

EARTHBALLS – BRITISH *SCLERODERMA* SPECIES

Malcolm Storey*

Earthballs are familiar fungi of late summer and autumn. They are often spoken of in the same breath as the superficially similar puffballs, but appearances can be deceptive among the fungi. Earthballs are much more closely related to the boletes (Boletales) than the puffballs (Lycoperdales), which are closely related to the agarics (Hibbett *et al.*, 1997). Puffballs are saprobes, obtaining nutriment from dead material in the forest floor, or in the case of Stump Puffball, *Lycoperdon pyriforme*, from rotting wood, whereas earthballs, like boletes, are ectomycorrhizal with a variety of forest trees. They also share with boletes (and rollrims, *Paxillus*) a propensity to infection by the golden *Sepedonium* chlamydospores of Bolete Mould (*Hypomyces chrysospermus*).

Like many boletes, fresh specimens also change colour when damaged. The peridium (see Glossary) of the thin-skinned species turns pinkish brown to vinaceous when cut, sometimes quite brightly so. In the thick-skinned species the peridium turns yellow to orange-brown.

Recognising Earthballs

Earthballs resemble other gasteromycetes in gross morphology, but are easily distinguished. They have a harder texture than puffballs—like an unripe orange compared with a satsuma! They are larger than most other gasteromycetes, but if in doubt the rubbery smell (like *Lepiota cristata*) and the dark purple gleba (see Glossary) will confirm.

Once the spores are ripe the gleba is replaced by the spore mass; earthballs can then be distinguished from puffballs by the lack of capillitium. In most Basidiomycete gasteromycetes this is visible as either a cotton-wool-like material mixed with the spores and left behind after the spores have blown away, or it forms a woolly base to the spore chamber. Earthballs don't have this.

Earthballs usually grow gregariously so a range of ages will generally be available for comparison.

Earthballs all form more or less globular fruitbodies, with a thick or thin skin (peridium) and grow from a variously developed rootstock (pseudostipe). In different species, the surface varies from almost smooth, especially when young, to warty (*S. citrinum*) but most species have a pattern of small dark scales on a paler ground. Earthballs open at the top by irregular breakdown of the peridium. Although their general appearance is a guide, the best diagnostic characters require a microscope.

We have five species (plus another doubtfully British), of which three are very common (i.e. more than 1000 records in FRDBI). All are widely distributed although, as usual, there are fewer records from further north than Yorkshire or from Eire. The species are presented here in decreasing order of frequency.

Scleroderma citrinum

Common Earthball. Figs 1a–b.

This is our commonest species (5000+ records), especially in acid woodland and on heathland, from late summer onwards. The star-shaped, split-open remains often persist through the winter and confuse novices into thinking they've found an earth-star!

S. citrinum can be recognised in the field by the large, thick irregular scales on the peridial surface (much more scaly than the "Scaly" Earthball!) and the lack of pseudostipe. Other characters include the thick peridium (2–5 mm) and its yellow tinges, although in older fruitbodies these are often hidden by green from algal growth. At 5–15 cm diameter, it is usually larger than the other common species.

The spores are 10–13 µm with a coarse but incomplete reticulum, with crests reaching over 1.0 µm high.

*43 Berry's Road, Upper Buckleberry, Reading RG7 6QL

Scleroderma verrucosum

Scaly Earthball. Figs 2a–b.

The second commonest species in our area (2000+ records) is less particular about habitat, being found in deciduous woods, parks and heathland. It can be recognised in the field by the well-developed and often furrowed pseudostipe combined with the small dark scales on the thin (0.5–1 mm) peridium. At 2–5 or 8 cm it is a medium-sized earthball.

Beware of *S. areolatum* which looks superficially similar but has a shorter pseudostipe and smaller peridial scales each surrounded by a ring-zone.

The spores are 9–11(–13.5) μm in diameter with isolated narrowly conical to almost cylindrical warts up to 1.5 μm high.

Scleroderma areolatum

Leopard-spotted Earthball. Figs 3a–c.

The Leopard-spotted Earthball is reasonably common (1000+ records). In the field it is probably the easiest of the genus to recognise by the dark scales each surrounded by a distinctive pale zone with a slightly darker line running down the centre (Fig. 3b). It has a thin peridium like *S. verrucosum* but a shorter pseudostipe and is usually slightly smaller at 1.5–3 or 4 cm diameter.

