Studies in Mycology No. 5 22 oktober 1973

Studies in Phyllosticta

H. A. VAN DER AA
Centraalbureau voor Schimmelcultures, Baarn

I. Introduction

The genus *Phyllostict*ain its classical sense was used for fungi growing on leaves and forming in the host-tissue small pycnidia with one-celled, colourless conidia. In general it was considered as the leaf-inhabiting counterpart of *Phoma*, in which species developing especially on stems and twigs of vascular plants were included. Up to now about 2000 species have been described in the genus *Phyllosticta*. On the assumption that each host genus or species is colonized by specialized *Phoma*or *Phyllostict*aspecies, the fungi were not distinguished on morphological characters, but only by means of their respective host plants. Species causing spots on living leaves were considered to be different from those on fallen leaves. On many host genera or [p. 2] species two or more *Phyllostict*aspecies have been described, which were distinguished morphologically and often also ecologically.
The genera *Phyllostict*aand *Phoma*, according to the 19th century sporological system, proved to be very unnatural taxa, containing fungi of different relationships. The importance of host specificity for the taxonomy of the fungi in general and for Sphaeropsidales in particular, has been strongly overestimated; only a rather small group of plant pathogens is really host specific. In pure culture large numbers of so-called species often proved to represent a limited number of morphological types. Examples are *Phoma exigua*Desm. (Boerema & Höweler, 1967; van der Aa & van Kesteren, 1971) and *Phoma macrostoma*Mont. (Boerema & Dorenbosch, 1970) which are known to develop on widely different host plants.
The first purpose of this study was a taxonomical revision of all the species described in *Phyllosticta*. Species have to be distinguished on morphological characters on the natural substrate and in pure culture under well defined conditions. The genus has to be redefined and characterized by its type species which is, according to Donk (1968), *Phyllosticta cruenta*(Kunze ex Fr.) Kickx, a well known fungus causing leaf-spots on *Polygonatum*. It is possible to select a limited number of species related to *Phyllosticta cruenta*and their revision forms the main part of the present study. A similar selection of species was placed by Petrak & Sydow (1927) in the genus *Phyllostictina*Sydow, now considered as a synonym of *Phyllosticta*(Donk, 1964). Therefore the species in *Phyllostictina*have also been revised, which forms the second part of this paper.
All the other species have to be excluded; they belong to several other genera, mainly to *Phoma, Phomopsis, Asteromella*and *Ascochyta*. These genera are easily distinguished morphologically from *Phyllosticta*. The revision of the excluded species of *Phyllostict*awill be published in a separate paper.
A number of *Phyllostict*aspecies proved to include an ascigerous and a spermatial state in their life cycle. The ascigerous state has to be classified in the genus *Guignardia*; the type species of *Guignardia*also forms a typical *Phyllostict*astate. For the spermatial state the genus name *Leptodothiorella* Höhnel is available.

2. Historical survey

In 1818 Persoon introduced the generic name *Phyllostict*afor *Sphaeria lichenoides*DC. (Persoon, 1818: 55 and 147). When describing *S. lichenoides*De Candolle (1805) had distinguished between var. *convallariae-polygonati*DC. and var. *heredae-helicis*DC.; in 1815 he called the first variety *Sphaeria lichenoides*var. *convallariaecola*DC. Persoon thought that these two fungi might be different from the other ‘Sphérules’ but, because of their small size, it was impossible to distinguish them. Provisionally he called these fungi *Phyllostict*aand regarded them as a subgenus of *Sphaeria*(Persoon, 1818: 55). But as Donk (1964) pointed out, when Persoon (l.c.: 147) [p. 3] reviewed the genus in the same publication, he accepted, ex tempore, the name for the genus.

The var. *convallariaecola*DC. is mentioned first and called *Phyllosticta convallariae*Pers. Fries (1823) brought the devalidated generic name *Phyllosticta*Pers. in the synonymy of *Depazea*with the notice 'ined.', since he did not know the place of the original publication. Amongst the recognized species, Fries (l.c.: 531) also described *Sphaeria Depazea cruenta*Fr., with the basionym *Sphaeria cruenta*Kunze.
The name *Phyllosticta*Pers. was validated by Desmazières (1847). He did not mention *Phyllosticta convallariae*, but this is no reason not to recognize this species as type of the genus (Donk, 1964). In the meantime *Phyllosphaera*Dumortier (1822, cited in Donk, 1964) became a typonym of *Phyllosticta*Pers. ex Desm. Since *Phyllosticta*is still generally recognized and a large number of species have been described in it, this name was proposed for conservation (Donk, 1964) and accepted at the International Botanical Congress in 1965 (Stafleu & al., 1972). *Phyllosticta convallariae*Pers. was clearly designated as the type species (Donk, 1968). The first validly published name of this species was *Sphaeria cruenta*Kunze ex Fr. (1823), which became *Phyllosticta cruenta*(Kunze ex Fr.) Kickx (1849) as the correct name of the fungus.
Desmazières (1847) recognized that the genus *Depazea*as circumscribed by Fries (1823) was a mixture of fungi belonging to the genera *Septoria, Leptothyrium, Cheilaria*and *Phyllosticta*. 'Le *Phyllosticta*présente la déhiscence du *Septoria*, mais il en diffère essentiellement par ses sporidies ovoïdes ou un peu oblongues et droites ... Les *Phyllosticta*prennent naissance sur les feuilles'. From this characterisation and from the descriptions of the species, Desmazières' genus concept of *Phyllosticta*can easily be deduced: small, globose fruitbodies in more or less characteristic leaf spots. Desmazières did not restrict the genus to species with one-celled conidia. The first mentioned *Phyllosticta destructiva*Desm. has both one-celled and septate conidia, as was already observed by Desmazières (l.c.). The species has recently been brought into synonymy of *Phoma exigua*Desm. (van der Aa & van Kesteren, 197l). Even when he could not find conidia, Desmazières included several species in *Phyllosticta*, although with some hesitation.
This delimitation of the genus was rather wide and vague but most of the subsequent authors did not provide sharper outlines. Only the statement that the conidia in *Phyllosticta*should be one-celled, gained in importance and became one of the most important characters of the generic concept proposed by Saccardo (1878, 1884), which became the guiding principle for almost all the mycologists working with the genus up to the present. Saccardo (1878 and 1884) gave the following generic diagnosis for the genus *Phyllosticta*:

'(Etym. phyllon = folium et stictos = punctatus). Perithecia epidermide velata, lenticularia, tenuiter membranacea, poro saepius amplo pertusa, punctiformia, areolas foliorum raro ramulorum decoloratas incolentia. Sporulae exiguae ovoideae v. oblongae, continuae, hyalinae v. chlorinae; basidia minima v. nulla.'

According to this concept, 1502 species, subspecies and varieties are treated in the subsequent 22 volumes of the Sylloge Fungorum (1882-1931). [p. 4] This large number of species has been taken over and extended by the authors of all important regional fungus floras (Allescher, 1898; Diedicke, 1915; Seaver, 1922; Grove, 1935; Migula, 1921; Byzova & al., 1967). In all these publications it is stated more explicitly than in Saccardo, that *Phyllosticta*is restricted to leaf inhabiting species. The number of species described according to Saccardo's generic concept is still increasing and has now exceeded 20
00.Later on more morphological characters were used to distinguish genera. For Sphaeropsidales in general the work of Klebahn (1918), v. Höhnel (numerous publications between 1900 and 1925), Petrak & Sydow (1927) and Petrak (numerous publications up to the present) have been of great importance. Klebahn investigated the life cycle of many species using pure cultures and inoculation experiments. Höhnel, Petrak and Sydow studied and redescribed numerous species in detail. Wollenweber & Hochapfel (1936, 1937) published cultural studies of numerous Sphaeropsidales. During the last decade Boerema & al. revised a number of *Phoma*species on cultural characters, whereas Sutton (in Kendrick, 1971) and Morgan-Jones & al. (1972) revised generic concepts in the Sphaeropsidales, applying modern criteria, particularly the mode of conidiogenesis.
The latest compilation of *Phyllostictina*was published in 1927, when Petrak & Sydow gave extensive descriptions of 28 species. In the meantime the genus has been expanded to 84 described species, most of which are congeneric with *Phyllosticta cruenta*.The large genus *Phyllosticta*as a whole has not yet been revised according to modern criteria.
Histological studies on the origin and development of the pycnidial cavity of *Phyllosticta*were carried out by Darnell-Smith (1919) with *Phoma citricarpa*(= *Guignardia citricarpa*), by Dodge (1923) with *Phyllostictina*(= *Phyllosticta*) *carpogena*, by Petrak & Sydow (1927) with

Phyllostictina hysterella(= *Guignardia philoprina*) and by Demaree & Wilcox (1947) with *Phyllostictina* (= *Phyllosticta*) *vaccinii*.

3. Material and methods

Herbarium material

Herbarium specimens were mostly studied using freezing microtome sections, mounted in water, aqueous crystal violet or methylene blue, or in lactophenol cotton blue. When the material this permitted, some pycnidia were prepared free from the leaf tissue to study the structures around the pore of the pycnidium. The most important characters sometimes became visible after boiling in lactic acid or lactophenol with cotton blue. Structures which disappear easily like the slime layer surrounding the conidia and the apical appendages could still be recognized on rather old herbarium collections after careful soaking in water and staining with crystal violet or methylene blue. [p. 5]
Whenever possible fresh material was also used. For several species the descriptions remain incomplete because of the absence of living material.
Material for this study was obtained from the herbaria and institutes which are listed below using the abbreviations according to the Index Herbariorum (Lanjouw & Stafleu, 1964).

B	Botanisches Museum, Berlin-Dahlem, Germany
BR	Jardin Botanique de l'État, Bruxelles, Belgium
CBS	Herbarium of the Centraalbureau voor Schimmelcultures, Baarn, Netherlands
FH	Farlow Library and Herbarium of Cryptogamic Botany, Harvard University, Cambridge, Massachusetts, U.S.A.
IMI	Commonwealth Mycological Institute, Kew, Great Britain
L	Rijksherbarium, Leiden, Netherlands
NY	he Herbarium of the New York Botanical Garden, New York, U.S.A.
PAD	Istituto e Orto Botanico dell'Università, Padova, Italy
PC	Museum National d'Histoire Naturelle, Laboratoire de Cryptogamie, Paris, France
S	Naturhistoriska Riksmuseet, Botaniska Avdelningen, Stockholm, Sweden
URM	Instituto de Micologia, Universidade do Recife, Recife, Pernambuco, Brasil
U	Botanical Museum and Herbarium, State University of Utrecht, Netherlands
ZT	Institut für spezielle Botanik der Eidgenössischen Technischen Hochschule, Zürich, Switzerland

Fresh collections

Fresh material of plants infected by *Phyllostictaor Guignardia* was collected mainly in the Netherlands, mostly in the surroundings of Baarn. Some more living material was obtained from Western Germany, Czechoslovakia, Italy, England and North America. This material was treated like the herbarium specimens.
Leaves with unripe fructifications or with only one state of the fungus, were kept in petri-dishes on moistened paper for several weeks, to allow further development. Before incubation the material was usually superficially desinfected by immersion in 1 or 2% formaldehyde for 30-60 seconds, and washing with water during 10-15 minutes. This was usually sufficient to kill the spores of other fungi occurring on the leaf surface. From such material it was usually possible to isolate the fungus and to obtain pure cultures.

Methods of isolation and cultivation

Until recently a restricted number of strains was available in culture collections, some of them, moreover, in a non-sporulating condition. Therefore most of the cultures studied were obtained from freshly collected material. The following isolation techniques were used.
Externally desinfected leaves with ripe pycnidia placed in a moist chamber extruded within a few hours thick masses or slender tendrils of conidia through the pore. The conidia were suspended in water and streaked out on an agar medium to obtain single spore cultures. Cherry decoct, oatmeal or maltagar were mostly used, the latter two with addition of penicillin and streptomycin, to suppress bacterial growth.
Sometimes yeasts overgrew all germinating conidia and in such cases pure [p. 6] cultures were

obtained by plating out very small pieces of the desinfected host tissue, removed from near the pycnidia. Sometimes pycnidia were squashed on a microscope slide under a cover glass and the fungus was isolated subsequently by streaking out the water suspension with fungal fragments on agar media. The latter method was always used for isolating when the spermatial state only was present, since the spermatia themselves do not germinate on artificial media. Cultures of the perithecial state were obtained by fixing leaf fragments with ripe perithecia to the lid of a petri-dish, allowing them to eject ascospores onto the agar. The success of this method was, however, rather limited. Mostly it was easier to make suspensions of the ascospores by squashing ripe perithecia under a cover glass and isolating from this suspension. Using this method no differentiation was made between colonies arising from ascospores and those from fragments of perithecial tissue.
The pure cultures so obtained were kept on cherry decoct agar, cornmeal agar or oatmeal agar, usually with sterilized lupine stems, which stimulate the formation of fruitbodies. Strains from the temperate zone were kept at room temperature (about 20°C), strains from tropical and sub-tropical origin or from glass-houses at 24° and 30°C. In older strains with limited or no sporulation, near UV light was successfully used to induce fructification. Under near UV light all isolates produced less aerial mycelium and gave better sporulation. Diffuse daylight also had a positive effect on sporulation, although to a less extend.
Colony morphology was studied on 9 cm petri-dishes containing about 15 cc or occasionally 30 cc of the agar medium. On a thin agar layer only conidial and spermatial states usually developed and occasionally young perithecia, which remained unripe; on thick agar layers or on agar slants these ripened in some cases after about 6-10 weeks. However, in some freshly isolated strains only the ascigerous state was observed; it ripened in about 2 weeks on thin and on thick agar layers. Exposure to near UV favours, in particular, the development of perithecia.
Germination of conidia was observed in hanging drops or directly on the host on stripped off pieces of the cuticle. Strains of all species studied in vitro are maintained in the CBS collection. Lyophilization was seldom successful; conidia only rarely survived the treatment. Typical cultures were also dried and kept as herbarium specimens; a number of permanent slides of all stages of the life cycle of the species are kept in the collection of the author (CBS).

