
Microfungi on the *Pandanaceae*: *Acrodictys*, with two new species

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Two new species of *Acrodictys* are introduced based on specimens identified on *Pandanus* species in Hong Kong and Mauritius. The new species are compared with presently accepted species. Three other species are also reported from the *Pandanaceae*, and a key to *Acrodictys* species is provided.

Key words: *Acrodictys lamma*, *Acrodictys triarmatus*, key, mitosporic fungi.

Introduction

Acrodictys was introduced by Ellis (1961) with the type species, *A. bambusicola* M.B. Ellis, and nine other species. The genus is characterised by dictyosporous conidia formed as blown out ends on macronematous, mononematous, erect, septate, brown conidiophores, which commonly undergo percurrent proliferation through the conidiophore apex (Ellis, 1961). Conidial morphology within *Acrodictys* is quite variable with species having many different shapes, pigmentation patterns, number and orientation of septa, and appendages. Variation in morphology of conidiophore and conidiogenous cells is usually limited to the degree of pigmentation, number of septa, and the number of percurrent proliferations. However, there are two exceptions, *A. stilboidea* Mercado and J. Mena, which has synnematous conidiophores and *A. malabarica* Subraman. and Bhat which has 2-4 lateral fertile branches in the upper half of the conidiophore. Conidia range in shape from turbinate, ellipsoid, pyriform/clavate, ovoid, spherical to lobed/irregular. *Acrodictys appendiculata* M.B. Ellis, *A. brevicornuta* M.B. Ellis, *A. corniculata* R.F. Castañeda and *A. eickeri* Morgan-Jones all have conidial outgrowths or appendages. The genus does not produce stroma, setae or hyphopodia.

Sutton (1969) and Ellis (1961, 1971, 1976) have produced keys to species of *Acrodictys*, and an updated key is provided in this paper. *Acrodictys kamatii* Narendra and V.G. Rao does not appear to be a species of *Acrodictys* and is omitted from the key, while *A. elaeidis* J.M. Yen and Sulmont has been transferred to *Septosporium* (Pirozynski, 1972), and *A. excentrica* B. Sutton to *Arachnophora* (Hughes, 1979). *Acrodictys satwalekeri* D. Rao appears to be identical to *A. erecta* and is also omitted from the key, while Deighton and Pirozynski (1966) suggested that the structures described as conidia of *A. brooksiae* M.B. Ellis are most likely aborted ascomata or ascomatal primordials of *Brooksia tropicalis* Hansf.

This work originates from an ongoing study of the saprobic microfungi that inhabit members of the monocotyledon family *Pandanaceae* (e.g., McKenzie, 1995; Hyde, 1997; Whitton *et al.*, 1999). No species of *Acrodictys* have been described or reported from the *Pandanaceae* (McKenzie and Hyde, 1996). In this paper, two new species found on *Pandanus* spp. are described, along with brief descriptions, based on material from *Pandanus*, of three previously known species.

Taxonomy

1. *Acrodictys elaeidicola* M.B. Ellis, Mycological Papers 79: 7 (1961).

Conidiophores 1-11 septate, 35-165 μm long, 4-7 μm wide towards the base, 2.5-4 μm wide towards the apex. *Conidiogenous cells* 0-2 percurrent proliferations. *Conidia* 20-27 \times 13-19 μm , 2 rows of transverse septa, 0-2 rows of longitudinal septa, internal septa with small, circular pores.

Habitat: Known to inhabit decaying leaves of *Acrocomia mexicana*, *Elaeis guineensis*, *Pandanus* sp., *Roystonea regia*.

Known distribution: Brunei (this paper), Cuba (Mercado, 1984), Gabon (Ellis, 1976), Mexico (Heredia *et al.*, 1997).

Material examined: BRUNEI DARUSSALAM, Temburong, Batu Apoi Forest Reserve, Kuala Belalong Field Studies centre, alongside the Track to Wak Wak, on decaying leaves of *Pandanus* sp., 24 Oct. 1995, S.R. Whitton [HKU(M) 13029].

