

## A Contribution to the Knowledge of coprophilous Pezizales of India

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The coprophilous fungi with small to very small fructifications and being inconspicuous are usually neglected while the macroscopic species are generally more represented in fungal collections of a region. However, such small-sized species are well represented in the collections of Pezizales made during a survey of various localities in the North Western and Eastern Himalayas during 1960—68. Some of these have already been described elsewhere (THIND & WARAITCH, 1964, 70) while four more are being described here. These all belong to the family Thelebolaceae of ECKBLAD (1968). A new combination, *Coprotus argenteus* (CURR.) WARAITCH, has been proposed for *Ascobolus argenteus* CURR. (Trans. Linn. Soc. Bot. 24: 496. 1864). This species as well as *Thecotheus holmskjoldii* (HANS.) ECKBL. are new records for India while *T. pelletieri* (Cr. & Cr.) BOUD. and *Lasiobolus pilosus* (Fr.) SACC. are redescribed on the basis of more collections from this country.

Various species of the above mentioned genera have previously been recorded from India by different workers. These species are: *Coprotus glacellus* (REHM) KIMBR. as *Ascophanus glacellus* REHM, *C. ochraceus* (Cr. & Cr.) LARSEN as *A. ochraceus* (CROUAN) BOUD.; *Lasiobolus pilosus* as *L. equinus* (MÜLL.) KARST. by BATRA & BATRA (1963); *C. lacteus* (Ck. & PHILL.) KIMBR. et al. as *A. lacteus* (COOKE & PHILL.) SACC. and *C. aurora* (Cr. & Cr.) THIND & WARAITCH by THIND & WARAITCH (1964, 1970, respectively) and *T. pelletieri* by BATRA & BATRA (1963) and KAR & PAL (1968). *A. holmskjoldii* HANSEN, recorded by BATRA & BATRA (1963), appears to be *T. cinereus* (CROUAN) CHENANT due to its smooth ascospores while the identity of *L. hirtellus* KARST. (MAHJU, 1933) seems doubtful as the latter species may be one of the many forms of *L. pilosus* (VAN BRUMMELEN, 1967).

Descriptions of the species have been drawn on the basis of fresh collections made during the present studies while the anatomical details are based on free hand and microtome sections. As mentioned

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under the species the material has been deposited in various herbaria (PAN-Herbarium of the Botany Department, Panjab University, Chandigarh, India; C-Institute of Thallophyta, Copenhagen, Denmark; TAA-Mycological Herbarium, Institute of Zoology & Botany, Academy of the Sciences of Estonian S. S. R. and BPI — The National Fungus Collections, Beltsville, Maryland, U. S. A.).

1. *Coprotus argenteus* (CURR.) comb. nov.

Basionym: *Ascobolus argenteus* CURR., Trans. Linn. Soc. 24: 496. 1864.  
Figs. 1—3.

Apothecia up to 0.2 mm in diameter, gregarious to densely gregarious, sessile, pyriform, plane to discoid, regular, soft, translucent; external surface white, smooth; margin entire; hymenium white, minutely roughened by the protruding ascial tips.

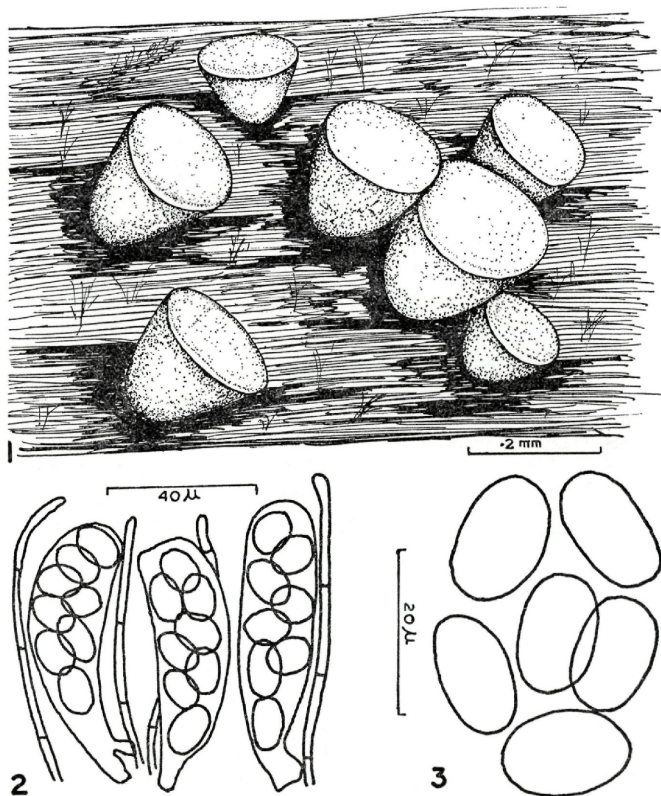
Asci 55—90 × 14.5—24 (—29)  $\mu$ , 8-spored, broad-clavate to subovoid, apex obtuse to subtruncate, J-ve. Ascospores (8.5—) 10.5—16 × 8.5—10.5  $\mu$ , irregularly biseriate, sometimes crowded near ascial tip, hyaline, broadly ellipsoid with obtuse ends, rarely subglobose (9 × 8  $\mu$ ), smooth, with a conspicuous DE BARY bubble. Paraphyses up to 1.5  $\mu$  wide below, enlarged and sometimes slightly clavate above (up to 4.5  $\mu$  wide), filiform, thin-walled, septate, simple, subhyaline, slightly projecting (10  $\mu$ ) beyond the ascial tips.

