
A synopsis of *Trichocladium* species, based on the literature

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The genus *Trichocladium* is reviewed, based on the literature, with a synopsis of 18 accepted species. A key to the species and a composite diagram of the conidial morphology of accepted species are provided. Short comments are given to the 22 *Trichocladium* names which are considered unacceptable or doubtful in the genus.

Key words: freshwater fungi, Hyphomycetes, mitosporic fungi, soil fungi, systematics, taxonomy.

Introduction

The genus *Trichocladium* Harz (1871), based on the lectotype species *T. asperum*, includes dematiaceous species of hyphomycetes producing solitary, thick-walled, more or less pyriform to clavate phragmoconidia, from micronematous or semi-macronematous, mononematous conidiophores (Hughes, 1952; Ellis, 1971). Species of *Trichocladium* are frequently isolated from soil (Dixon, 1968; Domsch and Gams, 1972) or encountered in aquatic environments (Crane and Shearer, 1978; Kohlmeyer and Volkmann-Kohlmeyer, 1995; Hyde and Goh, 1998, 1999; Hyde *et al.*, 1999). In our surveys of fungal diversity on submerged wood (Goh and Hyde, 1996; Hyde and Goh, 1998, 1999; Hyde, Goh and Steinke, 1998; Hyde *et al.*, 1999) we frequently encountered *Trichocladium* species. This has prompted us to carry out the present synoptic work on the genus.

It is evident that the genus *Trichocladium* is becoming heterogeneous and species identification has become difficult. The genus has included species producing effuse colonies on natural substrata (e.g. Hughes, 1969) as well as species forming sporodochioid conidiomata (e.g., Crane and Shearer, 1978). The genus has also included species with small or large conidia, e.g., *T. minimum* and *T. macrosporum*, respectively (de Hoog and Grinbergs, 1975;

Kirk, 1981). A few species have been reported to have conidia with germ pores (Hughes, 1969), and some have conidia which may be verrucose (Nath, 1978), deeply lobed (Sutton, 1975), or formed in chains (Batista and Upadhyay, 1965).

Previous synoptic work on *Trichocladium* species was carried out by Hughes (1952, 1958) who briefly discussed the status of historical species published during the past century. A synopsis of six *Trichocladium* species was presented in tabulated form (Dixon, 1968). Taxonomic keys to some *Trichocladium* species were given in Pidoplichko and Kirilenko (1972), Moustafa and Ezz-El-din (1990), and Kohlmeyer and Volkmann-Kohlmeyer (1995). Several species have been recently added to the genus (Tubaki, Tan and Ogawa, 1993; Matsushima, 1996; Hyde and Goh, 1999; Hyde *et al.*, 1999).

There are presently 40 binomial names in *Trichocladium*, and some have been previously transferred to other genera (de Hoog and Grinbergs, 1975; Palm and Stewart, 1982; Kirk, 1983; Zucconi and Lunghini, 1997). In the present paper, we present a bibliographic reflection on the genus and consider eighteen species to be acceptable. Eight species have been transferred to other hyphomycete genera; six names are listed as facultative synonyms of accepted *Trichocladium* species or of other hyphomycetes; and eight names are considered unacceptable in *Trichocladium*, or their identity remains doubtful because of insufficient information. The characters of the 18 acceptable species are presented for comparison in Table 1. A key to these species is also given and their conidia are illustrated (Figs. 1-18) to facilitate identification.

Taxonomy

Acceptable species of *Trichocladium*

Key to acceptable species of *Trichocladium*

1. Conidia laterally attached on conidiogenous hyphae, 2-celled, proximal cell subglobose, distal cell triangular and pointed at the apex..... *T. variosporum*
1. Conidia not laterally attached on conidiogenous hyphae, morphology not as above..... 2
2. Conidia rough-walled, ornamented or lobed..... 3
2. Conidia smooth-walled 5
3. Conidia tuberculate or lobed, lacking germ pores *T. lobatum*
3. Conidia reticulate to coarsely roughened, with germ pores..... 4

