

Notes on some plant-inhabiting fungi collected from the Nansei Islands (2)

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Abstract In this paper, four fungi collected in Nansei Islands are reported. One is *Strasseria garciniae*, which must be transferred to the genus *Phyllosticta*. This fungus was collected in Okinawa Main Island and Iriomote Island. The other three fungi are newly added to the Japanese fungal flora. *Phyllosticta ghaesembillae* on *Codiaeum variegatum* and *Cercospora asplenii* on *Asplenium antiq-uum* were collected in Yoron Island. The last one, *Coniella australiensis* on *Eucalyptus robusta* was collected in Okinawa Main Island. Their morphology and symptoms on the host plant are described, with some mycological notes.

Keywords *Cercospora asplenii* · *Coniella australiensis* · *Phyllosticta ghaesembillae* · *Strasseria garciniae*

Introduction

The Nansei Islands consist of many islands located in the south of Japan and belong to the subtropics. In our first

paper, four fungi collected from Okinawa Main Island, Hateruma, Ishigaki, and Amami-ohshima Islands were newly added to Japanese fungal flora (Kobayashi et al. 2003). Afterward, preliminary notes of some fungus collected from Nansei Islands were reported in Japanese (Kobayashi et al. 2006a, b, 2007, 2009; Kobayashi and Watanabe 1995; Motohashi 2008). In this paper, three species collected from Okinawa Main Island and Yoron Island newly recorded in Japan are described and discussed. These taxa consist of genus *Cercospora*, *Coniella*, and *Phyllosticta* s.str. In addition, *Strasseria garciniae* I. Hino & Katum. on *Garcinia* collected in Okinoerabu and Iriomote Islands is reexamined and its taxonomic position is based on morphological characteristics.

Materials and methods

The specimens examined were collected from 1992 to 2001 in the Nansei Islands in the southern part of Japan. The holotype specimen of *Strasseria garciniae* (Hino and Katumoto 1964) was borrowed from the Herbarium of Plant Pathology, Faculty of Agriculture, Yamaguchi University (YAM), Yamaguchi Prefecture, Japan. Slides for microscopic observation were prepared by hand sectioning from collected materials or herbarium specimens. The dried specimens were deposited at the Herbarium of Forest Pathology, Forestry and Forest Products Research Institute (TFM: FPH), Tsukuba, Ibaraki Prefecture, Japan. To obtain living cultures, monoconidial isolations were attempted according to the protocols of Nakashima and Kobayashi (1997). Living cultures were deposited in GeneBank, National Institute of Agrobiological Sciences (MAFF), Tsukuba, Ibaraki Prefecture, Japan.

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Descriptions

1. *Phyllosticta garciniae* (I. Hino & Katum.) Motohashi, Tak. Kobay. & Yas. Ono, comb. nov. Figs. 1–3

≡ *Strasseria garciniae* I. Hino & Katum., Bull. Fac. Agr. Yamaguti Univ. 15:514, 1964.

Leaf spots subcircular, white to grayish white, developed on leaf blade, often hemicircular at leaf margin. Pycnidia amphigenous, sparse, visible as small black dots, solitarily immersed at first, then erumpent breaking through the epidermis, black, subglobular, 80–155 µm in diameter; pycnidial wall composed of polyhedral cells. Conidiophores integrated, lined on innermost layer of pycnidial wall, short cylindrical, hyaline, bearing single conidium holoblastically from the tip, proliferating enteroblastically at least once, with minute periclinal thickenings. Conidia hyaline, unicellular, elliptic to obovoid, guttulate, 12–17 × 7–11 µm, 14.01 × 9.03 µm on average ($l/b = 1.55$), surrounded with thin mucous sheath, and with a mucous appendage at the tip; appendage hyaline, viscous, simple, filiform, straight or curved, 5–19 µm in length.

Disease name: White leaf spot (Hakuhan-byo in Japanese).

