

A new species of *Coprinus* from damp ceiling

by

Johannes A. Schmitt

FR Biochemie, Universität des Saarlandes, D-66041 Saarbrücken, Germany

and

Roy Watling

Royal Botanic Garden, Inverleith Row, Edinburgh, EH3 5LR, Scotland

With 2 figures and 2 tables

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Abstract: A new species in the *Coprinus gonophyllus* complex is described from a damp ceiling in Germany; a second collection is noted from Great Britain; the mean spore volumes in the considered species are discussed.

Zusammenfassung: Eine neue Art aus dem *Coprinus gonophyllus*-Komplex wird von einem Fund an einer feuchten Gipsdecke aus Deutschland beschrieben; eine zweite Kollektion stammt aus Großbritannien; eine Diskussion der mittleren Sporenvolumina der betrachteten Arten schließt sich an.

Key words: *Coprinus grossii* sp. nov., *Coprinus gonophyllus* complex, Coprinaceae, spore volume.

Introduction

Several coprini prefer to grow on calcareous soils etc. in woodlands, those especially containing *Fagus sylvatica* L., e.g. *Coprinus picaceus* (Bull.: Fr.) S.F. Gray (Sect. *Impexi*) and *C. episcopalis* P.D. Orton (Sect. *Impexi*) or even on base rich humus, e.g. *Coprinus cortinatus* J. Lge. (Sect. *Vestiti*), some even grow on plaster in houses, e.g. members of the *C. gonophyllus*-group. In total four distinct taxa have been recognised on damp plaster in addition to *C. gonophyllus*; one having been found in two European countries is now formally described. It differs from the related *C. gonophyllus* Quélet (Quélet 1872) in its much larger dimensions of both the basidiomes and basidiospores. Apparently there is still much work to do when good material comes to hand, many of the specimens noted below having been received in a late stage of maturity and so defy description.

Results and discussion

Coprinus grossii Schmitt & Watling, sp. nov.

Figs. 1, 2

Basidioma primo hemisphericus hirsutus albus. Pileus albus, pulverulentus 0.5-25 mm totus farinoso-squamulosus sordide ochraceotinctus obtectus margine plicato-sulcato. Stipes primo 4 × 1 mm prostremo 50-100 × 1-1.5 mm albus subaequalis vel sursum attenuatus ad basim applanato obscuriore hirsuto. Lamellae nigrae. Caro tenuis. Sporae 8-10.22-14 × 6.5-8.96-11.5 µm. Cellulae veli filamentosae pilei + cylindricae vel aseptis angustiores 7.2-14.5 µm diam.

Typus Schmitt 23091 Ad tectorium Germania.

BASIDIOMATA at first hairy, hemispherical, white; **PILEUS** white, powdery, expanding 0.5-25 mm, with ochraceous to light brown, desertile covering of squamules or flakes, resembling cotton; margin plicate-striate. **STIPE** white, cylindric, tapering, 4 mm at first elongating to 50-100 × 1-1.5 mm Ø, with flattened basal disc (2-4 mm Ø, 1 mm thick) with radiating mycelial strands, showing at first negatively then positively geotropic growth. **GILLS** finally black, soon deliquescent.

BASIDIOSPORES 8-10.22-14 × 6.5-8.96-11.5 µm, smooth, dark red-brown in water and ammoniacal solutions, with small apiculus and distinct but rather hidden germ-pore lacking marginal flange. **BASIDIA** 4-spored, clavate, hyaline, 22.5-25 × 8.5-10.5 µm. **BRACHYCYSTIDIA** vesiculose, hyaline, thin-walled, 21-30 × 14.5-17 µm. **CHEILOCYSTIDIA** inflated, hyaline, thin-walled, 27.3-30 × 36.5 µm; **PLEUROCYSTIDIA** probably similar, difficult to recover. **VEIL ON PILEUS** consisting of irregular filamentous, often inflated, hyaline hyphae with ochraceous brown lenses or deposits between adjacent cells, in places narrowed at septa, cells sometimes with scattered projections on the wall and sometimes thickened for short lengths, 7.3-14.5 µm broad. **PILEIPELLIS** filamentous of radially arranged hyphae <20 µm broad, often with glassy walls and seated on rather inflated broadly ellipsoid cells of the context (<20 µm broad). **CLAMP-CONNECTIONS** obscured.

