

A MODERN SYSTEM OF FUSARIUM TAXONOMY¹

by

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Abstract

A modern system of *Fusarium* taxonomy is proposed, based on the study over 30 years, of the morphology and growth characteristics of fungi of this genus, and their variability under a wide range of conditions. The system proposed here comprises 13 sections, 33 species and 14 varieties. It differs from systems published by other authors mainly in the sections *Eupionnotes*, *Sporotrichiella*, *Arthrosporiella*, *Gibbosum*, *Discolor*, *Macroconia* and *Martiella*.

Introduction

The genus *Fusarium* presents numerous difficulties to the taxonomist. These difficulties stem largely from the pronounced morphological and physiological variability of the isolates of many species and varieties of this genus.

Over the past 30 years, the author has conducted a comprehensive study of isolates of *Fusarium* collected in the warm, semi-arid climate of Israel and the cold climate of the U.S.S.R., and isolates received from research institutes in many countries. Among all these isolates, many derived from soils of the most diverse types, and from a great variety of diseased crop plants and seeds.

Some of the taxonomic aspects of our work, in relation to the sections *Elegans*, *Martiella* and *Liseola*, and to *F. equiseti* have been published elsewhere (Joffe, 1963a; Joffe & Palti, 1967, 1972; Joffe et al., 1973). This paper presents a concise review of the entire system of *Fusarium*.

Materials and Methods

Isolates of *Fusarium* from soil were taken from irrigated or unirrigated fields sown with various crops, generally from depths of 5–20 cm. The soil was placed into sterile test tubes weighed and diluted 1 : 2000 to 1 : 5000 (by weight) by addition of 0.75 % NaCl solution. Then 0.5 cc of the diluted sample was plated on each of 10 Petri dishes containing potato dextrose agar (DPA) and other media (Joffe, 1963b, 1967), adjusted to pH 4.5–5.0 by addition of lactic acid. The plates were incubated at 24 °C.

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Isolation of *Fusarium* from wilting or decaying plants was effected as follows: roots, collars and fruits were cut into small pieces, dipped into mercuric chloride (HgCl_2) 1 : 1000 or 1–2 % Sodium hypochlorite for 1–3 minutes, washed four times in sterile distilled water and plated on PDA in at least 10 dishes per sample. Samples of fresh or stored seed were disinfected as above and 100–200 seeds from each sample were plated on PDA and sometimes on other media, 4 to 10 kernels to each Petri dish. After incubation, the colonies that developed at various temperatures were transferred to PDA slants for further study.

After pure cultures, monoconidial cultures and microcultures had been obtained, the isolates were determined on the basis of their morphological and cultural characteristics. For measuring their size, 100 conidia of each isolate were taken from pure cultures and from monoconidial cultures when approximately 12–15 or sometimes up to 30 days old; measurements are given in microns. Many species of *Fusarium* produce abundant mycelium without forming conidia. We used various media to produce sporulation (Joffe, 1963b, 1967).

Further characteristics taken into account in identifying species and varieties were production of chlamydospores, and sometimes sclerotia, as well as pigmentation and formation of stroma. The rate of growth after five days was expressed as the average diameter of the colony in mm on PDA in Petri dishes at 24 °C. In the species and varieties possessing perithecial states (*Gibberella*, *Calonectria*, *Nectria*, *Hypomyces*, and *Plectosphaerella*) these were given due consideration.

Critical Review of Taxonomic Systems Proposed for *Fusarium*

Wollenweber (1932, 1943), and Wollenweber & Reinking (1935) laid the foundation for the taxonomic treatment of *Fusarium*. In distinguishing between 16 sections, 66 species, 55 varieties and 22 forms, they based themselves chiefly on the following characteristics:

Conidia: size, shape, length/width ratio, number of septa, and structure or shape of top and foot cells.

Cultural features: nature of aerial mycelium, presence of pigmentation, absence of sporulation, sporodochia, pionnotes, and sclerotia. The great merit of these authors lies in the fact that they created an orderly system out of the innumerable synonyms of species and varieties that had been created before.

Numerous attempts have since been made to further improve Wollenweber & Reinking's system (Bilal, 1955; Booth, 1960, 1971; Bugnicourt, 1939; Gerlach, 1970; Gerlach & Ershad, 1970; Gordon, 1952, 1954a, 1954b, 1956, 1959, 1960; Jamalainen, 1943a, 1943b, 1944, 1970; Joffe, 1963a, Joffe & Palti, 1967, 1970, 1972; Joffe et al., 1973; Raillo, 1950; Seemüller, 1968; Subramanian, 1952). Most of these authors have proposed certain limited changes in the earlier system, and the acceptability of these changes depends very much on the personal predilection of the reader.

However, sweeping changes in *Fusarium* taxonomy, evidently meant to make the life of phytopathologists easier, have been put forth by Snyder & Hansen (1940, 1941, 1945) and their school (Snyder & Tousson, 1965; Tousson & Nelson, 1968). In reducing the number of species in the genus to 9, these authors claim that the natural variability of *Fusarium* isolates renders distinction of more numerous species unreliable, and that within the species only *formae speciales* should be distinguished according to their pathogenic properties. This taxonomic system has proved unacceptable to the large majority of mycologists, and this has been well put by Gerlach & Ershad (1970): 'Als Ganzes kann unseres Erachtens dieses System nicht aufrecht gehalten werden; denn es wird keinesfalls der Vielfalt an morphologisch eindeutig verschiedenen Fusarien gerecht, verstösst in vieler Hinsicht gegen die Nomenklaturregeln und ist ausserdem in Praxis längst nicht von dem Nutzen, den es beim ersten Eindruck scheinbar hat'.

To advance the taxonomy of *Fusarium*, in itself only a means to the better understanding of, and easier working with, isolates of the genus, new approaches are required. These should certainly consider physiological properties much more carefully than in the past. As a step in this direction we have made a thorough study of the toxic properties of *Fusarium* including toxicity to man, animal and plants. When these studies will be completed, we shall attempt to utilize them taxonomically.

Pending the comprehensive study of physiological aspects, there is little point in further revising existing taxonomic systems, and we shall therefore limit ourselves, at this point, to listing the sections and species of *Fusarium* as we see them (Table I) and to brief descriptions of these sections. Our concept, deviates from those of Gordon (1952), Booth (1971) and Gerlach (1970) only in details. As mentioned above, it is based on the study of many hundred of isolates grown under varying conditions of substrate and environment (Table II). These isolates included many supplied by the following institutions in Europe and North America:

1. Food and Drug Administration, Washington
2. Biologische Bundesanstalt, Institut für Mykologie, Berlin-Dahlem
3. Winnipeg Laboratory (From the Gordon collection), Manitoba, Canada
4. CBS, Baarn, Netherlands
5. ATCC, Rockville, Maryland, U.S.A.
6. Tikkurila Laboratory, Finland
7. CMI, Kew England
8. Mycology Laboratory, Orenburg, Russia

As will be seen from Table I, the proposed system comprises 13 sections, 33 species and 14 varieties.

Table I
Classification of the genus *Fusarium*

Section	Species, Varieties and Perithecial State
Arachnites Wr.	<i>F. nivale</i> (Fr.) Ces. <i>Calonectria nivalis</i> Schafnit <i>F. larvarum</i> Fckl. <i>Nectria aurantiicola</i> Berk. & Br.
Eupionnotes Wr.	<i>F. dimerum</i> Penzig <i>F. tabacinum</i> (Beyma) W. Gams (Gams & Gerlach, 1968) <i>Plectosphaerella cucumis</i> Kleb. <i>F. aquaeductuum</i> (Radl. & Rab.) Lagerh. <i>Nectria episphaeria</i> (Tode ex Fr.) v. <i>coronata</i> Wr. <i>F. merismoides</i> Corda <i>F. melanochlorum</i> (Casp.) Sacc. <i>Nectria flavo-viridis</i> (Fckl.) Wr. <i>F. buxicola</i> Sacc. <i>Nectria desmazierii</i> Beec. & De Not. <i>F. sphaeriae</i> Fckl. <i>Nectria leptosphaeriae</i> Niessl
Sporotrichiella Wr. em. Joffe	<i>F. poae</i> (Peck.) Wr. <i>F. sporotrichioides</i> Sherb. v. <i>chlamydosporum</i> (Wr. & Rg.) Joffe comb. nov. v. <i>tricinctum</i> (Cda.) Rallo
Spicarioides Wr.	<i>F. decemcellulare</i> Brick. <i>Calonectria rigidiuscula</i> (Berk. & Br.) Sacc.
Macroconia Wr.	<i>F. coccidicola</i> P. Henn <i>Calonectria diploa</i> (Berk. & Curt.) Wr. <i>F. coccophilum</i> (Desm.) Wr. & Rg. <i>Nectria ecoccophila</i> Wr. <i>F. gigas</i> Speg.
Roseum Wr.	<i>F. avenaceum</i> (Fr.) Sacc. <i>Gibberella avenacea</i> R. J. Cook <i>F. arthrosporioides</i> Sherb.
Arthrosporiella Wr.	<i>F. semitectum</i> Berk. & Rav. <i>F. semitectum</i> Berk. & Rav. v. <i>majus</i> Wr. <i>F. camptoceras</i> Wr. & Rg. <i>F. concolor</i> Rg.
Lateritium Wr.	<i>F. lateritium</i> Nees <i>Gibberella baccata</i> (Wallr.) Sacc. <i>F. stilboides</i> Wr. <i>Gibberella stilboides</i> Gordon <i>F. xylarioides</i> Steyaerd <i>Gibberella xylarioides</i> Heim & Saccas