The spores are similar to *S. verrucosum* but larger (9–)11–14(–15) μm , with larger conical warts up to 2.5 μm high.

Scleroderma bovista

Potato Earthball. Figs 4a–b.

The Potato Earthball is fairly common and probably under-recorded with less than 400 records. It is found in well-drained woodland sites. At 2–5 cm diameter it is a medium-sized earthball, but is recognised in the field by its thin (1–1.5 mm) peridium with a coating of thin, dark irregular scales. The base is short and usually buried.

The spores are 11–14.5 μm in diameter and quite distinctive with a heavy complete reticulum with crests up to 2.0 μm high. Smooth, hyaline ‘sphaerocysts’ are sometimes found attached to the crests.

Scleroderma cepa

Onion Earthball. Figs 5a–c.

The Onion Earthball is probably our least common earthball (under 150 records), occasionally found under oak (*Quercus*) on sandy soil. This is a medium-sized earthball (2–6 cm diameter) with a dark and very thick peridium which is smooth at first but eventually minutely squamulose and opening by coarse cracking. There is no pseudostipe.

The spores are similar to those of *S. verrucosum*, 9–14(15) μm in diameter but the conical warts have broader bases and are all triangular in section. As in *S. bovista* the spores may sometimes retain attached sphaerocysts.

Scleroderma polyrhizum

Many-rooted Earthball

Not authentically British, although reported here; herbarium specimens at Kew have been re-examined and shown to be misidentified *S. verrucosum*. It is found on sandy soil in deciduous woodland but only rarely. It is commonest in the Mediterranean area.

This is a large species at 4–15 or even 18 cm diameter. It has a thick (>5 mm) peridium and no pseudostipe. As it opens the peridium often splits into radiating lobes like an earthstar which gave it its old name *Scleroderma geaster*.

The spores are 8–12 (–14) μm in diameter and have an incomplete reticulum with low crests up to only 0.8 μm high.

A photograph of this species may be seen at the Mycokey website: <http://www.mycologykey.org>

Pseudoboletus parasiticus

Parasitic Bolete. See Fig. 1.

No overview of earthballs could be complete without mention of *Pseudoboletus parasiticus* which grows upon earthballs. It is uncertain if it is a true parasite but infected earthballs are often found to be partially hollow or otherwise malformed when sliced in half and may lack mature spores. Earthballs infected later in their growth however, appear able to produce spores as normal. The infection seems to be mycelial in origin—it always grows from the very base of the earthball. For an extensive discussion of this bolete see Both (2006). This species is apparently confined to Common Earthball (*S. citrinum*).

Field Key to British Earthballs

Note: Earthball identifications should always be checked microscopically. This key just helps you select which specimens to take home for proper examination.

- 1. Peridium thin, 2mm or less in section 2
 - Peridium thick, 3mm or more in section . . 4
- 2. Pseudostipe well-developed, pushing above the soil. *S. verrucosum*
 - Pseudostipe undeveloped or very short and buried in the soil. 3
- 3 Peridial scales separated by a darker line along the middle of a pale zone (Fig. 3b) *S. areolatum*
 - Peridium smooth to finely areolate, without darker line between peridial scales *S. bovista*
- 4. Peridium usually with coarse polygonal scales when young, smoother when very large and old, sometimes splitting to become star-shaped when old (compare with *S. polyrhizum* below). . . . *S. citrinum*
 - Peridium more or less smooth throughout its life 5
- 5. Small species 2-6 cm in diameter, peridium flaking away slowly. *S. cepa*
 - Large species 4-15 (18) cm in diameter, peridium splitting to form large star-shape, often bursting through sandy soils (not authentically British) *S. polyrhizum*

Key to British Earthballs including microscopic characters

- 1. Spores with isolated warts or spines2
 - Spores with ridges or reticulum.....4
- 2. Spores 8–11 (-13.5) µm diam., spines 0.8–1.5 µm high; pseudostipe stout, well-developed, pushing above the ground;*S. verrucosum*
 - Spores 9–14 (-15) µm diam., spines 1–2.5 µm high; pseudostipe absent or buried.....3
- 3. Spores with slender spines 1.4-2.5 µm high; peridial scales often separated by a darker line along the middle of a pale zone; peridium usually 2 mm or less in section*S. areolatum*
 - Spores with pyramidal spines 1–2.5 µm high; peridial scales thin, irregular, without obvious areolate zones, peridium usually 3 mm or more in section*S. cepa*
- 4. Spores with ± complete, thick reticulate ornamentation*S. bovista*
 - Spores with incomplete, thinner, partial reticulum5
- 5. Spores with an incomplete reticulum of crests and spines 0.8–1.5 µm high, peridium with coarse polygonal scales.....*S. citrinum*
 - Spores with very incomplete reticulum and low warts 0.4–0.8 µm high, peridium smooth to minutely scaly, splitting to form large star-shape, often bursting through sandy soils (not authentically British)*S. polyrhizum*

