An annotated list of cercosporoid fungi in Northern Thailand

Jamjan Meeboon, Iman Hidayat and Chaiwat To-anun*

Department of Plant Pathology, Chiang Mai University, Chiang Mai, Thailand

Meeboon, J., Hidayat, I. and To-anun, C. (2007). An annotated list of cercosporoid Fungi in Northern Thailand. Journal of Agricultural Technology 3(1): 51-63.

A survey on the diversity of cercosporoid fungi in Northern Thailand was carried out. In total, forty-three species belonging to the genera *Asperisporium*, *Cercospora*, *Passalora* and *Pseudocercospora*, were collected. In detail, one species of *Asperisporium*, 24 species of *Cercospora*, five species of *Passalora* and 13 species of *Pseudocercospora* were identified, including twenty-nine species new to Thailand. Twelve species of genus *Cercospora* are *Cercospora apii sensu lato*.

Key words: leaf spot, plant pathogenic fungi, hyphomycetes

Introduction

Numerous species of cercosporoid fungi are already known from Thailand. Sontirat *et al.* (1980) enumerated 21 species of *Cercospora* Fresen. *sensu lato*. Giatgong (1980) listed 47 identified and 13 unidentified species of this genus in *The Host Index of Plant Diseases in Thailand*, and Petcharat and Kanjanamaneesathian (1989) reported 49 species. However, their reports were mainly based on the generic concepts introduced by Chupp (1954). Further reports of new species, new records and additions to the distribution of several cercosporoid fungi in Thailand were published by Manoch *et al.* (1986), Pons (1988), Ellis (1976), Barreto & Evans (1994), Crous (1998), Crous & Braun (2003), Lumyong *et al.* (2003), Braun *et al.* (2006), Hunter *et al.* (2006) and Meeboon *et al*. (2007; In press).

Cercosporoid fungi are common and widespread on a wide range of vascular plants, above all in tropical regions. The knowledge of these fungi in Thailand is only fragmentary. Therefore, further comprehensive examinations of cercosporoid fungi in Thailand, based on the current taxonomic classification (Crous & Braun, 2003), are urgently needed. In this report, 43 species of cercosporoid fungi are listed from Northern Thailand.

*Corresponding author: Chaiwat To-anun; e-mail: agppi006@chiangmai.ac.th

Materials and methods

Specimens were collected after observing symptoms of cercosporoid fungi on leaves using a 10× magnifying glass. Detailed observations of morphological characters were carried out by means of an Olympus CX31 light microscope using oil immersion (1000×).

Specimens for microscopic observation were prepared by hand sectioning. Water and lactophenol were used as mounting media. Thirty conidia, hila, conidiophores, conidiogenous loci and 10 stromata were measured for each specimen. Line drawings were prepared at a magnification of 400×. Dried herbarium specimens were deposited at CMU Herbarium, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.

Results and discussion

List of species

Family Acanthaceae

1. *Cercospora barleriicola* Payak and Thirum.
Material examined: THAILAND, Sak Yai National Park, A. Nam Pad, Uttradit Province, on leaves of *Barleria cristata* L., 25 November 2004, Chiharu Nakashima and Jamjan Meeboon, (CMU Herbarium 001 and CMU Herbarium 014).
Notes: This species belongs to *C. apii sensu lato*, fide Crous & Braun (2003). This is the first record from Thailand.

2. *Pseudocercospora rhinacanthi* (Höhn.) Deighton
Material examined: THAILAND, Chiang Mai University, Chiang Mai Province, on leaves of *Rhinacanthus nasutus* Kuntze, 25 November 2004, Jamjan Meeboon (CMU Herbarium 002).
Notes: Chandrasrikul (1962) reported the specimen on *R. nasutus* from Thailand as *Cercospora rhinacanthi* Höhn., based on Chupp's classification system (1954). We recollected and observed *R. nasutus* leaf spots and identified it as *P. rhinacanthi* because of inconspicuous conidial scars and unthickened hila (see Crous and Braun 2003).

The leaf spots of the specimens are visible on both upper and lower surfaces, circular-subcircular in shape. On the upper part, the colour is dark brown with whitish gray center, surrounded by a raised yellowish brown border line. On the lower surface, the colour is brown to yellowish with brown

margin. The conidiophores are slightly geniculate, 1-7-septate, 19.5-39(-44) × (2-) 5 µm, and conidial scars are inconspicuous. The conidia of this species are acicular to narrowly obclavate, hyaline, 3-7-septate, (32-)39-58.5(-66) × (3.5-) 5 µm, hilum unthickened and not darkened.

