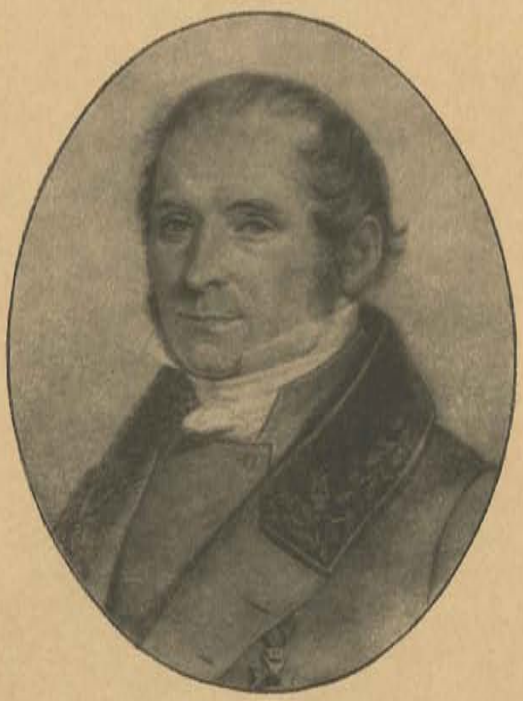
FRIESIA

NORDISK MYKOLOGISK TIDSSKRIFT



BIND IX HEFTE 1-2

KØBENHAVN 1969

FESTSKRIFT TIL PROFESSOR NIELS FABRITIUS BUCHWALD

INDHOLD

Fortsættes paa Omslagets Side 3

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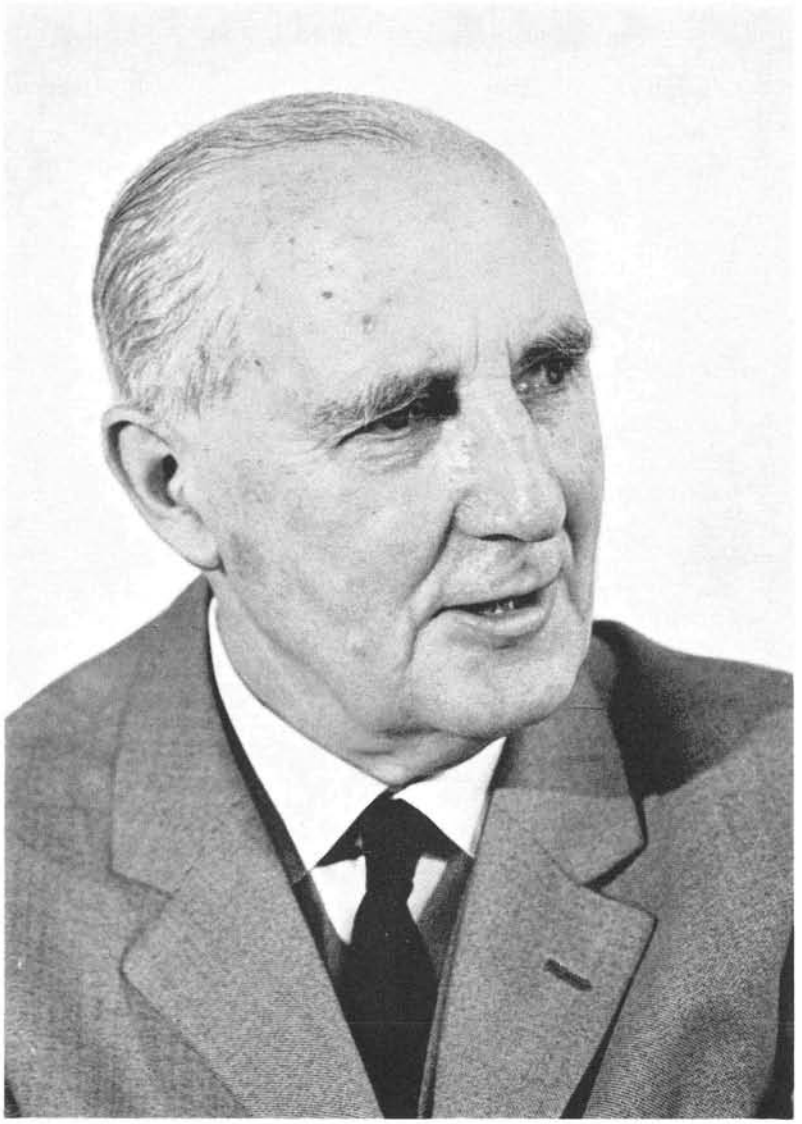
TIL

PROFESSOR NIELS FABRITIUS BUCHWALD

I ANLEDNING AF 70 ÅRSDAGEN DEN 10. AUGUST 1968
OG MED TAK FOR FORMANDSSKAB I

FORENINGEN TIL SVAMPEKUNDSKABENS FREMME

1944 - 1969



Juli 1968, I. P. fot.

N. Fabricius Reichwald

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RHODOPHYLLUS LEPTONIPES KÜHNER & ROMAGNESI

Af LEIF DØSSING

SUMMARY

Rhodophyllus leptonipes KÜHNER & ROMAGNESI in Denmark.

A description is given of *Rhodophyllus leptonipes* KÜHNER & ROMAGNESI, found for the first time in Denmark. The description is based on specimens from two different localities in the south of Denmark.

H a t 11-15 mm i diameter, 3-7 mm høj, med dyb spids navle og med nedbøjet rand, hygrofan, gennemskinneligt stribet, på visse eksemplarer kun i randzonen, på andre næsten til hatmidte, gråbrun med violet tone; ingen af de farvetavler, jeg har til disposition, giver et præcist indtryk af farven, men den stemmer godt overens med *Thelephora terrestris*' farve som gengivet i MORTEN LANGE: Illustreret svampeflora (1961), s. 53; hatoverflade med fin skælbeklædning, der kan være meget tæt i midten, tyndkødet.

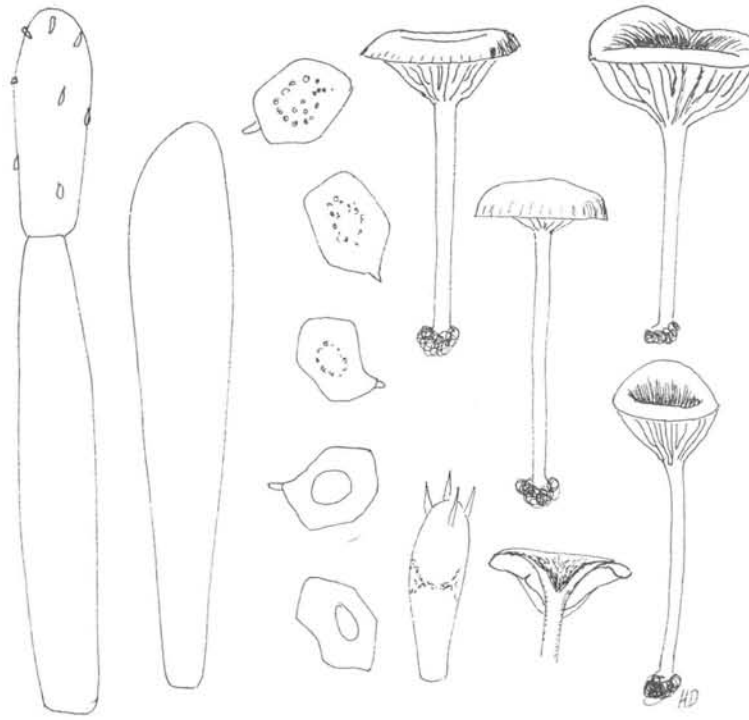
L a m e l l e r ofte langt nedløbende, tilspidsede mod hatrand og stok, af flere forskellige længder, eksemplarerne fra det sidste findested med 15-16 lange lameller fra hatrand til stok, tynde, først gråhvide, senere kødrøde, ensfarvede.

S t o k 20-25 × 1-1.5 mm, stiv og lige, ofte lidt tykkere foroven, glat, på et enkelt individ sås i lupen spredte fnug øverst, gråblå til turkisgrå (KORNERUP & WANSCHER: Farver i farver (1961): 23 D 2, 24 C 2, 24 D 2), med sparsom hvidlig filt forneden, marvfyldt.

S p o r e s t ø v kødrødt. S p o r e r 5-6 kantede, 8-10 × 6-7 (9) μ.

B a s i d i e r kølleformede, 28-41 × 9-12 μ, med 4 sterigmer, 4-6 μ lange.

Uden l a m e l c y s t i d e r. Ingen øskenceller iagttaget.



Rhodophyllus leptonipes KÜHNER & ROMAGNESI.
Celler fra hatbeklædning (× 1000); sporer (× 1500); basidie (× 1500); frugtlegemer (× 1.5).

Hatbeklædningens hyfer med gulbrunt indhold. Endeceller 23-110 × 12-17 μ, enkelte af dem inkrusterede. Den følgende celle er som regel smallere og cylindrisk i modsætning til den ofte kølleformet opsvulmede endecelle.

Uden karakteristisk lugt og smag.

Fund. Kristianssæde Skov, Lolland, 29. august 1967, 4 eksemplarer på jorden mellem mos i lavt, fugtigt terræn under *Fraxinus*. — Nykøbing Falster, 3. juli, 1. august og 29. september 1968, 3 frugtlegemer ialt, antagelig fra samme mycelium, på lys vokseplads med små mosser sammen med *Filipendula hexapetala, Helianthemum nummularium* og *Scutellaria hastifolia* i have.

Den første beskrivelse af *Rhodophyllus leptonipes* findes i *Flore analytique* (1953), hvor arten er anbragt i underslægten *Eccilia,* men den blev først regelret publiceret i *Revue de Mycologie* (1954). I

KÜHNER's franske beskrivelse af den nye art i samme årgang af tidsskriftet gives den interessante oplysning, at han og ROMAGNESI var uenige om placeringen af *Rhodophyllus leptonipes*. ROMAGNESI ønskede den sat under *Eccilia*, mens KÜHNER foretrak *Leptonia*.

Denne usikkerhed hos de to franske mykologer bør indgå i overvejelserne hos dem, der endnu er i tvivl om rigtigheden af at slå FRIES's gamle underslægter *Entoloma, Leptonia, Nolanea, Eccilia* og *Claudopus* sammen i slægten *Rhodophyllus*.

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Nykøbing Falster, Denmark, September 1968.

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CONTRIBUTIONS TO THE SCLEROTINIACEAE OF NORWAY

By FINN-EGIL ECKBLAD

Botanical Laboratory, University of Oslo

SUMMARY

The new species, *Ciboria polygoni-vivipari* ECKBL. n. sp. is described from mummified bulbils of *Polygonum viviparum*. *Sclerotinia scirpicola* and *Monilinia oxycocci* are recorded as new to Norway.

INTRODUCTION

Our knowledge of the Norwegian *Sclerotiniaceae* is mainly given in the papers of ROSTRUP (1904) and JØRSTAD (1945 and 1964).

Most interest has been paid to species parasitic on economically important plants, while a number of species growing on wild plants have not been collected or reported. Work on these fungi are in progress. Specimens are deposited in Botanical Museum, University of Oslo (O).

Ciboria polygoni - vivipari ECKBL. n. sp.

Fig. 1.

Material studied

H e d m a r k: Engerdal: Engerneset, among gras in a roadside, on fallen, last years bulbils of *Polygonum viviparum,* 9 Juli 1964, F.-E. ECKBLAD (O). Type.

F i n n m a r k: Sør-Varanger: Melkevarden at Vadsø on *P. viviparum,* 24 July 1961, F.-E. ECKBLAD 61-102 (O); Vardø: Domen near Vardø on *P. viviparum* 26 July 1961, F.-E. ECKBLAD 61-118 (O).

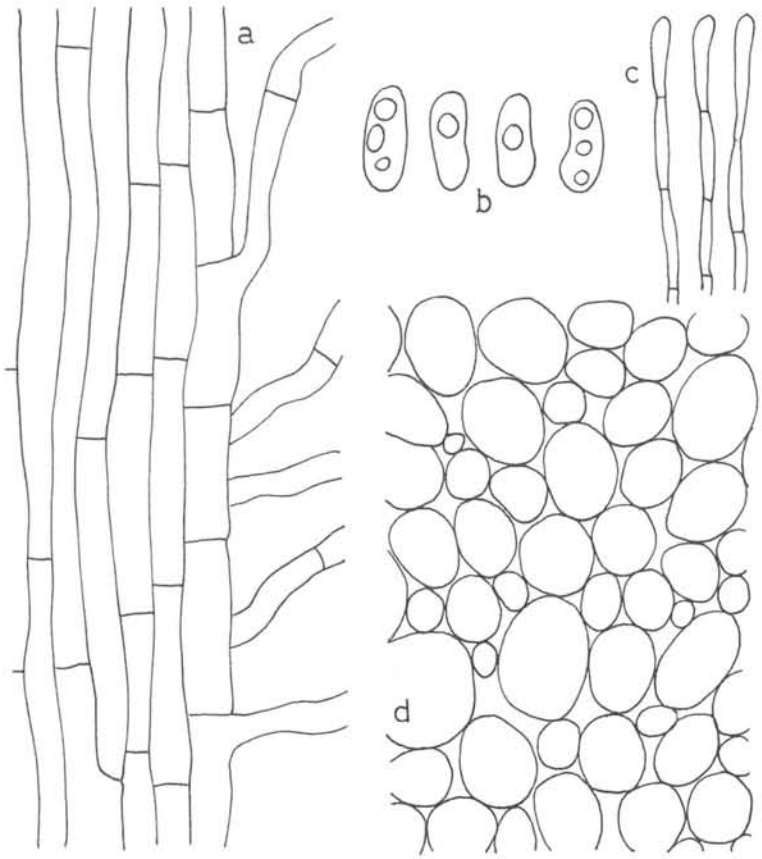

Fig. 1. *Ciboria polygoni-vivipari* ECKBL.
a. Section of stipe, peripheral part. — b. ascospores. — c. paraphyses. — d. textura globulosa of ectal layer of apothecium. — All × 900.
Type collection.

Descriptio.

Apothecia stipitata, e bulbillis *Polygoni vivipari* erumpentia. Stipes 4-8 mm longus, 0.5-1 mm crassus, brunneus, scabridus, textura porrecta compositus, cellulis 3.6-6.5 μ crassis, hyalinis, interioribus parce, exterioribus densius septatis, e parte superficiali hyphas septatas, raro ramosas emittens.

Apothecium proprium cupulatum, 2-4 mm latum, brunneum, glabrum; excipulum e stratis duobus compositum: stratum exterius cellulis elongatis, 7-18 μ crassis, pariete crasso pallide brunneo instructis; stratum interius e hyphis septatis, ramosis, hyalinis, 3.5-7 μ crassis compositum.

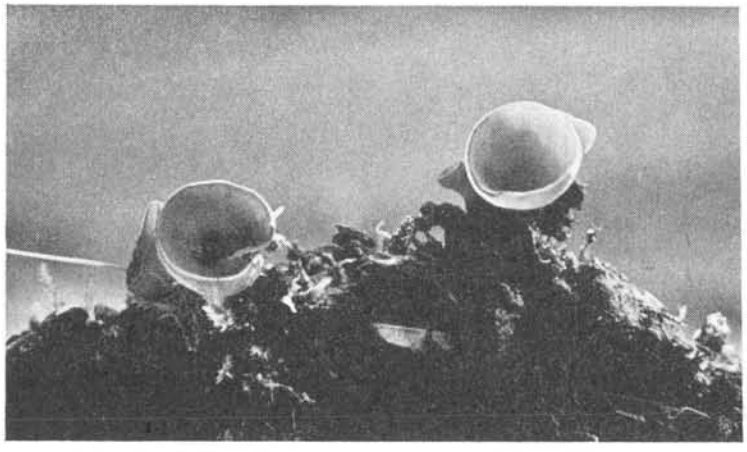

Fig. 2. *Sclerotinia scirpicola* REHM.
Apothecia. From Vestmarka 24 June 1964. — 2 ×.

Asci cylindrico-clavati, amyloidei, octospori. Sporae hyalinae, laeves, anguste ellipsoideae vel inaequilaterales, 13-16 × 5-6.5 μ unam vel paucas guttulas oleaceas includentes, paraphyses rectae, septatae, apicem versus leviter incrassatae, circa 2 μ crassae.

Typus: Norvegia, prov. Hedmark: Engerdal: Engerneset, inter gramina ad viam e bulbillis *Polygoni vivipari* caducis annotinis erumpens. 9 VII 1964, F.-E. ECKBLAD (O).

Description.

Apothecia stipitate, cupulate, springing from fallen, last years bulbils of *Polygonum viviparum*. Stipe 4-8 mm long. 0.5-1 mm thick, brown, slightly scabrous, composed of a textura porrecta of cells 3.5-6.5 μ thick, hyaline and sparingly septate in the central part, brown-walled and more densely septate in the peripheral part, from which appear hyphal, septate, rarely branched outgrowths.

Apothecial part cupulate, 2-4 mm wide, brown, glabrous. Excipulum two-layered. Ectal layer of textura globulosa of globose or elongated cells, 7-18 μ broad and with pale brown walls. Ental layer of textura intricata of septate, branched, hyaline, 3.5-7 μ thick hyphae.

Asci cylindrical-clavate, amyloid, eight spored. Spores hyaline, smooth, narrowly ellipsoid or inequilateral, 13-16 × 5-6.5 μ, con-

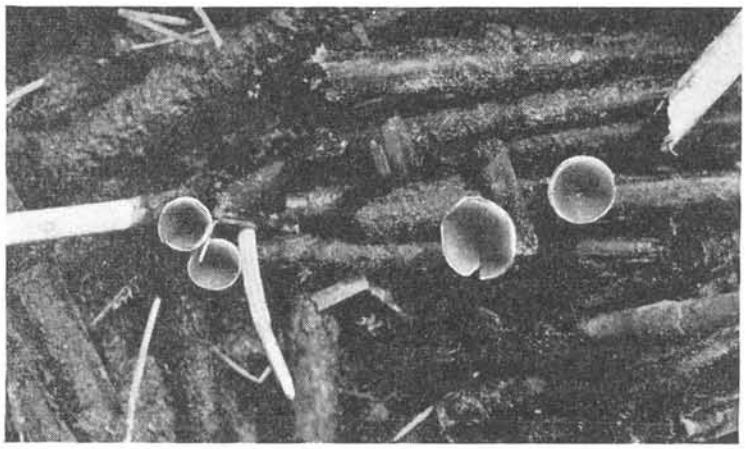

Fig. 3. *Sclerotinia scirpicola* REHM.
Apothecia on bits of *Scirpus lacustris*. From Vestmarka 24 June 1964.
Nat. size.

taining one to a few oil drops. Paraphyses straight, septate, barely enlarged above, above 2 μ thick.

Conidial state not known.

Comments

The species almost certainly belongs in *Ciboria* FUCK., but a study of its conidial state would have been very useful. No sclerotiniaceous species is known from *Polygonum viviparum* before. Owing to the extremely small size of the apothecia *C. polygoni-vivipari* has most probably been overlooked.

Sclerotinia scirpicola REHM

Fig. 2, 3.

Material studied

H e d m a r k: Eidskog: Vestmarka on *Scirpus lacustris,* 24 June 1964, F.-E. ECKBLAD (O).

Ø s t f o l d: Hvaler: Akerøy, in svamp on the western side of the island, on dead material of *Scirpus tabernaemontanii,* 20 June 1966, L. RYVARDEN (O).

Oppland: Brandbu: In Eltjern near Tingelstad new church, on *Scirpus lacustris,* 12 July 1964, F.-E. ECKBLAD (O).

Comments

New to Norway. In all cases this species has been found with apothecia. They are usually developed when the sclerotia are still hidden in the straw.

Together with *S. duriaena* and *S. sulcata,* reported earlier (JØRSTAD 1964), *S. scirpicola* belongs to the *Myriosclerotinia*-group (BUCHWALD 1947 as genus). As pointed out by JØRSTAD (op. cit.) the following species of this group still remain to be found in Norway: *S. caricis-ampullaceae* NYBERG on *Carex* spp., *S. vahliana* ROSTR. on *Eriophorum* spp., and *S. curreyana* (BERK.) KARST. on *Juncus effusus* and *conglomeratus.*

Monilinia oxycocci (WORON.) HONEY

Material studied

Østfold: Degernes: In a *Sphagnum*-bog west of Linnekleppen on detached fruits of *Oxycoccus quadripetalus,* 21 May, F.-E. ECKBLAD (O). — Øymark: By the Otteid-canal, east of Skinnerbodtjern, mummified fruits of *O. quadripetalus* only, 17 July 1964, GRO GULDEN & F.-E. ECKBLAD (O).

Oslo: In a *Sphagnum*-bog by a small pool west of Grefsenåsen, on *O. quadripetalus,* 20 May 1962, F.-E. ECKBLAD (O).

Comments

The above appears to be the first records of the species from Norway. BUCHWALD (1956) demonstrated that the dimorphism of the ascospores in this species is genetically determined.

ACKNOWLEDGEMENTS

The author is indebted to Professor, Dr. NILS HYLANDER, Uppsala, for the latin diagnosis, and to Mr. J. T. PALMER, Stockport, and Miss CLARA BAADSNES, librarian of the Botanical Museum, University of Oslo, for valuable assistance with literature.

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Oslo, september 1968.

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STUDIES IN THE BOTRYOBASIDIUM VAGUM COMPLEX (CORTICIACEAE)

By JOHN ERIKSSON and KURT HJORTSTAM

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SUMMARY

A new species, *Botryobasidium danicum* JOHN ERIKSS. et HJM., is described. The species, which comprises a large part of the *B. vagum* complex, seems to be distributed preferably in NW. Europe and NW. North America. *B. botryosum* (BRES.) JOHN ERIKSS. is found in connection with the imperfect fungus *Costantinella micheneri* (BERK. et CURT. ap. BERK.) HUGHES.

When studying *Botryobasidium vagum* (BERK. & CURT.) ROGERS, ERIKSSON (1958 a, b) found it to comprise several distinct taxa. He distinguished *B. botryosum* (BRES.) JOHN ERIKSS. as a species of its own and described four new species. *B. (Pellicularia) vagum* in the broad sense of ROGERS (1943) was considered to be a collective, from which several segregates could be expected. Such new taxa have also appeared later on: *B. aureum* PARM. and *B. robustior* POUZ. et JECHOVÁ. Several will probably follow.

In the material at hand in 1958 ERIKSSON had a specimen, collected in Denmark, which he considered to be a species of its own. It was not published but was given the temporary name *Botryobasidium danicum*. Later on he found the same species in the province of Småland in S. Sweden. In 1967 and 1968 HJORTSTAM collected it in the province of Västergötland, and ERIKSSON found it to be a common species in W. Canada. An investigation of the rich material in Ottawa (DAOM) gave the same result. ROGERS (1943), when reporting the variations within *Botryobasidium vagum,* was well aware of the

taxon, here described as a new species, but he had got the impression that it represented the true *B. vagum* and moreover that it was connected with *B. botryosum* through interjacent forms, why he found it necessary to keep *B. vagum* in a very wide sense. After having studied numerous collections of *Botryobasidium* from Europe and North America, we have come to the result that *B. danicum* is a good new species and, therefore, we give it a definite description here. Though it is by no means restricted to Denmark, we retain the species epithet *danicum* for it, in honour of outstanding Danish mycology.

Botryobasidium danicum JOHN ERIKSS. et HJORTSTAM n. sp.

Fig. 1.

Type specimen: B. & J. ERIKSS. & J. GINNS n. 7656.

Carposoma resupinatum, tenue, hypochnoideum, cinereum-cinereo-flavidum. Hyphae efibulatae, rectis angulis ramosae; hyphae basales hyalinae vel flavidae, crassiter tunicatae, 10-12 μ diam.; hyphae hymeniales hyalinae, tenuitunicatae, 7-8 μ diam. Basidia breviter cylindracea, 15-20 × 9-12 μ, 4 (-6) sterigm., 4-7 μ l. Sporae cylindraceo-naviculaeformes, (11-) 12-14 (-17) × 3-5 μ.

Fructification resupinate, thin, hypochnoid, grayish or by age yellowish; basal hyphae thickwalled, 10-12 μ; hymenial hyphae thinner, 7-8 μ; no clamps at any septa; basidia first rounded, then shortly cylindrical, as a rule with four sterigmata, 4-7 μ l; spores narrowly navicular to almost allantoid, (11-) 12-14 (-17) × 3-5 μ. Conidial state unknown.

This species is a characteristic and very uniform member of the *B. vagum* complex. It is distinguished preferably by the size and shape of the spores. All microscopical details are larger than in the other species of the group, e. g. *B. botryosum*. This species is besides easily recognized in the biapiculate shape of the spores. *B. danicum* might be identical with *B. vagum* s. str., but after having studied authentic material of this species (Society Hill, S. Carolina, n. 3240 in CURTIS collection of Farlow Herbarium, Harvard, and in the Herbarium of Kew Gardens), we have come to the opinion that it is a different species. The CURTIS material is sterile and therefore indeterminable. Some few spores found are ab. 9 μ l., shorter than in

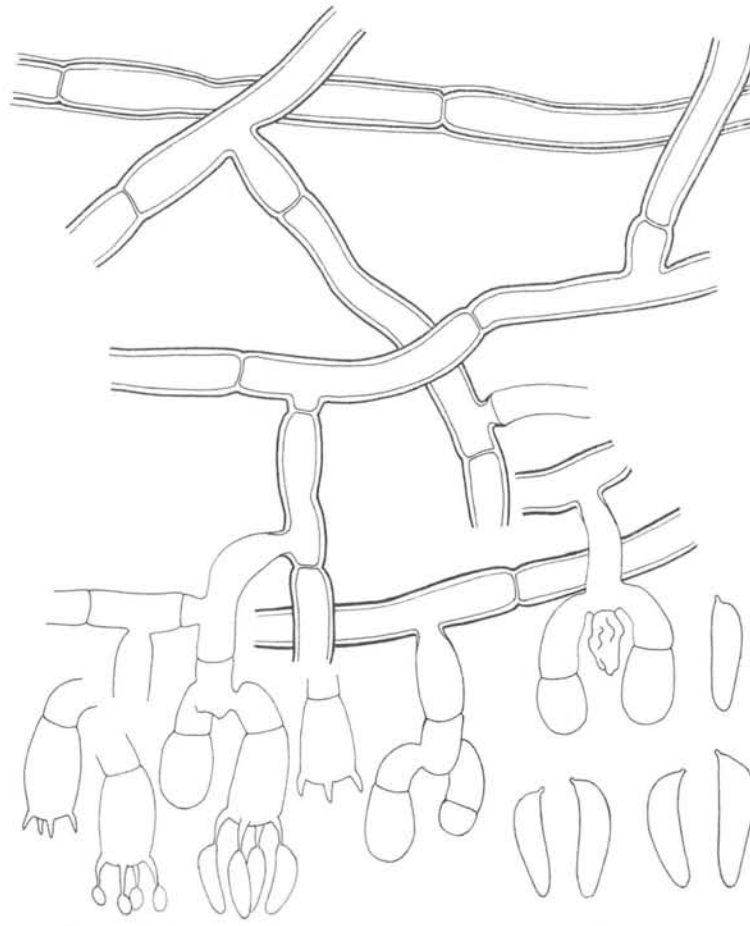

Fig. 1. *Botryobasidium danicum* JOHN ERIKSS. et HJORTSTAM. Loose spores 1200 ×; other details (hymenial hyphae with basidia in different stages of development, basal hyphae). — 600 ×.

B. danicum. *B. vagum* is furthermore stated (e. g. by ROGERS) to be connected with the conidial state of *Oidium curtisii*.

Though numerous specimens of *B. danicum* are studied, we have not been able to find any conidia at all. *B. vagum* s. str. is thus still an unsolved problem. It might well be a distinct species within the group where besides several segregates can be expected, judging from the number of *Oidium* species known.

One striking thing with the new species is its geographic distribution, which supports the idea that it is a species of its own. It seems to be restricted to humid oceanic and suboceanic areas. In

Europe we have hitherto material from Denmark and SW. Sweden. In Canada it is a common species in Br. Columbia while in E. Canada *B. botryosum* is the dominating species of the group as it is in most parts of Scandinavia. On Vancouver Island, where B. & J. ERIKSSON collected it several times in September 1967, *B. danicum* is found preferably on logs and branches lying on the ground in the humid *Pseudotsuga* forests with an undergrowth, dominated by *Polystichum munitum, Rubus spectabilis, Gaultheria shallon,* and *Vaccinium parviflorum.*

The true relationships within *Botryobasidium* are in some respects still unsettled. This is shown by a very interesting find in the DAOM herbarium. One specimen (n. 30441, Strachan, Alberta, on two-year old slash of *Pinus contorta* var. *latifolia,* June 5, 1953, V. J. NORDIN) contains *B. botryosum* together with *Costantinella michenerii* (BERK. & CURT. ap. BERK.) HUGHES. As far as we can judge basidial and conidial branches emanate from the same basal hyphae. Professor J. A. NANNFELDT to whom we have shown this material has come to the same opinion. All other conidial states of *Botryobasidium* hitherto known belong to the genus *Oidium.* If this link between *Botryobasidium* and *Costantinella* can be affirmed (e. g. on cultured material), it seems likely that *B. botryosum* is not so closely related to the other species of the genus as could be assumed from the morphological similiarities of the basidial states. The connection between *Costantinella michenerii* and a *Botryobasidium* species makes it plausible that also *Costantinella terrestris* (LINK ex PERS.) HUGHES in the conidial state of some *Botryobasidium* species. The species to consider should then be *B. pruinatum* which strikingly reminds of it in size and characteristic roughness of the basal hyphae. Ecologically these two fungi agree fairly well. As *B. botryosum* and *B. danicum* seem to be very close, it is not out of question that also the latter could be found in connection with a *Costantinella.*

Since 1958 when ERIKSSON listed the Swedish *Corticiaceae,* few changes have been made, concerning the genus *Botryobasidium.* PARMASTO has given *B. pruinatum* var. *laeve* JOHN ERIKSS. species rank — an arrangement which we accept — why the list now looks as follows:

Botryobasidium angustisporum (BOID.) JOHN ERIKSS.
B. botryosum (BRES.) JOHN ERIKSS.

Botryobasidium candicans JOHN ERIKSS.
B. conspersum JOHN ERIKSS.
B. danicum JOHN ERIKSS. et HJM.
B. heteronemum JOHN ERIKSS.
B. laeve (JOHN ERIKSS.) PARM.
B. medium JOHN ERIKSS.
B. obtusisporum JOHN ERIKSS.
B. pruinatum (BRES.) JOHN ERIKSS.
B. subcoronatum (HÖHN. et LITSCH.) DONK.

The conidial state of *B. aureum* is collected in Sweden but the basidial state is not hitherto found.

Key to the Swedish species of *Botryobasidium*.

1 a. With clamps.
  2 a. All septa with clamps.
    3 a. Basal hyphae hyaline or yellowish.
      4 a. Spores 2,5-3 μ br. No conidia. *B. subcoronatum.*
      4 b. Spores 5-6 μ br. Conidia usually present ..... *B. medium.*
    3 b. Basal hyphae brown ..... *B. heteronemum.*
  2 b. Hymenial hyphae without clamps ..... *B. angustisporum.*
1 b. Without clamps.
  2 a. Basal hyphae considerably (twice or more) broader than the hymenial branches. Spores ellipsoid, 5-8 μ l.
    3 a. All hyphae smooth..... *B. laeve.*
    3 b. At least basal hyphae rough ..... *B. pruinatum.*
  2 b. Basal hyphae about 1,5 of the width of the hymenial branches.
    3 a. Spores navicular, distinctly biapiculate.
      4 a. Spores 6-8 μ l. Conidial state *Oidium candicans* ..... *B. candicans.*
      4 b. Spores (7-) 9-12 μ l. As a rule no conidia ..... *B. botryosum.*
    3 b. Spores ellipsoid, 7,5-12 μ l. ..... *B. obtusisporum.*
    3 c. Spores longish (cylindric, allantoid or almost so).
      4 a. Spores 7-9 μ l. Conidial state *Oidium conspersum* ..... *B. conspersum.*
      4 b. Spores 12-14 (-17) μ l. No conidia. *B. danicum.*

We have seen some collections which we temporarily have determined as smallspored forms of *B. botryosum*. The existence of these collections seems to make it difficult to recognize *B. candicans* when conidial states are not present.

Apart from the conidial state of *B. botryosum* these species form together a good natural genus with the possible exception of *B. heteronemum*, the basidia of which give it a position closer to *Sistotrema* Fr. em. Donk, while the hyphal structures are those of *Botryobasidium*. The problem could possibly be solved in the way that this species is given a place in a genus of its own, but then there will still be the question in which subfamily to place it, in *Botryobasidioideae* or *Sistotrematoideae*. Interjacent taxa causing intergeneric taxonomic problems are common both within *Corticiaceae* and in the borderland between this and other families of *Aphyllophorales* as well as of *Heterobasidiomycetes*.

Specimens seen.

Sweden.

Småland: Värnamo parish, Björs, *Pinus silv.*, 1/9 1959, J. Erikss. n. 835; d:o, fallen trunk of coniferous wood, Sept. 1960, J. Erikss. n. 832.

Västergötland: Alingsås parish, Vikaryd, fallen trunk of *Picea abies*, 11/9 1967, K. Hjortst.; d:o, SW of Mårsjön, fallen trunk of *Betula* sp. in *Alnus glutinosa-Betula* bog, 5/9 1968, K. Hjortst.; Skepplanda parish, Rapenskår, *Juniperus communis*, 25/11 1967, K. Hjortst.; Östad parish, E of Åsjön, fallen trunk of *Picea abies*, 10/9 1968, K. Hjortst.

Danmark.

Sjælland: Grib Skov, 2/10 1955, J. Erikss. n. 834.

Canada.

Specimens collected in Br. Columbia in 1967 by B. & J. Erikss.:

Vancouver Island: W of Youbou, log of *Pseudotsuga menziesii*, 7/9 1967, B. & J. Erikss., J. Ginns n. 7656 (TYPUS); d:o, near Cedar Resort E of Youbou, wood of conifer, 14/9 1967, n. 8139; d:o, China Beach, virgin coast forest, on stems of *Rubus spectabilis*,

20/9 1967, n. 8404, 8405; d:o, near the road between L. Cowichan and L. Nitinat, branch of *Tsuga heterophylla* in virgin coast forest, 19/9 1967, n. 8329; d:o, on stems of *Rubus spectabilis* in virgin *Tsuga-Pseudotsuga* forest, n. 8334; d:o, L. Cowichan Provincial Forest, decayed branches on wet ground in *Lysichitum* bog, 8/9 1967, B. & J. ERIKSS. n. 7759, 7760, 7761; log of *Alnus rubra,* n. 7728; log of *Pseudotsuga menziesii,* n. 7718; on *Alnus rubra,* 10/9 1967, n. 7902; on *Thuja plicata,* 13/9 1967, n. 8042; d:o, log of *Alnus rubra,* 16/9 1967, n. 8178, d:o, 17/9 1967, n. 8201.

Vancouver: Mt Seymour Provincial Park, log of *Tsuga mertensiana,* 25/9 1967, B. & J. ERIKSS., R. BANDONI n. 8543; d:o, University of Br. Columbia Endowment Land, log of conifer, 24/9 1967, n. 8459.

Specimens from Plant Research Institute, Department of Agriculture, Ottawa (DAOM):

Br. Columbia: Vancouver Island, L. Cowichan, on *Tsuga heterophylla,* 30/9 1951, W. G. ZILLER n. 30650, *Pellicularia vaga* det. J. HANSON; d:o, Goldstream, on *Thuja plicata,* 19/11 1951, W. G. ZILLER n. 30649, *Pellicularia vaga* det. J. HANSON; d:o, on dead mature *Alnus rubra,* 10/10 1951, W. G. ZILLER n. 30646, *Pellicularia vaga* det. J. HANSON; d:o, Mt Newton, *Alnus sp.,* 20/11 1939, J. E. BIER n. F. 9831, *Corticium vagum* det. H. S. JACKSON; d:o, n. F. 9794; d:o, Ardmore, *Abies grandis,* 23/11 1939, J. E. BIER n. F. 9828, *Pellicularia vaga,* det. H. S. JACKSON; d:o, Cadboro Bay, on *Cornus pubescens,* 29/10 1940, J. E. BIER n. F. 10099, *Corticium vagum* det. H. S. JACKSON; d:o, on *Pseudotsuga taxifolia,* 29/10 1940, J. E. BIER n. F. 10100, *Corticium vagum* det. H. S. JACKSON; d:o n. 52800, *Pellicularia vaga* det. L. K. WERESUB; d:o, bark of *Pseudotsuga taxifolia,* 29/11 1940, J. E. BIER n. F. 10090, *Corticium vagum* "long spored form" det. H. S. JACKSON; Haney, on *Acer circinatum,* 7/9 1948, W. G. ZILLER n. 52692, *Pellicularia vaga* det. H. S. JACKSON; d:o, U. B. C. Forest Reserve, on *Betula papyrifera,* 23/8 1960, S. J. HUGHES n. 69206, *Pellicularia vaga* group det. L. K. WERESUB; d:o, n. 71134, *Pellicularia vaga* det. L. K. WERESUB; Saanichton, dead *Pseudotsuga taxifolia,* 7/11 1940, J. E. BIER n. 9809, *Corticium vagum* det. H. S. JACKSON; Courtenay, on *Tsuga heterophylla,* 22/9 1953, D. J. PHERSON n. 30991, *Pellicularia vaga* det. J. HANSON; Robert's Creek, on *Thuja plicata,* 8/8 1932, I. MOUNCE n. F. 6425, *Corticium vagum* det. M. K. NOBLES.

Pennsylvania: Furnace Gap, Hunt. Co., on hardwood, 7/8 1932, L. O. OVERHOLTS & L. WHITE n. F. 3158.

ACKNOWLEDGEMENT

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Göteborg, september 1968.

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SOME FRUIT INHABITING SCLEROTINIAS IN NORWAY

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SUMMARY

In this paper the following seven fruit inhabiting species of *Sclerotinia* and their distribution in Norway are treated: *S. aucupariae, S. baccarum, S. ledi, S. megalospora, S. oxycocci, S. padi,* and *S. urnula.*

INTRODUCTION

With the exception of species occuring on horticultural and agricultural crops, very little has been published on *Sclerotinia* FUCKEL s. lat. in Norway. LAGERHEIM (apud VESTERGREN 1899) described *Scl. empetri* of which he only had seen the sclerotial stage, ROSTRUP (1904) recorded *Scl. tuberosa,* and JØRSTAD (1964) contributed with two species living on *Carex* species.

The present paper deals with seven species which conidial stages belong to the group of the hyphomycetous genus *Monilia* PERS. ex FR. with disjunctors, i. e. the ripe conidia are separated by a small link (Fig. 1).

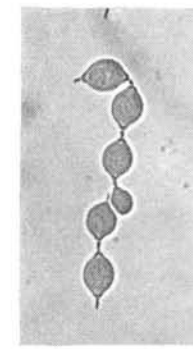

Fig. 1. *Sclerotinia urnula.* Conidia with disjunctors. (× 400)

These seven species, all thoroughly studied by WORONIN (1888, 1895) and by WORONIN & NAWASCHIN (1896), have the same pattern of life cycle. Their apothecia arise in the spring from mummified fruits (Fig. 2 and 3), and except for *Scl. ledi* (see no. 3), their ascospores infect young shoots and leaves of the same host. The shoots wilt and

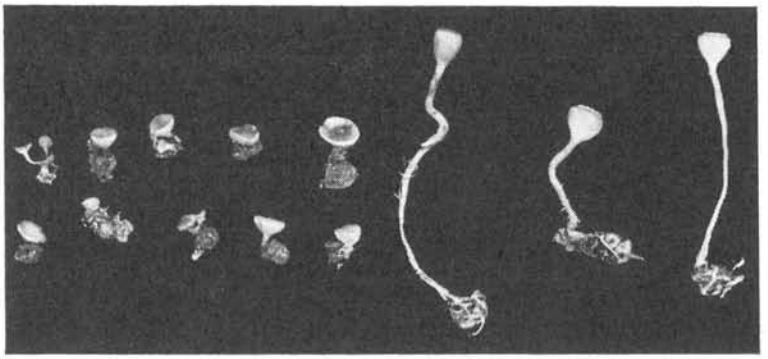

Fig. 2. *Sclerotinia aucupariae.* Apothecia. (nat. size).

Fig. 3. *Sclerotinia baccarum.* Apothecia. (× 2).

the leaves get necrotic areas (Fig. 4). Later, conidia produced on the infected parts of the plants, infect the stigmas, the germ tubes penetrate the styles into the ovaries, the flesh is filled up by hyphae, and the fruits are converted into a pseudo-sclerotium (Fig. 5).

Some years a considerable number of blueberries and cowberries which are picked in large quantities both for private and commercial use, are rottened due to attack by their respective *Sclerotinia* species.

Except for a few specimens, indicated in the lists of material examined, the material is preserved in the herbarium of the Norwegian Plant Protection Institute, Vollebekk. The herbarium of the Norwegian Forest Research Institute, Vollebekk, has been cited as NFRI. For the other herbaria are used the abbreviations listed in "Index Herbariorum". The names of secondary administrative districts ("herreder") correspond to those listed in the official calendar for 1959. The names of the primary districts of counties ("fylker") are abbreviated as follows:

HE: Hedmark	Te: Telemark	M: Møre & Romsdal
O: Oppland	AA: Aust-Agder	ST: Sør-Trøndelag
Ø: Østfold	VA: Vest-Agder	NT: Nord-Trøndelag
A: Akershus	R: Rogaland	N: Nordland
incl. Oslo	Ho: Hordaland	Tr: Troms
B: Buskerud	incl. Bergen	F: Finmark
V: Vestfold	S: Sogn & Fjordane	

If not otherwise stated, the measurements given, are from my own material. Average size of ascospores and conidia are based upon

measurements of 30 spores, mounted in lactophenol. It should be mentioned that the diameters of the apothecia increase with age and as the cups become more flattened. The lengths of the stalks depend on how deep into the ground the sclerotia hibernate.

1. **Sclerotinia aucupariae** LUDWIG 1892.

Fig. 2, 4 and 6, f, k.

Litt:. LUDWIG, Lehrbuch nied. Kryptog., p. 355, 1892; WORONIN, Mém. Acad. Sci. St. Petersbourg, VIII. Sér., Vol. 2, No. 1: 15, 1895.

Syn.: *Stromatinia aucupariae* (LUDW.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Str. aucupariae* (LUDW.) N. NAUMOV, Flora gribov Leningr. obl. 2: 132, 1964; *Monilinia aucupariae* (LUDW.) WHETZEL, Mycologia 37: 672, 1945.

Type locality: Erzgebirge, Germany.

Host: *Sorbus aucuparia* L.

Material examined:

Ø. Tune: Greåker (scl.) H. B. GJÆRUM. — A. Ås: Vardåsen (scl). H. B. GJÆRUM; Brekka (apoth.) H. B. GJÆRUM; near Kinn (con.) H. B.

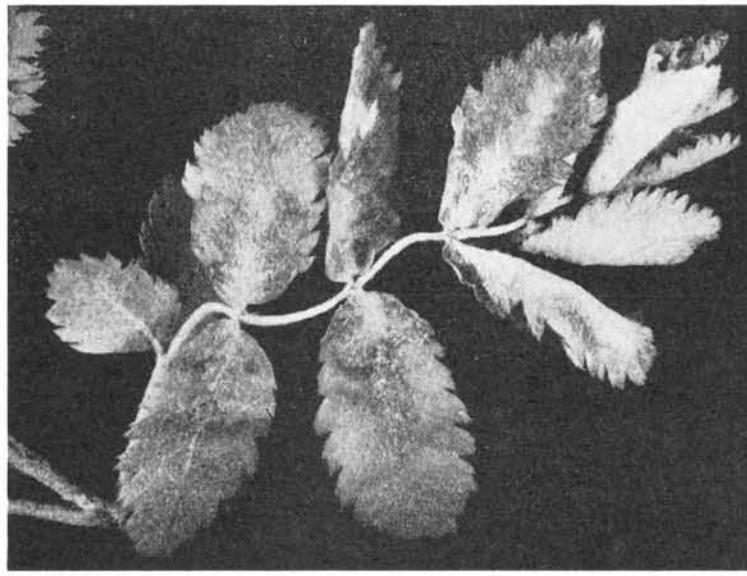

Fig. 4. *Sclerotinia aucupariae*. Attacked leaf of *Sorbus aucuparia* (nat. size).

GJÆRUM; the Norwegian Agric. College (con.) F. ROLL-HANSEN (NFRI); Nittedal: Vennervannet, 420 m above sea level (scl.) H. B. GJÆRUM. — Te. Solum: Hustvedtstranda (scl.) and Styggedal (scl.) H. B. GJÆRUM. — S. Leikanger: Skahaug (scl.) H. B. GJÆRUM.

Apothecia greyish brown, 2-4 mm in diameter, on thin stalks, 1-4 mm long, mostly one from each mummified fruit, rarely two or three. Asci (Fig. 6 f) cylindric, 100-160 × 6.5-8.0 μ with 8 oval ascospores, 9.5-13.0 × 4.0-5.5 (10.9 × 5.0) μ. Conidia (Fig. 6 k) on browned parts of the leaves, oval 7.0-11.0 × 5.0-9.5 (8.4 × 5.8) μ, disjunctors 2.5-3.0 μ long. Mummified fruits greyish brown, 3-5 mm long.

A few times a *Monilia* species has been collected on ripe fruits of *Sorbus aucuparia*. The conidia which lack disjunctors, are oval to elliptical, 16.0-24.0 × 9.0-13.0 (19.5 × 9.6) μ and correspond to those of *Monilia fructigena* PERS. ex FR. (cf. BUCHWALD 1943, p. 535), the conidial stage of *Scl. fructigena* SCHROET. ex ADERH. & RUHL. Among other hosts for this fungus, WORONIN (1900) also reported *Sorbus aucuparia*.

2. **Sclerotinia baccarum** (SCHROET) REHM 1885.

Fig. 3 and 6, b, c, and n.

Litt.: REHM, Hedwigia 24: 9, 1885.

Syn.: *Peziza baccarum* SCHROET., ibid. 12: 177, 1879; *Stromatinia baccarum* (SCHROET.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia baccarum* (SCHROET.) N. NAUMOV, Flora gribov Leningr. obl. 2: 133, 1964; *Monilinia baccarum* (SCHROET.) WHETZEL, Mycologia 37: 672, 1945.

Type locality: Badischer Murgthal, Germany.

Host: *Vaccinium myrtillus* L.

Material examined:

Ø. Aremark: S. Bergetjern (scl.) H. B. GJÆRUM; Hobøl: Krok (scl.) L. SEMB. — A. Frogn: Solbergstranda (scl.) H. B. GJÆRUM; Ås: Vardåsen and Brekka (apoth., con., scl.) H. B. GJÆRUM; Støkken (scl.) AINO HIRVONEN-SEMB; Åsmosen (apoth., con.) H. B. GJÆRUM; Dysterskogen (apoth.) H. B. GJÆRUM; Oslo: Haugerud and S of Steinsbruvatn at Grorud (apoth). F.-E. ECKBLAD (O). — B. Ådal: between Nes and Rysjubråtan (scl.) H. B. GJÆRUM. — V. Brunlanes: Viksfjord (scl.) H. B. GJÆRUM. — Te. Solum. Styggedalsåsene (scl.) H. B. GJÆRUM; Bø: Klokkesteinstjønna at Lifjell, 965 m above sea level (scl.) H. B. GJÆRUM. — VA. Lyngdal: Rom (scl.) H. B. GJÆRUM. — F. Vadsø: below Fossefjellet (scl.) G. VANNES.

Apothecia brown, up to 7 mm in diameter, on thin stalks, 15-40 mm long, mostly one from each mummified fruit, rarely two. Asci (Fig. 6 b, c) clavate, 145-165 × 9.0-11.0 μ with four large and four small ascospores, the large ones measuring 14.5-17.5 × 5.5-8.0 (16.0 × 6.5) μ. Conidia (Fig. 6 n) on wilting shoots and young leaves, oval with markedly protruding, rounded ends, 21.5-29.5 × 13.5-21.0 (25.9 × 17.4) μ, disjunctors 3.0-4.0 μ. Mummified fruits greyish white to greyish brown, 3-5 mm long.

3. **Sclerotinia ledi** NAWASCHIN 1894.

Litt.: NAWASCHIN, Ber. dt. bot. Ges. 12: 118, 1894.

Syn.: *Sclerotinia heteroica* WORONIN & NAWASCHIN, ibid. 12: 187, 1894, and Z. Pfl.Krankh. 6: 129, 1896; *Stromatinia heteroica* (WORON. & NAW.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia heteroica* (WORON. & NAW.) N. NAUMOV, Flora gribov Leningr. obl. 2: 135, 1964; *Monilinia ledi* (NAW.) WHETZEL, Mycologia 37: 673, 1945.

Type locality: Leistilä, Finland (now in USSR).

Host: *Ledum palustre* L.

Material examined:

F. Alta: Storelvdalen (scl.) J. M. NORDMAN (TRH); Bossekop (scl.) H. B. GJÆRUM; Kautokeino: Avžže (scl.) O. DAHL; Karasjok (scl.) E. FONDAL (TROM).

The fungus has never been found on *Vaccinium uliginosum* L. in Norway.

Mummified fruits dark brown, up to 8 mm long.

WORONIN & NAWASCHIN (1896, sub *Scl. heterocia)* described the ascospores as short cylindric - oval, 13.2 × 6.6 μ, and the conidia as oval, 17.6-22.0 × 11.0-17.6 μ.

While the six other species fulfil their cycle within the same host, ascospores of *Scl. ledi* infect young shoots and leaves of *Vaccinium uliginosum,* and later, when *Ledum palustre* is flowering, the conidia infect the stigma of the flowers. This type of host alternation is not of the same type as that in certain rust species where a change in phases takes place. In this case it is a seasonally conditioned host alternation of the gametophyt (JØRSTAD 1962).

4. **Sclerotinia megalospora** WORONIN 1888.

Fig. 6 a, l.

Litt.: WORONIN, Mém. Acad. Sci. St. Petersbourg. VII. Sér., Vol. 36, No. 6: 35, 1888.

Syn.: *Stromatinia oxycocci* (WOR.) BOUDIER var. *megalospora* (WOR.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia megalospora* (WOR.) N. NAUMOV, Flora gribov Leningr. obl. 2: 133, 1964; *Monilinia megalospora* (WOR.) WHETZEL, Mycologia 37: 673, 1945.

Type locality: Finland (now in USSR?).

Host: *Vaccinium uliginosum* L.

Material examined:

A. Ås: Åsmosen (scl. apoth., con.) H. B. GJÆRUM; Vardåsen (apoth., con.) H. B. GJÆRUM; Enebak: near Børtervannene (con.) N. ROLL-HANSEN (NFRI). — Te. Solum: Styggedalsåsene (scl.) H. B. GJÆRUM. — S. Lavik: Alvera (scl.) H. B. GJÆRUM. — F. Vadsø: Fossefjellet (scl.) G. VANNES.

Apothecia chocolate brown, up to 8 mm in diameter, on stalks 35-50 mm long, only one from each mummified fruit. Asci (Fig. 6 a) cylindric, 240-300 × 15-24 μ with 8 oval ascospores, 19.0-24.0 × 11.0-15.0 (21.7 × 13.0) μ. Conidia (Fig. 6 l) on wilting shoots and browned leaves, globose to oval, 19.0-25.0 × 16.0-20.0 (21.3 × 18.5) μ disjunctors 1.5-2.0 μ long. Mummified fruits greyish or bluish white becomming more grey when dry, 5-9 mm long.

5. **Sclerotinia oxycocci** WORONIN 1888.

Fig. 6 e, m.

Litt.: WORONIN, Mém. Acad. Sci. St. Petersbourg. VII. Sér., Vol. 36, No. 6: 28, 1888.

Syn.: *Stromatinia oxycocci* (WOR.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia oxycocci* (WOR.) N. NAUMOV, Flora gribov Leningr. obl. 2: 132, 1964; *Monilinia oxycocci* (WOR.) HONEY, Am. J. Bot. 23: 105, 1936.

Type locality: Finland (now in USSR?).

Host: *Oxycoccus quadripetalus* GIL.

Material examined:

Ø. Øymark: Otteidkanalen, E of Skinnerbodtjern (scl.) GRO GULDEN & F.-E. ECKBLAD (O); Rømskog: near Skilleviken (scl.) H. B. GJÆRUM. — A. Ås: Åsmosen (scl., apoth., con.) H. B. GJÆRUM; Nittedal: Vennervannet, 395 m above sea level, (scl.) H. B. GJÆRUM.

Apothecia brown, 3 mm i diameter, on stalks 20-45 mm long, only one from each mummified fruit. Asci (Fig. 6 e) clavate to cylindric, 115-145 × 6.0-11.0 μ, with four large oval ascospores and four small ones, the larger spores 10.5-13.5 × 5.0-8.0 (12.2 × 6.1) μ. Conidia (Fig. 6 m) on wilting shoots, oval with protruding ends, 14.5-22.5 × 9.5-14.5 (18.3 × 12.1) μ, disjunctors 3.0-5.0 μ long. Mummified fruits light greyish brown to grey, 4-7 mm long.

The dimorphism which occurs in the ascospores of *Scl. oxycocci* and *Scl. baccarum,* is a phenomenon known only from a few ascomycetes. Instead of 8 spores of equal size, there are four large ascospores and four small ones. WORONIN (1888) indicated that the four small spores were undeveloped and soon disappeared. BUCHWALD (1956) examined 100 asci of *Scl. oxycocci* and found the two types of spores arranged in 19 different ways. In 76 asci a regular order of the spores occured. Most common were the four large spores at the top of the ascus (occured in 18 asci) while the four small ones were at the top in 12 asci. In 46 asci spores of equal size were grouped either in four groups of two spores or in groups of two-four-two. In the rest of the asci examined the spores were arranged irregularly. Based on a pair of factors for spore size the order of spores in the 76 asci could be easily explained as a result of the meiotic divisions.

6. **Sclerotinia padi** WORONIN 1895.

Fig. 6 g, h.

Litt: WORONIN, Mém. Acad. Sci. St. Petersbourg. VIII. Sér. Vol. 2, No. 1: 3, 1895.

Syn.: *Stromatinia padi* (WOR.) BOUDIER. Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia padi* (WOR.) N. NAUMOV, Flora gribov Leningr. obl. 2: 130, 1964; *Monilinia padi* (WOR.) HONEY, Am. J. Bot. 23: 105, 1936; *Sclerotinia angustior* READE, Ann. mycol. 6: 113, 1908.

Conidial stage:

Monilia linhartiana SACC., Syll. fung. 4: 34, 1886; *Monilia peckiana* SACC. & VOGL. var. *angustior* SACC., Syll. fung. 4: 34, 1886; *Monilia angustior* (SACC). READE, Ann. mycol. 6: 113, 1908.

Type locality: Finland (now in USSR?).

Host: *Prunus padus* L.

Material examined:

He. Ringsaker: Moelv (con.) H. B. GJÆRUM. — O. Sør-Aurdal: Skaradalen, 940 m above sea level (con.) A. HAGEN (O). — A. Ås: Brekka (scl.,

apoth., con.) H. B. GJÆRUM. — B. Hurum: Mølen (con.) H. B. GJÆRUM; Krødsherad: Ørpen (con.) H. B. GJÆRUM; Sigdal: Medalen (con.) H. B. GJÆRUM. — R. Jelsa: Bjørklund (con.) I. LERUM. — Ho. Skånevik: Milje (con.) H. B. GJÆRUM. — S. Gloppen: Sandane and Vereide (con.) T. RAMSFJELL. — M. Norddal: Lingås (con.) T. RAMSFJELL. — ST. Åfjord. Prestegårdslia (con.) I. JØRSTAD (O). — F. Talvik: S of Storvannet in Vassbotndalen (scl., con.) H. B. GJÆRUM (TROM).

Apothecia brown, 1-3 mm in diameter, on stalks 3-8 mm long, only one from each mummified fruit. Asci (Fi. 6 g) cylindric, 130-150 × 8.0-9.5 μ, with 8 oval spores, 9.0-14.5 × 5.0-6.5 (11.6 × 5.2) μ. Conidia (Fig. 6 h) on young shoots, leaf stalks and leaves, oval 9.5-15.0 × 6.5-11.0 (11.6 × 8.6) μ, disjunctors 3.0-5.0 μ. Mummified fruits greyish brown, 3-5 mm long.

7. **Sclerotinia urnula** (WEINM.) REHM 1893.

Fig. 1, 5 and 6 d, i.

Litt.: REHM in Rabenh. Kryptog.-Fl. Deutschl., 1. Abt. 3: 804, 1893.

Syn.: *Peziza urnula* WEINM., Flora allg. Bot. Zeit. 5, Vol. 2, No. 29: 455, 1832; *Ciborinia urnula* (WEINM.) WEINM., Hymeno-, Gastero-Mycetes, p. 459, 1836; *Stromatinia urnula* (WEINM.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Stromatinia urnula* (WEINM.) N. NAUMOV, Flora gribov Leningr. obl. 2: 134, 1964; *Sclerotinia vaccinii* WORONIN, Mém. Acad. Sci. St. Petersbourg. VII. Sér., Vol. 36, No. 6: 3, 1888; *Stromatinia vaccinii* (WORON.) BOUDIER, Hist. Classif. Discom. Europe, p. 109, 1907; *Monilinia urnula* (WEINM.) WHETZEL, Mycologia 37: 673, 1945.

Type locality: Leningrad, USSR.

Host: *Vaccinium vitis-idaea* L.

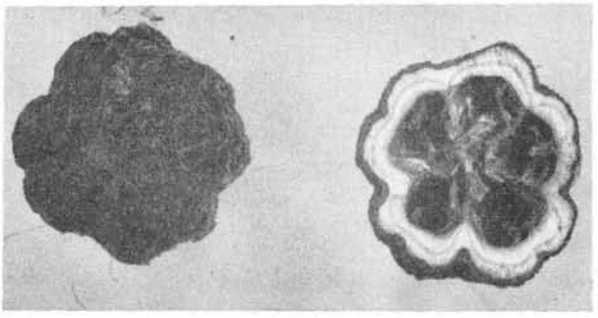

Fig. 5. *Sclerotinia urnula*. Cross section of a mummified fruit of *Vaccinium vitis-idaea*. (× 4). — Phot. L. SUNDHEIM.

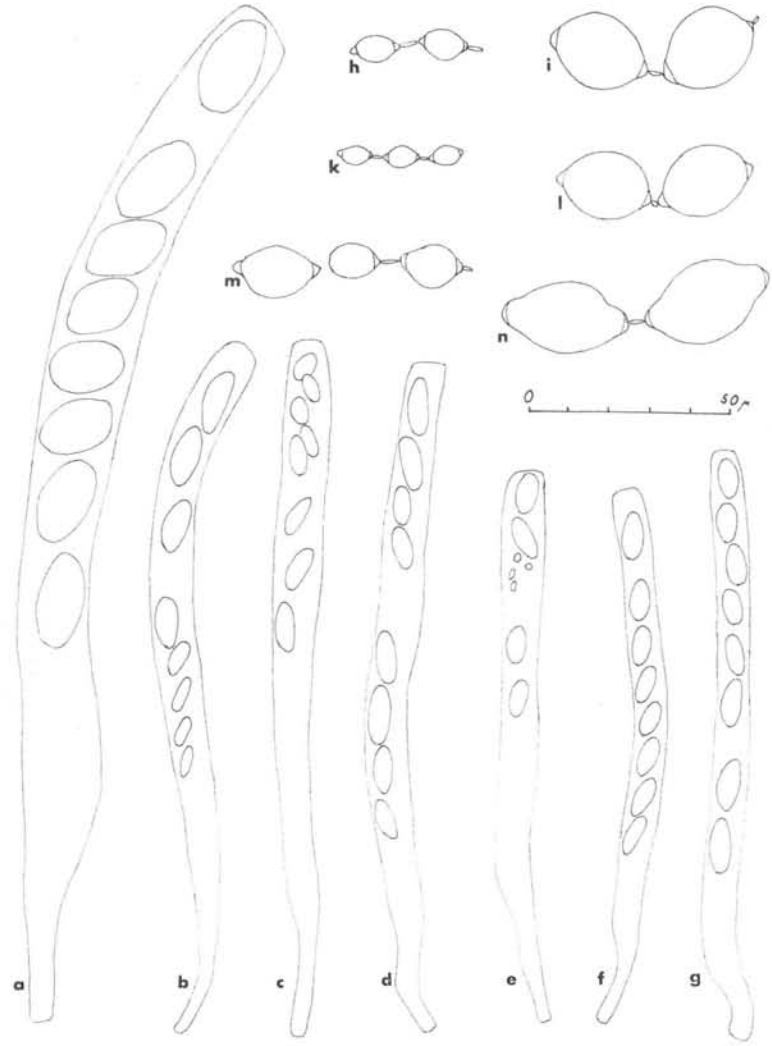

Fig. 6. *Sclerotinia* spp. Asci with ascospores, and conidia of: a, l: *Scl. megalospora;* b, c, n: *Scl. baccarum;* d, i: *Scl. urnula;* e, m: *Scl. oxycocci;* f, k: *Scl. aucupariae;* g, h: *Scl. padi.* (× 560).

Material examined:

He. Åsnes: Kvernhaugen near Gjesåssjøen (scl.) L. SEMB. — Ø. Idd: Prestebakke (con.) F. ROLL-HANSEN (NFRI); (scl.) H. B. GJÆRUM, H. RØED; Rød in Enningdal (con.) F. ROLL-HANSEN (NFRI); Rødenes: Orderudseter (scl.) L. SEMB & AINO HIRVONEN-SEMB. Hobøl: Bærø (scl.) L.

SUNDHEIM; Trøgstad: Lagerud (scl.) MARIE DAHL; Rømskog: near Skilleviken (scl.) H. B. GJÆRUM. — A. Frogn: Solbergstranda (scl.) H. B. GJÆRUM; Ås: Brekka (apoth., con.) H. B. GJÆRUM; the Norwegian Agricultural College and Askimskogen (con.) F. ROLL-HANSEN (NFRI), H. B. GJÆRUM; Årungen (scl.) K. SAKSHAUG; Nittedal: Vennerkollen (scl.) H. B. GJÆRUM. — B. Ø. Sandsvær: Moen in Jondalen (scl.) J. K. OSNES; Norderhov: Eggemoen (scl.) P. KOLSTAD, between Sokna and Hamremoen (scl.) K. VALSET; Ådal: between Nes and Rysjubråten (scl.) H. B. GJÆRUM; Sigdal: Kleiv (con.) H. B. GJÆRUM; Gol: Bergheim (scl.) H. B. GJÆRUM; Granheim (scl.) K. VALSET. — V. Brunlanes: Damsbakken (apoth.) H. B. GJÆRUM. — Te. Solum: Styggedal (apoth.) H. B. GJÆRUM; Vinje: Høgetveit, and Prestegard 980 m above sea level, (scl.) H. B. GJÆRUM. — AA. Landvik: Skiftenes (scl.) K. DOKKEDAL. — R. Imsland: Skjøljevatn (scl.) H. B. GJÆRUM. — S. Hyllestad: Bø and Staurdal (scl.) H. B. GJÆRUM. — S. Lavik: Alvera (scl.) H. B. GJÆRUM; Leikanger: Solheim, and below Fivelhola in Henjedalen (scl.) H. B. GJÆRUM; Sogndal: Nedre Amla (scl.) H. B. GJÆRUM; Borgund: between Breistølen and Borlaug (scl.) K. VALSET. — M. Skodje: Skodje (scl.) M. KROKÅ. — ST. Rennebu: Berkåk (scl.) M. Ø. KJØLSTAD. — F. Alta: Myreng, Lille Reipas and Alta Centrum (con.) H. B. GJÆRUM (TROM); Elvebakken (scl.) K. FURU; Tana: Tana (scl.) J. ASPHJEL; Langnes (scl.) G. VANNES; Sør-Varanger: Svanvik (scl.) G. VANNES.

Apothecia brown, 4-8 mm in diameter, on stalks 8-20 mm long, only one from each mummified fruit. Asci (Fig. 6 d) cylindric to clavate, 150-170 × 8.0-9.5 μ with 8 oval spores, 9.5-16.0 × 4.0-5.5 (11.5 × 5.1) μ. Conidia (Fig. 6 i) on young shoots, leaf stalks and leaves, oval, 22.5-35.0 × 13.5-20.0 (27.8 × 18.3) μ, disjunctors 2.0-5.0 μ. Mummified fruits when dry, greyish brown, 4-7 mm long.

ACKNOWLEDGEMENT

I am indebted to Prof. F. ROLL-HANSEN, the Norwegian Forest Research Institue, Vollebekk, for his valuable help when preparing this paper.

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Vollebekk, Norway, September 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

NOTES ON CIBORIA RUFO-FUSCA AND C. ALNI*)

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Cibora rufo-fusca (WEBERB.) SACC. and *C. alni* (O. ROSTR.) BUCHW. are two species of *Ciboria* which, to judge from published reports, have been rarely collected in North America. We have collected both species several times in the Ottawa district and have grown them in culture. Attempts have been made to develop apothecia in culture and although a few were produced in *C. rufo-fusca,* their appearance was rare and sporadic and it was not possible to draw any conclusions concerning the sexuality of these species from the experiments.

This note seeks primarily to broaden the known host range and distribution of *C. rufo-fusca,* and to give detailed discussion of the several nomenclatural problems in which *C. alni* is involved.

1. **Ciboria rufo-fusca** (WEBERB.) SACC.

C. rufo-fusca was originally described by WEBERBAUER (1873) as *Peziza rufo-fusca* and was transferred to *Ciboria* by SACCARDO (1889). Later authors have consistently treated it as a *Ciboria* but there has been some slight confusion as to its identity with another fungus, *Chlorosplenium bulgarioides* (RABH.) KARSTEN. REHM (1893) and RAMAMURTHI, KORF & BATRA (1957) have suggested that these two species might be placed in synonymy although KORF (1959) later realized that they are distinct and pointed out differences in the color and tissue structure of the apothecia. BUCHWALD, KLINGE & TOFT

*) Contribution No. 695 from the Plant Research Institute, Ottawa, Canada.

(1961) dealt with this problem in some detail and showed clearly that there were three fungi occurring on cone scales of conifers and that they could be distinguished by the size of the asci and ascospores and also by the color and tissue structure of the apothecia. We are not concerned with the third fungus, *Phialea eustrobilina* KORF, in this paper.

In the material studied by us, the asci and ascospores of *C. rufo-fusca* measured, respectively, (55) 65-85 (95) × (4.5) 5.0-6.0 (7.0) μ and (4.5) 5.0-6.0 (7.0) × 2.5-3.5 μ and those *Chlorosplenium bulgarioides* (65) 70-85 × 6.0-7.5 μ and (6.0) 7.0-9.0 × 3.0-4.0 (4.5) μ.

Hitherto the evidence has suggested that *Ciboria rufo-fusca* occurred on cone scales of *Abies* spp. whereas *Chlorosplenium bulgarioides* occurred on cone scales of *Picea* spp., although there is one report by BISBY *et al.* (1936) of *C. rufo-fusca* on *Picea* in Manitoba. However, in 1963, cones of *Picea glauca* were received from Mrs. G. O. KEMPTON, Anchorage, Alaska, bearing apothecia which proved to be of *C. rufo-fusca*. The specimens arrived in excellent condition (Fig. 5) and cultures were readily obtained from ascospores and they agreed well with cultures isolated from apothecia occurring on cone scales of *Abies balsamea* collected near Ottawa, Ontario. The morphological characters including the size of the asci (Fig. 1 a, 1 b, 2) and ascospores (Fig. 3), the color of the apothecia, and the tissue structure all agreed with *C. rufo-fusca*.

Another specimen which also agreed in all respects with *C. rufo-fusca* was received from British Columbia collected on cone scales of *Pseudotsuga*. No cultures were obtained from this material but on the basis of the morphological characters (Fig. 1 a, 1 c) there seems little doubt that this is also *C. rufo-fusca*.

The apothecia have been well described by other authors, for example REHM (1893) and BUCHWALD, KLINGE & TOFT (1961), and there is no need to redescribe them here.

Ciboria rufo-fusca (WEBERB.) SACC., Syll. Fung. 8: 203, 1889.
Fig. 1, 3, 5, and 6.

≡ *Peziza rufo-fusca* WEBERBAUER, Die Pilze Norddeutschl. 1: 7, 1873.

Host: cone scales of *Abies* spp., *Picea glauca* (MOENCH) VOSS, *Pseudotsuga taxifolia* (POIR.) BRITTON.

Specimens examined: Exsiccati. REHM, Ascom. 1554.

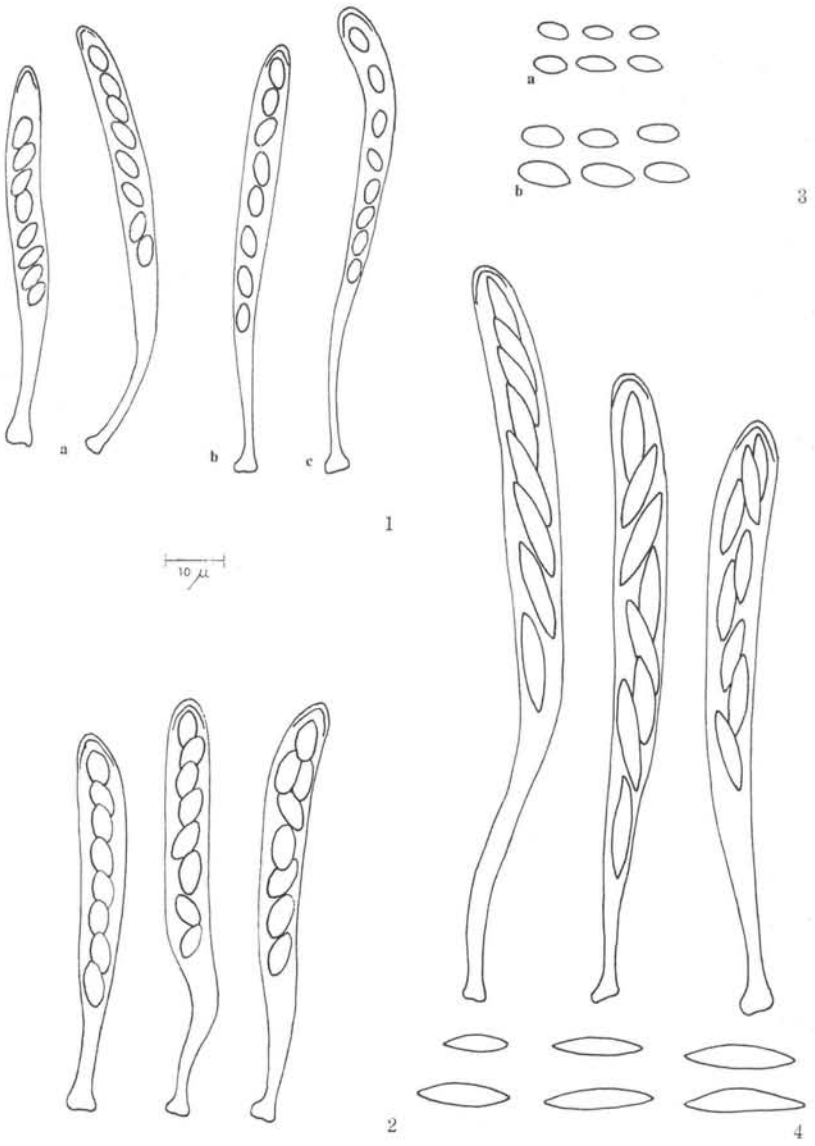

Fig. 1. *Ciboria rufo-fusca.* Drawings of asci from (a) *Abies balsamea,* (b) *Picea glauca,* (c) *Pseudotsuga taxifolia.* — Fig. 2. *Chlorosplenium bulgarioides.* Drawings of asci. — Fig. 3. Drawings of ascospores of (a) *Ciboria rufo-fusca,* (b) *Chlorosplenium bulgarioides.* — Fig. 4. *Ciboria alni.* Drawings of asci and ascospores.

Canada: Ontario. On *Abies balsamea* (L.) MILL. DAOM 43512, 37555, 113762, near Ottawa; DAOM 26243, Petawawa Forest Experiment Station; DAOM 64059 (TRTC 5866), DAOM 64063 (TRTC 10048), Bear Island, L. Timagami; DAOM 57528, apothecia developed in culture.

Quebec. On *Abies balsamea* (L.) MILL. DAOM 4464, 4589, 37552, 37557, Burnet; DAOM 23341, Tenaga; DAOM 70873, Fortune Lake, Gatineau Parkway.

British Columbia. On *Abies amabilis* (DOUGL.) FORB. DAOM 15633, Franklin River; on *Abies grandis* (DOUGL.) LINDL. DAOM 87511, Endowment Lands, U.B.C., Vancouver; on *Abies* sp. DAOM 91090, MacMillan Park, Vancouver, Island; on *Pseudotsuga taxifolia* (POIR.) BRITTON DAOM 87512, MacMillan Park, Vancouver Island; DAOM 97576, Beaver L., Vancouver Island.