Table I. (cont'd)

Section	Species, Varieties and Perithecial State
Liseola Wr.	<i>F. moniliforme</i> Sheld. <i>Gibberella fujikuroi</i> (Saw.) Wr. v. <i>subglutinans</i> Wr. & Rg. v. <i>subglutinans</i> Edwards <i>Gibberella fujikuroi</i> (Saw.) Wr. v. <i>anthophilum</i> (A. Br.) Wr.
Gibbosum Wr. em. Joffe	<i>F. equiseti</i> (Cda.) Sacc. <i>Gibberella intricans</i> Wr. v. <i>acuminatum</i> (Ell. & Ev.) Bil. <i>Gibberella acuminata</i> Wr. v. <i>compactum</i> (Wr.) Joffe comb. nov. v. <i>caudatum</i> (Wr.) Joffe comb. nov. v. <i>longipes</i> (Wr. & Rg.) Joffe comb. nov.
Discolor Wr.	<i>F. heterosporum</i> Nees ex. Fr. <i>F. graminearum</i> Schw. <i>Gibberella zeae</i> (Schw.) Petch <i>F. sambucinum</i> Fckl. <i>Gibberella pulicaris</i> (Fr.) Sacc. v. <i>coeruleum</i> Wr. v. <i>trichothecioides</i> (Wr.) Bil. <i>F. culmorum</i> (W. g. Sm.) Sacc. <i>F. tumidum</i> Sherb.
Elegans	<i>F. oxysporum</i> Schlecht. v. <i>redolens</i> (Wr.) Gordon
Martiella Wr. em. Joffe & Palti	<i>F. solani</i> (Mart.) Sacc. <i>Nectria hematococca</i> Bark. & Br. v. <i>coeruleum</i> (Lib.) Bil. v. <i>ventricosum</i> (Appl. & Wr.) Joffe <i>Nectria ventricosa</i> Booth <i>F. javanicum</i> Koord. <i>Hypomyces ipomoeae</i> (Hals) Wr.

TABLE II

Number of isolates of species and varieties on which morphological characteristics were studied under various conditions

Section	Number of isolates				
	from which those studied morphologically were selected	studied morphologically			
		total	from Israel	from USSR	from other countries
Arachnites	29	19	0	13	6
Martiella	1614	769	733	24	12
Eupionnotes	78	60	18	15	27
Macroconia	39	32	17	6	9
Spicarioides	8	8	0	0	8
Sporotrichiella	186	186	0	157	29
Roseum	112	84	17	60	7
Arthrosporella	118	97	51	27	19
Lateritium	93	77	35	32	10
Liseola	294	225	164	37	24
Gibbosum	424	229	109	88	32
Discolor	181	139	68	33	38
Elegans	974	429	345	35	49
Grand Total	4150	2354	1557	527	270

Brief descriptions of the sections, species and varieties of *Fusarium*Section *Arachnites* Wr. (2 species)

Macroconidia in aerial mycelium, rarely in sporodochia or pionnotes, curved, apedicellate. Chlamydospores and sclerotia absent.

Fusarium nivale (Fr.) Ces. (Plate I, fig. 9317).

Cultures white, rose-pale, yellow to brown. Macroconidia curved, falcate with pointed apex and wedge-shaped base, apedicellate.

0-sept.	7—11 × 2.2—3.4
1-sept.	11—18 × 2.8—4.2
2-sept.	12—22 × 3.2—4.6
3-sept.	18—28 × 3.0—4.8

Growth rate 1.4 cm.

Perithecial state: *Calonectria nivalis* Schaffnit.

F. larvarum Fckl. (Plate I, fig. 11138).

Cultures yellow, rose. Macroconidia strongly hyperbolic, sausage-shaped to sublunate, with pointed apex and marked foot-cell, 1–3 septate, occasionally 4–5 septate.

1-sept.	14—24 × 2.8—3.5
3-sept.	19—26 × 3.2—3.8
4–5-sept.	26—36 × 3.2—5.2

Growth rate 1 cm.

Perithecial state: *Nectria aurantiicola* Berk. & Br.

Section *Eupionnotes* Wr. (7 species)

Cultures pale, yellow, orange, yellow-brown, rose to green, growing slowly on PDA. Aerial mycelium usually sparse, slimy. Macroconidia in pionnotes, rarely in sporodochia, sublunate, cylindrical or spindle-shaped, falcate, elongate or curved, apedicillate, sometimes pedicellate. Chlamydospores and sclerotia present or absent. Perithecial states present in some of the species.

F. dimerum Penzig (Plate I, fig. 9375)

Cultures orange to rose. Macroconidia in pionnotes, sporodochia and aerial mycelium, curved, broadly lunate, spindle- to sickle shaped, mostly 1–3 septate.

0-sept.	7—13 × 2.4—3.0
1-sept.	11—18 × 2.5—3.2
2-sept.	13—19 × 2.7—3.6
3-sept.	18—24 × 3.0—3.8

Chlamydospores globose or oval, smooth-walled, intercalary, single or in pairs, or chains. Growth rate 2.5 cm.

Perfect stage unknown.

