

## On the type species of the genus *Kirschsteinothelia*, *K. aethiops*

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*Kirschsteinothelia aethiops*, typifying *Kirschsteinothelia*, is redescribed to clarify its delimitation. *Microthelia incrustans*, previously synonymized under *K. aethiops*, is proved to be a distinct species; therefore a new combination, *K. incrustans* comb. nov., is proposed. The definition of this genus is thus further clarified.

Keywords: *Kirschsteinothelia*, *Kirschsteinothelia aethiops*, *Kirschsteinothelia incrustans*.

The genus *Kirschsteinothelia* D. Hawksw. was established by Hawksworth (1985) to accommodate a group of species previously referred to the genus *Microthelia* Körber and close to the species *Microthelia incrustans* (Ellis & Everh.) Corlett & S. Hughes. Hawksworth (1985) considered *M. incrustans* to be a synonym of *Sphaeria aethiops* Berk. & Curtis, and therefore transferred the epithet 'aethiops', instead of 'incrustans', to *Kirschsteinothelia* as the epithet 'aethiops' predates 'incrustans'. Accordingly the genus *Kirschsteinothelia* is typified by *K. aethiops* (Berk. & Curtis) D. Hawksw. with *M. incrustans* as a synonym.

Examination of the type specimen of *Sphaeria aethiops* revealed that it is clearly separable from *M. incrustans*, despite the superficial similarity between them. They are distinguishable in several respects (Tab. 1), and can by no means be assigned to a single species taxon. Shearer (1993) has recognized the prominent ascospore sheath in *S. aethiops*, concordant to our present observation and its original description (Berkeley & Curtis, 1876) but inconsistent with the description of *K. aethiops* by Hawksworth (1985) where the ascospore sheath is described as poorly developed and does not appear in his drawing. However, it is in *M. incrustans* that the ascospore sheath is absent (Hughes, 1978; Sivanesan, 1984). Ascospore shape is also different between *S. aethiops* and *M. incrustans*, being equilateral in the former while largely inequilateral at the upper half in

the latter. Both forms of ascospore shape were included in Hawksworth's sense of *K. aethiops* (Hawksworth, 1985). Moreover, in his sense of *K. aethiops* he noticed the variations of ascoma shape and degrees of flattening at the base of ascoma from different collections, and then concluded that ascomata with more rounded base are more usually associated with a *Dendryphiopsis* anamorph. The variations of ascoma actually result from two different species. The fungus whose ascomata appear subglobose in longitudinal section and more or less flattened at the base (Figs. 2a–b) (Sivanesan, 1984) in association with *Dendryphiopsis* anamorph should be attributed to *M. incrustans*. Hughes (1978), in addition to establish the anamorph-teleomorph connection from culture, observed that the *Dendryphiopsis* anamorph also occurs on the lectotype material of *M. incrustans*. The fungus whose ascomata appear conical with a strongly flattened base in longitudinal section (Figs. 1a & d–e) and without the associated anamorph falls into the concept of the true *S. aethiops*. Consequently, there can be no doubt from Hawksworth's description that the species *K. aethiops* he had in mind was a complex of two different but closely related fungi, *M. incrustans* and *S. aethiops*, both of which can be assigned to the genus *Kirschsteiniothelia*. The name, *K. aethiops*, should only represent the fungus based on *S. aethiops*; the epithet 'incrustans' should be applied to *Kirschsteiniothelia* to represent a different fungus from *K. aethiops*. The two taxa are redescribed herein to clarify their separation.

Table 1. – Differences between *S. aethiops* (*K. aethiops*) and *K. incrustans*

	<i>S. aethiops</i>	<i>K. incrustans</i>
Ascomata	Conical in longitudinal section, brittle, never depressed, consistently black even around the ostiole.	Subglobose in longitudinal section, non-brittle, occasionally laterally depressed, usually pallid to yellowish around the ostiole.
Asci	Smaller, 80–110 µm long, usually broadest towards the base.	Larger, 100–130 µm long, usually broadest towards the middle.
Pseudo-paraphyses	Lacking an oil matrix.	Embedded in an oil matrix.
Ascospores	Equilateral.	Mostly inequilateral at the upper cell.
Anamorph	Not known.	<i>Dendryphiopsis atra</i>

## Material and Methods

Materials examined are from K and PAD. For those materials collected in Taiwan are deposited in NCHUPP (herbarium of the

Plant Pathology Department, National Chung Hsing University). Sections were cut on a freezing microtome. Measurements and photographs were made from slide preparations in water. Measurements are displayed by ranges between maximal and minimal dimensions.

