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To cite this article: M.J. Richardson (1998) New and interesting records of coprophilous fungi, Botanical Journal of Scotland, 50:2, 161-175, DOI: [10.1080/03746609808684913](https://doi.org/10.1080/03746609808684913)

To link to this article: <https://doi.org/10.1080/03746609808684913>



Published online: 22 Apr 2009.



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New and Interesting Records of Coprophilous Fungi

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Summary

Details are given of the occurrence in Britain, mainly Scotland, of 27 species of coprophilous ascomycetes which have either not been recorded from Britain or which are rare or otherwise of interest. Observations on the variation in spore size of *Anopodium ampullaceum* and *Sporormia fimetaria* and their identity, using data from French and British material, are discussed.

Introduction

During the preparation of a new edition of the British Mycological Society (BMS) *Keys to Fungi on Dung* (Richardson & Watling, 1997), and subsequently, samples of dung were collected from various localities, incubated on moist blotters and examined at intervals for the presence of coprophilous fungi. Details are given of ascomycetes which are either not recorded as occurring in Britain, or seem to occur only infrequently. Material of collections with an 'M.J.R. collection no./yr' identifier have been deposited in the Herbarium of the Royal Botanic Garden, Edinburgh. Samples were collected and identified by the author, unless otherwise indicated.

Ascobolus carletonii Boud.

Until 1990 the only three records of this distinctive species with pure white turbinate apothecia were from Scotland. The type collection on capercaillie dung was collected by Carleton Rea in December 1912 from Dunkeld, Inverness[?], and described by Boudier (1913). Two other collections were made on grouse dung from Glen Quaich, Amulree, Perthshire and Ben Ledi, Callander, Perthshire in November 1966 and 1967 respectively (Richardson, 1972). Van Brummelen (1990) described material from capybara dung from Brazil. Three more occurrences from grouse are reported here, two from the Pentland Hills, Edinburgh, and one from Yorkshire. Asci were $160\text{--}215 \times 16\text{--}21 \mu\text{m}$, clavate, gently tapering towards the base, agreeing well with van Brummelen (1967, 1990), who reported them as ' $160\text{--}220 \times 18\text{--}20 \mu\text{m}$ ' from the type description and $150\text{--}205 \times 16\text{--}22 \mu\text{m}$ from the Brazilian collection. Ascospores were quite characteristic, $(12.5\text{--})14\text{--}16 \times 7\text{--}8 \mu\text{m}$ with the pale violet exospore smooth at first but becoming finely, irregularly and distantly cracked, with a unilateral hemispherical gelatinous appendage swelling to $5\text{--}9 \mu\text{m}$ wide, but virtually invisible without the use of Indian ink. Another collection, on red grouse droppings collected by A. Henrici (Ryvoan, Aviemore [NJ007118], 26 May 1997, M.J.R. 34/97), produced apparently typical apothecia and asci, but spores were $18\text{--}20.5 \times 11.2\text{--}12 \mu\text{m}$, which is larger than the size given even for hypertrophied spores by van Brummelen (1967, 1990), but the identification was confirmed by J. van Brummelen (pers. comm.).

On red grouse (*Lagopus scoticus*) *droppings*: Black Hill, Edinburgh (NT181628), 31 Oct. 1996, M.J.R. 56/96 (K(M)44489); Caerketton Hill, Edinburgh (NT242662), 26 Dec. 1996, M.J.R. 68/96; Marrick Moor, Reeth, Yorkshire (NZ035015), 16 Oct. 1997, M.J.R. 120/97.

***Ascobolus hawaiiensis* Brumm.**

This species was described by van Brummelen (1967) from type material from Hawaii, with the comment that it is apparently a very rare species. It is illustrated by Bell (1983) from New Zealand, a Spanish collection is mentioned in passing by Valldosera & Guarro (1985) and van Brummelen (1990) describes material from Pakistan, but I have been unable to find any other records. I do not recall having seen it when I was collecting extensively in the 1960s, but it is clearly quite frequent now in SE Scotland. It is a distinctive fungus with its finely warted spores, which are completely surrounded by a gelatinous sheath, and which are relatively small for those species which have that type of ornamentation (for the 10 collections below, consistently in the range 18-22.5 × 9-11 μm , slightly narrower than the 10-11.5 μm of the type description, but van Brummelen [1990] gives 9.2-10.5 μm for the Pakistan collection).

On sheep (*Ovis aries*) *dung*: Cantick, Orkney (ND345895), 30 Sep. 1994; Bavelaw, Edinburgh (NT171625), 31 Oct. 1996, M.J.R. 57/96; Spittal Hill, West Linton, Midlothian (NT163582), 20 March 1997, M.J.R. 5/97; North Berwick Law, E. Lothian (NT555843), 30 March 1997, M.J.R. 8/97; St Abbs Head, Berwickshire (NT914690), 31 March 1997, M.J.R. 11/97; Achnahaird, W. Ross (NC020132), 16 June 1997, M.J.R. 62/97. *On rabbit* (*Oryctolagus cuniculus*) *dung*: Mellerstain, Roxburghshire (NT651388), 22 Sep. 1996, M.J.R. 49/96; Harlaw, Edinburgh (NT183650), 25 Oct. 1996, M.J.R. 54/96; North Berwick Law, E. Lothian (NT555843), 30 March 1997, M.J.R. 9/97; St Abbs Head, Berwickshire (NT909693), 31 March 1997, M.J.R. 12/97.