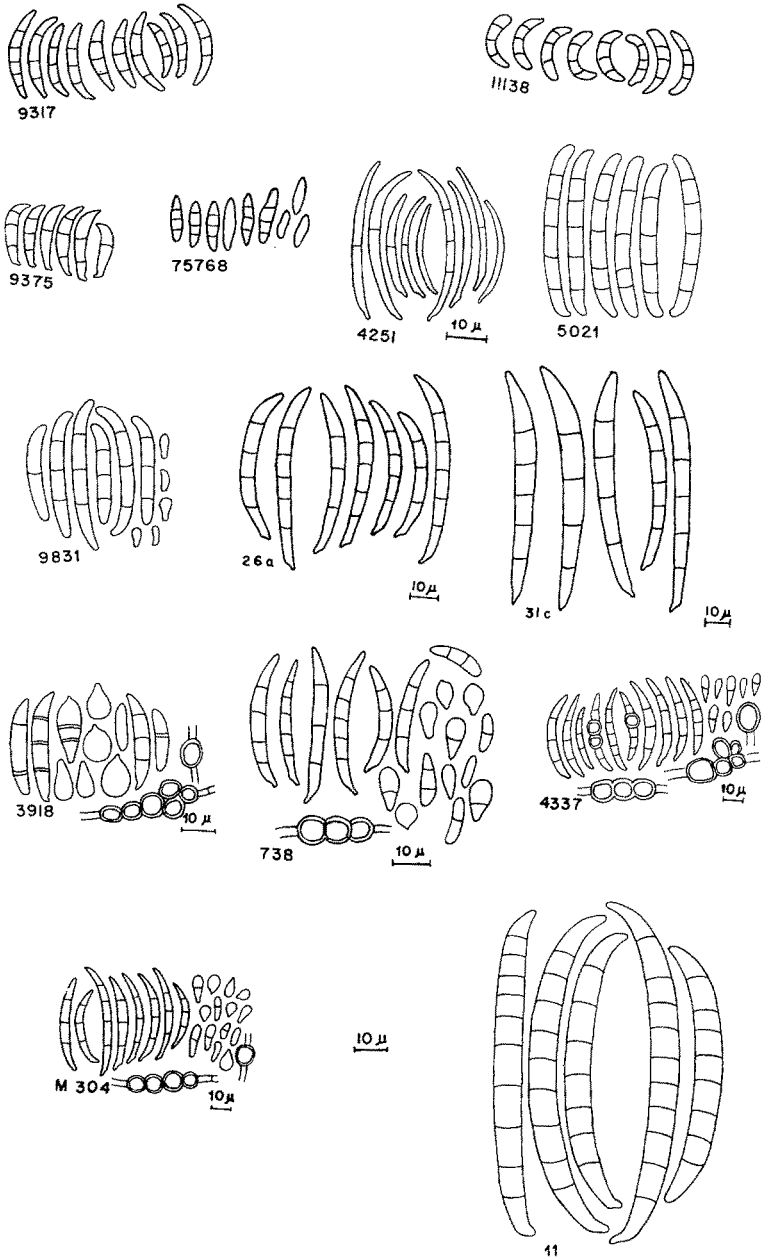


Plate I

Section Arachnites: 9317 *F. nivale*; 11138 *F. larvarum*.
 Section Eupionnotes: 9375 *F. dimerum*; 75768 *F. tabacinum*; 4251 *F. aquaeductuum*;
 5021 *F. merismoides*; 9831 *F. melanochlorum*; 26a *F. buxicola*; 31c *F. sphaeriae*.
 Section Sporotrichiella: 3918 *F. poae*; 738 *F. sporotrichioides*; 4337 *F. sporotrichioides*
 v. *chlamydosporum*; M 304 *F. sporotrichioides* v. *tricinctum*.
 Section Spicarioides: 11 *F. decemcellulare*.

F. tabacinum (Beyma) W. Gams (Plate I, fig. 75768)

Cultures white or yellow. Macroconidia formed in aerial mycelium, cylindrical, oblong or slightly curved with rounded apex and wedge-shaped base, 0-3 septate.

average 8-13 × 2.4-3.0

Chlamydospores absent. Growth rate 0.5 cm.

Perithecial state: *Plectosphaerella cucumeris* Kleb.

F. aquaeductuum (Radl. et Rab.) Lagerh. (Plate I, fig. 4251)

Cultures white, yellow to brown. Macroconidia in aerial mycelium and in sporodochia, curved, falcate, narrow.

0-sept. 8-21 × 2.0-3.0

1-sept. 15-35 × 2.1-2.8

3-sept. 30-40 × 2.5-3.0

Chlamydospores absent. Growth rate 0.5 cm.

Perithecial state: *Nectria episphaeria* (Tode ex Fr.) var. *coronata* Wr.

F. merismoides Corda (Plate I, fig. 5021)

Cultures slow-growing with weakly developed mycelium. Macroconidia formed in pionnotes, cylindrical, straight or slightly curved, with short rounded apex, with or without marked foot-cell.

1-sept. 17-26 × 2.7-3.4

2-sept. 24-35 × 3.6-4.0

3-sept. 28-41 × 3.2-4.5

5-sept. 35-44 × 3.8-4.7

Chlamydospores intercalary, single or in pairs, or chains.

Growth rate 1 cm.

Perithecial stage unknown.

F. melanochlorum (Casp.) Sacc. (Plate I, fig. 9831)

Cultures pale yellow or orange, differ from *F. merismoides* by presence of olive-green stroma. Microconidia hyaline, oval. Macroconidia cylindrical, elongate, sausage-shaped, apedicellate, slightly round at both ends.

0-sept. 6-9.5 × 2.0-2.6

1-sept. 15-28 × 2.5-3.2

3-sept. 30-35 × 3.5-4.2

5-sept. 42-47 × 3.2-4.0

Chlamydospores absent in hyphae, present in macroconidia, globose, thick-walled. Growth rate 0.9 cm.

Perithecial state: *Nectria flavo-viridis* (Fckl.) Wr.

F. buxicola Sacc. (Plate I, fig. 26a)

Cultures slow-growing, with sparse, white, yellow mycelium. Macroconidia in sporodochia, cylindrical, slightly curved, with beaked apical cell and wedge-shaped foot-cell. Microconidia absent.

3-sept.	36—55 × 3.2—5.4
5-sept.	50—66 × 3.6—6.0

Chlamydo-spores absent. Growth rate 0.7 cm.

Perithecial state: *Nectria desmazierii* Beec. & De Not.

F. sphaeriae Fckl. (Plate I, fig. 31c)

Cultures slow-growing, with sparse white aerial mycelium. Macroconidia in aerial mycelium or in sporodochia and pionnotes, slightly curved, cylindrical – lanceolate with pedicellate to wedge-shaped base.

3-sept.	45—66 × 4.3—6.8
5-sept.	54—80 × 4.5—7.4
7-sept.	63—96 × 5.2—7.5

Chlamydo-spores absent. Growth rate 0.5 cm.

Perithecial state: *Nectria leptosphaeriae* Niessl.

Section Sporotrichiella Wr. em. Joffe (2 species, 2 varieties)

The basis for classification in this section should be a) shape of microconidia, whether lemon- or pear-shaped, globose, ellipsoid or elongate, dispersed in aerial mycelium, or formed in false heads; b) relative frequency of micro- and macroconidia.

Macroconidia sparse, small, oblong, narrowly fusoid to falcate, pedicellate, formed in aerial mycelium or in sporodochia. Chlamydo-spores intercalary, terminal, in chains or knots, occasionally with plectenchy-matous sclerotia. Perithecial states absent.

F. poae (Peck.) Wr. (Plate I, fig. 3918)

Cultures white, yellow or red-brown. Microconidia in the aerial mycelium abundant in relation to macroconidia, oval, spherical with basal papilla, spindly-ellipsoid or elongate, rarely pear-shaped. Macroconidia sparse, curved, falcate, in aerial mycelium, sporodochia absent, pionnotes absent or very rare.

0-sept., oval	6.8—9 × 4.5—8.2
0-sept., spindle-ellipsoid shaped	10—15 × 2.6—4.2
1-sept., oval, pear-shaped	10.5—16 × 4.5—7.4
1-sept., spindle-ellipsoid shaped	12—22.5 × 3.6—4.5
3-sept., curved falcate	19—38 × 3.5—6.8

Chlamydo-spores intercalary, single or in pairs, knots, or chains. Growth rate 7.2 cm.

F. sporotrichioides Sherb. (Plate I, fig. 738)

Cultures white, white-rose or red. Microconidia globose, pyriform, ellipsoid, elongate or slightly falcate, dispersed in aerial mycelium. Macroconidia formed in aerial mycelium or in sporodochia, falcate to curved, with foot-cell.

0-sept., pear-shaped	6	—	9 × 5.5—7.0
0-sept., ellipsoidal	7	—	11 × 4.0—7.8
0-sept., elongate or sickle-shaped	8	—	11 × 2.8—3.8
0-sept., spindle-shaped	9	—	16 × 2.6—3.8
1-sept., pear-shaped	8	—	15 × 5.2—7.0
1-sept., ellipsoidal	9	—	20 × 3.8—8.0
1-sept., elongate or sickle-shaped	12.5	—	17 × 3.0—4.2
1-sept., spindle-shaped	15	—	26 × 2.5—4.2
3-sept., sickle or spindle-shaped	22	—	35 × 3.6—4.7
4-sept., sickle or spindle-shaped	33	—	40 × 3.8—4.5
5-sept., sickle or spindle-shaped	37	—	45 × 4.0—5.2

Chlamydo-spores intercalary, singly or in pairs, knots or chains.
Growth rate 3.5 cm.

F. sporotrichioides Sherb. var. *chlamydo-sporum* (Wt. & Rg.) Joffe
comb. nov. (Plate I, fig. 4337)

Cultures rose, carmine, rarely yellow or brown. Microconidia in aerial mycelium, spindle-shaped or elongate, sometimes oval-ellipsoidal. Macroconidia only in aerial mycelium, falcate, curved with narrowly pointed apex, marked foot-cell.

0-sept., spindle-elongate	7.5—10.5	×	2.6—3.2
1-sept., spindle-elongate	11	—	14 × 3.0—3.8
3-sept.	28	—	35 × 3.2—4.0
4-sept.	35	—	40 × 3.4—4.2
5-sept.	38	—	44 × 3.5—4.4
6-sept. (occasionally)	41	—	52 × 3.7—4.8

Chlamydo-spores terminal or intercalary, single or in pairs, knots or chains. Growth rate 3.5 cm.

