

## The *Diderma spumarioides-globosum* complex (Myxomycetes)

by

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*Abstract.* — A detailed study of *D. globosum* Pers., *D. crustaceum* Peck and *D. spumarioides* (Fr.) Fr. is carried out, based mainly on the collections of NY. Special attention is paid to microscopical features; all species, including *D. cinereum* Morg., *D. cingulatum* Nann.-Brem., *D. subviridifuscum* sp. nov. and *D. globosum* var. *europaeum* var. nov. are fully described and clearly and extensively illustrated. *D. scabrum* Eliass. & Nann.-Brem. and *D. rimosum* Eliass. & Nann.-Brem. are considered synonymous with resp. *D. spumarioides* and *D. cingulatum*. A neotype is designated for *D. globosum* and *D. spumarioides*.

### Introduction

The species involved in the studied complex all form fruitings consisting of white, sessile sporocysts seated on a well developed hypothallus, which is usually white from lime incrustation. Nannenga-Bremekamp (1968: 189-191) summarised the systematic situation of the species of the complex, mainly *Diderma globosum*, *D. crustaceum* and *D. spumarioides*, adding herself at that time a new one: *D. cingulatum*. The description of the latter species has solved a great deal of identification problems in Europe, whereas in America this paper seems to have passed unnoticed: even recent and typical American specimens of *D. cingulatum* are still identified as *D. spumarioides* by prominent American students of Myxomycetes. Eliasson & Nannenga-Bremekamp recently added *D. scabrum* and *D. rimosum* to this complex.

Apart from the excellent and well illustrated handbook of Nannenga-Bremekamp (1977) and the last editions of the Listers'

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Table 1. — Distribution of the studied specimens over the related species

Species	Herbarium															
	Before study							After study								
	NY	B	BPI	NYS	UPS	BR	GENT	NB	NY	B	BPI	NYS	UPS	BR	GENT	NB
<i>D. spumarioides</i> . . . . .	134	18	6	—	3	7	5	—	43	10	1	—	—	7	5	—
<i>D. globosum</i> var. <i>globosum</i> . . . . .	76	5	—	—	—	—	—	—	29	2	—	—	—	—	—	—
— var. <i>europaeum</i> . . . . .				var. nov.					5	—	1	—	—	—	—	—
<i>D. crustaceum</i> . . . . .	5	2	—	1	—	1	—	—	11	—	—	1	—	—	—	—
<i>D. antarcticum</i> . . . . .	—	—	2	—	—	—	—	—	—	—	3	—	—	—	—	—
<i>D. cinereum</i> . . . . .	—	—	1	—	—	—	—	—	29	—	1	—	3	—	—	2
<i>D. cingulatum</i> . . . . .	—	—	—	—	—	4	3	1	52	9	3	—	—	4	3	1
<i>D. donkii</i> . . . . .	—	—	—	—	—	—	7	1	—	—	—	—	—	—	7	1
<i>D. effusum</i> . . . . .	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
<i>D. indicum</i> . . . . .	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	—
<i>D. maculatum</i> . . . . .	—	—	—	sp. nov. (Buyck 1984)	—	—	—	—	1	—	—	—	—	—	—	—
<i>D. rimosum</i> . . . . .	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—
<i>D. scabrum</i> . . . . .	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—
<i>D. subviridifusum</i> . . . . .	—	—	—	sp. nov.	—	—	—	—	28	2	—	—	—	1	—	—
<i>D. testaceum</i> . . . . .	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—

Herbaria : Botanischer Garten und Botanisches Museum Berlin-Dahlem (B), Nationale Plantentuin van België (BR), U. S. National Fungus collections Beltsville (BPI), Rijksuniversiteit Gent (GENT), private collection Nannenga-Bremekamp (NB), New York Botanical Garden (NY), New York State Museum (NYS), Uppsala University (UPS).

monograph (1911, 1925), most literature used for the identification of European collections comes from American authors. The significance of good illustrations can not be stressed sufficiently. In table 1, the studied specimens of the species of this complex are given in two groups to illustrate the encountered identification problems. The first group (left) gives the specimens under the name under which they were received from the various herbaria; the second group (right) lists the specimens under the names they were finally sorted out.

When studying permanent slides of the species belonging to this complex, specimens can roughly be divided into two main groups. The first embraces pale spored species, mainly *D. spumarioides*, *D. cinereum* and most specimens of *D. cingulatum*. The second grouping of specimens with darker and larger spores, consists mainly of *D. subviridifuscum* and the predominantly nivicole *D. crustaceum* and *D. globosum*. In the nivicole group, sporocysts are considerably more voluminous and possess usually a well developed columella and a distinctly double peridium.

## Materials and methods

In addition to Belgian Myxomycete collections and the private collection of Nannenga-Bremekamp (Doorwerth, the Netherlands), already studied by Buyck (1981, 1982), the bulk of the material for this study came from NY (215 specimens), B (23 specimens), and a selected part of the material of BPI (10 specimens). All existing type material has been studied. The choice of the herbaria has been based upon the presence of important collections like those from Jaap, Hagelstein, Jahn, Sturgis, a.o.

First, permanent slides mounted in Hoyer's medium were made from all specimens. A detailed study of the slides made it possible to distinguish some rather well defined groups. Only afterwards, macroscopical features are taken into account.

All the descriptions are original; they first give the macroscopical characters as seen with a stereomicroscope (highest magnification:  $50\times$ ), then the lightmicroscopical characters as seen in the permanent slides.

For the spore size, 25 spores of each specimen have been measured, using a Wild M15 XSK ocular, and the average and

standard deviation have been calculated. The spore dimensions given consist of the lowest ( $\mu_1$ ) and highest ( $\mu_2$ ) average found; the figures between brackets indicating the lowest average decreased with its standard deviation ( $\mu_1 - s_1$ ) and the highest average increased with its standard deviation ( $\mu_2 + s_2$ ). The total number of spores measured (S) and the number of specimens (C) on which measurements are based, are indicated.

A colour guide (Kornerup & Wanscher 1978) has been used in describing the colour of the spores in the permanent slides, using a Leitz Orthoplan microscope without light filtering at a magnification of  $400\times$ . The references typically consist of three parts (table, column, row) placed between brackets, e.g.: (4B2). Different references are separated by a comma, e.g.: (4B2, 5C3). When referring to a series of colours the “-” sign has been used, e.g. (3B2-6) refers to the colours 3B2, 3B3, 3B4, 3B5 and 3B6.

### Importance of microscopical characters

The emphasis in delimiting groups within the studied material is on microscopical characters. Almost all earlier descriptions of the species studied, and of *Myxomycetes* in general, contain only some general information on the microscopy of spores and capillitium. To illustrate the chaotic situation in identification literature, we brought together data from different authors in a comparative table for spores and capillitium of the “best known” species, i.e. *D. spumarioides*, *D. globosum* and already to a much lesser degree *D. crustaceum* (see tables 2-7). When comparing the different authors, it is not very surprising to find either the work of the Listers or that of Martin & Alexopoulos to be an inspiration source for some of the later authors. Farr and Lakhanpal & Mukerji clearly made use of Martin's & Alexopoulos' monograph for their descriptions. While in Hagelstein's work, the microscopical features were literally taken from Listers' monograph, which is curious when one considers the number of specimens present at NY, the larger part consisting of his own and his students' collections. As for *D. crustaceum*, only a few descriptions are available, but all authors who recognize this species agree on the larger (12-15  $\mu\text{m}$  diam.), darker and densely spinose spores to separate it from *D.*

*globosum*. Usually, a more or less rough approximation of spore size is given, without comments on how many or how measurements were made, in which medium spores were mounted, which

Table 2. — *Diderma spumarioides*, features of the spores

Author	Character		
	Dimension ( $\mu\text{m}$ diam.)	Colour	Ornamentation
Massee (1892: 232) . .	9-12	colourless or dingy lilac	minutely warted
Torrend (1908: 101) . .	8-11	brown-violet or dark violet	minutely spinulose
Macbride (1922: 133) .	$\pm 10$	dark violaceous	minutely roughened
Lister A. & G. (1925: 85) . .	8-11	violet-brown	spinulose
Hagelstein (1944: 97) . .	8-11	violet-brown	spinulose
Martin & Alexoupoulos (1969: 369) . .	8-11	pale yellow-brown	minutely warted
Nannenga-Brem. (1974: 345) . .	8-11	pale lilac-grey	with dark warts, rather widely separated
Farr (1976: 212)	8-11	ligh yellowish or violaceous brown	minutely verrucose or spinulose, often irregularly
Emoto (1977: 208)	8-11	purple-brown	spinulose

Note: This species is not cited by Thind (1977) and Lakhanpal & Mukerji (1981).

percentage of the spores is reflected in the given spore size and so on... As for the capillitium, the situation is even worse, information usually being restricted to the presence or absence of anastomoses and the way of branching. Moreover, the lack of good illustrations in several modern works on *Myxomycetes* and in many type descriptions is acute. This is particularly true where microscopical features of spores and capillitium are concerned. For illustrations of "typical" specimens of *D. spumarioides*, *D. subviridifuscum* and *D. cingulatum* see also Buyck (1982).

As to the microscopical features of the spores in the studied species, the height and density of the ornamentation, the intensity of spore colour and even (as in *D. cingulatum*) spore size are very susceptible to variation. It is the total image one gets when looking at a permanent slide, that is important. This total approach towards spore features realises characteristics which are difficult to

Table 3. — *Diderma spumarioides*, features of the capillitium

Author	Character		
	Abundance	Colour	Habit
Massee (1892: 232) . .	—	colourless or dingy lilac	repeatedly bifurcating and connected laterally to form a net
Torrend (1908: 101) . .	more or less abundant	brown-purple, paler at the extremities	sparsely branching and anastomosing
Macbride (1922: 133) .	variable, sometimes abundant	brown	somewhat branching, anastomosing outward- ly, tips paler
Lister A. & G. (1925: 87) . .	—	purplish	slender, flexuose, branching at an acute angle, anastomosing
Hagelstein (1944: 97) . .	—	purplish	splender, flexuose, branching at an acute angle, anastomosing
Martin & Alexopoulos (1969: 369) . .	—	brown	sparsely branching and anastomosing, tips paler
Nannenga-Brem. (1974: 345) . .	usually abundant	purple-brown	branching, sparsely anastomosing
Farr (1976: 212)	usually abundant	purple-brown	rather sparsely branching, slender, sinuose
Emoto (1977: 208)	—	purple	slender, branched at an acute angle, anastomosing

Table 4. — *Diderma globosum*, features of the spores

Author	Character		
	Dimension ( $\mu\text{m}$ diam.)	Colour	Ornamentation
Massee (1892: 206) . .	8-10	lilac with tinge of brown	minutely warted
Torrend (1908: 101) . .	8-15	darker than in <i>D. spumarioides</i>	more spinulose than in <i>D. spumarioides</i>
Macbride (1922: 134) .	8	—	delicately spinulose
Lister A. & G. (1925: 88) . .	10-14	dark purplish brown	spinulose
Hagelstein (1944: 98) . .	10-14	dark purplish brown	spinulose
Martin & Alexopoulos (1969: 358) . .	(8-)9-10(-11)	yellow-brown	distinctly warted, sparsely
Nannenga-Brem. (1974: 346) . .	10-12	dark purple-brown	closely, finely warted
Farr (1976: 205)	(8-)9-10(-12)	yellowish brown, sometimes paler on one side	verrucose, sparsely to densely
Emoto (1977: 218)	10-15	dark purple-brown	coarsely warted
Thind (1977: 322-323)	9-10.5(*)	violaceous brown	distinctly verrucose
Lakhanpal & Mukerji (1981: 255)	9-11	yellowish brown	distinctly warted

(\*) including the warts.

define. We attempted to show these by photographs of groups of spores from permanent slides of several specimens.

Key to the species

1. Capillitium possessing typical perforated anastomoses where threads lie close to one another (especially forking sites near the columella); spores with an equatorial pale zone or cingulum (exceptionally absent and then sporocyst with a fragmented peridium); mean spore size: 7.5-13.5  $\mu\text{m}$  diam. . . . . *D. cingulatum*
1. Capillitium without such anastomoses; spores lacking an equatorial pale zone or prominent rim . . . . . 2

2. Peridial inner layer or the inner side of the peridium colourless or to cinereous or with some eventual pigmentation restricted to columella and sporocyst-floor . . . . . 3
2. Peridial inner layer brownish all over (inner side!), usually detached from the outer layer but sometimes closely adhering; columella never purely white . . . . . *D. subviridifuscum*
3. Peridium double, usually distinctly so and often with the inner layer adhering to the spore mass; fructification usually consisting of closely packed or almost superimposed sporocysts . . . . . 4
3. Peridium single or both layers closely united; mean spore size: 8-11  $\mu\text{m}$  diam.; fructification never of superimposed sporocysts (if the columella is reduced to a red brown, slightly convex thickening of the sporocyst-floor: see 7) . . . . . 8
4. Fructification always of one great mass of closely packed, ellipsoid sporocysts; columella globose on a constricted base or elongated to cylindrical, often rugose, usually hollow, easily breaking off near the base; mean spore size: 11-13  $\mu\text{m}$  diam. . . . . *D. crustaceum*
4. Fructification containing one or more tight groups of semiglobose to pulvinate sporocysts; mean spore size: 11-13  $\mu\text{m}$  diam. . . . . 5
5. Columella white, hemiglobose to convex . . . . . 6
5. Columella red-brown, a slightly convex thickening of the sporocyst floor . . . . . 7
6. Sporocysts never plasmodiocarpous; columella prominent, never reduced to a slight, convex thickening of the sporocyst floor; capillitium slender, flexuous or very uneven in diam; spores never globose, darker on one side; mean size: 9-12  $\mu\text{m}$  diam. . . . . *D. globosum* var. *globosum*
6. Sporocysts often plasmodiocarpous in habit or irregularly formed; columella reduced to a slight convex thickening of the sporocyst floor; capillitium very firm; spores globose or subglobose, homogeneous in transmitted light; mean size: 10-12  $\mu\text{m}$  diam. . . . . *D. globosum* var. *europaeum*
7. Spores with conspicuous, irregularly distributed warts, pale brown, ca. 8-9  $\mu\text{m}$  diam. . . . . *D. donkii* var. *donkii*
7. Spores verruculose, with distinct groups of closely aggregated warts, dark brown, ca. 10-11  $\mu\text{m}$  diam. . . . . *D. donkii* var. *echinosporum*
8. Spores with a few, often inconspicuous clusters of closer aggregated warts; the remaining part minutely to distinctly verrucose; capillitium flexuous, very slender but uneven in diam., profusely branching and anastomosing at an acute to right angle, brown to colourless *D. cinereum*
8. Spores distinctly verrucose to spinose, ornamentation evenly distributed; capillitium threads straight, sometimes a little undulating, locally with dark lens-shaped expansions of the wall leaving the paler centre of the filaments in optical section unaffected, dichotomously branched at an acute angle, never colourless over their whole length . . . *D. spumarioides*

*Diderma cinereum* Morgan, Journ. Cinc. Soc. Nat. Hist. 16: 154 (1894). — Fig. 1 & 2.

