

THE GENUS *COPROTUS* IN INDIA

BY K. S. THIND, S. C. KAUSHAL AND R. KAUSHAL
Department of Botany, Punjab University, Chandigarh



ABSTRACT

This paper includes four species of *Coprotus*. An illustrated account is given for *C. sarangpurensis* sp. nov., *C. disculus*, *C. lacteus* and *C. ochraceus*. A key to all the four species known from India is given.

INTRODUCTION

The genus *Coprotus* is accepted in the sense of Korf and Kimbrough apud Kimbrough and Korf (1967). As treated here, it is characterised by minute, sessile, discoid to convex, externally glabrous apothecia; white to pallid, faintly ochraceous to bright yellow hymenium; non-amyloid, cylindrical-clavate to broadly clavate, 8-multispored asci which stain uniformly in congo red; hyaline to subhyaline, smooth, eguttulate spores, usually with a conspicuous de Bary bubble; straight or uncinuate paraphyses; ectal excipulum is composed of textura angularis to textura globulosa; medullary excipulum textura intricata, hyphae often closely packed, short-septate and simulating textura angularis. The genus is mostly coprophilous.

1. Accepted for publication on September 17, 1977.

The authors are grateful to the United States Department of Agriculture for financial assistance under P.L. 480. They are thankful to Dr J. W. Kimbrough, Department of Botany, University of Florida, Florida, U.S.A. for his help in identification of some of the collections. The latin diagnosis was very kindly rendered by Father J.J. Serrano, S.J.

The genus is fairly represented in India. Its two species were listed by Batra and Batra (1963) and one was described by Thind and Waraitch (1964). These authors, however, treated the species under the generic name *Ascophanus* Boud. Recently, Thind and Waraitch (1970) reported one more species, *C. aurora* (Cr. and Cr.) Thind and Waraitch.

Of the four species of the genus included in this paper, *C. sarangpurensis* is treated as a new species, *C. disculus* Kimbr., Luck-Allen and Cain is reported for the first time from India, on the basis of a collection (PAN 386) described as *Ascophanus lacteus* (Cke. and Phill.) Sacc. by Thind and Waraitch (1964), *C. lacteus* (Cke. and Phill.) Kimbr., Luck-Allen and Cain is described for the first time, on the basis of recent collections, *C. ochraceus* (Cr. and Cr.) Larsen, listed as *Ascophanus ochraceus* (Cr. and Cr.) Bould. by Batra and Batra (1963), is fully described.

Observations are based both on fresh and dry material. Anatomical details have been studied both from free-hand and microtome sections. The abbreviations used are: PAN (Herbarium of Panjab University Botany Department, Chadigarh, India), FLAS (Herbarium Agriculture

Experiment Station, Gainesville, Florida, U.S.A.), TRTC (Cryptogamic Herbarium, Department of Botany, University of Toronto, Canada), H. P. (Himachal Pardesh), U.P. (Uttar Pradesh).

KEY TO THE SPECIES

1. Apothecia greyish-brown; ascospores broadly ellipsoid to globose.

C. sarangpurensis

1. Apothecia whitish to pale-yellow with a pink tinge, bright-yellow or orange; ascospores narrowly to broadly ellipsoid.

2. Ascospores more than 11 μm long; asci cylindrical; paraphyses straight or slightly bent at apices.

3. Apothecia whitish or with pinkish tinge; ascospores 10-14 \times 6-9 μm ; asci 75-93 (-105) \times 9-11.5 (-12.5) μm . *C. disculus*

3. Apothecia yellow; ascospores 13.75-18 \times 7.5-9 (-10) μm ; asci 110-150 (-210) \times 10-14 (-16, 18) μm . *C. ochraceus*

2. Ascospores less than 11 μm long; asci cylindrical to broadly clavate; paraphyses bent at apices.

C. lacteus

1. *Coprotus sarangpurensis* Thind et S. C. Kaushal sp. nov. Figs. 1-2.