United States: Alaska. On *Picea glauca* (MOENCH) Voss DAOM 92109, Anchorage.

2. **Ciboria alni** (O. ROSTR.) BUCHW.

NAWASCHIN (1894) stated that he had found a new *Sclerotinia* on *Alnus* fruits that he intended to describe later as *S. alni* n. sp. No description or diagnosis was ever published as far as we know, hence *S. alni* NAWASCHIN is a *nomen nudum* and not validly published (Art. 32).

Later in the same year MAUL (1894) independently described and figured a fungus on *Alnus* fruits that he named *Sclerotinia alni* MAUL. n. sp. but his description and figures were of the sclerotial and spermatial states only and he did not see any apothecia. Different interpretations seem to be possible concerning the manner in which MAUL's name should be treated and an apparent contradiction in the Code is revealed.

BUCHWALD (1947) treated *S. alni* MAUL as a *nomen nudum* but, since MAUL did provide adequate descriptions of the structures he observed, it would seem more appropriate to regard it as a *nomen provisorium* under Art. 34. MAUL saw structures of the sclerotial and spermatial states of a fungus but not of the perfect state. However, he believed that when found the perfect state would prove to be a *Sclerotinia*. Therefore he proposed the name *S. alni,* obviously in anticipation of the future acceptance of the taxon as a *Sclerotinia,* and

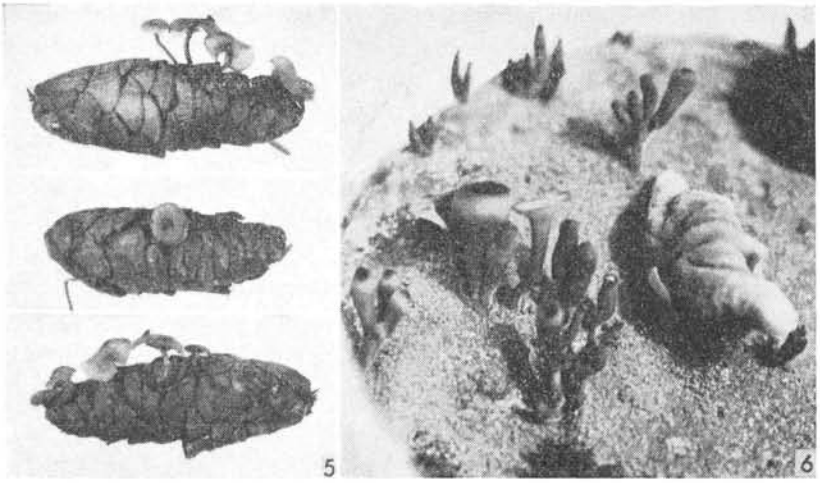

Fig. 5. *Ciboria rufo-fusca.* Apothecia on cones of *Picea glauca,* DAOM 92109. M = 1. — Fig. 6. *Ciboria rufo-fusca.* Apothecia developed in culture; on the left are developing fruit bodies and on the right are somewhat overmature fruit bodies with the margin reflexed and the hymenium strongly convex. M = 3 ×.

this actually took place when O. ROSTRUP (1897) found the perfect state two years later. If we consider the Vienna Code of 1905 to be the first real international acceptance of rules of botanical nomenclature it is clear that MAUL did not contravene any official rules of nomenclature but rather demonstrated his understanding of the life history of *Sclerotinia* species. Nevertheless under Art. 34 of the 1966 Code it must be considered as n o t v a l i d l y published.

However, if *S. alni* MAUL is considered under Art. 59, Par. 3, a contradiction appears. This paragraph states that a name is validly published but illegitimate if the type of a taxon whose name has been ascribed to a genus characterized by a perfect state is not a specimen of which the original description or diagnosis included a description or diagnosis of the perfect state. If *S. alni* MAUL is substituted for *Ravenelia cubensis* ARTH. & J. R. JOHNSTON in Example 1 it would read as follows: "The name *Sclerotinia alni* MAUL based on a specimen bearing only sclerotia and spermatia (imperfect states) was validly published but is considered illegitimate because the species concerned was described in a genus characterized by a perfect state."

Thus under Art. 34 *S. alni* is not validly published but under Art. 59 it is validly published but illegitimate. Furthermore there seems to be a further contradiction in Art. 59 itself, because in Example 3 it is

stated that *Corticium microslerotia* (MATZ) WEBER "is considered not validly published because this type does not show the characteristics of a perfect state genus". It is difficult to see why *Ravenelia cubensis* should not also be considered as not validly published because its type does not show the characteristics of a perfect state genus, or why it should not be considered as not validly published under Art. 34. In the case of *S. alni* we consider that Art. 34 is decisive.

O. ROSTRUP (1897) was the first to describe the perfect state which he called *Sclerotinia alni,* attributing the name to MAUL. This situation clearly comes under Art. 59, Par. 4 and here *Sclerotinia alni* should be considered as the validly published name of a new taxon and ascribed to O. ROSTRUP alone.

WHETZEL (1945) was the first to recognize that the fungus belonged in *Ciboria* rather than *Sclerotinia* and he published the combination *Ciboria alni* (MAUL) WHETZ. WHETZEL has stated verbally to the senior author that it was his firm conviction that the earliest epithet applied to any structure of a fungus — sclerotial state, spermatial state, conidial state, or perfect state — should be the correct one for the species concerned and he paid little attention to rules that stated otherwise. His citation of MAUL is, therefore, understandable but *Ciboria alni* (MAUL) WHETZ. must be rejected not only because its basionym was not validy published, but also because the type of the basionym lacks apothecia; nor may the combination *C. alni* be attributed to WHETZEL alone, since it was published without an accompanying Latin diagnosis necessary for post-1935 validation.

BUCHWALD (1947) published the combination *Ciboria alni* (O. ROSTRUP) BUCHW. and we consider this to be the correct name.

KIENHOLZ & CASH (1935) described a fungus occurring on alder seeds in Oregon as *Phialea seminicola.* Through the kindness of Dr. C. R. BENJAMIN the type has been examined and on taxonomic grounds this species is considered to be a synonym of *C. alni.* It might be noted that if MAUL's name were considered to be validly published under Art. 59, Par. 3, *S. alni* ROSTRUP would have to be rejected as a later homonym, and *seminicola* would become the earliest legitimate epithet for the species, and would require a new combination in *Ciboria,* a quite unnecessary contribution to nomenclatural instability.

It seems highly probable that *Ciboria macrospora* VELENOVSKY (1934) is also a synonym but no material of this species has been examined. If so, this would provide an earlier epithet than *seminicola.*

There seems no necessity to redescribe the fungus here. It is characterized by its habitat and the large, fusoid ascospores (12) 14-20 (22) × (3.5) 4.0-5.5 μ (Fig. 4).

Ciboria alni (O. ROSTR.) BUCHW., Friesia 3: 257, 1947.
Fig. 4.

≡ *Sclerotinia alni* O. ROSTR., Zeitschr. f. Pflanzenkrankh. 7: 257, 1897.

= *Sclerotinia alni* NAWASCHIN, Ber. Deutsch. Bot. Ges. 12: 118, 1894 *(nom. nud.)*.

= *Sclerotinia alni* MAUL, Hedw. 33: 215, 1894 *(nom. provis.)*.

≡ *Ciboria alni* (MAUL) WHETZ., Mycologia 37: 675, 1945 *(non val. publ.)*.

= *Phialea seminicola* KIENH. & CASH, Mycologia 29: 82, 1937.

? = *Ciboria macrospora* VELEN., Monogr. Disc. Bohem. p. 218. 1934.

Host: seeds of *Alnus* spp.

Specimens examined: Authentic! DAOM 84196. København, Marts 1898; Sklerotierne udsaaede Oktober 1896. O. ROSTRUP.

Canada: Ontario. DAOM 43491, 43493, 56329, 70860, 105972, 105976, near Ottawa; DAOM 87414 (TRTC 6063), S. King City.

United States: Oregon. BPI. Hood River, Oregon Feb. 1935, Kienholz K 10. Type of *Phialea seminicola* KIENH. & CASH.

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We wish to express our appreciation to Dr. LUELLA K. WERESUB for critical reading of the manuscript and helpful suggestions.

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VIRUS DISEASE OF MUSHROOM (PSALLIOTA BISPORA (LGE.) SCHÄFF. & MÖLLER) IN DENMARK

By HENNING P. HANSEN and B. BLOCK

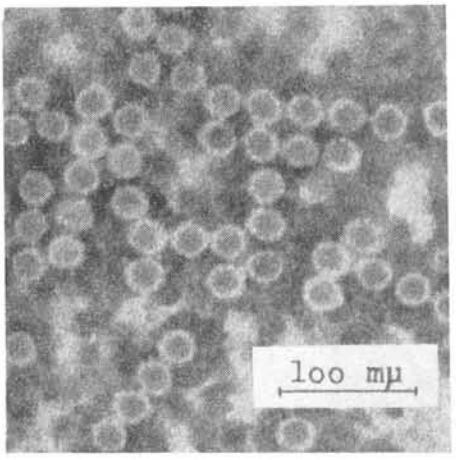
Contributions from The Department of Plant Pathology, No. 93,
The Royal Veterinary and Agricultural College, Copenhagen.

SUMMARY

Virus particles associated with disease of mushroom *(Psalliota bispora* (LGE.) SCHÄFF. & MÖLLER) were demonstrated for the first time in Denmark in 1967. The disease is believed to be identical with mushroom die-back in England.

The present virus is designated: *Mycophagapicorna psalliotae.*

A few years ago, virus-like particles were shown for the first time to be associated with die-back disease of mushrooms in England by GANDY & HOLLINGS (1962). The name of the disease refers to its only consistent feature: progressively dying back of the effective cropping area. An infected culture shows bare areas with only a few sporophores or none at all. The barren areas increase from one flush to the next. Fruit bodies within or from the border of such areas may show various types of malformation, but symptoms of fruit bodies are unreliable for diagnostic purposes because similar disturbances may be produced by a number of causes other than viruses. At present, the only reliable, positive diagnosis is with electronmicroscopy of purified extracts of the fungus, but the concentration of virus is often too low for this. An improved method, however, for detection and identification of viruses in mushrooms has been devised by HOL-



Virus particles from the diseased mushrooms (electronmicrograph, 180.000 ×).

LINGS et al. (1965). They applied ultrasound for disrupting the infected material, followed by purification and concentration of the liberated virus by differential centrifugation. Up to now three types of virus-like particles have been observed from mushroom, namely: 1) polyhedra, 25 mμ diameter; 2) polyhedra, 29 mμ dimeter; 3) bacilliformed particles, 19×50 mμ.

In the vicinity of Copenhagen, a commercial culture of mushrooms (*Psalliota bispora* (LGE.) SCHÄFF. & MÖLLER) showed the general feature of the die-back disease. Fruit bodies from 1st, 2nd, and 4th flushes were treated in the main according to the above method. Only those from the 4th flush were obviously diseased: curved stipe with tapering upper end, prematurely opened pileus of a greasy-wet appearance.

Each sample was treated as follows: The fruit bodies were crushed together with 3 parts by weight of M/30 phosphate-buffer, pH 7,5, in a mortar. 20 ml of the crude extract were then, in ice-bath, subjected to ultrasound (Ultrasonic, 60 W) 15 minutes and then centrifuged 20 minutes at 10.000 r.p.m. in rotor 30 of ultracentrifuge Spinco L. The precipitate was discarded. The supernatant liquid was ultracentrifuged for 60 minutes in rotor 40 at 39.000 r.p.m. (= 100.000× gravity). The resulting supernatant liquid was discarded, and the pellet suspended in 1 ml phosphate-buffer, pH 7,5, and centrifuged at low speed (4.500 r.p.m.) to eliminate insoluble substances. This parti-

ally purified liquid fraction, which thus was 20 times more concentrated than the original extract, was examined after negative staining with phosphotungstate (1 %, pH 7,-) in the electronmicroscope (R.C.A.-E.M.U.3F). The examination did not reveal any particles in samples from flushes 1 or 2, but the preparation from flush 4 contained numerous polyhedric particles with diameters ranging from 25 to 30 mμ. Although two sizes appeared to dominate in some plates, there seems to be no reason for believing that more than one particle-type was present. Apart from the occurrence of sizes between 25 and 30 mμ, the examined particles closely corresponded to those first observed in England and called mushroom viruses 1 and 2. Bacilliformed particles were not seen in the present material.

This is the first demonstration of virus particles associated with mushroom disease in Denmark (HANSEN & BLOCK 1967). It is believed to be identical with mushroom die-back in England.

According to the nomenclature proposed by HANSEN (1966) the name of the present virus should be *Mycophagapicorna psalliotae*.

ACKNOWLEDGEMENTS

Thanks are due to „Champignonlaboratoriet" of the Royal Veterinary & Agricultural College, Copenhagen, for calling attention to the incident of the disease and for supplying material for investigation; and to „Centrallaboratoriet", Københavns Kommunehospital, for kind admission to apply its ultrasound equipment.

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Copenhagen, August 1967.

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THANATEPHORUS CUCUMERIS (FRANK) DONK FUNDET PÅ IMPATIENS NOLI-TANGERE OG URTICA DIOECA I DANMARK

Af K. HAUERSLEV

SUMMARY

Thanatephorus cucumeris (FRANK) DONK on Impatiens noli-tangere and Urtica dioeca in Denmark.

Thanatephorus cucumeris (FRANK) DONK (syn. *Corticium solani* (PRILL. & DELACR.) BOURD. & GALZ.) has been found on *Impatiens noli-tangere* and *Urtica dioeca* in Denmark. Spores from different fructifications show some variation. The septal pore apparatus shows a different distinctness, but here and there it is possible to recognize that it has a more complicated structure, using a solution of phloxin with a little congo red.

Fig. 1. *Thanatephorus cucumeris* på *Impatiens noli-tangere* (i midten) — *Urtica dioeca* (til venstre og højre). Ørholm 21. juli 1963. Fot. K. HAUERSLEV.

På foreningens ekskursion til Ørholm den 7. august 1966 fandtes *Thanatephorus cucumeris* (FRANK) DONK (syn. *Corticium solani* (PRILL. & DELACR.) BOURD. & GALZ.) på stængler af Springbalsamin *(Impatiens noli-tangere)* og Stor Nælde *(Urtica dioeca)*. Den 6. og 21. juli 1963 havde jeg allerede fundet denne svamp på de samme værtplanter og voksende i det samme lavtliggende, fugtige og ret åbne skovstykke med især pil og el. De angrebne planter så ikke ud til at have taget skade af svampen, der strakte sig fra jordoverfladen og indtil 10 cm op ad stænglerne som en tynd, melet, løstsiddende, hvid til noget gul hinde med forsvindende eller fint trådet rand.

Basidierne er kort cylindriske eller ovale, 10-20 × 8-12 μ, med 4 sterigmer 7-13 × 1,5-3,5 μ. Sporerne er hyaline, glatte, ovale til noget aflange med den ene side lidt flad, ikke amyloide, 8-13,5 × 3,5-7 μ og med mere eller mindre afstumpet apiculus; ved spiring

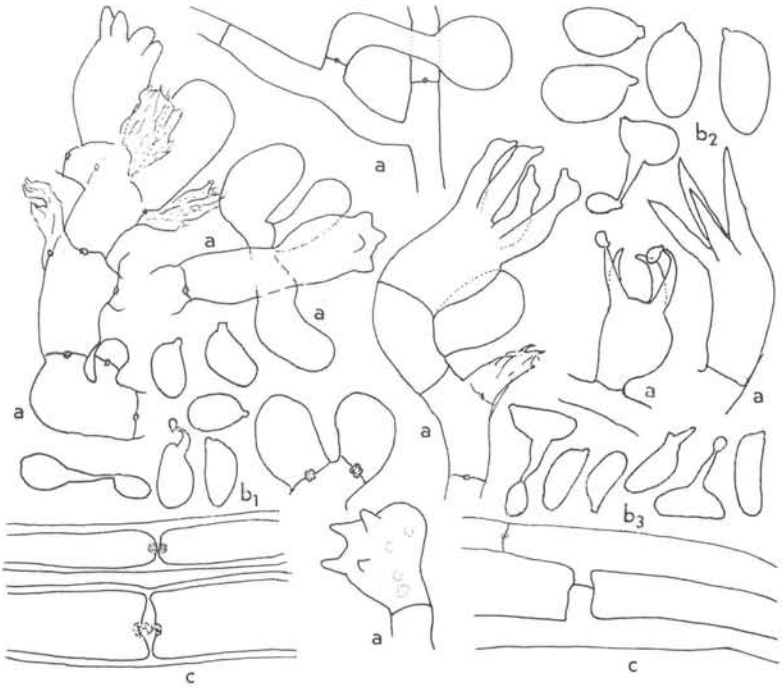

Fig. 2. *Thanatephorus cucumeris* (FRANK) DONK.
a. Unge og gamle basidier. — b_1 b_2 og b_3. Basidiesporer fra forskellige frugtlegemer. Bemærk den varierende størrelse. Nogle af basidiesporerne har spiret med sekundære sporer. — c. Hyfer med centralpore. — × 1000.

danner de sekundære sporer. De forskellige frugtlegemers basidiesporer varierer i form og størrelse; på en stængel af Springbalsamin var de nærmest aflange, 9-11,5 × 3,5-4,25 μ.

Hyferne er hyaline til gullige, tyndvæggede eller med lidt tykkere vægge, forgrenede i mere eller mindre rette vinkler, op til 11 μ i diameter og uden øskener. Midt på hyfernes septa ses centralporen ofte som en uklarhed eller et kort rør; hvis man anvender lidt congo rødt og phloxin til farvning, kan man ved heldig stilling af en hyfe iagttage, at centralporen ikke er et simpelt rør, men er mere kompliceret bygget, således som det også er påvist af BRACKER & BUTLER ved elektronmikroskopiske undersøgelser (1963).

LITTERATUR

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København, maj 1967.

FRIESIA . Bind IX . Hefte 1-2 . 1969

CHRISTIANSENIA PALLIDA GEN. NOV., SP. NOV.

A NEW PARASITIC HOMOBASIDIOMYCETE FROM DENMARK

By K. HAUERSLEV

On excursions to Hesede Skov on October 3, 1965 and to Torrig Skov on September 9, 1966 the author found on the bark of fallen branches of *Picea* patches of a resupinate fungus. A microscopic examination showed a mixture of *Peniophora crema* BRES. and a parasitic fungus which has basidia with 6 sterigmata together with an imperfect state and haustoria. To the writer's knowledge no such fungus has been preveously reported. The fungus is hereby described as a new species and a new generic name is proposed for it.

Christiansenia gen. nov.

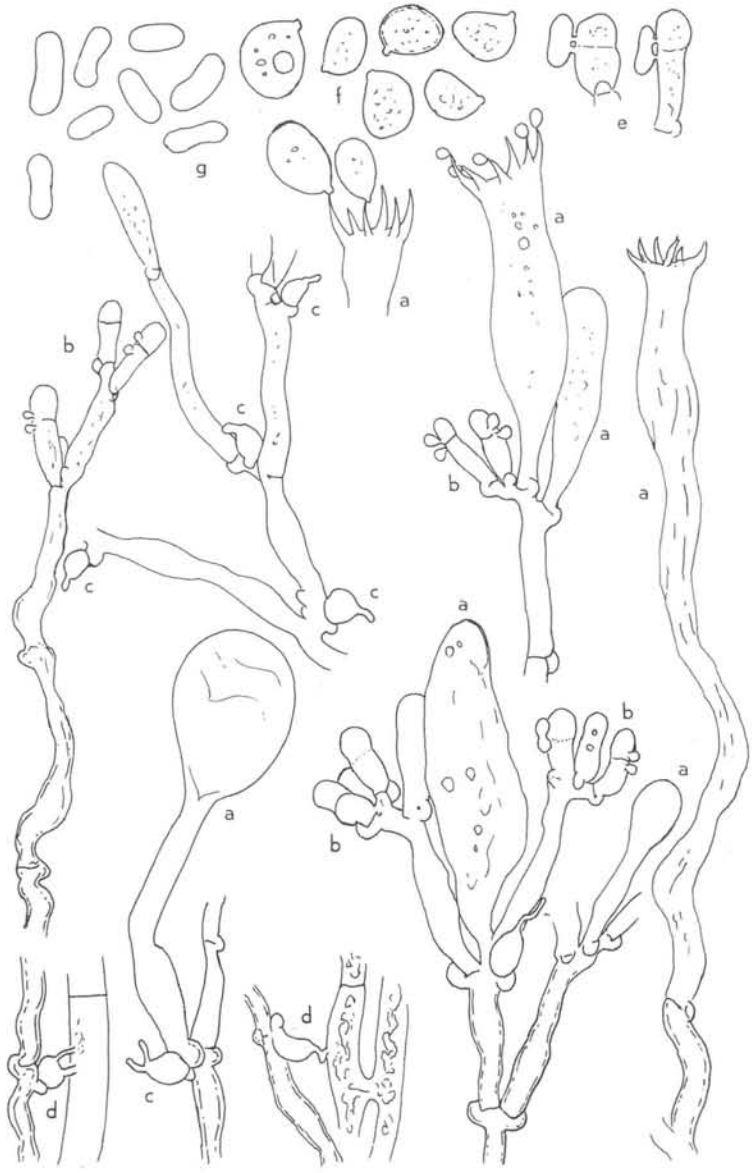
Fungus parasiticus, homobasidialis. Basidia suburniformia, interdum longissima, primitus clavata, sterigmata 6-gerentia. Basidiosporae hyalinae. Hyphae hyalinae, noduloso-septatae, conidiophora et basidia ferentes, conidiophoris 1-septatis. Conidia bini conjungunt.

Hab. Ad fungos *Peniophorae cremeae.*

Etymologia: Genus in honorem M. P. CHRISTIANSEN, auctor „Danish resupinate Fungi" I-II (1959 et 1960).

Christiansenia pallida sp. nov.

Fungus parasiticus. Fructificatio hyalina, pallida, irregulariter effusa, sub lente plus minusve granulosa, 300 μ crassa, sicca in vernicosa grisea membrana consistens. Hyphae hyalinae, plus minusve tenuiter tunicatae, 2-7 μ diam., noduloso-septatae, conidiophora et basidia ferentes. Basidia clavata vel suburniformia, interdum longis-



Christiansenia pallida gen. nov., sp. nov.

a. Basidia; b. conidiophores; c. haustorial branches; d. haustoria sticking to hyphae of *Peniophora cremea;* e. confluent conidia attached to conidiophores; f. basidiospores; g. conidia. — × 1000.

sime cylindracea, 35-140 × 5,5-11 μ, 6 sterigmata ferentia. Conidiophora cylindracea vel clavata, 10-20 × 2,5-5 μ, septo transverso bipartita, utraque pars conidium singulum format, conidia bini conjungunt, 7-11 × 3-4,5 μ. Basidiosporae ovatae, uno latere applanatae, granulosae vel guttulatae, 7,5-11 × 5-9 μ, laeves, apiculo prominente, non-amyloideae. Haustoria adsunt.

Hab. Ad fungos *Peniophorae cremeae.*

Fungus parasitic on *Peniophora cremea* BRES. forming irregular, hyaline, pallid, somewhat granulose, small patches, up to 300 μ thick, drying to a greyish or invisible film. Hyphae hyaline, more or less thin-walled, few basal ones up to 7 μ in diam. give rise to somewhat irregular cylindric hyphae, about 2-5 μ in diam., with clamp-connections, bearing basidia and conidiophores. Basidia clavate to suburniform or long cylindric, 35-140 × 5,5-11 μ, with 6 sterigmata. Basidiospores ovate, on one side flattened, smooth, with droplets or granular content, 7,5-11 × 5-9 μ, with large apiculus. Conidiophores cylindric-clavate, about 10-20 × 2,5-5 μ, becoming divided in two parts by a septum, each part bearing one conidium. The two conidia are confluent to one cell, almost cylindric, about 7-11 × 3-4,5 μ. Two pairs of conidia may occur on one conidiophore. Non-amyloid. Haustorial branches present growing out from clamp-connections of the hyphae.

COLLECTIONS

KH 2351. Hesede Skov, Oct. 3, 1965, on *Peniophora cremea,* on *Picea abies* (type).
KH 2492. Torrig Skov, Sept. 24, 1966, on *Peniophora cremae,* on conifer.
KH 2694. Sorgenfri, April 1, 1967, on *Peniophora cremea,* on frondose wood.
KH 2710. Sorgenfri, March 19, 1967, ibid.
KH 2744. Sorgenfri, June 10, 1967, ibid.
KH 3043. Ørholm, March 3, 1968, ibid.
KH 3186. Korsør Skov, Sept. 7, 1968, ibid.

ACKNOWLEDGMENT

The author is much indebted to Professor JOHN ERIKSSON, Göteborg University, for examination of the type-material and for his approval that the fungus must be referred to a new genus.

Copenhagen, September 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

OSTRACODERMA EPIGAEUM (LINK) HENNEBERT (PEAT MOULD) AND ITS PERFECT STAGE PEZIZA ATROVINOSA COOKE ET GERARD.

By ERNST HELLMERS.

Contribution from the Department of Plant Pathology, No. 70,
The Royal Veterinary and Agricultural College, Copenhagen.

SUMMARY

On steam sterilized peat moss and on fiber pots in Danish nurseries a curry coloured mould has obstructed the growth of seedlings of *Begonia* and *Petunia*. The fungus has been named Peat Mould *(Ostracoderma epigaeum* (LINK) HENNEBERT), and its perfect stage is *Peziza atrovinosa* COOKE et GERARD. Peat Mould has also been observed on casing soil in mushroom nurseries. — The avoidance of steam sterilization of peat moss, and the application of Dithane M-45 (0.5-2:1000) on the surface of soils, pots etc. has minimized the problem.

On steam sterilized peat moss *(Sphagnum)* in Danish nurseries a curry coloured mould has been observed growing so vigorously that the germination of *Petunia* and *Begonia* was now and then obstructed.

The fungus has been determined as *Ostracoderma epigaeum* (LINK) HENNEBERT (syn. *Botrytis epigaea* LINK), and for this stage the common name Peat Mould has been proposed. The perfect stage is a cup fungus named *Peziza atrovinosa* COOKE et GERARD (syn. *Plicaria fulva* SCHNEIDER).

The imperfect stage: *Ostracoderma epigaeum* (LINK) HENNEBERT. The mycelium grows superficially, delicately like cobweb,

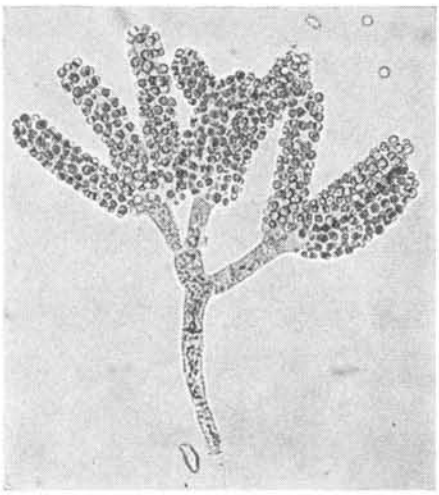


Fig. 1. Conidiophores of *Ostracoderma epigaeum*.

Note the dichotomously branching upper parts with the globose, hyaline conidia.—Stained with cotton blue. × 200.

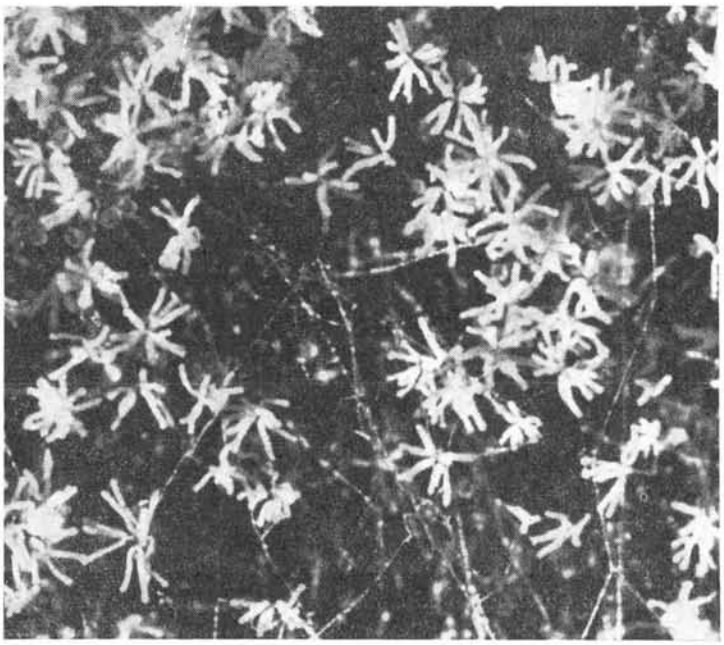


Fig. 2. *Ostracoderma epigaeum* (Peat Mould) growing on peat moss.

Note the stellate, white conidiophores (compare fig. 1). — × 60.

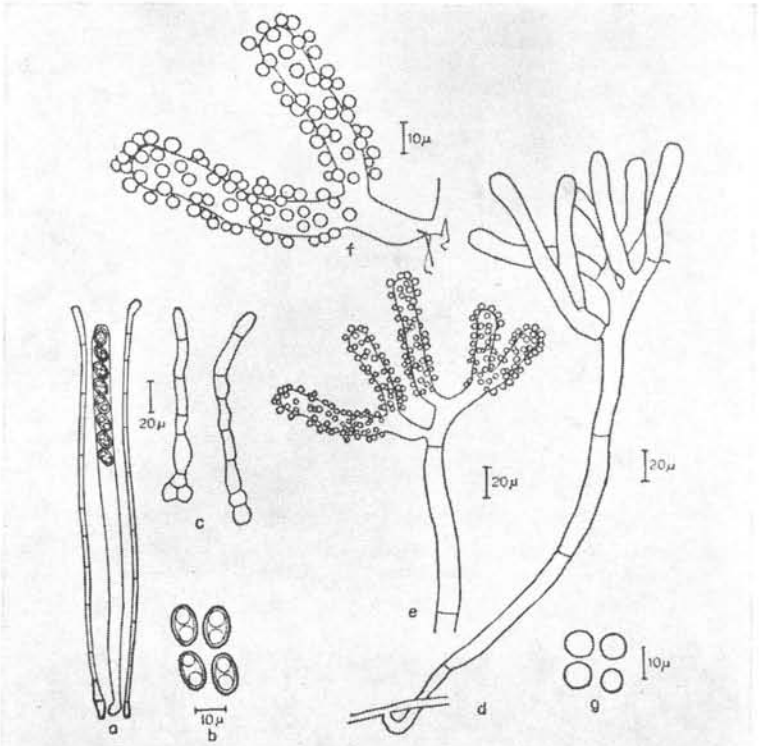


Abb. 3. *Plicaria fulva* n. sp.
a) Reifer Ascus mit Paraphysen. b) Ascosporen. c) Haarartige Gebilde am Scheibenrand. d) Konidienträger nach dem Abfallen der Konidien. e) Junger Konidienträger mit Konidien. f) Seitenast des gleichen Konidienträgers mit Konidien. g) Einzelne Konidien.

Fig. 3. *Peziza atrovinosa* (syn. *Plicaria fulva*).
Reproduction from R. SCHNEIDER's paper in Zentralbl. Bakt. II, 108: 149, 1954.

with 5-10 μ wide, multiseptate hyphae. The outer zone of the mycelium is grey, then white due to the formation of young conidiophores with conidia (figs. 1, 2). Overnight these become yellow-curry coloured. The basal part (300-400 μ) of the conidiophore is unbranched while the upper part is dichotomously branching into long (100-135 μ), cylindrical branches bearing numerous hyaline-subhyaline globose conidia (figs. 1, 3), in general measuring 8-10 μ. The size of the conida may vary according to temperature; SCHNEIDER (1954) states 5-11 μ at 19° C, and HENNEBERT (1960) 5-11 μ at 15-18° C and 10-21 μ at 27-28° C. The conidia germinate within 12-18 hours at 19° C. Optimum for growth is about 31° C and pH 6.6-7.4, but the fungus grows well at temperatures 9-35° C and pH 4.0-11.4.

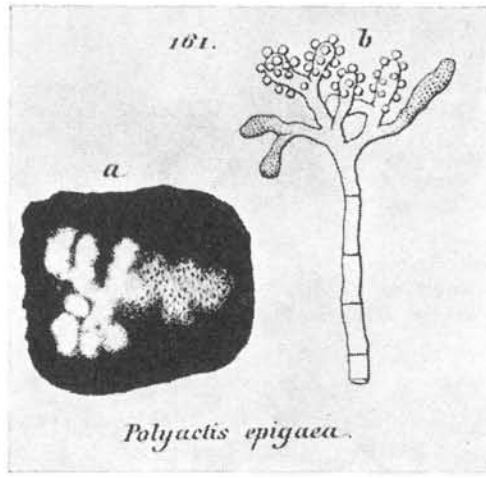


Fig. 4. *Ostracoderma epigaeum* (syn. *Polyactis epigaea).*

a: Coloured drawing showing from left: white, then yellow and curry coloured mould; b: Conidiophore with globose conidia. — Reproduction (× 1,3) from BONORDEN's fig. 161 in his »Handbuch der allgemeinen Mykologie« (1851).

SCHNEIDER (1954) described the above named conidial stage as well as its perfect stage *Plicaria fulva* SCHNEIDER as new, but she did not name the imperfect stage. This, however, is obviously identical with *Botrytis epigaea* LINK (1824), which BONORDEN 1851 transferred to the genus *Polyactis* LINK (1809) under the name *Polyactis epigaea* (LINK) BON. (fig. 4). HUGHES (1958) considers the genus *Polyactis* LINK as synonymous to *Botrytis* PERS. (1801) and 1960 HENNEBERT refers the species with globose conidia to the genus *Ostracoderma* FR. (1825). HENNEBERT assumes that the conidial stage of *Plicaria fulva* SCHNEIDER might be identical to *Polyactis crystallina* BON. (1864), but as this seems to be the young and white stage of *Polyactis epigaea* (LINK) BON., and as the latter name is the oldest one, this has priority. Therefore, the correct name of the imperfect stage should be *Ostracoderma epigaeum* (LINK) HENNEBERT.

The perfect stage: *Peziza atrovinosa* COOKE et GERARD. R. SCHNEIDER in 1954 described the apothecia as being dark brown, small (5-12 mm in diam., 3-5 mm high) with no stalk. Asci cylindrical 204-322×11.0-15.5 μ, with iodine positive operculum. Ascospores (8) biguttulate, onecelled, elliptical 11.4-15×7-9.8 μ, delicately verrucose (actually striate or reticulate (fig. 3). SCHNEIDER, and also the present author, has proved that the conidial stage *(Ostracoderma epi-*

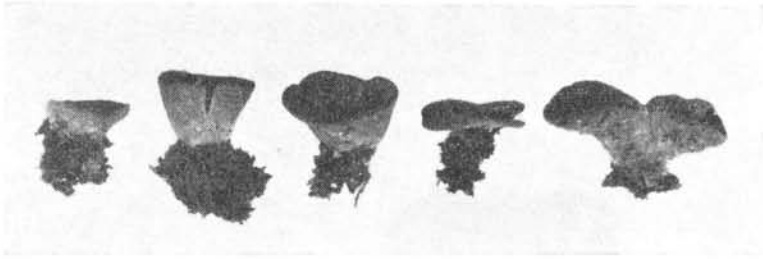


Fig. 5. *Peziza atrovinosa* (Peat Mould). Apothecia from peat moss in Danish nursery, February 1965. — × 2.

gaeum) develops from germinated ascospores. In Danish nurseries it usually takes 3-6 weeks before the sessile apothecia are formed, and they measure 4-25 (often 5-10) mm in diam. (fig. 5).

According to DENNIS (1960) the genus *Plicaria* has globose ascospores, and therefore he refers the above described discomycete to *Peziza* ST. AMANS (1821). He also states that *Plicaria fulva* SCHNEIDER is identical with *Peziza atrovinosa* COOKE et GERARD (1875) which is fully agreed by the Danish discomycete specialist H. DISSING (pers. communication). Therefore, the correct name of the perfect stage is *Peziza atrovinosa* COOKE et GERARD (syn. *Plicaria ostracoderma* KORF 1960).

Peat Mould has been recorded from Germany (LINK 1824, BONORDEN 1851, 1864, SCHNEIDER 1954, RIETH 1957), Norway (ROLL-HANSEN 1961), England (DENNIS 1960), Holland (VAN DER VLIET 1962), and USA (KORF 1960).

The fungus has also been found in Austria (KOCH 1961, unpublished), and in many other countries (C. RIBER RASMUSSEN, personal communication).

In Denmark the fungus has been known for many years, especially in nurseries where steam-sterilization of soil together with peat moss has been practiced. Also the so-called fiber-pots are frequently overgrown by the Peat Mould. On mushroom beds the mould is sporulating so vigorously that the workers have contracted serious allergic symptoms.

In ordinary glasshouse nurseries the mould has been controlled by avoiding steam sterilization of peat moss. In this connection it is recommended to steam the soil-mixtures before the untreated peat moss is mixed with the sterile soil. Spraying with Dithane M-45 (2:1000) on the surface of the soil and fiber-pots has checked the

growth of the fungus in *Gerbera* seed beds. When seeds are not covered, the concentration should be reduced to 0.5-1.0 : 1000 (HELLMERS 1965).

In mushroom beds no chemicals may be used, but optimal mycelial growth of the mushroom usually prevents the growth of the Peat Mould.

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Copenhagen, December 1966.

FRIESIA . Bind IX . Hefte 1-2 . 1969

BOTRYOTINIA SPHAEROSPERMA SUR LILIUM REGALE

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Cinq espèces de *Botrytis* [MICHELI] HALLER ex FR. sont actuellement connues sur des espèces du genre *Lilium* L. depuis que CORDA (1838) signala pour la première fois un de ces champignons sur *Lilium candidum* L. à Prague. Ce sont *Botrytis elliptica* (BERK.) COOKE, *B. cinerea* PERS. ex FR., *B. hyacinthi* WEST. et v. BEYMA, *B. tulipae* (LIB.) LIND et *B. liliorum* FUJIKURO.

CORDA, lorsqu'il décrivit et illustra son champignon, l'identifia quoique sous réserve, au *Botrytis cana* KUNZE et SCHMIDT ex FR. et le dénomma *Polyactis cana* (KUNZE et SCHMIDT ex FR.) CORDA. Mais l'espèce de KUNZE et SCHMIDT (1817), récoltée sur *Scrophularia nodosa* L., est vraissemblablement différente et identique à *Peronospora sordida* BERK. Par contre, par ses grandes spores ovales et ses spores septées et difformes, le champignon de CORDA apparaît bien être identique au „*Botrytis* du lys" de WARD (1888) et à l'*Ovularia elliptica* BERK. que BERKELEY (1881) décrivait sur *Lilium auratum* LINDL. et que COOKE (1906) renomma *Botrytis elliptica* (BERK.) COOKE. Entretemps, il avait été dénommé invalidement par BONORDEN (1851) comme *Polyactis cana* CORDA ex BON. pro syn. et transféré au genre '*Spicularia* PERS.' et ensuite nommé à nouveau par SACCARDO (1886) comme *Botrytis canescens* SACC. Considérant l'identité entre les espèces de BERKELEY et de CORDA, *Botrytis canescens* SACC. devient donc synonyme de *Botrytis elliptica* (BERK.) COOKE.

Botrytis elliptica (BERK.) COOKE est connu sur de nombreuses espèces et variétés de *Lilium* où il cause de grands dégâts au feuillage et aux inflorescences (WARD 1888, GROVE 1927, WRIGHT 1928, VAN

BEYMA et VAN HELL 1931, COTTON 1933, MOORE 1949). Cette espèce est caractérisée par des conidies grandes, ovales à elliptiques, souvent allongées, subhyalines à brunâtres claires, à paroi fine et lisse, à cicatrice d'attache large et évidente, mesurant 15-38 (45) × 10-25 μ, la plupart 20-25 × 14-17 μ, et en moyenne 23,5 × 15 μ, de rapport longueur/largeur variable (1.1) 1.5-2.1 (2.4) et en moyenne 1.60, et des conidies anormales fréquentes 1-2-septées, cordiformes, bifides ou trifides.

A côte de cette espèce, *Botrytis cinerea* PERS. ex FR. est fréquemment observé sur *Lilium* où il peut causer, lui aussi, d'importants dommages par temps humide et en particulier chez *Lilium candidum* L. Ses conidies, de beaucoup plus petites, mesurent (5) 8-14 (18) × (4) 6-9 (11) μ (HENNEBERT 1960).

Botrytis hyacinthi WESTERDIJK et v. BEYMA (1928), connu comme la cause du "feu" des jacinthes, a été observé aussi sur les bulbes de *Lilium* et s'est montré agressif au feuillage de *Lilium candidum* (VAN BEYMA et VAN HELL 1931). Nous l'avons observé aussi sur *Lilium regale* WILSON en Hollande du Nord. Ses conidies sont ovales, mesurant 12-18 × 10-15 μ et en moyenne 16 × 12 μ. En culture, l'espèce est facilement reconnaissable à ses nombreux sclérotes noirs de 1-2 mm solitaires ou en chaîne et régulièrement dispersés à la surface du milieu de culture.

Botrytis tulipae (LIB.) LIND est une quatrième espèce que nous avons occasionellement observée sur *Lilium* aux Pays-Bas. Elle s'y trouvait sur des tiges d'inflorescences en fin de floraison dans des parcelles situées à proximité de parcelles de *Tulipa* atteintes par le champignon. L'espèce est caractérisée par des conidies elliptiques mesurant 12-22 × 8-12 μ et en moyenne 17×10 μ. En culture, elle produit des sclérotes du même type que ceux de *Botrytis hyacinthi* mais plus petits.

Botrytis liliorum FUJIKURO a été décrite sur *Lilium longiflorum* THUNB. à Formose par FUJIKURO (1914). Ses conidies, produites en petit nombre, 4-6, sur les terminaisons enflées du conidiophore, sont presque sphériques ou largement ovoïdes à ovoïdes, parfois difformes, mesurant 28-37 × 21-31 μ et en moyenne 32 × 27 μ. Cette espèce n'a pas encore été observée en Europe.

Nous avons relevé en 1963 une sixième espèce à forme *Botrytis* sur *Lilium,* à savoir *Botryotinia sphaerosperma* (GREGORY) BUCHWALD. Cette espèce fut décrite pour la première fois par GREGORY (1941) sur *Allium triquetrum* dans les Iles de Scilly, en Cornouaille

et n'a été retrouvée qu'une seule fois en dehors de sa localité d'origine, notamment à Lambourne Hill, Penhallow, Cornouaille et sur le même hôte. Elle n'était jusqu'à présent connue que sur *Allium* (HENNEBERT 1963). Son existence sur *Lilium regale* WILSON aux Pays-Bas indique non seulement un nouvel hôte pour l'espèce mais aussi sa présence sur le Continent où elle n'avait pas encore été signalée.

Botryotinia sphaerosperma (GREGORY) BUCHWALD (forme conidienne *Botrytis sphaerosperma* (GREGORY) BUCHWALD) présente, sur *Lilium regale,* des colonies basses et denses, blanches sales ou ochracées, couvrant la surface des lésions de l'hôte et constituées des conidiophores dressés, de 300 à 500 μ de hauteur, émergeant solitaires ou par groupes de 2 à 5 des tissus épimermiques ou des stomates. Les conidiophores sont constitués d'une ou plusieurs cellules basales arrondies, à paroi épaisse, brunes, de 20-30 μ de diamètre et d'un stipe dressé, 1-2 septé, devenant vers le sommet subhyalin et ramifié avec 2 à 4 rameaux latéraux, courts, disposés en spirale et parfois eux-mêmes ramifiés, d'abord continus, puis plusieurs fois septés et enflés aux extrémités en une ampoule sporogène, et ensuite, à la maturité des conidies, sénescents, déprimés, plissés en accordéon et d'apparence annelée, bientôt caduques et ne laissant sur le stipe qu'une cicatrice large, circulaire et proéminente. Les proliférations du conidiophore sont terminales ou subterminales, généralement uniques, rarement à 2 ou 3, de 250-300 μ, 1-septées, developpant à leur sommet une nouvelle grappe de spores nées aux extrémités enflées de rameaux courts. Les cellules sporogènes, développées aux extrémités du stipe et de ses rameaux, arrivent presque simultanément à maturité, les inférieures cependant les premières; elles sont plus ou moins enflées et développent un petit nombre, 3-6, de bourgeons simultánés golbuleux ou sphériques sur des denticules courts de 1-2 μ de largeur. Les conidies, à maturité, sont des blastospores sphériques, subglobuleuses à largement ovales, parfois réniformes ou cordiformes, à paroi relativement épaisse, lisse et légèrement pigmentée, olivâtre à brunâtre, à cicatrice d'attache peu apparente et parfois latérale, et mesurant (15) 18-30 (33) $\times$ 15-28 (30) μ et en moyenne 23.8 $\times$ 20.7 μ, de rapport longueur/largeur variant de 1 à 1.40 et en moyenne de 1.16. (Fig. 1). Des sclérotes noirs plats et allongés ont été observés sur les parties pourissantes de l'hôte. En culture pure sur PDA, les sclérotes sont peu abondants, larges de 3-5 mm, de contour sinueux, de profil arrondi ou applati, dispersés radialement ou périphériquement sur un mycelium blanc à ochracé, peu abondant et ras.

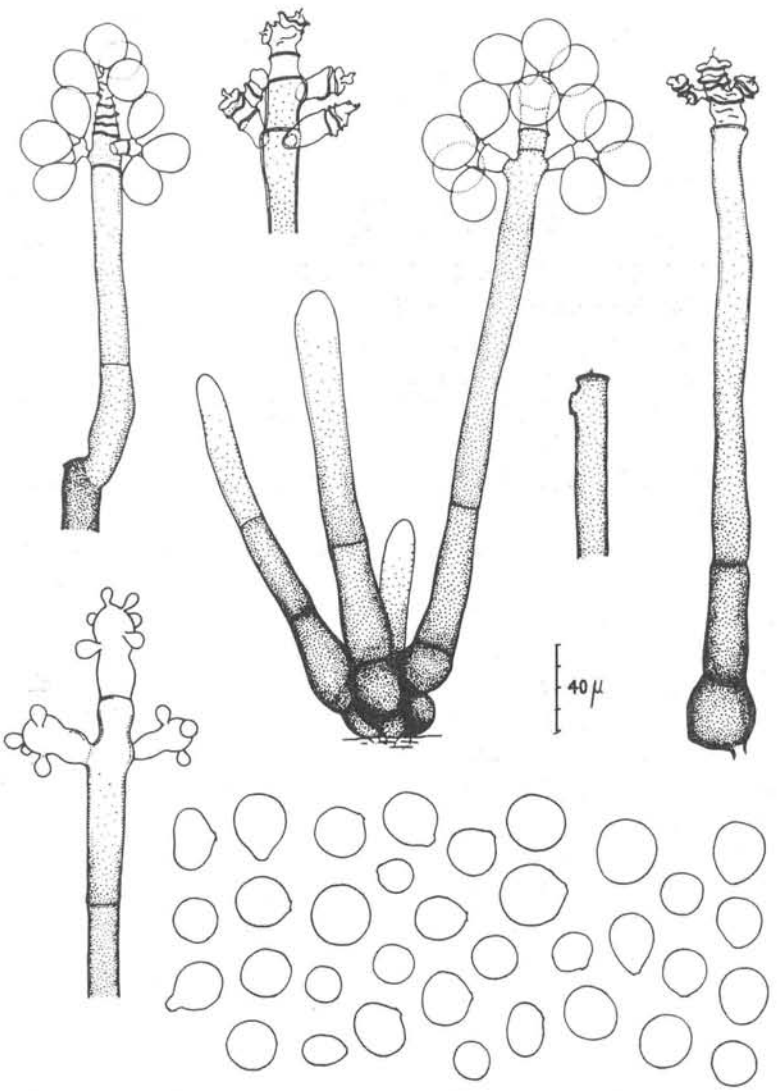

Fig. 1. *Botryotinia sphaerosperma* sur *Lilium regale* (GLH 3851-B).

Le champignon a été observé à deux reprises. (1) Sur les feuilles et tiges de *Lilium regale* WILSON, dans la plantation de Mr. C. VAN MEULEN, à Wijdenis, près de Andijk, Noord-Holland, par G. L. H., 23 août 1963 (Herb. GLH 3851-B). Le feuillage était partout gravement atteint et présentait les symptômes identiques à ceux d'une attaque par *Botrytis elliptica* (BERK.) COOKE, c'est-à-dire des lésions d'abord

lenticulaires brunâtres, parfois auréolées de rouge, s'élargissant ensuite et envahissant la feuille qui bientôt s'affaisse et se couvre de conidiophores. Sur les boutons floraux et les tiges des mêmes plantes, le même champignon a été retrouvé en mélange avec *Botrytis cinerea* PERS. ex FR. (GLH 3851-A) et, ici et là, *Botrytis tulipae* (LIB.) LIND (Herb. GLH 3851-C). (2) Sur les inflorescences senescentes de *Lilium regale* dans une culture abandonnée, à Andijk, Noord-Holland, par G. L. H., 23.8.1963 (Herb. GLH 3860). Il faut remarquer que dans aucune des deux parcelles *Botrytis elliptica* n'a été observé.

Botryotinia sphaerosperma (GREG.) BUCHW. se classe, pour sa forme conidienne, dans le sous-genre *Sphaerobotrytis* BUCHWALD (1949) où il se distingue de *Botryotinia globosa* BUCHW. à conidies de 12-18 μ de diamètre et de *Botryotinia polyblastis* (GREG.) BUCHW. à conidies de 30-70 μ de diamètre, deux espèces connues sur d'autres liliacées.

Malgré la similitude des symptômes et la présence dans nos récoltes de près de 40 % de conidies de forme plus ou moins ovale (de rapport longueur/largeur de 1.16 à 1.40), la forme conidienne de *Botryotinia sphaerosperma* (GREG.) BUCHW. sur le Lys ne peut être confondue avec *Botrytis elliptica* (BERK.) COOKE. En effet, elle en diffère par ses spores pour la plupart globuleuses et leur largeur moyenne nettement supérieure à celle de cette dernière espèce, par ses conidiophores plus foncés et plus courts et par ses caractères culturaux.

Je tiens à exprimer un hommage sincère et ma profonde gratitude au Professeur N. F. BUCHWALD qui, par son étude célèbre "Studies in the Sclerotiniaceae", par le vivant accueil qu'il me réserva en 1958 au Plantepatologisk Afdeling, Den kgl. Veterinær- og Landbohøjskole à Copenhague et par ses conseils autorisés, me guida dans l'étude du genre *Botrytis*.

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PUCCINIASTRUM GOEPPERTIANUM (KÜHN) KLEB. FOUND IN DENMARK

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Pucciniastrum goeppertianum (KÜHN) KLEB. was found for the first time in Denmark in 1965 and refound in 1966 on cowberry *(Vaccinium vitis-idaea)* and silver fir *(Abies alba)* in several plantations in the vicinity of Herning in Jutland. The plantations consist mainly of norway spruce *(Picea abies)* with a few young trees of silver fir in the clearings, the firs usually have low-hanging branches.

The shoots of cowberry infected by *Pucciniastrum goeppertianum* are thicker and longer than normal shoots so that the diseased ones stick up like candles among the healthy ones (Fig. 1). The teliospores were found to germinate in the middle of May in a rainy period. About the first of July it was possible to find the aecidia on the needles of young shoots of silver fir, but only on needles in very close vicinity (until 30 cm) of the infected cowberries.

Fig. 1. Cowberry *(Vaccinium vitis-idaea)* infected by *Pucciniastrum goeppertianum*. Phot. Oct. 1966.

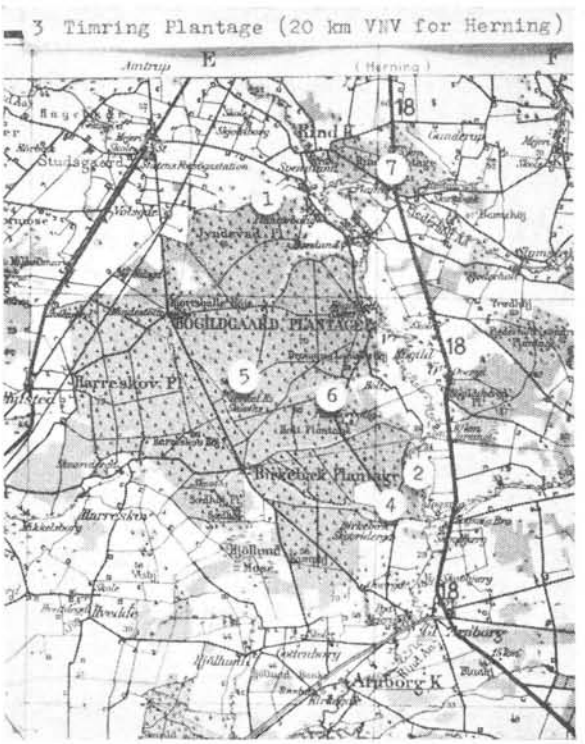

Fig. 2. Plantations in Western Jutland where *Pucciniastrum goeppertianum* was found on *Vaccinium vitis-idaea* and *Abies alba* in 1965 and 1966.

1. Jyndevad; 2 and 4. Birkebæk; 3. Timring; 5 and 6. Høgildgaard; 7. Rind.

It was noticed, that about the same time as the aecidia were emptied, the diseased needles dropped off.

J. KOCH (the Department of Plant Pathology, The Royal Veterinary and Agricultural College) has informed me about an infection experiment he made with some diseased cowberry plants I sent to him in May 1966: On the 20th of May some of the branches were placed on the shoots of some 3 years old potted plants of silver fir in the garden of the Department of Plant Pathology. During the 20th-29th of June aecidia developed on the underside of young needles.

Pucciniastrum goeppertianum is on record from Finland and Sweden (HYLANDER et al. 1953), Great Britain (WILSON & HENDERSON 1966), Germany (GÄUMANN 1959) and a few other European

countries. It is wrongly stated by WILSON & HENDERSON (1966) that the fungus has been recorded from Denmark and Norway. It was, however, expected already by E. ROSTRUP (1902, p. 307) and C. FERDINANDSEN (1928, p. 86) that the fungus would be found in Denmark.

Finds on *Vaccinium vitis-idaea* in Jutland (Fig. 2):

1. Jyndevad plantation Sept. 5, 1965 (the first find). — 2. Birkebæk plantation Oct. 3, 1965. — 3. Timring plantation Nov. 19, 1965. — 4. Birkebæk plantation March 13, 1966. — 5 and 6. Høgildgård plantation June 19, 1966. — 7. Rind plantation Oct. 7, 1966.

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Studsgård, November 1968.

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FOUR PREUSSIAN GENERA*)

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Some years ago, through the kindness of the Curator of collections in Herb. B, I was permitted to examine the presumed type collections of the type species of some Preussian form generic names. It was possible to confirm the current application of the name *Calcarisporium* and to explain the type species of *Botryonipha, Gongromeriza* and *Tolypomyria*. Brief notes on the relevant collections and on the identity of the type species are given below.

Botryonipha PREUSS.

Type species, *B. alba* PREUSS, Linnaea 25: 79. 1852.

The type collection is labelled '624 b. *Botryonipha alba* PR. fig. 1503 [scr. PREUSS]' and consists of pieces of coniferous wood showing a stringy type of rot. On the surface of this substratum are found scattered, white, hemisphaerical or flattened structures up to 500 μ wide. These have a fuscous stromatic centre covered on the outside with crowded, radiating, hyaline, cylindrical to clavate, inflated ends of hyphae; these swellings bear crowded denticle-like projections over their entire surface but they are fewer and more scattered toward the base. The swellings are 45-57 μ long and 6.3-10.5 μ wide and the cylindrical projections up to 3.0 μ long, mostly 1.5-2.0 μ, and 0.5-1.0 μ wide.

Dr. M. K. NOBLES kindly identified these cylindrical structures as (Fig. 1) the acanthophyses of a Hymenomycete (vide TALBOT 1954).

*) Contribution No. 701, Plant Research Institute.

There is no doubt that PREUSS's 'receptaculis emergentibus radiatis candidis' refers to the acanthophyses and his 'sporis globosis minutissimis pellucidis in ambitu tectis' refers to the denticulate projections which appear round in surface view.

Botryonipha PREUSS (1852 a) may safely be excluded from the *Moniliales* and included as a form genus of *Mycelia sterilia.*

Later, PREUSS (1852 b) described a second species in *Botryonipha, B. dubia,* but so far as I am aware its identity is unknown. SACCARDO (1886) compiled *B. alba* and *B. dubia* in a third section *'Botryonipha* PREUSS' of *Stilbum* as *S. botryonipha* SACC. and *S. dubium* (PREUSS) SACC. respectively.

Calcarisporium PREUSS.

Type species, *C. arbuscula* PREUSS (as *'arbusculum'*), Linnaea 24: 124. 1851.

Two extant specimens are labelled as follows: (1) '324 b. *Calcarisporium arbusculum* PR. [scr. PREUSS]', and (2) '324 b. *Calcarisporium arbusculum* PREUSS [scr. PREUSS]'. The first contains material which is badly fragmented but seems to be woody: conidiophores and conidia of *C. arbuscula* are present. The second packet contains slices of wood but these have been attacked by insects; a single sporogenous cell of *C. arbuscula* and some conidia were seen in the preparations. In neither packet could I find apothecia of *'Peziza nivea'* the precise habitat given by PREUSS (1851). Nevertheless the fungus present matches PREUSS's precise diagnosis and the redescription by HUGHES (1951) based upon collections on *Dasyscypha virginea,* decaying *Lactarius,* and on *Polyporus? adiposus.* TUBAKI (1955) redescribed *C. arbuscula* from a collection on *Marasmius* in Japan and WATSON (1955) has given an account of the same species living as an endophyte in apparently healthy sporophores of *Russula* and *Lactarius.*

Gongromeriza PREUSS.

Type species, *G. clavaeformis* PREUSS, Linnaea 24: 106. 1851.

The type collection is labelled '230 d. *Gongromeriza clavaeformis* PR. Fig. 1351. Auf Erlenholz [*Alnus glutinosa*] [scr. PREUSS]' and consists of a piece of wood which bears the *Chloridium* LINK conidiophores of *Chaetosphaeria myriocarpa* (FR.) BOOTH (1957). The conidio-

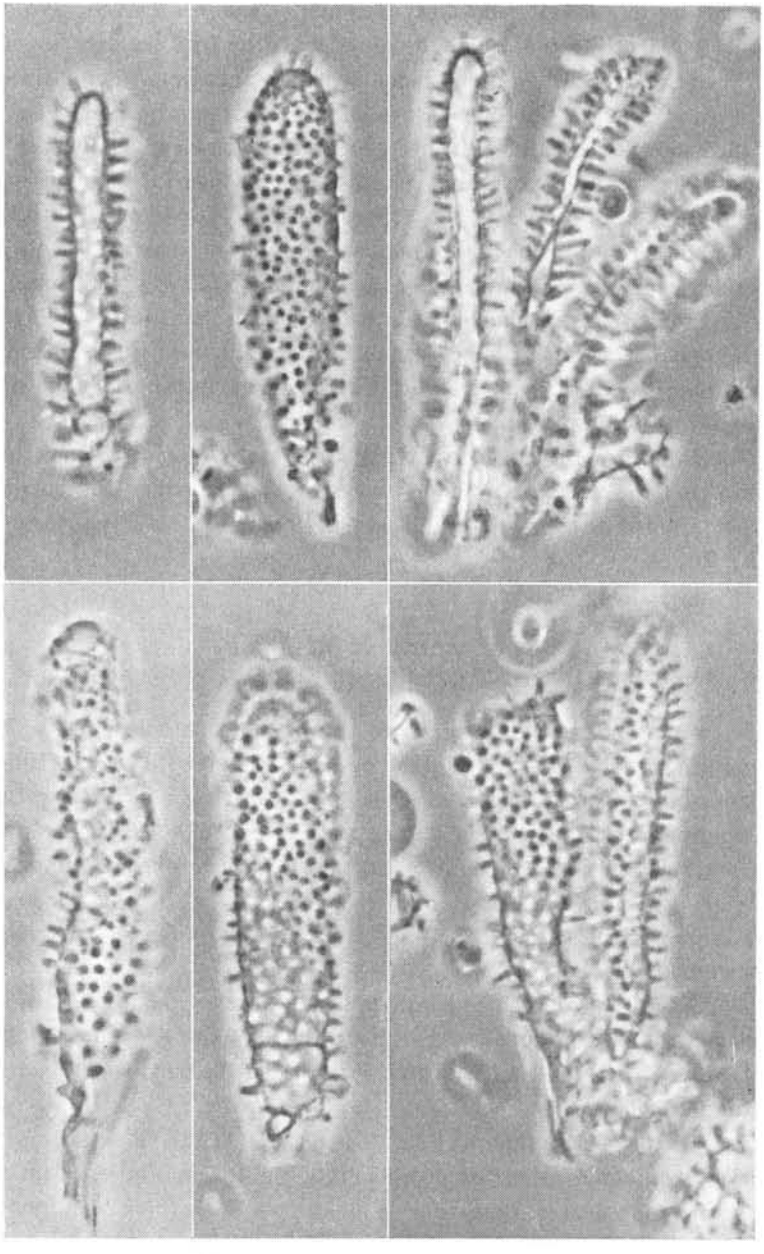

Fig. 1. *Botryonipha alba*. Acanthophyses, from the type collection. × 1160.

phores are composed of a septate, dark coloured, cylindrical stalk terminating in a single, obclavate phialide cell with an apical, funnel-shaped collarette from which hyaline, more or less cuneate phialospores are produced in a slimy head. It is not uncommon in species of *Chloridium* for the phialide to proliferate through the collarette to produce another phialide at the apex; this can occur a number of times so that a linear series of phialides is produced. Such series of phialides are found in the type collection of *G. clavaeformis;* apparently, PREUSS did not see the phialospores and considered the obclavate structures [phialides] to be the conidia as clearly indicated in his diagnosis: 'Caespitibus effusis atris; floccis basi dilatatis, atrofuscis opacis, septatis, apice attenuatis, simplicibus, fuscis, rigidis, fragillimis, in sporas clavaeformes diffractis. Habitat in lignis *Alni glutinosae.* Hoyerswerda.'

Gongromeriza PREUSS is a later synonym of *Chloridium* LINK and so far as I am aware *G. clavaeformis* PREUSS provides the earliest epithet applied to the phialidic state of *Chaetosphaeria myriocarpa* (FR.) BOOTH.

Tolypomyria PREUSS.

Type species, *T. prasina* PREUSS, Linnaea 25: 726. 1852.

The single collection assigned to this name is labelled '323 b. *Tolypomyria prasina* PREUSS, fig. 1889 [scr. PREUSS]' The specimen consists of a fragment of coniferous wood bearing a green stratum of conidiophores and conidia and is undoubtedly the type collection. The conidia are oval, 3.4 × 1.8 μ and the collection may be disposed as *Trichoderma viride* Auct.

Tolypomyria PREUSS (1852 b) is thus a later synonym of *Trichoderma* PERS.

In 1853 PREUSS described a second species in *Tolypomyria, T. alba;* there is nothing in the diagnosis that would exclude this from *Trichoderma sporulosum* (LINK) HUGHES, but its identity must await examination of the type.

Tolypomyria microspora (CORDA) SACC. (1866) is based upon *Colletotrichum microsporum* CORDA (1840); inspection of CORDA's illustrations indicates that this is neither a *Colletotrichum* nor a *Trichoderma.*

Tolypomyria fungicola KARST. (1888, p. 251) was considered a synonym of *Trichoderma sporulosum* by HUGHES (1958).

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THE BALLISTOSPORE

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SUMMARY

Ballistospores are violently discharged basidiospores and the similar aerial spores of mirror-image yeasts *(Sporobolomycetaceae)*. The structure of ballistospores is discussed paying particular attention to the junction between spore and sterigma. Spore discharge is considered with special reference to whether what is produced at the hilar appendix just before discharge is a droplet or a bubble. Possible mechanisms of discharge are reviewed including a detailed consideration of OLIVE's bubble-bursting theory.

1. INTRODUCTION

It gives me great pleasure to contribute to a volume in honour of Dr. N. F. BUCHWALD and in selecting to write about ballistospores I have deliberately chosen a subject which impinges on some of his work. His observations on ballistospore liberation in the perennial polypores shed new light on the phenomenal spore production and remarkable xerophytic capabilities of these fungi.

Interest in the problem of the discharge of ballistospores in fungi has been revived by the suggestion of OLIVE (1964) that essentially a bubble-bursting mechanism is involved.

Dr. M. A. DONK gave the name "ballistospore" (see DERX 1948) to a spore discharged after the manner of the basidiospore in *Hymenomycetes* and in *Tremellales* so fully illustrated by BULLER (Fig. 1).

To this category belong not only the basidiospores of *Hymenomycetes,* but also those of the *Uredinales,* the "secondary conidia" of *Tilletia,* and the aerial spores of the mirror-picture yeasts *(Sporobolomycetaceae).*

In *Gasteromycetes* the spores are not shot from their sterigmata. Thus not all basidiospores are ballistospores, and not all ballistospores are basidiospores.

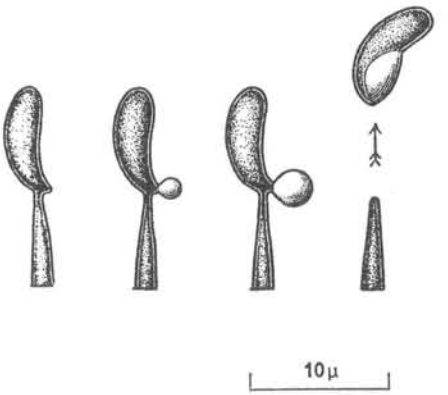

Fig. 1. *Calocera cornea.* Discharge of the basidiospore (ballistospore) from its sterigma. — After BULLER 1922.

2. STRUCTURE AROUND JUNCTION OF STERIGMA AND SPORE

Exact knowledge of the details of the basal part of the mature ballistospore and of its attachment to the sterigma is hard to obtain. The difficulty relates to the small size of the structures involved and to the fact that when basidia are mounted in water for microscopic examination any really mature spores invariably become detached. Ripe basidia can, of course, be viewed in air, but then only the external features are normally to be seen. One of the morphological problems is whether, immediately prior to discharge, there is a cross-wall separating spore and sterigma. In general it has proved impossible to decide this matter by light microscopy, although PRINCE (1943) in the rust *Gymnosporangium nidus-avis* considered that there was such a cross-wall and produced a fairly convincing photograph as evidence.

Recently WELLS (1965) has published an electronmicrograph of a section through a mature basidiospore and the apex of its sterigma in *Schizophyllum.* The ectoplast membranes of sterigma and spore are separate indicating that at this stage protoplasmic continuity between the two no longer exists. An electron-transparent region separates the two protoplasts (Fig. 2). It appears that the extremely thin outer layer of the sterigma wall is continuous with the outer spore-wall. It is desirable to follow WELLS' nomenclature and to distinguish the

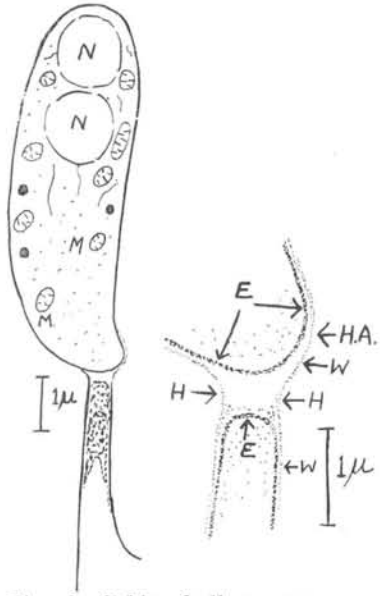

Fig. 2. *Schizophyllum commune.* Structure of junction of basidiospore and sterigma. — Left, at lower power: N, nuclei; M, mitochondria. — Right, part at higher magnification: E, ectoplast; H. A., hilar appendix; W, wall common to sterigma and base of spore; H, hilum. — Based on electronmicrograph by WELLS (1965).

actual region of attachment as the hilum and the characteristic projection near it as the hilar appendix, the structure which above all characterizes the liberated ballistospore. The hilum itself is not usually visible under the light microscope, but is readily seen with the electronmicroscope. It may be a mere scar as in *Schizophyllum* or a rather definite projection as in *Sporobolomyces* (INGOLD 1966).

3. SPORE DISCHARGE

We owe to BREFELD (1877) the first indication that spores of *Hymenomycetes* are actively discharged, but he thought that all four spores of a basidium were liberated together. In the first third of this century BULLER made extensive observations on a wide range of species and normally observed successive discharge, although as a rare occurrence two spores of a basidium might be shot away together. BULLER timed successive discharge from basidia in a number of species. For example in four basidia of *Stropharia semiglobata* the mean interval between the discharge of the first and the fourth spore was 302 seconds; for five basidia of *Coprinus sterquilinus* it was 67 seconds; and for the same number of basidia in *C. plicatilis* 11 seconds. It is clear that any adequate explanation of discharge must take account of this interval.

Again BULLER repeatedly observed, and this is confirmed by other workers especially MÜLLER (1954), that immediately following discharge the vacated sterigma retains its size and form apparently unaltered, and that no liquid remains behind on its tip. Only as a rare abnormality did BULLER see the slow exudation of a small droplet from a sterigma which had just shed its spore.

Initially BULLER favoured a rounding-off mechanism at a cross-

wall separating the sterigma from the spore, and this theory was later revived by PRINCE (1943). Such a mechanism is well-known in the discharge of the conidium in *Conidiobolus*. However, it would not explain the asymmetrical position of the ballistospore on its sterigma, nor would it bring the drop (or bubble), produced at the hilar appendix just before discharge, into the picture. BULLER later came to favour a water-squirting mechanism, comparable on a microscopic scale with sporangial discharge in *Pilobolus*.

However, if the mechanism is of this nature, the sterigma must be self-sealing immediately after discharge, if the turgidity of the basidium is to be retained for the discharge of the subsequent spores. Further, WELLS reproduces a longitudinal section through a sterigma, from which the spore has apparently been discharged, showing an unruptured ectoplast; a condition hardly to be expected if a jet of fluid had been squirted through it. MÜLLER (1954) contributed to knowledge of ballistospore discharge by filming the process in *Sporobolomyces*. In this yeast the "drop" produced at the hilar appendix grows to full size (3 μ diameter, nearly equal to that of the spore) in 2-3 seconds, before the spore is discharged. However, in one of the 14 examples filmed by MÜLLER, the "drop" (having grown to its normal size) disappeared, within the period of 1/64 seconds from one "frame" of the film to the next, leaving the spore behind on its sterigma. He interpreted this as d i s c h a r g e of the drop without discharge of the spore. On his view the "drop" is produced at the junction of spore and sterigma, and normally is shot (squirted) from the end of the sterigma carrying the spore with it. However, if what is produced is a gas bubble, its sudden disappearance could be the result of bursting. Part of MÜLLER's film can, nevertheless, be used as evidence for a drop being formed at the hilar appendix. In his paper (his Fig. 8) two successive "stills" are reproduced: the first showing the "drop" grown to its full size; the next the vacated sterigma and, 5-8 μ to the right of it, the discharged spore, just landed on the agar, looking as if it is surrounded by fluid. The effect might, however, be the result of the spore being slightly out of focus.

If a drop is formed at the hilar appendix there is no evidence about whether it is essentially water, or an aqueous solution of high osmotic potential as suggested by WELLS. CORNER (1948) considers that it is limited by a definite membrane, which may even survive in pickled material, and on the basis of his electronmicrographs WELLS also considers this likely.

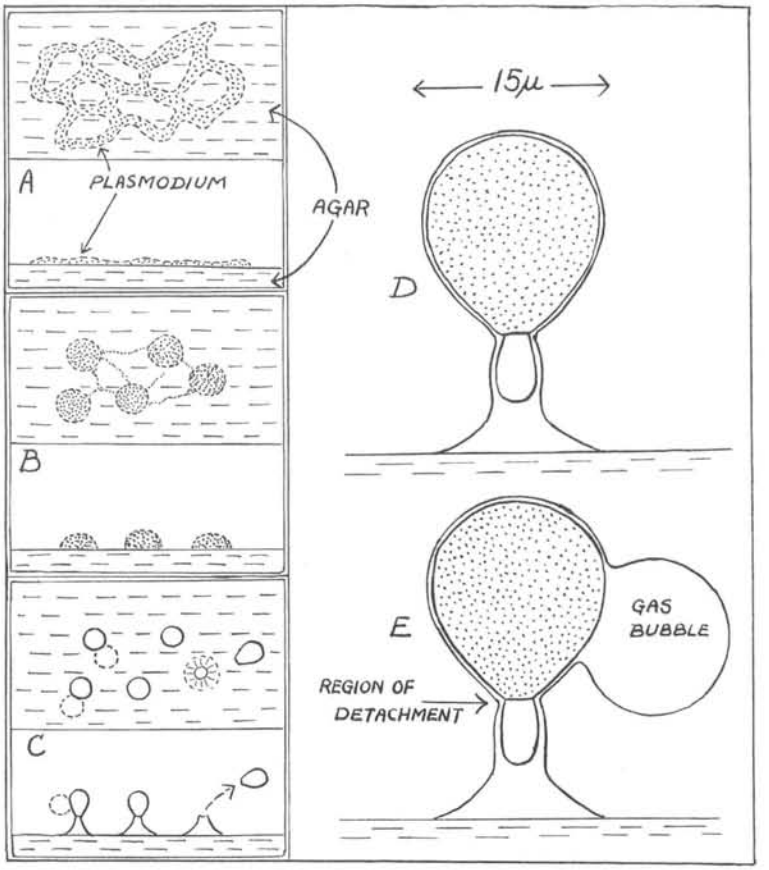

Fig. 3. *Schizoplasmodium cavostelioides*. A, B. C, three frames illustrating development. In each, above is a surface view and below a section of the culture. A, minute plasmodium of naked protoplasm on agar spread with bacteria; B, protoplasm has aggregated into hemispherical masses; C, spores have been produced each on a short stalk; some spores have formed bubbles (outlined by dashed lines); after discharge a crater-like stalk is left. D and E, longitudinal sections of stalked spore on agar. D, just before bubble formation; E, at bubble formation. — Diagram based on photographs and descriptions by OLIVE & STOIANOVITCH (1966).

