 33: 885, 1935.

≡ *Cercospora egenula* (Syd.) Chupp & Doidge, Bothalia 4: 885, 1948.

≡ *Paracercospora egenula* (Syd.) Deighton, Mycol. Pap. 144: 48, 1979.

= *Cercospora solani-melongenae* Chupp, Bothalia 4: 892, 1948.

Leaf spots 2 – 10 mm diameter, amphigenous, irregular, brown, only leaf decolorization, numerous and scattered through the leaf surface. *Caespituli* amphigenous. *Stromata* 22 – 147 µm diameter, intraepidermal, well-developed, globose to subglobose, brown to dark brown. *Conidiophores* 13 – 56 × 2 – 4 µm, 15 – 23 in a densely fasciculate, 0 – 2-septate, arising from stromata, straight to decumbent, smooth, pale brown, unbranched, cylindrical, non-geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 52 – 68 × 2.5 – 3.5 µm, solitary, obclavate to cylindrical, straight, hyaline to subhyaline, 4 – 10-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, with non-thickened, and not darkened hila. (Fig. 3.129)

Specimen examined: on leaves of *Solanum xanthocarpum* Schrad., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, Tumbol Wiang Ga Long, 22 July 2007, Jamjan Meeboon (JM 109).

Host: *Solanum xanthocarpum* Schrad. (Solanaceae).

Distribution: China, Ethiopia, Fiji, Hing Kong, India, Indonesia, Japan, Kenya, Korea, Malawi, Malaysia, Mozambique, New Caledonia, Saudi Arabia, Seychelles, Somalia, South Africa, Sudan, Tanzania, Tonga, and USA (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. egenula* from Thailand, and *Solanum xanthocarpum* is reported here as a new host of this fungus. *Solanum xanthocarpum* is common weeds distributed in tropical area, but leaves are edible.

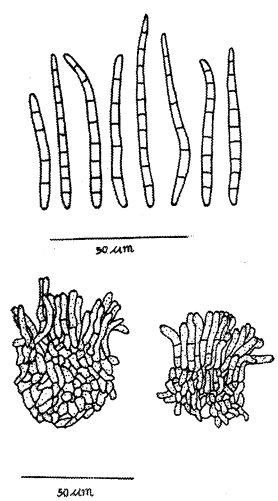


Fig. 3.129. Line drawings of conidia and conidiophores of *Pseudocercospora egenula* on *Solanum xanthocarpum*. Bars = 50 µm.

Pseudocercospora fuligena (Roldan) Deighton, Mycol. Pap. 140: 144, 1976.

≡ *Cercospora fuligena* Roldan, Philipp. J. Sci. 66: 8, 1938.

Leaf spots 1.5 − 7 mm in diameter, amphigenous, orbicular, often zonate, pale brown to dingy grey at center, with darker margin. *Caespituli* amphigenous. *Stromata* up to 37.5 µm in diameter, well-developed, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* (34 −) 40 − 70.5 (− 174) × (2.5 −) 3 − 4 µm, numerous, in a dense and divergent fascicles, 1 − 4-septate, straight, brown, paler towards the apex, uniform in width, not branched, slightly geniculate at the apex, with truncate apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (26 −)35.5 − 83(− 99.5) × 3 − (4 −)5 µm, hyaline or subhyaline, cylindric, 3 − 10-septate, straight to curved, smooth, truncate at the base, with subacute apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.130)

Specimen examined: on *Lycopersicon esculentum* var. *pyriforme* (Dunal) C. H. Müll., THAILAND, Chiang Mai Province, Doi Suthep-Pui National Park, 5 Febuary 2005, Jamjan Meeboon (CMU 27942).

Host: *Lycopersicon esculentum* var. *pyriforme* (Dunal) C. H. Müll. (Solanaceae) (Meeboon et al., 2008).

Distribution: Widely distributed, including Australia, Bangladesh, Belau, Brazil, Brunei, Cambodia, Chile, China, Cook Islands, Cuba, Gabon, Gambia, Hong Kong, India, Ivory Coast, Japan, Malaysia, Mexico, Netherlands, Antilles, New Caledonia, New Zealand, Nigeria, Palau, Papua New Guinea, Philippines, Senegal, Solomon Islands, Somalia, Taiwan, Tanzania, Thailand, Togo, Uganda, USA, Vanuatu, and Vietnam (Crosu & Braun, 2003; Meeboon et al., 2008).

Notes: The first report of this species was published by Sontirat et al. (1980) as '*Cercospora fuligena* Roldan' on *Lycopersicon esculentum*. Meeboon et al. (2008) re-collected again and reported as '*Pseudocercospora fuligena*'. The host, *Lycopersicon esculentum* var. *pyriforme*, is common crops native to Central, South, and southern North America.

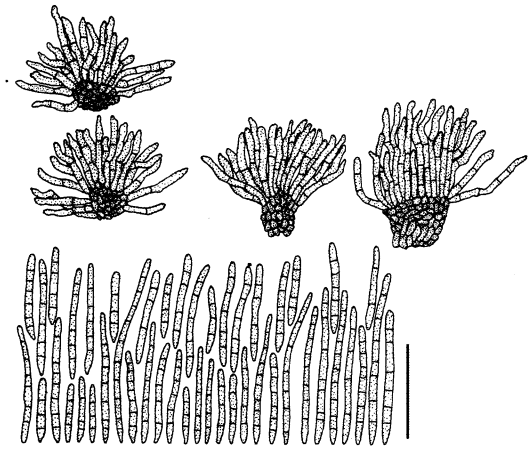


Fig. 3.130. Line drawings of *Pseudocercospora fuligena* on *Lycopersicon esculentum* var. *pyriforme*. a. Stroma and conidiophores. b. Conidia. Bar = 50 μm.

Pseudocercospora solani-melongenicola W. H. Hsieh & Goh, *Cercospora* and similar fungi from Taiwan: 318, 1990.

≡ *Cercospora melongenae* Welles *sensu* Sawada, Taiwan Agric. Res. Inst. Rept. 85: 115, 1943, non *C. melongenae* Welles, Phytopath. 12: 63, 1922.

Leaf spots 3 – 8 mm in diameter, amphigenous, orbicular to irregular, brown to grayish to brown with darker margin. *Caespituli* amphigenous, but chiefly hypophyllous. *Stromata* lacking, a few dark brown cells. *Conidiophores* (25) 83.8 ± 32.7 (160) × (4) 4.6 ± 0.3 (5.5) μm, loosely fasciculate, 1 – 4-septate, straight, brown, paler towards the apex, uniform in width, not branched, slightly geniculate at the apex, with truncate apex. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* (30) 70 ± 30 (135) × (3) 3.8 ± 0.5 (5) μm, hyaline, acicular, indistinctly multiseptate, straight to curved, smooth, truncate at the base, subacute to subobtuse apex, hila inconspicuous, unthickened, and not darkened.

Specimen examined: on *Solanum melongena* L., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 18 November 2005, Jamjan Meeboon (CMU 27877).

Host: *Solanum melongena* L. (Solanaceae) (Meeboon et al., 2007c).

Distribution: Taiwan and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of *P. solani-melongenicola* on *S. melongena* from Thailand was done by Meeboon et al. (2007c). The present determination of this species follows the publication of Hsieh and Goh (1990) who re-examined specimen of *C. melongenae* Welles from Taiwan, published by Sawada (1922), and described it as new species, *P. solani-melongenicola.*

Family Theaceae

Pseudocercospora ocellata (Deighton) Deighton, Trans. Brit. mycol. Soc. 88: 390, 1987.

≡ *Cercoseptoria ocellata* Deighton, Mycol. Pap. 151: 2, 1983.

≡ *Cercospora theae* Breda de Haan, in Chupp: 561, 1900.

Leaf spots 5 – 10 mm diameter, amphigenous, subcircular to irregular, light brown to brown, greyish white at the centre, with dark brown margin. *Caespituli* amphigenous. *Stromata* 50 – 85 µm diameter, substomatal, well-developed, and composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 14 – 53 × 2 – 3 µm, densely fasciculate, 0 – 2-septate, arising from stromata, straight to decumbent, smooth, pale brown, paler toward the apex, unbranched, slightly geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, sympodially proliferating. *Conidiogenous loci* inconspicuous, unthickened, and not darkened. *Conidia* 34 – 87 × 2 – 3 µm, solitary, acicular to cylindric, straight to mildly curved, subhyaline, 4 – 7-septate, smooth, truncate at the base, gradually tapering towards the apex, hila inconspicuous, unthickened, and not darkened. (Fig. 3.131)

Specimen examined: on *Camellia sinensis* Kuntze, THAILAND, Chiang Mai Province, Amphur Samoeng, Pang Da Royal Project, 7 February 2008, Jamjan Meeboon (BBH 23620).

Host: *Camellia sinensis* Kuntze (Theaceae).

Distribution: Azerbaijan, Brazil, China, Ethiopia, Georgia, India, Indonesia, Italy, Japan, Kenya, Mauritius, Nepal, Nigeria, Pakistan, Peru, Russia, Sri Lanka, Taiwan, Tanzania, and USA (Crous & Braun, 2003).

Notes: This specimen is the first record of *P. ocellata* from Thailand. Its host, *Camellia sinensis*, is common crops cultivated in the countries lie on the equator area.

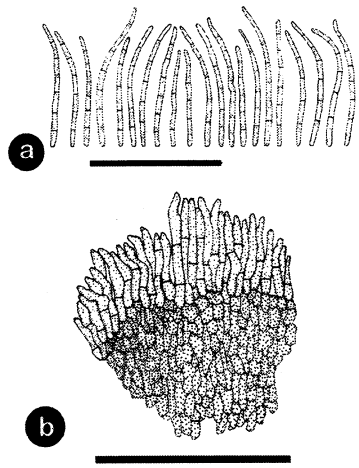


Fig. 3.131a-b. Line drawings of *Pseudocercospora ocellata* on *Camellia sinensis*. a. Conidia. b. Conidiophores and stroma. Bars: a, b = 50 µm.

Family Thelypteridaceae

***Cercospora* sp.**

Leaf spots 1.5 – 5 mm diameter, amphigenous, distinct, irregular, rarely orbicular, brown throughout, often whitish to paler at the center, often limited by leaf veins. *Caespituli* epiphyllous. *Stromata* 10 – 16 µm diameter, intraepidermal, well-developed, composed of 9 – 16 globose to subglobose, dark brown cells. *Conidiophores* 69 – 413.5 × 2.5 – 5 µm, 5 – 14 in a dense fascicles, cylindrical, arising through the plant epidermis, 3 – 13-septate, narrower toward the apex, straight to slightly sinuose or curved, smooth, brown at the base and paler towards the apex, unbranched, strongly geniculate throughout conidiophores. *Conidiogenous cells* 15 – 49.5 × 2.5 – 4.5 µm, pale brown, terminal or intercalary, holoblastic, polyblastic, integrated, proliferating sympodially. *Conidiogenous loci* 2 – 3 µm diameter, 1 – 3 per cell. protuberant, thickened, darkened. *Conidia* 36 – 205.5 × 1.5 – 3.5 µm, solitary, obclavate-filiform to acicular, straight to slightly curved, truncate to obconically truncate at base, acute to subobtuse at the apex, 3 – 17-septate, hyaline, smooth, hila 1.5 – 2 µm diameter, thickened, and darkened. (Fig. 3.132)

On PDA slow growing, smooth to folded, dark brown, white to smoke gray at the surface, producing red pigment in the medium.

Specimen examined: on *Christella parasitica* (Linn.) Lév., THAILAND, Chiang Mai Province, Amphur Hang Dong, as weeds at citrus plantation, 29 February 2008, Iman Hidayat (BBH 23574).

Host: *Christella parasitica* (Thelypteridaceae).

Distribution: Thailand.

Notes: This fungus was identified as *Cercospora s. str.* due to having pigmented conidiophores, thickened and darkened conidiogenous loci, and hyaline filiform to scolecoid conidia (Crous & Braun, 2003). Recently, only four species of cercosporoid fungi have been recorded associated with the plants of family Thelypteridaceae, viz, *Cercospora abacopteridis* J. M. Yen & Lim (Yen & Lim, 1973), *C. cyclosori* Goh & W. H. Hsieh (Hsieh & Goh, 1990), *Pseudocercospora abacopteridicola* (J. M. Yen & Lim) J. M. Yen (Yen & Lim, 1980), and *Pseudocercospora phyllitidis* (H. H. Hume) U. Braun and Crous (Crous & Braun, 2003).

Cercospora cyclosori is currently classified as *C. apii s. lat.* based on the present concept of the cercosporoid fungi (Crous & Braun, 2003), but *C. christellae* distinct from the plurivorous *C. apii sensu lato* (Crous & Braun, 2003) by having epiphyllous caespituli, well-developed stromata, numerous and densely fasciculate conidiophores with strongly geniculate throughout, and conidia obclavate-filiform under natural condition with obconically truncate base and smaller hila (1.5 − 2 µm wide). Another species, *C. abacopteridis,* was described by Yen & Lim (1973) as having amphigenous symptom, hypophyllous caespituli, lacking of stromata, conidiophores solitary to 2-8 fasciculate (15 − 118 × 4 − 5 µm), and conidia acicular to filiform (62 − 400 × 2 − 4 µm). However, *C christellae* is easily distinguishable from *C. abacopteridis* by its epiphyllous caespituli, well-developed stromata, and conidiophores in rich fascicles. Further examination is needed in order to clarify this specimen. Its host, *Christella parasitica*, is common weeds in tropical countries in Asia.

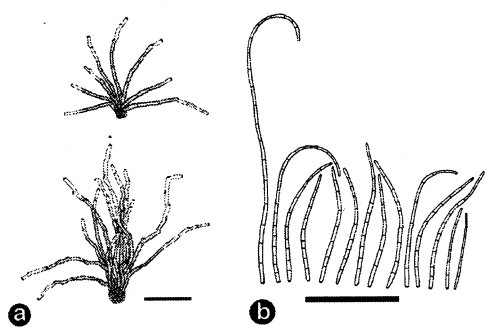


Fig. 3.132a-b. Line drawings of *Cercospora* sp. on *Christella parasitica*. a. Conidiophores and stromata. b. Conidia. Bars: a, b = 50 µm.

Family Tiliaceae

***Cercospora* sp.**

Leaf spots 15 – 30 mm diameter, amphigenous, circular or subcircular, pale greenish to ochraceous at young symptoms, later brown to dark brown, finally with grayish to brown centre, surrounded by a dark margin. *Caespituli* amphigenous, ochre yellow, velvety. *Stromata* 19 – 42.5 µm diameter, intraepidermal, small to well-developed, composed of globose to subglobose, brown to blackish-brown cells. *Conidiophores* 26 – 100 × 3.5 – 5 µm, 3 to numerous in a loosely to densely fasciculate, 1 – 4-septate, arising from stromata, erect to decumbent, smooth, pale yellow to pale brown, simple, straight, subcylindrical, geniculate to sinuous. *Conidiogenous cells* integrated, terminal, holoblastic, mostly monoblastic, sympodially proliferating. *Conidiogenous loci* 2 – 3.5 µm diameter, conspicuous, thickened, and darkened. *Conidia* 50 – 177 × 3.5 – 4 µm, solitary, narrowly obclavate to subacicular, straight, hyaline, 2 – 11-septate, smooth, apex subacute, base truncate, hila 2 – 3 µm diameter, thickened and darkened. (Fig. 3.133)

Specimen examined: on *Corchorus capsularis* L., THAILAND, Chiang Mai Province, Amphur San Sai, Tumbol Mae Jo, Farming area, 9 August 2008, Jamjan Meeboon (BBH 23701).

Host: *Corchorus capsularis* L. (Tiliaceae).

Distribution: Thailand.

Notes: This specimen is closed to *C. apii s. lat.*, and *Corchorus capsularis* is reported here as a new host of genus *Cercospora*. *Corchorus capsularis* is recognized as cotton and fibres crops, distributed in tropical countries.

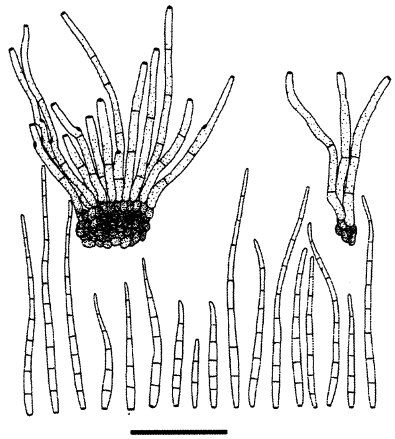


Fig. 3.133. Line drawings of conidia, conidiophores, and stromata of *Cercospora* sp. on *Corchorus capsularis*. Bar = 50 µm.

Family Verbenaceae

***Cercospora* sp.**

Leaf spots amphigenous, dark to yellowish, only leaf decoloration on the host. *Caespituli* hypophyllous. *Stromata* 18 – 25 µm diameter, small, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* 109 – 193.5 × 3 – 5 µm, 5 – 6 in a loosely fasciculate, 2 – 5-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, cylindrical, unbranched, mostly not geniculate. *Conidiogenous cells* integrated, terminal or intercalary, holoblastic, monoblastic or polyblastic, sympodially proliferating. *Conidiogenous loci* 2 – 3 µm diameter, conspicuous, thickened, and darkened. *Conidia* 87 – 300 × 3 – 3.5 µm, solitary, acicular, straight, hyaline, 6 – 21-septate, smooth, truncate at the base, tapering toward a subacute apex, hila 2 – 2.5 µm diameter, conspicuous, thickened, and darkened. (Fig. 3.134)

Specimen examined: on *Duranta repens* Linn., THAILAND, Lamphun Province, Amphur Ban Hong, Farming area, 24 August 2008, Jamjan Meeboon (BBH 23697).

