Four new coprophilous species of Ascobolus and Saccobolus from Greenland (Pezizales)

H. Dissing

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Ascobolus brantophilus sp. nov., *A. groenlandicus* sp. nov., *Saccobolus chenocopricus* sp. nov., and *S. ovibovinus* sp. nov. are described from dung of goose and musk ox from high arctic areas in Greenland. Supplementary material, mainly from Ellesmere Island, Canada and Svalbard, Norway has been studied.

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Introduction

In a preliminary list of all species of Operculate Discomycetes known at that time from Greenland, Dissing (1982) recorded four *Ascobolus* species, viz. *A. albidus* Crouan, *A. carbonarius* P. Karst., *A. furfuraceus* Pers.: Fr., *A. stictoideus* Speg. and two *Saccobolus* species, viz. *S. depauperatus* (Berk. and Br.) E. Chr. Hansen and *S. versicolor* (P. Karst.) P. Karst. *Saccobolus quadrisporus* Mass. and Salmon and *S. groenlandicus* Dissing were later added to the list (Dissing 1987).

Recent studies of dung samples collected during field work in 1981, 1982, 1983, and 1987 in addition to stray samples, kindly made by a.o. co-operative geologists and ornithologists, have revealed a still increasing number of coprophilous species among which are well known species like *Ascobolus immersus* Pers. and *A. saccharíferus* Brumm. as well as three undescribed *Ascobolus* species and five species of *Saccobolus* which represent undescribed taxa. In the present investigation two *Ascobolus* species and two *Saccobolus* species are described as new.

Material and methods

Excellent laboratory facilities have made it possible to prepare detailed notes on microscopic and macroscopic characters of fresh material of the species described, except for *Saccobolus ovibovinus* which has only been seen on musk ox dung in moist chamber. Measurements of spores, paraphyses and anatomic characters were made on fresh material mounted in water. Fresh dung samples of goose and musk ox as well as winter dung of musk ox were dried carefully and later incubated in moist chambers under room temperature, normally in late autumn or in the spring after the sampling.

In order to study the anatomy of *Saccobolus chenocopricus,* apothecia of fresh material were fixed in 2.5% glutaraldehyde and treated according to the method described by Dissing & Sivertsen (1988, cf. also Feder & O'Brien 1968). SEM photos were made in a Phillips Scanning Microscope after coating with gold-palladium alloy.

The localities investigated in Greenland, Ellesmere Island and Norway are presented in Tab. 1 and Fig. 1. It

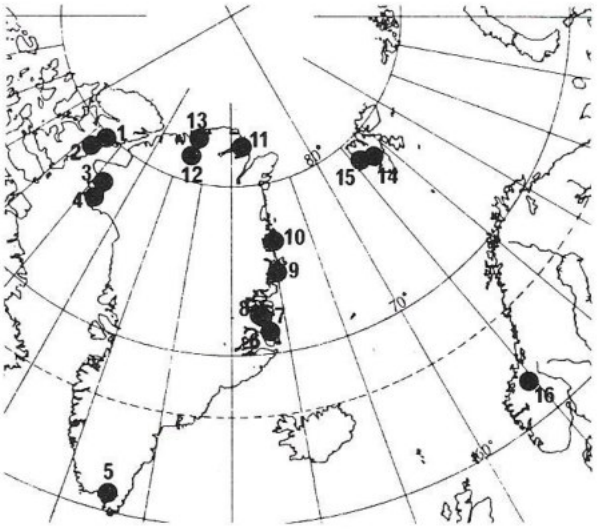

Fig. 1. Map showing the position of the 18 localities from which material has been studied in the present investigation (for the names and the exact position of the localities cf Tab. 1).

Tab. 1. List of investigated localities. The figure indicates the number of collections studied from the locality in question. A figure with an asterisk indicates that both material from nature and material from moist chambers have been studied. A figure without an asterisk indicates that only material from moist chambers have been studied.

	Ascobolus brantophilus	*Ascobolus groenlandicus*	*Saccobolus chenocopricus*	*Saccobolus ovibovinus*
Canada				
1. Sverdrup Pass 79°09′N, 79°39′W		1		1
2. Alexandra Fiord 78°53′N, 75°55′W	4*			
Greenland				
3. Qanaq (Thule) 77°28′N, 69°20′W				
4. Pituffik (Dundas, Thule) 76°34′N, 68°45′W				
5. Igaliko 61°10′N, 45°25′W		1		
6. Jameson Land,				
a. Ørsteddalen 71°45′N, 23°30′W	1	1	2*	
b. Head of Draba sibirica river, 71°N, 24°20′W	1			
7. Mestersvig 72°15′N, 24°W	15*			
8. Ella Island 72°30′N, 25°W	5*	8*		
9. Kuhn Island 75°N, 20°W		1		
10. Danmarks Havn 76°46′N, 18°48′W	1	1		
11. Peary Land 82°30′N, 24°W		1		
12. Nares Land 81°55′N, 44°40′W				1
13. Peter Freuchen Land 82°45′N, 43°W		1		
Norway				
14. Longyearbyen,				
a. Adventdalen 78°15′N, 16°E	2*	2*		
b. Bunsow Land, Gipselva 78°26′N, 16°35′E	4*		1*	
15. Ny-Ålesund 78°50′N, 12°E	2*			
16. Kongsvoll, Råtåsjönosi 62°15′N, 9°50′E		1*		

