Key to Phycomycetes predaceous or parasitic in Nematodes or Amoebae I. Zoopagales

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Summary

A key to 10 recognised genera and 92 species of predaceous or parasitic fungi in nematodes or amoebae, belonging to the order Zoopagales, is given here.

The key is intended primarily for those working in predaceous fungi. It is not phylogenetic but rather an arrangement for easy identification. No claim is made that these are all valid species; it will become evident as the key is used that further study must be made into some which are with difficulty separated from others, except by their host. The literature concerning these fungi has increased to such an extent that workers studying the group have for some time felt the need for a convenient aid to identification. This can be overcome only by furnishing with as many tools as possible for identification or recognition of genera and species. This paper is intended as one of the tools. It is a collection of 10 recognized genera and 92 species, brought together so that this information may be more easily available.

Guide to the Key

The measurements given in the key are those most frequently met within nematode infested cultures; in pure cultures traps are usally absent. Conidial dimensions are usually smaller and the morphology of the conidiophore may also alter considerably. Chlamydospores are formed more frequently in older cultures, but not in all the species. Full information on techniques for handling these fungi may be found in Duddington (1955). A complete key to the nematode destroying fungi is given by Cooke and Godfrey (1964) and is indispensible for definitions of terms and many other items of information.

Key

1. Fungi endo-parasitic. 2
1. Fungi predaceous. 28
2. Thallus disc-shaped, margins quadrilobate often quinquelobate.
Aplectosoma microsporum Drechsler (1951)

2. Thallus hyaline of filiform hyphae, nematodes trapped on adhesive cells borne on these hyphae. 3
3. Conidia fusiform. 6
3. Conidia filiform or pod-shaped. *Euryancale* 4
4. Conidia pod-shaped, 4.5–5.5 × 1.1–1.3 μ *E. obliqua* Drechsler (1955)
4. Conidia filiform. 5
5. Conidia 7–9 × 1.2–1.6 μ *E. marsipospora* Drechsler (1959)
5. Conidia 11–13 × 0.7 μ *E. sacciospora* Drechsler (1939)
6. Conidia sessile, with an empty apical appendage, haustoria coiled. *Endocochlus* 7
6. Conidia in long chains, haustoria coiled. *Cochlonema* 10
7. Conidia average less than 20 μ long. 8
7. Conidia average more than 20 μ long. 9
8. Conidia mostly 8–12 × 3.5 μ *Endocochlus brachysporus* Drechsler (1936)
8. Conidia mostly 12–16 × 3.6 μ *E. asteroides* Drechsler (1935)
9. Conidia mostly 20–45 × 5.7–9 μ *E. binarius* Drechsler (1949)
9. Conidia mostly 28 × 5.1 μ *E. gigas* Drechsler (1936)
10. Conidia similar in shape. 11
10. Conidia varying in shape in the same chain, proximal long, narrow, smooth, middle and distal shorter, wider, warty, with abruptly rounded ends. *Cochlonema megalosomum* Drechsler (1939)
11. Conidiiferous hyphae producing short sterile spurs, conidia cylindrical, minutely verrucose, 5–18 × 1.7–2.5 μ *C. cerasphorum* Drechsler (1959)
11. Not as above. 12
12. Conidia in flexuous chains. 13
12. Conidia in chains but not flexuous. 14
13. Conidia cylindrical 9–21 × 1–1.2 μ *C. explicatum* Drechsler (1955)
13. Conidia cylindrical, truncated at both ends, 4–17 × 1.1–1.3 μ *C. cylindricum* Drechsler (1937)
14. Conidia constricted at septa. 15
14. Conidia not as above. 16
15. Conidia cylindrical. 17
15. Conidia spindle-shaped or fusoid. 18
16. Conidia separated by special disc. 19
16. Conidia separated by wart-like protuberances. 20
17. Conidia minutely warted. 21
17. Conidia smooth. 22
18. Conidia warty. 23
18. Conidia smooth, 12–17 × 1.5–2 μ *C. fusisporum* Drechsler (1939)
19. Conidia blunt at both ends, 6–12 × 1.5–2 μ *C. symplocum* Drechsler (1941)
19. Conidia tapering at ends. 24
20. Conidia smooth, 9–19 × 1.6–1.9 μ *C. batrosporum* Drechsler (1939)