HABITAT: Germany, Saarbrücken, University of Saarland, Inst. Biochemistry, on damp ceiling in laboratory, 30.X.1995, Schmitt 23086, 2.XI.1995, Schmitt 23091 (Dupl. in E), 23.XI.1995, Schmitt 23160, accompanied by ascomata of *Peziza micropus* Pers. [Schmitt 23087] and *Peziza domiciliana* [Schmitt 23161].

A collection from Scotland (Strathclyde, Glasgow, in house, growing out from behind wall-paper at junction with ceiling, VIII.1979, Wat.13381) agrees in all ways with the Saarbrücken material. Unfortunately the material was received in a very deliquescent state.

ETYMOLOGY: *grossii*-named in honour of Dr. Gerhard Gross, the German specialist in hypogeous fungi.

NOTES: *C. grossii* has some characters in common with *C. gonophyllus* Quél. (Sect. *Impexi*) with which it shares a similar spore-shape (see Fig. 2), although the spores

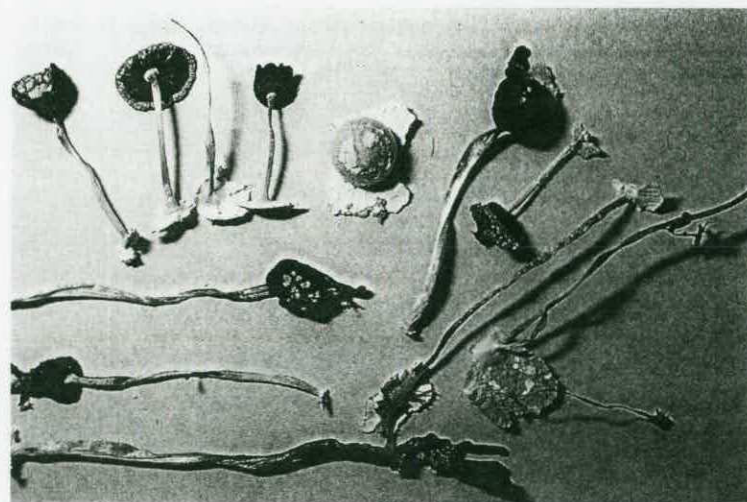
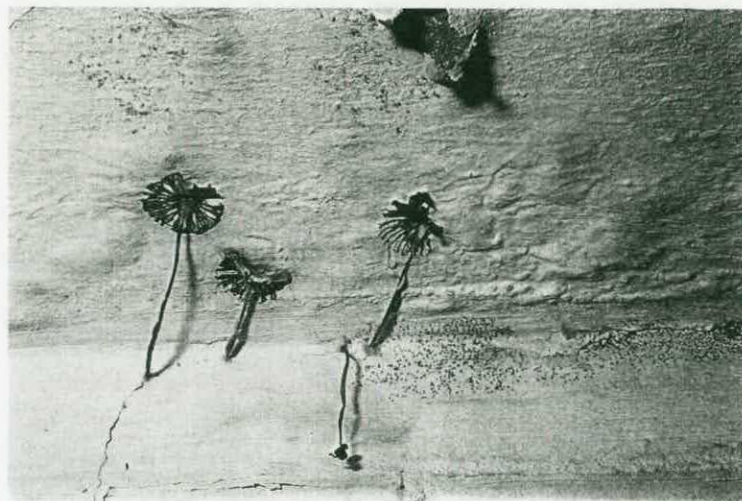
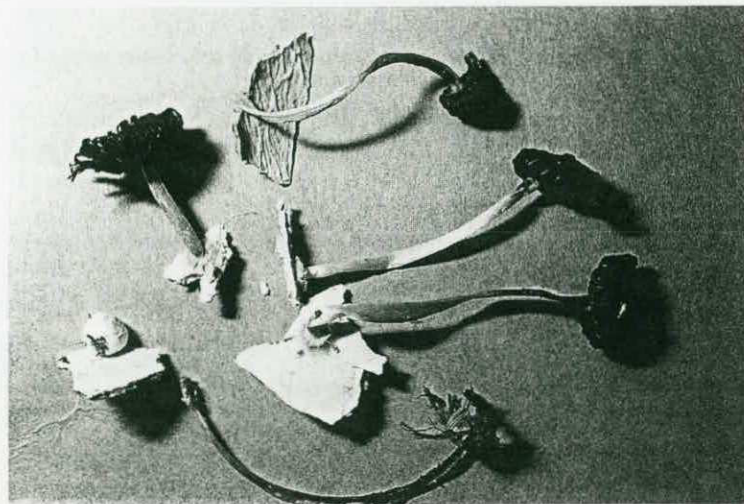
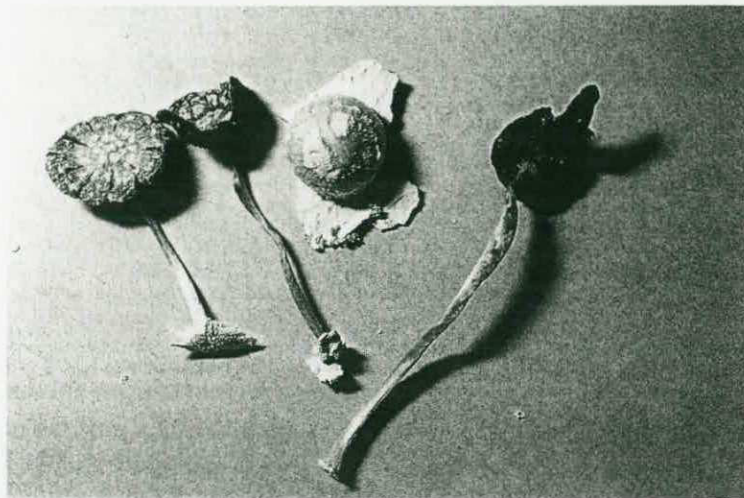