***Ascobolus michaudii* Boud.**

There appear to be no British records of this fungus. The Orkney material agreed well with van Brummelen's (1967) description, with yellow green apothecia up to 1.5 mm diam. with a white scurfy exterior; asci up to 280 × 30 μm ; spores 22-23 × 10 μm ornamented with relatively distant linear cracks with occasional anastomoses; paraphyses in greenish matrix, not inflated, up to 4 μm diam.

On cattle (*Bos sp.*) *dung*: Lea Taing, Orkney (ND545105), 27 Sep. 1994.

***Ascobolus sacchariferus* Brumm.**

Described by van Brummelen (1967), there appear to be no previous British records. Apothecia were white, 0.35-1 mm diam., slightly discolouring buff with age, lightly furfuraceous; spores 16-18 × (7-)8-9 μm , with close to distant anastomosing cracks and a conspicuous gel almost as large as the spore, mostly lateral but occasionally polar.

On roe deer (*Capreolus capreolus*) *dung*: Mote of Mark, Rockcliffe, Kirkcudbrightshire (NX845541), 14 Nov. 1996, M.J.R. 61/96; Glenmore, Aviemore, Inverness-shire (NH940103), 26 May 1997, M.J.R. 26/97.

***Saccobolus truncatus* Velen.**

Apothecia are insignificant and easily overlooked. The first was found attached to a perithecium which had been picked off for examination. Although described as pale yellow, the main impression is of a small brown dot, due to the colour of the ripe spores, which is good camouflage against the background. The Yorkshire specimens were solitary, up to 210 μm diam. The size and shape of the spore mass (36-44 μm before contraction \times 18-21 μm), the arrangement of spores, the contraction of the spore mass to 30 μm at maturity, and for the spores not to be held tightly together are characteristic. The spores were larger (16-19.5 \times 9-10 μm) than the measurements given by van Brummelen (1967) for *S. truncatus* (14-17.5 \times 7.5-8.5 μm), but the two species to which it is most closely related, *S. citrinus* and *S. minimus*, are distinguished by other characters; neither are reported to have fragile spore clusters; *S. citrinus* spore clusters are larger (43-51 \times 14-17 μm) and do not shorten with maturity, and its spores have markedly truncate ends; and *S. minimus* spore clusters and spores are smaller (29-33 \times 12-15 μm , and 10.14.5 \times 5.5-7.5 μm respectively). *S. truncatus* is a widely distributed species and it is suggested that the spore size of this material represents one extreme of the amount of variation which occurs. There appear to be no previous British records.

On cattle dung: Staindale, Yorkshire (SE875905), 16 July 1996, M.J.R. 15/96.

***Trichobolus zukalii* (Heimerl) Kimbr.**

This was first recorded in Britain from Forres (Richardson, 1972), and there is material at Kew from Surrey (K[M]38991), Northants and Yorks. (K[M]26307). Another collection, again from roe deer dung, was obtained in 1996. The apothecia, with their single polyspored ascus, were 330 μm diam., with sparse setae 340-500 \times 13 μm , up to 6-septate, with walls up to 3.5 μm diam. at the base. Spores hyaline ellipsoid 10.5 \times 8-8.5 μm .

On roe deer dung: Mote of Mark, Rockcliffe, Kircudbrightshire (NX845541), 14 Nov. 1996, M.J.R. 61/96.

***Trichobolus sphaerosporus* Kimbr.**

Distinguished from *T. zukalii* by its slightly larger and spherical spores, (9.5-)11-11.5 μm diam., this species is otherwise very similar, and similarly relatively infrequently recorded.

On roe deer dung: Glenmore, Aviemore, Inverness-shire (NH940103), 26 May 1997, M.J.R. 26/97; Loch Morlich, Inverness-shire (NH978100), 28 May 1997, M.J.R. 50/97.

***Lanzia cuniculi* (Boud.) Dumont**

Described as uncommon by Dennis (1962-3), with details from a single British collection by J.T. Palmer from Lancashire in 1961, there appear to be no other British records. Several apothecia developed on one pellet of a collection. Apothecial stalks were 275 μm diam. and up to 4 mm long, brown below, pale above. Apothecia up to 1 mm diam. Asci 130 \times 10 μm , with pore blue in KI.

Spores hyaline, ellipsoid, with two polar groups of droplets, obliquely l-seriate, $16 \times 5.5\text{--}6 \mu\text{m}$. Paraphyses hyaline, cylindrical $5 \mu\text{m}$ diam.

On rabbit dung: Rockcliffe, Kirkcudbrightshire (NX853525), 26 April 1997, M.J.R. 21/97.

Anopodium ampullaceum N. Lundq.

Lundqvist (1964) described *Anopodium* for *Podospora*-like fungi with spores having pedicels directed towards the apex of the ascus. There are three species in the literature, *A. ampullaceum*, *A. epile* N. Lundq. and *Podospora dagobertii* C. Moreau (*P. dagobertii* was not validly published, and the combination in *Anopodium* has not been made). Richardson (1972) recorded *P. dagobertii* from limited material from rabbit droppings from Moray in 1967. Lundqvist (1972) expressed doubt about the identity of this material, and questioned whether *P. dagobertii* and *A. epile* were distinguishable from each other. The samples examined during the present study have yielded seven records from the UK and one from France which, apart from spore size, could be *A. ampullaceum*, again all on leporid droppings. They are clearly close to *A. ampullaceum*. Most had characteristic ampullate hairs at the neck, although they were sparsely distributed or absent in some specimens. The globose gelatinous bodies noted on the pedicel by Lundqvist (1972) were present on spores of 83/97. Details of these collections are given in Table 1 for comparison with descriptions of the three species.

