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**

   
   *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 × 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
2. 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 × 25-58 μm .... *A. brevicornuta*
3. Appendages strongly curved ........................................... 4

4. Appendages corniform, strongly curved, 1-6 per conidium, 8-20 × 2-3.5 μm; conidia more or less spherical, 19-35 × 17.5-30 μm .......... *A. corniculata*
4. Appendages uncinate or curved, 4-12 per conidium, 4-18 × 3-4 μm; conidia broadly pyriform, 60-75 × 45-55 μm .............. *A. viridescens*

5. Appendages 2-4 per conidium, 15-56 × 3-4 μm; conidia turbinate or subglobose, 24-44 × 20-32 μm ........................................ *A. appendiculata*
5. Appendages 2-7 per conidium, 7-16 × 2-3 μm; conidia broadly pyriform to subglobose, 38-64 × 22-42 μm .................... *A. eickeri*

6. Conidiophores synnematous, conidia (18-)22-31 × (11.5-)13-16.5 μm ........ *A. stilboidea*
6. Conidiophores mononematous ......................................... 7

7. Conidia globose or subglobose ........................................ 8
7. Conidia not globose ....................................................... 10

8. Conidia 22-27 × 17-23 μm diam., 2 transverse septa, 1-3 longitudinal septa .... *A. globulosa*
8. Conidia less than 16 μm diam........................................... 9

9. Conidia globose, 11-15.6 μm diam., divided cruciately by septa; conidiophores 4-12 septate, 165-622 μm long, 8.9-11 μm wide at the base, 6.7-8.9 μm wide at the apex .......... *A. martini*
9. Conidia globose, 10-15 × 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 .......... *A. lamma*

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 × 19-30 μm, brown to dark brown, concolorous throughout .......... *A. dennisii*
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. atroapiculana*

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. peruamazonensis*

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*


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 *Argyroxyphium 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,
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.

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.

Colonies in substrato naturali effusae, brunneae. Mycelium immersum et superficialie; hyphae superficiales pallide brunneae, laeves, 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 integrae, cum proliferationibus percurrentis, laeves, pallide brunnea, truncata. Conidia singula, sicca, late elliptica vel globosa, laevia, pallide brunnea, 24-34 × 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 × 15-30 µm, solitary, dry,
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.,

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 (= 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
(13-20 × 12-20 μm (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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