can be seen from Tab. 1 that dots 6 and 14 in Fig. 1 cover two localities.

The material is deposited in the Botanical Museum, Copenhagen (C), with duplicates in Univ. of Trondheim (TRH) and Univ. of Toronto (TRTC).

Descriptions

Ascobolus brantophilus Dissing sp. nov.

Ascocarpium superficiale, 0.4–1 mm latum, 0.4–0.6 mm altum, primum turbinatum vel pyriforme vel subglobulare, deinde saepe in formam discoidem expansum, albidum vel pallide fuscidum, extra glabrum.

Excipulum exterius omnino 20–35 µm crassum, textura angulari vel globulosa, cellulis 10–25 µm diam., parietibus tenuibus.

Excipulum medullare e cellulis parvis, densissime intertextis compositum parietibus tenuibus; subhymenium paulum manifestum.

Hymenium 285–300 µm altum. Asci cylindrici, maturi 380–445 × 30–33 µm magni, valde prominentes, parietibus in liquore Melzeri paulum amyloides se praebentibus.

Paraphyses hyalinae, ramificatae, septatae, 2–3.5 µm crassae. Sporae in parte superiore asci in binas series vel irregulariter dispositae, 21.5–22.6–23.3 × 9.9–10.6–11.2 µm magnae, primum hyalinae, deinde dilute purpurascentes, demum fuscide vinaceae, rimis paucis longitudinalibus, saepe ramificatis fissae, tunicis gelatineis unilateralibus manifestis. – Figg. 2–4.

Hab. in fimo anserino vetere in regionibus arcticis.

Die 25 Julii anni 1982 in fimo recenti *Anseris brachyrrhynchi* in loco orario regionis groenlandicae Jameson Land ab ostio Fluminis *Drabae sibiricae* 5 km in meridiem sito (lat. bor. 71°, long. occ. 24°20′) a David Boertmann lectus, die 11 Januarii 1983 in cellulam humidam collocatus, ascocarpiis die 26 Januarii hinc exemptis, e glacie exsiccatis holotypum constituentibus sub numero Gr. 82.327b in Museo Botanico Hauniensi (C) depositum.

Ascocarp superficial, 0.4–1 mm broad, 0.4–0.6 mm

Fig. 2. *Ascobolus brantophilus*, ascocarp with protruding asci, Gr. 82.300, × 75.

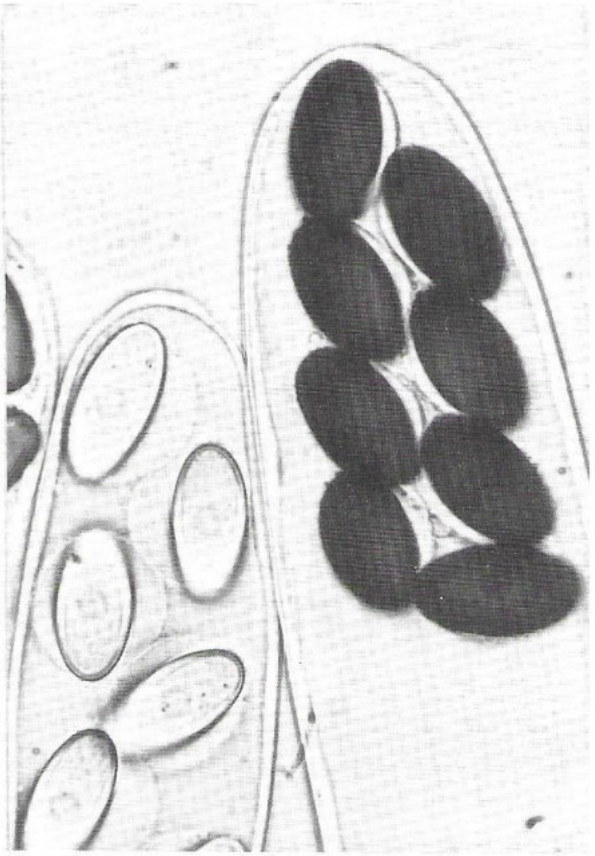

Fig. 3. *Ascobolus brantophilus,* asci and spores, note the unilateral gelatinous covering, Gr. 82.300, × 1000.

high, first turbinate, pyriform or subglobose, later often expanding to disc-shaped, whitish to pale brownish; in moist chamber the rounded, indistinct margin is often reddish brown; in nature the whole ascocarp is often brownish all over; outside glabrous.