Host: *Duranta repens* Linn. (Verbenaceae).

Distribution: Thailand.

Notes: The morphology characteristic of this specimen is much closed to *C. apii s. lat.* *Duranta repens* is reported here as a new host of genus *Cercospora*. The host, *Duranta repens*, is common ornamentals, originally native to Central and South America and the Caribbean. This plant is widely naturalized throughout the tropics and has become an invasive species in Australia, China, South Africa and on several Pacific Islands.

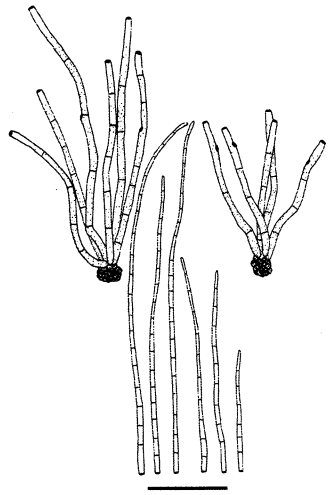


Fig. 3.134. Line drawings of conidia, conidiophores and stromata of *Cercospora* sp. on *Duranta repens*. Bar = 50 µm.

***Cercospora* sp.**

Leaf spots 2 – 5 mm in diameter, amphigenous, distinct, circular to subcircular, pale brown, centre greyish brown to greyish white, with dark brown margins. *Caespituli* amphigenous. *Stromata* 32 – 60 µm in diameter, small to well-developed, composed of globose to subglobose, brown to dark brown-walled cells. *Conidiophores* very variable in length, 61 – 185 × 3 – 4.5 µm, 2 – 12 in a dense fascicules, 1 – 7-septate, emerging from stromata through the cuticle, pale olivaceous to brown or sometimes paler towards the apex, straight to slightly curved, mostly strong geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2.5 – 3 µm diameter, conspicuous, thickened, and darkened. *Conidia* 75 – 120 × 2.5 – 4.5 µm, solitary, narrowly obclavate to acicular, straight to mildly curved, hyaline, 13 – 16-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 1 – 2.5 µm diameter, thickened and darkened. (Fig. 3.135)

Specimen examined: on *Duranta erecta* L., THAILAND, Chiang Mai Province, Amphur Chiang Dao, Huay Luek Royal Project, 6 February 2008, Jamjan Meeboon (BBH 23619).

Host: *Duranta erecta* L. (Verbenaceae).

Distribution: Thailand.

Notes: In general, *Cercospora* sp. is distincts from other closely related taxa in having well-developed stromata, dense fascicles conidiophores with strong geniculation, and being recorded from plant genus *Duranta*. *Cercospora cardiostegiae* differs from this specimen due to catenate conidia, small to lacking stromata, hypophyllous caespituli, and shorter

conidiophores. *Cercospora lantanae-indicae* also differs from this specimen in having small or lacking stromata and acicular and hyaline conidia (close to *C. apii s. lat.*). *Cercospora lippiae* and *C. pappilosa* differs in having small and lacking stromata, with slight geniculation, and indisitnct conidia septation. *Cercospora verbenicola* is also distincts from this specimen due to branched conidiophores, small to lacking stromata, and indistinct conidial septation (Chupp, 1954; Munjal et al., 1959). Because of the distinctiveness morphological characteristics of this specimen with other similar taxa; therefore, further investigation is necessary in order to determine this specimen. *Duranta erecta* is reported here as a new host of genus *Cercospora*. In addition, *Duranta erecta* is widely recognized as ornamental plant originally native to Central and South America and the Caribbean. It is also widely naturalized throughout the tropics and has become an invasive species in Australia, China, South Africa and on several Pacific Islands.

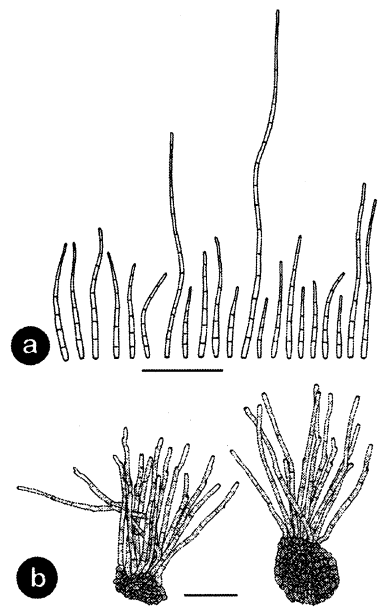


Fig. 3.135a-b. Line drawings of *Cercospora* sp. on *Duranta erecta*.
a. Conidia. b. Conidiophores and stromata. Bars: a, b = 50 µm.

Cercospora lantanae-indicae Munjal, Lall & Chona, Indian Phytopathol. 12: 134, 1960 [1959].

= *Cercospora lantanae-camarae* R. C. Rayak & R. K. Rayak, Curr. Sci. 50: 911, 1981 (*nom. illeg.*), homonym of *C. lantanae-camarae* J. M. Yen & Gilles, 1973.

Leaf spots 1 – 4 mm in diameter, amphigenous, distinct, circular to subcircular, pale brown to grey with indistinct brown border line, centre greyish white, with dark brown margins. *Caespituli* amphigenous. *Stromata* 28 – 40 µm in diameter. *Conidiophores* very variable in length, (50) 80.5 ± 25.5 (140) × (3) 3.8 ± 0.3 (4.5) µm, densely fasciculates, 1 – 8-septate,

emerging from stromata through the cuticle, pale olivaceous to brown or sometimes paler towards the apex, straight to slightly curved, mostly strong geniculate. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* conspicuous, thickened, and darkened. *Conidia* (65) 91.6 ± 19.5 (125) × (2.5) 3.7 ± 0.4 (4.5) µm, solitary, acicular, straight to mildly curved, hyaline, 5 – 12-septate, smooth, truncate at the base, acute apex, hila 2 – 2.5 µm diameter, thickened and darkened.

Specimen examined: on *Lantana camara* L., THAILAND, Chiang Rai Province, Amphur Wiang Pa Pao, 18 November 2005, Jamjan Meeboon (CMU 27896).

Host: *Lantana camara* L. (Verbenaceae) (Meeboon et al., 2007c).

Distribution: India and Thailand (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of *C. lantanae-indicae* from Thailand was done by Meeboon et al. (2007c). This species was previously only recorded from India (Munjal et al. 1959). Crous & Braun (2003) noted that *C. lantanae-indicae* is a true *Cercospora s.str.* close to *C. apii s.lat.* Its host, *Lantana camara*, is ornamental plant native to tropical regions in Central and South America.

Cercospora tectonae F. Stevens (*tectoniae*), Bernice P. Bishop Mus. Bull. 19: 155, 1925.

= ***C. apii s. lat.***

Leaf spots 2 – 14 mm in diameterangular to suborbicular, limited by leaves vein, confluent, brown to greyish brown or white at the centre, with a dark margin. *Caespituli* amphigenous, but chiefly epiphyllous. *Stromata* 8 – 41 µm diametersmall to medium, composed of a few globose to subglobose, brown to dark brown cells. *Conidiophores* (33.5 –) 41 – 72 (– 76) × 3 – 4 (– 5) µm, in a loosely fasciculate, 1 – 5-septate, straight to decumbent, light brown to medium brown, paler towards the apex, geniculate at the apex. *Conidiogenous cells* integrated, terminal, holoblastic, polyblastic, sympodially proliferating. *Conidiogenous loci* 2 – 3 µm diameterconspicuous, thickened, and darkened. *Conidia* (31 –) 38 – 63 (– 96.5) × (2 –) 2.5 – 3 µm, hyaline, acicular to obclavate-cylindric, 4 – 13-septate, straight to curved, truncate or obconically truncate at the base, with subacute apex, hila 2 – 2.5 µm diameterthickened and darkened. (Fig. 3.136)

Specimen examined: on *Tectona grandis* L.f., THAILAND, Chiang Mai Province, Chiang Mai University, Multiple Cropping Centre, 1 December 2005, Jamjan Meeboon (CMU 27928).

Host: *Tectona grandis* L.f. (Verbenaceae) (Meeboon et al., 2007c).

Distribution: China, Indonesia, Taiwan, Thailand, Trinidad and Tobago, and USA (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: Crous & Braun (2003) assigned this species to *C. apii s.lat.* The first record of *C. tectonae* from Thailand was done by Meeboon et al. (2007c). Its host, *Tectona grandis*, is ornamentals as well as timber crops, native to the south and southeast of Asia. It is also commonly found as a component of monsoon forest vegetation.

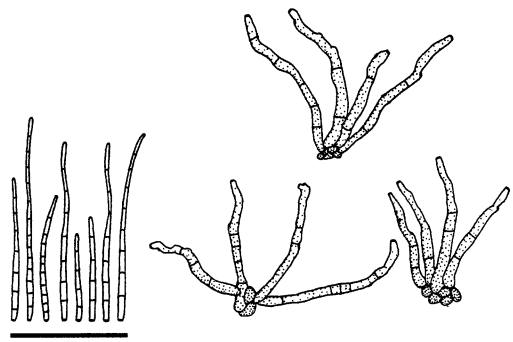


Fig. 3.136. Line drawings of *Cercospora tectonae* on *Tectona grandis*. a. Stroma and conidiophores. b. Conidia. Bar = 50 µm.

Pseudocercospora holmskioldiae C. Nakash. & Meeboon, Fungal Diversity 26: 261 – 263, 2007.

MycoBank: 510510

Maculis in foliis vivis, circularibus, anglularibus vel irregularibus, dispersis, 3 – 23 mm diametercinereo-brunneis, in epiphyllo margine atro-brunneis cinctis, in hypophyllo margine indistinctis, pallide viridulis cinctis. Stromatibus amphigenis, substmaicis vel intraepidermicis, atro-brunneis, 24 – 45 µm diameterhyphis internis et externis, superficialibus praeditis. Conidiophoris laxe vel dense fasciculatis, ex cellulis stromatibus emergentis, vel solitariis, ex hyphis superficialibus oriundis, pallide olivaceo-brunneis, laevibus, rectis vel geniculatis, simplicibus, 10 – 23 × 2.5 – 3 µm. Locis conidiogenis inconspicuis, non incrassatis, non pigmentiferis. Conidiis solitariis, acicularibus vel obclavatis, rectis vel leniter curvatis, laevibus, ad apicem acutis, ad basim truncatis, hilis non incrassatis, pallide olivaceis, 3 – 7-septatis, 50 – 72 × 1.8 – 2.5 µm.

Etymology: holmskioldiae, derived from the genus name of the host plant.

Leaf spots 1 – 2 mm wide, circular, angular to irregular, scattered, later coalescing to large spots, 3 – 23 mm diametergrayish to brown with blackish-brown border on the upper leaf surface, and pale greenish, indistinct border on the lower leaf surface. *Caespituli* amphigenous.

Stromata 24 – 45 μm diameter substomatal to intraepidermal, distinct, small to well-developed, dark brown, hyphae internal and external. *Conidiophores* 10 – 23 × 2.5 – 3 μm, loosely to densely fasciculate, arising from the upper part of stromata as well as external hyphae, smooth, pale olivaceous to brown, simple, straight or geniculate. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* 50 – 72 × 1.8 – 2.5 μm, solitary, acicular to obclavate, straight or slightly curved, 3 – 7-septate, smooth, pale olivaceous, with unthickened and truncate basal end, tip acute. (Fig. 3.137)

Specimen examined: on *Holmskioldia sanguinea* Retz., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27952: **holotype**).

Host: *Holmskioldia sanguinea* Retz. (Verbenaceae).

Distribution: Thailand (type locality).

Notes: On the plant genus *Holmskioldia*, *Cercospora holmskioldiae* Lall and Gill (Lall & Gill, 1963) is recognized as a species of *Cercospora* (Crous & Braun, 2003). In this survey, *C. holmskioldiae* is also observed on the same specimen as *P. holmskioldiae*. However, *P. holmskioldiae* is easily distinguishable from *C. holmskioldiae* by having well-developed stromata, superficial hyphae with solitary conidiophores and, above all, unthickened conidiogenous loci and conidial hila, and pigmented, narrow conidia. Its host, *Holmskioldia sanguinea*, is common ornamental plant originating from China.

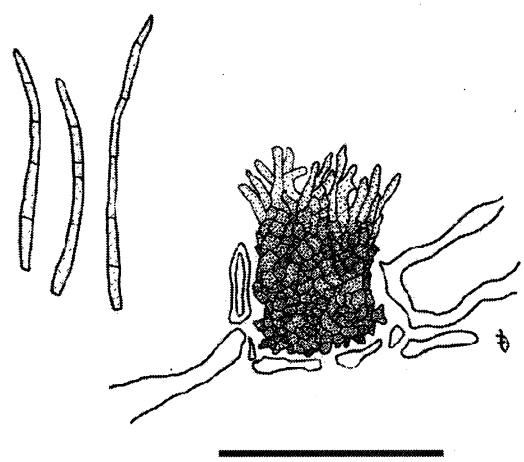


Fig. 3.137. Line drawings of conidia and conidiophores of *Pseudocercospora holmskioldiae* on *Holmskioldia sanginea* (from holotype). Bar = 50 μm.

Pseudocercospora viticicola (J. M.Yen & Lim) J. M. Yen, Gard. Bull., Singapore 33: 190, 1980.

≡ *Cercospora viticicola* J. M. Yen & Lim, Cah. Pacifique 17: 104, 1973.

= *Cercospora viticis* Ellis and Everh., J. Mycol. 3: 18, 1887.

≡ *Pseudocercosporella viticis* (Ellis & Everh.) B. K.Gupta and Kamal, Indian Phytopathol. 42: 388, 1989.

≡ *Pseudocercospora viticicola* U. Braun, Mycotaxon 48: 296, 1993.

= *Cercospora viticis* Sawada, Rep. Gov. Agric. Res. Inst. Taiwan 87: 90, 1944.

≡ *Pseudocercospora viticis* Goh & W. H. Hsieh, Trans. Mycol. Soc. R. O. C. 4: 11, 1989.

= *Cercospora viticis-quinatae* J. M. Yen, Bull. Soc. Mycol. France 93: 158, 1979.

≡ *Pseudocercospora viticis-quinatae* (J. M. Yen) J. M. Yen, Bull. Soc. Mycol. France 94: 388, 1979.

= *Pseudocercospora viticigena* J. M. Yen, A. K. Kar & B. K. Das, Mycotaxon 16: 68, 1982.

Leaf spots 2 – 8 mm wide, circular, angular to irregular, dark grayish to brown or center pale grey, grayish to brown to pale brown, dark brown margin. *Caespituli* amphigenous. *Stromata* lacking, a few dark brown cells. *Conidiophores* (15) 32.1 ± 10.2 (46) × (2.5) 3.3 ± 0.3 (4) µm, loosely to densely fasciculate, smooth, pale olivaceous to brown, straight to curved, geniculate, 0 – 3-septate. *Conidiogenous loci* inconspicuous, unthickened, not darkened. *Conidia* (15) 55.2 ± 18 (85) × (2.5) 3.4 ± 0.4 (4) µm, solitary, obclavate to obclavate-cylindrical, straight or slightly curved, 3 – 7-septate, smooth, pale olivaceous, subacute to obtuse at the apex, obconically truncate at the base, indistinctly 3 – 6-septate.

Specimen examined: on *Vitex quinata* (Lour.) Will., THAILAND, Chiang Mai Province, Suthep-Pui National Park, 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU 27964).

Host: *Vitex quinata* (Lour.) Will. (Verbenaceae) (Meeboon et al., 2007c).

Distribution: Brazil, China, Cuba, India, Japan, Philippines, Puerto Rico, Singapore, Taiwan, Thailand, USA, and Virgin Islands (Crous & Braun, 2003; Meeboon et al., 2007c).

Notes: The first record of this species from Thailand was done by Meeboon et al. (2007c). Its host, *Vitex quinata*, is common weeds native to tropical, subtropical, and also warm temperate regions throughout the world.

Family Zingiberaceae

Cercospora alpiniicola S. Q. Chen & P. K. Chi (*alpinicola*), Journal of South China Agricultural University 11: 57, 1990b; also in Chi, Fungal Diseases of Cultivated Medicinal Plants in Guangdong Province: 33, 1994.

Leaf spots 2 – 13 mm diameter amphigenous, distinct, circular to irregular, pale olivaceous to brown at the center, sometimes discoloration forming surrounding the margin. *Caespituli* amphigenous. *Stromata* 12.5 – 19 µm diametersmall, substomatal to intraepidermal, composed of a few globose to subglobose, brown-walled cells. *Conidiophores* 48.5 – 100 × 4.5 – 6.5 µm, 3 – 8 in a loosely to densely fasciculate, 1 – 3-septate, arising from stromata, straight, smooth, brown at the base, and paler toward the apex, unbranched, cylindrical, strongly geniculate. *Conidiogenous cells* integrated, holoblastic, terminal, polyblastic, sometimes monoblastic, sympodially proliferating. *Conidiogenous loci* 1.3 – 2.8 µm diameterconspicuous, thickened, and darkened. *Conidia* 39.5 – 162 × 3.5 – 5.5 µm, solitary, obclavate to acicular, straight, slightly curved, hyaline, 4 – 11-septate, smooth, obconically truncate at the base, tapering toward a subacute apex, hila 2 – 2.5 µm diameter, thickened and darkened. (Fig. 3.138)

Specimen examined: on *Alpinia purpurata* K. Schum, THAILAND, Chiang Mai Province, Amphur Sanpatong, Tambol Mae Win, Bahn Mae Sapok, Mae Sapok Royal Project, 8 February 2008, Jamjan Meeboon (BBH 23684).

Host: *Alpinia purpurata* K. Schum, (Zingiberaceae).