4. Conidia coarsely roughened, mostly 1-septate, with a single, apical germ pore.....*T. asperum*
4. Conidia reticulate, 2-3-septate, with several germ pores*T. ismailiense*
5. Occurring on dead palm material 6
5. Isolated from soil or occurring on wood, *Juncus*, or from marine/freshwater habitats 7
6. Conidia ellipsoidal to obovoid, 1-4-septate, very variable in dimension, 16-42 × 11-23 μm, distal cell hemispherical; occurring on dead leaf sheaths of *Rhopalostylis*.....*T. novae-zelandiae*
6. Conidia pyriform, 1-2-septate, 15-20 × 10-15 μm, distal cell subglobose and the largest; occurring on *Nypa* *T. nypae*
7. Conidia mostly 1-2-septate, rarely 4-5-celled, with a terminal germ pore in the distal cell 8
7. Conidia lacking germ pores 9
8. Conidia 8-12 μm wide, 1-3-celled, ellipsoidal or clavate, distal cell hemispherical with a rounded apex.....*T. canadense*
8. Conidia 6-7.5 μm wide, predominantly 3-celled, occasionally 4-celled, pyriform or clavate, distal cell ellipsoidal with a pointed apex .*T. pyriforme*
9. Conidia mostly with 3 or more cells 10
9. Conidia never more than 3-celled 14
10. Conidia distinctly constricted at the septa and appearing moniloid, distal cell usually larger and subglobose; occurring on submerged wood 11
10. Conidia not constricted or slightly constricted at septa, ellipsoidal or clavate, distal cell usually hemispherical; isolated from soil or occurring on wood in terrestrial habitat 13
11. Colonies sporodochioid; conidia obovoid to pyriform, with distal cell distinctly darker than the rest of the cells *T. achrasporum*
11. Colonies effuse; conidia clavate or moniloid, with cells more or less the same degree of pigmentation 12
12. Conidia straight, dark brown, distal cell up to 20 μm diam....*T. constrictum*
12. Conidia curved, light brown, distal cell up to 14 (rarely 17 μm) diam.....
..... *T. lignicola*

13. Vegetative hyphae verruculose; conidia 12-24 × 8-14 μm, not constricted at septa, distal cell hemispherical.....*T. taiwanense*
13. Vegetative hyphae smooth; conidia 20-40 × 11-16 μm, slightly constricted at septa, distal cell hemispherical or sometimes subglobose*T. opacum*
14. Conidia small, 8-12 × 4-5 μm, ellipsoidal, always 2-celled, distal cell brown and larger, proximal cell subhyaline.....*T. minimum*
14. Conidia larger, width greater than 6 μm and usually over 10 μm long 15
15. Conidia mostly less than 20 μm long, moderately to strongly constricted at the septa; occurring in marine or brackish habitats..... 16
15. Conidia 20-33 μm long, not constricted or slightly constricted at the septa; occurring on wood in terrestrial or freshwater habitats 17
16. Conidia curved, distal cell fuscous, elongate ellipsoidal, subobtuse at the apex, 7-10 μm wide; occurring on dead culms of *Juncus*..... *T. medullare*
16. Conidia straight, distal cell reddish-brown, subglobose to ellipsoidal, rounded at the apex, 15-20 μm wide; occurring on submerged wood.....
..... *T. alopallonellum*
17. Conidia 9-15 μm wide, distal cell oblong, pale to medium olivaceous brown; occurring on wood submerged in freshwater.....*T. englandense*
17. Conidia 12-18 wide, distal cell ovate to subglobose, dark brown to black and opaque; occurring on wood in terrestrial habitats*T. nipponicum*

Figs. 1-18. Conidiogenous hyphae and conidia of *Trichocladium* spp., drawn approximately at the same magnification for comparison. All bars = 10 μm. **1.** *T. achrasporum*, redrawn with reference to Kohlmeyer and Volkmann-Kohlmeyer (1995). **2.** *T. alopallonellum*, redrawn with reference to Ellis (1971). **3.** *T. asperum*, redrawn with reference to Ellis (1971). **4.** *T. englandense*, redrawn with reference to Hyde and Goh (1999). **5.** *T. constrictum*, redrawn with reference to Schmidt (1974). **6.** *T. canadense*, redrawn with reference to Hughes (1959) and Ellis (1971). **7.** *T. ismailiense*, redrawn with reference to Moustafa and Ezz-El-din (1990). **8.** *T. lignincola*, redrawn with reference to Schmidt (1974). **9.** *T. lobatum*, redrawn with reference to Sutton (1975). **10.** *T. medullare*, redrawn with reference to Kohlmeyer and Volkmann-Kohlmeyer (1995). **11.** *T. minimum*, redrawn with reference to de Hoog and Grinbergs (1975). **12.** *T. nipponicum*, redrawn with reference to Matsushima (1996). **13.** *T. novae-zelandiae*, redrawn with reference to Hughes (1969). **14.** *T. nypae*, redrawn with reference to Hyde *et al.* (1999). **15.** *T. opacum*, redrawn with reference to Ellis (1971). **16.** *T. pyriforme*, redrawn with reference to Ellis (1971). **17.** *T. taiwanense*, redrawn with reference to Matsushima (1983). **18.** *T. variosporum*, redrawn with reference to Zachariah *et al.* (1981).