Table 1. *Anopodium* collections compared with those of *A. ampullaceum*, *A. epile* and *P. dagobertii* (range or lower-mean-upper values).

Reference no.	Hairs	Spore l (μm)	Spore w (μm)	l/w	Pedicel (μm)	Asci (μm)
67/96	++	32-37.8-41.5	16.5-18.6-20	1.8-2.03-2.24	19-20 \times 4.5-5	220 \times 32
14/97	++	32.1-34.8-37	16.1-17.4-18.9	1.85-2.0-2.1		
23/97	++/-	32.1-36.2-38.5	16-18.4-19.3	1.8-1.97-2.23	19-22 \times 3-4	225-270 \times 32
43/97	++	30.5-35.2-36.9	16-19.3-20.9	1.69-1.83-2.01	19 \times 3	
47/97	+	29-35.5	16-17.5	1.8-2	19	
83/97	+	32-35	16	2-2.2		
109/97	+++	29-34-38	16-17.7-19.5	1.7-1.92-2.18	19-26 \times 3	175-240 \times 30-38
133/97	++	33.7-35.2-38.5	16.2-17.7-19	1.84-1.99-2.09	16-23 \times 3	190 \times 30-35
Moray, 1967	none seen	32-40	16-20	1.8-2.1	19-25 \times 3-3.5	
<i>A. ampullaceum</i> *	++	27-32	16-19	1.6-1.75-1.85†	15-18 \times 2.5-3	200-240 \times 25-32
<i>A. epile</i> *	-	28-32	16-21	1.5-1.56-1.7†	12-15 \times 3-3.8	170-230 \times 30-40
<i>P. dagobertii</i> *	-	(28-)30-36(-41)	16-21	1.7-1.9	up to 24 \times 5	250-300 \times 30-45

* From Lundqvist (1964).

† Measured from illustrations in Lundqvist (1964, 1972).

++ = present; + = present, but very few; - = absent.

On rabbit dung: Hillend, Edinburgh (NT246666), 26 Dec. 1996, M.J.R. 67/96; Portmoak Airfield, Kinross-shire (NO174005), 15 April 1997, M.J.R. 14/97; Ven Law, Peeblesshire (NT260410), 5 May 1997, M.J.R. 23/97; Kielder, Northumberland (NY659876), 27 July 1997, M.J.R. 83/97; Coulter, Lanarkshire (NT014293), 4 Dec. 1997, M.J.R. 133/97. *On mountain hare* (*Lepus timidus*) *dung*: Glenmore, Aviemore, Inverness-shire (NH999103), 27 May 1997, M.J.R. 43/97; Coire na Ciste, Aviemore, Inverness-shire (NH998074), 28 May 1997,

M.J.R. 47/97. *On brown hare* (*Lepus capensis*) *dung*: La Tour, Le Caroux, Hérault, France (2°59.75' E, 43°36.3' N), 2 Oct. 1997, M.J.R. 109/97.

A. ampullaceum and *A. epile* are very similar, differing mainly in the presence or absence of ampullate hairs on the upper part of the perithecium, spore length/width, and shape and size of the pedicel. Lundqvist (1972) observed that 'Genuine *A. ampullaceum* has turned up again ... [it] is restricted to leporid droppings. Of the five finds known, four have been made on hare dung, one on rabbit'. Lundqvist (pers. comm.), in commenting on 67/96 and 23/97, has noted that the 'presence of ampullate hairs is subject to great variation' and 'may be an unreliable character', and speculated that *A. epile* may be a glabrous form of *A. ampullaceum*. With respect to spore size, *A. ampullaceum* and *A. epile* are essentially smaller-spored, as described (27–32 μm long), and all eight collections had a mean spore length greater than the maximum given for these two spp. *P. dagobertii* spores are described as slightly larger and, if the full range of sizes obtained by Lundqvist (1964) from Moreau (1953) is considered (28–41 \times 14–23 μm), very variable. Bell & Mahoney (1995) have observed similar levels of variability in the spore size of *P. curvuloides*, with the largest spores observed being about 50% larger than the smallest. Moreau (1953) also presented information showing that there is a wide range of spore size in these fungi, although his species concepts were in some cases wider than is now accepted.

Spore length, width and l/w ratios of six collections were examined in more detail and the significance of differences in their means tested by ANOVAR and Scheffe's multiple comparison test (Table 2). For the relatively small number of spores measured, differences between means of ca 6% (for comparisons between the largest samples) and 10% (for the smallest) were significant for all parameters. These differences are smaller than the within-sample range of values

Table 2. Variation in mean length, width and l/w ratio of spores from five perithecia of one collection of *A. ampullaceum* and perithecia of five other collections (in ascending order of each parameter).