Distribution: China (Chen & Chi, 1990b).

Notes: This specimen is the first record of *C. alpiniicola* from Thailand, and *A. purpurata* is reported in this study as a new host of this fungus. The host, *Alpinia purpurata*, is ornamental plant native to Malaysian peninsula.

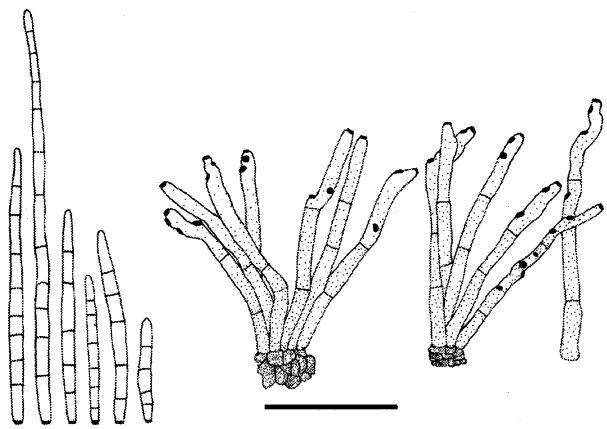


Fig. 3.138. Line drawings of conidia and conidiophores of *Cercospora alpiniicola* on *Alpinia purpurata*. Bar = 50 µm.

Table 3.1. The list of cercosporoid fungi published by Petcharat and Kanjanamaneesathian (1989), collected from Songkhla Province, Thailand.

Species of *Cercospora* (Published name)	**Current name**	**Family/Species of Host Plants**
Cercospora rhinacanthi Höhn.	*Pseudocercospora rhinacanthi* (Höhn.) Deighton	Acanthaceae/*Rhinacanthus nasutus* Kuntze
Cercospora celosiae Syd.	*Cercospora celosiae* Syd.	Amaranthaceae/*Celosia argentea* L.
Cercospora anacardii A.S. Mull. & Chupp	*Pseudocercospora anacardii* E. Castell. & Casulli	Anacardiaceae/*Anacardium occidentale* L.
Cercospora mangiferae Koord.	*Scolecostigmina mangiferae* (Koord.) U. Braun & Mouch.	Anacardiaceae/*Mangifera indica* L.
Cercospora apii Fresen.	*Cercospora apii* Fresen.	Apiaceae/*Apium graveolens* L.
Cercospora sp.1		Apocynaceae/*Alstonia macrophylla* Wall.
Cercospora plumeriae Chupp	*Pseudocercospora plumeriae* (Chupp) Tak. Kobay., Nishij. & C. Nakash.	Apocynaceae/*Plumeria acuminata* Ait.
Cercospora nerii-indici W. Yamam.	*Pseudocercospora kurimensis* (Fukui) U. Braun	Apocynaceae/*Nerium indicum* Mill.
Cercospora eupatorii Peck	*Pseudocercospora eupatorii* (Peck) U. Braun & R.F. Castañeda	Asteraceae/*Eupatorium odoratum* L.
Cercospora helianthicola Chupp & Viégas	*Cercospora apii s.lat.*	Asteraceae/*Helianthus annuus* L.
Cercospora mikaniicola F. Stevens	*Cercospora mikaniicola* F. Stevens	Asteraceae/*Mikania cordata* (Burm.f.) B.L.Rob.
Cercospora zinniae Ellis & G. Martin	*Cercospora apii s.lat.*	Asteraceae/*Zinnia elegans* Jacq.
Cercospora fukushiana (Matsuura) W. Yamam.	*Cercospora apii s.lat.*	Balsaminaceae/*Impatiens balsamina* L.
Cercospora brassicicola Henn.	*Cercospora brassicicola* Henn.	Brassicaceae/*Brassica oleracea* L.
Cercospora sp.2		Combretaceae/*Quisqualis conferta* (Jack) Exell
Cercospora timorensis Cooke	*Pseudocercospora timorensis* (Cooke) Deighton	Convolvulaceae/*Ipomoea batatas* (L.) Lam.
Cercospora citrullina Cooke	*Cercospora apii s.lat.*	Cucurbitaceae/*Coccinia grandis* (L.) Voigt
Cercospora citrullina Cooke	*Cercospora apii s.lat.*	Cucurbitaceae/*Momordica charantia* L.
Cercospora transvaalensis Syd.	*Pseudoercospora transvaalensis* (Syd.) Deighton	Euphorbiaceae/*Acalypha indica* L.
Cercospora henningsii Allesch.	*Passalora henningsii* (Allesch.) R.F. Castañeda & U. Braun	Euphorbiaceae/*Manihot esculenta* Crantz
Cercospora ricinella Sacc. & Berl.	*Cercospora ricinella* Sacc. & Berl.	Euphorbiaceae/*Ricinus communis* L.
Cercospora hydrangeae Ellis & Everh.	*Cercospora apii s.lat.*	Hydrangeaceae/*Hydrangea macrophylla* (Thunb.) Ser.
Cercospora abelmoschi Ellis & Everh.	*Pseudocercospora abelmoschi* (Ellis & Everh.) Deighton	Malvaceae/*Abelmoschus esculentus* Moench

Cercospora subsessilis Syd.	*Pseudocercospora subsessilis* (Syd. & P. Syd.) Deighton	Meliaceae/*Melia azedarach* L.
Cercospora tinosporae Syd. & P. Syd.	*Cercosporella dioscoreophylli* (Henn.) Deighton	Menispermaceae/*Tinospora cordifolia* Miers
Cercospora mori Hara	*Pseudocercospora mori* (Hara) Deighton	Moraceae/*Morus alba* L.
Cercospora sawadae W. Yamam.	*Pseudocercospora sawadae* (W. Yamam.) Goh & W.H. Hsieh	Myrtaceae/*Psidium guajava* L.
Cercospora nymphaeacea Cooke & Ellis	*Pseudocercospora nymphaeacea* (Cooke & Ellis) Deighton	Nymphaeaceae/*Nymphaea lotus* L.
Cercospora arachidicola Hori	*Passalora arachidicola* (Hori) U. Braun	Fabaceae/*Arachis hypogaea* L.
Cercospora personata (Berk. & M.A. Curtis) Ellis	*Passalora personata* (Berk. & M.A. Curtis) S.A. Khan & M. Kamal	Fabaceae/*Arachis hypogaea* L.
Cercospora bradburyae E. Young	*Pseudocercospora bradburyae* (E. Young) Deighton	Fabaceae/*Centrosema pubescens* Benth.
Cercospora kikuchii (Tak. Matsumoto & Tomoy.) M.W. Gardner	*Cercospora apii s.lat.*	Fabaceae/*Glycine max* (L.) Merr.
Cercospora canescens Ellis & G. Martin	*Cercospora apii s.lat.*	Leguminosae/*Phaseolus aureus* Roxb.
Cercospora cruenta Sacc.	*Pseudocercospora cruenta* (Sacc.) Deighton	Fabaceae/*Vigna sesquipedalis* (L.) Fruwirth
Cercospora fuscovirens Sacc.	*Passalora fuscovirens* (Sacc.) U. Braun & Crous	Passifloraceae/*Passiflora foetida* L.
Cercospora sesami Zimm.	*Pseudocercospora sesami* (Hansf.) Deighton	Pedaliaceae/*Sesamum orientale* L.
Cercospora artanthes Henn.	*Pseudocercospora artanthes* (Henn.) Crous, Alfenas & R.W. Barreto	Piperaceae/*Piper sarmentosum* Roxb.
Cercospora oryzae T. Miyake	*Passalora janseana* (Racib.) U. Braun	Poaceae/*Oryza sativa* L.
Cercospora punicae Henn.	*Pseudocercospora punicae* (Henn.) Deighton	Lythraceae/*Punica granatum* L.
Cercospora puderi B.H. Davis	*Pseudocercospora puderi* B.H. Davis ex Deighton	Rosaceae/*Rosa* L.
Cercospora borreriae Ellis & Everh.	*Pseudocercospora borreriae* (Ellis & Everh.) Deighton	Rubiaceae/*Mitracarpus* Zucc.
Cercospora capsici Heald & F.A. Wolf	*Cercospora physalidis* Ellis	Solanaceae/*Capsicum annuum* var. *grossum* Sendtn.
Cercospora capsici Heald & F.A. Wolf	*Cercospora physalidis* Ellis	Solanaceae/*Capsicum annuum* L.
Cercospora capsici Heald & F.A. Wolf	*Cercospora physalidis* Ellis	Solanaceae/*Capsicum frutescens* L.
Cercospora fuligena Roldan	*Pseudocercospora fuligena* (Roldan) Deighton	Solanaceae/*Lycopersicum esculentum* Mill.
Cercospora nicotianae Ellis & Everh.	*Cercospora physalidis* Ellis	Solanaceae/*Nicotiana tabacum* L.
Cercospora physalidis Ellis	*Cercospora physalidis* Ellis	Solanaceae/*Physalis minima* L.
Cercospora solani-melongenae Chupp	*Pseudocercospora egenula* (Syd.) U. Braun & Crous	Solanaceae/*Solanum melongena* L.

Cercospora sp. 3		Acanthaceae/*Thunbergia grandiflora* Roxb.
Cercospora formosana W. Yamam.	*Pseudocercospora formosana* (W. Yamam.) Deighton	Verbenaceae/*Lantana camara* L.
Cercospora guianensis F. Stevens & Solheim	*Pseudocercospora guianensis* (F. Stevens & Solheim) Deighton	Verbenaceae/*Lantana camara* L.

Table 3.2. The list of cercosporoid fungi from Thailand published by Sontirat *et al.* (1980).

Species of *Cercospora* (Published name)	**Current name**	**Family/Species of Host Plants**	**Collection site (province)**
Cercospora gerberae Chupp & Viégas	*Cercospora apii s.lat.*	Asteraceae/*Gerbera* L.	Patumthani
Cercospora longissima Cugini ex Traverso	*Cercospora lactucae-sativae* Sawada	Asteraceae/*Lactuca indica* L.	Chiang Mai
Cercospora zinniae Ellis & G. Martin	*Cercospora apii s.lat.*	Asteraceae/*Zinnia elegans* Jacq.	Chonburi
Cercospora henningsii Allesch.	*Passalora henningsii* (Allesch.) R.F. Castañeda & U. Braun	Euphorbiaceae/*Manihot esculenta* Crantz	Kalasin
Cercospora ricinella Sacc. & Berl.	*Cercospora ricinella* Sacc. & Berl.	Euphorbiaceae/*Ricinus communis* L.	Kanjanaburi
Cercospora oryzae T. Miyake	*Passalora janseana* (Racib.) U. Braun	Poaceae/*Oryza sativa* L.	Nakornpathom
Cercospora menthicola Tehon & E.Y. Daniels	*Cercospora apii s.lat.*	Lamiaceae/*Mentha arvensis* L.	Lumphun
Cercospora arachidicola Hori	*Passalora arachidicola* (Hori) U. Braun	Fabaceae/*Arachis hypogaea* L.	Kalasin
Cercospora canescens Ellis & G. Martin	*Cercospora apii s.lat.*	Fabaceae/*Vigna sesquipedalis* (L.) Fruwirth, *Phaseolus aureus* Roxb.	Singhburi
Cercospora cruenta Sacc.	*Pseudocercospora cruenta* (Sacc.) Deighton	Fabaceae/*Vigna sesquipedalis* (L.) Fruwirth	Singhburi
Cercospora kikuchii (Tak. Matsumoto & Tomoy.) M.W. Gardner	*Cercospora apii s.lat.*	Fabaceae/*Glycine max* (L.) Merr.	Nakornrachasrima
Cercospora personata (Berk. & M.A. Curtis) Ellis	*Passalora personata* (Berk. & M.A. Curtis) S.A. Khan & M. Kamal	Fabaceae/*Arachis hypogaea* L.	Kalasin
Cercospora gossypina Cooke	*Cercospora gossypina* Cooke	Malvaceae/*Gossypium* L. sp.	Kanjanaburi
Cercospora mori Hara	*Pseudocercospora mori* (Hara) Deighton	Moraceae/*Morus alba* L.	Khon Kaen
Cercospora dendrobii H.C. Burnett	*Pseudocercospora dendrobii* (H.C. Burnett) U. Braun & Crous	Orchidaceae/*Dendrobium* Sw. sp.	Bangkok

Cercospora sesami Zimm.	*Pseudocercospora sesami* (Hansf.) Deighton	Pedaliaceae/*Sesamum indicum* L.	Kalasin
Cercospora insulana Sacc.	*Cercospora insulana* Sacc.	Plumbaginaceae/*Limonium* Mill. sp.	Chiang Mai
Cercospora coffeicola Berk. & Cooke	*Cercospora coffeicola* Berk. & Cooke	Rubiaceae/*Coffea arabica* L.	Chiang Mai
Cercospora capsici Heald & F.A. Wolf	*Cercospora physalidis* Ellis	Solanaceae/*Capsicum annuum* L.	Lumphun
Cercospora fuligena Roldan	*Pseudocercospora fuligena* (Roldan) Deighton	Solanaceae/*Lycopersicon esculentum* Mill.	Bangkok
Cercospora nicotianae Ellis & Everh.	*Cercospora physalidis* Ellis	Solanaceae/*Nicotiana tabacum* L.	Lumphun
Cercospora apii Fresenius	*Cercospora apii* Fresenius	Apiaceae/*Apium graveolens* L.	Bangkok

The map of Thailand shows collection site.

CHAPTER 4

COMPARISON STUDY OF THE SPECIES DIVERSITY OF *CERCOSPORA* AND *PSEUDOCERCOSPORA* IN ASIA

In this thesis, basic information such as list of species in every floristic region is collected to overview the distribution of cercosporoid fungi in Asia. From the list of species, the ratio of *Pseudocercospora* to *Cercospora* species in each country and region, and the similarity of species composition among the regions were derived. The ratio of *Pseudocercospora* to *Cercospora* species in each country is very important to know in order to explain the tendency of geographical distribution on the generic level.

At this time, due to a lack of collections of cercosporoid fungi in tropical countries in Asia, which are mostly developing countries such as Indonesia, Thailand, Myanmar, Vietnam, etc., it is difficult to provide the definitive conclusion of geographical distribution of the cercosporoid fungi in this area. On the other hand, some regional monographs and list as part of plant pathogens were published by a few investigators (Sontirat et al., 1980; Kanjanamaneesathian, 1989; Nakashima et al., 2007; Meeboon et al.; 2007a, b, c, d, e; Thaung, 1976, 1984; Yen, 1966, 1981, 1983; Yen and Lim, 1969, 1973, 1980; Boedijn, 1961; and Braun, 2001). Based on these literatures, the composition of *Cercospora* and *Pseudocercospora* species were studied, and divided into two groups. These were;

1. Group of cosmopolitan species in the tropics or a temperate region, e.g. *Cercospora apii*, *C. canescens*, etc.
2. Group of indigenous species which are restricted the distribution related to that of host plants, e.g. *C. agavicola* on *Agave tequilana*.

From the results of aggregate number of these species, there appears to be a small number of cosmopolitan species of the *Cercospora* and *Pseudocercospora* in Asian floristic regions (tables 4.1 and 4.2). Of the 863 species of *Cercospora* species listed from several countries in Asia, 10 species, namely, *C. althaeina*, *C. apii*, *C. asparagi*, *C. beticola*, *C. brassicicola*, *C. canescens*, *C. citrullina*, *C. hydrangeae*, *C. ipomoeae*, and *C. physalidis*, have been commonly observed (table 4.1). However, the number of cosmopolitan species of *Pseudocercospora* is fewer than *Cercospora*. Only four out of 780 *Pseudocercospora* species, which are *P. abelmoschi*, *P. cruenta*, *P. fijiensis*, and *P. musae*, have been widely distributed in Asia (table 4.2). It is known that the hosts of *Cercospora* are mainly herbal plants, but that of *Pseudocercospora* are mainly arboreal plant in Asian countries. In addition, hosts of

cosmopolitan species are crop which are mainly cultivating as a vegetable or flowers. That is why the high rate of cosmopolitan species of *Cercospora* in these areas is elucidated.

4.1. Circumboreal region

Circumboreal region which is the largest floristic region located in temperate area includes Canada, Alaska, Europe, Caucasus and Russia and adjacent countries (former USSR), as well as North America. The systematic records of *Cercospora* and *Pseudocercospora* in Russia are published by Braun and Melnik (1997). In Russia and adjacent countries, the number of species of *Cercospora* (221 species) is more diverse than that of *Pseudocercospora* (45 species) (tables 4.1, 4.2, 4.3; fig. 4.1). The information from Russia and adjacent countries does not represent the Circumboreal region, as it is only small part of this region. Although, additional information from other countries within this region is required, the data of Russia and adjacent countries was used as the representative value of this region from its vast area. *Cercospora* species number is higher than *Pseudocercospora*, based on ratio between the two genera. This region is the highest in species number of *Cercospora* in other regions of Asia, but lowest in *Pseudocercospora*. Sørensen's index of similarity (QS) from this region showed the species composition and diversity of *Cercospora* in this region is similar to Eastern Asiatic region (QS= 0.358), but that of *Pseudocercospora* species is closed to Indochinese region (QS= 0.163) (table 4.5).

4.2. Eastern Asiatic region

The Eastern Asiatic Region located in northern part of temperate region range from the Tropic of Cancer (at 23.5°north latitude) to the Arctic Circle (at 66.5°north latitude). It has been recognized as a natural floristic area, and characterized by very old lineages of gymnosperms and woody plant families. The information of *Cercospora* and *Pseudocercospora* species from this region are mostly contributed by Guo (2001a, b; 2002a, b, c), Guo and Hsieh (1995), Guo and Jiang (2000a, b, c), Guo and Xu (2002a, b) from China; Shin and Kim (2001) from Korea; Goh and Hsieh (1987a, b, c), Hsieh and Goh (1990) from Taiwan; and Katsuki (1965), Katsuki and Kobayashi (1975), Kobayashi (2007), Nakashima (2001), Nakashima et al. (1999, 2002, 2004, 2006) from Japan.