4. The genus Phyllosticta

*Phyllosticta*Pers. - Traité Champ. comest.: 55 and 147. 1818; per Desm. - Annls Sci nat. Bot., Sér. 3, 8: 9. 1847 = *Phyllosphaera*Dumortier - Obs. bot.: 86. 1822.

*Phyllostictina*Syd. - Annls mycol. 14: 186. 1916; emend. Höhnel - Hedwigia 62: 64 1920.
*Caudophoma*Patil & Thirumalachar - Sydowia 20: 36 (1966) 1968. [p. 7]
Stroma prosenchymatous or plectenchymatous, well developed in pure culture, often reduced or absent on leaves. Pycnidia globose, pyriform or tympaniform, separate or in small groups, embedded in a subepidermal stroma, uni- or multilocular, perforated by an ostiolum; wall prosenchymatous or pseudoparenchymatous, variable in thickness, not sharply delimited from the stroma, the outer cells mostly dark and thick-walled, the inner cells hyaline and isodiametric, giving rise to conidiogenous cells. Conidiogenous cells short cylindrical or conical, forming blastoconidia in basipetal succession and abstricting them from a fixed locus with a broad base. Conidia one-celled, hyaline, globose, obovoidal, ellipsoidal or clavate, young ones often more strongly tapering towards the base, broadly rounded apically, flattened or indented, surrounded by a slime layer, bearing an apical appendage, usually containing characteristic greenish guttules; medium sized, once or twice as long as wide, generally measuring between 8-20 x 5-10 µm, often forming appressoria when germinating.

Discussion of the morphological characters

Phyllosticta species in general cause leaf spots but may also attack fruits or young stems. In leaves pseudostromata primarily develop subepidermally with inter- and intra-cellular dark brown to almost black hyphae, often reduced in thin leaves, sometimes, however, growing densely through the affected region or aggregated subepidermally and combining with remains of the host tissue into a clypeus-like structure, surrounding the apical part of the pycnidium.
Pycnidia develop from hyphal clusters, developing into undifferentiated tissue. They become globose, subglobose or tympaniform, flattened above, closely connected with the subepidermal pseudostroma. A flat or papillate ostiole develops apically and is perforated at maturity by a pore,

which is usually surrounded by a zone of somewhat flattened, thick-walled, darkly pigmented cells. The ostiole is filled at first with thin-walled, hyaline or subhyaline cells which are pushed aside at maturity under pressure from the conidial mass. The opening is often secondarily enlarged by disruption of the outer margin of the papilla. The pycnidia are unilocular, sometimes apparently multilocular and multiostiolate after concrescence of several pycnidia.
Growth and development of the vegetative parts in pure culture is different from that on the natural substrate. In pure culture the stroma is generally extended, forming an irregularly folded crust, composed of darkly pigmented pseudoparenchyma, partly submerged, sometimes, however, with a very loose texture. On this crust or directly from the submerged hyphae, globose, cylindrical or coralloid stromata arise, consisting of colourless to darkly pigmented parenchyma. Colourless stromata are very abundant in cultures of some species and remain permanently sterile. In their upper region pigmented stromata can develop one to many pycnidia, which are single or clustered, unilocular or multilocular, ostiolate, not papillate, the walls having a thicker outer pseudoparenchyma than is found in vivo. [p. 8]
In young stages of development, before the cavity has reached its ultimate shape and size, the first conidiogenous cells develop terminally on septate, hyaline hyphae, growing into the enlarging cavity. These distinct hyphae mostly disappear, but some may persist in mature pycnidia in an inactive state, between the younger conidiogenous cells and resemble pseudoparaphyses; they occur especially in species related to *Botryodiplodia*or *Lasiodiplodia*. In mature pycnidia the conidiogenous cells are formed only from the inner wall-cells.
The conidia are typically one-celled; only in *Phyllosticta flevolandica*one-septate conidia rarely occur; this species has also some other characters pointing to *Botryodiplodia.*The conidia can be globose, subglobose, broadly ellipsoidal, ovoidal, obovoidal, pyriform or broadly clavate, seldom curved, tapering especially when young towards the truncate base, broadly rounded and somewhat flattened or indented at the top. The conidia have a thin and rather flexible wall, which is covered by a slimy, sometimes very thick perisporium. After the conidia are liberated, their shape can change from pyriform or clavate into broadly ellipsoidal to globose, especially when mounted in water.
The conidia contain usually a number of small greenish guttules. Sometimes one or two large, bright guttules are present, which in some species almost fill the whole conidium; vacuolisation depends on the stage of development, temperature or staining method. Kvartskhava (1968) stated that the conidia of *Guignardia bidwellii*were multi-guttulate at 10-20°C, while at 35°C the guttules fused into one large drop. Fusion of guttules was also observed in germinating conidia. But often the occurrence of large guttules was found to be constant and useful to distinguish species, especially when used in combination with other characters and observed in slides which were not heated.
In most species the conidia have a hyaline, subulate or filiform gelatinous apical appendage; in some species with small conidia an irregular slime cap covers the upper half of the conidium. The appendage is rather caducous and usually visible on a number of the conidia only, in freshly collected specimens or even in pure cultures. In some species it is no longer recognizable in herbarium specimens, in others it can be very solid and persistent, as in the c. 60 year-old type specimen of *Macrophoma linderae*Miura, where it still occurs in a well preserved state on almost every conidium. The apical appendage or slime cap is regarded as part of the perisporium of the previous conidium.
The conidia are small to medium sized, 5-25 x 5-15 µm, usually 8-18 x 6-10 µm or about 6-12 µm in diameter. Within a species a large variation in size may occur but the length-width ratio is rather constant. The conidia are rather wide and the length seldom reaches twice the width.

The conidia are pushed out the pycnidia in white tendrils, which can become yellowish when old and dry and sometimes show a marked and well delimited brown top, when the outer conidia have germinated and produced appressoria.
Appressoria are formed directly on the conidium or on the germ tubes. [p. 9] They are one-celled or septate, of variable shape and size, sometimes irregularly lobed. They are easily observed on stripped off pieces of the cuticle, in the exuded tendrils and in hanging drop cultures.

Discussion of the synonyms

Amongst the synonyms of *Phyllosticta*, *Phyllosphaera*Dum. has been rejected after conservation of the generally recognized name *Phyllosticta*Pers. ex Desm. *Phyllosticta cruenta* (Kunze ex Fr.) Kickx was designated as the type species (Donk, 1964; 1968); this led to the synonymy of *Phyllostictina*Syd., of which the type species *Phyllostictina murrayae*Syd. is congeneric with *Phyllosticta cruenta.*
The position of the monotypical genus *Caudophoma*Patil & Thirum. has already been discussed by Petrak (1968), who transferred *Caudophoma ehretia*e Patil & Thirum. to *Phyllostictina*.

Comparison with related genera

Phyllostictais related to some other genera of the Sphaeropsidales, which also have *Guignardia*and *Botryosphaeria*ascigerous states.

*Dothiorella*Sacc. (Michelia 3: 5. 1880) has conidia with a rather thin slime layer, no apical appendage and a length mostly exceeding twice the width. The ascigerous state belongs to the genus *Botryosphaeria*. *Botryodiplodia*Sacc. (Syll. Fung. 3: 377. 1884) and *Lasiodiplodia*Griffon & Maubl. (Bull. Soc. mycol. Fr. 25:1 1909) have also *Botryosphaeria*ascigerous states but are easily distinguished by their one-septate, pigmented conidia. *Selenophoma*Maire (Bull. Soc. bot. Fr. 53: 87. 1906) has lunate conidia; some species have a *Guignardia*ascigerous state. The genus *Phoma*Fr. emend. Sacc. (Michelia 2: 4. 1880) is not directly related, but often confused with *Phyllosticta*. It is characterized primarily by a conidium development which is described by Brewer & Boerema (1965), and Boerema (1970) as a monopolar repetitive budding process from the top of somewhat cuspidate but otherwise undifferentiated cells (cf. Sutton, 1964; Sutton & Sandhu, 1969) and by its conidia which are one-celled or occasionally septate, usually smaller than those of *Phyllostictaa*nd without a slime layer and apical appendage.

5. The ascigerous state

*Guignardia*Viala & Ravaz - Bull. Soc. mycol. Fr. 8: 63. 1892 - Figs. 1,2. For synonyms see von Arx & Müller (1954). Type species: *Guignardia bidwellii* (Ellis) Viala & Ravaz (l.c.)
Stroma prosenchymatous or plectenchymatous, often reduced or absent. Ascomata globose, subglobose or tympaniform, seldom papillate, ostiolate at maturity; wall composed of an outer region of pigmented, mostly thick-walled [p. 10] pseudoparenchyma, somewhat darker around the ostiole, and an inner region of subhyaline isodiametrical pseudoparenchymatous cells; asci clavate, broadly rounded above, attenuated at the base to a shorter or longer stalk, bitunicate, with the inner membrane thickened near the top; ascospores one-celled, hyaline, faintly greenish or brownish, ovoidal, ellipsoidal or rhomboidal, at times with distinct hyaline gelatinous caps at one or both ends, mostly less than 20 µm, seldom over 25 µm long; filamentous paraphyses absent, but some remains of the former pseudoparenchyma may occur.

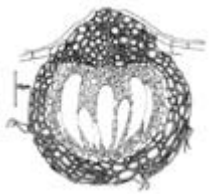


Fig. 1. *Guignardia philoprina*, ascoma. Coll. J. A. von Arx, 1966, on leaf of *Rhododendron*spec.



Fig. 2. *Guignardia philoprina*, a. ascus; b. ascospores. Coll. J. A. von Arx, 1966, on leaf of *Rhododendron*spec. [p. 12]

Discussion

In young ascomata ascogenous cells develop within the inner, hyaline, pseudoparenchymatous region. Erect receptive hyphae extend directly towards the perithecial apex, tapering into a very slender free end, where fertilization takes place by spermatia (microconidia). After dikaryotization of the ascogonia, the receptive hyphae disappear. Asci develop from the, ascogenous cells and push the surrounding pseudoparenchyma aside.
The genus *Guignardia* comprises the ascigerous states of *Phyllosticta* species and of some other related genera of the Fungi imperfecti. (The conidial state of *Guignardia bidwellii*is *Phyllosticta ampelicida* (Engelman) van der Aa, a typical representative of the genus).

Some ascomycetes, classified by von Arx & Müller (1954) in *Botryosphaeria* proved to have *Phyllosticta* conidial states and have to be transferred into *Guignardia*. In the family of the Botryosphaeriaceae sizes of ascospores and ascomata, extension of the stroma and conidial states are useful characters to distinguish genera (cf. table 1).