Reference no.	Spore l (μm)		Spore w (μm)		l/w
109/97(5) ($n = 15$)	32.4 a*	109/97(5)	16.4 a	43/97(2)	1.80 a
109/97(3) ($n = 15$)	32.6 a	109/97(4)	17.1 ab	43/97(1)	1.85 a
109/97(4) ($n = 15$)	33.9 ab	109/97(3)	17.2 ab	109/97(3)	1.90 ab
109/97(1) ($n = 15$)	34.2 abc	14/97	17.4 abc	109/97(1)	1.94 ab
14/97 ($n = 7$)	34.8 abc	109/97(1)	17.7 abc	109/97(2)	1.94 ab
43/97(2) ($n = 7$)	35.1 abc	133/97	17.7 abcd	23/97	1.97 ab
109/97(2) ($n = 15$)	35.1 bc	109/97(2)	18.2 bcd	109/97(5)	1.98 ab
133/97 ($n = 15$)	35.2 bc	23/97	18.4 bcd	109/97(4)	1.99 ab
43/97(1) ($n = 8$)	35.3 bcd	67/96	18.6 cd	133/97	1.99 ab
23/97 ($n = 15$)	36.2 cd	43/97(1)	19.1 cd	14/97	2.00 ab
67/96 ($n = 15$)	37.8 d	43/97(2)	19.5 d	67/96	2.03 b

* Values in any column with the same suffix letter are not significantly different ($P = 0.05$), Scheffe's multiple comparison test.

observed, which were mostly in the range of 10-25%. There were highly significant differences between the length and width, but not l/w, of spores from five perithecia from 109/97 ($P = <0.001$, <0.001 and 0.11 , respectively, analysis not shown). When these data were analysed with those from the other five collections, however, there were significant differences in all three parameters between samples from different perithecia from the same pellet; significant differences between different samples; and non-significant differences between some samples from the same pellet and some from other collections. In other words, intracollection differences can be significant, whilst intercollection differences might not be (Table 2). The spore sizes of the collections considered here could be interpreted as representing the full range of a continuum, from the smaller-spored *A. ampullaceum*, *A. epile* and 109/97, through the slightly larger and more variable 14/97, 23/97, 43/97, 47/97, 83/97 and 133/97, to the even larger and more variable *P. dagobertii*, Moray 1967 and 67/96 collections. The l/w ratio of the spores also seems subject to a similar degree of variation. Lundqvist (pers. comm.) has observed that the l/w for 67/96 is 1.9, which is narrower than the 1.68 for *A. ampullaceum*, but here again a continuum of ratios has been observed in these recent collections which spans the range between *A. ampullaceum* and *P. dagobertii*. Although the mean l/w of these collections all incline to suggesting a narrower spore than those described for *A. ampullaceum* and *A. epile*, the mean values mask a considerable range of variation for individual spores within each collection (Table 1). Given that the recent collections present many combinations of the three main characters of hairiness, spore size and shape, I believe that all can be considered to be one species, for which the correct name is *A. ampullaceum* N. Lundq., the first of the three to be validly published.

***Apiosordaria verruculosa* (C.N. Jensen) Arx & W. Gams**

This collection from a Yorkshire Naturalists' Union foray in 1971 has belatedly been recognized as *A. verruculosa*. It is widespread but not frequently recorded. The majority of records are from soil, e.g. Lundqvist (1972) reports four findings on dung out of twenty. This material, from cow dung, had globose perithecia 400 μm diam., 4-spored asci 150 \times 14 μm , with a pore not bluing in KI. Spores were characteristically two-celled, 23-28 \times 13-17 μm overall. The basal cell was triangular, hyaline, smoky brown, 6-8.5 μm long \times 8-10 μm wide at its junction with the upper cell. The upper cell was dark, 15-19 \times 13-17 μm , covered with close, blunt spines, giving the impression of a pitted and thick spore wall, and with an apical germ pore.

On cattle dung: Kirkham Abbey, Yorkshire (SE7366), Sep. 1971.

***Arnium leporinum* (Cain) N. Lundq. & J.C. Krug**

Reported as new to Scotland from Douglstown, near Glasgow, and Ochertyre, Stirling, by Lundqvist (1972), who also reported an unverified record from England as *Podospora setosa*, this seems to be a frequent but little recorded fungus, although there are two collections at Kew from Surrey and Hereford (K[M]28914 & 38002). It is characterized by its multisporous asci (normally 128),

spores $18-26 \times 12-14.5 \mu\text{m}$, and setose perithecia. I have thirteen recent records, all from lagomorph dung, which accords with Lundqvist's (1972) observation that it is mostly associated with leporid droppings. Lundqvist records it as a fungus of the northern taiga zone. Scotland may not be considered as being in that zone now, but such occurrences may be representative of a relict mycota.

On rabbit dung: Falgunzeon, Dumfriesshire (NX886624), 1 Sep. 1996, M.J.R. 22/96; Stonecliffe Wood, Yorkshire (SE272158), 3 Sep. 1996, M.J.R. 25/96; Skipwith Common, Yorkshire (SE654373), 5 Sep. 1996, M.J.R. 32/96; Calderwood, W. Lothian (NT076673), 21 Sep. 1996, M.J.R. 48/96; Mellerstain, Roxburghshire (NT651388), 22 Sep. 1996, M.J.R. 49/96; Harlaw, Edinburgh (NT183650), 25 Oct. 1996, M.J.R. 54/96; Little Cumbrae, Bute (NS151513), 16 Oct. 1996, coll. S.E. Foster, M.J.R. 58/96; Easter Craiglockhart Hill, Edinburgh (NT231704), 27 March 1997, M.J.R. 6/97; Portmoak Airfield, Kinross-shire (NO174005), 15 April 1997, M.J.R. 14/97; Delamere Forest, Cheshire (ST541714), 20 Sep. 1997, M.J.R. 104/97; Allermuir Hill, Edinburgh (NT220670), 30 Oct. 1997, M.J.R. 125/97; The Hirsell, Coldstream, Berwickshire (NT833405), 3 Nov. 1997, M.J.R. 126/97. *On mountain hare dung*: Allermuir Hill, Edinburgh (NT221667), 11 Oct. 1996, M.J.R. 52/96.

