

THE GENUS *DAEDALEA* PERS. : Fr. FROM INDIA

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Information on the morphological and cultural characters of seven species of *Daedalea* occurring in India namely, *D. cubensis*, *D. dickinsii*, *D. ostreiformis*, *D. sepium*, *D. serialis*, *D. stereoides*, and *D. sulcata* has been given along with a detailed and illustrated account of *D. quercina*, the type species of the genus *Daedalea*. Anatomical details of the basidiomes and cultural features of *D. dickinsii*, *D. sepium*, *D. serialis* and *D. quercina* have been furnished. The rest of the species being described elsewhere have been listed only with their references. Key to the Indian species has also been provided.

INTRODUCTION

Sarkar (1959) treated the genus *Coriolellus* Murr. comprising six species namely *C. heteromorpha* (Fr.) Bond. & Sing., *C. malicola* (Berk. & Curt.) Murr., *C. sepium* (Berk.) Murr., *C. serialis* (Fr.) Murr., *C. variiformis* (Peck.) Sarkar and *C. sinuosus* (Fr.) Sarkar, as representing a natural systematic group in the polyporaceous fungi with *C. sepium* as the type. The principal morphological features of this group are non-stipitate basidiomes, hyphae having clamp connections, thin-walled and thick-walled, some with irregularly thickened walls, fibre hyphae hyaline to brownish, branched and unbranched, and cylindric to cylindric-ellipsoid basidiospores. Donk (1966) recognised the homogenous nature of the group and placed the species in the genus *Antrodia* Karst, typified by *A. serpens* Karst. Since *Antrodia* predated *Coriolellus*. The genus *Antrodia* is usually characterised as a dimitic genus including species with two kinds of hyphae representing generative and skeletal hyphae (Ryvarden, 1976; Ryvarden & Johansen; 1980; Niemela, 1978). However, subsequently Aoshima (1967) transferred all the species treated by Sarkar (1959) except *C. sinuosus* to *Daedalea* Pers. ex Fr., a still earlier genus, typified by *D. quercina* L. ex Fr., a species having trimitic construction (Kotlaba & Pouzar, 1957; Teston, 1958; Cunningham, 1965; Domanski *et al.*, 1973). But Aoshima (1967) did not record the microscopic and macroscopic details of the species he studied.

Of the species treated by Aoshima (1967), *D. sepium* and *D. serialis* grow in India. Recently two taxa from India have been transferred to *Daedalea* namely

Polyporus ostreiformis Berk. (De, 1981) and *Trametes cubensis* (Mont.) Sacc. (Roy, 1982). During course of study with Indian polypores in our laboratory, we find that two more fungi, viz., *Daedalea stereoides* Fr., and *Hexagona sulcata* Berk, are also good representatives of the genus *Daedalea*.

Incidentally it may be mentioned that based on morphological studies of basidiomes, Ryvarden (1977) concluded that *H. sulcata* should belong to the genus *Daedalea* and therefore made new combination. Regarding *D. stereoides*, he believed that the species should be placed in the genus *Lenzites* and accordingly made the transfer (Ryvarden, 1972).

In the present investigation, a comparative study was made on the morphological, cultural and certain biological characters of these six species growing in India. The evidence from this study confirm the homogeneous nature of the group and justify the inclusion of those species in the genus *Daedalea*. This paper however amplifies a previous brief report (Roy, 1913). Morphological and cultural characters of *D. sepium* and *D. serialis* have also been described in detail. Good descriptions of the rest of the species having been published elsewhere, only their references are given. A key to the species leading to the identification of their basidiomes and cultures are provided.

MATERIALS AND METHODS

Specimens and cultures of the species studied were taken from the Mycological Herbarium of the Visva Bharati University (VBMH). Methods used in studying the basidiomes were as described by Roy (1979) and of cultures, by Nobles (1948, 1965). All isolates have been deposited in the VBMH.

