

## PYRENOMYCETOUS FUNGI OF PUNJAB-I<sup>1</sup>

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### ABSTRACT

This paper records five taxa of Pyrenomycetes viz. *Hypocrea rufa*, *Daldinia concentrica*, *Hypoxylon hematostroma*, *Hypoxylon investiens*, and *H. rubiginosum* var. *dieckmanni*, for the first time from Punjab State. An illustrated morphological and anatomical account of all these taxa is given. Three taxa : *Hypocrea rufa*, *Hypoxylon hematostroma*, *H. rubiginosum* var. *dieckmanni* are recorded for the first time from India.

### INTRODUCTION

Pyrenomycetes is a large group of fungi of order Sphaeriales (Ascomycotina), which grows on diverse habitat. They can be found growing on soil, on dung of the various animals and other decaying domestic articles, such as clothes, gunny bags, leather goods, etc. They can also be collected from fallen semidecomposed plant materials like stumps, twigs and leaves etc. and are associated with some wood-rot diseases. Some members grow on living plants and are important plant pathogens.

Several workers are engaged in the study of these important organisms in the various parts of our country. Inadvertently, there had been no systematic attempt to collect and study these fungi in the state of Punjab. A thorough search of the literature reveals that, so far only 37 taxa of Pyrenomycetes (this also includes 13 members of Loculoascomycetes) have been reported from various localities of Punjab (vide Bilgrami *et al.*, 1979).

Various districts of Punjab has lot of

potentialities for the study of these fungi. There are good forests in the submontaneous regions of Gurdaspur and Hoshiarpur districts and also few scattered patches in other districts situated in the plains. These forests support rich growth of these fungi. The temperature and rainfall during the various months of the year are also favourable for the growth of variety of fungi belonging to Pyrenomycetes.

Taking into consideration the need to explore the fungal wealth of Punjab, the present study is intended initially to explore the Pyrenomycetes fungi, which is very little known from Punjab State. Every year during monsoon season, several short excursions are undertaken to various localities of different districts of Punjab and some specimens are collected. The present paper deals with the species mainly collected from Patiala district. The specimens are preserved dry in herbarium packets and deposited in the herbarium, Department of Botany, Punjabi University, Patiala.

The present paper gives an account

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of five taxa of Pyrenomycetes, which were collected during 1978, 79 from the district of Patiala. These are : *Hypocrea rufa* (Pers. ex Fr.) Fr. (Hypocreaceae) ; and *Daldinia concentrica* (Bolt. ex Fr.) Ces. & de Not., *Hypoxyton hematostroma* Mont. Sagra., *Hypoxyton investiens* (Schw.) Curt., *Hypoxyton rubiginosum* Pers. ex Fr. var. *dieckmanni* (Theiss.) Mill., belonging to Xylariaceae. All these taxa were not previously known from Punjab. *Hypocrea rufa*, *Hypoxyton hematostroma* and *H. rubiginosum* var. *dieckmanni* are new records for India.

1. *Hypocrea rufa* (Pers. ex Fr.) Fr., Summa, Veg. Scand., 383. 1849. Plate I, Figs. 1-7.

Stromata irregularly subspheric, lobed, convex when fresh, contracted and rugose when dry, up to 1 cm in diameter, soft, dull, reddish brown to dark brown, surface punctate due to slightly projecting dark ostioles ; flesh white, soft. Perithecia completely immersed in the stromatic tissue, globose to subglobose and pyriform, 127-135  $\mu\text{m}$  in diameter, ostioles papillate. Asci 67.5-90  $\times$  4.5  $\mu\text{m}$ , strictly cylindric, with a short narrow stalk apex obtuse with eight, two celled ascospores, which break up into two single celled spores and at maturity the ascus has 16 single celled spores. Ascospores, uniseriate, 8.0-10.0  $\mu\text{m}$ , distal cell almost spheric, up to 5.0  $\mu\text{m}$  in diameter, proximal cell up to 4.0  $\times$  3.0  $\mu\text{m}$ , oblong to ovoid, finely punctate. Paraphyses not observed.