Specimens examined: On living leaves of *Garcinia subelliptica* Merr. (Japanese name: Fukugi), Iejima Is., Okinawa Pref., 19 July 1961, by I. Hino, as *Strasseria garciniae* I. Hino & Katumoto (YAM-21942, holotype); Wadamari, Okinoerabu Is., Kagoshima Pref., 19 November 2001, by T. Kobayashi (TK) and Y. Ono (YO) (TFM: FPH-7951; isolate, MAFF 239170); Taketomi, Iriomote Is., Okinawa Pref., 6 June 2000, by YO (TFM: FPH-7952).

Taxonomic notes: Most of the morphological characteristics of the fungus collected on *Garcinia* in Okinoerabu Is. were quite similar to those of holotype specimen of *Strasseria garciniae*. The genus *Strasseria*, which is recognized as an anamorphic state of Pezizomycetes (Kirk et al. 2008), has a cellular appendage formed preceding development of conidium body at the base and has an extracellular appendage originated by the mucoid sheath at the apex (Nag Raj 1993). On the other hand, most *Phyllosticta* species form an apical and mucoid appendage (extracellular appendage). The morphology of *S. garciniae* having an apical and mucoid appendage indicates this species should be belonged to the genus *Phyllosticta* s.str. based on its generic concept of van der Aa (1973) and van der Aa and Vanev (2002). For these reasons, *S. garciniae* was transferred to the genus *Phyllosticta* s.str. as *P. garciniae* (I. Hino & Katum.) Motohashi, Tak. Kobay. & Yas. Ono. Another species of *Phyllosticta* detected on *Garcinia* plant, *P. evernia* (Syd.) Aa, is easily differentiated from *P. garciniae* by its smaller pycnidia, and smaller and slender conidia (9–12 × 4–5 µm) with l/b ratio 2.33.

2. *Phyllosticta ghaesembillae* Koord., Verh. K. Acad. Wet., Sec. 2, 13:205, 1907 Figs. 4–6

≡ *Phyllostictina ghaesembillae* (Koord.) Petr., Ann. Mycol. 26:440, 1928.

= *Phyllosticta codiaei* Died., Ann. Mycol. 14:62, 1916.

≡ *Phyllostictina codiaei* (Died.) Petr., Ann. Mycol. 27:356, 1929.

= *Phyllosticta reyesii* Yates, Philipp. Agr. Rev. 15:129, 1922.

≡ *Phyllosticta codiaei* Sacc., Atti Accad. Sci. veneto-trent.-istriana 10:71, 1917.

≡ *Phyllosticta codiaeana* Sacc., Syll. Fung. 25:35, 1931.

= *Phyllosticta domingensis* Cif. & Gonz. Frag., in Gonzales Fragoso & Ciferri, Publ. Estac. Agron. Moca, Ser. B., Bot. 8:40, 1927.