Glossary

- Capillitium** thick-walled hyphae which run through the spore mass in many other gasteromycetes but not *Scleroderma*.
- Gleba** spore-producing tissue in the middle of the fruitbody. Dark purple in earth balls. It ripens to form the brown spore mass.
- Peridium** sterile protective wall (the skin) surrounding the gleba.
- Pseudostipe** stem-like base in some earthballs.

Keys by Geoffrey Kibby

References

Both, E.E. (2006). Personal encounters with the parasitic bolete. *Field Mycology* 7(3): 104-109.

Hibbett, D.S. *et al.* (1997). Evolution of gilled mushrooms and puffballs inferred from ribosomal DNA sequences, *Proc. Natl. Acad. Sci. USA* Vol. 94, pp. 12002–12006.

Pegler, D.N., Læssøe, T. & Spooner, B.M. (1995). *British Puffballs, Earthstars and Stinkhorns*, Royal Botanic Gardens, Kew.

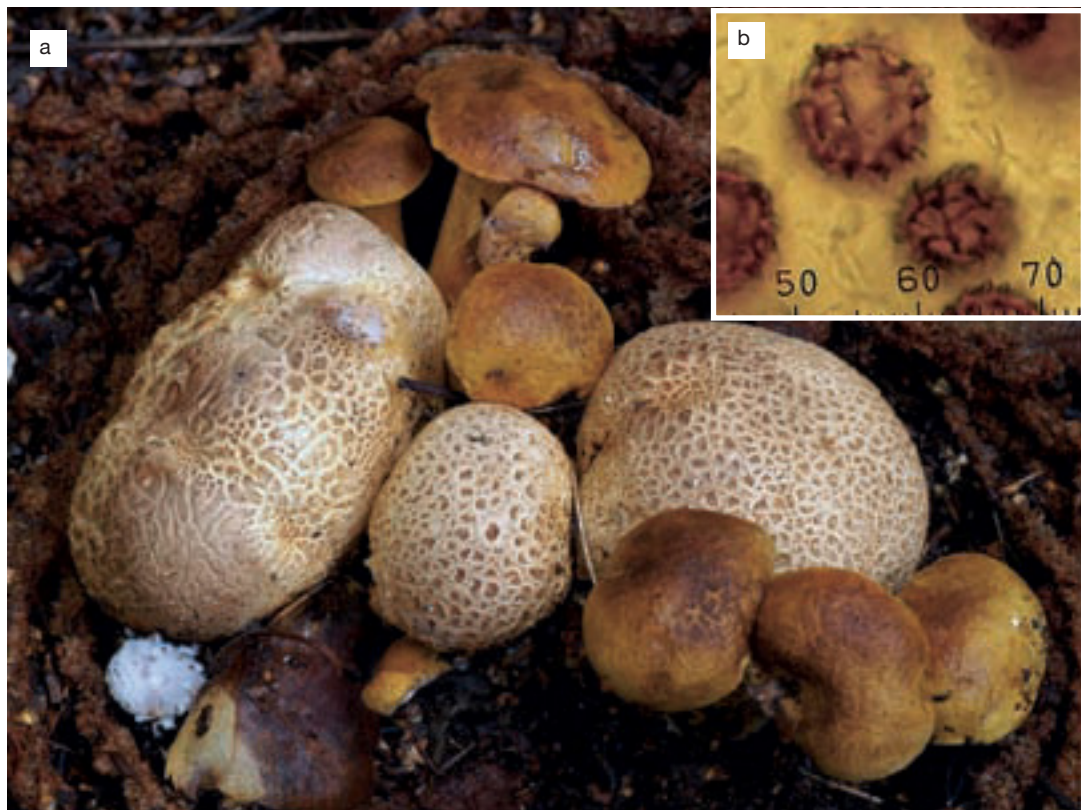


Fig. 1a. *Scleroderma citrinum* with typically coarsely scaly peridium. It is host on occasion (as here) to *Pseudoboletus parasiticus* which emerges in clusters from the base of the earthball. The earthball may become hollowed and slightly deformed by the bolete. 1b inset: spores showing incomplete reticulum. Photo © M. Storey.