Fig. 1. *Coprinus grossii* sp. nov., basidiomes of the collections from Saarbrücken, photos by J.A. Schmitt. - a) on damp ceiling; b, c, d) in different growing states.



are consistently smaller in the latter. *C. platypus* Berk. (Sect. *Herbicolae*) described from a greenhouse, and *C. episcopalis* also have smaller spores but their spore-volumes are an order of magnitude higher again. *C. flocculosus* DC. ex Fr. (= *C. rostrupianus* Hansen; Sect. *Micacei* emend.) is similar also in spore volume but differs in its lack of a flattened basal disc to the stipe, habitat preferences, viz. on soil mixed with sawdust or straw, and in its even longer and slender spores.

Spore volume consideration

It has been found that the mean spore volume V_m is a significant feature of a species, e.g. in the genera *Tuber*, *Scleroderma* a.s.o. (Gross & Schmitt 1974); also in *Agrocybe*, *Clitocybe*, *Cortinarius*, *Gyromitra*, *Hohenbuehelia*, *Hydnobolites*, *Lactarius*, *Morchella*/*Mitrophora*/*Ptychoverpa*, *Oudemansiella*, *Pholiota*, *Russula*, *Simocybe*, *Stropharia*, *Thelephora*, *Volvariella*, *Xylaria* a.s.o. (Derbsch & Schmitt 1987). In Table 1 the spore data of *Coprinus* collections from different sources and macroscopically similar to *C. grossii* are listed, the mean spore volumes are mostly calculated from the mean linear spore dimensions l_m , b_m and d_m .

Tables 1 and 2 show that all the four-spored *Coprinus* species discussed can be arranged easily in 'Ploidy-level-groups', based on the ratio of their mean spore volumes V_m . A doubling of V_m statistically indicates a doubling of the ploidy-level, according to the nucleus/cytoplasm-relation in cells. There is only few information on this interesting field in other papers. Wittmann-Meixner (1989) for example investigated *Paxillus* species concerning polyploidy and found, that their spore volumes are directly correlated with the relative nucleus DNA content, following the nucleus-plasma-relation (see also Wittmann-Meixner & Bresinsky 1989). The DNA contents in Boletales species allowed to postulate ploidy levels in the range of 1 to 10, the level 2 being the most distributed one. The five *Coprinus* species investigated by Wittmann-Meixner (*C. radiatus*, *C. lagopus*, *C. cinereus*, *C. comatus*, *C. atramentarius*) show a relative DNA content in mycelial hyphae in the range of 45 to 72 and a good correlation between chromosome number and nuclear DNA content (Wittmann-Meixner et al. 1989), therefore interpreted as aneuploid species. But it is very difficult to determine exactly the chromosome numbers in fungi, the reported results for one defined species may differ in a wide range. In *C. atramentarius* for example the chromosome numbers found by different authors are in the range of 3 to 16 (see table 10 in Wittmann-Meixner 1989). But there are no investigations in basidia or spores to show correlations between spore volumes and spore DNA contents or chromosome numbers in this *Coprinus* species.