4. BUBBLE-BURSTING THEORY

OLIVE & STOIANOVITCH (1966) have described a minute slime-mould in which the single aerial spore is apparently jerked off its stalk by the bursting of a gas-filled bubble or blister produced laterally between the outer and inner layers of the spore-wall. Fig. 3 gives a

diagrammatic illustration of this organism, *Schizoplasmodium cavostelioides*. The evidence that a gas-blister is produced at the side of the spore before discharge in this slime-mould seems unassailable. Observations on this organism led OLIVE (1964) to suggest that the mechanism of ballistospore discharge in the true fungi is essentially the same. He considered that in *Sporobolomyces* for example the black outlines of the aerial spore and of its sterigma when viewed (surrounder by air) under the microscope are due to a gas-phase between the inner and outer membranes in these structures. He suggested that a weakening of the outer layer in the region of the hilar appendix leads to this gas being blown out as a spherical blister, and that the ultimate bursting of this leads to the discharge of the spore. It is of interest to note that WEIMER (1917), in discussing basidiospore liberation in *Gymnosporangium* referred to the spore producing a b u b b l e at its base prior to discharge, but gave no evidence for regarding it as a bubble rather than a drop.

The evidence given by OLIVE (1964) for the presence of a gas phase associated with the fungal ballistospore (e. g. in *Sporobolomyces*) is not completely convincing, resting as it does on the black-edged appearance of the spore, the upper part of the sterigma and of the "bubble" as viewed in "dry" mounts under the high-power, because almost any hyaline conidium attached to its conidiophore has that appearance if viewed directly surrounded by air. The microscopic appearance of the bubble produced at the hilar appendix does not differ significantly from that of undoubted droplets, for example those formed on the surface of the sporangiophore of *Pilobolus*. Indeed, it is rather unlikely that a minute droplet surrounded by air would be destinguishable from a corresponding bubble on the basis of microscopic examination. Nevertheless, the analogy with *Schizoplasmodium* is so suggestive that there is a strong probability in favour of OLIVE's theory, and it must be remembered that in that slime mould OLIVE & STOIANOVITCH clearly demonstrated, in water mounts, the presence of gas between the two layers of wall in the sporulating structure.

It has been argued (INGOLD & DANN 1968) that under conditions of high external pressure (over 50 atmospheres) a water-squirting mechanism, or one involving the rounding-off of turgid cells, would be able to function, whilst one involving the blowing of a gas-bubble could not operate. It was found experimentally that under these conditions ascospore discharge in *Sordaria* and conidium take-off in

Conidiobolus continued, whilst the liberation of ballistospores was stopped (Fig. 4). In evaluating the evidence from these experiments with high pressures, it should be remembered that the actual distance of discharge must be considerably reduced as a result of the increased density of the air. Ballistospores are normally shot to such a short distance (0.1-0.5 mm) that a considerable reduction of this might result in a number failing to be shot far enough for their subsequent escape from the fruit-body. Nevertheless, the immediate, dramatic effect of high pressure on the rate of liberation of ballistospores from sporophores is strong evidence in support of OLIVE's theory.

If what is produced at the hilar appendix is a bubble limited by an aqueous film, no sign of this would be left after bursting, but if it is a gas-blister between outer and inner layers of the wall, or between the ectoplast and the wall, a ruptured membrane might be expected in the region of the hilar appendix of the discharged spore. In electronmicrographs of whole ballistospores of *Sporobolomyces* no such membrane was detectable (INGOLD 1966).

In considering the question of bubble v e r s u s drop, it must be recognized that BULLER did not merely assume that a drop was carried away with the spore. He attempted to demonstrate its presence on the spore immediately following liberation and before the drop had time to dry up. His evidence is quite impressive. His principal method was to examine the ripe gill of an agaric covered lightly with a thin coverslip, leaving here and there an air gap of a fraction of a millimetre between the hymenium and the under surface of the glass. By locating under high-power a basidiospore from which "drop" exudation was just starting, and immediately focusing upwards on the lower surface of the coverslip, he was able to see the spore on its impact with the glass a few seconds later. He noted that it was always associated with a little liquid corresponding, apparently, to the exuded drop. Further, BULLER reports for a number of species the occasional failure of discharge due to the exuded "droplets" from the four spores of a basidium running together into a single drop. If bubbles were involved, and especially if they were really blisters, it might be expected that they would retain their identities and not become confluent.

It is of interest that the bubble theory envisages what is essentially a surface-tension mechanism. Such a possibility was originally suggested by BULLER and developed by INGOLD (1939) who calculated that, on the assumption that a w a t e r droplet was formed at the

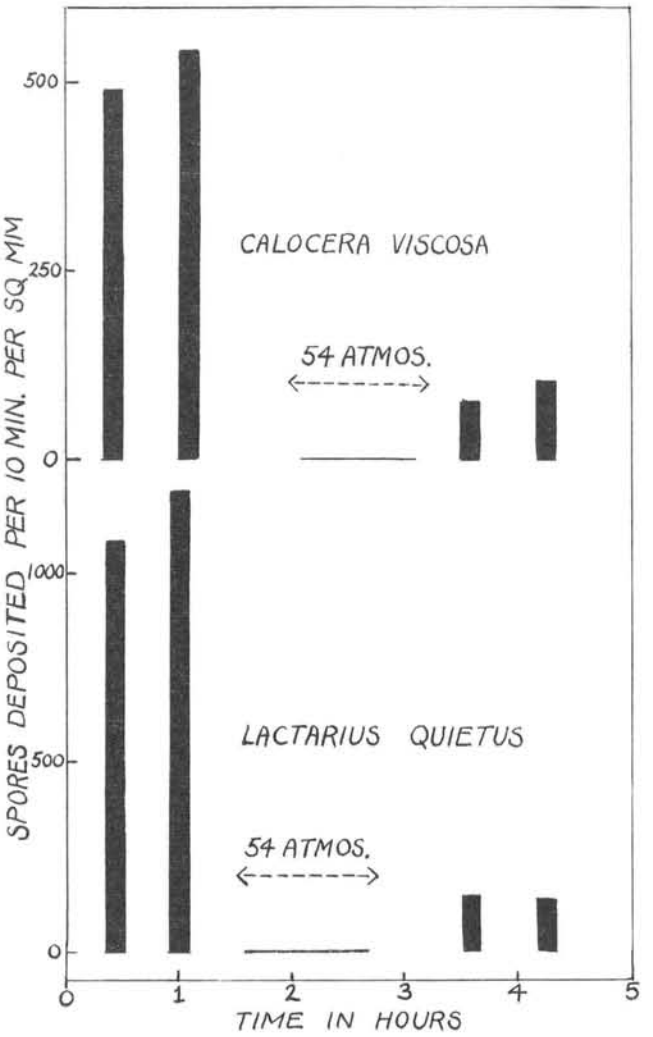

Fig. 4. *Calocera* and *Lactarius*. Ballistospore discharge in relation to pressure. Rate of spore liberation (as number of spores caught in unit time on unit area below a discharging fruit-body). Rate, sampled over period indicated by histogram column at atmospheric pressure, under high pressure and again at atmospheric pressure. By using a magnetic device, sampling under high pressure limited to period when the high pressure was actually operating. — See INGOLD & DANN 1968.

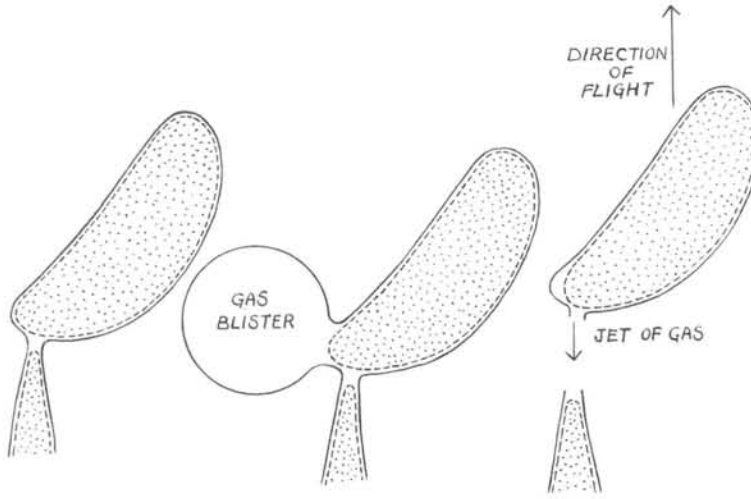

Fig. 5. *Sporobolomyces.* Diagram of possible behaviour of gas-blister during discharge based largely at the ideas of R. MOORE (1966).

hilar appendix, sufficient surface energy was available to effect discharge. In a bubble of corresponding size twice this energy is provided.

Little is known about the trajectory of discharged ballistospores. BULLER's figures (e. g. in *Panaeolus*) suggest that the direction of discharge is parallel with the longitudinal axis of the basidium. If this is so, it is difficult to envisage how a bursting bubble placed laterally near the base of the spore could impart a consistent movement in this direction. Some preliminary observations in my own laboraty suggest that the trajectory of discharge is, on the average, at an outward angle to the axis of the basidium (INGOLD 1966). The problem of the trajectory worried SAVILE (1965) and led him to suggest a "unified theory". He accepted bubble-bursting as causing the separation of the spore from its sterigma, but thought it must be combined with a "repulsive" force (possibly electrostatic) acting through the sterigma and propelling the spore along an appropriate course. The almost simultaneous action of two violent mechanisms co-operating to secure discharge in the right direction, seems highly improbable. Recently MOORE (1966) has suggested a way in which the gas pressure in the bubble might be utilized to launch the spore outwards. If at the moment of break at the hilum, the blister simply collapses driving a jet of gas through the hilum, not only would there

be no ruptured membrane at the hilar appendix, but also a suitable trajectory would be imparted to the spore impelling it in an outward direction away from the sterigma (Fig. 5). But it must be pointed out that the suggestion that bursting explains the sudden disappearance of the bubble from the hilar appendix, in an unusual instance filmed by MÜLLER and referred to above, would be hard to reconcile with the picture of blister collapse illustrated in Fig. 5.

Another problem in OLIVE's theory is the nature of the gas filling the blister. He has suggested that it may be carbon dioxide. However, in preliminary experiments I have been unable to observe any decrease in the rate of spore liberation from *Schizophyllum* in the close presence of a CO_2-absorbing surface. Whatever the nature of the gas it is difficult to see how it manages to accumulate between the two layers of the ballistospore wall.

The problem of the precise mechanism of ballistospore discharge, which has intrigued mycologists for so many years, is not yet solved, but it should be possible in the near future either to confirm or refute OLIVE's general theory and to clarify the whole position.

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GLOEOSPORIUM ROT ON STORAGE APPLES IN FINLAND

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SUMMARY

In tests in which the fungi causing *Gloeosporium* rot had not been determined, as well as in tests in which the fruit had been inoculated before storage with *Gloeosporium album* and *G. fructigenum,* the winter varieties Linda, Lobo and Åkerö proved least susceptible to *Gloeosporium* rot among the varieties at present cultivated in Finland. Also the varieties Antonovka, Atlas, Signe Tillisch and Wealthy kept satisfactorily until early December. The highest degree of susceptibility was shown by the summer varieties Bergius, Lavia and Snygg and the autumn varieties Melba and Punakaneli.

G. fructigenum was considerably more pathogenic than *G. album* (syn. *Phlyctaena vagabunda*).

In tests made in the rainy summer of 1962 with the Melba and Lobo varieties which had been inoculated with *G. fructigenum,* the fruit that had been picked September 30, and had been kept in room temperature, Melba 10 days and Lobo 20 days, after which it was stored in a temperature of + 4-6° C, showed the greatest resistance to storage rot. The largest percentage of decayed fruit was found in the unripe apples picked September 9, and stored forthwith in a temperature of + 4-6° C. A greater degree of resistance to storage rot was found in apples picked September 9 and kept 12-15 days in a temperature of + 8-10° C before being placed in storage.

The most significant species of *Gloeosporium* MONT. et DESM. — imperfect stage fungi causing decay in stored apple — are *Gloeospo-*

rium album OSTERW. (syn. *Phlyctaena vagabunda* DESM.), *G. fructigenum* BERK. and *G. perennans* ZELLER et CHILDS. *G. album* causes rotting of fruit during storage and is found as a saprophyte or wound parasite on the leaves and stems of different phanerogams. *G. fructigenum* occurs mostly as a wound parasite which also causes decay in fruit. *G. perennans* may cause damage also in the branches of apple trees. The infection of the fruit of *G. perennans* takes place in the summer and is to start with latent, the rot spots appearing only during storage (cf. VON ARX 1958, OLSSON 1965, WEBER 1965).

In the years 1952-1955 storage trials on the significance of storage diseases in apple varieties cultivated in Finland were made at the Department of Plant Pathology. In 1962-1965 storage trials of apples were arranged in which the fruit was inoculated with pure cultures of the fungi and the relation of the stage of ripeness to the occurrence of the rot was examined.

An investigation carried out at the Department of Plant Pathology on the species of *Gloeosporium* fungi occurring in apples stored in Finland (TALVIA 1960) revealed that *G. album* and *G. perennans* were the chief causes of storage rot. The material for these tests, which took place in the course of 1954-1958, came from 17 different localities and comprised twenty apple varieties. The average percentage of fruit infected by *G. perennans* was over 70 %, while the average figure for *G. album* was 30-50 %. Infection by *G. fructigenum* was in this material minimal, amounting to only a few per cents or nil.

1. VARIETY TESTS

The results of the apple variety tests made in the storage seasons in 1952/53, 1953/54 and 1954/55 have been published (JAMALAINEN 1953, 1956). The tests revealed that the decay was chiefly caused by *Gloeosporium* fungi, the species of fungi were not determined, however. Compared to storage rot, the significance of diseases caused by other fungi as well as that of physiogenic storage diseases was relatively small. The apples were stored in several different places and the test apples came from different orchards. The average temperature in the storage places was + 3-8° C. The analyses were carried out in December, January, March and April.

The least susceptible varieties were the winter varieties Linda, Lobo and Åkerö which remained relatively free from storage rot to

the end of February and some times even longer. Regarding the Åkerö apple, which is one of Finland's most valuable apple varieties, it was found that in the lots coming from different localities some lots were damaged by Crown heart of fruit caused by *Fusarium avenaceum* (Fr.) Sacc. If the apples are stored until end of November, which in Finnish conditions is regarded as a sufficiently long period for fruit due to be marketed, since the domestic apple crop is by then exhausted, there are also other varieties which have proved to be adequate for storage purposes. Among these should be mentioned the varieties Antonovka, Atlas, Sariola, Signe Tillisch (suitable for cultivation only in the southwestern parts of Finland and in the Åland Islands) and Wealthy.

2. INOCULATION TESTS WITH *GLOEOSPORIUM ALBUM* AND *G. FRUCTIGENUM*

In the storing season 1962/63 nine varieties were included in the tests, in 1963/64 the tests included twenty varieties. Results on the

TABLE 1.

Storage test of apple varieties 1962/63

Inoculation: G. a. = *Gloeosporium album;* G. f. = *G. fructigenum;* C. = Control; H = number of healthy apples; D % = degree of decay see p. 80.

Variety		Results in different analyses							
		14/12		14/1		13/2		18/3	
		H	D %	H	D %	H	D %	H	D %
Atlas	G. a.	25	0	0	17	0	23	0	48
	G. f.	25	0	0	20	0	26	0	63
	C.	25	0	23	10	15	10	10	15
Linda	G. a.	25	0	7	11	4	11	4	19
	G. f.	16	20	0	18	0	36	0	82
	C.	25	0	25	0	21	94	16	49
Lobo	G. a.	25	0	2	11	0	11	1	21
	G. f.	25	0	0	43	0	14	0	40
	C.	25	0	24	100	23	100	22	70
Melba	G. a.	0	7	0	27	0	79	0	100
	G. f.	0	15	0	43	0	84	0	100
	C.	25	0	18	14	2	27	0	86
Åkerö	G. a.	25	0	8	15	2	20	0	42
	G. f.	25	0	23	35	23	88	15	40
	C.	25	0	25	0	22	10	22	23

varieties at present cultivated in Finland are given in Tables 1 and 2. The cultures of the fungi had been obtained from the "Centralbureau voor Schimmelcultures" Institute in the Netherlands. The fruit was inoculated prior to being placed in storage with *G. album* and *G. perennans* fungi placed into three wounds in each apple. The apples were stored in October 1962 in the cellar of the Department of Plant Pathology, where the temperature in October-November was + 5-6° C, and subsequently + 4-5° C. In 1963 the varieties were stored at somewhat different dates (Table 2). The temperature of the cellar was in September + 10-11° C, in October + 7-9° C, in November about + 6° C, and subsequently + 2-4° C.

The degree of decay presented in the Tables (D %) was obtained by estimating at each inspection the percentage of surface decay in each apple and by calculating the mean of the decayed surface in the test apples compared to the total surface area of the test apples.

In the fruit of the controls storage rot was likewise found, with extended storage time the rot increased. In these cases, where infection of the fruit must have taken place already during the growing period, the species of the fungi were not determined. The tests show that *G. fructigenum* was more pathogenic than *G. album,* in several cases the degree of pathogenicity was in fact very much greater. In the 1962/63 tests, the winter varieties Linda, Lobo and Åkerö showed the highest degree of resistance to both fungi, the variety Melba proved the least resistant of the varieties. In the test made in 1963/64 the varieties with the greatest resistance to both fungi were Antonovka, Linda, Lobo, Wealthy and Åkerö. The susceptible varieties were the summer varieties Bergius, Lavia and Snygg and the autumn varieties Melba and Punakaneli (Red Cinnamon).

In these tests the incidence of storage rot in the different varieties was comparable to that in the earlier tests in which the fruit had not been inoculated.

3. STORAGE TESTS OF APPLES IN VARYING STAGES OF RIPENESS

The latter part of the summer, from September onwards, is in Finland often rainy and cool and the fruit has to be picked unripe. The summer of 1962 was cold and the apples did not ripen on the trees. A test was arranged for the storage period 1962/63 with the

TABLE 2.

Variety test of apple varieties 1963/64

Inoculation: G. a. = *Gloeosporium album;* G. f. = *G. fructigenum;* C. = Control; H. = number of healthy apples; D % = degree of decay, see p. 80.

Variety		Results in different analyses															
		9/10		7/11		9/12		9/1		10/2		10/3		9/4		8/5	
		H	D %	H	D %	H	D %	H	D %	H	D %	H	D %	H	D %	H	D %
Antonovka	G. a.	25	0	21	0.2	19	0.2	11	0.9	3	4.5	2	14.5	1	29.5	0	53
26.9.	G. f.	24	0.04	0	3	0	6	0	13	0	20	0	31	0	53.5	0	80.5
	C.	25	0	25	0	23	0.1	21	0.3	18	2	15	5	10	12.5	3	30
Atlas	G. a.	25	0	19	5	12	7	4	7.5	2	18.5	1	40.5	0	69	0	87.5
19.9.	G. f.	0	3.5	0	6	0	2	0	34	0	54	0	76	0	94	0	100
	C.	25	0	25	0	25	0	19	0.2	11	3	2	29.5	1	49	0	84
Bergius	G. a.	19	1.5	7	7.5	1	42.0	0	62.5	0	92.5	0	100				
11.9.	G. f.	0	7	0	26.5	0	78	0	95.5	0	100	0	100				
	C.	20	0	20	0	20	0	13	10.5	7	16	1	32.5				
Lavia	G. a.	3	11	1	21	0	100	0	100								
10.9.	G. f.	1	15	0	18	0	94.5	0	100								
	C.	1	0.04	0	2	0	69.5	—	—								
Linda	G. a.	25	0	25	0	25	0	24	0.2	22	2	14	5	3	8.5	0	68
23.9.	G. f.	22	0.1	8	2	3	9	3	15	0	21	0	31	0	43	0	68
	C.	25	0	25	0	24	4	24	4	24	4	24	4	21	7	18	16
Lobo	G. a.	25	0	22	0.1	16	0.4	15	0.4	13	1	9	2.5	5	4.5	0	12
2.10.	G. f.	25	0	5	0.8	2	2	2	5	2	11	0	22	0	40	0	54.5
	C.	25	0	25	0	25	0	24	0.04	24	0.5	24	1	21	7	18	17.5
Melba	G. a.	13	3	7	17	2	34.5	1	46.5	0	59	0	73	0	89	0	93
11.9.	G. f.	0	0.8	0	22	0	50	0	68.5	0	86.5	0	98.5	0	100	0	100
	C.	25	0	25	0	21	6	20	7.5	10	11.5	6	21.5	4	41	0	72
Punakaneli	G. a.	10	3.5	6	17	3	38.5	1	42	1	56	0	68	0	92	0	96.5
10.9.	G. f.	1	6	0	25.5	0	50.5	0	74.5	0	95	0	100	0	100	0	100
	C.	25	0	25	0	25	0	21	0.3	17	4.5	15	14.5	5	45	1	82
Sariola	G. a.	25	0	21	0.1	8	2.5	6	9.5	1	26	0	47.5	0	75	0	96.5
28.9.	G. f.	23	0.8	0	9	0	16	0	46.5	0	79.5	0	90	0	100	0	100
	C.	25	0	24	0.04	23	0.2	23	0.8	21	1.5	14	4.5	8	24	0	59
Snygg	G. a.	7	4	1	18	0	66.5	0	86.5	0	100						
11.9.	G. f.	1	10.5	0	27	0	69.5	0	95	0	100						
	C.	22	0.4	16	6.5	6	19	4	51.5	0	100						
Åkerö	G. a.	14	0.4	0	1	0	1	0	2	0	5	0	6.5	0	21.5	0	37.5
28.9.	G. f.	14	0.4	1	3	1	6	1	13.5	0	25	0	41	0	59	0	69
	C.	25	0	25	0	25	0	21	0.2	19	1	13	4	10	18.5	4	41

varieties Melba and Lobo, and the apples were inoculated before storage as already described with *Gloeosporium fructigenum*. At each inspection 25 apples were analysed. The storage place was a cellar with a temperature of + 5-6° C in October-November, and subsequently + 4-6° C. The test groups were as follows:

1. Picked and stored 11.9.1962.
2. Picked 11.9.1962, 12-15 days in a temperature of + 8-10° C prior to being stored.
3. Picked 30.9.1962, Melba 10 days and Lobo 20 days, in a temperature of + 19-21° C prior to being stored.

TABLE 3.

Storage test of apples in different stages of ripeness 1962/63

Inoculation prior to storage with *Gloeosporium fructigenum*. Tested varieties Melba and Lobo; 25 apples in each test group. Degree of decay %, see p. 80.

	No. of decayed fruit %	Degree of decay %	No. of decayed fruit %	Degree of decay %
Melba	Analysis 10.12.1962		Analysis 11.1.1963	
1. Picked and stored 11.9.1962	100	46	100	92
2. Picked 11.9.1962, prior to storage 12-15 days in + 8-10° C	100	39	100	84
3. Picked 30.9.1962, prior to storage 10 days in + 19-21° C	100	28	100	74
Lobo	Analysis 10.12.1962		Analysis 11.1.1963	
1. Picked and stored 11.9.1962	20	12	100	72
2. Picked 11.9.1962, prior to storage 12-15 days in + 8-10° C	0	0	28	13
3. Picked 30.9.1962, prior to storage 20 days in + 19-21° C	0	0	0	0
	Analysis 13.2.1963		Analysis 18.3.1963	
1. As above	100	62	100	100
2. —	36	25	48	47
3. —	28	26	40	27

The results are shown in Table 3, in which the degree of decay (D %) was estimated as described in p. 80. — Group 3, where the fruit had been kept at room temperature prior to being stored, showed the least amount of rot. In analyses made January 11, there were no infected fruit among the Lobo apples, decay became evident only in February. In analyses made early in December, the Melba variety in the group 3 showed a smaller degree of decay than in the groups 1 and 2. — The fruit picked early, September 11 (group 1), when it was still unripe, showed the highest amount of decay. In the December analysis all the Melba apples were infected the degree of infection being almost 50 %. All the fruit of the Lobo variety were found decayed in the analysis made on January 11, the degree of decay being 72 %. — Fruit that had been picked September 11 and had been kept in a cool place (+ 8-12° C) before being stored (group 2), had kept better than fruit in the group 1. In the Lobo variety signs of decay were found in the analysis made January 11, the decay increased gradually as the storage period grew longer.

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Dickursby, Finland, August 1968.

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RHIZOCTONIA CAROTAE RADER

A NEW AND IMPORTANT PATHOGEN TO CARROTS IN DENMARK

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SUMMARY

In the winter 1966/67 the cause of a rather serious disease of carrots in Danish cold storages was identified as *Rhizoctonia carotae* RADER by the present author. A preliminary description of the disease and some recommendations for its control were given in 1967 (A. JENSEN). In the storage season 1967/68 still more evidence was found showing that infected wooden crates were the most important source of inoculum.

Hot air treatment has not proved efficient enough as an eradicant in all cases in practise, but lining of the infected crates with polyethylene bags seems to be very promising.

Photographs illustrate the peculiar disintegration (crystallization) of the hyphae in the diseased parts (the craters) of the carrots. The cause of this is not yet determined.

Growth experiments with *Rhizoctonia carotae* and *Rh. solani* show large differences (Fig. 6) and this together with the disease symptoms, the colour of the mycelium, the abundance of clamp connections and dikaryotic cells in *Rh. carotae* are reasons for considering it as separate species.

In 1934 RAMSEY reported a disease which occurred in a cold storage in New York state, U.S.A., and which must be the same as the one discussed here. Because of rather severe attacks in the 1940's in the

Fig. 1. *Rhizoctonia carotae* RADER. Typical mycelium in "the crater" of a carrot.

same state, RADER investigated the disease and isolated a fungus which he named *Rhizoctonia carotae* n. sp.; he named the disease *Rhizoctonia* crater rot.

Since 1952 (RADER) there seems to have been very little published about *Rh. carotae* and the typical disease symptoms. MUKULA (1957) did not find *Rh. carotae* in his comprehensive investigations of storage diseases of carrots in Finland and besides the above mentioned occurrence in U.S.A., the disease only seems to have been observed in Denmark (A. JENSEN 1967) and Norway (ÅRSVOLL 1968).

1. THE DISEASE

S y m p t o m s. Attacks by *Rh. carotae* on the carrots are first seen as small, whitish hyphal knots, very often first in lesions from rough handling of the roots. Small pits appear under these hyphal knots, the pits enlarge into sunken craters lined with a white flocculent mycelium (Fig. 1). Normally the symptoms are first seen after approximately one month's storage; symptoms on newly harvested carrots have never been seen.

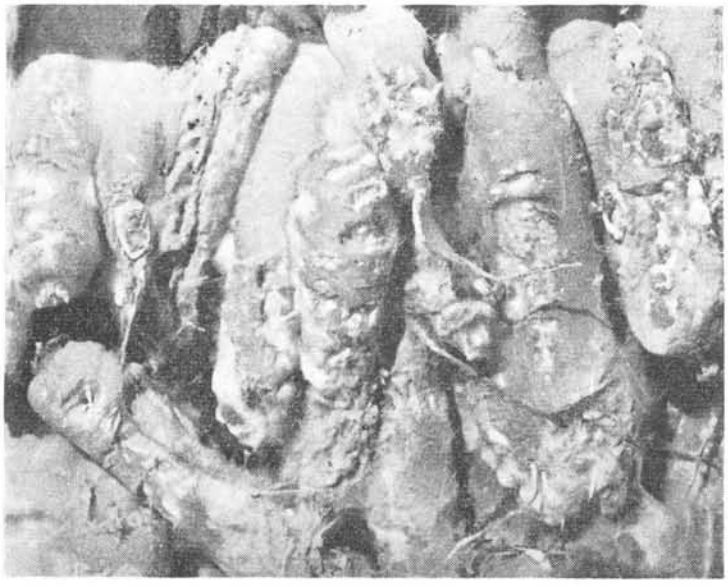

Fig. 2. *Rhizoctonia carotae*. Advanced stage of decay of carrots caused by the fungus.

Under favourable conditions in cold storages with high humidity, the mycelium spreads rapidly from the first attacked roots until all roots in the normally used 25 kg wooden crates are attacked; the symptoms in the advanced stage are as shown in Fig. 2. The attacked tissues are at first rather firm, but later on the carrots collaps in a wet rot, probably also due to other microorganisms entering the diseased roots.

As seen from Fig. 2 the typical yellow-brown mycelium spreads between the carrots and further on to the wooden slats of the crate on which the hyphae spread rapidly to other crates and very often form large web-like mycelial mats. In the more whitish mycelium on the diseased carrots yellow droplets are often seen. Sclerotia are rarely found in nature but if infected carrots are kept for a longer period under more dry conditions small sclerotia can be developed in the craters.

The disease symptoms can be distinguished from attacks by *Sclerotinia sclerotiorum* and *Botrytis cinerea* because of the craters, the more weft-like mycelium and the absence of sclerotia. Clamp connections are usually found in the hyphae and are easily seen by microscopy.

After washing and packing the carrots in perforated plasticbags, there is no further development of the disease.

Etiology. Like RADER (1952), I must admit that rather little is known about the origin of infection in new locations. It must be considered that the fungus lives in the soil and on a few occasions there can be no doubt that the carrots have carried the disease into the storage. In practice this primary infection from the soil seems to be of minor importance in the district (Lammefjorden, Zealand) where my investigations have been carried out. Here it is evident that infected wooden crates are the most important source. From one crate with carrots attacked by *Rh. carotae,* the fungus can easily spread to all the neighbouring crates, and in that way "epidemics" have taken place during recent years in the cold storages in Lammefjorden. RADER (1952) also mentions and demonstrates the survival of *Rh. carotae* in the storage containers but pays rather little attention to it.

Infection from the soil has been recognized clearly on one occasion where the carrots were stored in a clamp and had not been in touch with infected crates. On the other hand attack is very seldom found on carrots stored in clamps; this, perhaps, may be explained by the fact that the establishment of the disease is closely related to the storage conditions at low temperatures and high humidity. Evidence for this hypothesis is seen in practice and I have found, in an experiment, that more carrots were infected at 1° C than at 5° C; ÅRSVOLL (1968) has the same experience.

Control. Experiments carried out in 1967 and 1968 in cooperation with the Government Experiment Station, Roskilde, and the Carrot Growers Organization have clearly shown the importance of eliminating the risk of infection from the crates.

Steaming for 1-2 days has been successful in killing the fungus in the infected crates. Treatment with 3 per cent coppersulphate has also been effective. Hot-air treatment at 45-50° C for 2 or more days has been tried in practice, but has not been efficient enough to kill the fungus in all cases. Use of polyethylene (0,03 mm) to line the crates has proved to be very effective in protecting the carrots from being infected by *Rh. carotae.*

The best way of controlling the disease is still being investigated from different aspects.

Economic importance: The disease was first seen at the beginning of the 1960's in a few cold storages. During the past

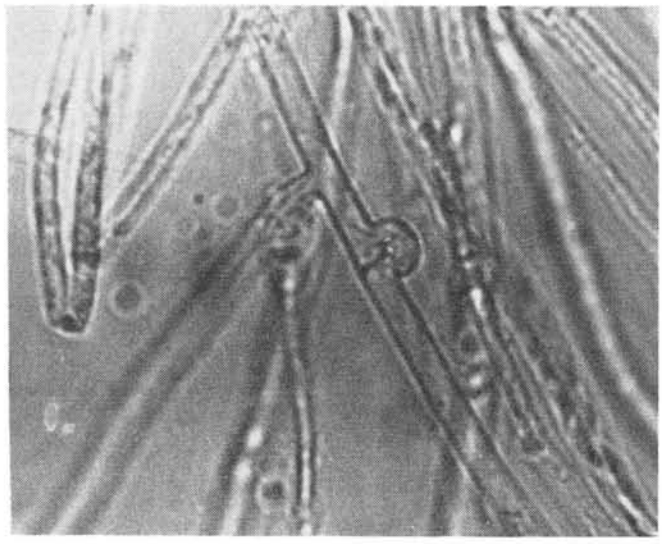

Fig. 3. *Rhizoctonia carotae*. Clamp connections in hyphae isolated from carrots. — × 1000.

years it has become still more widespread and losses have been estimated at many hundred thousand Danish kroner. In some storages more than 50 per cent of the carrots have been destroyed after 2-3 months' storage. Crater rot must now be considered as one of the most important diseases in Danish carrot cold storage.

2. THE FUNGUS

RADER (1948) gives the following description of the fungus: Hyphae hyaline to slightly brownish, 2.5 to 5.0 (mean 4.1) μ in diameter, richly branched, septated, and the septa provided with 1 to 5 clamps. Mycelium white in mass on the surface of the suscept tissue or in culture. Sclerotia golden-yellow to brownish when old, irregular, 2.5 mm in diameter, formed loosely in the hyphae; cells of the sclerotia barrelshaped when old, hyphaelike in juvenile forms, walls brownish to yellow, 4.1-7.1 (5.1) × 4.6-9.1 (6.2) μ, and germinating by a proliferation of one side of the cell.

My investigations support RADER's findings concerning the above description and also that *Rh. carotae* differs from *Rh. solani* in the pure white mycelium in the craters and in young cultures. The pre-

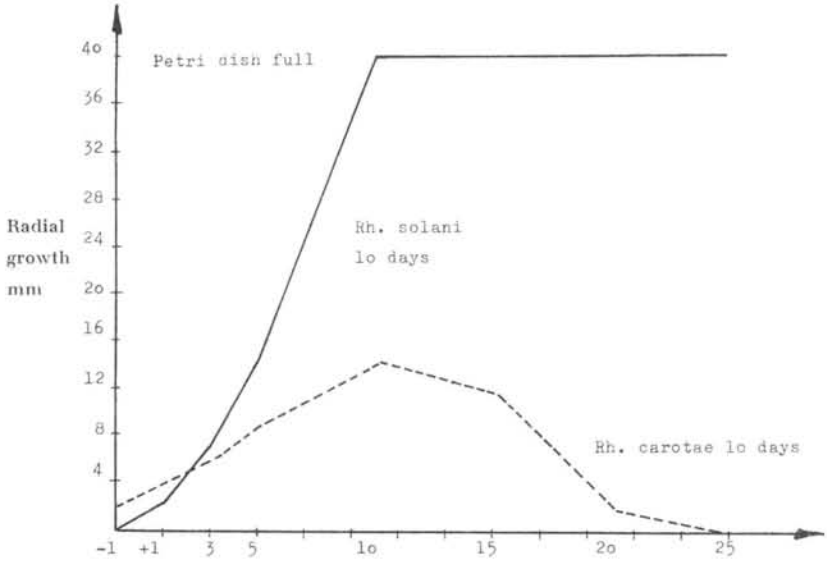

Fig. 4. *Rhizoctonia carotae* and *Rh. solani*. Growth on 3 artificial media. Average of the growth on PDA, carrot agar and malt agar.

sence of numerous clamp connections also gives a difference between the two species (Fig. 3).

Another significant difference between *Rh. carotae* and *Rh. solani* can be found in the growth of the fungi at different temperatures. RADER finds that *Rh. carotae* grows on agar over a temperature range from ÷ 4 to 24° C with the optimum being at 21° C.

In fig. 4 are given the results of an experiment carried out with isolates of *Rh. carotae* from carrots and *Rh. solani* from potatoes. Both fungi were grown on 3 different media: normal PDA, 3 per cent carrot agar and 2 per cent malt agar. There were only small differences in the growth of *Rh. carotae* on these media but *Rh. solani* had a markedly slower growth on malt agar.

As seen from the figure, there is a great difference between the growth of the two species and besides that optimum for growth of *Rh. carotae* is much lower than RADER's findings. ÅRSVOLL (1968) has found exactly the same growth curve for *Rh. carotae* as the author. According to SCHULTZ (1936) who compared several isolates of *Rhizoctonia,* there can be some differences in the ability to grow at low temperatures, but he finds that all isolates have a much higher optimum and maximum temperature than I found for *Rh. carotae.*

The occurrence of a perfect stage is mentioned by RAMSEY (1934), but the description is very incomplete. In spite of careful investigations carried out at a later date, especially by RADER, a perfect stage has not been found. A. FROM NIELSEN at the Government Experiment Station, Studsgård, Jutland, who is working on the taxonomic and karyotic aspects of the genus *Rhizoctonia,* writes in a letter to me that my isolate of *Rh. carotae* differs from *Rh. solani* (or the new proposed name for it: *Thanatephorus cucumeris* (FRANK) DONK) in having only two nuclei instead of being multinucleate (PARMETER et al. 1967).

If somebody succeeds in finding a perfect stage of *Rh. carotae,* the taxonomic questions can be clarified, but until then there seems to be reason enough for considering this fungus as a separate species.

3. NOTES ON THE BEHAVIOUR OF *RH. CAROTAE*

My investigations on this fungus started in the winter 1966/67 and at first I did not succeed in isolating it from the typical craters in the diseased carrots. Other research workers who received samples of diseased carrots sent to them by the Carrot Growers Organization had the same experience. One of the reasons for the difficulties in isolating the fungus must be high sensibility to surfacedisinfectants and evidently very reduced vitality of the fungus just in the infection sites. Microscopy of the mycelium in newly formed craters shows a pure white mycelium with a structure as seen from Fig. 1. It is almost impossible to take intact hyphae from the craters, as normally they fall into irregular pieces or crystals, when they are put into water on a slide. Hyphae which still retain their original form show the typical clamp connections but are more or less about to disintegrate (crystallize) as shown in Fig. 5. In culture on artificial media, these abnormalities have not been found. ARSVOLL (1968) thinks that too low humidity is the cause of the crystallization. On the borders of the craters hyphae are more intact, and here the isolation may be successful after repeated rinsing in sterile water followed by a dip in a tetracycline solution in order to prevent bacterial growth and then incubation at about 10° C. To keep a high humidity, which seems to be essential for the fungus, the petri dishes are kept in plastic bags. Inoculation of carrots with the isolate of the fungus gives typical crater rot symptoms under cold storage conditions.

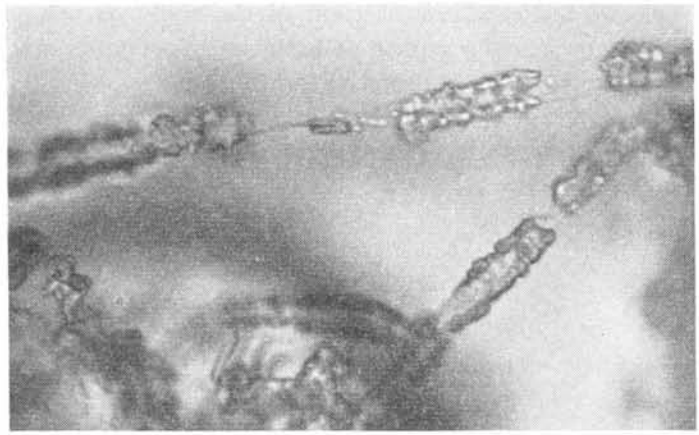

Fig. 5. *Rhizoctonia carotae*. Mycelium from the craters of diseased carrots, showing the crystallization in the hyphae. — × 1000.

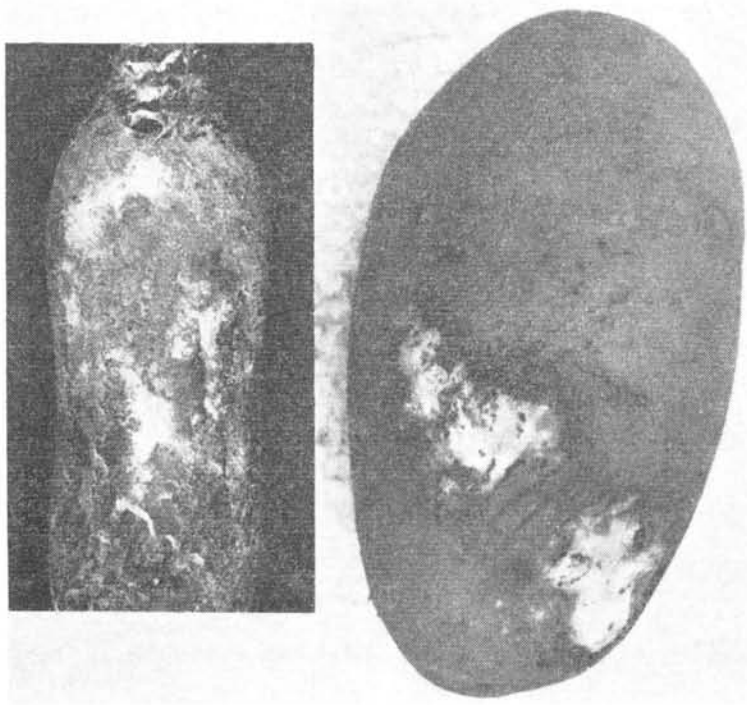

Fig. 6. *Rhizoctonia carotae*. Red beet and potato attacked by the fungus. B. WELLING phot.

In culture, the light brown colour of the mycelium can be seen after about one month's growth at optimum temperature and after about two months, sclerotia begin to form.

From an 8 months old culture new growth has been obtained by transferring the sclerotia to fresh agar plates. The sclerotia germinated with pure white mycelium.

4. HOST RANGE

RADER (1948, 1952) has not been able to infect other plants than carrots with *Rh. carotae*. In late winter 1967, I found typical disease symptoms on red beets (Fig. 6) stored in old carrot crates in a refrigerated storage. In 1968 I found *Rh. carotae* on potatoes under the same conditions. In both cases the source of inoculum was the infected crates. These findings give the impression that the host range is more wide than previously supposed. Further experiments on this subject are planned.

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København, November 1968.

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PUCCINIA PELARGONII-ZONALIS DOIDGE IN DENMARK AND ITS SPREAD THROUGH EUROPE

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At the end of November 1968 the Danish State Plant Pathological Institute at Lyngby (near Copenhagen) received some plants of *Pelargonium hortorum* (syn. *P. zonale*) which were severely infected with pelargonium rust (*Puccinia pelargonii-zonalis* DOIDGE). The plants had been grown in a glasshouse in a nursery near Århus (Jutland), where a big number of plants were infected. This seems to be the first record of *Puccinia pelargonii-zonalis* from Denmark.

The first symptoms of the disease consist in small circular, light yellow spots of a few mm in diameter, the centre of which soon becomes necrotic. After some days a greyish lesion appears surrounded by a light green halo. If the leaves are already withering and turning yellow, the edge of the lesion will appear as a green circle. On the underside of the leaves typical uredosori are soon produced in the centre of the spots. In spots of some age the uredosori very often appear in circular arrangements.

A heavy attack will, of course, influence considerably on the assimilation of the leaves and be able to cause dropping of the leaves and possibly complete withering of the plants.

The uredosori are generally hypophyllous, circular, surrounded by the ruptured epidermis, pulverulent and chestnut-brown. The uredospores are globoid or ellipsoid, slightly echinulate, with two equatorial pores. We have found 25,5 × 21,5 μ as average measure for the uredospores.

It seems as if *Puccinia pelargonii-zonalis* is able to overwinter by mycelium and by uredospores on plants kept from one season to the

Puccinia pelargonii-zonalis DOIDGE. Pelargonium leaf heavily infected with pelargonium rust. — Phot. F. HEJNDORF.

next. In France (TRAMIER & MERCIER 1963) and Hungary (FOLK 1967) formation of teleutospores has been noticed.

This rust species has only a few years ago been introduced into the European continent and was until then known only from Africa, Australasia and Oceania according to the Comm. Myc. Inst., Map no. 412 (1967). As the disease is of a fairly great economic importance and rather easily recognizable it has been comparatively easy to trace the spread of the fungus through Europe, since its first occurrence

in France at Cap d'Antibes along the Mediterranean coast at the end of 1962 (GROUET 1963).

Since the first discovery of *Puccinia pelargonii-zonalis* in France its spread was remarkably rapid. It reached Italy in 1963 (PESANTE 1964), where it was observed in the gardens of San Remo, and was found in different parts of France the same year. In the following year it appeared in Switzerland (GERLACH 1965). In 1965 the rust spread rapidly throughout several European countries, and was recorded from Belgium (POPULER 1966), England (EVANS 1966), Germany (LEIBER 1966), Hungary (FOLK 1967), and Holland (Anon. Wageningen 1968). In 1966 the rust was introduced into Sweden with cuttings from Germany (Anon. Växtskyddsnotiser 1966) and in 1968 we had the first record from Denmark.

Meanwhile *Puccinia pelargonii-zonalis* was observed on *Pelargonium* in U.S.A. where it was found in New York State and in California in 1967 (DIMOCK et al. 1968), probably introduced from Bermuda and Hawaii respectively. In fact the species must now be said to have a worldwide distribution.

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Lyngby, Denmark, November 1968.

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ON THE GENERAL FUNGUS FLORA OF DANISH GROWN BARLEY SEED

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SUMMARY

The purpose of the studies was to examine the specific composition of the fungus flora of Danish grown barley.

In each of the years 1965 and 1966 were drawn 100 samples of barley submitted to the seed testing station during September and October for germination analyses. Other samples were taken in the field during the months July and August 1966 and 1967, in order to study the influence of harvest time on the fungus flora.

Alternaria tenuis auct. was found on nearly 100 per cent of the seeds in all samples. This fungus was not eliminated by surface disinfection. *Cladosporium herbarum* FR., the second most frequent fungus, on an average appeared on 20 per cent of the seeds, but after surface disinfection it was found on a low percentage of the seeds only.

In nearly all samples, *Epicoccum* and *Stemphylium* were found on a small percentage of the seeds, and in many samples *Fusarium* and *Helminthosporium* were found on few seeds. Species of Fusarium tended to be more frequent on samples from Jutland than on samples from the islands while the opposite was the case with *Helminthosporium sativum* P. K. B.

Gonatobotrys simplex CORDA which apparently is attached to other fungi as a mycoparasite (12) appeared in more than 50 per cent of the samples in rather low frequences. *Penicillium* occurred on a great portion of the samples, but after surface disinfection it was only found to a limited extent. Occurrences of *Aspergillus* were rare which partly may be due to the kind of media used.

It is concluded that the fungus flora of barley at harvest time is largely the same regardless of locality in Denmark and of harvest time, when it takes place within a few weeks before or after maturity. However, the occurrence of pathogenic fungi species were rather low, and it is possible that heavy attacks of such species may tend to give variations in the fungus flora between localities and possibly also between different times of harvest.

When health examinations of seeds are made after incubation, the picture is often a rich fungus flora mostly consisting of saprophytes or weak parasites which apparently have little influence on seed quality. But these fungi cannot be ignored, because they may complicate the examinations and because the specific composition of this flora may give some indication of the health condition of the seeds. The evaluation of the results of seed health examinations, therefore, calls for some knowledge of the fungus flora of different seed species. Furthermore a knowledge of the general fungus flora is also of importance when samples for fodder and industrial purposes are examined.

During a survey on barley seed grown in Denmark the occurrence of pathogenic and certain saprophytic fungi was recorded. The purpose of the survey was to establish the composition of the fungus flora of Danish grown barley.

No complete analysis was attempted, the work being confined to the flora revealed by incubation on the media generally used for health examinations of barley.

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1. LITERATURE.

Most studies on the microflora of barley deal with pathogenic species of *Fusarium* and *Helminthosporium*, and statements as to the frequency of saprophytic species are few. Species of the two genera mentioned above occur at levels which vary from region to region and from year to year (2, 3, 4, 5, 7, 8, 10). Several workers mention the names of occurring saphrophytic species without giving any figures regarding their frequency. However, CHRISTENSEN (2) made an extensive survey of barley of different varieties, grown in different

years and localities in Minnesota, in which also the occurrence of *Alternaria tenuis* auct. was recorded. As a rule this species occurred on a great number of seeds in all samples, but a clear variation between years and localities was found.

WELLING & JØRGENSEN (11) examined a large number of samples of Danish grown barley and found great variation in the fungus flora between samples stored under different conditions.

2. MATERIALS AND METHODS.

In each of the years 1965 and 1966 100 samples of barley were selected among samples submitted to the seed testing station for germination in September and October. The samples were drawn so that they were considered representative of seed lots to be used for sowing. Only untreated samples were used. Until examination the samples were stored in plastic bags at 10° C.

Before examination the seeds were incubated on malt extract agar (Difco bacto malt agar, 0024-01) or on wet filter paper. Two per cent dextrose were added to the agar medium in 1965, but this was omitted in 1966 in order to give less mycelial growth.

The agar medium was poured into sterile plastic Petri dishes with a diameter of 9 cm. Ten seeds pretreated for ten minutes in a one per cent sodium hypochlorite solution were placed in each dish. Incubation was at 18-24° C.

The filter paper medium was saturated with water and placed in the same kind of Petri dishes. 25 seeds were placed in each dish and no hypochlorite pretreatment was used. Incubation was at 10° C.

All samples were incubated under continuous near ultra violet light (wave length about 3600 Å) or 12 hrs. near ultra violet light and 12 hrs. darkness.

The seeds incubated on agar were examined after 6 and 8 days' incubation while those incubated on paper at 10° C were examined after 14 days' incubation. The long incubation time on filter paper was found necessary to get good sporulation of some species, mainly those of *Epicoccum* and *Fusarium*.

The seeds were examined under a stereo-microscope with an enlargement of 25-50 × or when necessary — under a high power microscope. The identification of the fungi was exclusively based on spore characters as mycelial characters were considered to be insuffi-

cient for this purpose. Nearly all fungi belonging to the *Hyphomycetales* were recorded and identified to genera or species. An exception was *Pullularia pullulans* (DE BARY) BERKH. which was not recorded systematically.

Fungi belonging to *Sphaeropsidales* were usually not identified. Occurrences of pycnidia or pycnidia-like bodies were recorded as "pycnidia". Well-developed pycnidia were frequently examined under high magnification and proved often to belong to *Phoma* or *Aschochyta*.

Yeast fungi, the growth of which in general was insignificant, were not recorded systematically.

When well-developed perithecia were found, they were identified to genera or species. Occurrences of *Griphosphaeria nivalis* (SCHAFFN.) MÜLLER & V. ARX and *Gibberella zeae* (SCHW.) PETCH were recorded as *Fusarium nivale* (FR.) CES. and *F. graminearum* SCHW., respectively. *F. avenaceum* (FR.) SACC., *F. culmorum* (W. G. SM.) SACC. and *F. graminearum* SCHW. are grouped together as *Fusarium roseum* SNYDER & HANSEN. Other *Ascomycetes* are in the following tables grouped with "other fungi".

3. RESULTS.

1. The composition of the fungus flora of barley seeds in 1965 and 1966.

Table 1 gives the frequency of the different fungi found in 1965 after incubation at 10° C on wet filter paper. *Alternaria tenuis* auct. was by far the most frequent species occurring on 95.6 per cent of the seeds. The second most frequent fungus was *Cladosporium herbarum* FR. which on an average, occurred on 20.2 per cent of the seeds, and was found in all samples.

Species of *Penicillium* were found on 8.3 per cent of the seeds examined. In 10 samples *Penicillium* was not recorded. *Epicoccum* appeared in all samples and on 6.2 per cent of the seeds. Several species of *Fusarium* occurred. *F. nivale* was found on 4.7 per cent of the seeds. Its frequency varied greatly, and it was not found in 25 samples.

The results obtained after incubation on agar are given in table 2. *Alternaria tenuis* appeared on about the same percentage of the seeds as on those incubated on wet filter paper. *Cladosporium herbarum* in the contrary was found on a much lower percentage of the

TABLE 1.

The occurrence of different fungus species on seeds of 100 barley samples from each of the years 1965 and 1966 after incubation on wet filter paper at 10° C for 14 days.

Genus or species	Infection percentage					Average infection percentage in	
	0	1-10	11-20	21-50	51-100		
	Number of samples in 1965					1965	1966
Acremoniella sp.	53	45	2	0	0	1.0	0.3
Alternaria tenuis	0	0	1	0	99	95.6	93.9
Aspergillus sp.	100	0	0	0	0	0	0
Botrytis cinerea	85	15	0	0	0	0.1	0.1
Cladosporium herbarum	0	26	32	40	2	20.2	16.4
Epicoccum sp.	0	84	16	0	0	6.2	6.7
Fusarium nivale	25	59	8	8	0	4.7	0.3
Fusarium roseum	59	41	0	0	0	0.6	0.3
Fusarium sp.	98	2	0	0	0	0.1	0.3
Gonatobotrys simplex	35	65	0	0	0	1.4	5.5
Helminthosporium sativum	48	52	0	0	0	0.7	4.6
Helminthosporium sp.	75	24	0	1	0	0.5	0.4
Mucor sp.	92	8	0	0	0	0.1	0.1
Penicillium sp.	10	70	8	7	5	8.3	5.7
Stemphylium sp.	61	39	0	0	0	0.3	0.5
Trichothecium sp.	92	8	0	0	0	0.1	0.1
Other species	83	17	0	0	0	0.2	0.1
"Pycnidia"	7	70	21	2	0	7.0	15.2

seeds incubated on agar and the same was true of *Penicillium, Epicoccum, Fusarium nivale* and "pycnidia".

The corresponding results from the samples taken in 1966 are presented in the tables only by average figures because they were in very close agreement with the results from 1965. The only significant differences were that the species of *Fusarium,* especially *F. nivale,* were less frequent in 1966 while *Helminthosporium sativum* was more frequent in 1966 than in 1965.

The frequency of the different fungi on samples from Jutland and the islands were compared. No significant difference could be found between the two groups of samples as regard the more frequent fungi. However, the rather infrequent *Fusarium* species were significantly more frequent on samples from Jutland than on samples from the islands, while *Helminthosporium sativum* was much more frequent on samples from the islands than on samples from Jutland.

TABLE 2.

The occurrence of different fungus species on seeds of 100 barley samples from each of the years 1965 and 1966 after incubation on malt extract agar at 20° C for 8 days.

Genus or species	Infection percentage					Average infection percentage in	
	0	1-10	11-20	21-50	51-100		
	Number of samples in 1965					1965	1966
Acremoniella sp.	88	10	0	1	1	1.2	0.1
Alternaria tenuis	0	0	0	3	97	93.1	95.2
Aspergillus sp.	85	13	2	0	0	0.5	0.1
Botrytis cinerea	86	14	0	0	0	0.2	0.1
Cladosporium herbarum	15	85	0	0	0	1.9	1.3
Epicoccum sp.	4	95	1	0	0	2.9	4.3
Fusarium nivale	28	71	1	0	0	1.3	0.3
Fusarium roseum	25	73	2	0	0	1.8	1.0
Fusarium sp.	89	11	0	0	0	0.2	0.5
Gonatobotrys simplex	79	21	0	0	0	0.1	0.3
Helminthosporium sativum	36	64	0	0	0	0.8	4.0
Helminthosporium sp.	88	12	0	0	0	0.2	0.3
Mucor sp.	89	10	0	1	0	0.5	0.1
Penicillium sp.	63	33	1	3	0	1.9	2.6
Stemphylium sp.	11	89	0	0	0	1.8	2.7
Trichothecium sp.	92	8	0	0	0	0.1	0.1
Other species	80	20	0	0	0	0.2	0.1
"Pycnidia"	54	46	0	0	0	0.6	3.3

2. The influence of harvest time on the composition of the fungus flora of the barley seeds.

In order to get a rough estimate of the influence of harvest time on the composition of the fungus flora samples were harvested at different times during July and August in 1966 and 1967. The crop was mature for combine harvesting a few days before the middle of August. Samples of about 200 ears were taken at random in a 10 × 10 m plot with few days' intervals. The ears were dried at 40° C for 24 hours before 200 seeds from each sample were incubated on each of the two media mentioned earlier.

The results from 1966 are given in table 3. As seen from the table no clear effect of time of harvest was found for most of the fungi. Only in the case of *Alternaria tenuis* a clear effect was found as the frequency of this species was much lower in the early harvested samples. This is most clear after incubation on agar probably because

TABLE 3.

The significance of time of harvest for the occurrence of different fungi on barley seeds.

Genus or species	Time of harvest									
	13/7	22/7	3/8	15/8	20/8	13/7	22/7	3/8	15/8	20/8
	Incubated on paper					Incubated on agar				
Acremoniella sp.	0	13	0	2	0	0	0	0	0	0
Alternaria tenuis	83	98	99	98	98	22	52	99	99	100
Aspergillus sp.	0	0	0	0	0	0	1	0	0	0
Botrytis cinerea	2	1	0	1	0	0	0	1	0	0
Cladosporium herbarum	42	45	23	15	23	9	1	1	2	3
Epicoccum sp.	14	7	9	5	20	2	1	9	10	13
Fusarium spp.	1	0	0	0	1	1	0	1	2	6
Gonatobotrys simplex	1	2	5	22	20	0	1	0	23	2
Helminthosporium sativum	1	0	1	2	2	1	1	1	2	2
Penicillium sp.	2	1	0	0	1	1	1	1	0	0
Stemphylium sp.	6	4	2	1	0	2	1	2	4	12
Other species	1	0	0	0	0	0	0	0	0	0
"Pycnidia"	3	10	3	4	3	0	2	1	1	0

of the use of surface sterilization before the seeds were placed on this medium.

The results from 1967 are in very close agreement with those from 1966, and in order to save space these figures are not given in the tables.

4. DISCUSSION AND CONCLUSIONS.

The samples used for the survey were received at the seed testing station during the fall and selected to be representative of the part of the barley crop intended to be used for sowing. In general the germinating capacity was good, and it is assumed that the samples were drawn from well stored seed lots, and that the fungus flora of the seeds presumably was the same as at harvest time. A comparison of the fungus flora on the submitted samples with that on samples taken directly from the field confirms this assumption. However, a few of the samples deviated from the main part with respect to the specific composition of the fungus flora, but in these cases the germination capacity was low, which indicates that the storage conditions had been unfavourable.

In the present study media with a low osmotic pressure were used. Therefore, fungi requiring high osmotic pressure for growth or for the ability to compete with the other microorganisms present on the seeds, have not been found or only in relatively few cases. Also fungi which do not sporulate on media with low osmotic pressure have escaped notice.

However, as the barley was grown under rather humid conditions, there is good reason to assume that a medium with low osmotic pressure is better suited for the detection of a great part of the fungus species than a medium with high osmotic pressure.

The survey of 200 samples was based on an examination of seeds incubated on malt extract agar at about 20° C and on wet filter paper at 10° C. The seeds were surface disinfected with sodium hypochlorite before incubation on malt extract agar while the seeds incubated on wet filter paper were not disinfected. The fungus flora found after incubation on the two media was rather different. Whether this is due to the differences in media and temperature or to surface disinfection is not at all clear. However, it was found in other experiments that the differences for the most prevalent species were mainly due to the surface disinfection.

The results of the examination of the 200 samples harvested in 1965 and 1966, indicate that the fungus flora on Danish grown barley is about the same on newly harvested barley from all parts of the country.

The most common species was *Alternaria tenuis,* which in all samples was found on nearly 100 per cent of the seeds. This species occurred with the same frequency on untreated and on surface disinfected seeds which indicates that mycelium is present inside the epidermis of the glumes. On immature seeds, the fungus was eliminated to a large extent by surface sterilisation which indicates that the fungus does not invade the seeds until a short time before maturity. Comprehensive studies (1, 6, 9) of the occurrence of *A. tenuis* on wheat seeds confirm these results.

The second most frequent fungus, *Cladosporium herbarum,* occurred on about 20 per cent of the seeds. However, after surface disinfection with sodium hypochlorite it was found only on a few per cent of the seeds, which indicates that this species is mainly present on the surface only.

In nearly all samples, *Epicoccum* and *Stemphylium* and in many samples *Fusarium* and *Helminthosporium* were found on a small percentage of the seeds.

Gonatobotrys simplex which is probably attached to other fungus species as a mycoparasite (12), was found in more than 50 per cent of the samples. If the incubation period on filter paper had been longer, this fungus would no doubt have been found on a larger number of samples as it frequently developed rather slowly.

Penicillium appeared on a great number of the samples after incubation on wet filter paper, but after surface disinfection and incubation on malt extract agar it was found on a small part of the samples only. In a few samples *Penicillium* occurred on a great percentage of the seeds after pre-treatment, but these samples were atypical with regard to the other part of the fungus flora, and it is assumed that they had been stored under unfavourable conditions. The fact that *Penicillium* to a large extent was eliminated by pre-treatment indicates that species of this genera do not invade the seeds before harvest. This agrees well with studies on wheat carried out in U.S.A. by CHRISTENSEN (1).

Aspergillus was found in a few samples only but this may partly be due to the fact that the media used do not favour the growth and sporulation of species of *Aspergillus*. CHRISTENSEN (1) found that species of *Aspergillus* were common on the surface of wheat seeds in well-stored lots, while they were not found inside the epidermis.

As a whole, the present studies show that the fungus flora on Danish grown barley at harvest time is about the same on samples from all parts of the country. The specific composition of this fungus flora has many similarities with that of the fungus flora of wheat as found by PONCHET (9).

The fungus flora on the seeds seems to appear some time before maturity, and apparently it does not change much during the first few weeks after maturity. Therefore, the time of harvest does not seems to influence the specific composition of the fungus flora to any extent.

Variations between years were not found as regards the occurrence of the saprophytic fungus species, but prolonged studies might reveal such variations. With regard to the pathogenic species of *Fusarium* and *Helminthosporium*, the frequency of which was rather low, differences in prevalence between the two years were stated.

The effect of bad storage conditions on the fungus flora on newly harvested barley has not been studied, but if the specific composition of the fungus flora of a seed lot deviates essentially from the normal, it can be assumed that the lot has been stored under unfavorable conditions. This is also indicated by studies of WELLING & JØRGENSEN (11).

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The author is endebted to colleagues at the Seed Testing Station, Copenhagen, for valuable discussions and to Miss BIRGIT JENSEN for careful analytical work. He wants to thank Mr. P. D. HEWETT, Mycologist, Official Seed Testing Station, Cambridge, England, for useful advice during the preparation of the manuscript.

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Copenhagen, October 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

NOGLE INDTRYK FRA EN SVAMPETUR

Af BENT KOCH

Man har spurgt mig, om jeg ville yde et lille bidrag til „Friesia"'s festfyrværkeri for professor N. F. BUCHWALD — vel hovedsagelig fordi et lille eet-øres knald kan være en hel lise for trommehinderne i pauserne mellem de store bang'er — men vel også fordi en eet-øres kan affyres af hvemsomhelst. Der kræves ikke autorisation, og der skal ikke stås til regnskab, og jeg er da også den typiske amatør, et almindeligt medlem af Foreningen til Svampekundskabens Fremme. Af og til deltager jeg i ekskursionerne, og af og til samler jeg ind på egen hånd, flittigt assisteret af mine mindreårige børn, der fra de var helt små, lige som velopdrættede trøffelsvin, har skullet aflevere alt af mykologisk interesse til deres fader.

Ä propos ekskursionerne, så er det netop en sådan, jeg kunne tænke mig at bringe frem i erindringen.

Foreningen udsender hvert år ekskursionsplanen med alle oplysninger om tid, sted og ledere. Lad mig først opholde mig lidt ved lederne. Man kunne måske forestille sig dem som nogle strengt udseende herrer og damer, der med barske ansigter marcherer foran og bagved kolonnen og sørger for at marchtempo og rute overholdes til punkt og prikke. Intet er imidlertid mere forkert. Lederne er nemlig ikke at finde blandt de højeste og mest energiske, men blandt de langsomst slentrende — ja, man skal faktisk være heldig for at se dem bevæge sig. Det er, som om de glider frem over skovstierne uden at anvende lemmerne — nærmest som snegle — oftest stående helt stille med en svamp mellem fingrene, under en lup eller oppe i næse-

borene. Det er sket, at jeg frygtsomt har nærmet mig en sådan leder for at få opklaret navnet på et særligt interessant og for mig ukendt eksemplar af en svamp og så har truffet eksperten tænksomt gumlende på en lille bid med det yderste af tænderne og tungespidsen. Blikket var langt borte i en delikat smagskarakteristik og har næppe noteret sig min tilstedeværelse, for pludselig gav den tyggende smagsprøven fra sig — lidt skråt til siden ganske vist — men grumme nær det pæneste af mine ører. Nu kender svampeentusiaster hinandens problemer og er derfor meget tolerante. Hvor resterne af smagsprøven end endte, kan man kun glæde sig over at de ikke blev slugt med et senere besvær til følge. Tag derfor ikke fejl, under det meget civile ydre og den uforstyrreligt rolige og sindige fremtræden der kendetegner foreningens ledere og eksperter, gemmer der sig mænd og kvinder besjælet af samme ildhu og mod som lægevidenskabens pionerer.

Nå, men vi skal i gang med ekskursionen.

Fra det aftalte sted er de fremmødte medlemmer — iført spånkurve, plastikposer, barnevogne, forstørrelsesglas, lommebiblioteker, aviskræmmerhuse og madpakker — forlængst vandret ind i den dunkle skov til de længselsfuldt ventende svampe. Forfatteren er som sædvanlig kommet for sent og skal nu snarest have fundet ekspeditionen. Det er ikke vanskeligt, for ligesom i gamle dage kroen var det endelige mål for kirkegængerne, således er den det også i vore dage for svampesamlerne. Forfatteren lægger kursen og haster af sted. Tiden bliver ikke spildt med at kigge efter svampe — det ville være nytteløst, for der vokser ikke mykologiske seværdigheder, hvor Foreningen til Svampekundskabens Fremme nys har trådt.

Nået frem til hovedstyrken kan man vælge at afsøge terrænet med „næsen" som trækkraft, eller man kan støtte sig til hukommelsen og pløje de „sikre" steder igennem. Endelig er der som SELMA LAGERLØF siger: *En tredje utväg* — nemlig at holde sig til omegnen af den hårde ekspertkerne — og lad mig sige det straks til alle højtskattede begyndere: „*Den tredje utväg* er den rette vej for Jer til større lærdom. Saml i starten kun få svampe, og nærm Jer uden frygt professoren med Jeres eksemplarer, og han vil forklare Jer, hvad der er op og ned på svampen, om forskelle mellem stok, hat, lameller, porer, mycelium o. s. v. — om farver der skifter, om solen der bleger, om

regnen der opløser, om snegle og orme der gnaver — om tørke der skrumper — og om svampe der ikke altid vokser, hvor de burde, om andre der altid gør det, og om farver der ikke passer efter bogen. Han vil også fortælle Jer om svampe, der vokser i dyb bladmuld og om sådanne, der trives bedst på tørre, vindblæste steder, i toppen af træer eller under jorden — og om alle de små tegn der leder mykologen til de ydmyge steder. — Og langsomt bliver for Jeres undrende øjne et stykke tilsyneladende rodet og uforståeligt natur til et smukt komponeret billede, som hver ekskursion føjer nye detailler til."

Men lige meget om man vælger den ensomme vandring eller holder sig til midten, så fyldes kurve og poser efterhånden, og i takt hermed skrumper maverne, og madsynerne indfinder sig små småt: De bugnende borde og den duftende kaffe. Ä propos mad på bordet og svampe i kurvene, så skal jeg for min del indrømme, at ligesom den veltillavede ret tager sig bedre ud på bordet end i maven, så er svampene kønnere i skoven end i kurven, og som årene går, gør det mig mere og mere ondt at rive en svamp ud af dens voksested. Der er over de smukkeste eksemplarer en sådan ro og majestæt, og der er i samspillet mellem svamp og lokalitet oftest en så fornem farveharmoni, at man må tøve med at gribe ind og altid angrer bagefter ved synet af liget i den smudsige kurv.

Lidt efter lidt hober de tomme maver og de fyldte kurve sig op på kroen, og kampen med tjenerne om øllerne, wienerbrødet og kaffen tager sin begyndelse. Svampekurvene er et handicap for ekskursionsdeltagerne, for fristelsen er stor til mellem bidderne at rode lidt i naboens kurv, lade egne eksemplarer cirkulere med wienerbrødet og bladre i farvetavlerne med højre hånd, mens winerbrødet betjenes med venstre. Ikke mærkeligt, at mykologerne under disse forhold bliver et let bytte for tjenerne og nu selv står for tur til at blive plukket med vekslende nænsomhed.

Kun ved professorens bord hersker der en vis ro og afklarethed nærmest som ved kaptajnens på luksuslineren. Man genoplever i erindringen, sætter dagens begivenheder i kartotek og samler kræfter til den endelige identifikation af og forelæsning over dagens udbytte.

Stedet er et gammelt bord, hvorpå alt af interesse udbredes. For den ene langside tager professoren eller hans assisterende eksperter opstilling og rundt om fylkes så resten af menigheden. De første par

navne og beskrivelser påhøres med interesse, men efterhånden som gennemgangen skrider frem breder håbløsheden sig blandt de mindre velbevandrede udi latinen, og navne, findesteder og karakteristika svømmer ud i een stor tåge. Hvordan nogensinde kunne huske alt det — hvordan nogensinde kunne genkende de beskrevne svampe derude i naturen! Men netop som depressionen er størst, hales en eller anden særlig svamp op af bunken, og de lærde glemmer de andægtigt lyttende for at kaste sig ud i en voldsom diskussion om denne særlige svamps tvivlsomme afstamning og endnu mere tvivlsomme navngivning. Og modet vender straks tilbage hos tilskuerne, for det er da klart, at en stakkels amatør ikke behøver at skamme sig over sin ringe ballast af viden, når ikke engang de lærde altid er enige om fadderskab og dåbsritual. Det således genvundne mod på svampelivet fylder hurtigt amatørens hjerte helt for inden næste ekskursion endnu en gang at blive til brændende utålmodighed.

København, oktober 1968.

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GAUTIERIA OTTHII TROG FOUND IN DENMARK

By J. KOCH

Contribution No. 90 from the Department of Plant Pathology,
The Royal Veterinary and Agricultural College, Copenhagen.

SUMMARY

Gautieria otthii TROG is reported found in Denmark and the fungus described in detail. The mycelial strands were found to be partly composed of hyphae which at short intervals form pear-shaped, 12 × 18 μ vesicles with numerous about 1 μ long spines on the inside walls.

During the summer excursion July 10th, 1965, arranged by the Danish Mycological Society, to Ravneholmene, a little forest north of Copenhagen, a Gasteromycete — *Gautieria otthii* TROG — was collected (E. TRYEL). This fungus was later refound in greater numbers (B. RØNNE) in a new locality in the same forest medio July 1966 and 1967. No member of the genus *Gautieria* has previously been described from Denmark, and among the other Scandinavian countries collections have only been reported from Sweden (T. M. FRIES 1909, *Gautieria graveolens* and *G. retirugosa)*.

ECOLOGY

The fungus was found growing in an old beechwood on steep south and west slopes in a rather compact, naked or moss-clad soil, but could also be found at the foot of the slopes under the thick layers of downwashed beech leaf litter. The fruit bodies were not

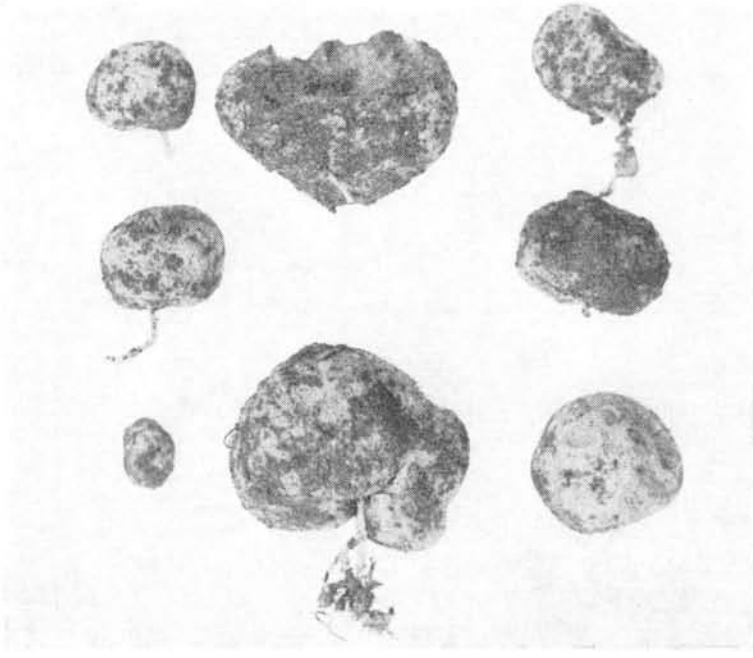

Fig. 1. *Gautieria otthii*. Fresh fruit bodies. The individual in the centre of the top row has been gnawed by snails. — Photo. July 17, 1966. × 0.6.

truly hypogaean, but developed in the surface layer of the soil, pushing it up during their growth into small banks along the sides. The fruit bodies appeared singly or in dense groups of up to 4 partially-fused individuals. In the summer of 1966 25 fruit bodies were counted within 1 m^2, and at a distance of approximately 20 m 10 more were found. An additional group of 8 fruit bodies was discovered by a dog, a Labrador retriever, under a 10-cm thick deposit of beech leaf litter.

