
MYRIOSTOMA COLIFORME IN AUSTRALIA

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Abstract

Myriostoma coliforme, widespread but not frequently encountered in most continents, is regarded as probably extinct in Britain from where it was first described. The species has been included in a list of 33 threatened fungal species proposed for protection under the Bern Convention. It has been observed over a period of 25 years at several locations near Sydney in the central coastal region in New South Wales, but its distribution in Australia is not fully explored. A morphological species description and field photograph of a collection of the species from the Royal Botanic Gardens, Sydney is given to assist with mapping the distribution of the species in Australia.

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Introduction

Fungi that produce basidiospores within an enclosed fruitbody at maturity, the angiocarpic fungi, were traditionally grouped together in the Friesian subclass 'Gasteromycetes'. Subsequent studies have shown that this class of fungi is made up of so varied a group of individuals with such different origins, that they can no longer be usefully thought of as one all embracing assemblage on the basis of a single character. They have gradually been reclassified over the years into several orders based on features they share with each other and with other families of fungi. One of the new orders arrived at, for species growing above ground, was the Lycoperdales, established by the New Zealand mycologist G.H. Cunningham (1944) to encompass those species in which the gleba (spore-bearing tissue) is pulverulent, with a copious capillitium (a network of hyphae in which the spores are supported). Prominent among the families now retained within the order Lycoperdales are the Geastraceae Corda (the earthstars) and the Lycoperdaceae Chevall. (the puffballs). The two families differ from each other in the persistence of the exoperidium, which is well developed and persistent in the Geastraceae, and thin and often inconspicuous in the Lycoperdaceae. The mode of dehiscence of the spores and the microscopic structure of the capillitium are also

important characters for differentiating between the two families (Pegler *et al.* 1995).

In the Geastraceae, the endoperidial body is usually borne on a single stalk above the splitting exoperidium as in *Geastrum* (Pers.) Pers., but in *Myriostoma* Desv., there are often many stalks supporting the endoperidium and many pores in the surface through which spores may escape, resulting in a structure which resembles a 'pepper-pot' resting on spreading "leaves" (Plate 1). This species was first described as *Lycoperdon coliforme* from England by Withering (1776), but has not been recorded from there since 1880. Its rarity has resulted in its inclusion in 'red lists' of rare and endangered species from several European countries and it has been listed as one of 33 threatened species proposed for protection under the Bern Convention (Bohlin 2004).

Young (1982), first published the only record of the species in Australia from New South Wales, but recently stated (2005) that the material examined was from the Royal Botanic Gardens, Sydney and that it may now be extinct in Australia. May *et al.* (2003) list no other records from mainland Australia. Although *Myriostoma coliforme* (With. : Pers.) Corda may therefore be regarded as rare in Australia, it has been reported widely from many

countries including Brazil (Sunhede 1989) and South Africa (Dyer 1948, Sunhede 1989) from the Southern Hemisphere. It is described in detail here to assist with the mapping of possible rare and endangered species in Australia, and its distribution may provide evidence as to whether the species is native to Australia or localized to an area where it may have been introduced with exotic plant material and from where it is slowly expanding.

Materials and Methods

Tissue was examined by bright field microscopy in 5% W/V KOH, with the later addition of 1% W/V Congo Red for contrast as described previously (Rees *et al.* 2001). Colour description numbers for features of the fruitbody follow Kornerup & Wanscher (1981). Preparations were also examined in Melzer's Iodine to determine colour change in iodine. Measures for spore sizes do not include spore ornamentation, but as spore ornamentation is so distinctive a feature in *Myriostoma coliforme*, figures have also been provided which include ornamentation. Spore size range is given for 20 spores.

Results

Myriostoma coliforme (With. : Pers.) Corda, in *Anleit. Stud. Mykol.* 81 (1842).

Lycoperdon coliforme With. in *Bot. arr. veg. Gr. Brit.* Ed. 1, 2: 783 (1776).

Geastrum coliforme (With.) Pers. in *Synops. Meth. Fung.* 131 (1801).

Myriostoma anglicum Desv., *J. Bot. (Morot)* 2: 104 (1809).

Geaster columnatum Lév., *Ann. Sci. Nat. Bot. Sér.* 3, 5: 161 (1846).

The 'Pepper Pot'.

Basidiomata 40–55 mm wide, epigeous, consisting of an outer exoperidium splitting unevenly into 9–11 lacerated rays recurving at the tips, mounted on a short pedicel (1–2 mm) with cottony, white, basal mycelium. The rays have three layers, an outer, pale ochraceous, mycelial layer tending to crack in places, revealing the middle fibrous layer consisting of densely packed, hyaline, hyphae (1.0–2.5 µm) wide. The uppermost cellular, pseudo-parenchymatous layer is pale beige initially, becoming more yellow to brown with age. It tends to wear away in places, leaving dark brown, pulverulent patches, which contain thick-walled, overlapping, spherical cells, 25–30 µm in diameter, forming a cellular, pigmented layer (Fig. 1C).