3. *Cercospora andrographidicola* S. Q. Chen and P. K. Chi
Material examined: THAILAND, Sak Yai National Park, Uttradit Province, on leaves of *Andrographis paniculata* Nees, 25 November 2004, Jamjan Meeboon (CMU Herbarium 003).
Notes: This is the first record of *C. andrographidicola* on *A. paniculata* from Thailand.

Family Amaranthaceae

4. *Cercospora celosiae* Syd.
Material examined: THAILAND, Wiang Pa Pao, Chiang Rai Province, on leaves of *Celosia argentea* L., 25 November 2004, Jamjan Meeboon (CMU Herbarium 005); on *Celosia argentea var. cristata* (L.) Kuntze, 25 November 2004, Jamjan Meeboon (CMU Herbarium 006).
Notes: *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.

Family Asteraceae

5. *Passalora assamensis* (S. Chowdhury) U. Braun & Crous
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Eupatorium adenophorum* Spreng., 12 October 2006, Ikumitsu Araki (CMU Herbarium 159).
Notes: This is the first record of *P. assamensis* on *E. adenophorum* from Thailand.

Family Balsaminaceae

6. *Cercospora fukushiana* (Matsuura) W. Yamam.
Material examined: THAILAND, Nam Nao National Park, Phetchabun Province, on leaves of *Impatiens balsamina* L., 24 November 2004, Jamjan Meeboon (CMU Herbarium 011).

Notes: This specimen belongs to *C. apii sensu lato*, fide Crous & Braun (2003). In Thailand, *C. fukushiana* on *I. balsamina* was first reported by Sontirat *et al.* (1980).

Family Bignoniaceae

7. *Pseudocercospora oroxyli* (A.K. Kar & M. Mandal) Deighton
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Oroxylum indicum* (L.) Benth. ex Kurz, 8 November 2006, Ikumitsu Araki (CMU Herbarium 163).
Notes: This is the first record of *P. oroxyli* on *O. indicum* from Thailand.

Family Compositae

8. *Cercospora eupatorii* Sacc.
Material examined: THAILAND, Nam Nao National Park, Phetchabun Province, on leaves of *Eupatorium odoratum* L., 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 023); Queen Sirikit Botanical Garden, Chiang Mai Province, on leaves of *Eupatorium adenophorum* Spreng., 20 November 2004, Jamjan Meeboon (CMU Herbarium 115).
Notes: This is the first record of *C. eupatorii* found on *E. adenophorum* in Thailand. The conidiophore 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.

9. *Cercospora helianthicola* Chupp and Viégas
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Helianthus annuus* L., 30 November 2004, Jamjan Meeboon (CMU Herbarium 024).
Notes: In Thailand, this fungus was first reported by Petcharat and Kanjanamaneesathian (1989). Crous & Braun (2003) noted *C. helianthicola* as *C. apii sensu lato*.

10. *Cercospora lactucae-sativae* Sawada
Material examined: THAILAND, Chiang Mai Province, on leaves of *Lactuca sativa* L., 31 October 2004, Jamjan Meeboon (CMU Herbarium 025).
Notes: This is the first report of *C. lactucae-sativae* on *L. sativa* from Thailand.

11. *Cercospora tridacis-procumbentis* Govindu and Thirum.
Material examined: THAILAND, Chiang Mai Province, on leaves of *Tridax procumbens* L., 31 October 2004, Jamjan Meeboon (CMU Herbarium 028).
Notes: In Thailand, *C. tridacis-procumbentis* was recorded by Sontirat *et al.* (1980). Crous & Braun (2003) noted *C. tridacis-procumbentis* as *C. apii sensu lato*.

Family Brassicaceae

12. *Cercospora brassicicola* Henn.
Material examined: THAILAND, Faculty of Agriculture, Chiang Mai University, Chiang Mai Province, on leaves of *Brassica pekinensis* Skeels, 31 October 2004, Jamjan Meeboon (CMU Herbarium 034); on leaves of *Brassica campestris* L., 15 October 2004, Jamjan Meeboon (CMU Herbarium 035); on leaves of *Brassica rapa* L., 9 November 2005, Jamjan Meeboon (CMU Herbarium 038); Suthep-Pui National Park, Chiang Mai Province, on leaves of *Brassica juncea* (L.) Czern., 21 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 039).
Notes: Reports of *C. brassicicola* from Thailand were published by Puckdeedindan (1966) and Petcharat and Kanjanamaneesathian (1989).

