

**STUDIES ON INDIAN POLYPORES. II,
MORPHOLOGICAL AND CULTURAL CHARACTERS OF
TRAMETES BADIA BERK.**

BY

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Detailed morphological and cultural characters of *Trametes badia* Berk. have been studied and in the light of these findings, the taxonomy of the species has been discussed.

INTRODUCTION

Trametes badia Berk. is a polypore occurring in India as a saprophyte on dead hardwoods causing white rots. It also grows in the Philippines, the East Indies, Java, Ceylon (Bakshi, 1971), Bangladesh (Ahmed, 1951) and Pakistan (Khan, 1952). The present paper gives the results of detailed studies on the morphological, cultural and certain physiological characters of *T. badia*. The taxonomic position of the species is also discussed in the light of modern concepts.

MATERIALS AND METHODS

Macroscopic and microscopic characters of the basidiocarps were studied from fresh materials collected locally by the authors during 1975 to 1978 following the method of Roy and De (1979). Cultural studies were made with polysporous cultures following the method of Nobles (1948). Voucher specimens and cultures have been deposited in the Mycological Herbarium of the Visva-Bharati University, Santiniketan.

Trametes badia Berk.

Basidiocarp annual, solitary, or imbricate, sessile with a thick base, coriaceous to corky, dimidiate, 5.0-8.0 x 3.0-5.5 x 0.5-0.8 cm; upper surface cinnamon, brown to dark reddish brown, subzonate to zonate, finely strigose when young,

glabrescent later, often showing small raised areas with age ; margin sterile, thin or thick, context brown, more or less fibrous and silky, upto 0.5 cm. thick ; hymenial surface olive brown, pores round to some what angular, 1-3 per mm ; tubes upto 0.3 cm long.

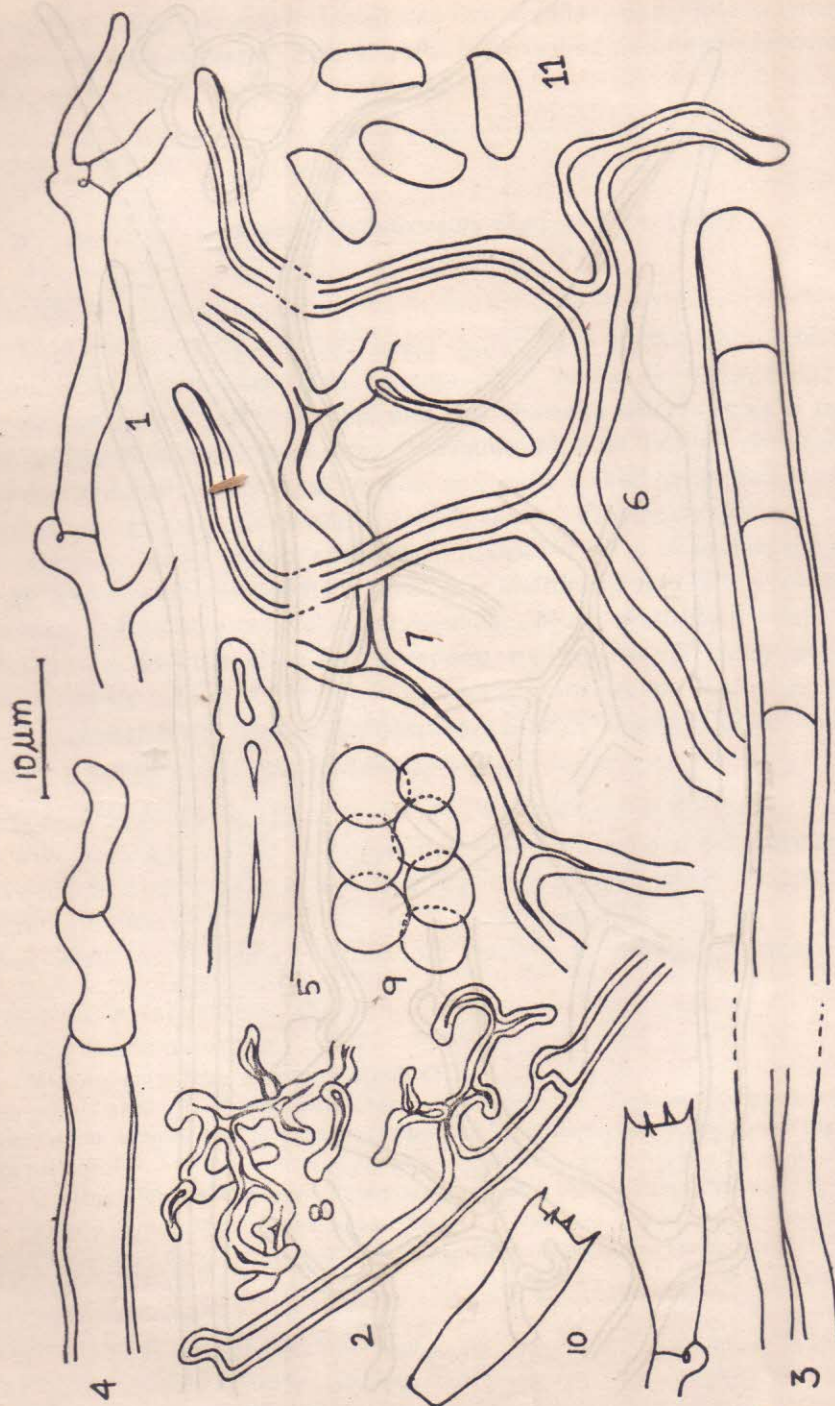
Hyphal characters : Hyphal system trimitic ; (a) generative hyphae with clamp connections, usually hyaline, thinwalled, $1.4-4.2\mu$ in diameter (Fig. 1), some thickwalled, hyaline to pale brown, frequently brown at clamps, showing lateral outgrowths of coralloid outlook, occurring in the lower context, $2.8-4.2\mu$ in diameter (Fig. 2) ; (b) skeletal hyphae $4.2-7.0\mu$ in diameter, hyaline to brown, thick-walled, slightly tortuous, aseptate, occasionally showing 2-3 septa at the apex (Fig. 3), apex variable, some thin-walled and characteristically tortuous (Fig. 4), others thick-walled and slightly constricted a little below the tip (Fig. 5), still others with a few branches (Fig. 6) ; (c) binding hyphae hyaline to subhyaline, aseptate, thick-walled to solid, much branched, $1.4-2.8\mu$ in diameter, of two types, with (i) somewhat tortuous long branches (Fig. 7) and (ii) short coralloid branches, the latter occurring only in the lower context and dissepiment (d) hyaline to pale brown, thin to slightly thick-walled pseudoparenchymatous cells, occurring in the pileus surface (Fig. 9).

