Taxonomic Investigations on the Ascomycetous Genus Cucurbitaria S. F. Gray[1])

By F. Mirza

With plates 69 (1)—82 (14)

A. INTRODUCTION

The fungus genus *Cucurbitaria* S. F. Gray includes ascostromatic ascomycetes belonging to the order Pseudosphaeriales; it comprises a considerable number of described species, but many of them seem to be indefinite in characters.

Cucurbitaria is one of the oldest Pyrenomycetes genera separated from *Sphaeria* Haller in the sense of Tode (1790) and Persoon (1801); Fries (1823) considered it under Pyrenomycetes along with the genus *Sphaeria*. *Cucurbitaria* was described by S. F. Gray in 1821 along with four species, three of which were subsequently removed to other genera. The remaining *Cucurbitaria berberidis* has to be considered the type of the genus. The original generic diagnosis given by Gray (1821) is as follows: "Thallus spreading irregular, thecae in tufts, placed on the thallus."

Due to the brief nature of the diagnosis given by Gray (1821) the scope of the genus was unlimited. Greville (1824–26), Tulasne (1863), Saccardo (1883), Winter (1887), Ellis & Everhart (1892) and Berlese (1900) have described the genus in more detail but still remained indefinite in their expressions.

In the arrangement of Winter (1887) the genus *Cucurbitaria* has been placed under the family Cucurbitariaceae with other forms having aggregate fruit bodies. In the sense of Winter (1887) and Lindau (1897) the family was heterogenous in characters and therefore Theissen and Sydow

[1]) From the Department of Special Botany of the Swiss Federal Institute of Technology, Zürich.

(1918) proposed the position of the genus under Pseudosphaeriales [Pleosporaceae sensu LUTTRELL (1951)].

The last monographic study on the genus was done by WELCH (1926) but his narrow concept of the genus and wide scope of the species do not satisfy the requirements of our present knowledge acquired through the recent advances made in ascomycetes taxonomy. He accepted only five species, namely *C. berberidis, C. caraganae, C. laburni, C. elongata* and *C. arizonica.* He discussed the rest of the species under two headings, (I) Doubtful species and (II) Excluded species. Under the first heading he mentioned 21 species but doubted the validity of most of them because the material examined by him was not in a good condition. The second heading he discussed under three sub-headings. Under (A) he considered 7 species which according to him were lacking the turbinate character of fruit bodies and hypostroma; to him this group appeared most closely related to the family Amphisphaeriaceae. Under subheading (B) he discussed 14 species, and as he found them lacking a typical stroma, he considered them more closely related to the family Sphaeriaceae than to the family Cucurbitariaceae. Under subheading (C) he mentioned species of various affinities and recognised synonyms; to him the thickened elongated basal extremity, the turbinate form and presence of hypostroma were the characters of prime importance. Imperfect stages were not considered with due importance.

The present status of the genus as recognised by NANNFELDT (1932), MUNK (1953) and GÄUMANN (1964) is under Pseudosphaeriaceae (Pleosporaceae). The family represents a group of fungi which appear to have been derived from simpler forms with solitary fruit bodies (e. g. *Pleospora* RBH.).

As a result of the publication by WELCH (1926) many of the well described species became doubtful. As the monographer did not allot other systematic positions to these species the genus name *Cucurbitaria* has been continuously used for them.

A revision of the genus seemed to be urgent. It should clear all such points of confusion and arrange the doubtful species in a natural order taking into account the aspects of modern ascomycetes taxonomy.

B. EXPERIMENTAL PART

1. Material

Authentic material from various herbaria of the world present in the ETH Herbarium along with those requested from Riksmuseet, Botanical Divi-

sion, Stockholm and the material collected during excursions have constituted the basis of the present study. Besides the cultures which have been available from ETH Culture collection, more cultures were isolated from freshly collected material. The isolations were made by the ascosphore shooting method; in some cases cultures were obtained by isolating asci.

Herbarium material has been examined by hand cutting and freezing microtome sections. Preparations for observing asci and ascospores were made by squash mount technique; Lactophenol cotton blue was used for staining purposes.

The material collected, cultures isolated and slides prepared have been deposited in the institute; only the materials considered important with regard to the host and geographical distribution have been mentioned.

2. Physiological Studies

Cultural Studies

The species of the genus *Cucurbitaria* GRAY do not easily produce perfect fruit bodies and conidial stages in culture. Although several authors e. g. BAUKE (1876), v. TAVEL (1886), BREFELD and v. TAVEL (1891), GREEN (1931), MÜLLER (1963) and MÜLLER and BAUMEISTER (1957) have done cultural work with these fungi, the available information on the behaviour of these fungi is still poor.

Amongst the above mentioned authors only v. TAVEL (1886), and MÜLLER and BAUMEISTER (1957) have succeeded in getting perfect fruit bodies in culture.

During the course of the present investigation an attempt was made to obtain perfect and imperfect fruit bodies. The following culture media were tried, the alphabets used to indicate different culture media (the same as used in table 1). Some more organic and inorganic media were tried but are not mentioned as the results were totally negative.

A — 2% malt extract agar.
B — Fagus wood scrapings + 2% malt extract water.
C — Fagus wood scrapings + 0.25% malt extract water.
D — Wheat straw + 0.25% malt extract water.
E — Wheat grains + water.
F — Coconut powder + water + agar.
G — Broaken maize grains + water + agar.
H — Coffee waste + 0.5% malt extract water + agar.

The results are summarised in table 1. Culture media A and D were found most successful and simple for both perfect and imperfect fruit body production. It was observed that light has a very pronounced effect on the production of fruit bodies. Although some species produced pycnidia in dark as well as in light, the time for pycnidial production was reduced to half if the cultures were exposed to constant light. In cases where the cultures were incubated in total dark, generally the colonies remained sterile, floccose and the pigmentation was lighter.

Table 1

Fruit body formation on different culture media under three different conditions; results taken after eight weeks

Inoculum	Culture Nr.	Media used A r	A l	A d	B r	B l	B d	C r	C l	C d	D r	D l	D d	E r	E l	E d	F r	F l	F d	G r	G l	G d	H r	H l	H d
C. berberidis	7024	m	m	m	m	m	m	m	m	m	m	m	m	–	–	–	–	–	–	m	m	m	m	m	m
C. elongata	7023	–	–	–	M	M	M	M	M	M	M	M	M	–	–	M	–	M	–	M	M	–	M	M	M
C. spartii	7019	–	–	m	–	P/m	m	–	–	–	m	P/m	m	m	m	–	–	–	–	m	m	m	m	m	–
C. laburni	7011	–	M	–	–	–	–	–	–	–	–	M	–	M	M	–	–	M	–	–	M	–	–	–	–
C. ahmadi	4981	M	M	–	M	M	–	M	M	–	M	M	–	–	–	–	–	–	–	–	–	–	–	–	–

Culture media A to H correspond to media mentioned on page 163.
— = no fruit bodies formed.
m = pycnidia containing microconidia developed.
M = pycnidia containing macroconidia developed.
p = perfect fruit bodies formed.
r = under room conditions temp. 21—24° C.
l = under constant light temp. 21° C.
d = under constant darkness temp. 21° C.

Temperature Requirements

The rate of growth of five different species at temperatures ranging from — 2 to + 33° C. have been compared. A 4 mm disc was used as inoculum on 2% malt extract agar plates; after 12 days an average of 5 plates incubated at each temperature was taken as result. The species of the genus *Cucurbitaria* were found to grow within a temperature range of 0 to 30° C, except *C. berberidis* which could only grow between 12 to

27° C. The optimum temperature for mycelial growth ranged between 21 to 24° C for all of the species tested. The results are summarised in table 2.

Table 2

Growth of mycelium at different temperatures, results taken after 12 days of incubation

Inoculum	Culture	Temperature in ° C Average diameter of the colony in mm												
	Nr.	−2	0	3	6	9	12	15	18	21	24	27	30	33
C. berberidis	7024	—	—	—	—	—	28	35	46	65	50	24	—	—
C. elongata	7023	—	10	15	15	15	52	65	72	77	81	80	70	—
C. spartii	7019	—	—	13	17	21	40	55	62	68	60	37	13	—
C. laburni	7011	—	9	19	24	24	50	60	72	85	84	65	42	—
C. ahmadi	4891	—	—	11	19	24	29	33	49	62	73	47	10	—

Nutritional Requirements

In the past no work has been done on the nutritional requirement of the genus *Cucurbitaria*. Presently the requirements for Carbon, Nitrogen, Vitamins and pH have been investigated.

Methods for Nutritional Studies

The cultures were maintained on 2% malt extract agar; for trial purposes the fungus was grown on 0.5% malt extract agar, incubated in dark and discs of 4 mm containing mycelium only (as far as possible) were used as inoculum. The liquid medium for Carbon, Nitrogen and Vitamin trials was used as recommended by LILLY and BARNETT (1951), the Glucose Casein-Hydrolysate medium was boiled with 0.5% of Active Charcoal to remove all traces of Vitamin in case of Vitamin trials. For pH trials 1% malt extract water was used along with Citrate Phosphate Borate buffer solutions (TEORELL and STENHAGEN, 1938). The constituents of the buffer solution were individually tested in the same dilutions and were found to have almost no toxic effect on growth.

The trials were made in 500 ml flasks containing 80 ml of liquid medium; the flasks were incubated on a shaking machine at 24° C. The dry weight of the mycelium was determined after 10 days in case of pH trials and after 15 days in all other trials. An average of 5 such flasks was taken as result.

Requirement of Carbon Source

The five species of *Cucurbitaria* could grow on all the ten Carbon sources tested, the optimum for each species being different. The results are summarized in table 3.

Requirement of Nitrogen Source

Species of *Cucurbitaria* tested were not able to utilize Nitrogen in all the forms of Nitrite; they could only use Nitrate Nitrogen but they grew best on organic Nitrogen sources as Asparagine and Casein Hydrolysate. *C. spartii* and *C. ahmadi* could use organic as well as inorganic Nitrogen sources almost equally well. The results are summarised in table 4.

Requirement of Vitamins

Five species of *Cucurbitaria* were tested for Vitamin deficiency. *C. ahmadi* was self sufficient and four others were found to be Vitamin deficient. Besides Thiamine, Biotin, Pyridoxine and Inositol, alone and in combinations, p-Aminobenzoic acid, Nicotine amide, Pantothenic acid and Riboflavin were also tried in concentrations of 8, 13, 5 and 250 μmg/l, but they showed no effect on growth.

Table 3

Milligrams of mycelium produced by five different species of *Cucurbitaria* on eleven different sugars. The sugars were used in a quantity so as to supply 4 g/l of Carbon.

Carbon source	Inoculum and culture Nr. Dry weight of mycelium in mg.				
	C. berberidis C. Nr. 7024	*C. elongata* C. Nr. 7023	*C. spartii* C. Nr. 7019	*C. laburni* C. Nr. 7011	*C. ahmadi* C. Nr. 4981
L(—)-Sorbose	148	146	69	105	207
D(—)-Xylose	507	324	472	273	415
L(+)-Arabinose	270	79	384	270	430
D(+)-Maltose	497	425	375	408	305
D(+)-Galactose	442	515	320	501	354
D(—)-Fructose	526	462	339	474	364
Lactose	106	98	210	96	308
D(+)-Mannose	510	442	284	531	374
Saccharose	414	444	318	523	374
Glucose	490	436	307	297	332
D(+)-Cellobiose	370	182	270	370	517
Control	17	00	00	00	55

The four species were found to be multiply deficient in Thiamine and Biotin (table 5). When used alone Thiamine had a minor effect, but Biotin had almost no effect on growth in the case of *C. berberidis* and *C. elongata* and showed no effect at all in the case of *C. spartii* and *C. laburni*. The effect of Thiamine and Biotin was very pronounced when they were used in combination. Pyridoxine, when used in combination with Thiamine and Biotin showed a depressing effect on growth in the case of *C. berberidis* and *C. spartii*. The combination had almost no effect on *C. laburni* but slightly increased the growth in the case of *C. elongata*. Inositol, when used in combination with Thiamine, Biotin and Pyridoxine, showed a depressing effect on three species, whereas growth in the case of *C. berberidis* was slightly increased.

Table 4

Milligrams of mycelium produced by five different species of *Cucurbitaria* on ten different sources of Nitrogen. The Nitrogen source was used in a quantity so as to supply the amount of nitrogen present in 2 g of Asparagine

Nitrogen source		*C. berberidis* C. Nr. 7024		*C. elongata* C. Nr. 7023		*C. spartii* C. Nr. 7019		*C. laburni* C. Nr. 7011		*C. ahmadi* C. Nr. 4981	
	O pH	mg	F. pH	mg	F. pH	mg	F. pH	mg	F. pH	mg	F. pH
Sodium Nitrite	5.6	00	6.1	00	6.0	00	6.1	00	6.1	00	6.1
Sodium Nitrate	4.4	51	6.1	91	6.5	290	7.3	87	6.5	344	7.5
Potassium Nitrite	5.6	00	6.1	00	6.1	00	6.1	00	6.1	00	6.1
Potassium Nitrate	4.5	117	6.6	91	6.5	271	8.0	89	6.5	238	7.4
Ammonium Sulphate	4.3	40	2.9	35	3.0	31	3.0	31	3.2	00	3.3
Ammonium Nitrate	4.3	34	2.9	41	3.2	55	3.0	31	3.0	00	3.2
L-Asparagine	4.5	512	7.6	412	7.0	302	7.8	433	6.7	445	7.2
Glycine	4.8	368	7.1	68	5.1	00	5.2	31	5.1	155	4.7
Urea	7.0	368	8.0	00	7.2	299	7.5	124	6.5	134	6.2
Caseine Hydrolysate	5.6	490	6.3	430	6.3	314	6.7	370	5.8	393	7.5
Control	4.5	00	4.6	00	4.8	00	5.0	00	5.1	00	4.5

O pH = pH of the medium at the time of inoculation.
F pH = pH of the medium at the time of harvest.

Table 5

Milligrams of mycelium produced by four different species of *Cucurbitaria* on Thiamine, Biotin, Pyridoxine and Inositol in concentrations of 100 µ gm., 5 µ gm., 100 µ gm. and 5 mg per lit. respectively. The vitamins and their combinations used are denoted in the table by their initial letters T, B, P and I respectively, control without Vitamin is denoted by C.

Inoculum and culture Nr.	Vitamins and their combinations Dry weight of mycelium in mg.									
	T	B	P	I	TB	PI	TBP	BPI	TBPI	C
C. berberidis C. Nr. 7024	60	18	52	27	312	29	268	43	322	11
C. elongata C. Nr. 7023	39	20	36	19	425	25	479	41	418	17
C. spartii C. Nr. 7019	42	00	27	00	266	18	217	30	214	21
C. laburni C. Nr. 7011	98	00	00	14	383	38	385	34	365	00

Table 6

Milligrams of mycelium produced by five different species of *Cucurbitaria* on sixteen different pH adjusted in 1% malt water

S. Nr.	Orgnl. pH	Inoculum and culture Nr. Dry weight of mycelium in mg									
		C. berberidis C.Nr. 7024		*C. elongata* C.Nr. 7023		*C. spartii* C.Nr. 7019		*C. laburni* C.Nr. 7011		*C. ahmadi* C.Nr. 4981	
		Fnl. pH	mg	Fnl. pH	mg	Fnl. pH	mg	Fnl. pH	mg	Fnl. pH	mg
1	2.6	2.6	00	2.6	00	2.6	00	2.6	00	2.6	00
2	3.2	3.2	00	3.3	46	3.2	00	3.2	00	3.2	00
3	3.7	3.7	101	4.0	164	3.7	96	3.8	116	5.8	181
4	4.1	4.1	151	5.3	187	6.1	182	5.2	112	6.2	251
5	4.5	4.5	161	5.4	198	6.4	194	5.5	136	6.4	257
6	4.9	4.9	138	5.4	178	6.5	202	6.1	140	6.4	232
7	5.3	5.3	137	5.5	176	6.7	240	6.1	150	6.4	200
8	5.7	5.9	140	5.8	167	6.7	191	6.4	146	6.4	193
9	6.3	6.3	137	6.2	158	6.7	176	6.5	146	6.6	171
10	6.7	6.5	122	6.5	131	6.8	160	6.7	141	6.8	173
11	7.4	7.0	88	7.0	108	6.9	147	7.2	124	7.2	160
12	7.8	7.7	74	7.3	94	7.2	132	7.4	116	7.3	165
13	8.4	8.0	61	7.7	82	7.5	80	7.9	114	7.5	140
14	8.8	8.2	25	7.7	79	7.8	60	8.0	93	7.6	90
15	9.2	8.4	27	8.0	39	8.0	50	8.3	80	7.8	63
16	9.6	8.6	30	8.1	80	8.2	37	8.4	67	8.0	57

Orgnl. pH = pH of the culture medium at the time of inoculation.
Fnl. pH = pH of the medium at the time of harvest.

pH Requirement

The five species of the genus *Cucurbitaria* tested for their optimum pH requirement were found to bring the original pH towards their respective optimum. This capacity of changing the original pH varied from species to species; in this respect *C. berberidis* was the weakest. By all the five species optimal growth was attained when an original pH ranging from 4.5–5.3 was applied. The lower pH limit was 3.2 in the case of *C. elongata* and for the rest of the species it remained above 3.2; the higher pH limits were always above 9.6. The results are summarised in table 6.

The buffer used (TEORELL & STENHAGEN 1938) has the following advantages over other buffers: It provides a wide range of pH. The amount of active chemicals viz. Citric Acid, Boric Acid, Phosphoric Acid and Sodium Hydroxide remains the same in all ranges. The sole constituent of the other solution (B) is 0.1 N Hydrochloric Acid which has almost no effect on the growth of these fungi.

C. TAXONOMY

The Genus *Cucurbitaria* S. F. GRAY

Nat. Arr. Brit. Pl. *1*, p. 519 (1821)

Fruit bodies produced singly or in large groups, light- to dark-brown or carbonacious, variable in form and shape, from globose to turbinate or almost flask shaped, papilla lacking or well developed, apically porate, pores simple without hairs of any sort, fully or partially erumpent, rarely remaining under the bark up to the last, basal extremity uniform to very much elongated, fruit bodies seated on or immersed in the hypostroma. Hypostroma subiculate or pseudoparenchymatous in texture, purely of fungal tissue or involving host tissue, very well developed or reduced to a plate below the fruit bodies. Asci characteristically bitunicate, mostly cylindrical to rarely subclavate, arising from hymenium at different levels, 2–8 spored, spores uni- or biseriately arranged. Paraphysoids numerous and filiform. Ascospores almost hyaline to dark-olive-brown, ellipsoidal to broadly fusiform with obtuse so subacute ends, prominently constricted at middle septum, also at other septa with less or the same intensity, transverse septa 3–9, rarely more, longitudinal septa 1–3, rarely up to 4, continuous or discontinuous. Saprophytic on dead branches, and twigs of Cormophytes.

Imperfect stage: In literature imperfect stage of the fungus is considered to be represented by at least 6 different genera of Sphaeropsidales, viz. *Phoma* FRIES, *Leptophoma* v. HÖHN., *Pyrenochaeta* DE NOT., *Coniothyrium* CORDA, *Hendersonia* BERK. and *Camarosporium* SCHULZ. A summary of the literature is given at the end of the description of each species. Most of these reports are based on direct observation of herbarium material.

During the course of present investigations, out of the 28 species described, 8 species represented by 22 strains in culture were examined for there imperfect stages. The cultures of the different species have been found to produce 2 different types of macro- and one type of microconidial stages. The cultures from the ascospores of *C. laburni* and *C. coronillae* have been found to possess a characteristic tendency toward producing abortive conidia, which although produced in a single pycnidium side by side, were comparable to, anywhere from *Phoma* FRIES to *Camarosporium* SHULZ.

The macroconidial stages produced in cultures are comparable to the form genus *Diplodia* FRIES and *Camarosporium* SCHULZ. It has been confirmed through germination trials that the microconidia produced by *C. berberidis* and *C. spartii* are true microconidia and not spermatia as is sometimes refered in the literature. The three types of the sphaeropsidacious fungi obtained in cultures have been fully described and drawn along with their perfect stages.

Key to the Groups of the Genus *Cucurbitaria*

The various species of the genus are considered under the following four groups. The grouping is based on the morphology and anatomy of fruit body and hypostroma. A preliminary separation of the fungi belonging to the genus can be done with the help of the following key.

1 — Peridium invariably thickest at the base, bases of the fruit bodies always considerably elongated, sometimes fusing together. Hypostroma subiculate (Pl. I, fig. 1) ..... *C. berberidis* Group (p. 171)

1*— Peridium not invariably thickest at the base, bases of the fruit bodies some times slightly elongated, not fusing together. Hypostroma subiculate or pseudoparenchymatous 2

2 — Bases of the fruit bodies not at all or slightly elongated, fruit bodies always in turbinate shape range (broadest and flat at the top) (Pl. III, fig 3) ..... *C. elongata* Group (p. 179)

2*— Bases of the fruit bodies never elongated, fruit bodies not in turbinate shape range 3

3 — Fruit bodies invariably globose, mostly with a short papilla, never fully erumpent (Pl. VIII, fig. 2) ..... *C. spartii* Group (p. 194)

3*— Fruit bodies never globose, from oblong, ovate, obovate to pear shaped, fully or partially erumpent (Pl. VIII, fig. 3) ..... *C. indigoferae* Group (p. 203)

Key to the Species of *C. berberidis* Group

1 — Spores constricted at middle septum only, transverse septa more than 7, surface of the fruit bodies carbonacious 2

1*— Spores constricted also at other septa, transverse septa not more than 7, surface of the fruit bodies not carbonacious 3

2 — Bases of the fruit bodies broadly conical, surface provided with short stiff hairs ..... *C. pilosa* (p. 171)

2*— Bases of the fruit bodies broad but not conical, surface without hairs of any sort ..... *C. berberidis* (p. 172)

3 — Fruit bodies smooth on surface ..... *C. caraganae* (p. 174)

3*— Fruit bodies rough on surface 4

4 — Fruit bodies fusing at the bases ..... *C. ahmadi* (p. 175)

4*— Fruit bodies not fusing at the bases ..... *C. laburni* (p. 177)

CUCURBITARIA PILOSA sp. nov.