Notes: *Acrodictys elaeidicola* is characterised by pyriform or clavate, muriform conidia, which typically have 3 transverse septa, 1-3 longitudinal septa and are 17-26 μm long and 11-19 μm wide at the widest point (Ellis, 1961). Morphologically and dimensionally the current specimen fits the description given by Ellis (1961) for *A. elaeidicola*, the only difference noted is the presence of circular pores on the internal septa of the conidia. This character is easily overlooked and is not thought to be significant enough to warrant further taxonomic treatment.

Key to species of *Acrodictys*

- | | | |
|-----|---|-------------------------|
| 1. | Conidia with appendages | 2 |
| 1. | Conidia without appendages | 6 |
| 2. | Appendages short and horn-like..... | 3 |
| 2. | Appendages longer, cylindrical, not strongly curved..... | 5 |
| 3. | Appendages straight up to 10 μm long; conidia 46-60 \times 25-58 μm | <i>A. brevicornuta</i> |
| 3. | Appendages strongly curved..... | 4 |
| 4. | Appendages corniform, strongly curved, 1-6 per conidium, 8-20 \times 2-3.5 μm ; conidia more or less spherical, 19-35 \times 17.5-30 μm | <i>A. corniculata</i> |
| 4. | Appendages uncinately or curved, 4-12 per conidium, 4-18 \times 3-4 μm ; conidia globose to broadly pyriform, 60-75 \times 45-55 μm | <i>A. viridescens</i> |
| 5. | Appendages 2-4 per conidium, 15-56 \times 3-4 μm ; conidia turbinate or subglobose, 24-44 \times 20-32 μm | <i>A. appendiculata</i> |
| 5. | Appendages 2-7 per conidium, 7-16 \times 2-3 μm ; conidia broadly pyriform to subglobose, 38-64 \times 22-42 μm | <i>A. eickeri</i> |
| 6. | Conidiophores synnematous, conidia (18-)22-31 \times (11.5-)13-16.5 μm | <i>A. stilboidea</i> |
| 6. | Conidiophores mononematous..... | 7 |
| 7. | Conidia globose or subglobose | 8 |
| 7. | Conidia not globose | 10 |
| 8. | Conidia 22-27 \times 17-23 μm diam., 2 transverse septa, 1-3 longitudinal septa .. | <i>A. globulosa</i> |
| 8. | Conidia less than 16 μm diam..... | 9 |
| 9. | Conidia globose, 11-15.6 μm diam., divided cruciately by septa; conidiophores 4-12 septate, 116-522 μm long, 8.9-11 μm wide at the base, 6.7-8.9 μm wide at the apex | <i>A. martinii</i> |
| 9. | Conidia globose, 10-15 \times 9.5-14 μm diam., divided cruciately or with 2 transverse and 1-2 longitudinal septa; conidiophores 0-5 septate, 14-57 μm long, 2.5-4 μm wide at the base | <i>A. lamina</i> |
| 10. | Conidia turbinate, pyriform or clavate | 11 |
| 10. | Conidia ellipsoid, ovoid or irregular in shape | 18 |
| 11. | Conidia with numerous transverse, longitudinal and oblique septa, 26-57 \times 19-30 μm , brown to dark brown, concolorous throughout | <i>A. dennisii</i> |
| 11. | Conidia with few longitudinal and transverse septa | 12 |
| 12. | Conidia apically dark brown to black | 13 |
| 12. | Conidia without a dark brown apex | 14 |