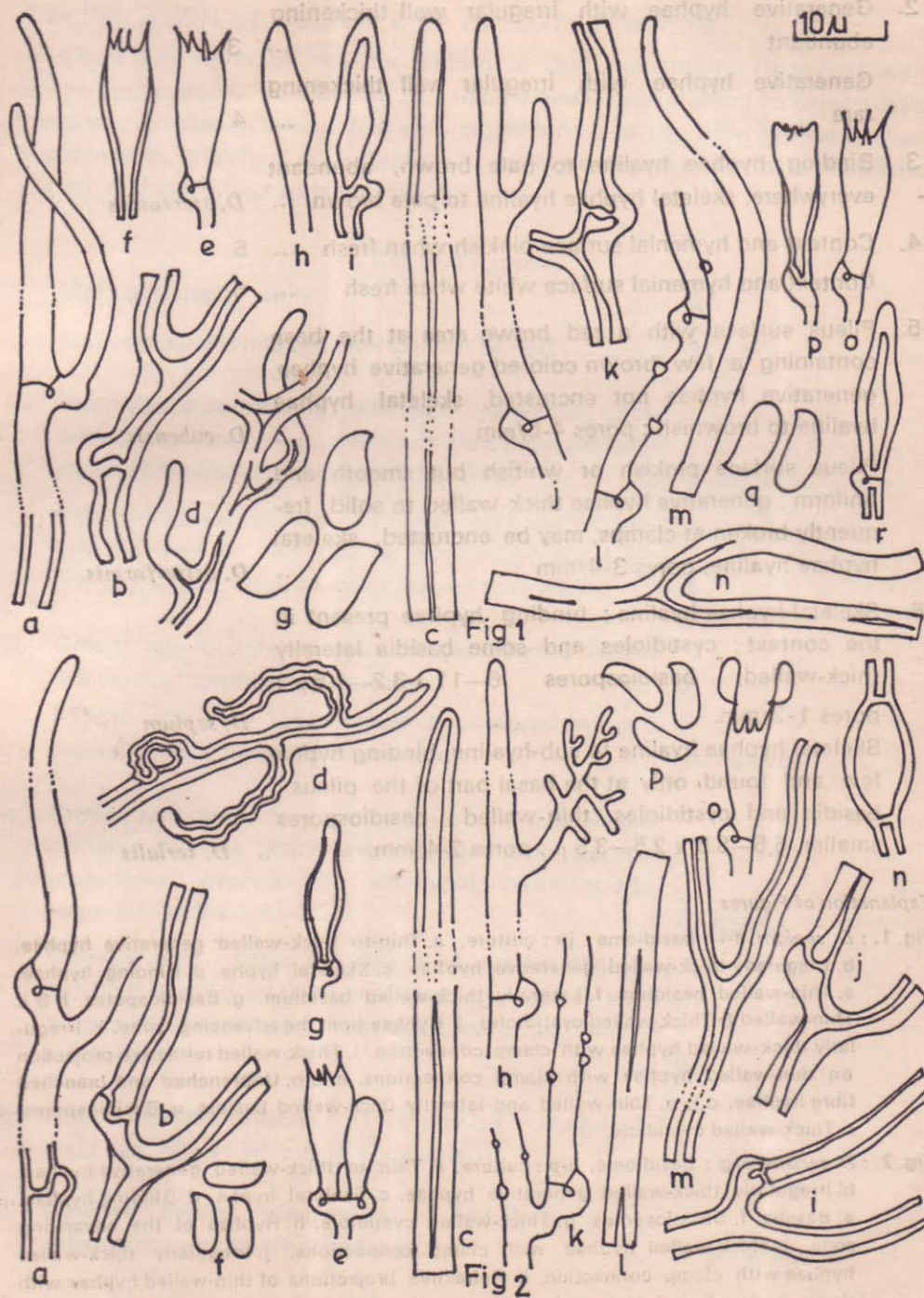
IDENTIFICATION OF *DAEDALEA* SPECIES

Daedalea Pers.; Fr. Syst. Myc. 1 : 331, 1821

Basidiomes white, whitish, brownish, or pinkish brown, sessile or effused-reflexed, rarely resupinate, the upper surface azonate or indistinctly zonate; context white or brownish, or pinkish, coriaceous or corky; hymenial surface whitish or pinkish, poroid or daedaloid, hyphal system trimitic; generative hyphae bearing clamp connections, thin-to thick-walled, with rare to abundant irregular thickenings in walls; skeletal hyphae hyaline to subhyaline to pale brown, unbranched, binding hyphae shortly branched, usually scarce and hyaline in some may be many, basidiospores hyaline, thin-walled, cylindric, apiculate; cystidioles usually present, fusoid; associated with brown rots.