C. gonophyllus with the smallest $V_m = 125,1 \mu\text{m}^3$ is the 'base-species' in the Ploidy-group 1. In the next, Ploidy-group 2, the species with a mean spore volume of about $211,6 \mu\text{m}^3$, that means twice as large as in *C. gonophyllus*, are *C. episcopalis*, *C. friesii* (excepting Lange's interpretation; Lange 1939), *C. platypus*, *Coprinus* sp. Wat. 638C, *Coprinus* sp. Wat. 17331 and *Coprinus* sp. from Japan (close to *C. platypus*, Nihon Nr. 938, 4.XII.76); these species should be (auto?-)'diploid' in relation to *C. gonophyllus*.

The *C. friesii* documented by Lange (1939) seems to be a species assignable to the Ploidy-level-group 3, because its mean spore volume V_m is $338.6 \mu\text{m}^3$, a figure corresponding well with the expected value of 340.8 (calculated from the mean basis-spore-volume $V_{Bm} = 113.6 \mu\text{m}^3$, see Table 2).

C. grossii and *C. flocculosus* are members of the Ploidy-level group 4 where the mean spore volume V_m of about $442.2 \mu\text{m}^3$ is two-fold higher than in Group 2 and four-fold higher than in *C. gonophyllus*, and should be 'tetraploid' in relation to this species. Genetic studies are essential to confirm these interpretations and conclusions, summarized in Table 2.

Concerning the mean spore volumes V_m (calculated from the spore data given in Moser 1983), this five *Coprinus* species investigated by Wittmann-Meixner can be arranged in the following scheme of ploidy levels in the range of 1 to 4: *C. atramentarius* with V_m of $126.3 \mu\text{m}^3$ in ploidy level 1 („base species“), *C. cinereus* and *C. lagopus* with V_m of about $240.6 \mu\text{m}^3$ in ploidy level 2, *C. radiatus* with $V_m = 301.5$ in ploidy level 3 and *C. comatus* with $V_m = 412.3 \mu\text{m}^3$ in ploidy level 4 (mean basis-spore-volume $V_{Bm} = 114.1 \mu\text{m}^3$) agreeing well with the ploidy-scheme of the *Coprinus* species near to *C. gonophyllus*, discussed in our paper (see Tables 1 & 2). But the DNA-content or the dimensions of the nuclei in the spores of all the discussed species should be investigated in the future, to confirm our spore volume considerations.

Additional material examined

UK material is deposited in E.

Coprinus gonophyllus. Germany-Saarland: Warndtweiher, 6.V.1972, legit H. Derbsch; 3 basidiomes on burnt ground; the distribution of this species in Saarland is documented in Derbsch & Schmitt (1984, No 344, p. 229; 1987, p. 305). United Kingdom-England: Lancashire, Freshfield, 16.VII.57, Orton 1147. Two collections from Scotland with darker spores but otherwise agreeing with Orton 1147 have been examined: Perthshire, Aberfoyle, in house, on wet plaster, legit A. Grierson, Oct. 1951. Midlothian, Edinburgh, Drumsheugh, on plaster wall, 19.VIII.1954, Henderson 1411.

C. aff. gonophyllus. Characterised by spores with a wide germ-pore encircled by wide lip-like flange ($7.3\text{-}9.4 \times 5.8\text{-}8.8 \mu\text{m}$) but otherwise very similar. United Kingdom-England: Yorkshire, Howdale, burnt patches, 31.X.1962, Wat. 619C;

Fig. 2. A-I. *Coprinus grossii* sp. nov., Holotype except D. J-N: Basidiospores of related *Coprinus* spp. mentioned in text. All material in E. - A: Development of basidiome. B: Mature basidiomes one showing pileus surface. C, D: Mature basidiospores (D: Wat. 13381). E, E': Section and face of gill showing pleuro- (p) and brachycystidia (b). F: Cheilocystidia. G: Basidia. H: Veil constituents. I: Cells from immediately below velar tissue. J: *Coprinus* sp. Wat. 17331, spores with a pale spot in place of a distinct germ-pore. K: *Coprinus gonophyllus*, Orton 1147. L: *Coprinus gonophyllus* with darker spores, Henderson 1411. M: *Coprinus aff. gonophyllus*, spores with lipped germ-pore, Wat. 552 C. N: *Coprinus* sp. Wat. 638 C, spores with a flat germ-pore.