MACROSCOPIC CHARACTERS

The fruit bodies are irregularly spherical, up to 5 cm in length, often vaulted in the apical part and roughly concave at the base (Fig. 1). A greyish-white, very fragile mycelial strand, approximately 2 mm in diameter and up to 2 cm in length, connects the fertile part with the mycelium in the soil, the particles of which are bound together

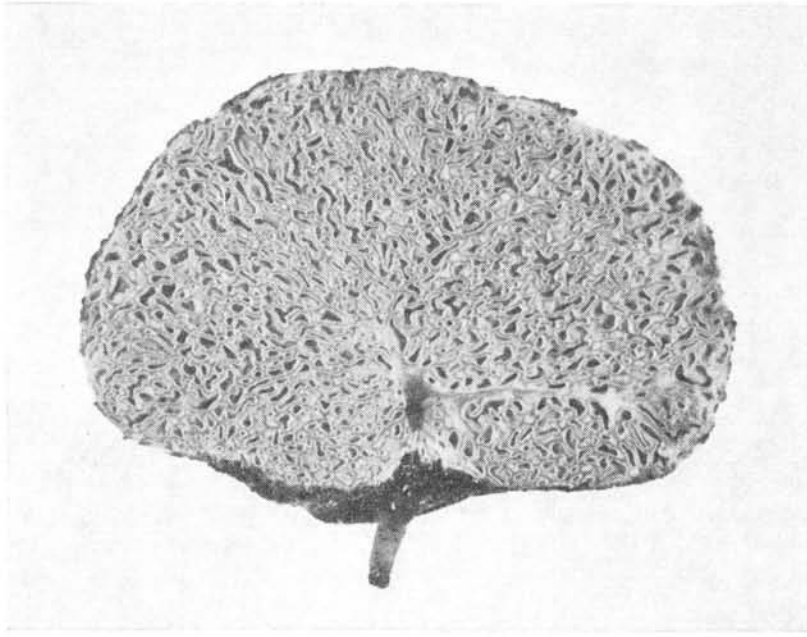

Fig. 2. *Gautieria otthii*. Vertical section through a mature fruit body showing the columella and the small labyrinthic chambers of the gleba. — Photo. July 12, 1967. × 3.

into a tough, grey conglomerate. The 8 fruit bodies shown in Fig. 1 weighed 75 g in the fresh condition (the largest weighed 23 g) and 10.2 g after drying.

The underground parts are whitish with rosa tones, and the freely-exposed apical parts coffee-brown with ochre to citrus yellow tones in places.

The young fruit bodies are almost smooth. The older ones, which lack a peridium, have a finely pitted surface originating from the fine minute chambers of the gleba.

O d o u r. The fresh fruit bodies has a penetrating odour reminiscent of a mixture of the odours of petrol and onions.

MICROSCOPIC CHARACTERS

G l e b a. The gleba consists of numerous labyrinthic chambers, 0.5 mm in breadth and up to 2 mm in length. The chambers are open

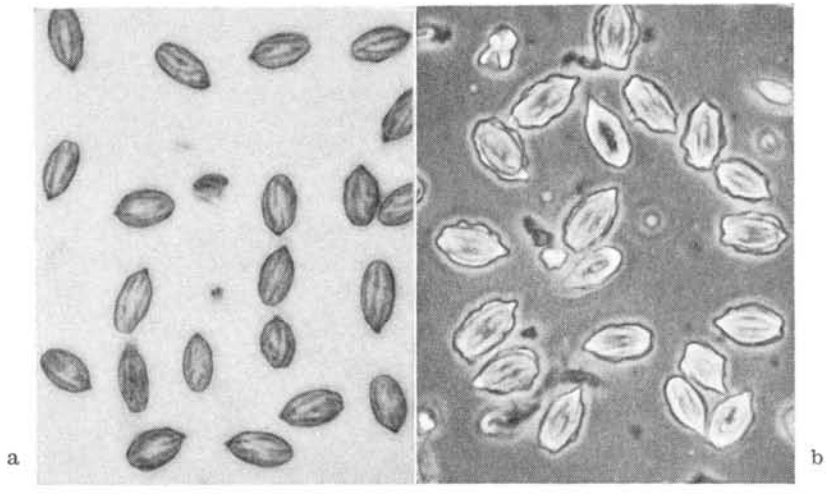

Fig. 3. *Gautieria otthii*. a. Spores mounted in „Shear"; b. Spores mounted in 3 % NaOH. — × 550.

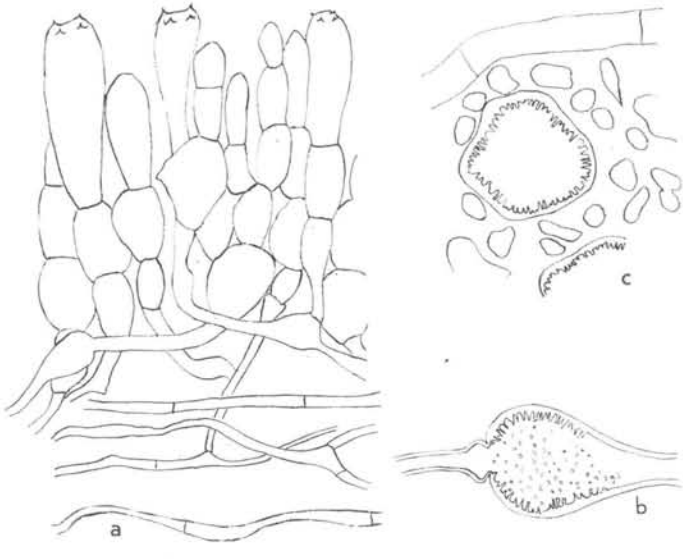

Fig. 4. *Gautieria othii*. a. Part of section through the gleba wall; b. Dominant type of hyphae in the mycelial strands. The inflated parts of the hyphae are clad with minute spines on the inside walls; c. Part of cross-section through a mycelial strand. — × 1250.

and the walls light brown in appearance due to a powdery deposit of spores. The colour of the gleba in a fresh condition, as it appeared in the patches gnawed by snails, is very like that of fallen beech leaves. The walls are 90-135-(180) μ thick. From the basal part a rather heavy greyish-white columella branches off into the gleba. Normally it soon disappears into the walls of the gleba (Fig. 2). —

Spores. The spores are ellipsoidal in form, often somewhat flattened at the apex, with a rather prominent apiculus and 9-11, generally 10, wavy longitudinal ribs (Fig. 3). The spores (100) measured 12.6-17.3 × 6.2-9.1 μ, with an average of 15.1 × 7.7 μ. Basidia are 4-spored and measure (12)-18-30-(45) × 7-9 μ in dimension. —

Gleba walls. The central third of the gleba walls consisted of loosely interwoven, somewhat gelatinized hyphae which, towards the lumen, were replaced by thicker, barrel-shaped hyphae (Fig. 4 a).

Mycelial strands. The extremely brittle mycelial strands are partly composed of gelatinized hyphae, partly of well-defined hyphae which, at short intervals, form pear-shaped, 12 × 18 μ vesicles with numerous about 1 μ long spines on the inside walls (Fig. 4 b and c.). This type of specialized hyphae, which is the dominant type in the mycelial strands was not observed in the gleba walls. Small crystals, deeply staining in cotton blue, could frequently be seen in the vesicles and in the connecting hyphae. According to H. Lohwag (1941) these crystalls could be protein crystals. No true cortex could be seen in the mycelial strands.

COMMENTS

Apart from the smaller spores the Danish fungus is very similar to *G. graveolens* Vitt. (Vittadini 1831), whose spores are reported by Pilát (1958) to measure 16.5-18.5 × 10.5-13.0 μ. *G. otthii,* as described by Trog (1857), appears to differ from *G. graveolens* only in the somewhat shorter and narrower spores which are found by Pilát (1958) to measure 15-19 × 9-11 μ and by Dodge & Zeller (1934) to measure 12-16 × 6-8 μ. The two last mentioned authors consider *G. otthii* to be a variety of *G. graveolens.* There is little doubt that *G. graveolens* and *G. otthii* are very closely related, but as the Danish collections throughout a period of three years proved to be very stable with respect to spore size, it is considered reasonable to classify this species as *G. otthii.*

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CONIOTHYRIUM FRAGARIAE OUDEM.

UN CHAMPIGNON NON CONSTATÉ JUSQU' ICI AU DANEMARK

Par GEORG KOVÁCS

Compte rendu N° 84 du Laboratoire de la Pathologie Végétale de l'Institut Royal Vétérinaire et Agronomique à Copenhague

SUMMARY

Analyses of the fungi isolated from flowers of strawberry (*Fragaria* cult.) during May 1967 revealed the presence of a fungus not noted in Denmark before. It produced pycnia on potato dextrose agar and was identified as *Coniothyrium fragariae* OUDEM.

A l'occasion de l'analyse d'une population fongique de fleurs de fraisier, un champignon formant des pycnides est apparu sur une gélose dextrosé à l'eau de pommes de terre. Il s'agissait de *Coniothyrium fragariae* OUDEM.

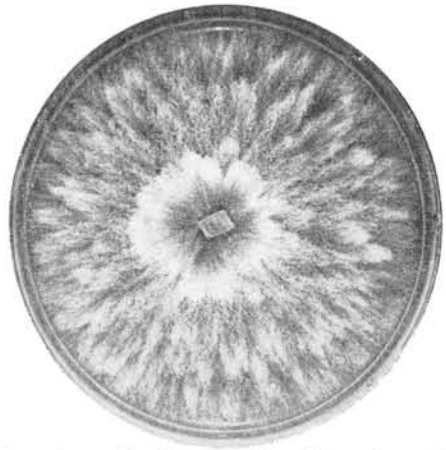

Fig. 1. *Coniothyrium fragariae* OUDEM. Mycélium de après 5 jours de culture. — × 1/2.

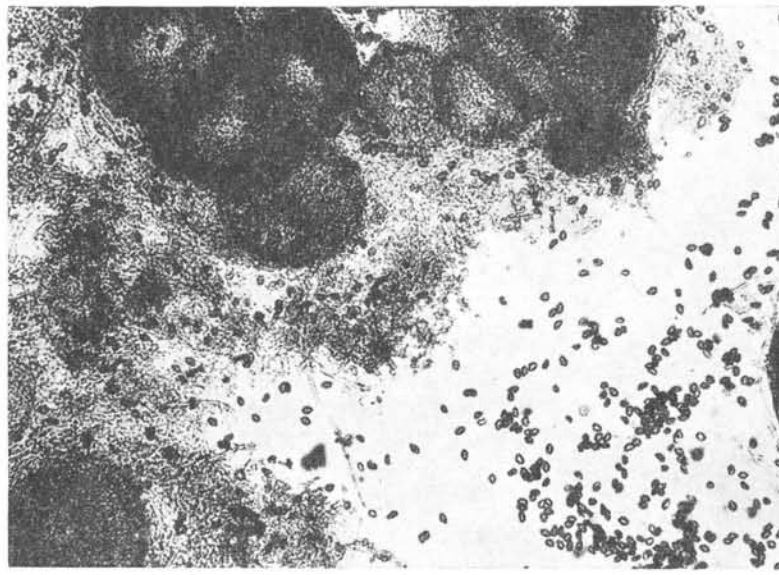

Fig. 2. *Coniothyrium fragariae.* Les pycnides et conidies. — × 120.

Les fleurs de fraisier des variétes 'Dybdal' et 'Senga Sengana' d'une parcelle d'expérience du jardin de l'Institut Royal Vétérinaire et Agronomique, à Copenhague, étaient cueillies au mois de mai 1967. 11 fleurs sur 120 étaient infectées. Les fleurs avaient été cueillies au début, au milieu et à la fin de la floraison (3 × 40 fleurs). On constatait également la présence du champignon chez des échantillons de fleurs cueillies à Vallekilde (Seeland). Par contre, des analyses à Brenderup (Fionie), n'indiquaient aucune fleur infectée par *Coniothyrium fragariae.*

Le mycélium de ce champignon est blanc pendant les 3-4 premiers jours de culture en laboratoire; plus tard, il est un peu coloré d'une teinte faiblement rougeâtre. Le mycélium montre un dessin caractéristique (fig. 1). La croissance du mycélium est rapide: si on met la semence (du mycélium ou des conidies) au centre du milieu solidifié dans une boîte de Petri normale (9 cm de diamètre), le mycélium développant atteint la bordure de cela en moins de 4 jours, à la température de la pièce (20-22° C).

La production des pycnides prend une forme visible au bout de 8-9 jours. Les pycnides qui sont mûres après 12-14 jours, sont globuleuses, elles ont une paroi mince, elles sont entièrement noires, souvent

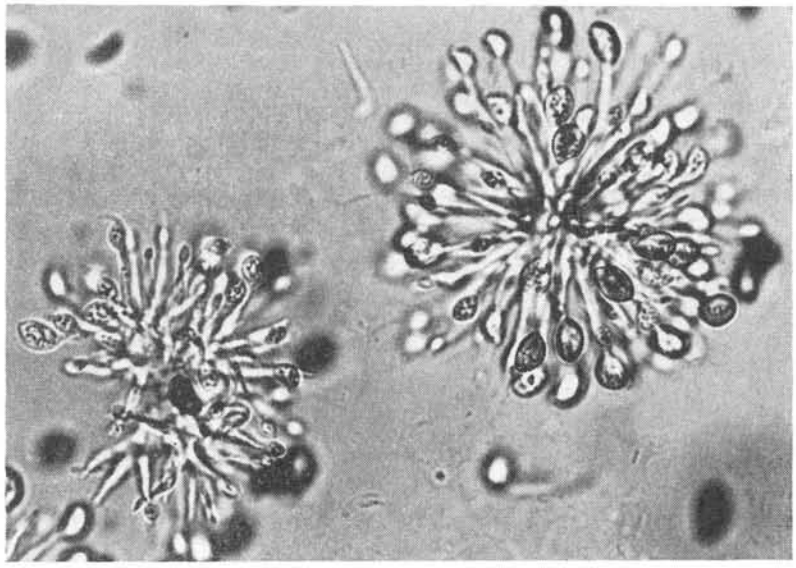

Fig. 3. *Coniothyrium fragariae.* Deux faisceaux de conidiophores vu d'au-dessus. — × 550.

pourvues d'un col (fig. 2). Les pycnides se placent aussi bien séparément que par groupes sur la gélose. Leur taille est de 50-160 μ, en moyenne (20 mesures) de 86 μ.

Les conidies se développent et sont disposées sur de courts conidiophores touffus (fig. 3.)

Les conidies sont unicellulées, largement elliptiques, pour la plupart pointues aux deux extrémités (fig. 2 et 4). Elles sont fuligineuses. Leur taille est de 7,6-11,4 × 4,8-7,6 μ, en moyenne (100 mesures) de 9,6 × 6,8 μ. Il est à noter que la description de Oudemans fait mention d'une taille légèrement supérieure: $11^2/_3 \times 9^1/_3$ μ. Le petit appendice hyalin que OUDEMANS a décrit et qui vient du conidiophore, était rarement constaté dans le cas présent.

Les pycnides mûres se fendent au bout d'une bonne semaine et les conidies s'en échappent en grande quantité.

SACCARDO mentionne dans les 4 volumes de son "Sylloge fungorum" 156 espèces du genre *Coniothyrium*. ALLESCHER énumère 107 espéces dans la "Kryptogamen-Flora" de RABENHORST. La plupart des espéces ont une unique plante-hôte. Mais par exemple *C. Fuckelii* a des plantes-hôte de genre très divers au point de vue systématique comme *Ampelopsis, Berberis, Citrus, Robinia, Rubus* etc.

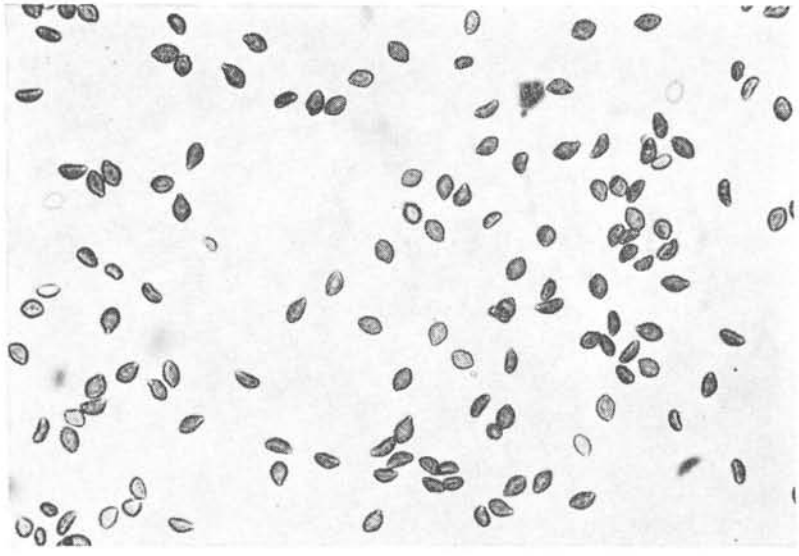

Fig. 4. *Coniothyrium fragariae*. Les conidies. — × 360.

Il est notoire que la distinction entre le genre *Coniothyrium* et le genre *Sphaeropsis* est plutôt artificielle. Le seul critère exact est en effet la taille des conidies. Elle est chez le *Coniothyrium* infèrieur à 15 μ. *C. fragariae* fait partie d'espèces ayant des conidies relativement grandes, en effet parmi les 107 espèces énumérées par ALLESCHER, environ 100 ont de plus petites conidies que *C. fragariae*.

Coniothyrium fragariae est digne d'attention comme espèce pathogène de plante. Il est à remarquer que OUDEMANS a trouvé des pycnides sur des receptacles de fruits mûrs. Dans le cas présent les pycnides n' ont pas été trouvées in vivo.

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JAKOB E. LANGE AND THE CREATION OF „FLORA AGARICINA DANICA"

By MORTEN LANGE

Iconographs on the *Agaricales* are few, most of them are selected and thus incomplete. The "Icones" of ELIAS FRIES rank prominently among the "selected", although the value is reduced through the fact that the pictures are executed by technical assistants. The quality of the pictures reproduced in the works of RICKEN and of KONRAD & MAUBLANC can be rated as mediocre, and the excellent standard of the BOUDIER-figures is limited by the low number of Agarics included.

Left is then three comprehensive iconographs on Agarics: COOKE, BRESADOLA and LANGE. All of these can claim merit already by their completeness. The lasting evaluation strongly depends on the quality of the presentation related to the personal responsibility of the author for each single determination. This makes it worth while to study the historical facts behind the creation of these works.

Information on the work of JAKOB E. LANGE can help in this evaluation, and also contribute a little to the history of mycology.

The story of Flora Agaricina Danica has a span from 1893 to 1941. A few data will form a background. J. E. LANGE was born in 1864. His father was a vicar in the city of Nyborg on Fyn; he was also a bryologist. The family was loaded with botanists (cp. CARL CHRISTENSEN 1924-26: 422).

As a very young man, in 1880, he got mycological advice from EMIL ROSTRUP, famous plant pathologist, and then teacher in Skårup on Fyn. From LANGE's time as an apprentice in the Royal Garden in Copenhagen a few notes show continued mycological interest, and from his study in 1882-84 at the Royal Veterinary and Agricultural University is preserved a series of Indian ink drawings of Micromycetes.

The interest in Micromycetes is further borne out by a large

number of pencil notes in his copy of WÜNSCHE (1877) given to him by his fellow student WILHELM ANDERSEN.

From 1888 J. E. LANGE occupied a position as teacher at the Agricultural Folk High School at Dalum near Odense. His subjects were botany, social economics and gymnastics. His mycological interest must have been lively since he procured SCHROETER: "Die Pilze Schlesiens" (1889) already in 1890. The very early notes in this book are also on Micromycetes.

It is evident, that J. E. LANGE then was one of the many provincial correspondents, who supplied EMIL ROSTRUP with information in his position as lecturer in plant pathology at the Royal Veterinary and Agricultural University in Copenhagen.

Pencil notes in WÜNSCHE and in SCHROETER make it possible to decide rather precisely when J. E. LANGE took up the study of Agarics. Almost all notes dated from 1881 to 1893 apply to Micromycetes but from 1894 the Agarics come strongly into the picture. The dating can probably be made even more precise. The notes from 1894 are referring to collections at Køge on Zealand. There can be no doubt that these collections were made on the excursion to Køge on 7th October, arranged by the Danish Botanical Society. Among the participants were all Danish mycologists of standing (cp. Bot. Tidsskr. 19 (3): LIII): ROSTRUP, KOLDERUP ROSENVINGE, EMIL CHR. HANSEN, and SEVERIN PETERSEN, who were "in charge" of the Agarics. It can safely be argued that from that day, J. E. LANGE pushed other mycological fields aside and concentrated on the Agarics.

The very first paintings are prior to this date. *Lactarius deliciosus* was painted in October 1893, *Armillaria mellea* at New Year 1894 and *Lactarius blennius* in September 1894. Painting water colours was not strange to the family. Both J. E. LANGE and his sister, JOHANNE, made nice landscapes. JOHANNE furthermore naturalistic sketches of flowers. But the three early sketches mentioned are quite primitive. The real decision to make a full series of water colours came to praxis in 1895, from which year 37 pictures are in the collection, and through which series a firm technique and style developed. The line is still somewhat primitive — as in *Collybia velutipes*, *Clitocybe odora*, *Mycena pelianthina*, but the entire harvest of this year shows a maturing presentation, best perhaps in *Cortinarius elatior* painted late in October.

The main bulk of the work was done in the following years, with a peak in 1897 where 110 species were depicted. Probably the year

when he fought a "slight" tuberculosis of the lung, and had a one year vacation from his teaching. 1898 came out with 96 figures and the highly productive period from 1896 to 1909 contributed with a total of 803 figures representing a somewhat lower number of species.

The first public demonstration of the pictures was at a meeting in the Botanical Society on 10th March, 1906, when LANGE gave a very significant lecture on the ecology of the Agarics. From a note to this paper (LANGE 1906), it appears that a duplicate set of the pictures was produced for the Copenhagen Botanical Museum. The duplicates were made by J. E. LANGE himself, and on a better quality of paper. The paper of the original set has a tendency to stain yellow.

It seems that LANGE then thought his job to be almost completed, the next years yielded a modest harvest. He indicated that the plates under the name "Danmarks Agaricaceer" were completed with 562 plates in 5 volumes as per 1910, and that further contributions were to be regarded as a supplement.

The copy in the Botanical Museum was of course available to interested students, but still it remained a very ineffective way of publication. Reviewing the plates, C. FERDINANDSEN (1912) very strongly recommended the publication of descriptions to accompany the plates. The possibility arose, when the Danish Botanical Society started its monograph series: "Dansk Botanisk Arkiv" in 1913, edited by KOLDERUP ROSENVINGE. The recommendation by FERDINANDSEN was followed, and the descriptions were brought in this series from April 1914. All together 12 numbers appeared under the title "Studies in the Agarics of Denmark", finished in 1938, when the publication of "Flora Agaricina Danica" was well under way. The publishing time of each number is given below.

No. 1.	April	1914	No. 7.	July	1928
— 2.	Oct.	1915	— 8.	May	1930
— 3.	July	1917	— 9.	June	1933
— 4.	April	1921	— 10.	July	1935
— 5.	Oct.	1923	— 11.	Jan.	1937
— 6.	July	1926	— 12.	Oct.	1938

Main emphasis in these texts was on microscopical data and critical notes, and on the presentation of keys to the species. The first issue has a general introduction where LANGE explains his preference for coloured iconographic presentation, which in his opinion was much preferable to herbarium specimens.

LANGE was no friend of long descriptions. This is clearly seen in the "Studies" as well as in "Flora Agaricina Danica". He loathed these long stories about a cap being present and probably also a stem. Instead he found the coloured picture to give the comprehensive description, where both colour and size and shape was evident without interpretation, and without the use of words which often would be understood differently by the students of the text.

The series brought the first chromo-lithographic reproduction of the plates. No. 1 has a plate with 11 species of *Mycena*, Nos. 5 and 7-10 have one colour plate each, while No. 6 has a colour chart to facilitate the indications of colour in the descriptions. This addition reflects a somewhat different approach to the mode of description. In the later numbers of the "Studies" a brief formal description was generally provided.

The invitation to open this series undoubtedly gave stimulus to a new production of plates, 1914 yielded 53 new paintings. In 1918 J. E. LANGE took over a new position as principal of the Smallholders Agricultural School at Odense. This gave him a new load of work and little time for agaricological studies. Specimens were collected on a morning walk through the wood or at one or two Sunday excursions. Each year gave some few paintings.

The final wave of initiative came from the invitation to a mycological (and political) study tour to USA in 1931 (LANGE 1934). The encounter with American Agarics and American mycologists was very stimulating and the plan for the printing of "Flora Agaricina Danica" was under development. The two professors with standing in mycology, Ø. WINGE and C. FERDINANDSEN, then chairmen of the Botanical and the Mycological Society respectively, took interest in his plan, and started hunting the economic support necessary. A hard job in these years of economic crisis. Late in 1933 the plans were clear, a sample plate came out in April 1934, and the firm economic guarantee from the Carlsberg and Rask-Ørsted Foundations came on 10 January 1935. The publishing dates for the volumens are as follows:

Vol. I, 1. part:	medio	Nov.	1935
— 2. — :	primo	March	1936
— II :	primo	March	1937
— III :	medio	March	1938
— IV :	primo	May	1939
— V :	medio	Sept.	1940

In 1934 J. E. Lange retired, and could take more time out to mycology. The work had to be completed. 48 plates were made in 1934 and all together 112 more pictures were made ready for the printing up to 1939. Only 1 plate from this year was ready soon enough to be reproduced: *Bolbitius lacteus*, from 10th July, 1939. But the work did not stop. 43 more plates were finished. The last of these unpublished plates is *Tricholoma pseudo-imbricatum* LANGE & TERKELSEN, painted on 5th Oct. 1941, less than three months before J. E. LANGE's death.

The plates follow a very uniform style through all the years. Same size of paper, same technique. Gills marked with a blunt needle, if no coloured margin should be shown, delicate hairs and other fine details done under a magnification glass. No shades, but often a nice ecological selection of mosses, leaves, or needles, carefully placed at base. On the plates also pencil drawings of microscopical details (× 1000) and indication of locality. Short descriptions and notes were compiled in two note-books covering the entire period to 1939 although first actually started in 1901. The information in the note-books is largely the same as is printed in the "Studies". There are, however, a few additional notes on more recent finds. The materials used for the water-colours were very simple. About a dozen bits of dry colours which were rasped in water and mixed to match the fungus.

The collections were almost all made by J. E. LANGE himself. He got numerous specimens from other mycologists, but rarely did he find them "fit" to paint. Only 49 painted specimens are recorded as found by other collectors. The largest share by F. H. MØLLER (19), next in number credited with M. LANGE as collector (16), 7 found by M. P. CHRISTIANSEN, and the rest by several others. The majority of the paintings of specimens collected by other mycologists were produced in late years, when J. E. LANGE strived to make "Flora Agaricina" as complete as possible. The paintings were made by himself with only one exception, *Tubaria embola*, a rather rough sketch by POUL LARSEN.

The total number of taxa depicted in "Flora Agaricina Danica" is 1184. There are 43 additional species or forms executed from 1939 to 1941, including some well known species very rare in Denmark: *Cortinarius violaceus*, *Lactarius repraesentaneus*, *Xeromphalina cauticinalis*, but also a number of species and forms described as new. These have never been published. The total number of plates is slightly larger. Seven were not found fit for publication. And further, there are more than one figure made of several species. About 50 of these are

reproduced in FAD, in many cases improved presentation of very early finds. Some 60 more of these supplementary figures have not been reproduced. This brings the total number of figures painted to 1340.

By far the larger number of these specimens were collected on J. E. LANGE's home island, Fyn (Funen) (Fig. 1). And even to a very large extend on a very limited hunting ground. About one third, 424 figures, are made from specimens found near J. E. LANGE's home up to 1917, Sejerskov at Dalum, south of Odense. The localities, Hjallese, Hunderup, Fruens Bøge, Hollufgård and a few minor places, are all inside walking distance from the home. Another 60 pictures are made from specimens collected near his home from 1918 and onwards: Husmandsskolen, Åløkke Skov, Tarup, north of Odense. It is characteristic that the ephemeral forms count heavily from these series of localities: *Mycena*, *Coprinus* to a very high percentage stem from such places where they could be carried straight home to be painted. Very little is left of these woods, the city of Odense has swalloved them up or made them into parklike stands.

Well above 600 figures represent specimens collected in other Funen localities. Most important among these are Langesø, north of Odense, Tommerup, to the west, Trolleborg, Holstenshus, and Kirkeby woods in South Fyn. From South Fyn should also be mentioned the woods at Lundeborg and Tiselholt. All these tracts should today be considered as the best preserved part of the fields.

From outside Funen there are about 160 figured specimens (Fig. 2). Most from Jutland (90) a large part of which are from two excursions made in 1897 and 1900 to Rold Skov, Skørping, Lindenborg and other stations in North Jutland (cp. J. E. LANGE 1954).

The specimens from Zealand, about 50, comprise a number painted from Grib Skov in 1896, and from the region Sorø-Slagelse in 1896, 1901, 1902 and 1906. The remaining part is largely sent by correspondents. From Lolland-Falster are some 20 specimens all sent by F. H. MØLLER and from Bornholm only 2 sent by correspondents.

Finally there are 3 pictures reproduced, representing specimens found in Sweden: Plate 96, *Cortinarius spilomeus*; Pl. 121, *Flammula spumosa*, and Pl. 195, *Russula claroflava*, the left specimen. All these are from Örkelljunga in Scania, South Sweden.

It is evident from above figures that "Flora Agaricina Danica" could well have been called "Flora Agaricina Fionica".

The laboratory facilities available for J. E. LANGE's work were of course not ample. Almost all microscope study was made with

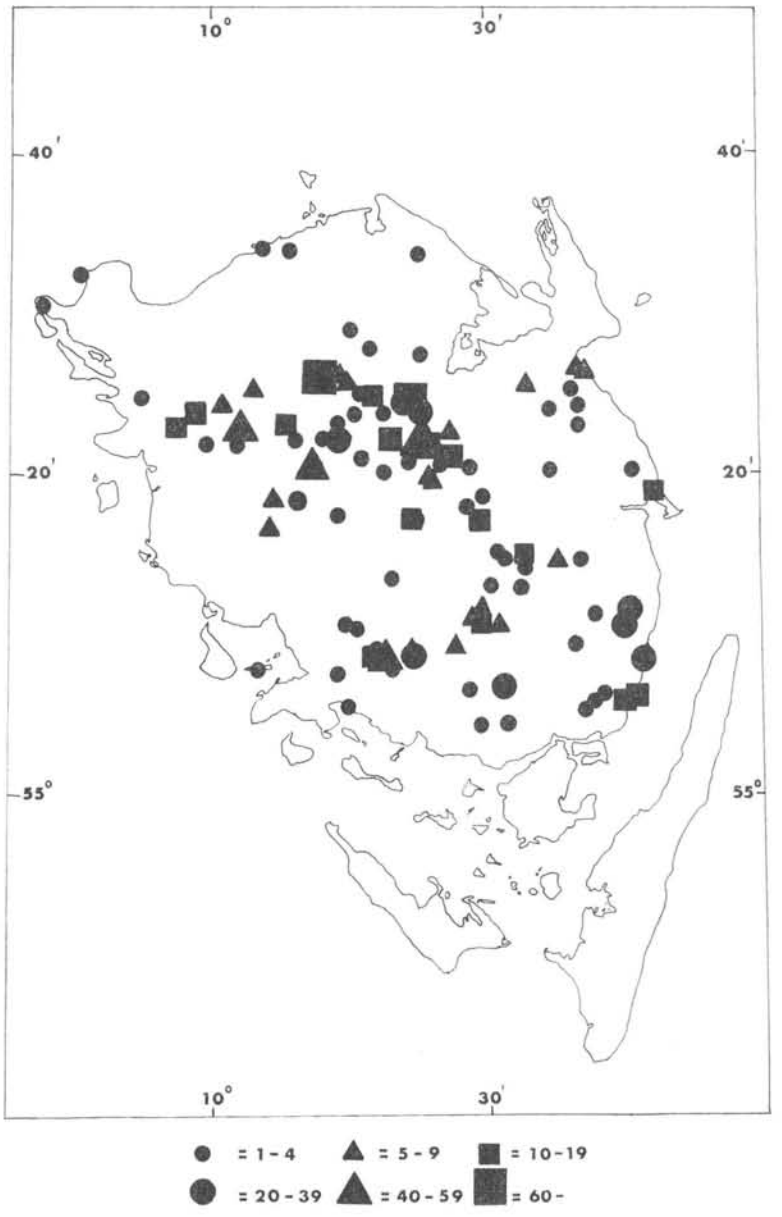

Fig. 1. J. E. LANGE's personal records on Agarics from localities in the island of Fyn (Funen).

400 × magnification, oil immersion used very rarely. The exception is drawings of the spores of *Russula* and *Lactarius*, which were undertaken in late years by F. H. MØLLER based on spore-prints sent by LANGE.

The interpretation of the identifications is of course much supported when the literature used is known. In the very first years, SCHROETER was the main base of the study. It was supplemented with KARSTEN: "Mycologia Fennica" and from 1896 with KARSTEN: "Kritisk öfversigt af Finlands Basidsvampar"; this latter work was apparently much used. When his uncle, professor JOH. LANGE died in 1898, J. E. LANGE inherited the two main works of FRIES: "Icones selectae" and "Hymenomycetes Europaei". The "Hymenomycetes" became the firm basis of the library. Of importance for later stages of the work were notably RICKEN: "Die Blätterpilze" and REA: "British Basidiomycetae". COOKE: "Illustrations of British Fungi" was available in a personal copy, but unbound and more rarely consulted. On the shelf and quite often used was BRESADOLA; and coming out just prior to "Flora Agaricina Danica" was the work by KONRAD & MAUBLANC, which was used much.

These are the main sources of literature. Other sources quoted now and then were used less regularly.

Among the contemporary authors which influenced J. E. LANGE'S work in the final stage were SCHAEFFER, SINGER, PILÁT, KÜHNER, JOSSERAND, and A. H. SMITH. To put it nicely: they were the people of which he kept the reprints.

As a private library the collection was not at all poor.

Language formed no barrier. J. E. LANGE was perfect in Victorian English and good in French and German. He had, however, his English writing gone over by A. A. PEARSON, a correspondent through many years.

The nomenclature in "Flora Agaricina Danica" does not follow any special code. Latin descriptions of new taxa, mandatory from 1935, were supplied after pressure from N. F. BUCHWALD, and the selection of names and of corresponding authors is done more with some prudence than in accordance with the rules.

A few notes could clarify the cooperation with other mycologists. It is of course not as limited as the records of the figures suggest. SEVERIN PETERSEN'S work, "Danske Agaricaceer" (1907-1911), clearly indicates a close connection between the two. Probably the Zealand excursions around 1900 were in company with SEVERIN PETERSEN —

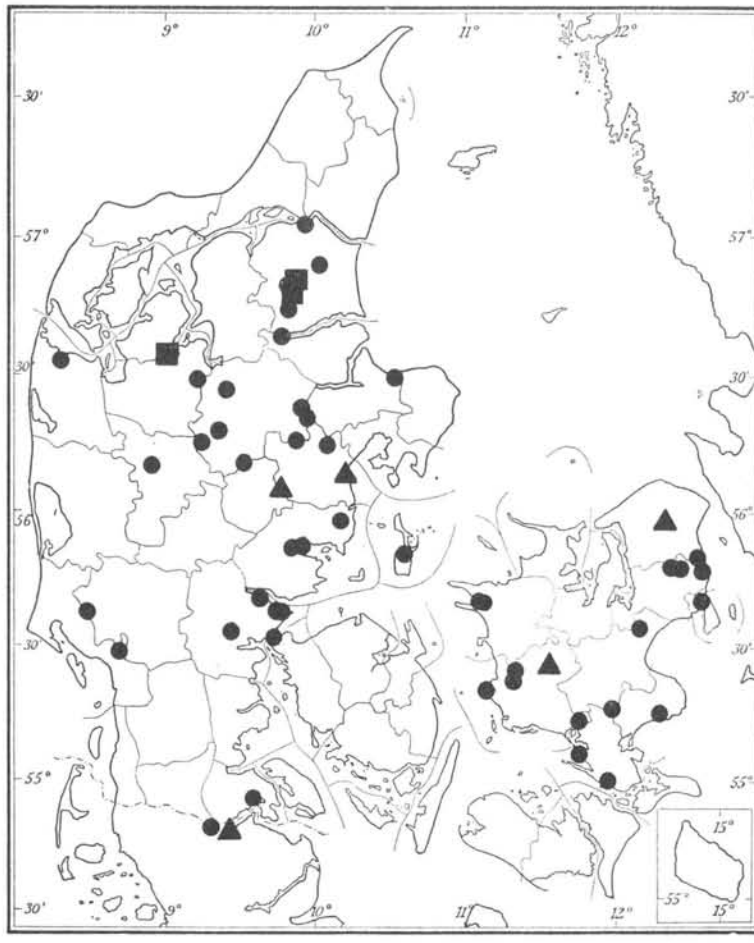

Fig. 2. J. E. LANGE's personal records outside Fyn (Funen).
Signatures as in Fig. 1.

although there is no written evidence of this, and there is little doubt that J. E. LANGE's original species concept was influenced by SEVERIN PETERSEN's strict adherence to the tradition of FRIES. This was further borne out through contact with the two Swedish mycologists who were the executors of the Friesian tradition: ROB. FRIES and L. ROMELL. But it is certain, that untill the midtwenties, J. E. LANGE worked quite much in isolation and formed his own concepts. His position as school principal gave him, however, new possibilities of

contact, and from 1925 he made his school the center of a series of mycological forays or "congresses", where Danish mycologists gathered to collect and discuss. The leading participants in these gatherings were those who are listed as collaborators of "Flora Agaricina Danica", N. F. BUCHWALD, M. P. CHRISTIANSEN, C. FERDINANDSEN, POUL LARSEN, F. H. MØLLER, Ø. WINGE. No doubt that F. H. MØLLER has the central position among these. He was the only agaricologist of the group, and considered himself a pupil of J. E. LANGE. He contributed with more records than any other collaborator, did spore drawings of the *Russulaceae*, and had most manuscripts sent for critical reading, to which he responded with extensive notes.

My father was not a man who collected close personal friends. But among the collaborators MØLLER might be rated as close to be a friend. The same holds true for POUL LARSEN. FERDINANDSEN and WINGE have their great part in the production of the work through their pressure to secure the economic basis, and in the primary development of the printing standards to be met. N. F. BUCHWALD served as secretary, helped to see the pages through the press, compiled the index, and organized the distribution. The production was in itself a very excellent job. The technical work of transferring the pictures to the lithographic stones was done by one highly skilled man (O. R. POULSEN) and as much as ten colours were generally needed to make up the final print.

When "Flora Agaricina Danica" shall be evaluated, it is clear that the long span of time from 1893 to 1939 plays a rôle. When the first large drive was finished around 1910, the work stood on the level of the Nordic successors to FRIES. The microscopical characters were used with heavy weight on spores and cystidia, thus bringing the work ahead of KARSTEN, and the new generic concepts, advocated by KARSTEN and QUÉLET were also discernible although often camouflaged as subsections in the Friesian classical model.

This pattern was mostly preserved through the whole series of "Studies I-XII".

"Flora Agaricina Danica" continues this line, and is thus placed as a work of the early part of the century, but not without influence of the mycologists of its proper decade, strongly noticeable in such genera as *Galerina*, *Conocybe*, *Inocybe*, *Russula*, *Lactarius*. The limit of the work is quite well defined. In characters of macroscopic appearance and of ecology of the species, J. E. LANGE was a very keen observer. His studies on the classical microscopical characters were

limited by his technical equipment but strongly utilized inside this limit. Hyphal structures studied were almost only those of the cap surface while he entirely abstained from using macro- and microchemical reactions.

His geographical position — far away from museum facilities — made a study of herbarium material very difficult, and he did not believe much in its usefulness. He never tried to make up a set of herbarium specimens.

The preserved material background behind "Flora Agaricina Danica" is then easy to characterize: The plates, one copy in my possession, the second one in the Botanical Museum of Copenhagen, the two note-books, also in my possession, and a rather incomplete collection of spore-prints in the Botanical Museum. The true value of the work rests with its completeness, with the outstanding qualities of the pictures, and with the keen observations on which the pictures rest.

The limit of "Flora Agaricina Danica" is the *Agaricales* in the classical delimitation: with the lamellate *Cantharellaceae* and without the Boletes. This is almost also the limit of the series of pictures. There are a few pictures from 1896 of larger Discomycetes and this trend was taken up again after FAD was finished.

Even if J. E. LANGE's mycological writings almost entirely centre on the *Agaricales*, he had a broad knowledge of other groups of fungi and of other groups of plants. His style was that of a 19. century polyhistor. He has written text-books in physics and social economy, he was a world recognized specialist in agricultural structure and adult education, and in his small note-books there will also be found linguistic studies and small musical compositions. But through 60 years he steadily worked with mycology and in almost the entire span of time, he concentrated this part of his activity on Agarics.

The story of "Flora Agaricina Danica" did not end with the edition of its last volume. The financial support granted had the exceptional condition that it should be paid back to the foundations. The last instalment on the debt was provided in 1949. Half of the revenue for the remaining copies was shared between the sponsoring societies. The Society of Advancement of Mycology erected a permanent fund on this money: "The Flora Agaricina Danica Fund". The Danish Botanical Society similarly made "JAKOB E. LANGE's Fund". The latter institution has by these means sponsored an annual mycological congress.

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København, October 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

SOME RESUPINATE FUNGI COLLECTED IN NORWAY NORTH OF THE POLAR CIRCLE

By J. BREGNHØJ LARSEN

SUMMARY

Of 44 resupinate fungus species collected in Norway north of the Polar Circle only one is not found in Denmark, namely *Tubulicrinis borealis* J. ERIKSS. The resupinate fungus flora in Denmark and on the finding places in Norway is, in spite of the big distance (more than 1300 km), very alike.

During visits to Norway in 1963 and in 1968 I had the opportunity to collect resupinate fungi. The collections were made in the end of July and at the beginning of August. When I venture to put into print this list of species it is because until now very little has been published about that group of fungi found in Norway north of the Polar Circle. I have collected resupinate fungi in Denmark for some years and was curious to know how a "bouquet" of resupinate species would be composed, when picked so far north. To my great astonishment the "bouquet" (with very few exeptions) looked just as one taken in Denmark.

The fungi were collected in the vicinity of Bodø (100 km north of the Polar Circle) and around Narvik (more than 200 km n. of the Polar Circle). Lake Soløyvatnet (10 km n. e. of Bodø) was the only place where I stayed for a longer time; many of the other finds are so to say made at the road side. The fungi are all taken near the coast and never more than 2-300 m above s. l.

As fare as the latitudes are concerned, there are no places on the globe with so mild a climate as the western coast of Norway (due of course to the Gulf Stream).

E. g. Bodø 67° 17′ n.:

Mean temperature in February	÷2,8° C
Mean temperature in July	12,5° C
Yearly precipitation	870 mm
Duration of snow cover	ca. 4 month

In comparison with

København (Copenhagen) 55° 42′ n.:	
Mean temperature in January	0,4° C
Mean temperature in July	16,7° C
Yearly precipitation	533 mm

Snow cover is formed annually but is a very irregular phenomenon.

At Lake Soløyvatnet the soil consists of weathered cambro-silurian schists and therefore is very fertile. The natural plant cover is birch forest mixed with *Sorbus aucuparia, Populus tremula, Salix* species and *Juniperus communis*. The forest floor is covered with a very rich vegetation of herbs; the most caracteristic species are *Geranium silvaticum, Filipendula ulmaria, Crepis paludosa* and the fern *Dryopteris phegopteris*. In humid places *Mulgedium alpinum* and *Aconitum septentrionale* are very common. The birch forest is often interrupted by small mires. *Pinus silvestris* is very rare in the vicinity of Lake Soløyvatnet, and *Picea abies* is only found in plantations; the spruce thrives well but the seeds don't ripen.

During my stay in 1968 the weather was very bad, it rained continually from morning to night. The fungus flora was very scanty and I got the idea, that the fungi for the most part were simply drowned.

ABBREVIATIONS

Sol. = Lake Soløyvatnet.
(B) = in the vicinity of Bodø.
(N) = in the vicinity of Narvik.

LIST OF SPECIES

1. *Amphinema byssoides* (PERS. ex FR.) J. ERIKSS.
Sol. 1.VIII-8.VIII 1963 (7 coll.) on *Betula, Juniperus, Picea,* and mosses.
Sol. 2.VIII-4.VIII 1968 (5 coll.) on *Betula* and *Picea.*
Very common in Denmark.

2. *Bjerkandera adusta* (WILLD. ex FR.) KARST. f. *resupinata.*
Sol. 6.VIII 1968 on *Betula.*
Very common in Denmark.

3. *Botryobasidium obtusisporum* J. ERIKSS.
Sol. 3.VIII 1963 on *Juniperus.* Bodø 10.VIII 1968.
Several danish finds.

4. *Botryobasidium subcoronatum* (HÖHN. & LITSCH.) DONK.
Nygårdsfjell (N) 22.VII 1963 on *Betula;* Skafoss (N) 27.VII 1963; Sol. 7.VIII 1963 on *Betula;* Misvær (Salten) 6.VIII 1963 on *Betula;* Heggmovatnet (B) 6.VIII 1968 on *Pinus.*
Very common in Denmark.

5. *Botryohypochnus isabellinus* (FR.) J. ERIKSS.
Sol. 31.VII-7.VIII 1963 (4 coll.) on *Betula;* Sol. 10.VIII 1968 on *Betula.*
Very common in Denmark.

6. *Corticium bicolor* PECK.
Narvik 25.VII 1963 on *Pinus*
Common in Denmark

7. *Corticium tuberculatum* KARST.
Forså (N) 24.VII 1963 on *Alnus.*
Very common in Denmark.

8. *Cristella farinacea* (PERS. ex FR.) DONK.
Forsnes elva (N) 23.VII 1963; Forså (N) 24.VII 1963; Tårstad Mark (N) 26.VII 1963; Sol. 2.VII-3.VII 1963 on *Betula;* Sol. 1.VIII-4.VIII 1968 on *Betula.*
Very common in Denmark.

9. *Cristella sulphurea* (PERS. ex FR.) DONK.
Heggmovatnet (B) 6.VIII 1968 on *Betula.*
Very common in Denmark.

10. *Fibuloporia reticulata* (PERS. ex FR.) BOND.
Sol. 7.VIII 1963 on *Betula;* Sol. 2.VIII 1968 on *Betula.*
Very common in Denmark.

11. *Hymenochaete cinnamomea* (PERS.) BRES.
Sol. 7.VIII 1963 on *Betula.*
Several danish finds.

12. *Hypochnicium lundellii* (BOURD. in J. ERIKSS.) J. ERIKSS.
Sol. 31.VIII 1963 on *Betula.*
Several danish finds.

13. *Hypochnicium punctulatum* (COOKE) J. ERIKSS.
Skafoss (N) 24.VII 1963; Sol. 31.VII 1963 on *Alnus*.
Common in Denmark

14. *Hypochnicium sphaerosporum* (HÖHN. & LITSCH.) J. ERIKSS.
Sol. 10.VIII 1968 on *Betula*.
Common in Denmark

15. *Hyphoderma radula* (FR. ex FR.) DONK.
Sol. 3.VIII 1963 on *Betula;* Narvik 25.VII 1963 on coniferous and frondose wood; Bodø 1.VIII 1968 (2 coll.); Sol. 6.VIII 1968 on *Betula*.
Very common in Denmark.

16. *Hyphoderma roseocremeum* (BRES.) DONK.
Forsneselva (N) 25.VII 1963 on *Pinus;* Svolvær (Lofoten) 28.VII 1963.
Very common in Denmark.

17. *Hyphoderma setigerum* (FR.) DONK.
Bjørnefjell (N) 22.VII 1963 on *Salix* sp.; Forså (N) 24.VII 1963 on *Betula;* Skafoss (N) 24.VII 1963 on *Betula;* Straumsnes (N) 27.VII 1963; Sol. 31.VII-5.VIII 1963 (4 coll.) on *Betula;* Sol. 4.VIII-10.VIII 1968 on *Betula*.
Very common in Denmark.

18. *Hyphoderma tenue* (PAT.) DONK.
Forså (N) 24.VII 1963 on *Betula;* Skafoss 24. VII 1963 on *Betula;* Sol. 3.VIII 1963 on frondose wood; Bodø 1.VIII 1968 on *Betula;* Sol. 4.VIII 1963 (3 coll.) on *Picea* and *Betula*.
Very common in Denmark.

19. *Hyphodontia breviseta* (KARST.) J. ERIKSS.
Sol. 4.VIII 1968 on *Picea*.
Very common in Denmark.

20. *Hyphodontia crustosa* (PERS. ex FR.) J. ERIKSS.
Sol. 2.VIII 1963 on frondose wood.
Very common in Denmark.

21. *Hyphodontia hastata* (LITSCH.) J. ERIKSS.
Forså (N) 24.VII 1963.
Several danish finds.

22. *Hyphodontia subalutacea* (KARST.) J. ERIKSS.
Nygårdsfjell (N) 22.VII 1963; Sol. 1.VIII 1963 on *Picea;* Bodø 1.VIII 1963 (3 coll.); Sol. 4.VIII 1968.
Very common in Denmark.

23. *Merulius tremellosus* SCHRAD. ex FR.
Sol. 2.VIII 1968 on *Betula.*
Very common in Denmark.

24. *Oidium conspersum* (LINK) LINDER.
(Conidial stage of *Botryobasidium conspersum* J. ERIKSS.).
Sol. 5.VIII-7.VIII 1963 on *Betula;* Sol. 2.VIII 1968 on *Picea;* Sol. 4.VIII 1968 on *Betula.*
Common in Denmark

25. *Peniophora (Membranicium) affinis* BURT.
Sol. 5.VIII 1963 on *Juniperus.*
Several danish finds.

26. *Peniophora (Membranicium) cremea* BRES.
Sol. 3.VIII 1963 (2 coll.) on frondose wood; Heggmovatnet (B) 6.VIII 1968; Sol. 10.VIII 1968 (2 coll.) on *Betula.*
Very common in Denmark.

27. *Peniophora incarnata* (PERS. ex FR.) KARST.
Narvik 25.VII 1963 *Betula;* Sol. 5.VIII 1963 on *Betula;* Bodø 1.VIII 1963 on *Betula;* Sol. 10.VIII 1968 on *Betula.*
Very common in Denmark.

28. *Peniophora (Membranicium) sanguinea* (FR.) HÖHN. & LITSCH.
Forsneselva (N) 22.VII 1963 on *Betula.*
Common in Denmark

29. *Peniophora (Stereum) laevigata* (FR.) KARST.
Sol. 2.VIII-8.VIII 1963 on *Juniperus.*
Very common in Denmark.

30. *Phlebia hydnoides* (COOK & MASSEE) M. P. CHRIST.
Sol. 1.VIII-7.VIII (5 coll.) on *Betula;* Sol. 4.VIII 1968 (2 coll.) on *Betula* and *Picea.*
Very common in Denmark.

31. *Sebacina effusa* (BREF.) PAT.
Svolvær (Lofoten) 28.VIII 1963 on *Betula.*
Not rare in Denmark.

32. *Sistotrema brinkmannii* (BRES.) J. ERIKSS.
Sol. 31.VII 1963 on *Betula;* Narvik 25.VII 1963 on *Betula.*
Very common in Denmark.

33. *Stereum (Lopharia) chailletii* (PERS.) FR.
Sol. 4.VIII 1968.
Several danish finds.

34. *Stereum rugosum* (PERS.) FR.
Bodø 1.VIII 1968 on *Betula*.
Very common in Denmark.

35. *Tomentella albomarginata* (BOURD. & GALZ.) M. P. CHRIST.
Sol. 5.VIII 1963 (2. coll.) on *Betula* and stem of fern.
Several danish finds.

36. *Tomentella echinospora* (ELLIS.) BOURD. & GALZ.
Sol. 3.VIII 1963 on moss.
Very common in Denmark.

37. *Tomentella subferruginea* (BURT.) SKOVST.
Sol. 8.VIII 1963 on *Juniperus*.
Very common in Denmark.

38. *Tomentella umbrina* (FR.) DONK.
Sol. 7.VIII 1963 (3 coll.) on frondose wood.
Very common in Denmark.

39. *Tomentellina bombycina* (KARST.) BOURD. & GALZ.
Bjørnefjell (N) 22.VII 1963 on *Betula*.
Several danish finds.

40. *Tubulicrinis borealis* J. ERIKSS.
Junkerdalen 9.VIII 1968 on *Pinus*.
Hitherto not found in Denmark.

41. *Tubulicrinis glebulosus* (BRES.) DONK.
Forså (N) 24.VII 1963; Skafoss (N) 24.VII 1963; Sol. 2.VIII-5.VIII 1963 (3 coll.); Bodø 1.VIII 1968 (3 coll.) on *Betula*.
Very common in Denmark.

42. *Tulasnella griseo-rubella* LITSCH.
Sol. 5.VIII 1963 on *Betula*.
Several danish finds.

43. *Tulasnella lactea* BOURD. & GALZ.
Sol. 10.VIII 1968 (2 coll.).
Several danish finds.

44. *Tulasnella rutilans* (JOHAN-OLSEN) BRES.
Heggmovatnet (B) 6.VIII 1968.
Several danish finds.

It is with some hesitation that I have named this *Tulasnella* species. It was found when I examined the texture of a specimen of *Botryobasidium subcoronatum*. The spores which have the characteristic

strongly curved form of *T. rutilans* spores, are perhaps a little smaller in size (7.5-10 × 2.5-3 μ). The epibasidia are similar to those of *T. rutilans*. M. P. CHRISTIANSEN describes in "Danish resupinate fungi" (1959) a find of a *Tulasnella* species similar to mine. This species was also included in the texture of a *Botryobasidium subcoronatum*. Is it a form (variety) of *Tulasnella rutilans* or a species of its own?

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Allerød, Denmark, September 1968.

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THE THERMOPHILIC FUNGUS HUMICOLA LANUGINOSA

By ERIKA LÖHR and J. OLSEN

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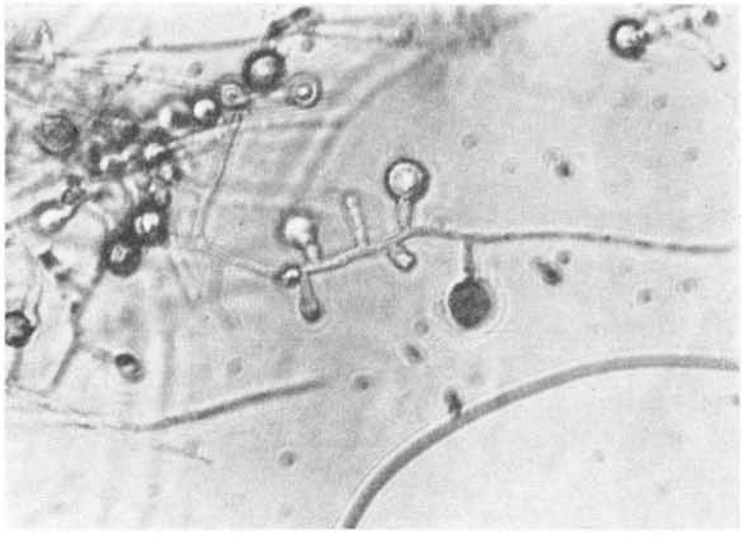
ABSTRACT

The thermophilic, imperfect fungus *Humicola lanuginosa* (GRIFFON et MAUBLANC) BUNCE was isolated from compost and farmyard manure. Optimal growth at 45°-50° C. The fungus excrets amylase and a deep red, water soluble pigment.

When YpSs-agar (Yeast-Starch agar) after EMERSON (4 g Difco powdered yeast extract; 1 g K_2HPO_4; 0,5 g $MgSO_4$, 7 H_2O; 15 g starch; 20 g agar; 1000 ml water) is inoculated with compost or farmyard manure the most likely microorganisms to develop at 53°-55° C are some *Actinomycetes* and the imperfect fungus *Humicola lanuginosa* (GRIFFON et MAUBLANC) BUNCE. *Humicola lanuginosa,* not before mentioned from Denmark, is the fungus with highest maximum temperature for growth (COONEY & EMERSON 1964). The fungus excrets amylase in the medium. It forms a deep red, water soluble substance, which gives the medium in the elder cultures a deep red colour. CRISAN (1962) has chromatographically separated the colouring matter in four different pigments. The aleuriospores are dark brown when old.

Humicola lanuginosa does not develop below about 30° C, optimal growth occurs at about 45°-50° C and there is no growth over 58°-59° C. According to MÜLLER (1946) optimal growth temperatures differentiate between *psychrophilic* (optimum below 20° C), *mesophilic*



Humicola lanuginosa (GRIFFON et MAUBLANC) BUNCE.
From a 5 days old culture on YpSs-agar by 52°-54° C, 1968. — × 700.

(optium between 20° C and 40° C), and *thermophilic* (optimum over 40° C) microorganisms. Thus *Humicola lanuginosa* is indeed a thermophilic organism.

Humicola lanuginosa was isolated from compost from the Botanical Garden, Copenhagen, and from farmyard manure from Allindelille in the middle of Zealand. We got another culture from amanuensis J. KOCH, The Royal Veterinary and Agricultural University, Copenhagen, who isolated it from manure for mushroom-growing.

Copenhagen, September 1968.

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ÜBER EINIGE KRITISCHE ODER NEUE CORTINARIEN AUS DER UNTERGATTUNG MYXACIUM FR. AUS SMÅLAND UND HALLAND

Von M. MOSER

Innsbruck

SUMMARY

A section *Defibulati* sect. nov. is proposed within *Cortinarius* FR. subgenus *Myxacium* FR. based on the complete lack of clamp connections in several closely related species. A new species, *Cortinarius pangloius* spec. nov., is described based on material both from Halland and Slovenia (Yugoslavia) and *C. mucifluus* ss. FR. is discussed on the basis of collections from the region around Femsjö (Småland).

Seit dem Jahre 1954 war es mir sechsmal möglich in Schweden Pilzstudien zu treiben. Dabei wurde auch in der Regel Femsjö und angrenzende Gebiete Smålands und Hallands für einige Zeit besucht und dort Pilzmaterial aus fast allen *Agaricales*-Gruppen, besonders aber aus der Gattung *Cortinarius* FR. gesammelt und studiert. Alle Perioden zwischen Mitte Juni und Mitte Oktober wurden jahreszeitlich berücksichtigt. Unter anderem fiel mir im Vergleich zum Alpenraum und süddeutschen Wäldern ein starker Reichtum an Formen aus der Untergattung *Myxacium* FR. auf. Dies erklärt vielleicht auch, warum manche der FRIES'schen Myxacien bei späteren Autoren fehlen oder falsch interpretiert worden sind. Ich möchte daher in einigen Beiträgen Vertreter dieser Untergattung vor allem auf Grund von Aufsammlungen aus Schweden näher beleuchten.

Cortinarius Fr. Subgen. **Myxacium** Fr.

Sektion **Defibulati** sect. nov.

Sporis magnis, valde verrucosis, limoniformibus sublimoniformibusve, rarior amygdaliformibus, hyphis defibulatis, cheilocystidiis vesiculosis usque claviformibus, pileo convexo, convexo-umbonato vel campanulato, saepe ± rugoso.

Typus sectionis *Cortinarius elatior* Fr., Epicrisis p. 274, 1838.

Dem Vorhandensein oder Fehlen von Schnallen wird verschiedentlich, besonders z. B. von Singer, grosses Gewicht beigelegt, und dieses Kriterium wird verschiedentlich als Gattungsmerkmal aufgefasst. Smith (1963) schreibt wohl zu Recht, dass die taxonomische Bedeutung dieses Merkmals im Lichte unserer gegenwärtigen Kenntnis neu überprüft werden müsse.

Innerhalb der Gattung *Cortinarius* Fr. ist die Schnallenbildung so allgemein verbreitet, dass das Fehlen von Schnallen zu den ganz seltenen Ausnahmen gehört. In dem äusserst umfangreichen Material aus verschiedensten Florengebieten der Erde, das ich bisher untersuchen konnte, habe ich diese Erscheinung nur innerhalb einer Gruppe von Myxacien beobachten können. Smith schrieb einmal, dass dem Fehlen von Schnallen bei Cortinarien kein besonders grosser taxonomischer Wert beigelegt werden könne. Immerhin bekommt man aber bei einem Vergleich der Arten, bei denen Schnallenbildung nicht nachgewiesen werden kann, den Eindruck, dass es sich um eine recht natürliche Gruppe handelt, die man zweckmässigerweise in eine Sektion zusammenfassen kann. An europäischen Arten gehören in diese Sektion: *C. elatior* Fr., *C. pseudosalor* Lge. *C. stillatitius* Fr. ss. Bres., *C. mucifluus* Fr., *C. mucifluus* ss. Ricken, K. & M., *C. pangloius* Mos.; eventuell auch *C. grallipes* Fr. und *C. arvinaceus* Fr., doch sind diese beiden Arten im Augenblick noch nicht genügend abgeklärt. Ferner sind einige nordamerikanische Art in die Gruppe zu rechnen. Weiters ist sie durch Nordasien und südwärts bis in den malayisch-indonesischen Raum mit einigen Arten vertreten, unter den Cleland'schen Aufsammlungen aus Australien konnte ich eine noch unbeschriebene Art nachweisen. Hingegen fehlt die Sektion völlig in Südamerika (ev. könnte man Vertreter noch im Kolumbianischen *Quercus*-Areal erwarten).

Vergleicht man die Arten so fällt auf, dass es sich meist um grössere Arten mit glockigem, gewölbt-gebuckeltem bis flacher konvexem Hut handelt, dessen Oberfläche bei vielen Arten ± stark runzelig sein

kann, der Hutrand ist in der Regel sehr dünnfleischig, fast häutig und feucht, oft durchscheinend gerieft. Die Stielform ist bei der Mehrzahl der Arten leicht doppelkonisch, d. h. von der Cortinazone an aufwärts und gegen die Basis verjüngt, seltener zylindrisch oder leicht keulenförmig (z. B. häufig bei *C. pseudosalor)*.

Mikroskopisch zeichnen sich die Vertreter der Sektion durch vorwiegend ± zitronenförmige, selten nur mandelförmige, grosse, ziemlich grob warzige Sporen, durch das Auftreten von blasenförmigen bis keuligen Cheilozystiden und eben das Fehlen von Schnallen in sämtlichen Teilen des Fruchtkörpers und auch am Mycel aus. Dem gegenüber sind bei den Vertretern der Sektion *Myxacium* [u. a. *C. collinitus* FR., *mucosus* (BULL. ex FR.) FR., *trivialis* LGE., *pumilus* (FR.) LGE., *favrei* MOS. ex HENDERSON, *alpinus* BOUD.] Schnallen stets vorhanden, Cheilozystiden fehlen meist.

In der Folge möchte ich auf zwei Arten aus der Sektion näher eingehen; die übrigen Vertreter der Reihe sollen in einem späteren Beitrag eingehender behandelt werden.

Cortinarius (Myxacium) pangloius spec. nov.

H u t stumpf kegelig bis flach gewölbt, gewölbt verbogen, Mitte etwas gebuckelt, Rand oft verbogen, 3-8 cm breit, Rand feucht durchscheinend gerieft, undeutlich hygrophan, stark schleimig schmierig, feucht dunkel graubraun, wässerig braun, hirschbraun, gegen den Rand oft gelbbraun bis heller rehbraun, (Mitte ca. R III Amber Brown bis XIV Hazel, Rand ca. XV Tawny bis fast III mars Yellow), ausserster Rand noch heller und jung weisslich, bisweilen jung auch mit olivlichem Ton, trocken insgesamt heller gelbbraun, bisweilen fast häutig, manchmal auch bis zur Hälfte des Radius runzelig.

L a m e l l e n jung fast weisslich, dann tonbraun, milchkaffeebraun, alt grau-rostbraun (R XV Ochraceous Buff, dann ca. III Mars Yellow bis XV Ochraceous Orange), dünn, sehr breit, 6-15 mm (= 6-15 × Hutfleischdicke), Schneide grob schartig, mässig gedrängt, L = ca.60, l = 1-3, abgerundet bis schwach oder stark ausgebuchtet angewachsen.

S t i e l in der Jugend bauchig, dann fast zylindrisch und die Basis wurzelnd zuspitzend oder leicht spindelig, seltener leicht keulig 4-8 cm lang, 10-18 mm dick, weiss bis weisslich, Spitze längsfaserig, unterhalb der Cortinazone stark schleimig, unterhalb des Schleimes die Oberfläche nicht oder kaum flockig aufreissend.

Fleisch im Stiel weisslich, im Hut feucht wässerig braun. Geruch unbedeutend, Geschmack mild.

Mikroskopische Merkmale. Sporen 10,5-13-(14) × 6,5-8 µ, dunkel gelbbraun, auffallend dickwandig, grob warzig, mandelförmig bis sublimoniform, apikales Ende jedoch nicht glatt. — Basidien 4-sporig 35-45 × 10-12 µ, Sterigmen 3,5-4,5 µ, hyalin, keulig, Inhalt körnig. — Lamellentrama regulär, Hyphen 7-14 µ dick, hyalin, z. T. durchsetzt mit stark goldbraunen, z. T. glatten, z. T. körnigen Oleiferen (5-9 µ). — Cheilozystiden an jungen Exemplaren deutlich, an alten manchmal nicht mehr zu beobachten, blasenförmig, keulig oder leicht bauchig, 20-40 (45) × 12-18 (20) µ. — Velum universale gelatinisiert, aus 3,5-4,5 µ dicken, hyalinen, schnallenlosen Hyphen. Cortinahyphen hyalin, 3-4 µ dick, ohne Schnallen. — Huthaut mit gelatinöser Epikutis von ca. 70-100 µ Dicke, aus 3,5-5 µ dicken, hyalinen, locker verflochtenen, schnallenlosen Hyphen, die z. T. ± aufgerichtet sind und nur in der obersten Schicht liegen. An der Basis geht diese Schicht in eine dünne Schicht ± parallel liegender, ebensolcher Hyphen über die dann in eine subzelluläre, hyaline (nur basal leicht pigmentierte) Schicht übergeht. Unter dieser folgt die gelbbraun (membranär) pigmentierte Schicht aus 5-10-20 µ dicken Hyphen, auch mit Oleiferen untermischt (Schichtdicke 70-120 µ). Huttrama subzellulär dickhyphig, Membranen in KOH sehr blass gelblich bis hyalin. — Stielhyphen hyalin, 6-20 µ, ohne Schnallen. — Basalmycelium ohne Schnallen.

Stand. Unter *Fagus silvatica* auf Erde zwischen Laub oder an grasigen Stellen, Typus 64/110, 22.8.1964, bei Mahult, Halland, Sweden. Weitere Kollektion: 63/715, 8.10.1963, bei Smartno südöstlich von Ljubljana, Slowenien, Jugoslavien.

Anmerkungen. Die beiden ziemlich weit auseinander liegenden Fundorte (Halland, Slowenien) deuten darauf hin, dass diese Art in Europa sicher weiter verbreitet ist. Trotzdem war es mir nicht möglich in der europäischen und nordamerikanischen Literatur eine Art zu finden, deren Beschreibung sich zufriedenstellend mit meinen Funden decken würde. Durch das Fehlen von Schnallen reiht sie sich in die Sektion *Defibulati* ein, weicht von allen anderen Arten der Reihe durch die feucht auffallend dunkle, braune Hutfarbe und den weissen Stiel ab.

Diagn. lat. Pileus obtuse conicus vel convexus, interdum umbonatus, 3-8 cm latus, indistincte hygrophanus, margine udo jove pellucido-striato, aquose et obscure brunneus, cervinus, marginem versus saepe flavobrun-

neus, juventute passim olivaceo-inhalatus, margine vero juventute albidulo, sicco totius flavobrunneus, valde glutinosus, interdum ad dimidium pilei hemidiam. rugulosus. Lamellae ex albidulo argillaceae, postremo griseo-ferrugineae, perlatae (6-15 mm), acie serrulatae, subconfertae, adnatae usque ± emarginatae. Stipes primo subfusoideus, dein subcylindraceus, basi radicante, rarior clavatus, 4-8 cm × 10-18 mm, albus vel albidulus, infra cortinam valde glutinosus. Caro stipitis albidula, pilei udo aquvse brunnea. Inodorus, sapor mitis.

Sporae amygdaliformes vel sublimoniformes, valde verrucosae, 10,5-13 (14) × 6,5-8 μ, basidia 4-sterigmatices, 35-45 × 10-12 μ, cheilocystidia vesiculosa vel claviformes, 20-40 (45) × 12-18 (20) μ.

Habitatio in silvis frondosis sub *Fago silvatica,* typus 64/110, 22.8.1964, prope Mahult, Hallandia, Suecia. Typus in herbario Moser (IB) asservatur.

Cortinarius (Myxacium) mucifluus Fr.

Bei den meisten mittel- und westeuropäischen Autoren (Ricken, Konrad & Maublanc, Kühner & Romagnesi, Henry u. a.) wird unter diesem Namen ein im Laubwald wachsender Pilz verstanden. Orton (1960) will diesen Laubwaldpilz mit *C. pseudosalor* Lge. identifizieren, ein Vorgang welchem ich nicht folgen kann. Ich gebe aber zu, dass bei manchen Autoren *C. pseudosalor* als *C. mucifluus* aufgefasst sein mag oder mit dem "Laubwald-*mucifluus*" zumindest vermengt worden ist. Ferner wird bei manchen Autoren (u. a. Fries 1884) auch noch *C. trivialis* Lge. als *C. mucifluus* beschrieben.

Dem gegenüber betont Fries jedoch bereits 1838: "I n p i n e t i s c o p i o s e". Dies wurde von den meisten Autoren nicht beachtet, da früher auch Standortsfaktoren, Begleitpflanzen etc. als taxonomisches Merkmal kein sonderliches Gewicht beigelegt wurde. Orton ist der einzige, der auf diesen Umstand ausdrücklich aufmerksam macht. Er vertritt aber die Meinung, dass die Beschreibung bei Fries 1838 aus einer Mischung von mehreren Arten besteht und der Name *C. mucifluus* daher als *nomen confusum* zu verwerfen sei. Er beschreibt dann unter dem Namen *"Cortinarius pinicola"* ein *Myxacium* aus schottischem Kiefernwald, von dem er vermutet, dass es die Hauptkomponente des Fries'schen *C. mucifluus* darstelle.

Ich kann mich dieser Meinung nicht anschliessen. In der Regel sind Arten, die Fries als c o p i o s e bezeichnet, im Typusgebiet nicht sehr schwer aufzuklären. Dies trifft umso mehr bei Kiefernwaldarten zu, da diese Bestände seit Fries keine nennenswerten Änderungen erfahren haben.

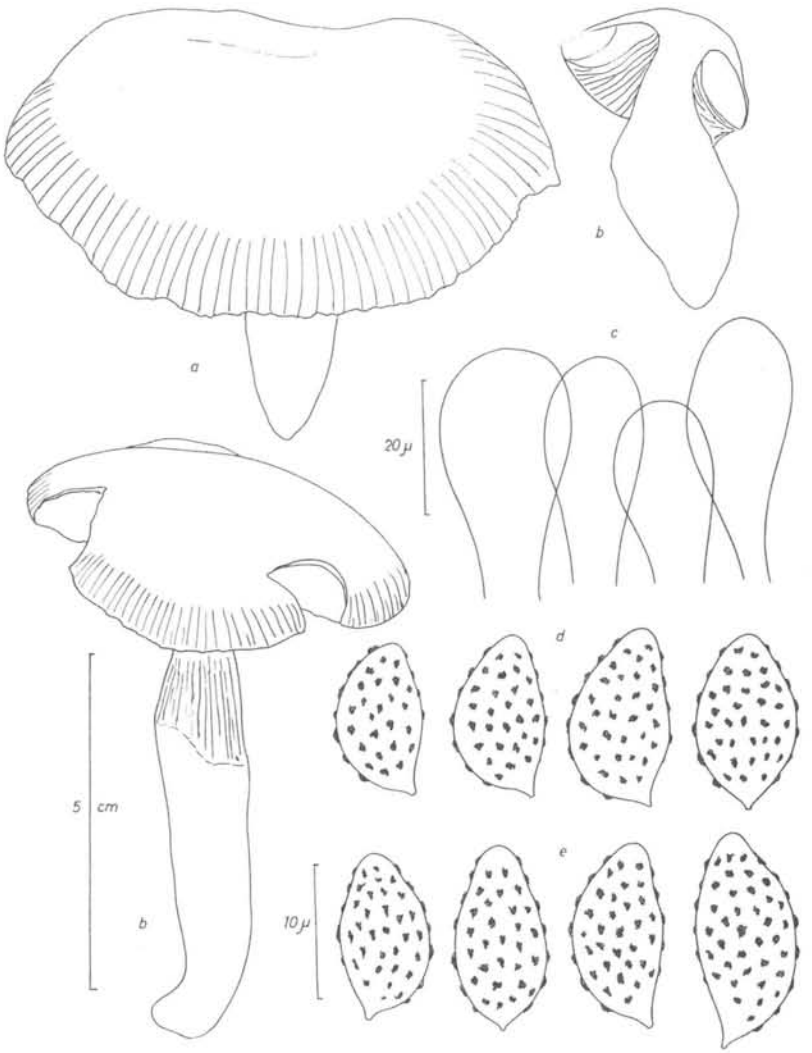

Fig. 1. *Cortinarius pangloius* sp. nov.
a. Fruchtkörper aus Koll. 63/715; b. desgl. aus Koll. 64/110; c. Cheilozystiden aus Koll. 63/715; d. Sporen von Koll. 63/715; e. Sporen von Koll. 64/110.