*Fructification* rather small, although sometimes consisting of up to a few hundreds of sessile sporocysts, closely gregarious to scattered. *Hypothallus* inconspicuous, membranous, continuous, colourless, more or less shining, locally with some lime incrustations and then whitish. *Sporocysts* hemispherical or subglobose



Table 5. — *Diderma globosum*, features of the capillitium

Author	Character		
	Abundance	Colour	Habit
Massee (1892: 206) . .	—	bright violet, sometimes almost colourless	forming a dense net
Torrend (1908: 101) . .	more or less abundant	brownish purple, paler at the extremities	sparsely branching and anastomosing
Macbride (1922 : 134) .	abundant	brown or purplish brown	branching, occasionally anastomosing to form a loosely constructed superficial net
Lister A. & G. (1925: 88) . .	—	pale purplish	slender, irregularly branched, irregular expansions towards the base enclosing a few lime-granules (often), anastomosing
Hagelstein (1944: 98) . .	—	pale purplish	slender, irregularly branching and anasto- mosing, often with irregular expansions towards the base, enclosing a few lime granules
Martin & Alexopoulos (1969: 358) . .	—	pale brown or purplish	rather delicate, irregular expansions towards base sparsely anastomosing
Nannenga-Brem. (1974: 346) . .	abundant	colourless or purplish brown	slender, dichotomously branching, sparsely anastomosing
Farr (1976: 205)	abundant	pale brown or purplish	slender, irregularly branching, bearing irregular expansions toward the base (often), sparsely anastomosing
Emoto (1977: 208)	—	pale purple	slender, irregularly branched, anastomo- sing, often with irregular expansions containing a few lime granules

Table 5 (continued)

Author	Character		
	Abundance	Colour	Habit
Thind (1977: 322-323)	—	violaceous brown, with pale extremities	branching and anastomosing, slender flexuous, often bearing irregular expansions near the base, rarely marked by nodular thickenings
Lakhanpal & Mukerji (1981: 255)	—	purplish brown	delicate, branching and sparsely anastomosing often with irregular expansions towards the base

Table 6. — *Diderma crustaceum*, features of the spores

Author	Character		
	Dimension ( $\mu\text{m}$ diam.)	Colour	Ornamentation
Massee (1892: 215) . .	$\pm 13$	black	—
Macbride (1922 : 135) .	12-15	dark violaceous	delicately roughened
Martin & Alexopoulos (1969: 354) . .	(11-)12- 14(-15)	dark	spiny, sometimes subreticulate
Lakhanpal & Mukerji (1981: 252) . .	11-12,5(-15)	dark purple-brown	closely and conspicuously warted

on a constricted base, circular to elliptic in outline, often depressed and then angular or distorted from mutual pressure and broadly sessile, less than 1 mm in diam., 0.2-0.6 mm high. *Peridium* double, often indistinctly so, even seeming to be single from irregular lime deposits, dehiscing irregularly and often first at the

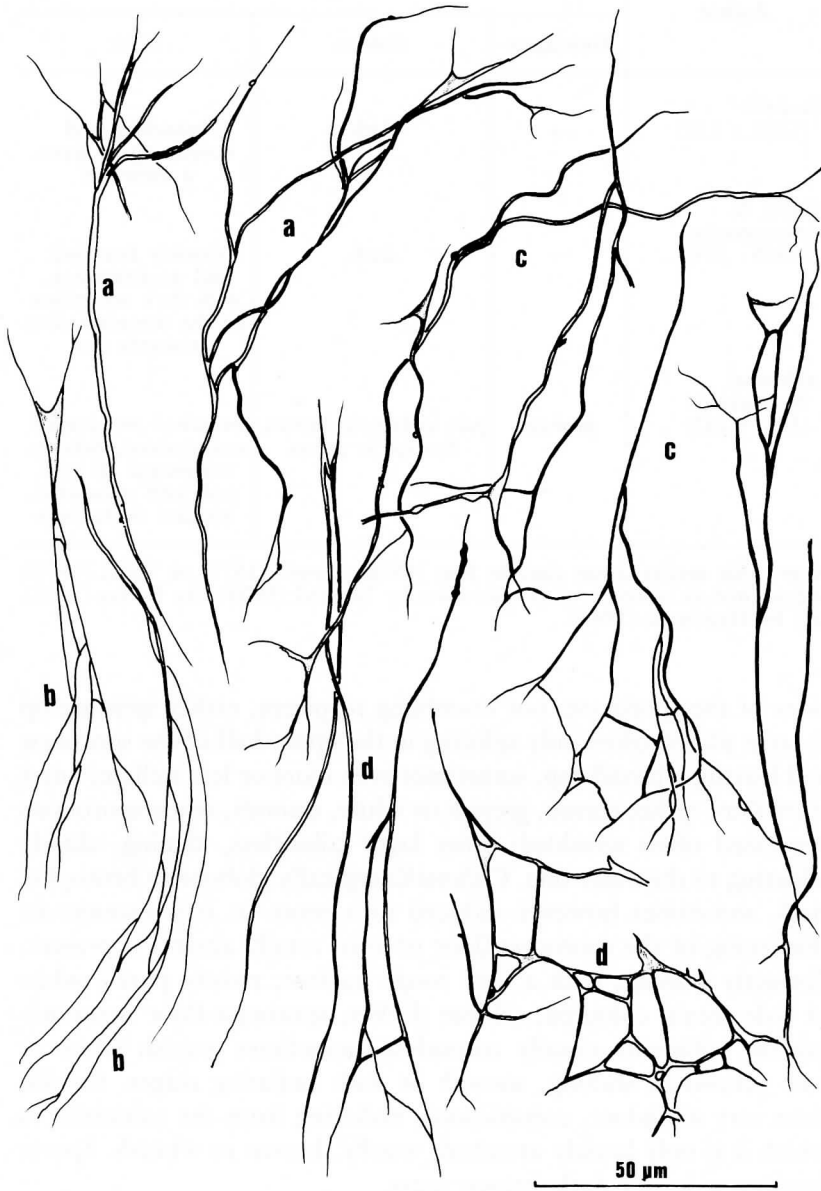


Fig. 1. — *D. cinereum*: habit of the capillitium (a, NY 4921; b, NY 5685; c, NY 2399; d, NY 12197).

Table 7. — *Diderma crustaceum*, features of the capillitium

Author	Character		
	Abundance	Colour	Habit
Macbride (1922 : 135) .	—	dark	branching and combining to form a loose net
Martin & Alexopoulos (1969: 354) . .	—	dark	sparsely branched and anastomosing, with dark accretions on the threads fading towards tips
Lakhanpal & Mukerji (1981: 252) . .	profuse	pale violaceous-brown, hyaline at apices	branched and loosely anastomosed, delicate, roughened all over and with occasional nodular thickenings

*Note:* This species is not cited by Farr (1976), Emoto (1977) or Thind (1977), and is cited as synonym of *D. globosum* by Torrend (1908), the Listers (1925), and by Hagelstein (1944).

sides of the sporocyst, not crumbling to pieces, rather splitting up in large plates, often only splitting in the upper half of the sporocyst and leaving a broad cup, sometimes even more or less stellate; outer layer thin, rather elastic, greyish or white, smooth, when sporocysts depressed often wrinkled; inner layer colourless, shining, closely adhering to the outer one. *Columella* typically globose to hemispherical, sometimes however reduced to a more or less pronounced thickening of the sporocyst-floor or even totally absent, if present, distinctly shining, with a very rough surface, mostly purely white or pale cream coloured, seldom darker; sporocyst-floor surrounding the columella usually colourless, sometimes greyish white or pale yellowish, shining, smooth or with radiating ridges. *Capillitium* very abundant, conspicuous, radiating from the columella to which it is only loosely attached, woolly, brown to whitish. *Spores* forming a loose, dark brown mass.

*Spores* nearly circular in optical section, (7.98)8.25-9.95(10.29)  $\mu\text{m}$  diam.; (675 S, 27 C), orange-grey (5B2,C2), pale greyish

orange (5B3) to brownish orange (5C3,4), very minutely to distinctly verrucose with a few, often inconspicuous clusters of closely aggregated warts. *Capillitium* abundant; threads usually very slender but uneven in diam., flexuous, profusely branched and anastomosing — especially near the extremities — at a more or less acute to even right angle, often with many, narrow to large dark, globular to irregular swellings or with axillary membranous expansions, warted or smooth, sometimes colourless — at least at the extremities — but usually brown. *Peridial inner layer* colourless, pale cream to even ochraceous, with a greyish look from adhering lime deposits.

NORTH AMERICA :

U.S.A. :

NEW YORK: Mill Neck, Long Isl., on leaves, 06-1924, *Hagelstein & Rispaud* 548, 695 (NY), 06-1925, *Hagelstein & Rispaud* 935 (NY); Albertson, Long Isl., on leaves, 07-1926, *Hagelstein & Rispaud* 993 (NY), 07-1927, *Hagelstein & Rispaud* 1128 (NY); Roosevelt, Long Isl., on moss, 09-1933, *Hagelstein & Rispaud* 1604 (NY); Shelter Isl., on leaves, 07-1935, *Hagelstein & Rispaud* 1798 (NY); Red Hook, Dutchess Co., on leaves, 05-1942, *Hagelstein & Rispaud* (NY 2394); Fultonham, Schoharie Co., on leaves, 06-1942, *Hagelstein & Rispaud* (NY 2399); Shawangunta Mts, on leaves, 08-1881, *Ellis* (NY 5684); Syracuse, on leaves, 07-1889, *O.F. Cook* 1765 (BPI).

NEW JERSEY: Newfield, on leaves, 06-1888, *Ellis & Everhart* (NY 5685, 5687).

PENNSYLVANIA: Blooming Grove Township, Pike Co., on moss, 08-1937, *Hagelstein & Rispaud* (NY 4191, 4198); Angels, Wayne Co., on leaves, 06-1937, *Hagelstein & Rispaud* (NY 4242); Dingman Township, Pike Co., on leaves, 05-1938, *Hagelstein & Rispaud* (NY 4790), 06-1938, *Hagelstein & Rispaud* (NY 4935); Angels, Wayne Co., on leaves, 05-1938, *Hagelstein & Rispaud* (NY 4783, 4893); Panther, Pike Co., on leaves, 06-1938, *Hagelstein & Rispaud* (NY 4921); Blooming Grove Township, Pike Co., on leaves, 06-1938, *Hagelstein & Rispaud* (NY 4932, 4796), Philadelphia, on leaves, 07-1907, *Bilgram* in *Sturgis* (NY 12188).

CONNECTICUT: Orange, on leaves, 06-1900, *Sturgis* 496 (NY 12197).

NEW HAMPSHIRE: Moose Mts, Hannover, on leaves, 08-1937, *Hagelstein & Rispaud* (NY 4077).

OHIO: Preston, on leaf, 1893, *Morgan* (BPI holotype).

ALABAMA: Auburn, Lee Co., on bark, 02-1897, *Earle* (NY 5683).

CANADA :

ONTARIO: Bear Isl., Lake Timagani, on twig, 09-1923, *Watson* 1498 (NY 9552).

EUROPE :

THE NETHERLANDS: Brakellaan, Doorwerth, on leaves in *Quercus* vegetation, 07-1953, *Nannenga-Bremekamp* 388 (priv.); *ibid.*, on leaf under *Pteridium* vegetation, 08-1960, *Nannenga-Bremekamp* 4213 (priv.).

SWEDEN: Djupviken, Uppsala, on leaf of *Quercus*, 08-1898, *R.E. Fries* 403 (UPS); Kungsparken, Uppsala, on leaf of *Lamium*, 08-1895, *Nyman* in *R.E. Fries* (UPS); Fristaden, Uppsala, on herbaceous material, 08-1897, *R.E. Fries* 402 (UPS).

*Discussion*: *D. cinereum* has been retained by Torrend (1908: 104-105) and Macbride (1922: 138), although both authors make the remark that it is probably a greyish variety of *D. spumarioides* with smoother spores. The Listers (1925: 87), Schinz (1920: 177) and Hagelstein (1944: 97) all placed this species in synonymy with *D. spumarioides*, whereas Martin & Alexopoulos (1969: 353-354) conclude, after re-examination of the type material, that *D. cinereum* should be recognized as an autonomous species on the basis of the lack of a prominent hypothallus, the smooth, apparently single, pearl-grey peridium, the very regular sporocysts, the loose attachment of the capillitium and the dark greyish, minutely warted spores.

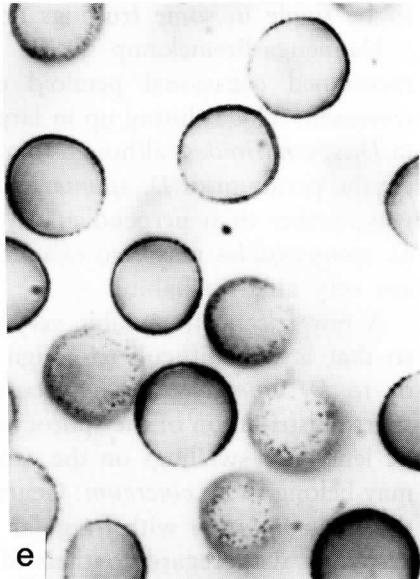
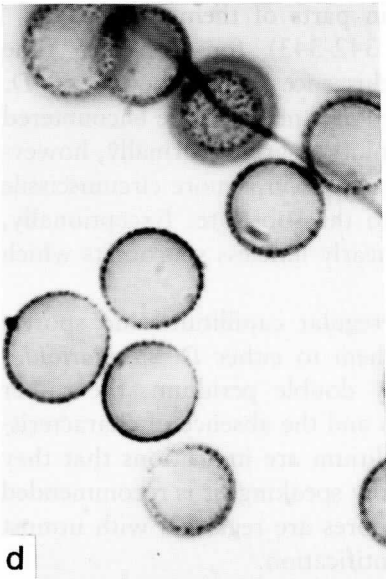
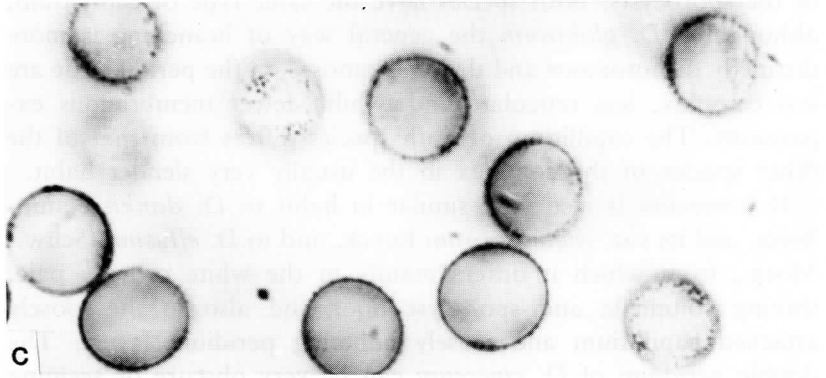
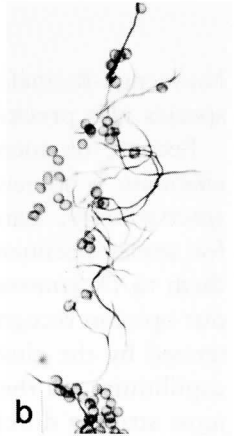
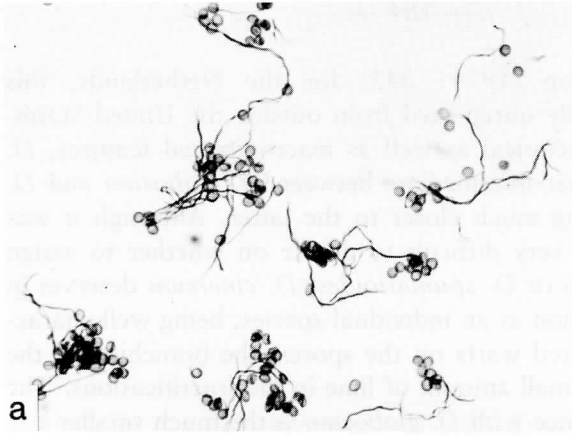
Hagelstein (1944: 97 & 1941: 301-302) describes *D. cinereum* as an early phase, originating from the revived *spumarioides*-sclerotia of the preceding winter and occurring mainly from May to July, whereas *D. spumarioides*-fruitings should originate from spores of these "*D. cinereum*"-sporocysts. Having studied most of the Hagelstein specimens, it is now clear that the late *D. spumarioides* fruitings, which he described as *D. spumarioides* fruitings, having "densely crowded sporangia with thick calcareous walls and a copious hypothallus in which the sporangia are often imbedded", all belong to *D. cingulatum*, which is in fact a late summer-autumn species. On the other hand, all Long Island specimens which Hagelstein (1936: 558) identified as *D. spumarioides* turn out to be *D. cinereum*-fruitings.

Apparently, nobody ever noticed the faint local clustering of the spore ornamentation, which is, together with the very slender, flexuose, irregularly and profusely branched capillitium, our main character in defining *D. cinereum*. Spore features seem less variable than in *D. spumarioides*, although the clusters of warts on the spore surface may exceptionally be very obscure, in which case the habit of the capillitium and macroscopical features are decisive.

