

ASCOZONUS MONASCUS, A NEW SPECIES OF ASCOMYCETES FROM GREAT BRITAIN

J. VAN BRUMMELEN¹ & M.J. RICHARDSON²

Ascozonus monascus Brumm. & M.J. Richardson, a new coprophilous ascomycete from Scotland, is described and illustrated. It is characterized by ascomata developing only a single multisporous ascus, with a subapical ring and a small operculum at the apex, and a few excipular cells near the base.

At the end of December 1998 the second author incubated rabbit dung from the neighbourhood of Edinburgh in a moist chamber. After seven days numerous apparently naked asci developed on the dung surface, on bundles of mycelial hyphae and on the surface of fruit-bodies of other coprophilous fungi.

From the structure of the asci, with a conspicuous, subapical ring, a conical apex, and a small operculum it is clear that this fungus belongs to *Ascozonus* (Renny) E. C. Hansen. Since it does not agree with any of the species of *Ascozonus* described thus far, it is described as a new species.

***Ascozonus monascus* Brumm. & M.J. Richardson, spec. nov.**

Ascomata solitaria vel arcte aggregata, superficialia, sessilia, 45–60 µm diam., 150–180 µm alta, initio subglobularia, deinde oblongo-ellipsoidea, alba, constans exasco unico et paraphysibus paucis. Excipulum reductum, textura globulosa. Asci saepe curvati, late clavati, apice conico, annulato operculatoque, 112–145 × 39–50 µm, 150–200-sporis, pariete iodo haud caerulescente. Sporarum fasciculi ovoidei, 57–80 × 32–38 µm. Ascosporae radiantes dispositae, fusiformi-ellipsoideae, saepe leniter asymmetricae, hyalinae, 8.7–9.8(–11.5) × 3.6–4.1(–4.6) µm, laeves. Paraphyses potius raras, irregulariter cylindricae, sinuosae, ramosae, 2.0–2.5 µm latae, apice leviter inflatae, hyalinae, extremo ascus obtectae.

In fimo cunicularum incolit.

Holotypus: Great Britain, Scotland, Newhailes near Edinburgh, *M. J. Richardson 109/98* (L).

Etymology: from Greek, *μονος*, alone, sole, single, and *ασκος*, a leathern-bag or sack: with a single ascus.

Ascomata solitary, in small groups, or closely gregarious, sometimes forming a waxy-looking crust, superficial, sessile, 45–60 µm diam., 150–180 µm high, consisting each of a single ascus surrounded by a small number of paraphyses and some excipular cells near the base, at first subglobular and closed (cleistohymenial, Fig. 1D), then opening and oblong-ellipsoid, white. Hymenium and hypothecium not differentiated. Excipulum reduced to a few thin-walled, isodiametric, rounded cells about 10–30 µm diam. (textura globulosa) near the base of the ascus, extending about 50–60 µm up the ascus; without cilia or hairs.

Asci broadly clavate with a short curved base, with a conical pointed apex, 112–145 × 39–50 µm, with a 1.2–1.5 µm thick subapical ring 35–40 µm diam. at the inner side of the wall, ending with an operculum (or 'apical disk') 5–9 µm across, reaching a thickness (after

1) Nationaal Herbarium Nederland, Universiteit Leiden branch, P.O. Box 9514, 2300 RA Leiden, The Netherlands.

2) 165 Braid Road, Edinburgh EH10 6JE, Scotland, United Kingdom.