Beim Studium der Cortinarienflora in den Sammelgebieten von FRIES um F e m s j ö bin ich seit 1954 nicht selten auf ein *Myxacium* gestossen, das dann besonders im Herbst 1957 im Gebiet sehr reichlich vertreten war, in dem sich unschwer der von FRIES unter dem Namen *C. mucifluus* beschriebene Pilz wieder erkennen lässt und der mich

zu der Ansicht bringt, dass bei FRIES keineswegs eine Mischung mehrerer Arten vorliegt. Ich sehe daher keinerlei Veranlassung, den Namen zu verwerfen. Der einzige Umstand, der eventuell die Vermutung nahelegen könnte, dass in der FRIES'schen Beschreibung 1838 noch Elemente einer zweiten Art stecken könnten ist der, dass FRIES 1838 schreibt: „Stipes albus leviter coerulescens", 1851 hingegen: „Nil in toto fungo violacei". Nach meinen Beobachtungen an dem reichlichen Material im Jahre 1957 konnte ich feststellen, dass der Stiel der Art fast stets weiss ist, nur bei ganz vereinzelten Exemplaren kann man in der Jugend einen undeutlichen, bläulich-violettlichen Ton im schleimigen Teil des Stieles beobachten.

Ich halte es für ziemlich sicher, dass ORTON's *C. pinicola* mit *C. mucifluus* FR. identisch ist, auch wenn ORTON die Hutfarbe etwas dunkler angibt, als ich sie in Småland beobachten konnte. Aber da ich aus den oben angeführten Gründen *C. mucifluus* nicht als *nomen confusum* betrachten kann, sehe ich auch keinerlei Notwendigkeit für einen neuen Namen. Ich gebe im folgenden eine Beschreibung nach Material aus Femsjö:

H u t jung unregelmässig glockig, dann stumpf kegelig, glockig-ausgebreitet, 4-12 cm breit, stark mit hyalinem Schleim bedeckt, feucht dunkler gelbbraun bis hell holzbraun, seltener etwas olivgelblich, trocken tonblass, lederblass, Rand etwas durchscheinend gerieft, aber die Oberfläche jung glatt, älter häufig glatt bleibend, manchmal aber auch gegen den Rand leicht runzelig werdend und etwas eingewachsen faserig, ziemlich dünnfleischig, Rand häutig.

L a m e l l e n graubraun (jung fast weisslich), später mehr gelbbraun bis hell gelbrostbraun, Schneide heller und fein flockig, im Alter dann meist gleichfarbig, ziemlich gedrängt, L = 60-80 (90), l = 1-3, ziemlich breit, 7-15-20 mm, flach ausgebuchtet angewachsen, Schneide uneben bis schartig.

S t i e l meist zur Gänze weiss, höchstens ganz jung an einigen Exemplaren mit undeutlich blauviolettlichem Ton, später unterhalb der Cortinazone feiner oder gröber flockig zerreissend, bisweilen auch in 2-4 Flockenzonen angeordnet, 10-20 cm lang, 10-25 mm dick, leicht spindelig, d. h. oberhalb der Cortina gegen die Spitze und abwärts gegen die Basis etwas verjüngt, jedoch seltener stark doppelkonisch, oft tief im Boden steckend (bis zu 2/3 der Stiellänge beobachtet).

F l e i s c h im Hut und Stiel weisslich oder im Hut leicht lederblass, seltener auch in der Stielrinde, besonders an älteren Exemplaren. Geruch unbedeutend, eher angenehm, Geschmack mild.

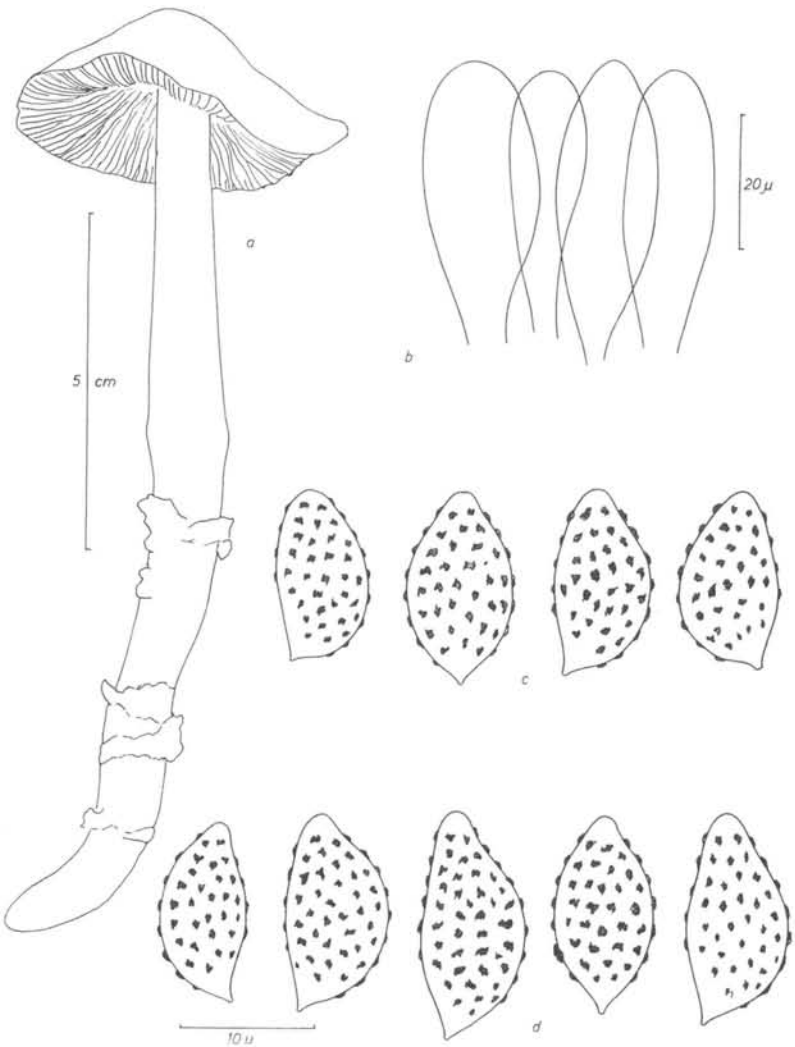

Fig. 2. *Cortinarius mucifluus* Fr.
a. Fruchtkörper von Koll. 57/5; b. Cheilozystiden von Koll. 57/5; c. Sporen von Koll. 57/30; d. Sporen von Koll. 57/5.

Mikroskopische Merkmale. Sporen selten mandelförmig, meist zitronenförmig oder zumindest sublimoniform, gelbbraun, manchmal ziemlich dunkel, grob warzig, 12-15,8 (17) × 7-8,5 (9) µ. — Basidien 4-sporig, 34-42 × 9-12,5 µ, keulig, Sterigmen 4-5 µ lang, oft mit körnigem, gelblichem Inhalt. Bisweilen auch einzelne Phaeo-

basidiolen. Zystiden an der Schneide an jungen Exemplaren reichlich, blasenförmig-pedicellat bis keulig, 30-34 × 12-18 μ, an älteren Exemplaren oft schwindend und dann oft nicht mehr zu beobachten. — Velum universale gelatinisert, aus 2-4 μ dicken Hyphen ohne Schnallen, hyalin. — Hut mit gelatinöser Epikutis aus 2-4 μ dicken, schnallenlosen, hyalinen, liegenden, leicht verflochtenen Hyphen, terminale Glieder bisweilen etwas angeschwollen, basal in eine ± zellige, hyaline, dünne Schicht (ca. 2 Lagen) übergehend. Darunter folgt die pigmentierte Schicht mit 5-14 μ dicken Hyphen ohne Schnallen, mit gelblichen bis gelbbraunen Membranen. Subkutis fehlend oder Hyphen nur leicht dicker. Schnallen fehlen auch am Basismycel.

S t a n d meist in reinem Kiefernwald *(Pinus silvestris)* oder auch in *Pinus-Picea*-Mischbeständen, aber stets bei *Pinus* wachsend. Untersuchtes Material: 57/5 (Herb. MOSER), Femsjö, Österskog, an der Abzweigung des Weges zur Nordseite des Femmen von der Strasse nach Bygget, 4.9.1957 und 57/30 (Herb. MOSER), Södra Bökeberg, Femsjö, 6.9.1957. Damals im gesamten Gebiet häufig.

A n m e r k u n g. Wenn man die Beschreibung ORTON's von seinem *C. pinicola* vergleicht, so liegt meines Erachtens der einzige Unterschied in der dunkleren Hutfarbe, die ORTON als fast jener von *Amanita fulva* gleichend bezeichnet. So dunkle Farben habe ich nicht beobachtet, doch halte ich es durchaus für möglich, dass auch diese noch in den Variationsbereich der Art fallen, wenn man eine ähnliche Variabilität der Hutfarbe bei anderen Myxacien berücksichtigt. Leider macht ORTON keine Angaben über das Fehlen bzw. Vorhandensein von Schnallen, ein Merkmal, das für diese Gruppe ja besonders typisch ist.

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Innsbruck, August 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

LASIOSPHAERIA HETEROTRICHA N. SP.

A NEW PYRENOMYCETE FROM VERY ROTTEN WOOD

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SUMMARY

A small Pyrenomycete at present referable to *Lasiosphaeria,* but with small, oval spores, is described as *Lasiosphaeria heterotricha* n. sp. It is pointed out how this species represents a combination of characters which has not been described previously.

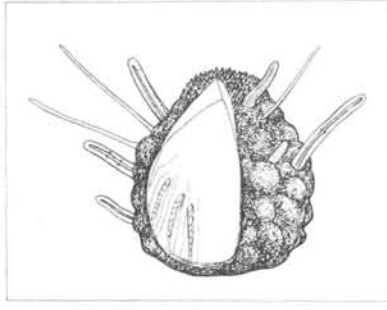
Lasiosphaeria heterotricha n. sp.

Perithecia superficialia, ostiolo inconspicuo, c. 225 μ diametro, plus minusve pilosa. Pili 1) 100-150 μ longi, c. 5 μ crassi, rigidi, atrofusci, ad apicem saepe fere hyalini, interdum phialophori. 2) 50-100 μ longi, 13-14 μ crassi, obtusi, interdum septati, pallide fusci, pariete c. 5 μ crasso instructi, extus punctato-sculptati vel quidem scabrosi. — Peridium 22-26 μ crassum. Pars externa pallide fusca, ex cellulis 7-9 μ diametro composita; extus tuberculata, tuberculis rotundatis, 20-25 μ latis. Pars interna ex cellulis hyalinis, collabentibus composita. — Ostiolum 50-60 μ diametro, leniter radiato-sulcatum, ex hyphis verticalibus atrofuscis 3-4 μ crassis compositum. — Asci cylindracei, sessiles, 55-65 × 3.5-6 (-8) μ, ad apicem leniter invaginati, annulo parvulo instructi. Paraphyses fere copiosae, 1-1.5 μ crassae. — Ascosporae uniseriatae vel irregulariter uni-biseriatae, non septatae, late ovatae, 10-11 × 5-6 μ, hyalinae vel dilutissime fuscidulae, episporio plus minusve minute punctato-spinuloso. Ascosporae ejectae interdum uniseptatae, phialidibus germinantes.

In ligno putridissimo. Typus die 3. decembri 1963 in silva Jægersborg Dyrehave prope Hafniam Daniae ab A. MUNK collectus; habitat truncus *Fagi silvaticae*.

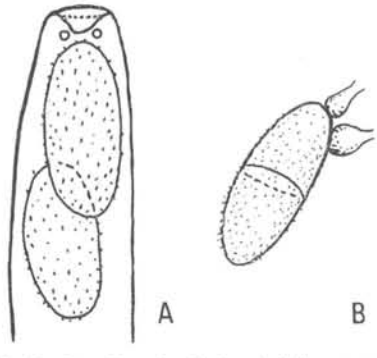
Lasiosphaeria heterotricha n. sp.

Perithecia superficial, subspheric with an inconspicuous ostiole, ca. 225 μ diam., with two different types of hairs: 1) 100-150 μ long, 5 μ thick, rigid, dark brown and thick-walled, springing from a broad base; most often they have hyaline tips producing phialospores or merely growing. 2) Short, blunt, occasionally septate hairs of the *Lasiosphaeria canescens*-type, 50-100 μ long, 13-14 μ thick; cell-wall 5 μ thick, very light brown, with a finely punctate to coarsely scaly surface (Fig. 1).



1. *Lasiosphaeria heterotricha* n. sp. Perithecium. — × 100.

Peridium 22-26 μ thick. Outer half light brown, cells 7-9 μ diam., some of the surface cells aggregating into low, rounded tubercles, 20-25 μ wide at their bases. The cell-walls are generally thin, but may on the external surface of the tubercles become rather thick, light brown as in the hairs of type 2). Inner half of the peridium built of collapsed, indistinct cells. – Ostiole almost at the level of the body, 50-60 μ diam.; the surface of the ostiole is made up of a palisade of very dark brown, 3-4 μ thick, rounded ends of hyphae forming slight radiating ridges.



2. *Lasiosphaeria heterotricha* n. sp. Ascus-top (A) and germinating spore (B). — × 2000.

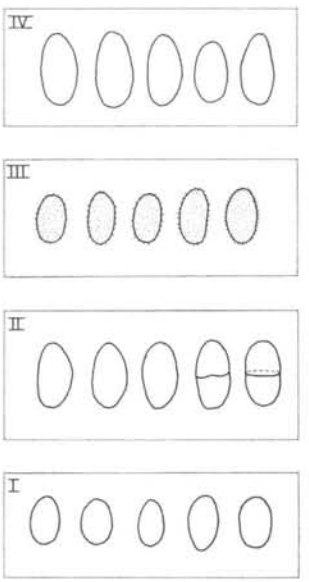
Asci 55-65 × 3.5- (-8) μ, subcylindric, almost sessile; apical structure as in e. g. *Coniochaeta* (Fig. 2 A); empty asci costate. Paraphyses 1-1.5 μ thick, rather abundant.

Ascospores 10-11 × 5-6 μ, 1-seriate (or irregularly 1-2-seriate), oval, 1-celled, hyaline or with a very faint tinge of light brown-

ish; epispore minutely punctate-spinulose. In discharged spores a septum may occur; they are seen in large number germinating by short, flask-shaped phialides (Fig. 2 B).

On a very rotten stump, probably of *Fagus*. — Denmark, Zealand: Jægersborg Dyrehave 3/XII 1963.

Another specimen of this fungus (Zealand: Jægersborg Dyrehave 22/XI 1964) shows a remarkable variability: The perithecia are from 200 to 400 μ in diameter. Some perithecia are naked; others are richly covered with the black type of hair with a subhyaline tip, tapering from 10 to 3 μ in thickness; others again are abundantly covered with the light-coloured, thick-walled, scabrous hairs. The variation from one perithecium to another in the spore characters is illustrated in Fig. 3. A correlation may be traced between perithecium-size, hairiness and spore size, inasmuch as the large perithecia generally have black hairs and large spores, but this certainly does not seem sufficient for taxonomic segregation within the material; my conclusion is that this species is labile in size of perithecia and spores as well as in differentiation of hairs. It is very stabile, however, in the peridium structure: all perithecia examined have the same tuberculate, pellucid perithecium with a tendency of radiating ridges of small cells near the ostiole.



3. *Lasiosphaeria heterotricha* n. sp. Ascospores from four different perithecia. — × 800.

DISCUSSION

The costate asci with an apical apparatus typical of e. g. *Coniochaeta,* are characters strongly indicating the family of *Sordariaceae* (sensu lato) as a natural place for this fungus. This family is already notorius for non-correlation of characters (see CARROLL & MUNK 1964 for a thorough discussion of this problem), and indeed, once again a new combination of characters has turned up in this species: Hairs of the *Lasiosphaeria canescens*-type (as well as dark hairs of

the *L. hispida*-type!) combined with a (slightly) sulcate ostiole, a tuberculate peridium, very small asci and a punctate-sculptate epispore. The spore-shape is unique — apart from *Coniochaeta,* the spores of which are very different in every other respect.

The genus *Lasiosphaeria* at present serves as a rubbishheap for peculiar members of the family (cp. CARROLL & MUNK l. c.), and this is my principal reason for introducing the present fungus as a *Lasiosphaeria.* However, the formation of phialides at the germination of the spores gives fair support for this decision (cp. again CARROLL & MUNK l. c.).

Type material is deposited in Botanical Museum, Copenhagen. — Furthermore, abundant material is ready for distribution to a limited number of herbaria.

RESUMÉ

Kernesvampslægten *Lasiosphaeria* omfatter primært arter med lange, ormformede sporer. Imidlertid viser visse arter med ovale sporer i deres øvrige bygning så mange lighedspunkter med de typiske *Lasiosphaeria*-arter, at de indtil videre med rimelighed kan placeres i samme slægt. Den her beskrevne art, som er fundet flere gange i Jægersborg Dyrehave, afviger drastisk fra hidtil beskrevne arter ved sine ganske små, bredt ovale sporer.

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Copenhagen, September 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

SVAMPE AFBILDET I STEN

Af D. MÜLLER

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SUMMARY

Toadstools carved in stone.

In the plinth of Palace Hotel, build 1909-1910, in Copenhagen there are seven granite blocks in which the danish artist ARNE BASSE has portraied *Amanita muscaria* (L.) FR., *Coprinus comatus* (MÜLLER) FR., *Morchella esculenta* (PERS.) FR., *Cantharellus cibarius* FR., *Boletus edulis* (BULL.) FR., *Lepiota rhacodes* (VITT.) FR., and *Psalliota bispora* (LGE.) SCHÄF. & MÖLLER.

Skovens svampe, efterårets flygtige hilsen, blev sjældent afbildet i ældre tid. Det ældste kendte billede stammer fra det Pompei, som blev dækket af askeregnen fra Vesuv år 79, beskrevet af COMES i 1879, l. c. p. 185-186. Han kalder svampen *Agaricus deliciosus*. Et andet berømt gammelt billede findes som freske i et romansk kapel ved slottet Plaincourault, departement Indre i Frankrig. Det forestiller en mærkværdig forgrenet, mandshøj fluesvamp, *Amanita muscaria*, der fungerer som kundskabens træ og derfor er forsynet med både Eva og slangen. Denne kundskabens svamp på godt og ondt er beskrevet af GUÉGUEN et al. (1911), også omtalt af FERDINANDSEN (1913).

Svampe afbildet i sten er endnu sjældnere, ældst vel den bladhat, der er gengivet foran titelbladet hos BUCHWALD (1937). Stenblokken, hvori hatten er hugget, ligger i ruinbyen Timgad i Algier. Byen anlagdes o. år 100 e. Kr. af kejser TRAJAN. Man har været uenig om, hvilken svampeart det forestiller. BUCHWALD skriver „formentlig en fluesvamp", HARSHBERGER mener *Amanita phalloides*, og LOHWAG

1 2 3

Fig. 1. Paryk-Blækhat (*Coprinus comatus* (MÜLLER) FR.). × 1/16. — Fig. 2. Morkel (*Morchella esculenta* (PERS.) FR.). ×1/16. — Fig. 3. Kantarel (*Cantharellus cibarius* FR.). × 1/15.

holder på, at det er den fortrinlige spisesvamp *Volvaria gloiocephala (V. speciosa)*, som den dag i dag sælges i store mængder på markederne i Algier.

Her i København findes på Palace Hotel i soklen mod Rådhuspladsen anbragt otte store blokke af Kråkeröygranit, tildannet i en form, der minder om ældre tiders bislagsten. I den sydligste af dem er fastgjort et metalrækværk; de øvrige syv har hver et lille, ikke meget iøjnefaldende reliefbillede forestillende en svamp. De forevigede er fra nord mod syd *Amanita muscaria* (L.) FR., afbildet sammen med en snog, *Coprinus comatus* (MÜLLER) FR., *Morchella esculenta* (PERS.) FR., *Cantharellus cibarius* FR., afbildet sammen med en frø, *Boletus edulis* (BULL.) FR., *Lepiota rhacodes* (VITT.) FR. og *Psalliota bispora* (LGE.) SCHÄF. & MÖLLER. Fire af de i sten huggede svampe er gengivet på de ovenstående figurer 1-4. Stenene er 100 cm høje og foroven, hvor rundingen begynder, 34 cm brede. D. v. s. at de på billederne 1-3 er formindskede til ca. 1/16 og på fig. 4 til 1/7.

Granitarbejdet er udført af stenhuggerfirmaet E. NIELSEN omkring 1909-1910 — Palace Hotel blev åbnet den 15. juli 1910. Modelarbejdet til reliefferne skyldes billedhugger ARNE BASSE (1873-1947).

Fig. 4. Rabarber-Parasolhat (*Lepiota rhacodes* (VITT.) FR.). $\times 1/7$.

BASSE har foruden modellerne til granitarbejdet på Palace Hotel udført mange andre dekorative arbejder, fx den gotiske drage på hofjuveler MICHELSEN's hjørneejendom i Bredgade og ornamenterne på Lurblæsersøjlen. — Oplysningerne om billedhugger ARNE BASSE, der ikke er optaget i WEILBACH's Kunstnerleksikon, stammer fra byhistorikeren, konservator PETER LINDE (1888-1958).

Billeder af svampe i soklen på et hotel genkalder i erindringen den af VALDEMAR HERTZ ofte citerede sentens, som siges at stamme fra den romerske digter MARTIAL:

Let er det at undvære sølv og guld og kærlighedens glæder — men at undvære en ret svampe er svært.

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København, september 1968.

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NOTES ON INTERESTING OR UNUSUAL AGARICS FROM SOUTHWESTERN SWEDEN

By T. NATHORST-WINDAHL

SUMMARY

In previous papers by the author (1945, 1949, 1958, 1961 and 1967) notes are given on different interesting or unusual agarics and other *Hymenomycetes* from the southwestern and southern part of Sweden. In the present paper the author has added some other agarics, which are more or less uncommon in the southwestern part of Sweden. *Pholiotina septentrionalis* (A. H. SMITH) SING. (*Conocybe brunnea* (J. E. LANGE & KÜHNER) KÜHN. & ROMAGN. is, however, reported for the first time from this country. The descriptions of the species are, on the whole, detailled so that doubt cannot arise as to what species have been found. The collection numbers cited are those of the writer, and the specimens are preserved in my private herbarium.

1. **Clitocybe inornata** (SOW. ex FR.) GILL. Syn. *Agaricus inornatus* SOW. ex FR., *Paxillus inornatus* QUÉL. — Göteborg: Hisingen, Lexby, on the ground in coniferous wood, 30.IX.1956 (n. 6194). — Fig. 1, spores.

C a p about 5-7 cm, convex, then expanded and finally somewhat depressed at the centre, fleshy, covered by a whitish, tomentose bloom at first, soon becoming dingy alutaceous, finally dirty grey with minute fibrils, margin incurved at first, whitish and somewhat grooved, with separable pellicle when moist; g i l l s crowded, broad, thin, greyish or brownish grey, adnate, separable from the context of the cap,

finally decurrent; stem about 5-7 cm × 6-8 mm, white-tomentose at first, especially above, then of the same colour as the fully developed cap, often curved, stuffed and with slightly thickened, cotteny base. Flesh white, tough, taste mild, smell nasty. Spore-print whitish or slightly coloured. — Spores 7,5-9 (10) × 3-4 μ, fusoid to ellipsoid-oblong; basidia 22-25 × 4,5-5,5 μ; cap cuticle fibrillose; hyphae 4-12 μ diam.; clamp connections very scattered.

Recognizable by separable gills which have a tendency to remain adnate for a long time and by large, fusoid spores.

The species seems to be rather uncommon in the area investigated by me. It is illustrated by J. E. LANGE, Flor. Agar. Dan., pl. 34 B and by KONRAD & MAUBLANC, pl. 294.

2. **Xeromphalina picta** (FR.) A. H. SMITH. Syn. *Agaricus pictus* FR., *Omphalia picta* (FR.) GILLET. — Göteborg: Botan. Trädgården, Naturparken, on fallen, decaying trunks of *Alnus glutinosa* in deciduous wood, 12.VII.1947 (n. 4382); Värmland: St. Kil parish, Apertins herrgårdspark, on dead plant remains lying on the ground, 1.VIII.1958 (n. 6730).

Cap 3-8 mm high, 3-5 mm broad, cylindric, not expanding, membranous, smooth, moist, yellowish and distinctly brownish striate, the yellow centre without striae and somewhat umbilicate, margin paler; gills distant, pale, very broad, adnate or somewhat decurrent, finally more or less buff-coloured; stem 2-3 (4) cm × 0,3-0,7 mm., equal, glabrous, shining, cartilaginous, apex somewhat inflated and paler, brownish, somewhat fistulose, at the base often springing from a pellicle of yellow, radiating, mycelioid hairs. — Spores 6-8 (9) × 4-4,5 μ, ellipsoid, amyloid; basidia 4-spored, clavate, 15-22 × 4-5 μ; cheilocystidia not observed on the dried specimens. According to O. K. MILLER (1968) these cystidia are, however "11-18 × 8-12 μ, ellipsoid, broadly clavate, thin-walled, hyaline in KOH or MELZER's solution, and have many finger-like or rod-like projections, 1,5-3,5 μ long, 1,5-2,2 μ wide, very difficult to see them clearly." Over the base of the stem I have found only a few caulocystidia.

This minute, very characteristic agaric is easily overlooked in the field. Good illustrations are not known to me and the figure in FRIES, Icones sel., tab. 77:4 as *Agaricus (Omphalia) pictus* FR. is mediocre. In recent times this fungus has been described by A. H. SMITH (description not at my disposal) and by O. K. MILLER (1968).

3. **Clitopilus passeckerianus** (PILÁT) SING., nom. nud. Syn. *Pleurotus passeckerianus* PILÁT. — Göteborg: close to Björkdalens old dumping station on bare soil with paper-débris, wood-chips etc. at the margin of a potato-land, 17.VIII.1942 (n. 3191); Slottsskogen, on stacked horse-dung, mixed with decaying straw, 8.VIII.1958 (n. 6760). — Fig. 2, spores.

C a p 1-4 cm, white or with a creamy to ochraceous hue, irregular spatulate or semicircular, often lobed, attached at the side by a white, rudimentary stem or entirely sessile, thin and soft, sericeous, not striate, with the margin incurved at first; g i l l s tend to remain whitish for a long time, then pale dirty cream-coloured, finally creamy-pinkish, narrow, radiating from an excentric point, decurrent where it is a distinct stem; f l e s h white; s m e l l faint, t a s t e mealy. S p o r e - p r i n t white with a pinkish tinge. — S p o r e s (6,5) 7-8,5 × 3,5-4 (4,5) μ, ellipsoid-subfusoid, non amyloid and without germ pore, with 5-10 longitudinal ridges (sub immers.); basidia 4-spored, 15-22 × 4-4,5 μ; cystidia and clamp connections absent. Cap cuticle with repent, smooth, somewhat branched hyphae, 2-3 μ diam.

This interesting fungus is ordinary growing in beds of cultivated mushrooms and is described and figured by A. PILÁT (1935) as *Pleurotus*.

4. **Rhodophyllus (Leptonia) mougeotii** (FR.) J. E. LANGE. Syn. *R. ardosiacus* (BULL. ex FR.) QUEL, KÜHN & ROMAGN. — Göteborg: Botan. Trädgården, Naturparken, on the ground under *Alnus glutinosa* amongst fallen, decaying branches on rather moist, shady, mossy place, 16.VIII.1956 (n. 6150). — Fig. 3, spores; 3 a, edge of gills with cylindric, obtuse, hyaline cells.

C a p 2-3 cm diam., rather thin, bell-shaped to convex, finally rather deeply umbilicate, downy-fibrous or tomentose-squamulose especially at the centre, grey to slate-coloured, often with a tinge of greyish-blue or greyish lilac, margin incurved at first; g i l l s distant, curved, decurrent, broadest behind, whitish or with a flush of lilac, finally pink with the spores; s t e m 4-6 cm × 4 mm, greyish lilac, often thickened and white tomentose at the base, finely granular-floccose and white-coloured above, often compressed, finally fistulose. F l e s h white; s m e l l and t a s t e none. — S p o r e s ellipsoid, angular, 9-11 (12) ×7-8 μ; basidia 4-spored; edge of gills with cylindric, obtuse, hyaline cells, 18-20 × 7-9 μ, which sometimes have clamp

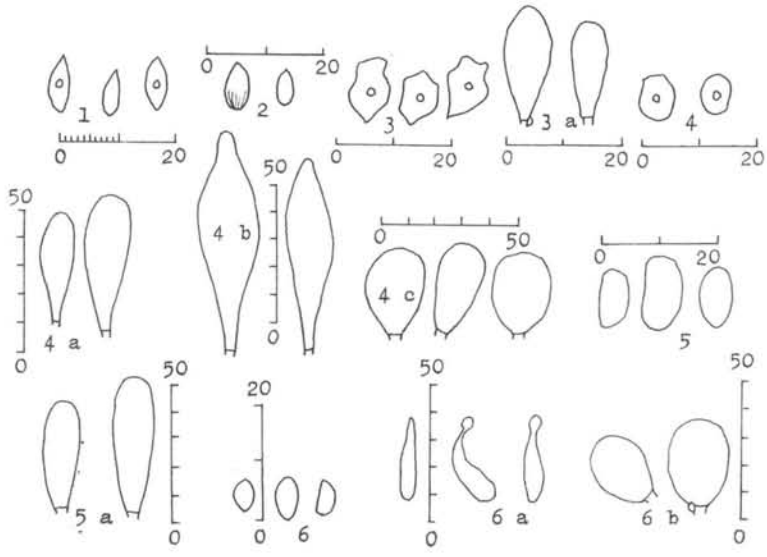

Fig. 1. *Clitocybe inornata,* spores. — Fig. 2. *Clitopilus passeckerianus,* spores. — Fig. 3. *Rhodophyllus (Leptonia) mougeotii,* spores, a. edge of gills with hyaline cells. — Fig. 4. *Pluteus phlebophorus,* spores, a. cheilocystidia, b. pleurocystidia, c. cells of cap cuticle. — Fig. 5. *Inocybe jurana,* spores, a. cheilocystidia. — Fig. 6. *Pholiotina septentrionalis,* spores, a. cheilocystidia, b. cells of cap cuticle.

connections at the base; cystidia absent; hyphae of cap cuticle with repent, cylindric, about 7-11 μ diam., hyaline or pale violet.

The species is illustrated by KONRAD & MAUBLANC, pl. 185, 2.

5. **Pluteus phlebophorus** (DITMAR ex FR.) KUMMER ss. RICKEN. Syn. *P. chrysophaeus* (SCHAEFF. ex FR.) QUÉL. ss. KÜHN. & ROMAGN. 1956. — Göteborg: Botan. Trädgården, Naturparken, growing on a fallen, decorticated trunk of *Alnus glutinosa* lying in a desiccated brook, 30.VII.1967 (nr. 7196). — Fig. 4, spores; 4 a. cheilocystidia; 4 b. pleurocystidia; 4 c. cells of cap cuticle.

C a p 2-3 cm, rather thin, convex, then expanded, yellowish-brown, somewhat darker brown in the centre and more or less coarsely veined, glabrous; g i l l s free, somewhat crowded, broad, white, finally more or less flesh-coloured; s t e m 3-5 cm × 2-4 mm, glabrous, shining, white or pale greyish, sometimes curved, hairy at the base and finally becoming hollow; f l e s h white; s m e l l unpleasant, t a s t e none or very faint. — S p o r e s ellipsoid or somewhat phaseoliform,

6,5-8 × 5-6 μ, smooth; basidia 4-spored; cheilocystidia vesiculose-fusiform, obtuse, 50-60 × 12-18 μ; pleurocystidia fusiform with rather pointed apex and prolonged base, 80-100 × 18-25 μ; cap cuticle with spheropedunculate or pyriform cells with brownish contents, 8-20 μ diam.

The species seems to be uncommon in the part of Sweden investigated by me. It is illustrated in KONRAD & MAUBLANC, pl. 23. Detailed description with drawings of the microscopical feature is given by KÜHNER & ROMAGNESI (1956), as *P. chrysophaeus.*

6. **Inocybe jurana** PAT. Syn. *I. rhodiola* BRES. — Göteborg: Hisingen, Rya skog, gregarious on shade and somewhat damp place in deciduous wood, especially under *Alnus glutinosa,* 5.VIII.1953 (n. 5694). — Fig. 5, spores; 5 a. cheilocystidia.

C a p 4-7 cm, conic-campanulate, finally somewhat expanded and umbonate, covered with dark vinaceous-fuscus, radiating fibrils and often cracked and paler round the edge; g i l l s whitish, then pale grey to greyish-brown, crowded, narrowly adnate, ventricose, edge white-fimbriate; s t e m 8-9 cm × 6-8 mm, with slightly bulbous base, white, flushed with a dingy vinaceous colour from base up, turning brownish when touched or handled, somewhat longitudinally fibrillose, stuffed, growing deep in the ground; f l e s h with a rather unpleasant s m e l l; t a s t e mild. — S p o r e s more or less ellipsoid or phaseoliform, smooth, 9-13 × 6-8 μ; cheilocystidia hyaline, clavate, 35-60 × 10-15 μ.

I also know this fungus from the southern part of Göteborg, just S. of Mossens sports field under *Alnus glutinosa* and from Lidhult in Småland, growing in grass.

Illustrations are given by J. E. LANGE in Flor. Agar. Dan., pl. 117 E, and by KONRAD & MAUBLANC, pl. 85.

7. **Phlegmacium balteatocumatilis** (R. HENRY ex ORTON) MOSER. — Göteborg: Slottsskogen, in short grass under different deciduous trees, 15.VIII.1939 (n. 1554).

This very fleshy and firm species which grows in deciduous wood, often in troops, I formerly (1949) have named *Cortinarius balteatus* FR. ss. J. E. LANGE. According to FRIES, however, that species is growing "praecipue in pinetis". In Bull. Soc. Myc. Fr. (1939) R. HENRY

has given LANGE's species a new name, *Cortinarius balteatocumatilis,* which differs mainly from the closely related *C. balteatus* FR. in having separable cap cuticle, stem with a few, more or less fugacious, violaceous patches from veil near base when young and other habitat.

I know this species only from Göteborg, Slottsskogen, where it grows in small troops under different, deciduous trees.

Illustrations are given by J. E. LANGE, Flor. Agar. Dan., pl. 87 D, as *C. balteatus* FR. and by MOSER (1960), pl. C. 124.

8. **Pholiotina septentrionalis** (A. H. SMITH) SING. Syn. *Conocybe brunnea* (J. E. LANGE & KÜHN.) KÜHN. & ROMAGN. — Göteborg: Lilla Danska Vägen, on humus between *Aegopodium* under deciduous trees in shady place, 15.VIII.1966 (n. 7162). — Fig. 6, spores; 6 a. cheilocystidia; 6 b. cells of cap cuticle.

C a p 1-2 cm, convex, then expanded, reddish brown and often slightly umbonate, shining and translucent striate when moist, glabrous, margin at first with appendiculate, white remnants of the veil, fading as dry; g i l l s somewhat crowded, ochraceous, finally yellowish brown, ventricose, slightly adnate; s t e m 2-3 cm × 1,5-2 mm, pale yellowish brown, powdered or at first with scattered flocci, which, however, usually soon disappear, in the lower part more or less brownish or darkbrown, especially when handled. — S p o r e s smooth, ellipsoid or somewhat phaseoliform, 6,5-8 (9) × 4-4,5 (5) μ; basidia 4-spored; cheilocystidia vesiculose below, with shorter or longer, narrow neck, occasionally capitate at the apex, 25-30 (35) × 5,5-7,5 μ, capitula about 4 μ diam., often with clamp connections at the base, neck sometimes flexuose. Cells of cap cuticle pyriform or sphaeropedunculate, 13-22 μ diam.

This plant seems to be rather uncommon in the area of Sweden investigated by me. It is illustrated in J. E. LANGE, Flor. Agar. Dan., pl. 129 E, and agrees very well with the description given by KÜHNER (1935).

9. **Russula atropurpurea** (KROMBH.) BRITZ. Syn. *R. fuscovinacea* J. E. LANGE. — This species is described in the validating description as having a deep, reddish-purple c a p, which almost is black in the centre at first, s t e m becoming greyish with age and is often stained brownish below, t a s t e finally somewhat acrid and s p o r e - p r i n t pure white. Different varieties and forms are, how-

ever, met with. Such a form is *R. fusco-vinacea* J. E. LANGE as illustrated by him in Flor. Agar. Danica, pl. 182 C.

Already 1945 I have sent a rich collect of *R. atropurpurea* to S. LUNDELL, Uppsala, as n:r 4086, and it was distributed as n:r 2363 in Fungi exsiccati Suecici by S. LUNDELL & J. A. NANNFELDT under the name of *R. fusco-vinacea* J. E. LANGE.

The species is rather common in the part of Sweden investigated by me and the var. *Krombholzii* SING. is particularly beautiful having a shining red margin of the cap and is often growing under *Quercus*.

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Göteborg, August 1968.

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PLENODOMUS LINGAM, BLACK-LEG OF CRUCIFERS

OCCURRENCE IN DANISH SEED LOTS FOR EXPORT, AND CONTROL BY GERMISAN-HOT-WATER TREATMENT*)

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SUMMARY

A survey of 14 years of testing a total of 3.494 seed lots of cabbage and other crucifers for *Plenodomus lingam* (Table 1) is given, the 2,4D-blotter method having been used. Complete control of infection in 6 seed lots was obtained by soaking the seed for 5 minutes in 2 per mille Germisan at 50°C (Table 2). This combined procedure was found superior to the classical procedure of hot-water treatment.

The causal agent of black-leg in crucifers, *Leptosphaeria maculans* (DESM.) CES. & DE NOT., imp. state *Plenodomus lingam* (TODE ex FR.) BOEREMA & KESTEREN, syn. *Phoma lingam* (TODE ex FR.) DESM. (see BOEREMA & KESTEREN 1964), has a world-wide distribution (CMI, Map no. 73, 1962). In many countries, particularly in United States (WALKER 1922, 1923, 1952), and New Zealand (CUNNINGHAM 1927, SMITH 1960), disastrous attacks are a serious economic menace to growers of cabbage, swede and turnip. Considerable losses in cruciferous crops have been encountered in most European countries, including Denmark (ROSTRUP 1894, NIELSEN 1932), France (DARPOUX, LOUVET & PONCHET 1957), Germany (LAUBERT 1916, SCHNEIDER 1960), Ireland

*) The investigations have been carried out at the Government Plant Protection Service, Copenhagen.

(HUGHES 1933), Netherlands (KOK 1962, BAKEL 1968), Poland (GARBOVSKI 1935), Romania (BONTEA 1955, BONTEA & BUCUR 1958), and United Kingdom (BUDDIN 1934, DENNIS 1939, BANT, BEAUMONT & STOREY 1950).

The parasite is seed-borne, usually in low percentages, and occurs often as a mere trace. The inoculum may, however, spread rapidly in the field or seed bed ultimately leading to heavy crop losses. As pointed out by WALKER (1923), abundant rainfall may cause sufficient spread of the fungus from very few primary infections appearing in the seed bed to produce an epiphytotic. Once introduced into a field, the pathogen may overwinter for many years on cruciferous hosts or débris (SNYDER & BAKER 1950, SMITH 1960), a fact that under circumstances increases the importance of seed transmission substantially. In Netherlands, as in United States, infected seed has been found to be a greater source of infection than remains of infected plants in the soil (KOK 1962, BAKEL 1968). On the other hand, in New Zealand, where the disease is known as endemic and widespread since 1905, undecomposed residues in the soil provide the main source of infection and seed transmission has become of less importance (SMITH 1960). In this country infection by ascospores occurs regularly (SMITH l. c.).

Some countries (Pakistan, Romania, Yugoslavia) have quarantine provisions specifically directed against *Plenodomus lingam*. Only seed lots tested and officially certified to be free of infection may be imported to these countries. Many countries require a general seed health certificate but give no specifications on pathogens. In these cases it is at the discretion of the plant inspection authorities of the exporting country to adopt reasonable tolerances for pathogens encountered in the seed. For about 25 years, including the period considered in this paper, the Danish Plant Protection Service has rejected all seed lots of cruciferous vegetables showing infection of *Plenodomus lingam**).

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*) According to recently issued provisions (Statens Plantetilsyn 1968) a tolerance of 0.2 per cent *Plenodomus lingam* has now been accepted for seeds of cabbage and other crucifers for consignments exported to those countries which do not issue any specific requirements as to this pathogen. It is worth noting that at the same time a voluntary seed health certification scheme, operating in connection with production of stock seed of cabbage and other cruciferous vegetable crops, has been introduced in co-operation between the Plant Protection Service and Danish seed exporting companies (H. ANDERSEN personal information).

1. Seed health testing for *Plenodomus lingam*

1. Testing method

In testing seeds of cabbage and other crucifers for health the so called "blotter method" is used by the Danish Plant Protection Service. In 1952 the author introduced a modification of this procedure which has been in use since then. The seeds are sown in petri dishes on three layers of blotter thoroughly moistened in a 0.2 per cent solution of the sodium salt of 2,4-dichlorophenoxyacetic acid (the herbicide "2,4-D") in order to inhibit germination of the seed. Incubation is for 10 days at room temperature (during recent years in an incubator at 20 ± 2° C). The infection percentages are usually very low, and consequently a minimum of 1000 seeds is sown. In the International comparative seed health testing scheme (Neergaard 1958), conducted 1957-58 by the Committee on Plant Diseases of International Seed Testing Association (ISTA), cabbage was tested according to this method (see Table 2, footnote). Since then the 2,4D-blotter method has been taken into use in various countries, and in 1965 it was adopted by ISTA as a Recommendation and included in the International Rules for Seed Testing, 1966.

2. Results of 14 years of testing

The results, published in the annual reports of the Plant Protection Service (Neergaard 1956-1967, Andersen & Neergaard 1956, Andersen 1961), have been collated in Table 1 for the period of 1952-1966.

It appears from this survey that there is a marked difference in the severity of infection in different botanical species and varieties of crucifers. *Plenodomus lingam* is considerably more frequent in head cabbage than in other kinds of *Brassica oleracea* (listed chronologically according to the time of harvest of the seed):

Brussels sprouts	6.9 %	seed	lots,	0 %	severely	inf.	(above	1 %)
Savoy cabbage	12.1 %	„	„	1 %	„	„	„	„
Spring cabbage	13.8 %	„	„	1 %	„	„	„	„
Red cabbage	17.1 %	„	„	2 %	„	„	„	„
White cabbage	21.8 %	„	„	4 %	„	„	„	„
Cauliflower	7.5 %	„	„	0 %	„	„	„	„

In so far as the four types of head cabbage are concerned, these differences in amount of infection are very likely due to the fact that

TA

Infection per milles of *Plenodomus lingam* in Danish export seed lots of cabbage examined after 10 days. Incubation at 21° C

Host	per milles	YEAR OF						
		52/53	53/54	54/55	55/56	56/57	57/58	58/59
Swede	0	34	44	2	26	32	24	44
	< 10	0	3	0	2	0	0	4
	> 10	0	0	0	0	0	0	0
Cauliflower	0	99	96	71	64	74	62	55
	< 10	3	1	3	11	3	2	8
	> 10	0	0	0	0	0	0	0
Kale	0	—	12	2	—	4	10	9
	< 10	—	1	1	—	1	1	0
	> 10	—	1	0	—	0	0	0
Cabbage	0	142	80	58	45	57	57	66
	< 10	17	17	15	39	24	15	31
	> 10	2	1	29	7	0	1	1
Brussels Sprouts	0	17	9	14	9	4	19	4
	< 10	0	1	0	0	2	1	2
	> 10	0	0	0	0	0	0	0
Red Cabbage	0	51	28	23	6	10	13	11
	< 10	3	4	1	3	4	4	5
	> 10	0	0	0	0	1	0	2
Savoy Cabbage	0	—	16	24	—	30	23	7
	< 10	—	2	1	—	1	5	5
	> 10	—	0	0	—	0	0	1
Spring Cabbage	0	—	16	6	—	9	13	6
	< 10	—	2	1	—	1	2	3
	> 10	—	0	1	—	1	0	0
Garden Turnip	0	—	4	10	—	12	10	11
	< 10	—	0	0	—	0	1	0
	> 10	—	0	0	—	0	0	0

the seed of savoy cabbage and spring cabbage is harvested earlier in Denmark (August) than red cabbage; white cabbage being harvested about a month later. The late seed crops are more exposed to infection as the morning dew remains longer on the later than on the earlier crops*). In the six varieties dealt with above the same correlation

*) The distinction between the four types of head cabbage in relation to time of harvest is becoming less sharp in modern time. New very early cultivars of the previously late types are developed and consequently the differences as to degrees of escape are likely to become less.

E 1

ussels sprouts, cauliflower, swede and turnip 1953-66. 1000 seeds of each sample
2° C on blotter, moistened in 0.2 % 2,4D.

XAMINATION							Total of distribution	Total of seed lots	Percentage infected seed lots
59/60	60/61	61/62	62/63	63/64	64/65	65/66			
30	33	24	27	31	40	26	417	428	2.6
0	0	1	1	0	0	0	11		
0	0	0	0	0	0	0	0		
55	28	32	41	34	55	57	823	890	7.5
11	3	6	6	3	1	6	67		
0	0	0	0	0	0	0	0		
10	4	12	9	4	7	7	90	98	8.2
0	0	1	1	0	0	1	7		
0	0	0	0	0	0	0	1		
71	36	55	75	34	70	53	899	1150	21.8
6	5	4	1	3	15	15	207		
0	0	0	1	0	0	2	44		
11	9	11	7	4	9	8	135	145	6.9
2	0	0	1	0	0	1	10		
0	0	0	0	0	0	0	0		
14	6	8	15	6	13	10	214	258	17.1
2	3	3	0	0	6	1	39		
0	0	1	0	0	0	1	5		
18	4	11	15	9	19	13	189	215	12.1
4	3	0	0	0	1	2	24		
0	0	0	0	0	0	1	2		
12	23	15	13	12	15	16	156	181	13.8
4	5	1	1	0	3	0	23		
0	0	0	0	0	0	0	2		
16	8	9	11	12	13	8	124	129	3.9
1	0	0	1	0	0	2	5		
0	0	0	0	0	0	0	0		
								3494	

between severity of *Alternaria brassicicola* (SCHWEIN.) WILTSH. and the time of harvest has been found for a seven year period (NEERGAARD 1945).

CHUPP & SHERF (1960) have placed white cabbage, red cabbage, savoy cabbage and brussels sprouts in the group of cruciferous hosts regarded as "most susceptible" to *Plenodomus lingam,* whereas cauliflower is placed in the group of "medium susceptible" hosts. In Denmark cauliflower is harvested later than any of the other botanical varieties of *Brassica oleracea.* Nevertheless, and well in accordance

with the indicated grouping, cauliflower is less attacked than head cabbage.

2. Seed treatment

In the period under discussion about 12 per cent out of a total of 3494 seed lots submitted to testing for health were rejected because of infection by *Plenodomus lingam,* and hence issuance of health certificates for the seed concerned was refused. In most cases rejected seed lots could be replaced for export by approved seed lots. However, in some cases substitutes were not available, and hot-water treatment of the consignments concerned was then considered.

1. The standard hot-water-treatment

The method of hot-water treatment for cruciferous seed, established by Walker (1923), is generally recommended, and is used in many countries as a common practice. The seed is soaked for 25-30 minutes in water maintained at 50° C.

However, although this procedure does reduce infections very substantially, it does not secure complete control. Seed lots, rejected on account of infection and again, after hot-water treatment, submitted by seed exporters to health testing, were repeatedly found still to be infected and, consequently, they had again to be rejected. These observations are well in line with the experiences published recently by Williams (1967) who reported a serious outbreak of blackleg in crops of cabbage cv. "Danish Ballhead", grown in 1966 in New York and neighbouring States and all originated from a seed lot produced in Australia. The epidemic was attributed to low percentages of *Plenodomus lingam* which withstood the seed treatment described above. Also Clayton (1928) and Bakel & Kraker (1963) demonstrated that hot-water treatment does not entirely eliminate the parasite from heavily infected cabbage seed.

In an attempt to overcome the shortcoming of the classical procedure, experiments have been conducted to improve the method.

2. Preliminary experiments

Preliminary experiments (1000 seeds sown per treatment) with samples of different seed lots of cabbage showed that *Plenodomus lingam* can withstand presoaking in water at room temperature for 20 minutes followed by hot-water treatment at 50° C for 15 minutes

as well as presoaking for 40 minutes followed by hot-water treatment at 50° C for 10, 25 and 30 minutes. In some of the investigated seed lots the parasite withstood the standard procedure, hot-water treatment at 50° C for 30 minutes.

On the other hand, dosages of 0.1 per cent Germisan (phenylmercuric pyrocathechin, 3 per cent active ingredient) at 40° C for 10-15 minutes, at 45° C for 10, 20, 30, 40 and 60 minutes, and at 50° C for 5, 15 and 30 minutes killed the fungus. Field germination experiments (2 × 500 seeds per treatment) showed that the germination capacity was maintained throughout the treatments in one seed lot while in another lot increasing dosages led to increasing reduction of germination. Treatment of different seed lots in 0.2 per cent Germisan at 50° C for 5 minutes was found to be fully effective against the parasite and not to injure germination. Hence this procedure was selected for further experiments.

3. Material and Methods

The following six seed lots of cauliflower and cabbage, issued by the seed firm J. E. OHLSENS ENKE, Copenhagen, were used for the experiments:

1. Cauliflower cv. Snebold, 71Sa (harvest 1956).
2. White cabbage cv. Brunsviger, JJ/S (harvest 1956).
3. White cabbage cv. Ditmarsker, 90R (harvest 1955).
4. White cabbage cv. Roem van Enkhuizen, JJ/S (harvest 1956).
5. Red cabbage cv. Erfurter, 71S (harvest 1956).
6. Savoy cabbage cv. Auberville, 1543R (harvest 1955).

In May 1957 samples of 2 kg. of the above mentioned seed lots were soaked for 5 minutes in 20 l of a 0.2 per cent solution of Germisan, maintained at 50° C. The treated and untreated seed samples were kept in the store house of J. E. OHLSENS ENKE at storage conditions normally applied by the company. These conditions are in general, 50-70 per cent R. H. and, in November-April 0-5° C, May-October 10-20° C, with a total temperature range from — 5° C to + 25° C.

Subsamples subsequently drawn from the experimental samples were tested for infection and laboratory germination (blotter) in June 1957, April 1958, April 1959 and April 1963, and for field germination in October 1957 and May 1958.

TABLE 2.

Germisan-hot-water treatment. (5 minutes in 0.2 % Germisan at 50° C). 10×50 seeds for each combination of treated or untreated sown on blotter moistened in water or in 0.2 % 2,4D. Permilles of *Plenodomus lingam*, percentages of *Alternaria brassicicola*.

Seed lot no. Year of harvest and treatment			Medium	*Plenodomus lingam* Permilles				*Alternaria brassicicola* Percentages			
				/6 1957	/4 1958	/4 1959	/4 1963	/6 1957	/4 1958	/4 1959	/4 1963
1	1956	Untreated	H_2O	0	0	2	0	2.2	5.2	10.2	0.2
			2,4D	1	2	0	0	0.4	17.4	7.8	0.4
		Treated	H_2O	0	0	0	0	0.2	0.4	0	0
			2,4D	0	0	0	0	0.4	0.2	0	0
2	1956	Untreated	H_2O	0	4	2	0	41.2	53.6	50.2	0.8
			2,4D	4	2	0	0	65.6	59.0	10.6	0.2
		Treated	H_2O	0	0	0	0	0.2	0.4	0	0
			2,4D	0	0	0	0	0	0	0	0
3	1955	Untreated	H_2O	0	2	0	0	0.6	0	0	0
			2,4D	0	0	4	0	0.2	0.2	0.2	0.4
		Treated	H_2O	0	0	0	0	0.2	0	0	0.2
			2,4D	0	0	0	0	0	0	0	0
4	1956	Untreated	H_2O	0	4	2	0	14.8	10.8	6.8	0
			2,4D	10	14	2	0	31.6	24.2	6.6	0.2
		Treated	H_2O	0	0	0	0	0.4	0	0	0.2
			2,4D	0	0	0	0	0.2	0	0	0
5*)	1956	Untreated	H_2O	12	22	10	0	2.4	1.4	0.6	0.6
			2,4D	52	40	8	0	4.8	2.6	0.2	0
		Treated	H_2O	0	0	0	0	0	0	0	0
			2,4D	0	0	0	0	0	0	0	0
6	1955	Untreated	H_2O	0	4	2	0	42.6	16.2	14.6	0.2
			2,4D	0	2	0	0	24.8	16.6	6.0	0
		Treated	H_2O	0	0	0	0	0.4	0.1	0	0
			2,4D	0	0	0	0	0.4	0	0	0

*) Seed lot no. 5 (Red Cabbage cv. "Erfurter", harvest 1956) was included in the International Comparative Seed Health Testing Scheme, organized 1957-58 by the Plant Disease Committee of International Seed Testing Association. 8 stations in different countries participated and reported the following infection per milles for *Plenodomus lingam* found in 20 × 50 seeds on blotter moistened in 0.2 % 2,4D: 40, 70, 49, 54, 48, 52, 39, 45, thus giving an average for all stations of 49 ‰ (NEERGAARD 1958).

TABLE 3

Germination in 1957, 1958, 1959, and 1963 of six cabbage seed lots, harvested 1955 or 1956, after treatment in May 1957 in 0.2 % Germisan at 50° C for 5 minutes.

Seed lot no. Year of harvest		June 1957 blotter 10 × 50 seeds	October 1957 *field* 2 × 500 seeds	April 1958 blotter 10 × 50 seeds	May 1958 *field* 2 × 500 seeds	April 1959 blotter 10 × 50 seeds	April 1963 blotter 10 × 50 seeds*)	February 1963**) Copenhagen germinator 200 seeds
1 1956	Untreated	94.6	67.8	96.2	62.4	92.8	62	83 + 1 (12)
	Treated	89.2	65.5	93.4	62.2	95.2	41	81 + 1 (6)
2 1956	Untreated	92.6	67.1	91.6	74.6	95.8	40	67 + 3 (5)
	Treated	92.6	77.7	93.0	68.4	93.4	32	50 + 1 (2)
3 1955	Untreated	90.8	64.2	93.8	64.1	90.8	52	70 + 1 (42)
	Treated	89.2	63.4	92.2	62.6	89.2	34	43 + 7 (12)
4 1956	Untreated	88.6	59.3	95.2	68.7	92.8	82	91 + 1 (61)
	Treated	84.4	63.7	89.8	52.9	90.4	73	89 + 1 (50)
5 1956	Untreated	86.2	54.2	93.0	56.6	84.2	34	79 + 2 (9)
	Treated	85.6	60.1	83.4	62.1	81.8	25	67 + 9 (0)
6 1955	Untreated	73.2	39.7	85.0	57.6	82.4	33	67 + 9 (15)
	Treated	81.8	34.9	74.6	49.5	74.4	12	51 + 10 (6)

*) Erronously only average values, the decimal having been omitted, have been recorded.
**) Normal + abnormal after 7 days (in parenthesis germinated after 3 days).

4. Results

The results are collated in Tables 2 and 3. Throughout the six years of the experimental period no incidence of the pathogen was encountered in any of the treated samples, while in the untreated samples infections still appeared in April 1959, in seed lots nos. 3 and 6 about 3½ years after harvest of the seed.

Furthermore, the treatment reduced substantially the incidences of *Alternaria brassicicola* (SCHWEIN.) WILTSH., bringing down infections of varying percentages (65 per cent in one seed lot) to percentages below one in all treated samples.

In the laboratory tests, throughout a period of three years the treated samples of seed lots nos. 1-5 maintained the germination capacity on equal level with that of the untreated samples while after five years of storage a clear general reduction was apparent in the treated as against untreated samples.

For field emergence the figures of treated and untreated seeds are by and large comparable. However, in lot no. 6 which has the lowest germination capacity of the lots investigated, the treatment led to further reduction of the vitality.

3. LONGEVITY OF SOME SEED-BORNE FUNGI OF CABBAGE

The following fungi found in the six seed lots studied in the Germisan-hot-water treatment experiments were still alive after the periods of time indicated in Table 4.

3. DISCUSSION AND CONCLUSIONS

Using a combination of heat treatment and chemical treatment (0.2 per cent Germisan at 50° C for 5 minutes) the following advantages against the classical hot-water procedure seem to have been obtained:

1. The effect against *Plenodomus lingam* has been improved and apparently complete control obtained. Further investigations dealing with heavily infected seed lots are, however, needed.
2. The period of heat treatment has been reduced substantially; this is a technical advantage (easier control of the temperature which must be accurate; quicker drying of the treated seed).

TABLE 4

Longevity of fungi in cabbage and cauliflower seed under normal storage conditions used by seed companies in Denmark.

Fungus	Longevity established beyond:		In seed lot nos.
Alternaria brassicicola	7 years	8 months	1, 2, 3, 4, 5, 6
Alternaria tenuis	6 years	8 months	2
Alternaria brassicae	1 year	2 months	5*)
Plenodomus lingam	3 years	8 months	1, 2, 3, 4, 5, 6
Pleospora herbarum	7 years	8 months	3, 5, 6
Rhizoctonia solani	0 years	10 months	2
Ulocladium consortiale	7 years	8 months	1, 2, 5, 6

In five of the six investigated seed lots the germination capacity was not substantially reduced and its level was maintained during at least three years of storage under commercial or warehouse conditions. Normally, the seed is sold the first or second year after harvest, seldom in the third year. Seed of high germination capacity may still be usable 5-6 years after harvest (cf. the germination of seed lot no. 4 after more than 6 years of storage). Seed lots with low germination capacity may be more sensitive to treatment than seed lots of better quality. For this reason it is advisable to try the chemical heat treatment on a sample of seed considered for treatment and to run a germination test before treating the bulk.

The results obtained experimentally have been substantiated by the fact that all seed lots treated according to the combined method since 1958 proved free of *Plenodomus lingam* while in previous years a considerable number of seed lots, treated according to the classical method, remained infected, though at a reduced rate.

It stands to reason that the proposed procedure may present many other possibilities of combination. There is at present a tendency to abandon mercurial compounds for seed treatment because of their toxicity. For further development less poisonous chemicals should be investigated for their suitability as components for the combined heat treatment procedure.

*) Based on a report of April 1958, received from the Plant Pathological Laboratory of the Ministry of Agriculture, Fisheries and Food, Harpenden, and dealing with this seed lot which was included in the international comparative seed health testing scheme 1957-58 (NEERGAARD 1958).

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Copenhagen, October 1968.

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MYKOLOGISKA NOTISER

AV INGVAR NORDIN

Botaniska trädgården, Göteborg.

SUMMARY

Notes on rare Swedish fungi.

The author lists new localities for 11 species of fungi in Sweden. Many species reach their northern limit near the river Dalälven; they occur more or less within the area of wild oak: *Climacodon septentrionalis, Neogyromitra gigas, Sparassis crispa* etc. *Climacodon* is not a rare fungus on cultivated trees; it occurs mainly on *Acer platanoides* in manor parks and avenues within the actual region. *Schizophyllum* and *Trogia* belong rather to the *Fagus*-region in Sweden, but are reported from some places outside this area. On the mountain Omberg in the county Östergötland, situated close to the big lake Vättern, there meet northern and southern elements among phanerogams, lichens and mosses. *Schizophyllum commune* on the one hand, *Daldinia concentrica, Phlebia centrifuga* and *Fomitopsis rosea* on the other have been found on Omberg; they represent southern and northern constituents of the mycoflora. The beautiful vernal discomycete *Sarcoscypha coccinea* was found for the first time in Östergötland. Finally *Hypocreopsis lichenoides* was collected three times on *Corylus*. It is a rare and interesting fungus, not known previously from Östergötland, Västmanland and Närke, where the species reaches its eastern and northern limits in Sweden. The distribution of *Hypocreopsis* in Scandinavia is rather similar to that of *Trametes rubescens* (syn. *Daedalea confragosa*); the majority of the known localities for the two species is in the region of Gothenburg on the Swedish west-coast. The fungus is reported for the first time from the archipelago of Gothenburg. *Hypocreopsis* has recently been investigated by STRID (1967), who listed 7 localities for the fungus; 12 new finds are given here. I think

it is quite clear that the fungus is spreading vigorously in Sweden at present.

I efterföljande artikel behandlas elva arter svampar med utgångspunkt från lokalfynd som gjorts främst i Mellansverige under 1967 och 1968. Arterna är mer eller mindre sällsynta, men ofta välbekanta och lätt igenkännliga. Jag har därför inskränkt mig till att kortfattat rapportera om deras utbredning och ståndort. Jag har fått uppmärksamheten riktad på svamparna eller vissa drag i deras ekologi genom andra mykologers artiklar. Särskilt vill jag nämna professor N. FABRITIUS BUCHWALD, vars intressanta artiklar om olika svampgrupper varit mycket stimulerande. Bland de arter som jag här tagit upp, har han för redan ganska länge sedan skrivit om *Schizophyllum commune, Sarcoscypha coccinea* och *Microstoma protracta.*

1. Schizophyllum commune FR.

Bl, Åryd, Tjärö. 1964 (I. N. 2456) UPS. På avsågade grenar av *Prunus cerasus* på hällmark tillsammans med *Phellinus pomaceus.*

Öl, Långlöt, Ismantorp. 1964 (I. N. 2402) UPS. På röjningsris av *Betula.*

Hl, Fjärås, Tjolöholm. 1967 (H. CARLSTEDT 382). På stam av nyfälld *Alnus glutinosa.* 1968 (I. N. 4579) GB. På *Quercus*-låga.

Ög, Omberg, Väversunda, SO. om Arnudden. 1967 (I. N. 4230) UPS. På död upprätt stam av *Quercus**. — Fig. 4.

„ , Linköping, lekpark vid Vasaskolan. 1967 (H. CARLSTEDT 410) UPS. En stor mängd fruktkroppar på en grönmålad krokodil.

„ , Linköping, Nykvarnsparken. 1968 (H. CARLSTEDT 512) UPS. På en nerfallen grov gren av *Aesculus hippocastanum* tillsammans med *Datronia mollis, Stereum hirsutum, Trametes hirsuta* och *Flammula velutipes.*

Upl, Uppsala, Fabriksgatan 6, Uppsala Optiska Industri, på "skrubbbalja". Troligen hösten 1942 (E. ÅBERG). Två större och en mindre fruktkropp på utsidan av ett gammalt sirapsfat av *Fagus**.

Artens utbredning och ekologi i Fennoskandien har behandlats av ANDERSSON (1945). Redan 1933 redogjorde BJØRNEKÆR & BUCHWALD för de danska förekomsterna. De nya lokalerna ligger i utkanten av den kända svenska utbredningen (karta hos ANDERSSON 1945, p. 133).

Schizophyllum är tidigare angiven från en lokal i Östergötland (V. Tollstad, Hästholmen, på *Acer platanoides,* 1945, G. DEGELIUS), strax

S. om Omberg. Den nytillkomna lokalen från Omberg är från bergets norra del, där skogen inom ett område mellan vägen och branten mot Vättern dödats genom fickning. På upprätta, döda stammar av *Corylus, Quercus, Salix caprea, Sorbus aucuparia* och *S. intermedia* förekom en rik vegetation med bland annat:

Bjerkandera adusta
Daldinia concentrica
Polyporus brumalis
Poria versipora
Schizophyllum commune
Stereum hirsutum
Trametes hirsuta
T. zonata

2. **Trogia crispa** (PERS.) FR.

Vg, Halleberg, V. Tunhem, Ovandalen. 1967 (A. BOHLIN 30) UPS. På *Corylus.*

Nrk, Hidinge, Sågaregården. 1967 (I. N. 4287) UPS, GB. På *Corylus.*

Dlr, Grangärde, Hässlen. 1968 (I. N. 4568) GB, UPS. Små fruktkroppar på *Corylus* tillsammans med *Coriolellus campestris, Inonotus radiatus, Hapalopilus nidulans, Hymenochaete tabacina, Phanerochaete affinis, Ph. tuberculata, Phellinus punctatus, Phlebia albida, Poria versipora* och *Trametes hoehnelii.*

Trogia och *Schizophyllum* behandlas samtidigt av ANDERSSON (1945). Om man undantar två uppgifter från Finnmarken och Västerbotten (karta hos ANDERSSON 1945, p. 139) som är mycket isolerade och nog verkar något förbryllande, är den skandinaviska utbredningen sydlig. De nya lokalerna skjuter fram den svenska nordvästgränsen.

Hässlen i Garpenberg (se SAMUELSSON 1960, pp. 116-20) tillhör en undersökning över edafiskt gynnade lokaler i Bergslagen, vars vegetation jag studerat i många år. *Helvella crispa* (se DISSING 1966, karta 10) har tidigare anträffats på en av dessa lokaler, kalkbrottet vid Jönsbacka i Västanfors. *Corylus* är ett av de vanligaste substraten för *Trogia* i Skandinavien.

3. **Fomitopsis rosea** (ALB. & SCHW. ex FR.) KARST.

Ög, Omberg, V. Tollstad, Ombergs skyddsområde. 1967 (I. N. 4225) UPS. En stor och många små fruktkroppar på lågor av *Picea abies.*

Upl, Vänge, Fiby urskog. 1965-67 (I. N. 3178, 3590, 4328) UPS. På lågor av *Picea abies* Ö. om Fibybäcken. Inom ett mycket begrän-

sat område antecknades på lågorna: *Fomitopsis pinicola, F. rosea, Hapalopilus nidulans, Phellinus abietis, Phlebia centrifuga, Poria vaporaria, Hirschioporus abietinus* och *Tyromyces mollis.*

Vrm, Eda, Charlottenberg, Vålängen. 1968 (H. CARLSTEDT 646). En liten fruktkropp på stock under logtrappa.

Dlr, Idre, Nipfjället, 2 km från toppen. 1968 (H. CARLSTEDT 618).

Fomitopsis rosea ser vanligen ut som en halvstor, död fruktkropp av *F. pinicola,* och det kan mycket väl tänkas, att den är förbisedd. Utbredningen i Sverige är nordlig. Enligt BUCHWALD (in litt.) ej känd från Danmark.

Svampen är i Uppsalaherbariet (UPS) obelagd från Götaland. På Riksmuséet (S) finns bland annat en kollekt av M. A. LINDBLAD (1845) från Ridön i Västeråsfjärden av Mälaren samt en (i herb. Romell 12565): "Gotland, *Picea.* 15.VII.1892".

Ombergsförekomsten var nedom en bergbrant i västra kanten av skyddsområdet. Följande hymenomyceter antecknades inom Ombergs skyddsområde vid ett kort besök den 16.IV.1967; då ej annat anges är substratet *Picea:*

Coriolellus serialis
Fomitopsis annosa
F. pinicola
F. rosea
Ganoderma applanatum
(Alnus glutinosa)
Gloeophyllum sepiarium
Gloeoporus amorphus
Hirschioporus abietinus
Inonotus radiatus
(Alnus glutinosa)
Ischnoderma resinosum
Osmoporus odoratus
Phellinus abietis
Phlebia centrifuga
Piptoporus betulinus (Betula)
Poria vaporaria
Spongipellis borealis

Fomitopsis rosea, Phlebia centrifuga och *Daldinia concentrica* representerar nordliga inslag i Ombergs svampflora, *Schizophyllum commune* ett sydligt. På berget möts nordliga och sydliga element, vilket redan tidigare påpekats i fråga om mossor, lavar och fanerogamer, och som gör bergets flora så intressant ur växtgeografisk synpunkt (se HEDBERG 1949 och 1950 samt där anförd litteratur).

4. **Phaeolus schweinitzii** (FR.) PAT.

Ög, Linköping, Trädgårdsföreningen. 1967 (H. CARLSTEDT 362) UPS. På *Pinus nigra.*

Srm, Sundby, Sundbyholm. 1966 (I. N. 4050). På *Pinus silvestris.*

Nrk, Knista, Villingsberg, herrgården. 1967 (I. N. 4309). På *Picea abies.*

Nrk, Knista, Villingsbergs skjutfält, Kringelhultsvägen W. om Råmossen. 1968 (H. CARLSTEDT 672). På *Pinus silvestris*-gren på marken.
Upl, Bälinge, Marstaskogen. 1962-65 (I. N. 1622, 3208). På *Picea abies*.
„ , Husby-Ärlinghundra, Steninge, N. om Västerängsudd. 1965 (I. N. 3278). På *Pinus silvestris*.
„ , Österlövsta, N. om brukskyrkogården. 1968 (I. N.). På *Pinus silvestris*.
Vsm, Rytterne, Kvicksund. 1963 (I. N. 2088). På *Pinus silvestris*.
„ , Rytterne, Åholmen. 1963-67 (I. N. 1974). På *Pinus strobus*. På nerfallna grenar av samma träd förekom *Hirschioporus abietinus*.
Dlr, Husby, Långshyttan. 1967 (I. N.). På *Larix*.
„ , Husby, Stjernsund. 1967 (I. N.). På *Pinus silvestris*. På en låga tillsammans med *Fomitopsis pinicola*.

Materialet i UPS fördelar sig i avseende på substratet på följande sätt: *Pinus* (13), *Picea* (2) och *Larix* (1). Enligt BUCHWALD etc. (1961) är *Ph. schweinitzii* känd som parasit på *Pinus strobus* i Danmark och Sverige.

5. **Climacodon septentrionalis** (FR.) KARST.

Ög, Slaka, Lambohov. 1967 (I. N. 4427) UPS. På *Aesculus hippocastanum* 5 m ö. m.
Upl, Film, Österbybruk, allé vid gamla bruksgatan. 1963-64 (I. N. 2068) UPS. På *Acer platanoides*, jättefruktkropp.
„ , Forsmark, herrgården, Engelska parken. 1965-66 (I. N. 3267) UPS. På *Acer platanoides*.
„ , Rimbo, Ekebyholm. 1967 (H. JAHN & N. SUBER in litt.). På *Acer platanoides*.
„ , Vendel, Örbyhus slott. 1967 (I. N. 4400) UPS. Solitärträd av *Populus nigra* i "ritningen" 4 m ö. m.
„ , Österlövsta, gammal vägslinga N. om Hellbo. 1967 (I. N. 4365*) UPS. På sågytan av gammal grov stam av *Acer platanoides* från Leufstabruk, delvis dold av högt gräs. Svampen uppträdde här i en ljus skuggform med tunn hattkant.
„ , Österlövsta, sockenkyrkan. 1967 (I. N.). En stor fruktkropp vid stambasen av *Populus nigra*. Fjolårsfruktkroppen kvarsittande ännu den 29 juli, men det frambrytande nya exemplaret höll på att stöta bort det gamla.
Vsm, Nora, Gyttorp, allén vid Bergsängs herrgård. 1967 (E. SUNDSTRÖM). På *Acer platanoides*.
„ , Grythytte, Flosjöhyttan, Flosjötorp. 1968 (E. SUNDSTRÖM). På *Acer platanoides*.
Nrk, Knista, Villingsberg, herrgården. 1967 (I. N.). 3 träd av *Acer platanoides* angripna.

Dlr, Husby, Stjernsund. 1967 (I. N. 4372) UPS. På *Acer platanoides* framför herrgården. Omfattande skador; många träd i allén bar tydliga spår av tidigare angrepp i form av knäckta stammar och fläkta kronor.

Arten når sin nordgräns i mellersta Dalarna. I sydkanten av Bergslagsterrängen är den ej så ovanlig på odlade träd, främst *Acer platanoides*. Svampen uppträder här tillsammans med bland annat *Fomes fomentarius, Oxyporus populinus, Phellinus igniarius* och *Spongipellis spumeus*. Liksom *Polyporus squamosus* är *Climacodon septentrionalis* en parksvamp, som sällan eller aldrig förekommer i naturlig vegetation.

Förutom redan nämnda substrat för *Climacodon* kan tilläggas *Betula* och *Populus balsamifera* (i UPS), *Quercus* och *Sorbus intermedia* (i S).