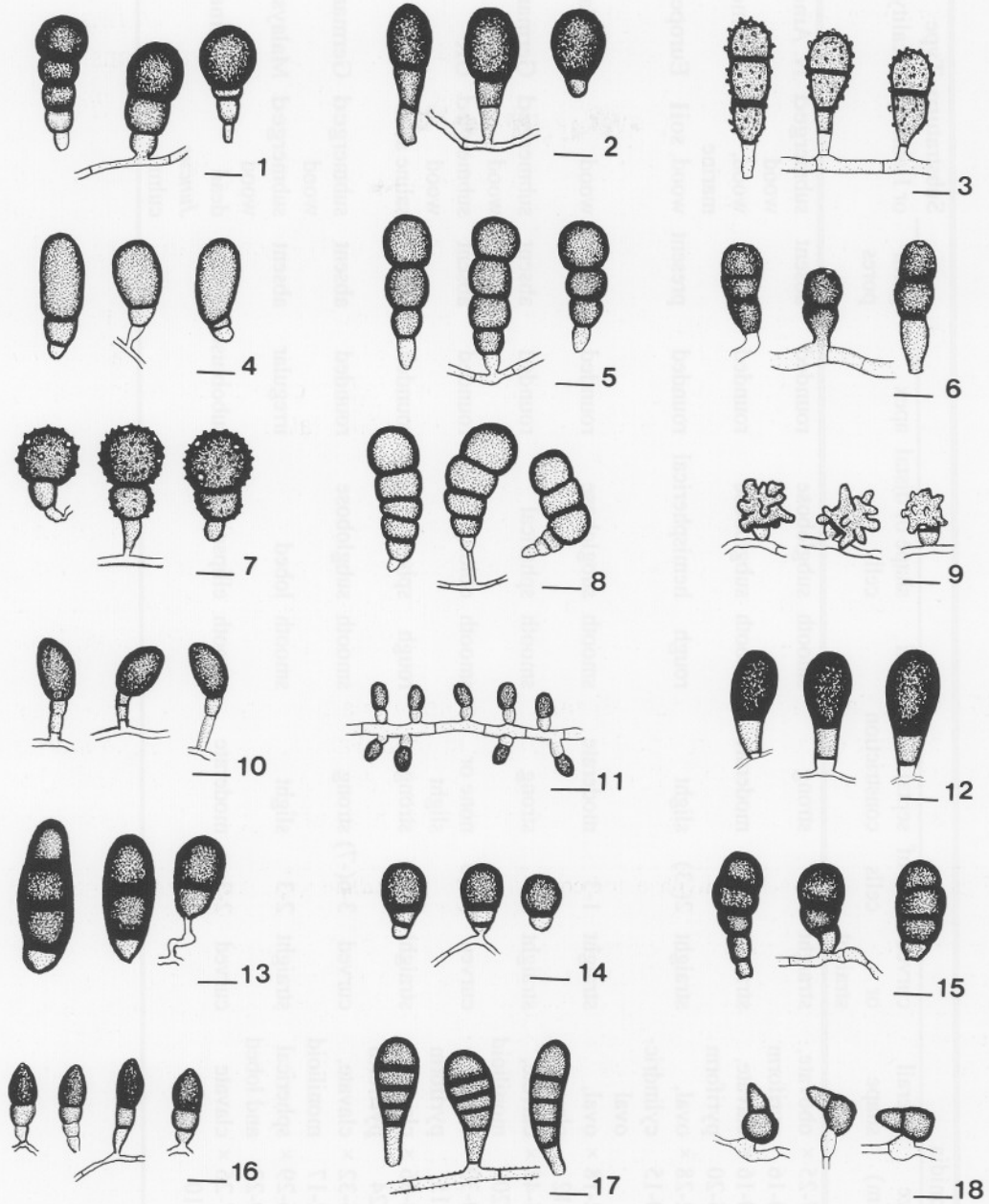


Table 1. Synopsis of characters of accepted *Trichocladium* species.