Even this study did not add much to the remarkably restricted area of occurrence of *D. cinereum*. Apart from a citation by

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Fig. 2. — *D. cinereum*: a-b, habit of the capillitium (NY 4921, X 280); c-e, spores, in (c) and (e) with distinct clusters of aggregated warts, in (d) the clusters are inconspicuous in most of the spores but when compared to *D. spumarioides*, spores are less globose and look more fragile (c, NY 4191; d, NY 12197); e, NY 2394; all X 2900).



Nannenga-Bremekamp (1974: 343) for the Netherlands, this species was previously unreported from outside the United States.

Because of microscopical as well as macroscopical features, *D. cinereum* is somewhat intermediate between *D. globosum* and *D. spumarioides*, leaning much closer to the latter. Although it was for some specimens very difficult to decide on whether to assign them to *D. cinereum* or *D. spumarioides*, *D. cinereum* deserves in our opinion recognition as an individual species, being well characterized by the clustered warts on the spores, the branching of the capillitium and the small amount of lime in the fructifications. The most striking difference with *D. globosum* is the much smaller size of the sporocysts. Both species have the same type of capillitium, although in *D. globosum* the general way of branching is more distinctly dichotomous and the anastomoses on the peridial side are less complex, less reticulate and exhibit fewer membranous expansions. The capillitium of both species differs from that of the other species of the complex in the usually very slender habit.

*D. cinereum* is also very similar in habit to *D. donkii* Nann.-Brem. and its var. *echinosporum* Buyck, and to *D. effusum* (Schw.) Morg., from which it differs mainly in the white or very pale, shining columella and sporocyst floor and also in the loosely attached capillitium and closely adhering peridium layers. The double peridium of *D. cinereum* can be very obscure or seeming to be single in some fruitings or in parts of them.

Nannenga-Bremekamp (1974: 342-343) for the first time mentioned occasional petaloid dehiscence in sporocysts of *D. cinereum*. This splitting up in large lobes may also be encountered in *D. spumarioides*, although to a minor degree. Normally, however, the peridium of *D. spumarioides* splits in a more circumscissile way, rather than perpendicularly to the substrate. Exceptionally, *D. spumarioides* may also exhibit nearly limeless sporocysts which are very alike in habit.

A few specimens exhibit very irregular capillitium and spores, so that it was difficult to assign them to either *D. spumarioides* or to *D. cinereum*. The obscurely double peridium, the rather sparse distribution of the sporocysts and the absence of characteristic lenticular swellings on the capillitium are indications that they may belong to *D. cinereum*. Generally speaking, it is recommended that *Myxomycetes* with irregular spores are regarded with utmost suspicion with regard to their identification.



*Diderma cingulatum* Nann.-Brem., Proc. K. Ned. Akad. Wet., ser. C, 71: 191 (1968). — Fig. 3-5.

*D. rimosum* Eliass. & Nann.-Brem., Proc. K. Ned. Akad. Wet., ser. C, 86: 148 (1983), syn. nov.

*Fructification* formed of hundreds, usually closely aggregated to crowded, sessile sporocysts, almost always powdered with the spores from damaged sporocysts. *Hypothallus* membranous, continuous, colourless to yellowish or even red-brown but usually white from heavy lime incrustation, crumbly-granular and wrinkled-folded, reminding one of fresh snow, often imbedding the sporocysts. *Sporocysts* usually higher than broad, ca. 0.5 mm diam., up to 1 mm high, whitish. *Peridium* usually appearing single with both layers closely adhering and disintegrating together, forming a brittle, thick and rough crust, in some parts or at the edge of the fructification often distinctly double with the inner layer closely applied to the spore mass and greyish from lime incrustation, during disintegration crumbling to little pieces, but adhering to the capillitium for a long time. *Columella* typically thin, slender, nearly extending to the top of the sporocyst, broadly spatulate or forked, white, usually still intact after spores and capillitium have been dispersed, often however, reduced to a more or less pronounced thickening of the sporocyst-floor, usually laterally flattened when well developed, white to cream coloured, exceptionally red-brown near the base. *Capillitium* very abundant, when the columella well developed, firmly attached to it, woolly, pale to purple-brown, expanding in mass after disintegration of the sporocyst-top. *Spores* greyish brown, sometimes dark purplish brown in mass.

*Spores* from circular to angular in optical section, (7.60)7.87-12.94(13.40)  $\mu\text{m}$  diam. (1675 S, 63 C), orange grey (5B2-6) to orange-brown (5C3-4, 6C3-6), sometimes light brown (6D6), exceptionally dark brown (6E6-8), minutely to distinctly verrucose, with a pale equatorial zone, which is present as a prominent rim when the spores are angular. *Capillitium* very abundant; threads nearly straight to distinctly undulate, in the latter case very brittle and with membranous anastomoses, at the extremities dichotomously branched or adhering together at an acute angle, mostly 100-200  $\mu\text{m}$  long, intensively anastomosing, especially near the columella, sometimes all along the threads when close to one

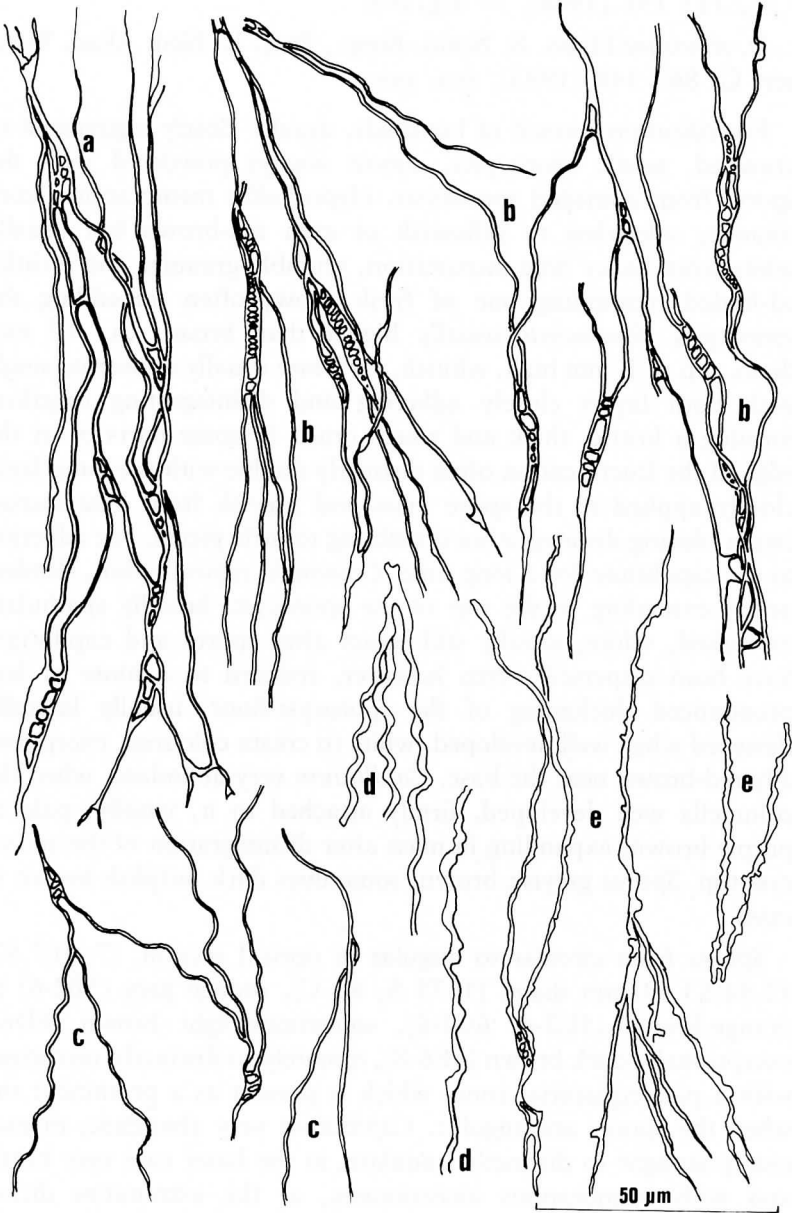


Fig. 3. — *D. cingulatum*: habit of the capillitium, badly developed in (d) and (e) (a, NB 6609 isotype, priv. coll.; b, NY 8068; c, NY 13204; d, NY 8652; e, NY 11597).

another, smooth, but frequently with large, pale or dark, blunt outgrowths, dark brown, fading at the extremities. *Peridial inner layer* membranous, colourless to cream-coloured, prominently veined.

NORTH AMERICA:

U.S.A.:

NEW HAMPSHIRE: Chocorua, on leaves and herbs, 09-1908, *Farlow* 368 (NY 6742).

NEW YORK: 7th Lake, Adirondack Mts, on leaves, 08-1934, *Hagelstein & Rispaud* (NY 3429); Middleburg, on herbs, 08-1934, *Hagelstein & Rispaud* (NY 3431, 3448); Randolph Coos Co., on leaves, 08-1936, *Hagelstein & Rispaud* (NY 3796); Putnam Co., on leaves, 09-1896, s. coll. (NY 8593); Westport, on leaves, Oct., *Peck* (NY 13459); Lake Pleasant, Hamilton Co., on herbs, Aug., *Peck* (NY 13473); Glen Cove, Long Isl., on leaves, 09-1943, *Atkinson* (NY 13541); Slaterville Springs, Tompkins Co., on herbs and twigs, 10-1947, *Rogerson* 1956 (NY); Syracuse, on leaves, 07-1889, *O.F. Cook* 860 (BPI); Kirkville, on twigs, 10-1889, *O.F. Cook* 874 (BPI).

PENNSYLVANIA: Angels, Wayne Co., on bark, 09-1937, *Hagelstein & Rispaud* (NY 4213).

VIRGINIA: White Oak Canyon, Shenandoah Nat. Park, on wood, 09-1935, *Shear* in *Hagelstein* (NY 8068, 8059); Augusta Co., on leaves, 09-1937, *Carr* in *Hagelstein* (NY 8231); s.l., on leaves, s.d., s. coll. (NY 9260).

NORTH-CAROLINA: Cranberry, on bark, 08-1896, *Thaxter* in *Sturgis* (NY 12187).

MICHIGAN: Corunna Mts., on bark, 07-1891, *Sturgis* 82 (NY 12181); McMillan, on leaves, 09-1916, *Sturgis* (NY 12182).

COLORADO: Wet Mt Valley, on herbs, 08-1911, *Sturgis* 801 (NY 11597); *ibid.*, on leaves and twigs, 08-1911, *Sturgis* 1601 (NY 12205, 12398), 09-1912, *Sturgis* (NY 13203, 13204); Boulder, in wood, s.d., *Sturgis* 650 (NY 12180); Manitou Park, on leaves, 08-1908, *Sturgis* (NY 12189); Cheyenne Mt, on leaves, 09-1915, *Sturgis* (NY 12199); *ibid.*, on twigs, 08-1908, *Sturgis* (NY 12200, 12201).

CANADA:

QUÉBEC: Hébertville, on leaves and twig, 08-1938, *Hagelstein & Rispaud* (NY 4644); St Gédéon, Lake St John, 08-1938, *Hagelstein & Rispaud* (NY 4645, 4646); Blue Sea Lake, on *Taxus canadensis*, 08-1921, *Lloyd* (NY 8125).

ONTARIO: Ottawa, on bark and leaves, 09-1909, *Ellis* (NY 6840, 6843); London, on stem of *Impatiens*, 08-1889, *Ellis* 618 (NY 6288); Toronto, on leaves, 1910, *Cain* in *Hagelstein* (NY 8444); New Burham, Brant Co., on leaves, 09-1938, *Cain* in *Hagelstein* (NY 8840); Cache Lake, Algonquin, on leaves and mosses, *Cain* in *Hagelstein* (NY 9091, 9092); Costello Lake, on leaves, 09-1939, *Cain* in *Hagelstein* (NY 9093); Queens Univ. Biol. Station, Lake Opinicon, on fern frond, mosses and *Equisetum*, 09-1958, *Rogerson* (NY).

SOUTH AMERICA:

PERU: ca 40 km from Tingo Maria, on the Tingo Maria-Pucallpa Rd Dpto Huanuco, ca 6200 ft alt., on leaf of orchid, 07-1976, *Dumont* 880 (NY s.n.).

ECUADOR: Galapagos Isl., Santa Cruz, on plant material, 02-1981, *Eliasson* 3337 in *Nannenga-Bremekamp* 12484 (priv.), *Eliasson* 3418 (holotype *D. rimosum*, n.v.) in *Nannenga-Bremekamp* 12613 (priv., isotype *D. rimosum*).

EUROPE :

BELGIUM: Klemskerke, De Haan, on leaf litter, 06-1971, *Vaes* (priv.); Brussegem, on leaves and twigs, 09-1965, *Van der Veken* 2025 (BR, GENT); *ibid.*, on herbaceous debris, 10-1965, *Van der Veken* 2366b (GENT); St-Joris-Weert, on bark and twigs, 10-1965, *Van der Veken* 2369a (BR, GENT); Hastières, on fallen leaves and mos, 10-1888. *Bommer & Rousseau* (BR): Malmédy, env. ferme Libert, on fallen leaves, s.d., *Libert* (BR).

THE NETHERLANDS: Oostvoorne, on twigs of *Betula*, 10-1956, *M. Geestera-nus* 11780 (L holotype) in *Nannenga-Bremekamp* 6609 (priv., isotype).

FRANCE: Hautes Alpes, on dead leaves, 09-1924, *Hagelstein* 5013 (NY 3430).

GREAT-BRITAIN: Crawley, Sussex, on dead leaves, 10-1927, *Elliot* in *Hagelstein* (NY 7167).

FED. REP. GERMANY: Hamburg, bei Wohldorf, on living herbs, 08-1912, *Jaap* in *Myxom.* Exs. 104 (NY 10260, B 900/82-1); Leipzig, on plant debris, 07-1872, *Winter* (B); Forbach, on wood, 08-1912, *Ludwig* (B 886/82-3).

DEM. REP. GERMANY: Triglitz, on leaves of *Populus canadensis*, 10-1910, *Jaap* in *Myxom.* Exs. 214 (B 900a/82-7).

AUSTRIA: Irenental, near Untertullnerbach in Wiener Wald, on herbaceous material, 08-1912, *von Höhnel* in *Jaap* in *Myxom.* Exs. 148 (B 900/82-3., BPI, NY 10304).