### Taxonomy

***Kirschsteiniothelia aethiops*** (Berk. & Curtis) D. Hawksw., Bot. J. Linn. Soc. 91: 185. 1985. – Fig. 1.

*Sphaeria aethiops* Berk. & Curtis, Grevillea 4: 143. 1876.

*Amphisphaeria aethiops* (Berk. & Curtis) Sacc., Syll. Fung. 1: 722. 1882.

*Melanopsamma suecicum* Rehm, Hedwigia 21: 120. 1882.

*Amphisphaeria suecica* (Rehm) Sacc., Syll. Fung. 9: 742. 1891.

*Melanomma heteromera* (Briard & Sacc.) Cooke, Grevillea 16: 53. 1887.

*Anphisphaeria heteromera* Briard & Sacc., in Sacc, Rev. Mycol. 7: 159. 1885.

*Amphisphaeria magnusii* Sacc., Bommer & Rouss., in Bommer & Rouss., Bull. Soc. R. Bot. Belge 26: 205. 1887.

Ascomata scattered, superficial with the basal wall broadly attached to and partly immersed in substrate, hemispherical, appearing conical in longitudinal section, 320–450  $\mu\text{m}$  wide, 220–300  $\mu\text{m}$  high, brittle, covered with tubercles, apex obtuse or pointed, base flattened; hyphae penetrating into the host, intercellular, dark brown, broad, 3–6  $\mu\text{m}$  wide, becoming as narrow as 1–2  $\mu\text{m}$  wide between adjoined hyphae. Peridium composed of textura angularis, cells appearing palisade-like at the base and rim regions. Ascii subcylindrical to obclavate, 80–110  $\times$  20–27  $\mu\text{m}$ , usually broadest towards the base, sessile to short-stalked, 8-spored, occasionally 4- or 6-spored. Pseudoparaphyses 1.5–2  $\mu\text{m}$  wide, frequently anastomosing and branched. Ascospores ellipsoid, 24–30  $\times$  8–11  $\mu\text{m}$ , dark brown, verrucose, with a conspicuously constricted, submedian septum, equilateral, surrounded by a distinct gelatinous sheath.

Exsiccatae examined. – Fuckel, Fungi rhenani, no 932 (as *Sphaeria applanata*, K). Petrak, Florae Bohemoslovakiae et Moraviae, no 1040 (as *Amphisphaeria applanata*, K). Rehm Ascomyceten, no. 1038b (as *Amphisphaeria suecica*, K).

Specimens examined. – USA, on old logs, M. A. Curtis 4414 (K, isotype of *Sphaeria aethiops*). FRANCE, Troyes Gallia, on decorticated wood of *Carpinus*, Mar. 1883, P. A. Briard (PAD, holotype of *Amphisphaeria heteromera*).

This fungus has been mistakenly referred to various names based on *Sphaeria applanata* Fr.: Fr. (Munk, 1957, Scheinpflug, 1958, Sivanesan, 1975), but, as *S. applanata* has turned out to be a *Cyclothyrium* species (Hawksworth, 1981), those names can not longer be used for this fungus.

*Amphisphaeria magnusii* is listed as a tentative synonym following Scheinpflug (1958). *Microthelia inops* Degelius was placed as a synonym by Hawksworth (1985). However, judging from his illustrations made from holotype, it belongs to neither *K. aethiops* nor *K. incrustans*.

***Kirschsteiniothelia incrustans*** (Ellis & Everh.) C. Y. Chen & W. H. Hsieh, comb. nov. – Fig. 2.

Basionym. – *Amphisphaeria incrustans* Ellis & Everh., North Amer. Pyren.: 201. 1892.

*Microthelia incrustans* (Ellis & Everh.) Corlett & S. Hughes, in Hughes, New Zeal. J. Bot. 16: 360. 1978.

Anamorph. – *Dendryphiopsis atra* (Corda) Hughes, Can. J. Bot. 31: 655. 1953.