#### Anatomy :

Ectostoma absent. Entostroma composed of two regions ; outer entostroma up to 37.5  $\mu\text{m}$  wide, textura sub-intricata, hyphae up to 7.0  $\mu\text{m}$  in diameter, thin walled light brown, compactly arranged ; Inner entostroma up to 1 mm wide,

textura angularis, cells up to 27.0  $\times$  13.0  $\mu\text{m}$ , slightly thick walled, hyaline, loosely placed, hyphae at the base of entostroma long, septate, brown up to 4.5-7.0  $\mu\text{m}$  in diameter. Perithecial wall up to 22.5  $\mu\text{m}$  wide, textura angularis, composed of two zones, outer zone up to 13.5  $\mu\text{m}$  wide, cells up to 23.0  $\times$  5.0  $\mu\text{m}$ , thick walled, elongated along the wall, inner zone up to 9.0  $\mu\text{m}$  wide, hyaline, thin walled.

Collection examined : Patiala ; Chhatbir Zoological Park, on wood of *Dalbergia sisoo* Roxb, M. Singh 237 (PUN), August 14, 1979.

This collection is characterised by irregularly subspheric, lobed stromata, which are convex when fresh, and become contracted and rugose when dry ; Perithecia being completely immersed in stromatic tissue, which is soft. This collection fits well in *Hypocrea rufa*, in its all essential features. This species differ from *Hypocrea citrina* (Pers.) Fries., in having smaller size of perithecia, ascospores and asci.

2. *Daldinia concentrica* (Bolt. ex Fr.) Ces. de Not., Comm. Soc. Critt. Ital. 1 : 197, 1863.

Stromata superficial, hemispheric to globose, 1.5-5.0  $\times$  1.5-4.0 cm and 2.5 cm high, sessile or subsessile, single or sometimes up to 7 stromata coalesced and deformed by mutual pressure, dark brown, turning black with maturity, dull or shining ; entostroma massive, clearly zoned into lighter and darker zones, light zone broader than dark zone. Perithecia monostichous up to 1.0 mm  $\times$  5 mm, clavate or cylindric, closely arranged, completely immersed in the stromata ; ostioles inconspicuous. Asci 153.0-250.0 (270.0)  $\times$  9.0-14.0  $\mu\text{m}$ , sp. p. 63.0-90.0  $\times$  9.0-14.0  $\mu\text{m}$ , stalk up to 90.0-135.0 (180.0)