Stora grentaggsvampen utbildar ettåriga jättefruktkroppar, och är en mycket aktiv rötsvamp (en svampig vitröta). Då svampen angriper stora parkträd *(Aesculus, Populus)* och alléträd *(Acer)* är den en stor fara för såväl bebyggelse som trafik. På flera av de ovannämnda lokalerna har de angripna träden förstörts under vinterhalvåret, i minst ett fall har den angripna stammen fällts för att förekomna skadeverkan.

WINGE (1945) anger kortfattat de få danska lokalerna samt ett nyfynd på *Aesculus hippocastanum*.

6. **Sparassis crispa** (WULF. ex FR.) FR.

Upl, Husby-Ärlinghundra, Steninge, N. om Västerängsudd, torr bergig udde i Mälaren med *Pinus silvestris*. 1965-67 (I. N. 3281) UPS. Små exemplar.

„ , Jumkil, Ullbolsta, Asplund. c. 1963 (B. ÅBERG).

„ , Uppsala, Valsätra. 1963 (K. & T. NORDIN; I. N. 1991) UPS.

„ , Österlövsta, Leufstabruk, intill Skälsjövägen. 1968 (H. EK.). — Fyndet är meddelat i en tidningsnotis (U. N. T. 3 okt. 1967), där den stora fruktkroppen avbildas. Enligt upptäckaren, som i tre veckor sett svampen växa, nådde den en ansenlig storlek: 104 cm i omkrets och 36 cm i höjd.

Uppsalaherbariet (UPS) har beläggexemplar av *Sparassis crispa* från Bollnäs (Hls) och Falun (Dlr), men i övrigt inget nordligare fynd än detta från Leufstabruk.

7. **Neogyromitra gigas** (KROMBHOLZ) IMAI

Upl, Österlövsta, Leufstabruk, intill Skälsjövägen. 1967 (I. N. 4318). Sex exemplar kring och på gammal låga av *Salix cinerea* i fuktig blandskog.

„ , Österlövsta, 1.5 km NNW. om Ledskär. 1967 (T. NORLIN). I. N. 4319. Ett jätteexemplar intill skogsstig.

NANNFELDT (1932) anger att de kända svenska lokalerna grupperar sig kring Uppsala och Stockholm, som är de mykologiskt bäst undersökta områdena. De ovannämnda lokalerna är belägna 80 km N. om Uppsala, strax söder om Dalälvens mynning och nära nordgränsen för vildväxande ek.

Neogyromitra gigas är ett exempel på en sällsynt, storvuxen vårdiscomycet, som ej visar sig varje år, andra sådana som jag iakttagit 1967 är *Helvella acetabulum* (Upl. Österlövsta, Leufstabruk, Hellbo), *Ptychoverpa bohemica* (Upl, Dannemora, W. om Andersby) och *Discina perlata* (Upl, Gamla Uppsala, Hamra).

8. **Sarcoscypha coccinea** (FR.) LAMBOTTE

Syn. *Peziza coccinea, Plectania c.*

Ög, Skälvik, S. om Stegeborg, lundmark med *Alnus glutinosa* och *Corylus avellana* dominerande vid en slingrande bäck. 1967 (I. N. 4254) UPS. Fem apothecier, varav två mätte c. 6 cm i diameter. På gamla pinnar i marken. — Fig. 3.

Vg, Kinnekulle, Medelplana, NW. om Hällekis. 1967 (K. BOHLIN & E. SUNDSTRÖM).

Srm, Södertälje, Lina bruk, smältvattengrop med *Betula-grenar*. 1959 (E. SUNDSTRÖM).

Denna svamp är tämligen sällsynt, men kanske ändå mer förbisedd på grund av sin märkliga fenologi. Den skandinaviska utbredningen har behandlats av GELIN (1938, karta, p. 195) och BUCHWALD (1941). Nytillkomna lokaler hos ANDERSSON (1942), KLINGE (1944) och JULIN (1963).

Scharlakansröda vårskålsvampen tar nog jämte koralltaggsvampen *(Hericium ramosum)* skönhetspriset i Skandinaviens svampflora. En mycket god avbildning finns hos POELT & JAHN (1963, tavla 11), vidare hos LANGE & LANGE (1964, p. 33) och DENNIS (1968, fig. VII: c). Det tidiga uppträdandet på säsongen gör säkert, att arten ej till-

räckligt uppmärksammas. Men färgen gör att den knappast kan förbises av den som tidigt på våren vistas ute i naturen och på lämpliga lokaler. Då jag fann svampen i Östergötland — så tidigt som den 23 april — var marken nästan vit efter täta hagelbyar. Hymeniet lyste intensivt, och min första tanke var, att någon tappat en röd plastboll på marken.

9. **Microstoma protracta** (Fr.) Kanouse

Syn. *Anthopeziza protracta, Plectania p., Sarcoscypha p.*

Upl. Mälaren, Enköpings-Näs, Karinskär, på fuktig sandmark. 1967 (G. Eriksson) UPS.

Även denna svamp är en vårdiscomycet, fyndet ovan gjordes i slutet av april månad. Arten finns återgiven hos Dennis (1968, fig. VII: d). Den är normalt betyligt mindre än *Sarcoscypha coccinea*. Gelin (1938) har behandlat även denna svamps utbredning. En ny lokal har publicerats av Söderberg (1949, 1950), och den svenska utbredningen är i korthet följande:

Srm	2 lokaler	Dlr	2
Upl	4	Ång	1
Vsm	1	Tl	1

Härav framgår att svampens förekomst har en viss nordlig prägel i Sverige. Enligt Dennis finns arten i de Skotska högländerna.

10. **Daldinia concentrica** (Bolton ex Fr.) Cesati & de Notaris

Ög, Hogstad, Lilla Ljuna. 1967 (I. N.). På *Prunus padus* och *Sorbus aucuparia*.

„ , Linköping, Nykvarnsparken, SO. om slussen. 1968 (H. Carlstedt 581). På *Alnus glutinosa* tillsammans med *Datronia mollis*.

„ , Vårdnäs, Brokind, N. om Järnlunden. 1967 (I. N. 4437) UPS Ett litet exemplar på låga av *Alnus glutinosa* i fuktig skogsmark tillsammans med *Trametes hoehnelii*.

„ , Omberg, Väversunda, SO. om Anudden. 1967 (I. N. 4233) UPS. Rikligt i stora exemplar på fickade stammar av *Sorbus aucuparia*. Se under *Schizophyllum!*

Nrk, Hidinge, Lövbråten (Villingsbergs skjutfält). 1967 (I. N. 4300) UPS. Ett exemplar på *Betula*.

Nrk, Hidinge, 600 m O. Kärmens N-spets (Villingsbergs skjutfält). 1968 (H. CARLSTEDT 672). På *Betula*-stubbe.

Upl, Vaksala, W. om Jälla lantmannaskola. 1967 (I. N. 4192) UPS. Ett exemplar på låga av *Betula* i skogsdunge tillsammans med *Fomes fomentarius, Merulius tremellosus, Phlebia radiata, Trametes hirsuta, T. unicolor* och *T. zonata.*

11. **Hypocreopsis lichenoides** (TODE ex FR.) SEAVER

Syn. *Hypocreopsis riccioidea.*

Gbg, Mölndal, Eklanda. 1967 (S. O. ANDERSSON). På *Crataegus* på 3 dm hög stamrest.

„ , Hisingen, Rödbo, Svankälle-områdets N-del. 1968 (I. N. 4518). GB, S, UPS, O. Tämligen rikligt på grenar och stambaser av *Salix cinerea* tillsammans med *Hymenochæte tabacina,* sparsamt på *Betula*-kvist i skuggigt, igenvuxet dike i skogskanten. 15 exemplar, varav ett mätte 10 × 15 cm och var kraftigt algövervuxet.

„ , Styrsö, Vargö. 1967-68 (E. SELSTAM). På *Salix* tillsammans med *Hymenochaete tabacina.*

Vg, Bjärklunda, Ore nabbe vid Hornborgasjön. 1968 (K. HJORTSTAM). På *Salix* sp. rikligt.

„ , Bälinge, N. om Torps hpl. nära Säveån. 1966 (K. HJORTSTAM). På döda och levande grenar av *Rhamnus frangula.*

„ , Bälinge, NW. om Lilla Munnsjön vid bäcken. 1966 (K. HJORTSTAM). På *Salix* sp.

„ , Kullings-Skövde, Vårgårda, Klovnasten. 1966-68 (U. ELIASSON). På *Salix* sp. på tre närbelägna lokaler.

„ , Trävattna, nära Lidan. 1968 (K. HJORTSTAM). På *Salix* sp.

„ , Hunneberg, V. Tunhem, ödetomt i alkärr-regionen på bergets S-sluttning. 1968 (G. WESTBERG) UPS*. På *Symphoricarpos rivularis* tillsammans med *Crucibulum vulgare* (A. BOHLIN in litt.). — Fyndet har anmälts av A. BOHLIN i Svensk Botanisk Tidsskrift 1968 (in press).

Ög, Hogstad, Stora Ljuna, hassellund vid E 4: an. 1967 (I. N. 4219) UPS. Ett exemplar på död, kvarsittande gren av *Corylus avellana* tillsammans med *Inonotus radiatus* och *Hymenochaete tabacina* (delvis överväxande denna) samt en fruktkropp på en nerfallen gren från samma buske. — Fig. 2.

Vsm, Västerås-Barkarö, N. om Gångholmen, hassellund intill landsvägen. 1967 (I. N. 4208) UPS. Ett litet ungt exemplar på död upprätt stam av *Corylus avellana* tillsammans med *Coriolellus campestris, Hapalopilus nidulans, Hymenochate tabacina, Inonotus radiatus, Phellinus punctatus, Poria versipora* och *Vuilleminia comedens.* — Fig. 1.

Hypocreopsis lichenoides anmäls här som ny för Ög, Vsm och Nrk. Förekomsten på Vargö i Göteborgs södra skärgård är den första svenska kustlokalen. De nämnda förekomsterna ger svampen ny väst-, öst- och nordgräns i Sverige.

KARLVALL (1963) redogör för det första fyndet av arten i Sverige i Göteborgs botaniska trädgårds arboretum. I sin undersökning över artens biologi, utbredning etc. redovisar STRID (1967) sju lokaler i landet. 12 nya lokaler har tillkommit på kortare tid än två år. Här anges kortfattat den nu kända svenska utbredningen:

Sm	1 lokal	Vsm	1
Gbg	4	Nrk	1
Vg	10	Vrm	1
Ög	1		

I fråga om svampens substratval har de nya lokalerna ytterligare visat, att *Salix* är det vanligaste. Första gången arten blev funnen hos oss var på det nämnda substratet, och andra har senare tillkommit, exempelvis *Rhamnus frangula*. Botanisterna har kanske ägnat för ensidig uppmärksamhet åt eventuella ytterligare förekomster på *Salices*. Vid mina undersökningar av polyporéfloran på *Corylus* har jag stött på *Hypocreopsis* så att säga i förbifarten. På flera lokaler har svampen utvecklats intill en punkt, där två grenar legat och skavt, och som nu hålls förenade genom *Inonotus radiatus*. Nya substrat är *Crataegus* och *Symphoricarpos*.

I svampsuccessionen på döda stammar av *Corylus, Salix* etc. kommer *Hypocreopsis* efter *Hymenochaete tabacina,* av vilken gamla fruktkroppar blivit övervuxna av *H. lichenoides* på flera av de uppräknade lokalerna.

Den europeiska utbredningen i stort är västlig, och STRID (1967) meddelar, att alla insamlingar dittills gjorts inom områden med maritimt influerat klimat. Östgötalokalen är belägen på slätten sydost om Tåkern och Vättern, västmanlandslokalen intill Mälaren inom området med den högsta julimedeltemperaturen i Sverige (och förekomst av värmekrävande växter såsom *Viscum album)*. KARSTEN insamlade redan 1861 *Hypocreopsis* i Lapponia rossica, Ryssland (Material i UPS!), cirka 1000 km N. om den nordligaste svenska lokalen (kartor hos STRID, pp. 84-85).

Hypocreopsis lichenoides är en mycket lättigenkännlig art, som finns återgiven i bland annat följande verk: DENNIS (1968, fig. XXVII: a), KLINGE (1956, p. 287), KARLVALL (1963, tavla 8: b) och STRID (1967, p. 80).

I sin utbredning visar *Hypocreopsis* stora likheter med *Trametes rubescens* (syn. *Daedalea confragosa*). Båda svamparna beskrevs av KARLVALL (op. cit.) från Göteborgs botaniska trädgård, *Hypocreopsis* som ny för Sverige, *T. rubescens* för första gången sedan ELIAS FRIES' dagar (han kände till en lokal för tickan i Mellansverige). KARSTEN insamlade båda arterna i nordligaste Fennoskandien. Gemensamma drag i utbredningen är framförallt en stark koncentration för bägge till tämligen triviala ståndorter i Sydvästsverige, en mindre förekomst i Mellansverige samt en nordlig (*T. rubescens* är här tagen både i Sverige och Finland; se KALLIO & KANKAINEN 1964, p. 189!). *Hypocreopsis* är ännu icke känd från Sydöstsverige, varifrån jag insamlat material av *T. rubescens*. Nya lokalfynd kommer säkert att vidga utbredningen för båda svamparna och något fylla igen utbredningsluckorna åtminstone i Syd- och Mellansverige; här finns mycket gott om passande ståndorter för båda arterna.

Det tycks som om *H. lichenoides* är stadd i stark expansion i Sverige, ett förhållande som kommer att följas med stor uppmärksamhet. Visserligen skulle man kunna invända att den senaste tidens ökade antal fynd endast sammanhänger med fackmännens likaså ökade intresse för arten. Emellertid talar mot detta att antalet nya lokaler är så stort — fynd görs ideligen och även av icke-fackmän — och inom tidigare tämligen väl genomforskade områden. Det förefaller därför rimligt att anta att svampen är stadd i en exlosionsartad utbredningsprocess i Sverige just nu. Det starkt ökade antalet fynd på kort tid kan knappast förklaras på annat sätt än genom artens dynamik.

Många vänner har generöst kompletterat mina lokallistor med egna fynd, för vilket jag tackar ANDERS BOHLIN, HÅKAN CARLSTEDT, GUNNAR ERIKSSON och ERIK SUNDSTRÖM. JOHN ERIKSSON har dels haft vänligheten att bestämma två *Phlebia*- och *Phanerochaete*-arter, dels förmedla nya västsvenska fynd av *Hypocreopsis*. Med JOHN AXEL NANNFELDT har jag haft nöjet diskutera frågor i samband med svamparnas utbredning etc. ERIC ÅBERG har bestämt vedprov från fyra kollekter (som är markerade med *).

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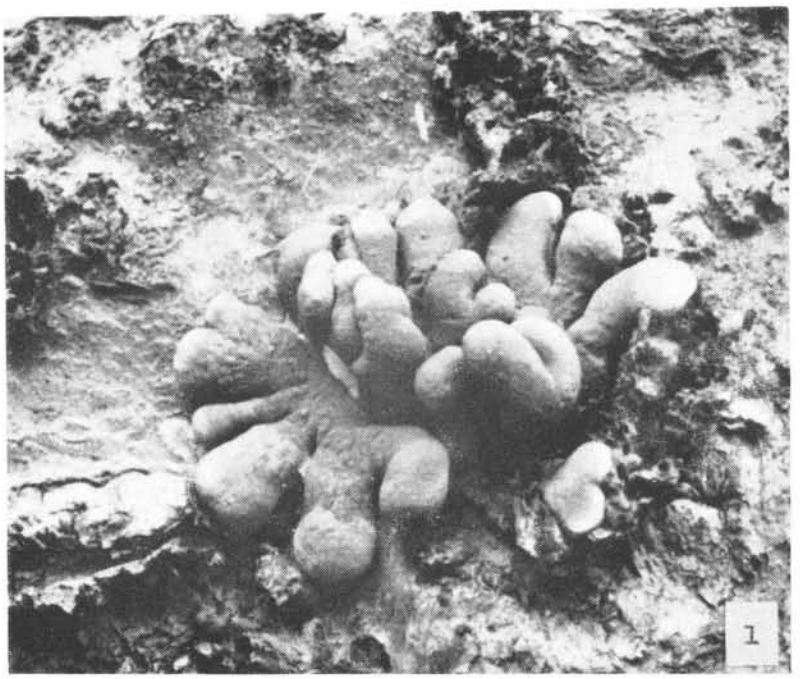
FIGURFÖRTECKNING

Foto: Ingvar Nordin

1. *Hypocreopsis lichenoides.* Vsm, Västerås-Barkarö, N. om Gångholmen, *Corylus.* 1967 (I. N. 4208) UPS. Fruktkroppens storlek: 19 × 12 mm.
2. *H. lichenoides.* Ög, Hogstad, Stora Ljuna, *Corylus.* 1967 (I. N. 4219) UPS. Tillsammans med *Hymenochaete tabacina.* Fruktkroppens storlek: 25 × 19 mm. Kvistens diameter: 15 mm.
3. *Sarcoscypha coccinea.* Ög, Skälvik, S. om Stegeborg. 23.IV.1967 (I. N. 4254) UPS. Apotheciernas diameter 60 mm. Till vänster blomknopp av *Anemone nemorosa.*
4. *Schizophyllum commune.* Ög, Omberg, Väversunda, SO. om Arnudden, *Quercus.* 1967 (I. N. 4230) UPS. Den största fruktkroppens storlek: 40 × 30 mm.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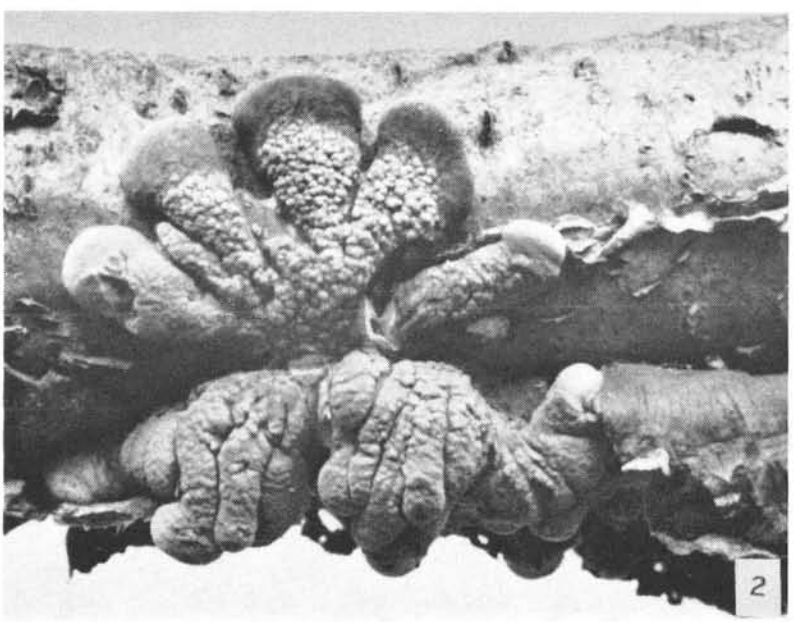
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COLLECTIONS EXAMINED

110 collections have been studied: 35 were preserved in my herbarium under *M. curreyana* prior to my becoming aware of the broad-spored fungus, 38 were made subsequently and 37 were exsiccati in herbaria CP, CUP, DBN, K, PR, S, UPS and J. GREMMEN, see Acknowledgements and LANJOUW & STAFLEU (1964). Only one collection in my herbarium (J. T. P. 2094, Halton Lodge, *J. effusus,* 6.VII.1953) had broad spores. The remainder had narrow allantoid spores except for a collection of overwintered sclerotia (Boghadoon, *J. effusus*), which produced apothecia containing narrow spores in April (J. T. P. 3375, Fig. 10) and two apothecia with broad spores from a single sclerotium in June, 1968 (J. T. P. 3376, Fig. 1).

11 collections have been made of the broad-spored species, including the above two: eight as developing apothecia in the field and three as sclerotia which produced apothecia in mid-summer.

On *Juncus balticus* × *inflexus,* large homogeneous stand in wet dune slack, Birkdale Hills, Ainsdale, Lancashire, England: J. T. P. 3138, fruited in natural culture 14.VI.-1.IX.1967; J. T. P. 3145, leg. 24.VI.1967 with apo-

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EXPLANATIONS OF FIGURES

Figs. 1-6. *Myriosclerotinia juncifida,* asci and ascospores. Fig. 1. J. T. P. 3376, Boghadoon, ascus. — Fig. 2. J. T. P. 3153, Ainsdale, ascus. — Fig. 3. Isotypus in H, ascus. — Fig. 4. J. T. P. 3138, Ainsdale, ascus. — Fig. 5. Holytypus in H, spores. — Fig. 6. J. T. P. 3150, Ainsdale, spores with some septate and producing spermatia.

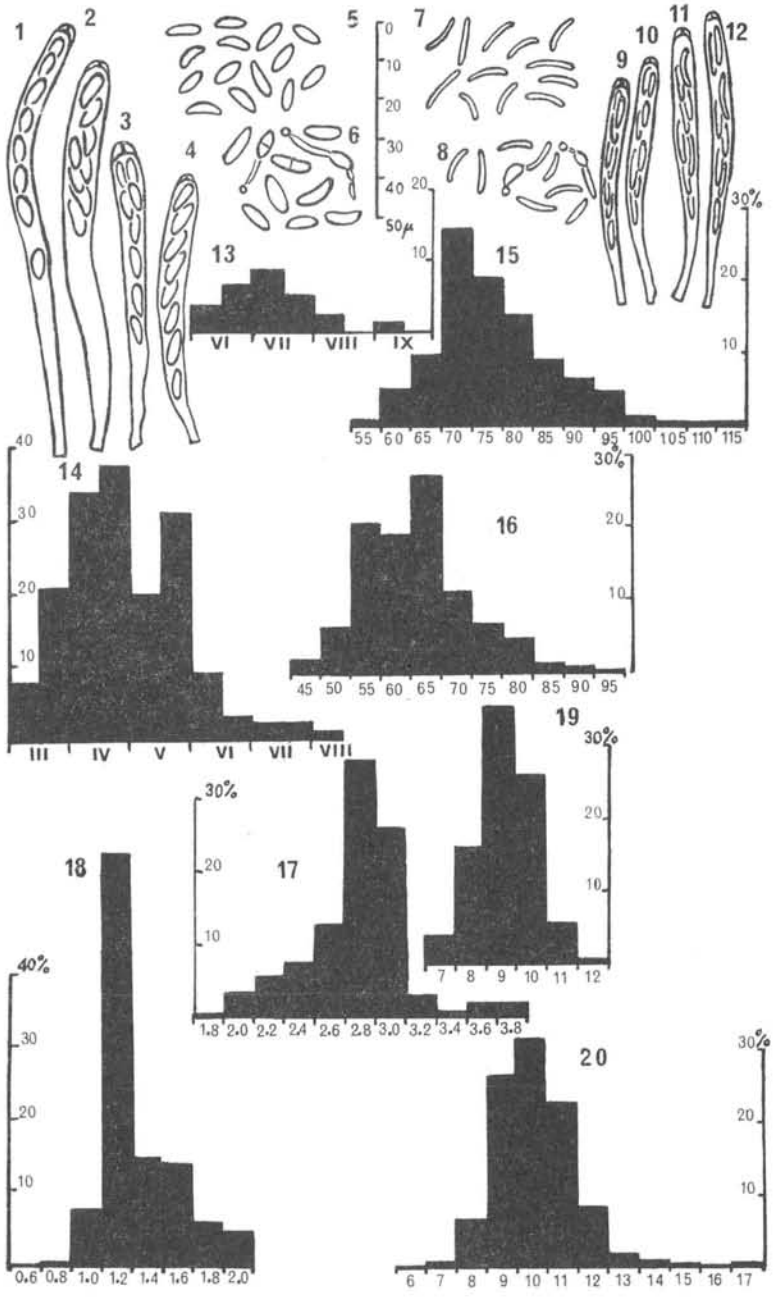
Figs. 7-12. *Myriosclerotinia curreyana,* ascospores and asci. Fig. 7. Holotypus in K, spores. — Fig. 8. J. T. P. 3144, Kinder Scout, Derbyshire, spores with some producing spermatia. — Fig. 9. J. T. P. 2753, Chinley, Derbyshire, ascus. — Fig. 10. J. T. P. 3375, Boghadoon, Co. Mayo, ascus. — Fig. 11. J. T. P. 3355, Wybunbury Moss, Cheshire, ascus. — Fig. 12. Holotypus in K., ascus.

Figs. 13-14. Comparison of fruiting periods showing number of collections (or samples removed when overwintered in natural culture) made in each fortnight. Fig. 13. *M. juncifida,* 25, 14. June to 1. September. — Fig. 14. *M. curreyana,* 169, 3. March to 14. August.

Figs. 15-16. Comparison of ascus lengths as % to nearest 5 μ. Fig. 15. *M. juncifida,* 254 asci, 60-115 μ. — Fig. 16. *M. curreyana,* 1091 asci, 45-95 μ.

Figs. 17-18. Comparison of ascospore widths as % to nearest 0.2 μ. Fig. 17. *M. juncifida,* 388 spores, 1.8-3.9 μ. — Fig. 18. *M. curreyana,* 1300 spores, 0.6-2 μ.

Figs. 19-20. Comparison of ascospore lengths as % to nearest 1 μ. Fig. 19. *M. juncifida,* 388 spores, 6.5-12 μ. Fig. 20. *M. curreyana,* 1300 spores, 6-17 μ.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30
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10
III
IV
V
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VII
VIII
16
30%
20
10
45 50 55 60 65 70 75 80 85 90 95
19
30%
20
10
7 8 9 10 11 12
17
30%
20
10
1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8
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0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
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thecia developing until 12.VII.1967; J. T. P. 3150, leg. 15.VII.1967; J. T. P. 3153, leg. 29.VII.1967; J. T. P. 3352, fruited in natural culture 6.VI.-30.VII. 1968; J. T. P. 3415, leg. 18.VII.1968.

On *Juncus effusus,* bordering pond in field, Halton Lodge near Runcorn, Cheshire, England: J. T. P. 2094, leg. 6.VII.1963; J. T. P. 3394, leg. 13.VII.1968; moorland, Boghadoon near Tristia, Co. Mayo, Irish Republic: J. T. P. 3376, fruited in natural culture 27.VI.1968.

The genus *Myriosclerotinia* is characterized by the spermatial stage (spermodochidia) developing on the host culm, which was observed in different stages of development at Ainsdale from late August onwards and collected on overwintered culms with apothecia at Halton Lodge. Both the spermodochidia and the spermatia appeared to be similar to those of *Myrioconium tenellum* (SACC.) V. HÖHN. and no evidence was found for separating the sclerotia, which are plastic structures, from those of *Sclerotium juncinum* DESM., the two imperfect states of *Myriosclerotinia curreyana.*

MICROSCOPICAL MEASUREMENTS

An examination of the published dimensions for *M. curreyana* shows considerable variations for ascus lengths and spores.

CURREY (1857) gave no measurements for *Peziza curreyana* in his original diagnosis but later (1864) published the spore length range. However, his collections in K, including the holotype, all have the characteristically narrow spores. The first complete microscopic measurements are those of the TULASNES (1861) in GROVE (1931), made from living material sent by CURREY from the London area in April, 1860. A comparison of the published measurements (converted to μ where necessary) is shown in Table I.

REHM (1893) wrote "...Exemplare des Pilzes bei PHILLIPS (Elvell. brit. 31), an denen ich allerdings die Sporen nur 1 μ breit fand, wie sie auch PHILLIPS l. c. zwischen 1-2,5 μ breit anführt." His illustrations (p. 803, Fig. 3 "Schlauch mit Paraphysen" and Fig. 4 "Sporen"), both as "Originalzeichnungen nach der Natur", show comparatively broad spores. No scale is given but the largest of the two in Fig. 4 measures 10 × 3 mm which, from the length range given, indicates a width of 2.1 μ to 3.6 μ. However, the only two collections made before 1893 in the REHM herbarium in S have apothecia containing narrow spores.

TABLE I.

Comparison of published records of asci and ascospores.

	ASCI	SPORES
CURREY (1864): *Peziza curreyana*	?	10.0-12.0 × ? (μ)
TULASNES (1861): *P. curreiana*	70.0-80.0 × 7.0-8.0 μ	8.0 × 1.5 μ
NYLANDER (1869): *P. juncifida*	? × 6.0 μ	7.0-9.0 × 2.5-3.0 μ
COOKE (1871): *P. curreiana*	?	10.0-12.0 × (?) μ
KARSTEN (1871): *Rutstroemia curreyana*	85.0 × 6.0 μ	7.0-10.0 × 2.5-3.0 μ
LAMBOTTE (1887): *Sclerotinia curreiana*	?	7.0-10.0 × 2.5-3.0 μ
PHILLIPS (1887) *Hymenoscypha curreyana*	?	10.0-13.0 × 1.0-2.5 μ
SACCARDO (1889): *Sclerotina curreyana*	?	10.0-13.0 × 1.0-2.5 μ
REHM (1893): *S. curreyana*	80.0-90.0 × 6.0 μ	7.0-12.0 × 2.5-3.0 μ
ELLIS & EVERHART (1894): *Ciboria juncigena***)	60.0 × 4.0-5.0 μ	7.0-8.0 × 1.25 μ
MASSEE (1895): *Sclerotinia curreyana*	?	8.0-14.0 × 2.0-3.0 μ
BOUDIER (1907): *S. curreyana*	70.0 × 7.0 μ	11.0-15.0 × 2.0 μ
CROSSLAND (1908): *S. curreyana*	75.0-85.0 × 5.5 μ	?
VELENOVSKÝ (1934): *Poculum juncorum**)	50.0-60.0 × 4.0-5.0 μ	15.0 × 1.0 μ
WHETZEL (1946): *Sclerotinia currcyana*	47.6-65.2-78.0 × 4.0-5.0-5.4 μ	7.9-11.5-14.5 × 1.3-2.5-2.9 μ
— (1946): *S. juncigena***)	?	7.2-8.9-10.8 × 1.2-1.8-2.4 μ
BUCHWALD (1947): *Myriosclerotinia curreyana*	80.0-90.0 × 5.0 μ	7.0-(13.4)-16.5 × 2.0-(2.5)-3.0 μ
FAVRE (1948): *Sclerotinia curreyana*	?	8.0-8.5 × 2.5-3.0 μ
DENNIS (1956, 1960 & 1968): *S. curreyana*	80.0-90.0 × 5.0-6.0 μ	7.0-15.0 × 1.5-3.0 μ
SVRČEK (1961): *S. curreyana*	?	7.0-16.0 × (1.5)2.0-3.0 μ
— (1961): *S. juncigena***)	?	7.0-11.0 × 1.2-2.4 μ
MOSER: (1963): *S. curreyana*	?	7.0-15.0 × 2.0-3.0 μ
Author: *M. curreyana*	43.0-63.0-94.0 × 2.3-4.8-7.3 μ	5.9-9.9-16.6 × 0.6-1.2-2.0 μ
— : *M. juncifida*	60.0-83.0-115.0 × 3.9-5.7-8.2 μ	6.5-9.0-12.0 × (1.8)2.0-2.8-3.9 μ

*) SVRČEK (1961) refered *Poculum juncorum* VELEN. to *M. curreyana* and *Sclerotinia curreyana* sensu VELEN. to *Sclerotinia sclerotiorum* (LIB.) DE BARY.

**) *Ciboria (Sclerotinia) juncigena* is probably a synonym of *M. curreyana*.

FAVRE (1948) appears to have been the next to comment on the discrepancies in the published measurements. When dealing with a collection referred to "*Sclerotinia Curreyana* sensu REHM, non PHIL.", "sur feuilles de joncacées" from "Marais du Bois des Tailles" in the Swiss Jura mountains, he wrote "Le *Sclerotinia* de ce marais a des spores elliptiques-cylindriques droites ou un peu courbée, de 8-8,5 × 2,5-3 μ. Il correspond exactement à celui que REHM a appelé de ce nom, mais ce n'est pas le véritable *S. Curreyana* de BERKELEY, redécrit et figuré par BOUDIER, car ses spores sont beaucoup plus étroites et plus longues: 10-13 × 1-2,5 μ. Il faudrait donc donner un nom nouveau à l'espèce de REHM." However, no collections are extant in the FAVRE herbarium in G, hence it is unlikely that anything further about this find will ever be known.

A perusal of Table I shows the first mention of broad spores to be by NYLANDER (1869) for *Peziza juncifidia* which KARSTEN (1871) treated as a synonym of his new combination *Rutstroemia curreyana*, and most subsequent authors have given a maximum spore width of 3 μ. However, my study of the exsiccati preserved in the national herbaria, many of which were probably examined by some of these authors, found no trace of the broad-spored fungus, hence I can only assume that they had studied collections not available to me or had taken the published measurements into account when preparing their descriptions.

PEZIZA JUNCIFIDA NYL.

The original diagnosis in NYLANDER (1869) reads "Apothecia spadicea, cupula (latit. circiter 3 millim.) cyathoidea, stipite mediocri (longit. circiter 4 millim.); sporæ ellipsoideæ vel oblongæ simplices, longit. 0,007-9 millim., crassit. 0,0025-0.0030 millim. (thecae cylindraceæ, crassit. 0,006 millim.). Ad culmos *Junci (compressi?)* in Lappfjerd (P. A. KARSTEN, d. 28 junii, 1859). Culmos findens prorumpit; ..... Thecæ obturaculo iodo dilute coerulescente; etiam hypothecium iodo coerulescens vidi. Stipes crassit. 0,3-0,5 millim." This was repeated by KARSTEN (1869), who added "Nec hanc neqve plurimas rariores a Cel. NYLANDER descriptas species invenire et videre in Herbario Musei Fennici mihi contigit." In his description of *Rutstroemia curreyana*, KARSTEN (1871) emended the original diagnosis as follows: "Apothecia e Sclerotio enata, ... stipes subaeqvalis, subflexuosus ..... Asci cylindracei vel cylindraceo-subclavati, longit. circiter 85

mmm., ... Sporae 8:nae, monostichae aut sursum subdistichae, oblongata, simplices ac eguttulatae, rectae vel saepius qvadantenus curvatae, incolores, longit. 7-10 mmm., ... Paraphyses filiformes, sursum leviter incrassatae, parcae. ..... in paroecia Lappfjerd nobis semel, die 8 mensis Junii 1859. occucurrit. Sclerotium ejus, in culmis *Juncorum* majorum latitans, cylindraceum, atrum, intus album, longit. circiter 3-4 mm., crassit. circiter 0,8 mm. Hunc fungillum *Pez. Curreyi* esse nulle modo in dubium vocari potest. Paries tamen cupulae internus speciminum nostrorum, verisimiliter ob juvenilitatem eorundem, non „mire sulcato-rugosus." Lappfjerd is the old Swedish name for Lapväärtti in Southwest Finland. The fungus has since been treated under *Myriosclerotinia curreyana* or its synonyms.

Microscopical measurements for KARSTEN's gathering in herb. H: Holotypus in herb. W. NYLANDER [A single apothecium in a packet marked by NYLANDER "*Peziza juncifida* Nyl./Lappfjärd/Karsten"]. 10 Asci: 65-72-79 × 3.9-5.4-6.4 μ; 30 Spores: 6.9-8.5-10.0 × (1.8) 2.0-2.3-2.8 μ.

Isotypus in Herb. P. A. KARSTEN [Two intact and several fragments of apothecia, broken sclerotia and host axes in packet annotated by KARSTEN "*Peziza* sp. nov. / det. (in another hand). P. A. KARSTEN 1883 (stamp) / in paroecia Lappfjärd / d. 28 Junii 1859 / Leg. P. A. KARSTEN", determined by NYLANDER as "*Peziza juncifida* NYL.", which is deleted and revised (by KARSTEN?) as "*Peziza curreyana* BERK.", with sketch of spores and "0,007-9 / 0,003-4" (pencil)]. 40 Asci: 62-78-91 × 4.9-5.6-5.9 μ; 120 Spores: 6.6-8.5-10.3 × (1.8) 2.0-2.5-3.1 (3.4) μ.

All measurements, including Table I and Figs. 13-20, have been made in 10 % Erythrosin Ammonia (PALMER 1968 a), using an oil immersion objective for the spores. Dr. CUTLER reports that sample axes from the isotype compare fairly well with leaf base material of *Juncus compressus* L.

CONCLUSIONS

Peziza juncifida appears to be identical with my collections on *Juncus balticus* × *inflexus* and *J. effusus*. The recombination with *Myriosclerotinia* BUCHW. is therefore proposed.

Myriosclerotinia juncifida (NYL.) J. T. PALMER, comb. nov.

Basionym: *Peziza juncifida* NYLANDER, Not. Sällsk. Fauna Flora fenn. Förh. 10: 39, 1869.

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DISTRIBUTION TOPOGRAPHIQUE D'ISOTOPE RADIOACTIF $^{40}_{19}$ K DANS LES CHAPEAUX DE TRAMETES VERSICOLOR ET PHELLINUS POMACEUS

AU POINT DE VUE DE LA PRÉSENCE COMME DES SUBSTANCES COLORANTES ORGANIQUES, DES RÉSINES ET DES SUBSTANCES AUX QUALITÉS ANTIBIOTIQUES DANS LA FAMILLE POLYPORACEAE

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RÉSUMÉ

Les chapeaux de *Trametes versicolor* (L. ex FR.) PIL. et *Phellinus pomaceus* (PERS.) MAIRE contiennent l'isotope radioactif naturel $^{40}_{19}$ K dans la douve, et même dans l'hyménophore. Celui-ci étant localisé dans l'hyménofor, dans la douve et dans les substances sur la surface de l'épiderme et dans les bouches des cavités à labyrinthe. L'activité relative d'hyménophore *Trametes versicolor* est $1{,}8 \cdot 10^{-11}$ c, des substances à l'épiderme du corps de champignon $2{,}5 \cdot 10^{-11}$ c; l'activité relative d'hyménophore *Phellinus pomaceus* est $1{,}5 \cdot 10^{-11}$ c; des gisements ressemblants aux îlots dans la douve $2{,}5 \cdot 10^{-11}$ c.

SOUHRN

Příspěvek k topografické distribuci přirozeného radiodraslíku a jeho isotopu $^{40}_{19}$ K v plodnicích *Trametes versicolor* (L. ex FR.) PILÁT a *Phellinus pomaceus* (PERS.) MAIRE z hlediska známého výskytu organickýck barviv, pryskyřic a látek s vlastnostmi antibiotik u čeledi *Polyporaceae*.

Plodnice chorošů *Trametes versicolor* a *Phellinus pomaceus* obsahují v dužině i hymenoforu přirozený draslík jehož součástí je radioaktivní isotop $^{40}_{19}$ K, který je lokalisován v hymenoforu, dužině a v látkách na povrchu pokožky a v místech vyústění labyrintických dutinek. Specifická aktivita hymenoforu *Trametes versicolor* je $1{,}8 \cdot 10^{-11}$ c, látek na pokožce plodnice $2{,}5 \cdot 10^{-11}$ c; specifická aktivita hymenoforu *Phellinus pomaceus* je $1{,}5 \cdot 10^{-11}$ c, ostrůvkovitých ložisek v dužině $2{,}5 \cdot 10^{-11}$ c.

Dans plusieurs travaux précédents j'ai suivi la distribution topographique d'isotope radioactif naturel $^{40}_{19}$ K dans les corps de champignons surtout par rapport à la translocalisation et la localisation d'isotope susdit. Au moyen d'analyse autoradiographique des chapeaux de *Trametes versicolor* (L. ex Fr.) Pil. et *Phellinus pomaceus* (Pers.) Maire on a constaté la localisation abnormale $^{40}_{19}$ K à la surface d'hyménophore ou le réseau ou les spores sont formés et dans les cavités à labyrinthe. L'isotope actif $^{40}_{19}$ K se présentait comme un composant de substance reconnaissable sous macroscope, appartenant probablement au groupe des substances colorantes organiques, des résines et des substances aux qualités antibiotiques. Les substances, mentionnées n'ont pas été décrites jusqu'alors dans *Trametes versicolor* (L. ex Fr.) Pilat et *Phellinus pomaceus* (Pers.) Maire, bien que ces champignons aient une grande importance économique dans la destruction de bois. Comme ces substances peuvent jouer une grande importance économique au futur, une attention particulière a été concentrée autour de la localisation d'isotope actif naturel $^{40}_{19}$ K qui forme un composant des substances trouvées.

La présence des substances appartenantes au groupe des substances colorantes organiques, des résines et des substances aux qualités antibiotiques dans la famille *Polyporaceae* est par exemple dans *Fomes officinalis* (Vill.) Neum., où les sécrétions spéciales apparaissent provenir des hyphes muqueuses. Ces hyphes muqueuses ressemblent aux hyphes résineuses (Tunmann & Rosenthaler 1931). Au bord du fructifications de champignon se trouvent quelquefois les acides agaricins. Sorokin (1875) a trouvé dans *Polyporellus squamosus* (Huds.) Pil., *Trametes suaveolens* (L.) Fr., *Grifola sulphurea* (Bull.) Pil. etc. selon la méthode de Schnell (1875) l'avide inguinal Zopf (1888) a découvert au chapeau de champignon et à l'hyménium dans *Trametes gallica* Fr. les jaunes corpuscules résineux ressem-

blants à la couleur de gummigutta, dans *Trametes cinnabarina* (JACQ.) FR. les jaunes corpuscules dont sont formés les cristals de la substance colorante de couleur rouge canelle xanthotrametin et d'autres corpuscules résineux appartenants probablement à l'acide résineux. Polypori ont de nombreuses substances au caractère et qualités antibiotiques. La substance polyporin de ZELLER (1913) dans *Trametes betulina* (L.) PIL. depuis longtemps connue a été renommée plus tard par FREREJACK (1938) l'acide unguline.

MATÉRIAUX ET MÉTHODES

Pour mon travail j'ai appliqué la méthode courante de radiographie contacte décrite par plusieurs auteurs (MYSLIVEC, 1958, MEDVEDĚV, 1958, Botanique d'agriculture, 1962) et l'élaboration courante des matériaux photographiques négatifs et positifs. Les matériaux photographiques f. d. ISOPAN AGFA ISS 21°/Din Veb. Film. Fabr. Kreis Bitterfeld, DDR ont été exposés 20×24 heures. Les matériaux végétaux provenaient du parc de Kinský à Prague, ils ont été déterminés au point de vue botanique par le docteur E. WICHANSKÝ, ramassés en mars 1963. Les autoradiogrammes positifs ont été évalués au point de vue de la localisation d'isotope actif $^{40}_{19}$ K. La détermination qualitative K on a réalisé de manière analytique. Les substances non specifiées de plus près à la surface du corps de champignon et à la coupe tangentielle ont été constatées de manière oculaire. Le contrôle d'image autoradiographique a été mesuré dans des matériaux végétaux de manière dosimètrique par le compteur d'impoulsions RA Q 615; les impulsions ont été recalculées à l'activité proportionelle des matériaux végétaux au point de vue d'isotope $^{40}_{19}$ K et d'autres isotopes stables K.

PARTIE EXPÉRIMENTALE

La localisation d'isotope $^{40}_{19}$ K du chapeau de *Trametes versicolor* (L. ex FR.) PILÁT. (*Polyporus versicolor* L. ex FR.).

Les macrogrumeaux des substances jusqu'alors non décrites et non spécifées de plus près étaient visibles sous macroscope à la surface du corps de champignon en deux types de localisation.

1. à l'épiderme de la douve du corps de champignon aux places marginales où ils touchent à l'hyménophore.
2. aux bouches des cavités à labyrinthe.

A part de deux localisations surdites découvertes de manière radiographique on les a trouvées aussi la douve du corps de champignon et dans l'hymen (voir la description du radiogramme). Ces substances ont été même identifiées par la vérification macroscopique après la construction de radiogramme. Cettes substances contiennent l'isotope radioactif naturel $^{40}_{19}$ K qui a laissé une trace radiographique (la trace radiographique — les taches noires laissées sur l'émulsion photographique après β-destruction de radiokalium — visibles sur le radiogramme).

La trace après β-l'émanation d'isotope naturel $^{40}_{19}$ K coincide avec la place où les substances organiques ont été découvertes.

La localisation d'isotope $^{40}_{19}$ K dans le chapeau de *Phellinus pomaceus* (Pers.) Maire (*Polyporus pomaceus* Pers.).

Les macrogrumeaux des substances jusqu'alors non décrites et non spécifiées de plus près étaient reconnaissables sous macroscope à la surface du corps de champignon dans un type de déposition.

1. à la bouche des cavités à labyrinthe.

Ces substances ont été découvertes par le radiographe voir le paragraphe 1. et au suplus même dans la douve du corps de champignons et dans l'hymenium. Ces substances ont été aussi identifiées par la vérification macroscopique après la construction de radiogramme.

L'analyse de radiogramme du chapeau de *Trametes versicolor* (L. ex Fr.) Pilát.

La localisation d'isotope actif $^{40}_{19}$ K évidente à l'épiderme de la douve du chapeau de champignon, à la bouche des cavités à la bouche des cavités à labyrinthe et en même temps dans l'hyménophore entier. L'activité relative d'hymenofor $1{,}8 \cdot 10^{-11}$ curie, des substances à l'épiderme de la douve du corps de champignon $2{,}5 \cdot 10^{-11}$ curie. Dans la douve se trouvent les gisements ressemblants aux îlots. Ils s'y présent séparément et ils sont prèsque de la même grandeur. Ils se trouvent régulièrement dans la zone intermédiaire entre hyménophore et douve. Dans la douve sont évidentes les places de la forme irrégulière à l'activité plus inférieure $1{,}8 \cdot 10^{-11}$ curie.

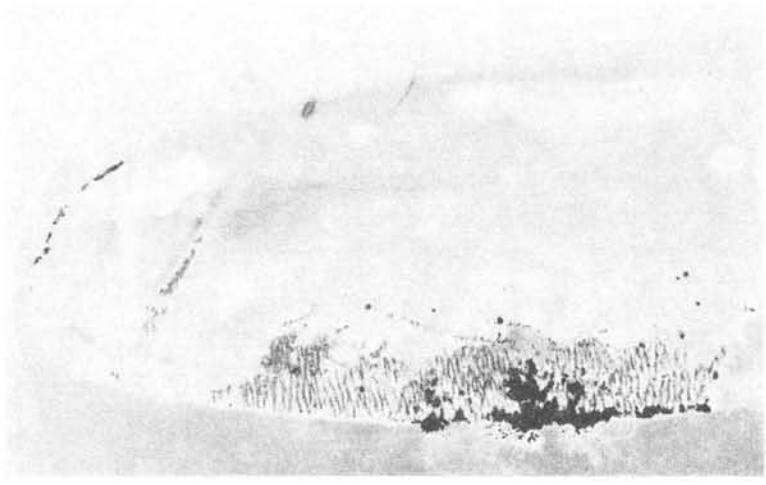

Figure 1. Le radiogramme positif de la coupe tangentielle du chapeau de *Trametes versicolor* (L. ex Fr.) Pil. où est évidente la distribution topographique d'isotope radioactif naturel $^{40}_{19}$ K (≐ les taches noires), surtout la localisation d'isotope actif dans l'hyménophore (l'activité relative ≐ $1{,}8 \cdot 10^{-11}$c). La localisation d'isotope actif $^{40}_{19}$ K dans les substances d'origine organique jusqu'à present non décrites, évidente sur l'épiderme de la douve, dans la douve et à la bouche des cavités à labyrinthe (l'activité relative de ces substances organiques qui n'ont pas été spécifiées jusqu'ici de plus près par la voie chimique ≐ $2{,}5 \cdot 10^{-11}$c). Les matériaux végétaux étaient ramassés en mars 1963. Les matériaux photographiques Isopan Agfa ISS 21° Din, VEB. Film Fabr. Kreis Bitterfeld, DDR. Le temps de pose 20 × 24 heurs; agrandi 4 ×.

L'analyse de radiogramme du chapeau de *Phellinus pomaceus* (Pers.) Maire.

La localisation d'isotope actif $^{40}_{19}$ K est évidente dans la douve du chapeau de champignon /c/ et dans l'hyménophore. L'activité relative d'hymenofor $1{,}5 \cdot 10^{-11}$ curie, des gisements ressemblants aux îlots dans la douve $2{,}5 \cdot 10^{-11}$ curie. Les gisements ressemblants aux îlots dans la douve sont irréguliers en grandeur aussi bien qu'en forme. Ils sont courbés de différentes manières, allongés dans les deux directions: transversales et longitudinales. Ils se trouvent dans la douve entière sur différents lieux. Il y a des places reconaissables en forme irréguliere dans la douve à l'activité inférieure $1{,}5 \cdot 10^{-11}$ curie.

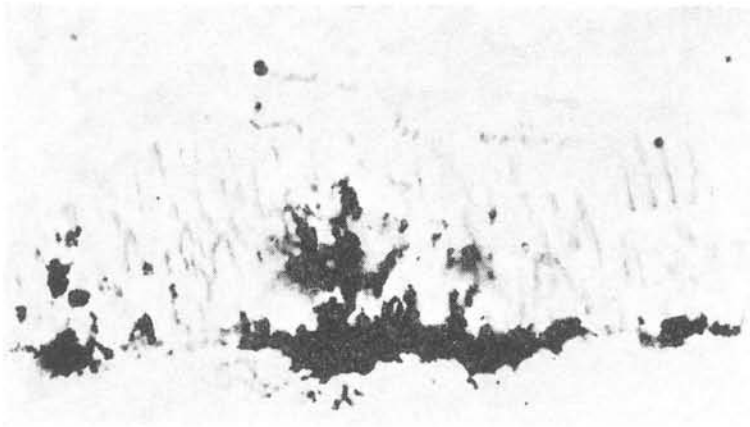

Fig. 2a.

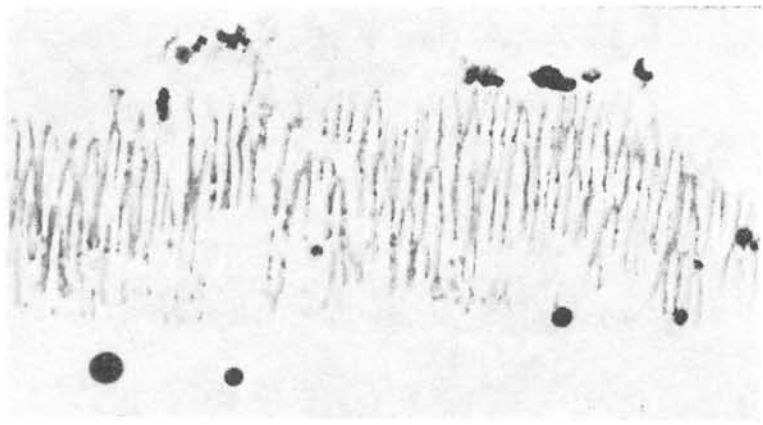

Fig. 2b.

Figure 2. Le radiogramme positif de la coupe tangentielle du chapeau de *Trametes versicolor* (L. ex Fr.) Pil. (en deux répétitions) où est évidente la distribution topographique d'isotope radioactif naturel $^{40}_{19}$ K (≐ les taches noires), surtout la localisation d'isotope actif dans l'hyménophore (l'activité relative ≐ $1{,}8 \cdot 10^{-11}$c). L'activité d'hyménophore est nettement évidente. Les matériaux végétaux étaient pris en mars 1963 (le même carpophore comme figure 1). La localisation d'isotope actif $^{40}_{19}$ K dans les substances d'origine organique jusqu'à present non décrites est évidente à la bouche des cavités à labyrinthe (Fig. 2a), dans les cavités à labyrinthe et dans la douve en forme d'ilot (Fig. 2b) (l'activité relative ≐ $1{,}8 \cdot 10^{-11}$c). Les matériaux photographiques Isopan Agfa ISS 21° Din, VEB. Film Fabr. Kreis Bitterfeld, DDR; le temps de pose 20 ×24 heures agrandi 8 ×.

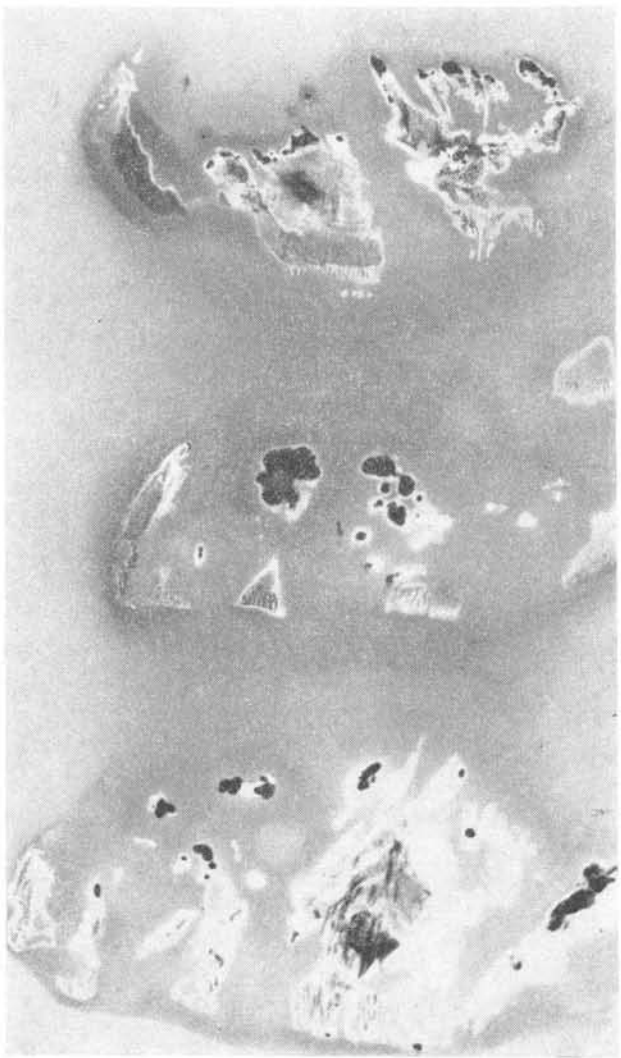

Figure 3. Le radiogramme positif de la coupe tangentielle du chapeau de *Phellinus pomaceus* (PERS.) MAIRE (en trois répétitions) ou est évidente la distribution topographique d'isotope radioactif naturel $^{40}_{19}$ K (= les taches noires) surtout la localisation d'isotope actif dans la douve / l'activité relative des gisements ressemblants aux îlots des substances d'orgine organique jusqu'alors non décrites dans la douve est $\doteq 2{,}5 \cdot 10^{-11}$c, dans l'hymenofor $1{,}5 \cdot 10^{-11}$c. Les matériaux végétaux étaient pris en mars 1963. Les matériaux photographiques Isopan Agfa ISS 21°, Din VEB. Film Fabr. Kreis Bitterfeld, DDR; le temps de pose 20 × 24 heures, agrandi 2 ×.

La translocalisation d'isotope actif $^{40}_{19}$ K de deux formes des chapeaux de champignons Polypori provient de la douve du chapeau de champignon à l'hyménophore, où l'isotope actif $^{40}_{19}$ K se localise /voir radiogramme figure 1.-3./, en même temps on y peut remarquer la localisation sur les lieux de l'épiderme et dans les grumeaux sur la surface de l'épiderme des substances susmentionnées.

DISCUSSION

Les substances organiques jusqu'ici non décrites se trouvantes à la surface et à l'intérieur du chapeaux de *Trametes versicolor* (L. ex FR.) PIL. et *Phellinus pomaceus* (PERS.) MAIRE contiennent l'isotope radioactif naturel $^{40}_{19}$ K et cela dans les limites des activités $1{,}5 \cdot 10^{-11}$ jusque $2{,}5 \cdot 10^{-11}$ curie. L'autre recherche de ces substances organiques, notamment au point de vue des recherches des effets antibiotiques peut être importante et il est probable que leur activité naturelle peut participer au mécanisme d'effet antibiotique.

La recherche de physiologie même au point de vue de présence et de localisation des isotopes actifs naturels est une démarche importante pour la reconnaissance de biologie des champignons attaquant le bois *Trametes versicolor* (L. ex FR.) PIL. et *Phellinus pomaceus* (PERS.) MAIRE. Les deux formes abondent dans la zone tempérée de l'hémisphère Nord et elles attaquent et provoquent la blanche pourriture du bois même celle du durament, par exemple *Trametes versicolor* (L. ex FR.) PIL. comme un saproparasite facultatif des genres *Quercus, Fagus, Carpinus, Salix, Malus, Cerasus* etc. et *Phellinus pomaceus* (PERS.) MAIRE se présente presque sur tous les espèces du *Prunus,* il existe aussi sur *Cerasus avium, Cerasus vulgaris, Armeniaca, Malus, Pyrus.*

On voit que la connaissance de biologie de ces types des Polypores est importante même au point de vue économique dans l'agri- et sylviculture.

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ÜBER DIE SEPTORIA-ARTEN AUF SISYMBRIUM

Von F. PETRAK

Eine, von meinem verstorbenen Freunde, Professor Dr. J. HRUBY im Juni 1929 bei Gurdau nächst Auspitz in Mähren gesammelte *Septoria* auf *Sisymbrium strictissimum* habe ich damals als *Septoria sisymbrii* P. HENN. et RANOJ. bestimmt und in meiner „Mycotheca generalis" unter Nr. 1400 ausgegeben. Unter verschiedenen von mir in letzter Zeit untersuchten und determinierten Pilzen, die meist von mir oder von HRUBY gesammelt wurden, habe ich wieder zwei Exemplare von Septorien auf *Sisymbrium* vorgefunden, bei deren Bestimmung ich die bisher auf *Sisymbrium* beschriebenen *Septoria*-Arten einem kritischen Studium unterziehen musste, dessen Ergebnisse in den folgenden Zeilen geschildert werden sollen:

In der Literatur werden drei Septorien auf *Sisymbrium* angeführt, die zwar als voneinander spezifisch verschieden aufgefasst, aber unter dem gleichen Artnamen beschrieben wurden. Ich führe sie hier zunächst in chronologischer Reihenfolge an und teile aus den Originaldiagnosen ihrer Autoren die wichtigsten Merkmale mit, durch welche sie sich voneinander unterscheiden sollen.

1. *Septoria sisymbrii* NIESSL. Flecken zuerst grünlich, später braun, zuletzt weisslich werdend. Pykniden herdenweise, eingewachsen, niedergedrückt. Konidien spindelig, sehr dünn, beidendig ziemlich spitz, 0,0179-0,0396 mm lang, kaum 0,0012 mm breit, mit 2-5, meist 4 Querwänden.

Der Autor bildet auf der Etikette der in RABENHORST, „Fungi europ." unter Nr. 1078 ausgegebenen Originalkollektion fünf Konidien ab, die von seiner Beschreibung nicht unwesentlich abweichen. Nach dieser sollen die Konidien beidendig ziemlich spitz und mit 3-5, meist 4 Querwänden versehen sein. Die abgebildeten Konidien sind aber

beidendig kaum verjüngt und stumpf abgerundet. Die kleinste Konidie enthält zwei, die vier anderen je drei Querwände.

2. *Septoria sisymbrii* ELLIS. Nach der kurzen, unvollständigen Beschreibung hat dieser Pilz kleine, zerstreute oder zu 3-4 gehäufte Pykniden. Konidien „linienförmig", mit 1-2 Querwänden, 30-40 × 3-3,5 μ, meist gekrümmt und beidendig stumpf.

3. *Septoria sisymbrii* P. HENN. et RANOJ. Flecken rundlich, weisslich, bis 6 mm im Durchmesser. Pykniden meist oberseits, mehr oder weniger dicht stehend, mit weitem Porus, kugelig oder abgeplattet, 90-198 μ im Durchmesser. Konidien einzellig oder mit 1-5 Querwänden, beidendig verjüngt oder breit nadelförmig, gerade oder gekrümmt, 19-62 × 2-3 μ, hyalin, auf eiförmigen, konischen oder birnförmigen, 7,5-15 × 3-7 μ grossen Trägern entstehend.

Die vorstehend genannten drei Septorien konnte ich auf Grund der Originalexemplare nachprüfen und ihre Identität feststellen. Von *Septoria sisymbrii* NIESSL, der ältesten auf *Sisymbrium* bekannt gewordenen *Septoria*-Art, teile ich nachstehend eine ausführliche Beschreibung mit; von den übrigen Arten und anderen, mir vorliegenden Kollektionen werden nur die vom Typus abweichenden Merkmale angeführt und kritisch besprochen.

Septoria sisymbrii NIESSL. Nach einem dürftigen Exemplar der oben genannten Originalkollektion, das den Pilz ziemlich spärlich zeigt, wurde die folgende Beschreibung entworfen:

Flecken beiderseits sichtbar, unregelmässig und meist auch sehr locker, seltener etwas dichter zerstreut, fast immer einzeln, im Umriss ziemlich regelmässig kreisrund oder breit elliptisch, seltener zu zwei oder mehreren dicht beisammen stehend, dann mehr oder weniger, oft vollständig zusammenfliessend und ganz unregelmässig werdend, vor dem gänzlichen Eintrocknen besonders auf den graugrünen oder bräunlichen, im Absterben befindlichen Blättern blaugrünlich oder spangrün, später ocker- oder lederbraun, zuletzt von der Mitte aus verbleichend und weisslich werdend, durch eine dunklere, dünne, erhabene Saumlinie meist sehr scharf begrenzt. Pykniden epiphyll, sehr selten und meist auch ganz vereinzelt auf der Blattunterseite, meist nur im mittleren Teile der Flecken, sehr unregelmässig zerstreut, bisweilen auch in 1-2 undeutlichen, konzentrischen Kreisen angeordnet, einzeln, selten zu 2-3 dicht gehäuft, dann mehr oder weniger, oft fast ganz miteinander verwaschen aber wohl nie zusammenfliessend, sich subepidermal im Mesophyll entwickelnd, die grösseren oft mit der Basis

die Epidermis der Gegenseite erreichend, rundlich oder breit ellipsoidisch die grösseren oft niedergedrückt, kein deutliches Ostiolum zeigend, sich durch einen unregelmässig rundlichen oder elliptischen, ca. 25-35 μ weiten, zuweilen mehr oder weniger gestreckten, dann fast spaltförmigen Porus öffend. Wand dünnhäutig, ca. 8-12 μ dick, pseudoparenchymatisch, aus 3-6 μ, selten bis ca. 8 μ grossen, rundlich eckigen, kaum zusammengepressten, unten und an den Seiten subhyalinen oder nur sehr hell gelbbräunlichen, am Scheitel besonders rings um den Porus dunkelbraun werdenden, relativ dickwandigen Zellen bestehend. Das im Mesophyll nur sehr spärlich vorhandene Myzel besteht aus subhyalinen, sich der Hauptsache nach interzellulär entwickelnden, meist schon stark verschrumpften, ca. 2-3 μ breiten Hyphen, die sich in den durch Verschrumpfen der Substratzellen bildenden Hohlräumen des Blattgewebes auch zu kleinzelligen, subhyalinen, ganz unregelmässigen Komplexen verdichten können. Konidien etwas schleimig verklebt zusammenhängend, ziemlich kurz und dünnfädig, beidendig bald kaum oder nur sehr schwach verjüngt, an den Enden stumpf abgerundet, zuweilen fast abgestutzt, nicht selten aber auch an einem oder an beiden Enden mehr oder weniger verjüngt, dann stumpf zugespitzt, selten fast gerade, meist mehr oder weniger bogig, vereinzelt auch S-förmig oder hakenförmig gekrümmt, hyalin, ohne oder mit 1-3, die grösseren auch mit 4 oder 5 Inhaltsteilungen, mit locker feinkörnigem Plasma, 12-36 μ, meist 20-30 μ lang, 1,5-2,5 μ breit, auf sehr kleinen, pupillenförmgien oder konischen Trägerzellen der inneren Wandfläche entstehend.

Septoria sisymbrii Ellis. Der Typus dieser Art wurde von W. A. Kellerman auf *Sisymbrium officinale* gesammelt, von Ellis in „North Amer. Fungi" unter Nr. 1142 und von Rabenhorst-Winter in „Fungi europ." unter Nr. 3396 ausgegeben. Ich habe diese beiden Exsiccaten untersucht und gefunden, dass sie in allen wesentlichen Merkmalen mit Niessl's Art übereinstimmen und damit identisch sind. Man bemerkt zwar einige kleine Verschiedenheiten, auf die hier kurz hingewiesen werden soll. Die Pykniden sind relativ kleiner, 40-70 μ selten bis 90 μ gross. Wenn die Gehäuse dicht beisammen stehen, wird oft ein mehr oder weniger ausgebreitetes, pseudoparenchymatisches Gewebe gebildet, welches nicht selten das ganze Mesophyll zwischen beiden Epidermen ausfüllt und aus subhyalinen, rundlich eckigen, 5-9 μ grossen Zellen besteht. Konidien mit Niessl's Kollektion vollständig übereinstimmend.

Septoria sisymbrii P. Henn. et Ranoj. Nach dem von Kabat und

BUBAK in „Fungi imp." unter Nr. 557 ausgegebenen Originalmaterial ist das intramatrikale Myzel dieses Pilzes ähnlich wie bei der vorstehend angeführten Kollektion von KELLERMAN kräftig entwickelt und besteht aus subhyalinen, undeutlich kurzgliederigen, oft grössere oder kleinere, pseudoparenchymatische Komplexe bildenden Hyphen, die besonders die zwischen dichter stehenden Pykniden befindlichen Hohlräume mehr oder weniger ausfüllen. Die Konidien sind meist 15-35 μ selten bis 40 μ, ganz vereinzelt bis 53 μ lang, 2-3,2 μ breit, stimmen aber sonst mit *S. sisymbrii* NIESSL völlig überrein. Deshalb kann auch dieser Pilz nur als eine besonders üppig entwickelte Form der *S. sisymbrii* NIESSL aufgefasst werden.

Depazea Erdingeri THÜMEN. Diesen Pilz hat der Autor auf *Sisymbrium Loeselii* bei Krems in Niederösterreich gesammelt, in seinen „Fungi austriaci" unter Nr. 697 ausgegeben und dort mit der folgenden, völlig wertlosen Beschreibung versehen: „Peritheciis numerosis, globosis, atris, in maculis expallescentibus, aridis, griseis". Auf einem mir vorliegenden Originalexemplar sind nur wenige, meist sterile Blattflecken verhanden. In einigen konnte ich spärliche Pykniden auffinden und feststellen, dass auch *Depazea Erdingeri* THÜMEN mit *Septoria sisymbrii* NIESSL identisch ist. Die Pykniden sind hier auch ziemlich klein, 60-80 μ, selten bis 125 μ gross. Die Konidien sind meist 12-27 μ, vereinzelt bis 30 μ lang, 2-2,5 μ, seltener bis 3 μ breit. Das intramatrikale Gewebe ist meist kräftig entwickelt und stimmt in dieser Beziehung mit der von P. HENNINGS und RANOJEWIC beschriebenen Form überein.

Mir liegen auch drei andere Kollektion der *Septoria sisymbrii* NIESSL vor, die hier noch erwähnt und kurz besprochen werden sollen.

Septoria sisymbrii P. HENN. et RANOJ. in PETRAK „Mycotheca generalis" Nr. 1400 auf *Sisymbrium strictissimum.* — Pyknidenwand aus sehr kleinen, meist nur ca. 3-4 μ grossen, Zellen bestehend. Konidien 15-32 μ, selten bis 40 μ lang, 1,5-2,5 μ breit.

Septoria sisymbrii NIESSL in SĂVULESCU „Herb. Rom. Exc." Nr. 592. Nach SĂVULESCU und SANDU in sched. l. c. sollen die Pykniden bis 198 μ gross und die Konidien bis 60 μ lang werden. Diese Kollektion stimmt weitgehend mit *S. sisymbrii* P. HENN. et RANOJ. in KABAT et BUBAK „Fungi imp. exs.", Nr. 567 überein. Auf dem von mir untersuchten Exemplar wurden die Pykniden 80-140 μ, selten bis 160 μ gross, die Konidien 15-40 μ, vereinzelt bis 52 μ lang gefunden.

Septoria sisymbrii NIESSL. Auf *S. officinale.* Tschechoslowakei; Mähr.-Weisskrechen: Schuttplatz am Ufer der Bečwa, VII 1937, leg.

F. PETRAK. — Die Gehäuse dieser Kollektion sind klein, ca. 45-70 μ im Durchmesser. Konidien bis ca. 45 μ lang, 2-3 μ breit. Sehr vereinzelt sind ganz junge Peritheziumanlagen vorhanden, deren kaum differenzierte Wand völlig hyalin ist und ein pseudoparenchymatisches, aus meist ca. 6 μ grossen Zellen bestehendes Binnengewebe umgibt.

Eine Nachprüfung der drei unter gleichem Artnamen aber als spezifisch verschieden beschriebenen *Septoria*-Arten hat gezeigt, dass sie miteinander identisch sind, nur in unwesentlichen Merkmalen abweichen, in bezug auf Form und Bau der Konidien jedoch vollständig übereinstimmen und nur in deren Länge etwas variieren. *Depazea Erdingeri* THÜM. hat sich auf Grund einer Untersuchung eines Originalexemplares auch als mit *Septoria sisymbrii* NIESSL identisch erwiesen. Für diese Art ergibt sich daher folgende Synonymie:

Septoria sisymbrii NIESSL in Bot. Zeitung, XXIV p. 411 (1866).

Syn.: *Septoria sisymbrii* ELLIS in Amer. Nat. 1882, p. 811.

Septoria sisymbrii P. HENN. et RANOJ. in Annal. Mycol., VIII, p. 390 (1910).

Depazea Erdingeri THÜMEN, „Fungi austriaci", Nr. 697.

Auf lebenden Blättern von *Sisymbrium strictissimum* in Steiermark und Mähren, von *S. officinale* in Kentucky, U.S.A., und Mähren, auf *S. Loeselii* in Niederösterreich, auf *S. orientale* in Serbien, auf *S. altissimum* in Serbien und Rumänien.

Wien, September 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

BUCHWALDOBOLETUS GENUS NOVUM BOLETACEARUM

Auctor ALBERT PILÁT

Auctor genus novum *Buchwaldoboletus* describit et duas species europaeas lignobioticas sectionis *Sulphurei* (SING.) SING. 1961 generis *Pulveroboletus* MURRILL illuc inserit.

Buchwaldoboletus g. n.

Synonymia: *Phlebopus* (HEIM) SINGER sectio *Sulphurei* SINGER, Am. Midl. Nat. 37:2, 1947.

Pulveroboletus MURRILL sectio *Sulphurei* (SING.) SINGER, Sydowia 15:82, 1961.

Mycelium in lignis emortuis coniferarum vel in deiectis huius ligni accumulatis vivit. Velum deest. Hymenophor in speciminibus iuvenilibus arcuato-fornicatum est, ut in genere *Gyrodon* OPAT. Stipes absque retina cum mycelio basali luteo. Caro lutea, minime caerulescens. Hyphae absque nodis. Tubulotrama cum mediostrato lato et stratis lateralibus parvis, parum conspectis et non modo typico boletoidei. Genus in honorem annorum septuaginta cel. professoris N. FABRITII BUCHWALDII dedicatum.

Typus generis: *Boletus lignicola* KALLENB.

Species: *Buchwaldoboletus lignicola* (KALLENB.) PILÁT comb. nov.; basionym: *Boletus lignicola* KALLENBACH, Pilze Mitteleuropas 1:57, 1929. — *Buchwaldoboletus hemichrysus* (BERK. et CURT.) PILÁT comb. nov.; basionym: *Boletus hemichrysus* BERKELEY et CURTIS, Ann. Mag. nat. Hist. Zool. Bot. Geol., ser. 2, 12:429, 1853.

Genus *Pulveroboletus* MURRILL, ut id R. SINGER emendat, vix naturale est. Qua de causa Z. POUZAR (1957) *Pulveroboletum gentilem* (QUÉL.) SING. in genus novum *Aureoboletus* POUZAR transtulit. Duae species europaeae, quae restant, et quae R. SINGER (1961) in hoc genere enumerat [*Puveroboletus hemichrysus* (BERK. et CURT.) SING. et *P. lignicola* (KALLENB.) PILÁT] a specie typica huius generis, *Pulveroboleto ravenelii* (BERK. et CURT.) MURRILL valde discrepant. Qua de causa eas in genus novum *Buchwaldoboletus* transferimus.

SINGER iam prius *Boletum hemichrysum* BERK. et CURT. in genus *Phlebopus* (HEIM). SING. inseruit et MOSER speciem secundam, *Boletum lignicolam* KALLENB. in hoc genere 1955 enumerat. Sed ambae species commemoratae in hoc genus neque pertinent, nam typus huius generis *Boletus (Phlebopus) colossus* HEIM (1936, p. 6) a speciebus generis *Buchwaldoboletus* valde differt. Ipse R. SINGER genus *Phlebopus* (HEIM) SING. (1962, p. 746) apud genera incertae sedis enumerat, nam haud exclusum sit *Boletum colossum* HEIM in genus *Phaeogyroporus* SINGER 1944 pertinere.

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Praha, April 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

ET BIDRAG TIL OPPKLARING AV FORHOLDET MELLOM TYPHULA GRAMINUM KARST. OG TYPHULA INCARNATA LASCH EX FR.