20. Conidia as above but larger, 20–31 × 1.6–1.9 μ
C. batrosporum var. *longuis* Drechsler (1942)
21. Conidia 6–11 × 1.5–2.5 μ *C. agamum* Drechsler (1946)
21. Conidia 10–47 × 1.5–2.7 μ *C. calosperma* Drechsler (1951)
22. Conidia with rounded ends, 8–12.5 × 1.2–1.5 μ *C. linearis* Jones (1962)
22. Conidia with slightly convex ends. 25
23. Conidia evacuating in an appendage, 15–25 × 1.2–2 μ
C. dolichosporum Drechsler (1935)
23. Not as above. 26
24. Conidia 8–36 × 1.2–2 μ *C. odontosperma* Drechsler (1937)
24. Conidia 20–45 × 1.6–3 μ *C. megaspirema* Drechsler (1937)
25. Conidia 3–6 × 0.9–1.1 μ *C. pumilum* Drechsler (1939)
25. Conidia 4.6–8 × 1.3–1.5 μ *C. ozotum* Drechsler (1945)
26. Conidia average less than 6 μ long. 27
26. Conidia average more than 6 μ long, 6–9 × 1.4–2 μ
C. verrucosum Drechsler (1935)
27. Conidiiferous branches usually 2–3 μ, conidia 3.5–6 × 1.2–1.5 μ
C. pygmea Jones (1959)
27. Conidiiferous branches usually 3–15 μ, conidia 3–6 × 1.5–2 μ
C. euryblastum Drechsler (1942)
28. Nematodes or amoebae trapped by adhesion to morphologically unmodified hyphae. 29
28. Nematodes or amoebae trapped by morphologically modified hyphal branches. 50
29. Fertile hyphae bearing conidia on slender upright conidiophores. *Stylopage* 30
29. Fertile hyphae bearing no conidia, but chlamydospores. *Cystopage* 44
30. Parasitic on nematodes. 31
30. Parasitic on amoebae. 32
31. Adhering by globular protuberance formed on hyphae at point of contact, conidia obovoid, 20–45 × 13–23 μ
Stylopage hadra Drechsler (1935)
31. No globular protuberance formed. 33
32. Conidiophore unbranched. 34
32. Conidiophore cymosely branched, conidia ovate, 12–21 × 6–10 μ
S. cymosa Duddington (1953)
33. Conidia elongate or elongate-obovoid, 20–35 × 7–18 μ
S. leiohypha Drechsler (1936)
33. Conidia obovoid or pyriform, 27–61 × 13–26 μ
S. grandis Drechsler (1955)
34. Conidia solitary. 35
34. Conidia in groups. 36
35. Conidia of one part only. 37

35. Conidia of two parts, living cell ellongate ellipsoidal, 17–27 × 4.5–6.5 μ, empty terminal appendage 5.8 × 1.2–1.8 μ, often collapsed.
S. rhicnacra Drechsler (1948)
36. Conidia produced successively. 38
36. Conidia produced in capitate manner, cylindrical, rounded at apex, tapering at base, 14–25 × 1.8–2.5 μ *S. cephalote* Drechsler (1938)
37. Conidia elongate ovoid. 39
37. Conidia fusoid. 40
38. Conidia filiform, hyaline, 20–32 × 1.3–1.9 μ
S. scoliospora Drechsler (1939)
38. Conidia elongate cylindrical. 41
39. Conidia minute, 7.5–9 × 2.6–3.6 μ *S. minutula* Drechsler (1945)
39. Conidia robust. 42
40. Conidia acute at base, with sharply tapering rounded apex, 12–19 × 1.9–2.7 μ *S. lepte* Drechsler (1935)
40. Conidia acute at base and bluntly rounded at distal end, 15–25 × 2.2–2.7 μ *S. haploe* Drechsler (1935)
41. Conidia larger, 25–57 × 2.7–3.5 μ *S. rhabdoides* Drechsler (1947)
41. Conidia smaller, 25–35 × 2.2–2.8 μ *S. rhabdospora* Drechsler (1936)
42. Conidia apiculate at base. 43
42. Conidia distally drawn out into a bluntly rounded beak, 27–34 × 7.5–5–10 μ *S. rhynchospora* Drechsler (1939)
43. Conidia 10–22 ×5.4–7 μ *S. area* Drechsler (1935)
43. Conidia 10–22 ×5.5–12 μ *S. area* var. *magna* Peach & Juniper (1955)
44. Parasitic on nematodes. 45
44. Parasitic on amoebae. 46
45. Chlamydospores on main hyphae. 47
45. Chlamydospores on short lateral branches, mostly terminal, 20–30 μ
Cystopage cladospora Drechsler (1957)
46. Chlamydospores produced laterally, 9–21 × 5–17 μ
C. sacciformis Drechsler (1959)
46. Chlamydospores produced intercalary. 48
47. Chlamydospores produced laterally, mostly sessile, pouch-like and lobate, 25–50 × 10–28 μ *C. lateralis* Drechsler (1941)
47. Chlamydospores produced intercalary, 18–35 × 15–30 μ
C. intercalaris Drechsler (1945)
48. Chlamydospores typically spherical, 9–21 μ
C. sphaerospora Drechsler (1955)
48. Chlamydospores subspherical. 49
49. Chlamydospores larger, 12–28 × 8–23 μ
C. ellipsospora Drechsler (1955)
49. Chlamydospores smaller, 7–20 μ *C. subtilis* Drechsler (1941)
50. Capturing animals by producing haustorium and yellowish adhesive material, conidia borne singly, haustorium never coiled.
Acaulopage 51

