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Records of French coprophilous fungi

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Résumé – Des détails sont donnés sur 169 espèces de mycètes coprophiles se développant sur 86 échantillons de fumier collectés en France (67 de la métropole, 5 de Corse, 5 de Guadeloupe et 9 des îles Kerguelen) après incubation en chambres humides.

ascomycètes / basidiomycetes / biogéographie / diversité / écologie / fimicoles

Abstract – Details are given of 169 species of coprophilous fungi developing on 86 samples of dung from France (67 from mainland France, 5 from Corsica, 5 from Guadeloupe and 9 from the Kerguelen Islands) and incubated in moist chambers.

ascomycetes / basidiomycetes / biogeography / diversity / ecology / fimicoles

INTRODUCTION

During various visits to France from 1997-2007 samples of herbivore dung were collected and, on return to the UK, incubated in a damp chamber. Additionally, through the kind help of Jean-Louis Chapuis (Muséum national de Histoire naturelle, Paris), some samples were obtained from the Kerguelen Islands in the southern Indian Ocean between Australia and South Africa. The coprophilous fungi that developed were recorded.

MATERIAL AND METHODS

Details of the samples collected and incubated to provide records are given in Table 1, and their distribution is shown in Fig. 1. Most were dry when collected, and were placed in paper envelopes. Those that were not were air dried and then packeted. Most samples, other than those from the Kerguelen Islands, were rehydrated and incubated soon after collection on moist paper towelling in plastic boxes with lightly fitting transparent lids, under ambient light and at room temperature (*ca* 15-18°C). Care was taken to ensure that cultures were not too wet. Samples were generally of similar size, with incubation chambers 10 × 7 cm, which would accommodate approx. 2-4 g D.W. (= 15 sheep/goat/deer - 20 rabbit pellets), or 13 × 8 cm for horse or cattle (approx. 10 - 20 g D.W.). Samples were

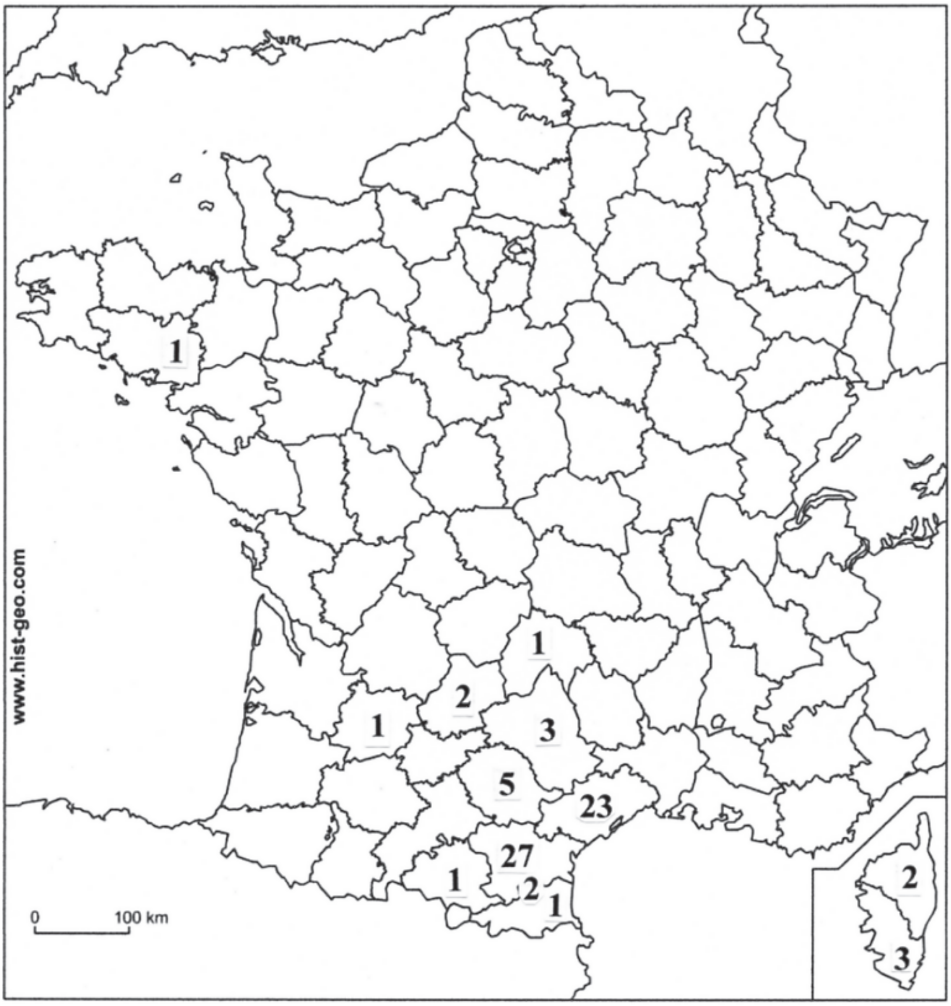

Fig. 1. Map showing the départements from which samples were collected, and the number from each. The two samples between Aude and the Pyrénées-Orientales were collected on the boundary between the two départements. In addition, 5 samples were collected from Guadeloupe and 9 from the Kerguelen Islands.

examined frequently at intervals of a few days, with a × 7 - 45 magnification stereomicroscope. Fruiting bodies were removed and mounted in water for examination and identification at higher magnification. Samples were mostly incubated for up to 22 wk (exceptionally for one sample for over a year), with observations continuing whilst new fungi were being observed. Sample locality coordinates (latitude and longitude) for most were determined with a Magellan GPS 4000 XL or eXplorist 100 GPS unit; those for Corsica and the Kerguelen Islands were obtained by using Google Earth and the locality details provided by the collectors. Selected material has been placed in the Herbarium of the Royal Botanic Garden, Edinburgh (**E**). In considering diversity, a cumulative species

Table 1. Details of French dung samples and collection localities

*Sample no.**	*Locality*	*Département*	*Elevation (m a.s.l.)*	*Latitude (°)*	*Longitude (°)*	*Date*	*Substrate*
106/97	le Caroux	Herault	1000	N43.59	E2.98	2.10.97	deer
107/97	le Caroux	Herault	1000	N43.60	E2.98	2.10.97	hare
108/97	la Tour	Herault	1050	N43.60	E3.00	2.10.97	deer
109/97	la Tour	Herault	1050	N43.60	E3.00	2.10.97	hare
110/97	le Caylar	Herault	750	N43.88	E3.32	7.10.97	sheep
111/97	la Couvertoirade	Aveyron	800	N43.91	E3.32	7.10.97	hare
112/97	la Couvertoirade	Aveyron	780	N43.90	E3.30	7.10.97	sheep
113/97	la Couvertoirade	Aveyron	780	N43.90	E3.30	7.10.97	rabbit
114/97	le Caylar	Herault	725	N43.87	E3.30	7.10.97	cattle
115/97	Colombieres	Herault	740	N43.60	E3.01	8.10.97	deer
116/97	St Gervais	Herault	350	N43.66	E3.06	10.10.97	deer
117/97	St Gervais	Herault	350	N43.66	E3.06	10.10.97	rabbit
18/98	Montgrand	Tarn	1240	N43.69	E2.72	20.4.98	hare
19/98	Roc de Montalet	Tarn	1240	N43.68	E2.74	20.4.98	cattle
20/98	Roc de Montalet	Tarn	1240	N43.68	E2.74	20.4.97	hare
21/98	Roc de Montalet	Tarn	1240	N43.68	E2.74	20.4.98	hare
22/98	Bois de Lause	Tarn	1200	N43.67	E2.87	20.4.98	mouflon
23/98	Soumal, Douch	Herault	950	N43.62	E2.97	22.4.98	mouflon
24/98	Soumal, Douch	Herault	950	N43.62	E2.97	22.4.98	mouflon
25/98	Salis, Douch	Herault	750	N43.62	E2.95	22.4.98	hare
26/98	Douch	Herault	920	N43.62	E2.97	22.4.98	hare
50/98	Garabit	Cantal	850	N44.97	E3.18	8.6.98	rabbit
51/98	Montagne de Liausson	Herault	500	N43.63	E3.37	11.6.98	hare
52/98	Monts de l'Espinouse	Herault	900	N43.67	E2.93	16.6.98	cattle
53/98	Monts de l'Espinouse	Herault	900	N43.67	E2.95	16.6.98	hare
54/98	Monts de l'Espinouse	Herault	900	N43.67	E2.93	16.6.98	deer