***Arnium mendax* N. Lundq.**

Arnium spp. are very close. Spores have no primary appendage, but a gelatinous secondary appendage at each end of the spore. Lundqvist (1972) chose the specific name for *A. mendax*, deceitful, to refer to the confusion of this species with others, and cites many records which have been misidentified as *A. olerum*, *A. caballinum*, *A. inaequilaterale* or undescribed species. Their discrimination is still not easy, since two critical features, the germ pores and caudal structure, are difficult to see. I have interpreted these collections as *A. mendax* largely on spore size and shape, and lack of any distinct caudal structure. Although they have an asymmetric appearance, due to the offset insertion of one or both caudae, the body of the spore is not asymmetric, as described for *A. caballinum* and *A. inaequilaterale*, and the spores, at $35-44 \times 21-24 \mu\text{m}$, are consistently larger than described for these two species. There are records from Surrey (Masse & Salmon, 1902) and Durham (K[M]18757), but apparently no other published ones. During the past two years I have 13 records from red and roe deer, rabbit, mountain hare and sheep dung, which accords with Lundqvist's (1972) findings that it is relatively widespread and catholic in its substrate requirements, and also that it is essentially a forest species, with 10 of the 13 samples coming from wooded areas.

On roe deer dung: Portmoak Airfield, Kinross-shire (NO173005), 15 April 1997, M.J.R. 15/97; Glenmore, Aviemore, Inverness-shire (NH940103), 26 May 1997, M.J.R. 26/97; Coylum Bridge, Inverness-shire (NH938103), 26 May 1997, M.J.R. 31/97; Loch Morlich, Inverness-shire (NH978100), 28 May 1997, M.J.R. 50/97; Linn of Dee, Aberdeenshire (NO063897), 4 Sep. 1997, M.J.R. 94/97. *On red deer* (*Cervus elephas*) *dung*: Loch Morlich, Inverness-shire (NH982107), 28 May 1997, M.J.R. 52/97; Inverey, Aberdeenshire (NO078898), 4 Sep. 1997, M.J.R. 91/97. *On rabbit dung*: Skipwith Common, Yorkshire (SE654373), 5 Sep. 1996,

M.J.R. 32/96; Harperrigg, W. Lothian (NT100630), 12 Dec. 1996, M.J.R. 66/96; Lui Bridge, Aberdeenshire (NO070899), 4 Sep. 1997, M.J.R. 97/97; Lui Water, Aberdeenshire (NO068901), 4 Sep. 1997, M.J.R. 99/97. *On mountain hare dung*: Glenmore, Inverness-shire (NH999103), 27 May 1997, M.J.R. 43/97. *On sheep dung*: Stac Pollaidh, Sutherland (NC112105), 16 June 1997, M.J.R. 60/97.

***Coniochaeta polymegasperma* M.J. Richardson**

A fifth collection of this recently described species (Richardson, 1998) was obtained on blue hare dung collected in the Scottish borders. It was present on the sample when collected, and agreed in all respects with the other collections.

On mountain hare dung: Woodycleuch Dod, Coulter, Lanarkshire (NT023287), 14 Dec. 1997, M.J.R. 137/97.

***Podospora excentrica* N. Lundq.**

Described by Lundqvist (1972), from material from one sample each from Sweden, Eire and Madeira, it has not been recorded with details from the UK but John Webster (pers. comm.) has observed that it is quite frequent in SW England, and there is material at Kew from Hampshire (K[M]16998). The Scottish material and collections from Yorkshire and Cumberland agree very well with the type description and illustrations, especially in respect of the asymmetric spore body, the appearance of the caudae, which are impossible to see without mounting in, for example, Indian ink, and the tapering fascicles of rigid hairs.

On rabbit dung: Broughton, Peeblesshire (NT119381), 7 July 1996, M.J.R. 11/96; Skipwith Common, Yorkshire (SE654373), 5 Sep. 1996, M.J.R. 32/96. *On roe deer dung*: Skipwith Common, Yorkshire (SE654373), 5 Sep. 1996, M.J.R. 31/96. *On sheep dung*: Skipwith Common, Yorkshire (SE661375), 5 Sep. 1996, M.J.R. 33/96; Red Point, Gairloch, W. Ross (NG731694), 15 June 1997, M.J.R. 56/97; Dock Tarn, Borrowdale, Cumberland (NY273142), 31 Aug. 1997, M.J.R. 86/97.

***Schizothecium nanum* N. Lundq.**

A small-spored, 4-spored *Schizothecium*. There appear to be no details of British records. It is noted by Dennis (1995) as occurring in East Anglia, but there is no material at Kew. Spores of all collections below were of similar size, 11-12.8(-14.4) × 6.5-7 μm, at the lower end of the size range (12-14.5 × 7-9 μm) given by Lundqvist (1972) in his description of the species.

