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***Australiasca queenslandica* gen. et sp. nov.**  
**(Chaetosphaeriaceae: Ascomycota) and its anamorph**  
***Dischloridium camelliae* sp. nov. from Australia**

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*Abstract.* A new ascomycete, *Australiasca queenslandica* gen. et sp. nov., belonging to Chaetosphaeriaceae, is described and illustrated from Queensland, Australia with *Dischloridium camelliae* sp. nov. as its anamorph from *Camellia sinensis*. This is the first report of a substantiated connection between a teleomorph and a *Dischloridium* anamorph.

## Introduction

A conidial isolate of a *Dischloridium* sp. on *Camellia sinensis* (L.) Kuntze from Queensland formed an ascomycete teleomorph in Sachs' agar + maize leaf medium. The teleomorph is characterised by a non-stromatic, solitary, glabrous to setose and beaked ascoma with a periphysate ostiole, consisting of a peridium with cells forming a textura epidermoidea in surface view, a hamathecium of septate, branched, persistent paraphyses; asci that are eight-spored, thin-walled, unitunicate with non-amyloid apical structures; and ascospores that are hyaline, aseptate, thin-walled, ellipsoid to ovoid, but may become 1–3-transversely septate or even dictyoseptate after release. The asci deliquesce to release the ascospores that accumulate as a waxy mass at the apex of the ostiolar beak. The anamorph is hyphomycetous with brown conidiophores and percurrently proliferating conidiogenous cells with a wide apical channel. These characters of the ascomata, asci, ascospores and anamorphic features clearly indicate that the teleomorph is a member of the family Chaetosphaeriaceae. However, no genus in this group matches this teleomorph in its ascospore characters and *Dischloridium* anamorph. A new genus *Australiasca* with *A. queenslandica* as its type species is erected with *Dischloridium camelliae* sp. nov. as its anamorph to accommodate both the teleomorph and anamorph.

## Materials and methods

The teleomorph was produced by growing the primary conidial isolate on Sachs' agar + maize leaf medium (Hebert 1971), dark-incubated at c. 26°C or exposed to a near-UV light source at about the same

temperature. Single-ascospore isolates were established and produced both the teleomorph and anamorph in culture. Observations, measurements and photomicrographs were made on materials mounted in lactophenol or lactofuchsin, using brightfield and Nomarski differential interference contrast microscopy.

## Taxonomy

*Australiasca* Sivan. & Alcorn, gen. nov.

*Ascomata* atrobrunnea, obpyriformia cum rostrata, ostiolata, setosa. Paries ascomati e cellulis compositi, textura epidermoidea formans. *Paraphyses* filiformes, hyalinae, septatae, ramosae. *Asci* cylindrici vel fusiformes, unitunicati, octospori, brevipedicellati, apex cum structura haud amyloidea tenua. *Ascosporae* ellipsoideae vel ovoideae, aseptatae, hyalinae, tenuitunicatae, rectae vel curvatae, 1–3 septatae vel dictyoseptatae ad maturitatem.

*Species typica:* *Australiasca queenslandica* Sivan. & Alcorn

*Ascomata* dark brown, setose, obpyriform with an ostiolar beak lined on the inside with paraphyses. *Peridium* composed of cells forming a textura epidermoidea in surface view. *Paraphyses* filiform, hyaline, septate, branched. *Asci* cylindrical to fusiform, unitunicate, 8-spored, short-stalked, with a non-amyloid apical structure. *Ascospores* ellipsoid to ovoid, aseptate, hyaline, thin-walled, straight to curved, may become 1–3-septate or dictyoseptate after discharge and when old.

*Etymology:* ascomycete from Australia, the country of origin.