Outer excipulum uniformly 20–35 µm thick, of textura angularis to textura globulosa, individual cells thinwalled, 10–25 µm broad, content dextrinoid in Melzer's reagents.

Medullary excipulum of very densely interwoven, thinwalled, small cells; subhymenium indistinct.

Hymenium 285–300 µm high. Asci cylindrical, above slightly narrowed, below gradually tapering to a narrow base, when mature 360–445 × 30–33 µm, strongly protruding; ascus wall weakly amyloid in Melzer's reagent (sometimes only staining blue at the base of the ascus).

Parahyses hyaline, branching, septate, 2–3.5 µm broad. In nature the paraphyses are often embedded in a brownish amorphous substance. Spores biseriate or irregularly disposed in upper part of ascus, 21.5–22.6–23.3 × 9.9–10.6–11.2 µm, first hyaline, then light purplish, finally brownish – vinaceous, with few longitudinal, often forked crackings, with prominent unilateral gelatinous covering. – Figs 2–4.

In nature common on old dung of goose in arctic areas; in moist chamber found to be very common on nearly all samples set up of goose dung after 10–14 days of incubation.

Material: Greenland: Jameson Land, along the coast, 5 km S of the mouth of river Draba sibirica, 71°N, 24°20'W, fresh dung of *Anser brachyrrhynchus* (Pink-footed Goose), coll. David Boertmann, July 25, 1982. Incubation in moist chamber January 11, 1983, isolated January 26, 1983, freeze dried (Holotype, Gr. 82.327b, C). Altogether 18 collections have been seen from Canada, Greenland, and Norway.

Discussion: Ascobolus brantophilus may be related to *A. albidus* Crouan but the very few longitudinal crackings in the spores are a distinctive diagnostic difference between the two species. As seen from Tab. 1, *A. brantophilus* has been found in arctic Canada, East Greenland and at Svalbard.

In East Greenland it has been found to be common on dung of both Barnacle Goose *(Branta leucopsis)* and on Pink-footed Goose *(Anser brachyrrhyncus)*. Dung of Barnacle Goose was collected in 1987 around Qanaq (Tab. 1, loc. 3) by the author and again in the same area by Sten Elborn in 1988. The dung was placed in moist chambers but no ascocarps developed. In Svalbard *A. brantophilus* was very common on dung of Barnacle Goose. The dung samples from Ellesmere Island are supposed to come from Snow Goose *(Anser coerulescens)* and/or Brent Goose *(Branta bernicla)*.

As earlier mentioned (Dissing 1987), it would certainly be interesting to study winter dung from the above mentioned geese in their respective winter quarters.

Ascobolus groenlandicus Dissing sp. nov.

Ascocarpium semiimmersum vel superficiale, subglobulare vel ovoide, 0.2–0.35 mm latum, 0.2–0.3 mm altum, omnino albidum vel purpurascens, extra furfuraceum.

Excipulum exterius 15–30 µm crassum, cellulis in parte superiore hyphoidibus, 2–4 µm latis, ad 10 µm longis, deorsum sensim formam globularem vel angulatum assumentibus. Cellulae globulares vel elongatae, 9.9–13.2 × 14.8–19.8 µm magnae parietibus crassis, purpurascentibus gregulos formantes per partem superiorem superficiei sparsos, furfurem constituentes.

Excipulum medullare ad 140 µm crassum.

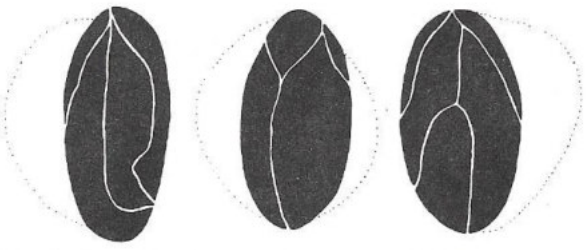

Fig. 4. *Ascobolus brantophilus,* spores with crackings, Gr. 82.300, × 1500.