Perithecia gregaria, erumpentia, subglobosa vel irregulariter tuberosa cum fundo longo qui in hypostroma dissolvitur; 310—370 μ latitudine, 415—520 μ altitudine. Peridium extus rugulosum cum setis, 60—75 μ crassitudine ex cellulis fuscis, crasse tunicatis, polygonatis vel elongatis, 5—15μ diam. compositum.

Hypostroma evolutum, subiculosum.

Asci breviter stipitati, subcylindracei, bitunicati, 4—8 spori, 125—165×12—22 μ magnitudine.

Sporae ellipsoideae, pallide fuscae, uni- vel biseriatae, 20—32 × 9—13 μ magnitudine; transverse 6—8 septate, medio verum constrictae, loculis 1—3 septis longitudinalibus divisis.

Paraphysoides hyalinae, filiformes.

Hab. in ramis emortuis *Hederae helicis L.*

MATRIX: On dead branches of *Hedera helix* L.

MATERIAL EXAMINED: Fungi of West Pakistan (without number), from W. Pakistan, Rawalkot, leg. S. AHMAD, in July 1966.

FRUIT BODIES: Gregarious in small groups of 2–3, erumpent, subglobose to irregularly turbinate with prominently elongated bases sometimes fusing together and diffusing with the hypostroma; from 310–370 × 415–520 μ in size. Peridium prominently rough, surface provided with hairs; from 60–75 μ thick, made up of dark-brown, thin walled, polygonal cells 5–10 μ in diameter, up to 15 μ when elongated, cells at the base of the fruit bodies comparatively thick walled and darker in colour.

HYPOSTROMA: Rather well developed, a subiculum of thick walled dark-brown interwoven hyphae.

ASCI: Characteristically short stipitate, subcylindrical to more or less club shaped in upper region, 4–8 spored, predominantly 8, spores mostly biseriately arranged, at least in the upper region of the ascus, sometimes obliquely to almost horizontally uniseriate, from 125–165×15–22 μ up to 28 μ thick in upper region.

SPORES: Light-brown with subacute ends, prominently constricted at middle septum, never at others; transverse septa 6–8, longitudinal septa up to 3 in each segment, continuous or discontinuous, from 20–32×9–13 μ in size (Pl. I – fig. 1, and Pl. XII – fig. 1).

The fungus *C. pilosa* appears to have no close relationship with *C. hederae* WINTER, also described on *Hedera helix*. Type material of *C. hederae* was not available for comparison; taking a substitute of type material, the description and the illustrations given by WINTER (1872) and BERLESE (1900) respectively, *C. pilosa* has been described as a new species. It can easily be distinguished from *C. hederae* by the presence of short stiff hairs on the surface of the fruit bodies and more than one longitudinal septum in spores of *C. pilosa*.

GEOGRAPHICAL DISTRIBUTION: Asia (West Pakistan).

CUCURBITARIA BERBERIDIS (PERS. ex FRIES) GRAY

Nat. Arr. Brit. Pl. *1*, p. 519 (1821)

Synonyms: *Sphaeria berberidis* PERS. – Syn. Fung. p. 52 (1801), and FRIES – Syst. Myc. 2, p. 415 (1823).

Gibberidea Berberidis (PERS.) KUNTZE – Rev. Gen. Pl. *3* (2) p. 481 (1898).

Crotonocarpia moriformis FUCKEL (teste v. HÖHNEL, 1903).

Cucurbitaria mahoniae RICH. forma *Phellodendri* SYD. – in Exs. Syd. Myc. ger. n. 117.

MATRIX: On dead branches of *Berberis* vulgaris L., *Berberis ceratophylla* G. DON. and *Phellodendron amurensis* RUPR.

MATERIAL EXAMINED: As *C. mahoniae* f. *Phellodendri*, in Exs. Sydow Mycotheca germanica, n. 117, on *Phellodendron amurensis*, from Germany, Berlin, leg. H. SYDOW, in 1903. — Fungi of West Pakistan, n. 16357, on *B. ceratophylla*, from W. Pakistan, Muzafferabad, leg. S. AHMAD, in July 1963. — On *B. vulgaris*, from Switzerland, Kt. Wallis, Verbier, leg. E. MÜLLER in June 1955 (= ETH Culture Collection, n. 2543). — On *B. vulgaris*, from France, Haute Savoie, Lanslevillard, leg. F. MIRZA, in July 1966 (= ETH Culture Collection, n. 7024). — On *Berberis* sp., from Switzerland, Kt. Zürich, Weiach, leg. R. A. SHOEMAKER, in September 1961 (= ETH Culture Collection, n. 4643).

FRUIT BODIES: Gregarious in groups of a few to many, erumpent through the ruptured bark, turbinate or subglobose to irregularly elongated, with very much elongated bases, collapsing at the top to become flat with a small depression bearing ostiole, from 500–850×400–650 μ in size. Peridium not very well marked, outermost prominently thick walled and carbonacious, from 28–85 μ thick, inside lighter in colour, from 45–92 μ thick on sides, made up of polygonal cells 9–23 μ in diameter, sometimes irregularly elongated.

HYPOSTROMA: Well developed, a subiculum of dark-brown, rather loosely interwoven hyphae sometimes penetrating host tissue mostly through medullary rays of the shoots.

ASCI: Rather short stipitate, 2–8 spored, predominantly 8, spores overlapping uniseriately arranged, often with a tendency towards biseriation in the upper region of the ascus in some strains; mostly in the size range of 160–260×17–21 μ, sometimes from 175–275×14–16 μ when the spores are typically uniseriate.

SPORES: Light- to dark-dull-brown, end cells invariably lighter in colour, subacute to obtuse, prominently constricted at middle septum, almost never at others, transverse septa 4–9 (sometimes up to 12), mostly 4–8, longitudinal septa up to 3, continuous or discontinuous; from 23–42×10–16 μ, rarely up to 45×17 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce dark-grey floccose mycelium on 2% malt extract agar; culture ETH Nr. 4643 was found to produce a yellow pigment in the culture medium. All the three strains examined produced micropycnidia almost under every condition within 4–6 weeks but the time for pycnidial production was reduced to half if the cultures were exposed to constant light. Germination tests were performed with the microconidia produced in culture; they germinated readily to produce septate germ tubes which subsequently gave rise to normal colonies.

PYCNIDIA: Pear shaped to ovate with a more or less prominent papilla bearing ostiole, surface provided with abundant undulating hairs; from 175–250×90–130 μ in size. Peridium outermost dark and thick walled,

becoming almost hyaline and thin walled towards inside with convoluted inner surface giving rise to septate conidiophores of variable lengths; from 25–45 μ thick.

MICROCONIDIA: Bacilliform, hyaline, from 3–4 × .75–1 μ in size (Pl. I– fig. 2, Pl. X – fig. 1, Pl. XI – fig. 3, and Pl. XII – fig. 2).

Cultural work with this fungus has already been done by BREFELD and TAVEL (1891) and MÜLLER and BAUMEISTER (1957), the reports of these authors taly with the present findings. MÜLLER and BAUMEISTER (1957) also found perfect fruit bodies in culture.

The reports of SACCARDO (1883), ELLIS and EVERHART (1892) and TULASNE (1863) regarding the imperfect stage of this fungus are not based on cultural studies but they mention almost the same type of imperfect fungus growing in association with the perfect stage of *Cucurbitaria berberidis*. TULASNE (1863) compares this imperfect fungus with that produced by *Sphaeria abducens* FRIES.

GEOGRAPHICAL DISTRIBUTION: Europe, North America and Asia (West Pakistan).

CUCURBITARIA CARAGANAE, KARSTEN

Medd. Soc. Fenn. 2, p. 182 (1878)

Synonym: *Gibberidea caraganae* O. KUNTZE — Rev. Gen. Pl. 3^2 p. 481 (1898).

MATRIX: On dead branches of *Caragana arborescens* LAM. and *Caragana frutescens* MEDIC.

MATERIAL EXAMINED: De Thümen, Mycotheca universalis, n. 1066, on *C. arborescens*, from Finnland, Hieme, leg. P. A. KARSTENS, in 1877. — Sydow, Mycotheca germanica, n. 321, on *C. arborescens*, from Germany, Brandenburg, Baumschulen zu Tamsel, leg. P. VOGEL, in December 1904. — F. Petrak, Mycotheca generalis, n. 1910, on *C. arborescens*, from Germany, Brandenburg, Tamsel, leg. P. VOGEL, in November 1925.

FRUIT BODIES: Gregarious in large groups, erumpent through the bark, subglobose to obovate or turbinate, sometimes oblong when laterally compressed, collapsing at the top to become flat without any depression at the ostiole, papilla lacking, bases of the fruit bodies prominently developed and embedded in the hypostroma but never diffusing with it, from 650–950×375–575 μ, up to 650 μ in diameter when globose. Peridium with smooth surface, thickest near the base, from 50–100 μ thick when measured in the middle, uniform in colour, outermost cells almost round or so, larger than inner ones, 7–16 μ in diameter, sometimes elongated up to 23 μ.

HYPOSTROMA: Well developed, a subiculum of rather loosely interwoven hyphae, dark-brown in colour.

ASCI: Predominantly short stipitate, rarely somewhat longer, 2–8 spored, mostly 8 spores, overlapping uniseriately arranged with a tendency towards biseriation in the middle of the ascus; from 140–230×12–15 μ in size, up to 255 μ long in some strains.

SPORES: Light-brown, predominantly straight except in some strains with 33% hunched spores, ends almost obtuse, prominently constricted at middle septa, also at others occasionally with the same intensity, transverse septa 5–7, mostly 7, longitudinal septa mostly one continuous, sometimes two discontinuous; from 23–32×8–12 μ in size, rarely up to 38×13 μ (Pl. I – fig. 3, and Pl. XII – fig. 3).

IMPERFECT STAGE: No cultural studies have been done; the following views of mycologists are based on direct observation of herbarium material: WINTER (1887) and ROSTRUP (1957) report *Camarosporium caraganae* KARST., WELCH (1926) states after v. HÖHNEL (1919) that *Pseudodichomera elaeagni* (KARST.) v. H. (=*Dichomera elaeagni* KARST.) is the pycnidial stage of *C. caraganae*.

GEOGRAPHICAL DISTRIBUTION: Europe and Sibiria.

CUCURBITARIA AHMADI sp. nov.

Perithecia gregaria, erumpentia, globosa vel subglobosa, 300—475 µ latitudine, 250—415 µ altitudine, basaliter elongata 500—1000 µ altitudine. Peridium ad ostiolum crassius, lateraliter 50—100 µ crassitudine, cellulis polygonatis vel elongatis 7—8 µ magnitudine compositum.

Hypostroma evolutum, subiculosum.

Asci bitunicati, longe stipitati, 4—8 spori, 200—250 × 12—14 µ magnitudine.

Sporae ellipsoideae, subfuscae, uni- vel biseriatae, 19—30 × 8—11 µ magnitudine, transverse 3—7 septatae, medio et nonnunquam ad altera septa verum constrictae, loculis uno septo longitudinali divisis.

Paraphysoides hyalinae, filiformes.

Status conidiophorus in culturis *Camarosporium* SCHULZ. Pycnidia globosa vel subglobosa, mycelio tecta, ostiolata, 300—400 µ diam. Conidiae subfuscae vel atro- olivaceo fuscae oblongae vel ovatae, transverse triseptatae, longitudinaliter uniseptatae, 11—18 × 5—8 µ magnitudine.

Hab. in ramis emortuis *Caraganae* sp.

MATRIX: On dead branches of *Caragana* sp.

MATERIAL EXAMINED: Fungi of West Pakistan, n. 17053, from W. Pakistan, Quetta, Zearat, leg. S. AHMAD, in June 1964 (= ETH Culture Collection, n. 4981). Type! — Fungi of West Pakistan, n. 15619, from W. Pakistan, Quetta, Zearat, leg. S. AHMAD, in June 1962.

FRUIT BODIES: Gregarious in groups of a few to many, erumpent through the bark in pustules of various forms, bases considerably elongated from 500–1000 μ, fusing completely to form a pseudoparenchymatous cushion below the centra, globose to subglobose or obovate becoming somewhat conical at the top to form an ambiguous papilla bearing a comparatively wide ostiole; from 300–475×250–415 μ in size, up to 375 μ in diameter when globose or so. Peridium with prominently rough surface, uniform on sides, thinnest near the ostiole; from 50–100 μ thick when measured on sides, made up of dark-brown polygonal cells becoming thin walled and lighter in colour towards inside; 7–15 μ in diameter, up to 18 μ when elongated.

HYPOSTROMA: Well developed, a subiculum of rather light-brown densely interwoven hyphae, sometimes sparse on sides.

ASCI: Characteristically long stipitate, sometimes short, 4–8 spored, spores overlapping uniseriately or biseriately arranged; from 200–250× 12–14 μ in size, rarely as short as 130×11 μ when 4 spored.

SPORES: Golden-brown with subacute to obtuse ends, ends somewhat lighter in colour, prominently constricted at middle septum, also at other septa sometimes with the same intensity, transverse septa 3–7, mostly 3 or 5, primary and secondary septa always darker in colour, longitudinal septum one, continuous or discontinuous; from 19–30×8–11 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce light-grey mycelium on 2% mat extract agar. Normally the cultures produced a few pycnidia under room conditions within 8–10 weeks; the mycelium remained sterile, highly floccose and lighter if the cultures were incubated in total darkness. A large number of pycnidia were produced if the cultures were exposed to constant light at 18° C.

PYCNIDIA: Subglobose to ovate with a small papilla bearing ostiole, surface provided with abundant undulating hairs; roughly from 300–400 μ in diameter. Peridium outermost darker and thick walled, inside thin walled and lighter in colour, staining dark with Lactophenol Cotton Blue, bearing conidia without conidiophores of any sort.

CONIDIA: Bright-brown to dark-olive-brown with age, mostly oblong, rarely ovate or irregular in form, transverse septa 3, sometimes oblique, constrictions lacking, longitudinal septum mostly one, rarely continuous; from 11–18×5–8 μ in size. Comparable to the genus *Camarosporium* SCHULZ (Pl. II – fig. 1, Pl. XI – fig. 1, Pl. XI – fig. 5, and Pl. XII – fig. 4).

GEOGRAPHICAL DISTRIBUTION: Asia (West Pakistan).

(I have named this species after my teacher Prof. Dr. SULTAN AHMAD in appreciation of his extensive work on the fungi of West Pakistan; the material for this species was also collected by him.)

CUCURBITARIA LABURNI (PERS. ex FRIES) DE NOT.

In Exs. Erbar. Critt. Ital. No. 875 (1862)

Synonyms: *Sphaeria laburni* PERS. — Syn. Fung. p. 50 (1801), and FRIES — Syst. Myc. 2, p. 413 (1823).

Gibberidae laburni O. KUNTZE — Rev. Gen. Pl. 3^2, p. 481 (1898).

Cucurbitaria laburni CES. et DE NOT. — Schema di Classif., 214 (1863).

MATRIX: On dead branches of *Laburnum anagyroides* MED. and *Cytisus radiatus* MERT. & KOCH.

MATERIAL EXAMINED: On *Laburnum anagyroides* from Switzerland, Kt. Tessin, leg. H. KERN, in May 1966 (= ETH Culture Collection, n. 7006). — On *Laburnum anagyroides*, from Switzerland, Kt. Tessin, leg. F. MIRZA, in May 1966 (= ETH Culture Collection, n. 7011). — On *Cytisus radiatus*, from Italy, Prov. Trento, Val. Concei, leg. E. MÜLLER, et M. EGGER, in June 1967 (= ETH Culture Collection, n. 7123). Wartmann and Schenk, Schweizerische Krypt., n. 109, from Switzerland, Kt. Schaffhausen, leg. B. SCHENK, in January 1862 [the material distributed in this exsiccata consists of two pieces of wood, one marked as *Cytisus laburnum* (= *Laburnum anagyroides*) and the other as *Colutea arborescens*, the fungus observed on the latter is not *C. laburni*]. — Sydow Mycotheca Marchica, n. 335, on *Cytisus alpinus* (= *Laburnum alpinum*), from Germany, Berlin, leg. P. SYDOW, in 1884. — On *Cytisus radiatus*, from Switzerland, Kt. Wallis, Bossonesse sur Ayent, leg. CH. TERRIER, in October 1945.

FRUIT BODIES: Gregarious in large groups of 5 to many, erumpent through the bark in rombic pustules, mostly turbinate, collapsing at the top to become flat with a small depression bearing ostiole, bases of the fruit bodies very much elongated, sometimes fusing with each other, roughly from 450–950 μ in diameter. Peridium with prominently rough surface, thinnest near the ostiole, thickest near the base, from 60–100 μ thick when measured on sides, made up of polygonal cells becoming thinner and lighter in colour towards inside, from 10–16 μ in diameter up to 32 μ when elongated.

HYPOSTROMA: Very well developed, a subiculum of rather loosely interwoven hyphae, sometimes penetrating between the elongated bases of the fruit bodies.

ASCI: Predominantly short stipitate, sometimes extremely long, 2–8 spored, mostly 6 or 8 spores, uniseriately arranged; from 156–260×11–16 μ in size, rarely up to 280 μ long.

SPORES: Light-brown with obtuse to sometimes subacute ends, prominently constricted at middle septum, also at other septa but never with the same intensity, transverse septa 4—8, mostly 4 to 7, longitudinal septa 1—2, mostly 1 continuous, rarely discontinuous, from 22—32×9—11 μ in size, rarely up to 40 μ long. (The specimen collected by P. SYDOW, material refered before, showed spores up to 13 μ broad.)

CULTURAL CHARACTERISTICS: The ascospores germinated to produce dark-green ish-grey mycelium on 2% malt extract agar; the colonies remained floccose and lighter in colour if the cultures were incubated in total darkness. Macropycnidia were produced within 8—10 weeks under room conditions but the time for pycnidial production was reduced to half if the cultures were incubated in constant light. Normally no pycnidia were produced in darkness on 2% malt extract agar on other culture media the fungus predominantly produced abortive pycnidia (see table 1).

PYCNIDIA: Globose to pyriform or irregular in shape with a short papilla bearing ostiole, surface provided with characteristic hair-like outgrowths, from 200—500 μ in diameter when globose, and from 600—1,400×250—950 μ in size when formed otherwise. Peridium outermost made up of thick walled dark-brown cells becoming thin walled and hyaline towards inside, conidia produced on the innermost layer without conidiophores of any sort.

CONIDIA: Light-golden-brown to dark-olive-brown with age, oblong to broadly fusiform rarely ovate or so, transverse septa 3—5, longitudinal septa one continuous or discontinuous, constrictions at transverse septa may be present or lacking; from 12—22×8—10 μ in size (Pl. II — fig. 2, Pl. XI — fig. 6, and Pl. XII — fig. 5).

A sort of abortive pycnidia, morphologically similar to normal pycnidia, bearing conidia light-brown to hyaline in colour, in shape ranging from bacilliform to oblong or ovate, mostly uniseptate; sometimes conidia with only one septum were also found. These various kinds of conidia have been described as different types by many mycologists. They are here designated as abortive conidia of the normal type described above, which are comparable to the genus *Camarosporium* SCHULZ.

It has been observed repeatedly that both these types of spores are produced in the same manner side by side in the same pycnidium, and all intermediate types between *Coniothyrium* CORDA and *Camarosporium* SCHULZ were observed. This may be taken as one of the reasons why mycologists have compared the imperfect stage of *C. laburni* with *Phoma* FRIES, *Coniothyrium* CORDA, *Diplodia* FRIES, *Hendersonia* BERK. and lastly *Camarosporium* SCHULZ, as they observed probably the same

fungus at different stages of development. The fact that the imperfect stage of *C. laburni* has a predominant tendency towards producing abortive pycnidia and conidia can not be denied.

Reports on the subject start from TULASNE (1863), TUBEUF (1886), SACCARDO (1882), BREFELD (1891), WELCH (1926), GREEN (1931), GROVE (1937), and MÜLLER and BAUMEISTER (1957); amongst the mycologists mentioned above only the informations coming from TUBEUF, BREFELD, GREEN and MÜLLER and BAUMEISTER are based on cultural studies. A good comparison of different views is given by GREEN (1931.)

GEOGRAPHICAL DISTRIBUTION: Central Europe.