| Species | Conidia | | | | | | | | | Substratum or Habitat | Type locality |
|--------------------------|---------------|------------------------|--------------------|--------------|---------------------|--------|----------------------|-----------|------------|-------------------------|---------------|
| | size (µm) | overall shape | curved or straight | No. of cells | septal constriction | wall | shape of distal cell | apex | germ pores | | |
| <i>T. achrasporum</i> | 17-25 × 10-16 | obovate, pyriform | straight | 2-5 | strong | smooth | subglobose | rounded | absent | submerged wood | N. America |
| <i>T. alopollonellum</i> | 10-16 × 15-20 | clavate, pyriform | straight | (2-)3 | moderate | smooth | subglobose | rounded | absent | wood, marine | N. America |
| <i>T. asperum</i> | 12-28 × 10-15 | oval, cylindrical-oval | straight | 2(-)3 | slight | rough | hemispherical | rounded | present | wood, soil | Europe |
| <i>T. canadense</i> | 12-18 × 8-12 | oval, clavate | straight | 1-3 | moderate | smooth | subglobose | rounded | present | wood | Canada |
| <i>T. constrictum</i> | 25-47 × 8-20 | clavate, monilioid | straight | 3-5 | strong | smooth | spherical | rounded | absent | submerged wood | Germany |
| <i>T. englandense</i> | 20-30 × 9-15 | clavate, pyriform | curved | (2-)3 | none or slight | smooth | oblong | rounded | absent | submerged wood | UK |
| <i>T. ismailiense</i> | 24-36 × 8-24 | clavate, pyriform | straight | 1-3 | strong | rough | spherical | rounded | present | saline soil | Egypt |
| <i>T. lignincola</i> | 25-32 × 12-17 | clavate, monilioid | curved | 3-6(-)7 | strong | smooth | subglobose | rounded | absent | submerged wood | Germany |
| <i>T. lobatum</i> | 26-29 × 19-22 | spherical and lobed | straight | 2-3 | slight | smooth | lobed | irregular | absent | submerged wood | Malaysia |
| <i>T. medullare</i> | 17-26 × 7-10 | clavate | curved | 2-3 | moderate | smooth | ellipsoid | subobtuse | absent | dead <i>Juncus</i> culm | N. America |

Table 1. (continued).

| Species | Conidia | | | | | | | | | Substratum or Habitat | Type locality |
|---------------------------|---------------------------|------------------------|--------------------------|-----------------|------------------------|--------|-------------------------|-----------|---------------|--------------------------|------------------|
| | size (μm) | overall shape | curved or straight | No. of cells | septal constriction | wall | shape of distal cell | apex | germ pores | | |
| <i>T. minimum</i> | 8-12 × 4-5 | ellipsoid, pyriform | straight | 2 | slight | smooth | ovate | subobtuse | absent | soil | Chile |
| <i>T. nipponicum</i> | 20-33 × 12-18 | clavate, pyriform | straight | 2-3 | none | smooth | ovate | rounded | absent | wood | Japan |
| <i>T. novae-zelandiae</i> | 16-42 × 11-23 | ellipsoid, obovoid | straight | 2-5 | none | smooth | hemispherical | rounded | absent | palm leaf- sheaths | N. Zealand |
| <i>T. nypae</i> | 15-20 × 10-15 | pyriform | straight | 2-3 | slight | smooth | subglobose | rounded | absent | aquatic palm | Brunei |
| <i>T. opacum</i> | 25-40 × 11-17 | ellipsoid, clavate | curved | 2-5 | slight | smooth | hemispherical | rounded | absent | wood, soil | Europe |
| <i>T. pyriforme</i> | 12-24 × 6-7.5 | pyriform | straight | 3(-4) | moderate | smooth | ellipsoid | pointed | present | soil | UK |
| <i>T. taiwanense</i> | 12-24 × 8-14 | ellipsoid, clavate | straight | 3-5 | none | smooth | hemispherical | rounded | absent | soil | Taiwan |
| <i>T. variosporum</i> | 12-20 × 6-9 | obpyriform | straight | 2 | strong | smooth | triangular, | pointed | absent | soil | India |

1. *Trichocladium achrasporum* (Meyers and Moore) Dixon *ex* Shearer and Crane, Mycologia 63: 244 (1971). (Fig. 1)

≡ *Culcitalna achraspora* Meyers and Moore, American Journal of Botany 47: 349 (1960).

≡ *Trichocladium achraspora* Dixon, Transactions of the British Mycological Society 51: 163 (1968), *nom. nud.*

This marine fungus, first described as *Culcitalna achraspora* (Meyers and Moore, 1960), produces conidia in sporodochioid form on wood. Species of *Trichocladium* producing conidia in the form of compact sporodochia have been transferred to *Bactrodesmium* (Palm and Stewart, 1982; Zucconi and Lunghini, 1997). Kohlmeyer and Kohlmeyer (1979), however, considered that the degree of conidiophore aggregation in *C. achraspora* could not be considered as a sporodochium, and they accepted its relocation in *Trichocladium*. The placement of this species in *Trichocladium* has been also recognised by Hughes (1969), Shearer and Crane (1971), and Roldán and Honrubia (1989). *Halosphaeria mediosetigera* Cribb and J. Cribb, a marine ascomycete, has been reported to be the teleomorph of *T. achrasporum* (Shearer and Crane, 1977).