Key to the species

1. Pore large, 0.8—4 mm. in diameter, heavily encrusted, clavate cystidia present in the pore mouths ... *D. sulcata*
- Pore much smaller, true encrusted cystidia absent ... 2



Caption of Figures at page 104

2. Generative hyphae with irregular wall thickening abundant ... 3
Generative hyphae with irregular wall thickening rare ... 4
3. Binding hyphae hyaline to pale brown, abundant everywhere, skeletal hyphae hyaline to pale brown ... *D. stereoides*
4. Context and hymenial surface pinkish when fresh ... 5
Context and hymenial surface white when fresh ... 6
5. Pileus surface with a red brown area at the base containing a few brown colored generative hyphae, generative hyphae not encrusted, skeletal hyphae hyaline to brownish ; pores 4-6/mm ... *D. cubensis*
Pileus surface pinkish or whitish but smooth and uniform ; generative hyphae thick-walled to solid, frequently broken at clamps, may be encrusted, skeletal hyphae hyaline, pores 3-4/mm ... *D. ostreiformis*
6. Skeletal hyphae hyaline ; binding hyphae present in the context ; cystidioles and some basidia laterally thick-walled, basidiospores $6-11 \times 3.2-4.5 \mu$; pores 1-2/mm. ... *D. sepium*
Skeletal hyphae hyaline to sub-hyaline, binding hyphae few and found only at the basal part of the pileus ; basidia and cystidioles thin-walled ; basidiospores smaller, $6.5-8.5 \times 2.5-3.5 \mu$; pores 2-4/mm. ... *D. serialis*

Explanation of Figures

Fig. 1. : *D. sepium*. a-i : basidiome ; j-r : culture. a. Thin-to thick-walled generative hyphae. b. Irregularly thick-walled generative hyphae. c. Skeletal hypha. d. Binding hyphae. e. Thin-walled basidium. f. Laterally thick-walled basidium. g. Basidiospores. h & i. Thin-walled & Thick-walled cystidioles. j. Hyphae from the advancing zone. k. Irregularly thick-walled hyphae with clamp connection. l. Thick-walled refractive projection on thin-walled hyphae with clamp connections. m & n. Unbranched and branched fibre hyphae. o & p. Thin-walled and laterally thick-walled basidia. q. Basidiospores. r. Thick-walled cystidiol.

Fig. 2. : *D. serialis*. a-g : basidiome. h-p : culture. a. Thin to thick-walled generative hyphae. b. Irregularly thick-walled generative hyphae. c. Skeletal hypha. d. Binding hyphae. e. Basidia. f. Basidiospores. g. Thick-walled cystidiol. h. Hyphae of the advancing zone. i. Thick-walled hyphae with clamp connections. j. Irregularly thick-walled hyphae with clamp connection. k. Refractive projections of thin-walled hyphae with clamp connection. l. Unbranched fibre hypha. m. Branched fibre hyphae. n. Chlamydospore. o. Basidium. p. Basidiospores.

IDENTIFICATION OF CULTURES OF *DAEDALEA* SPECIES

In culture mat white or may be pinkish or buff, constituting (i) hyphae with clamp connections, thin-walled to thick-walled, developing characteristic irregularly thickened walls, often with projections, and (ii) fibre hyphae hyaline or subhyaline, branched or unbranched; giving a negative test for extracellular oxidase and exhibiting bipolar sexuality.