Key to the Species of *C. elongata* Group

1 — Spores having not more than 6 transverse septa 2

1*— Spores having more than 6 transverse septa 3

2 — Spores having 3—5 transverse septa, ends invariably obtuse, surface of the fruit bodies prominently rough ..... *C. halimodendri* (p. 180)

2*— Spores having 3—6 transverse septa, ends not invariably obtuse, surface of the fruit bodies prominently rough ..... *C. dulcamarae* (p. 181)

3 — Spores having more than 7 transverse septa 4

3*— Spores having not more than 7 transverse septa 5

4 — Spores having 3—8 transverse septa, hypostroma well developed ..... *C. elongata* (p. 182)

4*— Spores having 4—9 transverse septa, hypostroma poorly developed ..... *C. ononidis* (p. 183)

5 — Spores invariably constricted at middle septum only, hypostroma not subiculate ..... *C. acervata* (p. 184)

5*— Spores also constricted at other than middle septum, hypostroma subiculate 6

6 — Surface of the fruit bodies extremely rough and carbonacious .. *C. rhamni* (p. 185)

6*— Surface of the fruit bodies rough but not carbonacious 7

7 — Hypostroma poorly developed ..... *C. coronillae* (p. 186)

7*— Hypostroma well developed ..... 8.

8 — Fruit bodies with invariably uniform bases, spores with anterior end prominently acuter than posterior ..... *C. negundinis* (p. 188)

8*— Fruit bodies with variably uniform or thickened bases, spores with subacute to obtuse ends 9

9 — Fruit bodies almost seated on hypostroma, surface of the fruit bodies prominently rough ..... *C. amorphae* (p. 189)

9*— Fruit bodies embedded in hypostroma, surface of the fruit bodies slightly rough 10

10 — Hypostroma invariably well developed, imperfect stage in culture comparable to the genus *Diplodia* ..... *C. emeri* (p. 191)

10*— Hypostroma well developed to reduced, imperfect stage in culture comparable to the genus *Camarosporium* ..... *C. cytisi* (p. 192)

(It may be mentioned that it will not always be possible to determine the fungi belonging to *C.elongata* group with the help of the key. The reader is requested to compare his material with the description and figures of the particular species. In the case of this group it is suggested to take into account the host also; sometimes it will be necessary to compare the material with an authentically determined one. The species of the genus *Cucurbitaria* belonging to this group appear to be more or less strictly bound to their respective hosts.)

CUCURBITARIA HALIMODENDRI REHM

Annal. Mycol. *9*, p. 370 (1911)

MATRIX: On dead branches of *Halimodendron argenteum* FISCH. and *Acacia modesta* WALL.

MATERIAL EXAMINED: Fungi of West Pakistan, n. 3087, on *A. modesta,* from W. Pakistan, Salt range, Choa Saidan Shah, leg. S. AHMAD, in March 1950.

FRUIT BODIES: Gregarious in groups of 2–5, rarely produced singly, erumpent, obovate to more or less turbinate, collapsing at the top to become flat, bearing ostiole, papilla almost lacking, from 350–475×275–380 μ in size, and from 300–400 μ in diameter when globose or so, peridium with slightly rough surface, thickest near the ostiole from 70–80 μ, remaining thin on sides, from 35–60 μ, made up of polygonal cells 9–16 μ in diameter, sometimes elongated up to 23 μ.

HYPOSTROMA: Very well developed, a subiculum of dark-brown, closely interwoven hyphae, sometimes engulfing host tissue, remaining loose and lighter in colour below the fruit bodies.

ASCI: With stipes of medium size ending in claw like structures, 4–8 spored, mostly 8, spores overlapping or uniseriately arranged; from 160–190×10–13 μ in size.

SPORES: Golden-brown with obtuse ends, prominently constricted at middle septum, also at others with more or less the same intensity, transverse septa 3–5, mostly 3 or 4, darker in colour, longitudinal septa mostly one continuous, very rarely two discontinuous, from 17–24×8–10 μ in size (Pl. III – fig. 1, and Pl. XII – fig. 6).

GEOGRAPHICAL DISTRIBUTION: Europe and Asia (West Pakistan).

CUCURBITARIA DULCAMARAE (KUNZE et SCHMIDT) FRIES

Summa. Veg. Scand., p. 391 (1849)

Synonym: *Sphaeria dulcamarae* KUNZE et SCHMIDT — Mykol. Hefte *1*, p. 62 (1817).

Sphaeria dulcamarae FRIES — Syst. Myc. 2, p. 421 (1823).

MATRIX: On dead branches of *Solanum dulcamara* L.

MATERIAL EXAMINED: Rehm, Ascomyceten, n. 1085, from Germany, Wörlitz, leg. STARITZ, in winter 1891/92. — Rabenhorst, Fungi europaei, n. 2231, from Italy, Parma, in Horto Botanico, leg. G. PASSERINI, in hieme 1875/76. — Sydow, Mycotheca germanica, from Germany, Brandenburg, Zehlendorf bei Berlin, leg. H. & P. SYDOW, in August 1903.

FRUIT BODIES: Gregarious in small groups, erumpent through the bark in more or less longitudinal pustules, subglobose to obovate, sometimes laterally compressed, collapsing at the top to become slightly flat, bearing ostiole, papilla lacking, from 400–525 μ in diameter. Peridium prominently rough, thickest near the top and base (up to 100 μ), remaining thin on sides, from 45–70 μ thick, made up of polygonal cells thicker and darker in the outer region, cells from 11–16 μ in diameter.

HYPOSTROMA: Very well developed, a subiculum of dark-brown, sometimes sinuate, densely interwoven hyphae, sparse on sides of the fruit body.

ASCI: Characteristically short stipitate, 2–8 spored, mostly 4 or 8, spores uniseriately arranged, sometimes showing a slight tendency towards biseriation; from 110–190×12–14 μ in size.

SPORES: Light-brown with subobtuse ends, invariably constricted at every septum with almost the same intensity, transverse septa 3–6, mostly 3 or 5, broad and darker in colour, longitudinal septum mostly one, continuous, sometimes discontinuous, very rarely two longitudinal septa in a segment also present; from 20–30 × 9–11 μ in size (Pl. III – fig. 2, and Pl. XII – fig. 7).

IMPERFECT STAGE: No cultural work has been done with this fungus; the reports of the following mycologists are based on the direct examination of herbarium material:

WINTER (1887), states, after FUCKEL, *Diplodia dulcamarae* FUCKEL as a microstylospore form and proposes that a macrostylospore form should be a *Hendersonia* PLOWRIGHT like fungus; ROSTRUP (1913) also mentions *Diplodia dulcamarae* FUCKEL, along with *Hendersonia solani* to be the conidial stages of C. *dulcamarae*.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA ELONGATA (FRIES) GREV.

Scot. Crypt. Fl. *4*, p. 195 (1826)

Synonyms: *Sphaeria elongata* FR. — Syst. Myc. *2*, p. 422 (1823).
? *Sphaeria scabra* SCHMIDT et KUNZE — Mykol. Hefte *1*, p. 58 (1817).

MATRIX: On dead branches of *Robinia pseudacacia* L.

MATERIAL EXAMINED: Sydow, Mycotheca germanica, n. 691., on *R. pseudacacia*, from Germany, Thüringen, Sondershausen, leg. G. OERTAL, in April 1908. — University of Toronto, Cryptogamic Herbarium, n. 12971, on *R. pseudacacia*, from Canada, New Durham, Brant County, Ont., leg. R. F. CAIN, in June 1938. — On *R. pseudacacia*, from France, Michel-Demorian, leg. F. MIRZA, in June 1966 (= ETH Culture Collection, n. 7023).

FRUIT BODIES: Gregarious in large groups, typically in longitudinal pustules, sometimes produced singly or in small groups in pustules of various forms, appearing only 2–5 in sections, erumpent, turbinate to obovate with broadly conical bases, slightly elongated but not diffusing with the hypostroma, collapsing at the top to become flat with a short papilla in a small depression bearing ostiole, from 650–950×500–775 μ in size. Peridium prominently rough, thickest at the base, from 100–180 μ when measured in the middle; outermost dark, becoming lighter in colour towards inside, made up of polygonal to irregularly shaped cells roughly 9–24 μ in diameter.

HYPOSTROMA: Very well developed, a subiculum of dark-brown, densely interwoven hyphae sometimes involving host tissue.

ASCI: Predominantly short stipitate and cylindrical, sometimes with stipes up to 70 μ long and more or less club shaped due to biseriation in the anterior region of the ascus, 2–8 spored, mostly 4 or 8, spores uniseriately, sometimes biseriately arranged; size appears to depend on the arrangement and number of spores present in the ascus, quite variable from 140—255×14–18 μ.

SPORES: Dull-brown, characteristically of variable form, shape and size, mostly with obtuse ends, prominently constricted at middle septum, also at others sometimes with the same intensity (spores without constrictions

attaining a broadly fusiform shape rarely present), transverse septa 3—8, mostly 5 or 7, longitudinal septa 1 or 2, almost never more, continuous or discontinuous, from 21—38×8—12 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce dark-grey, rather floccose mycelium on 2% malt extract agar; under room conditions the cultures produced a few pycnidia within 8—10 weeks; in total darkness the mycelium remained sterile but the time for pycnidial production was reduced to less than half if the cultures were incubated in constant light.

PYCNIDIA: Globose to ovate, sometimes irregular in form, with a short papilla bearing ostiole, surface provided with undulating long hairs, comparatively dark in colour, innermost layer hyaline bearing pear shaped cells giving rise to conidia; roughly from 400—500 μ in diameter.

CONIDIA: Golden to dull-brown with age, oblong to somewhat ovate with 3—5 transverse septa, without constrictions, longitudinal septum one, discontinuous, some end cells with Y septa, 13—21×7—10 μ in size (Pl. III — fig. 3, Pl. XI — fig. 4, and Pl. XII — fig. 8).

The imperfect fungus described above is comparable to genus *Camarosporium* SCHULZ but not to the species *C. robiniae* SACC. as reported by the following mycologists on the basis of direct examination of herbarium material: SACCARDO (1883), WINTER (1887), ELLIS and EVERHART (1892) mention *Hendersonia robiniae* WEST. and *Diplodia robiniae* BOMM; TULASNE (1863) observed micro- and macroconidia; FUCKEL (1869) mentions microstylospores but both these authors did not compare the fungus observed by them with any of the existing fungi; BERLESE (1900), WELCH (1926) and GROVE (1937) are of the opinion that *Camarosporium robiniae* SACC. is the imperfect stage of *C. elongata.*

GEOGRAPHICAL DISTRIBUTION: Central Europe and North America.

CUCURBITARIA ONONIDIS M. MASSENOT

Rev. de Mycol. *29*, p. 82 (1964)

MATRIX: On dead branches of *Ononis fruticosa* L.

MATERIAL EXAMINED: From France, Hautes-Alpes, Col de Larche, on the road above Condamine, leg. E. MÜLLER, in August 1955 (not fully mature). — From France, Val Queyras, gorge near Guillestre, leg. E. MÜLLER in June 1954.

FRUIT BODIES: Gregarious in small groups of 2—3, globose to subglobose, sometimes dorsoventrally compressed, collapsing at the top to become flat, forming a slight depression bearing ostiole; papilla lacking, remaining under the bark, later erumpent by ostiole only; from 520—675×400—570

μ in size and from 400–575 μ in diameter when globose or so. Peridium with slightly rough surface sometimes provided with hair-like structures, thickest near the ostiole, from 85–125 μ, remaining thin on the sides, from 70–90 μ, outermost nearly carbonacious becoming thin walled and lighter in colour towards inside, made up of somewhat rectangular to polygonal cells, from 12–20×12–15 μ or up to 20 μ in diameter.

HYPOSTROMA: Rather poorly developed, a subiculum of dark-brown, somewhat closely interwoven hyphae, sparse on sides.

ASCI: Short stipitate, sometimes slightly longer, 4—8 spored, mostly 8, spores overlapping or uniseriately arranged; from 184–242×15–18 μ in size.

SPORES: Brown, with subacute to slightly obtuse ends always lighter in colour, prominently constricted at middle septum, only slightly at other septa, transverse septa 5–9, mostly 6 or 7, longitudinal septa 1–3, mostly 2, continuous or discontinuous; from 12–27 × 13–15 μ in size (Pl. IV – fig. 1, and Pl. XII – fig. 9).

Two types of imperfect fruit bodies were found growing in association with the fungus described above, the first comparable to the genus *Camarosporium* SCHULZ, having 2–7-septate spores, from 17–27×8–13 μ in size; the second type was still immature. On the basis of a few spores and the structure of pycnidia it was found comparable to the genus *Pyrenochaeta* DE NOT.

MASSENOT (1964) states a close relationship between this fungus and *C. khurdica* BUBAK; it can be distinguished from the latter in which there is only one longitudinal septum in the spores.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA ACERVATA (FRIES) CES. et DE NOT.

Comm. Soc. Critt. Ital. *1*, p. 214 (1863)

Synonyms: *Sphaeria acervata* FRIES — Syst. Myc. 2, p. 416 (1823).
Gibberidea acervata KUNTZE — Rev. Gen. Pl. 3^2, p. 481 (1898).

MATRIX: On dead branches of *Pirus communis* L. and *Pirus malus* L.

MATERIAL EXAMINED: Fungi of West Pakistan, n. 18761, on *Pirus* sp., from W. Pakistan, Quetta, Zearat, leg. S. AHMAD, in June 1964.

FRUIT BODIES: Gregarious in small groups of 2–3, erumpent, rarely fusing together, subglobose to more or less turbinate, collapsing at the top to become flat (very rarely slightly cupulate), bearing ostiole, papilla lacking; from 350–525 μ in diameter. Peridium with prominently rough surface, outside almost carbonacious becoming light-brown to hyaline

towards inside, from 50–75 μ thick, made up of polygonal cells 7–9 μ in diameter, sometimes elongated up to 30 μ.

HYPOSTROMA: Very well developed, pseudoparenchymatous (or amorphous) in appearence, in finer details made up of minutely thin light-brown densely interwoven hyphae regularly involving host tissue, resulting overall colour becoming maroon, fungus penetrating deep into the host.

ASCI: Characteristically short stipitate, regularly 8 spored, spores obliquely uniseriately arranged; from 110–165×11–13 μ in size.

SPORES: Dark-brown with obtuse ends, prominently constricted at middle septum, never at other septa, transverse septa 3–7, mostly 3 or 6, longitudinal septa 1–2, continuous or discontinuous, from 20–24×10 μ in size (P. IV – fig. 2, and Pl. XIII – fig. 1).

WELCH (1926) has considered the fungus under doubtful species for the reason that type material was not available for examination; as the material examined during the present studies tallied quite well with the description given in the literature cited above the species is considered doubtless.

GEOGRAPHICAL DISTRIBUTION: Central Europe and Asia (West Pakistan).

CUCURBITARIA RHAMNI (NEES ex FRIES) FUCKEL

Symb. Mycol., p. 174 (1869)

Synonyms: *Sphaeria rhamni* NEES — Syst. Pilze, p. 299, fig. 326 (1817), and FRIES — Syst. Myc. *2*, p. 417 (1823).

Cucurbitaria rhamni FRIES — Summa. Veg. Scand., p. 391 (1846).

Cucurbitaria moravica REHM — Ann. Mycol. *10*, p. 393 (1912).

MATRIX: On dead branches of *Rhamnus alpina* L., *R. frangula* L. and *Alnus glutinosa* GÄRTN.

MATERIAL EXAMINED: On *R. alpina*, from Switzerland, Kt. Solothurn, Weissenstein, leg. H. WEGELIN, in October 1889. — On *R. frangula*, from Switzerland, Kt. Freiburg, Pfaffenholz, leg. H. WEGELIN, in April 1895. — On *R. frangula*, from Switzerland, Kt. Bern, Burgdorf, Meisenmoos, leg. H. WEGELIN, in April 1887. — On *R. frangula*, from Switzerland, Kt. Zürich, Zürichberg, leg. C. SCHRÖTER, in May 1876. — As *C. moravica* (Type) on *Alnus glutinosa*, from Czek., Mähr. Weisskirchen bei Hrabnoka, leg. F. PETRAK, in February 1912.

FRUIT BODIES: Mostly gregarious in large groups sometimes produced singly, subglobose to more or less turbinate or irregular in form, collapsing at the top to become flat with a small depression and papilla bearing ostiole, from 400–600×375–525 μ in size. Peridium with irregularly

rough surface and carbonacious, becoming lighter in colour towards inside, 40–75 μ thick, made up of polygonal cells 7–12 μ in diameter, cells sometimes elongated up to 20 μ.

HYPOSTROMA: Rather well developed, a subiculum of dark-brown interwoven hyphae, sometimes forming glomerations, hyphae penetrating deep into the host.

ASCI: Characteristically short stipitate, sometimes slightly longer, 4–8 spored, predominently 8, spores obliquely or overlapping uniseriately arranged, rarely showing a slight tendency towards biseriation; from 100–180×10–14 μ in size.

SPORES: Golden-brown with obtuse to subacute ends, anterior end almost invariably broadest, end cells lighter in colour, prominently constricted at middle septum, also at other septa (rarely with the same intensity), transverse septa 3–7, longitudinal septa mostly 1 sometimes 2 or 3, continuous or discontinuous; from 16–27×6–9 μ in size (Pl. IV – fig. 3, and Pl. XIII – fig. 2).

IMPERFECT STAGE: No cultural work has been done with this fungus, the following information is based on direct observation of herbarium material:

ROSTRUP (1913) reports *Diplodia frangulae* FUCKEL and *Camarosporium rhamni* ALLESCHER; GROVE (1937) is of the opinion that *Microdiplodia rhamni* FUCKEL is the imperfect stage of *C. rhamni.*

C. moravica has been cited here as a synonym of *C. rhamni:* Type material of *C. moravica* vas observed and no grounds were found to recognise it as a separate species. REHM (1912) while describing the fungus mentions the spores to be 3–5 septate whereas the same material shows 3–7 septate spores. The shape and form of spores and fruit bodies is essentially similar to *C. rhamni.*

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA CORONILLAE (FRIES) DE THÜMEN

In Exs. de Thümen, Mycotheca universalis, n. 1259 (1876)

Synonyms: *Sphaeria coronillae* FRIES — Syst. Myc. 2, p. 423 (1823) and S. Veg. Scand., p. 391 (1849).

Cucurbitaria elongata (FRIES) GREV. var. *coronillae* FUCKEL — Symb. Mycol., p. 174 (1869).

Cucurbitaria coronillae (FRIES) SACC. — Fungi Ital. t. 523 (1879) and Syll. Fung. 2, p. 312 (1883).

MATRIX: On dead branches of *Coronilla emerus* L.

Material Examined: Herb F. v. Tavel, from Switzerland, Kt. Bern, Schlosshalde, leg. F. v. Tavel, in March 1887. — De Thümen, Mycotheca universalis, n. 1259, from Switzerland, Kt. Neuchâtel, Corcelles, leg. Dr. P. Morthier, in spring 1876. — Ex herb. Dr. F. Petrak, from Czek., Mähr. Weisskirchen, leg. F. Petrak, in March 1915. — Flora Austriae inf., from Austria, Wien, Pfaffstätten, leg. F. Petrak, in April 1940. — From Switzerland, Kt. Solothurn, Steingrube, östl. Oberbuchsiten, leg. A. von Arx, in April 1947. — From Italy, Prov. Brescia above Iseo, leg. F. Mirza, in June 1967 (= ETH Culture Collection, n. 7125).

Fruit Bodies: Gregarious in large groups, 3—10 in vertical sections, appearing scattered on the matrix, turbinate to subglobose, collapsing at the top to become flat with a slight depression bearing ostiole, papilla lacking; from 380—550×300—480 μ in size (sometimes broader than high) up to 750 μ in diameter when subglobose or so. Peridium slightly rough on surface, mostly thickest near the ostiole (in strains collected from Italy also thickened at bases); 35—50 μ thick on sides (rarely up to 150 μ), near the ostiole and bases 80—140 μ thick, made up of polygonal cells darker and thick walled on outside, becoming slightly elongated, thin walled and lighter in colour towards inside, from 6—15 μ in diameter, up to 23 μ when elongated.

Hypostroma: Well developed to very much reduced, a subiculum of brown, sinuate, densely interwoven hyphae, sometimes involving host tissue giving a pseudoparenchymatous appearence.

Asci: Rather short stipitate, sometimes longer, up to 80 μ, 2—8 spored, predominantly 4—8 spores slightly overlapping or uniseriately arranged, from 150—220×11.5—15.5 μ in size.

Spores: Light to dark-golden-brown, of variable form and shape, ends subacute to obtuse, prominently constricted at middle septum, also at other septa but not with the same intensity, transverse septa 3—7, mostly 5 or 7, longitudinal septa one, continuous or discontinuous; from 19—27×9—12 μ in size, rarely up to 35 μ long.

Cultural Characteristics: The ascospores germinated to produce dark-grey floccose mycelium on 2% malt extract agar when exposed to constant light at 18—21° C; the cultures produced pycnidia as well as perfect fruit bodies within 5—7 weeks.

Pycnidia: Dark-brown to almost black, globose to rarely subglobose, surface provided with hairs (papilla lacking), from 190—375 μ in diameter. Peridium 25—48 μ thick, outermost dark-brown and thick walled, becoming thin walled and lighter in colour towards inside, conidia produced directly from innermost layer without conidiophores of any sort.

Conidia: Golden-brown with obtuse ends becoming dark-brown with age, not constricted at transverse septa, transverse septa predominantly

3, rarely up to 5, longitudinal septum 1 continuous or discontinuous; from 10.5–15×4.5–6 μ in size. Comparable to the genus *Camarosporium* SCHULZ (Pl. V – fig. 1, Pl. XI – fig. 8, and Pl. XIII – fig. 3).