Anatomy: Excipulum subhyaline, not demarcated into ectal and medullary excipulum, up to 125  $\mu$  thick, textura angularis, cells up to 12 × 10  $\mu$ , slightly thick-walled on the outside but distinct hyphal nature clear towards margin; hypothecium may or may not be distinct, up to 15  $\mu$  thick, textura subangularis, formed by closely compacted hyphae.

Material: WARAITCH 2484 (PAN), on cow dung in coniferous forest, Narkanda, Mahasu, Himachal Pradesh, September 7, 1962; WARAITCH 2105 (PAN, BPI, TAA, C), on buffalo dung in *Abies pindrow* forest, Narkanda, Mahasu, Himachal Pradesh, August 4, 1965.

This fungus belongs to *Coprotus* KORF & KIMBR. rather than *Ascophanus* BOUD. (which genus is a heterogeneous assemblage), due to its glabrous and whitish apothecia, 8-spored and iodine negative asci, and ascospores having DE BARY bubbles within them. As this transfer has not been made so far, the new combination under *Coprotus* as *C. argenteus* (CURR.) WARAITCH, is proposed here with the basionym *Ascobolus argenteus* CURR.

The broad-clavate to subovoid asci and slightly clavate paraphyses, coupled with small and white apothecia, differentiate this species from all others of this genus.



Figs. 1–3. *Coprotus argenteus*. 1. Gregarious to densely gregarious and pyriform apothecia. 2. Broad-clavate to subovoid asci and paraphyses. 3. Ascospores.

2. *Thecotheus pelletieri* (CR. & CR.) BOUD., Ann. Sci. nat. 5 Ser. Bot. 10: 236. 1869.

Figs. 8, 9

Apothecia up to 1 mm in diameter, densely gregarious to crowded, sessile or reduced below into a short base, at first obconic and finally turbinate, regular, soft; external surface whitish, concolorous with hymenium, smooth, sometimes rough due to the protruding ectal

cells; margin entire; hymenium whitish but greyish on drying, roughened by the protruding ascial tips; basal mycelial hyphae up to  $2.5 \mu$  wide, hyaline, thin-walled, septate, branched.

Asci 290—410 ( $-465$ ) $\times$ 59—67  $\mu$ , 32-spored, cylindric-clavate, apex obtuse, ending abruptly below into a short stem-like base, J+ve (younger asci entirely turning blue with Melzer's reagent but reaction decreasing with age of asci). Ascospores 28—31 $\times$ 14—17  $\mu$ , irregularly disposed, hyaline, ellipsoid, thick-walled, smooth, eguttulate, granular within, covered by a mucilaginous perispore layer. Paraphyses up to 3  $\mu$  wide below and 6  $\mu$  above, slender, thin-walled, septate, simple or branched below, hyaline, projecting up to 15  $\mu$  beyond the ascial tips.

Anatomy: Ectal excipulum subhyaline, up to 100  $\mu$  thick, textura angularis to textura globulosa, cells up to 22 $\times$ 16  $\mu$ , slightly thick-walled, projecting on the surface into bulbous cells (up to 25 $\times$ 20  $\mu$ ); medullary excipulum subhyaline, up to 260  $\mu$  thick, textura globulosa, cells up to 30 $\times$ 20  $\mu$ , thin-walled, interspersed with a few hyphae which are up to 8  $\mu$  wide, thin-walled, septate, branched; hypothecium subhyaline, up to 58  $\mu$  thick, densely textura intricata.