F. sporotrichioides Sherb. var. *tricinctum* (Corda) Raillo (Plate I, fig. M 304)

Cultures white, carmine, red to purple. Microconidia dispersed in aerial mycelium or in false heads, pear- or lemon-shaped, oval-ellipsoidal, spindly-elongate, or slightly falcate. Macroconidia in sporodochia and aerial mycelium, falcate, or elliptical, curved with well marked foot-cell.

0-sept., pear-shaped	7.0—	9.5 × 5.0—7.2
0-sept., elongate	8.5—13	× 2.8—3.5
1-sept., pear-shaped	10.5—16	× 4.7—5.5
1-sept., elongate	12	— 20 × 3.0—3.8
3-sept., curved falcate	23	— 45 × 3.4—4.0
4-sept.	32	— 48 × 3.6—4.5
5-sept.	34	— 51 × 3.7—4.4

Chlamydo-spores globose, smooth walled, intercalary, single or in chains.
Growth rate 3 cm.

Section Spicarioides Wr. (1 species)

Cultures rose, rose-red or purple. Microconidia in aerial mycelium in long chains or false heads, globose, oval. Macroconidia in sporodochia or pionnotes, thickwalled, slightly curved or straight, pedicellate, beaked at the tip with well marked foot-cell. Chlamydospores absent.

F. decemcellulare Brick. (Plate I, fig. 11)

Culture rose, rose-red, carmine to purple. Microconidia in aerial mycelium, powdery, in chains, hyaline, oval. Macroconidia large, slightly curved, cylindrical with thick wall, in sporodochia and pionnotes, typically with 5-9 septate.

0-sept.	6.5	—	9 × 3.0—4.0
1-sept.	11	—	21 × 3.6—4.5
3-sept.	26	—	44 × 4.5—5.2
5-sept.	50	—	62 × 4.8—6.5
7-sept.	56	—	77 × 5.2—7.5
9-sept.	72	—	95 × 5.4—8.2
11-sept.	83	—	112 × 5.2—8.7

Chlamydospores absent. Growth rate 3 cm. Stroma rose-red, purple.

Perithecial state: *Calonectria rigidiuscula* (Berk. & Br.) Sacc.

Section Macroconia Wr. (3 species)

Cultures white-rose, yellow-orange, slow-growing, slimy. Microconidia absent or rare. Macroconidia multi-septate, large, thick-walled, cylindrical, slightly curved, pedicellate, in sporodochia. Chlamydospores absent or occasionally in the macroconidia.

F. coccidicola P. Henn (Plate II, fig. T 50)

Cultures orange to carmine or red. Macroconidia formed in sporodochia or pionnotes, sublunate, elongate, falcate, narrowing at both ends, rarely with foot-cell.

3-sept.	44—61	× 2.8—3.8
4-sept.	51—72	× 3.0—4.0
5-sept.	60—88	× 3.1—4.5
6-sept.	72—96	× 3.3—4.7

Chlamydospores absent. Growth rate 0.5 cm.

Perithecial state: *Calonectria diploa* (Berk. & Curt.) Wr.

F. coccophilum (Desm.) Wr. & Rg. (Plate II, fig. 11140)

Cultures white, rose or orange. Macroconidia in sporodochia, pionnotes and aerial mycelium, cylindrical, slightly curved or sometimes falcate with narrow or beaked apex and weakly developed basal cell.

3-sept.	38—	54 × 3.6—4.8
5-sept.	49—	72 × 4.4—6.4
7-sept.	66—	84 × 4.8—7.2

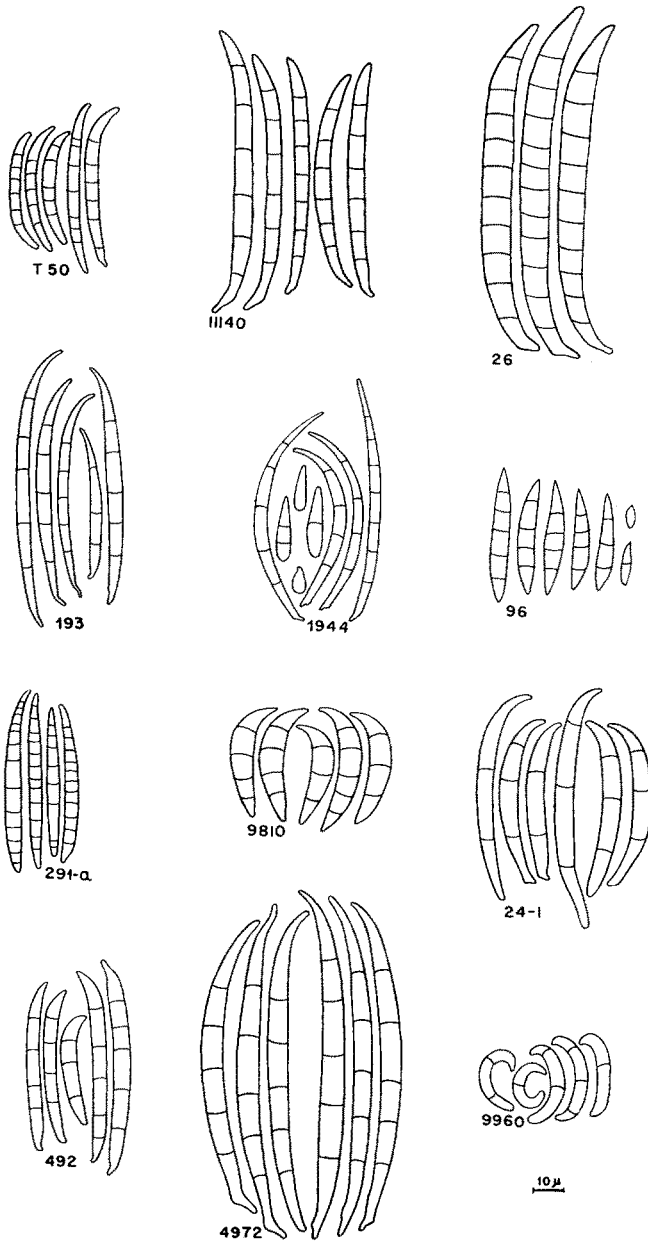


Plate II

Section Macroconia: T 50 *F. coccidicola*; 11140 *F. coccophilum*; 26 *F. gigas*.

Section Roseum: 193 *F. avenaceum*; 1944 *F. arthrosporioides*.

Section Arthrosporella: 93 *F. semitectum*; 291a *F. semitectum* v. *majus*; 9810 *F. campitoceras*; 24-1 *F. concolor*.

Section Lateritium: 492 *F. lateritium*; 4972 *F. stilboides*; 9960 *F. xylarioides*.

9-sept.	77—96 × 5.0—7.4
10-sept.	86—102 × 5.2—7.5
12-sept.	91—114 × 5.3—7.7

Chlamydo-spores absent. Growth rate 0.6 cm.

Perithecial state: *Nectria ecoccophila* Wr.

F. gigas Speg. (Plate II, fig. 2b)

Cultures white to white-rose. Macroconidia in aerial mycelium, rarely in sporodochia or pionnotes, cylindrical or spindle shaped, dorsiventral, or straight, narrowing at both ends with markedly pedicellate basal cell.

5-sept.	54—67 × 3.7—5.4
7-sept.	72—95 × 4.2—6.8
9-sept.	90—113 × 5.8—9.4
10-sept.	95—127 × 6.9—10.8
11-sept.	98—134 × 7.4—12.5
12-sept.	102—148 × 8.0—13.8

Chlamydo-spores absent.

Perithecial state unknown.

Section Roseum Wr. (2 species)

Cultures yellow, ochre, carmine, purple or red. Microconidia absent or sparse, chlamydo-spores absent. Macroconidia in sporodochia, pionnotes, or aerial mycelium, subulate, slender, almost filiform, falcate with thin walls, narrowing at both ends, pedicellate. Sclerotia white, yellow, purple to brown. Stroma yellow, red.

F. avenaceum (Fr.) Sacc. (Plate II, fig. 193)

Cultures rose, red, olive or reddish-brown. Macroconidia in aerial mycelium, sporodochia and pionnotes, narrow, filiform, elliptical or hyperbolic, with elongated apical cell and well marked foot-cell.