Table 1. Details of French dung samples and collection localities *(continued)*

*Sample no.**	*Locality*	*Département*	*Elevation (m a.s.l.)*	*Latitude (°)*	*Longitude (°)*	*Date*	*Substrate*
55/98	le Caylar	Herault	800	N43.89	E3.30	18.6.98	sheep
56/98	le Caylar	Herault	800	N43.89	E3.30	18.6.98	sheep
57/98	le Caylar	Herault	800	N43.89	E3.30	18.6.98	rabbit
13/99	Gourdon	Lot	300	N44.68	E1.42	3.6.99	sheep
15/99	Carnac	Morbihan	15	N47.60	W3.08	14.6.99	horse
23/99	le Fourquet	Lot	300	N44.73	E1.40	4.8.99	deer
3/01	Île Cimetiere	Kerguelen	40	S49.49	E70.08	31.1.01	rabbit
4/01	Port-aux-Francais	Kerguelen	100	S49.35	E70.22	13.2.01	rabbit
5/01	Col de Serra	Corsica	360	N42.97	E9.37	9.4.01	goat
6/01	Cascades des Anglais	Corsica	1100	N42.12	E9.10	10.4.01	sheep
7/01	Acqua Doria	Corsica	250	N41.76	E8.72	12.4.01	sheep
8/01	S of Col de Lava	Corsica	400	N42.23	E8.64	13.4.01	goat
9/01	Ota	Corsica	350	N42.26	E8.76	13.4.01	donkey
11/01	Île Cimetiere	Kerguelen	40	S49.49	E70.08	4.1.01	rabbit
12/01	Île Cimetiere	Kerguelen	40	S49.49	E70.08	4.1.01	rabbit
13/01	Île Cimetiere	Kerguelen	40	S49.49	E70.08	4.1.01	rabbit
14/01	Île Cimetiere	Kerguelen	40	S49.49	E70.08	4.1.01	rabbit
15/01	Île Haute	Kerguelen	50	S49.39	E69.93	6.2.01	sheep
16/01	Île Haute	Kerguelen	50	S49.39	E69.93	6.2.01	sheep
17/01	Île Haute	Kerguelen	50	S49.39	E69.93	6.2.01	sheep
86/01	Lac de Montbel, Puivert	Ariège	400	N42.96	E2.02	4.11.01	horse
03/02	Espéraza cross, Aude	Aude	340	N42.94	E2.22	28.3.02	rabbit
04/02	W of Espéraza cross	Aude	350	N42.94	E2.22	28.3.02	sheep
05/02	W of Espéraza cross	Aude	350	N42.94	E2.22	28.3.02	deer

Table 1. Details of French dung samples and collection localities *(continued)*

*Sample no.**	*Locality*	*Département*	*Elevation (m a.s.l.)*	*Latitude (°)*	*Longitude (°)*	*Date*	*Substrate*
06/02	Route D54, Arques	Aude	460	N42.96	E2.38	1.4.02	hare
07/02	les Plas, Antugnac	Aude	370	N42.94	E2.23	5.4.02	hare
08/02	Camps de la Borde, Cavirac	Aude	400	N42.85	E2.22	6.4.02	deer
09/02	Bitrague, Quillan	Aude	300	N42.88	E2.19	6.4.02	rabbit
17/02	Pic de Brau, Roquetaillade	Aude	600	N43.01	E2.23	1.7.02	sheep
18/02	Pic de Brau, Roquetaillade	Aude	620	N43.01	E2.23	1.7.02	sheep
19/02	Pic de Brau, Roquetaillade	Aude	620	N43.01	E2.23	1.7.02	hare
08/03	Soumal, Douch	Herault	940	N43.61	E2.96	18.3.03	mouflon
09/03	Soumal, Douch	Herault	940	N43.61	E2.96	18.3.03	hare
10/03	Soumal, Douch	Herault	960	N43.61	E2.97	18.3.03	rabbit
11/03	path to Pic de Bugarach	Aude	800	N42.87	E2.38	21.3.03	cattle
12/03	la Frau Haute	Aude	600	N42.97	E2.36	23.3.03	horse
56/03	Quéribus, Cucugnan	Aude	640	N42.84	E2.62	15.11.03	goat
57/03	road to le Poux, Espéraza	Aude	300	N42.94	E2.21	17.11.03	rabbit
18/04	Col de Jau	Aude	1510	N42.69	E2.25	21.4.04	hare
19/04	Pic Dourmidou	Aude/ Pyrénées-Orientales	1840	N42.71	E2.26	21.4.04	hare
20/04	Pic Dourmidou	Aude/ Pyrénées-Orientales	1840	N42.71	E2.26	21.4.04	cattle
21/04	Col de Jau	Aude	1510	N42.69	E2.25	21.4.04	vole?
22/04	Rennes-le-Château	Aude	400	N42.92	E2.26	24.4.04	hare
88/04	Granès, Quillan	Aude	300	N42.89	E2.21	11.9.04	hare
89/04	Antugnac, Couiza	Aude	470	N42.95	E2.21	12.9.04	hare

Table 1. Details of French dung samples and collection localities *(continued)*

*Sample no.**	*Locality*	*Département*	*Elevation (m a.s.l.)*	*Latitude (°)*	*Longitude (°)*	*Date*	*Substrate*
1/05	Domaine de Garenaud, Montazels	Aude	250	N42.95	E2.23	14.3.05	hare
28/05	near Fa	Aude	400	N42.93	E2.20	21.6.05	hare
29/05	GR36, Col de Gardiole, nr Peyrepertuse	Aude	575	N42.87	E2.54	22.6.05	cattle
30/05	GR36, Col de Gardiole, nr Peyrepertuse	Aude	565	N42.87	E2.55	22.6.05	sheep
31/05	La Girude, Soulatgé	Aude	460	N42.93	E2.20	22.6.05	sheep/goat
6/06	nr la Toupine, St-Ferriol	Aude	420	N42.91	E2.22	28.4.06	hare
1/07	Fond Heliot, Deshaies, Basse-Terre	Guadeloupe	20	N16.28	W61.80	8.2.07	goat
2/07	Fond Heliot, Deshaies, Basse-Terre	Guadeloupe	20	N16.28	W61.80	8.2.07	donkey
3/07	Roches Caraibes, Bailiff, Basse-Terre	Guadeloupe	200	N16.03	W61.74	8.2.07	cattle?
4/07	nr Plage Bois Jolan, St-Anne, Grande-Terre	Guadeloupe	5	N16.23	W61.35	11.2.07	goat
5/07	nr Plage Bois Jolan, St-Anne, Grande-Terre	Guadeloupe	5	N16.23	W61.35	11.2.07	cattle
44/07	Tourtrès	Lot-et-Garonne	175	N44.51	E0.43	11.10.07	rabbit
45/07	D619, road junction to Comes, Eus	Pyrénées-Orientales	880	N42.67	E2.43	15.10.07	hare
46/07	Camp Gast, Puivert	Aude	610	N42.90	E2.07	21.10.07	cattle
50/07	la Coume, Espéraza	Aude	450	N42.93	E2.20	27.12.07	hare

* = MJR sample no. and year identifier

curve was plotted for the samples from mainland France and Corsica. The equation for that curve was calculated (y = ax^b, where y = cumulative no. of species observed in x samples) and solved for x = 50 samples. That value was compared with those obtained from the same assemblage of species recorded in a worldwide study of a similar range of substrates (Richardson 2001a).