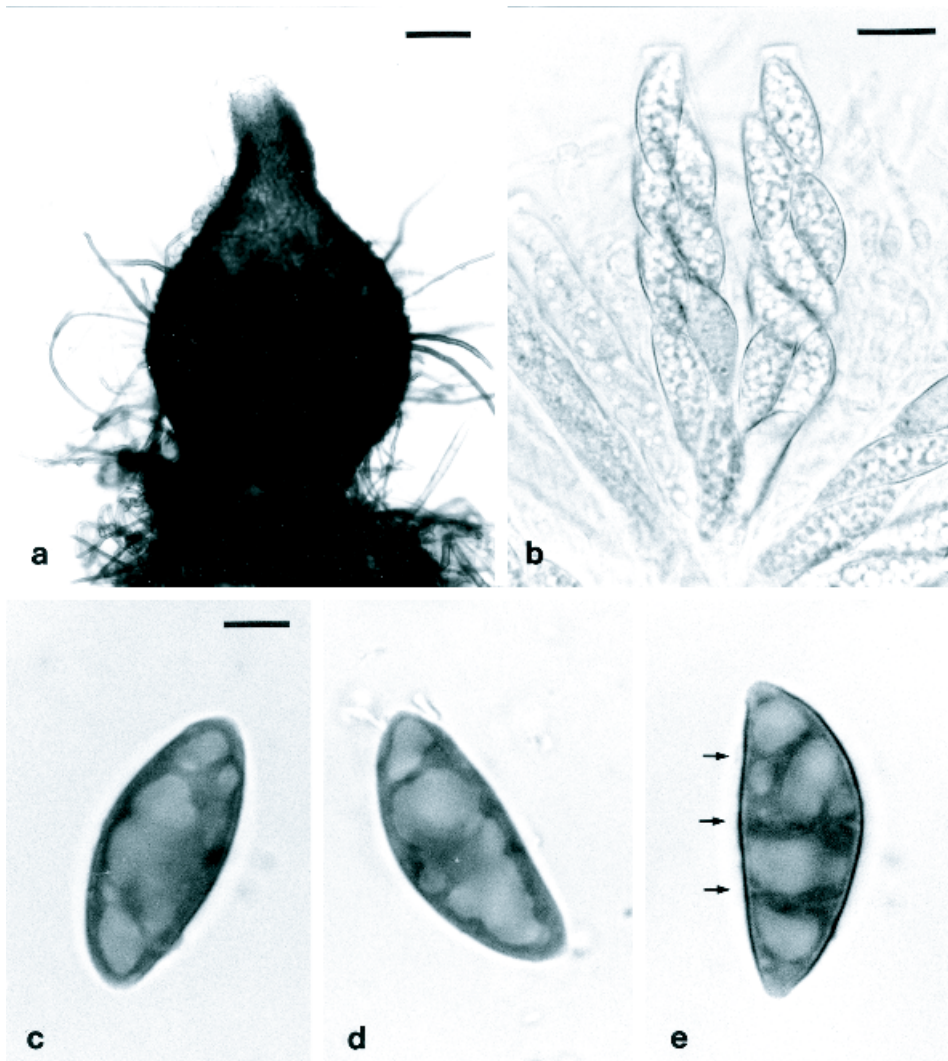
*Australiasca queenslandica* Sivan. & Alcorn, sp. nov. (Figs 1a–e, 2)

*Ascomata* solitaria raro binaria, atrobrunnea, obpyriformia, setosa, rostrata, superficialia, 215–300  $\mu\text{m}$  alta, 155–195  $\mu\text{m}$  crassa, rostrum plus minusve cylindricum, rectum vel curvatum, 50–90  $\times$  40–60  $\mu\text{m}$ , ostiolatum cum periphysatum. *Setae* atrobrunneae, crassitunicatae, 4–10 septatae, laeves, simplices, rectae vel curvatae, apice attenuatae, basaliter inflatis, 50–195  $\mu\text{m}$  longae, ad bases 6.5–9(–11)  $\mu\text{m}$  et 4.5–6  $\mu\text{m}$  prope bases et 2–4  $\mu\text{m}$  ad apices. Paries ascomati textura epidermoidea in pagina visa, 9–12  $\mu\text{m}$  crassus, externo 5–6-strato e cellulis compressis, plus minusve rectangularibus, crassitunicatis, atrobrunneis, 5–13  $\times$  3–6  $\mu\text{m}$ , interno pallide tenuitunicatis, 5–9  $\times$  1.5–3  $\mu\text{m}$  compositus. *Paraphyses* filiformes,