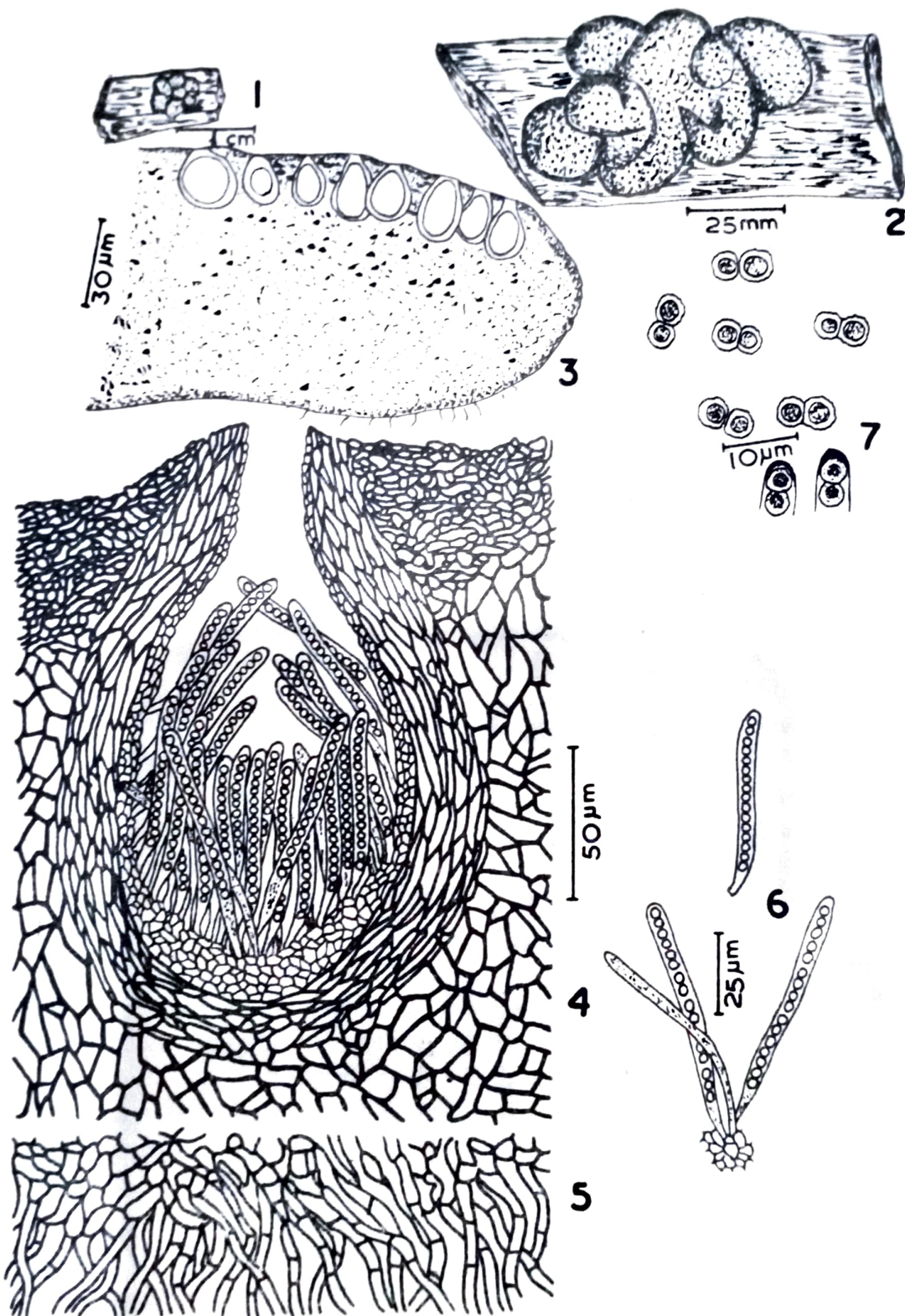


Plate I. Figs. 1—7. *Hypocrea rufa*

1. Stromata general habit. 2. Stromata magnified. 3. V. S. stroma showing various regions. 4. V. S. part of stroma showing detailed structure of perithecium and various regions of stroma. 5. Basal region of stroma-detailed structure. 6. Asci. 7. Ascospores and ascus apex.

$\mu\text{m}$ , apex obtuse, ascal plug very small, discoid, staining blue with Melzer's reagent. Ascospores uniseriate, light brown to dark brown,  $11.0-15.0$  ( $17.0$ )  $\times$   $6-7.0$   $\mu\text{m}$ , inequilateral-ellipsoid, ends round, uniguttulate, with longitudinal germ slit. Paraphyses long, filiform, aseptate.

#### Anatomy :

Ectostroma absent. Entostroma composed of two regions, outer entostroma dark brown, carbonaceous, up to  $187.5$   $\mu\text{m}$  wide, *textura angularis*, cells  $2.0-18.0$   $\times$   $2-9.0$   $\mu\text{m}$ ; inner entostroma well developed, concentrically zonate, *textura porrecta*, lighter zones broader than darker zones; lighter zone hyphae up to  $18.0$   $\mu\text{m}$  wide, light brown, thin walled; darker zone hyphae up to  $16.0$   $\mu\text{m}$ , highly pigmented, dark brown, thick walled, tissue at the base of perithecia *textura angularis*, cells  $5.0-18.0$   $\times$   $5.0-14.0$   $\mu\text{m}$ , dark brown, thick walled. Perithecial wall up to  $36.0$   $\mu\text{m}$  wide, *textura angularis*, cells up to  $36.0$   $\times$   $7.0$   $\mu\text{m}$ , elongated along the perithecial wall.