Hymenium : Basidia clavate, with 4-sterigmate, $20.0-22.0 \times 5.6-7.0\mu$ (Fig. 10) ; basidiospores hyaline, thin-walled, cylindrical, $8.4-9.8 \times 3.5-4.2\mu$ (Fig. 11) ; hyphal pegs present.

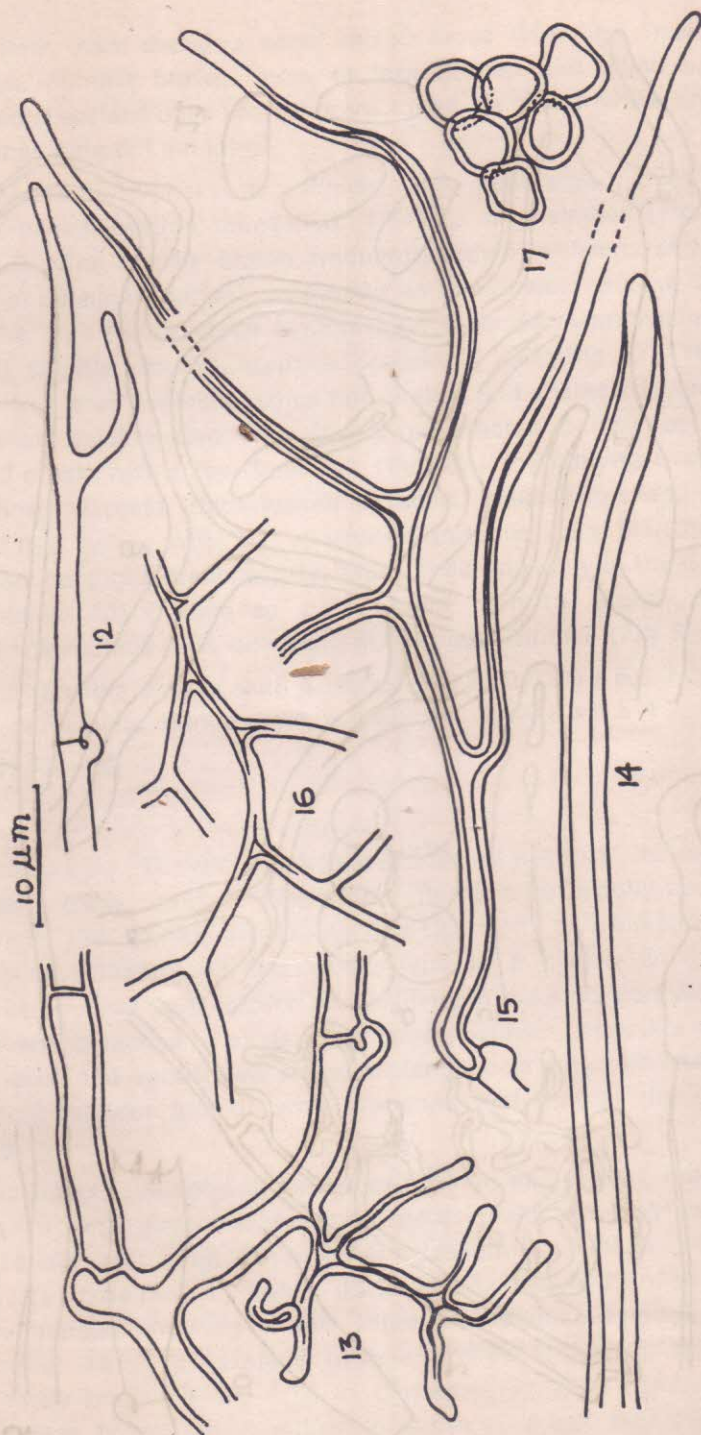
Culture

Growth characters : Growth rapid, plates covered within 10-12 days. Advancing zone even, sharp. Mat at first white, floccose to woolly-floccose, more raised towards the margin, developing fine radiations and indistinct zonations, soon becoming golden brown and woolly-felty in a narrow zone behind the growing margin and buff brown and subfelty in the older part with fine radiations. Reverse bleached ; oxidase reactions positive. Diffusion zones strong on gallic acid and moderately strong on tannic acid agar ; no mycelial growth on gallic acid but poor growth with mycelium just around the inoculum on tannic acid.

Hyphal characters : Advancing mycelium-hyaline, thin-walled, branched generative hyphae with clamp connections, occasionally showing pseudoclamps, $1.4-2.8\mu$ in diameter (Fig. 12). Aerial mycelium (a) hyphae as in the advancing zone ; (b) pale brown, slightly thick-walled, branched, inflated generative hyphae, sometimes showing simple septa and lateral outgrowths, $3.5-5.2\mu$ in diameter (Fig. 13) ; (c) skeletal hyphae hyaline to brown, thick-walled to subsolid, rarely branched, $2.8-4.2\mu$ in diameter (Fig. 14) ; (d) binding hyphae hyaline to pale brown, thick-walled to subsolid, much branched with long branches, $1.4-2.8\mu$ in diameter (Fig. 15) ; (e) scarcely occurring hyaline,



Captions of Figures at page 5



Captions of Figures at page 5

dichotomously branched, very fine, hair-like fiber hyphae, upto 1.4μ in diameter (Fig. 16); (f) pale brown thin-to slightly thick-walled pseudoparenchymatous cells (Fig. 17).