3-sept.	28—45 × 2.5—3.5
5-sept.	43—62 × 3.0—4.5
7-sept.	61—74 × 3.5—4.1

Chlamydo-spores absent. Growth rate 5.2 cm.

Perithecial state: *Gibberella avenacea* R. J. Cook

F. arthrosporioides Sherb. (Plate II, fig. 1944)

Cultures rose, carmine to brown. Microconidia absent or sparse, in aerial mycelium, pyriform to oval. Macroconidia in pionnotes or sporodochia, fusiform, lanceolate, narrowly falcate, strongly dorsiventral with marked foot-cell and pointed elongated tip.

0-sept.	7—16 × 2.2—4.2
1-sept.	18—34 × 3.0—4.0
2-sept.	25—39 × 3.2—4.5
3-sept.	30—46 × 3.0—4.8

5-sept.	43—62 × 3.8—5.1
7-sept.	66—78 × 4.5—5.4

Chlamydo-spores absent. Growth rate 4.5 cm.

Perithecial state unknown.

Section *Arthrosporiella* Wr. (3 species, 1 variety)

Cultures white, peach, ochre-yellow to carmine red. Microconidia absent or sparse in aerial mycelium, elliptical, oval or pyriform. Macroconidia formed in aerial mycelium, in sporodochia, rarely in pionnotes, falcate, lanceolate with wedge-shaped, pedicellate basal cell and with narrow apex, typically 3–5 septate. Chlamydo-spores intercalary, single, sometimes in chains or knots; terminal chlamydo-spores rare or absent.

Perithecial state unknown.

F. semitectum Berk. & Rav. (Plate II, fig. 96)

Cultures white, yellow to brown. Macroconidia in aerial mycelium. Sporodochia absent. Conidia curved, lanceolate, spindle-to sickle-shaped with wedge-shaped foot-cell and curved apex.

0-sept.	7—11 × 2.4—3.5
1-sept.	10—16 × 2.5—4.1
3-sept.	18—29 × 2.7—4.2
5-sept.	24—38 × 3.4—4.5

Chlamydo-spores sparse, globose, intercalary, single or in chains. Growth rate 6 cm.

F. semitectum Berk. & Rav. var. *majus* Wr. (Plate II, fig. 291a)

Cultures white-rose to brown. Microconidia often sparse. Macroconidia formed in aerial mycelium, rarely in sporodochia, curved or almost straight, narrowing at both ends.

0-sept.	10—15 × 2.3—3.0
1-sept.	12—24 × 2.8—3.4
3-sept.	25—43 × 3.3—4.6
4-sept.	29—48 × 3.7—5.0
5-sept.	37—51 × 3.8—5.3
6-sept.	39—54 × 4.0—5.5
7-sept.	42—65 × 3.7—5.8

Chlamydo-spores sparse, intercalary, globose and smooth, single or in pairs, or chains. Growth rate 5.2 cm.

F. camptoceras Wr. & Rg. (Plate II, fig. 9810)

Cultures white, beige-yellow to light brown. Microconidia ellipsoid, oval. Macroconidia in aerial mycelium, falcate, lanceolate, hyperbolic with sharp ends, apedicellate or pedicellate.

0-sept.	9—17 × 3.2—4.0
1-sept.	13—21 × 3.4—4.2
2-sept.	19—26 × 3.5—4.6

3-sept.	23—35 × 3.9—5.2
4-sept.	25—38 × 4.1—5.5
5-sept.	29—41 × 4.3—5.7
6-sept.	31—43 × 4.5—5.4
7-sept.	35—45 × 4.2—5.2

Chlamydo-spores sparse, globose, intercalary. Growth rate 1.5 cm.

F. concolor Rg. (Plate II, fig. 24-1)

Cultures peach, orange or rarely light brown. Micro-conidia sparse, elliptical or oval. Macroconidia in aerial mycelium or sporodochia, falcate, spindle- or sickle-shaped, with curved apical cell and well-marked foot-cell.

0-sept.	8—13 × 2.6—3.1
1-sept.	15—25 × 3.2—4.2
3-sept.	32—52 × 3.5—4.5
5-sept.	45—61 × 4.0—4.7
7-sept.	59—72—4.3—4.9

Chlamydo-spores, intercalary and terminal. Growth rate 4 cm.

Section *Lateritium* Wr. (3 species)

Cultures white, rose, yellow, orange, carmine-red, violet to dark blue. Microconidia oval, elliptical, sparse or absent. Macroconidia elongated, cylindrical, straight, or slightly curved, with beaked apical cell and pedicellate base, formed in the aerial mycelium or sporodochia, rarely in pionnotes. Chlamydo-spores intercalary, sparse in mycelium or macroconidia.

F. lateritium Nees (Plate II, fig. 492)

Cultures white, yellow, white-rose, dark-blue, green to reddish-brown. Microconidia in aerial mycelium, sometimes absent or very sparse. Macroconidia thin-walled formed in floccose or felted mycelium or in sporodochia, rarely in pionnotes; oblong or short, falcate to straight with beaked apex, usually with pedicellate foot-cell.

0-sept.	6—13 × 2.8—4.5
1-sept.	12—27 × 2.5—4.0
3-sept.	21—44 × 3.0—4.5
4-sept.	29—50 × 3.4—5.1
5-sept.	32—58 × 3.2—5.5
7-sept.	35—62 × 3.5—5.8

Chlamydo-spores intercalary, rare in mycelium or macroconidia. Growth rate 3.6 cm.

Perithecial state: *Gibberella baccata* (Wallr.) Sacc.

F. stilboides Wr. (Plate II, fig. 4972)

Cultures carmine red to ochre-yellow. Macroconidia in aerial mycelium and sporodochia, sometimes in pionnotes, spindle- or sickle-shaped, with pointed or beaked apex and pedicellate foot-cell.

3-sept.	24—	49 × 2.8—4.7
5-sept.	38—	82 × 3.4—5.4
7-sept.	52—	95 × 3.6—5.6
9-sept.	66—	104 × 3.8—5.8

Chlamydospores sparse, intercalary in macroconidia, globose, smooth-walled. Growth rate 3.0 cm.

Perfect state: *Gibberella stilboides* Gordon.

F. xylarioides Steyaert (Plate II, fig. 9960)

Cultures blue, violet or peach to black. Heterothallic: Macroconidia of male isolates, in sporodochia or pionnotes, curved, cylindrical, with beaked apex and marked foot-cell. Micro- and macroconidia of female isolates cylindrical, strongly curved with beaked apex and marked foot-cell.

Macroconidia of male stains:	5-sept.	38 × 81	× 3.2—4.1
	7-sept.	48 × 95	× 3.5—4.3
Conidia of female stains:	0-sept.	7—10	× 2.2—2.8
	1-sept.	12—16.5	× 2.2—3.0
	3-sept.	17—28	× 2.4—3.6

Chlamydospores absent, sometimes intercalary, in mycelium or macroconidia.

Perithecial state: *Gibberella xylarioides* Heim & Saccas.

Section *Liseola* Wr. (1 species, 2 varieties)

Cultures white-cream-brown, orange, violet. Microconidia in aerial mycelium, usually in long chains, or small false heads, oval, fusiform, oblong, rarely pyriform. Macroconidia thin-walled, in sporodochia, pionnotes and aerial mycelium, sublunate, spindle-shaped to cylindrical, straight or curved, with narrow apex and base cells, typically 3-septate. Chlamydospores absent.

F. moniliforme Sheld. (Plate III, fig. 505)

Cultures cream-coloured, violet to lilac. Microconidia in chains, ovoid, spindly, elongate. Macroconidia in sporodochia, pionnotes and aerial mycelium, spindly, falcate, with elongated narrowly curved apical cell and pedicellate basal cell, typically 3-septate.

0-sept.	6.5	—12 × 2.2—3.2
1-sept.	12	—23 × 2.5—3.7
3-sept.	29	—47 × 2.6—3.8
4-sept.	33	—52 × 2.9—3.5
5-sept.	44	—58 × 3.1—3.6
6-sept.	52	—61 × 2.9—3.8
7-sept.	60	—67 × 3.2—4.0

Chlamydospores absent. Growth rate 4.9 cm.

Perithecial state: *Gibberella fujikuroi* (Saw.) Wr.