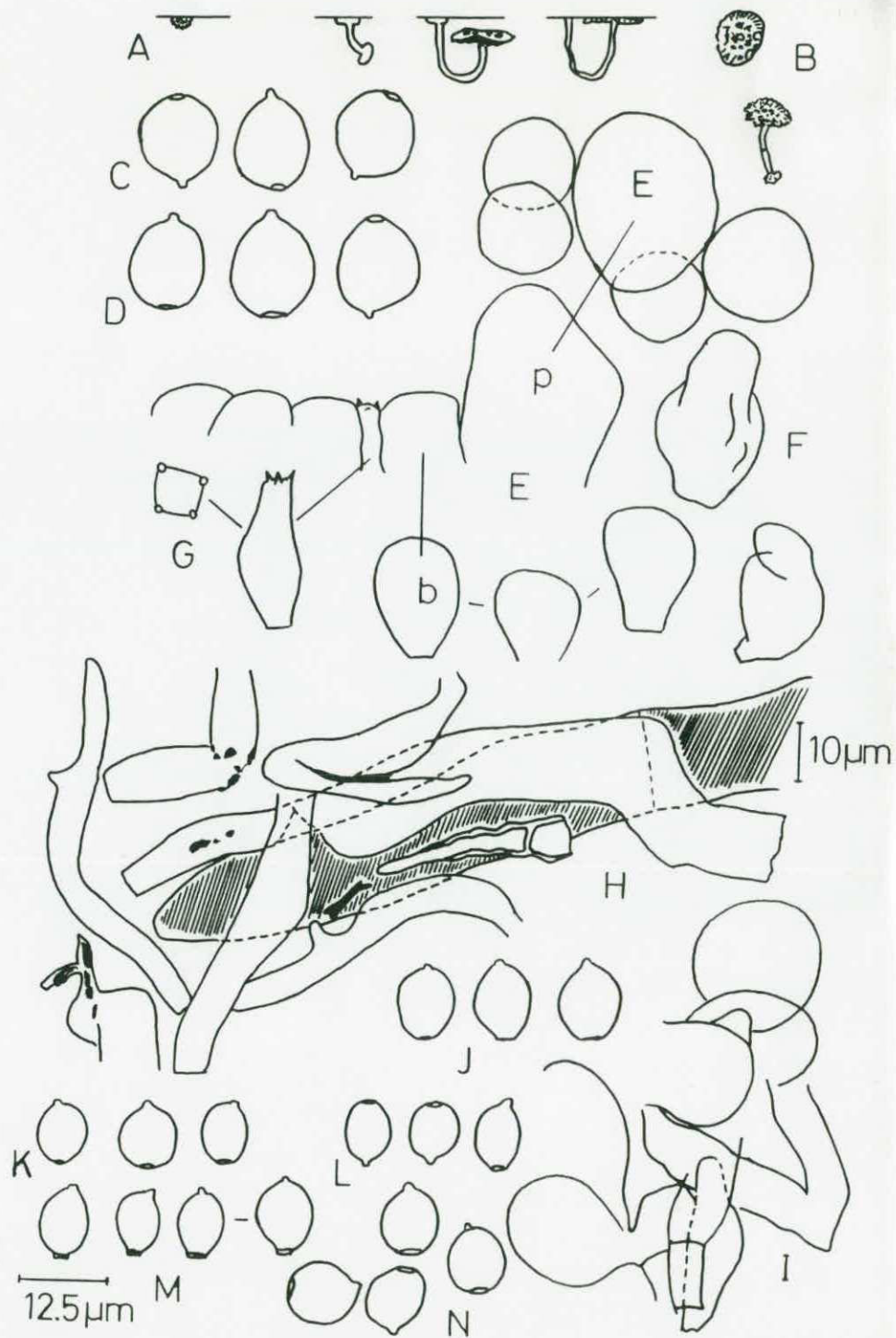


Table 1. Overview on spore dimensions in *Coprinus* species, macroscopically related to the new species *C. grossi*, from various sources (papers, collections); dates with * are mean values from arithmetical mean of measured values; the spore volumes are calculated from the ellipsoid volume formula $V = (\pi : 6) \cdot d \cdot b \cdot l$, where d = breadth, b = thickness and l = length of spore; volume dates without * are calculated from the mean of the range of the linear spore dimensions, given in the sources; * mean values calculated from arithmetic mean of spore measurements. The great range of V_m in groups bases on the gaussian distribution of spore volume values.

a) Ploidy = deduced from the comparison of the mean V_m -values of the groups 1 to 4 in respect to the general nucleus/cytoplasm-relation in cells.