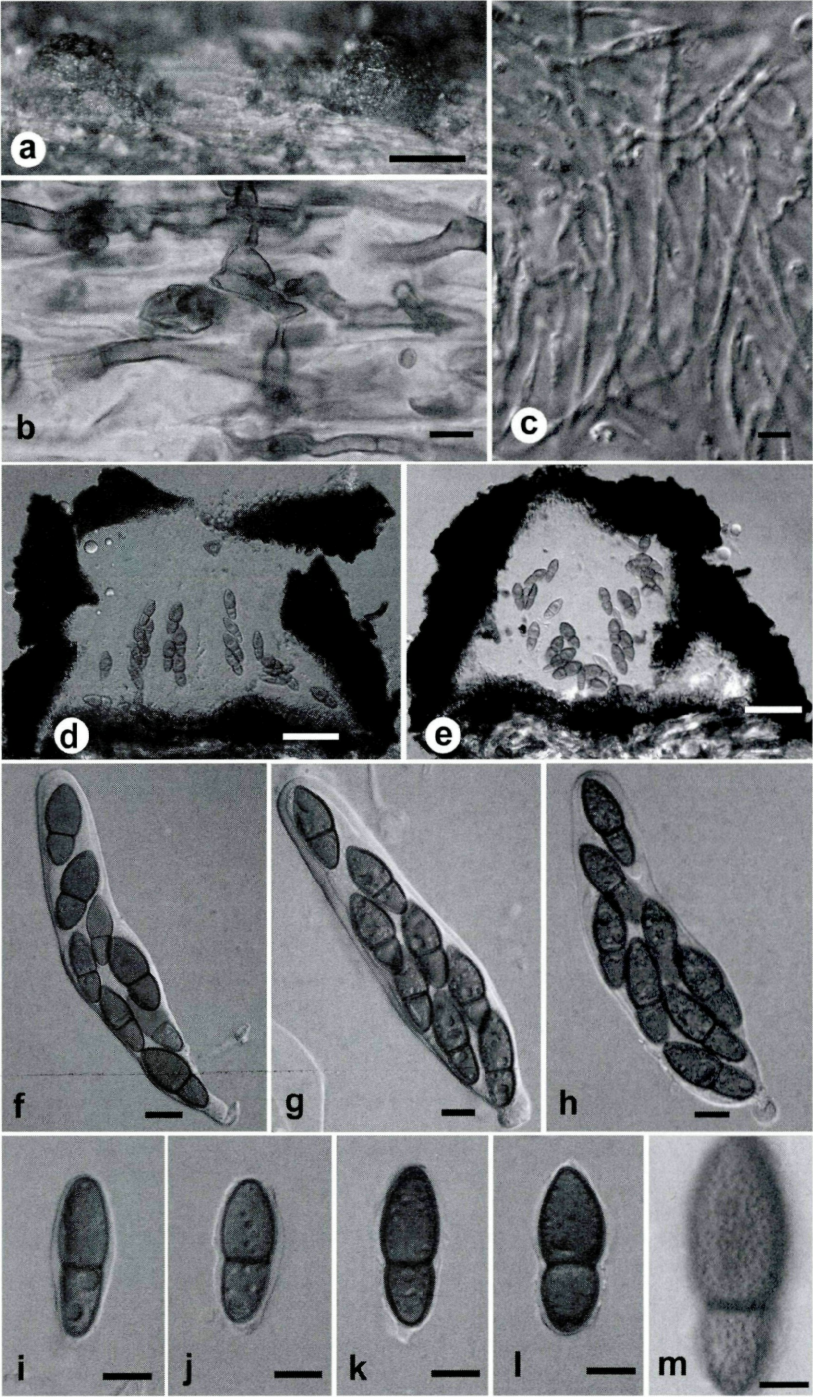
For synonyms of this anamorph, see Hughes (1958) and Sivanesan (1984).