RESULTS

The records are listed by 'département' in alphabetical order, and within each départment in order of collection. They are treated in two ways; common and ubiquitous species are simply listed, with the sample number/year and départment from which they were recorded. More interesting or unusual records are treated in more detail, with descriptions and discussion in the context of information from observations from over 1000 other samples collected worldwide, yielding over 10000 records of coprophilous fungi. Details of incompletely identified taxa are provided for future reference. Dried material and/or slides for collections marked **E** have been placed in the Herbarium of the Royal Botanic Garden, Edinburgh.

ZYGOMYCOTINA

Cunninghamella echinulata (Thaxt.) Thaxt. ex Blakeslee
Guadeloupe: 5/07

Mortierella bainieri Costantin
Kerguelen: 14/01

Phycomyces nitens Kunze
Herault: 117/97

Pilaira anomala (Ces.) J. Schröt.
Aude: 3/02, 8/02, 9/02, 1/05; Herault: 117/97, 26/98

Pilaira moreaui Y. Ling
Herault: 23/98, 10/03; Lot-et-Garonne: 44/07

Pilobolus crystallinus var. ***crystallinus*** (F. H. Wigg.) Tode
Aude: 5/02, 18/02, 56/03, 1/05, 30/05, 31/05; Corsica: 5/01; Guadeloupe: 1/07; Lot: 13/99, 23/99

Pilobolus crystallinus var. ***kleinii*** (Tiegh.) R.Y. Zheng & G.Q. Cheng
Aude: 30/05, 46/07; Corsica: 7/01; Guadeloupe: 2/07, 4/07; Kerguelen: 16/01, 17/01

Pilobolus roridus var. ***umbonatus*** (Buller) F.M. Hu & R.Y. Zheng
Aude: 18/02; Herault: 106/97, 109/97, 115/97, 23/98, 24/98, 8/03, 10/03; Tarn: 22/98

Piptocephalis lepidula (Marchal) R. K. Benj.
Herault: 25/98

Members of the genus are of interest because of their obligate parasitism on other Mucorales, and they are quite frequently recorded in the early stages of incubation of dung samples, when host species are most frequently seen. *P. lepidula* is recognised by its dry heads with two-celled merosporangia, and fusoid spores 4-5 × 2-3 μm.

ASCOMYCOTINA

Pezizales

Ascobolus albidus Crouan
Aude: 12/03; Herault: 115/97, 24/98, 26/98, 54/98; Tarn: 22/98

Ascobolus cervinus Berk. & Broome
Herault: 106/07, 115/97
Ascobolus hawaiiensis Brumm.
Aude: 4/02, 5/02; Herault: 110/97, 56/98; Pyrénées-Orientales: 45/07

A coprophil with a worldwide distribution, in spite of its specific name. It has now been recorded from many countries, from Iceland, UK and Greece in the northern hemisphere through to Chile, Australia, New Zealand and the Falkland Islands in the southern hemisphere (Richardson 2004).

Ascobolus immersus Pers.
Aude: 5/02, 18**E**/02, 28/05, 29/05, 30/05, 46/07, 50/07; Aveyron: 112/97; Corsica: 9/01; Herault: 110/97, 114/97, 115/97, 23/98, 24/98, 52/98, 55/98; Guadeloupe: 2/07, 3/07, 4/07, 5/07; Pyrénées-Orientales: 45/07
Ascobolus sacchariferus Brumm.
Aude: 8/02; Corsica: 5**E**/01; Herault: 24/98; Tarn: 18**E**/98, 22**E**/98

Described from the Netherlands by van Brummelen (1967) from two samples of deer dung, the substrate range of this species is increased by its occurrence also on sheep, hare and goat dung among the French samples, and I also have a record on rabbit from Scotland. Apart from the substrate differences, the collections agree well with van Brummelen's original description, with characteristically white, superficial apothecia with a granular excipular surface.

Cheilymenia fimicola (de Not. & Bagl.) Dennis
Aude: 11/03
Coprotus *cf.* ***disculus*** Kimbr., Luck-Allen & Cain
Aude: 4/02, 8/02
Coprotus granuliformis (P. Crouan & H. Crouan) Kimbr.
Aude: 11/03, 30/05
Coprotus sexdecimsporus (P. Crouan & H. Crouan) Kimbr.
Aude: 5/02, 8/02, 22**E**/04, 46/07, 50/07; Aude/Pyrénées-Orientales: 20/04; Aveyron: 112/97; Herault: 110/97, 114**E**/97, 55/98; Kerguelen: 13/99, 15/99; Pyrénées-Orientales: 45/07
***Coprotus* spp.**
Aude: 17/02, 1**E**/05, 29/05; Aude/Pyrénées-Orientales: 20/04; Corsica: 8/01, 9/01

Without a modern monograph of the genus, the identification of small white *Coprotus* species with 8-spored asci presents difficulties. The morphological features of these 6 collections, particularly ascus size and shape and spore size and arrangement, are sufficiently distinct to allow the six to be considered different from each other, but do not agree well with the description of existing species. Indeed one (9/01) produced apothecia with dimorphic asci and spores – asci 95-100 × 26-29 µm and 50 × 8-10 µm, and spores 16 × 9-10 µm and 6 × 3 µm. – perhaps a 'chimera' composed of two species forming a single apothecium.

Iodophanus carneus (Pers.) Korf
Aude: 4/02, 17**E**/02, 18/02, 19/02, 56**E**/03, 88/04, 1/05, 30/05, 46**E**/07; Aveyron: 113/97; Corsica: 7**E**/01, 9/01; Guadeloupe: 1/07, 4/07; Herault: 114/97, 55/98, 56/98; Kerguelen: 4/01,11/01, 14/01; Lot: 23/99
Lasiobolus ciliatus (J. C. Schmidt: Fr.) Boud.
Corsica: 6/01; Herault: 51/98; Lot: 13/99
Lasiobolus cuniculi Velen.
Ariège: 86/01; Aude: 4/02, 6/02, 29/05, 46/07; Corsica: 5/01, 8/01, 9/01; Herault: 107/97, 108/97, 115/97, 24/98, 52/98, 55/98
Lasiobolus diversisporus (Fuckel) Sacc.
Aude: 11/03, 12/03; Pyrénées-Orientales: 45/07

Lasiobolus ruber (Quél.) Sacc.
Aude: 12/03
Peziza bovina Phill.
Corsica: 9/01
Peziza fimeti (Fuckel) Seaver
Aude: 29**E**/05
Peziza vesiculosa Bull.
Herault: 55**E**/98
Saccobolus *cf.* ***beckii*** Heimerl
Aude: 12/03

Distinguished from *S. versicolor* by the very thick and warted nature of the epispore. I observe a range of spore ornamentation, from smooth, through lightly cracked or flaky to quite rough, often from the same apothecium, in collections that I am content to identify as *S. versicolor*. The spores of this collection were on occasion notably very rough, although not consistently so, and are with hesitation identified as near to *S. beckii*.

Saccobolus citrinus Boud. & Torrend
Aude: 46/07; Corsica: 7/01, 9/01; Guadeloupe: 2/07, 3/07, 4/07, 5/07; Lot: 13/99, 23/99
Saccobolus depauperatus (Berk. & Broome) E.C. Hansen
Aude: 5/02; Corsica: 7/01, 8/01; Herault: 51/98; Lot: 13/99, 23/99; Morbihan: 15**E**/99
Saccobolus truncatus Vel.
Guadeloupe: 2/07, 3/07, 4/07, 5**E**/07

Van Brummelen (1967) observes that this is a widely distributed species, but in my experience it tends to occur at lower latitudes, with all but one of twelve other records from samples collected between 31°N and 20°S, so its occurrence on French samples only in the Caribbean region is perhaps not surprising.