*Collection examined* : Patiala : Chhatbir zoological Park, on dead wood of *Dalbergia sissoo*; Roxb., M. Singh 236(PUN), August 12, 1979, and M. Singh 238 (PUN), September 7, 1979.

This is a widely distributed species of the genus and has been reported from various localities of India, by several workers (fide Thind and Dargan, 1978). However, it was not previously known from Punjab. This above said Punjab collection is typical of the species and resembles with other Himalayan collections studied earlier by Thind and Dargan (1978). However, this Punjab collection differs anatomically by having *textura angularis* tissue just below the perithecia. This feature may be an ecological adaptation due to relatively high temperature in Punjab.

3. *Hypoxyton hematostroma* Mont. Sagra., R. de, le. Fl. Cuba. 344. 1842.

Stromata widely effused with the host surface, irregular, pulvinate to cushion shaped, surface smooth, or with very prominent perithecial elevations, yellowish brown to reddish brown,  $1.5-15.0$   $\times$   $1.0-3.0$   $\times$   $2-3$  cm. Perithecia up to  $1.6$  mm  $\times$   $375.0$   $\mu\text{m}$ , tubular, closely appressed, easily separating, blood red particles present within the perithecial vertices. Asci  $126.0-225$   $\times$   $9.0-14.0$   $\mu\text{m}$ , sp. p.  $85-99$   $\times$   $9.0-14.0$   $\mu\text{m}$ , cylindric with long tapering stalk  $40.0-126.0$   $\mu\text{m}$ , apex obtuse, ascal plug small, discoid, staining deep blue with Melzer's reagent. Ascospores ( $11.0$ )  $13.0-17$   $\times$   $7.9$   $\mu\text{m}$ , inequilateral-ellipsoid, with rounded ends, dark brown, guttulate and with a longitudinal germ slit. Paraphyses long, filiform, aseptate.

#### Anatomy :

Ectostroma absent. Outer entostroma *textura angularis*, cells  $4.0-9.0$   $\times$   $4.0$   $\mu\text{m}$  thin walled, followed below by hyphae up to  $4.5$   $\mu\text{m}$  wide. Inner entostroma present below the perithecia, dark brown, *textura angularis*, cells  $7.0-40.0$   $\times$   $4-14.0$   $\mu\text{m}$ , cells on the outer side much longer, thick walled. Perithecial wall up to  $63.0$   $\mu\text{m}$  *textura angularis*, cells elongated along the perithecial wall, composed of two zones, outer zone up to  $40.5$   $\mu\text{m}$  wide from the sides, cells up to  $9.0-32$   $\times$   $4.0-9.0$   $\mu\text{m}$  dark brown, thick walled, inner zone up to  $22.5$   $\mu\text{m}$  wide, cells  $19.0-45.0$   $\times$   $2.0-9.0$   $\mu\text{m}$ , light brown, thin walled, cells at the base much smaller  $4.0-14.0$   $\times$   $4.0-9.0$   $\mu\text{m}$ , forming a massive zone.

*Collection examined* : Patiala: Chhatbir Zoological park, on dead wood of *Dalbergia sissoo* Roxb., M. Singh 240 (PUN), September 9, 1979.

The above Punjab collection is typical

of the species and resembles in all essential details with the species described by Miller (1961). However, the colour of the stromata in this collection is yellowish brown to reddish brown, as against bright red to yellow red reported for this species. This species was not previously reported from India.

4. *Hypoxyton investiens* (Schw.) Curt., Geol. and Nat. Hist. Survey N. C. III. 140. 1867. Plate II, Figs. 1-6.