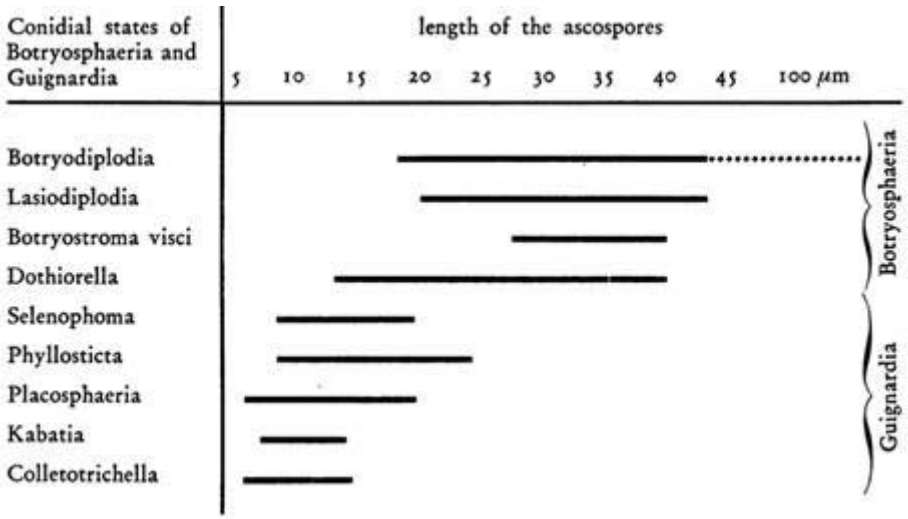


table 1. Conidial states of *Botryosphaeria* and *Guignardia*in relation to the length of the ascospores
[p. 11]

*Botryopshaeria*has conidial states in *Botryodiplodia*, *Lasiodiplodia*and *Dothiorella*; the ascospores are longer than 20 µm, usually exceeding 25 µm; in the type species *B. quercuum*(Schw.) Sacc. they are up to 50 µm and in some other species up to 100 µm long. Generally in *Botryosphaeria*the stroma is much more extended than in *Guignardia*. Both genera can also be distinguished by different growth characters in pure culture. *Botryosphaeria*species spread rapidly with flat colonies, which reach the margin of a 9 cm diameter petri-dish within about one week; they produce scattered stromata after 1 or several weeks. *Guignardia*species have slow growing colonies composed of densely crowded stromata.
Petrak (1958) united *Guignardia*with *Botryosphaeria*and renamed the type species in *Botryosphaeria bidwellii*(Ellis) Petrak. The ascigerous state of *Phyllosticta cruenta*(Kunze ex Fr.) Kickx, first described as *Melanops cruenta*Petrak (1927) was also transferred to *Botryosphaeria*by Petrak (1963).
Barr (1970 and 1972) followed the concept of Petrak and transferred some more *Guignardia*species with *Phyllosticta*conidial states into *Botryosphaeria*. Reusser (1964) and Kvartskhava (1968) on the other hand, maintained the genus *Guignardia*as circumscribed by von Arx & Müller (1954). *Guignardia*and *Botryosphaeria*are well defined and delimited genera. Only a few intermediate *Botryosphaeria*species with a *Dothiorella*conidial state and with well developed stroma occur, with rather small ascospores of the *Guignardia*type (cf. Stevens, 1925; Shear, Stevens & Wilcox, 1924 and 1925).
Other *Guignardia*species have conidial states which belong to the genera *Kabatia, Colletotrichella, Placosphaeria*and *Selenophoma*. These *Guignardia*species have 10-25 µm long ascospores and can only be distinguished by different conidial states and by their host range.
For a group of apparently aparaphysate *Guignardia*species, Petrak used the generic name *Discosphaerina*Höhnel (Sber. K. Akad. Wiss. Wien, math.-nat. Kl., Abt. I, 126: 353. 1917). The presence or absence of so-called paraphyses, can not however, be used as distinguishing character, since these paraphyses are only remains of the former pseudoparenchyma, filling the centre of the young ascomata. Their occurrence is dependent on several circumstances; they can be present in one perithecium and absent in another of the same species. Therefore *Discosphaerina*is regarded as a synonym of *Guignardia*, as suggested by von Arx & Müller (1954).

6. Spermatial or microconidial state

In the life cycle of *Botryosphaeria*and *Guignardia*species a spermatial state often occurs. On the host plant and in pure culture this state develops simultaneously with the conidial state or somewhat later. Although well known for a long time, it has not yet been classified satisfactorily. Darnell Smith [p. 13] (1919) called the spermatia x-spores; Dodge (1923) recognized the

spermogonial nature and in 1931 he called the fruitbodies spermogonia with microconidia; he also noticed that they can occur together with the macroconidia in one pycnidium.
Several authors classified the spermatial states in *Asteromella*(Steward, 1916; Petrak, 1957; Müller, 1957). However, the type species *Asteromella ovata*Thüm. and numerous other comparable species differ in several characters from the spermatial state of *Guignardia*and *Botryosphaeria*and represent the spermatial states of *Mycosphaerella*and *Sphaerulina*species, which are not related to *Guignardia*.
Sydow (1926) classified the spermatial state of *Melanops concinna*Sydow (= *Guignardia concinna*(Syd.) van der Aa) as *Leptodothiorella concinna*Syd. It was the first of two species described by Sydow in the genus *Leptodothiorella*, which was mentioned by von Höhnel (1923) in his key to the imperfect fungi, without diagnosis and indication of a species. The type specimen of *Melanops concinna*Syd. shows the complete cycle of a *Guignardia*, with ascigerous, conidial and spermatial states. The second species, *Leptodothiorella cyatheae*Syd. (l.c.) is the spermatial state of another member of the Botryosphaeriaceae, apparently not a *Guignardia*species, since the well developed stroma is erumpent (syntype in Sydow, Fungi exot. exs., U). Sydow (1932) found *Phyllostictina tinospora*Sydow to be accompanied by a *Leptodothiorella*state and although the material of the latter was very scanty, Sydow's conception of *Leptodothiorella*is hereby underlined once more.
The spermatial states of *Guignardia*species described in this study resemble in many details *Leptodothiorella concinna*; the name *Leptodothiorella*is validated here in the sense of the first published and well described species *Leptodothiorella concinna*Sydow (1926).

LeptodothiorellaHöhnel sensu Sydow ex van der Aa, nov. gen. - Fig. 3.

*Leptodothiorella*Höhnel - System der Fungi imperfecti in R. Falck - Mycologische Untersuchungen and Berichte 1: 328; sensu Sydow - Annls mycol. 24: 407. 1926.

Status spermatialis Botryosphaeriacearum. Pycnidia globosa, subglobosa, tympaniformia vel irregularia, sursum plana vel papillata, ostiolata; pariete crassitudine variabili, pseudoparenchymatico, extus pigmentato, sursum cum stromate subepidermidali fuso, intus in pseudoparenchyma hyalinum, tenuitunicatum transeunte, e quo cellulae conidiogenae oriuntur. Cellulae conidiogenae cylindricae blastoconidia basipetalia proferunt. Spermatia halteriformia vel cylindrica, continua, hyalina, duobus guttulis oleaginosis distalibus praedita.

Species typica *Leptodothiorella concinna*Sydow. Specimen typicum sub *Melanops concinn*a Sydow in U 178462B.
Pycnidia globose, subglobose, tympaniform or irregular in shape, flattened above or papillate, with a well defined ostiole. Wall 2-5 cells thick, of subhyaline to brownish, thin- or thick-walled pseudoparenchyma, more abundant in the upper region and often not clearly delimited from the subepidermal stroma, becoming hyaline towards the spermatiogenous region, in which the cells are isodiametrical; spermatiogenous cells filamentous or cylindrical, [p. 14] in immature pycnidia borne on branched, septate spermatiophores, at maturity linine the caxity in a palisade-like arrangement. Spermatia formed in basipetal succession as blastoconidia and separated from the spermatiogenous cells by a septum; cylindrical or dumb-bellshaped, straight or slightly curved, bi-guttulate at the swollen ends, 5-15 x 0.5-3 µm in size.

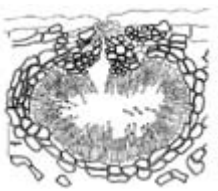


Fig. 3. *Guignardia philoprina, Leptodothiorella*state, spermogonium. Coll. H. A. van der Aa nr. 1737, on fallen leaf of *Ilex aquifolium*.

Discussion

Spermatial states have not yet been observed in all species, but are found in connection with several *Botryosphaeria*species (cf. Funk, 1964; van der Aa, unpublished data), *Guignardia cytisi*(Fuckel) v. Arx & Müller (new observation) and a number of *Guignardia*species with *Phyllostictа*conidial states. Mostly they are scarce, at times, however, more abundant than the other states. The fruit-bodies are similar to those of the conidial state and the two states can be distinguished only, when conidia or spermatia are produced. Both conidia and spermatia can be formed simultaneously in the same pycnidial cavity, particularly in early stages of development. The spermatia have no vegetative function; they do not germinae on artificial media but only on the trichogyne which grows out from the ascogonium. The fertilization [p. 15] process is the same as in *Mycosphaerella*, where spermatia are produced in pycnidia of the form genus *Asteromella*(Klebahn, 1918; Higgins, 1920, 1929 and 1936; von Arx, 1949; Gäumann, 1964).

7. Host relationships

Identity of the phanerogam host plant is used too often as taxonomic character for parasitic and saprophytic fungi. Many hundreds of species in genera as *Phoma, Coniothyrium, Phyllosticta, Colletotrichum*and others are morphologically indistinguishable forms of a restricted number of common, plurivorous species. By comparison of type collections with freshly collected material and isolates from different hosts, numerous synonyms could be recognized, e.g. in *Phoma herbarum*Westend. (Boerema, 1970), *Phoma macrostoma*Mont. (Boerema & al., 1970) and *Phoma exigua*Desm. (Boerema & Höweler, 1967; van der Aa & van Kesteren, 1971). Von Arx (1970) found nearly 750 names for *Glomerella cingulata*(Stonem.) Spauld. & v. Schrenk and its conidial state *Colletotrichum gloeosporioides*Penzig. *Coniothyrium olivaceum*Bon. in Fuckel is another example, being a common plurivorous species, described separately on many host plants (Wollenweber & Hochapfel, 1937; van der Aa, unpublished data). All these species are saprophytes or, at times, plant pathogens. They cause symptoms which are often more characteristic for the host plant than for the fungus. *Phoma exigua, Coniothyrium olivaceum*and *Colletotrichum gloeosporioides*occur often on exactly the same type of leaf spots.
In contrast, inoculation experiments with *Guignardia*species and their conidial states nearly always showed that these species are specific plant pathogens for one host species or the species of one host genus. Reusser (1964) found six *Guignardia*species which were hardly distinct on ascomatal characters but could be separated by their conidial states together with their very narrow host range. Inoculation experiments with isolates of *Guignardia aesculi* from *Aesculus*on the same host plant were successfull, but cross inoculations from one *Aesculus*species to another failed (Steward, 1916). Neely (1971) found 5 out of 41 *Aesculus*species and subspecies to be resistent to *G. aesculi*. Luttrell (1946 and 1948) carried out extensive experiments with *Guignardia bidwellii*on different members of the Vitaceae and recognized 3 formae speciales based on the host range.
On the other hand, Kiely (1948) and Schüepp (1961) reported morphologically similar *Phyllostictа*species on unrelated host plants, growing near the *Citrus*orchards, where they studied the black-rot disease caused by *Guignardia citricarpa*. Kvartskhava (1968) listed 26 host plants in 17 families, which were comparably infected by *Phyllosticta*, some of them with microconidial or ascigerous states. She regarded these fungi all as conspecific with *Guignardia bidwellii*, and explained the wide spread in morphological characters by variation of hosts and external factors. [p. 16]
Nearly all the species described in this paper are plant pathogens, causing leaf spots or fruit rot. Species are considered to be identical only when all states are morphologically identical. Several morphologically similar *Phyllostictа*species have distinguishable ascigerous states. The opposite case can also be found for similar *Guignardia*species which differ in their conidial states. [p. 17]

8. Key to the species of Phyllosticta

1a.	Conidia one-celled or one-septate (soil-borne)	*P. flevolandica*
1b.	All conidia one-celled	2
2a.	Conidia less than 10 µm long	3
2b.	Conidia at least some longer than 10 µm	13
3a.	Conidia with an apical slime cap (on *Pyrola*and *Erica*)	*P. pyrolae*
3b.	Conidia without apical slime cap, sometimes with an apical appendage	4

4a.	All pycnidia less than 100 µm in diameter	5
4b.	Pycnidia at least some exceeding 100 µm diameter	6
5a.	Pycnidia apically flattened; conidia up to 8 µm long (on *Aplectrum*)	*P. aplectri*
5b.	Pycnidia distinctly papillate; conidia up to 10 µm long (on *Rhus*)	*P. toxica*
6a.	Pycnidia up to 200 µm in diameter (on *Dorycnium*)	*P. moravica*
6b.	Pycnidia smaller, 70-130 µm in diameter	7
7a.	Pycnidial wall up to 10 µm thick	8
7b.	Pycnidial wall more than 10 µm thick	10
8a.	Pycnidia distinctly papillate; wall in the basal and lateral region hardly developed (on *Clethra*)	*P. clethricola*
8b.	Pycnidia flat; wall well developed all around	9
9a.	Pycnidial wall one cell thick; conidia up to µm long (on *Vinca*)	*P. minor*
9b.	Pycnidial wall 1-3 cells thick; conidia up to 8 µm long (on *Podophyllum*)	*P. podophylli*
10a.	Pycnidia subglobose to pyriform, distinctly papillate (on *Morinda*)	*P. morindae*
10b.	Pycnidia depressed or flattened above	11
11a.	Pore surrounded by a distinct dark brown ring-wall (on *Dioscorea*)	*P. dioscoreae*
11b.	No distinct dark brown ring-wall around the pore	12
12a.	Subepidermal stroma well developed; conidia containing fine guttules (on *Hymanaea*)	*P. hymanaeae*
12b.	Subepidermal stroma not developed; conidia containing rather coarse guttules (on *Gaultheria*)	*P. gaultheriae*
13a.	Conidia medium sized, 8-15 µm long	14
13b.	Conidia at least some over 15 µm long	38
14a.	Pycnidia 5-12 together in well developed, erumpent stroma (on Cycadaceae)	*P. encephalarti*
14b.	Pycnidia single, seldom clustered or stroma not erumpent (on Angiospermae)	15
15a.	Pycnidia large, up to 300 µm in diameter	16
15b.	Pycnidia up to 200 µm in diameter, mostly much smaller	17
16a.	Pycnidial wall up to 3 cells thick; apical appendage of the conidia 12-20(30) µm long (on *Lindera*)	*P. phanerura*
16b.	Pycnidial wall 3-10 cells thick; apical appendage of the conidia 5-15 µm long (on *Citrus*) [p. 18]	*P. citricarpa*
17a.	All pycnidia less than 100 µm in diameter	18
17b.	Pycnidia at least some exceeding 100 µm in diameter	20
18a.	Conidia up to 15 µm long (on Palmaceae)	*P. arecae*
18b.	Conidia up to 12 µm long	19
19a.	Subepidermal stroma not developed; apical appendage of the conidia distinct (on *Putranjiva*)	*P. putranjivae*
19b.	Subepidermal stroma well developed; apical appendage indistinct (on *Melochia*)	*P. melochiae*
20a.	Apical appendage of the conidia absent	21
20b.	Apical appendage of the conidia present	23
21a.	Conidia about 2 times as long as wide (on Araceae)	*P. colocasiicola*
21b.	Conidia 1-1.5 times as long as wide	22