ASIA :

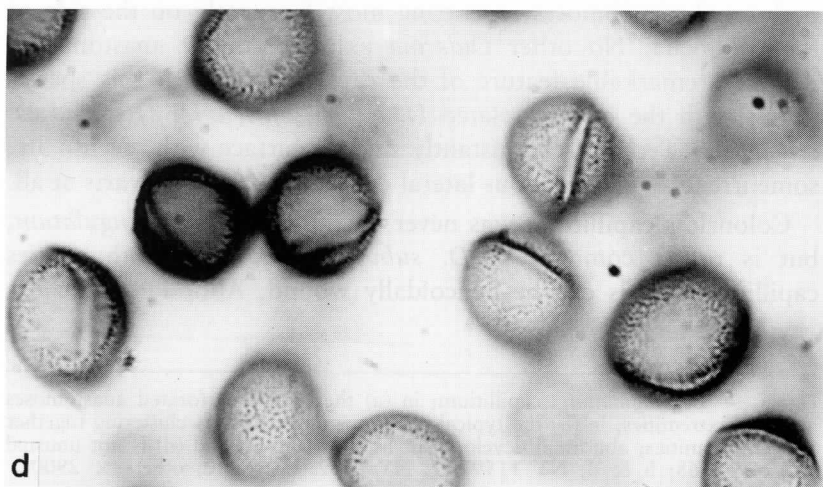
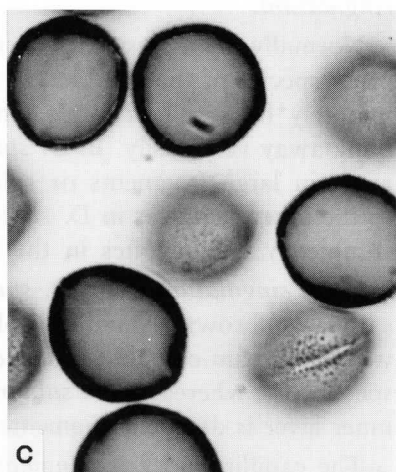
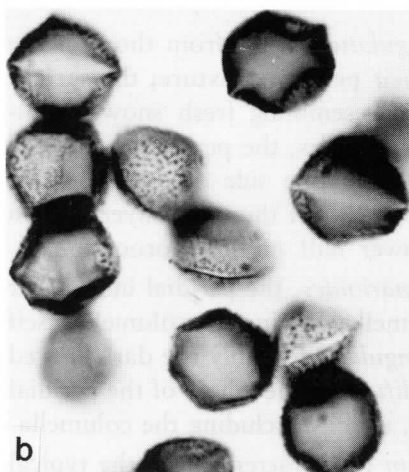
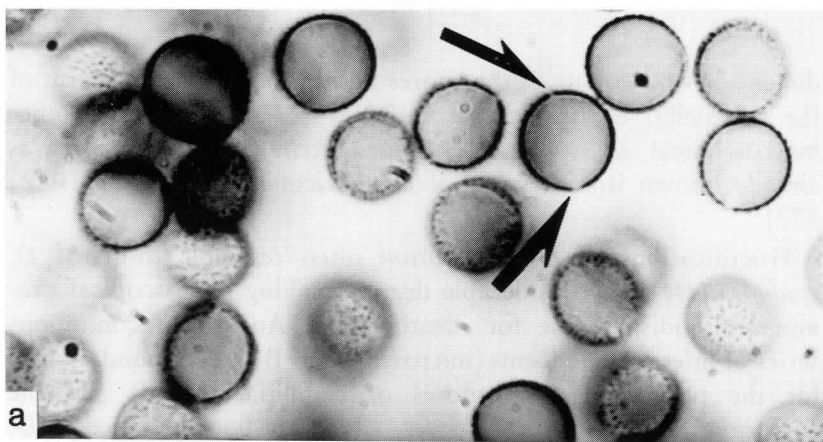
CHINA: N-Manchuria, Great Kingan Mts, Barim station, on herbaceous material, 08-1931, *Skvortzov* in *Hagelstein* (NY 8652).

*Discussion*: A detailed study of American material of the *spumarioides-globosum* complex revealing such a large amount of *D. cingulatum* specimens was not totally unexpected. There existed already indications that *D. cingulatum* is a widely distributed and very common species: *Hagelstein* (1941: 302) cited in his comments on *D. spumarioides* a peculiar specimen collected by Sturgis in 1912, possessing "long, thin, flattened or cylindrical columellae, which are often bifurcate and extend to the tops of the high sporangia". *Martin & Alexopoulos* (1969: fig. 327) even illustrated *D. spumarioides* with a drawing of a specimen that certainly belongs to *D. cingulatum*.

The recognition of so many *cingulatum*-specimens leads to the above emendation of the original description. It shows that *D. cingulatum* is a very variable species, with a remarkable range in

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Fig. 4. — *D. cingulatum*: spores; in (a) the spore type encountered in most of the specimens, small when compared to the type and with the distinct equatorial rim substituted by a pale inconspicuous zone (arrows); in (b) as encountered in badly fructificated specimens, resembling *D. crustaceum* but still exhibiting the equator cingulum; in (c) and (d) the spore type encountered in a few specimens, including the type (a, NY 4644; b, NY 8652; c, NY 12205; d, NY 11597; all  $\times 2900$ ).



dimension and colour of the spores and in dimension and form of the columella. A considerable variability exists also in the other macroscopical characters. To some extent this variability was already known from a study of Belgian collections (Buyck 1982: 177).

Fructifications of *D. cingulatum* often resemble those of *D. spumarioides* to a considerable degree, making microscopical examination indispensable for identification. An almost continuous series of intermediate forms (microscopically!) can be found, except for the perforated anastomoses of capillitial threads and the equatorial cingulum on the spores, which are both confined to *D. cingulatum*.

Normally, sporocysts of *D. cingulatum* differ from those of the other species of the complex in their peridium texture; the surface minutely furrowed-wrinkled, often resembling fresh snow, crumbling away very easily. In *D. spumarioides*, the peridia usually fall apart in large fragments or split from one side of the sporocyst to the other; whereas in *D. subviridifuscum* the outer layer seldom completely disintegrates in the lower half of the sporocyst.

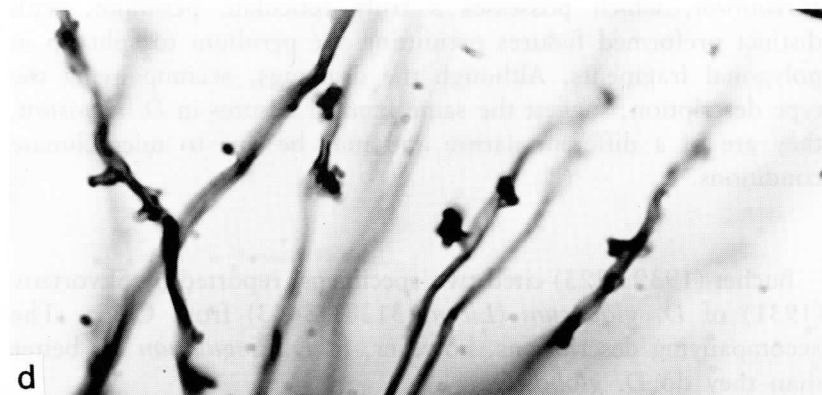
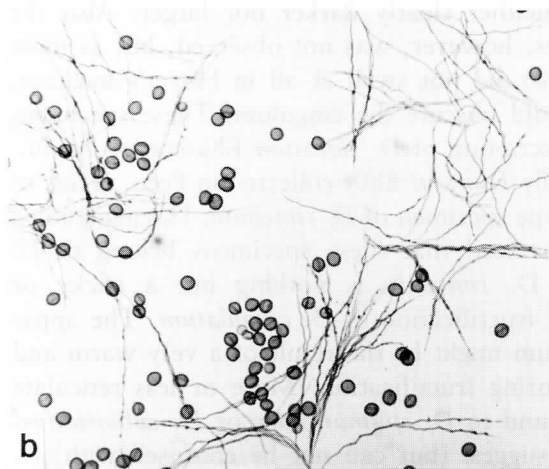
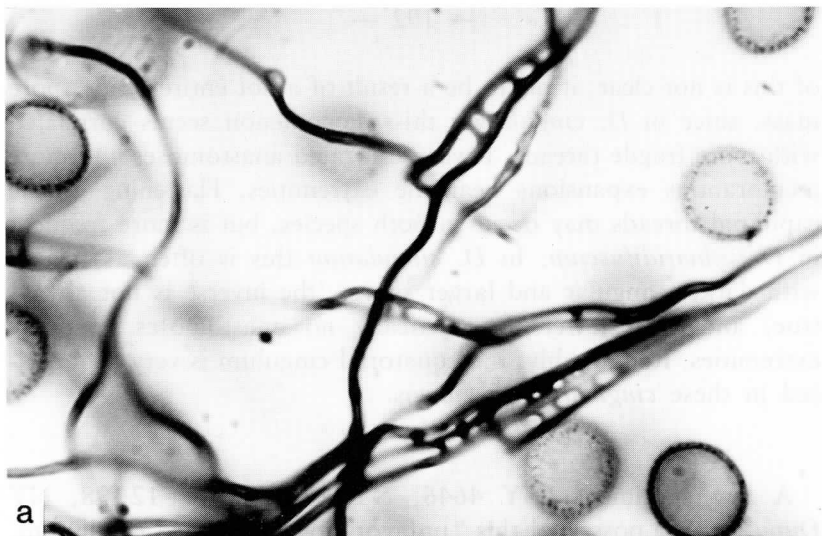
In *D. cingulatum*, as in *D. spumarioides*, the peridial inner layer can be red-brown around the columella, leaving the columella itself white to cream-coloured (in *D. cingulatum* mainly the dark spored specimens), whereas in *D. subviridifuscum* the whole of the peridial inner layer is distinctly pigmented, usually including the columella.

The capillitium of *D. cingulatum* is characterized by the typical perforated anastomoses, occurring most frequently on the side of the columella. No other *Diderma* exhibits similar anastomoses. Another remarkable feature of the capillitium, which this species shares with the closely related *D. subviridifuscum* Buyck and *D. crustaceum* Peck, is its constantly smooth surface with, eventually, some irregular membranous lateral outgrowths, but no warts at all.

Colourless capillitium was never encountered in *D. cingulatum*, but is rather common in *D. subviridifuscum*. In both species capillitial threads can be helicoidally wound. Although the cause

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Fig. 5. — *D. cingulatum*: capillitium; in (a) the typical perforated anastomoses near the extremities; in (b) the typical phenomenon of threads clustering together at the extremities; abnormal development as shown in (c) and (d) is not unusual (a, NY 8068; b & d, NY 11597; c, NY 8652; b × 280; others × 2900).



of this is not clear, it might be a result of a not entirely ripe spore mass, since in *D. cingulatum* this phenomenon seems correlated with more fragile threads, fewer perforated anastomoses and more membranous expansions near the extremities. Flattening of the capillitial threads may occur in both species, but is more frequent in *D. subviridifusum*. In *D. cingulatum* this is often associated with darker, angular and larger spores (the inverse is not always true) and with fewer to practically no anastomoses near the extremities. Remarkably, the equatorial cingulum is very pronounced in these *cingulatum*-specimens.

A few specimens (NY 4646, NY 12187, NY 12198, NY Dumont 880) possessed this “unfavorably” developed capillitium, but the spores were neither clearly darker nor larger. Also the cingulum on the spores, however, was not observed, but as most of the spores (80-90%) did not swell at all in Hoyer’s medium, their poor swelling could obscure the cingulum. These specimens fitted very well the description of *D. rimosum* Eliasson & Nann.-Brem. (1983). Especially Dumont 880, collected in Peru, seems to be identical with the type specimen of *D. rimosum*. Having studied this type, we are convinced that these specimens belong to *D. cingulatum* and that *D. rimosum* is nothing but a tricky or unfavorably developed fructification of *D. cingulatum*. The apparently reticulate peridium might be the result of a very warm and humide atmosphere during fructification. More or less reticulate peridia can also be found in *D. spumarioides* or *D. subviridifusum*. Such specimens suggest (but can not be confused with) *D. corrubrum*, which possesses a truly reticulate peridium, with distinct preformed fissures permitting the peridium to split up in polygonal fragments. Although the drawings, accompanying the type description, suggest the same kind of fissures in *D. rimosum*, they are of a different nature and may be due to microclimate conditions.

Buchet (1939: 223) cited two specimens, reported by Skvortzov (1931) of *D. globosum* (*Licent* 3138, 3443) from China. The accompanying descriptions, however, fit *D. cingulatum* far better than they do *D. globosum*.



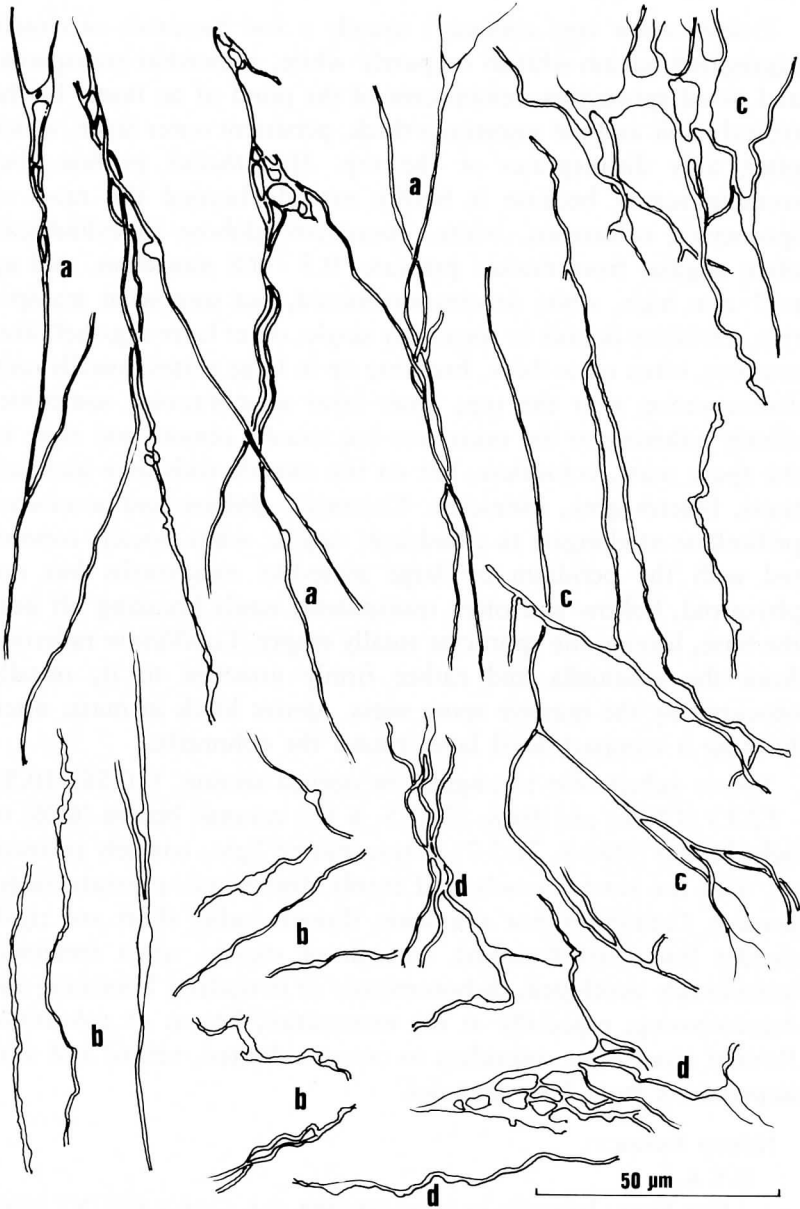


Fig. 6. — *D. crustaceum*: habit of the capillitium (a, NY 11603; b, Peck 121; c, NY 5694; d, NY 7178).

*Diderma crustaceum* Peck., Ann. Rep. N.Y. State Mus. 26: 74 (1894). — Fig. 6 & 7.

*Fructification* very compact: usually a few hundreds of closely aggregated, cream-whitish or purely white, somewhat transparent and ovoid sporocysts, reminiscent of the pond of an insect by the typical habit and the sometimes thick, persistent outer layer, which often only disintegrates at the top. *Hypothallus* profuse, but seeming scanty because it hardly extends beyond the mass of sporocysts, calcareous, white. *Sporocysts* globose to cylindrical, often angular from mutual pressure, 0.5 - 0.8 mm diam. and up to 1 mm high, white or cream-coloured, but somewhat transparent. *Peridium* double or seemingly single; outer layer egg-shell like, crustose, often quite thick, breaking up in large plates, usually only disintegrating near the top; inner layer membranous, sometimes closely adhering to the outer one but usually remote and close to the spore mass, colourless, but on the outside with lime incrustations, blueish grey, iridescent. *Columella* globose and somewhat pedicellate or elongate to cylindrical, rugose, white, locally connected with the peridium by large plate-like outgrowths but not physaroid, hollow and often transparent, easily breaking off near the base, leaving the sporocyst totally empty. *Capillitium* radiating from the columella and rather firmly attached to it, usually obscured by the massive spore mass. *Spores* black in mass, often forming a compact hard layer round the columella.

*Spores* subcircular to angular in optical section, (10.56) 10.95 - 12.13 (12.76)  $\mu\text{m}$  diam. (200 S, 8 C); caramel brown (6C6) to light brown (6D4-8, 7D5-7) in transmitted light, coarsely verrucose, with the warts densely and evenly distributed, pressure ridges present. *Capillitium* not abundant, threads rather short and rigid, slender but often flattened, smooth or rugose, often seemingly unfavorably developed, dichotomously or irregularly branching and anastomosing, especially at the extremities, brown or colourless. *Peridial inner layer* colourless to cream coloured, veined and with impressions from lime granules.

NORTH AMERICA:

U. S. A.:

NEW YORK: Jamesville, on leaves, 09-1889, O.F. Cook in Ellis (NY 5696); Memphis, on leaf of *Thuja*, s.d., Peck 121 (NYS holotype).

