
Two new species and a new record of cercosporoids from Thailand

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Cercosporoid leaf-spotting hyphomycetes are being studied in the northern areas of Thailand. *Pseudocercospora christellae* on *Christella parasitica* and *P. radermachericola* are two new species introduced in this paper, while *P. balsaminae* on *Impatiens balsamina* is a new record for Thailand. The three *Pseudocercospora* species are described, illustrated and discussed.

Key words – anamorphic fungi – hyphomycetes – South East Asia – taxonomy

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Introduction

Cercospora sensu lato is one of the largest genera of hyphomycetes, cosmopolitan in distribution, and causing leaf spots and other lesions on a wide range of host plants. Species of this genus are important pathogens responsible for severe damage to beneficial plants such as maize, rice, grasses, vegetables, forest trees and ornamentals (Crous & Braun 2003).

There have been several recent comprehensive accounts of the fungi of Thailand, which are among the best documented in the region (Thongkantha et al. 2008, Shirouzu et al. 2009, Wannathes et al. 2009). Some studies include pathogenic microfungi (Than et al. 2008, Prihastuti et al. 2009), while the cercosporoid fungi have been well studied in Thailand since 1980. Sontirat et al. (1980) recorded 21 species of *Cercospora*. Giangthong (1980) listed 60 cercosporoids, including 13 unidentified species of the genus *Cer-*

cospora in the host index of plant diseases in Thailand, and Petcharat & Kajanamaneesathian (1989) recorded 49 cercosporoid species. Nakashima et al. (2007b) described three new species and recorded 11 species that were new to Thailand. Forty-three cercosporoid species were included in the annotated list of cercosporoid fungi in Northern Thailand (Meeboon et al. 2007), and two taxa associated with necrotic leaflets of areca palms (*Areca catechu*) were published by To-anun et al. (2009). Meeboon (2009) included 166 cercosporoids in her Ph.D. thesis on “Diversity and Phylogeny of True cercosporoids fungi from Northern Thailand”. To-anun et al. (2010) reported *Cercospora cristellae*, a new cercosporoid species associated with the weed *Cristella parasitica* from Northern Thailand. Phengsintham et al. (2010a) gave three new records of cercosporoid fungi (*Cercospora diplaziicola*, *Pseudocercospora duabangae* and *P. trematicola*) from Thailand,

while Phengsintham et al. (2010b) recorded 14 new records of cercosporoids from Thailand. The objective of this paper, and planned subsequent contributions, is to investigate and describe the cercosporoid fungi of Laos and Thailand, with an expectation to provide data on Thailand's fungi in comparison with the diversity of these fungal groups in neighbouring countries.

Materials and Methods

Leaves of plants with leaf spots were collected during the course of field trips in the northern areas of Thailand. Photographs were taken of symptoms, and of fungal colonies or fruiting bodies.

Macroscopic characters were observed using a stereomicroscope and measurements were made of morphological features. The average was estimated using the formula:

$$(\bar{x} = \frac{\sum M}{n} \mu\text{m}),$$

Notes: M = is the size of each components
n = is the number of components

Dried specimens were prepared and stored in the herbarium of the School of Science, Mae Fah Luang University, Chiang Rai, Thailand (MFLU). Duplicates are also preserved in the herbarium of the Institute of Biology, Geobotany and Botanical Garden, Halle (Saale), Germany (HAL).

Results

Symptoms of the host plants

The three described *Pseudocercospora* spp. are plant pathogens. Symptoms caused by these fungi are variable in size and colour (Figs 1–3).

Taxonomy

Pseudocercospora balsaminae (Syd.)
Deighton, Mycol. Pap. 140: 139. 1976.
Figs 1, 4, 5.

Description: Leaf spots subcircular to irregular, 2–15 mm diam., at first yellowish, later becoming brown in the center, brown to



Fig. 1 – Leaf spots caused by *Pseudocercospora balsaminae* on *Impatiens balsamina*.