Ploidy- Group ^{a)} (level)	Coprinus species Source	Range of linear spore dimensions			Mean spore dimensions			
		l	d	b [µm]	l _m	d _m	b _m [µm]	V _m [µm ³]
1 C. gonophyllus Quélet, Ann. Sci. Nat. Bordeaux, 14, Supp. 5, pl. 1 (1884)								
	Derbsch/Saar 6.5.1972):	7-8.1	x 5.5-7.1	x 5.5-6	7.55	x 6.3	x 5.75	143.2
	Joss, 1955: 120-123	6.6-9	x 6.5-8	x 5.2-6	7.8	x 7.25	x 5.6	165.8
	Kühn./Romagn. 1953: 387	6-8	x 5.5-6.7	x 4.5-5	7.0	x 6.1	x 4.75	106.2
	Mal./Bert. 1970 I: 232	7-8.2	x 6.5-7	x 4.5-5	7.6	x 6.75	x 4.75	127.6
	Moser 1983: 255	6-8	x 5.5-6.7	x 4.5-5	7.0	x 6.1	x 4.75	106.2
	Orton 1957: 273	6-7.5(-8)	x 5.5-6.5	x 4.5-5	6.75	x 6.0	x 4.75	100.7
	Orton/Watl. 1979: 46-47	6.5-9	x 6-7.5	x 5-6	7.75	x 6.75	x 5.5	150.6
	Piliát 1951: 377	6-7.5(-8)	x 5.5-6.5	x 4.5-5	6.75	x 6.0	x 4.75	100.7
	Romagn. 1945: 79-80	6-7.5(-8)	x 5.5-6.5	x 4.5-5	6.75	x 6.0	x 4.75	100.7
	Uljé/Noord. 1997: 299-300	6.2-8.7	x 5.3-8.2	x 4.8-6.5	7.45	x 6.75	x 5.65	148.8
mean V_m = 125.1								
Ploidy-Group 1: mean V_m = 125.1								
2 C. episcopalis Orton, Trans. Brit. Myc. Soc. 40: 270 (1957)								
	Moser 1983: 254	7.5-10	x 6-8		8.75	x 7.0		224.6
	Orton 1957: 270-272	7.5-10	x 6.5-8	x 5.5-6.5	8.75	x 7.25	x 6.0	199.3
	Orton/Watl. 1979: 37-38	7.5-10	x 6.5-8	x 5.5-6.5	8.75	x 7.25	x 6.0	199.3
	Uljé/Noord. 1997: 305-307	(6.7-7.9-10.7(-11.3)) x 5.8-9.0(-11.0)	x 4.8-6.7		9.3	x 7.4	x 5.75	207.2
mean V_m = 207.6								
2 C. friesii Quélet, Les Champignons du Jura et des Vosges, I. 159 (1872)								
	Bas 1971: 47	7-9.5	x 6-7.5(-8.5)		8.25	x 6.75		167.0
	Bend./End. 1988: 54-55	8-9.2	x 5.8-7.6		8.6	x 6.7		202.0
	Imaz./Hongo 1965: 56	7.5-9.5	x 6-7		8.5	x 6.5		188.0
	Kühn./Romagn. 1953: 387	8-10	x 5.5-7.5		9.0	x 6.5		199.1
	Mal./Bert. 1970 I: 230	8.6-11.8	x 6-7.7		10.2	x 6.85		250.6
	Moser 1983: 256	8-10	x 7.5-9	x 5.5-7	9.0	x 8.25	x 6.25	243.0
	Orton/Watl. 1979: 45-46	7-9(-11)	x 7-8(-9)	x 6-7	8.0	x 7.5	x 6.5	204.2
	Pil./Svr. 1967: 137-142	7-9.5	x 6-7.5(-8.5)		8.25	x 6.75		167.0
	Redh./Traq. 1981: 375	7.5-9.3	x 5.5-7.9		8.4	x 6.7		197.4
mean V_m = 202.0								