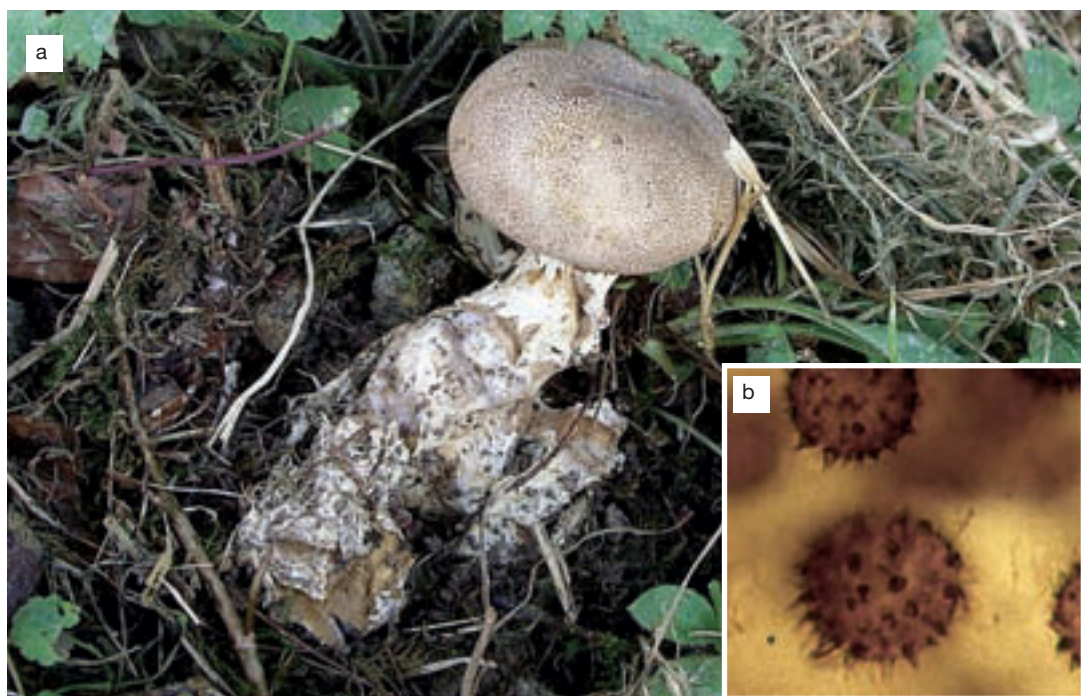
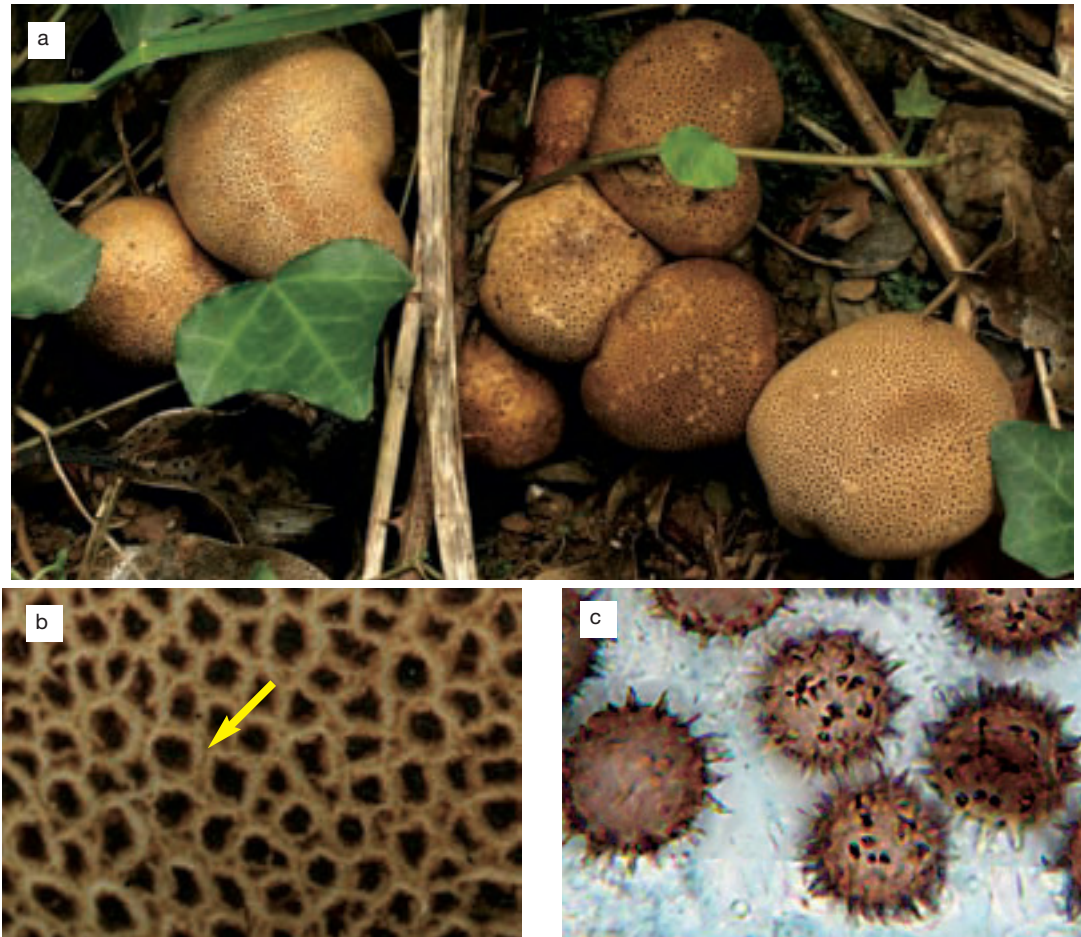