Family Caricaceae

13. *Asperisporium caricae* (Speg.) Maubl.
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Carica papaya* L., 12 October 2006, Ikumitsu Araki (CMU Herbarium 158).
Notes: This is the first report of *A. caricae* on *C. papaya* from Thailand.

Family Convolvulaceae

14. *Cercospora ipomoeae* G. Winter
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Argyreia henryi* Craib, 10 November 2006, Ikumitsu Araki (CMU Herbarium 164).

Notes: This is the first report of *C. ipomoeae* from Thailand and *Argyreia henryi* is a new host for *C. ipomoeae*. Crous & Braun (2003) listed this species as *C. apii sensu lato*.

Family Cucurbitaceae

15. *Cercospora citrullina* Cooke
Material examined: THAILAND, Faculty of Agriculture, Chiang Mai University, Chiang Mai Province, on leaves of *Coccinia grandis* (L.) Voigt, 19 January 2005, Jamjan Meeboon (CMU Herbarium 041).
Notes: *Cercospora citrullina* was previously reported from Thailand by Petcharat and Kanjanamaneesathian (1989). Crous & Braun (2003) cited this species as *C. apii sensu lato*.

Family Dioscoreaceae

16. *Pseudocercospora carbonacea* (L. E. Miles) N. Pons and B. Sutton
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Dioscorea bulbifera* L., 8 November 2006, Ikumitsu Araki (CMU Herbarium 162).
Notes: This is the first report of *P. carbonacea* on *D. bulbifera* from Thailand

Family Euphorbiaceae

17. *Pseudocercospora glochidionis* (Sawada) Goh & W.H. Hsieh
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Glochidion sphaerogynum* Kurz, 7 November 2006, Ikumitsu Araki (CMU Herbarium 161).
Notes: This is the first report of *P. glochidionis* on *G. sphaerogynum* from Thailand. *Glochidion fortunei, G. hohenackeri, G. hongkongense* and *G. zeylanicum* were previously recorded as hosts of *P. glochidionis* (Crous and Braun, 2003).

18. ***Cercospora acalyphae*** Peck
Material examined: THAILAND, Nam Nao National Park, Phetchabun Province, on leaves of *Acalypha wilkesiana* Mull. Arg., 24 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 046).
Notes: This is the first report of *C. acalyphae* on *A. wilkesiana* from Thailand.

19. *Pseudocercospora melanolepidis* Goh and W. H. Hsieh
Material examined: THAILAND, Sak Yai National Park, Uttradit Province, on leaves of *Mallotus pierrei* (Gagnep.) Airy Shaw, 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 048).
Notes: This is the first report of *P. melanolepidis* on *M. pierrei* from Thailand. *Pseudocercospora melanolepidis* was previous recorded on *M. moluccanus* and *M. multiglandulosa* (Crous and Braun, 2003).

20. *Cercospora ricinella* Sacc. and Berl.
Material examined: THAILAND, Doi Inthanon National Park, Chiang Mai Province, on leaves of *Ricinus communis* L., 22 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 049).
Notes: The first report of this species from Thailand was made by Petcharat and Kanjanamaneesathian (1989).

21. *Cercospora phyllanthicola* S.A. Khan and Kamal
Material examined: THAILAND, Sak Yai National Park, A. Muang, Uttradit Province, on leaves of *Phyllanthus* sp., 25 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 052).
Notes: This is the first report of *C. phyllanthicola* on *Phyllanthus* sp. from Thailand. Crous & Braun (2003) referred this species to as *C. apii sensu lato*.

22. *Passalora henningsii* (Allesch.) R.F. Castañeda and U. Braun
Material examined: THAILAND, Wiang Pa Pao, Chiang Rai Province, on leaves of *Manihot esculenta* Crantz, 18 November 2005, Jamjan Meeboon (CMU Herbarium 053).
Notes: In Thailand, this species was first reported by Chandrasrikul (1962) who published it as *C. cassavae* Ellis and Everh.; however, *C. cassavae* is now considered a synonym of *Passalora henningsii* (see Crous and Braun, 2003). The present specimen is close to *P. henningsii* rather than *P. manihotis* (F. Stevens and 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 x 3.5-5 µm) (Chupp, 1954).