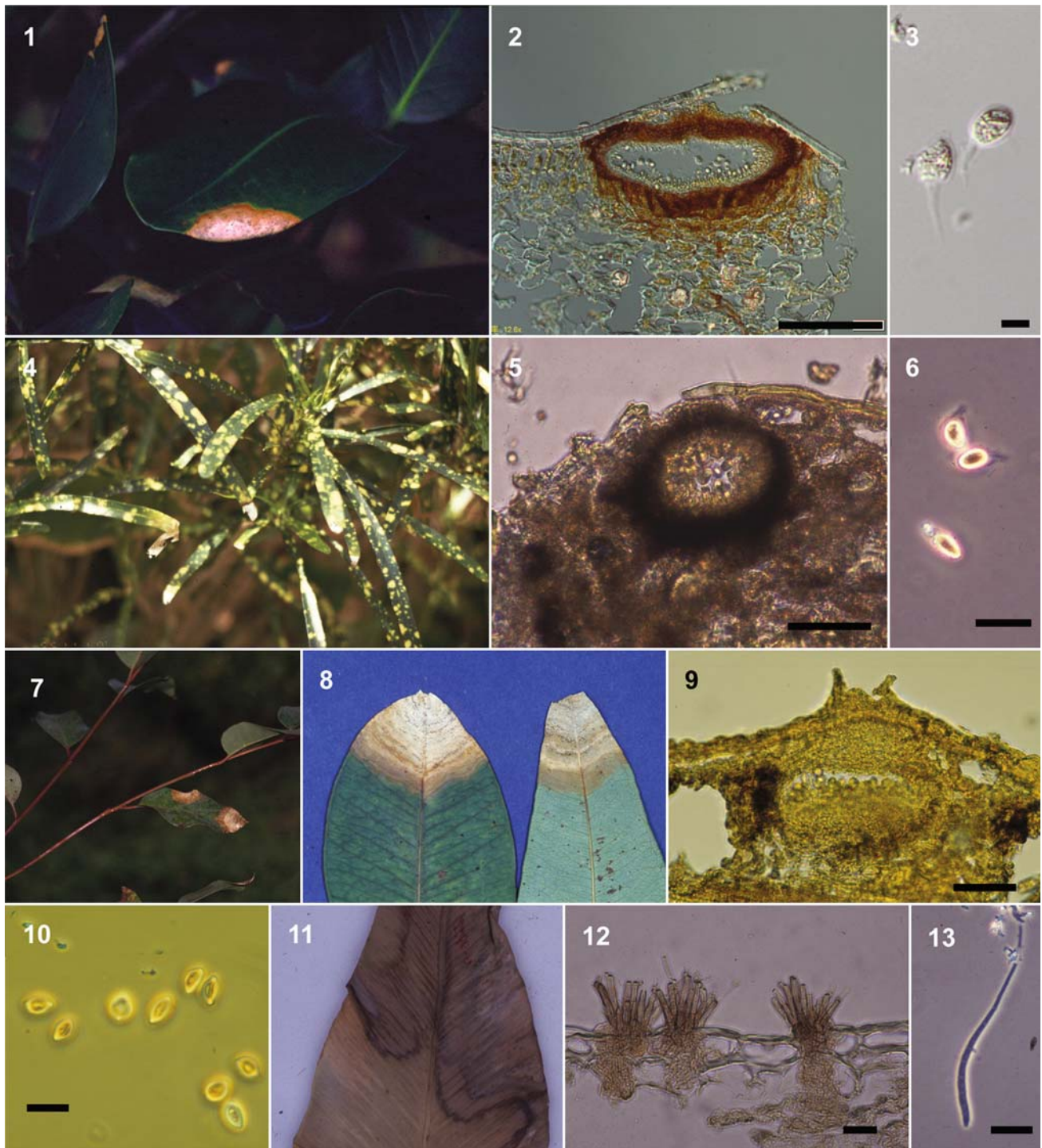
≡ *Phyllosticta codiaeicola* Gonz. Frag. & Cif., Boln R. Soc. Esp. Hist. Nat. 26:197, 1925.

= *Phyllostictina euphorbiae* Petrak, Sydowia 7:115, 1953.

Leaf spots pale brown to brown, subcircular, 5–10 mm in length, often covered the whole width of the leaf blade, often turned tip blight. Pycnidia mainly epiphyllous, scattered on leaf spot, visible as black small dots, immersed at first, then erumpent, black, subglobular, 80–100 µm in diameter, 79–87 µm in height. Conidiophores integrated, lined on innermost hyaline layer of pycnidial wall, small, hyaline, cylindrical, short, to 5 µm in length. Conidia hyaline, unicellular, subglobular to obovate, 9.6–13.2 × 5.3–7.7 µm, 10.37 × 6.8 µm on average ($l/b = 1.53$), surrounded with mucoid sheath, with a mucoid appendage at the tip; appendage hyaline, viscous, simple, straight or curved, 5–8.5 µm in length.