Ascomata scattered, superficial, sometimes with the base slightly embedded in substrate, subglobose to hemispherical, appearing subglobose in longitudinal section, 260–500  $\mu\text{m}$  wide, 300–400  $\mu\text{m}$  high, occasionally laterally depressed, externally finely roughened, apex obtuse, usually pallid to yellowish around the ostiole, base flattened; hyphae protruded from the underside of ascomata, intercellular in substrate, dark brown, broad, generally 3–5  $\mu\text{m}$  wide, mutually connected by narrow 1–2  $\mu\text{m}$  wide hyphae. Peridium composed of textura angularis, cells tending to be vertically orientated and palisade-like towards the base. Asci broadly subcylindrical, 100–130  $\times$  17–26  $\mu\text{m}$ , usually broadest towards the middle, sessile to short-stalked, 8-spored, occasionally 4 or 6 spored. Pseudoparaphyses 2–2.5  $\mu\text{m}$  wide, frequently anastomosing and branched, embedded in an oil matrix which will turn up to be numerous oil droplets of various sizes (Fig. 2d) when mounted in water. Ascospores broadly fusiform, 25–34  $\times$  9–13  $\mu\text{m}$ , dark brown, verrucose, slightly constricted at the submedian septum, at first equilateral, then becoming mostly inequilateral at the upper cell when mature, without a sheath.

Specimens examined. – TAIWAN: Nantou Hsien, Piluchi, on decorticated wood, 10 May 2000, C. Y. Chen (NCHUPP c0016); Meifeng, on decorticated wood of *Litsea*, 16 Feb. 2002, C. Y. Chen (NCHUPP c0618). Hualien

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Fig. 1. *Kirschsteiniothelia aethiops* (from holotype of *A. heteromera*). – a. Ascomata on host surface. – b. intercellular hyphae in substrate. – c. Pseudoparaphyses. – d–e. Sections of ascomata. – f–h. Asci (ectotunica ruptured in f). – i–l. Ascospores. – m. Ascospore, showing the warts. – Bars: a = 200  $\mu\text{m}$ ; b = 10  $\mu\text{m}$ ; c = 5  $\mu\text{m}$ ; d–e = 50  $\mu\text{m}$ ; f–l = 10  $\mu\text{m}$ ; m = 5  $\mu\text{m}$ .



Hsien, Tienshiang, on wood, 28 Dec. 2001, C. Y. Chen (NCHUPP c0405). Taoyuan Hsien, Lalashan, on decaying wood, 5 Aug. 2003, C. Y. Chen (NCHUPP c1102).