Family Hydrangeaceae

23. *Cercospora hydrangeae* Ellis and Everh.
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Hydrangea macrophylla* (Thunb.) Ser., 21 November 2004, Jamjan Meeboon (CMU Herbarium 057).
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 (2006) assigned this species to *C. apii sensu lato*.

Family Leguminosae

24. *Pseudocercospora dalbergiae* (S. H. Sun) J. M. Yen
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Dalbergia cultrata* Graham, 13 November 2006, Ikumitsu Araki (CMU Herbarium 169).
Notes: This is the first report of *P. dalbergiae* on *D. cultrata* from Thailand. *Pseudocercospora dalbergiae* was previously recorded on *D. sissoo* (Crous and Braun, 2003).

25. *Passalora aenea* (Cif.) U. Braun and Crous
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Cassia agnes* (de Wit) Brenan, 10 December 2006, Jamjan Meeboon & Ikumitsu Araki (CMU Herbarium 170).
Notes: This is the first report of *P. aenea* on *C. agnes*. 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* (Crous and Braun, 2003).

26. *Cercospora erythrinicola* Tharp
Material examined: THAILAND, Mushroom Research Centre, Chiang Mai Province, on leaves of *Erythrina* sp., 12 November 2006, Ikumitsu Araki (CMU Herbarium 166).
Notes: This is the first report of *C. erythrinicola* from Thailand.

27. *Passalora arachidicola* (Hori) U. Braun
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Arachis hypogaea* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 058).

Notes: This species was first reported from Thailand by Sontirat *et al.* (1980) as *Cercospora arachidicola* Hori.

28. *Cercospora kikuchii* T. Matsumoto and Tomoy.
Material examined: THAILAND, Chiang Mai University, Chiang Mai Province, on leaves of *Glycine max* Merr., 21 November 2004, Jamjan Meeboon (CMU Herbarium 061).
Notes: The first record of this species from Thailand was listed in Sontirat *et al.* (1980). Crous and Braun (2003) assigned this species to *C. apii sensu lato*.

29. *Pseudocercospora griseola* (Sacc.) Crous & U. Braun
Material examined: THAILAND, Wiang Pa Pao, Chiang Rai Province, on leaves of *Phaseolus vulgaris* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 062).
Notes: The first record of this species from Thailand was published by Giatgong (1980). Based on molecular sequence analyses and reassessments of morphological characters, this species has recently been reallocated to *Pseudocercospora* Speg. (Crous *et al.*, 2006).

30. *Cercospora canescens* Ellis and G. Martin
Material examined: THAILAND, Wiang Pa Pao, Chiang Rai Province, on leaves of *Vigna radiata* (L.) R.Wilczek, 25 October 2005, Jamjan Meeboon (CMU Herbarium 071); on leaves of *Vigna unguiculata* var. *sesquipedalis*, 25 November 2005, Jamjan Meeboon (CMU Herbarium 066).
Notes: This species was first reported from Thailand by Sontirat *et al*. (1980) who found *C. canescens* on *V. radiata*.

31. *Pseudocercospora abelmoschi* (Ellis and Everh.) Deighton
Material examined: THAILAND, Queen Sirikit Botanic Garden, Chiang Mai Province, on leaves of *Hibiscus* sp., 20 November 2004, Chiharu Nakashima and Jamjan Meeboon (CMU Herbarium 075).
Notes: Petcharat and Kanjanamanseethian (1989) reported *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 hilum. 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 septa.

32. *Pseudocercospora fici* (Heald and F.A. Wolf) X.J. Liu and Y.L. Guo
Material examined: THAILAND, Chiang Mai University, Chiang Mai Province, on leaves of *Ficus rumphii* Blume, 3 December 2005, Jamjan Meeboon (CMU Herbarium 080).
Notes: This is the first report of *P. fici* on *F. rumphii*. 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 and Braun, 2003).

33. *Cercospora morina* Chupp
Material examined: THAILAND, Chiang Mai University, Chiang Mai Province, on leaves of *Morus alba* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 081).
Notes: This is the first report of *C. morina* on *M. alba* from Thailand. A previous report of *C. morina* on this plant was made by Chandrasrikul (1962).