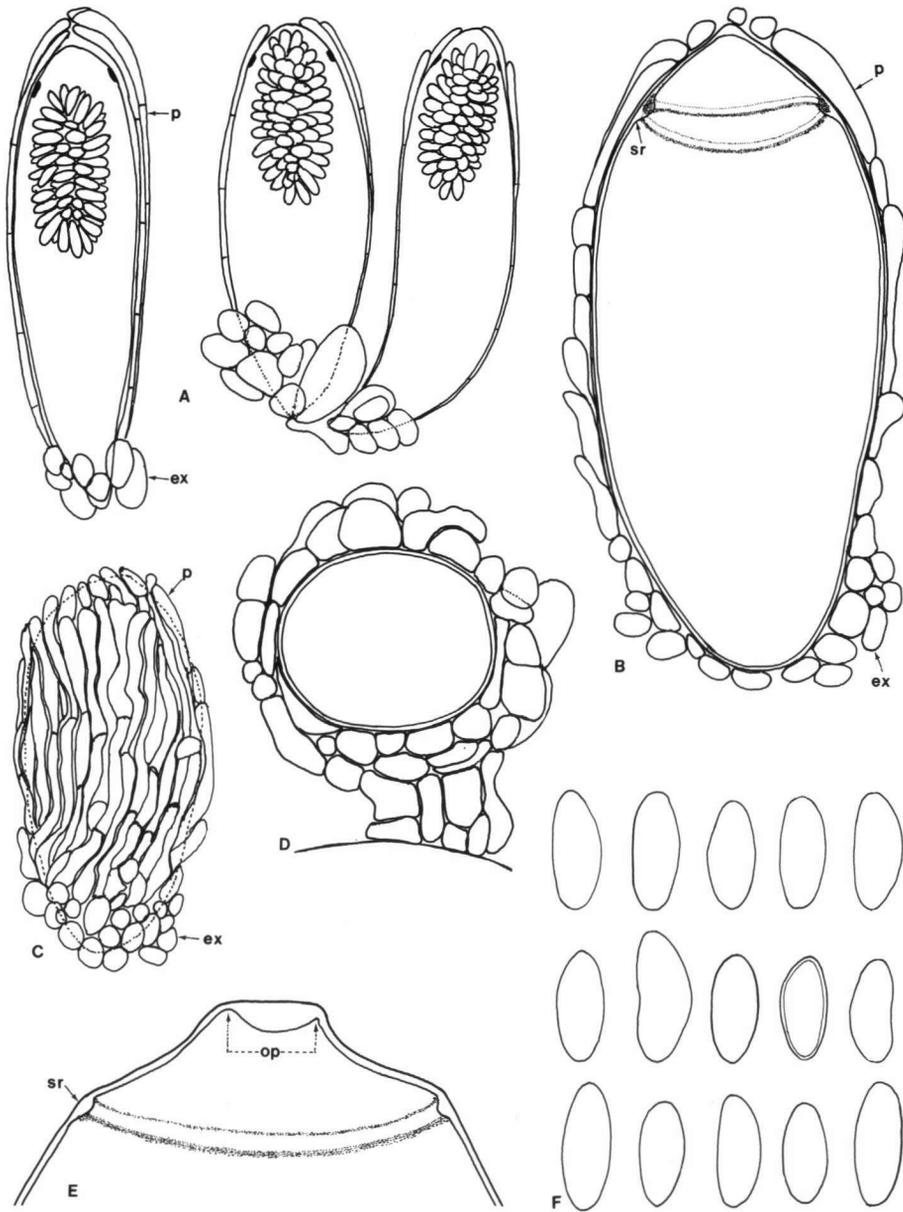


Fig. 1. *Ascozonus monascus*. A. Lateral view of living ripe fruit-bodies, $\times 400$; B. detail of fruit-body in median section without ascospores, showing appressed paraphyses (p) and excipular cells (ex), $\times 1000$; C. lateral view of fruit-body, showing layer of paraphyses covering the ascus, $\times 600$; D. median section through fruit-body in early mesohymenial phase, showing ascus mother cell surrounded by a closed layer of excipular cells, $\times 1600$; E. detail of ascus apex with subapical ring (sr) and operculum (op), $\times 2000$; F. ascospores, $\times 1600$ (all from holotype of *A. monascus*).

swelling) of 2.5 µm in the centre, 150–200-spored, opening at the top along the operculum above the subapical ring with a bi-labiate or laciniate split; the wall not staining blue with iodine. Ascospores united in a single ovoid cluster 57–80 × 32–38 µm, arranged as if radiating from a central spindle and ejected together, fusiform-ellipsoid with rounded or truncate ends, often slightly asymmetrical (length / width ratio 2.2–2.7, average 2.38), hyaline, 8.7–9.8(–11.5) × 3.6–4.1(–4.6) µm, without oil drops or granules, not easily producing air-bubbles, smooth. Paraphyses rather scarce, septate, sinuous, bending inwards at the apex to cover the ascus apex, hyaline, 2.0–2.5 µm thick, enlarged up to 4–7 µm at the tip, not embedded in mucus.

Habitat — Only known from dung of rabbits.

Specimens examined. GREAT BRITAIN: Scotland, Newhailes, near Edinburgh (55°56.4' N, 3°4.6' W), 21.XII.1998, *M.J. Richardson 109/98* (holotype of *Ascozonus monascus*, L); West Lothian, Polkemmet Country Park (55°51.7' N, 3°43.1' W), 29.XII.1998, *M.J. Richardson 111/98*.

As in other species of *Ascozonus*, the tiny, delicate, white fruit-bodies develop on the surface of the dung as well as on hyphal bundles or fruit-bodies of other fungi.

An ascospore number between 150 and 200 as in *A. monascus* has not been recorded before in the genus. The highest ascospore number in *Ascozonus* till now was found in *A. subhirtus* (Renny) E. C. Hansen with up to 128 spores per ascus, but it has many asci in a fruit-body, and a well-developed receptacle with a ciliated margin and several rows of connate hairs below.