13. Conidia 17-26 × 10-15 μm, 3-5 transverse septa, 1-3 longitudinal or oblique septa, often breaking away from the conidiophore with the conidiogenous cell attached *A. atroapicula*
13. Conidia 21-26 × 12-16 μm, 3 (rarely 4) transverse septa, 3-6 oblique or longitudinal septa, never breaking away with the conidiogenous cell attached..... *A. fuliginosa*
14. Conidiophores with 2-4 lateral fertile branches, conidia 16-21 × 14-17 μm, 3 transverse and *ca.* 4 longitudinal septa *A. malabarica*
14. Conidiophores simple..... 15
15. Conidia typically with (2-)3-5 transverse septa..... 16
15. Conidia typically with 2-3 transverse septa 17
16. Conidia 17-36 × 12-18 μm, (2-)4-5 transverse septa, 1-2 longitudinal septa, pale brown to dark brown, often slightly constricted at the septa *A. bambusicola*
16. Conidia 17-22.5 × 9.5-11.5 μm, 3-4 transverse septa and a few longitudinal or oblique septa, pale brown to brown, often slightly constricted at the septa *A. similis*
17. Conidia 17-27 × 11-19 μm, 2-3 transverse septa, 1-3 longitudinal septa, brown to dark brown, basal cell pale; conidiophores 35-180 μm long, 1-13 septate, proliferating percurrently *A. elaeidicola*
17. Conidia 18-25 × 13-19 μm, 2-3 transverse septa, 1-2 longitudinal septa, brown to dark brown, basal cell pale; conidiophores 25-50 μm long, 0-1 septate, non-percurrent *A. balladynae*
18. Conidia ellipsoid or ovoid 19
18. Conidia irregular in shape 25
19. Conidia typically wider than high 20
19. Conidia typically higher than wide 21
20. Basal cell of conidia protruding and always oriented in the centre of the long axis, conidia always wider than high and regular in shape, composed of 9-13 cells, 21-36 × 10-15 μm ...
..... *A. queenslandica*
20. Basal cell of conidia protruding but orientation is somewhat varied, conidia often wider than high but irregular in shape, composed of 8-28 cells, 24-35 μm wide at the widest point.....
..... *A. obliqua*
21. Conidia oval, 24-40 × 15-22 μm, numerous transverse, longitudinal and oblique septa, typically very dark brown or black, opaque *A. erecta*
21. Conidia not so dark in pigmentation 22
22. Conidia ellipsoid to almost cylindrical, many transverse, longitudinal and oblique septa, brown, 64-105 × 24-40 μm *A. septosporioides*
22. Conidia smaller..... 23
23. Conidia ellipsoid, numerous transverse, longitudinal and oblique septa, constricted at the septa, 28-36 × 17-21 μm *A. peramazonensis*
23. Conidia with few internal septa 24

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24. Conidia broadly ellipsoidal, 3-5 transverse septa, 0-2 longitudinal or oblique septa, 10-27 × 6-17 µm, no percurrent proliferation *A. sacchari*
24. Conidia oval to almost spherical, 2-3 transverse septa, 0-2 longitudinal or oblique septa, 15-24 × 11-15 µm, up to 6 percurrent proliferations.....*A. fimicola*
25. Conidia undivided, dark brown to black, numerous transverse, longitudinal and oblique septa, peripheral cells often protruding and swollen or forming lobes, 40-86 × 30-55 µm ..
.....*A. deightonii*
25. Conidia often divided or strongly constricted along septa 26
26. Conidia composed of three columns of cells, divided at the columns or not, dark brown to black except for the basal cells of each column, 4-5 transverse septa per column, 24-34 × 15-30 µm.....*A. triarmatus*
26. Conidia composed of 2-3 columns of cells, columns always divided or strongly constricted at the septa, concolorous throughout, each column with 1-2 transverse septa, 27-37 × 11-21 µm *A. furcata*

2. *Acrodictys fimicola* M.B. Ellis and Gunnell, Mycological Papers 79: 10 (1961).

Conidiophores 3-12 septate, 46-204 µm long, 4.5-6 µm wide towards the base, 3-4.5 µm wide towards the apex, with 0-4 percurrent proliferations. *Conidia* 15-26 × 10-16 µm, 2 transverse septa, 0-1 longitudinal septa, internal septa with small, circular pores.

Habitat: Known to inhabit decaying culms of *Bambusa vulgaris*, decaying leaves of *Argyroxiphium sandwicense*, *Pandanus* sp. and elephant dung.

Known distribution: Hawaii (Raabe *et al.*, 1981), Malaysia (this paper), Sierra Leone (Ellis, 1961).