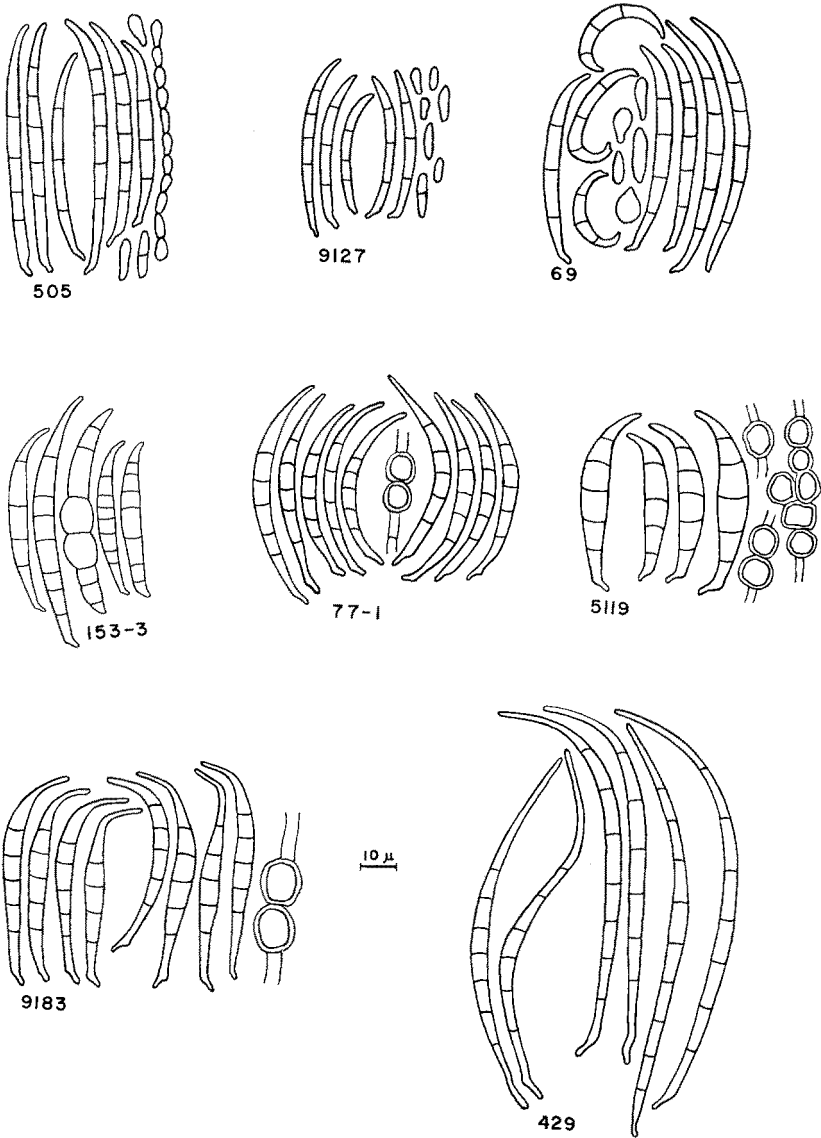


Plate III

Section *Liseola*: 505 *F. moniliforme*; 9127 *F. moniliforme* v. *subglutinans*; 691 *F. moniliforme* v. *anthophilum*.

Section *Gibbosum*: 153-3 *F. equiseti*; 77-1 *F. equiseti* v. *acuminatum*; 5119 *F. equiseti* v. *compactum*; 9183 *F. equiseti* v. *caudatum*; 429 *F. equiseti* v. *longipes*.

F. moniliforme Sheld. var. *subglutinans* Wr. & Rg. (Plate III, fig. 9127)

Cultures white to greyish-white, purple to dark purple. Microconidia only in heads, oval to fusiform. Macroconidia in sporodochia, falcate, 3–5 septate.

0-sept.	10–15 × 1.9–3.1
1-sept.	14–21 × 2.3–3.4
2-sept.	18–26 × 2.7–3.6
3-sept.	26–41 × 2.8–3.4
4-sept.	35–45 × 2.5–3.7
5-sept.	42–53 × 2.6–3.7

Chlamydo-spores absent. Growth rate 4.8 cm.

Perithecial state: *Gibberella fujikuroi* (Saw.) Wr. var. *subglutinans* Edwards

F. moniliforme Sheld. var. *anthophilum* (A. Br.) Wr. (Plate III, fig. 691)

Cultures white-rose to violet. Microconidia in aerial mycelium, pyriform, spindle-shaped to oval, formed in heads. Macroconidia in small pionnotes and sporodochia, cylindrical, falcate, typically 3–septate.

Microconidia spindle-shaped	0-sept.	7–13 × 2.1–3.2
	1-sept.	14–24 × 2.3–4.3
Microconidia pyriform	0-sept.	6–10 × 3.8–5.7
	1-sept.	12–17 × 4.8–5.6
Macroconidia	3-sept.	35–50 × 2.8–4.4
	4-sept.	47–60 × 3.1–4.3
	5-sept.	51–67 × 3.2–4.2
	7-sept.	62–77 × 3.2–4.6

Chlamydo-spores absent. Growth rate 3.5 cm.

Perithecial state unknown.

Section *Gibbosum* Wr. em. Joffe (1 species, 4 varieties)

Culture white-pale pink, pale ochre, olive, carmine-red. Microconidia absent or sparse, in aerial mycelium. Macroconidia in pionnotes and sporodochia, falcate, narrowing at both ends with elongated apical cell, and well-developed pedicellate foot-cell, dorsiventral, parabolic or hyperbolic, typically with 5, rarely 3–septate. Chlamydo-spores intercalary, abundant, smooth or rough-walled, single, or in chains and knots, yellow-brown.

F. equiseti (Cda.) Sacc. (Plate III, fig. 153–3)

Cultures white, pale-olive to yellow-brown. Macroconidia narrowly falcate to parabolic, elongate, thin-walled, with pedicellate foot-cell and pointed apical cell, in pionnotes and sporodochia, typically 5–septate.

0-sept.	7.5–15 × 2.5–4.0
1-sept.	10–21 × 2.6–4.2
3-sept.	26–35 × 3.8–4.8

5-sept.	40	—46 × 4.0—5.2
7-sept.	50	—61 × 4.2—5.5

Chlamydo-spores intercalary, single or in pairs, knots or chains, occasionally terminal, globose, smooth to roughwalled. Growth rate 6.0 cm.

Sclerotia absent. Stroma brown or yellow-brown to red.

Perithecial state: *Gibberella intricans* Wr.

F. equiseti (Cda.) Sacc. var. *acuminatum* (El. & Ev.) Bil. (Plate III, fig. 77-1)

Cultures white-rose, peach-beige, brown, carmine-red to purple. Macroconidia broadly falcate, hyperbolic, dorsiventral with elongated apical cell and well marked foot-cell, in sporodochia, pionnotes and aerial mycelium, typically 5-septate.

3-sept.	22—44	× 3.5—4.5
4-sept.	28—50	× 3.7—4.4
5-sept.	36—54	× 3.8—4.6
6-sept.	43—58	× 3.6—5.1
7-sept.	46—65	× 3.5—5.3

Chlamydo-spores intercalary, smooth-walled, oval, in chains and knots. Growth rate 4.5 cm.

Stroma plectenchymatous red, yellow-cream to brown.

Perithecial state: *Gibberella acuminata* Wr.

F. equiseti (Cda.) Sacc. var. *compactum* (Wr.) Joffe comb. nov. (Plate III, fig. 5119)

Cultures white-olive, red-carmine. Macroconidia in sporodochia and pionnotes, spindle- or sickle-shaped, narrowing at both ends, elliptical, curved or straight, with short, pointed apical cell and well-marked foot-cell, typically 5-septate.

3-sept.	24—30	× 4.4—6.8
4-sept.	33—38	× 4.7—6.2
5-sept.	37—46	× 4.9—6.4
6-sept.	42—51	× 4.5—6.2
7-sept.	45—54	× 4.6—6.0

Chlamydo-spores intercalary, single or in pairs and chains. Growth rate 4.8 cm.

Stroma yellow-brown to carmine.

Perithecial state unknown.

F. equiseti (Cda.) Sacc. var. *caudatum* (Wr.) Joffe comb. nov. (Plate III, fig. 9183)

Cultures white-ochre, cream-light rose to brown. Macroconidia formed in sporodochia and pionnotes, dorsiventral, elliptical, curved with short, sharp and strongly pointed, curved apical cell and well-developed foot-cell, typically 5-septate.