Saccobolus verrucisporus Brumm.
Guadeloupe: 4/07
Saccobolus versicolor (P. Karst.) P. Karst.
Aude: 5/02, 88/04, 1/05, 30**E**/05; Aude/Pyrénées-Orientales: 20/04; Aveyron: 113/97; Cantal: 50/98; Herault: 114/97, 117/97, 52/98, 57/98; Pyrénées-Orientales: 45/07
Thecotheus holmskjoldii (E. C. Hansen) Chenant.
Aude: 4**E**/02, 8/02, 17/02, 18**E**/02; Corsica: 9/01

Thecotheus species are widespread, but not very common. I have 23 records of the genus from a total of over 10000 coprophil records, twelve of which are of *T. holmskjoldii*, on which basis it is one of the commonest species of the genus. Aas (1992) cites numerous collections worldwide, and examined material collected by Lundqvist from the Alpes de Haute Provence (Gorge du Verdon), and two collections from Corsica.

Thecotheus lundqvistii Aas
Aude/Pyrénées-Orientales: 20**E**/04

Thecotheus apothecia often take some time to appear in moist chamber culture, but after just 8 d'incubation a pure white, concave apothecium, 2.5 mm diam. was observed on a sample of cattle dung. The spores of the French collection were obliquely uniseriate, ellipsoid, symmetrical, 22.5-24 (-25.5) × 12.5-13 µm, smooth, with a hemispherical papilla at each pole, and a distinct gel. It is interesting that the sample was collected from the summit of a high pasture hill (elevation 1840 m) in the foothills of the Pyrénées, still with large snow patches and no cattle on the hill, so it is assumed that the dung was deposited the previous autumn and would have passed much of the winter under snow cover. It is apparently rare, with records only from Sweden and Spain (Aas, 1992), Italy (Doveri, 2004), and Greece (Richardson, 2008).

Trichobolus sphaerosporus Kimbr.
Corsica: 5/01; Herault: 54/98, and
Trichobolus zukalii (Heimerl) Kimbr.
Aude: 8/02, 56/03, 31/05; Corsica: 8/01

Trichobolus species occur early in the incubation period. They are infrequently recorded, although Doveri (2004) has described *T. zukalii* from 29 Italian collections, and discussed the differences between *T. zukalii* and *T. sphaerosporus.* Doveri distinguishes the two species particularly on the basis of spore morphology, considering collections with globose to subglobose spores with a Q (l/w) value of 1-1.16 (mean = 1.07), and with smaller spores (8.9-9.9 × 8.4-9.4 µm) to be *T. sphaerosporus*, and those with subglobose to predominantly ellipsoid spores (Q = 1-1.26, mean 1.19), and larger spores (10.5-12.6 × 9.4-10.5 µm) to be *T. zukalii*. Dissing (in Hansen & Knudsen 2000) distinguishes the two species on the basis of presence (*T. zukalii*) or absence (*T. sphaerosporus*) of de Bary bubbles in the spores, and gives very similar sizes for the spores of both species (*T. zukalii*: 9-11 × 7-8.5 µm, *T. sphaerosporus*: 9-10.5 × 8.5-9 µm), describing them both as subglobose. Doveri (2004), conscious of the readiness with which artefacts can be formed, prefers not to place reliance on the presence or absence of de Bary bubbles as a diagnostic feature, and I rarely observe them. Given the variation in interpretation of these two species, and the variation observed in material from individual collections, I treat the six French collections together. I have examined the spore sizes from 25 collections, including the 6 French ones, with the results as illustrated in Fig. 2, in which the minimum and maximum spore lengths and widths are plotted. There is considerable overlap between those identified as *T. sphaerosporus* (mean 10.4 × 9.6 µm, Q = 1.0-1.13 (mean = 1.08) and *T. zukalii* (mean 9.7 × 8.3 µm, Q = 1.14-1.21 (mean = 1.17), and it is still open to debate as to whether or not these differences are sufficient to separate two species, or represent the opposite ends of the range of a single species, one end with a tendency to have larger more rounded spores, the other with smaller more ellipsoid spores. These values agree very well with those given by Doveri (2004) for the material he has studied. In the French material apothecia were up to 350 µm diam., immersed, setose, each with a single polysporus ascus. In 54/98 setae were up to 420 µm long, hyaline, thick-walled, with septa 20-30 µm apart; ascospores hyaline, globose to broad ellipsoid, 9.5-10 × 9-9.5 µm. In 5/01 setae were shorter, up to 225 µm long and spores were a little larger, but still almost globose to broad ellipsoid, 9-12 × 8–11 µm. These two collections were determined as *T. sphaerosporus*. The other four collections, with sub-globose to ellipsoid spores 8-11 × 8-9.5 µm, were determined as *T. zukalii.*

Thelebolales
Ascozonus woolhopensis (Renny) Boud.
Aude: 3**E**/02, 6/02, 9/02; Tarn: 18**E**/98
Thelebolus microsporus (Berk. & Broome) Kimbr.
Herault: 24/98
Thelebolus stercoreus Tode
Aude: 3**E**/02, 6/02, 7/02, 1/05; Herault: 106/97, 107/97, 109/97, 24/98, 25/98, 26/98, 51/98, 53/98, 9/03, 10/03; Tarn: 18**E**/98, 20/98, 21/98, 22**E**/98

De Hoog *et al.* (2005), on the basis of molecular studies, accept only four species of *Thelebolus*: *T. stercoreus*, *T. microsporus*, and two new species described from biomats in Antarctica. They found that many cultures from phenotypically very different teleomorphs, including cultures from uniascal and polyascal types, with small to large asci, and few to very many-spored types, and

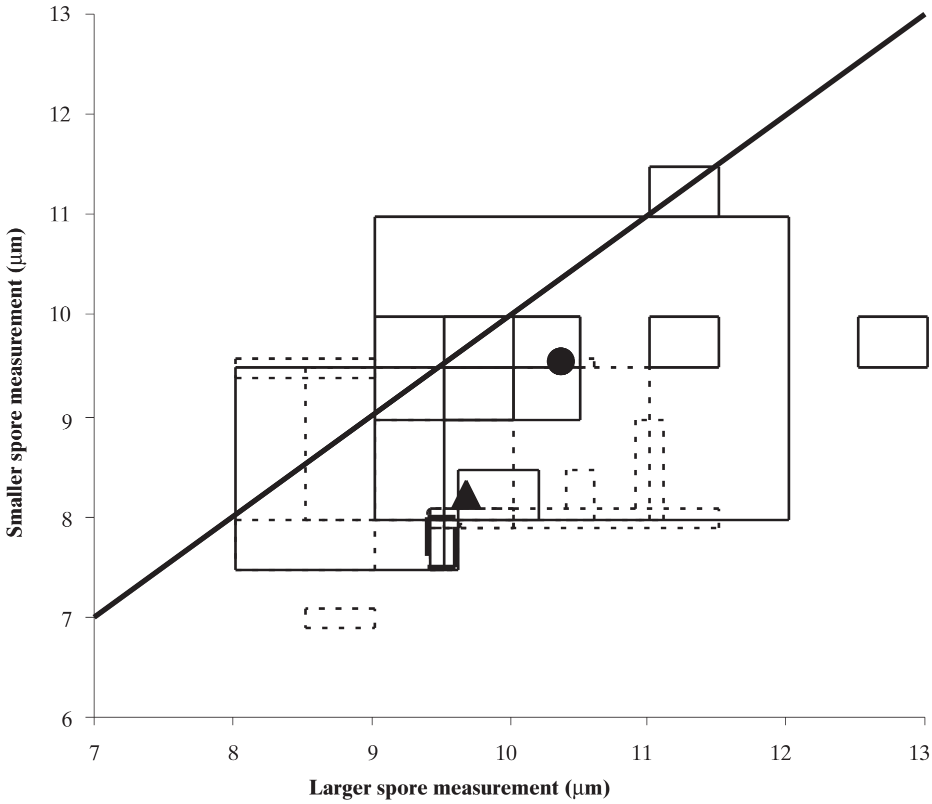

Fig. 2. Plots to show range of spore size recorded for 11 collections of *Trichobolus sphaerosporus* (unbroken lines, mean = ●) and 14 collections of *T. zukalii* (broken lines, mean = ▲). The straight line represents 'length = width', i.e. spores spherical; points below that line indicate a tendency towards spores being ellipsoid.

with many names, are molecularly indistinguishable from each other and from cultures of *T. stercoreus* from material with the classical morphological criteria of a single large ascus with 2000+ spores, and ecological preference for lagomorph dung. The records associated with the *T. stercoreus* entry above refer to that morphological understanding of *T. stercoreus*, and it was present on 13 of the 24 French samples of hare dung.