Stromata applanate or widely effused, superficial, gregarious,  $1.2-7 \times 1.0-3.5 \times .1-2$  cm, surface smooth or with prominent perithecial elevations, black, carbonaceous, brittle. Perithecia up to  $447.5 \times 375.0$   $\mu\text{m}$ , oblong or cylindrical, completely immersed or with slightly protruding out necks, giving rough appearance to the surface; ostioles inconspicuous, and punctate. Asci,  $90.0-113.0 \times 9.0-11.0$   $\mu\text{m}$ , sp. p.  $45.0-63.0 \times 9.0-11.0$   $\mu\text{m}$ , cylindrical with small tapering stalk  $45-50$   $\mu\text{m}$ , apex obtuse, ascal plug small, 'T' shaped, staining blue with Melzer's reagent Ascospores  $8.0-12.0 \times 4.0-7.0$   $\mu\text{m}$ , uniseriate, smooth, inequilateral or ellipsoid with rounded ends, light brown with a longitudinal germ slit, uniguttulate. Paraphyses up to  $4.5$   $\mu\text{m}$  wide, thin walled, simple or branched, septate, hyaline.

#### Anatomy :

Ectostroma absent. Entostroma up to  $437.5$   $\mu\text{m}$  wide, dark brown, textura angularis on the sides, cells  $4.0-14.0 \times 4.0$   $\mu\text{m}$ , thick walled. Perithecial wall up to  $8.5$   $\mu\text{m}$  wide, cells of inner wall textura angularis, cells  $6.0-11.0 \times 4.0-9.0$   $\mu\text{m}$ . Tissue of entostroma below outer wall and at the base of the perithecium textura intricata, hyphae, up to  $4.5$   $\mu\text{m}$  in diameter.

Collection examined : Patiala: Chhatbir Zoological Park, on dead stumps of *Eugenia* sp., M. Singh 244 (PUN), September 9, 1979.

This species is characteristic in having applanate stromata, with prominent perithecial elevations, and punctate inconspicuous ostioles.

5. *Hypoxyton rubiginosum* Pers. ex Fr. Fr. var. *dieckmanni* (Theiss.) Mill., Miller. J. H. World species of *Hypoxyton* 33. 1961. Plate III. Figs. 1-6.

Stromata effused, superficial, gregarious,  $1-5 \times 5-2.5 \times .2$  cm, surface rough, due to prominent perithecial elevations, violet to purplish red, finally becoming black with age, carbonous and brittle. Perithecia up to  $525 \times 325$   $\mu\text{m}$ , subglobose to oblong and angular due to compression, almost completely immersed, ostioles non-protruberant, dot like and umblicate. Asci  $113-135.0 \times 7-9.0$   $\mu\text{m}$ , sp. p.  $63.0-77 \times 7-9.0$   $\mu\text{m}$ , cylindrical with short tapering stalk  $50-59$   $\mu\text{m}$ , apex obtuse ascal plug small, discoid, staining blue with Melzer's reagent ascospores  $7.0-10.0 \times 3.0-5.0$   $\mu\text{m}$ , uniseriate, smooth, inequilateral-ellipsoid, light brown, with a longitudinal germ slit. Paraphyses not observed.

#### Anatomy :

Ectostroma not observed. Entostroma up to  $750$   $\mu\text{m}$  wide, dark brown, textura subintricata, hyphae  $3.0-4.5$   $\mu\text{m}$  wide, thick walled, perithecial wall up to  $31.5$   $\mu\text{m}$ , textura angularis, cells  $4.5-13.5 \times 4.5-7.0$   $\mu\text{m}$ , composed of two zones, cells of outer zone thick walled and dark, and those of inner zone, thin walled and hyaline.

Collection examined : Patiala; Chhatbir Zoological Park, on fallen twigs of *Dal-*