2. *Trichocladium alopallonellum* (Meyers and Moore) Kohlm. and Volkm.-Kohlm., Mycotaxon 53: 352 (1995). (Fig. 2)

≡ *Humicola alopallonella* Meyers and Moore, American Journal of Botany 47: 346 (1960).

Trichocladium alopallonellum is a marine species (Meyers and Moore, 1960; Kohlmeyer and Volkmann-Kohlmeyer, 1995), with conidia that are mostly 2-septate and pyriform, with a fuscous, subglobose distal cell. The inclusion of this fungus in the genus *Humicola* Traaen has been considered inappropriate because the conidia of *Humicola* species are all one-celled (Ellis, 1971; DeBertoldi, Lepidi and Nuti, 1972).

3. *Trichocladium asperum* Harz, Bulletin de la Société Impériale de Naturalistes de Moscou 44: 125 (1871). (Fig. 3)

This species was selected by Hughes (1952) to be the lectotype of *Trichocladium* because Harz (1871) did not designate a type species for the genus. This species has been well described and illustrated (Hughes, 1952; Matsushima, 1985). It is unique in having coarsely warted, two-celled conidia with a single germ pore in each cell. There has been some taxonomic confusion involving *T. asperum* and *Dicoccum asperum* (Corda) Sacc. (syn. *Sporidesmium asperum* Corda). For discussion and treatment of this taxonomic confusion, see Hughes (1952) and Hughes and Pirozynski (1972).

4. *Trichocladium canadense* S. Hughes, Canadian Journal of Botany 37: 857 (1959). (Fig. 6)

Conidia in this species are 1-3-septate, but are mostly 1-septate, the distal cell always bearing a terminal germ pore (Hughes, 1959). Germ pores have also been noted in conidia of *T. asperum*, *T. ismailiense*, and *T. pyriforme* (Dixon, 1968; Hughes, 1969; Moustafa and Ezz-El-din, 1990). A synanamorph producing phialospores in some isolates of *T. canadense* has been noted by Hughes (1959), the only *Trichocladium* species reported to have a synanamorph.

5. *Trichocladium constrictum* I. Schmidt, Mycotaxon 24: 419 (1985). (Fig. 5)
= *Trichocladium angelicum* Roldán and Honrubia, Mycotaxon 35: 353 (1989).

This species was described from submerged wood from the Baltic Sea. The name was published without designation of the holotype (Schmidt, 1974), but was validated later (Schmidt, 1985). The conidia are unique in having 2-5 cells that are strongly constricted at the septa, and resemble chains of balls (Schmidt, 1974). *Trichocladium angelicum*, which was also described from submerged wood and has the same conidial morphology and dimensions (Roldán and Honrubia, 1989), is placed here as a synonym of *T. constrictum*. Some conidia of *T. achrasporum* resemble those of *T. constrictum* in having constricted cells, but they are shorter and darker (Meyers and Moore, 1960; Ellis, 1976).

6. *Trichocladium englandense* Goh and K.D.Hyde, Mycological Research 103: (In press). (Fig. 4)

This is a species reported from submerged wood (Hyde and Goh, 1999). It is distinct in having conidia with an oblong to cylindrical, pale brown distal cell.

7. *Trichocladium ismailiense* A.F. Moustafa and E.K. Ezz-El-din, Nova Hedwigia 50: 255 (1990). (Fig. 7)

This species was isolated from saline soil in Egypt (Moustafa and Ezz-El-din, 1990). The presence of several germ pores in the distal cell of the conidia, and the pigmentation of the aerial mycelium may suggest some superficial resemblance to species of *Gilmaniella* Barron. The mode of conidiogenesis in *Gilmaniella*, however, differs from that in *Trichocladium* (i.e., mono- or polyblastic versus holothallic, respectively, *sensu* Cole and Samson, 1979).

8. *Trichocladium lignicola* I. Schmidt, Mycotaxon 24: 420 (1985). (Fig. 8)

This species was described from wood submerged in a river in Germany. The name was first published without designation of the holotype (Schmidt, 1974), but was later validated (Schmidt, 1985). It is similar to *T. constrictum* in having multicellular conidia which are strongly constricted at the septa (Schmidt, 1974). However, the conidia are curved and are lighter in colour than those of *T. constrictum*.

9. *Trichocladium lobatum* B. Sutton, Antonie van Leeuwenhoek 41: 181 (1975). (Fig. 9)

This species is unique in having spherical conidia which are ornamented with flabelliform, spatulate or petaloid lobes (Sutton, 1975).

10. *Trichocladium medullare* Kohlm. and Volkm.-Kohlm., Mycotaxon 53: 349 (1995). (Fig. 10)

This is a marine species reported from dead, standing culms of *Juncus roemerianus* from saltmarshes (Kohlmeyer and Volkmann-Kohlmeyer, 1995). The conidia are comparable to those of *T. alopallonellum*, another marine species. However, in *T. medullare*, the distal cell of the conidium is elongate ellipsoidal and fuscous, whereas it is subglobose to ellipsoidal and reddish brown in *T. alopallonellum*.