Material: WARAITCH 2166 (PAN, BPI, C), on dung in coniferous forest, Bhadarwah, Doda, Jammu & Kashmir, October 2, 1966.

This species has previously been reported from India by BATRA & BATRA (1963) but the present collection has smaller ascospores than reported by them.

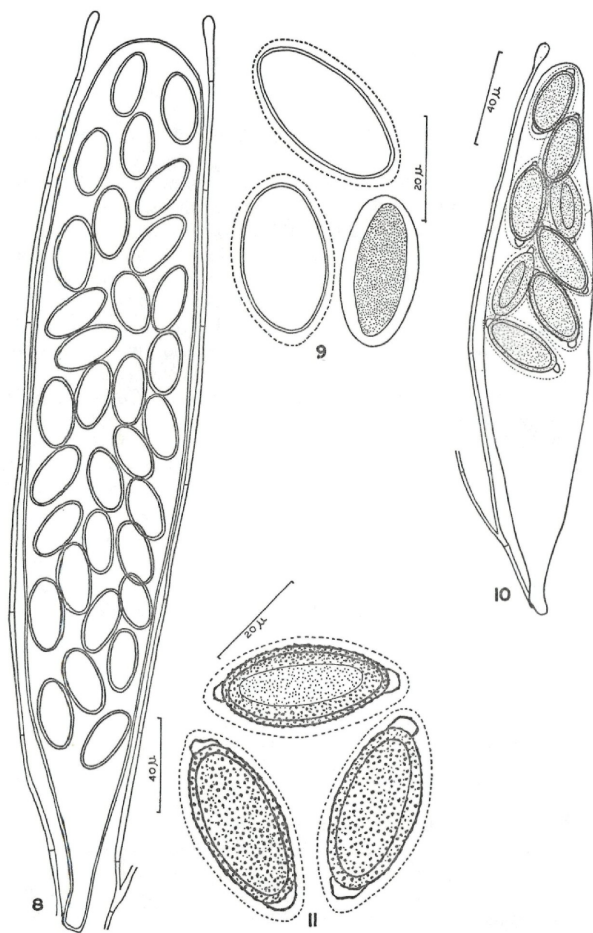
This is the only multispored species of the genus and can very easily be separated on this character from the rest of its species.

### 3. *Thecotheus holmskjoldii* (HANS.) ECKBL., Nytt Mag. Bot. 15: 25. 1968.

Figs. 10, 11

Apothecia up to 2.5 mm in diameter, gregarious to crowded, sessile, at first subconical, finally turbinate, regular, soft; external surface greyish, concolorous with the hymenium; margin entire; hymenium greyish, whitish on drying, roughened by the protruding ascial tips; basal mycelial hyphae up to 3.5  $\mu$  wide, hyaline, thin-walled, septate, branched.

Asci 245—305  $\times$  31—43 $\mu$ , 8-spored, cylindrical to broad-clavate, apex obtuse, J+ve, (younger asci entirely turning blue with Melzer's reagent but reaction decreases with age of asci). Ascospores 26—34 $\times$  13—16  $\mu$ , biseriate to irregularly disposed, subhyaline, ellipsoid, smooth and granular within in young condition, later covered with fine granules and becoming prominently apiculate at both ends, apiculi up to 3  $\mu$  long and 6.5  $\mu$  broad at the base, obtuse, whole of the ascospore surrounded on the outside with a mucilaginous perispore layer. Paraphyses up to 1.5  $\mu$  wide below and 8  $\mu$  at the capitate tips,



Figs. 8—11. *Thecotheus pelletieri*. 8. Cylindric-clavate and 32-spored ascus and paraphyses. 9. Large-sized ascospores covered with a mucilaginous perisporic covering. *T. holmskjoldii*. 10. Broad-clavate and 8-spored ascus, and filiform paraphysis with capitate tip. 11. Large-sized apiculate ascospores with fine granules and covered on the outside with mucilaginous perisporic sheath.

filiform, thin-walled, septate, branched, hyaline to subhyaline, agglutinated at their apices.