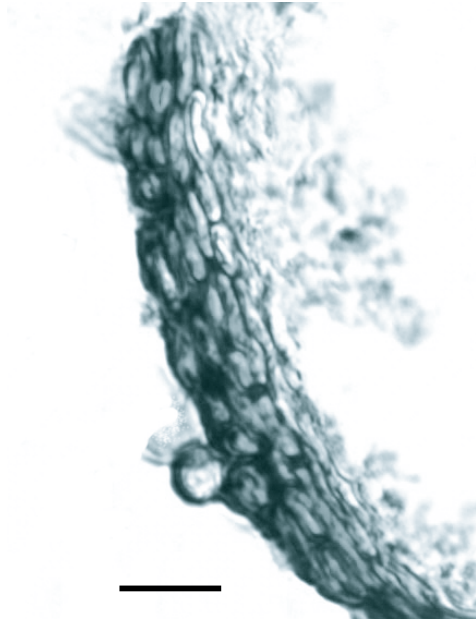
hyalinae, septatae, ramosae, 2–5  $\mu\text{m}$  crassae. *Asci* cylindrici vel fusiformes, unituncati, octospori, brevipedicellati, apex cum structura haud amyloidea tenua, 65–140  $\times$  12.5–17.5  $\mu\text{m}$ . *Ascosporae* ellipsoideae vel ovoideae, hyalinae, tenuitunicatae, rectae vel leviter curvatae, 18–31  $\times$  7.5–10.5  $\mu\text{m}$ , 1–3 septatae vel dictyoseptatae ad maturitatem. *Microconidia* hyalina, aseptata, tenuitunicata, oblonga vel late ellipsoidea vel plus minusve obovoidea, 3–6  $\times$  2–3.5  $\mu\text{m}$ .

*Anamorphosis*: *Dischloridium camelliae* Alcorn & Sivan., sp. nov.

*Holotypus*: Australia, Queensland, Malanda, J. L. Alcorn, ex *Dischloridium* cultura ex folii et cauli *Camelliae* *sinsensis*, 26.iii.1998, BRIP 25190a.



**Fig. 1.** *Australiasca queenslandica*. (a) Ascoma. (b) Asci and ascospores. (c–e) Ascospores, in e with transverse septa (arrows). Scale bar = 50  $\mu\text{m}$  (a), 15  $\mu\text{m}$  (b), 5  $\mu\text{m}$  (c–e). All from Sachs' agar + maize leaf culture.



**Fig. 2.** *Australiasca queenslandica*. Vertical section of ascoma wall. Scale bar = 10  $\mu$ m. From Sachs' agar + maize leaf culture.

*Ascomata* solitary or rarely in pairs, dark brown, superficial or suspended in the aerial mycelium, 215–300  $\mu$ m high, 155–195  $\mu$ m wide, obpyriform with a globose to broadly oval setose body and a more or less cylindrical, slightly paler, straight to curved, periphysate, ostiolar beak 50–90  $\times$  40–60  $\mu$ m. *Peridium* forming a textura epidermoidea in surface view, 9–12  $\mu$ m thick, composed of 5 or 6 layers of compressed cells  $\pm$  rectangular in vertical section; cells of outer layer thick-walled and dark brown, 5–13  $\times$  3–6  $\mu$ m; cells of inner layers paler and thinner-walled, 5–9  $\times$  1.5–3  $\mu$ m. *Setae* dark brown, paler at the apex, thick-walled, smooth, straight or bent, simple, gradually tapering to an obtuse tip, 50–195  $\mu$ m long, often swollen at the base up to 6.5–9(–11)  $\mu$ m, 4.5–6  $\mu$ m wide near the base and 2–4  $\mu$ m at the tip, 4–10-septate. *Paraphyses* filiform, hyaline, septate, branched, often inflated below the septa, 2–5  $\mu$ m thick. *Asci* cylindrical to fusoid, tapered towards the base and truncate at the apex, unitunicate, 8-spored, 65–140  $\times$  12.5–17.5  $\mu$ m, with a non-amyloid, thin, flattened disk-like apical structure. *Ascospores* ellipsoid to ovoid, aseptate, thin-walled, hyaline, straight to slightly curved, overlapping monostichous or distichous, 18–31  $\times$  7.5–10.5  $\mu$ m, accumulating in a waxy mass at the apex of the ascoma beak. Released ascospores often become 1–3-transversely septate or even develop vertical septa to become dictyoseptate, and some form cylindrical phialidic conidiogenous extensions up to 16  $\times$  3  $\mu$ m which produce microconidia. *Microconidia* hyaline, thin-walled, aseptate, oblong, broadly ellipsoidal or more or less obovoid, 3–6  $\times$  2–3.5  $\mu$ m.