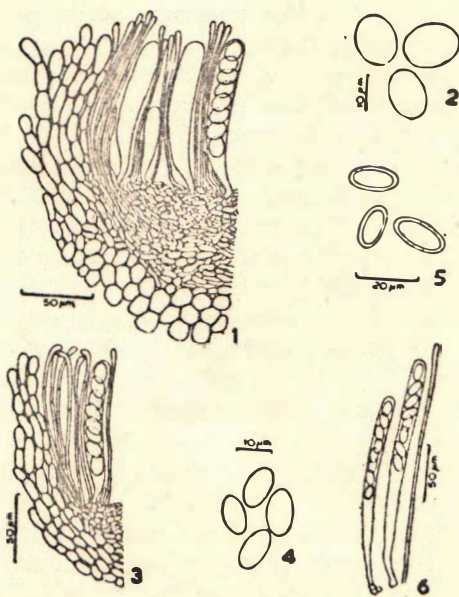
Apothecia add 0.5 mm diam. dense gregaria, sessilia, discoidea, ordinata, mollia, carnosae; superficies externa fusca, glabra vel furfuracea propter affixas hyphas; margo integer; hymenium concolor cum protrudentes ascos. Asci (75-)89-115 \times 12-16 (-18) μm , octosporiedi, cylindrici vel cylindrico-clavati, apice rotundo, basi attenuata, J-ve. Ascospores (11-) 12-16 \times 9-11.5 (-12.5) μm , late ellipsoideae vel subgloboae, uniseriatae, hyalinae, lenes, continentem bullam unicam de Bary. Para-

physes ad 1.5 μm latae infra et ad 2.5 (-3.5) μm supra, tenuitunicatae, septatae, simplices vel ramosae infra, subhyalinae, rectae (raro curvatae), eminentes ad 15 μm ultra apices ascorum. Anatomia: Ectal excipuli textura angularis, 53 μm crassa, cellula ad 25 \times 20 μm , gradatim minor et angusti ad marginem, cellulae marginales longae ad 25 \times 8 (-10) μm ; excipuli medullaris textura dense intricata, hyphae parvicellulares (simulantes texturam angularem), ad 7.5 μm latae, minores fere.

Collectio examinata: S. Chander 2590-Typus (PAN), in stercore, Sarangpur, Chandigarh, October 7, 1973.

Distribution: India.

Coprotus sarangpurensis Thind and S.C. Kaushal sp. nov. (Figs. 1-2.)



FIGS. 1-5, *Coprotus*. 1-2. *Coprotus sarangpurensis* Thind and S.C. Kaushal. Fig. 1. V.s. of the apothecium passing through its margin. Fig. 2. Ascospores. Figs. 3-4. *C. disculus* Kimbr., Luck-Allen and Cain. Fig. 3. V.s. of the apothecium passing through its margin. Fig. 4. Ascospores. Figs. 5-6. *C. ochraceus* (Cr. and Cr.) Larsen. Fig. 5. Ascospores. Fig. 6. Asci and paraphyses.

Apothecia up to 0.5 mm in diameter, densely gregarious, sessile, discoid, regular soft, fleshy; external surface greyish-brown, glabrous or furfuraceous due to attaching hyphae; margin entire; hymenium concolorous with external surface, minutely roughened by the protruding asci. Asci (75-) 89-115 × 12-16 (-18) μm , 8-spored, cylindrical to cylindric-clavate, apex rounded, base attenuated, J-ve. Ascospores (11-) 12-16 × 9-11.5 (-12.5) μm , broadly ellipsoid to subglobose, uniseriate, hyaline, smooth, containing single de Bary bubble. Paraphyses up to 1.5 μm wide below and up to 2.5 (-3.5) μm at the top, thin-walled, septate, simple or branched below, subhyaline, straight (rarely curved), projecting up to 15 μm beyond the ascus tips.

Anatomy: Ectal excipulum *textura angularis*, up to 53 μm thick in the middle, cells up to 25 × 20 μm , gradually becoming smaller and narrower towards margin, marginal cells long, up to 25 × 8 (-10) μm ; medullary excipulum *textura intricata*, hyphae short-celled and simulating *textura angularis*, up to 7.5 μm broad, usually less; hypothecium indistinct.

Collection examined: S. Chander 2590-Type (PAN), on cow dung, Sarangpur, Chandigarh, October 7, 1973.

Distribution: India.

Comments: The species was collected from dry cow dung in an open place (altitude 300m) at the end of rainy season. It is characterised by greyish-brown apothecia, broadly ellipsoid to subglobose ascospores and long marginal cells. This species is close to *C. aurora* (Cr. and Cr.) Kimbr., Luck-Allen and Cain, but the latter differs in having yellow to orange apothecia, slightly smaller asci (65-95 × 10-15 μm), narrower ascospores (12-14 × 6-9 μm) and smaller marginal cells. In spore measurements, *C. sarangpurensis* resembles

C. dextrinoideus Kimbr., Luck-Allen and Cain, but the latter has white hymenium, much broader asci (80-125 × 18-24 μm), and slightly smaller marginal cells.

Collection examined: *Coprotus disculus* Kimbr., Luck-Allen and Cain, *Can. J. Bot.* 50: 962. 1972. Figs. 3-4.