The highest number of *Cercospora* species in several countries within this region was recorded from China with 228 species, followed by Japan (129 species), Taiwan (90 species), Korea (62 species) and Hong Kong (18 species) (table 4.1). Likewise, that of *Pseudocercospora* species was also reported from China (369 species), followed by Taiwan (210 species), Japan

(183 species), Hong Kong (116) and Korea (44 species) (table 4.2). From this information, it is suggested that *Pseudocercospora* is dominant in this region except Korea (fig. 4.1). Although the data from Korea was mainly reported from South Korea, the species composition of Korea was similar to that of Russia rather than that of Eastern Asiatic region. In general, the composition of *Cercospora* species in this region is similar to Circumboreal region (QS= 0.358), but *Pseudocercospora* species composition is much closer to Indochinese region (QS= 0.391) (table 4.5).

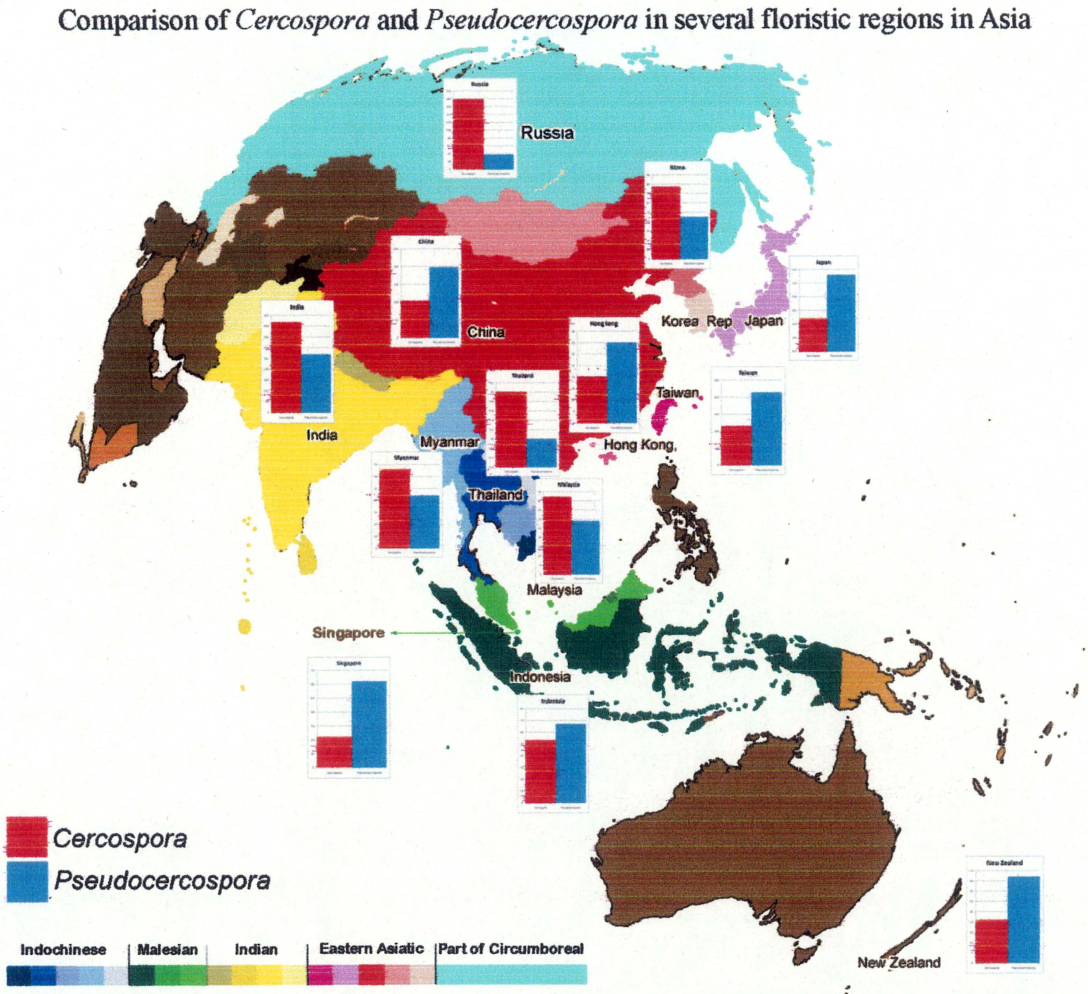


Fig. 4.1. Comparison of *Cercospora* and *Pseudocercospora* species diversity in several floristic regions in Asia.

4.3. Indian region

India also contains a large number of cercosporoid fungi, many of which are also known from neighboring countries. The information of *Cercospora* and *Pseudocercospora* species from this region were mostly contributed by Thirumalachar and Misra (1953), Thirumalachar and Govindu (1953, 1956), Govindu and Thirumalachar (1955), Chona et al. (1959), Munjal et al.

(1959), Vasudeva (1963), Bagyanarayana and Braun (1999), and Bhartiya et al. (2000). In general, the flora of India is characterized by the tropical forests which is similar to Indochinese region. Nowadays these areas are covered by secondary forest, shrubs or grassland, crops, etc. Natural vegetation in India ranges over Himalaya rain forests of Southern part, and desert. Especially, the tropical rain forests of Southern India are playing an important role in natural vegetation in India.

In this region, the species number of *Cercospora* is higher than *Pseudocercospora*. However, among other regions, Indian region is the highest in species richness of *Pseudocercospora* (tables 4.1, 4.2, 4.3). Sørensen's index of similarity (QS) showed that species composition of *Cercospora* and *Pseudocercospora* from Indian region is the most similar in that from Eastern Asiatic and Indochinese regions (table 4.5). This pattern is probably due to the similarity in geographical location where these regions are located in northern part of temperate region; and besides, the Indian region, Circumboreal and Eastern Asiatic region are adjacent to one another.

4.4. Indochinese region

The flora of Indochinese region is well known as the tropical monsoon area which is dominated by evergreen broad-leaves, mixed or coniferous forest. But it nowadays is covered by secondary forest, shrubs or grassland, bamboo, tree plantation, crops, and vegetable fields. The information of *Cercospora* and *Pseudocercospora* species from this region were mostly contributed by Sontirat et al. (1980), Kanjanamaneesathian (1989), Nakashima et al. (2007), Meeboon et al. (2007a, b, c, d, e) from Thailand; and Thaung (1976, 1984) from Myanmar.

In our dataset, the species richness of *Cercospora* and *Pseudocercospora* species are higher in Thailand than Myanmar (tables 4.1; 4.3). The *Cercospora* and *Pseudocercospora* species composition from this region is most similar to those of Malesian region with QS = 0.622 and QS = 0.382, respectively (table 4.5). It is probably due to the similarity in flora composition (vegetation) and geographical location between the two floristic regions. However, due to the limited information collected from this region (only Thailand and Myanmar) (fig. 4.1), it is difficult to estimate the diversity and species composition of *Cercospora* and *Pseudocercospora* species from this region. Ongoing investigations in Thailand reveal the presence of a large number of previously unrecorded species of the *Cercospora* and *Pseudocercospora* (Nakashima et al., 2007; Meeboon et al., 2007a, b, c, d, e). Then, the number of records for *Cercospora* and *Pseudocercospora* species in this region might increase significantly with the consecutive survey. Further survey in other countries of this region is

required in order to have a better understanding of species diversity and composition of *Cercospora* and *Pseudocercospora*.

4.5. Malesian region

The information of *Cercospora* and *Pseudocercospora* species from this region are mostly contributed by Yen (1966, 1981, 1983), Yen and Lim (1969, 1973, 1980) from Singapore and Malaysia; and Boedijn (1961) and Braun (2001) from Indonesia. In Malesian region, *Pseudocercospora* is higher in species number than *Cercospora*, and the species richness of *Cercospora* in this region is only higher than New Zealand and surrounded islands (table. 4.1; 4.2; 4.3).

The data from Malaysia showed that the number of species of *Cercospora* is higher than that of *Pseudocercospora* (table. 4.1; 4.2; 4.3). On the other hand, another part of Malaysia which is adjacent to Borneo island of Indonesia has not been explored well. In fact, this area is known as one of the largest rainforests that maintain the high diversity of tropical plants. Thus, a great deal of unknown species of cercosporoid fungi maybe discovered by further research in rainforests of Indonesia and Peninsular Malaysia. Indonesia is the richest in the species number of *Cercospora* species (48 species), followed by Malaysia (37 species) and Singapore (22 species) (table 4.1). The species number of the genus *Pseudocercospora* in Singapore, however, was richer (69 species) than that in Indonesia (66 species) and Malaysia (28 species) (table. 4.2). Furthermore, the *Cercospora* and *Pseudocercospora* species composition from this region is the most similar in those of Indochinese region with QS= 0.622 and QS= 0.382, respectively (table 4.5).

4.5. New Zealand and Cook islands

In this region, *Pseudocercospora* is higher in species number than *Cercospora* (table 4.3). Most of the information of the species of *Cercospora* and *Pseudocercospora* in this floristic region were mostly contributed by McKenzie (1989, 1996), McKenzie and Jackson (1986, 1990, 1996), and Pennycook (1989). These information have shown that the species number of *Cercospora* species from this region is the lowest in that from other regions in Asia (table 4.3), and the diversity of *Pseudocercospora* is only higher than Circumboreal region (table 4.3). The species composition of *Cercospora* and *Pseudocercospora* in this region is similar to those of eastern Asiatic and Indochinese regions (table 4.5).

4.6. Northern and southern hemisphere distribution of *Cercospora* and *Pseudocercospora*

The species number of *Cercospora* is richer than that of *Pseudocercospora* in continent countries, while *Pseudocercospora* is richer than *Cercospora* in the pacific island countries in Asia. There are some factors that might affect this phenomenon. Cercosporoid fungi depend on host plants on most of its life cycle. Therefore, the species diversity of cercosporoid fungi reflect that of host plants. It is consistent that Asian countries is rich in diversity of that. As for the richness in species diversity of *Cercospora* in continental part of Asia, it is concerned in the diversity of herbal crops which are generally used as host plants by these fungi. According to the hitherto known results of inoculation tests, the incubation period before sporulating of *Cercospora* on herbal plants are usually 5 to 14 days. On the other hand, those of *Pseudocercospora* on arboreal plants are usually 1 to 6 months. In addition, the host specificity of *Cercospora* appear to be doubt (Nakashima, unpublished data). These facts show that the genus *Cercospora* fungi has the wide-host range and the ability of spreading quickly. From these reason, it is natural for *Cercospora* species to be dominant in Asian continent having continuous flora. On the other hand, *Pseudocercospora* species which mainly inhabit on arboreal plants and indicate the independent lineage on each of the plant genus on phylogenetic relationship (Hunter, unpublished data) are rich in the Pacific-island countries where endemic plants are diverse. More detail studies on diversity and phylogeny of cercosporoid fungi in these region might bring in the scientific benefits such as the origin, adaptation, and speciation of these plant-parasitic fungi.

Table 4.1. Species diversity and distribution of genus *Cercospora* in Asia.

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora abacopteridis					1									
Cercospora abchasica		1												
Cercospora abelmoschi-cannabini													1	
Cercospora abelmoschidis													1	
Cercospora abromae												1		
Cercospora acalyphae							1				1	1	1	1
Cercospora acalyphigena													1	
Cercospora acanthacearum var. macrospora													1	
Cercospora acanthacearum													1	
Cercospora acanthi							1							
Cercospora acerigena												1		
Cercospora acerina	1											1		
Cercospora aceris	1										1			
Cercospora acerosum														
Cercospora acetosellae var. maculosa		1												
Cercospora achyranthina							1					1	1	
Cercospora achyranthis	1		1	1								1	1	
Cercospora aconiti		1												
Cercospora acrocarpicola													1	
Cercospora actinidiae												1		
Cercospora acuminata													1	
Cercospora adenostemmatis	1													
Cercospora adhatodae													1	
Cercospora adianticola													1	
Cercospora adiantigena														1
Cercospora adinae							1						1	
Cercospora adiniana													1	
Cercospora adonidis		1												
Cercospora adusta		1	1									1		
Cercospora aecidiicola													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora aegles-marmelos													1	
Cercospora aeruae													1	
Cercospora aervae-lanatae													1	
Cercospora ageraticola				1								1		
Cercospora agerati-conyzoidis													1	
Cercospora agharkari										1			1	
Cercospora agnostoica		1												
Cercospora agrostidis		1												
Cercospora ailanthi		1												
Cercospora aizoacearum													1	
Cercospora ajrekari													1	
Cercospora albiziae													1	
Cercospora albizzicola													1	
Cercospora alchemillae		1												
Cercospora alchemillicola						1								
Cercospora alhagi		1												
Cercospora alismaticola												1		
Cercospora alocasiae	1			1			1				1	1		
Cercospora alpiniae-katsumadae												1		
Cercospora alpiniicola												1		1
Cercospora althaeae		1		1										
Cercospora althaeina	1	1	1	1		1	1	1				1	1	1
Cercospora alysicarpi							1						1	
Cercospora amaranthi		1												
Cercospora amaryllidicola													1	
Cercospora amberboae													1	
Cercospora ammanniae													1	
Cercospora amorphophalli	1										1	1		
Cercospora amorphophallicola											1			
Cercospora amphicarpaeae	1											1		
Cercospora amygdali		1												
Cercospora anacardii-occidentale													1	
Cercospora anagallidis													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora anaphalidis													1	
Cercospora andrographidicola												1		1
Cercospora andrographidis													1	
Cercospora angulata		1										1		
Cercospora angustata													1	
Cercospora anisochilicola													1	
Cercospora anisochilicola													1	
Cercospora annamalaiensis													1	
Cercospora annulata													1	
Cercospora anonae													1	
Cercospora antirrhini	1													
Cercospora angelicae												1		
Cercospora carotae	1	1		1										
Cercospora apii var. petroselini		1												
Cercospora apii	1	1	1	1	1	1	1	1	1		1	1	1	1
Cercospora apiicola			1											
Cercospora apiifoliae		1												
Cercospora apios				1										
Cercospora aquilegiae		1												
Cercospora arachidis		1												
Cercospora arachniodis												1		
Cercospora araliae-cordatae	1		1	1								1		
Cercospora arctii-ambrosiae	1	1	1	1								1		
Cercospora ardisiae				1										
Cercospora arecacearum														1
Cercospora argyreiae													1	
Cercospora ari		1												
Cercospora aricola												1		
Cercospora arisaematis	1			1								1		
Cercospora aristolochiae-contortae			1											
Cercospora armoraciae	1	1	1			1								
Cercospora arracacina												1		
Cercospora artemisiae												1		1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora artocarpi													1	
Cercospora asparagi	1	1	1	1				1	1		1	1	1	
Cercospora aspera													1	
Cercospora asperuginis		1												
Cercospora asplenii							1			1			1	
Cercospora aspleniifoliae													1	
Cercospora assamensis													1	
Cercospora asteracearum													1	
Cercospora asteris	1													
Cercospora astilbes	1	1												
Cercospora astragali	1	1		1								1		
Cercospora asystasiana					1									
Cercospora atractylidis												1		
Cercospora atriplicis		1												
Cercospora atromaculans	1	1												
Cercospora atylosiae													1	
Cercospora atylosigena													1	
Cercospora atylosiicola													1	
Cercospora aucubae	1													
Cercospora austrinae												1		
Cercospora averrhoae				1					1		1	1		
Cercospora avicennae												1		
Cercospora avicenniae		1												
Cercospora bakeri	1			1								1		
Cercospora balaghatensis													1	
Cercospora balsaminiana					1									1
Cercospora bangalorensis													1	
Cercospora barleriicola													1	1
Cercospora baroipurensis													1	
Cercospora barringtoniae										1				
Cercospora bartholomei	1													
Cercospora basellae-albae													1	1
Cercospora bauhiniae-variegatae													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora begoniae	1			1				1				1		
Cercospora benghalensis													1	
Cercospora berteroae		1												
Cercospora bertrandii												1	1	
Cercospora beticola	1	1	1	1		1	1	1	1	1	1	1	1	1
Cercospora bidentis	1			1			1			1	1	1	1	1
Cercospora bidentis-biternatae													1	
Cercospora biharica													1	
Cercospora biophyti													1	
Cercospora bixaecola													1	
Cercospora bizzozeriana		1												
Cercospora blainvilleae													1	
Cercospora blumeae-olydontae													1	
Cercospora blumeicola													1	
Cercospora bombacicola													1	
Cercospora bombacina													1	
Cercospora bombacis				1								1	1	
Cercospora borreriae													1	
Cercospora borreriae-strictae													1	
Cercospora boswelliae													1	
Cercospora brachiata	1	1										1	1	
Cercospora brassicicola	1		1	1			1	1		1	1	1		1
Cercospora breyniae-rhamnoidis													1	
Cercospora broussonetiicola														1
Cercospora brunkii	1		1									1		
Cercospora burserae													1	
Cercospora buteae													1	
Cercospora cacaliae												1		
Cercospora cadabae													1	
Cercospora caesalpiniae													1	
Cercospora caladiicola										1		1	1	
Cercospora calendulae				1			1					1	1	
Cercospora calendulaecola													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora californiensis												1	1	
Cercospora calotropidis													1	
Cercospora campanulae													1	
Cercospora camptothecae				1								1		
Cercospora cana		1												
Cercospora canavaliicola				1								1	1	
Cercospora canavaliana					1									
Cercospora canescens	1	1	1	1		1	1	1	1	1		1	1	1
Cercospora cannabis	1											1	1	
Cercospora cannae												1	1	
Cercospora canscorina													1	
Cercospora capparidicola													1	
Cercospora capparis														
Cercospora capsicigena														1
Cercospora caracasensis													1	
Cercospora caracallae												1		
Cercospora carbonacea													1	
Cercospora cardamines			1									1		
Cercospora cardiospermi							1					1	1	
Cercospora careyae													1	
Cercospora caricigena													1	
Cercospora caricae-papayae													1	
Cercospora caricis													1	
Cercospora caricola														1
Cercospora carissae													1	
Cercospora carotae	1	1	1	1		1					1	1	1	
Cercospora carthami							1					1	1	
Cercospora caryopteridis													1	
Cercospora casearíae													1	
Cercospora cassiae-montanae													1	
Cercospora cassiae-nodosae					1			1						
Cercospora cassiatorae													1	
Cercospora cassiocarpa													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora castillae				1								1		
Cercospora catalpae												1		
Cercospora catharanthi													1	
Cercospora caulicola		1												
Cercospora caulophylli	1													
Cercospora ceibae							1						1	
Cercospora celastricola												1	1	
Cercospora celosiae	1						1	1				1	1	
Cercospora celosiicola													1	
Cercospora celosiae				1							1			1
Cercospora celosiicola													1	
Cercospora centaureae		1					1							
Cercospora cerasella		1												
Cercospora ceratocarpi		1												
Cercospora cercestidis-afzelii													1	
Cercospora chaae	1													
Cercospora chamaecyparidis	1													
Cercospora cheilanthis													1	
Cercospora cheiranthi var. brassicae													1	
Cercospora chelidonii												1		
Cercospora chevalieri													1	
Cercospora chondrillae		1												
Cercospora christellae														1
Cercospora cissi-japonicae	1													
Cercospora cercosporelloides				1										
Cercospora cestri-parqui													1	
Cercospora chenopodii-ambrosioidis				1										
Cercospora chenopodiicola		1												
Cercospora chidambarensis													1	
Cercospora chinensis												1		
Cercospora chionanthi				1								1		
Cercospora chloroxyli													1	
Cercospora chowdhuryi													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora chrozophorina													1	
Cercospora chrysanthemi	1	1	1	1			1		1			1	1	1
Cercospora cichorii		1	1										1	
Cercospora cichorii-intybi		1												
Cercospora cimicifugae												1		
Cercospora cipadessae													1	
Cercospora cirsii												1		
Cercospora cissi-japonicae	1													
Cercospora citrullina	1	1	1	1			1	1	1	1		1	1	1
Cercospora clausenae													1	
Cercospora clematidis		1												
Cercospora cleomes													1	
Cercospora clinopodii-vulgaris		1												
Cercospora cocciniae													1	1
Cercospora cocculi-hirsuti													1	
Cercospora codiaei														1
Cercospora codonopsis		1												
Cercospora coffeae-olivaceae													1	
Cercospora coffeicola	1			1			1			1	1	1	1	1
Cercospora coicis													1	
Cercospora coleana					1									
Cercospora colei											1			
Cercospora coleicola										1				
Cercospora colocasigena													1	
Cercospora combreti-ovalifolii													1	
Cercospora commelinae													1	
Cercospora commelinae-salicifoliae													1	
Cercospora commelinicola	1											1		
Cercospora confluens		1												
Cercospora confusa		1												
Cercospora consobrina		1												
Cercospora conyzoidis													1	
Cercospora corchori	1	1		1			1					1	1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora cordiae					1									
Cercospora coriandri		1												
Cercospora coreopsidis			1											
Cercospora coryli		1												
Cercospora corylina												1		
Cercospora cosmi												1	1	
Cercospora crassa		1												
Cercospora crassa var. solani-nigri		1												
Cercospora crassa f. sonchi		1												
Cercospora crinicola													1	
Cercospora crossandrae													1	
Cercospora crotalariae				1										
Cercospora crotonicola													1	
Cercospora cruciferarum		1					1					1		
Cercospora cryptocorynes													1	
Cercospora cryptomeriicola	1													
Cercospora cucurbitacea														1
Cercospora cucurbitae		1												
Cercospora cudraniae			1											
Cercospora curcumae							1						1	
Cercospora curcumae-longae													1	
Cercospora curcumina													1	
Cercospora curvata		1												
Cercospora cyathoclines													1	
Cercospora cyclosori				1									1	1
Cercospora cynanchi		1												
Cercospora cynarae												1		1
Cercospora cynodontis								1					1	
Cercospora cynoglossi		1												
Cercospora cyperi				1							1	1	1	
Cercospora daemiicola													1	
Cercospora dahlia	1													
Cercospora dahliicola	1												1	1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora dalbergiae-latifoliae													1	
Cercospora dalbergiicola													1	
Cercospora dandeliensis													1	
Cercospora dapoliana													1	
Cercospora datiscicola		1												
Cercospora davisii	1	1										1		
Cercospora delphinii		1												
Cercospora demetrioniana												1	1	
Cercospora depazeoides	1	1				1						1		
Cercospora depressa var. angelicae		1												
Cercospora depressa		1												
Cercospora desmodiicola													1	
Cercospora deutziae	1		1											
Cercospora dharwarensis													1	
Cercospora dianthi	1											1		
Cercospora digitalis			1									1	1	
Cercospora digitariae													1	
Cercospora dioscoreae-pyrifoliae					1							1	1	
Cercospora diospyricola													1	
Cercospora dispori	1		1											
Cercospora diplaziicola													1	
Cercospora dodonaeae													1	
Cercospora dontostemonicola		1												
Cercospora dracunculi												1	1	
Cercospora drymariae	1												1	
Cercospora dryopteridis												1		
Cercospora duddiae		1					1	1		1	1	1	1	
Cercospora dulcamaricola		1												
Cercospora durantae-erectae														1
Cercospora echii		1												
Cercospora echinochloae										1			1	
Cercospora eclipticola													1	
Cercospora edgeworthiae	1													