*Etymology*: specific epithet based on Queensland, the state where the fungus was collected.

#### Notes

The family Chaetosphaeriaceae was erected by Réblová *et al.* (1999) and is characterised by superficial to basally immersed or subiculate, smooth to setose perithecia with a thin peridium and periphysate ostiole; paraphyses that are hyaline, branched, septate and filiform; asci that are unitunicate with a non-amyloid apical structure; and ascospores that are hyaline to pigmented, ellipsoidal to fusiform and transversely septate. The anamorphs in members of this family have phialidic conidiogenesis. The family consists of seven genera and *Chaetosphaeria* Tul. & C.Tul. is the only genus in this family to show some resemblance to *Australiasca* in the setose perithecia and in the hyaline 1–3-septate ascospores. The anamorphs in *Chaetosphaeria*, however, belong to a range of different genera: *Cacumisporium* Preuss, *Catenularia* Grove, *Chalara* (Corda) Rabenh., *Chloridium* Link : Fr., *Cylindrotrichum* Bonord., *Dictyochoeta* Speng., *Gonytrichum* Nees & T.Nees, *Menispora* Pers. : Fr., *Phialophora* Medlar and *Zanclospora* S.Hughes & W.B.Kendr. (Réblová 2000). A *Dischloridium* anamorph has so far not been connected to any teleomorph. Kirk (1986) reported a probable teleomorph of *D. laeense* (Matsush.) B.Sutton referable to the Trichosphaeriaceae near *Trichosphaeria* but a full description of this morph has not been published (P. M. Kirk, pers. comm. 2001). This teleomorph may belong to *Australiasca* on the basis of setose ascomata with unitunicate asci. *Dischloridium* is another hyphomycete with phialidic conidiogenesis. *Australiasca* can be distinguished from *Chaetosphaeria* by its mostly aseptate ascospores that may become 1–3-transversely septate or dictyoseptate after discharge, by phialidic germ tubes on ascospores and by its *Dischloridium* anamorph. In the phialidic germination of ascospores, *Australiasca* shows affinity with members of Lasiosphaeriaceae where this type of germination is frequently found. The ascospores in *Chaetosphaeria* species germinate by germ tubes (Réblová *et al.* 1999). *Australiasca queenslandica* is homothallic and the teleomorph can be produced by growing conidial isolates on Sachs' agar medium supporting sterilised maize leaf.