22a.	Pycnidia up to 200 µm in diameter; wall-cells brown to dark-brown; conidia obovoidal to subglobose (on *Murraya*)	*P. murrayicola*
22b.	Pycnidia up to 140 µm in diameter; wall subhyaline to brownish; conidia obovoidal to broadly ellipsoidal (on *Hamamelis*)	*P. hamamelidis*
23a.	On Monocotyledonae	24
23b.	On Dicotyledonae	26
24a.	Pycnidia up to 200 µm in diameter; stroma absent or not well developed; conidia up to 15 µm long (on Orchideaceae)	*P. capitalensis*
24b.	Pycnidia up to 150 µm in diameter; subepidermal stroma well developed; conidia up tot 13 µm long	25
25a.	Pycnidia globose or pyriform; subepidermal stroma clypeus-like; apical appendage of the conidia up to 7 µm long (on *Amaryllis*)	*P. amaryllidicola*
25b.	Pycnidia subglobose or depressed; stroma not clypeus-like; apical appendage of the conidia up to 15 µm long (on Liliaceae, in N. America)	*P. subeffusa*
26a.	Conidia up to 15 µm long	27
26b.	Conidia up to 13 µm long	29
27a.	Conidia obovoidal to subglobose, up to 10 µm wide (on *Celastrus*)	*P. celastrina*
27b.	Conidia obovoidal or broadly ellipsoidal, up to 8 µm wide	28
28a.	Pycnidia distinctly papillate (on *Glycosmis*)	*P. murnadensis*
28b.	Pycnidia flattened above, inconspicuously papillate (on *Artocarpus*)	*P. artocarpina*
29a.	Apical appendage up to 15 µm, seldom up to 20 µm long	30
29b.	Apical appendage of about the length of the conidium	32
30a.	Conidiogenous cells slender and elongated; pycnidia globose or pyriform (on *Malus*and probably on other Rosaceae)	*P. solitaria*
30b.	Conidiogenous cells short cylindrical or conical; pycnidia globose or depressed	31
31a.	Wall often not developed in the lower and lateral parts of the pycnidium (on *Myrsine*)	*P. africana*
31b.	Wall well developed all around (on *Loranthus*)	*P. loranthi*
32a.	Pycnidia up to 125 µm in diameter (on *Acer*) [p. 19]	*P. minima*
32b.	Pycnidia up to 200 µm in diameter	33
33a.	Pycnidial wall often more than 3, up to 8 cells thick	34
33b.	Pycnidial wall 1-3 cells thick or only thicker around the pore	35
34a.	Pycnidia distinctly papillate; stroma not developed (on *Mangifera*)	*P. anacardiacearum*
34b.	Pycnidia apically flattened; stroma well developed (on *Vaccinium*)	*P. vaccinii*
35a.	Apical appendages distinct, of about the length of the conidium	36
35b.	Apical appendages hardly developed	37
36a.	Pycnidial wall typically 1, seldom up to 3 cells thick; conidia obovoidal to globose (on Vitaceae)	*P. ampelicida*
36b.	Pycnidial wall, especially in the apical part of the pycnidium thicker; conidia obovoidal or broadly ellipsoidal (on *Cyamopsis*)	*P. cyamopsidicola*
37a.	Pycnidial wall pale brown, darker around the pore; (causing distinct, well delimited leaf spots on *Hevea*)	*P. heveana*
37b.	Pycnidial wall brown all around; not in distinct leaf spots (on various other Euphorbiaceae)	*P. ghaesembillae*
38a.	Conidia only occasionally more than 15 (up tot 18) µm long	39
38b.	Conodia at least some more than 15, up to 22 µm long; often	42

variable in size

39a. Conidia pyriform, obovoidal, ellipsoidal or inequilateral, surrounded by a thin slime layer — 40
39b. Conidia obovoidal to subglobose, with a rather thick slime layer — 41

40a. Pycnidial wall hardly developed; conidia with coarse guttules (on *Diospyros*) — *P. arxii*
40b. Pycnidial wall well developed; conidia containing fine guttules (on *Coffea*) — *P. bokensis*

41a. Pycnidia 120-250 µm in diameter, distinctly papillate; pore lined with pseudophyses (on *Ruscus*) — *P. hypoglossi*
41b. Pycnidia 80-160 µm, usually about 120 µm in diameter, inconspicuously papillate (on *Tabernaemontana*) — *P. zimmermannii*

42a. Apical appendages not longer than the conidia or absent — 43
42b. Apical appendages at least some much longer than the conidia — 44

43a. Pycnidia thin-walled, pale brown with a dark, thickened wall around the pore, up to 160 µm in diameter (on *Aesculus*) — *P. sphaeropsoidea*
43b. Pycnidia thick-walled, 200-330 µm in diameter (on Boraginaceae) — *P. concinna*

44a. Pycnidia thin-walled, single or clustered; subepidermal stroma well developed (on *Musa*) — *P. musarum*
44b. Pycnidial wall thicker; subepidermal stroma not developed or loosely prosenchymatous — 45

45a. Conidia 12-22 x 5-10 µm, usually over 16 µm long, containing fine guttules and surrounded by a thin slime layer (on Liliaceae) — *P. cruenta*
45b. Conidia 8-20 x 4-14 µm, but usually less than 16 µm long; containing rather coarse guttules and surrounded by a thick slime layer (on leaves of various trees and shrubs) — *P. concentrica*
[p. 20]



Fig. 4. Conidia of:
a. *Phyllosticta cruenta*;
b. *P. africana*(type);
c. *P. amaryllidicola*(type);
d. *P. ampelicida*;
e. *P. anacardiacearum*;
f. *P. aplectri*(type);
g. *P. arecae*;
h. *P. arxii* (type);
i. *P. artocarpina*;
j. *P. bokensis*(type);
k. *P. capitalensis*;
l. *P. celastrina*(type);
m. *P. citricarpa*;
n. *P. clethricola*;
o. *P. colocasiicola.* [p. 21]

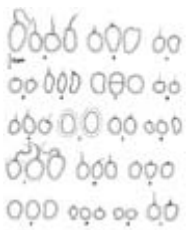


Fig. 5. Conidia of:
a. *Phyllosticta concentrica*;
b. *P. concinna*(type);
c. *P. cyamopsidicola*(type);
d. *P. dioscoreae*;
e. *P. encephalarti*(type);
f. *P. flevolandica*(type);
g. *P. gaultheriae*;
h. *P. ghaesembillae* (type);
i. *P. hamamelidis*;
j. *P. heveana*;
k. *P. hymanaeae*(type);

i. *P. hypoglossi*;
m. *P. loranthi*(type);
n. *P. melochiae;*;
o. *P. minima*(type);
p. *P. minor*;
q. *P. moravica*;
r. *P. morindae*. [p. 22]

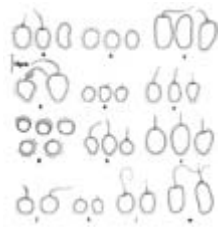


Fig. 6. Conidia of:
a. *Phyllosticta murnadensis*(type);
b. *P. murrayicola*(type);
c. *P. musarum*;
d. *P. phanerura*(type);
e. *P. podophylli*;
f. *P. putranjivae*(type);
g. *P. pyrolae*;
h. *P. solitaria*(type);
i. *P. sphaeropsoidea*;
j. *P. subeffusa*;
k. *P. toxica*(type);
l. *P. vaccinii*(type);
m. *P. zimmermannii*(type). [p. 23]

9. Description of the species

1.**Phyllosticta cruenta** (Kunze ex Fr.) Kickx - Figs. 4a, 7

1.*Sphaeria lichenoides*var. *convallariae-polygonati* DC. -Fl. fr. *2:* 299.1805 = *Sphaeria lichenoides* var. *convallariaecola* DC. -Fl. fr. *6*: 148. 1815 = *Phyllosticta convallariae* Pers. -Traite Champ. comest.: 148. 1818.
*Sphaeria cruenta*Kunze - Exs. *6*, 77; per Fr. -Syst. mycol. 2: 531. 1823 = *Depazea cruenta*(Kunze ex Fr.) Chev. - Fl. gen. Envir. Paris *1*: 452. 1826 = *Phyllosticta cruenta*(Kunze ex Fr.) Kickx - Mem. Acad. Sci. Lett. Arts Belge *23*: 22. 1849 = *Ascospora cruenta*(Kunze ex Fr.) Lambotte - Fl. mycol. Belg. 2: 199. 1880 = Macrophoma cruenta (Kunze ex Fr.) Ferraris -Annls mycol. *20:*288. 1912 = *Phyllostictina cruenta*(Kunze ex Fr.) Petrak & Syd. - Phaeospore Sphaerops.: 209. 1927 = Sphaeropsis cruenta (Kunze ex Fr.) Gilman & Archer -Iowa St. Coll. J. Sci. 3: 433 1929
Phyllosticta cruenta f. polygonati multiflori Thuem. - Mycoth. univ. 1189. 1878.
Macrophoma polygonati Ferraris -Malpighia *20*: 147. 1906.
Strasseria polygonati Camara & Luz - Agron. lusit. *1:* 183. 1939.

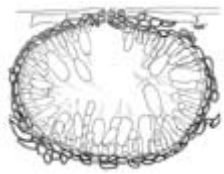


Fig. 7. *Phyllosticta cruenta*, pycnidium. Coll. U 178333B, from leaf spot on *Polygonatum officinale.*

Ascigerous state: **Guignardia reticulata** (DC. ex Fr.) van der Aa, comb. nov. [p. 24]

Sphaeria reticulata DC. - Fl. fr. *4*: 138. 1815 = *Dothidea reticulata (DC.)* Fr. - Syst. mycol. *2:* 56o. 1823 (basionym) = *Asterina reticulata* (DC. ex Fr.) Chev. - Fl. gen. Envir. Paris *1:* 447. 1826 = *Botryosphaeria reticulata* (DC. ex Fr.) Petrak - Sydowia *16:*166. 1962.
Melanops cruenta Petrak - Annls mycol. *25:* 226.1927.

Spermatial state: Leptodothiorella spec.

Leaf spots subcircular or ellipsoidal, 0.5-3 cm in diameter, at first reddish-brown, later pale brown to cream, surrounded by a purplish-brown to almost blackish margin. *Pycnidia* epiphyllous, single, unilocular, 80-200, mostly 120-160 µm in diameter, globose, seldom somewhat depressed, the upper region firmly grown together with the epidermis, flat or papillate, with a single, circular or somewhat angular pore of 12-30 µm diameter. *Wall* 1-4 cells (7-20 µm) thick, composed of partly thick-walled, partly thin-walled, brownish cells, darker around the pore, hyaline and isodiametrical towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 7-12 x 2-4 µm. *Conidia* one-celled, ellipsoidal, ovoidal, cylindrical or pyriform, somewhat clavate, when young with a truncate base, broadly rounded or slightly indented apically, 12-21 x 5-10, mostly 16-19 x 8-10 µm, surrounded by a thin slime layer, containing numerous fine greenish guttules and sometimes a large, bright, central vacuole, with an apical appendage, 4-17 µm long and up to 3 µm wide at the base, tapering towards the tip. Germ tubes occasionally with subglobose or irregularly lobed, sometimes 1-4 septate, thick-walled *appressoria.*

Ascigerous state: Description summarized from Petrak (1927): *Ascomata* subglobose, flattened above, 75-140 µm in diameter, papillate. *Wall* 12-20 µm thick, composed of thick-walled, greyish-black pseudoparenchymatous cells. *Asci* 40-60 x 12-18 µm, cylindrical or clavate, broadly rounded above, at the base often attenuated into a short stalk, 8-spored. *Ascospores* 2-3 seriate, ellipsoidal, containing numerous small and one large guttules, 14-18 x 6.5-8 µm. *Paraphysoids* scarce, indistinct, disappearing in an early stage.