On rabbit dung: Iron Hellia, Orkney (ND550073), 27 Sep. 1994; Braid Hills, Edinburgh (NT251700), 20 May 1996, M.J.R. 2/96; Winchburgh, W. Lothian (NT087757), 20 Sep. 1996, M.J.R. 47/96; Ven Law, Peeblesshire (NT260410), 5 May 1997, M.J.R. 23/97; Kielder Forest, Northumberland (NY659876), 27 July 1997, M.J.R. 83/97; Lui Bridge, Braemar, Aberdeenshire (NO070899), 4 Sep. 1997, M.J.R. 97/97; Barcloy, Kirkcudbrightshire (NX861526), 14 Sep. 1997, 103/97; Keld, Yorkshire (NY899011), 17 Oct. 1997, M.J.R. 121/97; Kisdon, Yorkshire (SD896993), 17 Oct. 1997, M.J.R. 122/97. *On mountain hare dung*: Glenshee, Aberdeenshire (NO139783), 4 Sep. 97, M.J.R. 88/97.

***Zygospermella insignis* (Mouton) Cain**

Lundqvist (1972) and Dennis (1978) note that this appears to be common, but there are few British records – one from Wales by Walkey & Harvey (1965), six from Scotland (Dennis, 1971; Richardson, 1972; Henderson & Watling, 1978) and one from Surrey, England, but without details (Dennis, 1995). Three further collections have been made, at the Centenary Foray of the BMS, at the spring Foray in 1997, and from Sutherland. The collections were all slightly different. The Yorkshire collection had perithecia 620-760 μm diam., with a neck 340 μm high \times 240 μm diam. with rough brown aseptate setae up to 65 \times 3 μm , and spores 48-61 \times 14-15 μm , with a hollow appendage at each end 26-48 \times 6-7 μm . The Aviemore collection had perithecia with very few setae, 24-20 μm long, spores 56-64 \times 16-22.5 μm , and appendages 32-65 \times 7-10 μm . Spores of the collection from Durness were 67-70 \times 19 μm .

On horse (*Equus caballus*) *dung*: Elland Park Wood, Yorkshire (SE114128), 7 Sep. 1996, M.J.R. 44/96. *On cattle dung*: Coylum Bridge, Aviemore, Inverness-shire (NH915105), 26 May 1997, M.J.R. 38/97; Durness, Sutherland (NC405685), 19 June 1997, M.J.R. 69/97.

***Sordaria alcina* N. Lundq.**

When describing *S. alcina*, Lundqvist (1972) noted that it is apparently confined to cervid dung. There do not appear to be any British records, but material developing on mountain hare dung from Sutherland, with relatively narrow spores 21-22.5 \times 9.5-10 μm , with a conspicuous gel sheath enlarging to 6 μm thick in water, agreed well with Lundqvist's description. Although the substrate was not cervid but lagomorph dung, red deer are common in the area where the sample was collected, so it is not beyond the bounds of possibility that some 'exchange' of inoculum occurs.

On mountain hare dung: Stac Pollaidh, Sutherland (NC108106), 16 June 1997, M.J.R. 59/97.

***Sordaria minima* Sacc. & Speg.**

Insignificant perithecia, 95-100 μm diam. \times 150-210 μm high, sometimes up to 190 μm diam. with two ostioles, developed on several pellets. They were schizothecioid in structure, with thin walls composed of smoky-hyaline globose cells, tending to be larger and inflated towards the ostiole. Asci were cylindrical, 8-spored, 45 \times 6 μm , with no obvious apical structure or reaction with KI. Spores were grey-black, ellipsoid, 4.5 \times 3 μm , with a germ pore at one end, mainly l-seriate but some partially biseriate, with no indication in water or Indian ink of a gel sheath or appendages. Given the lack of apical structure to the ascus, the lack of any gel sheath to the spore, and the un-*Sordaria*-like structure of the apothecium, it is probable that this is not a *Sordaria*. It is, however, clearly the same as those described by Masee & Salmon (1901) from rabbit and hare dung from Kew, and illustrated and described by Larsen (1971) from Danish material, and identified as *S. minima*. This appears to be a rare fungus, with only three previous British records, the two by Masee & Salmon (1901) and one from rabbit dung from Fair Isle by Dennis (1972).

On red grouse dung: Huddersstone, Coulter, Lanarkshire (NT025274), 14 Dec. 1997, M.J.R. 134/97.

***Copromyces bisporus* N. Lundq.**

Described by Lundqvist (1967) from two finds in Sweden and with two subsequent records from Mallorca and California (Lundqvist, pers. comm.) this is clearly not a common coprophilous fungus. Good material was found on the Northumberland collection after 5 wk incubation. Cleistothecia were superficially black, the wall dark brown s.m., spherical, up to 325 μm diam. The fungus is easily recognized by its characteristic 2-spored clavate-cylindrical asci, 32-40 \times 14-16 μm with brown, coarsely verrucose, almost globose spores 9.5-12.5 μm , with a slight apiculus with a single germ pore.

On rabbit dung: Dunstanburgh Castle, Northumberland (NU257216), 18 July 1996, M.J.R. 17/96.

***Pyxidiophora microsporus* (D. Hawksw. & J. Webster) N. Lundq.**

This was described by Hawksworth & Webster (1977) from dog dung collected from the Linn of Dee in 1975, with additional material from sheep dung from Callander, Perthshire collected in Jan. 1996 by the author. Abundant material developed on four samples of red deer and sheep dung collected in the Linn of Dee, Braemar and Glenshee areas during the autumn 1997 foray of the BMS.