50. Capturing animals by producing haustorium but no yellowish adhesive material, conidia catenulate, haustoria various shaped. 80
51. Parasitic on nematodes, conidia single, spindle-shaped, imbedded proximally in the substratum, bearing a distal droplet, 180–246 × 7–14 μ *A. pectospora* Drechsler (1962)
51. Not as above. 52
52. Parasitic on rhizopods. 53
52. Parasitic on amoebae. 54
53. Conidia bearing bush-like branching crest at tip, 10.5–27 × 6.8–1.4–3 μ *A. crobylospora* Drechsler (1947)
53. Not as above. 55
54. Conidia of one part only. 56
54. Not as above. 57
55. Conidia bearing appendages in divaricate manner, 9–20 × 5–12 μ *A. bicornis* Drechsler (1955)
55. Conidia bearing appendages in trivaricate manner, 10–17 × 5–10 μ *A. longicornis* Drechsler (1955)
56. Conidia occuring singly and unbranched. 58
56. Conidia occuring singly but branched in regular dichotomous manner, 25–40 × 4.5–7 μ *A. dichotoma* Drechsler (1945)
57. Conidia of two parts. 59
57. Conidia of three parts. 60
58. Conidia filled with protoplasm, without appendages. 61
58. Conidia later evacuating in an appendage. 62
59. Living cell filamentous. 63
59. Not as above. 64
60. Conidia elongate-ellipsoidal, 20–34 × 4–6 μ, with a lower empty part 2–6 × 0.8–1.2 μ and distal tapering empty part 30–70 × 1.3 μ at base and 0,5–0,8 μ at tip. *A. ceratospora* Drechsler (1935)
60. Conidia elongate spindle-shaped, 33–52 × 2.4–3.1 μ, with a lower empty part 0.8–4 × 0.6–1.2 μ and a distal empty part 15–30 × 0.8–1.3 μ *A. marantica* Drechsler (1939)
61. Conidia filiform, straight or curved. 65
61. Conidia acicular, straight or curved, 30–40 × 1.2–1.7 μ *A. rhapidospora* Drechsler (1935)
62. Appendage single at apex, conidia elongate-cylindrical. 66
62. Appendages numerous. 67
63. Conidia tapering at both ends, 50–80 × 1.6–2 μ, while empty part 4–13 × 0.8–1.2 μ *A. ischnospora* Drechsler (1947)
63. Similar to *A. ischnospora,* but having no empty part. *A. ischnospora* var. *pleacra* Drechsler (1959)
64. Living cell elongate-ellipsoidal. 68
64. Living cell elongate-fusiform. 69
65. Conidia tapering at both ends, 25–60 × 1.2–1.6 μ *A. stenospora* Drechsler (1941)