Spermatial state: Only observed in pure culture. *Spermogonia* similar to the pycnidia; in the early stages of development conidia and spermatia are sometimes formed in the same pycnidial cavity. *Spermatiogenous cells* long, slender, usually 6-12 µm long and 1-2 µm wide, lining the cavity at maturity in a regular pattern, forming spermatia in basipetal succession, often in persistent chains. *Spermatia* cylindrical or dumb-bellshaped, biguttulate, 4-9(-15) x 1-2 µm.

Cultural characters: Colonies growing slowly, on oatmeal agar 0.8 cm in diameter, on cornmeal agar 1.2 cm in diameter, both in 20 days at 20°C; at first pale and flat, darker after about 10 days but sometimes only in sectors. Fresh isolates without aerial mycelium. *Stromata* visible from about the 10th day onwards, white at first, then pale orange, finally turning black. Numerous stromata, especially in the centre of the colony remain sterile and are reddish orange, giving some cultures a characteristic reddish [p. 25] spotted appearance. Stromata usually scattered or gregarious, cylindrical or branched at the base, forming one to numerous conidial and spermatial cavities in the upper part, ostiolate, not papillate. *Wall* pseudoparenchymatous, 2-15 cells thick and composed of brownish, thin-walled cells, with an intercellular brown pigment, giving the walls in older stromata a very dark colour. Spermogonia develop after 12-15 days, with spermatia exuded in clear to milky white tendrils. The pycnidia mature after 20-25 days, with conidia protruding in white to yellowish tendrils. In some isolates a yellow pigment occurs in the hyphae, generally restricted to sectors and visible in young cultures only.

Host plants: Polygonatum multiflorum, P. latifolium, P. odoratum (P. officinale), according to Grove (935), *Convallaria majalis* and, according to Oudemans (1919: 1173) also *Majanthemum bifolium* (Liliaceae).

Material examined

Herbarium specimens
Phyllosticta cruenta, Westendorp, Herb. Crypt., Fasc. *13*: 649*,* on leaves of *Polygonatum multiflorum,* near Namur, leg. M. l'Abbé Bellynck (ZT); Rabenhorst, Fungi europ. 152, on leaves of *Polygonatum multiflorum,* Olaszinum, Sept. 1859, leg. Kalchbrenner (L); Herb. A. Volkart, on *Polygonatum multiflorum,* Zürich, Leimbach, 21.7.1894, leg. F. v. Tavel (ZT); Migula, Krypt. Germ. Austr. Helvet. exs., Fasc. 19, Pilze 115, on *Polygonatum officinale,* Berka am Ilm, Rosenberg, July 1903, leg. I. Bornmüller (ZT); Weese, Eumycetes sel. exs., on leaves of *Polygonatum officinale,* Vöslau, Lower Austria, leg. Dr. J. Weese, in Herb. K. B. Boedijn, (U 178333B); on leaves of *Polygonatum officinale,* Bentveldt, 7. 1919, leg. C. Cool (L); Tr. Savulescu, Herb. mycol. romanicum, Fasc. 4: 154, on leaves of *Polygonatum latifolium,* Bessarabia, Distr. Lapusna-Cornesti, 18.6.1931 (ZT); in Herb. J. Gremmen 2493, on leaves of *Polygonatum officinale,* Horner near Lisen, Moravia, C.S.S.R., 23 June 1968, leg. L. Marvanová (CBS); Herb. H. A. van der Aa 2505, on leaves of *Polygonatum odoratum,* Romania, Calugareni, distr. Mizil, 31 July 1970, leg. O. Constantinescu (CBS); Herb. H. A. van der Aa 2727, on leaves of *Polygonatum officinale,* Hornek, Lisen, Moravia, C.S.S.R., 22 June 1971, leg. A. J. van der Plaats-Niterink and L. Marvanová (CBS).
Depazea cruenta, Fl. Gall. Germ. exs. 600, on leaves of *Polygonatum multiflorum,* Limoges, 5 July 1841, leg. E. Lamy (PC).
Phyllosticta cruenta f. polygonati multiflori, De Thuemen, Mycoth. univers. 1189, on leaves of *Polygonatum multiflorum,* August 1874, leg. G. Passerini (L). *Phyllostictina cruenta,* Herb. F. Petrak, on leaves of

Polygonatum officinale, Niketsburg, May 1913, leg. H. Zimmermann (ZT);F. Petrak, Mycoth. gen. 693, on leaves of *Polygonatum latifolium,* Niederdonau, Hundsheimerkogel bei Hainburg, July 1939, leg. F. Petrak (ZT).

Living strain
CBS 858.71, isolated from leaves of *Polygonatum odoratum,* Hornek, Lisen, Moravia, C.S.S.R., 22 June 1971, leg. A. J. van der Plaats-Niterink and L. Marvanová.

Discussion

This species is the type of the genus *Phyllosticta* (cf. p. 3). Petrak & Sydow (1927) considered it as an intermediate form between *Phyllostictina* and *Dothiorella.* [p. 26]
On the European *Polygonatum* species only *Phyllosticta cruenta* occurs, but in North American material a second species was encountered on several Liliaceae. This species, *Phyllosticta subeffusa,* has smaller conidia and occurs occasionally on the same plants, even on the same leaf spots as *Dothiorella smilacina* (Peck) Petrak & Sydow (1927: 250). In the North American literature the three species are often confused and given several names. Seaver (1922) selected *Phyllosticta convallariae* Pers. as the type species of the genus but his description clearly points to *P. subeffusa.* Gilman & Archer *(1929)* considered several species of *Dothiorella, Haplosporella, Phyllosticta, Phyllostictina* and *Sphaeropsis* occurring on *Smilax, Smilacina* and *Polygonatum* as developmental stages of a single fungus: *Sphaeropsis cruenta* (Kunze ex Fr.) Gilman & Archer. Petrak & Sydow (1927) recognized the following three *Phyllostictina* species in the North American material they studied: *P. cruenta* on *Polygonatum, P. subeffusa* on *Smilax* and *P. pallidior* on *Smilacina.* While the last mentioned species is considered to be conspecific with *Phyllosticta subeffusa,* the three remaining species on these hosts can be distinguished as follows:

1a.	Conidia globose or subglobose, seldom more than 12 µm long	*Phyllosticta subeffusa*
1b.	Conidia ellipsoidal, often longer than 12 µm	2
2a.	Conidia surrounded by a slime layer and provided with an apical appendage, about 2 times longer than wide	*Phyllosticta cruenta*
2b.	Conidia without slime layer and apical appendage, about 3 times longer than wide	*Dothiorella smilacina*

2. **Phyllosticta africana** (Pandotra & Husain) van der Aa, comb. nov. - Fig. 4b

Phyllostictina africana Pandotra & Husain - Mycopath. Mycol. appl. *29:* 160. 1966 (basionym).

Leaf spots small, up to 2 mm in diameter, brownish, sharp in outline, with purple discolorations in the adjacent parts of the leaf. *Pycnidia* epiphyllous, unilocular, 80-120 µm in diameter, globose or somewhat depressed, with a flattened upper region which is firmly grown together with the epidermis, with a single, circular or somewhat angular pore of 7-10 µm diameter. *Wall* 2-3 cells (10-16 µm) thick, composed of thin-walled, brownish, isodiametrical or flattened cells, sometimes missing in the lower region of the pycnidium, darker around the pore, hyaline and isodiametrical towards the conidiogenous region. *Conidiogenous cells* usually cylindrical, 3-9 x 1.5-3 µm.*Conidia* one-celled, obovoidal or short cylindrical, seldom almost globose, with a truncate base when young, broadly rounded and indented apically, surrounded by a thick slime layer, containing a homogeneous mass of fine greenish guttules, 7-13 x 6-7.5 µm, with an apical appendage, 6-8, seldom up to 20 µm long. [p. 27]

Host plant: Myrsine africana (Myrsinaceae).

Material examined

Phyllostictina africana, on leaf of *Myrsine africana,* Jammu, India, 17 April 1962, leg. *V.* R. Pandotra, holotype IMI 102149.

3. **Phyllosticta amaryllidicola** van der Aa, spec. nov. -Figs. 4c, 8

Pycnidia in partibus emortuis foliorum zona obscure rubra circumdatis sparsa vel aggregata, epiphylla, supepidermalia, globosa vel piriformia, 120-150 µm diam., papilla plerumque conspicua prominente, poro rotundo 8-12 µm diam. perforata. Paries fere 15 µm crassus e 2-4 stratis cellularum pseudoparenchymaticarum, prismaticarum, brunnearum, crassitunicatarum compositus, prope papillam clarior, transiens in stroma velut clypeum e cellulis fere hyalinis vel brunneis pseudoparenchymaticis compositum. Cellulae conidiogenae breviter cylindricae, 2-6 x 1.5-4 µm. Conidia continua, breviter cylindrica, obovata vel pyriformia, primum deorsum saepe truncata sursum semper rotundata, guttulis parvis viridulis et vacuola lucida maiore repleta, strato mucido circumdata, 9-12 x 5.5-7.5 µm, appendiculo apicali hyalino, mucido, 4-7 µm longo praedita.

Typus herb. U 161086 B, in foliis languidis *Amaryllidis* spec., Bogor, Indonesia, March 1950, leg. van Hoof.

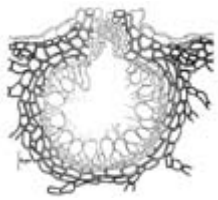


Fig. 8. *Phyllosticta amaryllidicola,* pycnidium. Coll. U 161085B = holotypus, on leaf of *Amaryllis* spec. [p. 28]

Pycnidia densely scattered over the infected areas, which shade into the healthy parts of the leaf with a deep red colour, not in distinct leaf spots, epiphyllous, subepidermal, unilocular, 120-150 µm in diameter, globose or pyriform, with usually well developed stroma in the upper region, composed of subhyaline to brownish pseudoparenchyma, firmly grown together with the epidermis, forming a clypeus-like tissue, erumpent through the epidermis with a conspicuous papilla which is pierced by a more or less circular, 8-12 µm wide pore. *Wall* 2-4cells (about 15 µm) thick, composed of isodiametrical or rounded, thick-walled, brownish cells, 7-14 µm in diameter and flattened towards the outer surface, but hyaline towards the conidiogenous region and isodiametrical or flattened. *Conidiogenous cells* short cylindrical, 2-6 x 1.5-4 µm, but in very young pycnidia sometimes much longer. *Conidia* one-celled, short cylindrical, obovate, pyriform or due to mutual pressure polygonal; when young with a truncate base, broadly rounded apically, surrounded by a thick slime layer, containing a large number of fine greenish guttules and usually a large, bright, central vacuole, 9-12 x 5.5-7.5µm, provided with a slimy apical appendage, 4-7 µm long.

Host plant: Amaryllis spec. (indet.) (Amaryllidaceae).

Material examined

Phyllosticta spec. on withering leaves of *Amaryllis* spec., Bogor, March 1950, leg. van Hoof; Herb. K. B. Boedijn (U 161085 B) holotypus.

Discussion

This species differs from other *Phyllosticta* species with similar conidia by the shape of the papillate pycnidia and the well developed clypeus-like stroma. On *Amaryllis* or related hosts, no *Phyllosticta* species with these characters is known. *Phyllosticta amaryllidis* Bres. (Hedwigia *1896*: 55)has conidia of 4 x 1.5 µm and is therefore without doubt another species. *Phyllosticta hymenocallidis* Seaver (1922) is described from *Hymenocallis* spec. but can also occur on *Amaryllis purpurea.* In the description there are some features indicative of *Phyllosticta:* ‘spores ellipsoidal or short cylindrical, densely filled with granular content, about 4-15 µm’. These measurements are sufficient to consider it as a separate species, whose classification in *Phyllosticta* remains doubtful.

4. **Phyllosticta ampelicida** (Engelman) van der Aa, comb. nov. -Fig. 4d

Naemospora amplecida Engelman - Trans. St. LouisAcad. Sci., J. Proc. *2:* 165. 1861 (basionym).
Phoma uvicola Berk. & Curt. - Grevillea *2:* 82. 1872 = *Phyllostictina uvicola* (Berk. & Curt.) Höhnel - Annls mycol. *18:* 94. 1919.
Phoma ustulatum Berk. & Curt. - Grevillea *2*: 82. 1873. [p. 29]
Depazea labruscae Engelman - Trans. St. Louis Acad. Sci., J. Proc. *3*: 215. 1877.
Phoma uvicola Berk. & Curt. var. *labruscae* Thümen - Die Pilze des Weinstockes: 16. 1878.
Phyllosticta viticola Thümen - l.c.: 188. 1878 = *Phyllostictina viticola* (Thümen) Petrak - Annls mycol. *38:* 258. 1940.
Phyllosticta labrusca Thümen – l.c.: 189. 1878.
Septoria viticola Berk. & Curt. apud Thümen - l.c.: 168. 1878.
Phyllosticta viticola Thümen f. *vitis vulpinae* Thümen - l.c.: 188. 1878.
Sacidium viticolum Cooke apud Thümen - Mycoth. univers. 1393. 1879.
Phyllosticta ampelopsidis Ellis & Martin *apud* Martin - J. Mycol. 2: 14. 1886.
Phyllosticta vulpinae Allesch. - Rabenhorst, Kryptog. Fl. 1, *6*: 98. 1898.
Phyllostictina clemensae Petrak - Annls mycol. *26:* 441. 1928.