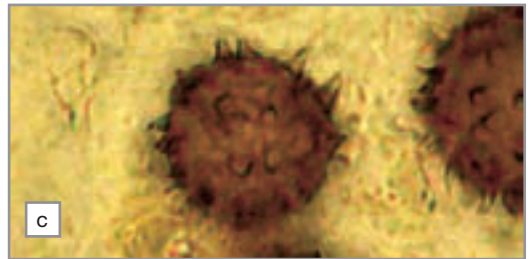
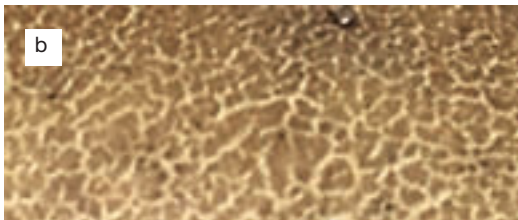
Fig. 2a. *Scleroderma verrucosum* showing a particularly well-developed pseudostipe, greatly swollen at the base. 2b inset: Close-up of spores showing very slender isolated spines. Photo © M. Storey.



Figs 3a–c. *Scleroderma areolatum*. 3a: Fruitbodies *in situ*. 3b: Close-up of the peridium showing the pale zone surrounding the scales with a faint, darker line running down the centre (arrowed). 3c: Spores showing the very tall isolated spines. Photos © M. Storey.



Figs 4a–b. 4a: *Scleroderma bovista* showing its relatively smooth to finely roughened or scaly peridium. 4b: Spores showing the complete reticulum of thickened ridges and warts. Photos © M. Storey.



Figs 5a-b. *Scleroderma cepa*.

5a: *Scleroderma cepa* has a similarly smooth to finely roughened or scaly peridium to that of *S. bovista*, but the spores have mainly isolated broad spines without any obvious reticulum.

5b: Close-up of the peridium showing the irregular and very fine scales.

5c: Close-up of the spores showing the very broad-based isolated spines. Photos © Geoffrey Kibby.

READERS' FINDS



Reader Daniel Kemp sent us this photograph of *Pachyphloeus citrinus*. This rare truffle was highlighted in an article in FM 10 (1):5–8 by Carol Hobart, who found it to the west of Sheffield. This collection by Daniel was made in Hampshire in May 2008. It was found in a decaying cavity at the base of a Pedunculate Oak, *Quercus robur*, not really underground at all. The photograph demonstrates the bright yellow flesh which is characteristic for the species.