Fig. 2 – Leaf spots caused by *Pseudocercospora christellae* on *Christella parasitica*.

brown-yellowish at the margin. Caespituli/colonies hypophyllous, scattered, conspicuous. Mycelium internal; hyphae branched, 2–9 μm wide ($\bar{x} = 6 \mu\text{m}$, $n = 7$), septate, constricted at the septa, distance between septa 5–27 μm ($\bar{x} = 15.5 \mu\text{m}$, $n = 7$), subhyaline to brownish, wall 0.3–1 μm wide ($\bar{x} = 0.65 \mu\text{m}$, $n = 7$), forming plate-like plectenchymatous stromatic hyphal aggregations. Stromata oval to



Fig. 3 – Leaf spots caused by *Pseudocercospora radermachericola* on *Radermachera ignea*.

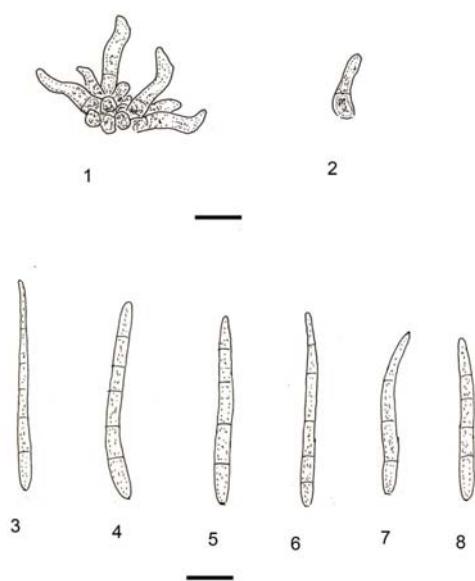


Fig. 4 – *Pseudocercospora balsaminae* on *Impatiens balsamina*. **1.** Stroma with attached conidiophores. **2.** Conidiophore. **3–8.** Conidia. Bars = 10 μm .

ellipsoidal, 15–30 μm diam. (\bar{x} = 22.6 μm , n = 6), brown to dark brown, stroma cells oval, ellipsoidal and angular, 3–7 μm wide (\bar{x} = 5 μm , n = 10), dark brown, wall 0.5–0.8 μm wide (\bar{x} = 0.65 μm , n = 10), smooth. Conidiophores fasciculate, arising from stomata (9–30 per fascicle), geniculate, unbranched, 9–16 \times 2–4 μm (\bar{x} = 12.35 \times 3.05 μm , n = 15), 0–1-septate,

slightly constricted at the septa, distance between septa 4–12 μm (\bar{x} = 7.64 μm , n = 15), uniformly pale to medium brown, much paler and narrower toward the tip, wall 0.3–0.5 μm (\bar{x} = 0.47 μm , n = 15), smooth. Conidiogenous cells terminal, 7–12 \times 2–4 μm (\bar{x} = 9.64 \times 2.70 μm , n = 14), obtuse; conidiogenous loci inconspicuous, unthickened, not darkened. Conidia solitary, obclavate, straight to slightly curved, 32–44 \times 2–4 μm (\bar{x} = 38.52 \times 2.64 μm , n = 13), 3–5-septate, pale olivaceous brown, wall 0.3–0.5 μm wide (\bar{x} = 0.36 μm , n = 13), smooth, tip subacute, base truncate, hila 1–2 μm wide (\bar{x} = 1.39 μm , n = 13).

Known hosts: *Impatiens balsamina* (Balsaminaceae).

Known distribution: China, Singapore, Thailand (this paper).

Material examined: Thailand, Chiang Rai Province, Muang District, Sri Pangsang Village, on leaf of *Impatiens balsamina* (Balsaminaceae), 20 July 2010 (MFLU10-0404).