The perithecia produced in culture were almost similar in shape and structure to those observed from natural host (rather regularly turbinate), the spores mostly remained 5 septate with subacute ends, although nearly all the variations in shape observed in spores from the natural host were also present.

The fungus *C. coronillae* is closely related to *C. elongata* and *C. emeri;* by naked eye observation it can be separated from both these fungi on the basis of its scattered habit which in case of the other two fungi is almost typically in longitudinal pustules. The hypostroma in *C. coronillae* is remarkably less developed as compared to the other two related fungi; a comparison of all the closely related species of *C. elongata* group is given on page 195.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA NEGUNDINIS WINTER

Rabh. Crypt. Fl. *1*[2], p. 329 (1887)

Synonym: *Cucurbitaria ailanthi* RABH. — in EXS. Fungi europ., n. 1833; Sacc. Syll. Fung. *2*, p. 315 (1883).

(The name given by RABENHORST in 1874 was provisional as is mentioned on the exsiccata cited above.)

MATRIX: On dead branches of *Acer negundo* L. (not *Ailanthus glandulosa* DESF.) The correction of host was made by the collector of the material, JACK, through a letter to WINTER (1887).

MATERIAL EXAMINED: Fungi europaei, n. 1833, as *C. ailanthi* RABH. — Provisional on ... *Ailanthus glandulosa* DESF. corrected to (...) *Acer negundo* L., from Germany, Baden, Schlossgarten zu Salem, leg. JACK, in 1874. — Fungi europaei, n. 2550, as *Cucurbitaria vagans* SACC. (*Ailanthus glandulosa* DESF. corrected to) *Acer negundo* L., from Germany, Baden, Schloßgarten zu Salem, leg. JACK.

The following description is based on the observation of the above cited two materials which are not quite similar, especially in spore character, but taking into consideration the variability of spores in the type material and the rather immature state of the material observed under Fung. eur., n. 2550, it was considered more desirable to follow the author who based the description on the observation of these two materials; however, the measurements are given within brackets along with the description of the type material.

FRUIT BODIES: Gregarious in small groups of 2–4, characteristically diffused on the surface of the host, erumpent, collapsing at the top to

become flat with a small depression bearing ostiole, papilla almost lacking, globose to subglobose from 400–500 μ in diameter, (sometimes up to 600 μ). Peridium minutely rough, slightly thicker near the ostiole, from 55–70 μ thick, (up to 100 μ near the ostiole) outermost darker, sometimes opaque becoming thin walled and lighter in colour towards inside, made up of polygonal cells 9–16 μ in diameter, (10–18 μ) sometimes elongated up to 23 μ.

HYPOSTROMA: Well developed, a subiculum of dark-brown rather loosely interwoven hyphae, regularly involving host tissue.

ASCI: Short stipitate, 4–8 spored, mostly 6 or 8 spores, obliquely uniseriately arranged showing a slight tendency towards biseriation in the middle of the ascus; from 160–200×13–20 μ in size (160–185×12–14 μ).

SPORES: Dark- to light-brown in colour, variable in form and shape predominantly with anterior end somewhat acuter than posterior, end cells invariably lighter in colour, prominently constricted at middle septum, also at other septa with less intensity, transverse septa 3–7 (mostly 3, 4 or 5), longitudinal septum one, mostly continuous, sometimes discontinuous, from 26–37×9–12 μ (20–26×9–11 μ) (Pl. V – fig. 2, and Pl. XIII – fig. 4).

IMPERFECT STAGE: No cultural work has been done with this fungus; the reports of the following authors are based on direct observation of herbarium material:

BERLESE (1900) reports *Camarosporium negundinis* E. et E. – He found it growing in the same stroma; WINTER 1887) observed the occurrence of spermogonia in Fung. eur., n. 1834, distributed under the name *Cucurbitaria ailanthi* RABENH. *St. microstylosporiferus* and relates this fungus to the genus *Diaporthe* NITS.; the findings of SACCARDO (1883) are the same as those of WINTER (1887).

WELCH (1926) has treated this fungus as a synonym of *C. elongata* (FRIES) GREV. without giving his reasons for doing so; a detailed comparison was made between the two fungi and enough differences were found to recognise *C. negundinis* as an independent species.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA AMORPHAE (WALLR.) FUCKEL

Symb. Myc., p. 174 (1869)

Synonyms: *Sphaeria amorphae* WALLR. – Fl. Crypt. Germ. *2*, p. 782 (1833).
Gibberidea amorphae KUNTZE – Rev. Gen. Pl. *3*^{2}, p. 481 (1898).
Pleosphaeria otagensis (LINDS) SACC. – Syll. *9*, p. 912 (1891).

MATRIX: On dead branches of *Amorpha fruticosa* L., *Sophora japonica* L. and *Sophora japonica* L. var. *pendula* LOUD.

MATERIAL EXAMINED: Rabenhorst, Fungi europaei, n. 1627, on *A. fruticosa,* from Germany, Baden, leg. JACK, in February 1873. — On *S. japonica,* from Switzerland, Kt. Bern, Alter Kirchhof bei Burgdorf, leg. H. WEGELIN, in spring 1888. — On *S. pendula,* from Switzerland, Kt. Bern, Alter Kirchhof bei Burgdorf, leg. H. WEGELIN, in April 1887 (not fully mature).

FRUIT BODIES: Gregarious in small groups or produced singly, diffused all over the substratum, erumpent, subglobose to obovate, collapsing at the top to form a small depression bearing ostiole, rarely cupulate, sometimes almost turbinate (broader than high), papilla lacking, from 360–570×360–520 μ in size. Peridium prominently rough, thickest near the ostiole due to the presence of a mass of hyaline cells, outermost almost black and thick walled, becoming lighter and thin walled towards inside, from 60–100 μ thick on sides, made up of polygonal cells 10–23 μ in diameter, sometimes elongated, from 25–30 μ

HYPOSTROMA: Rather well developed, a subiculum of dark-brown rather loosely interwoven hyphae, sometimes involving host tissue.

ASCI: Rather short stipitate, sometimes long, 2–8 spored, mostly 6 or 8, spores uniseriately arranged; from 175–225×11–15 μ in size.

SPORES: Light-golden-brown with subacute to obtuse ends, characteristically variable in form and shape, prominently constricted at middle septum, also at other septa but never with the same intensity, transverse septa 5–7, mostly 7, incomplete transverse septa also common, longitudinal septum mostly one, continuous or discontinuous, anterior end always broadest; from 22–32×9–13 μ in size (Pl. V — fig. 3, and Pl. XIII — fig. 5).

IMPERFECT STAGE: No cultural work has been done with this fungus; the following information is based on direct observations of herbarium material: SACCARDO (1883), WINTER (1887), and ROSTRUP (1913) are of the opinion that *Diplodia amorphae* (WALLR.) SACC. and *Camarosporium amorphae* SACC. are the imperfect stages of this fungus.

WELCH (1926) has treated this fungus as a synonym of *C. elongata;* microscopic examination has revealed that both these fungi differ in fruit body structure. The bases of the fruit bodies in the case of *C. elongata* are broadly conical, rather prominently elongated, sometimes even diffusing with the hypostroma, which is not the case in *C. amorphae.* The fungus, however, appears more closely related to *C. coronillae* from which it can be easily separated on the following grounds: The fruit bodies of the fungus *C. amorphae* are almost seated on a well developed hypostroma whereas they are embedded in a rather reduced hypostroma in the case of the latter.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA EMERI sp. nov.

Perithecia gregaria, erumpentia, turbinata vel obovata, 550—775×300—523 μ magnitudine. Peridium extus rugulosum, basaliter 24 μ crassitudine, lateraliter 35—160 μ crassitudine, cellulis polygonatis vel elongatis, 10—38×10—18 μ magnitudine compositum.

Hypostroma evolutum, subiculosum.

Asci bitunicati, stipitati, 2—8 spori, 150—220×11.5—15.5 μ magnitudine.

Sporae subfuscae, constrictae medio septo, transverse 3—7 septatae, 19—32×9—11 μ magnitudine.

Paraphysoides hyalinae, filiformes.

Status conidiophorus in culturis *Diplodia* FRIES.

Pycnidia 950—1550 × 450—600 μ magnitudine, oblongata, ostiolata, mycelio tecta.

Conidiae olivaceo-fuscae, oblongae, ellipsoideae, uniseptatae, 18—23×7—9 μ magnitudine.

Hab. in ramis emortuis *Coronillae emeri* L.

MATRIX: On dead branches of *Coronilla emerus* L.

MATERIAL EXAMINED: From Switzerland, Kt. St. Gallen, near first water fall on road from Weesen to Walensee, leg. F. MIRZA, in June 1967 (= ETH Culture Collection, n. 7115). Type! — As *Cucurbitaria coronillae* FR., Herbarium B. Jacob, from Switzerland, Kt. Neuchâtel, sur les rameaux desséchés, leg. (not mentioned), in October 1881. — From Switzerland, Kt. Wallis, Ardon, digue de la Lizerne près de la gare, leg. CH. TERRIER, in May 1947. — From Italy, Prov. Brescia, Limone, leg. H. KERN, in June 1949. — From Italy, Prov. Bergamo, Val di Scalve, leg. F. MIRZA, in June 1967. — From France, Montgenèvre, leg. E. MÜLLER, in June 1954.

FRUIT BODIES: Gregarious in large groups appearing 3—10 in sections, erumpent, turbinate to obovate, rarely oblong, collapsing at the top to become flat with a slight depression and a very nominal papilla bearing ostiole, sometimes broader than high; from 550—750×300—525 μ in size. Peridium slightly rough on surface, mostly thickest near the ostiole, sometimes also near the base as thick as 240 μ, on sides and tops from 35—160 μ thick, made up of polygonal cells, thick walled and darker in colour towards outside becoming somewhat elongated, thin walled and almost hyaline towards inside; from 10—18 μ in diameter and from 18—38×10—18 μ in size when elongated.

HYPOSTROMA: Very well developed, a subiculum of light-brown, rather loosely sinuate interwoven hyphae, hyphae sometimes penetrating deep into the host tissue.

ASCI: Short or long stipitate depending on the number of spores, 2—8 spored mostly 4 or 8, spores overlapping or uniseriately arranged; from 150—220×11.5—15.5 μ in size.

SPORES: Golden-brown with subacute to obtuse ends, variable in form and shape, prominently constricted at middle septum, sometimes also at other septa with less or the same intensity, transverse septa 3–7, mostly 6 or 7 incomplete transverse septa also common, longitudinal septum predominantly one continuous, sometimes two discontinuous; from 19–32× 9–11 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce dark-grey mycelium on 2% malt extract agar; the cultures when exposed to constant light at 18–21° C produced abundant pycnidia within 3–4 weeks.

PYCNIDIA: In cultures produced in groups of 4–20, embedded in subiculate hypostroma up to 2 mm high from the surface of the medium, mostly oblong to broadly fusiform or irregularly formed and fusing at the bases with a rudimentary papilla bearing ostiole; roughly from 950–1550×450–600 μ in size. Peridium well marked, surface provided with abundant mycelial growth, made up of thick walled polygonal cells, outermost darker than inner, inner surface undulating, forming cavities of various shapes, giving rise to conidia without conidiophores of any sort.

CONIDIA: Olive-brown, invariably oblong with round ends, sometimes anterior end broadest, transverse septum one, from 18–23×7–9 μ in size. Comparable to genus *Diplodia* FRIES (Pl. VI – fig. 1, Pl. X – fig. 3, Pl. XI – fig. 7, and Pl. XIII – fig. 6).

In fruit body shape and structure the fungus *C. emeri* appears closely related to *C. elongata* and *C. coronillae;* it has been described as a new species on the firm bases of its imperfect stage. Other morphological points of distinction along with a comparison with related species are given on page 195.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA CYTISI sp. nov.

Synonym: *Cucurbitaria laburni* (PERS. ex FRIES) CES. et DE NOT. fa. *cytisi sessilifolii* REHM – Hedwigia 30, p. 261 (1891) (Sine diagn.).

Perithecia gregaria, erumpentia, tuberosa vel subovata, apice plano, 300–700 µ altitudine et 350–610 µ crassitudine. Peridium extus rugulosum, ad ostiolum et basaliter crassius, lateraliter 55–100 µ crassitudine, cellulis polygonatis vel elongatis, 10–28 µ magnitudine compositum.

Hypostroma evolutum, raro vix manifestum, subiculosum, hyphis confusis compositum, pseudoparenchymatum.

Asci bitunicati, stipitati, 2–8 spori, 140–200×13–15 µ magnitudine.

Sporae ellipsoideae, uniseriatae, atrofuscae vel pallide fuscae, 18–26×7,5–10 µ magnitudine, transverse 3–7 septatae, medio nonnunquam ad altera septa verum constrictae, loculis uno septo longitudinali divisis.

Paraphysoides hyalinae, filiformes.

Status conidiophorus in culturis *Camarosporium* SCHULZ.

Pycnidia suglobosa, mycelio tecta, ostiolata, 325—610 μ magnitudine. Peridium 30—60 μ crassitudine.

Conidiae pallide- vel atrofuscae, oblongae vel ovata, transverse triseptatae, loculis 1—2 septis longitudinalis divisis.

Hab. in ramis emortuis *Cytisi sessilifolii* L.

MATRIX: On dead branches of *Cytisus sessilifolius* L., *Cytisus capitatus* SCOP., *Genista pilosa* L. and *Genista cinerea* L.

MATERIAL EXAMINED: On *C. sessilifolius*, from France, A.M., Tende, Val Rio Freddo, leg. E. MÜLLER, in May 1967 (= ETH Culture Collection, n. 7116). Type! — On *C. sessilifolius*, from France, Col de Brouis, leg. E. MÜLLER, in May 1967 (= ETH Culture Collection, n. 7114). — On *C. sessilifolius*, from France, A.M., Roya Valley, Val Cairos, leg. E. MÜLLER, in May 1967 (= ETH Culture Collection, n. 7113). — On *C. sessilifolius*, from France, A. M., Cipières, leg. E. MÜLLER, in June 1957 (= ETH Culture Collection, n. 2729). — On *C. sessilifolius*, from Italy, Prov. Bergamo, Iseosee, leg. E. MÜLLER, in June 1967 (= ETH Culture Collection, n. 7122). As *Cucurbitaria laburni* (PERS. ex FRIES) CES. et DE NOT. fa. *cytisi sessilifolii* REHM: On *C. sessilifolius*, REHM, Ascomyceten, n. 146 b, from Botanischer Garten, Berlin, leg. DR. HENNINGS, in 1890. — On *C. capitatus*, from Italy, Passo di Tre Termini, leg. H. KERN, in June 1967 (= ETH Culture Collection, n. 7124). — On *G. pilosa*, from France, A.M., Tende, leg. E. MÜLLER et J. GRUNER, in May 1967 (= ETH Culture Collection, n. 7112). — On *G. cinerea*, from France, A.M., Caussols, leg. LOEFFLER, in June 1956.

FRUIT BODIES: Gregarious in groups of 2—8, erumpent, sometimes fusing near the bases, mostly turbinate to obovate, collapsing at the top to become flat, sometimes elongated when dorsoventrally compressed in dense groups or almost subglobose when produced in loose groups, top remaining prominently flat in all cases, ostiolate, papilla almost lacking or rarely represented by a small projection near the ostiole; from 300—700×350—610 μ in size. Peridium prominently rough on surface, thickest near the ostiole and base, from 75—160 μ thick, rarely more when bases abnormally thickened, on sides from 55—100 μ thick, made up of polygonal cells dark-brown in colour, from 15—23 μ in diameter, innermost cells nearly hyaline to very light-brown, mostly elongated, 10—28 μ long.

HYPOSTROMA: Mostly well developed, rarely rather reduced, a subiculum of light-brown, septate, sinuate, densely interwoven hyphae usually involving host tissue sometimes giving a pseudoparenchymatous appearance.

ASCI: With stipes of variable lengths, 2—8 spored mostly 4, 6 or 8, spores overlapping or uniseriately arranged; from 140—200×13—15.5 μ in size.

SPORES: Dark- to light-golden-brown with subacute to obtuse ends, prominently constricted at middle septum, also at others sometimes with the same intensity, spores with only a slight constriction at middle septum also common (the percentage of spores with broad ends was generally higher in fungi observed on other hosts than *Cytisus sessilifolius*, names mentioned before) transverse septa 3–7, predominantly 3 or 5, oblique transverse septa also present, longitudinal septum one continuous or discontinuous; from 18–26×7,5–10 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce dark-greenish-grey mycelium on 2% malt extract agar; the cultures produced abundant pycnidia at 18–21° C within 2–3 weeks in constant light.

PYCNIDIA: Dark-brown to almost black, subglobose to pyriform with a short papilla bearing ostiole, surface provided with abundant hairs; from 380–610 μ in diameter when globose or so and from 500–610× 325–500 μ in size when otherwise. Peridium rather thin, from 38–60 μ in thickness, outer composed of dark and thick walled cells, innermost nearly hyaline and thin walled giving rise to conidia.

CONIDIA: Light- to dark-brown with age, oblong to rarely ovate in form, ends obtuse, slightly constricted at transverse septa, transverse septa invariably 3, longitudinal septum one mostly discontinuous; from 10.5–15×4.5–7 μ in size. Comparable to the genus *Camarosporium* SCHULZ (Pl. VI – fig. 2, Pl. XI – fig. 9, and Pl. XIII – fig. 7).

No description of this fungus has ever been published. REHM (1891) quotes SACCARDO (1883) "quam vidi in *Cytiso sessilifolio* media videtur inter *C. elongatam* et *Laburni*." The opinion of REHM (1891) is as follows: "Es gibt auch keinen sicheren äußeren oder inneren Unterschied zwischen *C. Laburni, elongata, coluteae, amorphae*, welche wohl nur Formen mit Abweichungen je nach der Wirths-Pflanze sind."

The present studies reveal that the fungus *C. cytisi* has no close relationship with *C. laburni, C. coluteae* and *C. amorphae*. It, however, appears related to *C. elongata, C. coronillae* and *C. emeri;* a comparison of all the closely related species of the *C. elongata* group is given on page 195.

GEOGRAPHICAL DISTRIBUTION: Central Europe.

Table 7

Interrelationship between four closely related species of *C. elongata* Group

Characters	*C. elongata*	*C. coronillae*	*C. emeri*	*C. cytisi*
Fruit bodies	650—950×500—775 μ	380—550×300—480 μ	550—750×300—525 μ	300—700×350—610 μ
Peridium	prominently rough 100—180 μ thick	slightly rough 35—50 μ rarely upto 150 μ thick	slightly rough 30—160 μ thick	prominently rough 75—160 μ thick
Peridial cells	9—24 μ in diam.	6—15 μ in diam.	10—18 μ in diam.	15—23 μ in diam.
Hypostroma	very well developed hyphae thick loosely woven	rather poorly developed hyphae sinuate closely woven	very well developed hyphae sinuate closely woven	well developed to reduced, hyphae sinuate closely woven
Asci	140—225×14—18 μ	150—220×11.5—15.5 μ	150—220×11.5—15.5 μ	140—200×13—15.5 μ
Spores	21—38×8—12 μ transv. sep. 3—7 long. sep. 1—2	19—27(35)×9—12 μ transv. sep. 3—7 long. sep. 1	19—32×9—11 μ transv. sep. 3—7 long. sep. 1—2	18—26×7.5—10 μ transv. sep. 3—7 long. sep. 1
Imperfect stage	*Camarosporium* type transv. sep. 3—5 13—21×7—11 μ	*Camarosporium* type transv. sep. 3—5 10.5—15×4.5—6 μ	*Diplodia* type transv. sep. 1 18—23×7—9 μ	*Camarosporium* type transv. sep. 3 10.5—15×4.5—7 μ
Perfect stage	not developed	developed	not developed	not developed

Key to the Species of *C. spartii Group*

1 — Spores having not more than 6 transverse septa 2

1*— Spores having more than 6 transverse septa 3

2 — Spores having 3—5 transverse septa, ostiole funnel shaped .... *C. varians* (p. 197)

2*— Spores having 3—6 transverse septa, ostiole papillate ..... *C. rubefaciens* (p. 198)

3 — Fruit bodies with hairs on the surface, papilla lacking ..... *C. evonymi* (p. 198)

3*— Fruit bodies without hairs on the surface, papilla prominent 4

4 — Hypostroma rather well developed, peridium less than 55 µ thick ..... *C. elaeagni* (p. 199)

4*— Hypostroma poorly developed, peridium more than 55 µ thick 5

5 — Spores not more than 25 µ in lenght, fruit bodies as large as 250 µ in diameter ..... *C. crataegi* (p. 200)

5*— Spores longer than 25 µ, fruit bodies larger than 250 µ in diameter 6

6 — Spores with transverse septa, dark, more than one longitudinal septum and constrictions at other than middle septum common ..... *C. coluteae* (p. 201)

6*— Spores with transverse septa, lighter in colour, more than one longitudinal septum and constrictions at other than middle septum uncommon ..... *C. spartii* (p. 202)

CUCURBITARIA VARIANS HAZSL.

Verh. zool.-bot. Ges. Wien 15, p. 451 and fig. 15 (1865)

Synonyms: *Dothidea lycii* DUBY — in Exs. Fungi eur., n. 55.
Cucurbitaria lycii (HAZSL.) PETR. — in Exc. Fl. Boh. et Mor., n. 11/1.
Pleomassaria varians (HAZSL.) WINTER — Rabh. Crypt. Fl. 2, p. 552 (1887).