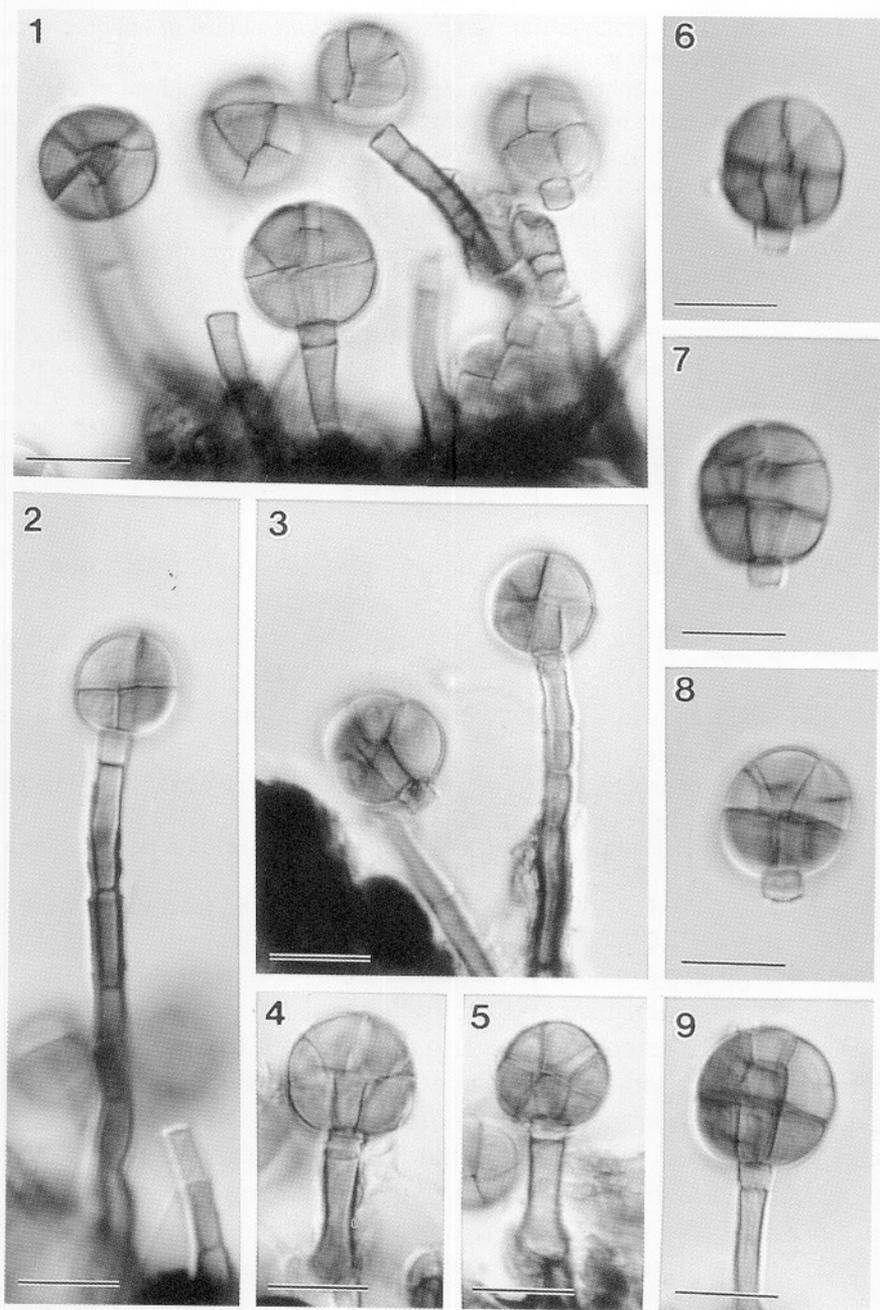
Material examined: MALAYSIA, Old Gombak, on decaying leaves of *Pandanus* sp., 7 Sep. 1995, K.D. Hyde [HKU(M) 13030 and HKU(M) 13031].

Notes: *Acrodictys fimicola* is characterised by ellipsoid, muriform conidia, which have 2-3 transverse septa, 0-2 longitudinal septa, and sometimes also a few oblique septa. The conidia are also slightly constricted at the septa, pale brown to brown, smooth, and 15-24 × 11-15 µm (Ellis, 1961). The current specimens are dimensionally and morphologically similar to *A. fimicola*, however, the number of internal septa in these specimens are fewer than typical, as described by Ellis (1961). No oblique septa were observed, and internal pores are also present in the current specimens. These differences are small, and not interpreted as taxonomically significant.

3. *Acrodictys lamma* Whitton, McKenzie and K.D. Hyde, **sp. nov.** (Figs. 1-9)

Etymology: refers to the type locality, Lamma Island, Hong Kong.