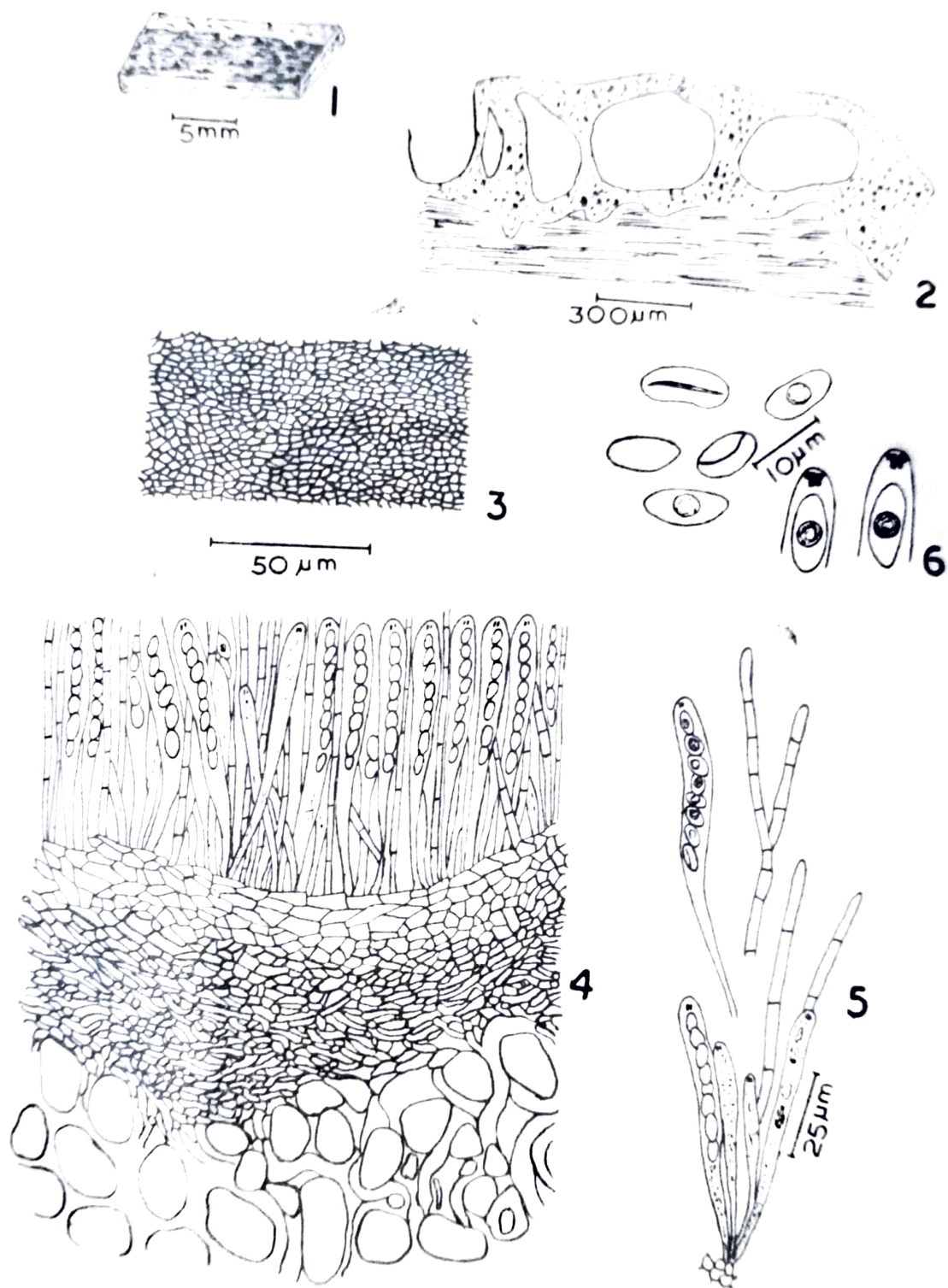


Plate II. Figs. 1—6. *Hypoxylon investiens*.

1. Stroma general habit. 2. V. S. stroma showing various regions. 3. V. S. entostroma showing detailed structure. 4. V. S. base of perithecium showing detailed structures. 5. Asci and paraphyses. 6. Ascospores and ascus apex showing ascus plug.