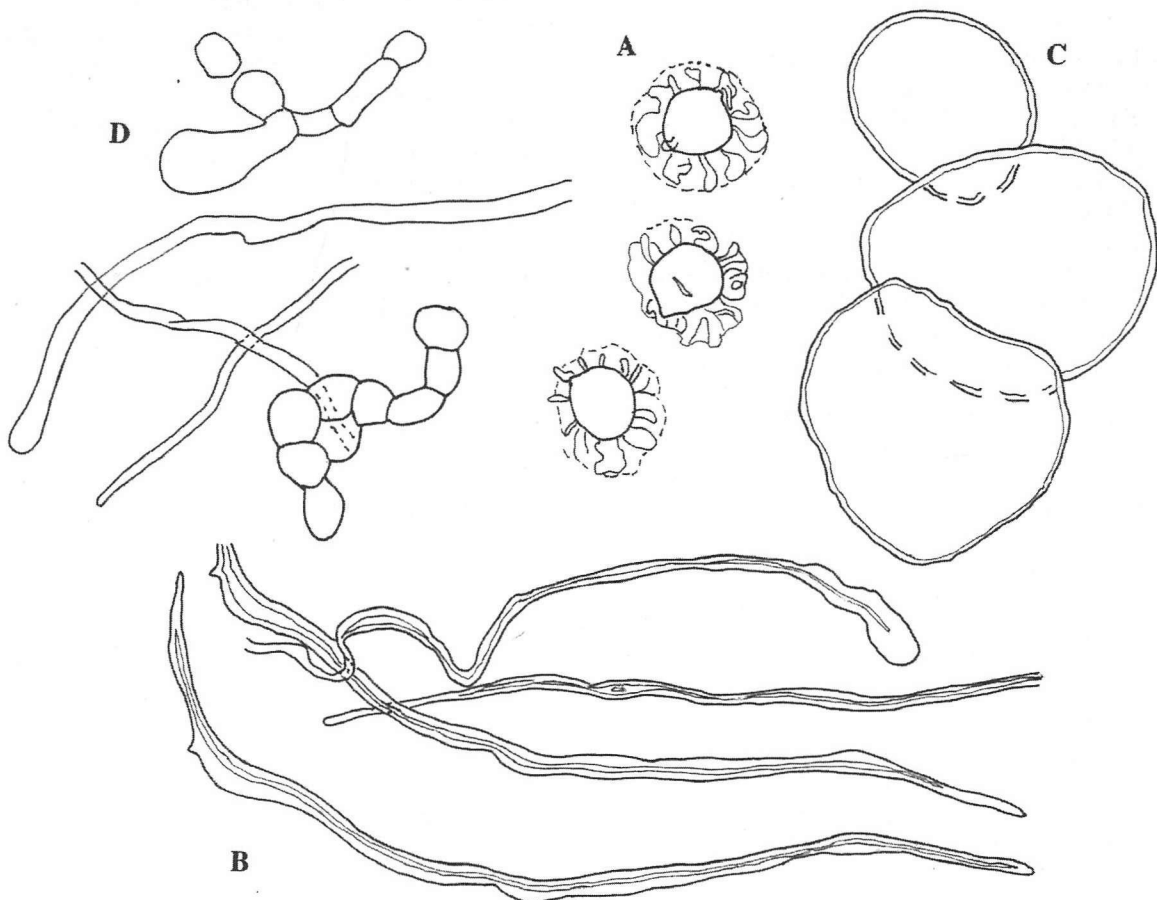
Surmounting the rays, on laterally flattened, short, cream stalks 3–4 mm high which tend to fuse near the top, is the flattened, globose to oval endoperidium, 20–30 mm wide with a punctate, shiny, gun-metal grey-brown surface broken by one to six stomata which have fimbriate margins. The greyish brown glebal contents are hairy, containing several columellae, continuous with the flattened stalks at the base of the endoperidium. Attached to the columellae and the peridial walls, are aseptate, thick-walled, unbranched, yellow-brown, capillitial threads 3.6–6.0 µm wide with tapering ends (Fig. 1B). The columellae are not connected to the stomata, but terminate at various points in the glebal mass some distance from the stomata. Basidiospores (20) 3.9–4.8 × 3.9–4.8 µm excluding ornamentation, 5.4–7.0 × 5.4–7.0 µm including conspicuous, irregular, flaring ornamentation up to 2 µm high (Fig. 1 A), are globose to marginally subglobose, yellow-brown, and exhibit no reaction in Melzer's Iodine. Basidia and clamp connections were not observed. Hyphae of the endoperidial wall (2.6–4.0 µm wide) are aseptate and pigmented, except at the margins of the stomata, where there are densely packed, hyaline, thin-walled, narrow hyphae, 1.0–2.6 µm in width, similar to the fibrous layer of the exoperidium, accompanied by small spherical to oval cells (Fig. 1D). These structures may be the remains of the pseudoparenchymatous, exoperidial layer from which they detached as the basidiome expanded.