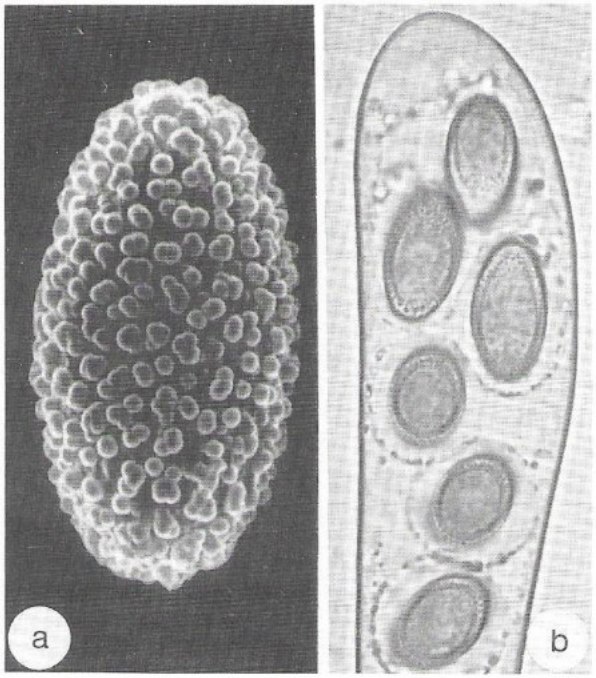

Fig. 5. *Ascobolus groenlandicus*, spores, a. SEM photo, b. asci and young spores with common gelatinous covering, in H_2O. a. Gr. 87.202, × 4000, b. Gr. 85.06, × 1085.

Subhymenium paulum manifestum.

Hymenium circiter 150 µm altum. Asci 140–180 × 20–27 µm magni, cylindrici vel claviformes, in liquore Melzeri omnino coerulescentes, maturi longe prominentes.

Paraphyses septatae, ramificatae, hyalinae, supra 3–4 µm crassae.

Sporae 16.5–18.4–19.8 × 8.8–9.8–10.6 µm magnae, biseriatae vel irregulariter dispositae, primum hyalinae, laeves, deinde purpurascentes, mox verrucis vel spinis valde regulariter ornatae, demum fuscidae, ex initio tunicis gelatineis crassis indutae. – Figg. 5–6.

Hab. in fimo Ovibovis, Rangiferi, Ovis.

Holotypus die 30 Julii anni 1983 cum *Lasiobolo diversisporo* et *Coproto dextrinoide* in fimo Ovibovis in insula groenlandica Ella Ø (lat. bot. 72°45′, long. occ. 25°) inter laboratorium et lacum Langesø ab auctore lectus, sub numero Gr. 83.83 siccus in Museo Botanico Hauniensi (C) depositus.

Ascocarp semiimmersed or superficial, subglobose to ovoid, 0.2–0.35 mm broad, 0.2–0.3 mm high, whitish to purplish all over, outside furfuraceous.

Outer excipulum 15–30 µm thick, above of hyphae-like cells, 2–4 µm broad, up to 10 µm long, below the cells gradually becoming more globose or angular, mostly small, 2–6 µm broad, rarely up to 10–15 µm broad. At the base with anchoring, 2–3 µm broad hyphae. Outside above with scattered clusters of globose or elongated cells, 9.9–13.2 × 14.8–19.8 µm, with amorphous purplish pigment on the wall.

Medullary excipulum up to 140 µm thick, of textura intricata, individual cells very small, sometimes intermixed with ascogenous cells with cyanophilic content.

Subhymenium indistinct.

Hymenium 150 µm high. Asci 140–180 × 20–27 µm, cylindrical to club shaped, gradually tapering below into a narrow base, staining blue all over in Melzer's reagent (the bluish pigment dissolving in H_2O on the slide). Asci strongly protruding when mature.

Paraphyses septate, branching, hyaline, above 3–4 µm broad.

Spores 16.5–18.4–19.8 × 8.6–9.8–10.6 µm, biseriate or irregularly disposed, first hyaline, smooth, later purplish and soon with a very regular spiny – warty ornamentation, finally brownish, from the beginning with a thick common gelatinous covering. – Figs 5–6.

On dung of musk ox, reindeer, and sheep.

Material: Greenland: Ella Island, 72°30′N, 25°W, on musk ox dung, between the field station and Lake Langesø, July 30, 1983, together with *Lasiobolus diversisporus* (Fuck.) Sacc. and *Coprotus dextrinoides* Kimbr., Luck-Allen and Cain, leg. H.

Fig. 6. *Ascobolus groenlandicus*, surface of excipulum, with purplish pigmented clusters of cells, Gr. 85.06, × 1085.