11. *Trichocladium minimum* de Hoog and Grinbergs, Transactions of the British Mycological Society 64: 341 (1975). (Fig. 11)

This species was isolated from soil in Chile. It can be recognised by its small conidia, consisting of a brown distal cell and a subhyaline proximal cell (de Hoog and Grinbergs, 1975).

12. *Trichocladium nipponicum* K. Matsush. and Matsush., Matsushima Mycological Memoirs 9: 40 (1996). (Fig. 12)

This is a typical *Trichocladium* with clavate conidia borne on repent hyphae (Matsushima, 1996). The conidia have a dark brown to black, opaque distal cell, and thus superficially resemble those of *Melanocephala*. *Melanocephala* species, however, have distinct conidiophores which proliferate percurrently, and conidia with a distinct basal frill when detached.

13. *Trichocladium novae-zelandiae* S. Hughes, New Zealand Journal of Botany 7: 153 (1969). (Fig. 13)

This was described from dead, fallen leaf-sheaths of *Rhopalostylis sapida*. The conidia are variable in size, with 1-4 septa. Illustrations of hyphae in host epidermal cells, with conidiophores and developing conidia, are given by Hughes (1969).

14. *Trichocladium nypae* K.D.Hyde and Goh, Mycological Research 103: (In press). (Fig. 14)

This is an intertidal marine species that has been found only on decaying fronds of *Nypa fruticans*, a mangrove palm species common in Brunei Darussalam and Malaysia. The fungus is common in this habitat (Hyde *et al.*, 1999).

15. *Trichocladium opacum* (Corda) S. Hughes, Transactions of the British Mycological Society 35: 154 (1952). (Fig. 15)

= *Sporidesmium opacum* Corda, Icones fungorum 1: 7 (1837).

= *Xenodochnus opacus* (Corda) Bonorden, Handbuch der allgemeinen Mykologie: 49 (1851).

= *Clasterosporium opacum* (Corda) Sacc., Sylloge Fungorum 4: 387 (1886).

This species is well described and illustrated, having been reported from rotten wood (Ellis, 1971), dead herbaceous stems and leaves (Matsushima, 1980), and soil (Hughes, 1952; Matsushima, 1983).

16. *Trichocladium pyriforme* Dixon, Transactions of the British Mycological Society 51: 160 (1968), as "*pyriformis*". (Fig. 16)

= *Trichocladium brosimi* Ram, Broteria 39: 30 (1970).

Most conidia in this species are 3-celled, comprising a dark brown, pointed distal cell that often has a terminal germ pore, a pale brown to subhyaline central cell, and a hyaline proximal cell (Dixon, 1968). The conidia of *T. brosimi* are identical in shape and size (Ram, 1970), and is thus synonymised with *T. pyriforme*.

17. *Trichocladium taiwanense* Matsush., Matsushima Mycological Memoirs 3: 18 (1983). (Fig. 17)

This species is unique in having verruculose vegetative hyphae (Matsushima, 1983). The conidia are clavate, comprising mostly five cells. The basal cell is usually paler. The septa are closely spaced and not constricted.

18. *Trichocladium variosporum* Zachariah, Sankaran and Rahman, Mycologia 73: 1186 (1981). (Fig. 18)

This species was isolated from soil in India (Zachariah, Sankaran and Rahman, 1981). It is unique in having two-celled conidia which are borne laterally on semi-micronematous conidiophores. Mature conidia are obpyriform, with a wider, subglobose proximal cell and a triangular distal cell.

Relocated and doubtful names in *Trichocladium*

Three names in *Trichocladium* have been transferred to *Bactrodesmium* based on the presence of compact sporodochia (Palm and Stewart, 1982; Zucconi and Lunghini, 1997). Compact sporodochia indicate little affinity with *Trichocladium*, which is characterized by mononematous and scattered conidiophores (Ellis, 1971).

1. ***Bactrodesmium cubense*** (R. F. Castañeda and G. Arnold) Zucconi and Lunghini, *Mycotaxon* 58: 324 (1997).

≡ *Trichocladium cubense* R. F. Castañeda and G. Arnold, *Revista del Jardín Botánico Nacional* 6: 53 (1985).

2. ***Bactrodesmium linderi*** (Crane and Shearer) M.E. Palm and E.L. Stewart, *Mycotaxon* 15: 319 (1982).

≡ *Trichocladium linderi* Crane and Shearer, *Mycologia* 70: 866 (1978).