Submerged mycelium—hyaline, thin-to slightly thick-walled generative hyphae $2.8-4.2\mu$ in diameter; mostly empty

Sexuality: *T. badia* shows tetrapolar sexuality (Roy and De, 1979).

DISCUSSION

Above description stating that *T. badia* is trimitic in construction agrees with the views of Fidalgo (1968) who considered *T. badia* as synonymous with *Hexagona aspera* (Jungh). Imazeki and described the latter species as trimitic. But she did not record the presence of hyaline to pale brown pseudoparenchymatous cells on the pileus surface and thick-walled generative hyphae in the lower context as described above for *T. badia*. Obviously patient teasing is necessary to reveal these structures. Bakshi (1971) described the sporophore of "*Trametes badia* (Berk.) Cooke" as constituting two kinds of hyphae representing generative and skeletal hyphae. Most probably he had made a mistake in the author citation and described the fungus *T. badia* Berk. and not of *T. badia* (Berk) Cooke. However, nomenclatural confusion around the taxa *Trametes badia* Berk. and *Polystictus badius* (Berk) Cooke has been discussed critically by Fidalgo (1968: 54).

T. badia resembles *T. suaveolens* (L. ex. Fr.) Fr., the type of the genus *Trametes* Fr. in that both are trimitic in construction, show tetrapolar sexuality and give positive reaction in oxidase tests. But the two species differ greatly in the characters of their microstructures. In *T. suaveolens* all hyphae are consistently hyaline; while in *T. badia*, hyphae are hyaline to brown. Besides, brown

Explanation of Figures from page 3 & page 4

Fig. 1—17. *Trametes badia* Berk.

1—11. Microscopic structures from sporophors.