Specimen examined: On living leaves of *Codiaeum variegatum* Blume (Japanese name: Henyoboku or Kuroton-no-ki), Yoron, Yoron Is., Kagoshima Pref., 22 November 2001, by TK & YO (TFM: FPH-7977).

Taxonomic notes: On related host genera *Codiaeum* and *Antidesma* in Euphorbiaceae, four species of *Phyllosticta* and *Phyllostictina* are known. Among them, three species of *Phyllosticta*, *P. oahuensis* Cash on *C. moluccanum*, *P. hispaniolae* Cif. & Gonz. Frag. on *Codiaeum* sp., and *P. codiaeicola* Died. on *Codiaeum* sp., were excluded from the genus *Phyllosticta* s.str. based on their conidial morphology. According to van der Aa and Vanev (2002), *Phyllosticta oahuensis*, which has small and fusoid conidia without mucous sheath, does not belong to *Phyllosticta*, but to *Phomopsis*. *Phyllosticta hispaniolae* was transferred to the genus *Phomopsis* as *P. hispaniolae* (Cif. & Gonz.



Figs. 1–13 1–3 *Phyllosticta garciniae* (I. Hino & Katum.) Motohashi, Tak. Kobay. & Yas. Ono. **1** Symptom on leaf of *Garcinia subelliptica*. **2** Pycnidium containing conidia; bar 50 μm . **3** Conidia having mucous appendage, bar 20 μm . **4–6** *Phyllosticta ghaesembillae* Koord. **4** Symptom on leaf of *Codiaeum variegatum*. **5** Pycnidium containing conidia; bar 50 μm . **6** Conidium having mucous appendage on the top; bar 20 μm . **7–10** *Coniella*

australiensis Petr. **7** Symptom on leaf of *Eucalyptus robusta*. **8** Enlarged lesions showing concentric zone. **9** Pycnidium forming conidiogenous region at the bottom; bar 50 μm . **10** Conidia showing front view or side view; bar 20 μm . **11–13** *Cercospora asplenii* Jaap. **11** Symptom on leaf of *Asplenium antiquum*. **12** Section of stromata and conidiophores showing thick scar; bar 40 μm . **13** Conidium with truncate and thickened basal end; bar 20 μm

Frag.) Vanev & Aa. Likewise, *Phyllosticta codiaeicola*, the conidia of which are hyaline, small, elliptic, and without sticky membrane on those surfaces, must be transferred to the genus *Phoma*. The other species, *P. ghaesembillae*, is identical to the fungus collected on *Codiaeum variegatum* in Yoron Island in its morphological characteristics. This is the first record of *P. ghaesembillae* in Japan.

3. *Coniella australiensis* Petr., Sydowia 9:567, 1955

Figs. 7–10

Leaf spots pale brown to grayish brown at the leaf margin or the apex of the leaf, small, then enlarged to hemispherical, 10–20 mm in diameter, gradually spread down from the tip to the basal area with brown concentric zone. Conidiomata amphigenous, formed densely, visible, minute brown to dark brown dots. Pycnidia immersed at first, then erumpent, subglobose, 100–225 µm in diameter, 80–150 µm in height, with brown to dark brown wall composed of plectenchymatous cells; conidiogenous region formed at the bottom of the pycnidia with pseudoparenchymatous layer. Conidiogenous cells lined on pseudoparenchymatous layer, bearing conidia phialidically, 17.5–25 µm in length. Conidia unicellular, brown, black in mass, subglobose to napiform at a front view, elliptic at a side view, base truncate, apex obtuse with minute projection, 10–12.5 × 7.5–10 µm, 11.33 × 8.9 µm on average (*l/b* ratio = 1.27), smooth.

Specimen examined: On living leaves of *Eucalyptus robusta* Sm. (Japanese name: Teriha-yuukari), Nago, Okinawa Is., Okinawa Pref., 10 November 1994, by TK (TFM: FPH-7980; isolate: MAFF 237171).