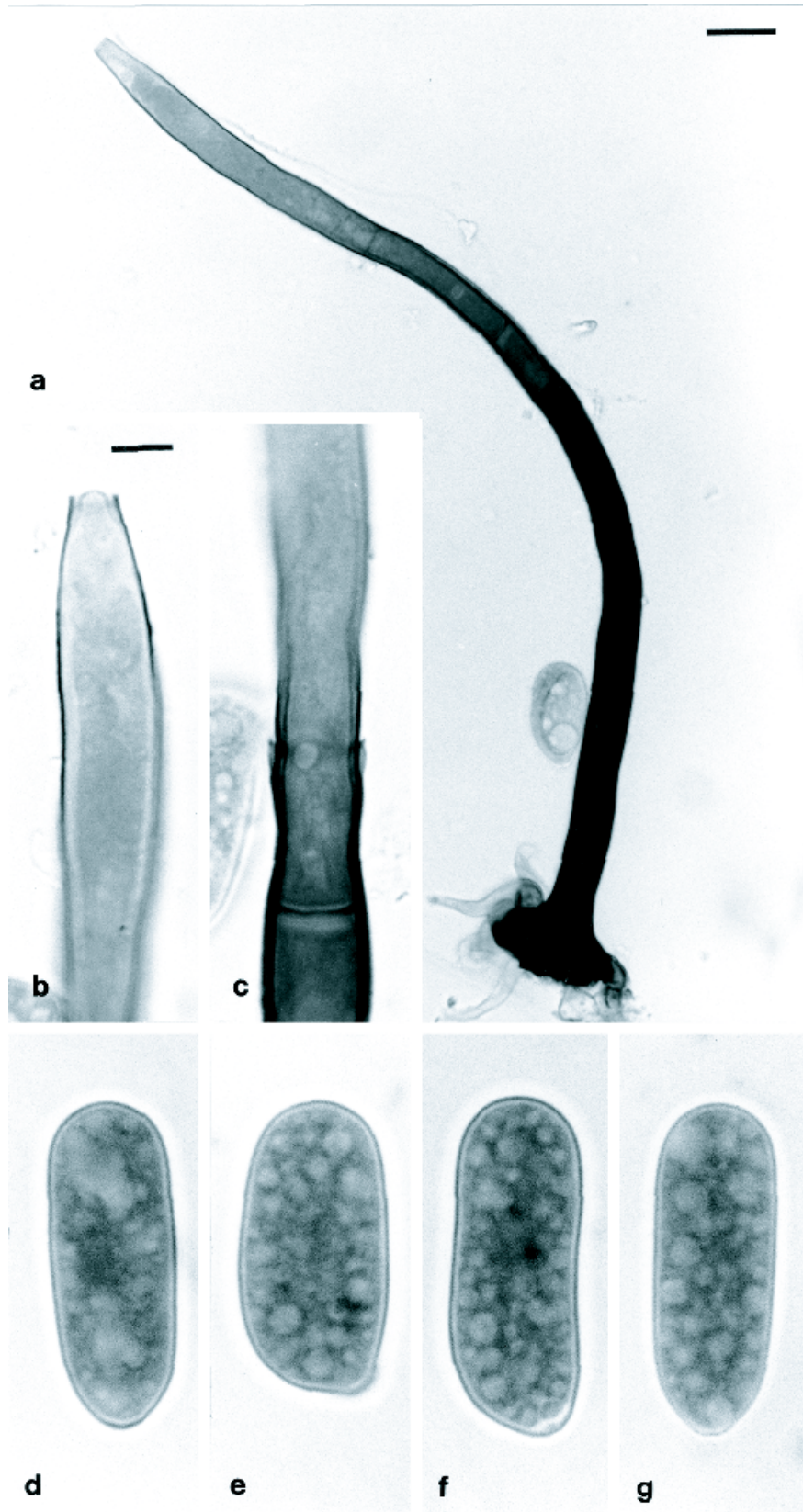
#### Other specimens examined

Australia, Queensland: on Sachs' agar + maize leaf, J.L. Alcorn, 26.v.1997, BRIP 24445; on Sachs' agar + maize leaf, J.L. Alcorn, 22.vii.1997, BRIP 24475; on Sachs' agar + maize leaf, J.L. Alcorn, 16.xii.1997, BRIP 24857 (all dried cultures derived from the primary isolate).

*Dischloridium camelliae* Alcorn & Sivan., sp. nov. (Fig. 3a–g)

*Conidiophora* macronemata, fasciculata vel singularia, cylindrica, brunnea, pallidiora versus apicem, laevia, 3–17 septata, non-ramosa vel ramosa, interdum percurrentia,





**Fig. 3.** *Dischloridium camelliae*. (a) Conidiophore. (b) Conidiophore tip. (c) Percurrent proliferation of conidiophore. (d–g) Conidia. Scale bar = 15  $\mu\text{m}$  (a), 5  $\mu\text{m}$  (b–g). a–c from natural host; d–g from Sachs' agar + maize leaf culture.