1. Thin-walled generative hypha with clamp connections. 2. Thick-walled generative hypha showing lateral outgrowths of coralloid outlook. 3. Unbranched skeletal hypha with a few septa at the special end. 4. Thin-walled and characteristically tortuous apex of a skeletal hypha. 5. Thick-walled and constricted terminal part of a skeletal hypha. 6. Skeletal hypha showing 3 branches at the apical part. 7. Binding hyphae with numerous long tortuous branches. 8. Binding hyphae with numerous short, coralloid branches. 9. Pseudoparenchymatous cells. 10. Basidia. 11. Basidiospores.

12—17. Microscopic structures from cultures.

12. Thin-walled generative hypha from advancing zone. 13. Pale brown, slightly thick-walled, inflated generative hypha showing simple septum, clamp connections and lateral outgrowths. 14. Unbranched skeletal hypha. 15. Binding hyphae with long branches. 16. Dichotomously branched, hair-like fibre hyphae. 17. Pseudoparenchymatous cells.

pseudoparenchymatous cells, as found in the basidiocarp of *T. badia* are not reported for the basidiocarps of *T. suaveolens*. Pale brown pseudoparenchymatous cells and hair-like branched fiber hyphae appearing in cultures of *T. badia* are also not recorded for cultures of *T. suaveolens* (Nobles, 1948 ; Van der Westhuizen, 1971). Above all white, fleshy, spongy sporophore of *T. suaveolens* has no resemblance with brown, coriaceous basidiocarp of *T. badia*. These differences are enough to separate *T. badia* from *T. suaveolens* at generic level.

Murrill (1907) assigned *T. badia* to the genus *Coriolopsis* and the idea was accepted by Ryvarden (1976). In possessing trimitic hyphal system with hyaline to brown skeletal hyphae *T. badia* shares the characters of *Coriolopsis occidentalis* (Kl.) Murr., the type species of the *Coriolopsis* Murr. But hyaline to brown thick-walled generative hyphae, coralloid type of binding hyphae and hyaline to pale brown pseudoparenchymatous cells which occur in the basidiocarps of *T. badia* are not reported before for the basidiocarps of *C. occidentalis*. Moreover, pale brown slightly thick-walled inflated generative hyphae with lateral outgrowths, pale brown pseudoparenchymatous cells and hair-like dichotomously branched hyphae as are formed in cultures of *T. badia* are not reported to be produced in cultures of *C. occidentalis* (Nobles, 1948 ; Van der Westhuizen, 1971). These differences indicate phylogenetic differences and *T. badia* therefore cannot be congeneric with *Coriolopsis occidentalis*.

Imazeki (1952) transferred *T. badia* to the genus *Hexagona* Fr., a genus closely related to *Coriolopsis*. In the literature considerable confusion still exists as to the identity of the type species of *Hexagona* Fr. While *H. apiaria* Pers. ex Fr. has been accepted as the type by some authors, according to others, *H. crinigera* Fr. is the type. Fidalgo (1968), however, regarded the latter species as synonymous with *H. hirta* (Palisot de Beauvois ex Fr.) Fr. Comparison of basidiocarps of *H. apiaria* and *H. hirta* (= *H. crinigera* of Fidalgo, 1968) from the descriptions given by Fidalgo (1968) with the basidiocarp of *T. badia* as described above shows that these three species are greatly similar. All of them are characterised by brown coloured context and dissepiment, trimitic hyphal system containing brown skeletal hyphae and subhyaline coralloid type of binding hyphae, producing hyphal pegs and large hyaline cylindrical basidiospores. These similarities of these three species are highly significant.

Cultural characters of *T. badia* as well as of *H. apiaria* and *H. crinigera* have not been studied before. Detailed cultural characters along with basidiocarp morphology are known only for *Hexagona tenuis* (Van der Westhuizen, 1971), *H. hydroides* (Swartz. ex Fr.) K. Fidalgo and *H. papyracea* Berk. (Wright et al, 1973). From these records it is evident that like *T. badia*, all these species of *Hexagona* are trimitic in construction containing hyaline to brown skeletal and binding hyphae, have pseudoparenchymatous cells in the pileus surface,

produce in culture thick-walled pale brown generative hyphae, hyaline to pale brown skeloted and binding hyphae and brown pseudoparenchymatous cells. Moreover, all these species give positive reactions in oxidase tests like *T. badia*. *H. tenuis* is also tetrapolar (Roy & De 1979),

Such great similarities between *T. badia* and members of *Hexagona* as regards morphological cultural and certain biological characters suggest that the transfer of *T. badia* to *Hexagona* by Imazeki (1952) is justified—a view also supported by Fidalgo (1968), and she treated the species *T. badia* as synonymous with *H. aspera*.

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