Taxonomic notes: The disease described here occurred in the nursery of *Eucalyptus* spp. to supply the feed of koala in Kagoshima Zoo Garden. Among ten species of *Eucalyptus*, *E. robusta* seems to be highly susceptible to this disease. In the other *Eucalyptus* species, occurrence of this disease was weak to moderate. The causal fungus was identified as a species of *Coniella* Höhn. based on its unique pycnidium structure, which has been limited to the conidiogenous region at the bottom. As the result of observation of morphological characteristics, this fungus was identical with *C. australiensis*. According to Yuan et al. (1997) and Brown (2000), this fungus was detected from the seeds of *Eucalyptus*. Therefore, it might have been brought into Japan together with the seeds of *Eucalyptus* from Australia.

4. *Cercospora asplenii* Jaap “*aspleni*”, Ann. Mycol. 14:43, 1916

Figs. 11–13

Teleomorph: *Mycosphaerella asplenii* Thirum. & Govindu, Sydowia 8:345, 1954 (nom. illeg.), later homonym of *M. asplenii* (Auersw.) Lindau, in Engl. & Prantl, Naturlichen Pflanzenf. 1:426, 1897.

Leaf spots semicircular at leaf margin, or irregular at leaf tip, pale brown to brown, surrounded by dark brown

border, grayish brown to whitish gray at the center, covered with numerous brownish powdery masses composed of conidiophores and conidia, observed numerous minute black dots of stroma after the conidial secession. Caespituli amphigenous. Stroma amphigenous, immersed at first, then erumpent, 24–36 µm in diameter, brown to olive, composed of irregular and thick-walled cells. Conidiophores fasciculate loosely, simple, 31–50 × 4.3–5 µm; conidiogenous cells terminal; loci thickened, apical. Conidia hyaline to very pale brown, long cylindrical to long obclavate, base truncated and thick-walled, tip subacute, 2–13 septa, 29–139 × 3–5.3 µm, smooth.

Specimen examined: On living leaves of *Asplenium antiquum* Makino (Japanese name: Ootaniwatari), Chabana, Yoron Is., Kagoshima Pref., 21 November 2001, by TK & YO (TFM:FPH-7981; Isolate: MAFF 239176).

Taxonomic notes: Only three species of cercosporoid fungi on fernery plants have been recorded in Japan. They are *Pseudocercospora pyrrosiae* Togashi & Katsuki on *Pyrrosia lingua* (Katsuki 1953, 1965), *P. cyatheae* C. Nakash. & S. Inaba on *Cyathea* sp. (Nakashima et al. 2006) and *Passalora pteridis* (Siemaszko) U. Braun & Crous on *Pteridium aquilinum* var. *japonicum* (Crous and Braun 2003; Sawada 1958). *Cercospora asplenii* could be easily distinguished from the two species of *Pseudocercospora* listed above by slender and hyaline conidia and thick-walled scar at the basal end of conidia and the tip of conidiophores. It is also differentiated from *Passalora pteridis* by the simple holoblastic conidiogenesis. In the genus *Passalora*, conidiogenous cells produce brownish conidia as polyblastic.

Among the other cercosporoid fungi described on fernery plants, *Cercospora asplenii* (Jaap 1916; Chupp 1954) has quite similar morphological characteristics to the fungus described here: in the former, conidia are hyaline to subhyaline, 20–120 × 2–4 µm in size, and have a truncated basal end; in the latter, hyaline to subhyaline conidia truncated and thick-walled basal end, 29–139 × 2.9–5.3 µm in size. Originally, *C. asplenii* was detected on *Asplenium irichomanes* from Dalmatia, Yugoslavia (Jaap 1916; Chupp 1954). Then it was found on three species of *Asplenium* and the other fernery plants belonging to *Adiantum* of Adiantaceae and *Alsophila* of Cyatheaceae from India, Myanmar, Canada, and USA. This is the first record of *C. asplenii* in Japan.