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora edgeworthiicola												1		
Cercospora ehikomontana	1													
Cercospora elaeagni														1
Cercospora elasticae											1			1
Cercospora elaterii		1												
Cercospora eleocharitis	1													
Cercospora eleusines	1												1	
Cercospora elongata	1	1										1		
Cercospora emodi													1	
Cercospora epilasiae		1												
Cercospora epilobii		1												
Cercospora epipactidis		1												
Cercospora eragrostis						1								
Cercospora erechtitis				1								1		
Cercospora erigeronicola							1							
Cercospora erysimi		1												
Cercospora erythrinae										1				
Cercospora erythrinae-lithospermae													1	
Cercospora erythrinae-suberosae													1	
Cercospora erythrinicola				1						1		1	1	1
Cercospora eulophiae													1	
Cercospora euodiae-rutaecarpae												1		
Cercospora euonymigena												1		
Cercospora eupatorii											1			1
Cercospora eupatorii-fortunei												1		
Cercospora euphorbiae												1		
Cercospora eupteleae	1													
Cercospora euryae												1		
Cercospora exitiosa		1												
Cercospora exochordae	1													
Cercospora fabae		1												
Cercospora fagopyri	1		1									1	1	
Cercospora farsetiana													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora ficina											1			1
Cercospora firmianae													1	
Cercospora flacourtiicola													1	
Cercospora flagellaris	1		1									1		
Cercospora flagelliformis			1											
Cercospora fleuryae							1						1	
Cercospora forsteriana												1		
Cercospora fragariae		1												
Cercospora fragarina												1		
Cercospora fuchsiae														1
Cercospora fuckelii		1												
Cercospora fukushiana	1	1	1	1			1	1	1		1	1	1	1
Cercospora fulvescens		1												
Cercospora fumosa		1												
Cercospora furfurella							1						1	
Cercospora gaillardiae													1	
Cercospora ganjetica													1	
Cercospora garugae													1	
Cercospora garugaecola													1	
Cercospora genkwa												1		
Cercospora gerberae				1	1		1	1	1	1	1	1	1	1
Cercospora glandulosa		1										1		
Cercospora glauciana										1				
Cercospora gloriosae											1		1	
Cercospora gloriosicola					1									
Cercospora glottidiicola												1		
Cercospora golaghatii													1	
Cercospora gorakhanathii													1	
Cercospora gorakhpurensis													1	
Cercospora gossypii		1	1									1	1	
Cercospora gossypiicola													1	
Cercospora gossypina	1			1			1				1	1	1	
Cercospora graminicola		1												

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora grandissima	1	1		1			1	1		1	1	1	1	
Cercospora guatemalensis	1											1	1	
Cercospora guizotiae		1												
Cercospora guizotiicola							1						1	
Cercospora gundeliae		1												
Cercospora gymnematis	1													
Cercospora gynandropsicola													1	
Cercospora gynandropsiicola													1	
Cercospora habenariicola														1
Cercospora haematoxyli													1	
Cercospora hainanensis												1	1	
Cercospora hamasensis	1													
Cercospora hamiltoniae													1	
Cercospora handelii	1					1								
Cercospora hanseni		1												
Cercospora hebbalensis													1	
Cercospora hederae	1													
Cercospora helvola		1												
Cercospora helianthicola	1									1		1	1	1
Cercospora heliconiae													1	
Cercospora heliotropii-bocconii		1												
Cercospora heliotropiicola													1	
Cercospora hemerocallidis												1		
Cercospora heraclei		1												
Cercospora heterophragmatis													1	
Cercospora heylandiae													1	
Cercospora hibicina													1	
Cercospora hibisci		1	1											
Cercospora hibisci-manihotis	1		1											
Cercospora hibiscivora												1		
Cercospora hitcheniae													1	
Cercospora holmskioldiae													1	
Cercospora hostae	1		1									1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora houttuyniicola				1										1
Cercospora hoveniae												1		
Cercospora humilis													1	
Cercospora humuligena												1		
Cercospora hyalina												1	1	
Cercospora hyalofilispora					1									
Cercospora hyalospora				1			1			1				
Cercospora hydrangeae	1	1	1	1			1	1	1	1		1	1	1
Cercospora hydrocotyles	1													
Cercospora hydroleae													1	
Cercospora hygrophilae													1	
Cercospora hyptidisicola													1	
Cercospora ilicicola	1													
Cercospora ilicis-opacae			1											
Cercospora imperatoriae var. indica													1	
Cercospora incarnata		1												
Cercospora indigoferae													1	
Cercospora instabilis				1							1	1	1	
Cercospora insulana	1	1				1	1						1	
Cercospora integrifoliae													1	
Cercospora iphigeniae													1	
Cercospora ipomoeae	1		1	1		1	1	1	1	1		1	1	1
Cercospora ipomoeae-illustris													1	
Cercospora ipomoeae-indicae				1										
Cercospora ipomoeae-pedis-caprae								1						
Cercospora ipomoeae-pes-caprae					1									
Cercospora jagdalpurensis													1	
Cercospora jamuensis													1	
Cercospora jasminae													1	
Cercospora jatrophae										1				
Cercospora jatrophicola				1				1					1	
Cercospora jatrophigena													1	1
Cercospora junci-filiformis		1												

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora juncicola	1	1										1		
Cercospora juncina		1												
Cercospora justiciaecola												1	1	
Cercospora justiciicola												1	1	
Cercospora kabatiana		1												1
Cercospora kalanchoes											1			
Cercospora kakivora	1		1											
Cercospora kamatensis													1	
Cercospora kanpurensis													1	
Cercospora kashiensis													1	
Cercospora kerriae	1	1												
Cercospora kickxiae													1	
Cercospora kigeliae													1	
Cercospora kikuchii	1		1	1				1		1	1	1		1
Cercospora kriegeriana		1												
Cercospora knautiae		1												
Cercospora knoxiae													1	
Cercospora koepkei var. sorghi	1													
Cercospora koraiensis			1											
Cercospora koreana			1											
Cercospora krugiana				1			1					1	1	
Cercospora kuznetzoviana		1												
Cercospora kyotensis	1										1			
Cercospora labiatacearum													1	
Cercospora labiatarum												1		
Cercospora lactucae-sativae	1	1	1	1							1			
Cercospora lagenariae													1	
Cercospora lanneae													1	
Cercospora lantanae											1			
Cercospora lantanae-indicae													1	1
Cercospora laporticola													1	
Cercospora lasianthi				1										
Cercospora lasianthicola				1										

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora lathyri		1										1		
Cercospora lathyrina	1	1										1		
Cercospora launaeae-aspleniifoliae													1	
Cercospora lawsoniae-albae													1	
Cercospora laxipes f. filipendulae		1												
Cercospora lecanthi													1	
Cercospora leeae-aecidiicola													1	
Cercospora lentis													1	
Cercospora leonuri		1	1									1		
Cercospora lepidagathidis													1	
Cercospora leptadeniana													1	
Cercospora lespedezae		1		1										
Cercospora leucaenae													1	1
Cercospora leucaenae-leucocephalae													1	
Cercospora levistici		1												
Cercospora licualae					1									
Cercospora ligustici	1													
Cercospora ligustri		1										1		
Cercospora ligustricola												1		
Cercospora lilacina		1												
Cercospora lingii												1		
Cercospora linicola													1	
Cercospora lippiae													1	
Cercospora longipes				1			1				1		1	
Cercospora longissima var. indica													1	
Cercospora loti		1				1								
Cercospora ludwigiana			1											
Cercospora luffae	1	1												
Cercospora lycii		1	1									1		
Cercospora lycopersici													1	
Cercospora lycopersicicola													1	
Cercospora lycopidis		1												
Cercospora lygodiicola													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora macromaculans												1		
Cercospora maculicola													1	
Cercospora madhauliensis													1	
Cercospora madrasensis													1	
Cercospora maianthemi	1	1												
Cercospora malachrae				1			1						1	
Cercospora malayensis	1		1	1				1		1		1	1	1
Cercospora malloti	1			1								1		
Cercospora malvacearum													1	
Cercospora malvarum		1	1									1		
Cercospora malvastri										1		1		
Cercospora malvicola		1										1		
Cercospora mandira													1	
Cercospora manihobae												1	1	
Cercospora marrubii												1	1	
Cercospora marsileae							1						1	
Cercospora martynicola													1	
Cercospora medicaginicola		1												
Cercospora medicaginis		1										1	1	
Cercospora medicaginis-lupulinae													1	
Cercospora megaspermae													1	
Cercospora mehran												1		
Cercospora melampyri		1												
Cercospora meliae				1			1					1	1	
Cercospora meliicola												1		
Cercospora meliloti		1												
Cercospora meliosmae												1		
Cercospora melonis		1												
Cercospora menthae	1													
Cercospora menthicola							1	1				1		
Cercospora mercurialis		1												
Cercospora mercurialis var. latvica		1												
Cercospora mercurialis var. multiseptata		1												

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora merremiae													1	
Cercospora microlaenae						1								
Cercospora microsorii													1	
Cercospora mikaniicola					1			1	1	1				1
Cercospora mimosae													1	
Cercospora mimulicola													1	
Cercospora miyakei	1													
Cercospora moravica		1												
Cercospora mirabilis			1								1	1	1	
Cercospora miscanthi				1										
Cercospora miyakei	1											1		
Cercospora moghamiicola													1	
Cercospora monsterae													1	
Cercospora moracearum													1	
Cercospora moricola		1										1	1	
Cercospora morina														1
Cercospora morindicola										1				
Cercospora mucronata													1	
Cercospora mucunicola												1		
Cercospora muelleriana													1	
Cercospora myristicae											1			
Cercospora myrti		1												
Cercospora nanocnides	1													
Cercospora nasturtii	1	1	1	1		1			1			1		
Cercospora nebulosa		1											1	
Cercospora negundinis		1										1		
Cercospora neobougainvillae														1
Cercospora neo-sphaeranthi													1	
Cercospora nepetae													1	
Cercospora nicotianicola					1			1						
Cercospora nigellae		1												
Cercospora nilghirensis												1	1	1
Cercospora nothosaervae														