Coloniae in substrato naturali effusae. *Mycelium* immersum et superficiale; hyphae superficiales ramosae, septatae, pallide brunneae, ubique laeves. *Conidiophora* macronemata,



Figs. 1-9. *Acrodictys lamma* (from holotype). 1-5. Conidia and conidiophores. 6-9. Conidia. Note the persistent, cylindrical portion of the conidiogenous cell at the base of each free conidium. Bars = 10 μ m.

mononemata, cylindrica, erecta, flexuosa, 14-57 × 2.5-4 µm, laevia, brunnea, ad apicem pallidiora, 0-5 septata. *Cellulae conidiogenae* holoblasticae, monoblasticae, in conidiophoris integratae, cum proliferationibus percurrentis, laeves, pallide brunneae, truncatae. *Conidia* singula, sicca, late elliptica vel globosa, laevia, pallide brunnea, 10-15 × 9.5-14 µm.

Colonies effuse, consisting of conidiophores scattered singly or in small groups over the substrate surface. *Mycelium* immersed and superficial, superficial hyphae branched, cylindrical, septate, pale brown, smooth throughout. *Conidiophores* 14-57 µm long, 2.5-4 µm wide at the widest point, macronematous, mononematous, cylindrical, erect, flexuous, smooth, brown fading to pale brown at the apex, arising from a small knot of cells at the base of the conidiophores, basal cells often slightly swollen (up to 5 µm wide), 0-5 septate, thickened walls and septa, apex truncate, undergoing up to 8 successive percurrent proliferations, terminated by a single conidium. *Conidiogenous cells* holoblastic, monoblastic, integrated into the apex of the conidiophores, terminal, smooth, cylindrical, pale brown, truncate. *Conidia* 10-15 × 9.5-14 µm, solitary, dry, broadly elliptical to globose, terminal, smooth, pale brown, 1-2 transverse septa and 1-2 longitudinal septa, septa sometimes dividing the conidia cruciately, with persistent basal cell protruding, basal cell pale brown, cylindrical, 3.2-5 µm diam.

Habitat: Known to inhabit decaying leaves of *Pandanus tectorius*.

Known distribution: Hong Kong.

Material examined: HONG KONG, Lamma Island, beyond Hung Shing Yhe Beach, on decaying leaves of *Pandanus tectorius*, 17 Aug. 1995, S.R. Whitton [HKU(M) 13033, HOLOTYPE].

Notes: Three other species of *Acrodictys* have globose conidia, *A. corniculata*, *A. globulosa* and *A. martinii*. In *A. corniculata* the conidia have many internal septa, are 19-35 × 17-30 µm diam. and have numerous irregular appendages originating at the apex of the conidia (Castañeda, 1985). The conidia of *A. globulosa* are morphologically similar to *A. lamma*, but are larger (22-27 × 17-23 µm diam.) and typically have a few more internal septa (Ellis, 1965). In *A. martinii* the conidia are morphologically and dimensionally (11-15.6 µm diam.) very similar to the current specimen, but the conidiophores are significantly larger (116-522 × 8.9-11 µm, and 4-12 septate) and the conidia are always divided cruciately by the septa (Crane and Dumont, 1975). As the conidia of *A. martinii* are similar to those in *A. lamma*, these could represent the same taxon, the difference in conidiophore size being due to natural variation. However, the difference is quite extreme, and as the conidia of *A. martinii* are always cruciately divided, whilst those of *A. lamma* are only sometimes divided in this fashion, we believe specific recognition is warranted until further collections prove otherwise.

4. *Acrodictys obliqua* M.B. Ellis, Mycological Papers 79: 13 (1961).

Conidiophores 5-8 septate, 72-110 μm long, 5-6.7 μm wide at the base, 3.2-4 μm wide at the apex. *Conidia* 20-27 μm high, 27-35 μm wide, cells connected via small, round, simple pores situated on the inner septa.

Habitat: Known to inhabit decaying leaves of *Pandanus* sp., and decaying wood.

Known distribution: Brunei (this paper), Cuba (Holubová-Jechová and Mercado, 1986), Ghana (Ellis, 1961).

Material examined: BRUNEI DARUSSALAM, Temburong, Batu Apoi Forest Reserve, Kuala Belalong Field Studies Centre, alongside the Track to Wak Wak, on decaying leaves of *Pandanus* sp., 25 Oct. 1995, S.R. Whitton [HKU(M) 13032].