OHIO: s.l., on twig, s.d., Morgan 289 in Sturgis (NY 11603); Cedar Point, Eric Co., on wood, 07-1872, Fulner in Sturgis (NY 11604).

WISCONSIN: Trelease, on wood, 09-1885, *Ellis* (NY 5694).

SOUTH DAKOTA: Big Stone, on leaf, 08-1895, *Shear* (NY 7178).

IOWA: SW Holway, on leaf, 08-1882, *Ellis* (NY 5695); Cone Pres., Muscatine Co., on plant debris, 07-1969, *Sais* (NY s.n.).

CANADA:

ONTARIO: Toronto, on leaf, 09-1912, *Langton* in *Hagelstein & Cain* 9166 (NY 8430); Ottawa, on leaves and mosses with *D. subviridifuscum* *Buyck*, 10-1883, *Ellis* (NY 5689).

EUROPE:

AUSTRIA: s.l., on plant debris, s.d., *Bresadola & Torrend* in *Sturgis* (NY 10369).

*Discussion*: *D. crustaceum* is an example of a totally mis-conceived species: what we described as *D. subviridifuscum* represents the taxon, generally accepted as "*D. crustaceum*". All cited collections of the true *D. crustaceum* have been identified as *D. globosum* by almost every author. Indeed, the closely packed sporocysts are like those of *D. globosum*, but they are much more cylindrical in shape; microscopical features are also quite different from *D. globosum*: spores are larger, homogeneously coloured when observed in transmitted light and they lack the ovoid, elliptic or somewhat compressed outline in optical section; the capillitium is shorter, usually darker and not so slender nor so flexuous as that of *D. globosum*.

One very peculiar detail in the cited specimens is the fact that only two of them date from this century, while all the others have been collected between 1870 and 1899! I have no explanation for this phenomenon.

Fructifications of *D. crustaceum* are intermediate between *D. cingulatum* and *D. subviridifuscum*. The sporocysts remind those of *D. cingulatum* by the rather elongated shape, the sometimes high columella, which reaches almost to the top of the sporocysts and breaks off very easily near the base. Microscopically, the absence of the cingulum on the spores and of the typical perforations of the capillitium separate this species from *D. cingulatum*, but result on the other hand in a stronger resemblance to *D. subviridifuscum*.

Fructifications of this species suggest a bad development by the hardened spore mass, formed of angular spores and containing poorly developed capillitium, by the very fragile and usually hollow columella, as well as by the glazy structure of the peridial outer layer.

*Diderma globosum* Pers., Neues Mag. Bot. 1: 89 (1794).

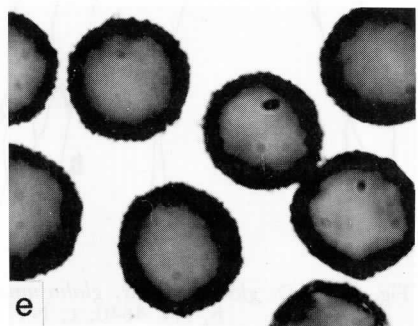
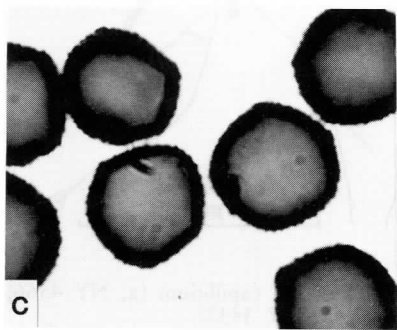
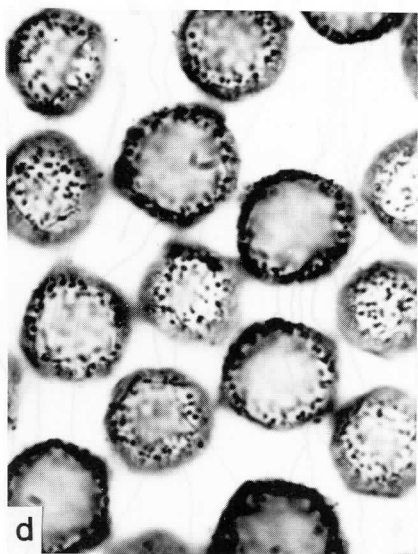
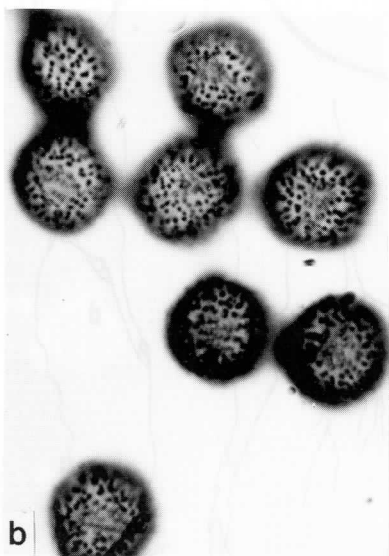
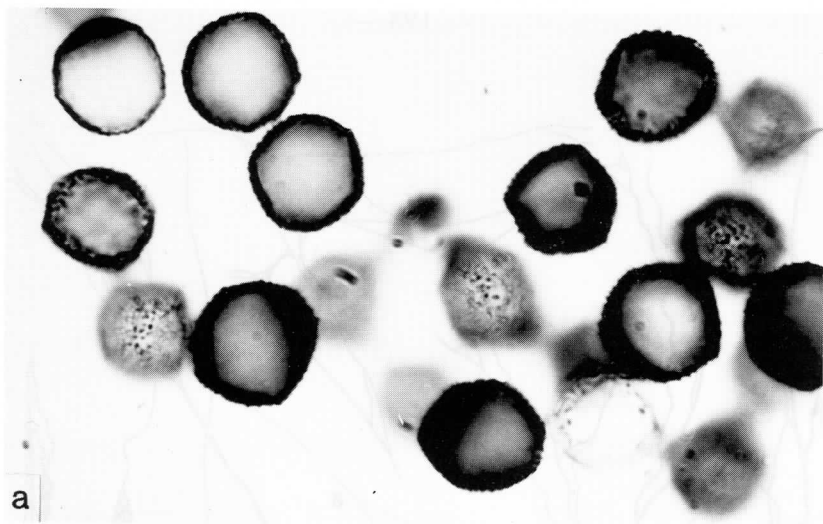
— var. *globosum* — Fig. 8 & 9.

*Fructification* from about hundred to several hundreds of sporocysts, closely gregarious, brilliantly white. *Hypothallus* inconspicuous, locally not continuous, often with some crystalline or amorphous lime incrustation round the base of the sporocysts, but usually rather sparse, colourless or seldom a little red-brown. *Sporocysts* hemispherical to globose, remarkably regular in form and outline, but often angular from mutual pressure, 0.5-0.6 mm high, ca. 0.7-1 mm diam. *Peridium* distinctly double; the layers widely separated, dehiscing independently and irregularly; outer layer white, forming a more or less thick egg-shell like crust, breaking up in large plates; inner layer membranous, close to the spore mass without, however, adhering to it, often not extending to the sporocyst floor but leaving the stipe of the pedicellate columella free, colourless and iridescent, with incrustations of white lime; the inner side shining. *Columella* large, hemispherical to globose, sometimes pedicellate, 0.2-0.3 mm diam., about 0.1-0.2 mm high, white or pale cream coloured. *Capillitium* radiating from the columella and strongly attached to it, seldom coming out of the sporocyst during disintegration, woolly. *Spores* dark purplish brown in mass.

*Spores* ovoid, ellipsoid to subglobose, (8.90) 9.23 - 11.67 (12.07)  $\mu\text{m}$  in diam. (675S, 26C), brownish orange (5C5-6, 6C4-6), pale brown (5D5-7) or dark brown (6E5-7, 6F7-8) in transmitted light, usually paler on one side accentuated in a small percentage of the spores by a local swelling, giving the spore a remarkable polarity and shape; ornamentation rather dense and evenly distributed, distinctly verrucose to spinulose. *Capillitium* abundant; threads slender or rather rigid, often very uneven in diam., flexuous, profusely branching and anastomosing (especially near the extremities); if rather rigid with local, dark and irregular swellings, usually rugose, predominantly colourless. *Peridial inner*

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Fig. 7. — *D. crustaceum*: spores; notice the typical angular form, the distinct warts and the absence of an equatorial rim as in *D. cingulatum* (a, Peck 121; b-c, NY 5694; d-e, NY 8430; all X 2900).



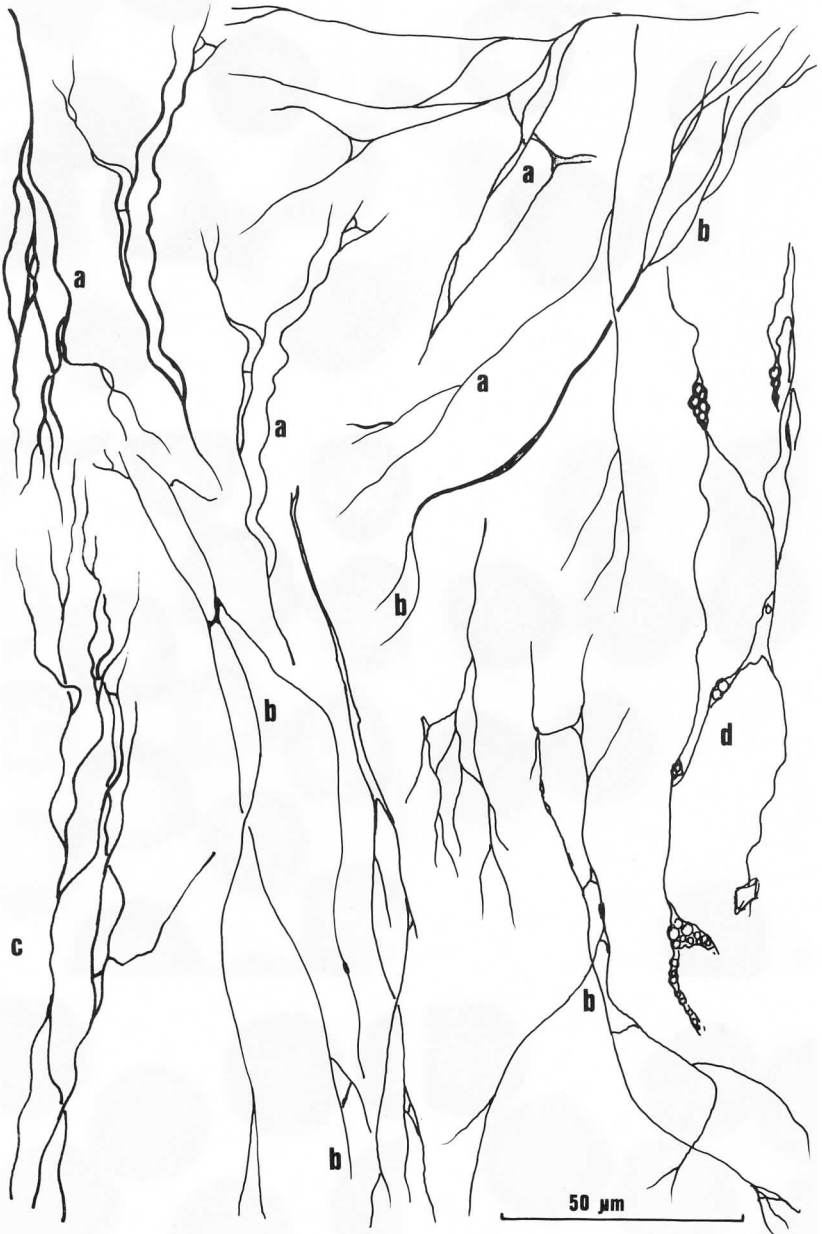


Fig. 8. — *D. globosum* var. *globosum*: habit of the capillitium (a, NY 4566; b, NY 4640; c, NY 11592; d, NY 3432).

layer colourless to cream-coloured, veined, with impressions of lime granules near the columella.

*Neotype*: U.S.A., Colorado, Cheyenne Mt, on leaves, twigs and bark, 09-1915, *Sturgis* (NY 11 592).

NORTH AMERICA:

U.S.A.:

MAINE: Kittery Point, on moss, 09-1902, *Thaxter* 5942 (NY 8078).

MASSACHUSETTS: Buckenham, Norfolk, on grass and moss, 10-1921, *Howard* in *Hagelstein* (NY 7182, B 892/82-8).

NEW YORK: Mc Leans, near Ithaca, on moss, 08-1935, *Hagelstein* & *Rispaud* (NY 3196); Seventh lake, Adirondack Mts., on moss, 08-1934, *Hagelstein* & *Rispaud* (NY 3432); Sharon, on moss, 08-1888, *Sturgis* (NY 12179).

COLORADO: Estes Park, 8700 ft, on wood, 10-1929, *Smith* in *Hagelstein* (NY 7177); Wet Mt Valley, on wood, 08-1911, *Sturgis* in *Hagelstein* 725 (NY 7180, 11 600); *ibid.*, on leaves and twigs of *Alnus*, 08-1914, *Sturgis* (NY 11 598); *ibid.*, on leaves and twigs with *D. trevelyani*, 09-1914, *King* in *Sturgis* (NY 11 599); Cheyenne Mt, Colorado Springs, on stone, leaves and twig, 08-1911, *Hagelstein* (NY 7181, 11 583, 11 594); *ibid.*, ca. 8000 ft, on moss and plant debris, 08-1912, *Sturgis* in *Jaap*, *Myxomyc. Exs.* 126 (NY 10 282, B 892/82-4); *ibid.*, on leaves, twigs and bark, 09-1915, *Sturgis* (NY 11 592 neotype); Atten's Park, 9000 ft, on bark, *Smith* in *Sturgis* (NY 11 605); Bear Creek Canyon, on leaves, 07-1905, *Sturgis* (NY 12185).

CANADA:

QUEBEC: Duchesmay, on moss, 08-1938, *Hagelstein* & *Rispaud* (NY 4491); near Hébertville, on moss, 08-1938, *Hagelstein* & *Rispaud* (NY 4566); O'Briens Camp, Laurentian Mts, on leaves and mosses, 09-1938, *Hagelstein* & *Rispaud* (NY 4640, 4641).

ONTARIO: Pinetree Lake, Algonquin Park, on twig and bark, 09-1939, *Cain* (NY 9087); Cache Lake, Algonquin Park, on moss, 09-1939, *Cain* (NY 9088); Costello Lake, on bark, 08-1939, *Cain* in *Hagelstein* (NY 9089, 9090); Swansea, Toronto, on moss with *D. effusum*, 10-1904, *Cain* 9878 (NY 8331).

— var. *europaeum* Buyck var. nov.; a var. *globoso* recedens plasmodiocystis vel sporocystis irregularibus, columella depressa et fere convexa, capillitio firmo, sporis subglobosis, (10.07) 10.41 - 11.57 (12.30)  $\mu\text{m}$  diam. (75 S, 3 C), lucem orientem versus visae egaliter coloratis. — Fig. 10 & 11.

*Type*: Switzerland, on herbs and twigs, 1914, *Jaap* (BPI holo-; NY 7830, 7831 iso-).

EUROPE:

SWITZERLAND: s. l., on herbs and twigs, 1914, *Jaap* (BPI holotype, NY 7830, 7831 iso-); s.l., on plant debris, s. d., *Meylan* in *Torrend* and in *Sturgis* (NY 10 367, 10 368).

FRANCE: Le Cochet, St. Croix, 1400 m alt., on herbs, 04-1934, *Meylan* in *Hagelstein* (NY 8318).

*Discussion:* Persoon (l.c.) cites no specimens in his original description of *D. globosum*, which consists of only four terms (acaule, leve, globosum, candidum) involving some major macroscopical characters that may be encountered in all of the species of this complex. Since there is no specimen of *D. globosum* present in the Persoon collection at the Rijksherbarium Leiden, we may presume that a neotype should be designed for this species. As for *D. spumarioides* we think it better to choose this specimen in accordance to the modern and now commonly applied concept of this species (which is mainly based on microscopical features), instead of trying to find a specimen which suits the best the very short, macroscopically-based diagnose by Persoon. The Sturgis collection from Colorado consists of a large and beautiful fruiting which is in every way typical for our modern concept of *D. globosum*.