Table 1. continued

Ploidy- Group (level)	Coprinus species Source	Range of linear spore dimensions			Mean spore dimensions			
		l	d	b [µm]	l _m	d _m	b _m [µm]	V _m [µm ³]
2 C. platypus Berkeley, in: Cooke's Illustr. 1888: 234, 1886 pl. 687B [675B]								
	Gröger 1959: 55-56	(6.5-7.5-10(-11))	x 6-7.5(-8)		8.75	x 6.75		208.7
	[Masseé 1892/1902	8	x 6		8	x 6		150.77]*
	Moser 1983: 255	(6.5-7.5-10(-11))	x 6-7.5(-8)		8.75	x 6.75		208.7
	Redh./Traq. 1981: 398 = Mesh. Pegler from type	7.5-9.5	x 6-7.5		8.5	x 6.75		202.8
mean V_m = 206.7								
2 C. sp. Wat. 638C*								
		7.0-7.9	x 6.6-7		7.42	x 6.83		181.2
2 C. sp. Wat. 17588*								
		8.2	- 9.4	x 6.1-7	8.79	x 6.53		196.2
2 C. sp. Wat. 17331								
		8.5-9.1	x 6.1-7.9		8.8	x 7.0		225.8
2 C. sp. Japan (cf. platypus)								
	Nihon Nr. 938, 4.12.76	9-11	x 6.8-8	x 6.5-7	10.0	x 7.4	x 6.75	261.5
Ploidy-Group 2 mean V_m = 211.6								
3 C. friesii ss. Lange, Flora Agaricina Danica, Vol. IV: 112 (1939)								
	Lange 1939: 112	8.5-10.5	x 7.5-9		9.5	x 8.25		338.6
Ploidy-Group 3: "mean" V_m = 338.6								
4 C. flocculosus De Candolle ex Fries, Epicrisis Syst. Myc.: 245 (1838)								
	Bend./End. 1988: 51-53	12-17	x 7-9		14.5	x 8.0		485.9
	Derbsch/Saar 7.5.1950*:	12.5-17.5	x 7-8.5		15.13	x 8.16		527.5*
	Derbsch/Saar 1.5.1964*:	10-14	x 6.5-8		12.46	x 7.46		363.1*
	Derbsch/Saar 9.5.1972:	11-16.3	x 6.7-8.5		13.65	x 7.6		412.8
	Derbsch/Saar 15.5.1975:	13-17.4	x 6.7-7.8		15.2	x 7.25		418.0
	Imaz./Hongo 1965: 56	12-16	x 7-9.5		14.0	x 8.25		498.9
	Kühn./Romagn. 1953: 383	11.5-16.5	x 6-9.5		14.0	x 7.75		440.3
	Lange 1939: 109-110; 1915	12-15	x 7-8		13.5	x 7.5		397.6
	Moreno et al. 1986: 891	12-15	x 8-9		13.5	x 8.5		510.7
	Moser 1983: 257	11.5-16.5	x 6-9.5		14.0	x 7.75		440.3
	Orton/Watl. 1979: 60	11-15(-16)	x 7-9.5	x 6.5-7.5	13.0	x 8.25	x 7	393.1
	Piliát 1951: 372	12-15	x 7-8		13.5	x 7.5		397.6
	Reid 1958: 429-430	11-18	x 6-9		14.5	x 7.5		427.1
	Romagn. 1945: 83-86	11.5-16.5	x 6.2-9.5		14.0	x 8.0		469.1
	Romagn. 1976: 205	11.5-16.5	x 6.2-9.5		14.0	x 8.0		469.1
mean V_m = 443.4								

Table 1. continued

Ploidy-Group (level)	Coprinus species Source	Range of linear spore dimensions			Mean spore dimensions				
		l	d	b [μm]	l_m	d_m	b_m [μm]	V_m [μm^3]	
4 C. grossii sp. nov.									
	JAS 23099, 2.11.95*	8.1-13.8 x 6.4-11.5			10.22 x 8.96				460.6
	[V_m calculated from the mean linear spore dimensions:				10.22 x 8.96				429.6]
	[V_m calculated from the mean of linear spore dimensions range:				10.95 x 8.95				459.3]
	Wat. 13380, 8.79:	8.9-12.2(-13.0) x 8.8-10.3			10.16 x 8.90				421.4
mean V_m = 441.0									
Ploidy-Group 4: mean V_m = 442.2									

*: G. Masse's spore measurements are often incorrect - RW, therefore the mean V_m are calculated without Masse's data.