Table 1. Synopsis of described *Dischloridium* species

Species	Conidiophore size (µm) <sup>A</sup>	Shape	Conidia Size (µm)	Colour	Septa	Reference
<i>D. basicurvatum</i> Matsush.	200–300(–600) × [10] 5–7 × 3–4	Oblong; apex rounded, base obtuse	9–25 × 3.5–6(–7)	Hyaline	0	Matsushima (1995)
<i>D. cylindrosperrum</i> S.K.Srivast. <sup>B</sup>	→ 350 × [11.5] 4–5 (median)	Cylindrical; base truncate	18–22 × 4.5–5.7	Hyaline	0	Srivastava (1986)
<i>D. inaequiseptatum</i> (Matsush.) Hol.-Jech.	80–160 × 5–7 × 4–5	Cylindrical; apex rounded; base narrowly truncate	18–26 × 5.5–6.5	Brown (versicolored)	3	Matsushima (1975)
<i>D. keniense</i> P.M.Kirk	180–420 × [14] 7–9(–11)	Broadly ellipsoidal to obovate; base sometimes truncate	11–18 × (6–)7–9	Brown	(0–)1	Kirk (1985)
<i>D. laeense</i> (Matsush.) B. Sutton	140–220(–400) × 6–8	Rectangular elliptical	17–26 × 8–12; 15–20 × 8–10	Hyaline	0	Matsushima (1971); Bhat and Sutton (1985)
<i>D. microsporium</i> R.F.Castañeda & W.B.Kendr.	100–150 × 2.5–3.5	Ellipsoidal; apex rounded; base subtruncate	6–9 × 2–3	Hyaline	0	Castañeda and Kendrick (1991)
<i>D. regenerans</i> Bhat & W.B.Kendr.	→ 300 × 8–10	Cylindrical to ellipsoidal; apex obtuse; base narrower and truncate	25–38 × 12–16	Hyaline	0	Bhat and Kendrick (1993)
<i>D. roseum</i> (Petch) Seifert & W.Gams	125–500 × 8–12	Ellipsoidal, oblong ellipsoidal or ovate	28–48 × 16–23	Hyaline	0	Seifert and Gams (1985)
<i>D. tenuisporium</i> Hol.-Jech.	80–200 × 4–5	Ellipsoidal to elongate ellipsoidal	10–18 × 3.5–5	Hyaline	0	Holubová-Jechová (1987a)
<i>D. triseptatum</i> Hol.-Jech.	80–320 × 8–9.5 × 5–6.5	Broadly ellipsoidal to cylindrical-ellipsoidal	20–28 × 8–10.5	Pale- to yellow-brown	3	Holubová-Jechová (1987b)
<i>D. venezuelense</i> (J.L.Crane & Dumont) Bhat & B.Sutton <sup>C</sup>	(220–)240–330(–440) × 8–9(–11)	Fusiform with conical apices	(23–)27–35(–42) × 15–20; 31–46 × 16–19.5	Hyaline	0	Crane and Dumont (1978); Bhat and Sutton (1985)
<i>D. ychaffrei</i> (Bhat & B.Sutton) Hol.-Jech.	110–400 × 6.5–8	Cylindrical to cylindrical-clavate	19–22.5 × 7.5–9	Medium brown	3	Bhat and Sutton (1985)

<sup>A</sup>Values in square brackets refer to diameter at base; subsequent ranges refer to diameter near base and near apex, respectively, unless indicated otherwise.

<sup>B</sup>*Monilochaetes infuscans* Ellis & Halstead (Rong and Gams 2000).

<sup>C</sup>*Dischloridium roseum* (Seifert and Gams 1985).

usque ad 420 µm longa, ad basim 6–12.5 µm diam., ad apicem 6.5–10 µm diam. *Cellulae conidiogenae* in conidiophoris incorporatae, apicales, determinatae vel indeterminatae, enteroblasticae, phialidicae, 25–58 × 6.5–10 µm. *Conidia* hyalina, aseptata, laevia, oblonga, ad basim saepe truncata, ad apicem obtusa, guttulata, 18–35 × 8–13 µm, raro 1–3 septata ad maturitatem.

*Holotypus*: Australia, Queensland, Malanda, J.L. Alcorn, culturae ex folii et cauli *Camelliae sinensis*, 26.iii.1998, BRIP 25190b.

*Conidiophores* macronematous, mononematous, single or in tufts arising from a basal stroma, cylindrical but often somewhat swollen in the subapical region and tapered gradually towards the truncate apex, smooth, mid- to dark brown below and paler apically, 3–17-septate, unbranched or once branched, sometimes percurrent, up to 420 µm long, 6–12.5 µm wide at the base and 6.5–10 µm at the apex. *Conidiogenous cells* integrated, apical, phialidic, determinate or indeterminate, with a wide channel and minute collarette, 25–58 × 6.5–10 µm. *Conidia* hyaline, mostly aseptate, thick-walled, guttulate, smooth, oblong with the base often asymmetrically truncate and the apex obtuse, produced in heads or chains of up to 21 conidia, 18–35 × 8–13 µm, occasionally becoming 1–3-septate when mature.