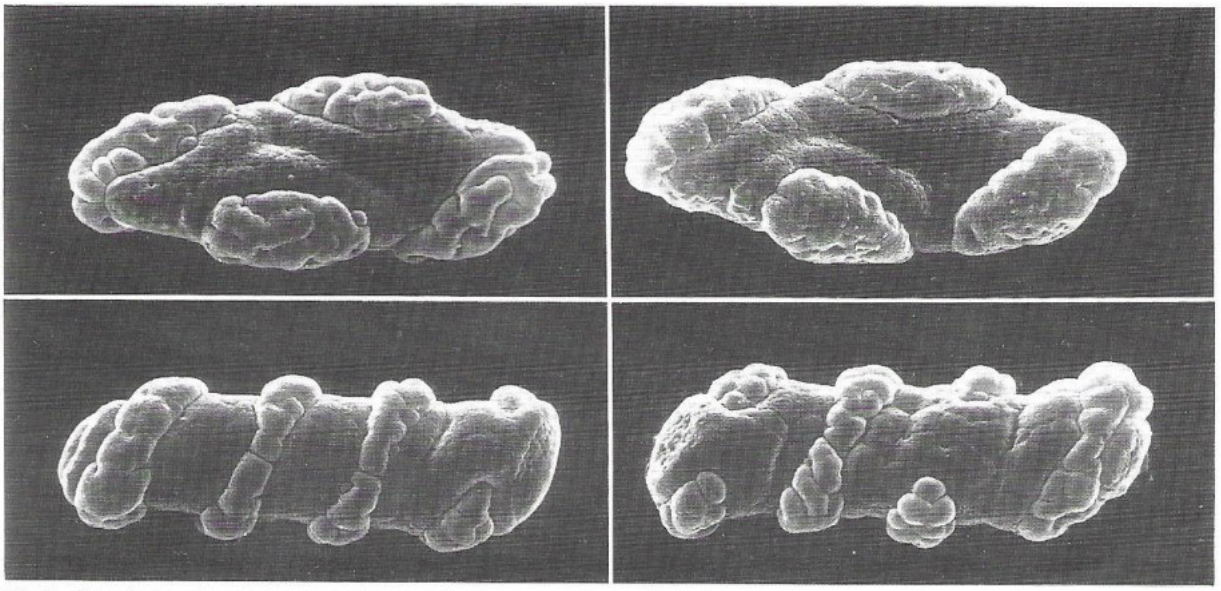

Fig. 7. *Saccobolus chenocopricus*, SEM photo's of spore clusters, above 4 spores in two rows, below 4 spores in one row, Gr. 88.201, × 2000.

Dissing and H. Gøtzsche (Holotype, Gr. 83.83, C). Altogether 35 collections have been seen from Canada, Greenland, and Norway.

Discussion: Ascobolus groenlandicus is related to *A. hawaiiensis* Brumm. and *A. siamensis* Brumm. (cf. van Brummelen 1967). The former has a glabrous outside and larger ascospores, while the latter has semiglobose ascospores. *A. groenlandicus* was first found on dung of sheep from South Greenland (Fig. 1, loc. 5). Later it has been found very commonly on musc ox dung all over North East and North Greenland (cf. Tab. 1). In arctic Canada it was found at the only locality where musk ox dung was examined (Sverdrup Pass, loc. 1), which might indicate that it is common also there.

A. groenlandicus was sought on musc ox dung in loc. 3 (Tab. 1) where a single animal stayed very close to the village for a couple of months in mid-winter 1986–87 and again on dung from Kangarssuk (Kap Atholl, 76°08′N, 69°30′W) where six animals were set free during the summer season, 1986. The dung was inspected in moist chambers, but no specimens were found.

This may be explained as follows: musk oxes became extinct in North West Greenland about 1900. In 1961 30 animals were caught in Jameson Land, East Greenland. They overwintered in the zoological garden in Copenhagen. In 1962 they were set free around the head of Kangerdlugssuaq (Søndre Strømfjord) in West Greenland. This population is now increasing rapidly. There are about 3000 animals. In 1986 it was decided to catch about 20–25 young animals and set them free in three different places around Thule, North West Greenland. Transportation was by an American icebreaker. This means that the animals have twice been prevented from feeding on vegetation with spores of f.i. *A. groenlandicus*.

In Svalbard *A. groenlandicus* may be common on dung of reindeer (cf. Tab. 1, loc. 14a and 15).

In 1985 material of *A. groenlandicus* was seen on sheep dung from a alpine locality in central Norway (cf. Fig. 1, loc. 18) by courtesy of Dr O. Aas.

Saccobolus chenocopricus Dissing sp. nov.

Ascocarpium 0.2–0.5 mm latum, disciforme vel pulvinatum, ascis prominentibus punctatum, omnino pallide purpurascens vel vinaceum vel lilacinum.