MATRIX: On dead branches of *Lycium halimifolium* MILL. and *Lycium bararum* L.

MATERIAL EXAMINED: Rabenhorst, Fungi europaei, n. 1537, on *L. barbarum*, from Czek., Brünn, leg. G. v. NIESSEL. — Flora exsiccata Austro-Hungarica, n. 785, on *L. barbarum*, from Czek., Brünn, leg. NIESSEL. — Ex herbario Dr. F. Petrak, Flora moravica, as *C. lycii*, on *L. halimifolium*, from Czek., Mähr. Weißkirchen, Garten, leg. F. PETRAK, in June 1923. — Ex herbario Dr. F. Petrak as *C. lycii* on *L. halimifolium*, from Germany, Brandenburg, Ruhlsdorf, leg. H. et P. SYDOW, in May 1926. — F. Petrak Mycotheca generalis, on *L. halimifolium*, from Austria, Niederdonau bei Wien, leg. F. PETRAK, in June 1940.

FRUIT BODIES: Produced singly or in small groups of 2–3, never erumpent, globose to subglobose, papilla lacking, ostiole surrounded by a mass of hyaline cells giving a funnel shaped appearence; from 450–800 μ in diameter. Peridium thickest near the ostiole, outermost nearly black and thick walled, becoming thin walled and lighter in colour towards inside, from 45–140 μ thick, made up of polygonal cells 6–12 μ in diameter, cells usually elongated in the innermost layer up to 18 μ.

HYPOSTROMA: Rather poorly developed, giving a pseudoparenchymatous appearence sometimes involving host tissue, rarely reduced to a plate-like structure below the fruit bodies, scanty on sides.

ASCI: Short or long stipitate, 6–8 spored, spores overlapping or uniseriately arranged, sometimes showing a slight tendency towards biseriation specially in the middle of the ascus, asci thickest at the top, from 180–230×11–18 μ in size.

SPORES: Golden-brown with obtuse ends, in some strains broadest in the middle, invariably constricted at every septum with more or less the same intensity, transverse septa 3–5, mostly 3 or 4 , longitudinal septum mostly one, continuous or discontinuous, rarely lacking, end cells in some strains prominently lighter in colour; from 20–32×9–13 μ in size (Pl. VI – fig. 3, and Pl. XIII – fig. 8).

IMPERFECT STAGE: No cultural work has been done with this fungus; the information given below is based on direct examination of herbarium material by the following mycologists: HAZSLINSZKY (1865) mentions *Hendersonia* BERK. and *Coryneum* NEES. to represent stylospores; SACCARDO (1883) reports *Karstenulla varians* (HAZSL.) SACC.; WINTER (1887)

wrote this fungus to produce conidia of *Sporidesmium lycii* NIESSL and *Seimatosporium lycii* KALCHBR., and he also believed *Staurosphaeria lycii* RABH. to be another pycnidial stage; PETRAK (1924), is of the opinion that *C. varians* produces conidia of *Diplodia* FR. and *Camarosporium* SCHULZ Type.

GEOGRAPHICAL DISTRIBUTION: Middle Europe.

CUCURBITARIA RUBEFACIENS PETRAK

Ann. Mycol. *21*, p. 242 (1923)

MATRIX: On dead branches of *Salix caprea* L.

MATERIAL EXAMINED: Dr. F. Petrak, Mycotheca generalis, n. 68, from Czek., Mähr. Weißkirchen, leg. F. PETRAK, in April 1927. — Flora Moravica, from Czek., Mähr. Weißkirchen, leg. F. PETRAK, in 1927.

FRUIT BODIES: Usually in groups of 2—3 or produced singly, remaining below the bark, later erumpent by a small papilla bearing ostiole, globose to subglobose, sometimes laterally compressed when born in groups, from 425—525 μ in diameter; peridium almost uniform becoming thick near the ostiole by a mass of hyaline cells, outermost nearly opaque becoming lighter in color towards inside, from 35—70 μ thick made up of polygonal cells 9—14 μ in diameter.

HYPOSTROMA: Rather well developed, consisting of thin, dark-brown, densely interwoven hyphae giving a pseudoparenchymatous appearance, sparsely arranged on the sides of the fruit bodies.

ASCI: Mostly long stipitate, sometimes short, 4—8 spored, predominantly 8, spores overlapping uniseriately arranged, rarely showing a slight tendency towards biseriation; from 110—175$\times$11—14 μ in size.

SPORES: Light-brown with obtuse to subacute ends, ends comparatively lighter in colour, overall shape ranging from broadly fusiform to oblanceolate, prominently constricted at middle septum, slightly at others, transverse septa 3—6, mostly 3 or 5, longitudinal septa never more than one in each segment, continuous or discontinuous; from 21—24$\times$8—10 μ in size (Pl. VII — fig. 1, and Pl. XIII — fig. 9).

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA EVONYMI COOKE

Grevillea *3*, p. 67 (1874—75)

Synonym: *Cucurbitaria spartii* NEES. f. *Evonymi* REHM — in exs. Rehm Ascom., n. 682 (1883); Hedwigia *22*, p. 54 (1883).

MATRIX: On dead branches of *Evonymus europaeus* L.

MATERIAL EXAMINED: As *C. spartii* f. *Evonymi*, in Rabenhorst — Winter, Fungi europaei, n. 3153, from Czek., Vere, leg. W. KRIEGER, in 1882.

FRUIT BODIES: Gregarious in small groups or produced singly, remaining below the bark, subglobose to dorsoventrally compressed, papilla lacking, upper portion almost flat bearing ostiole from 600—750×550—625 μ in size; peridium rather thick from 80—150 μ, surface almost black, provided with hairs, becoming lighter in colour towards inside, made up of polygonal cells from 6—12 μ in diameter, sometimes elongated up to 18 μ.

HYPOSTROMA: Very well developed, composed of sinuate, dark-brown, interwoven hyphae giving a plectenchymatous appearence.

ASCI: Predominantly short stipitate, rarely long, regularly 8 spored, spores overlapping or uniseriately arranged; from 170—225×10—13 μ in size.

SPORES: Light-brown with subacute ends, prominently constricted at middle septum, only rarely and slightly constricted at other septa, transverse septa 5—8, mostly 5 or 7, longitudinal septum one continuous or discontinuous, anterior end broadest; from 23—26×10—13 μ in size.

The fungus *C. evonymi* is closely related to *C. spartii* NEES. but the absence of papilla and presence of hairs in the case of *C. evonymi* are differences enough to recognise it as an independent species although there is almost no difference in the spores.

GEOGRAPHICAL DISTRIBUTION: Central Europe and Africa (Congo).

CUCURBITARIA ELAEAGNI sp. nov.

Synonym: *C. caraganae* KARSTEN var. *Elaeagni* REHM — Brenckle, Mycologia *9*, p. 279 (1917) (Sine diagn.).

Perithecia dispersa, sub corticem nascentia, deinde paulo erumpentia, globosa vel subglobosa, 400—520 μ diam. Peridium extus paulo rugulosum, 35—50 μ crassitudine, cellulis polygonatis elongatis, 12—20 × 7—13 μ magnitudine compositum.

Hypostroma evolutum, subiculosum.

Asci bitunicati, breviter stipitati, octospori (raro 4—8 spori), 200—400 × 15—18 μ magnitudine.

Sporae ellipsoideae, subfuscae, uni- vel biseriatae, 26—33 × 10—12 μ magnitudine, transverse 5—7 septatae, medio verum constrictae, ad altera septa raro et parum constrictae, loculis 1—2 septis longitudinalis divisis.

Paraphysoides hyalinae, filiformes.

Hab. in ramis emortuis *Elaeagni angustifoliae* L.

MATRIX: On dead branches of *Elaeagnus angustifolia* L. and *Elaeagnus argentea* PURSH.

MATERIAL EXAMINED: Fungi Dakotenses, Brenckle, n. 477, on *E. angustifolia*, from North America, Kulm, North Dakota, leg. J. F. BRENCKLE, in June 1920, Type! — Fungi Dakotenses, Brenckle, n. 306, on *E. argentea*, from Nort America, Bjur farm, leg. J. F. BRENCKLE, in July 1914. — North Dakota Fungi, n. 758, on *E. argentea*, from North America, Bjur farm, leg. J. F. BRENCKLE, in July 1914.

FRUIT BODIES: Borne diffusedly overall the substratum, never very close to each other, produced under the bark, later partially erumpent through a small papilla bearing ostiole, globose to subglobose, sometimes dorsoventrally compressed, from 400–520 μ in diameter. Peridium slightly rough on surface, somewhat thickened near the ostiole; from 35–50 μ thick, made up of elongated polygonal cells almost hyaline towards inside, from 12–20×7–13 μ in size.

HYPOSTROMA: Well developed, a subiculum of brown densely interwoven hyphae regularly involving host tissue.

ASCI: Characteristically short stipitate, rarely longer, 4–8 spored mostly 8, spores overlapping uniseritaly or biseriately arranged; from 200–240×15–18 μ in size.

SPORES: Golden- to dull-brown with subacute ends slightly lighter in colour, prominently constricted at middle septum, rarely and slightly at others, transverse septa 5–7, sometimes oblique, longitudinal septa up to 2, predominently 1, mostly continuous, sometimes discontinuous; from 26–33×10–12 μ in size (Pl. VII – fig. 2, and Pl. XIV – fig. 1).

No description of this fungus has ever been published. WELCH (1926) has treated this fungus as a synonym of *C. elongata* (FR.) GREV. Microscopic examination reveals that it has no relationship with either of the fungi *C. caraganae* KARST. and *C. elongata*, at least in fruit body structure. The fungus appears related to *C. spartii* (NEES) CES. et DE NOT. from which it can be separated on the basis of well developed hypostroma, thin peridium, shorter papilla and form of spores present in the case of *C. elaeagni*.

GEOGRAPHICAL DISTRIBUTION: North America.

CUCURBITARIA CRATAEGI (SCHW.) ELLIS et EVERHART

N. Am. Pyrenom., p. 240 (1892)

Synonyms: *Sphaeria crataegi* SCHW. — Trans. Am. Phil. Soc. 2^4, p. 207 (1832).
Gibberidea crataegi KUNTZE — Rev. Gen. Pl. 3^2, p. 481 (1898).
(*Cucurbitaria crataegi* NIESSL has been cited as synonym of *Fenestella princeps* TUL. by BERLESE (1900); ELLIS and EVERHART (1892) point out the difference between *C. crataegi* SCHW. and *C. crataegi* NIESSL.)

MATRIX: On dead branches of *Crataegus Oxyacantha* WALT, *Crataegus monogyna* JACQ. and *Crataegus mollis* SCHEELE.

MATERIAL EXAMINED: On *Crataegus monogyna*, from France, Alpes Maritimes, Antibes, leg. E. MÜLLER, in April 1959.

FRUIT BODIES: Gregarious in small groups of 2–4 or produced singly, erumpent, globose to subglobose, sometimes pyriform with nominal papilla bearing ostiole; from 200–250 μ in diameter when globose or so and from 190–230×130–170 μ in size when otherwise. Peridium rather uniform, thickest near the ostiole, surface prominently rough and dark, becoming lighter and thin walled towards inside, from 25–35 μ thick, made up of polygonal cells 7–14 μ in diameter, sometimes elongated up to 20 μ.

HYPOSTROMA: Well developed, composed of rather thick walled, bright brown, densely interwoven hyphae sometimes involving host tissue giving a pseudoparenchymatous appearence.

ASCI: Almost long stipitate, 4–8 spored, predominantly 8, spores obliquely uniseriate to almost horizontally arranged, some showing a tendency towards biseriation; from 115–175×11–14 μ in size, up to 23 μ thick when the spores are biseriately arranged.

SPORES: Dark-dull-brown with obtuse ends, prominently and almost characteristically constricted at middle and secondary septa, rarely at others, transverse septa 3–7, longitudinal septa one or two, mostly continuous, sometimes discontinuous, from 15–21×8–10 μ in size (Pl. VII – fig. 3, and Pl. IV – fig. 2).

WELCH (1926) excluded this species and proposed a relationship with the family Sphaeriaceae; taking into consideration the present concept of ascostromatic ascomycetes, the position of the fungus under the genus *Cucurbitaria* is reinstated.

GEOGRAPHICAL DISTRIBUTION: Central Europe and Arabia.

CUCURBITARIA COLUTEAE (RABH.) AUERSW.

Symb. Myc., p. 174 (1869)

Synonym: *Spaeria coluteae* RABH. – in Exs. Herb. Myc., n. 1239 (1849).

MATRIX: On dead branches of *Colutea arborescens* L.

MATERIAL EXAMINED: Rabenhorst, Fungi europaei, n. 2578, leg. AUERSWALD. – From France, Drôme, Grignan, leg. E. MÜLLER, in June 1956.

FRUIT BODIES: Produced singly or in groups of 2–5, remaining below the bark, later erumpent through a short papilla bearing ostiole, globose, subglobose to dorsoventrally or laterally compressed when in compact

groups, from 500–850 μ in diameter. Peridium almost uniform in thickness, from 55–100 μ, outermost darker and thicker than inner, made up of polygonal cells, 9–13 μ in diameter, sometimes elongated up to 29 μ.

HYPOSTROMA: Rather poorly developed, a subiculum of dark-brown interwoven hyphae dense below the fruit body, sparse on sides.

ASCI: Characteristically short stipitate, 2–8 spored, predominantly 8, spores overlapping or uniseriately arranged; from 170–290×16–18 μ in size.

SPORES: Light- to dark-olive-brown, ends obtuse, prominently constricted at middle septum, also at others with almost the same intensity, transverse septa 5–7, darker in colour, mostly 7, longitudinal septa usually 1 or 2 sometimes up to 3, continuous or discontinuous, from 30–37× 11–13 μ in size (Pl. VIII – fig. 1, and Pl. XIV – fig. 3).

IMPERFECT STAGE: The only informations available on the pycnidial stage of this fungus come from ROSTRUP (1913) and WINTER (1903) who report *Diplodia Coluteae* SCHNABL.

WELCH (1926) made this fungus a synonym of *Cucurbitaria elongata* (FRIES) GREV. Microscopic examination has revealed that it, however, has no similarity with *C. elongata;* in fruit body structure the fungus is close to *C. spartii,* from which it can be distinguished on the basis of an overall remarkably large size and dark septate spores (frequently-constricted) in the case of *C. coluteae.*

GEOGRAPHICAL DISTRIBUTION: Central Europe.

CUCURBITARIA SPARTII (NEES ex FRIES) CES. et DE NOT.

Comm. Soc. Critt. Ital. *1*, p. 214 (1863)

Synonyms: *Sphaeria spartii* NEES ex FRIES — Syst. Myc. 2, p. 424 (1823).

Cucurbitaria spartii CES. et DE NOT. — Comm. Soc. Critt. Ital. *1*, p. 214 (1863).

Gibberidea spartii O. KUNTZE — Rev. Gen. Plant 3^2, p. 481 (1898).

Cucurbitaria spartii fa. *Genistae tinctoriae* FUCKEL — Symb. Myc. 2, p. 32 (1873).

MATRIX: On dead branches of *Sarothamnus scoparius* (L.) WIMMER, *Genista tinctoria* L. and *Cytisus capitatus* SCOP.

MATERIAL EXAMINED: F. Petrak, Mycotheca generalis, n. 1909, on *S. scoparius* from Hungary, Budapest, leg. G. VON MOESZ, in Mai 1920. — On *S. scoparius* from Switzerland, Kt. Tessin, Monte Generoso, leg. F. MIRZA, in May 1966 (= ETH Culture Collection, n. 7019). — On *Cytisus capitatus* as *Cucurbitaria laburni* (PERS. ex FRIES) CES. et DE NOT.: F. Petrak, Mycotheca generalis, n. 1944, from Germany, Brandenburg, Tamsel, Baumschulen, leg. P. VOGEL, in May 1929.

FRUIT-BODIES: Mostly produced singly, also in small groups of 2–4, remaining below the bark, later erumpent by a prominently short papilla bearing ostiole, globose to rarely subglobose, from 380–670 μ in diameter. Peridium rather uniform in thickness from 45–96 μ, outermost comparatively darker and thick walled becoming lighter and thin walled towards inside, made up of polygonal cells 14–24 μ in diameter.

HYPOSTROMA: Poorly developed, a subiculum sometimes reduced to a tomentum of interwoven brown hyphae rarely involving host tissue, usually from 20–100 μ thick below the fruit bodies.

ASCI: Rather short stipitate, 2–8 spored, predominantly 8, spores uniseriately arranged; from 150–242$\times$14–16 μ in size.

SPORES: Brown with obtuse to rarely subacute ends, prominently constricted at middle septum also at others but never with the same intensity, transverse septa 3–7, mostly 7, longitudinal septa mostly 1, rarely 2, continuous or discontinuous; from 21–35$\times$9–12 μ in size.

CULTURAL CHARACTERISTICS: The ascospores germinated to produce scanty white mycelium (turning to light-grey with age) on 2% malt extract agar; under room conditions the cultures produced a few pycnidia within 6–8 weeks, in total darkness the mycelium remained sterile. The time for pycnidial production was reduced to half if the cultures were incubated in constant light. Germination tests were performed with the microconidia produced in cultures, they germinated readily in 2% malt water with coenocytic germ tubes and subsequently gave rise to normal colonies. Under certain conditions of nutrition and environment (see table 1) the cultures produced perfect fruit bodies; the ascospores were similar to those observed from natural hosts but the fruit bodies were irregularly formed.

PYCNIDIA: Globose to oblong or irregular in form, surface provided with abundant hair-like outgrowths (ostiole not observed), peridium outermost dark and thick walled, innermost thin walled and darkly staining, giving rise to short, septate, sometimes branched conidiophores bearing microconidia; roughly from 300–575 μ in diameter.

MICROCONIDIA: Bacilliform, hyaline, from 4–6$\times$1–2 μ in size (Pl. VIII – fig. 2, Pl. XI – fig. 2, and Pl. XIV – fig. 4).

GEOGRAPHICAL DISTRIBUTION: Europe.

Key to the Species of *C. indigoferae* Group

1 — Fruit bodies produced in large groups of more than three 2

1*— Fruit bodies produced singly, never more than three 4

2 — Surface of the fruit bodies provided with hairs, spores having more than 7 transverse septa ..... *C. sorbi* (p. 204)

2*— Surface of the fruit bodies without hairs, spores having not more than 7 transverse septa 3

3 — Spores almost hyaline, transverse septa never more than 7 .. *C. indigoferae* (p. 205)

3*— Spores golden-brown transverse septa less than 7 (4) ..... *C. alni* (p. 205)

4 — Spores predominantly constricted at middle septum, constrictions at other septa rare, longitudinal septa up to three in each segment ..... *C. ribis* (p. 206)

4*— Spores predominantly constricted at every septum, constrictions only at middle septum rare, longitudinal septa never more than two in each segment ..... *C. ignavis* (p. 207)

CUCURBITARIA SORBI KARSTEN

Myc. Fenn. 2, p. 62 (1873)

Synonym: *Gibberidea sorbi* KUNTZE — Rev. Gen. Pl. 3^2, p. 481 (1898).

MATRIX: On dead branches of *Sorbus aucuparia* L., *Sorbus aria* CRANTZ and *Sorbus americana* MARSH.

MATERIAL EXAMINED: On *Sorbus aria*, from Switzerland, Kt. Graubünden, Davos, Stillberg (Dischmatal), leg. E. MÜLLER, in September 1963.

FRUIT BODIES: Characteristically in large groups appearing 2—8 in sections, erumpent at maturity, subglobose, oblong, ovate or obovate to more or less pyriform, papilla lacking, slightly collapsing at the top to become flat, bearing ostiole; from 500—950×275—775 μ in size. Peridium outside almost carbonaceous, bearing characteristic hairs, becoming lighter and thin walled towards inside, from 60—100 μ thick, made up of polygonal cells 6—12 μ in diameter.

HYPOSTROMA: Well developed, a subiculum of dark-brown rather loosely interwoven hyphae, sometimes involving host tissue.

ASCI: Characteristically with long undulating stipes, 2—8 spored predominantly 6 or 8, spores overlapping or uniseriately arranged; from 230—310×18—21 μ in size.

SPORES: Golden-brown, mostly with obtuse ends sometimes more or less acute, prominently constricted at middle septum but never at other septa, anterior end broadest, transverse septa 6—10, mostly 6 to 8, longitudinal septa up to 3 continuous or discontinuous, from 26—34×11—15 μ in size (Pl. IX — fig. 1, and Pl. XIV — fig. 5).

WELCH (1926) excluded this fungus from the genus; he proposed a relationship to the family Sphaeriaceae. In the light of our present knowledge of ascostromatic ascomycetes the position of the fungus under the genus *Cucurbitaria* is reinstated.

GEOGRAPHICAL DISTRIBUTION: Central Europe and North America.

CUCURBITARIA INDIGOFERAE MÜLLER et AHMAD

Biologia, Vol. 3, n. 1, June (1957)

MATRIX: On dead branches of *Indigofera gerardiana* GRAH.

MATERIAL EXAMINED: (Type) from W. Pakistan, Changla-gali, leg. S. AHMAD, in August 1954.

FRUIT BODIES: Produced singly or in groups of 2–6, remaining under the bark, becoming erumpent at maturity, globose to subglobose, sometimes pear shaped with a comparatively long papilla bearing ostiole, roughly from 250–350 μ in diameter; peridium almost smooth, outer dark and thick walled than inner, from 30–50 μ thick, made up of polygonal cells 6–10 μ in diameter.