On red deer dung: Braemar, Aberdeenshire (NO135912), 4 Sep. 1997, M.J.R. 90/97; Linn of Dee, Aberdeenshire (NO063897), 4 Sep. 1997, M.J.R. 95/97; Lui Bridge, Aberdeenshire (NO070899), 4 Sep. 1997, M.J.R. 96/97. *On sheep dung*: Glenshee, Aberdeenshire (NO139783), 4 Sep. 1997, M.J.R. 87/97.

***Delitschia consociata* Mouton**

Described from Belgium in the last century, there appears to be only one published British record of this species, from near Stirling (Bevan & Moodie, 1981), although I have details of a collection from sheep dung from Callander, Perthshire made on 25 Jan. 1966. It is characterized by its biseriate, non-constricted, ellipsoid, almost oblong, spores 16-19.5(-22.5) \times (5-)6.5-7(-8.5) μm . Perithecia are small, 200-275 μm diam., with a prominent neck to give an overall height of up to 500 μm . Asci are 145 \times 20-26 μm , longer than the 80 μm reported from the type, but the difference may be due to the state of maturity of the ascus pre- as against post-expansion of the ascus following rupture of the outer ascial wall. I have nine records from the last two years, seven on sheep dung and two on rabbit.

On sheep dung: Broughton, Peeblesshire (NT125385), 7 July 1996, M.J.R. 12/96; North Berwick Law, E. Lothian (NT555843), 30 March 1997, M.J.R. 8/97; Red Point, Gairloch, W. Ross (NG731694), 15 June 1997, M.J.R. 56/97; Fionn Loch, Sutherland (NC119187), 17 June 1997, M.J.R. 63/97; Suilven, Sutherland (NC155184), 17 June 1997, M.J.R. 64/97; Dock Tarn, Cumberland (NY273142), 31 Aug. 1997, M.J.R. 86/97; Coulter, Lanarkshire (NT023286),

14 Dec. 1997, M.J.R. 136/97. *On rabbit dung*: Gosford Bay, E. Lothian (NT442778), 30 March 1997, M.J.R. 7/97; Glentress, Peeblesshire (NT281411), 27 Sep. 1997, M.J.R. 105/97.

***Delitschia leptospora* Oudem.**

Characterized by its distinctive spores, $22-24 \times 4.5-6 \mu\text{m}$, with each cell markedly tapered towards the tip, slightly flexed at the septum to give a curved appearance and readily breaking into two at maturity. Perithecia globose, glabrous, $200 \mu\text{m}$ diam. Observed after 6 weeks incubation, this appears to be the first British record.

On rabbit dung: Gullane, E. Lothian (NT479823), 11 June 1996, M.J.R. 6/96.

***Delitschia perpusilla* Speg.**

Perithecia small, black, glabrous. No asci were seen, but spores were undoubtedly those of a *Delitschia*. They were small, $9-10.5 \times 4.5 \mu\text{m}$, not or hardly constricted at the septum which was transverse, not or only slightly oblique, with a thin gelatinous sheath. There appear to be no previous British records.

On red deer dung: Loch Morlich, Aviemore, Inverness-shire (NH982107), 28 May 1997, M.J.R. 52/97.

***Sporormia fimetaria* (De Not.) De Not.**

These collections, two British and two French, had pseudothecia $70-110 \mu\text{m}$ diam. with cylindrical asci $55-65 \times 11-12 \mu\text{m}$, abruptly tapered below to a short stalk. Spores were consistently 16-celled, $37.5-42 \times 3-3.8 \mu\text{m}$ diam., 8 to an ascus, tightly bundled together, the bundles $40-51 \times 9.5-11.5 \mu\text{m}$, with gelatinous appendages at each end of the bundle *ca* $20-25 \mu\text{m}$ long. There are few British records, although there are two collections in Kew from Surrey (K[M]17184 & 17214)).

On rabbit dung: Little Cumbrae, Bute (NS151513), 16 Oct. 1996, coll. S.E. Foster, M.J.R. 58/96. *On sheep dung*: Suilven, Sutherland (NC155184), 17 June 1997, M.J.R. 64/97. *On herbivore (roe deer?) dung*: La Tour, Le Caroux, Hérault, France ($2^{\circ} 59.75' \text{ E}$, $43^{\circ} 36.3' \text{ N}$), 2 Oct. 1997, M.J.R. 108/97; Colombières-sur-Orb, Hérault, France ($3^{\circ} 0.5' \text{ E}$, $43^{\circ} 36' \text{ N}$), 8 Oct. 1997, M.J.R. 115/97.

S. fimetaria sensu Ahmed & Cain (1972) has spores $50-57 \mu\text{m}$ long, with asci $70-80 \times 12-16 \mu\text{m}$, from five north and central American samples. I drew attention to the markedly smaller spores of the first Scottish collection (Richardson & Watling, 1982) and Bell (1983), commenting on a similar collection from New Zealand, noted that 'this may be a new species'. Dissing (1992) describes 11 arctic and north temperate collections with spores $40-55 \mu\text{m}$ long, which appears to bridge the gap between the shorter-spored Scottish, French and New Zealand specimens and the American material with longer spores and asci. Dissing does not comment on any variation in spore size among his collections; the one illustrated in detail (9 spore bundles) has spores $40-42 \mu\text{m}$ long. Apart from Ahmed & Cain's material all spores are consistently 16-celled. Although Ahmed & Cain (1972) described spores as 16-20 celled, all their illustrations (with the