Key to the species

1. Mat consistently white ... 2
- Mat originally white but later pinkish or buff ... 3
2. Chlamydospore absent; abundant irregular thick-walled projections on walls: in fruit bodies basidia and cystidia frequently thickened at base ... *D. sepium*
- Chlamydospores present, irregular thick-walled projections may or may not be present, when present few in number; basidia when formed thin-walled ... 4
3. Growth rate moderately rapid, plates covered within 4-5 weeks; hyphae not encrusted ... 5
- Growth rate very slow, plates not covered within 6 weeks, hyphae frequently encrusted ... *D. sulcata*
4. Growth rate rather slow, plates covered in 5-6 weeks, clamped hyphae with a few thickened characteristic projections; hyphae not encrusted, basidiospores large, $6.5-8.5 \times 2.5-3.5 \mu$... *D. serialis*
- Growth rapid, plates covered in 4 weeks, characteristic thickened areas on walls lacking, hyphae may or may not be encrusted, basidiospores when formed much smaller ... 6
5. Fibre hyphae hyaline to brownish, abundant, branched, often with clamp connections ... *D. cubensis*
6. Clamped hyphae often with conical projections, chlamydospores of great variation ... *D. stereoides*
7. Hyphae often encrusted, fibre hyphae hyaline, not with clamp connections, fruiting within 4-5 weeks ... *D. ostreiformis*

DESCRIPTION OF SPECIES

D. cubensis (Mont.) Roy, Can. J. Bot. 60 : 1012, 1982

Special literature : Roy (1982)

D. ostreiformis (Berk.) De, Can. J. Bot. 59 : 1297, 1981

Special literature : De (1981).

BASIDIOME

Resupinate or effuso-reflexed, often imbricate, coriaceous, 0.1-1.3 x 0.8—5.5 x 0.2—0.6 cm ; upper surface white or wood brown, pubescent to glabrous, azonate or indistinctly zonate, margin thick or thin ; context white, corky, up to 1.5 mm thick ; pore tubes 2-6 mm long ; pore surface white or wood coloured, pores circular to angular, 1-2/mm ; hyphal system trimitic ; generative hyphae hyaline, with clamp connections, thin—to thick-walled (fig. 1, a), some with irregularly thickened walls (fig. 1 b), 2.2-3.4 μ in diameter ; skeletal hyphae hyaline, thick-walled to solid, unbranched, 2.2-4 μ in diameter (fig. 1 c), binding hyphae few in number, hyaline, thick-walled to solid, shortly branched, 2.5-4 μ in diameter (fig. 1 d), basidia narrow-clavate, tetrasterigmatic, mostly thin-walled (fig. 1 e), some laterally thick-walled, particularly at the base (fig. 1 f), 18-24 x 5.9 μ ; basidiospores hyaline, thin-walled, cylindric-ellipsoid, apiculate, 6-11 x 3.2-4.5 μ (fig. 1 g), cystidioles hyaline, thin—to thick-walled, lanceolate shaped, 17.5-24 x 4.5-8 μ (fig. 1 h & i).

CULTURE*Growth characters :*

Growth moderately rapid, plates covered in 4 weeks. Advancing zone even, sharp. Mat white, downy to farinaceous—felty to start with, later becoming woolly-felty with zonations, usually developing pebbled fruiting areas after three to four weeks. Reverse unchanged. Oxidase reactions negative, growth 1.8-2.5 cm on gallic acid agar, growth nil or up to 1 cm on tannic acid agar.

Hyphal characters :

Advancing zone-hyphae hyaline, thin-walled, with clamp connections, branched, 2.2-4 μ in diameter (fig. 1, j). Aerial mycelium—(i) hyphae hyaline, branched, with clamp connections, thin-walled or thick-walled, frequently with irregular wall thickening (fig. 1, k) and abundant thick-walled refractive projections on the walls (fig. 1 l), 2.2-6 μ in diameter ; (ii) fibre hyphae hyaline, subsolid or solid, unbranched (fig. 1, m) and branched (fig. 1, n), 2.2-4 μ in diameter. Fruit body-basidia narrow-clavate, tetrasterigmatic, usually thin-walled (fig. 1, o), some laterally thickened, specially at the base (fig. 1, p), 22-28 x 5-8 μ ; basidiospores hyaline, cylindric-ellipsoid, apiculate, 7-10 x 3.2-4.5 μ (fig. 1, q) ;

cystidioles at first thin-walled usually becoming thick-walled later, $14-26 \times 4-6 \mu$ (fig. 1, r). Submerged mycelium—hyphae hyaline, with clamp connection, branched, thin-walled to thick-walled, often with irregular wall thickening.