Cultural characteristics: Mycelial colonies on PDA after 3 weeks at 25°C dark grey, reaching 20–25 mm diam., hyphae 2–9 μm wide (\bar{x} = 9 μm , n = 20), septate, constricted at the septa, distance between septa 5–27 μm (\bar{x} = 15.25 μm , n = 20), brownish or subhyaline, wall 0.3–1 μm wide (\bar{x} = 0.65 μm , n = 20), smooth. Conidiophores and conidia not formed in culture.

Remarks: *P. balsaminae* is a variable species with a wide range of conidial length. Guo & Hsieh (1995) described conidiophores of 6.5–40 \times 2.5–4 μm and conidia 25–90 \times 1.5–3 μm . Shin & Kim (2001) even described conidiophores up to 56 \times 4 μm and conidia up to 105 \times 3.5 μm . The conidiophores and conidia in the collection from Thailand are relatively short, but they are within the variation of this species. *P. balsamicola* (J.M. Yen & Lim) U. Braun and Crous (Yen & Lim 1980, Crous & Braun 2003) is a similar confusable species, but clearly differentiated by its hyaline acicular-filiform, basally truncate, long and narrow conidia 45–132 \times 2–2.5 μm .

Pseudocercospora christellae Phengsintham, McKenzie, K.D. Hyde & U. Braun, **sp. nov.**

Figs 2, 6, 7.

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Fig. 5 – *Pseudocercospora balsaminae* on *Impatiens balsamina*. **1, 2.** Lesions on host leaves (1. upper surface and 2. lower surface). **3.** Caespituli. **4, 5.** Stromata with attached conidiophores. **6–11.** Conidia. **12.** Culture. Bars 1, 2 = 10 mm, 4–11 = 10 μ m.

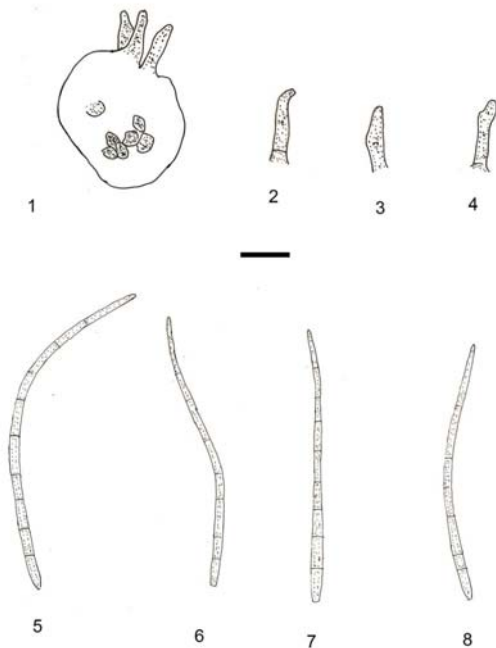


Fig. 6 – *Pseudocercospora christellae* on *Christella parasitica*. **1.** Stroma with attached conidiophores. **2–4.** Conidiophores. **5–8.** Conidia. Bars = 10 μ m.

Maculae subcirculares vel leniter irregulares, 3–9 mm diam., primo pallide brunneae, deinde in centro brunneae, margine brunneae vel atro-brunneolae cinctae. Caespituli epiphylli, conspicui. Mycelium immersum. Hyphae immersae ramosae, 2–3 μ m latae, septatae, septis remotis, 6–8 μ m, ad septa constrictae, brunneae, pariete tenui, subhyalinae, 0.3–0.5 μ m latae, levia. Stromata ovoidea vel ellipsoidea, 22–40 μ m diam., brunnea vel atro-brunnea, ex cellulis, 3–10 μ m latis, ovalibus, ellipsoidibus vel angularibus, 0.5–0.8 μ m latis, levebusi composita. Conidiophora fasciculata (3–16), geniculata, non ramosa, 9–14 \times 2–4 μ m, 0–1-septata, septis remotis, 3–12 μ m, pallide brunnea, apicem versus pallidiora, pariete tenui, 0.3–0.5 μ m lata, levia. Cellulae conidiogenae terminales, 8–12 \times 2–4 μ m, apice obtuso. Cicatrices coniales inconspicuae. Conidia solitaria, obclavata, recta vel curvata, 53–105 \times 2–4 μ m, 3–9-septata, pallide olivaceo-brunnea, 0.3–0.5 μ m lata, levia; apice subacuto, basi truncatae, hila 1–2 μ m lata.