3. ***Bactrodesmium moenitum*** (Crane and Shearer) M.E. Palm and E.L. Stewart, *Mycotaxon* 15: 323 (1982).

≡ *Trichocladium moenitum* Crane and Shearer, *Mycologia* 70: 871 (1978).

Trichocladium cylindroclavatum (Matsushima, 1975) has been transferred to *Henicospora* by Kirk and Sutton (1980) because the conidia are cylindrical, multi-distoseptate, pale olivaceous brown, and secede rhexolytically. Three other *Trichocladium* species, similar to *T. cylindroclavatum*, are synonymised here in *Henicospora*.

4. ***Henicospora coronata*** B. Sutton and P.M. Kirk, *Transactions of the British Mycological Society* 75: 249 (1980).

≡ *Trichocladium elegans* R. F. Castañeda and G. Arnold, *Revista del Jardín Botánico Nacional* 6: 52 (1985).

≡ *Trichocladium singaporense* Tubaki, Tan and Ogawa, *Mycotaxon* 46: 438 (1993).

Trichocladium elegans (Castañeda Ruíz and Arnold, 1985) and *T. singaporense* (Tubaki *et al.*, 1993) are two species published after the introduction of the genus *Henicospora* by Kirk and Sutton (1980). The striking similarities of these two *Trichocladium* species to *Henicospora coronata* are evident, and they are therefore synonymised here. The similarity of *T. elegans*

to *Henicospora* was also noted by Matsushima (1995). Although the coronate feature of the conidial apex was not included in the description, nor shown in the line diagram of *T. singaporensis* (Tubaki *et al.*, 1993), it is evident in the scanning electron micrograph published in that paper.

5. *Henicospora cylindroclavata* (Matsush.) B. Sutton and P.M. Kirk, Transactions of the British Mycological Society 75: 252 (1980).

≡ *Trichocladium cylindroclavatum* Matsush., Icones Microfungorum a Matsushima Lectorum p. 155 (1975).

= *Trichocladium diversicoloratum* Gamundí and Arambarri, Darwiniana 22: 194 (1979).

Kirk and Sutton (1980) considered that in *Trichocladium cylindroclavatum* (Matsushima, 1975) the conidiophore insertion and arrangement, conidiogenesis, conidial morphology and conidial secession are clearly typical for *Henicospora*. The description and illustration of *T. diversicoloratum* given by Gamundí, Arambarri and Bucsinzky (1979) agrees entirely with that of *T. cylindroclavatum* in Matsushima (1975).

6. *Monodictys ucrainica* (Kirilenko) de Hoog and Grinbergs, Transactions of the British Mycological Society 64: 343 (1975).

≡ *Trichocladium ucrainicum* Kirilenko, Mikrobiologichnyi Zhurnal 29: 199 (1967).

This species was transferred to *Monodictys* based on the presence of longitudinal septa in the conidia (Kirilenko, 1967; Pidoplichko and Kirilenko, 1972).

7. *Pithomyces pavgii* (Nath) M.E. Palm, E.L. Stewart and Rossman, Mycotaxon 13: 465 (1981).

≡ *Trichocladium pavgii* Nath, Sydowia 31: 123 (1978).

This species has conidia which are verrucose (Nath, 1978) and was transferred to *Pithomyces* based on its conidium development and conidial secession (Palm and Stewart, 1981).

8. *Torula deospora* (Bat. and Upadhyay) de Hoog and Grinbergs, Transactions of the British Mycological Society 64: 343 (1975).

≡ *Trichocladium deosporum* Bat. and Upadhyay, Atas do Instituto de Micologia 2: 326 (1965).

The placement of this species in *Trichocladium* has been questioned by Hughes (1969) and Sutton (1975). It was transferred to *Torula* (de Hoog and Grinbergs, 1975) because it has 4-celled, verrucose conidia, which arise in short chains (Batista and Upadhyay, 1965).

9. *Torula diversa* Cooke, Grevillea 7: 33 (1878).

= *Trichocladium olivaceum* Petch, Annals of the Royal Botanic Gardens, Peradeniya 7: 318 (1922).

Trichocladium olivaceum was described with catenate, warted, 1-septate conidia measuring 16-18 × 9-12 µm (Petch, 1922). Sutton (1975) suggested that it should be excluded from *Trichocladium*, since all *Trichocladium* species have solitary conidia. Hughes (1952) examined the type collection of this species and considered it to be identical to *Torula diversa* Cooke.

10. *Triadelphia uniseptata* (Berk. and Broome) P.M. Kirk, Transactions of the British Mycological Society 80: 464 (1983).

≡ *Sporidesmium uniseptatum* Berk. and Broome, Annals and Magazine of Natural History Series 3, 3: 360 (1859).