#### Other specimens examined

*Dischloridium camelliae*: single-ascospore cultures on Sachs' agar + maize leaf, J.L. Alcorn 97/ 2003, 10.vii.1997, BRIP 24607. *Dischloridium laeense*: Sri Lanka, Perideniya Botanic Garden, B.C. Sutton, *Victoria regia*, 24.i.1973, IMI 173432a; India, Uttar Pradesh, Gorakhpur, P.C. Misra, *Tinospora quadrifolia*, 16.ix.1981, IMI 260833; Australia, Qld, Mt Kondalilla, B.C. Sutton & J.L. Alcorn, undet. host, 30.viii.1981, IMI 263460.

#### Notes

The hyphomycete genus *Dischloridium* was erected by Sutton (1977) to accommodate *Chloridium laeense* Matsush. Features used to distinguish the new genus from *Chloridium*, as represented by its type species *C. virescens* (Pers.: Pers.) Gams & Hol.-Jech., were the following: the occurrence of compact fascicles of long conidiophores arising from a distinct immersed stroma; large thick-walled conidia; wide phialides showing pronounced periclinal thickening associated with a small collarette and a very wide apical channel; and the far greater dimensions of conidiophores and conidia compared with those of all other taxa retained in *Chloridium* at the time (Gams and Holubová-Jechová 1976). Subsequently, Kirk (1985) pointed out that not all collections of *D. laeense* have an immersed stroma and conidiophores may arise singly from the immersed mycelium. Eleven other taxa have been added to *Dischloridium*, either as newly described species or as transfers of epithets from other genera (Table 1). This fungus on and isolated from *Camellia sinensis* in Australia, and shown to be the anamorpha of

*Australiasca queenslandica*, is considered sufficiently distinct to require description as a new species.

Eight of the previously described species of *Dischloridium* have aseptate conidia, the remainder having either 1-septate or 3-septate conidia (Table 1). Of the former group, *D. camelliae* is most similar to *D. laeense*, differing mainly in having longer conidia and rather more robust conidiophores, often swollen subapically (Matsushima 1971; Sutton 1977). In the latter aspect, a similarity to conidiophores of *Kylindria excentrica* Bhat & B.Sutton is apparent, but in that species conidiogenous cells have a narrow cytoplasmic channel and marked periclinal thickening in the upper quarter and conidia are always 3-septate (Bhat and Sutton 1985). *D. regenerans* Bhat & W.B.Kendr. differs in its shorter conidiophores which are often verrucose in the lower half (Bhat and Kendrick 1993). A key to the 13 taxa described in or transferred to *Dischloridium* is provided below.

#### Key to *Dischloridium* species

1. Conidia septate ..... 2  
Conidia aseptate ..... 5
2. Conidia 1-septate ..... *D. keniense*  
Conidia 3-septate ..... 3
3. Conidia asymmetrically septate ..... *D. inaequiseptatum*  
Conidial septation symmetrical ..... 4
4. Conidia 19–22.5 × 7.5–9 µm ..... *D. ychaffrei*  
Conidia 20–28 × 8–10.5 µm ..... *D. triseptatum*
5. Conidiophores hyaline ..... 6  
Conidiophores brown ..... 8
6. Conidia 6–9 × 2–3 µm ..... *D. microsporium*  
Conidia 27–48 × 15–23 µm ..... 7
7. Conidia ellipsoidal, oblong ellipsoidal or ovate .... *D. roseum*  
Conidia fusiform with conical apices ..... *D. venezuelense*
8. Conidiophores curved at base ..... *D. basicurvatum*  
Conidiophores not curved at base ..... 9
9. Conidiophores roughened in lower half ..... *D. regenerans*  
Conidiophores smooth ..... 10
10. Width of conidia less than 6 µm ..... 11  
Width of conidia greater than 6 µm ..... 12
11. Conidia cylindrical with truncate base ... *D. cylindrospermum*  
Conidia ellipsoid to elongate ellipsoid ..... *D. tenuisporum*
12. Conidia 15–26 × 8–12 µm ..... *D. laeense*  
Conidia 18–35 × 8–13 µm ..... *D. camelliae*

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