Apothecia up to 0.75 mm in diameter, densely gregarious to crowded, sessile, discoid to lenticular, regular, soft, fleshy; external surface whitish with a light pinkish tinge, smooth; margin entire; hymenium concolorous with the external surface, minutely roughened by the protruding out asci.

Asci 75-93 (-105) × 9-11.5 (-12.5) μm , 8-spored, cylindrical, apex rounded, base attenuated, J-ve. Ascospores 10-14 × 6-9 μm , ellipsoid, uniseriate, rarely biseriate, hyaline, smooth, containing a de Bary bubble. Paraphyses up to 1.5 μm wide below, inflated above to 3.5 μm , filiform, thin-walled, septate, simple or branched below, hyaline, slightly curved at apices, projecting up to 8 (-10) μm beyond the ascus tips. **Anatomy:** Excipulum poorly differentiated, up to 105 μm thick (usually less), *textura angularis* cells on the outside and those below the hymenium usually smaller (5-9 μm across), marginal cells elongated, up to 25 × 8.75 μm , cells of outer few layers slightly thick-walled than others.

Collection examined: Waraich 386 (PAN), on buffalo dung in Oak forest, Fagu, Simla, H.P., September 2, 1961.

Distribution: Europe, North America, India.

Comments: This species is known from India only by a single collection which was placed under *Ascophanus lacteus* (Cke. and Phill.) Sacc. by Thind and Waraich (1964). It is not surprising as *C. disculus* is close to *C. lacteus* and, as mentioned by Kimbrough et al. (1972), in fact, specimens of

the former have been accessioned under the name of the latter. Because of its larger ascospores and asci, PAN 386 is now placed under *C. disculus*. The marginal cells of the excipulum in the Indian collection are larger and narrower ($25 \times 8.75 \mu\text{m}$) than those described by Kimbrough et al. ($8-12 \times 6-10 \mu\text{m}$). Also in this collection the ascospores are slightly larger and the asci a little narrower than in the type material (ascospores $12-13.5 \times 5-8 \mu\text{m}$; asci $75-90 \times 10-15 \mu\text{m}$, vide Kimbrough et al., 1972). These differences are, however, well within the range of variability of the species.

Coprotus ochraceus (Cr. and Cr.) Larsen, *Dan. Bot. Tidskr.* 66: 1-32. 1971.

Basionym: *Ascobolus ochraceus* Cr. and Cr., *Fl. Finist.* 57. 1867. Figs. 5-7.

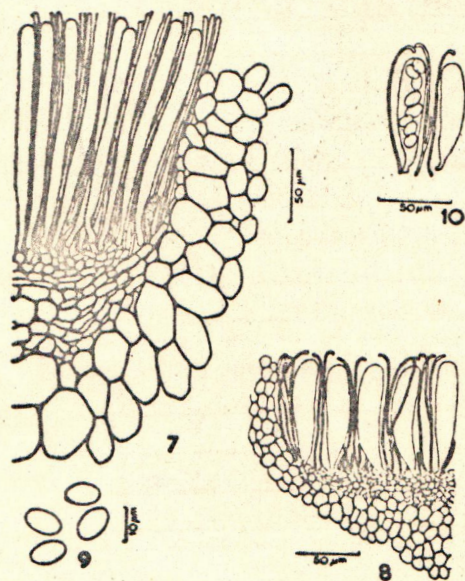


FIG. 7. *Coprotus ochraceus* (Cr. and Cr.) Larsen. V.s. of the apothecium passing through its margin. Fig. 8-10. *C. lacteus* (Cke. and Phill.) Kimbr., Luck-Allen and Cain. Fig. 8. V.s. of the apothecium passing through its margin. Fig. 9. Ascospores. Fig. 10. Asci and paraphyses.

Apothecia up to 1 mm in diameter, densely gregarious to crowded together, sessile, pulvinate to discoid, regular, soft, fleshy; external surface smooth, yellow; margin entire; hymenium yellow, roughened due to projecting ascial tips. Asci $163-200 (-210) \times 10-14 (-16) \mu\text{m}$, 8-spored, cylindrical, apex rounded, base gradually narrowing below, J-ve. Ascospores $13.75-18 \times 7.5-9 \mu\text{m}$, ellipsoid, uniseriate, hyaline, smooth, containing a de Bary bubble. Paraphyses up to $3.5 \mu\text{m}$ wide below, expanding above up to $5 \mu\text{m}$ at the apices, thin-walled, septate, simple, containing yellowish contents, not or slightly curved at apices, projecting up to $16 (-25) \mu\text{m}$ beyond the ascial tips.