Ascigerous state: Guignardia bidwellii(Ellis)Viala & Ravaz

Sphaeria bidwellii Ellis - Bull. Torrey bot. Club 7: 90. 1880 = *Physalospora bidwellii* (Ellis) Sacc. - Syll. Fung. *1:* 441. 1882 = *Laestadia bidwellii* (Ellis) Viala & Ravaz - Progresso agric. vitic. *9*: 490-493. 1888 = *Guignardia bidwellii* (Ellis) Viala & Ravaz - Bull. Soc. mycol. Fr. *8*: 63. 1892 = *Carlia bidwellii* (Ellis) Prunet - Revue gen. Bot. *10*: 127. 1898 = *Botryosphaeria bidwellii* (Ellis) Petrak - Sydowia *11:* 440. 1957.

Spermatial state: Leptodothiorella spec.

Leaf spots circular or angular, often limited by the veins, slightly irregular, occasionally coalescent, reaching a diameter of 5 mm, brown, later pale yellowish-brown, surrounded by a dark purple-brown margin; fruitspots small, circular, purple to brownish, finally spreading all over the surface which becomes black and shrunken. *Pycnidia* epiphyllous, seldom amphigenous, single, unilocular, 70-180, usually about 100 µm in diameter, globose or depressed, flat or inconspicuously papillate, with a circular pore, 5-15 µm in diameter. *Stroma* poorly developed on leaves, abundant on fruits and composed of brownish pseudoparenchyma. *Wall* 1, seldom up to 3 cells (4-10µm*)* thick, composed of isodiametrical, brown cells, 5-12 µm in diameter, usually thin-walled, smaller around the pore and with thicker cell-walls, hyaline towards the conidiogenous region and isodiametrical. *Conidiogenous cells* cylindrical or conical, about 6 x 3 µm.*Conidia* one-celled, broadly ovoidal, ellipsoidal or almost globose, somewhat clavate when young with a truncate base, broadly rounded apically and slightly indented, 5-12 x 4-7 µm, but usually less than 10µm long, or when globose, 5-7 µmin diameter, surrounded by a slime layer, containing a large number of coarse guttules and a large, bright, central vacuole, with an apical appendage of about the length of the conidium.

Ascigerous state (description modified from von Arx & Müller, 1954, who had examined the type collection of the fungus). *Ascomata* developing as loculi in a stroma, depressed globose, 130-230 µm in diameter, flat or papillate. *Wall* pseudoparenchymatous, 3-10 cells thick, composed of an outer region of almost black, thick-walled, isodiametric cells and an inner region of lighter, sometimes reddish-brown cells, 8-15 µm in diameter. *Asci* arise from a cushion-shaped tissue at the base of the perithecium, cylindrical [p. 30] to clavate, bitunicate, 45-65 x 9-14 µm.*Ascospores* one-celled, hyaline, ellipsoidal or ovoidal, 12-17 x 6-7.5 µm.

Spermatial state: On the specimens examined no spermatial state was observed but in the literature such a state has often been reported, both on the host plant and in vitro. Descriptions and figures clearly point to *Leptodothiorella,* with fruit bodies resembling those of the conidial state and with dumb-bellshaped, one-celled, hyaline spermatia, 4-7 x 0.7-2 µm in size (Prillieux, 1895; Reddick, 1911; Arnaud, 1931; Caltrider, 1961).

Cultural characters: The in vitro characters are described in studies by Viala & Paccottet (1904a, 1904b, 1912), Shear & al. (1909), Reddick (1911), Luttrell (1946 and 1948) and Caltrider *(1961).* An atypical strain, more than 20 years old, was the only available for cultural studies.

Host plants: Ampelopsis arborea; Cissus spec.; *Muscadina munsoniana (= Vitis munsoniana); Parthenocissus quinquefolia, P. tricuspidata; Vitis aestivalis, V. labrusca, V. rotundifolia, V. rupestris, V. simpsonii, V. vulpina,* and *V. vinifera* (Vitaceae).

Material examined

Herbarium specimens

Phyllosticta ampelopsidis, Herb. E. Bommer & M. Rousseau, on leaves of *Ampelopsis quinquefolia,* Ohio (BR); Ellis, N. amer. Fungi 1169 (L). *Phyllosticta viticola f. vitis-vulpinae* Thümen, Mycoth. univ. *1393,* on living leaves of *Vitis vulpina,* Aiken, Carolina, Sept. 1876, leg. H. W. Ravenel (L).

Phyllosticta labruscae, Thümen, Herb. mycol. oecon. 652, on living leaves of *Vitis labrusca,* near Newfield, N.J., Aug. 1877, leg. J. B. Ellis (L).

Living strain

CBS 237.48 *Guignardia bidwellii,*isol. fr. *Parthenocissus tricuspidata,* byC. J. Alexopoulos.

Discussion

The oldest epithet *ampelicida* has previously been unnoticed, because the year of publication of *Naemospora ampelicida* Engelman is usually cited as 1881 instead of 1861. Therefore *Phoma uvicola* Berk. & Curt. (1873) apparently had priority. Moreover, the spermatial state was called *Naemospora ampelicida* Engelman by Rose (1898) and v. Höhnel (1918a), but the original description clearly points to the conidial state.
The different names, given to the stem, leaf and fruit forms of the fungus are easily explained from the Saccardian concept of generic distinctions (cf. Reddick, 1911; Petrak, 1940).
Luttrell (1946and 1948) proved by means of cross inoculations, that *Guignardia* species described from different host genera and species of the Vitaceae may be reduced to one, but he differentiated the following three [p. 31] formae on host specificity: *Guignardia bidwellii f. euvitis* Luttrell (1948) on *Euvitis and Vitis vinifera; f. muscadinii* Luttrell *(1946)* on *Vitis rotundifolia* and *V. vinifera* and *f. parthenocissi* Luttrell (1948) on *Parthenocissus* species; but they were morphologically identical.
Phyllostictina clemensae Petrak, which has presumably a *Cissus* species as host plant is included in the synonymy on the base of the description.
Pande (1969) mentioned *Heptapleurum venulosum* and *Canthium umbellatum* as host plants of *Guignardia bidwellii.* Part of the collection of *Guignardia bidwellii* on *Heptapleurum venulosum* was received from Pande and was recognized as *Guignardia philoprina* (see p. 49). The fungus on *Canthium umbellatum* could not be studied.
Kvartskhava (1968) observed *G. bidwellii* during the summer of 1966 on 26 host plants from 17 families. Some of her cross inoculation experiments showed positive results, and from her work it might be concluded that *Guignardia bidwellii* has a wide host range, but infections may only take place during favourable conditions.
Guignardia bidwellii, G. citricarpa, G. aleuritidis and possibly some other species can hardly be distinguished on morphological characters and are undoubtedly closely related. For the present, these species are kept separate and *G. bidwellii is* considered to be restricted to Vitaceae, on which it is a damaging pathogen.

5. **Phyllosticta anacardiacearum** van der Aa, nom. nov. -Fig. 4e

Phyllostictina mangiferae Batista & Vital - Bolm Secr. Agric. Ind.Com. Est. *19:* 214.1952 (replaced synonym) [non *Phyllosticta mangiferae* Batista -l.c. 19: 212. 1952].

Leaf spots subcircular or angular when bounded by the veins, reaching a diameter of about 1 cm, at first purplish-black and surrounded by an indefinite red or purple discoloured leaf surface, soon becoming white in the centre. *Pycnidia* epiphyllous, loosely scattered in the spot, 80-160 µm in diameter, globose or somewhat lenticular, distinctly papillate, with a circular or somewhat angular pore, 8-15 µm in diameter. *Wall* 3-6 cells (15-25 µm)thick, usually composed of isodiametrical, brownish cells, often somewhat flattened, hyaline and sometimes very flat towards the conidiogenous region. *Conidiogenous cells* short cylindrical,

usually about 5-8 x 2-4 µm,broadest at the base, sometimes reduced and hardly differentiated from the inner wallcells. *Conidia* one-celled, obovoidal, sometimes pyriform or ellipsoidal, with a truncate base when young, broadly rounded apically and conspicuously indented, 8-12 x 5.5-7 µm, surrounded by a slime layer, containing a large number of rather fine guttules, with an apical appendage which can be very slender or with a rather broad base, tapering gradually towards the tip, 5-12 µm long.

Host plant: Mangifera indica (Anacardiaceae). [p. 32]

Material examined

Phyllosticta mortoni Fairm. in Herb. A. van Luyk, on leaves *of Mangifera indica,* Miami, Fla, February 1920, leg. J. G. Stevenson 1168 (U).

Discussion

The type specimen of *Phyllosticta mangiferae* Batista (URM) proved to be *a Phomopsis* species; no original material of *Phyllostictina mangiferae* and *Phyllosticta mortoni* was available but the description of the latter points rather to *Phomopsis* than to *Phyllosticta.* This *Phomopsis* species was also found on the collection examined, where it occurred on leaf spots similar to those of *Phyllosticta anacardiacearum.*

6. **Phyllosticta aplectri** Ellis & Everh. - Fig. 4f

Phyllosticta aplectri Ellis & Everh. - Proc. Acad. nat. Sci. Philad. *1894*: 356.

Leaf spots circular or angular, up to about 1 cm in diameter, consisting of dead areas which blend into the healthy tissue and are visible on either side of the leaf. *Pycnidia* epiphyllous, single, unilocular, 65-90 µm in diameter, globose or irregularly stromatic, the upper region firmly grown together with the epidermis, with well developed lateral and apical dark brown stromatic pseudoparenchyma, merging at the margin into 6-8 µm thick, septate, brownish-black hyphae, which may form local chains of large, chlamydospore-like swollen cells, 12-18 µm in diameter, flat or inconspicuously papillate (pore not yet developed). *Wall* 1-3, locally even 10 cells (9-18 µm) thick, composed of thin-walled, isodiametrical, verydark brown cells, 5-12 µm in diameter, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical, 2-7 x 2.5-3 µm. *Conidia* one-celled, obovate, or globose, apically slightly indented, 5-8 x 4-6 µm,or about 6-7 µm in diameter, surrounded by a thick slime layer, without conspicuous guttules or vacuoles, with remains of an apical appendage, insufficiently preserved but probably about 1-1.5 times longer than the conidium.

Host plant: Aplectrum hyemale (Orchidaceae).

Material examined

Phyllosticta aplectri, in Herb. A. Commons nr. 2408, on leaf of*Aplectrum hyemale,* Naamans' Creek, Delaware, April 1894; holotypus(NY).

Discussion

The description is incomplete since the only collection in existence is very [p. 33]poor and the pycnidia only show an early stage of development and are often without conidia. The species differs from the more common species on various Orchids, *Phyllosticta capitalensis,* because of its smaller conidia, which are often more globose. Morphologically there is more resemblance to *Phyllosticta pyrolae* and *P. gaultheriae* occurring on Ericaceae and *Pyrola.*

7. **Phyllosticta arecae** Höhnel - Fig. 4g

Phyllosticta arecae Höhnel - Sber. Akad. Wiss. Wien, math. naturw. Kl. 1*, 121:* 385. (Fragm. Mykol.: 765) 1912 = *Phyllostictina arecae* (Höhnel) Petrak & Syd. *apud* Petrak - Annls mycol. *32*: 376. 1934.

Phyllosticta arecae Died. apud Sydow & Butler - Annls mycol. *14:* 185. 1916 = *Phyllostictina arecae* (Died.) Petrak & Syd. - Phaeospore Sphaerops.: 188. 1927.
Phyllostictina banosensis Petrak - Annls mycol. *32:* 437. 1934.

Ascigerous state: Guignardia calami (Syd.) von Arx & Müller

Physalospora calami Syd. - Annls mycol. *9*: 407. 1911 = *Guignardia calami* (Syd.) von Arx & Müller -Amerospore Pyrenom.: 55. 1954.
Physalospora arecae Höhnel - Sber. K. Akad. Wiss. Wien , math. naturw. Kl.*121:* 383. 1912.
Guignardia arecae Sacc. - Atti Accad. scient. venetro-trent.-istriana *10:*63.1917.
Melanops calami Petrak - Annls mycol. *32*: 374.1934.
Melanops banosensis Petrak - Annls mycol. *32:* 436. 1934. = *Guignardia banosensis* (Petrak) von Arx & Müller -l.c.:57. 1954.