Family Meliaceae

34. *Pseudocercospora subsessilis* (Syd. & P. Syd.) Deighton
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Melia azedarach* L., 10 December 2006, Jamjan Meeboon and Ikumitsu Araki (CMU Herbarium 174).
Notes: This is the first report of *P. subsessilis* on *M. azedarach* from Thailand.

Family Myrtaceae

35. *Pseudocercospora paraguayensis* (Tak. Kobay.) Crous
Material examined: THAILAND, Ban Doi Lo, Chiang Mai Province, on leaves of *Eucalyptus* sp., 15 August 2006, Jamjan Meeboon (CMU Herbarium 168).
Notes: This is the first report of *P. paraguayensis* on *Eucalyptus* sp. from Thailand.

Family Nephrolepidaceae

36. *Pseudocercospora phyllitidis* (H. H. Hume) U. Braun and Crous
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Nephrolepis cordifolia* (L.) C. Presl, 10 December 2006, Jamjan Meeboon and Ikumitsu Araki (CMU Herbarium 173).

Notes: This is the first report of *P. phyllitidis* on *N. cordifolia* from Thailand.

Family Polypodiaceae

37. *Cercospora platycerii* Chupp
Material examined: THAILAND, Doi Sa Ket, Chiang Mai Province, on leaves of *Platycerium bifurcatum* (Cav.) C. Chr., 5 July 2006, Jamjan Meeboon (CMU Herbarium 157).
Notes: This is the first report of *C. platycerii* on *P. bifurcatum* from Thailand.

Family Saururaceae

38. *Cercospora houttuyniicola* Goh & W.H. Hsieh
Material examined: THAILAND, Chiang Mai University, Chiang Mai Province, on leaves of *Houttuynia cordata* Thunb., 6 December 2006, Ikumitsu Araki (CMU Herbarium 176).
Notes: This is the first report of *C. houttuyniicola* on *H. cordata* from Thailand.

Family Solanaceae

39. *Cercospora capsicigena* Bhartiya, R. Dubey and S. K. Singh
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Capsicum annuum* var. *acuminatum* Fingerh., 21 November 2004, Jamjan Meeboon (CMU Herbarium 095).
Notes: The first record of this species from Thailand was made by Sontirat *et al.* (1980). Crous and Braun (2003) considered this species to be a part of *C. apii sensu lato*.

40. *Pseudocercospora solani-melongenicola* W. H. Hsieh and Goh
Material examined: THAILAND, Wiang Pa Pao, Chiang Mai Province, on leaves of *Solanum melongena* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 098).
Notes: This is the first record of *P. solani-melongenicola* on *S. melongena* from Thailand. The present determination of this species follows the publication of Hsieh and Goh (1990). They re-examined specimen of *C. melongenae* Welles from Taiwan, published by Sawada (1922), and described it a as new species, viz. *P. solani-melongenicola*.

41. *Passalora nattrassii* (Deighton) Crous and Braun
Material examined: THAILAND, Suthep-Pui National Park, Chiang Mai Province, on leaves of *Solanum trilobatum* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 099).
Notes: This is the first record of *P. nattrassii* on *S. trilobatum* from Thailand.

Family Verbenaceae

42. *Cercospora lantanae-indicae* Munjal, Lall and Chona
Material examined: THAILAND, Wiang Pa Pao, Chiang Mai Province, on leaves of *Lantana camara* L., 21 November 2004, Jamjan Meeboon (CMU Herbarium 110).
Notes: This is the first record of *C. lantanae-indicae* on *L. camara* from Thailand. This species was previously only recorded from India (Munjal *et al*. 1959).

43. *Cercospora tectonae* F. Stevens
Material examined: THAILAND, Multiple Cropping Centre, Chiang Mai University, Chiang Mai Province, on leaves of *Tectona grandis* L.f. (Verbenaceae), 1 December 2005, Jamjan Meeboon (CMU Herbarium 113).
Notes: Crous and Braun (2003) assigned this species to *C. apii sensu lato*. This is the first record of *C. tectonae* on *T. grandis* from Thailand.

Acknowledgements

This work was financially supported, in part, by a Grant-in-Aid from the Hitachi Scholarship Foundation and the Thailand Research Fund (PDF/47/2542). The authors thank Prof. Dr. Uwe Braun for critical reading of the manuscript, and Dr. J. F. Maxwell for identification of the host plants.

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(Received 26 January 2007; accepted 18 May 2007)