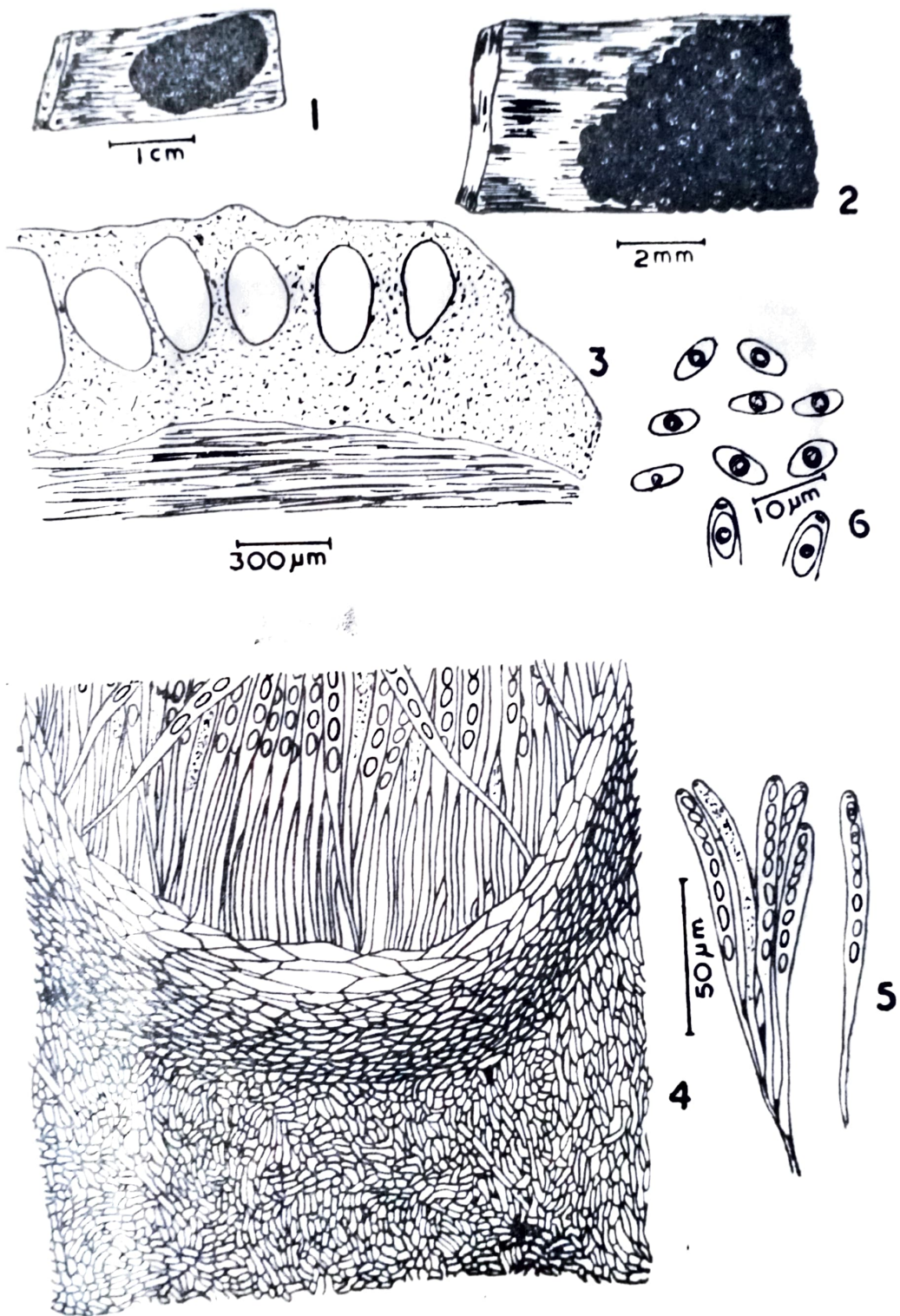


Plate III. Figs. 1—6. *Hypoxylon rubiginosum* var. *dieckmanni*.

1. Stroma general habit. 2. Stroma magnified. 3. V. S. stroma showing various regions.  
 4. V. S. base of peritheccium and inner entostroma showing detailed structure. 5. Asci. 6. Ascospores  
 and ascus apex showing ascus plug.

*bergia sisoo* Roxb. M. Singh, 241 (PUN), September 9, 1979.

This species is characteristic in having effused superficial, gregarious nature of stromata, which is violet or purplish red at first, but becomes black with age. It differs from *H. rubiginosum* var. *typica* in having smaller size of the asci and ascospores.

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