*D. globosum* (in both of its varieties) belongs to the best recognizable species in the subgenus *Eudiderma*, due to its typical, constant features. The chief variations exist between European specimens (var. *europaeum*) and those from elsewhere (var. *globosum*). The var. *globosum* looks like a very firm and tall *D. cinereum*, exhibiting also the same capillitial features. The capillitium of the var. *europaeum*, however, is much more like that of *D. spumarioides*.

One third of the specimens have been collected on moss, which seems to constitute a substrate preference, not encountered in the other species of the complex.

In fact, *D. globosum* stands quite apart from the other species of the complex and has its own periferic or closely related species like *D. niveum*, *D. alpinum* or *D. deplanatum* (all three were considered varieties of *D. globosum* by most of the early authors). With *D. globosum* we come to the more robust species of the genus, which all seem to prefer lower temperatures. For *D. niveum* (and *D. alpinum*) this was commonly accepted, but this study has revealed the same nivicole "preference" in *D. globosum*.

*D. globosum* differs from *D. niveum* (and *D. alpinum*) in having a white columella, somewhat smaller sporocysts and more intense

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Fig. 9. — *D. globosum* var. *globosum*: spores, notice the distinct but rather low warts and the much darker half of the spore (a, NY 7177; b & d, NY 9087; c, NY 11594; all X 2900).



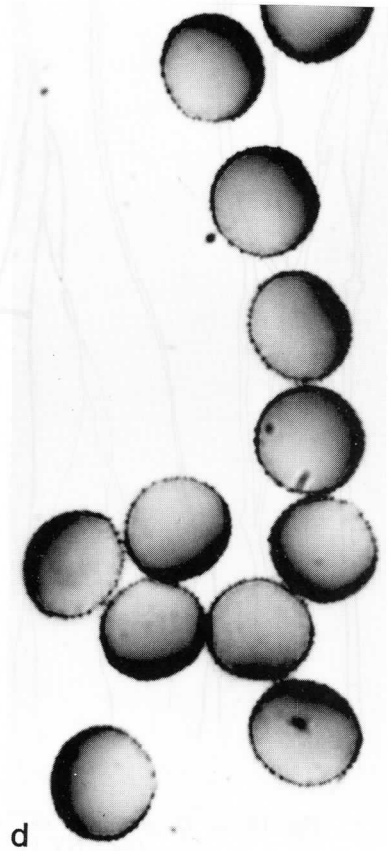
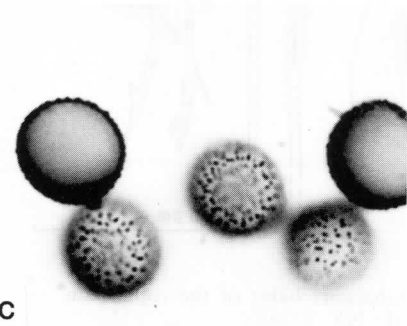
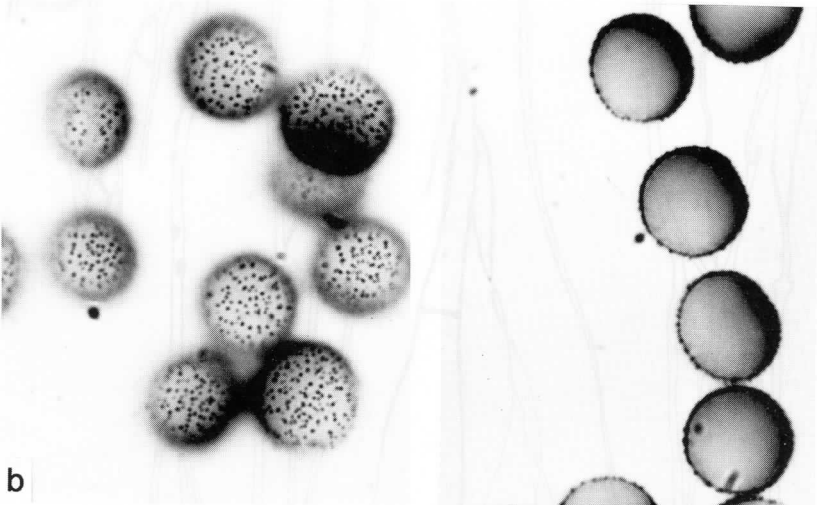
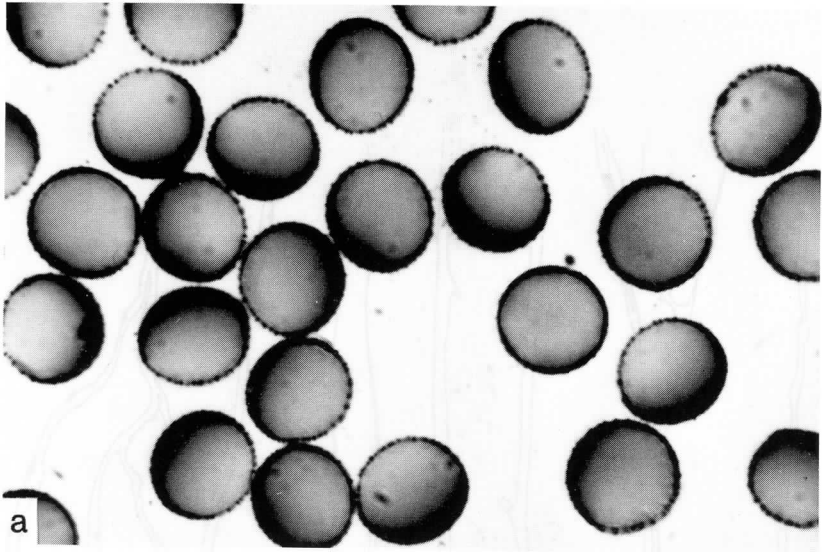




Fig. 10. — *D. globosum* var. *europaeum*: habit of the capillitium (a-c: NY 7831; d: NY 10368).

iridescence of the peridial inner layer. The var. *globosum* shares with *D. niveum* typical spore features in having spores of which one side (being distinctly darker in transmitted light) seems better developed than the other.

*D. testaceum* may also produce white hemispherical to almost globose sporocysts, but it differs in the more scattered habit of the fructifications, the absence of iridescence of the peridial inner layer and the tendency of the peridium to become three-layered by the formation of a membranous, pigmented middle layer adhering to the outer one (especially in tropical specimens). The non-areolate dehiscence of the peridium distinguishes the three layered specimens from *D. maculatum* (Buyck 1984).

***Diderma spumarioides*** (Fries) Fries, Syst. Mycol. 3: 104 (1829).  
— Fig. 13, 14, 15.

*Didymium spumarioides* Fries, Symb. Gasteromyc.: 20 (1818), non *Didymium spumarioides* Fries 1829.

*Diderma scabrum* Eliass. & Nann.-Brem., Proc. K. Ned. Akad. Wet., ser. C. 86: 151 (1983), syn. nov.

*Fructification* of several hundreds of sessile sporocysts, typically closely gregarious, rarely scattered, often powdered with the spores from disintegrating sporocysts. *Hypothallus* membranous, continuous, colourless to reddish brown, often hidden by lime incrustation, without, however, embedding them. *Sporocysts* hemispherical to subglobose or distorted by mutual pressure, narrowly sessile, broadly when sporocysts depressed, ca. 0.5 mm broad and high, usually greyish white or dirty white, seldom purely white. *Peridium* appearing single, sometimes clearly double but both layers always adhere very closely to one another and disintegrate together, in some fruitings breaking up into rather large fragments which fall away very easily; the outer layer usually wrinkled or with scaly lime deposits as in *Physarum*. *Columella* large or small, hemispherical, conical, slightly convex or even lacking; the surface usually very rough, often strongly spiky with numerous, radiating, fusiform lime-aggregations, mostly cream-coloured, yellowish or even reddish brown, sometimes white, often surrounded by a distinctly darker sporocyst-floor. *Capillitium* usually abundant, sometimes distinctly physaroid, often expanding elastically on dehiscence of

the sporocyst during its disintegration, brown or hyaline, only lightly attached to the peridium. *Spores* forming a fade to dark brown mass, usually vanishing quickly after disintegration of the peridium.

*Spores* usually perfectly circular, sometimes also subcircular in optical section, (8.01) 8.19-11.03 (11.31)  $\mu\text{m}$  diam. (1450 S, 58 C), greyish orange (5B3-5), brownish grey (5C2, D2), brownish orange (5C3-5), greyish brown (5 D3), to yellowish brown (5D4-5, E4-5), distinctly verrucose to spinose; ornamentation evenly distributed, dense or sparse, with the height of the elements inversely related to their density. *Capillitium* abundant: threads straight, sometimes a little undulating, locally with dark, lens-shaped expansions, the latter leaving the distinctly paler centre of the filaments unaffected in optical section, at the extremities often with enclosed lime granules, dichotomously branched at an acute angle, sparingly interconnected at the extremities, very variable in diam., pale yellow-brown to greyish yellow, with dark, fine warts, seldom smooth. *Peridial inner layer* ochraceous or red-brown near the sporocyst-floor, fading upwards, veined, with many impressions of lime granules.

*Neotype*: U.S.A., Indiana, Clarck, Co., on rotten leaves, 08-1938, *Gray* in *Hagelstein* (NY 8712).

NORTH AMERICA:

U.S.A.:

NEW YORK: Coys Glan, Ithaca, on leaves of *Picea*, 08-1935, *Hagelstein* & *Rispaud* (NY 3084); Middleburg, on leaves, 09-1936, *Hagelstein* (NY 3665); *ibid.*, Schoharie Co., on twigs, 08-1938, *Hagelstein* & *Rispaud* (NY 4779); Newcomb, Essex Co., on leaves, 07-1924, *House* in *Hagelstein* (NY 7964); Putnam Co., on leaves and twigs, 07-1896, *s. coll.* (NY 8594).

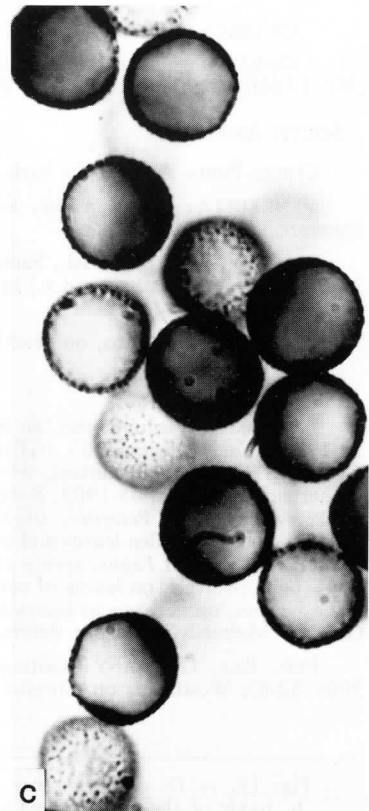
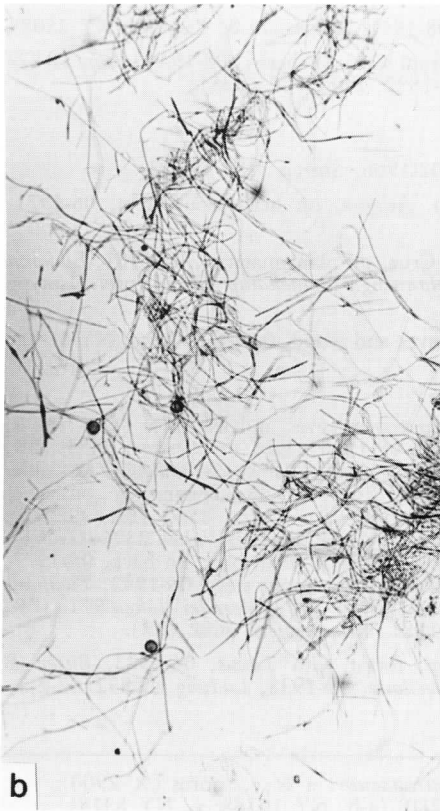
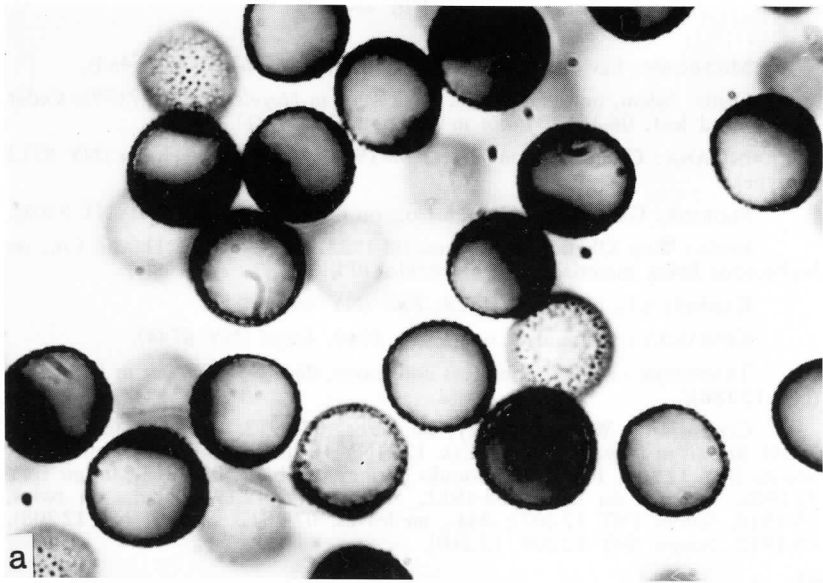
PENNSYLVANIA: Dingman Township, Pike Co., on herbs, 06-1940, *Hagelstein* & *Rispaud* (NY 2807); Angels, Wayne Co., on leaves, 06-1936, *Hagelstein* & *Rispaud* (NY 3874), 09-1937, *Hagelstein* & *Rispaud* (NY 4210, 4277), 07-1938, *Hagelstein* & *Rispaud* (NY 4937); Rexford, on bark of *Tilia*, 08-1938, *Shear* in *Hagelstein* (NY 8823).

CONNECTICUT: Poquonock Co., on plant debris, 06-1893, *Sturgis* (NY 12193).

NEW JERSEY: Sussex Co., on leaves and bark, 06-1936, *Hagelstein* & *Rispaud* (NY 3746, 3747).

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Fig. 11. — *D. globosum* var. *europaeum*: a & c, spores ( $\times 2900$ );  
b, habit of the capillitium ( $\times 280$ ) (NY 7830).



MICHIGAN: Lewiston, on bark, 08-1898, *Beardslee* (NY 13463).

OHIO: Salem, on plant debris, N. E. Peck in *Hagelstein* (NY 7179): Cedar Pt. on dead leaf, 06-1912, *Brain* in *Sturgis* (NY 12191).

INDIANA: Clark Co., on leaves, 08-1938, *Gray* in *Hagelstein* (NY 8712 neotype).

FLORIDA: Gainesville, Alachua Co., on moss, R. & W. West (NY 9308).

IOWA: West Okoboji, on leaves, 08-1932, *Rogers* (NY); Hardin Co., on herbaceous living material, s.d., *Macbride* (BPI).

KANSAS: s.l., on leaves, 1828, *Ellis* (NY 5691).

KENTUCKY: Crittenden, on leaves, 1910, *Lloyd* (NY 6744).

TENNESSEE: Burtank, on moss and leaves, 08-1896, *Thaxter* in *Hagelstein* (NY 12186).

COLORADO: Wet Mt Valley, on herbs, 07-1912, *Ronn* in *Sturgis* (NY 7834), *Sturgis* in *Jaap*, Myxomyc. Exs. 125 (NY 10281); *ibid.*, on bark, 07-1912, *Sturgis* (NY 12204, 12206): Colorado Springs, on bark, 08-1912, *Sturgis* (NY 12190); Tolland, on herbs, 08-1912, *Sturgis* (NY 12195); *ibid.*, on twigs, 08-1914, *Sturgis* (NY 12207); *ibid.*, on leaves, 07-1912, *Sturgis* (NY 12208), 09-1912, *Sturgis* (NY 12209, 12210).