The following, according to the above, should be considered as forms of *T. stercoreus*, but were originally recorded as:

Thelebolus caninus (Auersw.) Jeng & J.C. Krug
Aude: 1/05

Thelebolus crustaceus (Fuckel) Kimbr.
Herault: 21/98, 53/98

Thelebolus nanus Heimerl
Aude: 5/02; Herault: 109/97, 25/98; Lot-et-Garonne: 44/07; Pyrénées-Orientales: 45/07

Thelebolus polysporus (P. Karst.) Otani & Kanzawa
Aude: 3/02, 4/02, 6/02, 7/02, 1/05, 50/07; Cantal: 50/98; Herault: 107/97, 26/98, 52/98, 57/98, 9/03; Kerguelen: 3/01, 4/01, 11/01, 12/01, 14/01; Lot-et-Garonne: 44/07
***Thelebolus* sp.**
Aude: 56/03; Aude/Pyrénées-Orientales: 19/04; Herault: 25/98

Helotiales
Orbilia leporina Velen.
Aude: 11/03, 12/03; Herault: 116/97; Pyrénées-Orientales: 45/07

Sordariales
Anopodium ampullaceum N. Lundq.
Herault: 109**E**/97; Tarn: 20**E**/98

Details of one of the French collections (109/97) were included in a discussion by Richardson (1998) of the various names given to the taxon, which has pedicellate spores like *Podospora* and *Schizothecium* but is unusual in having the pedicel directed towards the apex of the ascus. Since then another French collection has been found (20/98). This would seem to be a temperate species, recorded also from the UK and Sweden (unpublished), and from Sweden, Norway and Belgium by Lundqvist (1972), and the two French records would seem to be the most southerly so far. It occurs mainly on lagomorph dung (34 records), with occasional occurrences on other substrates (2 vole, 1 deer and 1 goose).
Apodospora gotlandica N. Lundq.
Aude: 29**E**/05

There appear to be no reports of this fungus since its description by Lundqvist (1972) from Swedish horse dung collected in 1959, so the French collection is described. Perithecia large, up to 750 µm diam, reddish brown below and opaque, so difficult to make out any detailed cellular structure, with a very dark, short (110 µm), opaque neck. Asci 8-spored, 320-385 × 23-27 µm, cylindrical above, tapering below to 100 µm long stipe, and with a marked KI-ve apical pore. Spores uniseriate, smooth, blackish brown, ellipsoid, (32-) 38-42 × (16-) 17.5-21 µm, with a faint germ pore at the distal end. Gel broad and uniform, expanding to 10 µm in water, and with an apical invagination.
Arnium arizonense (Griffiths) N. Lundq. & J.C. Krug
Aude: 4**E**/02, 5**E**/02, 18**E**/02, 30**E**/05, 31/05, 46/07; Corsica: 9/01; Lot: 23/99

Arnium is distinguished from related genera by the possession of gelatinous appendages on the ascospores, but no pedicel or primary appendage. *A. arizonense* is so far unique in having 4-spored asci. French collections had clavate asci 290-340 × 32-38 µm, and spores 41.5-55 × 19-26 µm, with tapering gelatinous appendages up to 200 µm long × 8-13 µm wide at their base, inserted asymmetrically at each end of the spore.
Arnium caballinum N. Lundq.
Aude: 12/03, 29**E**/05; Corsica: 6/01
Arnium hirtum (E.C. Hansen) N. Lundq. & J. C. Krug
Aude: 30**E**/05; Aveyron: 113**E**/97; Herault: 108**E**/97
Arnium imitans N. Lundq.
Aude: 29**E**/05
Arnium leporinum (Cain) N. Lundq. & J. C. Krug
Herault: 108**E**/97
Arnium mendax N. Lundq.
Aude: 11**E**/03; Corsica: 8**E**/01; Herault: 115**E** /97

***Arnium* sp**.
Aude/Pyrénées-Orientales: 20/04

Positive identification was not possible, with only limited material seen. The perithecium was schizothecioid in structure, the ascus form typical of an *Arnium* sp., and with no apical structure, and spores very small for 8-spored *Arnium* species, 19-19.5 × 12 µm.

Bombardioidea stercoris (DC.) N. Lundq.
Herault: 51**E**/98

Cercophora** cf. **anisura N. Lundq.
Aude: 29**E**/05

A tentative identification of limited and immature material, based on the schizothecioid structure of the perithecium, vermifom spores 42-52 × 4.5 µm, with appendages of unequal length.

Cercophora sordarioides (Speg.) N. Lundq.
Aude: 12**E**/03

Chaetomium bostrychodes Zopf
Aude: 9/02; Cantal: 50/98; Herault: 109/97, 51/98; Kerguelen: 13/01, 14/01; Lot-et-Garonne: 44/07

Chaetomium cf. cuniculorum Fuckel
Aude: 1/05

Coniochaeta hansenii (Oudem.) Cain
Aude: 6**E**/02; Aude/Pyrénées-Orientales: 19/04; Herault: 117**E**/97, 53/98

Coniochaeta leucoplaca (Berk. & Ravenel) Cain
Aude: 11/03, 22/04; Aude/Pyrénées-Orientales: 20**E**/04; Cantal: 50**E**/98

Coniochaeta ligniaria (Grev.) Massee
Aude: 17/02, 18**E**/04, 21**E**/04; Aude/Pyrénées-Orientales: 19**E**/04; Aveyron: 113/97; Corsica: 8/01; Herault: 109/97, 26/98, 52/98, 56/98, 9**E**/03; Pyrénées-Orientales: 45/07; Tarn: 19/98, 20/98, 21/98

Coniochaeta scatigena (Berk. & Broome) Cain
Aude: 18**E**/04, 29/05; Corsica: 6/01; Herault: 116/97,117/97, 52/98, 53/98, 54/98, 9**E**/03

Fimetariella microsperma J.C. Krug & J.H. Mirza
Herault: 114/97

Podospora australis (Speg.) Niessl
Aude: 4**E**/02, 5**E**/02, 18/02

Podospora bifida N. Lundq.
Herault: 115/97

Podospora communis (Speg.) Niessl
Guadeloupe: 1**E**/07, 2/07, 5/07

This is one of three species that appears to be characteristic of the perithecial mycobiota of dung from lower latitudes, with *P. immersa* and *P. longicaudata* (*q.v.*) (Richardson, in press). *P. communis* is the most frequent of the three and, although Lundqvist (1972) noted that it 'seems to be worldwide, … records from the tropics are still very few', and he refers to unverified records from France, my experience is that it is more frequent in samples from lower latitudes, with 24 of 30 of my collections from within the tropics.

Podospora curvicolla (G. Winter) Niessl
Ariège: 86/01

Podospora decipiens (G. Winter ex Fuckel) Niessl
Ariège: 86**E**/01; Aude: 4/02, 6/02, 57/03, 22**E**/04, 29/05, 30**E**/05, 31/05, 46/07; Aude/Pyrénées-Orientales: 20/04; Aveyron: 112/97, 113/97; Corsica: 6/01, 9/01; Herault:

110/97, 114/97, 115/97, 116/97, 24**E**/98, 52/98, 55/98; Lot 13/99, 23/99; Pyrénées-Orientales: 45/07; Tarn: 19/98, 20/98,

Podospora gigantea Mirza & Cain
Corsica: 9**E**/01

Podospora gwynne-vaughaniae (Page) Cain
Herault: 115/97

Podospora immersa (R. Stratton) Cain
Guadeloupe: 1**E**/07, 5/07

A lower latitude species with, in addition to these two records from Guadeloupe, six other occurrences from the Caribbean region (Richardson, in press), none from temperate regions in my collections or studied by Lundqvist (1972), and the type and other collections from the USA and Mexico all from south of 40°N (Mirza & Cain, 1969).