Excipulum exterius infra ad 100 µm crassum, cellulis globularibus vel subglobularibus membranis tenuibus, supra 30–40 µm crassum, cellulis claviformibus vel paraphysium similibus.

Excipulum medullare inconspicuum, 30–40 µm crassum.

Hymenium circiter 100 µm altum. Asci 4-spori, 110–122 × 13–22 µm magni, liquore Melzeri omnino pallide coerulescentes.

Paraphyses septatae, ramificatae, supra rectae vel curvae, paulum incrassatae, ad 5–6.5 µm crassae.

Sporae 11–12.2–13.5 × 7–8.2–9.5 µm magnae, ellipsoides vel reniformes, primum hyalinae, laeves, maturae rubescenter umbrinae vel purpureo-fuscae, pigmento duas partes occupante linea longitudinali irregulari albida separatas, in altera parte verrucis vel costis irregularibus demum coalescentibus insidente, alteram partem sublaevem sinente, ornamento sporarum veterum madefacto saepe dejecto.

Glomus sporarum duas series formantium 26–31.5 × 11–14 µm, sporarum uniseriatarum 32–35 × 7.5–10 µm

magnum, binis tunicis gelatineis polaribus manifestis bene separatis. – Fig. 7.

Hab. in fimo *Brantae leucopseos.*

Die 25 Julii anni 1988 in valle Ørsteddalen paeninsulae groenlandicae Jameson Land (lat. bor. 71°45′, long. occ. 23°30′) in fimo recenti *Brantae leucopseos* a David Boertmann lectus, die 1 Novembris Hauniae in quattuor cellulas humidas distributus, in omnibus cum *S. quadrisporo* et *Ascobolo brantophilo* initio mensis Decembris fructiger, carposomatibus hinc exemptis e glacie exsiccatis holotypum constituentibus sub numero Gr. 88.101 in Museo Botanico Hauniensi (C) depositum.

Ascocarps 0.2–0.5 mm broad, disc-shaped to pulvinate, dotted with protruding asci, pale purplish to vinaceous or lilac all over.

Outer excipulum below up to 100 µm thick, of thin-walled, globose or subglobose cells, above 30–40 µm thick, of club-shaped or paraphyse-like cells.

Medullary excipulum inconspicuous, 30–40 µm thick, of loosely interwoven, globose or hyphae-like cells. Subhymenium inconspicuous.

Hymenium 100 µm high. Asci 4-spored, clavate, truncate above, gradually tapering below into a slender base, staining pale bluish all over in Melzer's reagent, when mature somewhat protruding, 110–122 × 13–22 µm.

Paraphyses septate, branching, above straight or curved, slightly enlarged to 5–6.5 µm broad.

Spores 11–12.2–13.5 × 7–8.2–9.5 µm, ellipsoid to reniform, at first hyaline, smooth, when mature reddish brown to dark purplish brown; in mature spores the pigment is deposited in two zones, separated by an irregular, longitudinal whitish line: one half of the spore is nearly smooth, while on the other half part, the pigment is deposited as irregular warts or ridges which finally unite. In slides with old spores, mounted in water, from material from nature the ornamentation sometimes peels off. Each of the normally 4 spores contain two carminophilous nuclei (see below).

Spore clusters 26–31.5 × 11–14 µm (when the spores are displaced in two rows) or 32–35 × 7.5–10 µm (when displaced in one row), with two separated, clearly visible, polarly placed, gelatinous coverings. – Fig. 7.

On dung of Barnacle Goose.

Material: Greenland: Jameson Land, Ørsteddalen, 71°45′N, 23°30′W, on fresh dung from Barnacle Goose *(Branta leucopsis),* 17 July 1982, coll. David Boertmann. Incubated in moist chambers 11 January 1983, isolated 25 January 1983 (Gr. 82.328), where it was fruiting together with *Saccobolus quadrisporus* and *Ascobolus brantophilus,* and again 16 February 1983 where it was fruiting on the filter paper in the moist chamber, Gr. 82.341 (C); ibid., July 25, 1988, coll. D. Boertmann. Incubated in 4 moist chambers on November 1, 1988, where it was fruiting together with *S. quadrisporus* and *Ascobolus brantophilus* in all samples, isolated in the beginning of December 1988, freeze dried (Holotype, Gr. 88.101, C).

Norway: Svalbard, Bunsow Land, Gipselva, 78°28′N, 18°35′E, on dung from Barnacle Goose, August 10, 1985, leg. S. Sivertsen and H. Dissing (S. 85.115).