Description: Leaf spots subcircular to irregular, 3–9 mm diam., at first brownish, later becoming brown, brown to dark yellowish brown at the margin. Caespituli/colonies epiphyllous, conspicuous. Mycelium internal; hyphae branched, 2–3 μ m wide (\bar{x} = 2.5 μ m, n = 5), septate, constricted at the septa, distance between septa 6–8 μ m (\bar{x} = 4 μ m, n = 5), subhyaline to brownish, wall 0.3–0.5 μ m wide (\bar{x} = 0.4 μ m, n = 5), smooth, forming plate-like plectenchymatous stromatic hyphal aggregations. Stromata oval to ellipsoidal, 22–40 μ m diam. (\bar{x} = 28.5 μ m, n = 7), brown to dark brown, stroma cells oval, ellipsoidal and angular, 3–10 μ m wide (\bar{x} = 7.66 μ m, n = 30), dark brown, wall 0.5–0.8 μ m wide (\bar{x} = 0.63 μ m, n = 30), smooth. Conidiophores fasciculate, arising from stromata (3–16 per fascicle), geniculate, unbranched, 9–14 \times 2–4 μ m (\bar{x} = 10.58 \times 3.05 μ m, n = 13), 0–1-septate, slightly constricted at the septa, distance between septa 3–12 μ m (\bar{x} = 8.8 μ m, n = 15), uniformly pale to medium brown, paler and narrower towards the tip, wall 0.3–0.5 μ m wide (\bar{x} = 0.47 μ m, n = 15), smooth. Conidiogenous cells terminal, 8–12 \times 2–4 μ m (\bar{x} = 9.99 \times 2.77 μ m, n = 8), obtuse; conidiogenous loci inconspicuous, unthickened, not darkened. Conidia solitary, obclavate, straight to slightly curved, 53–105 \times

2–4 μm ($\bar{x} = 81.36 \times 2.90 \mu\text{m}$, $n = 17$), 3–9-septate, pale olivaceous-brown, wall 0.3–0.5 μm wide ($\bar{x} = 0.36 \mu\text{m}$, $n = 17$), smooth, tip subacute, base truncate, hila 1–2 μm wide ($\bar{x} = 1.81 \mu\text{m}$, $n = 17$).

Known hosts: *Christella parasitica* (Thelypteridaceae).

Known distribution: Thailand (this paper).

Material examined: Thailand, Chiang Rai Province, Muang District, Mae Chan Village, on leaf of *Christella parasitica* (Thelypteridaceae), 18 July 2010, P. Phengsintham (MFLU10-0405, **holotype**).

Cultural characteristics: Mycelial colonies on PDA after 3 weeks at 25°C dark grey, reaching 10–15 mm diam., hyphae 2–7 μm wide ($\bar{x} = 4.25 \mu\text{m}$, $n = 20$), septate, constricted at the septa, distance between septa 9–19 μm ($\bar{x} = 14 \mu\text{m}$, $n = 20$), brownish or subhyaline, wall 0.3–0.8 μm wide ($\bar{x} = 0.52 \mu\text{m}$, $n = 20$), smooth. Conidiophores and conidia not formed in culture.