CANADA:

QUÉBEC: Jesus Isl., on bark, 08-1941, *Hagelstein* & *Rispaud* (NY 2508).

ONTARIO: Oakland swamp, Brant Co., on herbs, 08-1943, *Cain* 18873 (NY 13610); London, on leaves, 07-1892, *Ellis* (NY 6635).

SOUTH AMERICA:

CHILI: Punta Arenas, on bark, 02-1906, *Sturgis* (NY 12183).

VENEZUELA: near Caracas, Edo. Aragua, on herbaceous stem, 06-1971, *Dumont* VE-442 (NY s.n.).

ECUADOR: Galapagos Isl., Santa Cruz, on plant material, 02-1981, *Eliasson* 3407 (holotype *D. scabrum*, n.v.) in *Nannenga-Bremekamp* 12614 (priv., isotype *D. scabrum*).

BOLIVIA: Puerto Rico, on dead leaves and wood, 01-1917, *Leno* (NY 6740).

EUROPE:

BELGIUM: Oostduinkerke, on herbaceous leaves and leaves of *Salix repens*, 10-1975, *Goetghebeur* 2403 (GENT), 09-1966, *Van der Veken* 3431 (BR, GENT); De Panne, on mosses, 04-1907, *Bommer* & *Rousseau* (BR); Koksijde, on herbaceous leaves, 05-1909, *Bommer* & *Rousseau* (BR); Zwijnaarde, on leaves of *Polygonum* and *Petasites*, 06-1974, *Van der Veken* 8552 (BR, GENT); St-Joris-Weert, on fallen leaves and twigs, 10-1965, *Van der Veken* 2396 (GENT); Kanne, on leaves of *Fagus*, spring 1981, *Gubbels* (BR); *ibid.*, on bark, 05-1977, *Vaes* (priv.); Ravels, on leaves of conifers and deciduous trees, 06-1943, *Tuymans* (BR); Nismes, on herbaceous leaves and twigs, 08-1972, *Van der Veken* 9713 (BR, GENT); Malmédy, on plant debris, 1881, *Roumeguère* 1682 (BR).

FED. REP. GERMANY: Göttingen, forest with *Taxus*, 06-1923, *Bitter* (B 900a/82-8); Westfalen, on *Corylus avellana*, 10-1938, *Ludwig* (B 892/82-2).

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Fig. 12. — *D. globosum* var. *europaeum*: a & c, spores ( $\times 2900$ ); b, habit of the capillitium ( $\times 280$ ) (a-b, NY 10368; c, NY 8318).

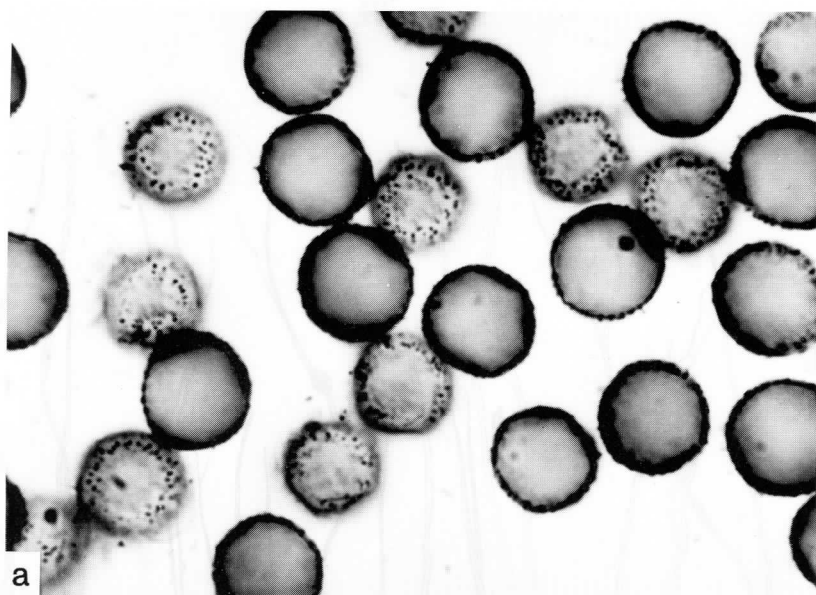




Fig. 13. — *D. spumarioides*: habit of the capillitium (a, NY 4937; b, NY 2508; c, B 900/82-6; d, NY 12206; e, NY3034; f, NY 10365).



DEM. REP. GERMANY: Prov. Brandenburg, under *Pinus*, 09-1931, *Peters* in *Jahn* (B 900a/82-1); Strausberg am Herrensee, on plant material, 06-1965, s. coll. (B 900/82-2), 09-1931, *Hennig* (B 900a/82-6); Eberswalde, on herbaceous plants, 06-1931, *Hesmer* in *Jahn* (B 900a/82-2).

PORTUGAL: Benfica, on herbaceous material, *Torrend* in *Sturgis* (NY 10 365, 10 366).

*Discussion*: At the herbarium of the Uppsala University, where the Fries herbaria are deposited, no indication of a possible type specimen could be found. I received the only three specimens of *D. spumarioides* present in the Fries' collection. They were not gathered by Elias Magnus Fries, who first described this species, but by his grandson, Robert Elias Fries, and were identified by the latter as *D. spumarioides* (Fr.) Rost. Although coming from the Uppland province, where most of the Elias Magnus Fries' collections are from, those three specimens were in no way typical *spumarioides*-specimens in the sense this species is conceived by recent authors. In fact, microscopical features point clearly to *D. cinereum* Morgan. Since the original descriptions of both *Diderma spumarioides* and its basionym *Didymium spumarioides* involve only macroscopical characters and contain no citations of specimens, I think it is best to choose a neotype which suits the generally accepted concept of this species in most of the recent works on *Myxomycetes*.

*D. spumarioides* usually differs from *D. cingulatum* and *D. subviridifuscum* in the sparser arrangements of the sporocysts. Peridium and hypothallus exhibit less lime incrustation and the capillitium adheres more firmly to the peridium, which splits up in larger fragments.

Many specimens of *D. spumarioides* and *D. subviridifuscum* exhibit a spiky columella and capillitium with distinct radiating, fusiform lime incrustations. This clearly illustrates the artificial place in most of the recent works on *Myxomycetes* of the genus *Diderma* — or of at least some of the species — within the family *Didymiaceae* (based upon the absence of lime in the capillitium). The pattern of radiating lime incrustation is also present on the sporocyst-floor in *D. subviridifuscum*.

Features of typical capillitium like the presence of typical lenticular swellings, the firm habit and the sparse branching of the threads, which possess a distinct lumen in optical section, are very

useful indications of *D. spumarioides*. Unfortunately, some specimens of *D. spumarioides* possess a capillitium that branches more irregularly and where the threads are shorter and more slender, thus more like those of *D. cinereum* or *D. donkii*. This phenomenon is usually accompanied by a more dense ornamentation, consisting of smaller warts as in *D. cinereum* (but without clustering of warts). In such cases, it becomes very difficult to decide whether a specimen belongs to *D. spumarioides* or to *D. cinereum*. One usually has to appeal to the less reliable features of the peridium or the columella for naming the specimen. Also *D. globosum* may exhibit a similar type of capillitium but, on the contrary, has a very different and characteristic habit, which makes it quite recognizable. A few specimens exhibit capillitium with dark, globose swellings, as if originating from large, enclosed lime granules. This phenomenon has not been observed in other species (see fig. 13).

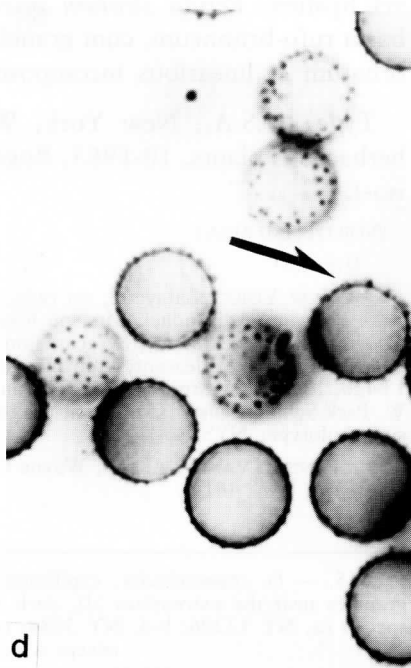
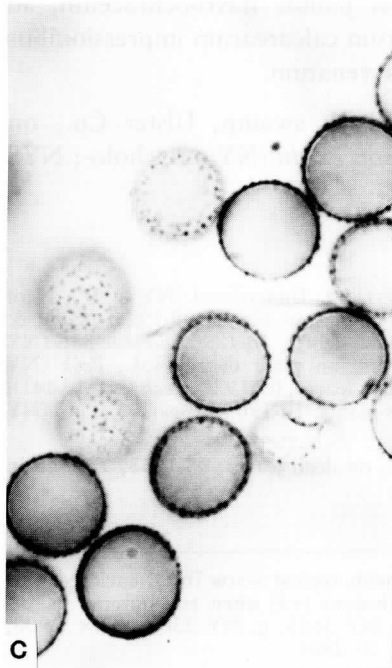
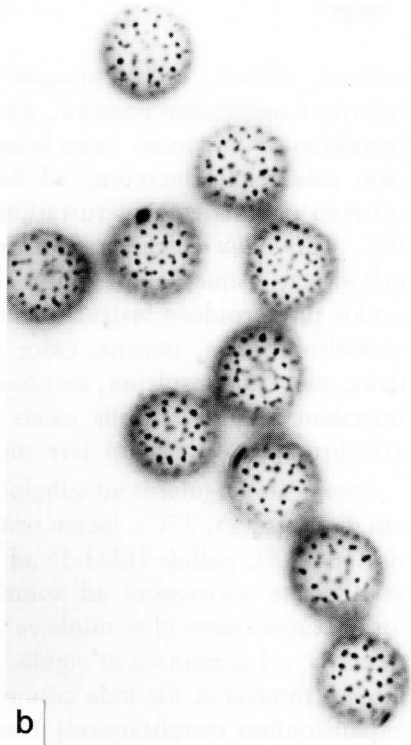
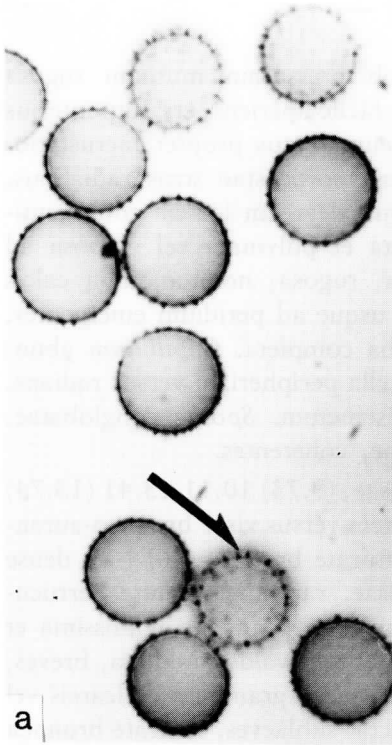
Examination of the type material of *D. scabrum* Eliass. & Nann.-Brem. showed it to belong undoubtedly to *D. spumarioides*, with the same type of capillitium, which is much larger than the drawing by Nannenga-Bremekamp suggests. The capillitium exhibits very few lenticular swellings and is somewhat darker than that of temperate collections. The spores, although not completely swollen and lacking the spines of the typical specimens, perfectly fit our description and are quite normal for this species.

***Diderma subviridifusum* Buyck sp. nov. — Fig. 16 & 17.**

*Fructificatio* sporocystis numerosis plerumque gregariis composita. *Hypothallus* bene evolutus, membranaceus, continuus, brunneus sed plerumque ob incrustationem calcaream albus, dense rugulosus vel venosus, fragilis, sporocystarum basi hic inde plicatus. *Sporocystae* sessiles, semiglobosae vel globosae, saepe in sectione transversali ob pressuram mutuam angulatae, usque ad 0.7 mm altae, ca 0.5 - 1.1 mm diam., albae. *Peridium* bistratum, irregulariter dehiscens; stratum externum calcareum, laeve, non

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Fig. 14. — *D. spumarioides*: spores; remark the almost perfectly globose form; spore ornamentation may occasionally resemble that of the other species (c), but typically exhibits large spines (arrows) (a, NY 4277; b, NY 13610; c, NY 12204; d, NY 4210; all  $\times 2900$ ).



micans, album, saepe margine ob pressuram mutuum rugosa igiturque operculum imitanti, apice facile aperiens; stratum interius membranaceum, intus luteo-brunneum, extus propter incrustationem calcaream cinereum, ad basin sporocystae striis radialibus, quarum pallidis cum incrustationem calcaream fortem congruentibus. *Columella* calcarea, indistincta et pulvinata vel globosa ad cylindrica, usque ad 0.3 mm alta, rugosa, nonnumquam calcis nodos physaroideos instructa, fere usque ad peridium emergentes, viridulo-brunnea, micans, calce alba completa. *Capillitium* abundans, saepe inconspicuum, ex columella peripheriam versus radians, interdum aliquot nodulis calcis instructum. *Sporae* conglobatae, atro-brunneae, interdum fere nigrae, coherentes.

*Sporae* subangulares ad subglobosae, (9.73) 10.11-13.41 (13.74)  $\mu\text{m}$  diam. (675S, 27C), lucem orientem versus visae brunneo-aurantiae (6C3-5), pallide (6D3-5) ad saturate brunneae (6F4-7), dense et distincte verrucosae ad spinulosae, rarissime minute verruculosae. *Capillitium* plus minusve exiguum; filamenta tenuissima et flexuosa vel applanata et rigida, interdum valde undulata, breves, intense ramosa et hic inde connecta, saepe granulibus calcareis vel expansionibus membranaceis instructa, sublaeves, saturate brunnea vel hyalina. *Peridii stratum interius* pallide flavo-ochraceum, ad basin rufo-brunneum, cum granularum calcarearum impressionibus ornatum et linearibus incompositis venatum.

*Type*: U.S.A., New York, W. Park swamp, Ulster Co., on herbaceous plants, 10-1963, *Rogerson et alii* (NY s.n., holo-; NYS iso-).

NORTH-AMERICA:

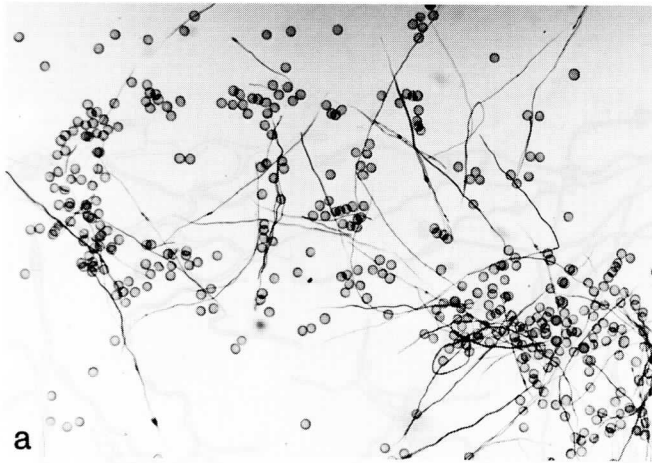
U.S.A.:

NEW YORK: Lafayette, on twig, 07-1890, *Underwood* (NY 5007); N of Lake Pleasant, Adirondack Mts, on leaves of various plants, 09-1925, *Wann & Muenscher* 54 (NY 8264); Syracuse, on plant debris, 10-1890, *Banker* 396 (NY 9664); near Lake Pleasant, Adirondack Mts, on plant debris, s.d., *Peck* (NY 13 420, 13 480); Westport, Essex Co., on dead leaves, 09-1928, *Peck* (NY 13 441); W.-Park Swamp, Ulster Co., on herbaceous plants, 10-1963, *Rogerson et alii* (NY s.n., holotype; NYS iso-).

PENNSYLVANIA: Angels, Wayne Co., on dead leaves, 08-1938, *Thomas* in *Hagelstein* (NY 4814).

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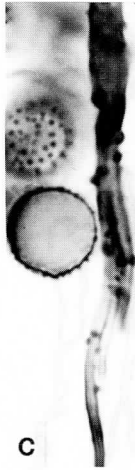
Fig. 15. — *D. spumarioides*: capillitium, with typical warts (b-c), enclosed lime granules near the extremities (d), dark inclusions (e-f) often encountered in this species (a, NY 12206; b-d, NY 3084; e-f, NY 3665, g, NY 2508; all  $\times 2900$ , except a & g  $\times 280$ ).