HYPOSTROMA: Rather much reduced, sometimes to only a plate like structure, made up of polygonal cells 6–10 μ in diameter, giving a pseudoparenchymatous appearence.

ASCI: Short stipitate, 8 spored, spores uni- or almost biseriately arranged; from 80–90 × 10–12 μ in size.

SPORES: Subhyaline to light-brown, anterior end mostly broadest, prominently constricted at middle septum, also at others with almost the same intensity, transverse septa 3–7, mostly 3 or 6, longitudinal septum one nearly always discontinuous; from 18–27 × 5.5–8 μ in size (Pl. VIII – fig. 3, and Pl. XIV – fig. 6).

GEOGRAPHICAL DISTRIBUTION: Asia (West Pakistan).

CUCURBITARIA ALNI sp. nov.

Perithecia gregaria, erumpentia, subglobosa vel obovata, 415–725 × 310–570 µ magnitudine. Peridium rugulosum, crassum ad ostiolum carbonaceum, 35–100 µ crassitudine, cellulis polygonatis vel elongatis 10–20 × 5–10 µ magnitudine compositum.

Hypostroma evolutum, subiculosum.

Asci stipitati, bitunicati, 6–8 spori, 175–225 × 7–8 µ magnitudine.

Sporae uniseriatae, subfuscae, medio septo constrictae, transverse 3–4 septatae, 16–22 × 7–8 µ magnitudine.

Paraphysoides hyalinae, filiformes.

Hab. in ramis emortuis *Alni viridis* LAM. et D. C.

MATRIX: On dead branches of *Alnus viridis* LAM. et D. C.

MATERIAL EXAMINED: From Switzerland, Kt. Graubünden, Arosa, Alpenblick, leg. E. RAHM, in July 1966. Type!

FRUIT BODIES: Gregarious in large groups, sometimes fusing together or appearing one above the other in sections, erumpent, subglobose to oblong or ovate to almost pyriform with prominent papilla bearing ostiole; from 415–725×310–570 μ in size; peridium rough characteristically thick and almost carbonacious near the ostiole, from 35–100 μ thick, made up of polygonal cells thickened at the corners up to 10 μ in diameter and from 15–20×5–10 μ in size when elongated.

HYPOSTROMA: Very well developed, a subiculum of thin brown densely interwoven hyphae regularly involving host tissue which imparts an overall orange-red colour to the hypostroma.

ASCI: Rather long stipitate, 6–8 spored mostly 8, spores uniseriately arranged, from 175–225×7–8 μ in size.

SPORES: Golden-brown with obtuse ends, prominently constricted at middle septum, also at other septa sometimes with the same intensity, anterior end always broadest, transverse septa 3–4 mostly 3 darker in colour, longitudinal septum one, continuous or discontinuous; from 16–22×7–8 μ in size (Pl. IX – fig. 2, and Pl. XIV – fig. 7).

In fruit body structure the fungus is somehow related to *C. indigoferae* from which it can be separated by the presence of subiculate hypostroma and almost hyaline spores in case of the former.

The other fungus described on *Alnus glutinosa* is *C. moravica* which appears to have no close relationship with *C. alni*.

GEOGRAPHICAL DISTRIBUTION: Middle Europe.

CUCURBITARIA RIBIS NIESSL

Verh. Naturfor. Ver., Brünn *10*, p. 198, (1871)

Synonyms: *Sphaeria ribis* FRIES — Syst. Myc. 2, p. 413 (1823).
Gibberidea ribis KUNTZE — Rev. Gen. Pl. 3^2, p. 481 (1898).

MATRIX: On dead branches of *Ribes rubrum* L.

MATERIAL EXAMINED: Fungi of West Pakistan, n. 18747, from W. Pak., Ziaret, leg. S. AHMAD, in June 1964. — Flora moravica, from Czek., Mähr. Weißkirchen, Garten, leg. F. PETRAK, in April 1934.

FRUIT BODIES: Produced singly or in groups of 2–3, on decorticated wood, subglobose to pear shaped with prominent papilla bearing ostiole;

from 325–430×300–410 μ in size; peridium with rough undulating surface, almost black, becoming thin walled and lighter in colour towards inside, made up of polygonal cells 7–10 μ in diameter.

HYPOSTROMA: Rather well developed, made up of thin, brown, closely interwoven hyphae sometimes involving host tissue, giving an obliterated plectenchymatous appearance, rarely reduced to a plate-like structure.

ASCI: Mostly short stipitate, 4–8 spored predominantly 6 or 8, spores overlapping or uniseriately arranged; from 160–230×14–16 μ in size.

SPORES: Dark-olive-brown, with obtuse to subacute ends, predominantly constricted at middle septum, rarely at others, in some strains anterior end broadest, transverse septa 3–8, longitudinal septa 1–3 continuous or discontinuous; from 26–31×10–12 μ in size, rarely as small as 21×9 μ (Pl. X – fig. 2, and Pl. XIV – fig. 8).

IMPERFECT STAGE: No cultural work has been done with this fungus; the following information is based on direct observation of herbarium material by ROSTRUP (1913) and GROVE (1937) who believe *Diplodia ribis* SACC. to represent the imperfect stage of *C. ribis*.

GEOGRAPHICAL DISTRIBUTION: Central Europe and Asia (West Pakistan).

CUCURBITARIA IGNAVIS DE NOT.

Sferiac. ital., p. 61 and Taf. 58 (1863)

Synonyms: *Teichospora ignavis* KARSTEN — Mycol. Fenn. 2, p. 65 (1873).
Teichospora morthieri FUCKEL — Symb., p. 61 (1869).
Strickeria ignavis WINTER — Hedwigia, n. 10, p. 175, (1880).

MATRIX: On dead branches of *Lonicera coerulea* L., *Lonicera nigra* L. and *Salix* sp.

MATERIAL EXAMINED: On *L. coerulea*, from Switzerland, Kt. Graubünden, Bergün, Val Tuors, leg. E. MÜLLER, in July 1961. — On *L. nigra*, from Switzerland, Kt. Wallis, Aletschwald, alter Belalpweg, leg. E. MÜLLER, in September 1962. — On *Salix* sp., from France, Hautes Alpes, St. Veran, Kupferminen, leg. E. MÜLLER, in August 1954. — Fungi of Pakistan, n. 4793, on *Lonicera* sp., from W. Pak., Shogran, 6500 ft., leg. S. AHMAD, in July 1951.

FRUIT BODIES: Usually produced singly, sometimes in large or small groups, remaining below the bark, later erumpent, globose to subglobose or irregular in form with a very rudimentary papilla bearing ostiole, roughly from 500–700 μ in diameter; peridium with undulating rough surface, sometimes with hair-like projections, very variable in thickness up to 80 μ, outermost darker and thicker walled than inner.

HYPOSTROMA: Poorly developed mostly as thin as 5–8 μ, very rarely up to 15 μ, made up of isodiametric parenchyma.

Asci: Characteristically short stipitate, regularly 8 spored, spores uniseriately arranged; from 120–160×16–18 μ in size.

Spores: Brown, predominantly with obtuse ends, prominently constricted at middle septa, also at others but never with the same intensity, transverse septa 6–8, longitudinal septum one or two, mostly continuous, sometimes discontinuous, 20–30×8–10 μ in size (Pl. IX – fig. 3, and Pl. XIV – fig. 9).

Macro- and Microconidia: Cultural studies with this fungus were done by Müller (1963) who found two types of pycnidia, one comparable to *Camarosporium polymorphum* de Not. which he considers a synonym of *Camarosporium xylostei* Sacc.; the second type he designates as microconidia comparable to genus *Leptophoma* von Höhn.

Geographical Distribution: Central Europe and Asia (West Pakistan).

ACKNOWLEDGEMENTS

The present investigations were carried out at the Department of Special Botany of The Swiss Federal Institute of Technology, Zürich. I am deeply indebted to Dr. E. Müller without whose help this work would not have been possible. I wish to thank the Conservator, Riksmuseet, Botanical Division, Stockholm, for sending me the type material for *C. moravica* and *C. caraganae* var. *elaeagni*. My thanks are also due to Prof. Dr. S. Ahmad of Govt. College, Lahore for sending valuable material for new species and who also recommended me to this institute.

I am greatful to the Govt. of Pakistan for providing me the finances for my stay in Switzerland.

SUMMARY

The limits of the genus *Cucurbitaria* S. F. Gray have been extended, many of the species excluded by Welch (1926) have been reinstated under the genus. 28 of the species belonging to the genus have been described, 27 have been drawn. The species mentioned in this work have been discussed under four groups viz. *C. berberidis, C. elongata, C. spartii* and *C. indigoferae* groups.

Pycnidial stages of *C. berberidis, C. laburni, C. ahmadi, C. elongata, C. coronillae, C. cytisi, C. emeri* and *C. spartii* have been studied in culture. *C. spartii* and *C. coronillae* also produced perfect fruit bodies in culture.

Nutritional studies have revealed that the five species tested, namely *C. berberidis, C. elongata, C. spartii, C. laburni* and *C. ahmadi* are not able to utilize Nitrogen in the form of Nitrite. *C. ahmadi* was self sufficient in its vitamin requirements, multiple deficiency for Thiamin and Biotin was found in the rest of them.

ZUSAMMENFASSUNG

Die taxonomischen Grenzen der Gattung *Cucurbitaria* S. F. Gray wurden erweitert und viele der von Welch (1926) aus der Gattung ausgeschlossenen

Arten wieder in diese aufgenommen. 28 zur Gattung gehörende Arten wurden beschrieben und 27 davon in Zeichnungen dargestellt. Die in der vorliegenden Arbeit erwähnten Arten wurden in die 4 Gruppen von *C. berberidis, C. elongata, C. spartii* und *C. indigoferae* eingeteilt.

Die Pyknidien als Nebenfruchtformen von *C. berberidis, C. ahmadi, C. elongata, C. coronillae, C. cytisi, C. emeri* und *C. spartii* wurden in Kulturversuchen untersucht. *C. spartii* und *C. coronillae* bildeten in Reinkultur auch Hauptfruchtformen.

Ernährungsversuche zeigten, daß 5 der untersuchten Arten — *C. berberidis, C. elongata, C. spartii, C. laburni* und *C. ahmadi* — Stickstoff in Form von Nitrit nicht verwenden können. In bezug auf Vitamine ist *C. ahmadi* autotroph, während die anderen Arten Thiamin und Biotin benötigen.

REFERENCES

Bauke, H. (1876) — Beiträge zur Kenntnis der Pyknidien. I. Nova Acta d. Ksl. Leopold. Carol. Deutsch. Ak. d. Naturforscher, vol. 38 (5), p. 439—512.

Berlese, A. (1900) — Icones Fungorum, vol. 2, 216 pages. Padova.

Brefeld, O., and von Tavel, F. (1891) — Untersuchungen aus dem Gesamtgebiete der Mycologie, 10. Heft. Ascomyceten. II, p. 21—278. Münster.

Brenckle, J. F. (1917) — North Dakota Fungi. I. Mycologia, vol. 9, p. 275—293.

Cesati, V., and de Notaris, G. (1863) — Schema di classificazione degli Sferiacei italici. Comment. Soc. Crittogram. Ital., vol. 1, Pt. 4, p. 177—240.

Cooke, M. C. (1874—75) — New British Fungi. Grevillea, vol. 3, p. 65—69. Leipzig.

Ellis, J. B., and Everhart, B. M. (1892) — North American Pyrenomycetes, 793 pages, 41 Plates. New Jersey.

Fries, E. M. (1823) — Systema Mycologicum, vol. 2, sectio II, 620 pages. Gryphiswaldiae.

— (1849) — Summa Vegetabilium Scandinaviae, sectio posterior, p. 259—572. Uppsala.

Fuckel, L. (1869—70) — Symbolae mycologicae. Beiträge zur Kenntnis der rheinischen Pilze. Jb. Nassauisch. Ver. Naturk., vol. 23—24, 459 pages. Wiesbaden. (Reprint Lehre 1967.)

— (1873—74) — Symbolae mycologicae. Beiträge zur Kenntnis der rheinischen Pilze. Jb. Nassauisch. Ver. Naturk., vol. 27—28. Zweiter Nachtrag. 99 pages. (Reprint Lehre 1967.)

Gäumann, E. (1964) — Die Pilze. Grundzüge ihrer Entwicklungsgeschichte und Morphologie, 2. Auflage, 541 pages. Basel.

Gray, S. F. (1821) — A Natural Arrangement of British Plants, vol. 1, p. 519.

Green, F. M. (1931) — Observations on *Cucurbitaria Laburni.* Transactions British Mycological Society, vol. 16, p. 289—303.

Greville, R. K. (1824—26) — Scottish Cryptogamic Flora, vol. 2, tab. 85; vol. 3, tab. 135; vol. 4, tab. 195. Edinburgh.

Grove, W. B.(1937) — British Stem and Leaf Fungi, 406 pages. London. (Reprint Lehre 1967.)

HAZSLINSKY, F. (1865) — Beitrag zur Kenntnis der Sphärien des Lyciums. Verhandlungen d. k. k. zoologisch-botanischen Gesellschaft in Wien (besonders abgedruckt) vom 5. Juli, p. 1—6, tab. 15.

v. HÖHNEL, F. (1903) — Mycologische Fragmente. XXX. Über *Crotonocarpia moriformis* FUCKEL. Annales Mycologici, vol. I, p. 522—534.

— (1919) — Fungi imperfecti. Beiträge zur Kenntnis derselben. Hedwigia, vol. 60, p. 129—209.

KARSTEN, P. A. (1873) — Dispositio systematica Pyrenomycetum. I. Pyrenomycetes proprii. Mycoligia Fennica, vol 2, 250 pages.

— (1878) — Observationes mycologicae. III. Meddel. of Soc. pro Fauna et Flora Fennica, vol. 2, p. 183—188.

KUNTZE, O. (1898) — Revisio generum plantarum, vol. 3 (2), 4. Fungi. p. 437—544. Leipzig.

KUNZE, G., and SCHMIDT, J. C. (1817) — Mykologische Hefte, vol. 1, 109 pages. Leipzig.

LINDAU, G. (1897) — Pilze. In: Engler and Prantl: Die natürlichen Pflanzenfamilien, Teil I, Abt. 1. Sphaeriales, p. 385—491.

LILLY, V. G., and BARNETT, H. L. (1951) — Physiology of the Fungi, 464 pages. New York.

LUTTRELL, E. S. (1951) — Taxonomy of Pyrenomycetes. The University of Missouri Studies, vol. 24, nr. 3, 120 pages. Missouri. (Reprint Lehre 1967.)

MASSENOT, M. (1964) — Sur quelques espèces de *Cucurbitaria* du Sud-Est de la France. Revue de Mycologie, vol. 29, 82—87.

MÜLLER, E. (1963) — Kulturversuche mit Ascomyceten. IV. Sydowia. Annales Mycologici II, vol. 16, Heft 1—6, p. 117—120.

MÜLLER, E., and AHMAD, S. (1957) — Über einige neue oder bemerkenswerte Ascomyceten aus Pakistan. II. Biologia, vol. 3. 1—18.

MÜLLER, E., and BAUMEISTER, G. (1957) — Kulturversuche mit drei *Cucurbitaria*-Arten. Sydowia. Annales Mycologici II, vol. 11, p. 70—75.

MUNK, A. (1953) — The System of Pyrenomycetes. Danish Botanish Arkiv, Bind 15, nr. 2, 163 pages. Copenhagen.

NANNFELDT, J. A. (1932) — Studien über die Morphologie und Systematik der nicht-lichenisierten inoperculaten Discomyceten. Nova Acta Regiae Societatis Scientiarum Upsaliensis, ser. IV, vol. 8, nr. 2, 368 pages.

NEES v. ESENBECK, E. C. G. (1817) — Das System der Pilze und Schwämme, vol. 38, 329 pages, 44 tab. Würzburg.

NIESSL, G. (1871—72) — Beiträge zur Kenntnis der Pilze. Beschreibung neuer und wenig bekannter Pilze. Ver. Naturfor. Ver., Brünn, vol. 10, p. 153—217.

DE NOTARIS, G. (1863) — Sferiacei italici, I, centuria (unica). Genova.

PERSOON, C. H. (1801) — Synopsis Methodica Fungorum, 706 pages. Gottingae.

PETRAK, F. (1923) — Mykologische Notizen. VI. Annales Mycologici, vol. 21, p. 182—335.

— (1924) — Mykologische Notizen. VII. Annales Mycologici, vol. 22, p. 1—182.

REHM, H. (1891) — Sammlungen Rehm. Ascomyceten, fasc. XXI. Hedwigia, vol. 30, Heft 5, p. 250—262.
— (1911) — Ascomycetes novi, 3 Ascomycetes asiatici. Annales Mycologici, vol. 9, p. 363—371.
— (1912) — Ascomycetes novi. V. A. Germania et Austria. Annales Mycologici, vol. 10, p. 387—397.

ROSTRUP, E. (1913) — Danish Fungi (Revised by J. Lind). 648 pages. Copenhagen.

SACCARDO, P. A. (1882) — Michelia, vol. 2, 682 pages. Patavii.
— (1883) — Sylloge Fungorum, vol. 2, 815 pages. Patavii.
— (1891) — Sylloge Fungorum, vol. 9, 1141 pages. Patavii.

SCHWEINITZ, L. D. (1832) — Synopsis Fungorum in America Boreali media degentium. Trans. of the American Phil. Soc., vol. 2 (4), 316 pages. Philadelphia. (Reprint Weinheim 1962.)

v. TAVEL, FR. (1886) — Beiträge zur Entwicklungsgeschichte der Pyrenomyceten. Dissertation (Universität Strassburg).

TEORELL, T., and STENHAGEN, E. (1938) — Ein Universalpuffer für den pH-Bereich 2,0 bis 12,0. Biochemische Zeitschrift, Band 299, p. 416—419.

THEISSEN, F., and SYDOW, P. (1918) — Vorentwürfe zu den Pseudophaeriales. Annales Mycologici, vol. 16, p. 1—34.

TODE, H. J. (1790) — Fungi Mecklenburgenses Selecti Lüneburgi (Lemke). Fasc. I. Nova Fungorum genera complectens, 4°, VIII et 47 pp. tabaeneis I—VII.

TUBEUF, C. (1886) — *Cucurbitaria laburni* auf *Cytisus laburnum*. Bot. Centralbl., vol. 26, p. 229, 278, 310, 352; vol. 27, p. 23, 74, 123, 173.

TULASNE, L. R. and C. (1863) — Selecta Fungorum Carpologia, vol. 2, 319 pages, 34 Pl. Paris.

WALLROTH, K. F. W. (1833) — Flora Cryptogamica Germaniae, Pars 2, 923 pages. Norimbergae.

WELCH, D. S. (1926) — A monographic study of genus *Cucurbitaria* in North America. Mycologia, vol. 18, nr. 2, p. 51—86.

WINTER, G. (1872) — Pyrenomycetes novi austriaci. Hedwigia, nr. 10, p. 145—160.
— (1880) — Mykologisches aus Graubünden (Schluss). Hedwigia, nr. 11, p. 170—184.
— (1882) — Rehm: Ascomyceten, fasc. XIII. Hedwigia, nr. 6, p. 81—96.
— (1887) — Rabenhorst's Kryptogamen-Flora: Die Pilze, vol. 2, 928 pages. Leipzig. (Reprint Weinheim 1963.)
— (1903) — Rabenhorst's Kryptogamen-Flora: Die Pilze, vol. 7, 1072 pages. Leipzig. (Reprint Weinheim 1963.)

EXPLANATION OF PLATES 69 (1)—82 (14)

PLATE 69 (1)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. pilosa*, × 100. Fig. 2. *C. berberidis*, × 60. Fig. 3. *C. caraganae*, × 60.

PLATE 70 (2)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. ahmadi*, × 100. Fig. 2. *C. laburni*, × 60.

PLATE 71 (3)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. halimodendri*, × 100. Fig. 2. *C. dulcamarae*, × 100. Fig. 3. *C. elongata*, × 60.

PLATE 72 (4)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. ononidis*, × 100. Fig. 2. *C. acervata*, × 100. Fig. 3. *C. rhamni*, × 100.

PLATE 73 (5)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. coronillae*, × 100. Fig. 2. *C. negundinis*, × 100. Fig. 3. *C. amorphae*, × 100.

PLATE 74 (6)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. emeri*, × 100. Fig. 2. *C. cytisi*, × 100. Fig. 3. *C. varians*, × 100.

PLATE 75 (7)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. rubefaciens*, × 100. Fig. 2. *C. elaeagni*, × 100. Fig. 3. *C. crataegi*, × 200.

PLATE 76 (8)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. coluteae*, × 60. Fig. 2. *C. spartii*, × 100. Fig. 3. *C. indigoferae*, × 200.

PLATE 77 (9)

(a) Fruit bodies in vertical sections. (b) Asci with spores, × 1000. — Fig. 1. *C. sorbi*, × 60. Fig. 2. *C. alni*, × 100. Fig. 3. *C. ignavis*, × 100.

PLATE 78 (10)

Fig. 1. *C. berberidis* culture pycnidium in vertical section, × 500. Fig. 2a. *C. ribis* fruit body in vertical section, × 200. Fig. 2b. *C. ribis* ascus with spores, × 1000. Fig. 3. *C. emeri* culture pycnidium in vertical section, × 100.