Remarks: This is the first record of *Pseudocercospora* on the genus *Christella*. There are a numerous *Pseudocercospora* spp. on ferns, but *P. christellae* differs from all species with fasciculate conidiophores in having very short conidiophores, viz. *P. arachnioidis* Y.L. Guo, *P. athyri* W.H. Hsieh & Goh, *P. cyatheae* C. Nakash. & Ivana, *P. lonchitidis* (Chupp) U. Braun & Crous, *P. nephrolepidis* R. Kirschner, *P. plagiogyiae* Goh & W.H. Hsieh, *P. pteridophytophila* Goh & W.H. Hsieh, *P. thelypteridis* Goh & W.H. Hsieh (Chupp 1954, Hsieh & Goh 1990, Guo & Hsieh 1995, Crous & Braun 2003, Nakashima et al. 2007a, Kirschner & Chen 2007). Other species are distinguished by forming superficial mycelium with solitary conidiophores, viz. *P. abacopterica* (J.M. Yen & Lim, *P. adianthi* (Syd.) Deighton, *P. lygorii* (Goh & W.H. Hsieh) J.M. Yen, *P. rumohrae* W.H. Hsieh & Goh (Chupp 1954, Hsieh & Goh 1990, Yen & Lim 1980). Four *Pseudocercospora* spp. on hosts of the *Thelypteridaceae* have been described: *P. abacopterica* on *Abacopteris urophylla* (with superficial mycelium and solitary conidiophores); *P. phyllitidis* (H.H. Home) U. Braun & Crous, e.g. on *Thelypteris tetragona* (conidiophores up to 100 μm long, conidia 3–5 μm wide); *P. pteridophytophila* on *Cyclosorus*

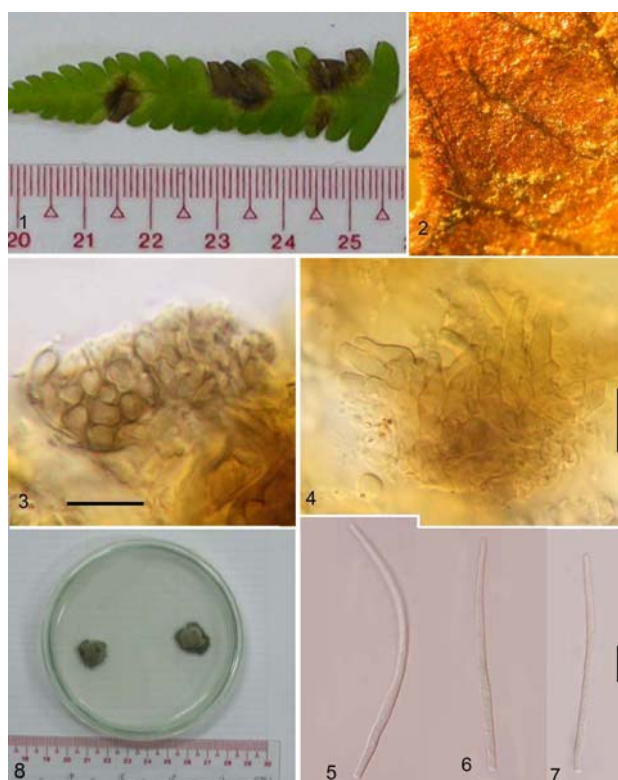


Fig. 7 – *Pseudocercospora christellae* on *Christella parasitica*. **1.** Lesions on host leaf (upper surface). **2.** Caespituli. **3.** Stroma. **4.** Stroma with attached conidiophores. **5–7.** Conidia. **8.** Culture. Bars 1 = 10 mm, 3–7 = 10 μm .

acuminatus (conidiophores up to 50 μm long, conidia shorter and narrower, 30–70 \times 1–1.5 μm); and *P. thelypteridis* (conidiophores up to 60 μm long, conidia acicular, filiform (Chupp 1954, Hsieh & Goh 1990, Yen & Lim 1980).

Pseudocercospora radermachericola Phengsintham, McKenzie, K.D. Hyde & U. Braun, **sp. nov.** Figs 8, 9.