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora nucifera													1	
Cercospora nyctanthidis													1	
Cercospora ochracea													1	
Cercospora ocimigena		1												
Cercospora oculata var. indica													1	
Cercospora odontitis													1	
Cercospora oedibasis		1												
Cercospora oldenlandiicola		1												
Cercospora olivascens var. minor													1	
Cercospora olivascens		1												
Cercospora onagrae		1										1		
Cercospora onobrychidis													1	
Cercospora operculinae														1
Cercospora oplismeni													1	
Cercospora oryzae var. rufipogonis													1	
Cercospora oxalidis														1
Cercospora oxyphylli													1	
Cercospora padi		1												
Cercospora paederiicola												1		
Cercospora paeoniae		1										1		
Cercospora panacicola												1		
Cercospora panacis										1				
Cercospora pantoleuca		1											1	
Cercospora papaveri		1	1	1			1					1	1	
Cercospora papavericola				1								1	1	
Cercospora papaverina													1	
Cercospora papayae				1			1			1	1	1	1	1
Cercospora papillosa											1			
Cercospora paridis		1												
Cercospora parthenii													1	
Cercospora partheniphila													1	
Cercospora passifloricola												1		
Cercospora patriniae												1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora pavettae-tomentosae													1	
Cercospora pavetticola													1	
Cercospora peckiana		1												
Cercospora pedicularis		1												
Cercospora pegani												1		
Cercospora pellioniae	1													
Cercospora penniseti	1												1	
Cercospora pentatis													1	
Cercospora penzigii	1	1										1	1	
Cercospora peregrina														1
Cercospora pericampyli													1	
Cercospora perillae	1		1											
Cercospora peristrophes													1	
Cercospora petila													1	
Cercospora phaseoli		1												
Cercospora phellodendri												1		
Cercospora phlogina		1												
Cercospora phlomidis		1												
Cercospora phyllanthicola					1			1						1
Cercospora physalidis	1	1	1		1		1	1	1	1	1	1	1	1
Cercospora physalidis-angulatae													1	1
Cercospora physostegiae														1
Cercospora piaropi													1	
Cercospora pileae												1		
Cercospora pingtungensis				1								1		
Cercospora pinnulaecola													1	
Cercospora piperata							1	1					1	
Cercospora piperis-betle				1								1	1	
Cercospora pircuniae												1		
Cercospora pisi-sativi											1	1	1	
Cercospora pistiae												1	1	
Cercospora plantaginis	1	1	1							1				
Cercospora platycerii														1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora pleopeltidis													1	
Cercospora plucheae-tomentosae													1	
Cercospora plumbaginea		1		1										
Cercospora polliae-japonicae												1		
Cercospora polygonacea	1	1	1	1								1	1	
Cercospora polygonati		1												
Cercospora polygoni-multiflori												1		
Cercospora polymorpha		1												
Cercospora polysciatis										1				
Cercospora poonensis													1	
Cercospora populicola		1												
Cercospora pouzolziae-auriculatae													1	
Cercospora pouzolziicola													1	
Cercospora populicola												1		
Cercospora potentillae		1										1		
Cercospora premnae	1													
Cercospora primulae		1												
Cercospora prosopidicola													1	
Cercospora pruinosivora													1	
Cercospora prunina				1										
Cercospora psophocarpicola	1				1		1							
Cercospora psoraleae-bituminosae		1					1					1		
Cercospora psychotriae				1								1		
Cercospora psylliostachydis		1												
Cercospora pteleae		1												
Cercospora pteridigena													1	
Cercospora pudicae'										1				
Cercospora puerariae-thomsonii												1		
Cercospora pulcherrimae	1			1			1	1	1		1	1	1	
Cercospora punctiformis		1		1								1		
Cercospora pupaliae													1	
Cercospora putranjivae													1	
Cercospora puttemansii													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora pycnanthemicola													1	
Cercospora pycnicola													1	
Cercospora querci var. robur		1												
Cercospora rabdosiae												1		
Cercospora radiata		1												
Cercospora ramularia		1												
Cercospora ranunculi		1												
Cercospora raphanistri		1												
Cercospora ratibidae												1		
Cercospora rautensis		1												
Cercospora rejouae													1	
Cercospora resedae		1				1								
Cercospora rhapontici		1												
Cercospora rhei		1												
Cercospora richardiicola	1													
Cercospora rhynchosiae													1	
Cercospora rhynchosiae-minimae													1	
Cercospora ribis		1				1						1		
Cercospora richardiicola								1	1					1
Cercospora ricinella	1	1	1	1			1	1		1	1	1	1	1
Cercospora ricini		1												
Cercospora riveae													1	
Cercospora rosigena										1				
Cercospora rottboelligena												1		
Cercospora roxburghii													1	
Cercospora rubigo		1												
Cercospora rufula								1			1			
Cercospora rumicis													1	
Cercospora rungiae													1	
Cercospora ruscicola													1	
Cercospora ryukyuensis	1													
Cercospora sagittariae	1	1	1									1		
Cercospora salviicola	1											1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora sapindicola	1								1			1		
Cercospora sauropodis												1		
Cercospora scaevolae											1			
Cercospora scandens		1								1				
Cercospora scharifii														1
Cercospora schreberae													1	
Cercospora scirpi		1												
Cercospora scopariae				1								1	1	
Cercospora scorzonerae		1												
Cercospora scrophulariae												1		
Cercospora sechiicola													1	
Cercospora selini-gmelinii												1		
Cercospora senecionicola												1	1	
Cercospora senecionis		1												
Cercospora senecionis-grahamii													1	
Cercospora sesami	1		1	1			1	1		1		1	1	
Cercospora sesamigena					1									
Cercospora sessilis		1												
Cercospora setariae	1	1		1		1						1	1	
Cercospora setariicola		1												
Cercospora sidaecola												1		
Cercospora sigesbeckiae	1											1		
Cercospora simarubaciensis													1	
Cercospora siphocampyli												1		
Cercospora smilacina		1												
Cercospora solanacea				1								1	1	
Cercospora solani		1					1						1	
Cercospora solanigena													1	
Cercospora solani-tuberosi													1	
Cercospora sonchi										1		1	1	
Cercospora sonchifolia													1	
Cercospora sophorae				1								1	1	
Cercospora sorghi var. cymbopogonis													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora sorghi	1	1	1	1			1	1		1	1	1		
Cercospora sorokinii		1												
Cercospora spermacoces													1	
Cercospora sphaeranthi													1	
Cercsopora spinaciicola											1			
Cercospora stachydis												1		
Cercospora stachyuricola												1		
Cercospora stahlianthi												1		
Cercospora stephaniae				1								1	1	
Cercospora stevensonii													1	
Cercospora stolziana		1												
Cercospora strigae													1	
Cercospora strobilanthis												1	1	
Cercospora stuhlmanni		1												
Cercospora styracicola												1		
Cercospora subhyalina			1											
Cercospora szechuanensis												1		
Cercospora tabacina			1											
Cercospora taccae								1		1	1			
Cercospora tagetis-erectae													1	1
Cercospora talini														1
Cercospora tamarindi													1	
Cercospora tarrii													1	
Cercospora taurica		1												
Cercospora tau-saghysiana		1												
Cercospora tectonae				1						1		1	1	1
Cercospora tephrosiicola													1	
Cercospora teramnicola													1	
Cercospora ternateae				1			1	1		1	1	1	1	
Cercospora tetragoniae	1	1												
Cercospora tetrastigmatis													1	
Cercospora teucrii		1											1	
Cercospora thalictricola	1													

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora theae	1	1		1							1	1	1	
Cercospora therryana		1												
Cercospora thirumalachariana													1	
Cercospora thirumalacharii													1	
Cercospora thumbergiae													1	
Cercospora thumbergiana					1								1	
Cercospora thunbergiana												1	1	
Cercospora togashiana	1													
Cercospora tomentosae										1				
Cercospora toxicodendri												1		
Cercospora trachyspermi		1												
Cercospora tragiae-folii													1	
Cercospora tragopogonis		1												
Cercospora trapae													1	
Cercospora trapae-bispinosae													1	
Cercospora traversiana		1					1					1	1	
Cercospora tremae-orientaliicola													1	
Cercospora trewiae													1	
Cercospora trianthematis													1	
Cercospora tricholepidis													1	
Cercospora tridacicola													1	
Cercospora tridacis-procumbentis							1			1			1	1
Cercospora triumfettae-rhomboideae													1	
Cercospora triumfetticola										1			1	
Cercospora truncata												1	1	
Cercospora tussilaginis												1		
Cercospora tylophorina													1	
Cercospora typhae		1												
Cercospora typhoidis													1	
Cercospora typhonii													1	
Cercospora ueharae	1													
Cercospora ugandensis													1	
Cercospora ulmicola		1												

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora undulata											1			
Cercospora uramensis												1	1	
Cercospora vangueriae													1	
Cercospora varanasiana													1	
Cercospora venezuelae var. indica													1	
Cercospora verbascicola		1										1		
Cercospora verniciferae												1		
Cercospora vernoniae													1	
Cercospora veronicae		1												
Cercospora viciae		1												
Cercospora vicina	1													
Cercospora vicoae													1	
Cercospora victorialis		1												
Cercospora villebruneae											1			
Cercospora violae	1	1	1	1		1						1		
Cercospora violae-sylvaticae		1												
Cercospora violae-tricoloris		1												
Cercospora violamaculans	1													
Cercospora virgaureae		1												
Cercospora volkameriae			1	1	1			1				1	1	1
Cercospora wagateae													1	
Cercospora wedeliicola													1	
Cercospora weigelae-japonicae												1		
Cercospora withaniae var. somnifera													1	
Cercospora wulffiae										1				
Cercospora xanthiicola														
Cercospora xanthi-strumari													1	
Cercospora yakushimensis	1													
Cercospora zeae-maydis		1										1	1	
Cercospora zebrina	1	1	1			1						1		
Cercospora zelkovae	1													
Cercospora zingibericola													1	
Cercospora zingiberis	1												1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Cercospora zinniae	1	1	1	1			1	1	1	1		1	1	1
Cercospora zinniicola													1	1
Cercospora zizaniae													1	
Cercospora ziziphigena												1		
Cercospora zonata	1	1		1								1	1	
Cercospora zygophylli		1												

Table 4.2. Species diversity and distribution of genus *Pseudocercospora* in Asia.

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora abacopteridicola					1									
Pseudocercospora abelmoschi	1	1	1	1		1	1	1		1		1	1	1
Pseudocercospora abeliae	1													1
Pseudocercospora aberrans				1								1		
Pseudocercospora abricola											1			
Pseudocercospora acaciae-confusae				1					1			1		
Pseudocercospora acalyphae													1	
Pseudocercospora acericola		1							1			1		
Pseudocercospora acerosa						1								
Pseudocercospora acetosellae		1												
Pseudocercospora actinidiae	1			1								1		
Pseudocercospora actinidiicola				1										
Pseudocercospora actinostemmae	1													
Pseudocercospora actinostemmatis	1			1					1			1		
Pseudocercospora adenosmae												1		
Pseudocercospora adinandrae												1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora adinicola													1	
Pseudocercospora agarwalii												1	1	
Pseudocercospora ageraticola				1										
Pseudocercospora ageratoides	1								1			1		
Pseudocercospora agharkarii													1	
Pseudocercospora ailanthicola												1		
Pseudocercospora ailanthigena													1	
Pseudocercospora alangii									1			1	1	1
Pseudocercospora aleuritis	1			1					1	1	1	1		1
Pseudocercospora allamandae					1									
(Pseudocercospora allophyli									1					
Pseudocercospora allophylina				1								1		
Pseudocercospora allophylorum													1	
Pseudocercospora alphitoniae								1						
Pseudocercospora alpiniae												1		
Pseudocercospora alpiniae-katsumadicola									1			1		
Pseudocercospora alpiniicola												1		
Pseudocercospora alstoniae				1								1		
Pseudocercospora alternantherae													1	
Pseudocercospora alternantherae-nodiflorae				1					1			1		
Pseudocercospora alternanthericola													1	
Pseudocercospora amaranthicola				1								1		
Pseudocercospora amomi											1	1		
Pseudocercospora amoorae													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora angiopteridis				1							1	1		
Pseudocercospora angolensis														1
Pseudocercospora angulata							1	1						
Pseudocercospora angulo-maculae				1								1	1	
Pseudocercospora angustata							1							
Pseudocercospora anisomelicola				1		1			1			1		
Pseudocercospora anisomelicola var. Ramosa													1	
Pseudocercospora annonacea													1	
Pseudocercospora annonae											1			
Pseudocercospora annonae-squamosae	1			1								1		
Pseudocercospora anogeissi													1	
Pseudocercospora aphanamixidis													1	
Pseudocercospora arachniodis												1		
Pseudocercospora araliae	1	1	1	1					1			1	1	1
Pseudocercospora arecacearum						1								
Pseudocercospora argyreiae													1	
Pseudocercospora aristoteliae						1						1		
Pseudocercospora artanthes												1		
Pseudocercospora artemisiicola												1		
Pseudocercospora artocarpi									1	1			1	
Pseudocercospora arunjae													1	
Pseudocercospora asiatica													1	
Pseudocercospora assamensis													1	
Pseudocercospora asteracearum													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora asystasiae	1													
Pseudocercospora athyrii				1								1		
Pseudocercospora atromarginalis	1				1				1			1	1	1
Pseudocercospora atrofiliformis				1					1			1		
Pseudocercospora atromarginalis			1	1		1				1		1		
Pseudocercospora atylosiae													1	
Pseudocercospora azanzae													1	
Pseudocercospora bacilligera									1			1		
Pseudocercospora bagdogrensis													1	
Pseudocercospora bakeriana				1					1			1		
Pseudocercospora baliospermi							1						1	
Pseudocercospora balsaminae	1		1									1		
Pseudocercospora balsaminicola					1									
Pseudocercospora bambusae													1	
Pseudocercospora bangalorensis												1	1	
Pseudocercospora baphicacanthi				1								1		
Pseudocercospora barleriae					1									
Pseudocercospora basellae				1								1		
Pseudocercospora barringtoniae-acutangulae													1	
Pseudocercospora baruipurensis													1	
Pseudocercospora basiramifera														1
Pseudocercospora bastiana													1	
Pseudocercospora bauhiniae														1
Pseudocercospora bauhiniicola				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora bauhiniigena													1	
Pseudocercospora beilschmiediae						1								
Pseudocercospora biophyti														1
Pseudocercospora biophyticola													1	
Pseudocercospora bischofiae				1	1				1			1		
Pseudocercospora bixae				1					1			1		
Pseudocercospora blepharis													1	
Pseudocercospora blumeae	1			1		1	1		1			1	1	
Pseudocercospora blumeae-balsamiferae				1					1			1		1
Pseudocercospora blumeae-balsamiferae var. microcephalae				1										
Pseudocercospora boedijniana											1		1	
Pseudocercosporella boehmeriae				1								1		
Pseudocercospora boehmeriigena	1					1			1		1	1		1
Pseudocercospora boraginis													1	
Pseudocercospora borreriae										1				
Pseudocercospora bougainvilleae												1		1
Pseudocercospora brachypus									1			1		
Pseudocercospora bradburyae				1	1			1	1	1		1		1
Pseudocercospora bretschneiderae												1		
Pseudocercospora brevis													1	
Pseudocercospora breyniae-rhamnoidis													1	
Pseudocercospora brideliicola													1	
Pseudocercospora broussonetiae	1								1			1		
Pseudocercospora bruceae											1	1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora buddleiae	1			1					1			1		1
Pseudocercospora butleri	1			1			1		1			1	1	1
Pseudocercospora byliana					1				1					
Pseudocercospora cadabae													1	
Pseudocercospora caesalpiniae				1								1		
Pseudocercospora caesalpiniicola													1	
Pseudocercospora cajanicola													1	
Pseudocercospora cajani-flavi												1		
Pseudocercospora callicarpae	1			1					1			1		
Pseudocercospora callicarpicola												1		1
Pseudocercospora calopogonii											1		1	
Pseudocercospora campanumoeae									1			1		
Pseudocercospora camptothecae												1		
Pseudocercospora camelliae						1								
Pseudocercospora camelliicola				1		1								
Pseudocercospora campanumoeae				1										
Pseudocercospora canarii												1		
Pseudocercospora canavaliigena	1			1								1		
Pseudocercospora cannabina	1		1			1			1			1		
Pseudocercospora cantuariensis		1	1						1					
Pseudocercospora capsellae				1								1	1	
Pseudocercospora carbonacea											1		1	1
Pseudocercospora careyae													1	
Pseudocercospora carii	1													