Leaf spots pale brown, with a broad, darker brown margin, spreading over large areas of the leaf; sometimes the whole leaf tip and margin become pale brown and necrotic. *Pycnidia* epiphyllous, unilocular, occasionally appearing to be multilocular when pycnidia are clustered, 60-100 µm in diameter, the upper region firmly grown together with the epidermis, flat or papillate, with a circular or somewhat angular pore of 10-15 µm diameter. *Wall* 1-5 cells (5-15, in the upper region up to 25 µm) thick, composed of irregular or isodiametrical, thin-walled, brown to almost black cells, hyaline and sometimes flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, 5-12 x 1.5-3 µm. *Conidia* one-celled, sometimes remaining in chains, ovoidal, ellipsoidal or short cylindrical, seldom almost globose, when young somewhat clavate with a truncate base, broadly rounded apically and slightly indented, 7-15 x 5-9 µm, surrounded by a thick slime layer, containing a dense mass of coarse, greenish guttules and often a large, bright vacuole, with a distinct apical appendage, 3-10 µm long, slightly tapering and disappearing on older conidia.

Ascigerous state: Ascomata develop often in association with the conidial state, ripening at the same time; globose or depressed, 120-200 µm in diameter, lifting the epidermis markedly, flat or papillate, with an atypical [p. 34] pore which enlarges when the protruding region of the perithecium breaks off. *Wall* 1-4 cells thick, composed of brown pseudoparenchymatous cells of variable diameter. *Asci* 40-70 x 12-18 µm, broadly cylindrical or clavate, broadly rounded above, truncate at the base, bitunicate, 8-spored. *Ascospores* 1-3-seriate, ovoidal or ellipsoidal, one-celled, hyaline, 12-18 x 59 µm, sometimes with the remains of slime caps at both ends.

Host plants: Areca catechu, Calamus tenuis, Caryota spec. (Palmaceae).

Material examined

Phyllosticta arecae Höhnel, together with *Physalospora arecae* Höhnel, on leaves of *Areca* spec., Botanic Garden Buitenzorg, Java, August 1907, leg. F. von Höhnel; holotypus (FH).
Melanops banosensis Petrak, with *Phyllostictina banosensis* Petrak, on leaves of *Caryota* spec., Medan (Deli) Sumatra, March 1926, leg. K.B. Boedijn nr. 60 (U).

Discussion

The synonymy for the conidial state is partly adopted from Petrak (1934), that of the ascigerous state from von Arx & Müller (1954), who however separated *Guignardia banosensis* and *G. calami.* The rather large variation in size of ascospores mentioned above is based on well developed material and the measurements mentioned by von Arx & Müller (l.c.)and in the original descriptions of these species fall within this range.
According to Petrak (1934)*Phyllostictina banosensis* only differs from the other *Phyllostictina* species by its well developed conidiogenous cells. However, this character was also found on all the other collections studied and has to be considered as a character of the whole genus *Phyllosticta.* All the species brought together in *Guignardia calami,* with the conidial state *Phyllosticta arecae* have been described on different Palmaceae, where they occur on comparable leaf spots.

8. **Phyllosticta arxii** van der Aa, nom. nov. -Fig. 4h

Gloeosporium diospyri Ellis & Everh. - J. Mycol. *3*: 129. 1887 (replaced synonym) = *Dothiorella diospyri* (Ellis & Everh.) von Arx – Verh. K. ned. Akad. Wet. Reeks 2, *61*: 821. 1957 = *Phyllostictina diospyri* (Ellis & Everh.) von Arx - Proc. K. Akad. Wet. Amsterd. C, *66*: 180. 1963 (not *Phyllosticta diospyri* Sydow & Butler – Annls mycol. *14:* 183- 1916) .

Pycnidia not in characteristic leaf spots, generally restricted to the major veins of living and withering leaves, usually epiphyllous, single, unilocular, 80-300, usually 150-200 µm in diameter, globose, depressed or irregular in shape, arching the epidermis conspicuously, papillate, with a single, circular [p. 35] pore 7-15 µm in diameter. *Wall* hardly developed, composed of the shrunken remains of host tissue, locally with some hyaline, thin-walled pseudoparenchymatous cells. *Conidiogenous cells* cylindrical, sometimes curved and wrinkled, growing between the parenchymatous cells of the host, usually 4-12 x 1.5-2.5 µm. *Conidia* one-celled, cylindrical, clavate, reniform or curved, sometimes irregular in shape, isodiametrical or lobate, with the truncate base persisting until maturity, broadly rounded apically and slightly indented, 6-18 x 2-8 µm, surrounded by a thin slime layer which disappears at maturity, containing a mixture of coarse and fine greenish guttules and usually one or two large, bright vacuoles, apically with a slimy residue, (but no distinct appendages were recognizable on the collection examined).

Host plant: Diospyros virginiana (Ebenaceae).

Material examined

Gloeosporium diospyri, Herb. A. Commons nr. 606, on leaves of *Diospyros virginiana,* Faulkland, Del., August 1887, two similar specimens, stamped as ‘type’ (NY); Ellis & Everhart, N. Am. F. 2274, on leaves of *Diospyros virginiana,* Faulkland, Del., August 1888, leg. A. Commons (NY).

Discussion

This species differs from all the other *Phyllosticta* species in the peculiar structure of the pycnidia and in the shape and size of the conidia, which when young are typically like in *Phyllosticta,* but when older sometimes resemble *Dothiorella.*
Phyllosticta diospyri Syd.& Butler (l.c.) has conidia3.5-4.5 x 2.5-3.5 µm and is without doubt a different species and does not fit into any well known genus, according to its diagnosis.

9. **Phyllosticta artocarpina** Syd. & Butler - Fig. 4i

Phyllosticta artocarpina Sydow & Butler - Annls mycol. *14*: 180. 1916 = *Phyllostictina artocarpina* (Syd. & Butler) *apud* Petrak & Syd. - Phaeospore Sphaerops.: 189. 1927.

Spermatial state: Leptodothiorella spec.

Leaf spots circular or somewhat angular, reaching a diameter of about 1 cm, sometimes coalescent, shiny red brown, paler in the centre, finally completely pale with a red-brown outline. *Pycnidia* epiphyllous, subepidermal, single, unilocular, 120-to200 µm in diameter, without distinct stroma, flat or slightly papillate, with a 10-15 µm wide pore. *Wall* 1-4 cells (12-25 µm) [p. 36] thick, composed of irregularly shaped, dark brown cells, darker and thick-walled around the pore, firmly grown together with the epidermis in the upper region, hyaline, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical, conical, sometimes very slender, straight or curved, 7-10 x 1-3 µm. *Conidia* one-celled, obovate, pyriform or even club-shaped, with a truncate base when young, broadly rounded and indented apically, 7-15 x 5-7.5 µm, surrounded by a thick slime layer which is often thicker near the base and containing numerous coarse greenish guttules, with a tongue-shaped or thread-like apical appendage, up to 10 µm long, somewhat broadened at the base, very unstable and not always present even on fresh conidia.

Spermatial state: Only observed in pure culture. *Spermogonia* similar to the pycnidia; sometimes conidia and spermatia are formed in the same pycnidial cavity. *Spermatiogenous cells* hardly distinct from the conidiogenous cells but generally somewhat thinner. *Spermatia* 8-12 x 1.5-3 µm, cylindrical or dumb-bellshaped, straight or somewhat curved, usually with two distinct guttules.

Cultural characters: Colonies growing rather slowly, attaining a diameter of 6.5-8 cm on oatmeal or cornmeal agar in about 20 days at 24°*C,* turning from greyish to green and finally blackish, with a small greenish-grey zone at the margin, regular in outline, without aerial mycelium when growing under near UV light, but with some thin, green to brownish aerial mycelium when growing in daylight at room temperature. *Stromata* formed in concentric rings; many of them remaining sterile but a limited number of pycnidia have conidial or spermatial states, unilocular or multilocular when fructifications are clustered. *Wall* more variable in thickness, 1-20 cells thick and composed of brownish pseudoparenchyma.

Host plants: Artocarpus integrifolia and *A. heterophylla* (Moraceae).

Material examined

Herbarium material

Phyllosticta artocarpina, Herb. crypt. ind. orient. 1654, on leaves of *Artocarpus integrifolia,* Bombay Presidency, leg. H. M. Butler, holotypus (S).

Living strain

CBS 873.72 *Phyllosticta artocarpina*, isol. from living leaves of *Artocarpus heterophylla,* July 1972, Balaghat (M.P.), India, leg. S. M. Singh.

10. **Phyllosticta bokensis** (P. Henn.) van der Aa, comb. nov. -Fig. 4J

Gloeosporium bokense P. Henn. - Annls Mus. r. Congo belge, Ser. Bot. *2*: 228. 1909 [p. 37] (basionym) =*Dothiorella bokensis* (P. Henn.) von Arx - Verh. K. ned. Akad. Wet., Afd. Natuurk., *2, 61 (3): 65.* 1957 = *Phyllostictina bokensis* (P. Henn.) von Arx - Proc. K. Akad. Wet. Amsterd., C, *66*: 179. 1963.
Phyllosticta coffeae-arabicae Sawada - Spec. Publs Coll. Agric. natn. Taiwan Univ. *8:* 135. 1959 (without Latin diagnosis).

Spermatial state: Leptodothiorella spec.

Leaf spots usually circular but often enlarged by coalescence, sharply delimited, about 1-3 cm in diameter, pale brown to grey, with rose and red-brown zones near the border, marked with slightly elevated, concentric lines. *Pycnidia* epiphyllous, numerous, usually arranged in concentric rings, single, unilocular, 80-200 µm in diameter, globose or depressed, flat or papillate with a sub-circular pore of 8-15 µm diameter. *Wall 2-3* cells (6-15 µm) thick, composed of brown, globose or isodiametrical cells, towards the conidiogenous region hyaline and flattened. *Conidiogenous cells* cylindrical or conical, 4-10 x 2-3 µm.*Conidia* one-celled, ovoidal, ellipsoidal, cylindrical or inequilateral, sometimes reniform, clavate when young with a truncate base, broadly rounded apically, 12-16 x 5-7 µm, surrounded by a thin slime layer, containing numerous fine greenish guttules and one large, central, bright vacuole, with a distinct apical appendage, variable in shape and size, up to 25 µm long and up to 3 µm wide at the base.

Spermatial state: Fructifications similar to those of the conidial state. *Spermatiogenous cells* thinner, sometimes long and slender or on spermatiophores which can be branched at the base. *Spermatia* cylindrical to dumbbellshaped, with two large guttules at either ends, 6-9 x 1-2 µm.

Host plants: Coffea arabica, C. liberica (Rubiaceae).

Material examined

Gloeosporium bokense P. Henn., on leaves of *Coffea liberica,* Kwango, Boko, Congo, leg. Vanderyst nr. 261; holotypus (B).

Discussion

This species differs from the other *Phyllosticta* species with similar pycnidia and very long and persistent conidial appendages by the relatively long conidia, which are sometimes curved and a typical spotting on the leaves.
Sawada (1959) had some doubt on the generic position of *Phyllosticta coffeae-arabicae,* but he gives a good figure of conidia with slime layer and apical appendage.
Althoug the fungus seems to be pathogenic, it is without economic importance. In the literature on fungal diseases of *Coffea,* there are many *Phoma, Macrophoma* and other so-called *Phyllosticta* species, but none of them is comparable with *Phyllosticta bokensis.* [p. 38]

11. **Phyllosticta capitalensis** P. Henn. - Fig. 4k

Phyllosticta capitalensis P. Henn. - Hedwigia *48:* 13. 1908.
Phyllosticta phalenopsidis Marchal & Verplancke - Bull. Soc. R. Bot. Belg. *59:* 19. 1926.
Phyllosticta phalenopsidis Marchal & Verplancke var. *vanillae* Verplancke & Claessens - Natuurw. Tijdschr. *16*: 183-184. 1934.
Phyllosticta cymbidii Sawada - Rep. Govt Res. Inst. Dep. Agric. Formosa *85:* 62. 1943 (without latin diagnosis).
Phyllostictina pyriformis Cash & Watson -Mycologia *47*: 737. 1955.

Pycnidia amphigenous, more frequently hypophyllous, evenly but rather densely spread over large circular or elliptic pallid spots, with a brown or purple border, or distributed over most of the leaf surface; unilocular, 150-200 µm in diameter, depressed globose, apically flattened or inconspicuously papillate with a circular or somewhat angular pore 8-15 µm in diameter. *Wall* of variable thickness, pseudoparenchymatous, 1-5 cells thick and composed of dark greenish-brown to almost black, thick-walled cells; hyaline, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 3-6 x 1.5-4 µm. *Conidia* one-celled, obovate or pyriform, rarely almost globose, ellipsoidal or cylindrical, usually with a truncate base, broadly rounded apically and slightly indented, 8-15 x 5-8 µm, surrounded by a thick slime coat (swelling in water up to 5 µm), containing numerous rather coarse greenish guttules and usually a distinct, large, bright vacuole, with a hyaline, unstable apical appendage, 5-12 µm long.