Discussion: The existence of a third 4-spored *Saccobolus* species was indicated by Dissing (1987), who gave an informal, short description based on a rather scarce material developed on goose dung from East Greenland in 1983. In 1985 the same fungus was found on Svalbard in nature. Again the material consisted of a few ascocarps only. In 1988 rich material was developed from goose dung from East Greenland in moist chambers. This material has been chosen to serve as the holotype for *S. chenocopricus.*

As mentioned above, *S. chenocopricus* has everywhere been found together with *S. quadrisporus,* which it is very much like, and with *Ascobolus brantophilus.* However, in all measureable characters *S. chenocopricus* is smaller than *S. quadrisporus,* viz. size of ascocarp, asci, spore clusters, and individual spores.

It is interesting to note that both species have two carminophilous nuclei in normal spores. If there were only three spores in an ascus, two of these had three nuclei, and if there were five spores in a cluster two of these had only a single nucleus.

Saccobolus ovibovinus Dissing sp. nov.

Ascocarpium primum turbinatum vel disciforme, deinde pulvinatum, extra glabrum, pallide flavidum vel, imprimis ad basem versus, album, hymenio aureo vel electrino ascis prominentibus punctato, margine rotundato, concolori.

Excipulum exterius inconspicuum, ad 60–80 µm crassum, cellulis in parte inferiore globularibus, ad superficiem versus verticaliter subseriatis, in parte superiore claviformibus, paraphysium valde similibus, contento homogeneo, flavido.

Excipulum medullare ut subhymenium inconspicuum.

Hymenium 110–130 µm altum. Asci 8-spori, maturi valde prominentes, ad 160 µm longi, 22–30 µm crassi, in liquore Melzeri omnino subcoerulescentes.

Paraphyses rectae vel curvae, septatae, supra paulum incrassatae, 3–4 µm diam., summis cellulis contento homogeneo, flavido.

Sporae singulae, 18.5–19.5–20.0 × 8.0–8.7–10.0 µm magnae, ellipsoides vel typice inaequilaterales, primum hyalinae, deinde purpurascentes, demum saturate purpureo-fuscae, superficie ut in *Saccobolo glabro* passim irregulariter rimosa.

Sporae modo I (van Brummelen 1967) dispositae. Glomera 46.2–49.5 × 15.0–16.5 µm magna, tunicis gelatineis communibus conspicuis, ad 5–8 µm crassis induta. – Fig. 8.

Hab. in fimo Ovibovis.

Mense Augusto anni 1984 in fimo Ovibovis in area groenlandica nomine carente e lacu magno inter meridiem et occidentem, e terra Nares Land inter meridiem et orientem sita (lat. bor. 81°55′, long. occ. 44°40′) a J.