The species causes brown rot and is bipolar.

Species code : 1. 3. 8. 9. 32. 36. 38. 44. 45. (48). 54. 55. 59.

Special literature : Sarkar (1959).

D. stereoides Fr., Nov. Symb. Mycol., 1 : 99, 1851

Special literature : Roy & Mitra (1983).

D. serialist (Fr.) Aoshima, Trans. Mycol. Soc. Japan 8 : 2, 1967.

BASIDIOME

Usually resupinate, rarely slightly reflexed, coriaceous ; pileus $0-1 \times 1-5 \times 0.3-1$ cm. flat or slightly convex above and concave below, frequently imbricate and laterally confluent ; margin thin or thick, acute or obtuse, entire, slightly undulate, white or pale ; upper surface white, cream brown, or brown, indistinctly zonate, slightly pubescent in some specimens ; context white, coriaceous, 1 mm or less thick ; pore surface smooth, usually white, sometimes light brown ; pore tubes white, 2-8 mm long, not separable from the substance of the context ; pore mouth white or nearly so, circular or angular, in old specimens often becoming dentate, 2-3/mm ; hyphal system trimitic ; generative hyphae hyaline, with bulging clamp connections, thin-to thick-walled (fig. 2, a), a few with irregularly thickened walls (fig. 2, b), $2-4 \mu$ in diameter, rare in the context, common in the trama ; skeletal hyphae hyaline to subhyaline, thick-walled to solid, unbranched, $2.5-3 \mu$ in diameter (fig. 2, c), predominating everywhere, binding hyphae scarce, hyaline to subhyaline, thick-walled to solid, shortly branched and somewhat tortuous, $2-4 \mu$ in diameter (fig. 2, d) ; basidia narrow-clavate, $16-20 \times 4-6 \mu$ (fig. 2, e) ; basidiospores hyaline, thin-walled, short cylindric, apiculate, $6.5-8.5 \times 2.5-3.5 \mu$ (fig. 2, f) ; cystidioles fusoid, thin-walled (fig. 2, g).

CULTURE

Growth characters :

Growth slow, plates covered in 5-6 weeks. Advancing zone hyaline and appressed, 1-2 cm. wide. Mat white, subfelty, developing corrugated fruiting areas within 2-3 weeks. Reverse unchanged. Oxidase reactions negative, growth trace to 1.9 cm. on gallic acid agar, no growth or only a trace on tannic acid agar.

Hyphal characters:

Advancing zone—hyphae hyaline, thin-walled, with clamp connections, branched, branching occasionally very frequent over a short distance, $1.5\text{--}5\mu$ in diameter (fig. 2, h). Aerial mycelium—(i) hyphae hyaline, with clamp connections, thin-walled and thick-walled (fig. 2, i), thickening often irregular (fig. 2, j), with a few small refractive projections on the walls (fig. 2, k), $2.2\text{--}6\text{--}(8)\mu$ in diameter; (ii) fibre hyphae hyaline, subsolid or solid, usually unbranched (fig. 2, l), occasionally branched (fig. 2, m); chlamydospores rare to numerous, terminal or intercalary, $8\text{--}20 \times 6\text{--}12\mu$ (fig. 2 n). Fruit body—basidia narrow-clavate, tetrasterigmatic, $16\text{--}22 \times 4\text{--}6\mu$ (fig. 2, o); basidiospores hyaline, thin-walled, short cylindric, apiculate, $6\text{--}8 \times 2.5\text{--}3.5\mu$ (fig. 2, p). Submerged mycelium—hyphae with clamp connections, thin-walled, branched, often irregularly wide.

The species causes brown rot and is bipolar. Species code: 1, 3, 8, 9, 32, 34, 38, 45, 46, 48, (54) 55, 59. Special literature: Sarkar (1959).

D. sulcata (Berk) Ryv. Norw. J. Bot. 24: 213-230, 1977. Special literature, Mitra & Roy (1984).

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