3-sept.	25—41	× 3.2—4.2
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4-sept.	31—46 × 3.3—4.1
5-sept.	38—55 × 3.5—5.2
6-sept.	43—68 × 3.6—4.7
7-sept.	51—76 × 3.4—4.4

Chlamydo-spores intercalary, abundant, in chains or knots. Growth rate 3.8 cm. Stroma ochre-brown, ochre-olive, brown to brown-carmine.

Perithecial state unknown.

F. equiseti (Cda.) Sacc. var. *longipes* (Wr.&Rg.) Joffe comb. nov. (Plate III, fig. 429)

Culture white-rose to purple. Macroconidia in sporodochia, sickle-shaped, dorsiventral, falcate-hyperbolic, with filiform, strongly elongated, curved apical cell and well-marked foot-cell, typically 5—7 septate.

4-sept.	48— 82 × 2.6—3.5
5-sept.	51— 87 × 2.5—3.8
6-sept.	55— 96 × 2.6—4.0
7-sept.	64—103 × 2.7—4.2
8-sept.	75—107 × 2.8—4.3
9-sept.	86—111 × 2.7—4.1
10-sept.	91—115 × 2.8—4.3
11-sept.	102—118 × 2.9—4.2
12-sept.	109—124 × 2.6—3.8

Chlamydo-spores intercalary, single, globose, oval, slightly rough. Growth rate 4.2 cm. Stroma yellow-cream, white-olive to purple.

Perithecial state unknown.

Section *Discolor* Wr. (5 species, 2 varieties)

Cultures white-rose, peach, greyish, rose, red to brown. Microconidia absent. Macroconidia thick-walled, in aerial mycelium, sporodochia and pionnotes, either broad, falcate with short apical cell, and well-developed foot-cell, or spindle- or sickle-shaped, with elongated gradually narrowing apical cell, well-marked basal cell, typically 5—septate. Chlamydo-spores intercalary, sometimes, terminal, often in knots and chains. Sclerotia purple-blue, brown to dark. Stroma yellow.

F. heterosporum Nees ex Fr. (Plate IV, fig. 3396)

Cultures white or red, cream or yellow. Macroconidia in sporodochia and aerial mycelium, rarely in pionnotes, spindle- or sickle-shaped, elliptical, curved, with gradually narrowing, elongated apical cell and well-marked basal cell, typically 3—5 septate.

3-sept.	22—34 × 3.0—3.8
4-sept.	25—45 × 3.2—4.4
5-sept.	34—48 × 3.5—4.7

Chlamydo-spores intercalary, single or in chains and knots. Growth rate 3.5 cm. Stroma yellow-brownish, yellow-purple, or brown-red.

Perithecial state unknown.

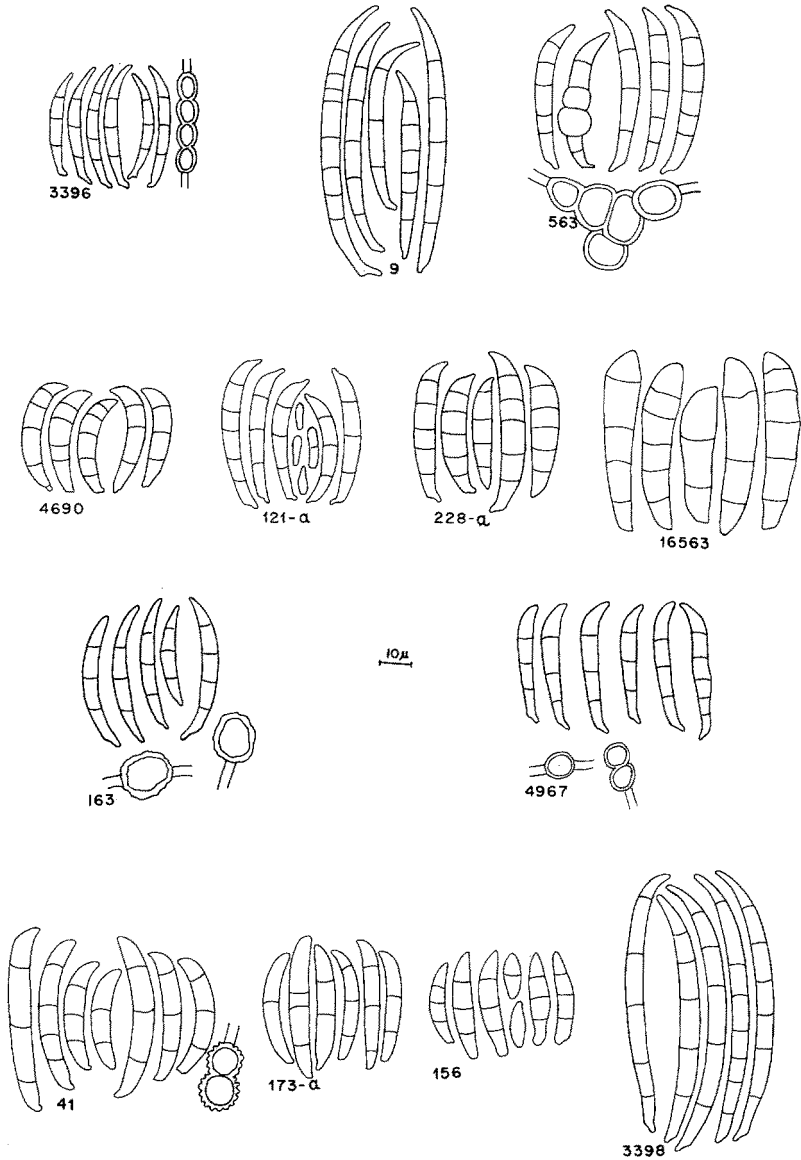


Plate IV

Section Discolor: 3396 *F. heterosporum*; 9 *F. graminearum*; 563 *F. sambucinum*; 4690 *F. sambucinum* v. *coeruleum*; 121a *F. sambucinum* v. *trichothecioides*; 228a *F. culmorum*; 16563 *F. tumidum*.

Section Elegans: 163 *F. oxysporum*; 4967 *F. oxysporum* v. *redolens*.

Section Martiella: 41 *F. solani*; 173a *F. solani* v. *coeruleum*; 156 *F. solani* v. *ventricosum*; 3398 *F. javanicum*.

F. graminearum Schwabe (Plate IV, fig. 9)

Cultures rose, greyish rose, or red to red-brown. Macroconidia in sporodochia, pionnotes and aerial mycelium, spindle- to sickle-shaped, falcate or dorsiventral, with or without elongated apical cell, with well-marked foot-cell, typically 5-septate.

3-sept.	28—45 × 3.2—4.2
4-sept.	34—54 × 3.6—4.5
5-sept.	40—57 × 4.4—5.2
6-sept.	44—60 × 4.2—5.5
7-sept.	52—65 × 4.3—5.8

Chlamydospores absent or rare. Growth rate 8.8 cm. Stroma carmine brown. Sclerotia rose to deep-red, or absent.

Perithecial state: *Gibberella zae* (Schw.) Petch.

F. sambucinum Fckl. (Plate IV, fig. 563)

Cultures rose colored to carmine. Macroconidia in aerial mycelium, sporodochia and pionnotes, elliptic, curved, lanceolate, strongly dorsiventral, with pointed apex and well-marked foot-cell, typically 5-septate.

3-sept.	26—41 × 4.2—5.1
4-sept.	35—43 × 4.5—5.0
5-sept.	38—52 × 4.7—5.3
7-sept.	42—55 × 4.6—5.8

Chlamydospores intercalary, often in chains and knots, sometimes terminal. Growth rate 5.6 cm. Stroma white, yellow, brown to purple. Sclerotia dark-red or brown sometimes absent.

Perithecial state: *Gibberella pulicaris* (Fr.) Sacc.

F. sambucinum Fckl. var. *coeruleum* Wr. (Plate IV, fig. 4690)

Cultures white, grey, reddish brown to purple. Macroconidia thick-walled, in sporodochia and sparsely in aerial mycelium, strongly curved, beaked at apex, with marked basal cell.

0-sept.	7.5— 9 × 3.5—4.4
1-sept.	11 —14 × 4.0—6.0
2-sept.	15 —21 × 5.1—5.8
3-sept.	18 —28 × 5.2—5.7
4-sept.	25 —30 × 5.4—6.2
5-sept.	27 —37 × 5.2—6.4

Chlamydospores intercalary, single or in chains. Growth rate 4.5 cm. Stroma yellow, rose or carmine-brown.

Perithecial state uncertain.