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora casearigena													1	
Pseudocercospora cassiae-alatae					1			1						
Pseudocercospora cassiae-fistulae	1			1								1		
Pseudocercospora cassiae-occidentalis				1	1							1		
Pseudocercospora cassiae-siameae													1	
Pseudocercospora cassiae-sophorae													1	
Pseudocercospora cassiigena					1									
Pseudocercospora castanae													1	
Pseudocercospora catappae	1			1	1	1			1		1	1	1	
Pseudocercospora caudata												1		
Pseudocercospora cavarae												1		
Pseudocercospora ceanothi						1						1		
Pseudocercospora cedrelae													1	
Pseudocercospora celosiarum	1											1	1	
Pseudocercospora centrosematicola					1			1						1
Pseudocercospora cephalanthi				1								1		
Pseudocercospora ceratoniae				1					1			1		
Pseudocercospora cercidis-chinensis	1		1									1		
Pseudocercospora chebulae													1	
Pseudocercospora chengtuensis	1		1	1					1			1		
Pseudocercospora cerasella			1											
Pseudocercospora ceratoniae		1												
Pseudocercospora chiangmaiensis														1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora chibaense	1													
Pseudocercospora chionanthicola	1			1								1		1
Pseudocercospora chloranthi	1											1		1
Pseudocercospora chloroxyli													1	
Pseudocercospora chloroxylicola													1	
Pseudocercospora chorisiae	1													1
Pseudocercospora chrysanthemicola			1	1	1			1				1		
Pseucocercospora cinchonae											1			
Pseudocercospora cinchonicola											1			
Pseudocercospora cinerea													1	
Pseudocercospora cinnamomi				1					1			1		
Pseudocercospora citri												1		
Pseudocercospora cladophora				1							1	1		
Pseudocercospora cladosporioides	1								1					
Pseudocercospora cladrastidis	1	1							1			1	1	
Pseudocercospora clausenae												1		
Pseudocercospora clematidigena											1			
Pseudocercospora clematidis			1	1							1			
Pseudocercospora clematoclethrae												1		
Pseudocercospora clerodendri	1			1			1		1	1		1	1	1
Pseudocercospora clerodendri-hastati											1			
Pseudocercospora clerodendrigena													1	
Pseudocercospora clitoriae													1	1
Pseudocercospora cocculi	1			1			1		11			1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora cocculicola													1	
Pseudocercospora cocculigena												1		
Pseudocercospora cochlospermi											1			
Pseudocercospora coffeigena												1		
Pseudocercospora colebrookiae													1	
Pseudocercospora colebrookiicola													1	
Pseudocercospora colocasiae				1			1			1		1		
Pseudocercospora columnaris					1									
Pseudocercospora combretacearum													1	
Pseudocercospora combretacearum var. combretacearum													1	
Pseudocercospora combretacearum var. minima													1	
Pseudocercospora combreti													1	
Pseudocercospora combretigena											1			
Pseudocercospora cornicola		1												
Pseudocercospora consociata	1								1			1		
Pseudocercospora contraria	1		1								1	1		1
Pseudocercospora conyzae	1			1								1		
Pseudocercospora coprosmae						1								
Pseudocercospora coriariae												1		
Pseudocercospora cordiicola					1								1	
Pseudocercospora cornicola	1	1							1			1	1	
Pseudocercospora corylopsidis	1													1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora cosmicola													1	1
Pseudocercospora costina				1					1	1		1	1	
Pseudocercospora cotini	1													1
Pseudocercospora cotizensis				1	1		1	1	1	1	1	1	1	
Pseudocercospora cotoneastri	1		1									1		1
Pseudocercospora crousii						1								
Pseudocercospora crataegi	1	1										1		
Pseudocercospora crotalariana				1									1	
Pseudocercospora crotalariicola				1	1							1	1	
Pseudocercospora cruenta	1	1	1	1	1		1	1	1	1	1	1	1	1
Pseudocercospora cryptolepidis													1	
Pseudocercospora cryptomeriaecola	1													
Pseudocercospora cryptostegiae				1					1			1		
Pseudocercospora cubensis								1						
Pseudocercospora cupheae														1
Pseudocercospora curculiginis												1		
Pseudocercospora cyatheae	1													
Pseudocercospora cybistacis												1		
Pseudocercospora cycleae												1		
Pseudocercospora cydoniae	1	1	1						1			1		
Pseudocercospora cylindrata									1			1	1	
Pseudocercospora cylindrosporioides												1		
Pseudocercospora cymbidiicola	1					1								
Pseudocercospora cymbopogonis				1								1		
Pseudocercospora daemiae							1						1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora dalbergiae				1								1	1	1
Pseudocercospora daphniphylli	1													1
Pseudocercospora daspurensis													1	
Pseudocercospora daturina					1								1	1
Pseudocercospora daucicola				1										
Pseudocercospora davalliae													1	
Pseudocercospora davidiicola	1													
Pseudocercospora deglupta								1						
Pseudocercospora delonicis					1									
Pseudocercospora dendrobii	1		1	1								1		
Pseudocercospora denticulata	1													
Pseudocercospora desmodiicola													1	
Pseudocercospora desmodii-salicifolii													1	
Pseudocercospora destructiva	1		1						1			1		
Pseudocercospora dichrocephalae				1					1			1		
Pseudocercospora diclipterae													1	
Pseudocercospora didymochitonis					1							1		
Pseudocercospora dilleniae													1	
Pseudocercospora dingleyae						1								
Pseudocercospora diospyri-erianthae				1					1			1		1
Pseudocercospora diospyri-morrisianae	1		1	1					1			1		
Pseudocercospora diospyricola				1								1		
Pseudocercospora diversispora				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora dodonaeae						1								
Pseudocercospora dominicana													1	
Pseudocercospora dovyalidis												1		1
Pseudocercospora dracaenae														1
Pseudocercospora duabangae													1	
Pseudocercospora ebulicola	1			1								1		
Pseudocercospora ecbolii													1	
Pseudocercospora ecdysantherae				1								1		
Pseudocercospora egenula	1				1					1	1			1
Pseudocercospora elaeocarpi	1												1	
Pseudocercospora elaeocarpicola	1													1
Pseudocercospora elaeodendri													1	
Pseudocercospora ehretiae-thyrsiflorae				1								1		
Pseudocercospora elaeodendri												1		
Pseudocercospora elephantopodis				1					1			1		
Pseudocercospora entebbeensis									1					
Pseudocercospora eriobotryae	1			1					1		1	1		
Pseudocercospora eriobotryicola				1								1		
Pseudocercospora eriodendri											1			
Pseudocercospora ervatamiae					1									
Pseudocercospora erythrinigena				1								1		
Pseudocercospora erythroxyli													1	
Pseudocercospora eucalypticola													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora eucalyptorum	1					1								
Pseudocercospora eucommiae												1		
Pseudocercospora euodiicola												1		
Pseudocercospora eupatorii											1	1	1	
Pseudocercospora eupatorii-formosanae				1	1		1	1				1	1	1
Pseudocercospora euphorbiae-piluliferae													1	
Pseudocercospora euphorbiae-pubescentis									1					1
Pseudocercospora euryae												1		
Pseudocercospora evodiicola	1										1	1		
Pseudocercospora exosporioides	1								1					
Pseudocercospora fagarae	1			1								1		
Pseudocercospora fatouae	1			1					1			1		1
Pseudocercospora fengshanensis				1					1			1		
Pseudocercospora fici	1								1			1		1
Pseudocercospora ficicola													1	
Pseudocercospora fici-caricae			1	1										1
Pseudocercospora fici-chartaceae					1		1							
Pseudocercospora fici-religiosae													1	1
Pseudocercospora fici-septicae				1								1		
Pseudocercospora ficigena													1	
Pseudocercospora ficina													1	
Pseudocercospora fijiensis												1		
Pseudocercospora filiformis												1		
Pseudocercospora flagellariae				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora flavomarginata														1
Pseudocercospora flemingiae													1	
Pseudocercospora flemingiae-macrophyllae													1	
Pseudocercospora formosana	1			1	1				1			1	1	
Pseudocercospora forrestiae				1								1		
Pseudocercospora forsythiae	1								1			1		
Pseudocercospora fothergillae	1													
Pseudocercospora fragarina												1		
Pseudocercospora fraxinites	1											1		
Pseudocercospora fudinga												1		
Pseudocercospora fukuii	1			1							1	1		
Pseudocercospora fukuokaensis	1		1						1			1		
Pseudocercospora fuligena	1			1		1		1	1	1	1	1		1
Pseudocercospora fuliginosa												1		
Pseudocercospora fumosa											1			
Pseudocercospora gentianacearum													1	
Pseudocercospora gangetici												1	1	
Pseudocercospora gardeniae	1										1			1
Pseudocercospora geicola		1	1			1						1		
Pseudocercospora ghissambilae													1	
Pseudocercospora giranensis				1								1		
Pseudocercospora glaucae									1			1		
Pseudocercospora globosae					1									

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora glochidionis	1			1					1			1		1
Pseudocercospora glycines				1								1		
Pseudocercospora glycosmidis													1	
Pseudocercospora gmelinae													1	
Pseudocercospora gomphrenae				1	1				1			1	1	
Pseudocercospora gorakhpurensis													1	
Pseudocercospora grewiicola													1	
Pseudocercospora grewiigena												1		
Pseudocercospora guianensis	1						1							
Pseudocercospora gunnerae						1								
Pseudocercospora gymnopetali				1								1		
Pseudocercospora hachijokibushi	1													
Pseudocercospora haldibariensis													1	
Pseuocercospora hamamelidicola	1													
Pseudocercospora handelii	1		1			1						1		
Pseudocercospora hangzhouensis												1		
Pseudocercospora haplophragmatis													1	
Pseudocercospora hardwarensis							1						1	
Pseudocercospora hebicola						1								
Pseudocercospora hedychii											1			
Pseudocercospora hedyotidis													1	
Pseudocercospora helleri													1	
Pseudocercospora helminthostachydis							1						1	
Pseudocercospora hemidesmi													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora heteromalla												1	1	
Pseudocercospora heveae												1		1
Pseudocercospora hibisci-cannabini		1		1								1	1	
Pseudocercospora hibisci-mutabilis				1								1		
Pseudocercospora hibiscina									1			1		
Pseudocercospora hiptages							1							
Pseudocercospora hiratsukana	1				1									1
Pseudocercodpora hoehnelii		1												1
Pseudocercospora holarrhenae													1	
Pseudocercospora holmskioldiae														1
Pseudocercospora holopteleae							1						1	
Pseudocercospora horiei	1													
Pseudocercospora houttuyniae	1			1								1		1
Pseudocercospora humuli	1		1	1		1			1			1	1	1
Pseudocercospora hyaloconidiophora				1								1		
Pseudocercospora hydrangeae-angustipetalae				1								1		
Pseudocercospora hymenodictyonis												1	1	
Pseudocercospora ibuskii	1													
Pseudocercospora ichnocarpi													1	
Pseudocercospora ilicis-micrococcae				1								1		
Pseudocercospora imazekii	1													
Pseudocercospora indica													1	
Pseudocercospora indonesiana											1			
Pseudocercospora inulae												1		
Pseudocercospora ipomoeae				1					1					

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora ipomoeae-purpureae					1									
Pseudocercospora iteae				1					1			1		
Pseudocercospora ixorae				1					1		1	1		
Pseudocercospora ixorana					1									
Pseudocercospora ixoricola				1	1							1		
Pseudocercospora izuohshimensis	1													
Pseudocercospora jahnii														1
Pseudocercospora jasminiola					1									
Pseudocercospora jatrophae												1	1	1
Pseudocercospora jatrophae-curcas					1			1					1	
Pseudocercospora jindaiensis	1													
Pseudocercospora juglandicola												1		
Pseudocercospora jujubae												1	1	
Pseudocercospora juniperi	1													
Pseudocercospora jussiaeae				1	1		1		1	1		1		
Pseudocercospora jussiaeae-repentis				1					1			1		
Pseudocercospora justiciae									1			1		1
Pseudocercospora kadsurae	1											1		1
Pseudocercospora kaiseri													1	
Pseudocercospora kaki	1	1		1					1			1	1	
Pseudocercospora kallarensis												1		
Pseudocercospora kalmiae	1													
Pseudocercospora karaka						1								
Pseudocercospora kashotoensis				1					1			1	1	
Pseudocercospora katongensis					1									
Pseudocercospora kirganeliae													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora kirishimensis	1											1		
Pseudocercospora kleinhoviae										1				
Pseudocercospora kobayashii	1													
Pseudocercospora kolanensis													1	
Pseudocercospora kopsiae-fruticosae														1
Pseudocercospora kurimensis	1					1			1				1	
Pseudocercospora kydiae													1	
Pseudocercospora lagerstroemiigena				1								1		
Pseudocercospora lamiacearum													1	
Pseudocercospora latens	1								1			1		
Pseudocercospora launaeae													1	
Pseudocercospora lauracearum													1	
Pseudocercospora leeae-macrophyllae													1	
Pseudocercospora leguminum									1			1		
Pseudocercospora lespedezicola			1	1								1		
Pseudocercospora leucaenicola													1	
Pseudocercospora leucothoes	1													1
Pseudocercospora liebenbergii							1							
Pseudocercospora ligustri			1											
Pseudocercospora lilacis	1	1										1		
Pseudocercospora linaeriae													1	
Pseudocercospora lindericola				1					1			1		
Pseudocercospora lini		1												
Pseudocercospora liquadambaricola	1			1					1			1		1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora litseae-cubebae												1		
Pseudocercospora litseigena	1												1	1
Pseudocercospora litseicola											1	1		
Pseudocercospora longispora								1						
Pseudocercospora lonicerae												1		
Pseudocercospora lonicericola	1		1	1		1			1			1		
Pseudocercospora lupini						1								
Pseudocercospora luxurians													1	
Pseudocercospora lyciicola					1									
Pseudocercospora lygodii				1								1		
Pseudocercospora lyoniae	1											1		1
Pseudocercospora lysimachiae		1												
Pseudocercospora lythracearum	1		1	1					1		1	1		1
Pseudocercospora lythri			1											
Pseudocercospora macarangae				1	1				1			1		
Pseudocercospora macarangicola										1				
Pseudocercospora machili				1								1		
Pseudocercospora macleyae												1		
Pseudocercospora madhauliensis													1	
Pseudocercospora mali	1	1							1		1	1	1	
Pseudocercospora malloti-repandi													1	
Pseudocercospora malloticola	1			1								1		
Pseudocercospora malvastricola													1	
Pseudocercospora marsdeniae							1					1		1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora marsdeniicola													1	
Pseudocercospora mate	1											1		
Pseudocercospora medicaginicola													1	
Pseudocercospora meibomiae												1	1	
Pseudocercospora melaena													1	
Pseudocercospora melanolepidis				1					1			1		1
Pseudocercospora melastomobia	1			1					1		1	1		
Pseudocercospora melicyti						1								
Pseudocercospora meliicola													1	
Pseudocercospora melochiigena													1	
Pseudocercospora melothriae				1					1			1		
Pseudocercospora menispermacearum													1	
Pseudocercospora metrosideri						1								
Pseudocercospora meynae-laxiflorae													1	
Pseudocercospora micheliae											1		1	
Pseudocercospora micheliicola													1	
Pseudocercospora midnapurensis													1	
Pseudocercospora millettiae				1								1		
Pseudocercospora millettiicola												1		
Pseudocercospora millingtoniae													1	
Pseudocercospora mirophora													1	
Pseudocercospora mississippiensis			1											
Pseudocercospora mitracarpigena														1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora mitteriana				1								1	1	
Pseudocercospora modesta							1							
Pseudocercospora molleriana	1	1												
Pseudocercospora mombin										1			1	
Pseudocercospora monoicae												1		
Pseudocercospora montantiana													1	
Pseudocercospora moracearum													1	
Pseudocercospora mori	1	1		1	1		1				1	1	1	1
Pseudocercospora morindae													1	
Pseudocercospora mucunae-ferrugineae				1							1	1		
Pseudocercospora muntingiae					1			1			1			
Pseudocercospora muntingiicola				1								1		
Pseudocercospora musae	1			1							1	1		1
Pseudocercospora musae-sapientium													1	
Pseudocercospora mussaendae	1													
Pseudocercospora mycetiae												1		
Pseudocercospora myriactidis				1								1		
Pseudocercospora myrtacearum									1				1	
Pseudocercospora myrtacearum var. robusta								1						
Pseudocercospora mysorensis				1					1			1	1	
Pseudocercospora myrticola	1	1				1								
Pseudocercospora mytilariae												1		
Pseudocercospora naitoi	1													1
Pseudocercospora nandinae	1					1						1		1