Table 2. „Ploidy-Groups“ in the Coprinus species discussed, based on mean spore volumes, according to Table 1 (see Groß & Schmitt 1974).

"Ploidy-Group" = Ploidy-level	mean spore-volume V_m [μm^3], see Table 1	V_m Ploidy-level = basis-spore-vol. V_B [μm^3]	mean V_{Bm} x Ploidy-level = theor. V_m [μm^3]
1	125.1	125.1	113.6
2	211.6	105.8	227.2
3	338.6	112.9	340.8
4	442.2	110.6	454.4
mean V_{Bm} = 113.6			

Scotland: Midlothian, Edinburgh, on potting compost on growth chambers, 15.11.1961, Wat. 552C (2 collections); ditto, Queen's Street, on plaster and debris in ceiling, June 1972, Wat. 9152; ditto, Great King Street, at cornice on ceiling, 17.VIII.1984, Wat. 17588; ditto, Currie, in house, 8.XI.1977, Wat. 12500.

Coprinus episcopalis. United Kingdom-England: Surrey, Mickleham Down, 24.XI.1953, Orton 75; ditto, 27.XI.1953, Orton 76; ditto, 1.X. 1954, Orton 340; ditto, 25.X. 1968, Orton 3242; Polesden Lacey, 5.X.1968, Orton 3241. Scotland. Midlothian, Edinburgh, in rock garden, 5.X.1960, Wat.289C.

Coprinus flocculosus. Germany-Saarland: Völklingen, Kreuzberg, legit H. Derbsch: a) 7.V.1950, on ground; b) 1.V.1964, on rotting straw of *Zea mays*; c) 9.V.1972, on rotting grass; d) 15.V. 1975, on rotting potato leaves; the mean spore volume of this

4 collections is $430.4 \pm 69.3 \mu\text{m}^3$, and corresponds well with the value of $443.4 \mu\text{m}^3$ calculated from a lot of sources, see Table 1. The distribution of this species in Saarland is documented in Derbsch & Schmitt (1984, No 342, p. 228; 1987, p. 305). United Kingdom-England: Norfolk, Surlingham, Wheatfen, 24.VII.1960, Orton 2167; Co. Durham, Middleton Moor, in garden under *Crataegus*, 29.VII.1962, Wat. 481C; Warwickshire, Stratford on Avon, in greenhouse, legit W. Brand, 14.VII.1985, Wat. 20263. Scotland: Midlothian, Edinburgh, on soil in box of *Primula*, 17.IV.1956, Henderson 2750; Argyll, Mull, Glen Forsa, on straw and sweepings by road-side, 12.IX.1968, Wat. 6045; Perthshire, Kindrogan, edge of pile of silage, 10.VI.1973, Wat. 10035; Fife, Dumferline, Crossford, on bonfire site 16.IX.1992, Coppins 3358; Orkney, Mainland, on soil in newly sown lawn, 21.VIII.1992, Wat. 26882.

Coprinus scobicola P.D. Orton. United Kingdom England: Devon, Plym Bridge, 29.VIII.1956, Orton 964 (Type); Devon, Kennford, Bullers Hill, legit J. Webster, 8.IX.1994. Scotland: Orkney, Mainland, Binscarth, amongst old woody debris, 26.IX.1994, Wat. 26266.

Coprinus sp. characterised by spores resembling a blackcurrant (*Ribes nigrum*) with a small pale spot in place of a distinct germ-pore, $8.5-9.1 \times 6.1-7.9 \mu\text{m}$. United Kingdom-England: Oxford, Cromwell near Chinor, 5 ft. up bedroom wall on painted plaster, Wat.17331.

Coprinus sp. characterised by pip-shaped spores resembling those of *C. patouillardii*-group with a flat germ-pore. United Kingdom Scotland: Midlothian, Edinburgh, Buckingham Ter., on wall-paper in damp room, 20.III.1963, Wat. 638C.

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