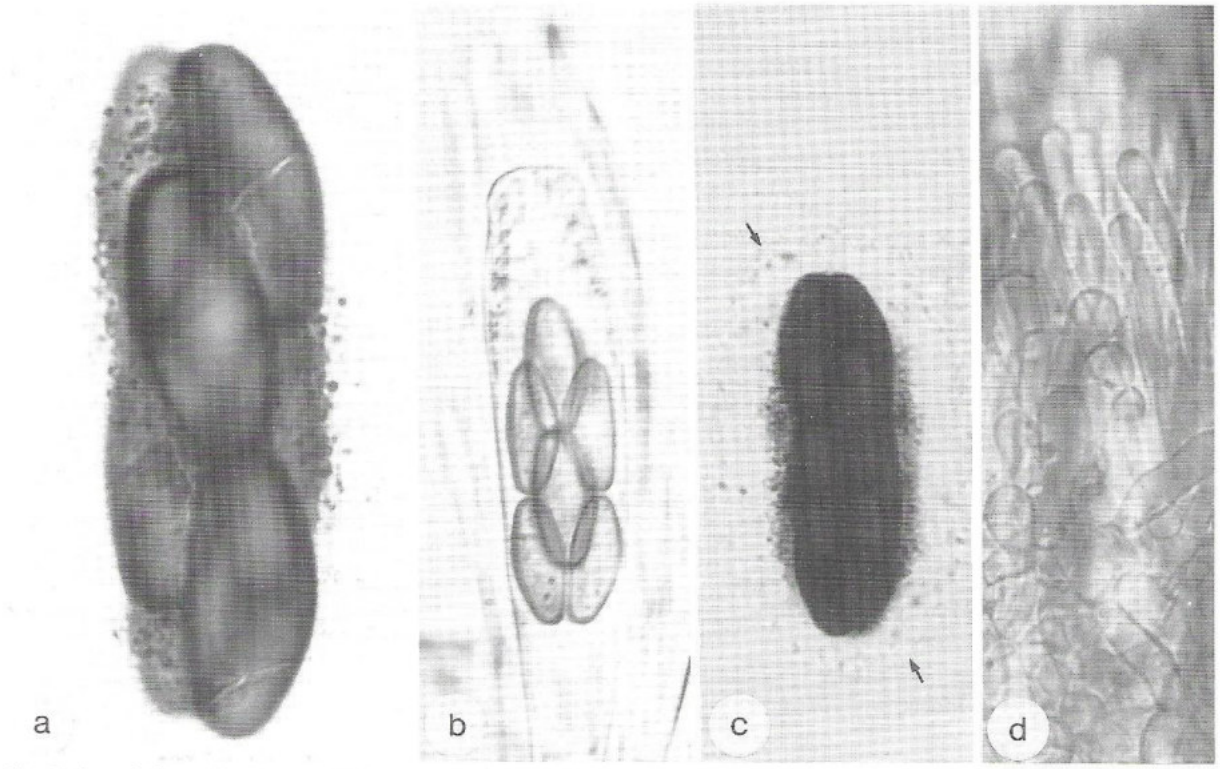

Fig. 8. *Saccobolus ovibovinus:* a. Mature spore cluster in H_2O, note granular adhering substance and crackings in spores, b. Immature spore cluster showing spore pattern, c. Mature spore cluster with conspicous gelatinous covering (arrows), in H_2O, d. Uppermost cells in outer excipulum and paraphyses. a. GP. 84.10, × 2000, b–d. EI. 84.111, × 1000.

S. Peel lectus, die 31 Octobris in cellulam humidam collocatus, ascocarpiis die 22 Decembris hinc exemptis e glacie exsiccatis holotypum constituentibus sub numero GP 84.10 in Museo Botanico Hauniensi (C) depositum.

Ascocarps at first turbinate to disc-shaped, then pulvinate, 0.2–0.6 mm broad, hymenium golden yellow to amber, dotted with protruding asci, margin rounded, concolorous, outside glabrous, pale yellowish – white, especially towards the base.

Outer excipulum inconspicuous, up to 60–80 µm thick, below of globose cells, tending to form vertical rows towards the margin, club-shaped, much like paraphyses, above with homogenous yellowish content.

Medullary excipulum and subhymenium inconspicuous.

Hymenium 110–130 µm high. Asci 8-spored, strongly protruding when mature, then up to 160 µm long, 22–30 µm broad, clavate, gradually tapering into a slender base below, truncate above, staining weakly blue all over in Melzer's reagent.

Paraphyses straight or curved, slightly enlarged above to 3–4 µm broad, septate, uppermost cells with homogenous yellowish content.

Individual spores 18.5–19.5–20.0 × 8.0–8.7–10.0 µm, ellipsoid or typically inequilateral, at first hyaline, located in the lower half of the ascus, later purplish, finally dark purplish brown, located in the upper part of the ascus, surface with a few irregular crackings like *Saccobolus glaber* (Fig. 8a).

Spores arranged according to pattern I (cf. van Brummelen 1967). Often they are slightly broader at one end. Spore clusters 46.2–49.5 × 15.0–16.5 µm, with a very prominent, common, gelatinous covering, up to 5–8 µm thick (Fig. 8c). A delicate, dark pigmented, granular substance is deposited in between the individual spores in the cluster. – Fig. 8.

On dung of musk ox.

Material: Greenland: Unnamed area SE of Nares Land, SW of big lake, on musk ox dung, 81°55′ 44°40′W, coll. J. S. Peel, August 1984. Incubated in moist chamber in October 31, 1984, isolated December 22, 1984, freeze dried, GP 84.10 (Holotype, C); ibid. January 18, 1985, GP 84.13, GP 84.14, GP 84.19 (C).

Canada: Ellesmere Island, Sverdrup pass, on musk ox dung, 79°09′ 79°39′W, coll. L. M. Kohn, July 31, 1984. Incubated in moist chamber in February 13, 1985, isolated April 9–13, 1985, freeze dried, EI 84.109, EI 84.110, EI 84.111, EI 84.112 (C, TRTE).

Discussion: While there are at least eight species of *Saccobolus* from sect. *Eriobolus, Saccobolus ovibovinus* is the only species from section *Saccobolus* which has been found in Greenland or any arctic area which has been visited.

S. ovibovinus and *S. glaber* (Pers.) Lamb. have sev-

eral characters in common, viz. the type of spore ornamentation, the granular substance in between the individual spores and the amber coloured hymenium, but in all measurable characters, viz. size of ascocarp, size of asci, size of spore clusters, and individual spores, *S. ovibovinus* is significantly smaller than *S. glaber*.

S. succineus Brumm. is similar in the size of the spores and the spore clusters but has a very delicate ornamentation of small, regular dots and is without the very characteristic crackings found in *S. ovibovinus*.

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