65. Conidia tapering at base with rounded tips. 70
66. Conidia broad, 13.0–32 × 2.0–4.2 μ *A. aristata* Jones (1959)
66. Conidia narrow. 71
67. Appendages small, distributed on distal part or entire surface. 72
67. Appendages long, limited and on apical zone. 73
68. Ellipsoidal part 14–20 × 4–6.5 μ, while upper empty tubular part 20–37 × 1.3–1.9 μ, often collapsed. *A. gyrinodes* Drechsler (1948)
68. Ellipsoidal part 7–15 × 2.2–3.6 μ, while upper empty tubular part 6–20 × 0.4–0.8 μ, often collapsed. *A. cercospora* Drechsler (1936)
69. Fusiform part 11–22 × 1.3–1.8 μ, while upper empty part 8–20 × 0.5 μ. *A. gomphoclada* Drechsler (1942)
69. Fusiform part 13–21 × 2.8–3.6 μ, while upper empty part 10–22 × 0.8–1.3 μ at base and 0.4–0.8 μ at apex. *A. tenuicornis* Drechsler (1959)
70. Conidia 21–22 × 1.8–2.1 μ. *A. baculispóra* Drechsler (1948)
70. Conidia larger than *A. baculispora*, mostly 24–30 × 1.5 μ. *A. retusa* Jones (1959)
71. Conidia 30–70 × 1.6–2.5 μ. *A. macrospora* Drechsler (1935)
71. Conidia 20–55 × 1.5–2 μ. *A. rhicnospora* Drechsler (1935)
72. Appendages on distal hemisphere only. 74
72. Appendages all over the surface. 75
73. Conidia 16–24 × 7–10 μ, appendages mostly 4. *A. tetraceros* Drechsler (1935)
73. Conidia larger than *A. tetraceros*, 24–36 × 4.8–8.7 μ. *A. tetraceros* var. *longa* Jones & Peach (1959)
74. Appendages 7–8. 76
74. Appendages 8–15, conidia obovoid. 13–25 × 8–15 μ. *A. lophospora* Drechsler (1946)
75. Conidia simple. 77
75. Conidia lobed, 7–9 × 9–14 μ, bilobate or trilobate with 10–30 appendages. *A. dactylophora* Drechsler (1955)
76. Conidia turbinate, 10–12 × 9–10.5 μ. *A. acanthospora* Drechsler (1938)
76. Conidia larger than *A. acanthospora*, 12–19 × 8–15 μ. *A. acanthospora* var *magna* Juniper (1953)
77. Protuberances finger-shaped, never expanded at tip. 78
77. Protuberances finger-shaped, expanded at tip or bilobate. *A. dasyspora* Drechsler (1955)
78. Protuberance equal in width from base to tip. 79
78. Protuberances tapering, unequal in width, 20–90 in number, conidia 12–18 × 11–27 μ. *A. trachyspora* Drechsler (1959)
79. Protuberances varying from 10–50 in number, conidia 7.5–12.5 × 7–14 μ. *A. hystricospora* Drechsler (1946)
79. Protuberances varying from 25–125 in number, conidia 12–16 × 11–16 μ. *A. lasiospora* Drechsler (1942)

80. Adhering to animals by one end forming a pedicellate globose or bilobate or trilobate haustorium, while free and producing conidia singly or in chains, 4–24 × 1.8–2.7 μ.
Amoebophilus scicyosporus Drechsler (1959)
80. Not as above. 81
81. Adhering to animals by germ tube that develops into a large globose ellipsoidal haustorium, conidia fusoid, 6–16 × 2–3 μ, after vegetative enlargement globose ellipsoidal, 20 × 15 μ, terminating in closely dichotomous branching system.
Bedellospora helicoides Drechsler (1935)
81. Adhering to animals by a pedicellate haustorium, having several swollen lobules in botryoid manner, conidia in short erect chains on short lateral branches. *Zoopage* 82
82. Parasitic on rhizopods, conidia in chains. 83
82. Parasitic on amoebae, conidia single or in chains. 84
83. Conidia elongate-ellipsoidal, 24–54 × 4.4–7 μ, having one living segment 15–26 with 2–4 empty segments, 2–10 μ.
Z. toechospora Drechsler (1947)
83. Conidia spindle shaped, minutely warted, 6–22 × 1.2–2.2 μ.
Z. tryphera Drechsler (1937)
84. Conidia similar in shape. 85
84. Conidia vary in shape, filamentous at base, smooth, 30–50 × 1.7 μ, end-conidia clavate, middle ones elongate fusiform, pointed at ends, verrucose, 15–30 × 1.6–2.3 μ, with a broad germ hypha.
Z. pachyblasta Drechsler (1947)
85. Conidia filiform, simple or in chains. 86
85. Conidia fusiform, in chains. 87
86. Conidia simple, unbranched, not separated by special disc. 88
86. Conidia simple, branched or in chains, separated by special disc, tapering at ends, 35–65 × 1.5–2.1 μ. *Z. nematospora* Drechsler (1936)
87. Conidia minutely but distinctly warted. 89
87. Conidia inconspicuously warted, 10–45 × 1.4–2.7 μ.
Z. atractospora Drechsler (1936)
88. Conidia limited in number, in fours, lowermost longest and twice of distal end, tapering, 20–61 × 1.5–2.5 μ. *Z. tetraspora* Jones (1962)
88. Not as above. 90
89. Conidia rounded at both ends, 8–25 × 1.5–2.6 μ.
Z. thamnospira Drechsler (1938)
89. Conidia tapering at both ends. 91
90. Conidia bluntly rounded at distal end and tapering at proximal end, 22–156 × 1.6–3 μ. *Z. mitospora* Drechsler (1938)
90. Conidia tapering noticeably towards both ends, 11–41 × 1.2–2.2 μ.
Z. virgispora Drechsler (1947)
91. Conidia 19–36 × 1.3–1.8 μ. *Z. cladosperma* Drechsler (1936)
91. Conidia 25–60 × 2.2–2.8 μ. *Z. phanera* Drechsler (1935)

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