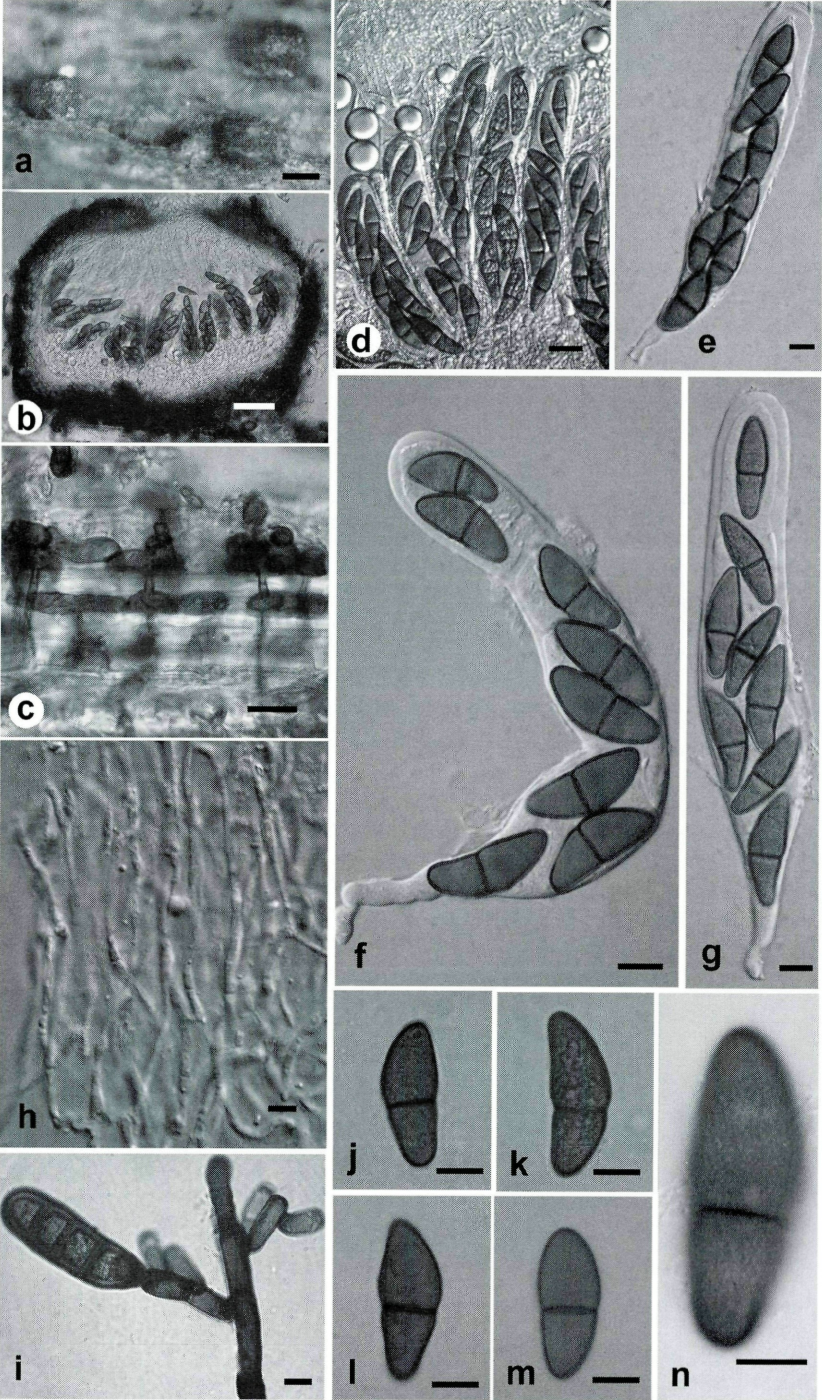
The anamorph state *Dendryphiopsis atra* can be obtained from the cultures of single ascospore isolation and can also be found around ascomata for all the Taiwan specimens in this study. This anamorph state was well-illustrated by Ellis (1971), Hughes (1953; 1978) and Sivanesan (1984). The specimens NCHUPP c0405 was erroneously reported as *K. aethiops* (Chen & Hsieh, 2003).

## Discussion

As *Kirschsteiniothelia aethiops* is the type species of *Kirschsteiniothelia*, clear and correct recognition of its characters is essential to the circumscription of this genus. Ascospores of this genus were defined by Hawksworth (1985) as being 'without a distinct gelatinous sheath', and the six species involved in his treatment were also described as that. In this study it is certain that *K. aethiops* possesses a distinct ascospore sheath, whereas *K. incrustans* lacks the ascospore sheath. There is a need to introduce an unequivocal description, i.e. 'ascospore sheath present or absent', to define this genus, while it should be noted that a distinct ascospore sheath is consistently present in the type species. The use of additional characters which are common to both *K. aethiops* and *K. incrustans* can provide a better delimitation of this genus. Asci in both species exhibit a tendency to have ascospores developed at the lower part. To be specific, asci are usually broadest towards the base in *K. aethiops* and towards the middle in *K. incrustans*. The intercellular broad brown hyphae in substrate (Figs. 1b & 2c) are also found to be characteristic of both species, and can be used to characterize the genus. In addition to the aforementioned characters, the ascomata are subglobose to hemispherical, with a flattened base; the brown ascospores are ornamented, with an uneven septum. All these characters constitute a clear contour in demarcating the genus *Kirschsteiniothelia*.

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Fig. 2. *Kirschsteiniothelia incrustans* (from NCHUPP c1102). – a. Ascomata on host surface. – b. Section of ascoma. – c. intercellular hyphae in substrate. – d. Asci and pseudoparaphyses with surrounding oil droplets. – e–g. Asci with ectotunica ruptured. – h. Pseudoparaphyses. – i. Conidium and conidiophore of *Dendryphiopsis atra* anamorph. – j–l. Ascospores. – m. Immature ascospore. – n. Ascospore, showing the warts. – Bars: a = 200  $\mu\text{m}$ ; b = 50  $\mu\text{m}$ ; c = 10  $\mu\text{m}$ , d = 20  $\mu\text{m}$ , e–g = 10  $\mu\text{m}$ , h = 5  $\mu\text{m}$ ; i–n = 10  $\mu\text{m}$ .



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