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Pseudocercosporae radermacheriae similis, sed conidiophoris laxe fasciculatis, brevioribus, 9–26 \times 3–5 μm , 0–2-septatis et conidiis brevioribus, 29–38 \times 2–3 μm , 0–3-septatis distinctguitur.

Description: Leaf spots/lesions subcircular to irregular, 1–6 mm diam., at first brown-violet, reddish brown in the centre, brown to dark brown at the margin. Caespituli/colonies amphigenous, conspicuous. Mycelium internal; hyphae branched, 2–3 μm wide ($\bar{x} = 2.66 \mu\text{m}$, $n = 7$), septate, constricted at the septa, distance between septa 5–9 μm ($\bar{x} = 6.66 \mu\text{m}$, $n = 7$),

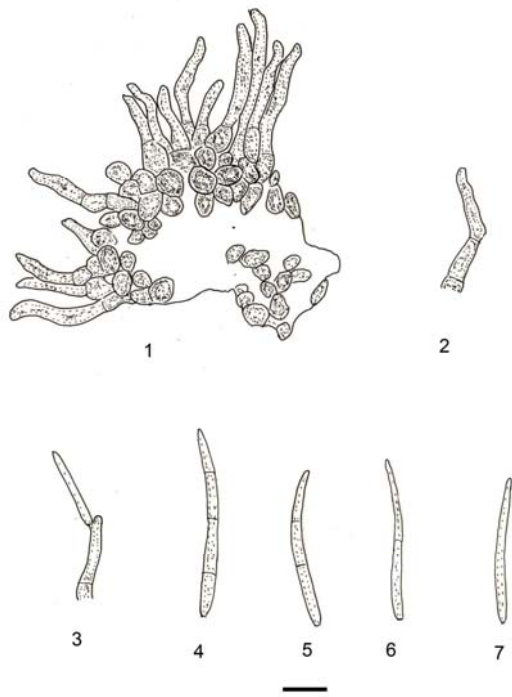


Fig. 8 – *Pseudocercospora radermachericola* on *Radermachera ignea*. **1.** Stroma with attached conidiophores. **2.** Conidiophore. **3.** Conidiophore with attached young conidium. **4–7.** Conidia. Bars = 10 μ m.

brownish, subhyaline, wall 0.3–0.5 μ m wide (\bar{x} = 0.36 μ m, n = 7), smooth, forming plate like plectenchymatous stromatic hyphal aggregations. Stromata oval to ellipsoidal, 8–44 μ m diam. (\bar{x} = 22.35 μ m, n = 6), brown to dark brown, stroma cells oval, ellipsoidal to angular, 3–6 μ m wide (\bar{x} = 4.8 μ m, n = 10), dark brown, wall 0.5–0.8 μ m wide (\bar{x} = 0.65 μ m, n = 10), smooth. Conidiophores fasciculate, arising from stromata (2–46 per fascicle), geniculate, branched, 9–26 \times 3–5 μ m (\bar{x} = 16.94 \times 3.67 μ m, n = 9), 0–2-septate, slightly constricted at the septa, distance between septa 3–25 μ m (\bar{x} = 10.16 μ m, n = 15), uniformly pale to medium brown, paler and narrower towards the tip, wall 0.3–0.5 μ m (\bar{x} = 0.48 μ m, n = 15), smooth. Conidiogenous cells terminal, 6–25 \times 2–3 μ m (\bar{x} = 13.52 \times 2.49 μ m, n = 12), apex obtuse; conidiogenous loci inconspicuous, unthickened, not darkened. Conidia solitary, obclavate, straight to slightly curved, 29–38 \times 2–3 μ m (\bar{x} = 32.79 \times 2.22 μ m, n = 15), 0–3-septate, pale olivaceous-brown, wall 0.3–0.5 μ m wide (\bar{x} = 0.36 μ m, n = 15), smooth, tip subacute, base truncate, hila 1–2 μ m wide (\bar{x} = 1.18 μ m, n = 15).