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora naraveliae													1	
Pseudocercospora neobalsaminae													1	
Pseudocercospora nephrolepidis				1										
Pseudocercospora neriella		1		1		1	1	1	1		1	1		
Pseudocercospora newtonensis									1					
Pseudocercospora nicolaiae											1			
Pseudocercospora nicotianae-benthamianae				1								1		
Pseudocercospora nigricans	1			1			1	1	1	1		1	1	
Pseudocercospora nogalesii	1					1								
Pseudocercospora nojimae	1		1									1		1
Pseudocercospora nothopegiae													1	
Pseudocercospora noveboracensis				1								1		
Pseudocercospora nyctanthis													1	
Pseudocercospora nymphaeacea	1								1		1	1		1
Pseudocercospora ocellata	1	1									1			1
Pseudocercospora ocimicola				1			1		1			1		
Pseudocercospora odinae													1	
Pseudocercospora odontoglossi						1								
Pseudocercospora oenotherae	1		1						1			1		
Pseudocercospora ogawae	1													
Pseudocercospora olacicola													1	
Pseudocercospora oleariae						1								
Pseudocercospora operculinae													1	
Pseudocercospora opuli		1										1		
Pseudocercospora ormosiae												1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora oroxyli							1						1	1
Pseudocercospora oroxyligena													1	
Pseudocercospora osbeckiae													1	
Pseudocercospora osmanthicola				1					1			1		
Pseudocercospora oxalidis				1								1		
Pseudocercospora oxysporae												1	1	
Pseudocercospora oxystelmatis													1	
Pseudocercospora pachyrrhizi				1					1			1		
Pseudocercospora paederiae	1		1	1					1			1		
Pseudocercospora pallida			1											
Pseudocercospora pamelae-ellisiae													1	
Pseudocercospora panacis	1										1	1	1	1
Pseudocercospora pancratii	1													
Pseudocercospora pandoreae						1								
Pseudocercospora pantoleuca							1	1					1	
Pseudocercospora paraguayensis				1										1
Pseudocercospora paramignyae												1	1	
Pseudocercospora paulowniae	1			1								1		
Pseudocercospora pavettae-indicae													1	
Pseudocercospora peltophori					1									
Pseudocercospora pergulariae					1									
Pseudocercospora pericampyli														1
Pseudocercospora persicariae	1			1					1			1		
Pseudocercospora petila				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora phaseolicola				1								1		
Pseudocercospora photiniae	1													
Pseudocercospora phrymae	1											1		
Pseudocercospora phyllanthi				1			1			1		1	1	
Pseudocercospora phyllanthi-niruri					1									
Pseudocercospora phyllanthi-reticulati				1								1	1	
Pseudocercospora phyllitidis														1
Pseudocercospora phytolaccacearum													1	
Pseudocercospora pini-densiflorae	1		1	1					1			1		
Pseudocercospora piperina					1									
Pseudocercospora piperis		1											1	
Pseudocercospora piperis-muricati					1							1		
Pseudocercospora pittospori	1													
Pseudocercospora pyricola		1		1								1		
Pseudocercospora pittospori	1											1		
Pseudocercospora plagiogyriae				1								1		
Pseudocercospora platani	1			1								1		
Pseudocercospora platensis						1								
Pseudocercospora platycaryae				1								1		
Pseudocercospora plumeriae	1										1			
Pseudocercospora pluriseptata													1	
Pseudocercospora pogostemonis													1	
Pseudocercospora polliae	1			1								1		
Pseudocercospora polygonicola				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora polygonigena					1									
Pseudocercospora polypodiacearum												1		
Pseudocercospora polysciadis				1						1	1	1		
Pseudocercospora polysciatis	1													
Pseudocercospora polysciatis-pinnatae	1													
Pseudocercospora polyalthiae													1	
Pseudocercospora polypodiacearum													1	
Pseudocercospora pomaderridis						1								
Pseudocercospora pongamiae-pinnatae													1	
Pseudocercospora populi												1		
Pseudocercospora poranae													1	
Pseudocercospora pouzolziae	1											1		
Pseudocercospora premnicola											1	1	1	
Pseudocercospora profusa	1	1	1									1		
Pseudocercospora protensa								1		1	1			
Pseudocercospora pruni-persicicola				1								1		
Pseudocercospora prunicola	1	1		1								1		1
Pseudocercospora pseudehretiae	1			1										1
Pseudocercospora pseudotrichodesmatis													1	
Pseudocercospora psidii	1											1	1	
Pseudocercospora psophocarpi					1		1	1			1			
Pseudocercospora psophocapicola					1									
Pseudocercospora psoraleae													1	
Pseudocercospora pteridophytophila				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora pterocarpicola					1									
Pseudocercospora pterocaryae												1		
Pseudocercospora pterocauli							1							
Pseudocercospora pteroceltidis												1		
Pseudocercospora puderi	1		1					1	1	1	1	1	1	1
Pseudocercospora puerariae												1		1
Pseudocercospora puerariicola	1		1	1	1				1		1	1		
Pseudocercospora puerariina					1									
Pseudocercospora pulvinulata	1	1							1					
Pseudocercospora pulviniformis													1	
Pseudocercospora punctiformis		1		1								1		
Pseudocercospora punensis													1	
Pseudocercospora punicae	1	1		1			1		1			1	1	
Pseudocercospora punjabensis													1	
Pseudocercospora purpurea											1			
Pseudocercospora pyracanthae	1													
Pseudocercospora pyricola				1										
Pseudocercospora qinlingensis												1		
Pseudocercospora quarta												1		
Pseudocercospora quilingensis												1		
Pseudocercospora quisqualidis												1	1	1
Pseudocercospora radermacherae											1			
Pseudocercospora ramischiae		1												
Pseudocercospora randiae												1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora ranjita												1		
Pseudocercospora rauwolfiae		1												
Pseudocercospora rauwolfiae-serpentinae													1	
Pseudocercospora repens		1												1
Pseudocercospora rhabdothamni						1								
Pseudocercospora rhamnaceicola				1								1		
Pseudocercospora rhapidicola	1			1								1		
Pseudocercospora rhinacanthi											1	1		1
Pseudocercospora rhododendricola					1				1			1		
Pseudocercospora rhododendrigena											1			
Pseudocercospora rhoidis												1		
Pseudocercospora rhoina	1	1	1							1		1		
Pseudocercospora rhynchosiae-suaveolentis													1	
Pseudocercospora rhynchosiicola													1	
Pseudocercospora riachueli	1						1					1	1	1
Pseudocercospora riachueli var. horiana	1													
Pseudocercospora robusta								1						
Pseudocercospora rubi	1	1	1			1						1		
Pseudocercospora rubicola		1										1		
Pseudocercospora rubropurpurea				1								1		
Pseudocercospora rumohrae				1		1						1		
Pseudocercospora rungiae													1	
Pseudocercospora ryukyuensis	1													
Pseudocercospora sabiae												1		
Pseudocercospora sacchari													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora saccharicola				1								1		
Pseudocercospora sagarensis													1	
Pseudocercospora saketensis													1	
Pseudocercospora salicina	1	1	1	1	1		1					1	1	
Pseudocercospora salvadorae													1	
Pseudocercospora salviae				1								1		
Pseudocercospora sambucigena														1
Pseudocercospora samuhabeeja													1	
Pseudocercospora sapii-sebiferi				1								1		
Pseudocercospora sapindi-emarginati												1	1	
Pseudocercospora sarcocephali				1								1		
Pseudocercospora saururicola	1			1								1		
Pseudocercospora sawadae	1			1		1						1	1	
Pseudocercospora schefflerae				1								1		
Pseudocercospora schefflericola												1		
Pseudocercospora scopariicola				1	1		1					1		
Pseudocercospora securinegae	1											1		
Pseudocercospora sedi		1												
Pseudocercospora sequoiae	1													
Pseudocercospora sesami												1		
Pseudocercospora sesbaniae				1			1					1	1	
Pseudocercospora sesbaniicola				1								1		
Pseudocercospora shihmenensis				1								1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora sieberiana													1	
Pseudocercospora singaporensis					1									
Pseudocercospora siraitiae												1		
Pseudocercospora solani-longisporae				1								1		
Pseudocercospora solani-melongenicola				1								1		1
Pseudocercospora solani-torvicola				1								1		
Pseudocercospora solenae-heterophyllae													1	
Pseudocercospora sophorae												1		
Pseudocercospora sordida	1											1		
Pseudocercospora sphaeriiformis	1	1							1			1		
Pseudocercospora sphendamnophila				1										
Pseudocercospora spilosticta				1					1			1		
Pseudocercospora spiraeicola	1											1		
Pseudocercospora stachyurina				1								1		
Pseudocercospora stahlii				1	1		1	1		1		1	1	
Pseudocercospora stemonae											1			
Pseudocercospora stephanandrae	1													
Pseudocercospora stephanicola												1		
Pseudocercospora stephanotidis					1									
Pseudocercospora sterculiana													1	
Pseudocercospora stereospermicola												1		
Pseudocercospora stewartiana	1													
Pseudocercospora stillingiae				1					1			1	1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora stigmaphyllicola					1									
Pseudocercospora stizolobii	1			1			1		1	1	1	1		1
Pseudocercospora stranvaesiae	1													
Pseudocercospora styracae												1		
Pseudocercospora strychni													1	
Pseudocercospora subsessilis	1			1			1		1			1	1	1
Pseudocercospora subtorulosa				1										
Pseudocercospora subulata						1								
Pseudocercospora sugimotoana	1											1		
Pseudocercospora superficialis													1	
Pseudocercospora sydowiana												1	1	
Pseudocercospora symphyti				1								1		
Pseudocercospora symploci	1											1	1	
Pseudocercospora synedrellae							1			1				
Pseudocercospora syzygii-cumini													1	
Pseudocercospora tabernaemontanae				1	1		1				1	1		
Pseudocercospora tabernaemontanicola					1									
Pseudocercospora tagetis													1	
Pseudocercospora tagetis-erectae				1								1		
Pseudocercospora taichungensis				1								1		
Pseudocercospora taiwanensis	1			1					1			1		
Pseudocercospora takiensis													1	
Pseudocercospora tecomae-heterophyllae	1				1							1	1	1
Pseudocercospora tecomicola					1									

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora tectonicola													1	
Pseudocercospora tetrapanacis												1		
Pseudocercospora teysmanii													1	
Pseudocercospora theae				1					1			1		
Pseudocercospora thelypteridis				1								1		
Pseudocercospora thespesiae													1	
Pseudocercospora thladianthae				1								1		
Pseudocercospora thunbergiae											1			
Pseudocercospora thunbergiicola					1									
Pseudocercospora tibouchinae						1								
Pseudocercospora tiglii											1			
Pseudocercospora tiliacorae													1	
Pseudocercospora timorensis	1			1	1			1	1	1	1	1	1	
Pseudocercospora tinea												1		
Pseudocercospora tinosporae													1	
Pseudocercospora tinosporicola													1	
Pseudocercospora tokushigeii	1													
Pseudocercospora toonae												1	1	
Pseudocercospora trematicola				1	1							1	1	
Pseudocercospora trematis-cannabini					1			1						
Pseudocercospora trematis-orientalis				1								1	1	
Pseudocercospora trewiae-nodiflorae													1	
Pseudocercospora trichodesmatis													1	
Pseudocercospora trichophila	1			1				1				1		

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora trichoxanthidicola													1	
Pseudocercospora triloba	1											1		
Pseudocercospora trinidadensis											1			
Pseudocercospora triumfettae				1						1		1	1	
Pseudocercospora tylophoricola													1	
Pseudocercospora ubi	1	1		1						1	1	1	1	
Pseudocercospora ubicola					1							1		
Pseudocercospora udagawana	1											1		
Pseudocercospora unicolor		1												
Pseudocercospora urariae				1								1	1	
Pseudocercospora vaccinii	1											1		
Pseudocercospora vanieriae												1		
Pseudocercospora varia			1			1						1		
Pseudocercospora variicolor	1											1		
Pseudocercospora vernoniacearum													1	
Pseudocercospora vexans												1		
Pseudocercospora vexillatae				1										
Pseudocercospora viburni-cylindrici			1									1		
Pseudocercospora vignigena													1	
Pseudocercospora violamaculans	1													
Pseudocercospora violicola												1		
Pseudocercospora viticicola	1			1	1							1	1	1
Pseudocercospora vitigena													1	
Pseudocercospora vitis	1	1	1				1					1	1	
Pseudocercospora vitis-heterophyllae	1													
Pseudocercospora waltheriae													1	

Species	Japan	Russia	Korea	Taiwan	Singapore	New Zealand	Myanmar	Malaysia	Hong Kong	Cook islands	Indonesia	China	India	Thailand
Pseudocercospora websteri													1	
Pseudocercospora weigeliae	1											1		
Pseudocercospora wellesiana												1		
Pseudocercospora whalianensis				1										
Pseudocercospora wisteriicola				1								1		
Pseudocercospora withaniae													1	
Pseudocercospora wrightiae												1	1	
Pseudocercospora xanthoxyli												1		
Pseudocercospora xenosyzygiicola	1			1										
Pseudocercospora xeromphina													1	
Pseudocercospora yakushimensis	1													
Pseudocercospora yoshinagaiana	1								1					
Pseudocercospora zambiensis													1	
Pseudocercospora zanthoxyli				1								1		
Pseudocercospora zanthoxylicola													1	
Pseudocercospora zehneriae													1	
Pseudocercospora zelkovae	1		1						1			1		
Pseudocercospora ziziphicola				1								1		
Pseudocercospora ziziphina													1	

Table 4.3. Species number and ratio of *Cercospora* and *Pseudocercospora* in several regions in Asia.

Region	Species number		Ratio
	Cercospora	*Pseudocercospora*	(*Cercospora*/ *Pseudocercospora*)
Eastern Asiatic Region	327	464	0.71
Indochinese region	112	127	0.88
Circumboreal region	221	45	4.91
Malesian region	84	136	0.61
Indian region	421	272	1.55
New Zealand and Cook islands	65	136	0.48

Table 4.4. Distribution of *Cercospora* and *Pseudocercospora* in Asian part of northern and southern hemisphere.

Hemispheres	*Cercospora*	*Pseudocercospora*
Northern hemisphere (excluding Indonesia)	1117	978
Southern hemisphere (Including Indonesia)	113	202

Table 4.5. Sorensen index of similarity (QS) of *Cercospora* and *Pseudocercospora* amongst floristic regions in Asia.

Regions	Sorensen index of similarity (QS)	
	Cercospora	*Pseudocercospora*
Eastern Asiatic Region - Indochinese region	0.199	0.391
Eastern Asiatic Region - Circumboreal region	0.358	0.155
Eastern Asiatic Region - Malesian region	0.3	0.271
Eastern Asiatic Region - Indian region	0.332	0.265
Eastern Asiatic Region - New Zealand & Cook islands	0.258	0.185
Indochinese region - Circumboreal region	0.199	0.163
Indochinese region - Malesian region	0.622	0.382
Indochinese region - Indian region	0.323	0.259
Indochinese region - New Zealand & Cook islands	0.517	0.278
Circumboreal region - Malesian region	0.118	0.098
Circumboreal region - Indian region	0.115	0.09
Circumboreal region - New Zealand & Cook islands	0.201	0.155
Malesian region - Indian region	0.172	0.172
Malesian region - New Zealand & Cook islands	0.485	0.249
Indian region - New Zealand & Cook islands	0.146	0.123

CHAPTER 5
GENERAL DISCUSSION

Plant pests which include insects, pathogens, and weeds are still major constraints on food and agricultural production, and they are difficult to control because these ecology is variable. Crop losses significantly reduce the amount of food available for human and animal consumption; thus, it cause directly food shortage. At least 10% of global food production is lost by plant diseases (James, 1998; FAO, 2000). Among them, various taxa of plant pathogenic fungi including a group of *Cercospora* complex cause catastrophic plant diseases.

At the present time, the threat is particularly greater in developing countries such as Thailand which are mostly located in tropical areas where the biodiversity including plant pathogens is higher than temperate areas (Hawksworth, 1993; Shivas and Hyde, 1997) but the infrastructures and number of plant pathologists are not equivalent with the number of threats caused by plant pathogens. Because of shortage of plant pathologists and infrastructures, the diagnosis of plant diseases is difficult, and plant diseases cause the failure of crops. In this study, 154 species of the cercosporoid fungi have been recorded from Thailand, whereas approximately 50 species of the cercosporoid fungi (30% of this study) were recorded as of 1994 (Giatgong, 1980; Sontirat et al., 1980, 1994; Petcharat and Kanjanamaneesathian, 1989). This taxonomical and ecological knowledge of cercosporoid fungi revealed in this study contribute to the field of plant pathology and mycology as well as improvement in agricultural development in developing countries.

5.1. Important Findings in This Study

This study has surveyed, collected, and investigated a diversity of *Cercospora* and allied genera which belong to the true cercosporoid fungi proposed by Crous and Braun (2003) in several provinces of northern part of Thailand (chapter 3). A total 154 species of the cercosporoid fungi associated with 148 plants genera of 62 families have been examined and identified which consist of one *Asperisporium*, 73 *Cercospora*, one *Distocercospora*, 19 *Passalora*, and 60 *Pseudocercospora* species. Nine novel species have been validly published or are in the process of publication. Sixty-six species were newly recorded to mycoflora of Thailand, and 52 plants species were new host of this group of fungi. In addition, 35 species of genus *Cercospora* were recognized as *C. apii s. lat.* (chapter 3). In addition, 34 important crops such as tea (*Camellia sinensis*), coffee (*Coffea arabica*), banana (*Musa acuminata*), lettuce (*Lactuca*

sativa), etc., 97 ornamentals plants, 11 weeds, and 30 plants with other properties, have been affected with the cercosporoid fungi.

The number of the cercosporoid fungi collected in this study fell below the expectation of several investigators (Pirozynski, 1988; Rossmann et al., 1987; Hawksworth 1991, 1993; Shivas and Hyde, 1997) whose expected more diverse plant pathogens in tropical regions than temperate regions based on the presence of two-thirds the world's flowering plants in the tropics (Heywood, 1985). The dataset of the *Cercospora* and *Pseudocercospora* species have shown that many temperate countries such as China, Japan, and Taiwan are the richest in species diversity of these genera (chapter 4). These results may reflect the species diversity of plants which are maintained in this area where was not glaciated in the pleistocene. However, it is also difficult at this stage to provide any definitive conclusions to the proportion of species diversity of the *Cercospora* and *Pseudocercospora* between tropical and temperate regions, due to the lack of appropriate mycologists (plant pathologists) particularly in the tropical areas, means that there is a limited amount of data available.

The number of the cercosporoid fungi observed in this study also represents a high number of total plant pathogens associated with various plants in Thailand. In this study solely, 34 important crops such as affected by members of the cercosporoid fungi have been recorded, and also, the number of species of the cercosporoid fungi affecting crops relatively increased. The cropping system of these plants is monoculture in Thailand. Accordingly, once the epidemics occur in these fields, the wreck of these crops is extensive. Cases of epidemics caused by the cercosporoid fungi with a significant damage to the crops were reported from several countries, for examples, *Cercospora* leaf spots of sugar beet (*Beta vulgaris* L.) caused by *C. beticola* was reported from southern Germany from the late 1980s to early 1990s (Wolf and Verreet, 2005) and from Hokkaido, Japan in 2000 (Yuko et al., 2002). Although *Cercospora* leaf spot is no longer considered the most destructive disease on many crops owing to the introduction of the chemicals and resistant varieties, we have to keep a sharp look out for the occurrence of these diseases caused by cercosporoid fungi.

We found many migrant species of cercosporoid fungi which seem to invade Thailand from the asian continent or other tropical areas. We must pay attention to these tendencies because migrant species often cause infinite damage on crops and extinction of endemic species in a new habitat. For example, *C. zeae-maydis,* a foliar pathogen causing gray leaf spot of maize/corn (*Zea mays* L.), was discovered in 1924 in Illinois, USA. At first, *C. zeae-maydis* had not become an important pathogen of maize until the 1980s, however, by the mid-1990s, the fungus caused significant losses throughout the corn belt of the U.S., and it is now the most

devastating foliar pathogen of maize in much of the world (Ward et al., 1999). Unfortunately, such a migrant pathogen is very difficult to control because the transferences of plants and agricultural products generated by human activities are increasing.

5.2. Conclusions and Future Directions

It is revealed that a vast number of the cercosporoid species collected and preserved in this study (chapter 2) indicated a great diversity of plant pathogens in tropical area as predicted by investigators (Hawksworth et al., 1993; Shivas and Hyde, 1997). Although the study on biodiversity of plant pathogen such as the cercosporoid fungi is indirect contribution to the diagnosis and control of plant diseases, which causes 30% of losses of agricultural production worldwide (Agrios, 2005) and sometimes devastate native species (Newhook and Podger, 1972), these studies are recognized as key components to develop the effective control of plant diseases, and make a great benefit to humankind, for example, in basic scientific research, in biotechnology, in screening of novel metabolites, and bio-pesticide production.

Moreover, it is necessary for the disease prediction to survey on plant parasitic fungi associated with crops in farming area or wild plants in natural ecosystems. The prediction of the threat of a plague of destructive diseases in the future and development of disease control strategies in such situation are very important, and these actions can only be prepared by studying the biology and diversity of plant pathogens. Finally, it is important to end this section by making a point that is so obvious that as long as there is a need to control the devastating effects of pathogens on plants, there is an equal need to study in depth the ways in which pathogens interact and evolve with their hosts (host specificity) and adapt to their environment (in particular with the global climate change and introduction of resistant plants).

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APPENDIX

Index of host plants

Index of fungi