AV HÅKON RØED

SUMMARY

On the relationship between Typhula graminum KARST. and Typhula incarnata LASCH ex FR.

Working with cultures of *Typhula graminum* KARST. received from C. B. S., Baarn, *T. itoana* IMAI from Canada, *T. incarnata* LASCH ex FR. from Japan, and *Typhula*-cultures isolated from winter cereals and pasture grasses in Norway it was shown by crossing of monospore cultures that all the cultures were heterothallic with tetrapolar sexuality. By interfertility tests between the different cultures positive results were attained. Thus the different cultures are regarded as strains of one and the same species, viz. *T. incarnata* LASCH ex FR.

I en tidligere melding (RØED 1956) har forf. angitt at 3 forskjellige arter av slekten *Typhula,* nemlig *T. itoana* IMAI, *T. idahoensis* REMSBERG og *T. borealis* EKSTRAND, er påvist i forbindelse med vinterskader på høstsæd og engvekster i Norge. Bestemmelsen av soppmaterialet til de nevnte arter har vært basert på undersøkelser av soppenes fruktlegemer og egenskaper i kultur og på sammenlikning med diverse kulturer mottatt fra forskjellige utenlandske forskere og institusjoner.

Som en foreløpig meddelelse vil forf. nedenfor gi resultatene av noen undersøkelser foretatt med enkelte av soppkulturene som hittil har vært bestemt som *T. itoana* og som løser enkelte spørsmål som har vært knyttet til denne art.

Skader av denne sopp regnes å være studert for første gang i Europa av ERIKSSON (1879) i forbindelse med en vinterskade på høsthvete i Sverige. Skadene ble av ERIKSSON tilskrevet *T. graminum* KARSTEN. Dette syn har senere vært fulgt av flere europeiske plantepatologer ved senere tilfelle av liknende skader, således også av VOLK (1937), som har foretatt en av de mest detaljerte undersøkelser over selve soppen og dens egenskaper som parasitt. IMAI (1929) fant imidlertid ved studiet av tilsvarende skader i Japan at skadene der måtte tilskrives en inntil da ubeskrevet *Typhula*-art, som av IMAI ble beskrevet som *T. itoana*. I en senere undersøkelse (IMAI 1936) lyktes det IMAI å frembringe fruktlegemer fra en kultur mottatt som *T. graminum* KARST. fra Centraalbureau voor Schimmelcultures, Baarn, Holland, og da disse, så vel som soppens egenskaper i kultur, viste full overensstemmelse med *T. itoana* i alle vesentlige karakterer, antok IMAI (l. c.) at *T. itoana* er den egentlige årsak til skadene også i Europa. Senere har REMSBERG (1940) vist at *T. itoana* er en av årsakene til vinterskader på høstsæd og gras i U.S.A. og funnet full overensstemmelse mellom japansk og amerikansk materiale av denne sopp. Ved undersøkelse av kulturer mottatt fra Europa som *T. graminum* KARST. fant REMSBERG også full overensstemmelse mellom disse kulturer og kulturer av *T. itoana* med hensyn til kulturegenskaper og sklerotieanatomien. Selv om sklerotieanatomien iflg. REMSBERG (l. c.) er en sikker artskarakter innen slekten *Typhula,* fant hun imidlertid ikke å kunne trekke sikre slutninger om de europeiske kulturers identitet, siden undersøkelsen ikke var basert på studiet av fruktlegemer.

Nå har alle de *Typhula*-kulturer forf. har arbeidet med, vist bøyledannelser i de dikaryotiske mycelstadier, mens ensporemycelene eller de såkaldte primære mycel har vært bøylefri. Det dreier seg altså åpenbart om heterothalliske hymenomyceter og i studiet av disse utgjør de såkalte "interfertility tests" et meget viktig hjelpemiddel nettop ved undersøkelse av spørsmål som det ovenfor nevnte. Metoden bygger på det forhold at ensporemycel isolert fra fruktlegemer av samme art, men fra forskjellige lokaliteter, vil gi opphav til dikaryotiske bøylemycel når de dyrkes sammen. Bøyledannelsen antas da å være et uttrykk for en interfertilitet som igjen antas være bestemt av forekomsten av multiple alleler.

Ved hjelp av denne metode har forf. forsøkt å belyse det spørsmål som er nevnt ovenfor. Den nærmere beskrivelse av forsøkenes utførelse vil bli gitt annet steds. Her skal bare kort nevnes at frukt-

legemer er forsøkt skaffet til veie ved at sklerotier fra de forskjellige kulturer er lagt til spiring i jord i sommerhalvåret. I de fleste tilfelle har sklerotiene spirt med fruktlegemer i løpet av høsten og fra disse er så enkelte basidiesporer blitt isolert dels ved hjelp av mikromanipulator, dels ved vanlig spredning av sporesuspensjoner. Etter nøye kontroll av at de antatte ensporemycel virkelig har vært bøylefrie, er de blitt dyrket to og to i alle mulige kombinasjoner i skålkulturer. Dannelsen av eventuelle bøyler er derpå blitt undersøkt i grensesonen mellom de to kolonier.

Av hensyn til den rette forståelse av krysningsforsøkene har det vært nødvendig først å undersøke de respektive soppers seksuelle polaritet eller seksuelle faser. Såvidt forf. har kunnet finne, er spørsmålet om homothalli eller heterothalli hos arter innen slekten *Typhula* undersøkt eksperimentelt bare hos *T. erythropus* FR., *T. gyrans* (BATSCH) FR. og *T. trifolii* ROSTR. av henholdsvis LEHFELDT (1923), MACDONALD (1934) og NOBLE (1937). For disse arter ble påvist at de er heterothalliske, men hvor vidt det dreier seg om bipolaritet eller tetrapolaritet er ikke undersøkt.

Materialet som har inngått i undersøkelsene, har vært følgende:

Kultur nr. 2218 isolert som *T. itoana* fra sklerotier på timotei samlet 5.6.1951 i Elverum, Hedmark.

„ „ 2253 isolert som *T. itoana* fra sklerotier på høstrug samlet 2.6.1951 i Romedal, Hedmark.

„ „ 2303 isolert som *T. itoana* fra sklerotier på timotei samlet 29.5.1952 i Ø. Slidre, Oppland.

„ „ 2352 mottatt som *T. graminum* KARST. 27.10.1952 fra Centraalbureau voor Schimmelcultures, Baarn, Holland.

„ „ 2614 mottatt som *T. itoana* 8.3.1956 fra W. M. CORMACK, Department of Agriculture, Science Service Laboratories, Lethbridge, Alberta, Canada. Kulturen er oppgitt å være et reisolat av subkultur fra originalkultur studert av REMSBERG.

„ „ 2723 mottatt som *T. incarnata* LASCH ex FR. 10.10.1956 fra K. TOMIYAMA, Hokkaido National Agricultural Experiment Station, Kotoni, Sapporo, Japan.

Med hensyn til betegnelsen på sistnevnte kultur er å merke at iflg. CORNER (1950) er *T. itoana* og *T. incarnata* synonymer hvor sist-

nevnte navn har prioritet. Dette syn er godtatt både i Japan (sml. TOMIYAMA 1955), og i U.S.A. (sml. SPRAGUE, FISCHER & FIGARO 1961) og forfatteren vil slutte seg til dette.

Som eksempel på resultatene av krysningsforsøkene med ensporemycel isolert fra ett og samme fruktlegeme er i fig. 1 gjengitt resultatet for den norske kultur 2218, hvor 18 vilkårlig valgte ensporemycel ble krysset parvis i alle mulige kombinasjoner. I figuren angir den horisontale og den vertikale tallrekke de enkelte ensporeisolaters nummer, tegnet + at krysningen har resultert i bøyledannelse og tegnet — at bøyler ikke har latt seg påvise. Av figuren framgår at de 18 isolatene faller i 4 grupper svarende til heterothalli med tetrapolar fordeling av de seksuelle faser. Samme resultat ble også oppnådd i forsøk med kulturene 2253, 2303, 2352, 2614 og 2723, hvor henholdsvis 24, 20, 12, 14 og 18 ensporemycel ble krysset på tilsvarende måte.

Som kjent forklares den tetrapolare seksualitet genetisk ved at evnen til kobling med påfølgende bøyledannelse er bestemt av 2 allele

		AB			ab				Ab							aB			
		1	13	15	5	8	12	18	2	4	7	9	14	16	17	3	6	10	11
AB	1	—	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—
	13	—	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—
	15	—	—	—	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—
ab	5	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	18	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ab	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+
aB	3	—	—	—	—	—	—	—	+	+	+	+	+	+	+	—	—	—	—
	6	—	—	—	—	—	—	—	+	+	+	+	+	+	+	—	—	—	—
	10	—	—	—	—	—	—	—	+	+	+	+	+	+	+	—	—	—	—
	11	—	—	—	—	—	—	—	+	+	+	+	+	+	+	—	—	—	—

Fig. 1. Alle mulige krysninger mellom 18 vilkårlig valgte ensporemycel fra kultur nr. 2218 *(Typhula itoana)*.

faktorer og at bare de koblinger som medfører en kombinasjon som er heterozygotisk med hensyn til begge faktorer, utløser bøyledannelse. Betegnes disse faktorer med henholsvis A og B, får de 4 grupper av ensporemycel innen hver kultur faktorkombinasjonene AB, ab, Ab og aB slik som antydet på fig. 1.

For å undersøke det innbyrdes forhold mellom soppene representert ved de forskjellige kulturnumre ble i første omgang foretatt krysningsforsøk mellom de 4 typer av ensporemycel hos kulturene nr. 2218 og 2253 av norsk opprinnelse. Resultatet av dette forsøk er gjenngitt i fig. 2, som viser at bøyledannelser opptrådte ved samtlige kombinasjoner av ensporemycel.

Samme resultat ble videre oppnådd i krysningsforsøk mellom de 4 typer av ensporemycel i den norske kultur 2303 og de tilsvarende mycel i kulturene 2218 og 2253.

		2253			
		A_1B_1	a_1b_1	A_1b_1	a_1B_1
2218	AB	+	+	+	+
	ab	+	+	+	+
	Ab	+	+	+	+
	aB	+	+	+	+

Fig. 2. Krysning mellom de 4 typer av ensporemycel fra kulturnumrene 2218 og 2253 *(Typhula itoana)*.

Krysningsresultatene bekrefter altså antakelsen om at de tre kulturer representerer en og samme art, hvor de enkelte kulturer kan betraktes som geografiske raser av denne.

Ved undersøkelsen av forholdene mellom de norske kulturer og de mottatt fra utlandet ble i første omgang de 4 typer av ensporemycel fra kulturen av *T. incarnata* fra Japan krysset med samtlige typer av ensporemycel innen kulturnumrene 2218 og 2253. Resultatet av disse krysninger er gjengitt i fig. 3, som viser at bøyledannelser opptrådte ved samtlige mycelkombinasjoner, hvilket viser at den japanske og de norske kulturene representerer samme art.

Det samme forhold ble videre funnet ved krysningsforsøk med de ulike typer av ensporemycel fra kulturen mottatt som *T. graminum* fra Holland og de tilsvarende myceltyper fra kulturene 2218 og 2253; sml. fig. 4.

		2218				2253			
		AB	ab	Ab	aB	A_1B_1	a_1b_1	A_1b_1	a_1B_1
2723	A_5B_5	+	+	+	+	+	+	+	+
	a_5b_5	+	+	+	+	+	+	+	+
	A_5b_5	+	+	+	+	+	+	+	+
	a_5B_5	+	+	+	+	+	+	+	+

Fig. 3. Krysning mellom de 4 typer ensporemycel fra kultur nr. 2723 *(Typhula incarnata)* og fra kulturnumrene 2218 og 2253 *(Typhula itoana)*.

		2218				2253			
		AB	ab	Ab	aB	A_1B_1	a_1b_1	A_1b_1	a_1B_1
2352	A_3B_3	+	+	+	+	+	+	+	+
	a_3b_3	+	+	+	+	+	+	+	+
	A_3b_3	+	+	+	+	+	+	+	+
	a_3B_3	+	+	+	+	+	+	+	+

Fig. 4. Krysning mellom de 4 typer ensporemycel fra kultur nr. 2352 *(Typhula graminum)* og fra kulturnumrene 2218 og 2253 *(Typhula itoana)*.

Når det gjelder den amerikanske kulturen av *T. itoana,* har foreløpig bare 2 forskjellige ensporemycel fra denne kultur vært krysset med de forskjellige typer av ensporemycel fra de norske kulturene 2218 og 2253 og videre med de tilsvarende mycel fra kulturen av *T. incarnata* fra Japan. Resultatet av disse forsøk er gjengitt i fig. 5 som viser at også her har bøyledannelse inntrådt ved alle mycelkombinasjoner. Selv om bare 2 mycel er anvendt av den amerikanske kulturen, kan resultatet ikke tolkes på annen måte enn at kulturen representerer samme art som de øvrige kulturene.

		2218				2253				2723			
		AB	ab	Ab	aB	A_1B_1	a_1b_1	A_1b_1	a_1B_1	A_5B_5	a_5b_5	A_5b_5	a_5B_5
2614	A_4B_4	+	+	+	+	+	+	+	+	+	+	+	+
	a_4b_4	+	+	+	+	+	+	+	+	+	+	+	+

Fig. 5. Krysning mellom 2 forskjellige ensporemycel fra kultur nr. 2614 og de 4 typer av ensporemycel fra kulturnumrene 2218, 2253 og 2723.

Tilsammen viser altså krysningsforsøkene at de undersøkte kulturer må betraktes som geografiske raser av en og samme art. Oppfatningen om at de tilsvarende skader på høstsæd såvel i Europa som Japan og U.S.A. sannsynligvis har samme årsak, er altså blitt bekreftet. Videre må en kunne slutte at den sopp som i Europa har vært isolert i forbindelse med vinterskader på høstsæd og som har vært angitt å være *T. graminum* KARST., i virkeligheten har vært *T. incarnata* LASCH ex FR.

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THE EFFECT OF TEMPERATURE ON THE GROWTH AND SURVIVAL OF AUREOBASIDIUM PULLULANS AND OF THE RADULASPORIC STAGE OF GUIGNARDIA FULVIDA AND OF SYDOWIA POLYSPORA

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SUMMARY

Aureobasidium pullulans (DE BY.) ARNAUD (16 strains) and the radulasporic stage of *Guignardia fulvida* SANDERSON (3 strains) and of *Sydowia polyspora* (BREF. et v. TAVEL) MÜLLER (6 strains), isolated from a wide variety of sources, were found very sensitive to heat.

After ten days most strains showed visible growth at 0° C. Only strains of *A. pullulans* began growth at higher temperatures, six at 3° and one human pathogen strain between 10 and 15°.

All strains but one had their optimum at 22-25°, where the growth rate varied greatly from strain to strain. In the majority of the strains, growth stopped below or at 33°. Only the human pathogen strain showed just visible growth after ten days at 37°. After ten days' incubation at 33 and 35° all but one of the pink chlamydospore-less *A. pullulans* strains and all the *G. fulvida* strains died, while most of the dark strains of *A. pullulans* and *S. polyspora* survived 37°. At 40° C all the strains were inactivated, the number of colony-forming conidia being reduced by a factor of 10 in 45 minutes for the human pathogen strain and by 3×10^3 for the most sensitive strain; all others were in between. The inactivation rate increased greatly with the temperature.

The heat resistance of the chlamydospores was a little higher than that of the radulaspores. No protective effect of 1 and 4 % pullulan was demonstrated.

1. INTRODUCTION

The exceedingly common and very radio-resistant fungus *Aureobasidium pullulans* (DE BY.) ARNAUD is often outstanding on various products (fruits, vegetables, beech parquet flooring) after irradiation (SARAVACOS et al. 1962, SKOU 1964 and unpubl., JENSEN 1966). During these studies a rather high heat sensitivity of the fungus was observed. As this property might be useful in the control of it on irradiated products, a closer study was carried out, the results of which are reported below.

Scattered in the literature remarks may be found about the effect of temperature on *A. pullulans,* but to the author's knowledge no general picture has been given. RENNERFELT (1942) found good growth between 12 and 32° C with an optimum at 22-27°, and no growth at 37°. LINGAPPA et al. (1963) made similar observations, and CIFERRI et al. (1957) noted sparse growth at 37°, also for the human pathogen strains. In contrast to this, WYNNE & GOTT (1956) noted that most strains grow at 37°. Studying the ability of *A. pullulans* to cause bluestain in pine wood, BUTIN (1961-1962) found attack between 4 and 34° with an optimum at 26°. Finally GUNDERSSON (1962) noted *A. pullulans* to be the most frequently encountered species in frozen foods out of 52 moulds able to grow at 5° or below.

A. pullulans and *Sydowia polyspora* (BREF. et v. TAVEL) MÜLLER often occur on the same materials (LAGERBERG et al. 1927, COOKE 1959, 1963, BUTIN 1963, 1965) and may be rather difficult to separate at the radulasporic stage (ROBAK 1952, BUTIN 1963, 1964); thanks to BUTIN (1963), however, separation is now possible with fair accuracy. These facts make it natural to include in the studies not only strains of *S. polyspora,* but also the radulasporic stage of *Guignardia fulvida* SANDERSON, which taxonomically is a flax pathogen variety of *A. pullulans* and which LAFFERTY (1920-1922) found extremely heat resistant on affected seeds.

2. EXPERIMENTAL

a. Fungi used in the Temperature Experiments

1. The almost omnivorous, ubiquitous and highly variable fungus *Aureobasidium pullulans* (DE BY.) ARNAUD (syn. *Pullularia pullulans* (DE BY.) BERKH., *Dematium pullulans* DE BY., and several others; possible ascogenous state, *Guignardia pullulans* KLEB. (cf. v. ARX

TABLE 1.

Cultures of the fungi investigated

Culture number	Source and original number	Habitat and supplier
	1. Aureobasidium pullulans	
	a. Dark, brownish to greenish black isolates	
83	Not stated	CBS, Baarn, Dec. 1960
245	Intestine of a bumble-bee queen	Højbakkegård, Zealand; auth. 1962
260	Intestine of a bumble-bee queen	Højbakkegård, Zealand; auth. 1962
288 s	Irradiated piece of beech parquet	A/S Junckers Savværk, Køge, Zealand; auth. 1962
528*)	Norway Spruce, 1334/1, 1957	Vollebekk, Norway; F. ROLL-HANSEN 1964
531*)	Larch species, 60-127/2, 1960	Vollebekk, Norway; F. ROLL-HANSEN 1964
767	Case of tinea nigra palmaris, CBS 359.66	Paramaribo, Suriname; CBS, Baarn 1968
	b. Pale, pink to cream or white isolates	
32	Irradiated carrot	Risö, Zealand; auth. 1960
67	Raspberry	Risö, Zealand; auth. 1960
77	Strawberry	Risö, Zealand; auth. 1960
121	Piece of beech parquet	A/S Junckers Savværk, Køge, Zealand; auth. 1962
130	Irradiated Asparagus	Risö, Zealand; auth. 1961
288 h	Irradiated piece of beech parquet	A/S Junckers Savværk, Køge, Zealand; auth. 1962
289	Irradiated piece of beech parquet	A/S Junckers Savværk, Køge, Zealand; auth. 1962
530*)	Norway Spruce, 1558/3 S, 1957	Vollebekk, Norway; F. ROLL-HANSEN 1964
764	Douglas Fir, dirty-looking needles	Floes Skov, Jutland; auth. 1968
	2. Guignardia fulvida stat. conid.	
769	Flax (S.p.F. 1189)	Danish State Seed Test. St. 1939; H. A. JØRGENSEN 1968
770	Flax (S.p.F. 1195)	Belfast, U. K. 1939; H. A. JØRGENSEN 1968
771	Flax (S.p.F. 1237)	Virumgård, Zealand 1940; H. A. JØRGENSEN 1968
	3. Sydowia polyspora stat. conid.	
98	Norway Spruce, 726/11, 1945	Vollebekk, Norway; F. ROLL-HANSEN 1961
180	Scots Pine, 1295/1, 1957	Vollebekk, Norway; F. ROLL-HANSEN 1961
763	Douglas Fir (from same spot as no. 764)	Floes Skov, Jutland; auth. 1968
765	Pine or spruce wood; MELIN 1929, CBS 116.29	Sweden; CBS, Baarn 1968
766	White Fir; ROBAK 1950, CBS 215.50	Norway; CBS, Baarn 1968
768	Norway Spruce, 6147/2, 1959	Vollebekk, Norway; F. ROLL-HANESN 1961, 1968

*) Very slow growers, det. Dr. M. B. SCHOL-SCHWARS, Baarn; 530 not exam. more closely.

1957)), was represented by 16 strains, seven dark and nine pink, on malt extract agar (Table 1). The pink strains become dark (i. e. produce chlamydospores and/or dark-walled mycelium) under suitable conditions, e. g. in older cultures or on special media, but in particular when contaminants are present (also observed by COOKE 1962).

2. The radulasporic stage*) of *Guignardia fulvida* SANDERSON (SANDERSON 1965) (syn. *Aureobasidium pullulans* var. *lini* (LAFFERTY) COOKE (cf. COOKE 1959, 1962), *Polyspora lini* LAFFERTY), which is only distinguishable from *A. pullulans* by the somewhat longer radulaspores (9-24- × 3-9 μ) and by the pathogenicity to flax (cf. LAFFERTY 1920-1922, COOKE 1959, 1962, SANDERSON 1965). The three strains used in the experiments were pink, becoming dark from chlamydospores only in older cultures (Table 1).

3. The radulasporic stage*) of *Sydowia polyspora* (BREF. et v. TAVEL) MÜLLER (MÜLLER 1953) (syn. *Sclerophoma pithyophila* (CDA.) HÖHN., *Dothichiza pithyophila* (CDA.) PETRAK, *Hormonema dematioides* LAGERBERG et MELIN (no. 765, Table 1), and others (cf. LAGERBERG et al. 1927, ROBAK 1952, CIFERRI et al. 1957, COOKE 1959, 1963, BUTIN 1963, 1964)). In accordance with BUTIN's (1963) criterion, six typical strains of *S. polyspora* were selected for the experiments. They were dark and all came from coniferous sources (Table 1; cf. BUTIN 1965, ROLL-HANSEN 1967).

b. Methods

Where not otherwise stated, 12-15 ml 1.6 % malt extract agar (MA) was used. The growth rate was determined as the diameter extension of a 7 mm inoculating disc with the mycelium coat against the agar surface (BRANCATO & GOLDING 1953, GUNDERSEN 1962, COOKE 1963). The extension was measured daily at temperatures not greatly restricting the growth. Experiments were carried out at five-degree intervals from 0° C and at 3, 26, 27, 33, and 37°. At lower temperatures there was a lag-period, which was shortened by starting the growth at room temperature before the incubation. Apart from this, the growth was found proportional to time for all strains but

*) *G. fulvida* and *A. pullulans* may also produce conidia in acervuli (LAFFERTY 1921, v. ARX 1957), as may *S. polyspora* in pycnidia (ROBAK 1952, BUTIN 1964). Where not otherwise stated, the radulasporic stage is always implied in this paper. This stage reproduces secondarily by blastospores and arthrospores. No distinction was made in the experiments.

nos. 765 and 768, whose growth rate varied with time, and the margin of the colonies became irregular. On this basis the extension per ten days was calculated.

For studying the inactivating effect of the temperature, 24-hour shaking cultures (1.6 % malt extract), for slow growers 48-hour cultures, were used. The conidia were transferred to fresh extract, counted in a haemacytometer and, in samples of 1.0 ml in preheated test tubes, placed in a cyclotherm (STRUER's, Copenhagen) at the temperature in question (± 0.2°). The initial number of conidia pro ml varied from 5.5×10^6 to 10^8 for the different experiments and strains. The dilutions needed were made in Ringer's solution and, in 0.1 ml portions plated on surface-dried MA dishes. The incubation lasted four to five, for slow growers seven days at room temperature.

Below 20° the temperature in question was kept within ± 0.5° and above 20° within ± 0.3°.

In the temperature span for growth, ten replicates were used, at the lower temperatures (0-15°) only four, however, and for the study of the inactivating or killing effect six replicates (no. 83 at different temperatures) or three replicates of each of three dilutions were used because the fraction of living and surviving conidia was unknown. The numbers of colonies at adequate dilutions were directly plotted in a semilogarithmic co-ordinate system as % surviving conidia without any further calculations. *A. pullulans* no. 83 was used as reference in all experiments.

c. Results of the Temperature Experiments

1. Investigations on the temperature span for growth

For most strains the growth began at or perhaps just below 0° (0.5-3.5 mm diameter extension in ten days (d. e. 10) without distinct differences between the three species). Six *A. pullulans* strains started growth at 3°, and one human pathogen strain (no. 767) only began visible growth between 10 and 15° (2.6 mm d. e. 10 at 15°; Table 2).

The growth rate at optimum varied substantially from one isolate to another in *A. pullulans*. Nos. 528, 530, 531, and 767 grew very slowly (12-14 mm d. e. 10) compared with nos. 245 and 288s (74 and 69 mm d. e. 10). Generally the strains of *S. polyspora* grew faster at optimum, the extremes found being nos. 180 and 768 with 105 and

TABLE 2.

The temperature extremes for growth of *Aureobasidium pullulans, Guignardia fulvida* and *Sydowia polyspora* at the radulasporic stage. The figures give the number of strains at each temperature.

Species	Visible growth at			Maximum temperature for growth					Dead after 10 days at*)			
	0°	3°	15°	<33°	33°	35°	37°	>37°	33°	35°	37°	>37°
A. pullulans, dark	2	4	1	1	0	2	3	1	1	0	2	4
A. pullans, pale	6	2	0	4	3	1	0	0	4	3	1	0
G. fulvida	3	0	0	3	0	0	0	0	3	0	0	0
S. polyspora	6	0	0	0	3	2	1	0	0	0	1	4

*) One *S. polyspora* strain (768) not tested.

43 mm d. e. 10 respectively (Fig. 1). The optimum for *G. fulvida* was not investigated.

To determine the optimum temperature an interpolation was made between the curve parts for increasing and decreasing growth rate. For all the different strains of *A. pullulans* and *S. polyspora* but one (no. 766, 26-27°) the optimum varied between 22-25° (Fig. 1).

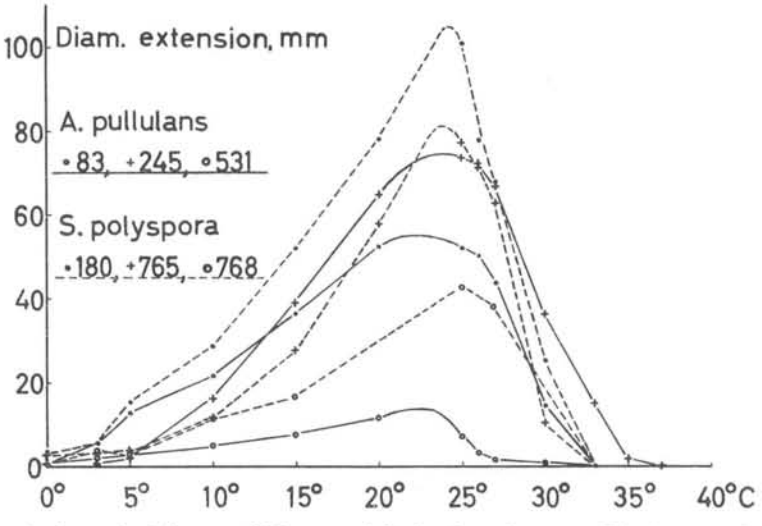

Fig. 1. *Aureobasidium pullulans* and *Sydowia polyspora*. The temperature span for growth.

The extremes in growth rate at optimum for strains of *A. pullulans* and *S. polyspora* are shown together with the more common growth rates of nos. 83 and 765. Note the differences in slope at supraoptimal temperatures.

All strains of *G. fulvida,* half the *S. polyspora,* all but one of the pink, and one (no. 83) of the dark *A. pullulans* strains ceased growing at or below 33°. Only the human pathogen (no. 767) showed just visible growth at 37° after ten days (Table 2).

On the conclusion of the individual experiments the dishes were stored at room temperature for a long time for observation of growth. Apart from the very sensitive strain no. 83, a clear difference in heat sensitivity between the dark chlamydospore-producing and the pink chlamydosporeless strains was found. Most of the latter strains died within ten days at 33 and 35° while the majority of the former survived 37° (Table 2).

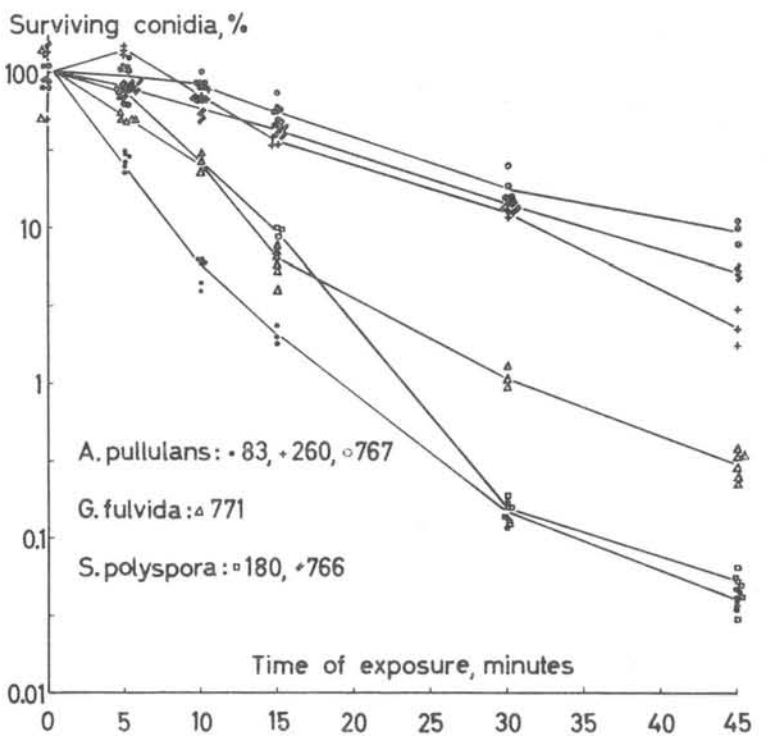

Fig. 2. *Aureobasidium pullans, Guignardia fulvida* and *Sydowia polyspora.* Inactivation of the three species at 40° C.

A. pullulans nos. 83 and 767, and *S. polyspora* nos. 180 and 766 show the sentitivity extremes found for the two species. At zero time only the highest and the lowest figure are plotted. 100 % = average score at zero time.

2. Investigations at temperatures above the maximum for growth

Ten strains (*A. pullulans:* 32, 83, 260, 528, 764, 767; *G. fulvida:* 771; *S. polyspora:* 180, 763, 766) were selected for closer examination of temperature sensitivity. Some of the results from the three species, and the extremes, are shown in Fig. 2. *A. pullulans,* no. 83, used as reference in all experiments, was the most sensitive strain, closely followed by no. 32 and *S. polyspora* no. 180. The number of colony-forming conidia was reduced by a factor of 3×10^3 at 40° in 45 minutes, while that of the most resistant strain, the human pathogen strain no. 767, was only reduced by a factor of ten under these conditions. All the other strains studied lay in between.

No. 83 was further investigated at different temperatures and under different conditions in several experiments; the results of one experiment are illustrated in Fig. 3. At room temperature (22-23°) the cell number was doubled in 2.5-3.0 hours. The increase was smaller at 25°, see above. At 35° the colony-forming number of conidia was reduced by a factor of 10^2 in 4.5 hours, while at 40° the reduction factor was 10^4 after one hour, see above. At 45° the number of radula-

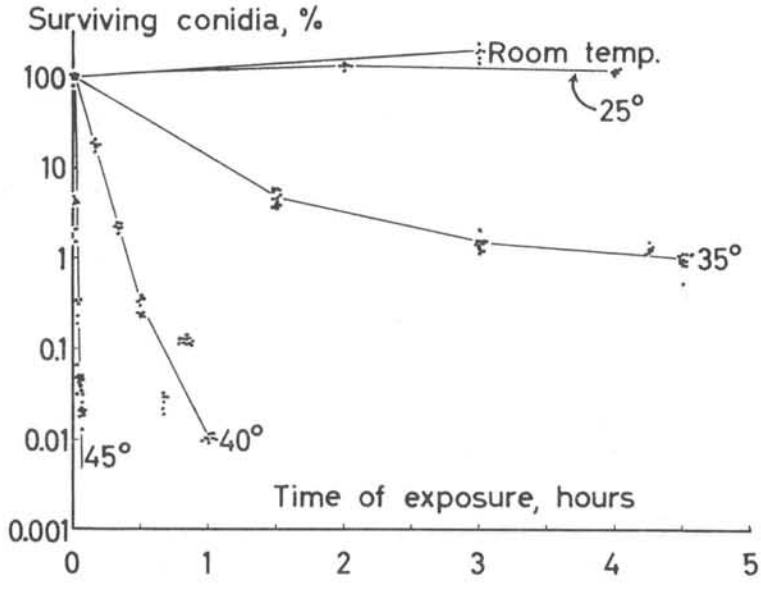

Fig. 3. *Aureobasidium pullulans.* The effect of different temperatures on strain no. 83.
All figures are plotted. 100 % = average score at zero time.

spores was inactivated very rapidly, the reduction factor being 10^3-10^4 after four minutes.

Selected chlamydospores (SKOU 1964) from no. 83 were investigated at 40°. They showed a somewhat higher resistance than the radulaspores.

All these results confirm that of the preceding series.

Finally the effect of the mucous polysaccharide pullulan, isolated from cultures of no. 83 by the method of SOWA et al. (1963), was tried on radulaspores of no. 83 in two experiments, but no protective effect of 1 and 4 % pullulan was demonstrated as compared with that of distilled water, malt extract or Ringer's solution.

3. DISCUSSION

The results are in close agreement with most of the remarks in the literature (see Introduction), but is was impossible to detect any growth at 37° in all but one strain even on the same media as those used by WYNNE & GOTT (1956), who claimed growth in most strains of *A. pullulans* at this temperature.

At supraoptimal temperatures the slope of the curve may be steeper for *S. polyspora* than for *A. pullulans* (Fig. 1), but generally the difference reached is insufficient for separating the species at 30° as stated by BUTIN (1963). No special heat resistance was found in the strains of *G. fulvida* (cf. LAFFERTY 1920-1922).

Now and then a very sparse growth may be seen through a magnifying glass at the maximum temperatures, but it always stops within the first 24 hours, which means that the inactivation rate is higher than the growth rate. Even when growth takes place close to the optimum temperature, the cultures are subject to a considerable inactivation, the colony-forming cell number being always much smaller, often by more than 50 %, than that found in the haemacytometer. Similar observations were made by RENNERFELT (1942). This, of course, is due to many other things than the temperature, but the temperature accelerates the processes.

If the conidia were of uniform sensitivity a straight inactivation curve should result. The reason why they are not is that two or more cells stick together and, at all temperatures, give only one colony down to one living cell. The relatively high resistance of nos. 766 and 767 may in part be due to this fact as coherent cells or incipient my-

celium production are common in these cultures. No. 771, in which the latter is also common, is nevertheless much more sensitive (Fig. 2).

The relatively high resistance of no. 260 may be due to a rather large chlamydospore production within the first 24 hours.

The fact that the experiments with the slow-growing no. 767 were made with 48-hour cultures may have contributed to its resistance, but corresponding 48-hour cultures of no. 83 showed no measurable increase as compared with 24-hour cultures.

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Roskilde, September, 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

NOTES ON BOTRYTIS ANTHOPHILA BOND. OF TRIFOLIUM PRATENSE IN DENMARK

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SUMMARY AND CONCLUSION

During my investigations in 1933 of the pollination of red clover *(Trifolium pratense)* in Czechoslovakia I happened to find conidia of *Botrytis anthophila* BONDARZEW in pollen samples of red clover (pollen loads gathered by honey bees).

Botrytis anthophila is parasitic in red clover, causing systemic infection. It fructifies with conidia on the anthers. Honey bees transmit at random pollen and conidia to other flowers, in which, after germination on the stigmas, the conidia cause intraseminal mycelium infection in the seeds. At investigations of the pollination of red clover in Denmark during the years of 1934-1959, conidia of the fungus were found in at least 16,000 out of the 40,000 investigated samples of red clover pollen. This shows that the fungus is widespread in red clover seed fields in this country.

Direct investigations of flowers in scattered seed fields have shown that such attacks, as a rule, hardly comprise more than a few per cent of the plants.

In 1934, very severe seed infection were found, but of the progeny of these seed consignments only a few per cent of the plants were infected by *Botrytis anthophila.*

This fact together with the low frequency of attacks in the seed fields in general, and the fact that the germinating capacity and the growth of the plants are evidently not affected by the attack have brought about the view that the disease is of no special importance to the seed-growing.

Irrespective of this view, further investigations of two stages in the life cycle of the fungus under field conditions are considered to be of plant pathological interest, namely:

1. The conditions under which seed infection results in systemic infection, and
2. the circumstances decisive for flower infection resulting in seed infection.

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1. OCCURRENCE OF *BOTRYTIS ANTHOPHILA* IN CZECHOSLOVAKIA 1933

In the beginning of the 1930's, the growing of red clover *(Trifolium pratense)* for seed production was considered so uncertain in Denmark that a major seed firm tried to grow new Danish varieties of red clover in traditionally clover seed producing parts of southeastern Europe. In this connection I investigated the pollination of the red clover in Czechoslovakia in 1933. I used i. a. pollen analysis to determine the pollen plants of the honey bees. Bees with pollen loads on their legs were caught at the entrance of the hive, and later the pollen was analysed as to species. Out of 2,207 pollen loads gathered and analysed, 1,244 proved to be red clover pollen, which means that

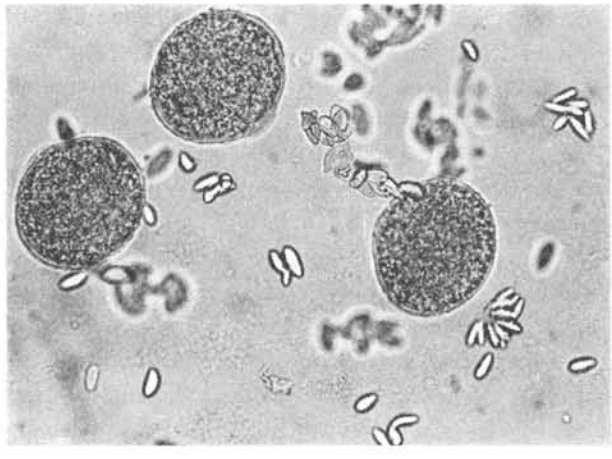

Fig. 1. Pollen grains of red clover and conidia of *Botrytis anthophila*. × 500. BOLDT WELLING phot.

56.3 per cent of the pollen-gathering bees had visited red clover (STAPEL 1934).

By microscopy I found in pollen samples of red clover numerous spores of a fungus (Fig. 1), which were determined by H. W. WOLLENWEBER as *Botrytis anthophila* BONDARZEW (cf. letter of 10th November, 1933*). Thereby it was proved that this fungus was found in red clover florets in Czechoslovakia in 1933, but my investigations offered no possibility of finding out whether the red clover in question was of Danish or Czech origin, probably both. SILOW (1933) states that the fungus had i. a. been found in material from Czechoslovakia, and as will be seen below, it was common in Denmark in 1934; and, since then, it has been found in a great number of cases.

2. BIOLOGY

As regards the fungus, its taxonomy and biology etc., reference is, in the main, made to SILOW (1933), who i. a. refers to the first description (in Russian) by BONDARZEW (1913). However, a few features of the biology of the fungus are given below: The fungus occurs by systemic infection of red clover, and evidently it only appears when the red clover is flowering, specifically on the surface of the anthers where it fructifies. Inside the anthers, the mycelium is found among the pollen grains, and from there numerous conidiophores are sent out to the surface, on which an ample formation of conidia takes place (Figs. 2 and 3). To the naked eye the anthers appear to be ash-grey in contrast to the normal yellow colour. The fact that the infection is systemic is i. a. to be seen from the attack comprising all clover heads and all florets on the same plant, although, as an exception, partial infection may occur (as is the case with Loose Smut and other fungal diseases with systemic infection). Honey bees and other pollinating insects transmit at random pollen and conidia to other flowers, on which the conidia germinate on the stigmas, causing intraseminal infection of the seeds. Such attacks on the seeds can be determined by laboratory methods. Infected seed

*) WOLLENWEBER was aware of the fact that BEYMA THOE KINGMA (1927) had described a similar fungus from red clover s e e d s, named *Botrytis trifolii* nov. spec. WOLLENWEBER did not find it impossible that the said fungus was identical with *Botrytis anthophila*, which BONDARZEW had isolated from red clover f l o r e t s, but incidentally he has proved that it could also be isolated from s e e d s.

Fig. 2. *Botrytis anthophila.* Conidiophore with several clusters of conidia. From clover seed on malt agar. × 500.

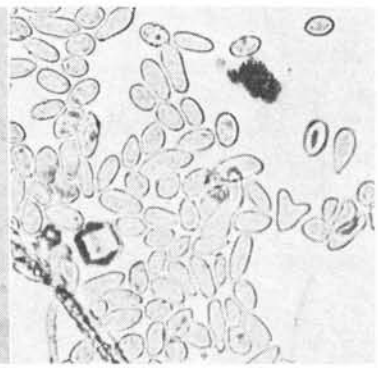

Fig. 3. Conidia of *Botrytis anthophila.* From clover seed on malt agar. × 500.

seems to germinate in a normal way, causing, in certain cases — but by no means in all cases — a systemic infection of the plants. Apparently, such plants develop in a normal way, apart from the abnormal anthers, but in reality too little is known about the conditions under which infected seeds give infected plants.

3. OCCURRENCE OF *BOTRYTIS ANTHOPHILA* IN FLOWERS OF RED CLOVER

In the summer of 1934 I examined scattered red clover seed fields in Denmark and established the occurrence of the fungus in the clover flowers, however, at most in 1-2 per cent of the plants.

In the years of 1934-1959, as part of investigations of the pollination of red clover, I have used the pollen-analytic method. Out of 120,000 pollen samples from honey bees, a little less than 40,000 originated from red clover, and in these were often found conidia of *Botrytis anthophila.* As the investigations were made for another purpose, unfortunately no counts have been made, but according to my estimate, conidia were present in at least 40 per cent of the samples. In very few cases, the number of conidia exceeded the number of red clover pollen; in the vast majority of cases the number of conidia amounted to a few per cent of the pollen grains only. The investigation showed that the fungus generally occurs in flowering

red clover in Denmark, probably, however, only in a few per cent of the plants.

This last-mentioned point is corroborated by a direct investigation made in the summer of 1968. Out of 19 red clover seed fields investigated, 16 showed attacks, the number of attacked plants varying from 1 to 5 per cent, or, on an average, 2.7 per cent. The investigation comprised clover flowers from only 100 plants in each field. If the investigation had been more comprehensive, it is probable that attacks had been found in all the fields. A similar investigation of the flowers from 11 Danish varieties of early-flowering red clover at the State Experimental Stations of Tystofte and of Årslev showed attacks in all varieties. At Tystofte an average of 2.2 per cent of the plants were attacked, at Årslev, on the other hand, 5.4 per cent. As the seeds sown at the two places originated from the same consignments, the difference in the number of attacks corroborates what is mentioned above, namely, that special conditions are decisive for the degree to which seed infection results in systemic infection of the plant. At Tystofte, 13 Danish varieties of semi-late-flowering red clover were also investigated, but no attacks were found in these varieties. From other investigations in this country (see below) as well as abroad (i. a. SILOW 1933) it is known that the late-flowering varieties of red clover are just as frequently attacked as early-flowering varieties; this is borne out by the fact that two varieties of semi-late-flowering red clover of foreign origin (Swedish and German) showed attacks in 3 and 1 per cent of the plants, respectively.

4. OCCURRENCE OF *BOTRYTIS ANTHOPHILA* IN SEEDS OF RED CLOVER

With a view to seed infection I investigated 56 seed consignments of Danish red clover in 1934 and found attacks on the seeds investigated amounting, on an average to 22.4 per cent, varying from 5.6 per cent to 47.0 per cent in the consignments. After disinfection the seeds were placed on malt agar, about 250 seeds from each consignment. After 5 days at room temperature, the attacked seeds were conspicuous by chalk-white mats of conidiophores and conidia (Figs. 4 and 5). Ten consignments of early-flowering and 26 consignments of semi-late-flowering red clover varieties, all of Øtofte origin, were examined. On an average, 27.3 per cent and 23.3 per cent of the seeds,

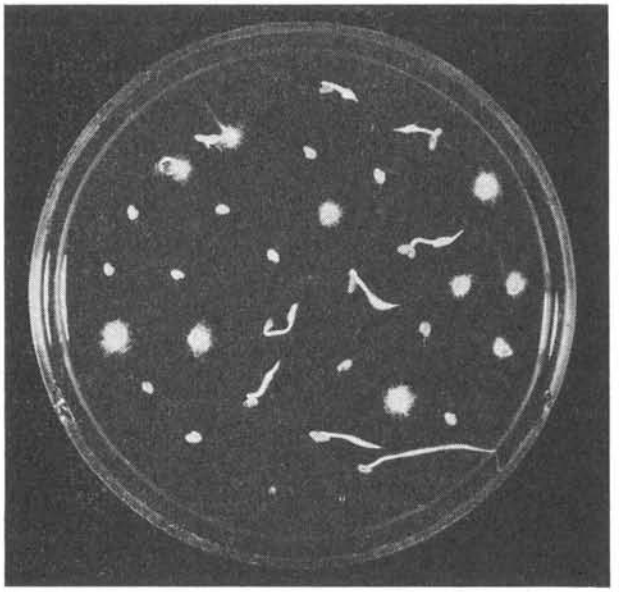

Fig. 4. Red clover seeds on malt agar. Several of the seeds infected by *Botrytis anthophila*.

respectively, were infested, i. e. there was no essential difference between the two types of red clover. The average germination capacity of the clover seeds from the said seed consignments (determined in an ordinary germinating apparatus) was 95 per cent. This corroborates what is said above, namely, that attacks d o n o t seem to influence the germination capacity of the seeds.

Seeds that, on the agar plates, proved to be attacked by *Botrytis anthophila* and, at the same time, had germinated normally were planted out in outdoor soil for the purpose of following the development of the attack. About 30 per cent of these seeds gave plants that, during the flowering period, showed attacks on the anthers. This shows that by no means, all infested seeds give attacked plants, but otherwise the laboratory method used in this case gives no answer to the question to what degree seed infection brings about systemic infection under field conditions.

In spite of the high percentage of infection in seed consignments of red clover in 1934, the attacks on their progeny, i. e. in the florets in the seed fields, were slight; as mentioned above, the number of attacked plants did not normally exceed a few per cent. Accordingly,

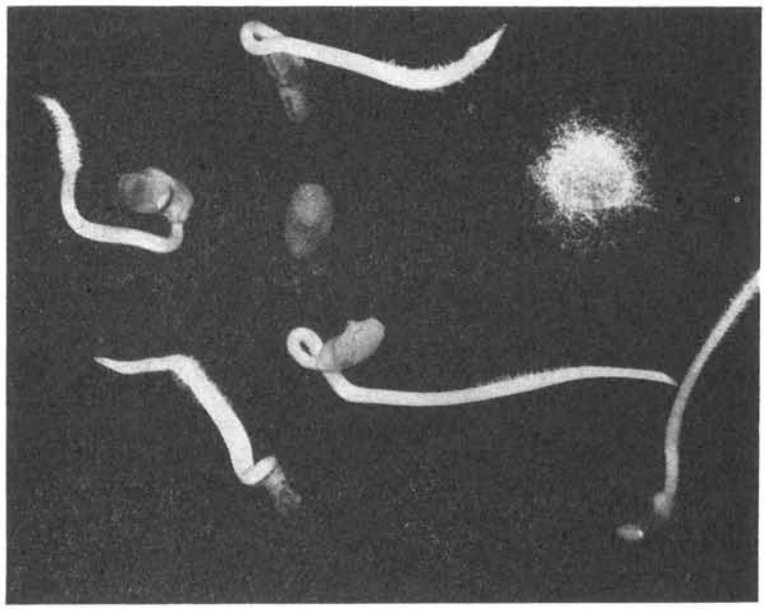

Fig. 5. *Botrytis anthophila* infection of one seed of red clover on malt agar (enlarged).

I considered the disease to be without practical importance to the seed-growing, and I think that my opinion has been corroborated by results obtained abroad. Rightly or wrongly, this is probably the reason why no further investigations of the attacks have been carried through in this country.

With a view to the present paper I have, during the summer of 1968, examined some samples of red clover seed. Out of 10 investigated seed consignments from practice, only 5 were attacked, the number of attacked seed varying from 1 to 5 per cent, or, on an average, 2.4 per cent. In 24 different varieties of red clover used in varietal experiments at the Danish State Experimental Stations, attacks were found in 12 varieties, with the number of infected seeds varying from 1 to 7 per cent, or, on an average, 3.5 per cent.

Thus, in 1968, a much smaller percentage of infected seeds was found, compared with the percentage in 1934. Nothing is known about the reason for this difference, but it may be mentioned that KINGMA (1927) found that the occurence of the closely related or identical *Botrytis trifolii* was rather capricious. Thus, the Dutch seed

testing station, the "Rijksproefstation", has stated that *B. trifolii* occured generally in clover seeds in 1923, whereas no attacks were found at all in 1925.

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Lyngby, Denmark, September 1968.

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ADDITIONS TO THE MELIOLINEAE OF THE UNITED STATES

By JOHN A. STEVENSON*)

SUMMARY

Additions are made to the distributional and host records of the *Meliolineae* in the United States supplementing those reported by HANSFORD in his Monograph (2). Ten species are considered, three of which are described as new, namely: *Asteridiella negundinis, Meliola castela,* and *M. sideroxylicola.*

HANSFORD, in his comprehensive monograph (2) of the *Meliolineae* of the world, included of course previously known records of the occurrence of species of this group in the United States. He also proposed a number of new species and noted the occurrence of certain additional species and host in this country. Further records of ten species, three of which are described as new, are added here from American materials deposited in the National Fungus Collections at Beltsville, Maryland.

1. **Asteridiella negundinis** sp. nov.**)

Coloniis caulicolis, orbiculatibus vel irregularibus, 2-6 mm diam.; hyphis septatis, anastomosantibus, 6-8 μ diam.; hypho-podius capitatis alternatis vel unilateralibus, stipitatis, 15-30 μ longis; cellulis basalibus cylindracis, 5-9 μ diam.,

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**) I am endebted to Miss EDITH K. CASH for the Latin diagnoses used in this paper.

longis; cellulis apicalibus 2-usque multilobatis vel irregulatiter lobatis; 9-22 μ diam., 15-30 μ longis; hypopodiis mucronatis non visis; setis nullis; perithecciis globosis, verrucosis, 225-325 μ diam., ascis 2-4; sporis 3-septatis, leniter constrictis, utrinque late rotundatis, subcylindraceus, 40-58 $\times$ 15-20 μ.

Colonies on twigs and small branches, apparently never foliicolous, black, 2-6 mm in diameter, circular or oval to irregular, coalescing to form irregular patches over extensive areas; hyphae brown to dark brown, somewhat irregular, 6-8 μ in diameter, septate, with cells very variable, 10-40 μ long, branching freely to form very close, dense networks; capitate hyphopodia alternate or unilateral, 2-multilobed and very irregular, rarely simply ovate, long stalked, 20-35 μ long; stalk cells short to long cylindrical 5-9 μ in diameter, 3-15 μ long; head cells extremely variable in size and shape, 9-22 μ in diameter; 15-30 μ long; mucronate hyphopodia not seen; setae none; perithecia numerous, globose, verrucose, crowded at center of colonies, as many as 35 in a primary colony, 225-325 μ in diameter, without setae or appendages, but with numerous basal, septate, flexuous hyphae, up to 200 μ long and 6-7 μ in diameter; asci hyaline, evanescent, broadly oval, 90-100 $\times$ 35-40 μ, 2-4-spored; spores 3-septate, dark brown, straight or slightly curved, with end cells smaller than central ones, obtusely rounded at both ends, slightly constricted at the septa, 40-58 $\times$ 15-20 μ. The specific epithet is derived from that of the host. Beeli formula: 2101. 5240.

Host and distribution: On living twigs and small branches of *Acer negundo* L. *(Aceraceae)*, Alabama, Florida, and Georgia, U.S.A.

Type locality: Sugarfoot Hammock, Alachua Co., Florida.

Specimens examined: Forida: Alachua Co., Hawthorne, G. F. WEBER, Feb. 1941; Sugarfoot Hammock, west of Gainesville, A. S. RHOADS (Type, Nat. Fungus Collections, no. 71495); Buzzard's Roost Hammock, west of Gainesville, A. S. RHOADS, April 1944 and D. P. ROGERS, Sept. 1954; Georgia: Butts Co., Griffen, E. S. LUTTRELL, April 1946. There is a small specimen of this species in the CURTIS collection of the Farlow Herbarium at Cambridge labelled *Meliola amphitricha* FR., collected by PETERS, no. 940, "Ala. super.", April 1956. MILLER (3, p. 37) records the species from Clark Co., Georgia, again as *M. amphitrica*. HANLIN (1, p. 42) reports

specimens on *A. negundo* from Clark, Pierce, and Washington Cos., Georgia, using the same species name, which has been discarded by specialists concerned with the *Meliolineae*.

This species is very distinct from *Meliola aceris* described from Taiwan on leaves of *Acer oblongum* WALL by YAMAMOTO (6), the only other species of the *Meliolineae* known on the *Aceraceae*. *M. aceris* has 4-septate spores, denticulate mycelial setae, small, regular ellipsoid or subglobular capitate hyphopodia, and grows on the leaves of its host in contrast to *A. negundinis* which has 3-septate spores, no setae, very irregular hyphopodia, and is presumably caulicolous only.

2. **Irenopsis tehoniana** (TROTT.) HANSF., Sydowia Beihefte II: 339. 1961.

Meliola tehoniana TROTT. in SACC., Syll. Fung. 29: 376, 1926.

Meliola compacta EARLE, Bull. N. Y. Bot. Garden 3: 306. 1905.

This species is abundant throughout the range of its host *Rhacoma ilicifolia* (POIR.) TREL. (*Crossopetalum floridanum* GARDNER), *(Celastraceae)*, in southern peninsular Florida and the Keys. HANSFORD (2, pp. 339-340) in recording the occurrence of the species from Puerto Rico, the Dominican Republic, and Brasil, mentions Florida, but without details of distribution. The Florida collections examined have included, A. H. CURTIS, 1880 (no other data found); Monroe Co.: No Name Key, J. H. SIMPSON, 168, May 1891; Dade Co.: Royal Palm State Park, C. A. MOSIER, Oct. 1897; Coconut Grove, R. THAXTER, Nos. 3, 45, 54, 1898; Miami, Mrs. E. G. BRITTON, Mar. 1904; Perrine, J. K. SMALL and J. J. CARTER, 2791, Nov. 1906; Snapper Creek Hammock, J. A. STEVENSON, Feb. 1922; Homstead, M. F. BARRUS, Mar. 1931; Naranja, J. L. FENNELL, 1936.

3. **Meliola bumeliae** HANSF., Sydowia Beihefte II: 505-506. 1961.

HANSFORD based this species on a single specimen issued by S. M. TRACY as No. 7268 of his exsiccati „Plants of the Gulf States" and named by F. S. EARLE as *Meliola amphitrica* FR., a rejected name. The host was cited as *Bumleia parviflora*. No such binomial is given in Index Kewensis and the species actually involved would appear to be *B. parvifolia* CHAPM. non A. DC., a synonym of *B. angustifolia*

NUTT. *B. parvifolia* A. DC. is a West Indian species not known from Florida.

M. bumeliae is common and generally distributed in Florida on several species of *Bumelia* of the *Sapotaceae*.

Specimens examined: *Bumelia angustifolia* NUTT., Manatee Co., S. M. TRACY, 7268, Dec. 1901; *B. lanuginosa* WILLD., Alachua Co., Gainesville, G. F. WEBER, 11318, April 1936; *B. microcarpa* SMALL, Hardee Co., Wauchula, T. H. CARLTON, 8051, Nov. 1932; *B. reclinata* VENT., Highlands Co., Highlands Hammock, C. L. SHEAR, Mar. 1937; Clay Co., near Middleburg A. S. RHOADS, Dec. 1949; *B. tenax* (L.) WILLD., Orange Co., Winter Park, C. L. SHEAR, Mar. 1943; *Bumelia* sp., Seminole Co., Longwood, C. L. SHEAR, 1937; Alachua Co., Sugarfoot Hammock, A. S. RHOADS and E. WEST, Jan. 1944; Highlands Co., Sebring, C. L. SHEAR, Mar. 1937.

4. **Meliola castelae** sp. nov.

Coloniis epiphyllis, rare hypophyllis vel caulicolis, 1-2 mm diam., saepe coalescentibus; hyphis e rectis undulatis, opposite ramosis; cellulis 15-25 × 7-9 μ; hyphopodiis capitatis oppositis, rare unilateralibus, antrorsis, 18-28 μ longis; cellulis basalibus cylindraceis, 5-8 μ longis; cellulis apicalibus rotundatis usque irregularibus, 10 17 × 7-10 μ; hyphopodiis mucronatis paucis, e conoideis ampulliformibus, alternatis vel unilateralibus usque 18 μ longis; setis mycelii erectis simplicibus, ad apices acutis, usque 600 μ longis; peritheciis dispersis, verrucosis, usque 225 μ diam.; sporis culindraceis usque subellipsoideis, 4-septatis, ad septa constrictis, 40-46 × 15-18 μ.

Colonies epiphyllous, rarely hypophyllous or caulicolous, black, 1-2 mm in diameter, often coalescent covering much of the leaf blade, thin to subdense; hyphae straight to undulate, branching opposite, rarely unilateral, acute to wide-angled; cells 15-25 × 7-9; capitate hyphopodia opposite, rarely unilateral, antrorse, 18-28 μ long; stalk cells cylindrical, 5-8 μ long; head cells rounded to irregular, 10-17 × 7-10 μ, mucronate hyphopodia few, conoid to ampulliform, alternate or unilateral, to 18 μ long; mycelial setae few, erect, simple, tips acute, to 600 μ long, 7-12 μ in diameter at the base; perithecia scattered, ver-

rucose, to 225 μ in diameter; spores cylindrical to sub-ellipsoid, 4-septate, constricted at the septae, 40-46 × 15-18 μ. The specific epithet is derived from the generic name of the host. Beeli formula: 3112. 4223.

Host and distribution: On living leaves of *Castela tortuosa* LIEBM. *(Simarubaceae)*, Texas, U.S.A. It is possible that the host species should be referred to *C. texana* (TORR. et GRAY) ROSE.

Type locality: Cameron Co.: Brownsville, Texas.

Specimens examined: Texas: Cameron Co., Brownsville, ROBERT RUNYON, Feb., 1945. (Type 71770, BPI at Beltsville, Maryland.); Brownsville, Plant Quarantine Service, 58677, Feb. 1945.

This species appears distinct from *M. falcatiseta* SPEG., known only from Argentina on *Castela* spp., in its longer, non-uncinate mycelial setae, smaller perithecia and capitate hyphopodia which are mostly alternate.

5. **Meliola krugiodendri** CIF., Ann. Myc. 36: 213. 1938.

This species has been known heretofore only from the Dominican Republic and Puerto Rico on *Krugiodendron ferreum* (VAHL) URBAN *(Rhamnaceae)* as noted by HANSFORD (2, p. 368). Puerto Rican collections were referred earlier by STEVENS (5) to *M. thouiniae* EARLE, but as CIFERRI pointed out (Loc. cit.) the species on *Krugiodendron* differs sufficiently in its morphological characters from the EARLE species to warrant a new name. The Florida material agrees fairly well with CIFERRI's description, although some setae exceeded the length recorded by him, the tips of a few were 2-5 dentante (as was the case with a few of those in the type collection) and the spores were at times larger. The Beeli formula based on Florida material would appear to be 31 1/3 1.4223, rather than HANSFORD's (2) 3111. 3223 as based on CIFERRI's description.

Specimens examined: On *Krugiodendron ferreum* (VAHL) URBAN, Indian River Co., Sebastian, A. S. RHOADS, Feb. and Mar. 1944; Dade Co. Snapper Creek, A. S. RHOADS, Mar. 1944.

6. **Meliola malacotricha** SPEG., Anal. Soc. Cienc. Argentina 22: 59. 1888.

This species, common and widespread throughout most tropical and subtropical regions of the world on *Ipomoea* spp. and many

related plants of the Convolvulaceae, has not been reported heretofore from the continental United States. A specimen of *Breweria* sp. in the New York Botanical Garden Herbarium, collected by J. K. SMALL and J. J. CARTER, No. 1344, between Cutler and Longview Camp., Dade Co., Florida, in Nov. 1903 is here referred to this species. It agrees morphologically with typical collections from Puerto Rico on *Ipomoea* spp. *Meliola francevilleana* GAILL. reported on *Breweria* sp. from Congo appears to differ in longer spores, larger perithecia and other minor morphological details.

7. **Meliola psychotriae** EARLE, Bull. N. Y. Bot. Garden 3: 308. 1905.

This species is common on a wide range of Rubiaceous hosts throughout the tropical world. On *Guettarda* it has been reported only from Puerto Rico. Florida specimens on *G. scabra* LAM. *(Rubiaceae)* have been found typical of the species.

Specimens examined: Dade Co., Brickell Hammock, John A. STEVENSON, Feb. 1922; Homestead, V. K. CHARLES, Jan. 1939; Castellow Hammock, C. L. SHEAR, Mar. 1942.

8. **Meliola psychotriae** EARLE var. **chiococcae** HANSF., Sydowia 10: 83. 1957

This well marked variety reported by HANSFORD (2) from Puerto Rico and Barbados is common in southern Florida on the same host, *Chiococca alba* (L.) A. S. HITCHC. *(Rubiaceae)*.

Specimens examined: Dade Co., Coconut Grove, R. THAXTER, 1898; Snapper Creek and Royal Palm State Park, A. S. RHOADS, Mar. 1944; Indian River Co., Orchid and Sebastian, A. S. RHOADS, Feb. 1944.

9. **Meliola serjaniae** F. L. STEVENS, III. Biol. Monog. 2: 512. 1916.

HANSFORD (2) reports this species from Brasil, Costa Rica, and Puerto Rico. A specimen from Brownsville, Cameron Co., Texas (Plant Quarantine Service 57135) on *Serjania brachycarpa* A. GRAY

(Sapindaceae) agrees very well with HANSFORD's redescription of the species in his monograph.

10. **Meliola sideroxylicola** sp. nov.

Coloniis epiphyllis, tenuibus, 2-4 mm diam.; hyphis rectis vel subsinuosis, opposite ad angulos 45°-60° ramosis, laxe anastomosantibus, 5-7 μ diam.; hyphopodiis capitatis alternatis interdum unilateralibus, 15-21 μ longis; cellulis basalibus rectis, cylindraceis, 2-5 μ longis, 5-6 μ diam.; cellulis apicalibus subglobosis usque obovoideis, 10-15 × 8-10 μ; hyphopodiis mucronatis oppositis vel unilateralibus, ampulliformibus, 18-24 μ longis; setis mycelii rectis vel subcurvatis, 125-250 μ longis, ad apices obtuse rotundatis vel bifidis trifidisve, ramulis 3-24 μ longis; peritheciis paucis in centrum coloniae aggregatis, verrucosis; sporis 4-septatis, ad septa modice constrictis, 42-48 × 15-18 μ.

Colonies few, 2-4 mm in diameter, but often confluent to form large black patches, epiphyllous, loose and easily detached; hyphae straight to slightly sinuous, branching opposite at 45° to 60° angles, less often unilateral, loosely anastomosing, 5-7 μ in diameter; capitate hyphodia alternate, sometimes unilateral, 15-21 μ long; stalk cells straight, cylindrical 2-5 μ long, 3-5 μ in diameter; head cells subglose to obovoid, 10-15 × 8-10 μ; mucronate hyphopodia opposite or unilateral, ampulliform, 18-24 μ long; mycelial setae straight to somewhat curved, 125-250 μ long, black, opaque, obtuse rounded tips or bi-trifid branched branchlets 3-24 μ long, 3 μ in diameter; perithecia few, clustered at center of colonies, verrucose; spores 4-septate, moderately constricted at the septa, 42-48 × 15-18 μ. The specific epithet is derived from the host genus. Beeli formula 3131. 4221.

Host and distribution: On living leaves of *Sideroxylon foetidissimum* JACQ. (*S. mastichodendron* JACQ.)., *Sapotaceae.*

Type locality: Dade Co., Royal Palm State Park, Florida.

Specimen examined: Paradise Key, Royal Palm State Park, W. E. SAFFORD and C. C. MOSIER, Sept. 1917 (Type collection. No. 71771, BPI).

This new species differs from *M. sideroxyli,* which is endemic in Hawaii on *Sideroxylon* sp., in its dentate mycelial setae, opposite capitate hyphopodia, longer spores, and larger perithecia.

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Beltville, Maryland, U.S.A., September 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

EN FÖR SKANDINAVIEN NY ART AV SLÄKTET TRICHOLOMA

ETT EFTERLÄMNAT MANUSKRIPT AV GUSTAF E. HAGLUND TILLRÄTTALAGT FÖR PUBLIKATION

AV NILS SUBER

SUMMARY

Tricholoma helviodor PILÁT et SVRČEK found in Sweden.

The very rare *Tricholoma helviodor* was allready found in Sweden (Uppland) on 7. September 1946 and on 17. October 1948. Since that time several Swedish finds have been made. A detailed description of the species given by the late Swedish botanist and mycologist GUSTAF HAGLUND*) is published below.

I Sverige växer flera sällsynta musseronarter. Störst är Jättemusseronen, *Tricholoma colossus,* som vår store svampkännare Professor ELIAS FRIES beundrade mycket icke blott för dess storlek utan mer för dess säregna växt och förekomst i hans födelsebygd.

För tjugo år sedan (1948) fann jag intill jättemusseronen i moss- och lavrik barrskog en kalkvit lakrits- eller selleriluktande musseronart. Då hade jag också den stora glädjen att få samarbeta med Fil. Dr. GUSTAF HAGLUND och andra mykologer vid Sveriges Riksmuseums Botaniska avdeling för att inventera Stockholmstraktens svampflora. Allt gjorde att mina svampfynd visades och insamlades till museets samlingar.

*) See „Friesia" 6: 372-373, 1961.

GUSTAF HAGLUND var en entusiastisk, noggrann och kunnig forskare och jag vill gärna låta honom själv berätta om den först vita muserronen och dess förekomst innan senare års fynd av arten omtalas:

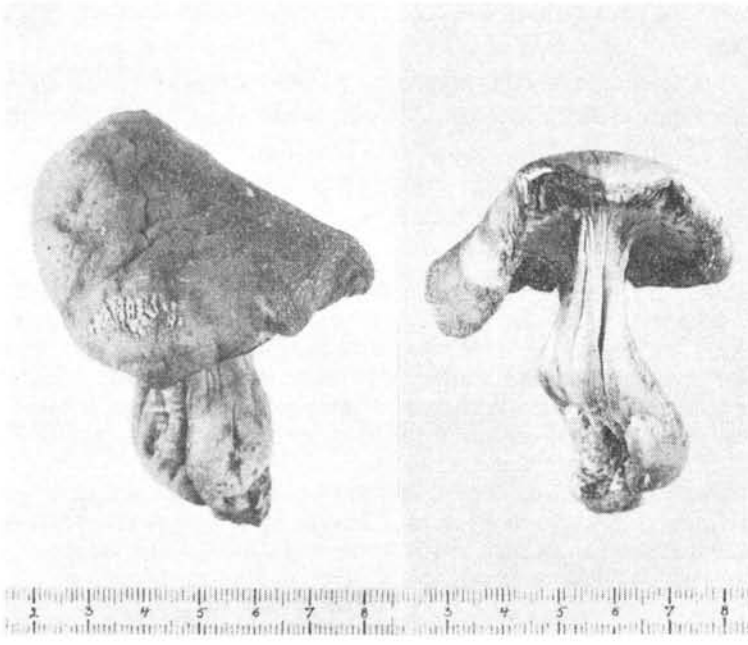
EN FÖR SKANDINAVIEN NY ART AV SLÄKTET TRICHOLOMA

AV GUSTAF E. HAGLUND

År 1946 planlades en inventering av Stockholmstraktens Hymenomycet-flora. Jag skall ej närmare gå in på de samlingar och den litteratur, på vilken en sådan uppgift hade förmånen att bygga vidare utan vill här med tacksamhet blott notera de betydande bidrag, som sedan nämnda tidpunkt årligen influtit såväl i form av anteckningar från exkursioner m. m. som beläggmateral, som tillförts Naturhistoriska Riksmuséets botaniska avdelning. Bland de värdefulla samlingar, som tillvaratagits befinner sig bl. a. en hittills i Skandinavien obekant *Tricholoma*.

Det har länge visat sig omöjligt att få något namn på densamma, trots att den på grund av sina särpräglade karaktärer knappast lämnar några tvivel om sin ställning i systemet. Det erbjuder ej heller några svårigheter att känna igen den i naturen, om man haft tillfälle att se den där eller erhålla den i friskt skick, för den som har någon erfarenhet om släktet i övrigt. I den amerikanska litteraturen har den ej stått att finna, ej heller i den monografiska sammanställning över europeiska *Tricholoma*-arter, som gjorts av E. NÜESCH (1923). Först 1951 blev den bekant genom ett omfattande verk av A. PILÁT. PILÁT & SVRČEK hade fyra år tidigare publicerat en beskrivning av den i „Studia Botanica Čechoslovaca", nr. 7. PILÁT's förstnämnda arbete, helt avfattat på tjeckiska, innehåller några avbildningar (nrs. 239-240) av densamma och i sistnämnda publikationsserie finnas flera sådana jämte latinsk diagnos och åtföljande diskussion, likaledes å latin. Den nybeskrives under namnet *Tricholoma helviodor* PILÁT & SVRČEK på grund av sin starka lakritsdoft påminnande om doften hos *Lactarius helvus*.

Innan jag övergår till att diskutera dess systematiska ställning, vill jag härmed i korthet giva en beskrivning av densamma grundad på personlig erfarenhet och på de iakttagelser och anteckningar, som



Tricholoma helviodor PILÁT et SVRČEK.
Södermanland, Bo-Värmdö, Kåktorpsjön, mossig barrskog, 15.IX.1953.

agronom N. SUBER varit vänlig meddela mig. Samtidigt hänvisar jag till bifogade avbildning och förutnämnda reproduktioner (PILÁT, PILÁT & SVRČEK l. c.).

F r u k t k r o p p e n är köttig, medelstor, torr och kompakt, köttet ostigt (i hatten), vitt och milt samt har en stark doft av lakrits.

H a t t först konvex och regelbunden, snart nästan plan, vågig och mer eller mindre difform, knappast intryckt och ej heller umbonat, i mitten fast och köttig men tunnar snabbt av mot kanten, denna är först nedvikt, förblir länge något invikt och är ostrimmad och utan fåror, ytan torr, flockigt tomentös, bottenfärgen blekvit eller nästan kalkvit — då svampen först visar sig har den helt denna färg (en viktig iakttagelse som gjorts av NILS SUBER, vilket ej omnämnes i originalbeskrivningen) — men mycket snart sämskfärgad och mörkare brun (Buckthorn Brown-Dresden Brown, RIDGWAY plate XV) och djupt sprickig till mer eller mindre areolerad, varigenom det vita hattköttet kommer till synes.

L a m e l l e r smala, långa, täta hela, smutsvita, ej sällan med ett skimmer i gult eller grönaktigt, emarginerade (eller nästan fria), ej

så fasta till konsistensen som svampen i övrigt, ej annorlunda färgade i eggen.

Fot tjock och köttig, kompakt, vit eller något gråvit, ibland en smula tappformigt avsmalnande mot basen eller nedtill obetydligt vidgad, bulbös, fibrillös, oregelbundet fjällig.

Sporer vita, hyalina, små, 4-5 × 3,5-4 µ, subglobosa, släta, svagt amyloida; basidier 2-4-sporiga.

Uppland: Östra Ryd, Bogesund, Fridhemsområdet, bergssänka bland mossa och lav, som lokal för *Boletus bovinus*, 1.IX.1946, E. INGELSTRÖM; do, Rydbo, ml. Rydbo och Veda, utefter vägen, c. 1 km från Rydbo jvstn, i mossig barrblandskog, 17.X.1948, NILS SUBER; do, 2 km V om Rydbo, backig gran- och tallskog, i mossa, 17.X.1948, idem; do, Rydbo, 23.X.1949, E. INGELSTRÖM; do, 1 km från Rydbo, i bergig, lavrik tallskog (å lokal för *Tricholoma Colossus*), ASTRID SUBER 1952; Munsö, Sjöängen, mossig barrskog, 27.IX.1950, ASTRID och NILS SUBER.

Södermanland. Salem, Bornhuvud, bergig barrskog, i mossa under gran, 18.IX.1949, NILS SUBER; Bo-Värmdö, Björknäs, Kåktorpsjön, mossig barrskog, 15.IX.1953, fru E. BJÖRKEDAL, comm. NILS SUBER.