Notes: *Acrodictys obliqua* is characterised by muriform conidia which are typically wider than they are high, somewhat irregular in shape and 24-33 μm wide at the widest point. The basal cell of the conidium often protrudes beyond the edge of the conidial wall (Ellis, 1961). Conidial dimensions and morphology of the current specimen agree with the description given by Ellis (1961) for *A. obliqua*, the only observable difference being circular pores on the internal septa of the conidia.

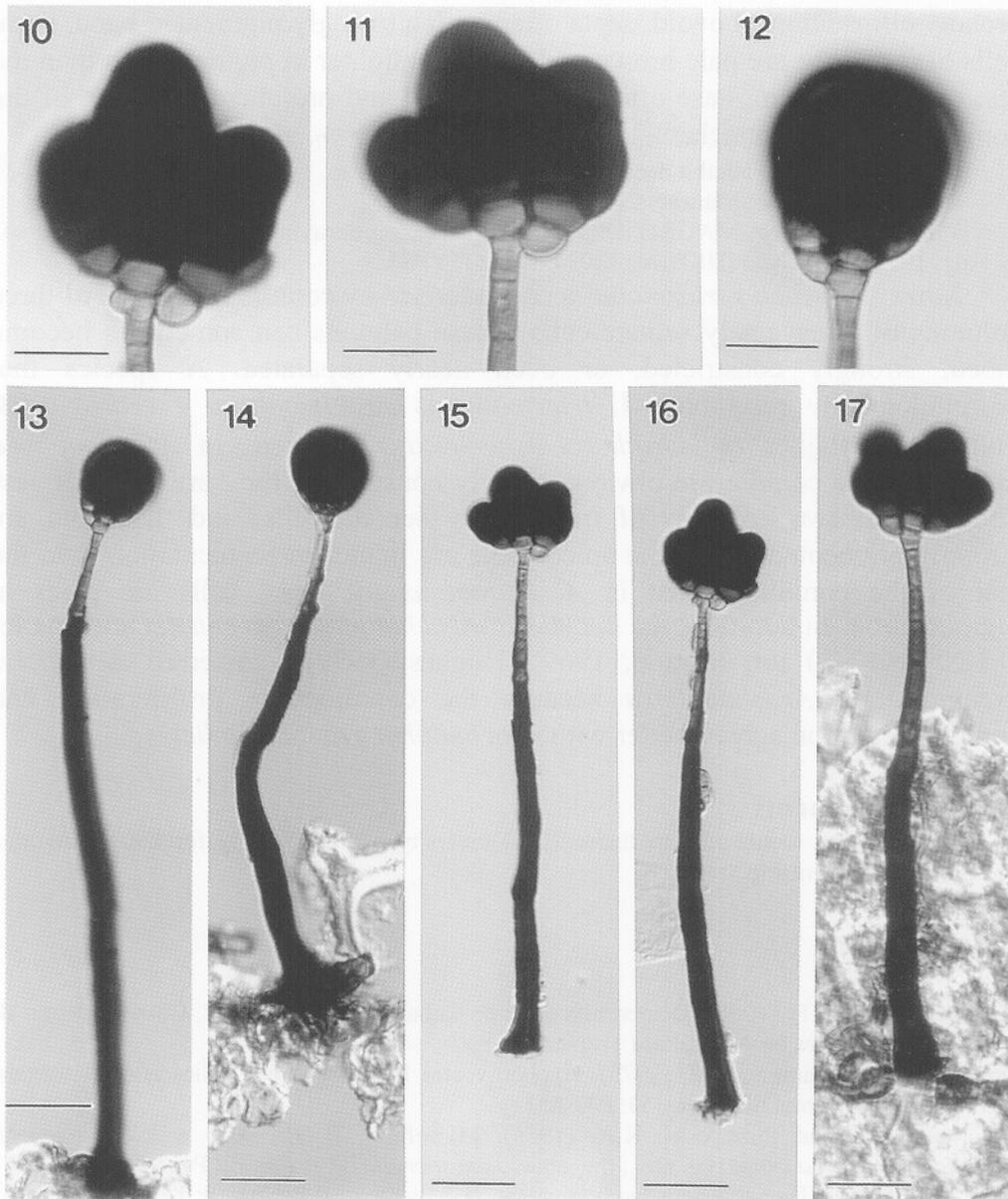
5. *Acrodictys triarmatus* Whitton, McKenzie and K.D. Hyde, **sp. nov.**

(Figs. 10-17)

Etymology: from *tri-* prefix for three, *armatus* meaning armed, referring to the conidia, which are composed of three columns of cells.