Anatomy: Ectal excipulum subhyaline, up to 85  $\mu$  thick, *textura angularis*, cells up to 28  $\times$  16  $\mu$ , slightly thick-walled, radially arranged; medullary excipulum subhyaline, up to 130  $\mu$  thick, *textura globulosa* to *textura angularis*, cells up to 30  $\times$  25  $\mu$ , thin-walled, interspersed with a few hyphae which are up to 8  $\mu$  wide, thin-walled, septate, branched, hyphae more clear towards margin; hypothecium subhyaline, up to 40  $\mu$  thick, densely *textura intricata*.

Material: WARAITCH 2094 (PAN, BPI, C), on cow dung in mixed forest, Jandhri Ghat, Dalhousie, Himachal Pradesh, July 25, 1966; WARAITCH 2255 (PAN, BPI), on dung in open place, Bisaran, Pahalgam, Jammu & Kashmir, August 31, 1967.

BATRA & BATRA (1963) have recorded *Ascophanus holmskjoldii* HANS. from India for which they reported the ascospores to be smooth. However, due to the smooth ascospores, it may represent *A. cinereus* (CROUAN) BOUD. = *Thecotheus cinereus* (CROUAN) CHENANT. as this character is exhibited by the material of CROUAN (VAN BRUMMELEN, 1967). This has been accepted by ECKBLAD (1968) who has kept *T. holmskjoldii* distinct from *T. cinereus* on the ascospore characters. If this view is accepted, the collections of the Indian authors represent *T. cinereus* rather than *T. holmskjoldii*, if at all both species are to be kept separate. In that case, the present collections represent true *T. holmskjoldii* due to the sculptured ascospores and constitute the first record of this species from India. Further, the ascospores of the present collections are slightly broader and apothecia bigger than reported by the previous workers.

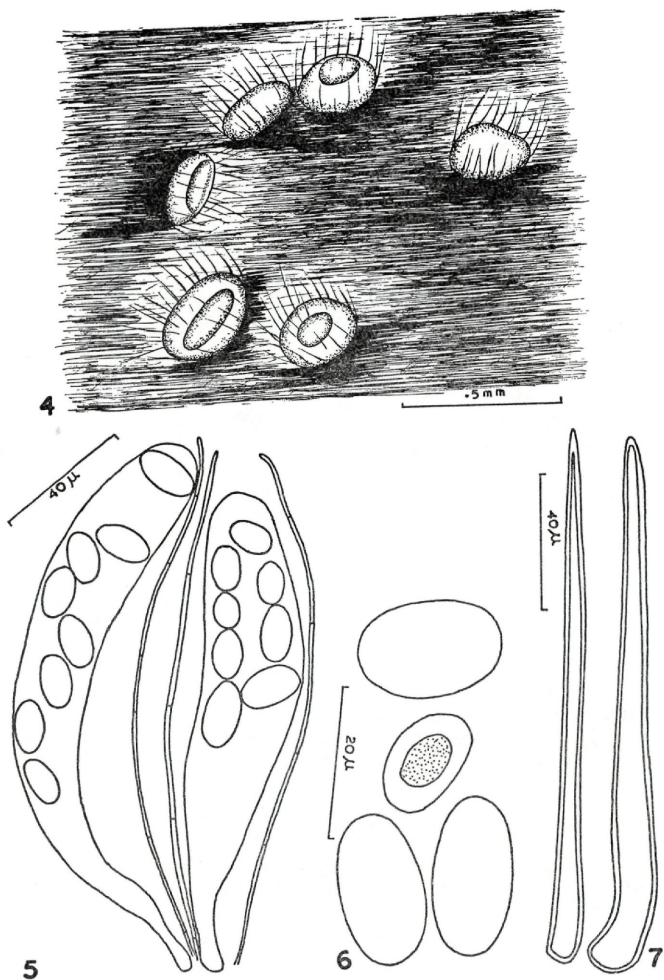
4. *Lasiobolus pilosus* (FR.) SACC., Bot. Centrbl. 18: 22. 1884.

Figs. 4-7

Synonym: *L. equinus* (MÜLL. ex S. F. GRAY) KARST., Acta Soc. F. Fl. Fenn. 2: 122. 1885.

*L. ciliatus* (SCHMIDT ex FR.) BOUD., Hist. Class. Discom. d'Eur., p. 78. 1907.