exception of one 18-celled spore) are of 16-celled spores. The original description (De Notaris, 1849), has no spore or ascus measurements, and no scale with the illustration. The spores are described as 16-18-celled, but only 18-, 19-, and 20-celled spores are illustrated. Saccardo (1879) reports the spores as $50-55 \times 3-4 \mu\text{m}$ and, in a poor representation which may not be accurate, as being 13-19-celled, with asci $100-110 \times 15 \mu\text{m}$. Rabenhorst (1987) in the main text has asci $80 \times 14-16 \mu\text{m}$, with spores up to 20-celled, $50 \times 4 \mu\text{m}$, with the terminal cells $4 \mu\text{m}$ long, the others $2.5 \mu\text{m}$; in a subtext, however, reference is made to constantly 16-celled spores $38 \mu\text{m}$ long, in asci $50-55 \times 12-13 \mu\text{m}$, which suggests an observation based on experience by one of the authors of material very similar to the recent European and New Zealand records, rather than the American material studied by Ahmed & Cain (1972). It is possible, therefore, that the European and New Zealand collections represent *S. fimetaria sensu* De Notaris, and that *S. fimetaria sensu* Ahmed & Cain, with markedly longer spores and asci, is a different species.

***Sporormiella octonalis* Ahmed & Cain**

A species with 8-celled ascospores described by Ahmed & Cain (1972) for North American specimens which had previously been interpreted as *S. corynespora* (Niessl) Ahmed & Cain, *S. octonalis* is clearly different, distinguishable by both ascus and ascospore morphology. Asci of *S. corynespora* are clavate, $23-26 \mu\text{m}$ wide, tapering gradually to a stalk $25-35 \mu\text{m}$ long, while those of *S. octonalis* are cylindrical, $28-34 \mu\text{m}$ wide, abruptly contracted below to a short stipe. Spores of *S. corynespora* are 3-4-seriate in the upper ascus, $50-59 \times 10-12 \mu\text{m}$, with the third cell from the upper end abruptly larger than the rest, and the apical cell narrowing towards its upper end, a feature which seems to be typical of those species which have tapering, stipitate asci. Spore of *S. octonalis* are 2-3-seriate, wider, $12-14 \mu\text{m}$, with hemispherical terminal cells, all cells broader than long with the third cell from the upper end slightly wider than the adjacent ones. The North Berwick Law collection had cylindrical shortly stalked asci $160-210 \times 30-35 \mu\text{m}$, with biseriate spores $49-54.5 \times 11.5-14.5 \mu\text{m}$, with the third cell the widest, all cells wider than long, and the apical cells $9.5 \mu\text{m}$ diam. and distally rounded. The pseudothecia were immersed, more or less globose, translucent olivaceous, $170-200 \mu\text{m}$ diam. $\times 210-260 \mu\text{m}$ high, with a short black emergent neck *ca* $65 \mu\text{m}$ diam. $\times 65-80 \mu\text{m}$ long, so they are not very obvious. This record appears to be the first from Britain.

On sheep dung: North Berwick Law, E. Lothian (NT555843), 30 March 1997, M.J.R. 8/97.

***Sporormiella vexans* (Auersw.) Ahmed & Cain**

The first British record was on rabbit dung from Forres, Moray (Richardson, 1972), and I have also found it on rabbit droppings in Yorkshire (Bramley, 1985). Good material was collected near Aviemore in 1997, during the BMS spring foray. Spores of both roe deer collections were $38.5-50 \times 7.5-9.5 \mu\text{m}$, slightly shorter than those of the Forres collection, and almost coincident with the range given by Ahmed & Cain (1972). Material from red deer was old, with no fruit

bodies being observed, only spores. There appear to be no other British records, but it is frequently recorded on elk dung in Sweden (Eriksson, 1992), so the scarceness of reports from the UK is more likely to be due to a lack of sampling, rather than a distributional difference, since many other boreal/taiga coprophilous fungi do occur in northern Britain.

On roe deer dung: Coylum Bridge, Aviemore, Inverness-shire (NH940103), 26 May 1997, M.J.R. 26/97; Glenmore Forest Park, Aviemore, Inverness-shire (NH982107), 28 May 1997, M.J.R. 51/97. *On red deer dung:* Glenmore Forest Park, Aviemore, Inverness-shire (NH982107), 28 May 1997, M.J.R. 52/97.

***Preussia funiculata* (Preuss) Fuckel**

Non-ostiolate ascomata distinguish *Preussia* from *Sporormiella*, although some consider the two genera synonymous. Clark (1980) records *P. vulgaris* on dung, but *P. funiculata* does not appear to be recorded as coprophilic in Britain, although it occurs frequently on other organic substrates, e.g. rope, sacking, cloth etc. It is distinguished from *P. vulgaris* by the clavate asci with 45-50 μm long stalks comprising about half the total ascus length. Spores 29-32 \times 5.5 μm , 3-septate, with rounded cells and slightly oblique septa when mature, readily fragmenting into the individual cells. These spores are slightly shorter than those recorded by Valldosera & Guarro (1990) from four Spanish isolates from sheep, goat and horse dung (34-36 μm), and 36-40 μm as originally described for *P. funiculata*.

On rabbit dung: Storthes Hall, Huddersfield, Yorkshire (SE183129), 4 Sep. 1996, M.J.R. 27/96.

Acknowledgements

I am grateful to Drs Nils Lundqvist and Joop van Brummelen for commenting on various collections, David Pegler for information about material at Kew, and Roy Watling for the opportunity to examine some of his collections, and for much assistance and companionship in the field over many years.

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