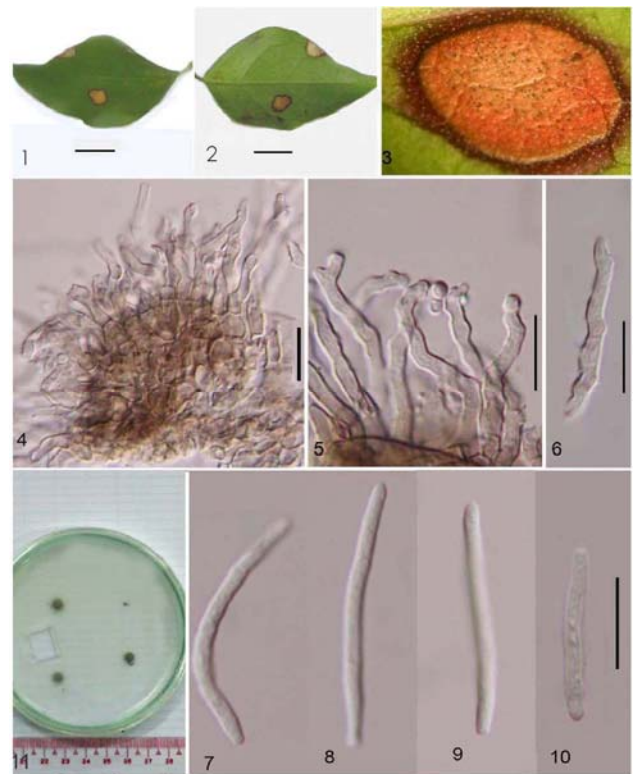


Fig. 9 – *Pseudocercospora radermachericola* on *Radermachera ignea*. **1, 2.** Lesions on host leaves (1. upper surface and 2. lower surface). **3.** Caespituli. **4.** Stroma with attached conidiophores. **5, 6.** Conidiophores. **7–10.** Conidia. **11.** Culture. Bars 1–2 = 10 mm, 4–10 = 10 μ m.

Known hosts: *Radermachera ignea* (Bignoniaceae).

Known distribution: Thailand (this paper).

Material examined: Thailand, Chiang Rai Province, Muang District, Ban Sri Pangsang Village, on leaf of *Radermachera ignea* (Bignoniaceae), 12 August 2010, P. Phengsintam (MFLU10-0406, **holotype**).

Cultural characteristics: Mycelial colonies on PDA after 3 weeks at 25°C dark grey, reaching 4–7 mm diam., hyphae 2–6 μ m wide (\bar{x} = 4.75 μ m, n = 10), septate, constricted at the septa, distance between septa 9–16 μ m (\bar{x} = 12.75 μ m, n = 10), brownish or subhyaline, wall 0.3–0.8 μ m wide (\bar{x} = 0.52 μ m, n = 10), smooth. Conidiophores and conidia not formed in culture.

Remarks: *Cercospora radermacheriae* Boedijn (1961) was described from Indonesia on *Radermachera glandulosa* (as “glandulata”). Braun (2001) re-examined type material of this species, assigned it to *Pseudocercospora* and published a description and illustration. *P. radermacheriae* is quite distinct from the new

species on *Radermachera ignea* by its long (25–80 × 2–4 µm), pluriseptate, densely fasciculate, often almost synnematus conidiophores and longer conidia, 30–70 × 2–4 µm. *Radermachera ignea* is not closely allied to *R. glandulosa*. In the “Flora of China” (Wu & Raven 1998), the accepted name of this species is *Mayodendron igneum*.

Discussion

Ornamental plants are grown for their beauty and ornamental value but may suffer from disease. Damages to living leaves and fruits of ornamental plants caused by cercosporoid hyphomycetes reduce their beauty and potential to be used as ornamentals. Three cases of diseases caused by cercosporoids are documented in this study.

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