Apothecia up to 0.5 mm in diameter, densely gregarious to crowded and forming congested masses up to 2 cm in length, sessile or reduced below into a short base, subglobose at first, later shallow cupulate to plane, regular, soft; external surface pallid to orange, slightly lighter than the hymenium, hairy; hairs up to 590  $\times$  22  $\mu$ , hyaline to subhyaline, single, erect and bristly, simple, thick-walled, wall up to 4.3  $\mu$  thick, aseptate, broader near the simple base and tapering upwards into obtuse to acute apices; margin entire, fringed with hairs; hymenium pallid to orange, fading on drying, slightly roughened by the protruding ascial tips; basal mycelial hyphae up to 5  $\mu$  wide, subhyaline, thick-walled (wall up to 0.6  $\mu$  thick), aseptate, unbranched.



Figs. 4–7. *Lasiobolus pilosus*. 4. Hairy apothecia. 5. Paraphyses and cylindric – clavate to clavate asci which are abruptly narrowed below. 6. Broadly ellipsoid ascospores. 7. Thickwalled and aseptate bristly hairs.

Asci 115—200×17.5—30  $\mu$ , 8-spored, cylindric-clavate to clavate, apex obtuse, abruptly narrowed below into a short stem-like base, J-ve. Ascospores 15—23×9.5—13  $\mu$ , uniseriate to irregularly biseriate, subhyaline, broadly ellipsoid, a few subglobose (13×10.5  $\mu$ ), smooth, eguttulate. Paraphyses up to 2.5  $\mu$  wide below and only slightly enlarged above (up to 3  $\mu$ ), filiform, straight, thin-walled, septate, simple or branched at all levels, subhyaline to orange, projecting up to 15  $\mu$  beyond the ascial tips.

Anatomy: Ectal excipulum subhyaline to light orange, up to 50  $\mu$  thick, *textura angularis*, not demarcated from medullary excipulum in early condition, cells up to 25×20  $\mu$ , decreasing in size towards margin, slightly thick-walled, wedged into these are bristly hairs (hairs as described above); medullary excipulum light orange, up to 80  $\mu$  thick, *textura intricata*, approaching almost *textura angularis*, hyphae up to 15  $\mu$  wide, short-celled (up to 15×15  $\mu$ ), thin-walled; hypothecium subhyaline, up to 20  $\mu$  thick, densely *textura intricata*.

Material: WARAITCH 2010 (PAN, BPI, C), on goat pellets in mixed forest, Taradevi, Simla, Himachal Pradesh, July 26, 1965; WARAITCH 2086 (PAN, BPI), on buffalo dung in mixed forest, Bakrota, Dalhousie, Himachal Pradesh, July 19, 1966; WARAITCH 2091 (PAN, BPI), on buffalo dung in open place, Banikhet, Dalhousie, Himachal Pradesh, July 23, 1966; WARAITCH 2212 (PAN, BPI), on dung in *Abies* forest, Pahalgam, Jammu & Kashmir, July 29, 1967.

The specific epithets *equinus*, *ciliatus* and *pilosus* have widely been used along with a long list of other synonyms (VAN BRUMMELEN, 1967; KIMBROUGH & KORF, 1967; RIFAI, 1968). The epithet "*equinus*" used by BATRA & BATRA (1963) and KIMBROUGH & KORF (1967), though it is the oldest (MÜLLER, 1778), is untenable under the "International Code of Botanical Nomenclature" as it was not taken up by FRIES (1822) but due to PERSON'S (1822) revalidation of the name *Ascobolus ciliatus* SCHMIDT (1817), it was accepted by RIFAI (1968) on the pretext that it has priority over *Ascobolus pilosus* FR.

VAN BRUMMELEN (1967) preferred the name *L. pilosus* (1884) over *L. equinus* (1885), the former being the earlier of the two and also following BOUDIER (1869) and HEIMERL (1889), while ECKBLAD (1968) accepted "*pilosus*" on not being so but because this was accepted by FRIES (1822).

Further, VAN BRUMMELEN (1967) has refrained from putting *Ascobolus ciliatus* as a synonym of *L. pilosus* as he did not examine the material of the former species. ECKBLAD (1968) has not made mention of this epithet while RIFAI (1968) has chosen *L. ciliatus* as the correct name. However, "*pilosus*" may be taken as the correct epithet of the species because this is the one coined by FRIES (1822) himself, though



"*ciliatus*" was also used by him. The issue has been well discussed by VAN BRUMMELEN (1967), ECKBLAD (1968) and RIFAI (1968).

The species has been reported previously from India by BATRA & BATRA (1963) and seems common in this country. It is a very variable species and on the basis of hairs, ascospores and type of dung, various varieties of this species and even different species are recognised.

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