Podospora intestinacea N. Lundq.
Aude: 11**E**/03, 12**E**/03, 29**E**/05; Corsica: 6**E**/01, 9/01

Podospora longicaudata (Griffiths) Cain
Guadeloupe: 2/07, 3**E**/07, 4/07

A lower latitude species, with three records from Guadeloupe, three from St Lucia (Richardson, in press), one from Brazil (Richardson 2001b), none from temperate regions in my collections or studied by Lundqvist (1972), and the type and other collections from the USA, Puerto Rico, Mexico and Pakistan all from south of 40°N (Mirza & Cain, 1969).

Podospora myriaspora (P. Crouan & H. Crouan) Niessl
Aude: 28/05; Herault: 52/98

Podospora pauciseta (Ces.) Traverso
Aude: 31/05; Corsica: 9/01; Guadeloupe: 2/07, 4/07, 5/07; Lot: 13/99, 23/99; Morbihan: 15/99

Podospora pleiospora (G. Winter) Niessl
Aude: 8/02, 18/02, 22/04, 89/04, 1/05; Aveyron: 113/97; Cantal: 50/98; Herault: 110/97, 115/97, 24**E**/98, 25/98, 26/98, 51**E**/98, 55/98, 57/98; Lot 13/99, 23/99; Lot-et-Garonne: 44/07; Pyrénées-Orientales: 45/07

Podospora pyriformis (Bayer) Cain
Corsica: 8**E**/01

Podospora setosa (G. Winter) Niessl
Aude: 8**E**/02, 31/05; Corsica: 7/01; Lot: 13/99, 23/99; Lot-et-Garonne: 44/07

Podospora cf. similis (E.C.Hansen) Niessl
Aude/Pyrénées-Orientales: 20/04; Corsica: 6**E**/01

There are relatively few species of *Podospora*/*Schizothecium* with 16-spored asci, and details of the collections are given as they differ from those described. Perithecia dark, opaque, pyriform, 525-900 µm high × 200-410 µm diam, flexuose hairy below and distinctly setose at the neck, with dark septate hyphae, paler towards the tip, <200 µm long, some aggregated into asymmetrically arranged fascicles around the neck. Asci 16-spored, 225-340 × 35-70 µm, fusoid, tapering below, with no apical apparatus. Spores ellipsoid, the dark cell 32-35 × 16-19 µm, with apical germ pore. Pedicel small, 6-10 × 2-3 µm. Secondary appendages not obvious, but the whole spore is surrounded by a faint halo when mounted in Indian ink. *Schizothecium dubium* has spores of similar size, but is distinctly schizothecioid in perithecial structure, without rigid hairs, and has persistent appendages; *P. pleiospora* has characteristic sect. *Rhypophila* spores and tubercules at the perithecial neck, which were absent from this material. They are nearest to *P. similis*, but that is described without rigid setae, and with spore appendages (Mirza & Cain 1969), so this may be an undescribed species.

Schizothecium conicum (Fuckel) N. Lundq.
Aude: 8/02, 11/03, 12/03, 21**E**/04, 28/05, 29/05, 30/05, 31/05; Aude/Pyrénées-Orientales: 19/04, 20/04; Herault: 114/97, 52/98; Kerguelen: 12/01; Lot: 23/99
Schizothecium dakotense (Griffiths) N. Lundq.
Aude: 57**E**/03; Cantal: 50**E**/98
Schizothecium miniglutinans (Mirza & Cain) N. Lundq.
Herault: 9/03, 10E/03; Pyrénées-Orientales: 45/07
Schizothecium tetrasporum (G. Winter) N. Lundq.
Aude: 3/02, 4/02, 6/02, 7**E**/02, 8/02, 9/02, 19/02, 57/03, 21**E**/04, 88**E**/04, 1/05; Aveyron: 113/97; Cantal: 50/98; Herault: 108/97, 109/97, 117/97, 24/98, 26/98, 54/98, 57/98, 8/03, 9/03, 10**E**/03; Kerguelen: 4/01; Lot-et-Garonne: 44/07; Tarn: 18/98
Schizothecium vesticola (Berk. & Broome) N. Lundq.
Ariège: 86/01; Aude: 4/02, 5/02, 8/02, 18/02, 28/05, 29/05, 31/05, 46/07, 50/07; Aveyron: 113/97; Cantal: 50/98; Corsica: 5/01, 6/01, 7/01, 8/01, 9/01; Herault: 108/97, 109/97, 110/97, 115/97, 116**E**/97, 117/97, 24/98, 25/98, 26/98, 52/98, 53/98, 54/98, 55/98, 8/03; Lot: 13/99, 23/99; Pyrénées-Orientales: 45/07
Sordaria alcina N. Lundq.
Herault: 23**E**/98, 25/98, 8/03; Tarn: 18/98, 22**E**/98
Sordaria fimicola (Roberge ex. Desm.) Ces. & de Not.
Ariège: 86**E**/01; Aude: 18/02, 19/02, 56/03, 88/04, 89/04, 1/05, 28/05, 6**E**/06; Aveyron: 111/97; Cantal: 50/98; Corsica: 5/01; Herault: 106/97, 107/97, 108/97, 109/97, 115/97, 117/97, 51/98, 52/98, 53/98, 57/98, 8/03, 9/03; Lot: 13/99; Morbihan: 15/99; Tarn: 18/98
Sordaria humana (Fuckel) G. Winter
Aude: 18/04, 1/05; Herault: 106/97,107/97, 23/98, 26/98, 52/98, 53/98, 9/03; Lot: 13/99; Morbihan: 15/99
Sordaria macrospora Auersw.
Aude: 89**E**/04
Sordaria superba de Not.
Cantal: 50**E**/98; Tarn: 18/98
Zygopleurage zygospora (Speg.) Boedijn
Guadeloupe: 5/07
Zygospermella insignis (Mouton) Cain
Aude: 11**E**/03, 29**E**/05; Aude/Pyrénées-Orientales: 20**E**/04

Hypocreales
Melanospora fusispora (Petch) Doguet
Herault: 24/98, 25**E**/98
Selinia pulchra (G. Winter) Sacc.
Aude: 5**E**/02; Herault: 114**E**/97

Microascales
Cephalotrichum stemonitis (Pers.) Nees
Kerguelen: 3/01, 4/01, 11/01, 13/01, 14/01, 15/01

Occurring as the anamorphic form, *Doratomyces stemonitis* (Pers.) F.J. Morton & G. Sm. Noticeably prevalent on the samples from the Kerguelen Islands, perhaps favoured by the conditions in which they had been kept before or during transmission, since it usually only develops occasionally in my cultures.
Viennotidia fimicola (Marchal) P. F. Cannon & D. Hawksw.
Herault: 115/97

Onygenales
Arachniotus ruber (Tiegh.) J. Schröt.
Kerguelen: 16**E**/01
Gymnoascus reessii Baran.
Aude: 9**E**/02; Herault: 25**E**/98

Xylariales
Hypocopra brefeldii Zopf
Aude: 22**E**/04, 89/04, 1/05, 28/05, 6**E**/06, 50/07; Aveyron: 113/97; Herault: 26/98, 51**E**/98; Pyrénées-Orientales: 45/07
Hypocopra equorum (Fuckel) G. Winter
Aveyron: 111/97
Hypocopra festucacea J. C. Krug & Cain
Herault: 56**E**/98
Hypocopra merdaria (Fr.) Kickx f.
Aude: 17/02
Hypocopra ornithophila Speg.
Aude/Pyrénées-Orientales: 19/04
Hypocopra parvula Griffiths
Aude: 12**E**/03