PLATE 79 (11)

Fig. 1. *C. ahmadi* culture pycnidium in vertical section, × 300. Fig. 2. *C. spartii* culture microconidia and stages of germination, × 4000. Fig. 3. *C. berberidis* culture microconidia and stages of germination, × 4000. Fig. 4. *C. elongata*

culture conidia, × 2000. Fig. 5. *C. ahmadi* culture conidia, × 2000. Fig. 6. *C. laburni* culture conidia, × 2000. Fig. 7. *C. emeri* culture conidia, × 2000. Fig. 8. *C. coronillae* culture conidia, × 2000. Fig. 9. *C. cytisi* culture conidia, × 2000.

PLATE 80 (12)

Spores, × 2000. — Fig. 1. *C. pilosa.* Fig. 2. *C. berberidis.* Fig. 3. *C. caraganae.* Fig. 4. *C. ahmadi.* Fig. 5. *C. laburni.* Fig. 6. *C. halimodendri.* Fig. 7. *C. dulcamarae.* Fig. 8. *C. elongata.* Fig. 9. *C. ononidis.*

PLATE 81 (13)

Spores, × 2000. — Fig. 1. *C. acervata.* Fig. 2, *C. rhamni.* Fig. 3. *C. coronillae.* Fig. 4. *C. negundinis.* Fig. 5. *C. amorphae.* Fig. 6. *C. emeri.* Fig. 7. *C. cytisi.* Fig. 8. *C. varians.* Fig. 9. *C. rubefaciens.*

PLATE 82 (14)

Spores, × 2000. — Fig. 1. *C. elaeagni.* Fig. 2. *C. crataegi.* Fig. 3. *C. coluteae.* Fig. 4. *C. spartii.* Fig. 5. *C. sorbi.* Fig. 6. *C. indigoferae.* Fig. 7. *C. alni.* Fig. 8. *C. ribis.* Fig. 9. *C. ignavis.*

Plate - I

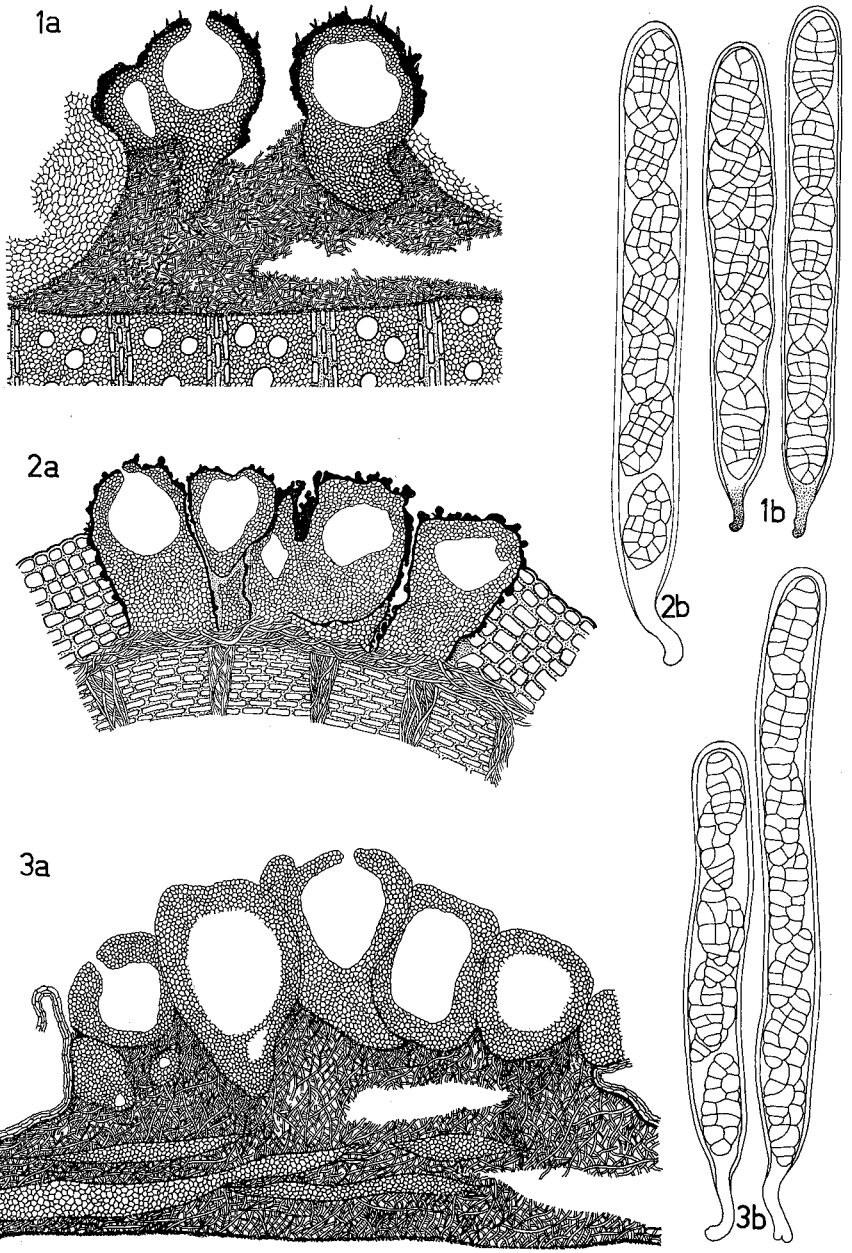


Plate-II

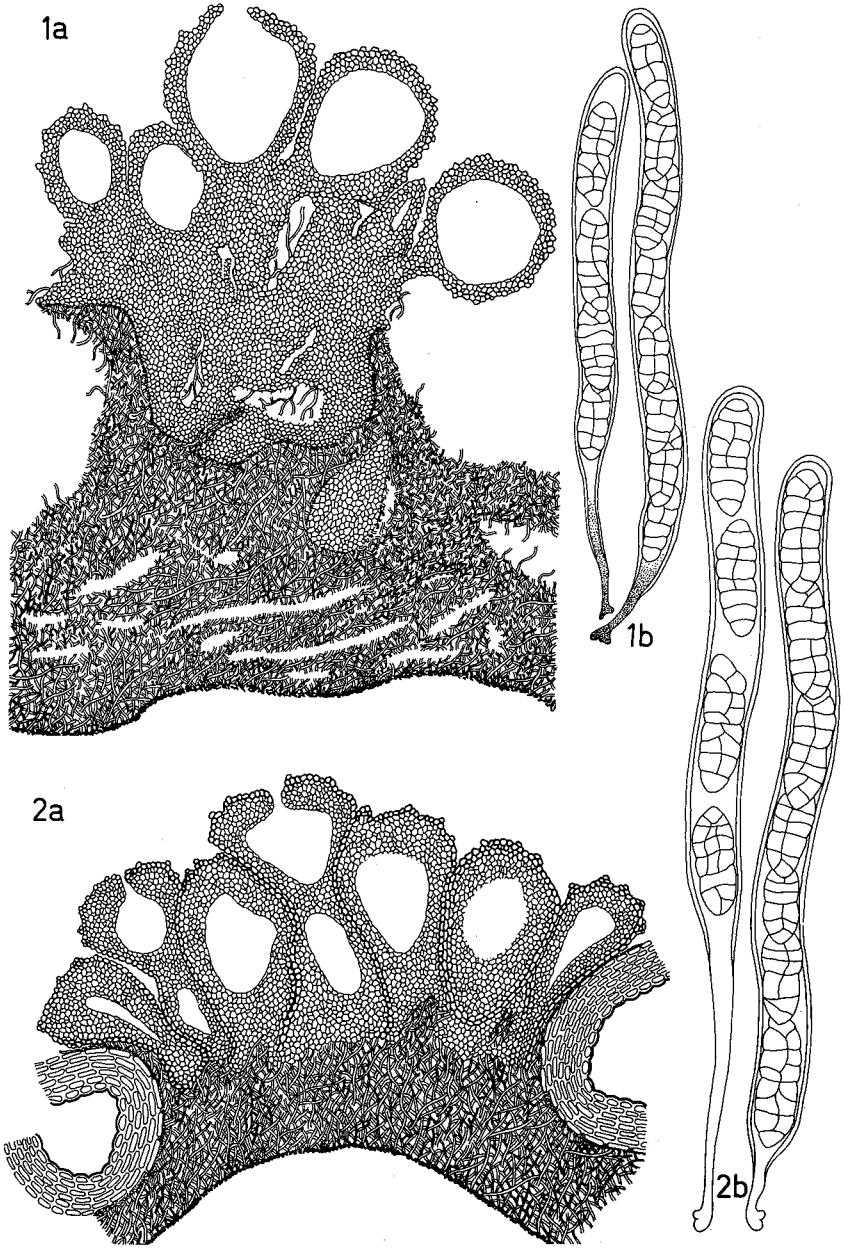
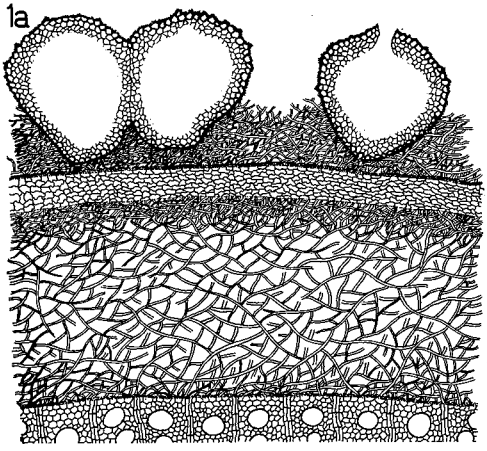
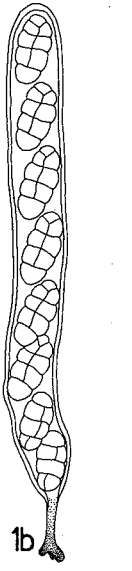
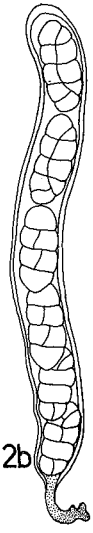
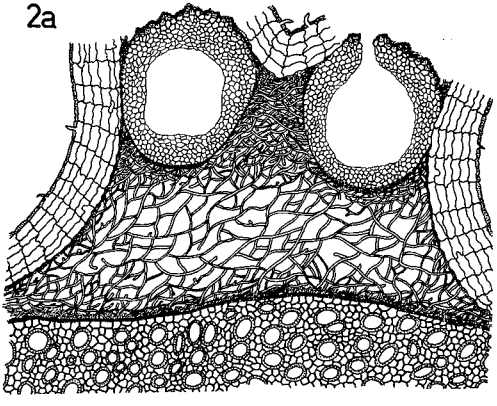


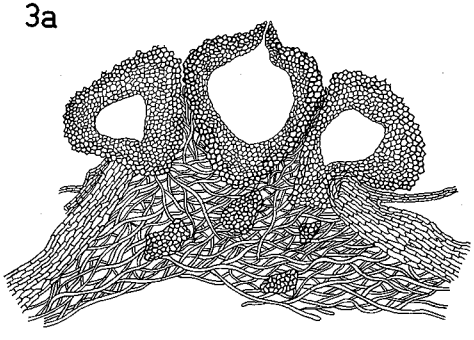
Plate-III











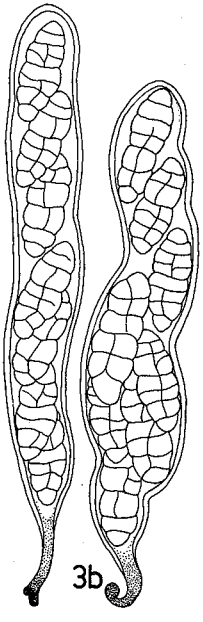
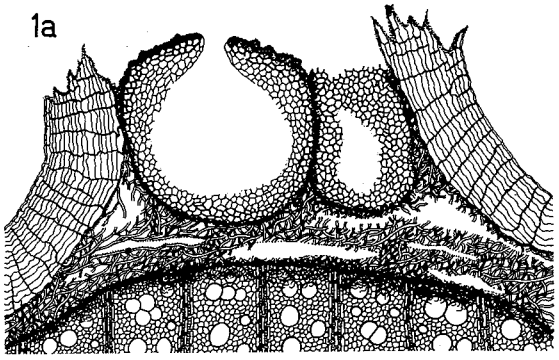
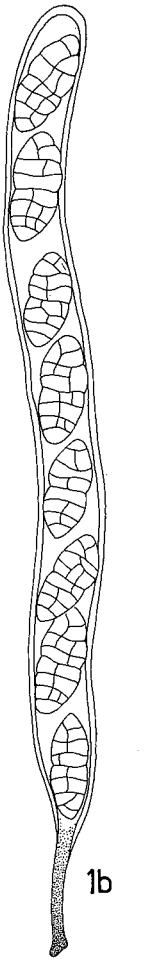
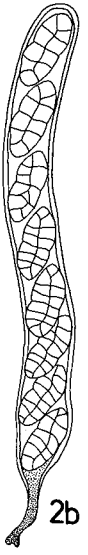
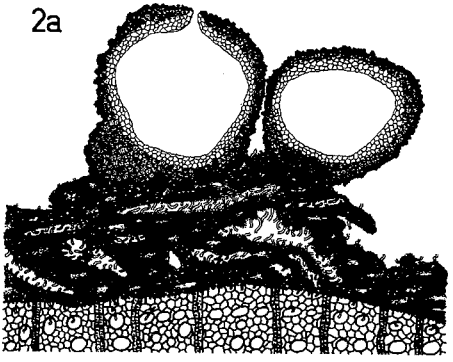


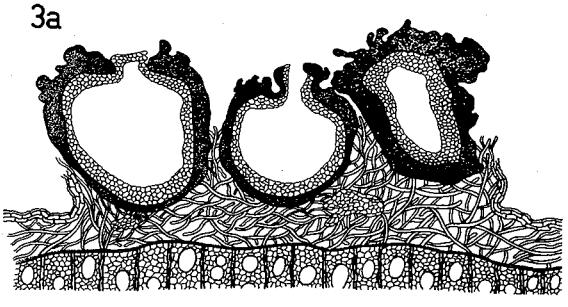
Plate-IV











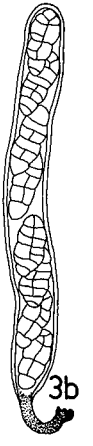


Plate-V

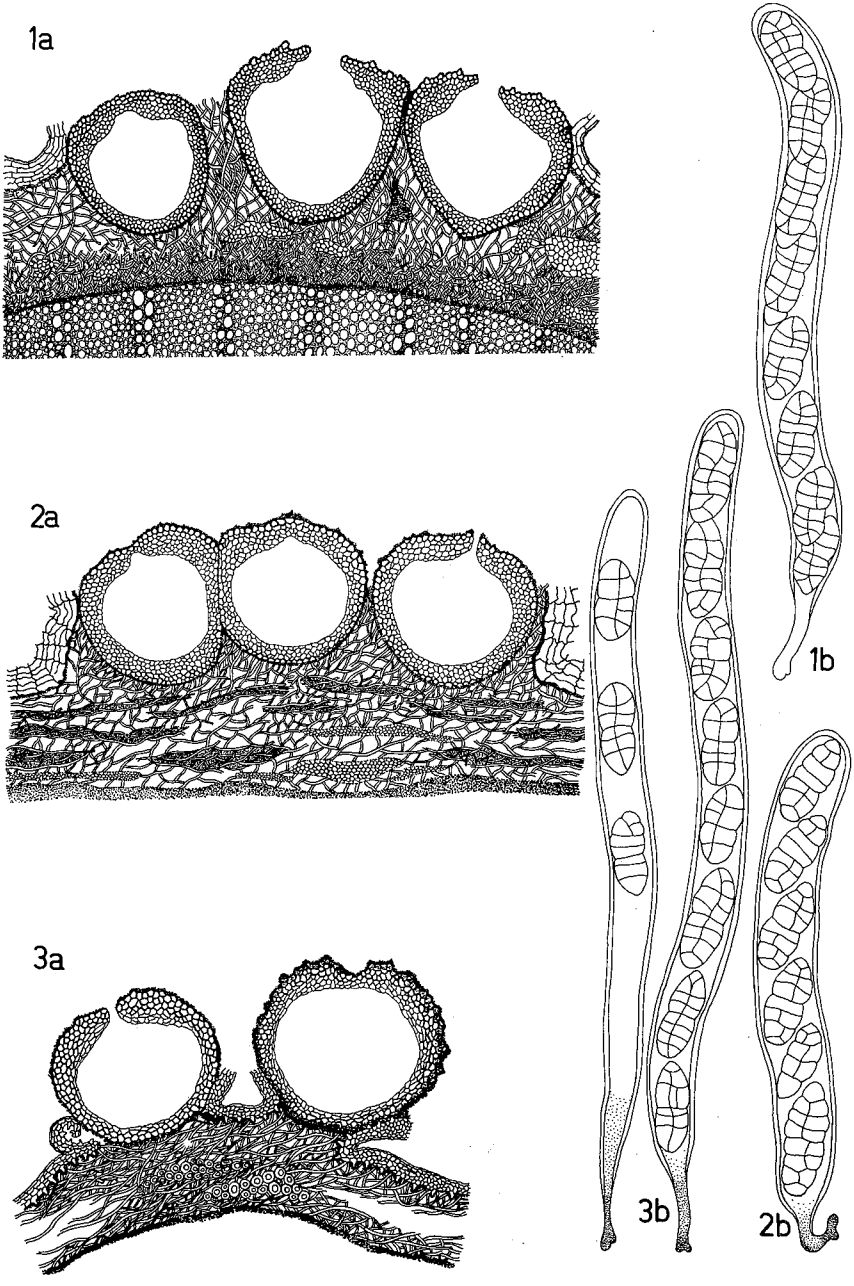
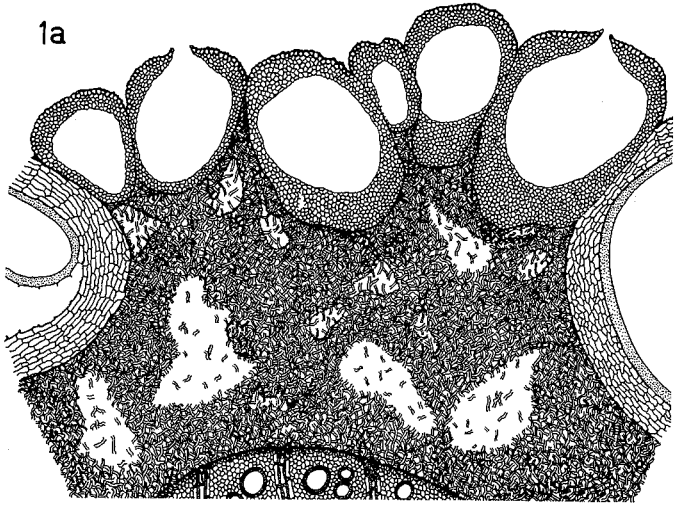
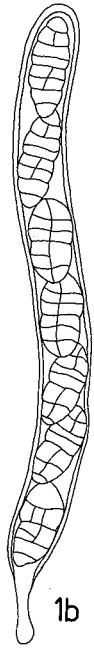
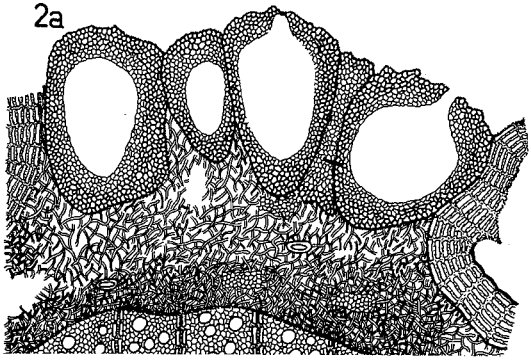
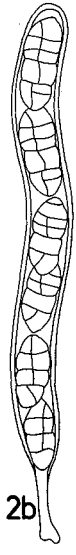


Plate-VI









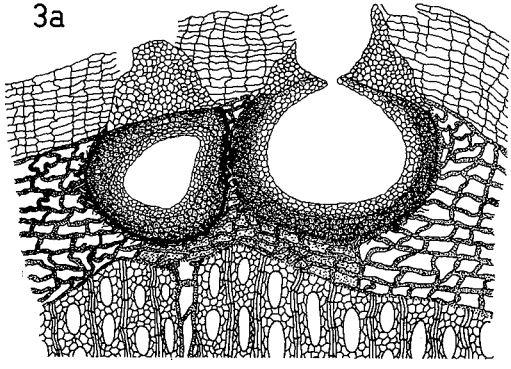
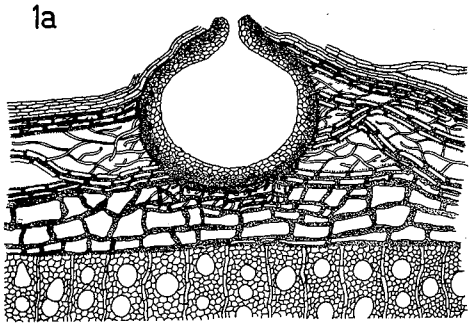
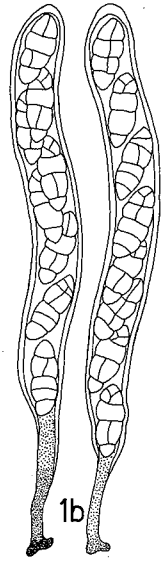
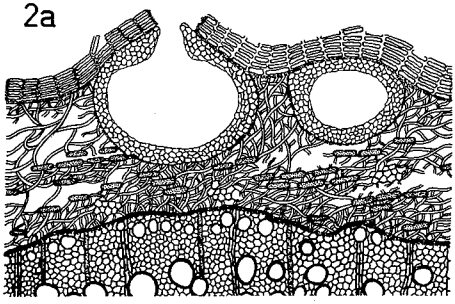
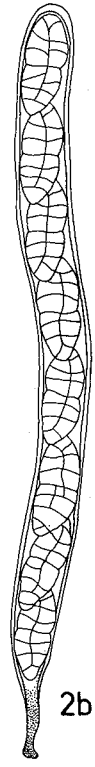