References

- Brown BN (2000) Diseases and fungi of the reproductive structures of Eucalypts. In: Keane PJ, Kile GA, Podger FD, Brown BN (eds) Diseases and pathogens of eucalypts. CSIRO, Melbourne, pp 103–118

- Chupp C (1954) A monograph of the fungus genus *Cercospora*. Charles Chupp, Ithaca
- Crous PW, Braun U (2003) *Mycosphaerella* and its anamorphs: 1. Names published in *Cercospora* and *Passalora*. Centraalbureau voor Schimmelcultures, Utrecht
- Hino I, Katumoto K (1964) Notes on some new species of fungi collected in the Ryukyu Archipelago. Bull Fac Agric Yamaguti Univ 15:505–516
- Jaap O (1916) Beitrage zur Kenntnis der Pilze Dalmatiens. Ann Mycol 14:1–44
- Katsuki S (1953) Notes on parasitic fungi of Yaku-Island. J Jpn Bot 28:279–288
- Katsuki S (1965) *Cercosporae* of Japan. Trans Mycol Soc Jpn (Extra Issue) 1:1–100
- Kirk PM, Cannon PF, Minter DW, Stalpers JA (2008) Ainsworth and Bisby's dictionary of the fungi, 10th edn. CABI International, Wallingford
- Kobayashi T, Watanabe K (1995) Three unrecorded tree pathogenic fungi collected in Okinawa Island. In: Proceedings of 39th annual meeting of the Mycological Society of Japan, Tokyo, 27–28 May, p 52
- Kobayashi T, Nakashima C, Nishijima T (2003) Notes on some plant inhabiting fungi collected from the Nansei Islands (I). Mycoscience 44:473–479
- Kobayashi T, Ono Y, Furukawa T, Nishikawa J (2006a) Diseases and their causal fungi collected on woody plants in Yoron Island, southern Kyushu (I) (in Japanese). For Pests 55:28–33
- Kobayashi T, Ono Y, Furukawa T, Nishikawa J (2006b) Diseases and their causal fungi collected on woody plants in Yoron Island, southern Kyushu (II) (in Japanese). For Pests 55:56–63
- Kobayashi T, Ono Y, Furukawa T, Nishikawa J, Nakashima C, Hirooka Y (2007) Diseases and their causal fungi collected on woody plants in Okinoerabu Island, southern Kyushu, Japan (in Japanese). For Pests 56:17–32
- Kobayashi T, Ogimi C, Kameyama N, Yaguchi Y, Gushiken M (2009) Diseases of woody plants and their causal microorganisms in Okinawa Island—results of the surveys carried in 1988, 1990, 1994 and 1995 (in Japanese). Forest Pests 58:53–67
- Motohashi K (2008) Study on reexamination and molecular phylogeny of Japanese species belonging to the genus *Phyllosticta*. PhD thesis, Mie University, Tsu, Mie Prefecture
- Nag Raj TR (1993) Coelomycetous anamorphs with appendage-bearing conidia. Mycologue Publications, Waterloo
- Nakashima C, Kobayashi T (1997) Etiological studies on brown spot disease of *Pyracantha*. Ann Phytopathol Soc Jpn 63:309–315
- Nakashima C, Inaba S, Park JY, Ogawa Y (2006) Addition and reexamination of Japanese species belonging to the genera *Cercospora* and allied genera. IX. Newly recorded species from Japan (4). Mycoscience 47:48–52
- Sawada K (1958) Researches on fungi in Tohoku District of Japan (IV). Fungi Imperfecti (in Japanese). Bull Gov For Exp Stn Tokyo 105:35–140
- van der Aa HA (1973) Studies in *Phyllosticta* I. Stud Mycol 5:1–110
- van der Aa HA, Vanev S (2002) A revision of the species described in *Phyllosticta*. Centraalbureau voor Schimmelcultures, Utrecht
- Yuan ZQ, Old KM, Midgley SJ (1997) Mycoflora and pathogenicity of fungi present on stored seeds from provenances of *Eucalyptus pellita*. Aust Plant Pathol 26:195–202