For a discussion of the identity of this material see Richardson (2004). Krug (in litt.) has suggested that the European material determined as *H. parvula* is a different species still to be described.
Hypocopra stephanophora J. C. Krug & Cain
Herault: 107**E**/97, 117**E**/97
Hypocopra stercoraria (Sowerby) Sacc.
Herault: 56**E**/98
Phomatospora minutissima (P. Crouan & H. Crouan) N. Lundq.
Guadeloupe: 4/07, 5**E**/07; Herault: 114**E**/97; Lot: 23/99

This fungus is probably commoner than records indicate. It is usually seen only after a long period of incubation (at least 1 month, and often much longer, Richardson, 2002). The perithecia are very small, <150 µm diam., and immersed in the substrate, with only the erumpent neck and ostiole visible. *P. minutissima* has obliquely uniseriate, ellipsoid hyaline spores, 5-6 × 3 µm, while the very similar *P. coprophila* M. J. Richardson has spores that are short-rod shaped aligned linearly in the ascus. *P. coprophila* is frequent in the UK, and I have a record from the Falkland Islands; *P. minutissima* is widespread, and in addition to the French collections I have records from Brazil, Australia, St Helena, St Lucia and Dominica. Both species seem to occur most frequently on the dung of ruminants.
Podosordaria tulasnei (Nitschke) Dennis
Aude: 88/04, 30/05, 6/06; Aveyron: 111/97, 113/97; Herault: 106/97, 107/97, 108/97, 110/97, 24/98, 25/98, 26/98, 52/98, 53/98, 55/98, 57/98; Kerguelen: 4/01; Tarn: 18/98, 22/98

Identification of this species is based on the development of the characteristic long, branching stromata that grow from the dung. They have never produced perithecia in my cultures.

Dothideales
Delitschia excentrica Griffiths
Aude: 17**E**/02
Delitschia furfuracea Niessl
Aude: 57**E**/03; Herault: 107**/**97, 109**E**/97, 24/98, 25**E**/98

Delitschia marchalii Berl. & Voglino
Aude/Pyrénées-Orientales: 19/04
Delitschia niesslii Oudem.
Aude: 22**E**/04
Delitschia patagonica Speg.
Aude: 18/04, 50/07; Herault: 9**E**/03
Delitschia perpusilla Speg.
Aude: 22/04; Herault: 56/98
Delitschia tomentosa Luck-Allen & Cain
Aude/Pyrénées-Orientales: 19/04
Delitschia winteri Phill. & Plowright
Ariège: 86/01; Aude: 4/02, 46/07; Aude/Pyrénées-Orientales: 20/04; Aveyron: 112/97; Corsica: 9/01; Herault: 114/97, 117**E**/97
Preussia funiculata (Preuss) Fuckel
Pyrénées-Orientales: 45/07
Sporormia fimetaria (De Not.) De Not.
Herault: 108**E**/97, 115/97, 26**E**/98, 8/03

A widespread but infrequently recorded fungus, characterised by very small pseudothecia, *ca* 100 µm diam, and the eight 16-celled spores amalgamated into a bundle, resembling a maize cob, with terminal gelatinous appendages. Recorded from the UK, France, Morocco, Australia, USA and New Zealand.

Sporormiella australis (Speg.) S. I. Ahmed & Cain
Ariège: 86/01; Aude: 4/02, 5/02, 6/02, 7/02, 8/02, 9/02, 57/03; Aude/Pyrénées-Orientales: 20**E**/04; Aveyron: 111/97, 112/97; Cantal: 50/98; Corsica: 5/01, 6/01, 7/01, 8/01, 9/01; Herault: 106/97, 107/97, 108/97, 109/97, 114/97, 115/97, 117/97, 24/98, 25/98, 26/98, 52/98, 53/98, 54/98, 55/98, 57/98, 8/03, 9/03, 10**E**/03; Kerguelen: 4/01; Lot-et-Garonne: 44/07; Tarn: 18/98, 20/98, 21/98, 22/98

One of the commonest and most widespread coprophilous fungi, along with *S. intermedia*. At the upper end of its spore range there is often overlap with the lower end of that of *S. intermedia*, but on most occasions it is possible to distinguish them with confidence.

Sporormiella bipartis (Cain) S.I. Ahmed & Cain
Aude: 1/05; Tarn: 18/98, 20/98

Collection 1/05 differed from typical *S. bipartis* in having spores broader than normal, 9-9.5 µm *cf*. the more typical 6-7 µm, and a less obvious tendency for spores to break into 4-celled halves.

Sporormiella borealis (I. Egeland) J.C. Krug
Aude: 29/05
Sporormiella dubia S.I. Ahmed & Cain
Aude: 22/04
Sporormiella grandispora S.I. Ahmed & Cain
Aude: 11/03, 29/05, 46/07
Sporormiella heptamera (Auersw.) S.I. Ahmed & Cain
Cantal: 50/98
Sporormiella intermedia (Auersw.) S.I. Ahmed & Cain
Ariège: 86/01; Aude: 3/02, 6/02, 7**E**/02, 8/02, 9/02, 19/02, 11/03, 12/03, 56/03, 57/03, 18**E**/04, 22/04, 88/04, 89/04, 1/05, 28/05, 29/05, 6**E**/06, 46/07, 50/07; Aude/Pyrénées-Orientales: 19**E**/04, 20**E**/04; Aveyron: 111/97, 112/97, 113/97; Cantal: 50/98; Corsica: 5**E**/01, 6/01, 8/01; Herault: 107/97, 109/97, 110/97, 115/97, 117/97, 24/98, 25/98, 26/98, 51/98, 52/98, 53/98, 54/98, 55/98, 56/98, 57/98, 9/03, 10/03; Kerguelen: 4/01; Pyrénées-Orientales: 45/07; Tarn: 18/98, 19/98, 20/98, 21/98

Sporormiella lageniformis (Fuckel) S.I. Ahmed & Cain
Ariège: 86/01; Aude: 6/02, 12/03, 46/07; Aveyron: 113/97; Corsica: 8/01; Herault: 115/97, 116/97
Sporormiella leporina (Niessl) S.I. Ahmed & Cain
Aude: 8**E**/02
Sporormiella longispora (Cain) S.I. Ahmed & Cain
Aude: 1**E**/05
Sporormiella megalospora (Auersw.) S.I. Ahmed & Cain
Aude: 4/02, 8/02,17/02; Aveyron: 112/97; Herault: 56/98
Sporormiella minima (Auersw.) S.I. Ahmed & Cain
Ariège: 86/01; Aude: 4/02, 18/02, 19/02, 28/05, 31/05, 46/07; Aveyron: 111/97, 112/97; Guadeloupe: 3/07, 4/07; Herault: 109/97, 110/97, 114/97, 115/97, 117/97; Lot: 13/99
Sporormiella octonalis S.I. Ahmed & Cain
Corsica: 6/01
Sporormiella ontariensis (Cain) S.I. Ahmed & Cain
Aude: 22**E**/04
Sporormiella ovina (Desm.) S.I. Ahmed & Cain
Aude: 17/02, 46/07
Sporormiella pascua (Niessl) S.I. Ahmed & Cain
Aude/Pyrénées-Orientales: 20**E**/04
Sporormiella pulchella (E.C. Hansen) S.I. Ahmed & Cain
Aude: 17**E**/02
Sporormiella teretispora S.I. Ahmed & Cain ex J.C. Krug
Aude: 57/03; Aude/Pyrénées-Orientales: 22**E**/04; Aveyron: 111/97; Corsica: 6/01
Trichodelitschia bisporula (P. Crouan & H. Crouan) Munk
Aude: 18**E**/04, 22**E**/04,1/05; Aude/Pyrénées-Orientales: 19**E**/04; Aveyron: 113/97; Cantal: 50/98; Corsica: 6/01, 8/01, Herault: 107/97, 108**E**/97, 115/97, 116/97, 26/98, 54/98, 55/98, 9/03, 10/03; Tarn: 20/98
Trichodelitschia munkii N. Lundq.
Pyrénées-Orientales: 45/07