F. sambucinum Fckl. var. *trichothecioides* (Wr.) Bilai (Plate IV, fig. 121a)

Cultures light rose, peach to orange, Microconidia in aerial mycelium. sparse, oval, elliptical, rounded at both ends. Macroconidia in aerial.

mycelium, rarely in sporodochia, falcate, curved with short beaked apical cell; short foot-cell with well-marked heel.

3-sept.	22—30 × 4.3—5.2
5-sept.	32—39 × 4.2—6.0
6-sept.	36—44 × 4.5—6.6

Chlamydospores sparse, intercalary in chains or knots. Growth rate 8.6 cm.

Perithecial state unknown.

F. culmorum (W. G. Smith) Sacc. (Plate IV, fig. 228a)

Cultures red-brown, carmine to purple. Microconidia absent. Macroconidia in sporodochia and pionnotes, thick-walled, abundant, elliptical, slightly curved and strongly dorsiventral, parabolic, with pointed apex and well-marked foot-cell.

3-sept.	25—35 × 4.8—6.5
4-sept.	30—41 × 5.0—6.8
5-sept.	32—48 × 5.2—7.3
6-sept.	40—52 × 5.4—7.5
7-sept.	43—56 × 5.5—7.2

Chlamydospores intercalary, sometimes terminal, oval, smooth to rough-walled, single or in chains or knots. Growth rate 8.5 cm. Stroma reddish-brown or absent.

Perithecial state unknown.

F. tumidum Sherb. (Plate IV, fig. 16563)

Cultures white, white yellow, greyish-brown. Microconidia sparse, oval. Macroconidia in sporodochia and pionnotes, straight, or inequilaterally curved, ellipsoidal curved, with obtruse apex, short, narrow foot-cell.

0-sept.	13—20 × 4.6— 8.2
1-sept.	19—26 × 5.2— 8.2
2-sept.	25—37 × 5.8— 9.0
3-sept.	28—43 × 6.2— 9.6
4-sept.	34—47 × 7.0—10.2
5-sept.	36—59 × 7.2—10.8
6-sept.	38—63 × 7.5—11.2
7-sept.	45—68 × 7.6—11.6

Chlamydospores intercalary. Growth rate 3.6 cm. Stroma yellow-brownish, white.

Perithecial state unknown.

Section *Elegans* Wr. (1 species, 1 variety)

Cultures white, light rose, orange, violet to purple. Mycelium felted, striate or floccose. Microconidia in mycelium or false heads abundant, variable, oval-elliptical, straight to curved, powdery. Macroconidia in

aerial mycelium and sporodochia, sometimes in pionnotes, falcate, elongated, subulate, spindle- or sickle-shaped, narrowing at both ends. Chlamydospores abundant, terminal and intercalary, smooth to rough-walled.

Perithecial state unknown.

F. oxysporum Schlecht. (Plate IV, fig. 163)

Cultures white, peach, violet to purple. Microconidia in aerial mycelium or false heads, abundant, oval, elliptical, cylindrical, straight or curved. Macroconidia thin-walled, in aerial mycelium, rarely in sporodochia or pionnotes, spindle- or sickle-shaped, falcate, elliptical, curved, subulate, or straight, with narrowed upper cell and pedicellate foot-cell.

0-sept.	5—11 × 2.2—3.1
1-sept.	12—18 × 2.5—3.5
3-sept.	26—35 × 2.7—4.0
4-sept.	28—38 × 3.3—4.2
5-sept.	31—43 × 3.6—4.6

Chlamydospores smooth or rough-walled, abundant, terminal and intercalary, single or in pairs. Growth rate 4.9 cm. Sclerotia mostly present, sometimes absent.

F. oxysporum Schlecht. var. *redolens* (Wr.) Gordon (Plate IV, fig. 4967)

Cultures white, rose, beige, red-brown. Microconidia oval, cylindrical, slightly curved. Macroconidia in sporodochia and pionnotes, falcate, or spindle-shaped, with rounded apex and narrowing basal cell, pedicellate with foot-cell, typically 3-septate.

0-sept.	7 —15 × 3.2—4.0
1-sept.	16.5—24 × 3.5—4.3
3-sept.	27 —34 × 4.0—5.2
5-sept.	36 —45 × 4.4—5.5

Chlamydospores, terminal and intercalary, globose to oval. Growth rate 4.5 cm. Sclerotia rare or absent, cream to light brown.

Section *Martiella* Wr. em. Joffe & Palti (2 species, 2 varieties)

Cultures white, cream, orange-blue to brown. Microconidia abundant, oval or oblong, hyaline. Macroconidia in aerial mycelium, sporodochia or pionnotes, fusoid, cylindrical, curved, or elongate, with thick walls and short rounded apical and foot-cells. Chlamydospores globose, oval smooth or rough-walled, terminal and intercalary, single or in pairs, short chains or knots.

F. solani (Mart.) Sacc. (Plate IV, fig. 41)

Cultures greyish-white to brown. Microconidia oval, abundant, Macroconidia in aerial mycelium, sporodochia or pionnotes, elliptical, curved with short, round and sometimes beaked apical cell and round foot-cell.

0-sept.	10—14 × 3.4—4.2
1-sept.	17—24 × 4.0—4.5

3-sept.	27—38 × 4.4—6.4
4-sept.	35—43 × 4.6—6.5
5-sept.	36—48 × 5.2—6.6

Chlamydo-spores oval, terminal and intercalary, occasionally in short chains. Growth rate 3.5 cm.

Perithecial state: *Nectria haematococca* Berk. & Br.

F. solani (Mart.) App. & Wr. var. *coeruleum* (Lib.) Bilai (Plate IV, fig. 173a)

Cultures white-greyish, violet-blue to green. Microconidia oval, sparse. Macroconidia in sporodochia, pionnotes and in aerial mycelium, curved, cylindrical to slightly fusoid, with slightly rounded beaked apex, with marked apedicellate foot-cell or sometimes pedicellate.

0-sept.	7—11 × 2.2—4.0
1-sept.	14—20 × 3.0—4.8
3-sept.	30—42 × 4.7—5.5
5-sept.	44—53 × 4.8—5.6

Chlamydo-spores terminal or intercalary, single or in pairs, in hyphae and macroconidia. Growth rate 3.3 cm.

Perithecial state uncertain.

F. solani (Mart.) App. & Wr. var. *ventricosum* (App. & Wr.) Joffe comb. nov. (Plate IV, Fig. 156)

Cultures white, grey, cream to yellow-brown. Microconidia oval, in false heads or dispersed. Macroconidia in aerial mycelium, cylindrical or slightly curved, apedicellate, or marked, wedge-shaped foot-cell.

0-sept.	9—13 × 2.5—4.4
1-sept.	17—29 × 5.0—6.0
3-sept.	35—46 × 5.5—8.0

Chlamydo-spores abundant, terminal, single or in little groups, usually rough. Growth rate 2.8 cm.

Perithecial state: *Nectria ventricosa* Booth.

F. javanicum Koord. (Plate IV, fig. 3398)

Culture white, cream, light yellow to brown. Microconidia oval, oblong, in false heads. Macroconidia in aerial mycelium, pionnotes or rarely in sporodochia, elliptic, curved, elongate, with slightly narrowing apical cell, with or without foot-cell.

0-sept.	6—9 × 2.5—3.2
1-sept.	14—23 × 2.8—4.0
2-sept.	19—24 × 3.4—3.8
3-sept.	28—46 × 4.0—4.8
5-sept.	37—61 × 4.4—5.0

Chlamydo-spores terminal or intercalary, single, or in pairs, smooth or rough-walled. Growth rate 2 cm.

Perithecial state: *Hypomyces ipomoeae* (Hals.) Wr.

Zusammenfassung

Ein modernes System der *Fusarium* Taxonomie wird hier präsentiert, basierend auf einer Studie von 30 Jahren der Morphologie und kulturellen Eigenschaften dieser Pilze und ihrer unter sehr verschiedenen Bedingungen zum Ausdruck kommenden Variabilität.

Das hier unterbreitete System besteht aus 13 Sektionen, 33 Arten und 14 Varietäten. Es weicht von den Systemen, die von anderen Autoren veröffentlicht wurden, hauptsächlich in der Behandlung der Sektionen *Eupionnotes*, *Sporotrichiella*, *Arthrosporiella*, *Gibbosum*, *Discolor*, *Macroconia* und *Martiella* ab.

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