Coloniae in substrato naturali effusae, brunneae. *Mycelium* immersum et superficiale; hyphae superficiales pallide brunneae, laevies, septatae, ramosae. *Conidiophora* macronemata, mononemata, cylindrica, erecta, recta vel flexuosa, 98-178 μm longa, prope basim 6-8 μm lata, ad apicem 2-3.2 μm , laevia, brunnea, ad apicem pallidiora, 8-12 septata. *Cellulae conidiogenae* holoblasticae, monoblasticae, in conidiophoris integratae, cum proliferationibus percurrentis, laeves, pallide brunnea, truncata. *Conidia* singula, sicca, late elliptica vel globosa, laevia, pallide brunnea, 24-34 \times 15-30 μm .

Colonies effuse, consisting of individual conidiophores scattered over the substrate surface, brown. *Mycelium* immersed and superficial, superficial hyphae pale brown, cylindrical, smooth, septate, branched. *Conidiophores* 98-178 μm long, 6-8 μm wide towards the base, 2-3.2 μm wide at the apex, macronematous, mononematous, straight, curved or flexuous, erect, unbranched, solitary, tapering from the base to the apex, very dark brown to brown at the base, fading to pale brown towards the apex, smooth, strongly thickened walls especially towards the base, narrowing towards the apex, 8-12 septate, septa thickened and easily visible, apex terminated by a single conidium and truncate, basal cell slightly swollen 10-15 μm , often with several superficial hyphae growing out from it, undergoing up to 5 successive percurrent proliferations. *Conidiogenous cells* holoblastic, monoblastic, integrated into the apical cell of the conidiophores, terminal, cylindrical, smooth, pale brown, truncate. *Conidia* 24-34 \times 15-30 μm , solitary, dry,



Figs. 10-17. *Acrodictys triarmatus* (from holotype). **10-12.** Conidia. Note the pale basal cells and the lobed nature in 10 and 11. **13-17.** Conidia and conidiophores. Bars: 10-12 = 10 μm , 13-17 = 20 μm .

terminal, consisting of three columns of cells, each column with 4-5 transverse septa, smooth, sometimes wider than high, either entire or with the individual columns strongly constricted forming lobes, non-lobed conidia are black and

broadly ellipsoid or obovoid, septa often with a strongly pigmented band, basal cells of each lobe are pale brown and distinctly lighter in pigmentation than the rest of the conidium, base often with a conical and protuberant portion of the conidiogenous cell attached.

Habitat: Known to inhabit decaying leaves of *Pandanus* sp.

Known distribution: Mauritius.

Material examined: MAURITIUS, Petrin Reserve, on decaying leaves of *Pandanus* sp., 11 Aug. 1995, K.D. Hyde [HKU(M) 13034, HOLOTYPE].

Notes: *Acrodictys triarmatus* is characterised by conidia composed of three columns of transversely septate cells. These columns can sometimes become lobed, strongly constricted, or even nearly separated. A species that morphologically resembles *A. triarmatus* is *Arachnophora excentrica* (B. Sutton) S. Hughes (\equiv *Acrodictys excentrica*). However, in *Arachnophora excentrica* the conidia are always strongly constricted, they are more or less divided into two columns of transversely septate cells, and the septa are strongly pigmented. Often the apical cells are lighter in pigmentation than the rest of the conidia, whilst in *A. triarmatus* the basal cells are paler in pigmentation. In addition, the conidia of *Arachnophora excentrica* are smaller ($13\text{-}20 \times 12\text{-}20 \mu\text{m}$ (Sutton, 1969). Hughes (1979) transferred *Acrodictys excentrica* to *Arachnophora* because the conidiophore proliferation and conidial septation agreed better with *Arachnophora* than *Acrodictys*.

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