BASIDIOMYCOTINA
Coprinellus curtus (Kalchbr.) Vilgalys, Hopple & Jacq. Johnson
Ariège: 86/01
Coprinellus heptemerus (M. Lange & A.H. Sm.) Vilgalys, Hopple & Jacq. Johnson
Aude: 30/05; Corsica: 5/01; Herault: 24/98, 52/98; Lot: 13/99; Tarn: 18/98
Coprinellus** cf. **heterosetulosus (Locq. ex Watling) Vilgalys, Hopple & Jacq. Johnson
Aude: 46/07
Coprinellus marculentus (Britzelm.) Redhead, Vilgalys & Moncalvo
Guadeloupe: 2**E**/07
Coprinellus pellucidus (P. Karst.) Redhead, Vilgalys & Moncalvo
Aude/Pyrénées-Orientales: 20/04; Guadeloupe: 3**E**/07; Herault: 114/97, 115/97
Coprinopsis filamentifer (Kühner) Redhead, Vilgalys & Moncalvo
Aude: 18/02, 12/03, 56**E**/03; Aveyron: 112/97; Herault: 110/97, 114/97, 115/97, 24/98
Coprinopsis nivea (Pers.) Redhead, Vilgalys & Moncalvo
Guadeloupe: 4**E**/07, 5/07
Coprinopsis radiata (Bolton) Redhead, Vilgalys & Moncalvo
Lot: 23/99; Morbihan: 15/99,
Coprinopsis stercorea (Fr.) Redhead, Vilgalys & Moncalvo
Aude: 5/02, 56/03, 46/07; Aude/Pyrénées-Orientales: 20/04; Corsica: 5**E**/01, 8/01; Guadeloupe: 1**E**/07; Herault: 109/97, 110/97, 114/97, 54/98, 8/03, 10/03; Lot-et-Garonne: 44/07; Tarn: 22/98,

Coprinopsis utrifer (Joss. ex Watling) Redhead, Vilgalys & Moncalvo
Aude: 11/03
Coprinopsis vermiculifer (Joss. ex Dennis) Redhead, Vilgalys & Moncalvo
Aude: 18/02, 29/05, 30/05, 31/05
Coprinus cordisporus T. Gibbs
Aude: 11**E**/03, 12/03, 57/03, 29/05; Aude/Pyrénées-Orientales: 20/04; Guadeloupe: 2**E**/07; Herault: 54/98
Coprinus ephemeroides (DC.) Fr.
Aude: 12/03; Corsica: 9/01; Herault: 8/03
Coprinus *cf.* ***foetidellus*** P.D. Orton
Aude: 46/07
Coprinus pseudoradiatus Kühner & Joss.
Guadeloupe: 3**E**/07; Lot: 13/99
Panaeolus fimicola (Pers.) Gillet
Aude: 29**E**/05
Panaeolus sphinctrinus (Fr.) Quél.
Aude: 11**E**/03; Aude/Pyrénées-Orientales: 20**E**/04
Parasola misera (P. Karst.) Redhead, Vilgalys & Hopple
Aude: 11/03, 12/03, 56**E**/03, 28/05, 46/07; Corsica: 6/01, 8/01, 9/01; Herault: 109/97, 115/97, 117/97, 24/98, 25/98, 26/98, 52/98, 56/98,8/03, 9/03, 10/03; Kerguelen: 4/01; Pyrénées-Orientales: 45/07

Together with *Coprinopsis stercorea*, one of the commonest and most widespread basidiomycetes occurring on incubated dung.

Pholiotina coprophila (Kühner) Singer
Aude: 29**E**/05
Psathyrella coprophila Watling
Aude: 29/05
Psilocybe coprophila (Bull. ex Fr.) Quél.
Aude: 19/02
Stropharia semiglobata (Batsch. ex Fr.) Quél.
Herault: 51/98; Tarn: 19/98

MITOSPORIC FUNGI

Dictyosporium toruloides (Corda) Guég.
Herault: 114/97
Volutella ciliata (Alb. & Schwein.) Fr.
Aude: 19/02; Lot-et-Garonne: 44/07

MYXOMYCOTA

Didymium difforme (Pers.) Gray
Lot-et-Garonne: 44/07

DISCUSSION

The sixty-seven samples from mainland France provided a total of 738 records of 150 species. The mean species richness of 11 per sample is within the range of values of 9-12 obtained for various herbivore mammalian dungs in the worldwide survey (Richardson 2001a). The five Corsican samples provided

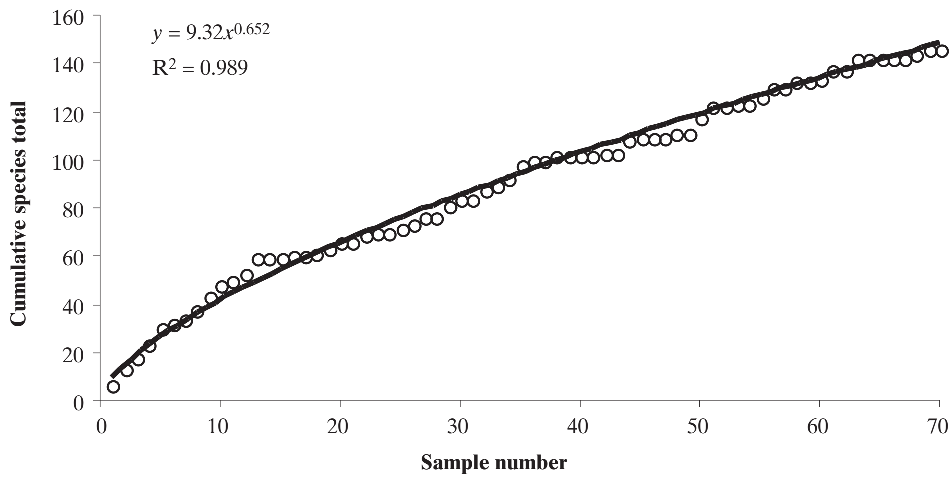

Fig. 3. Cumulative total of taxa observed in successive samples of mammalian herbivore dung from mainland France and Corsica (latitude 41.75 – 44.75°N). The equation for the line of best fit is given on the graph.

a further 62 records of 41 species, of which seven were additional to those recorded from the mainland. The cumulative species curve for the 70 samples collected in a 3° belt of latitude in mainland France and Corsica (41.75-44.75°N) provide an estimate of 119 species to be expected from 50 samples (Fig. 3). Richardson (2001a, 2006) showed that studies of coprophilous fungi can be used to illustrate the latitudinal gradient of increasing species richness with decreasing latitude. The value of 119 species for around 43°N in France can be compared with values of 73-102 for samples from higher latitudes (65-50°N, Iceland, Canada/USA, Finland, Faroe Islands and the UK, and the Falkland Islands, 51°S), and 117-142 for lower latitudes (40°N-40°S, USA, Brazil, the Caribbean region, St Helena and Australia) (Richardson, 2006). The samples from the Kerguelen Islands produced a very limited mycota, with only 26 records of 13 species from nine samples. More samples would be needed to determine whether this is due to their remote position *per se*, or the difficulties of collecting and returning samples in a way that is not deleterious to the fungi. In contrast, the five samples from Guadeloupe provided 21 species typical of lower latitude coprophilous fungi, although the overall diversity estimate of 85 species from 50 samples from 21 Caribbean island samples was much lower than would be expected from tropical regions. It may be that this low value is due to the fact that the Caribbean islands have never been connected to a continental landmass, and have a restricted terrestrial mammalian fauna (Richardson, in press).

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