Anatomy: Ectal excipulum up to $95 \mu\text{m}$ thick, *textura angularis*, cells up to $56 \times 45 \mu\text{m}$, smaller towards margin; medullary excipulum up to $425 \mu\text{m}$ thick, decreasing towards margin, *textura globulosa-angularis* with hyphoid tendency towards margin, cells up to $25 \mu\text{m}$ across, smaller and narrower towards hymenium and margin; hypothecium indistinct.

Collection examined: Batra 6 (PAN), on sod formed of dung, rotting foliage of *Quercus incana* and needles of *Cedrus deodara*, Jabber Khet, Mussoorie, U. P., September 1, 1953.

Distribution: Europe, North America, India.

Comments: Batra's collection seems to be very close to *C. ochraceus* but has two important differences, (a) the size of the asci in this collection is very large as compared to the size reported by Kimbrough et al. (1972) ($110-150 \times 12-18 \mu\text{m}$), and (b) the substratum on which it was growing is not exclusively dung. However, the size, shape and colour of the fruitbody and the size of the ascospores in the Indian collection resembles *C. ochraceus* and it is, therefore, placed under this species.

Coprotus lacteus (Cke. and Phill.) Kimbr., Luck-Allen and Cain, *Can. J. Bot.* 50: 965. 1972.

Basionym: *Ascobolus lacteus* Cke. and Phill., *Grevillea* 5: 119. 1876. Figs. 8-10.

Apothecia up to 0.3 mm in diameter, gregarious, singly, sessile, discoid, regular, soft, fleshy; external surface white-yellow, smooth; margin entire; hymenium white to white-yellow, roughened by slightly protruding out ascus tips. Asci 60–85 × (11–) 15–21.5 μ m, 8-spored, cylindrical to broadly clavate, apex rounded to slightly truncate; base attenuated, J-ve. Ascospores 9 × 10.5 (–12.5) × 6–7 (–8) μ m, broadly ellipsoid, sometimes subglobose (9 × 8 μ m), containing a conspicuous de Bary bubble. Paraphyses upto 1.5 μ m wide below, not or slightly expanded above, filiform, thin-walled, septate, simple or branched below, subhyaline, curved at the apices, projecting up to 11 μ m beyond the ascus tips.

Anatomy: Ectal excipulum up to 70 μ m thick, usually less, *textura angularis*, cells up to 15.25 × 12 μ m, slightly thick-walled; medullary excipulum densely *textura intricata* of short-celled hyphae, simulating

textura angularis, cells up to 5 μ m across; hypothecium indistinct.

Collections examined: S. Chander 2412 (PAN, FLAS), mixed with a *Thecothecus* sp., on cow dung, Narkanda, Simla, H.P., August 18, 1971; S. Chander 2427 (PAN), on dung of goat in coniferous forest, Kalpa, Kinnaur, H.P., September 6, 1971; S. Chander 2519 (PAN), on sheep dung in mixed forest, Jandri Ghat, Dalhousie, H.P., September 18, 1972; Cain and Luck-Allen 40111 (TRTC), on deer dung, Inverhuron, Bruce Co. Ontario, Canada, October 8, 1961.

Distribution.—Canada, Europe, U.S.A., India.

Comments.—The fungus is recorded here for the first time from India. Kimbrough et al. (1972) had designated Phillip's collection on cow dung, Shrewsbury, England, 1876, Phillips D 11141 (CUP) as the type. In the description of the excipulum they mentioned marginal cells elongated. But these are rather iso-diametric in the Indian collections. Also the ascospores in the Indian collections are slightly larger. However, these variations are well within the range of specific variability.

REFERENCES

- BATRA, L.R., AND S.W.T. BATRA. 1963. Indian Discomycetes. *Univ. Kansas Sci. Bull.* 44: 109-256.
- KIMBROUGH, J. W., AND R.P. KORF. 1967. A synopsis of the genera and species of the tribe Theleboleae (=Pseudoascoboleae). *Am. J. Bot.* 54: 9-23.
- , E.R. LUCK-ALLEN AND R.F. CAIN. 1972. North American species of *Coprotus* (Thelebolaceae: Pezizales). *Can. J. Bot.* 50: 957-971.
- THIND, K.S., AND K.S. WARAICH. 1964. The Pezizales of India-VIII. *J. Indian bot. Soc.* 43: 459-475.
- , AND —. 1970. The Pezizales of India X. *Res. Bull. Panjab Univ. N.S.* 21: 145-155.