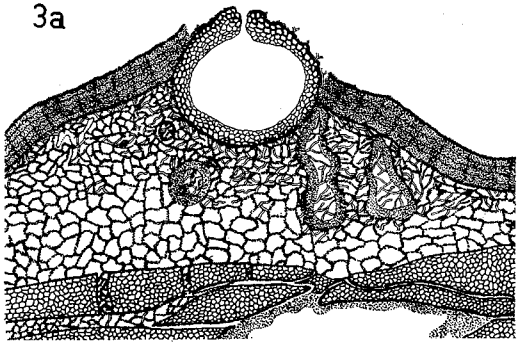
Plate-VII











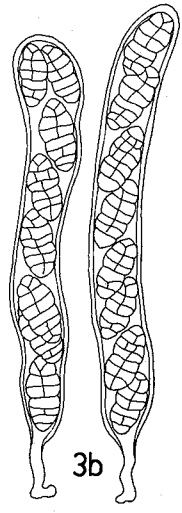
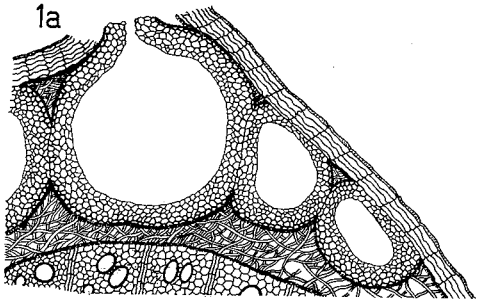
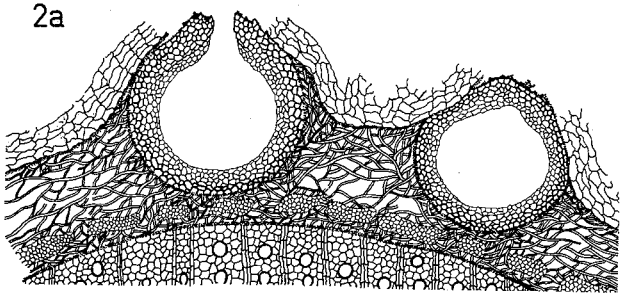
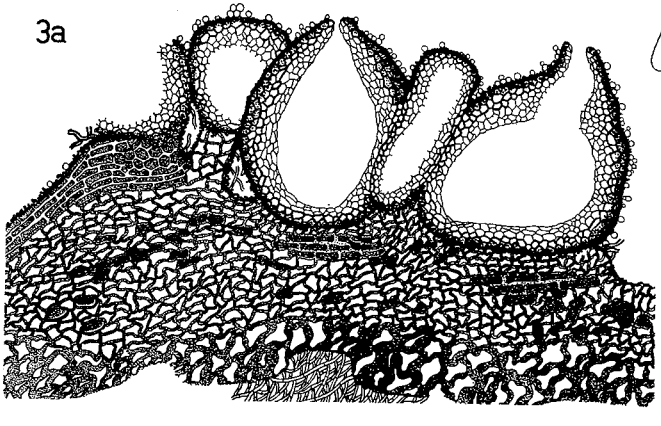
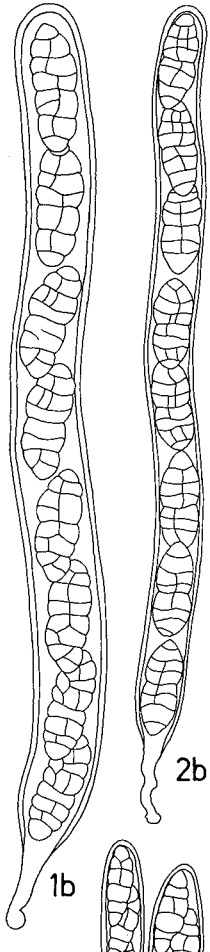


Plate-VIII









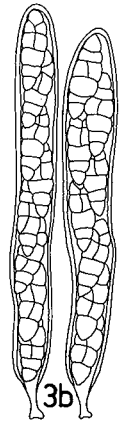


Plate-IX

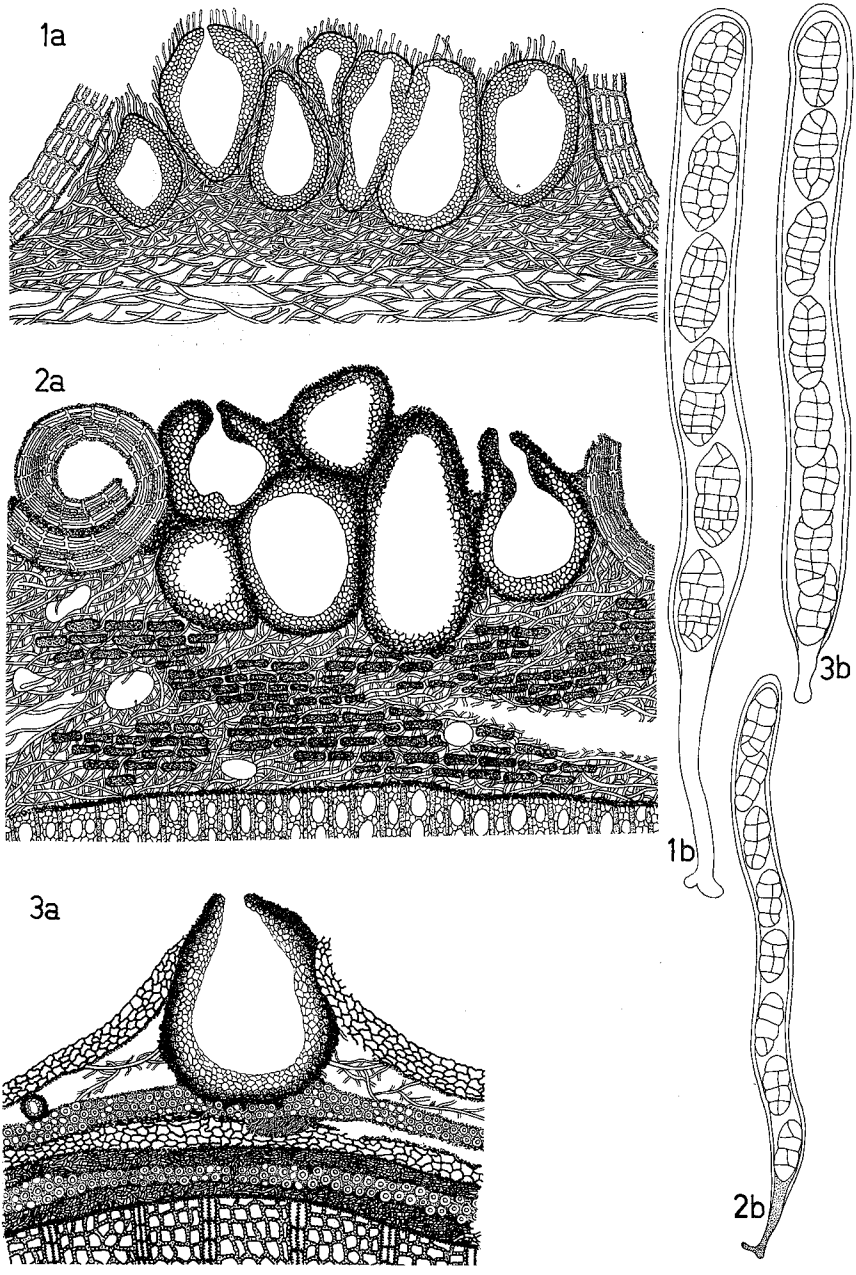
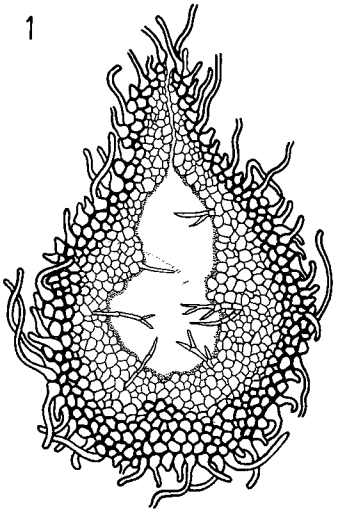
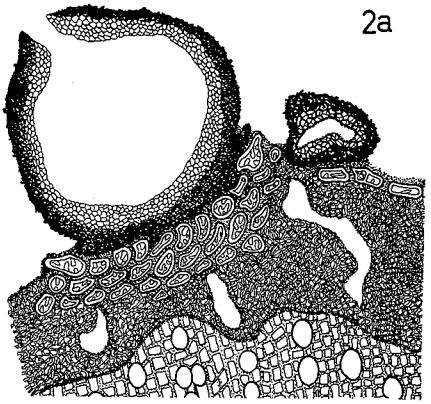
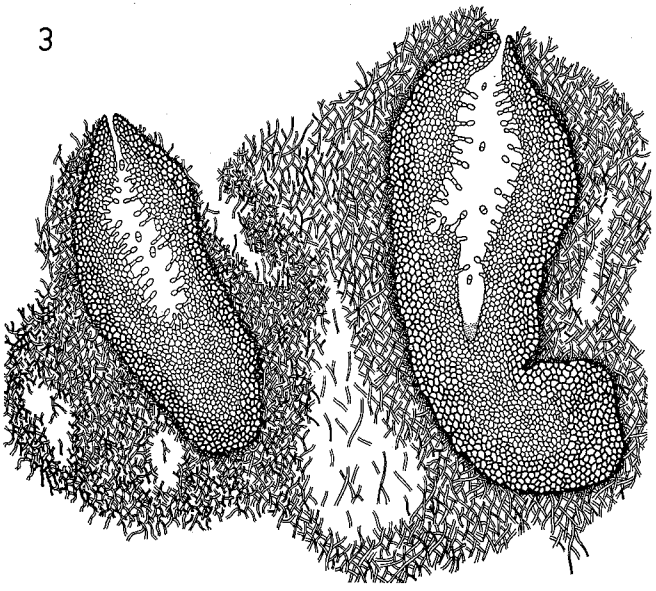


Plate-X







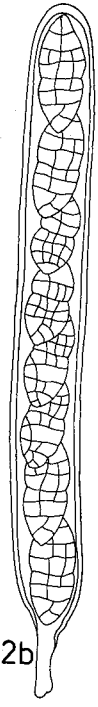
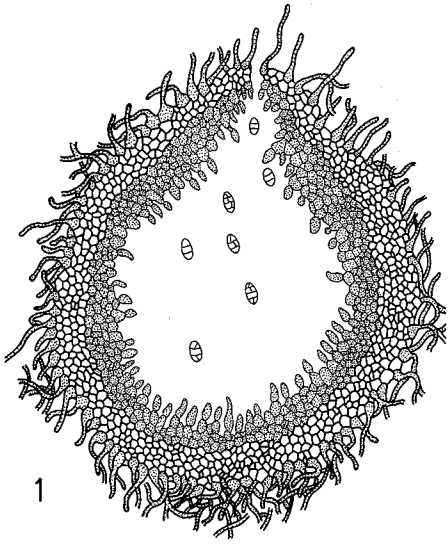
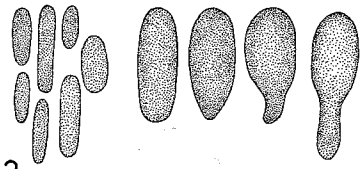
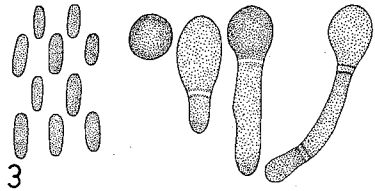


Plate-XI

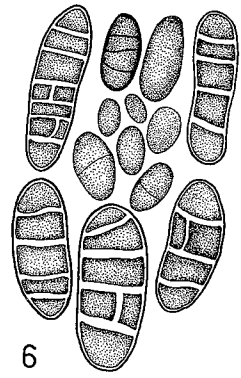

1

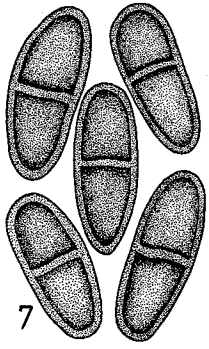

2


3


4


5


6


7


8

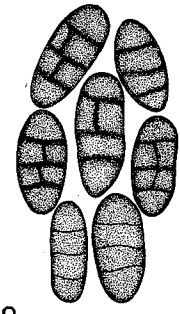

9

Plate-XII

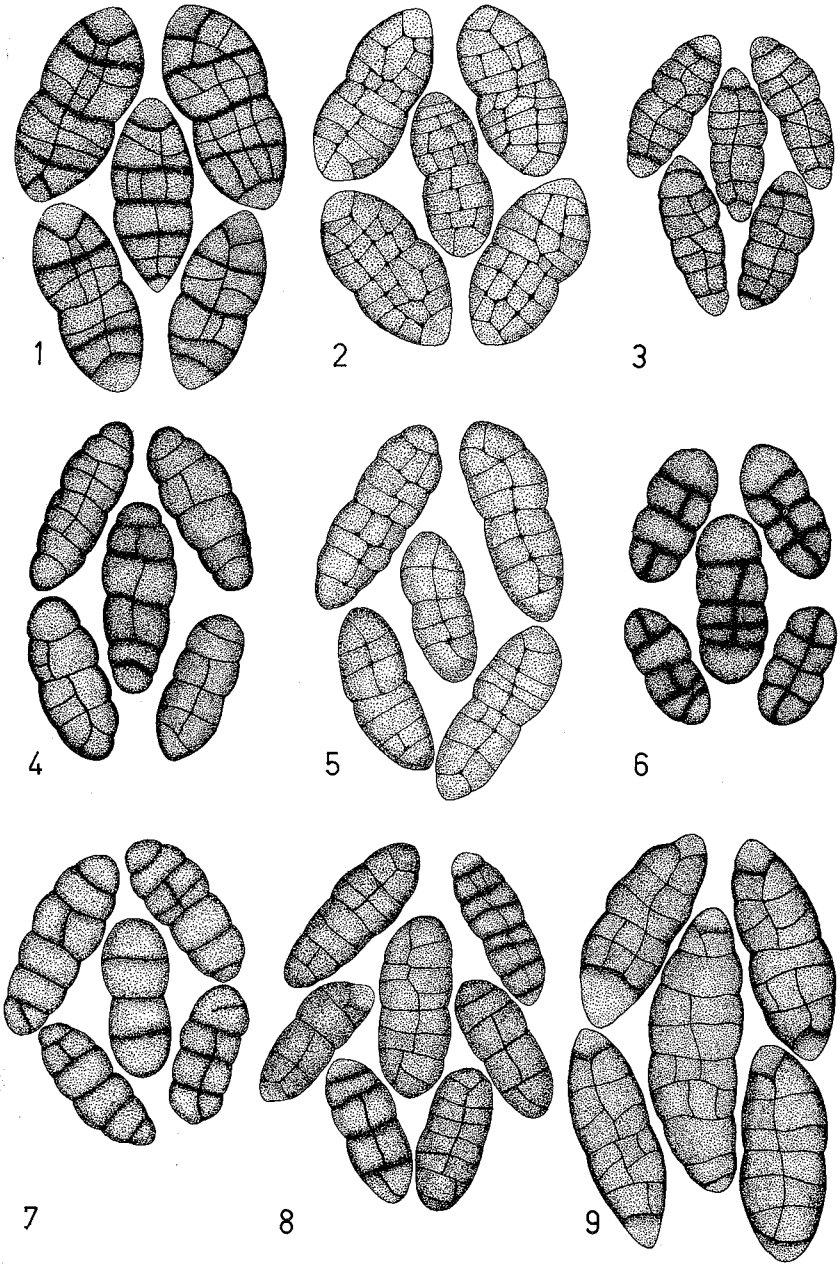


Plate-XIII

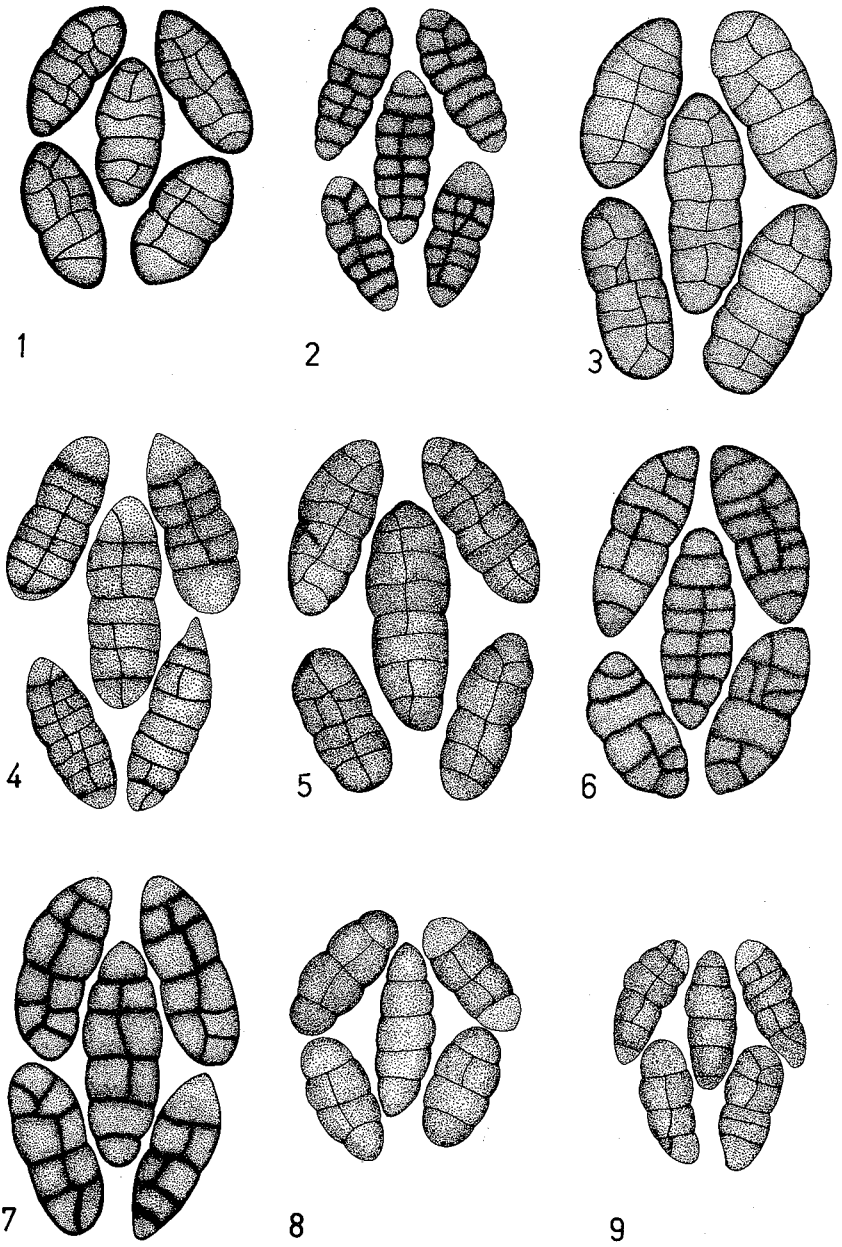
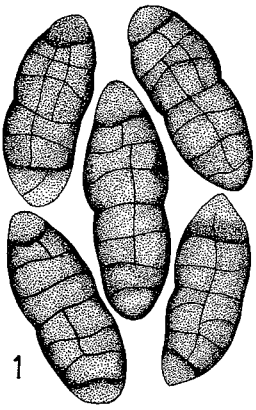
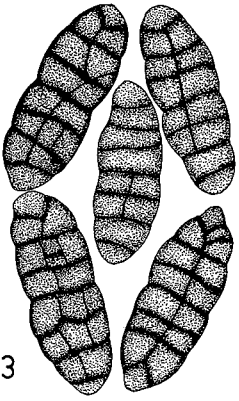
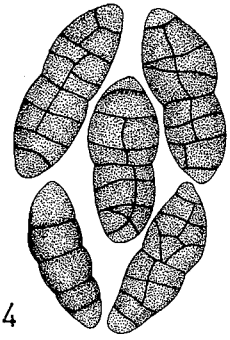


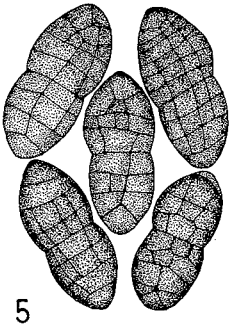
Plate-XIV


1


2

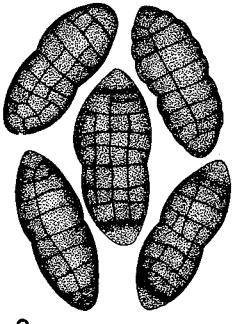

3

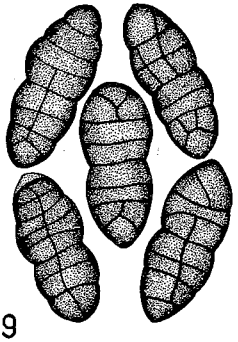

4


5


6


7


8


9