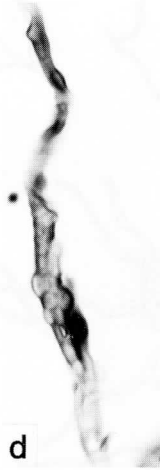
a



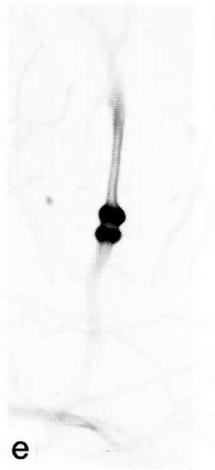
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c



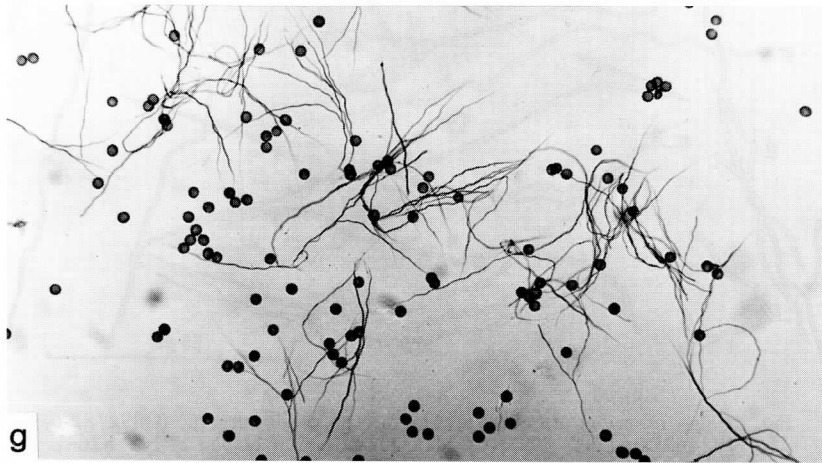
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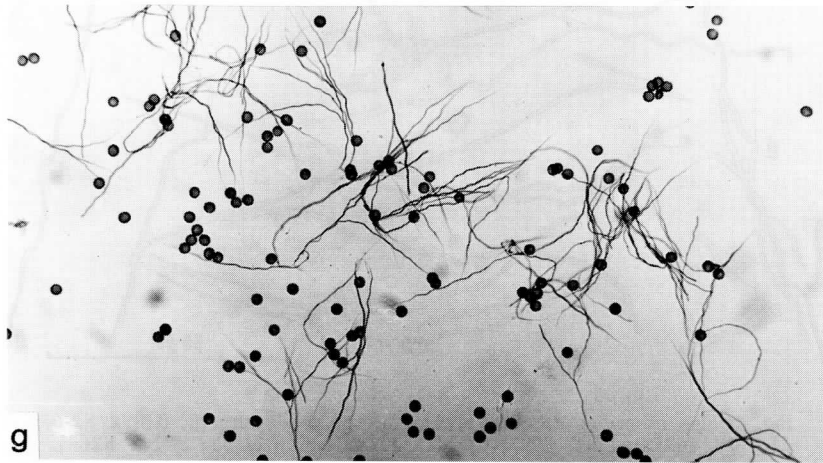
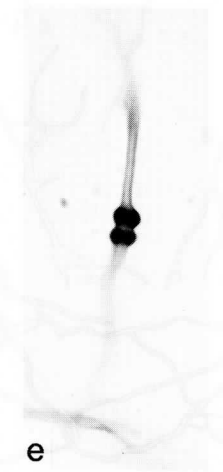
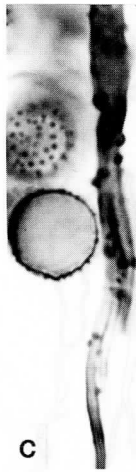
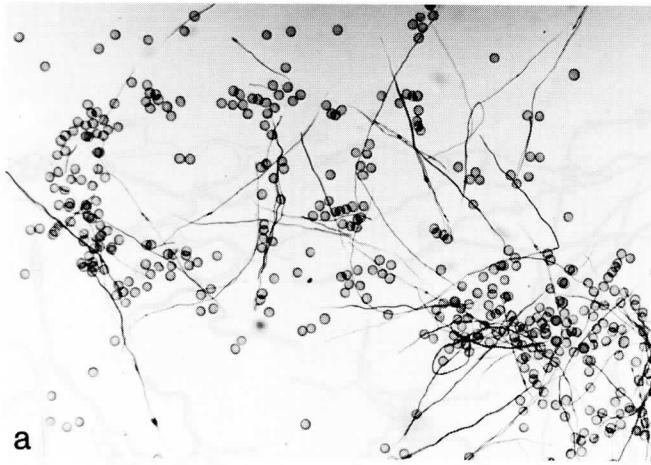
e



f



g



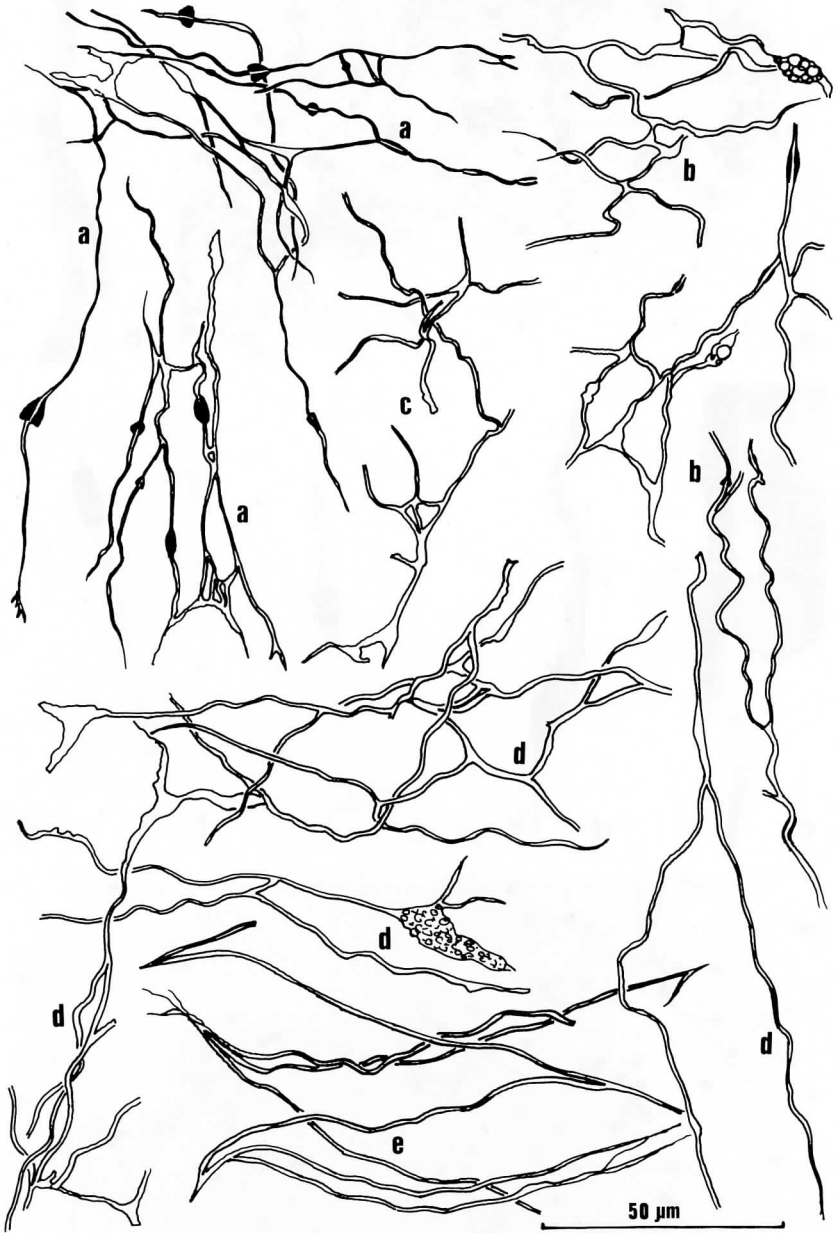


Fig. 16. — *D. subviridifuscum*: habit of the capillitium (a, B 892/82-6); b, NY 4639; c, NY 5693; d, NY s.n. Rogerson *et al.*; e, NY 8264).

DISTRICT OF COLUMBIA: Plummers Isl., near Cabin John, on plant debris in low woods, 11-1890, *Maxon* 490 in *Sturgis* 582 (NY 11595).

VIRGINIA: woods near Receiving Reservoir, near Washington, on leaves and well rotted log, 10-1890, *Maxon* 483 in *Sturgis* 581 (NY 11596).

INDIANA: Boy Scout Isl., on herbaceous material, 01-1934, *R. C.* (NY s.n.).

IOWA: near Turkey Creek, Johnson Co., on plant debris, 12-1931, *Shimek* in *Jahn* (NY s.n., B 889/82); Johnson Co., on plant debris, 07-1902, *Shimek* in *Jahn* (B 892/82-7); Cone Pres., Muscatine Co., on plant debris, 07-1969, *Sais* (NY s.n.).

CAROLINA: Ravenel. Fungi Caroliniana Exsicc. Fasc. 1/79 (as *Didymium cinereum*), in graminibus, *Ellis* (NY 5697).

COLORADO: Cheyenne Mts., on mosses and debris of herbaceous plants, 08-1912, *Sturgis* (NY 12202, 12203, 12399), *ibid.* on herbaceous material, 07-1912, *Sturgis* in *Jaap*, *Myxomyc. Exs.* 125 (NY 10281).

CANADA:

QUÉBEC: St-Gédéon, Lake St John, on herbaceous material, 08-1938, *Hagelstein & Rispaud* (NY 4638, 4639); O'Briens' Camp, Laurentian Mountain, 08-1938, *Hagelstein & Rispaud* (NY 4642).

ONTARIO: Toronto, on rotten wood, 09-1908, *Langton* 2343 (NY 8124), 09-1912, *Langton* 2306 in *Cain* 9879 (NY 8420), E of New Durham, Brant Co., on *Betula*, 10-1937, *Cain* 9786 in *Hagelstein* (NY 8426); S of Aurora, York Co., on rotten log, 09-1937, *Cain* 8971 in *Hagelstein* (NY 8028); Komoka, Middlesex Co., on wood, 10-1937, *Hagelstein* (NY 8713); *ibid.*, on dead leaf, 10-1939, *Sutton* 105 (NY 9586); *ibid.*, on bark of young oak, 05-1897, *Ellis* 644 (NY 6845).

EUROPE:

BELGIUM: Merlemont, on herbaceous leaves, 10-1968, *Thieu* 3733 (BR).

*Discussion*: Macroscopically, *D. subviridifuscum* strongly resembles *D. spumarioides* and sometimes even *D. cingulatum*, but it differs from both in the greenish brown inner side of the peridial inner layer, which is cinereous in the two other species (if visible at all). *D. subviridifuscum* is also distinctly different from *D. cinereum* in its pigmentation (absent or limited to the sporocyst-floor in *D. cinereum*), in the double peridium, in the microscopical features of capillitium and usually also in spore features (especially the spore size).

The capillitium resembles that of *D. cingulatum* and *D. crustaceum* in many respects. Compared to *D. cingulatum*, the threads are shorter, branching more intensively, sometimes even forming a reticulum throughout the sporocyst. The main difference, however, is in the absence of the typically perforated anastomoses near the forking sites. Dark swellings, reminiscent of those of *D. spumarioides*, are often present.

Microscopically, the features of the spores are sometimes uncomfortably close to those of *D. globosum* or *D. crustaceum*, but since



both species are quite different in habit, confusing them is not likely.

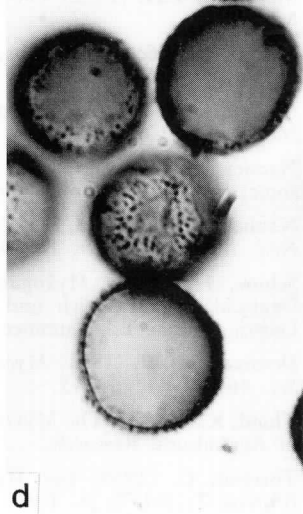
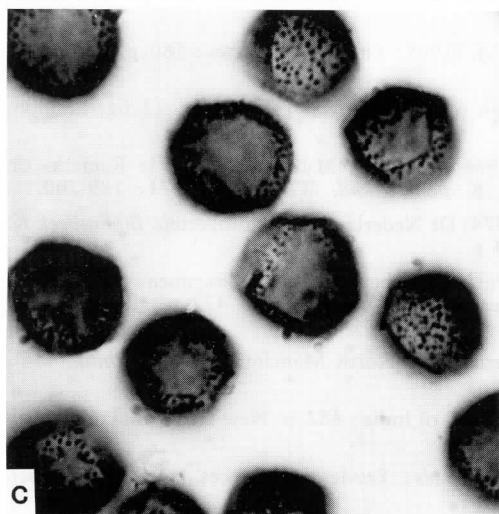
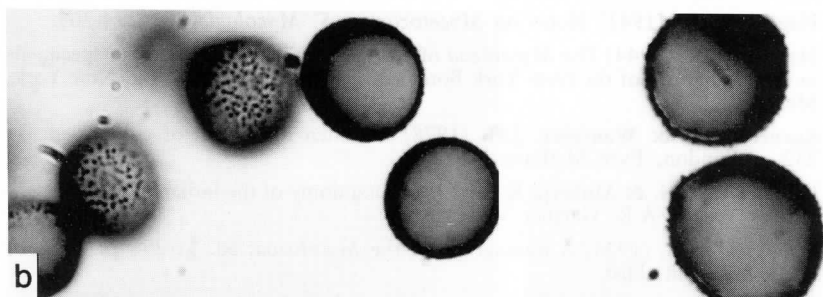
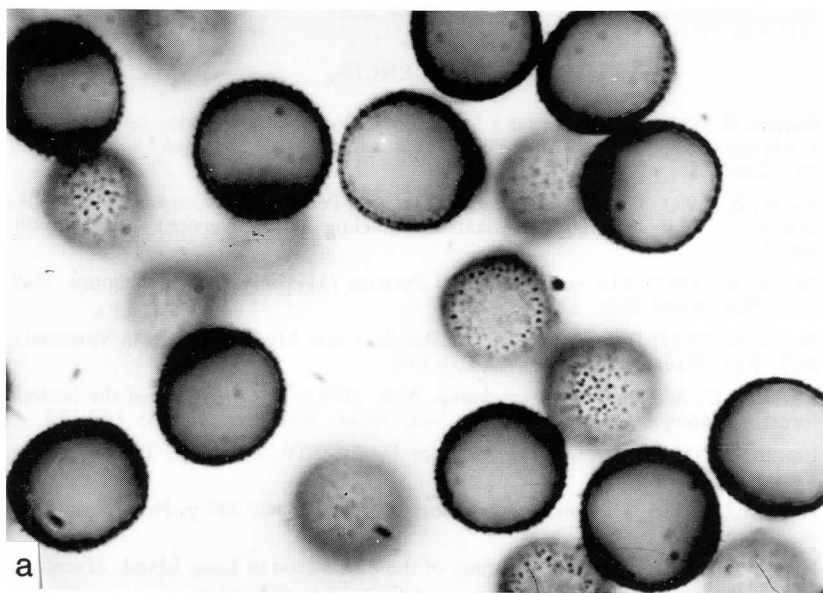
This species sometimes suggests a dwarf form of *D. alpinum* (or *niveum*); however, the columella is totally different: very rugose and distinctly physaroid in most specimens. Moreover, the spores and capillitium are too different to suggest such a close relationship.

The Belgian specimen has been described and illustrated by Buyck (1982: 178-180, fig. 6), but was at that time identified as *D. crustaceum* Peck.

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Fig. 17. — *D. subviridifuscum*: spores, poorly developed in c (a, NY 8264; b, NY 5697; c, NY 6845; d, NY 9586; all X 2900).



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