Som synes av ovanstående lokalförteckning (minst sex olika fyndorter) förekommer *Tricholoma helviodor* spontan i bergiga, mossiga eller lavrika barrskogar eller barrblandskogar. På samma sätt anträffas den även i Tjeckoslovakiet. Hos oss uppträder den gärna å dylika ståndorter, varest *Boletus bovinus* brukar finnas eller som den sällsynta *Tricholoma colossus* med förkärlek väljer. Å de sex fyndorter, varest den påträffats i Tjeckoslovakien, kommer den liksom hos oss vanligen sent å säsongen. Såvitt jag hittills kunnat finna, är den blott känd från Tjeckoslovakiet (Böhmen, Mähren) och Sverige. Den är t. ex. ännu okänd från Frankrike (KÜHNER & ROMAGNESI 1953, p. 158).

Av våra svenska arter liknar *T. helviodor* otvivelaktigt mest *Tricholoma (Leucopaxillus) amarum*. Den skiljer sig dock lätt från den senare bl. a. genom sin lakritslukt och milda, ej bittra smak.

På grund av sina amyloida sporer och karaktärer i övrigt (SINGER & SMITH 1943, 1947) måste den liksom *Tricholoma amarum* hänföras till släktet *Leucopaxillus* (BOURSIER 1925) i SINGER och SMITH's mening (l. c.). På grund av sina släta, svagt amyloida sporer bör den placeras i sektionen *Aspropaxillus* (SINGER & SMITH 1943) omfattande ett fåtal såsom lägre organiserade ansedda typer inom släktet till skillnad från *Leucopaxillus amarus*, vars glest skrovliga, starkt amyloida sporer skulle berättiga den till en ställning i den artrikare, polymorfa sektionen *Eu-Leucopaxillus*.

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Under åren fram till år 1958 gjordes allt mer sällan fynd av den av oss kallade lakritsmusseronen. I „Friesia" skrev K. BÜLOW och F. H. MÖLLER samma år en synnerligen intresseväckande uppsats med bild av *Tricholoma helviodor* PILÁT et SVRČEK. J. SCHÄFFER's art *Tricholoma apium* överensstämmer i stort med vår beskrivning av *Tricholoma helviodor*. Säkerligen är dessa båda artbeskrivningar efter delvis olika iakttagelser gjorda på samma musseronart.

Lakritsmusseronen som är sällsynt i vårt land har trots ivrigt sökande de senaste åren blott ytterst sparsamt förekommit, så är också fallet med *Tricholoma colossus*. Enär vi vet att det kan dröja tio år eller mer innan en svampart återkommer på samma växtplats så hoppas vi på framtida fynd.

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Stockholm, september 1968.

FRIESIA . Bind IX . Hefte 1-2 . 1969

PERONOSPORA RUMICIS SUR RUMEX ET EMEX

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Le *Peronospora rumicis* CORDA a été peu étudié en ce qui concerne son comportement à l'égard des différentes espèces vivaces du genre *Rumex* qui sont aujourd'hui reconnues comme des plantes-hôtes habituelles. Il s'observe principalement sur *R. acetosa* L., *R. acetosella* L., *R. arifolius* ALL. Cependant GÄUMANN (1919 et 1913) ajoute à cette liste *R. lunaria* L. aux Iles Canaries; *R. thyrsiflorus* FINGERH. qui est une variété du *Rumex acetosa,* et *R. vesicarius* L. en Grèce. Enfin plusieurs mentions sont connues de la présence de ce *Peronospora* sur l'*Emex spinosus* CAMPD.

L'évolution du *Peronospora rumicis* sur le *Rumex acetosa* se manifeste par des déformations foliaires très apparentes, visibles dès le début du printemps aussitôt après l'émergence des feuilles, pouvant se généraliser à l'ensemble du feuillage. Ces altérations ont été signalées par DE BARY (1863) qui a montré que le Champignon hiberne à la base des souches. A. FISCHER (1892) reconnait le caractère de pérennance de ce *Peronospora* dans les organes souterrains, et précise en outre que les feuilles provenant de souches parasitées restent plus petites que la normale, jaunissent ou manifestent un rougissement accusé. Leur port est érigé et leur bord souvent profondément enroulé.

Les observations qui suivent apportent quelques précisions concernant la biologie de ce parasite. Elles ont été réalisées sur le *Rumex acetosa* cultivé pour son feuillage.

Le maintien du *Peronospora rumicis* pendant la période de repos de végétation de l'hôte s'effectue dans les souches du *Rumex acetosa*

à la base des écailles des bourgeons souterrains. Ce mode de persistance a pu être établi par la recherche du mycélium qui n'est présent qu'à ce niveau. Il se présente sous la forme de pelotons denses, pourvus d'h a u s t o r i a, tantôt dilatés, tantôt contractés, appliqués le long de la paroi des cellules parasitées. Cette forme de persistance est d'ailleurs connue pour plusieurs Péronosporacées. On peut citer le cas du *Pseudoperonospora humuli* (MIYAB. et TAK.) WILS. dans le rhizome de l'*Humulus lupulus* L. ou celui du *Peronospora ficariae* (NEES) TUL. dans les bourgeons transformés en bulbilles du *Ranunculus ficaria* L.

Le *Peronospora* poursuit son développement par une progression ascendante au niveau des méristèmes apicaux dans lesquels les hyphes peuvent être mis en évidence par la simple coloration des coupes axiales au bleu coton lactique à chaud.

Il se produit alors deux phénomènes concomitants:

1 — une transformation tissulaire,

2 — un désordre pigmentaire.

Dans le mésophylle des limbes envahis avant leur épanouissement, il ne se produit pas de différenciation précise entre le tissu lacuneux et le tissu palissadique, celui-ci se trouvant le plus souvent constitué par des cellules isodiamétriques lâchement juxtaposées, plus courtes que celles des tissus sains. De ce fait, l'épaisseur totale du limbe se trouve nettement réduite en même temps que la surface foliaire diminue. Pour l'épiderme inférieur, la réduction en surface entraine une augmentation du nombre des stomates par unité de surface sans que, pour celà, le nombre total et la disposition respective de ceux-ci soient modifiées. Ceci explique la très grande uniformité du feutrage mycélien conidifère qui fait émergence au travers des stomates.

Cette transformation tissulaire intéresse presque toujours la totalité du limbe. Dans certains cas cependant, lorsque la progression hyphale n'est que partielle, elle peut se limiter au tiers ou à la moitié proximale de la feuille dont la croissance se trouve alors réduite par rapport à la portion distale qui conserve ses dimensions, sa structure et sa pigmentation.

Quant aux altérations de coloration qu'on observe aussi bien sur le *Rumex acetosa* que sur le *R. acetosella* (beaucoup moins nettement sur le *R. arifolius*), elles correspondent à un jaunissement local ou généralisé, lié à la disparition partielle ou totale du pigment chlorophyllien tandis que dominent les pigments caroténoïdes, ceux-ci étant répartis de façon très inégale suivant qu'on examine la marge du limbe (où ils

sont plus abondants) ou les parties contigües à la nervure principale.

L'une des manifestations très typiques de la présence du *Peronospora rumicis* est l'enroulement du limbe, suivant ses bords, vers la face inférieure. Cette rétractation accuse l'aspect linéaire que présentent les feuilles du *Rumex acetosa* attaquées par le mildiou. La déformation du limbe se prononce d'autant plus que la production du feutrage conidifère devient abondante. Elle est à peine perceptible lorsque les conditions ambiantes sont défavorables à l'émission conidienne, par exemple en présence d'une faible humidité relative. Par contre des feuilles de *Rumex acetosa* infectées par le *Peronospora,* soumises de façon durable à une atmosphère saturée en humidité, produisent un feutrage conidifère abondant et homogène tout en restant planes. On peut en conclure que le repliement du limbe parasité est corrélatif à la perte en eau subie par le mésophylle sous l'influence du parasite.

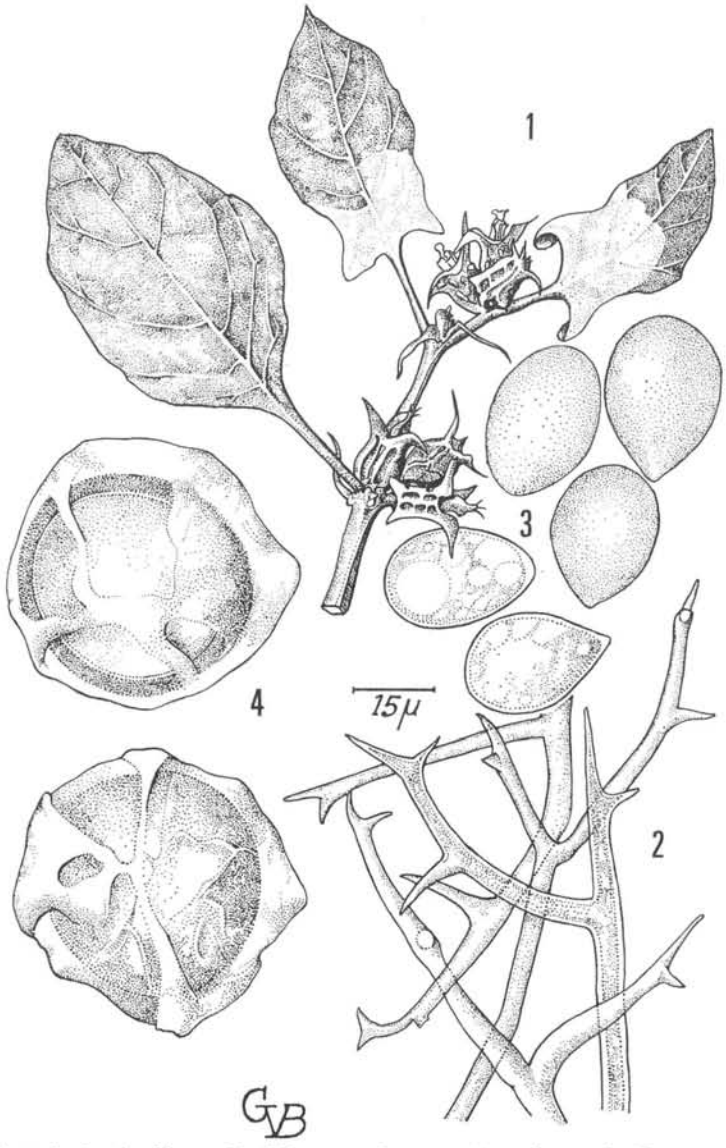
La production conidienne débute normalement à partir d'une température voisine de 10°. L'optimum de développement se situe vers 15° à condition que le taux d'humidité soit voisin de la saturation. Le feutrage conidifère se constitue uniquement sur les limbes bien que le mycélium soit présent dans les pétioles et en même temps dans les tiges. Il recouvre les parties du limbe aux dépens desquels interviennent les altérations pigmentaires. De cette façon la face inférieure d'une feuille peut en être totalement recouverte.

L'apparition des conidiophores précède de peu la sénescence foliaire puis son flétrissement. Au delà de ce stade, la production en conidiophores et en conidies s'interrompt. Dans les tissus désorganisés du *Rumex acetosa* ou du *R. acetosella* on n'observe jamais la production d'oospores.

La pérennance du *Peronospora rumicis* se réalise de 2 façons:

1 — par la persistance du mycélium dans la souche, au niveau de bourgeons de remplacement infectés au printemps. Elle se constate au moment de la progression et de la prolifération mycélienne. Ceci peut être prouvé sur le *Rumex acetosa* en supprimant le feuillage porteur de conidiophores, en désinfectant superficiellement la souche et en la remettant ensuite en végétation dans une terre saine. Malgré ces opérations le parasite réapparait dans 78 % des cas.

2 — par l'infection des pousses à partir des conidies formées à



1. Aspect du feuillage de l'*Emex spinosus* attaqué par le *Peronospora rumicis*. — 2. Conidiophores du *Peronospora rumicis* sur *Emex*. — 3. Conidies prélevées sur *Emex*. — 4. Oospores formés dans les feuilles de l'*Emex spinosus*.

la fin du printemps sur les feuilles développées. Des souches saines peuvent ainsi être contaminées. Elles manifestent des symptômes maladifs un an après.

Ces deux possibilités de persistance expliquent l'inefficacité des traitements classiques à l'égard des mildious lorsqu'ils sont appliqués sur des souches de *Rumex acetosa* infectées par le *Peronospora rumicis*.

L'existence d'un *Peronospora* sur l'*Emex spinosus* CAMPD. a été signalée pour la première fois par MAIRE (1909) en Tunisie. Cet Auteur a trouvé le parasite dans un champ d'Orge au sud de Gabès lors de la session de la Société Botanique de France. MAIRE désigna l'espèce *Peronospora rumicis* CORDA sans toutefois justifier cette détermination tandis que l'*Emex spinosus* est considéré comme *matrix nova* de cette Péronosporacée.

Dans sa monographie du genre *Peronospora* (1923) GÄUMANN tient compte de cette mention sans définir une position systématique définitive.

Il semble bien qu'aucune trace n'est restée de la récolte tunisienne, et qu'ainsi le mycologue suisse n'ait pas eu la possibilité de faire les comparaisons indispensables. Nous-même (1956), tout en tenant compte de la présence signalée d'un *Peronospora* sur l'*Emex,* n'avons pas été dans la possibilité d'en établir les caractéristiques morphologiques et biologiques.

Ce mildiou se présente ainsi comme une espèce rare et exceptionnelle. Il convient de remarquer que l'*Emex spinosus,* qui occupe une aire de répartition géographique restreinte (région méditerranéenne, macaronésie), est cependant relativement fréquent au sein de cette aire. Il abonde quelquefois au détriment des cultures. Son maintien est en relation avec la partie souterraine qui est charnue, épaisse, résistante aux façons culturales, ainsi qu'à la plupart des produits utilisés comme herbicides. Sa multiplication est due aux fruits très nombreux produits en cymules aériennes ou souterraines. Le mode très particulier du développement des inflorescences et des fleurs hypogées a été étudié par MURBEK (1901).

La présence d'un *Peronospora* sur l'*Emex spinosus* rapporté au *P. rumicis* des Polygonacées, risquait donc de tomber en désuétude (ou de devenir hypothétique). Fort heureusement, à deux reprises différentes (1964 puis 1968), au cours de missions accomplies en Tunisie, nous avons retrouvé cette espèce et pû ainsi procéder à son étude en nature et au laboratoire.

Les premières observations sont basées sur des prélèvements effectués aux environs de Sousse; les secondes se rapportent à des spécimens récoltés aux alentours de Tunis (mai 1968) dans les cultures de l'Institut national de la Recherche agronomique.

Les plantes parasitées, dans les deux localités, présentent un aspect rabougri lié à une modification profonde dans le développement des tiges et du feuillage. Les entrenoeuds sont plus courts que ceux d'une plante saine si bien que les feuilles et les groupements d'inflorescences se trouvent rassemblés à faible hauteur au-dessus du sol.

Quant aux feuilles, elles présentent une forme très particulière. Le pétiole, anormalement court, est prolongé par un limbe dont la base devient hastée, tandis que pour une feuille normale, il est insensiblement décurrent sur le pétiole. Cette anomalie de forme intervient tant sur des feuilles totalement envahies par le parasite que sur celles qui ne le sont que partiellement. Dans ce dernier cas, comme pour les *Rumex* parasités par le *Peronospora rumicis,* c'est uniquement la portion basale du limbe qui est déformée. Un aspect "lyré" du feuillage, qui a été décrit pour le *Peronospora Schachtii* FCK. de la betterave peut être aussi considéré sur l'*Emex.*

Indépendamment des feuilles, la formation conidienne se manifeste également aux dépens des bractées florales.

L'examen de ce *Peronospora,* réalisé comparativement avec le *P. rumicis* sur différents *Rumex,* permet plusieurs constatations:

1 – Il existe une identité certaine quant aux symptômes apparents. Les limbes parasités, réduits en surface, subissent des anomalies pigmentaires et se rétractent vers l'épiderme inférieur qui s'enroule suivant ses bords.

2 — L'efflorescence conidifère, très homogène et dense, a la même couleur (gris-violacé) sur les différents hôtes.

3 — Les caractéristiques biométriques des conidiophores et des conidies présentent des variations sensiblement comparables. Les écarts qui interviennent entre les dimensions des conidies prélevées sur l'*Emex* et le *Rumex acetosa* sont moins importants que ceux qui interviennent entre des conidies formées sur le *Rumex arifolius* et le *R. acetosella.* Les conidies obtenues sur le *R. acetosella* sont en moyenne sensiblement plus grosses que celles de tous les autres prélèvements.

Dimensions des conidies.

	Extrèmes	Moyennes
Rumex acetosa	22-34 × 16-22 μ	29,30 × 18,97 μ
— *arifolius*	22-32 × 17-23 -	26,08 × 19,60 -
— *acetosella*	26-37 × 17-28 -	33,94 × 18,57 -
Emex spinosus	25-37 × 17-25 -	29,55 × 21,57 -

Toutefois il convient de noter que:

1 — les conidies prélevées sur l'*Emex spinosus* sont fréquement apiculées tandis que sur les *Rumex* presque toutes les spores apparaissent régulièrement ovales.

2 — tandis que la formation d'oospores n'a jamais été observée sur les *Rumex,* ils sont abondants dans les tissus altérés de l'*Emex spinosus.* Ce sont des corps globuleux, mesurant 32 à 50 μ de diamètre, à paroi faiblement brunâtre, le plus souvent lisse, ou pourvue de replis faibles et irréguliers, souvent à peine marqués.

En conclusion, l'étude comparative du *Peronospora rumicis* sur ses hôtes habituels et du *Peronospora* vivant sur l'*Emex spinosus* n'a pas permis de mettre en évidence des caractères autorisant à une séparation d'ordre morphologique ou biologique.

Cette étude a montré incidemment que le *Peronospora rumicis,* se développant dans des conditions écologiques particulières, peut produire des oospores.

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REVISION OF THE MORPHOLOGICAL CHARACTERISTICS OF MYCOGONE ROSEA LINK

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SUMMARY

Detailed investigations on *Mycogone rosea* LINK, a *Hyphomycete* inhabiting mushrooms, revealed new characteristics of the fungus. Typical *Mycogone* chlamydospores and *Diplocladium*-like, mainly two-celled conidia on verticillate conidiophores develop simultaneously in the colony of the fungus. The production of these two types of spores by *Mycogone rosea* LINK was observed for the first time. On the basis of these characteristics, the original description of *Mycogone rosea* LINK is amended.

Occurrence of *Mycogone rosea* LINK, a *Hyphomycete* inhabiting mushrooms, is comparatively rare in Hungary. A single published contribution is available concerning the occurrence of this species from the country (MOESZ 1942). It appears also in G. MOESZ's "List of the identified fungi", a manuscript, deposited in the Library of the Hungarian Museum of Natural Sciences.

According to the original description of *Mycogone rosea* LINK, the fungus is characterized by the production of two-celled chlamydospores exclusively (LINDAU 1907). No other types of conidial fructifications, such as *Verticillium* or *Diplocladium*, have been mentioned by the author. No further data concerning the ontogenesis of *Mycogone rosea* have been published since that time. Detailed life

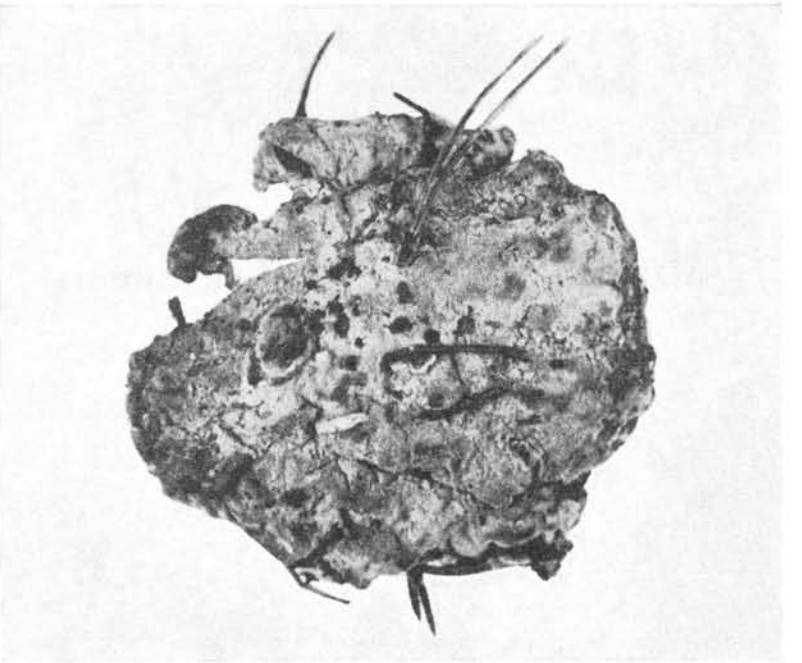

Fig. 1. *Mycogone rosea* LINK covering the pileus of a fruit-body of a *Russula*.

history studies are available only in the case of the single economically important member of the genus: *Mycogone perniciosa* MAGN. (WOOD 1960).

In the autumn of 1967 a sample of *Mycogone rosea* LINK was collected in a pine forest in Transdanubia, Hungary. The fungus developed on a decayed fruit-body of a *Russula* species. Since the entire fruit-body was covered by the colony of the *Hyphomycete,* the exact identification of the "host" fungus was impossible.

Mycogone rosea was successfully cultivated on Czapek's agar, containing 2 % malt extract. Poor growth of the fungus was observed on a number of media of other composition, including regular Czapek's agar.

Our investigations of *Mycogone rosea* from the natural substratum and from artificial cultures revealed basically new characteristics of the fungus. These observations and results justify the correction of the original description of *Mycogone rosea* LINK.

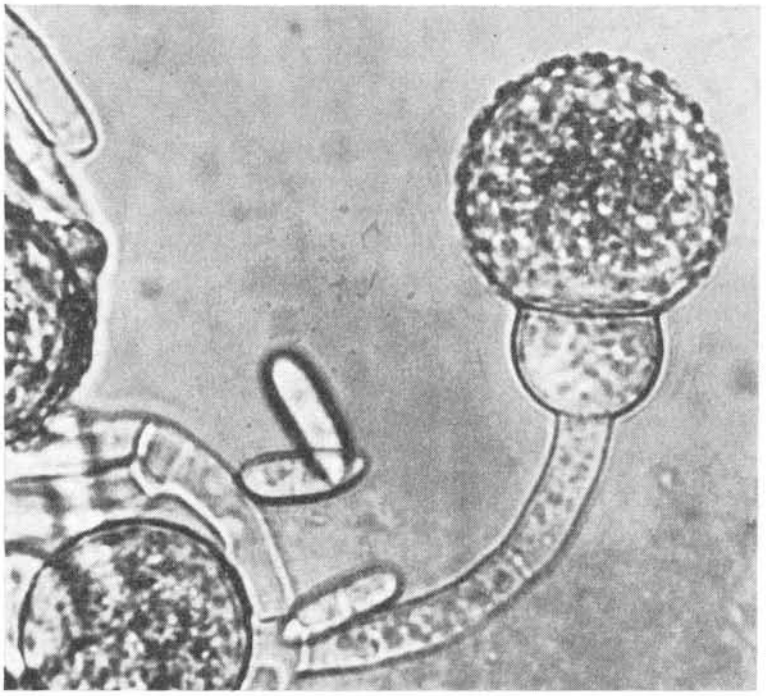

Fig. 2. Young, newly developed chlamydospore of *Mycogone rosea* LINK, and three *Diplocladium*-like conidia. — 1.300 ×.

Mycogone rosea LINK emend. VÖRÖS et UBRIZSY

On the natural substrate (*Russula* sp.). Colony is spreading all over the substrate, velutinous or pulverous, light-pink or flesh-coloured (Fig. 1). Two types of reproductive cells are present:

a. Chlamydospores, characteristic to the genus *Mycogone* LINK ex CHEV. are generally two-celled (Figures 2 and 3). The upper, more coloured, larger cell is sphaerical or sometimes a little pressed down, verrucose or echinulate, 27-36 μ in diameter. The lower cell of the chlamydospore is light, almost hyaline, smooth, 16-22.5 μ in diameter. Measurements of the chlamydospore bearing short branches: 20-40 × 4.5-5 μ.

b. Conidia. A considerable number of *Diplocladium*-like conidia are present in the colony, too. They are inhomogeneous in size and in shape. The majority of these conidia are ellipsoidal or elongated dropp-shaped, unicellular or divided by one septum. A limited number

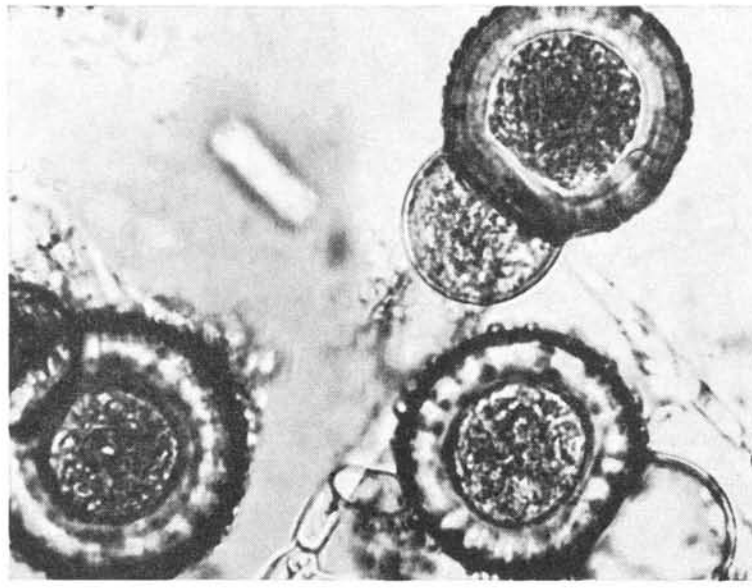

Fig. 3. *Mycogone rosea* LINK. Mature, fully developed chlamydospores. 1.300 ×.

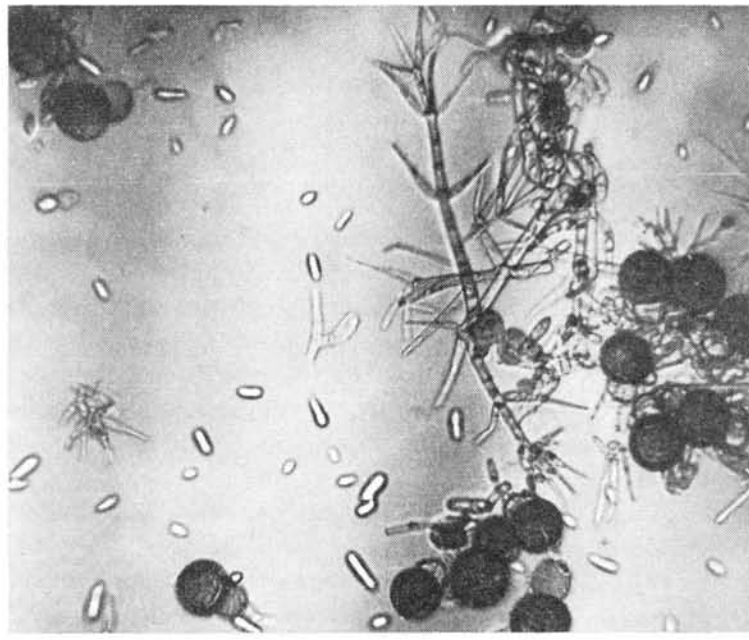

Fig. 4. *Mycogone rosea* LINK. *Diplocladium*-like verticillate conidiophores and chlamydospores, produced simultaneously in artificial culture. — 200 ×.

of three-celled conidia also occurred. The conidia are 6.2-27 × 3.5-8 μ. Conidiophores are hyaline and smooth walled, 50-200 × 3-4.5 μ and the sterigmata are 15-27 × 1.5-2.2 μ. They are usually arranged in multiple verticilles, but isolated sterigmata also occur.

On Czapek's agar, with 2% malt extract. Colonies spreading rapidly, reaching a diameter of 5 cm in 3 days, at first white, later pale yellow and finally pink in colour. The colony is thinn, velutinous or pulverous. The two types of reproductive cells are produced simultaneously (Fig. 4). Conidiophores of both types arise from the agar, no real aerial mycelium occurs.

a. Chlamydospores are more transparent and less coloured than those of the natural substratum. The size of the upper cell is 27-34 μ, while the lower one is usually 18-22.5 μ in diameter. Chlamydospore bearing branches are usually longer than those from the mushroom: 50-80 × 5-6 μ.

b. Conidiophores of the *Diplocladium* type are 170-260 × 3-3.5 μ, with loosely arranged sterigmata. Sterigmata are 18-40 × 1.5-2.2 μ. Conidia are more uniform in shape and in size. They are one- or two-celled, 6.5-16 × 3.3-4.5 μ. No three-celled conidia occurred.

Hab.: *Russula* sp. (indet.), Oct. 12, 1967., Szentgotthárd, Transdanubia, Hungary.

Legit: Dr. G. Ubrizsy.

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TANKER OM EN GRÆNSE-ZONE MELLEM DET LEVENDE OG DET IKKE-LEVENDE

Af JOHAN HENRIK WANSCHER

Vil man nærme sig det spørgsmål, som ligger gemt i titlen, kan man begynde fra oven eller fra neden, d. v. s. fra det, som man fuldt ud anerkender som værende levende, og det, som man fuldt ud erkender som værende ikke-levende. Jeg bruger ikke ordet dødt herom, thi det døde *har været* levende. Lad os først begynde fra neden af. Lad begyndelsen være den atomare verden: ilt, brint, kvælstof, kulstof m. v. er efter vor opfattelse af liv at betegne som ikke-levende stoffer, grundstoffer karakteriseret ved deres atomvægte og antal elektroner. Et skridt opad er sammensatte molekyler. Ozon (O_3), vand (H_2O) og kuldioxyd (CO_2), er simpelt sammensatte luftarter (ved alm. temperatur). Vi skal meget længere op i graden af sammensathed, før vi nærmer os zonen mellem det ikke-levende og det levende.

Med de ca. 20 *aminosyrer,* der indgår i forskellig rækkefølge i proteinerne, er vi nær ved den nedre zonegrænse. Som et eksempel på en aminosyre skal nævnes *arginin,* der har formlen $NH_2C(:NH)$ NH_2-$(CH_2)_3CH$ (NH_2)-COOH og en molekylevægt på 174,21, eller 10 gange så tungt som ilt. I aminosyrernes gruppe finder vi endnu ikke noget, der med rette kan kaldes liv; men „liv" spores i de yderst sammensatte *proteiner,* som opbygges af aminosyrerne. Nogle proteiner, kaldet *enzymer,* er meget specialiserede og meget aktive. Med aminosyrerne står vi ved den nedre grænze for den *zone,* der ligger mellem det ikke-levende og det levende. Lad os nu søge denne zones øvre grænse, idet vi nærmer os den ovenfra.

Lad os blot begynde med mennesket, som er vedtaget at være det højest udviklede væsen — selv for en nøgtern betragtning. Mennesket

er af en sammensat bygning, og betragter vi *individet* (egl. det udelelige) som en kinesisk æske, finder vi mange klasser af æsker inde i hinanden. Æskeserie nummer to er da *organerne,* der har vist sig at have en så stor individualitet, at de kan transplanteres, hvis ikke vævstyperne er antagonistiske. Hjerte, nyrer, lunger, hjerne, skelet og hud er organer: strukturer med særlige funktioner. Men hvert organ er i sig selv sammensat af cellevæv, som også viser en vis selvstændighed, idet vævene kan dyrkes i kolber (ofte sker der dog en ændring af cellerne i primitiv retning ved denne proces; man siger, at der sker en dedifferentiering). Cellerne kan ligge frit svævende i næringsvædsken. De er derfor at betragte som selvstændige, *levende enheder,* der i rene cellevæv måske kan danne noget, der kan sammenlignes med *kolonier,* men slet ikke som i den differentierede organisme. hvor forskellighederne er enorme — *trods samme arvestof* i alle cellerne. I naturen findes talrige organismer, der aldrig kommer ud over encellestadiet. I den flercellede organisme — mennesket siges at bestå af to billioner celler — betragtes og betegnes cellen som „mindste byggesten". Den er ikke blot fra organ til organ af yderst forskellig udformning, men også indadtil stærkt differentieret. Har vi ovenfor sammenlignet organismen med en kinesisk æske med organismen selv som den største, organerne som æsker af anden orden, cellevævene som æsker af tredie orden og de enkelte celler af fjerde orden, må vi også betragte cellerne som et nyt æske-system af stor forskelligartethed. *Liv inden i liv.* Det er ikke ved siden af at beskrive en levende celle som en hel „zoologisk have". Søger vi en etage neden under cellen, møder vi strukturer, som vi tvinges til at anerkende som *væsener,* men som vi på den anden side ikke tør fastholde som levende væsener. Vi er her nået til zonens øvre grænse.

En celle består yderst af en hinde, eventuelt tillige omgivet af en beskyttende cellevæg. Dernæst er cellen opfyldt af cytoplasma, en tyndtflydende slimet væske, som rummer protein i opløst form. Cytoplasmaet er dog ikke strukturløst, og i elektronmikroskopet røber et såkaldt *endoplasmatisk reticulum* sig, et netværk af tynde hinder, på hvilke, i dyreceller, en del af de nedenfor omtalte ribosomer har deres plads.

Cellens organer betegnes som *organeller.* Mest iøjnefaldende og længst kendt er cellekernen, *nucleus.* Den består af en plasmaklump omgivet af en hinde, der tidligere mentes tæt omsluttende, men nu antages at have porer, således at kerneplasma og celleplasma står i livlig forbindelse med hinanden. Cellekernen deler sig med synlig-

gørelse af kromosomer. Efter delingen kommer en fase, hvor man tidligere troede, at cellekernen var i ro. Det er dog helt anderledes, thi med „hvilen" indtræder tværtimod aktiviteten, men en aktivitet, der ikke kan iagttages, end ikke i elektronmikroskopet. I forbindelse med cellekernens aktivitet må også de uden for kernen placerede *ribosomer* nævnes. De ses på det endoplasmatiske reticulum som små runde kugler eller dobbeltkugler. Desuden må *mitochondrierne* nævnes. I planteceller findes *plastider*. Mitochondrierne har deres eget arvestof, og plastiderne formentlig ligeledes. Det er af denne grund, vi kan sige, at cellen er „liv i liv".

Hvis vi klatrer ned ad den systematiske stige, kommer vi fra de højere planter til bregner og ulvefødder og derfra til mosser, alger, svampe og til slut til blågrønalger og bakterier. Med undtagelse af de to sidste grupper besidder alle grupper rigtige cellekerner. Blågrønalgerne og bakterierne er kerneløse, men har deres arvestof „svævende frit" i cytoplasmaet. Bakterierne kan optage næring, vokse og dele sig. Men de kan også *dø*. Dette er et vigtigt kriterium for liv. Vi tvivler ikke om, at bakterieceller er levende, ligesom vi ikke tager fejl, når vi har dræbt dem. *Evnen til at dø er en definition på liv.*

Før vi går videre, nogle ord om arvestoffet, der bærer det kemiske navn *desoxyribonucleinsyre,* forkortet til DNA. DNA-kæden er egentlig en dobbeltkæde bestående af to om hinanden snoede kæder af skiftevis en pentosesukker, benævnt desoxyribose, og fosforsyre. Hos bakterierne er kæden vel en mm lang, hos mennesket omkring en meter tilsammen fra de 23 forskellige *kromosomer*. De to sukkerfosforsyrekæder danner, hvad man kalder en dobbelthelix. Til sukkermolekylerne er tilknyttet fire forskellige baser, nemlig to purinbaser, adenin (A) og guanin (G), og to pyrimidinbaser, thymin (T) og cytocin (C). Disse purin- og pyrimidinbaser danner tilsammen en slags trappetrin i dobbelthelixens lange vindeltrappe. Der er dog den begrænsning, at A kun kan „række T hånden" (ved en brintbinding) og G kun C. Dette betyder, at de to trappevanger altid er komplementære til hinanden. Det ser ud, som om disse trappetrin eller snarere halvtrin, arbejder sammen tre og tre i såkaldte triplets eller *codons* („kodeord"). Det bliver til $4^3 = 64$ forskellige „ord". Den videre procedure er følgende (se fig. 1).

Der tages en komplementær afstøbning af et så langt stykke af en af trappevangerne, at der bliver kodeord nok til at „kode" opbygningen af et givet protein. Et sådant kædestykke kaldes for et *gen* i arvelighedslærens almindelige betydning. Afstøbningen har betegnel-

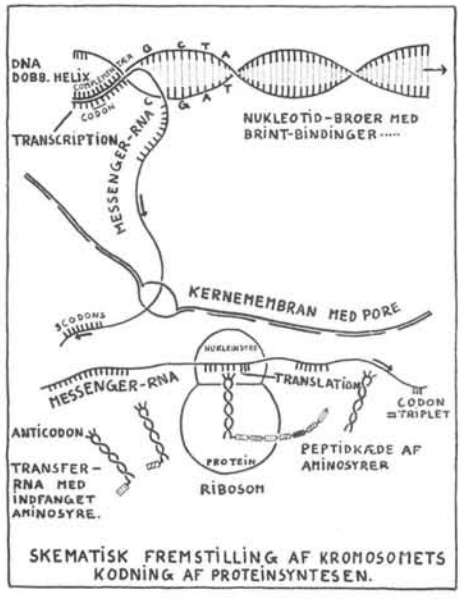

Fig. 1. Skematisk fremstilling af, hvordan et stykke af DNA-molekylet „koder" opbygningen af et protein. Et sådant stykke DNA-molekyle modsvarer det fra arvelighedslæren kendte genbegreb.

DNA-molekylet er bygget som en dobbelthelix af to kæder bestående skiftevis af fosforsyre og pentosesukker. Fra sukkerdelene udgår der korte tværkæder af organiske baser, betegnet med bogstaverne G (guanin), C (cytosin), T (thymin), erstattes i RNA med U (uracil), og A (adenin). Med brintbindingen kan G kun forenes med C, og T kun med A. Herved bliver de to kæder komplementære i forhold til hinanden. Tre baser danner tilsammen et såkaldt kodeord (codon). Til et codon på den ene tråd svarer et anticodon på den anden. Ved transkription (komplementær afstøbning) dannes af den ene kæde et messenger-RNA, der forlader cellekernen gennem en åbning. Af den anden kæde tages små komplementære afstøbninger, kodeord for kodeord. Også disse såkaldte transfer-RNA forlader kernen. (I bakteriofagerne findes slet ingen kerne, men kun en fri DNA-tråd). Messenger-RNA søger imod et såkaldt ribosom, og imedens søger de forskellige transfer-RNA efter de til deres codons svarende aminosyrer, som de efter indfangning transporterer til ribosomet. Her forenes kortvarigt codon med anticodon (translation), idet aminosyren heftes på den kæde, som er under opbygning. Nogle hundrede aminosyrer af 20 slags og i rette orden bliver til et protein af bestemt form og virkning. DNA (og RNA) kan vi måske betragte som „livets tråd".

sen *messenger-RNA*. Den forholdsvis korte tråd glider ud gennem en af cellekernens mange porer og henimod et *ribosom*. Dette er et lille dobbeltlegeme bestående af RNA (ribonukleinsyre) og protein. Det er et organel af særegen struktur, som ikke er meget kendt. Vi skal

samtidig nævne, at der af den anden trappevange også tages komplementære afstøbninger, men kun af en codon ad gangen. Hertil føjes så nogle flere, neutrale led samt et enzym. Disse små afstøbninger kaldes for *transfer-RNA*. Der sker nu dette, at messenger-RNA med alle sine kodeord glider hen over ribosomet, medens transfer-RNA, efter at have „jagtet og fanget" en bestemt blandt de 20 aminosyrer i plasmaet, ved sit antikodeord drages imod kodeordet på messenger-RNA og fæstner sig her. Ved et enzyms hjælp løsnes den indfangne aminosyre og hæftes som bageste vogn i det „tog" af aminosyrer, som til slut bliver til proteinet. Tyve forskellige aminosyrer i rette rækkefølge og måske flere hundrede i „toget" bliver efter foldning til et protein. Nogle proteiner er neutrale og kan bruges som byggesten, andre er højest aktive i opbyggende eller nedbrydende kemiske processer. De fleste proteiner består af flere kæder.

Der er nylig kommet en meddelelse om, at man kan fremstille hormonet (proteinet) insulin syntetisk. Det består af to hver for sig inaktive kæder, polypeptidkæder, der efter adskilt syntese bringes sammen og forbinder sig ved såkaldte svovlbindinger. Herigennem tager det dannede stormolekyle sin *form* og opnår sin *funktionsevne*. Man tør måske vove at sige, at det er denne *funktionsstruktur*, der giver molekylet dets præg af liv.

Hvad nu med selve DNA, der har givet en portion „liv" til mitochondrier, plastider og andre celle-organeller. Er DNA at betragte som levende eller måske livet selv? Jeg mener det ikke, selv om DNA er selvformerbart. DNA er som dirigenten i et symfoniorkester: Dirigenten er lederen, men giver ikke de toner fra sig, som de forskellige musikanter gør det. Når et orkester stemmer, spiller alle instrumenter mellem hinanden, hulter til bulter, men slår dirigenten an, klinger musikken *ordnet*. Vi kan blive lidt i billedet ved at sige, at uden mad og drikke klinger musikken ikke. Dette udlagt sådant, at uden næringsoptagelse, stofskifte og ånding, udvikler cellen ikke livsfunktioner. Bakteriofagerne mangler et sådant stofskifte og er derfor ikke-levende, men deres DNA „dirigerer" den angrebne celles stoffer på en sådan måde, at nye bakteriofager skabes i stort tal. De låner cellens stofskifte som energikilde. Stofskiftet er derfor „tegn" på liv.

Medens man som nævnt om ribosomerne ikke ved noget personligt — om man må sige så — så véd man en del om *plastiderne* hos planterne. Til dem hører grønkornene, hvis opbygning er opklaret ved elektronmikroskopets hjælp. Plastidens krop er opbygget af tynde lameller, der forøger den indre overflade mangefold. I plastiderne

indfanger det grønne farvestof, klorofyl, en del af sollysets energi og bruger den til opbygningen af sukker — og heraf videre af stivelse. Man kender tilfælde af mutationer i plastider, og man må velsagtens tillægge dem en vis selvstændig arvelighed. Plastiderne formerer sig ved at dele sig i to. Er de ikke-levende? Nej! Er de levende? Ikke helt!

Mitochondrierne findes både i dyriske og plantiske celler. Det er små legemer med en ydre, glat og en indre, stærkt foldet hinde, på hvilke der endda findes ganske små kugleformede korn. Tilsammen en overmåde stor indre overflade. Det er i mitochondrierne, at cellens ånding sker. Den vundne energi transporteres til andre dele af cellen ved hjælp af ATP (adenotrifosfat). Mitochondrierne rummer lidt DNA i form af en lille ring. De formenes at have en vis evne til at „kode" protein, da de besidder ægte gener. På spørgsmålet, om de er levende, bliver svaret vel, at de ikke er selvstændigt levende. De „lever" kun i symbiose med cellen, som de betjener med energi. Vært og gæst kan ikke undvære hinanden.

Som *lysosomer* betegnes nogle små sæklignende blærer af protein. De kan ses i elektronmikroskopet. Lysosomets indhold er højst broget og højst farligt. Lysosomerne tjener cellen ved at fordøje eller nedbryde komplekse kemiske forbindelser, og det sker ved deres indhold af enzymer, der er stærkt aktive proteiner. De er så farlige, at slipper de ud af sækken, dræber de cellen. Der er proteinnedbrydende enzymer og sukkernedbrydende enzymer. Et særligt enzym kan, hvis det får lejlighed dertil, klippe DNA-tråden lige midt over. Dette enzymmolekyle er to-polet og klipper dobbelt-helixen over i et eneste nu. Medens helixen normalt kan reparere brud i den ene vange, så kan et dobbeltbrud ikke heles. Man har konstateret, at leucocyter hos stenhuggere, der indånder kiselstøv, optager støvpartiklerne i lysosomerne. Her virker kiselsyren opløsende på lysosom-væggen, enzymerne slippes som „rasende rovdyr" løs, og kort efter dør leucocyten. De døde celler skaber fibromdannelser i mandens lunger med sygdommen silikose som følge. Lysosomerne er ikke selv levende dannelser, men er indholdet levende? Vi nærmer os grænsen. Cellen som helhed er nok levende, men den klarer sig kun qua vært for de strukturer, vi kalder for organeller og måske kan betragte som delvis levende væsener. Det er meget svært at trække nogen grænse. Men vi kan forsøgsvis afstikke en zone for alt det, der på engang bærer præg af at være levende og ikke-levende.

Går vi fra de levende bakterier til smittekim en fuld etage under dem, kommer vi til virus-klassen. Vira kan ikke dræbes. Altså er de

ikke levende i samme forstand som et dyr eller en plante er levende. Men et virus er en *organisme,* ikke blot et stof bestående af et overmåde stort enkeltmolekyle. Nogle vira er så simpelt byggede, at man næsten kan sige at de er helt uden krop. De består da blot af en lille ring af arvestof, DNA, omfattende 6-10 gener. Eksempler herpå finder vi blandt nogle smålegemer, hos bakterier kaldet for *episomer.* Efter japanske undersøgelser kan generne i episomerne mutere, f. eks. i retning af modstandsdygtighed mod et bestemt antibiotikum. De formerer sig hurtigt, og man taler ligefrem om „smitte" bakterierne imellem „med modstandsdygtighed" imod nye medikamenter. Problemet er just oppe i tiden og er af meget stor betydning i den medicinske verden. Smitten kan overføres fra bakterie til bakterie gennem smalle kanaler, benævnt „pili", f. eks. fra en colibakterie til en tyfusbakterie. Disse pili (ental pilus) er blevet betragtet som konjugationsrør dannet af en bakterie, der gennem det søger kontakt med en anden af „andet køn". Da pilus kan forbinde helt artsfremmede bakterier, er der næppe tale om nogen egentlig kønnet akt. Derimod bringes tanken ind på, om ikke det virusagtige episom selv er den fremkaldende årsag til pili-dannelse? Bakteriofag T 4 har sin egen „pilus", men episomet lader bakterien gøre den for sig.

Det på figur 2 afbillede herpesvirus er forsynet med en kapsel, der er ligesom besat med møtrikker. Inde i kapsel-hulrummet ligger en DNA-kæde oprullet. Partiklen kan ikke ånde, ikke tage næring, ikke dræbes. Men den er aktiv. Er den levende? Det kan man næppe sige, thi intet middel uden ild og lign. kan slå den „ihjel". Herpes fremkalder sår omkring munden hos mennesket. Herpes kan „ligge i dvale" i lange tidsrum, men bryder før eller senere ud igen. Nogle af de kapselklædte vira besidder evnen til at forbinde sig med hinanden regelbundet til tredimensionale krystaler (deres egne kapsler kan også være af regelbundet krystalform, se fig. 2). Krystaldannelse er et hos de levende celler og organismer ganske ukendt fænomen. Også visse proteiner har man kunnet bringe til krystallisering. Krystaldannelse plejer at være de simple, absolut ikke-levende stoffers kendemærke. Hvad skal man så tro om vira? Fra krystallens stive struktur kan partiklerne dog frigøres og atter blive virulente. Vi må erindre, at det er virus-kapslerne, der forbinder sig i krystaller.

Mest udviklet blandt vira er gruppen af *bakteriofager,* ordret oversat: bakterieædere. Navnet er dog lidt fejlagtigt, thi en bakteriofag, der er mere end 200 gange mindre end en colibakterie, kan selvsagt ikke opæde denne; men den bringer bakterien til opløsning, *lysis.* Den

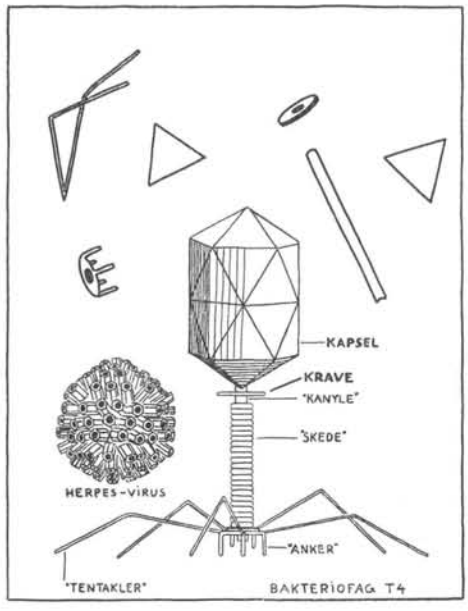

Fig. 2. Forneden til venstre i figuren ses en kapsel af herpes-virus, der hos mennesket giver sår omkring munden. Midler imod dette kendes ikke. Den mangekantede kapsel er som dækket af møtrikker.

Stående i midten ses et bakterie-virus med den officielle betegnelse T 4. Tegningen er udført efter elektronfotografier offentliggjort i *Scientific American* 1967. Tegningen er kun let skematiseret. Bakterie-vira kaldes også for bakteriofager, „bakterieædere", bakterie-opløsere ville have været mere korrekt. T 4 er af meget sammensat skikkelse og minder umiddelbart om tegneseriernes „marsmænd". Den store kapsel foroven er sammenbygget af 30 præfabrikerede lige store, ligesidede proteinplader. Det er et kort, femkantet prisme, endende i to femsidede pyramider. I hulrummet ligger den lange DNA-tråd-ring. Ned fra kapslen går et smalt rør, der til sin tid skal tjene som kanyle. Under kapslen en krave og omkring kanylen en spiral af kontraktibelt protein. Kanylen stikker løst igennem en såkaldt ankerplade, der er forsynet med gribere. På ankeret er tillige heftet 5, måske 6 tentakler; når disse lange følere har fået berøring med en colibakterie, sker der en hurtig sammentrækning af spiraltrådens molekyler, idet ankeret griber fat, og kanylen jages gennem bakteriens hud. DNA-tråden glider ind i bakteriekroppen, og nu sker der to ting: DNA-tråden spaltes (den er en dobbelthelix, d. v. s. snoet dobbelttråd), og nye dobbelttråde dannes, så mange som der skal blive af „børn". Dernæst præfabrikeres alle de løse del til de nye bakteriofager, som sluttelig bliver samlet deraf. Rent symbolsk har jeg tegnet sådanne præfabrikater svævende i plasmaet omkring den færdige bakteriofag. Grundmaterialerne til de løse dele tages fra bakteriens plasma, men fabrikationen styres af moderorganismens DNA-kodebånd. Det hele sker hurtigt, og kun 13 minutter efter smitten er 200 færdige. Et sidste enzym bliver dannet, lysozym, og det bevirker bakteriehudens opløsning indefra. Ud i den omgivende vædske træder nu de nye bakteriofager, parate til at smitte. Af moder-bakteriofagen er nu kun den ydre mekaniske „skal" tilbage. Tømt for den DNA-tråd, hvortil betegnelsen „levende" bedst kunne have været knyttet.

mest udviklede blandt bakteriofagerne er vel den afbildede med betegnelsen T 4. Den er en *„maskine"*, som skaber sine børn ved hjælp af et kodebånd (DNA). Først præfabrikeres løsdelene, siden samles de. Når bakteriofagen er færdig, har den straks sin fulde størrelse. Den vokser altså ikke i almindelig forstand. Dens bygning er forunderlig, mest mindende om en „marsmand", således som tegneserierne forestiller sig ham. Den har øverst en kapsel sammensat af 30 ligesidede trekanter, hver opbygget af proteinmolekyler. I kapslen er der en opsnoet DNA-tråd omfattende omtrent 100 gener (svarende til produktionen af 100 forskellige proteiner). Under kapslen findes en krave. Fra kapslen går der nedefter et rør, der kommer til at fungere som kanyle, når bakteriofagen angriber bakterien. Om røret snor der sig en spiral af kontraktibelt protein. Forneden er der et såkaldt anker samt 5-6 tentakler, lange og med et knæk. Når de berører en bakterie, i dette tilfælde *Bacterium coli,* trækker spiralen sig kraftigt sammen; idet ankeret holder fast, stødes kanylen dybt i bakterien. DNA-tråden baner sig vej ind i bakterien, og produktionen — man kan næsten sige fabrikationen — af enkeltdele til ca. 200 nye bakteriofager tager sin begyndelse. Samtidigt sættes bakteriens DNA ud af funktion. I sjældne tilfælde kan lidt bakterie-DNA komme med ind i en ung bakteriofagkapsel. Det hele sker over meget korte afstande og derfor meget hurtigt. På kun 20 minutter er ca. 200 nye bakteriofager dannet. Det sidste, der sker, er, at et sidste enzym opløser bakteriehuden indefra. Lysis indtræder, og bakterien er borte, „ædt". Bakteriofagfænomenet er kendt allerede fra 1909, da D'HERELLE første gang iagttog huller i bakteriehinderne forårsaget af et dengang ganske usynligt bakterie-smitstof. Nu kan bakteriofagernes struktur ses i elektronmikroskopet.

Det er naturligt, at man stiller sig spørgsmålet: Er bakteriofagerne fuldt levende? Svaret må delvis blive negativt, thi bakteriofagerne viser ingen livsfunktioner, d. v. s. de tager ikke næring til sig, har derfor heller intet stofskifte, de vokser ikke, men fødes (kodes) fuldt færdige. De kan formere sig, men gør det på den ejendommelige måde, at de udtømmer deres DNA i en levende bakterie og lader dette kodebånd „kode" dannelsen af et stort antal „unger" så at sige på samlebånd. Bakteriofagerne er mere at ligne ved maskiner end ved levende celler. Svaret på vort spørgsmål må da blive, at bakteriofagerne og de andre vira er *væsener,* men ikke-levende. Dette ses bl. a. af, at de ikke kan ødelægges uden ved ild (eller tilintetgøres af den angrebnes modstoffer). *En celle kan dø; derfor kalder vi den for*

levende. En bakteriofag, derimod, kan ikke dø og derfor kan den heller ikke besidde liv.

Vil man gøre alt dette op, må man sige, at der ikke findes nogen skarp grænse, på den ene side af hvilken alt kan karakteriseres som levende, på den anden side alt kan beskrives som ikke-levende. Der er derimod en ret bred *zone,* mellem hvis ydergrænser tingene bærer præg af både liv og død på engang. Ikke alle kan betegnes som væsener, således som tilfældet er for bakteriofagerne. Lad disse stå nærmest de egentligt levende celler. Lidt længere nede står da episomerne, der er nøgne vira, som lever i symbiose med en værtbakterie, og mitochondrierne, der varetager vigtige funktioner i cellerne. Men begge kategorier viser deres karakter af *væsen ved at besidde deres eget arvestof i form af DNA.* Plastiderne er i samme klasse og besidder muligvis også eget arvestof (kan mutere). De kan ikke klare sig i den ydre verden, men er fuldt afhængige af værtcellen. De er væsener, måske af lavere grad end vira, hvormed de i øvrigt slet ikke må sammenlignes. Lysosomerne er slet ikke at betragte som væsener, men som neutrale proteinsække med et meget broget indhold af højaktive enzymer af så farlig karakter, at de må være „bag lås og slå". Disse enzymer er kemisk definerbare stormolekyler, men med funktioner af rovdyrkarakter. De „lugter" lidt af liv. Med enzymerne er vi nået til zonens nederste grænse. Herfra og til atomkernens mindste bestanddele er der ikke liv længere.

For at afrunde denne drøftelse af et såre vanskeligt emne, vil jeg tillade mig at fortsætte, som jeg begyndte og tage tråden op på en sådan måde, at jeg igen arbejder mig nedefra og opefter. Jeg starter således på ny så langt nede, at der ingen tvivl er hos nogen, at de *stoffer,* der fremhæves, er ikke-levende. Med stof i almindelig betydning mener jeg et af ensartede molekyler sammensat materiale — ganske uanset om dette materiale er i luftform, i flydende form, eller er krystallinsk. Stof har molekylær struktur, men ikke organisation, endsige arbejdsdeling. Stoffer, hvis molekyler indeholder kulstof, kalder vi gerne for organiske, fordi mange af dem optræder i og dannes af levende organismer. Det kan være stoffer af forbløffende stabilitet trods stor molekylevægt. I nyeste tid har man i afrikanske sedimentlag af 3,1 mias ælde kunne påvise en hel række organiske stoffer. Stenarten knuses, og der laves et udtræk med træsprit, hvorefter man ved tyndtlags-kromatografi og belysning gør de forskellige stoffer kendelige. Disse fossile organiske stoffer har i sin tid været skabt i levende organismer, formentlig blågrønalger, som dog i stenarten ikke

kan spores længere. De nævnte stoffer er skabt af noget levende, men er ikke selv levende og har aldrig været det.

Aminosyrerne, som tidligere er omtalt, er heller ikke i sig selv levende, men de indgår i *tur og orden* i proteiner, som er polypeptidkæder, der har fået *form* ved løsere eller fastere oprulning og fasthold af *formen* gennem brint- og svovlbindinger. Proteinerne er gennem deres indre opbygning blevet *til mere end blot og bart summen af de aminosyrer, som indgik i dem**). Det kan dreje sig om et antal fra 100 til 500 aminosyrer. Proteinerne er af mange slags, men den gruppe, som kaldes for enzymer, er meget specifikt aktive, og denne aktivitet skyldes netop formen og strukturen. De er en lille smule *mere* end blot og bart stof.

Kommer vi til virus-gruppen, finder vi, at mange af dem bygger sig sindrige boliger, ja, former sig som sindrige maskiner. Alt dette sker gennem kodning, således at en fremmedorganisme, en bakterie eller anden celle leverer byggestofferne; T_4 er organiseret, således at forstå, at dens forskellige af protein opbyggede dele har forskellig funktion. Bakteriofagen T_4 er et væsen eller en organisme, men den er ikke-levende. Den optager ikke næring, og formering sker uden for den selv.

Først i cellen med dens enorme formbarhed og forskellighed i funktion og form finder vi liv med stofoptagelse, fordøjelse, energiproduktion og -forbrug og genopbygning. Som cellen ovenfor er skildret med den regerende kerne med dens DNA-kodebånd, *de vekslende tidspunkter for de enkelte geners virke,* proteinkodningen på ribosomerne, fordøjelsen i lysosomerne, energiproduktionen og åndingen i chondriosomerne o. s. v. er den blevet et særpræget *samfund* af elementer, der ikke hver især kan betegnes som levende, men som i samarbejdet skaber dette underlige *liv,* der brat kan ophøre ved døden.

Af alt dette skulle fremgå, at der ikke kan ansættes nogen skarp *grænse* mellem det, vi kalder for fuldt levende, og det, vi betegner for fuldt ikke-levende. Men mellem disse to tilstande er der en *zone,* hvor alt det mellemliggende finder sin plads.

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*) Denne sætning, hvis tanke jeg udtrykte i „Vor Viden", Oktober 1949, peger, hvad jeg dengang var uvidende om, på noget centralt i den russiske filosofi, der bærer navnet: Dialektisk materialisme. Det var tryllordet i enhver kommunistisk diskussion, uforståelig for den uindviede. Det morede mig meget, at jeg uforvarende havde „genopfundet" denne filosofi.

RESUMÉ

Hvis vi nu skal sammenfatte det her fremsatte i ord, har vi på den ene side celler og bakterier som de helt levende mindste-organismer kendetegnet ved stofoptagelse, vækst og stofskifte (ånding) — på den anden side som repræsentanter for en ikke-levende natur de simple indtil meget komplicerede kemiske forbindelser uden selvformeringsevne og uden stofomsætning. Mellem disse to grænser forestiller jeg mig da en bred zone af strukturer, der hverken kan dømmes helt levende eller helt ikke-levende. Som de „mest levende" har vi vira og bakteriofager, og som de mindst levende den store gruppe af proteiner (enzymer o. s. f.). Fordelt i zonen finder vi en del selvformerbare organeller som mitochondrier, episomer samt — og frem for alle — DNA, i en cellekerne eller fritliggende.

København, august 1968.

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SVALBARDS STORSVAMPAR I LITTERATUR OCH NATUR

AV STIG WOLDMAR

SUMMARY

The macromycetes of Svalbard in literature and nature.

Information is given about finds of larger fungi of Svalbard, described in the literature. Also researches in Greenland and in northernmost Scandinavia are mentioned. The author presents some excerpts from entries during visits in Spitsbergen 1967 and 1968.

Floran på den arkipelag i norr, som brukar benämnas Svalbard, d. v. s. Spetsbergen jämte Björnön, Vitön, Kong Karls land och Hopen, är relativt väl känd — på ett undantag när, storsvamparna. Fanerogamer, mossor och lavar är väl representerade i allmänna och enskilda herbarier, medan storsvamparna, makromyceterna, ofta föreligger i dåligt material eller saknas. Anledningen härtill är lätt att förstå. Forskningen har haft traditionell inriktning på kärlväxter, mossor och lavar, och efterhand som kännedomen om dessa växters systematik, ekologi, morfologi o. s. v. ökats, har nya problem kommit i blickpunkten. Herbariematerial har härvid kunnat användas och bearbetas, vilket även varit fallet med de på de nämnda växterna förekommande mikromyceterna.

Annorlunda har förhållandet varit med storsvamparna. Teckningar och beskrivningar av färskt material har varit nödvändiga, men ställt stora krav på insamlaren, som dock i senare tid haft stor hjälp av den moderna fototekniken. Våtkonservering i sprit eller formalin har visat sig svårbemästrad. Först genom det numera använda torkningsförfarandet, lanserat av bl. a. LUNDELL & NANNFELDT i „Fungi

exsiccati suecici", har man lyckats att åt eftervärlden herbariemässigt bevara insamlat storsvampmaterial.

Om man bortser från några enstaka fynd av den norske geologen J. M. KEILHAU och den danske botanisten J. L. VAHL, publicerade i bl. a. „Botaniska Notiser" 1840, bör den finländske mykologen P. A. KARSTEN få äran av att ha lämnat det första bidraget till kännedomen om Svalbards storsvampflora. I Sv. Vetenskapsakademiens „Öfversigt" för år 1872 föreligger nämligen en avhandling av honom med titeln „Fungi in insulis Spetsbergen et Beeren Eiland collcti". Den artlista KARSTEN här framlägger upptar för Spetsbergens del 12 agariceer, 2 gasteromyceter och 2 discomyceter, de flesta insamlade av THORE M. FRIES under en resa till Spetsbergen 1868 och artbestämda av dennes berömde fader, ELIAS FRIES.

Från vårt århundrade föreligger några intressanta arbeten om Spetsbergens makromycetflora. Sålunda innehåller den 1945 nedlagda engelska tidskriften „The Journal of Botany" i sitt sista band (vol. 80) en avhandling av C. G. DOBBS: „Note on the larger Fungi of Spitsbergen" 1942. DOBBS' material — ett 20-tal arter — i huvudsak insamlat vid Billefjordens inre delar och i Longyeardalen, ger författaren anledning till några allmänna reflexioner angående Spetsbergens storsvampar, särskilt deras förekomst och spridningssätt. Att svampfloran är särskilt rik i Svalbards våtmarker anser DOBBS bero på den tämligen höga humushalten i dessa marker. I art- och individrikedomen i bebodda trakter ser han ett kriterium på människans roll som spridningsfrämjande faktor. Det är emellertid troligt, at DOBBS överbetonar denna roll. På det människofattiga Svalbard är och förblir det med största sannolikhet ishavsvindarna, som mest bidrar till svamparnas spridning.

I „Notes on Arctic Fungi" (1950) presenterar ASBJÖRN HAGEN ett 20-tal högre svampar insamlade av P. F. SCHOLANDER (under prof. HANS AHLMANN's Spetsbergsexpedition 1931), A. P. G. MICHELMORE (The Cambridge Exp. to Edge Island 1927), HANNA RESVOLL-HOLMSEN (material från 1907), JOHN EGELAND m. fl. Av stort intresse är uppgiften om TH. IVERSEN's och E. KOEFOED's fynd av *Psalliota arvensis* på Hotellnäset (se nedan).

Under 1958 hemförde en polsk expedition en samling storsvampar från Spetsbergen. Samlingen, som var i dåligt skick, bearbetades av dr. ALINA SCIRGIELLO vid Warschavauniversitetets institution för systematisk botanik. 10 arter blev härvid bestämda, varav 8 visade sig vara nya för Spetsbergen.

Slutligen kan nämnas ESTERI KANKAINEN's, PAULA KARLSTRÖM's och HELI HEIKKILÄ's anteckningar från en resa till Spetsbergen sommaren 1966 (Luonnon Tutkija 71, sv. övers.). Här behandlas storsvamparna vid Grönfjorden, i Longyeardalen och i Ny-Ålesundsområdet. De förekommande *Galerina*- och *Omphalina*-arternas parasitära förhållande till mossor (*Drepanocladus*- och *Calliergon*-arter) och vissa *Omphalina*-arters roll som Basidiolichenes-komponenter diskuteras i anslutning till de senaste årenes forskningar. *Marasmius epidryas* antecknas f. f. g. från Spetsbergen.

En kort resumé över litteraturen om Spetsbergens makromycetflora vore helt ofullständig, om ej de viktigaste av de arbeten omnämnes, som berör den subarktiska storsvampfloran. Det är emellertid diskutabelt, om gränsdragning mellan arktisk och subarktiskt i förevarande sammanhang kan vara berättigad, då praktiskt taget alla de på Spetsbergen förekommande arterna återfinnes i nordligaste Skandinavien. Det torde snarare förhålla sig så att en mot norr tilltagande uttunning av artsortimentet föreligger, stundom även en modifiering av arterna, beroende bl. a. av det hårdare klimatet. Förhållandena är något annorlunda på Grönland. Här räknar MORTEN LANGE ("Macromycetes" III, p. 104) med ett 20-tal storsvamparter, "restricted to arctic-alpine areas, or rarely occurring outside these areas". De följande listorna upptar emellertid 65 arter, som även förekommer i sydligare trakter.

År 1911 utkom LARS ROMELL's "Hymenomycetes of Lappland". Ett 50-tal arter, huvudsakligen polyporaceer, blir här utförligt beskrivna. TH. C. E. FRIES beskriver under åren 1914-1921 10 gasteromyceter från den svenska lappmarken. Härifrån föreligger även ett stort antal fynd redovisade i LUNDELL & NANNFELDT's ovan nämnda exsickatverk.

PILÁT & NANNFELDT's "Notulae ad cognitionem Hymenomycetum Lapponiae Tornensis (Sueciae)" (1954) upptar förutom en utförlig bibliografi ett 20-tal arter från det behandlade området. Av de nybeskrivna märkes *Omphalia luteovitellina* PILÁT & NANNFELDT, som senare anträffats på Spetsbergen.

I samma område har MORTEN LANGE tidigare (1945) exkurrerat. Han redovisar härför i „Mykologiske Indtryk fra Lapland" („Friesia" III: 3). I utförliga artlistor markerar han storsvamparnas frekvens inom de olika högfjällszonerna. Från samtliga möter vi på Spetsbergen växande arter.

Ett viktigt bidrag till kännedomen om den subarktiska svamp-

floran utgör JOHN ERIKSSON's utförliga avhandling om de „vedboende" svamparna i Muddus nationalpark (1958). Av det här behandlade svampmaterialet kan man av förklarliga skäl ej vänta sig att finna många arter på det trädlösa Svalbard. På gammalt virke i Longyearbyen har jag emellertid funnit *Stereum sanguinolentum* (A. & S. ex FR.) FR., *Sistotrema coroniferum* (v. HÖHN. & LITSCH.) DONK, och *Litschaurella abietis* (BOURD. & GALZ.) OBERW. (det. JOHN ERIKSSON). Benämningen „storsvampar" är visserligen ej tillämplig för dessa arter, men de nämnas här, då de ej tidigare antecknats från Spetsbergen.

Det bör också nämnas, att ett intensivt mykologiskt forskningsarbete bedrives vid Kevo subarktiska station i nordligaste Finland. Sålunda har man där ägnat särskild uppmärksamhet åt „dubbelorganismerna" *Botrydina vulgaris* och *Coriscium viride,* som visat sig vara uppbyggda av *Coccomyxa*-alger och svamparter hörande till släktet *Omphalina* (HEIKKILÄ & KALLIO, 1966). En utförlig förteckning över Nordkalottens svampar finnes i KALLIO & KANKAINEN: "Additions to the mycoflora of northernmost Finnish Lapland" (1967).

Av vad som nämnts torde framgå, att uppgifter om Svalbards storsvampflora finnes att tillgå om än sparsamma och i några fall dolda i relativt svårtillgängliga arbeten. Sedda i samband med den makromycetforskning, som under de senaste årtiondena bedrivits på Grönland och i nordligaste Skandinavien, kan dock grunddragen skönjas av den högre svampfloran på Svalbard.

Slutligen något om ännu icke bearbetat material. Som man kan vänta har norrmännen gjort betydande insamlingsarbete. Lektor JENS STORDAL och intendenten vid Tromsö museum OLA SKIFTE har företagit insamlingar på skildra platser på Svalbard. Materialet är mig veterligt ännu ej publicerat.

Under några sommarveckor 1967 och 1968 insamlade undertecknad i Adventdalen, Longyearbyen och i den omgivande trakten en kollektion storsvampar, representerande ett 50-tal arter. Materialet har översänts till Institutionen för systematisk botanik i Uppsala, där det kommer att bearbetas. I avvaktan härpå kan några utdrag ur dagböckerna från exkursionerna anföras.

Laccaria laccata har jag antecknat från flere lokaler, även en rödaktig form (var. *rosella?*). På en fjällsluttning vid vägen till Hotellnäset fann jag ett flertal ex. av *L. amethystina,* som såvitt jag vet ej tidigare antecknats från Svalbard.

En överraskande stor koloni — ett 20-tal exemplar — av vackra champinjoner, förmodligen *Psalliota campestris* eller närstående art, fann jag den 24/7 1967 i Longyearbyen ej långt från kyrkan. Champinjonfynd på Spetsbergens karga tundramark är onekligen överraskande, och det ligger nära till hands att anta, att arten blivit „kulturspridd" i senare tid. Så bör måhända förekomsten tolkas, men det är anmärkningsvärt, att KARSTEN har antecknat *Psalliota campestris* från samma trakt och i vackra exemplar: „Pulchra, bene evoluta specimina circa Adventbay initio Augusti sunt lecta". Det var förmodligen THORE FRIES, som gjort insamlingen. Vid min återkomst till Longyearbyen 1968 sökte jag upp champinjonlokalen, men den var tyvärr förstörd av vägmaskiner, buldozers.

Jag skulle emellertid ännu en gång träffa på champinjonlokaler på Spetsbergen, nämligen på Hotellnäset.*) Jag fann nämligen där i slutet av juli 1968 tre kraftiga *Psalliota*-exemplar, något deformerade av den ogynnsamma grogrunden. De växte nämligen på en hård vägbana och formligen trängde sig upp ur den asfalthårda kolstybben. Arten stämmer habituellt väl med FRIES' teckning av *Psalliota arvensis* i „Sveriges ätliga och giftiga svampar", tavla IV.

Även från Hotellnäset föreligger ett tidigare champinjonfynd, omnämnt i HAGEN a. a. sid. 23: „—TH. IVERSEN och K. KOFOED collected fine specimens of *Psalliota arvensis* (SCHAEFF.) FR. in Adventfjorden: Hotellneset, Aug. 16, 1925 (pileus 8-10 cm broad, stem c. 6 cm high, c. 1,5 cm thick). Motsvarande av mig antecknade mått är: „Hatt 7-10 cm — Fot 5-6 cm". Fotens tjocklek är på de torkade exemplaren c:a 1 cm.

Ännu en champinjonart antecknade jag från Hotellnäset, en art som nära överensstämmer med *Psalliota comptula* sådan denna beskrives av MØLLER i „Friesia" IV: 3 och är tecknad av LANGE i „Fl. Ag. Dan.", tavla 136 A.

Sommaren 1968 var mycket torr i trakterna kring Isfjordens inre delar. Detta satte sin prägel på svampfloran. Så t. ex. var *Russula*-arterna, som man kunde iakttaga här och var på fjällängarna sommaren 1967, sällsynta det följande året och därtill exceptionellt små. De fåtal exemplar jag insamlade synes representera tre arter.

Spindelskivlingarnas art- och individrikedom förvånade mig, då jag och säkerligen många med mig förbinder dessa svampar med

*) Hotellnäset har namn efter ett hotell, som byggdes 1896 på strandpartiet v. om Adventfjordens yttersta del. Rörelsen upphörde efter två år och har sedan ej återupptagits.

genuin skogsmark, där åtskilliga arter bildar mykorrhiza. Om *Salix*-arternas rotsystem bildar substitut för skogsträdens rötter är diskutabelt, men faktum är att *Cortinarius*-arterna mycket ofta förekommer tillsammans med *Salix polaris* och/eller *S. reticulata*.

Av övriga släkten, varav materialet ännu ej artbestämts, har jag antecknat bl. a. *Galerina, Hebeloma, Psilocybe, Naucoria, Mycena, Lactarius* och *Inocybe*. Det skulle glädja mig, om detta material i sin helhet kunde utgöra ett bidrag — om än så litet — till kännedomen om Svalbards makromycetflora.

Till Styrelsen för VILHELM och MARTINA LUNDGREN's Vetenskapsfond, som gjort det ekonomiskt möjligt för mig att företa min andra resa till Spetsbergen, framföres härmed ett vördsamt tack.

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