In an unpublished series of exact ascospore counts in multi-spored strains of *Thelebolus* and *Ascozonus* the first author could confirm the constant spore number within any given strain as found by Wicklow & Malloch (1971) in *Thelebolus*. As a result of successive mitoses the spore number found was up to 2ⁿ, with the restriction that, as in 8-spored ascomycetes, sometimes in a certain line one or a few abortive spores are produced.

Little attention has been paid to the early development of the ascomata in species of *Ascozonus*. The descriptions and images published by Renny (1871, 1873, 1874) suggest the presence of paragymnohymenial ascomata (Van Brummelen, 1967), but in *A. monascus* the ascogenous system is extremely reduced; neither remnants of an ascogonium nor of an antheridium could be found near the base of young asci. As in *Lasiobolus monascus* Kimbr., the ascus directly develops from the ascogonium (Kimbrough, 1974; Kimbrough & Benny, 1978). In the early stages the ascogonium and the ascus-mother-cell are completely surrounded by excipular cells (Fig. 1D). During the prohymenial or early mesohymenial phase these cleistohymenial ascomata open and the hymenium, here consisting of a single ascus surrounded by several paraphyses, becomes exposed. The ripening ascus shows a restricted receptacle at its base, and remains enclosed with a tight single layer of appressed paraphyses (Fig. 1C).

The operculum at the top of mature asci is often found encircled by an irregular collar consisting of the swollen ends of twelve to twenty paraphyses (Fig. 1B).

While the operculum in most species of *Ascozonus* shows a diameter of 2 to 3 µm, it reaches a width of 5 to 9 µm in the present species.

Studies of ascus apex ultrastructure in species of *Ascozonus* (Van Brummelen, 1974, 1978, 1994, 1998) revealed a most peculiar and constant apical apparatus described as the *Ascozonus* type. The *Ascozonus* type of ascus apical structure shows clear resemblance to both the *Thelebolus* type and the *Octospora* type by the presence of a subapical ring in the lateral ascus wall at some distance below the ascus tip; while in *Ascozonus* and *Thelebolus*

the subapical ring is a constant prominent wall thickening which acts as a barrier against dehiscence of the ascus top below the level of the ring, it is a far less pronounced structure, at some distance below the future rather roughly delimited operculum, in the *Octospora* type (typical of the Pyronemataceae). The last can be made visible by staining, electron microscopy, or post-mortem water imbibition of wall layers.

Samuelson (1978) in a study of the ascus apical apparatus in representatives of the Pyronemataceae, studied the ascus of *A. woolhopensis* (Renny) E.C. Hansen. He failed to find the typical operculum and arrived at the remarkable conclusion that the apical apparatus in this species most clearly resembled that of *Anthracobia melaloma* (Alb. & Schw.: Fr.) Boud.

REFERENCES

- Brummelen, J. van. 1967. A world-monograph of the genera *Ascobolus* and *Saccobolus* (Ascomycetes, Pezizales). *Persoonia* (Suppl.) 1: 1–260.
- Brummelen, J. van. 1974. Light and electron microscopic studies of the ascus top in *Ascozonus woolhopensis*. *Persoonia* 8: 23–32.
- Brummelen, J. van. 1978. The operculate ascus and allied forms. *Persoonia* 10: 113–128.
- Brummelen, J. van. 1994. Problems in the systematics of Pezizales. In: D.L. Hawksworth, *Ascomycete systematics, Problems and perspectives in the nineties*. New York.
- Brummelen, J. van. 1998. Reconsideration of relationships within the Thelebolaceae based on ascus ultrastructure. *Persoonia* 16: 425–469.
- Kimbrough, J.W. 1974. The structure and development of *Lasiobolus monascus* sp. nov. (Pezizales, Ascomycetes). *Mycologia* 66: 907–918.
- Kimbrough, J.W. & G.L. Benny. 1978. The fine structure of ascus development in *Lasiobolus monascus* (Pezizales). *Can. J. Bot.* 56: 862–872.
- Renny, J. 1871. A description of some species of the genus *Ascobolus* new to England. *Trans. Woolhope Nat. Fld. Club* 1871: 45–48.
- Renny, J. 1873. New species of the genus *Ascobolus*. *Trans. Woolhope Nat. Fld. Club* 1872–3: 127–131.
- Renny, J. 1874. New species of the genus *Ascobolus*. *J. Bot., Lond.* 12: 353–357.
- Samuelson, D.A. 1978. Asci of the Pezizales. II. The apical apparatus of representatives in the Otidea-Aleuria complex. *Can. J. Bot.* 56: 1876–1904.
- Wicklow, D. & D. Malloch. 1971. Studies in the genus *Thelebolus*: temperature optima for growth and ascocarp development. *Mycologia* 63: 118–131.