≡ *Dicoccum uniseptatum* (Berk. and Broome) Sacc., Sylloge Fungorum 4: 342 (1886).

≡ *Trichocladium uniseptatum* (Berk. and Broome) S. Hughes and Piroz., Canadian Journal of Botany 50: 2526 (1972).

The placement of this fungus in a suitable genus has been problematic. Hughes and Pirozynski (1972) considered its position in *Dicoccum* and concluded that it should be referred to *Trichocladium*, with some diffidence. Although this species produces only a single type of conidium, Kirk (1983) considered its placement in *Triadelphia*, since the conidiogenous cell morphology, conidium ontogeny and conidium morphology in this species are comparable to that in other species of *Triadelphia*.

11. *Trichocladium angelicum* Roldán and Honrubia, Mycotaxon 35: 353 (1989).

This is synonymised with *Trichocladium constrictum* (Schmidt, 1985).

12. *Trichocladium basicola* (Berk. and Broome) Carmichael, Genera of Hyphomycetes: 185 (1980).

≡ *Torula basicola* Berk. and Broome, Annals and Magazine of Natural History Series 2, 5: 455 (1850).

≡ *Thielaviopsis basicola* (Berk. and Broome) Ferraris, Flora Italica, Hyphales p. 233 (1912).

Carmichael *et al.* (1980) proposed the name *Trichocladium basicola* for *Thielaviopsis basicola*, but did not explain or justify the relocation. *Thielaviopsis basicola* is well-known to plant pathologists as a cause of root rot of tobacco and other plants (Hawksworth *et al.*, 1995). The main characteristics of *Thielaviopsis* include thick-walled arthroconidia borne in chains, which eventually break into part-spores (Carmichael *et al.*, 1980; Ellis, 1971, 1976). Species in the genus are known to be anamorphs of *Ceratocystis* (Ellis, 1971,

1976), and often have a phialidic *Chalara* state synanamorph (Ellis, 1971). These features are distinct in *Thielaviopsis basicola*. We therefore consider the relocation of *Thielaviopsis* to the genus *Trichocladium* inappropriate.

13. *Trichocladium brosimi* Ram, Broteria 39: 30 (1970).

This is a facultative synonym of *Trichocladium pyriforme* (Dixon, 1968). The similarity of *T. brosimi* and *T. pyriforme* was noted earlier by Sutton (1975).

14. *Trichocladium charticola* Sacc., Sylloge Fungorum 15: 424 (1901).

Hughes (1952) reported that there has been a nomenclatural confusion between *T. charticola* and *T. asperum* Harz var. *charticola* Sacc. The identities of these two names remain unresolved.

15. *Trichocladium fuscum* (Hallier) Harz, Bulletin de la Société Impériale de Naturalistes de Moscow 44: 125 (1871).

≡ *Diplosporium fuscum* Hallier, Pflanzenvz (1886).

This was not compiled in Saccardo's *Sylloge Fungorum*. The identity of this name remains unresolved (Hughes, 1952).

16. *Trichocladium heterospora* Udaiyan, Journal of Ecological and Taxonomical Botany 15: 644 (1991), *nom. nud.*

This name is invalidly published because no holotype was designated. The fungus was described as a thermophilic species with two types of conidia produced from distinct conidiophores (Udaiyan, 1991). Based on these features the fungus is unacceptable in *Trichocladium*.

17. *Trichocladium indicum* Vasant Rao, K.A. Reddy, D.R. Kumar and B.S. Reddy, Indian Journal of Botany 8: 154 (1985).

Rao *et al.* (1985) noted that this fungus was tentatively placed in *Trichocladium*. It was described as having darkly pigmented, discrete, ampuliform to subglobose, polyblastic conidiogenous cells (Rao *et al.*, 1985). These features do not fit the generic concept of *Trichocladium*.

18. *Trichocladium macrosporum* P. M. Kirk, Transactions of the British Mycological Society 76: 84 (1981).

This species was reported to have cylindrical, verrucose, dark brown to blackish brown conidia, 80-200 μm long and 14-28 μm wide, with 8-35 septa (Kirk, 1981). The septa are closely spaced, and the conidia resemble those of

Sporidesmium species. The dimension of conidia in other *Trichocladium* species ranges from 8-40 μm long and 4-24 μm wide, with 1-6(-7) septa (see Table 1). We consider *T. macrosporum* too large and with too many septa to be included in *Trichocladium*.

19. *Trichocladium tenellum* Harz, Bulletin de la Société Impériale de Naturalistes de Moscou 44: 125 (1871).

This was described as a fungus parasitizing *Stilbum* species. It was not compiled in Saccardo's *Sylloge Fungorum* and has not since been recognized (Hughes, 1952).

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