Habit and habitat: In the Sydney region, *Myriostoma coliforme* occurs in groups on sandy soil in association with a range of plants in well mulched, but well-drained, urban garden plots with a sunny aspect, close to marine foreshores.

Material examined: Sydney. Royal Botanic Gardens, on leaf litter on garden beds, *R.G. Coveny*, 3.vi.1978 (F172); 27.vi.1980 (*R.G. Coveny* 61); 13.iv. 1981 (*R.G. Coveny* 49); 25.iii.1982 (*R.G. Coveny* 1982); on soil under *Ficus virens* Aiton., Bed 29, *F. Taeker*, 24.v.1985, (UNSW 85/478); Bed 16, on soil under *Ficus virens*, *R. Coveny*, 18.viii.2003, (UNSW 03/23).

Plate 1 (top right). *Myriostoma coliforme* (UNSW 85/478) with numerous stomatal openings. Photography F. Taeker.

Figure 1 (bottom right). *Myriostoma coliforme* (UNSW 03/23). A. Basidiospores. B. Capillitial threads with tapering ends. C. Cells from the pseudoparenchymatous layer of the exoperidium. D. Cells from the single stomatal opening in the smallest fruitbody. Scale 1 mm = 0.5 µm for A, 2.0 µm for B and 1 µm for C and D.



The size, number of stomata and number of rays in the exoperidium of the collections examined, fall within the very variable range for collections of the species described by Sunhede (1989) in which specimens up to 14.5 cm diameter, with one to 68 stomata and generally 6 to 8 rays have been observed. One of the Australian collections examined possessed a single stoma with remnants of the inner exoperidial layer still attached. Spore size range (including height of ornamentation) also conforms to that of exotic collections. Some spore size variation may be present in South African collections, but this was not observed in Australian material.

Discussion

The presence of numerous stalks and stomatal openings distinguishes *Myriostoma coliformae* from *Gastrum* species and has earned the species the appropriate common name of the 'pepper-pot'. *Myriostoma* is a monotypic genus with a cosmopolitan distribution, including North and South America and South Africa (Dyer 1948). Although it was originally described from England (Withering 1776), and has not been observed in the United Kingdom since 1880, it is widespread in the Channel Islands and many countries in continental Europe (Pegler *et al.* 1995) and in India (Sunhede 1989).

Its distribution in Australia seems restricted to the central coast of New South Wales from the George's River area (Wood pers. comm.) to the Newcastle region (O'Sullivan pers. comm.) where it has been reported from nature strips and gardens with exotic plants close to harbour foreshores. Collections from the Sydney region prefer well mulched, but well drained slopes facing north, while those from the Northern Hemisphere prefer similar conditions on south facing slopes (Sunhede 1989). The species seems to be limited to the

central New South Wales coast on present indications, but may either be a cosmopolitan species with a world wide natural distribution or confined to urban areas having been imported with exotic plant material.

References

- Bohlin, A. (2004). 33 threatened fungi in Europe. *Mycological Research* **108** (1), 1–4.
- Cunningham, G.H. (1944). *The Gasteromycetes of Australia and New Zealand*. John McIndoe, Dunedin.
- Dyer, R.A. (ed.) (1948). A Record of contributions from the National Herbarium Union of South Africa Pretoria **4** (III), 473–810. Government Printer, Pretoria.
- Kornerup, A. & Wanscher, J.H. (1978). *Methuen Handbook of Color*. 3rd edition. English translation. Eyre Methuen, London.
- May, T.W., Shingles, S. & Jones, R.H. (2003). *Fungi of Australia Vol. 2B*. ABRIS, Canberra & CSIRO, Melbourne.
- Pegler, D.M., Læssøe, T. & Spooner, B.M. (1995). *British Puffballs, Earthballs and Stinkhorns*. Royal Botanic Gardens, Kew.
- Rees, B.J. & Strid, Å. (2001). Relationships between Australian and Northern Hemisphere *Gymnopilus* species I. New species and common misconceptions regarding earlier names. *Australasian Mycologist* **20** (1), 29–48.
- Sunhede, S. (1989). Geastraceae (Basidiomycotina). *Synopsis Fungorum* **1**. Fungiflora, Oslo.
- Withering, W. (1776) *A Botanical Arrangement of all the Vegetables growing in Great Britain* Vol. 2, Birmingham.
- Young, A.M. (1982). *Common Australian Fungi*. UNSW Press, Sydney.
- Young, A.M. (2005). *A Field Guide to the Fungi of Australia*. UNSW Press: Sydney.