Cultural characters: Colonies growing slowly on oatmeal and cornmeal agar at 24°C, reaching about 5 cm in diameter in 20 days, at first greenish, soon turning black, with a lobed margin. Submerged mycelium dark brown, very dense but not forming a stromatic crust. Aerial mycelium is usually not formed. *Stromata* laid out in concentric rings but sometimes only at the margin of the colony, globose, pyriform or cylindrical, composed of dark brown pseudoparenchyma, bearing in their upper region one to numerous pycnidial cavities; unilocular or more often multilocular when fructifications are clustered. *Wall* pseudoparenchymatous, 2-10, usually 3-6 cells thick, composed of almost black isodiametrical cells, hyaline towards the conidiogenous region.
Only a low percentage of conidia germinate in hanging drops of sterile water, forming fast growing, slender or short and swollen, often septate germ tubes, but no appressoria.

Host plants: Stanhopea spec. (type host) and numerous other Orchidaceae in different genera, listed by Cash & Watson (1955).

Material examined

Herbarium specimens [p. 39]

Phyllosticta capitalensis, Fungi S. Paulenses a Puttemans collecti, nr. 736; on leaves of *Stanhopea,* S. Paolo, Capital, April 1903; holotypus (B).

Living strain

CBS 271.64 isol fr. *Cymbidium* spec.cult.by G. H. Boerema, Wageningen, Netherlands, PD.64/120, May 1964.

Discussion

On the type specimen of *Phyllosticta capitalensis* conidia measure 9-15 x 5-8 µm, in the living strain 9-13 x 6-7.5 µm. In both collections conidia are often pyriform or clavate and have a rather short, caducous appendage, coarse contents and a conspicuous bright vacuole.
The name *P. capitalensis* was not noticed by Cash & Watson (l.c.)in their study of *Phyllostictina pyriformis.* Amongst the other *Phyllosticta* species described from Orchids, only *P. aplectri* Ellis & Everh. is here retained in this genus. It differs from *P. capitalensis* by smaller conidia which are ovate to globose, containing fine guttules and no central vacuole.
P. capitalensis isdistributed all over the world, especially in warmer areas. In the temperate zone it occurs only on cultivated Orchids in glasshouses (Belgium, Germany, Netherlands).

12. **Phyllosticta celastrina** (Died.) van der Aa, comb. nov. -Fig. 4l

Macrophoma celastrina Died. - Annls mycol. *14*: 188. 1916 (basionym) = *Phyllostictina celastrina* (Died.) Petrak & Syd. - Phaeospore Sphaerops.: 192. 1927.

Leaf spots small, circular, up to 10mm in diameter, brown to very pale when old, surrounded by a brownish-red border. *Pycnidia* epiphyllous, single or clustered, unilocular, 75-220, usually about 100 µm in diameter, globose or somewhat depressed, flat or papillate, with a single, subcircular or irregularly shaped pore up to 15 µm in diameter, secondarily enlarged by disruption of the upper region of the papilla. *Stroma* clypeus-like, prosenchymatous to pseudoparenchymatous, subhyaline to dark brown directly under the epidermis. *Wall* usually 2-4 cells thick, but up to 8 in the upper region (7-20 µm), composed of globose to isodiametrical, partly thick-walled, partly thin-walled brownish cells, which are much darker around the pore, but flattened and hyaline towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, caducous, 5-8 x 3-4 µm.*Conidia* one-celled, broadly ovate, ellipsoidal to almost globose, somewhat clavate with a truncate base when young, broadly rounded apically and slightly indented, 10-15 en 7-11 µm, or about 10-11µm in diameter, surrounded by a slime layer, containing rather coarse guttules, with an apical appendage of which only 4-7 µm long, badly preserved remnants were observed. [p. 40]

Host plant: Celastrus spec. (Celastraceae).

Material examined

Macrophoma celastrina, on leaf of *Celastrus* spec., Pusa, East India, 31.1.1910, leg. E. J. Butler, nr. 1658; holotype (B).

Discussion

This species, represented only by a rather poor collection needs further study on fresh material. It resembles several *Phyllosticta* species with medium-sized conidia, but is considered tentatively as a distinct species.

13. **Phyllosticta citricarpa** (McAlp.) van der Aa, comb. nov. -Fig. 4m

Phoma citricarpa McAlp. - Diseases of *Citrus* in Australia: 21 and 81. 1899 (basionym) = *Phyllostictina citricarpa* (McAlp.) Petrak - Sydowia 7: 115. 1953.
Ascigerous state: Guignardia citricarpa Kiely
Guignardia citricarpa Kiely - Proc. Iinn. Soc. N.S.W. 73: 259. 1948.
Spermatial state: Lepdorothiorella spec.

Pycniria thickly scattered over infected areas of leaves, petioles, twigs and fruits, not in definite leaf spots. Affected leaves turning pale over large parts, the fruits turning black; *pycnidia* 70-330 µm in diameter, globose or depressed on the leaves, somewhat pyriform on the fruits, flat or conspicuously papillate with a circular pore of 10-15 µm diameter. *Stroma* developed on fruits only, prosenchymatous or pseudoparenchymatous, composed of strongly twisted hyphae, intermixed with isodiametrical, irregular or spherical cells, subhyaline to

dark brown, 5-18 µm in diameter, closely grown together with the peel, forming a solid crust. *Wall* 3-10 cells thick, composed of isodiametrical or flattened cells, subhyaline to brownish on leaves but brown to almost black on fruits; cell-walls of variable thickness, hyaline towards the conidiogenous region, isodiametrical or flattened and thin-walled. *Conidiogenous cells* cylindrical, about 4-8 x 2-3.5 µm, sometimes intermixed with longer, inactive cells, persisting from early stages of development of the pycnidial cavity. *Conidia* one-celled, obovoidal, ellipsoidal or subglobose, somewhat clavate when young, with a truncate base, broadly rounded apically and slightly indented, 6-13 x 5-9, usually 9-10 x 6-7 µm, surrounded by a thick slime layer, containing coarse guttules, with an apical appendage of 5-15 µm length, very caducous.

Ascigerous state (description according to Kiely, l.c.): *Perithecia* 125-360 µm in diameter, papillate, with a 14-16 µm wide pore; *wall* 20-22 µm thick. *Ascospores* hyaline to greyish, containing granula and a large central vacuole, covered by a clear gelatinous cap at each end, measuring 8-17.5 x3.3-8 µm. [p. 41] Ascomata may occur on both sides of decaying leaves but have never been found on the fruits. Wager (1952)observed them in pure culture.

Spermatial state: Occurs both in pure culture and on the host and usually develops simultaneously with the conidial state, but is much more scarcely found. *Fruitbodies* similar to those of the conidial state. *Spermatiogenous cells* elongated cylindrical, 4-10 x 0.5-2 µm. *Spermatia* dumb-bell-shaped, seldom cylindrical, straight or slightly curved, 5-8 x 0.5-1 µm.

Cultural characters: Colonies growing slowly, reaching a diameter of 7 cm in 20 days on various media at 24 °C; submerged mycelium dark, forming a plectenchymatous crust. *Stromata* develop within 8 days as hard, black masses, resembling those on the fruits, pyriform, globose or cylindrical, with one to numerous conidial and spermatial cavities in the upper region.
The effect of light and temperature on symptom development and sporulation, both on fruits and in pure culture, has been studied extensively by Brodrick & Rabie (1970).

Host plants: Citrus aurantium, C. limonia and *C. nobilis* (Rutaceae).

Material examined

Herbarium specimen

Phyllostictina spec., on leaves of *Citrus* spec., Prapat, Sumatra, June 1926, leg. K. B. Boedijn (U).

Living strain

CBS 111.20 *Phoma citricarpa,* obtained from W. A. Birmingham, April 1920.

Discussion

Guignardia citricarpa isa damaging pathogen on *Citrus* species, occurring in all areas where *Citrus is* cultivated (McAlpine, 1899; Fawcett & Lee, 1926*;* Kiely, 1948; Wager, 1952;Schüepp, 1961).
Kiely (1949) observed the fungus on several other plants, growing in gardens adjacent to the *Citrus* plantations. One of them was *Ilex aquifolium,* a well known host plant of *Guignardia philoprina.* Kvartskhava (1968) made similar observations. It is difficult to distinguish *G. citricarpa* from some other species merely on morphological characters. The ascigerous state is comparable with *Guignardia philoprina,* which has, however, larger conidia. There is also some resemblance to *Guignardia birwellii,* but this species is specialized on host plants in the Vitaceae. The spermatia of *G. citricarpa* are very small, seldom over 1 µm wide and in this character the species is distinct from the other species mentioned. However, the spermatial state is scarce and therefore it is preferable to use host-specificity for species delimitation, especially since these species all produce typical symptoms on leaves and fruits. [p. 42]

14. **Phyllosticta clethricola** Ellis & Martin - Fig. 4n

Phyllosticta clethricola Ellis & Martin - Am. Naturalist 16*:* 1002. 1882.

Leaf spots subcircular, frequently coalescing, 2-5 mm in diameter, reddish brown with a definite, slightly elevated dark border, paler on the under side of the leaf. *Pycnidia* epiphyllous, single, unilocular, 75-120 µm in diameter, globose or depressed, erumpent, with a distinct papilla and a single, about 6-15 µm wide pore. *Wall* thin, often not developed at all in the basal and lateral regions of the pycnidium, or composed of a single layer of rounded or isodiametrical, rather thick-walled cells, about 4-7 µm in diameter, locally compressed or intermixed with remains of the host tissue, darker around the pore, hyaline and flattened towards the inner region. *Conidiogenous cells* often cylindrical or conical, 3-6 x 2-3 µm, sometimes hardly differentiated from the inner wall-cells. *Conidia* one-celled, obovate or ellipsoidal, seldom pyriform or globose, somewhat clavate with a truncate base when young, broadly rounded apically and slightly indented, 6.5-10 x 5-7 µm, surrounded by a thick slime layer, containing numerous fine greenish guttules, with an apical appendage, 1-2 times longer than the conidia but very ephemeral.

Host plant: Clethra alnifolia (Clethraceae).

Material examined

Phyllosticta clethricola, Ellis, N. Am. F. 1953, on leaves *of Clethra alnifolia,* Newfield, N.J., 1882; syntype (L).

Discussion

On the only specimen examined most of the conidia were old and without apical appendages. Schwarze (1917) described another specimen of the same collection and noticed ‘frequently hair-like appendages’, which are illustrated as being 1-z times longer than the conidia.

15. **Phyllosticta colocasiicola** Höhnel - Fig. 4o

Phyllosticta colocasiicola Höhnel - Sber. K. Akad. Wiss., Wien, math.-nat. Kl. *116,* Abt. 1: 60 (Fragm. Mykol. *3*: 140) 1907.

According to the description of von Höhnel (l.c.) this fungus does not cause leaf spots. *Pycnidia* numerous, growing densely together, 100-120 µm in diameter, globose and distinctly papillate. *Wall* composed of large, dark [p. 43]brown cells. *Conidiogenous cells* very short. *Conidia* hyaline, ovoidal, containing coarse guttules, measuring 10 x 5-6 µm.
No collection on a natural substrate was available. A more detailed description is given of an isolate, considered as belonging to the same species.

Cultural characters: Colonies on oatmeal and cornmeal agar growing slowly, reaching about 4 cm in diameter in 20 days at 24° and at 30°C, at first pale, then grey, turning almost black with a white lobed margin. Aerial mycelium scarse, dark-grey, submerged mycelium very dense, composed of septate, brown to almost black, 4-7 µm wide hyphae. *Stromata* numerous, globose, cylindrical, pyriform or columnar, variable in size, up to 800 µm high, pseudoparenchymatous, at first only differentiated in a central region of thin-walled, hyaline cells, darker towards the outside, often remaining sterile but sometimes forming conidial cavities in the upper part. They are uni- or multilocular, not papillate, uni- or multiostiolate, 70-450 µm in diameter. *Wall* 1-8, sometimes up to 15 cells thick, composed of an outer region with globose, brownish or blackish cells, usually 4-15, sometimes up to 35 µm in diameter, hyaline and sometimes flattened towards the conidiogenous region. *Conidiogenous cells* often short cylindrical, sometimes hardly differentiated from the inner wall-cells, intermixed with the inactive remains of the previous conidiophores, which project into the mature cavity as pseudoparaphyses. *Conidia* one-celled, ovoidal or short cylindrical, clavate when young with a truncate base, rounded apically and sometimes indistinctly indented, 9-13 x 4-6 µm,surrounded by a thick slime layer, containing numerous greenish guttules, without apical appendage.
Good sporulation was only obtained above 25°C and was best at 30°C.

Host plants: Colocasia spec., *Dieffenbachia* spec. and possibly other tropical and subtropical Araceae.

Material examined

CBS 205.65, isolated from *Dieffenbachia* spec., Aalsmeer, 1965, by H. A. van Kesteren.

Discussion

The type collection of *Phyllosticta colocasiicola* was not available. The isolate mentioned agrees in most characters with the rather short diagnosis given by v. Höhnel. It was first identified as *Guignardia dieffenbachiae* Frag. & Cif., but in subcultures of the fungus no ascigerous state has been seen. Examination of several herbarium collections and living strains isolated from different genera of the Araceae makes it probable that at least 3 species of *Guignardia* or *Botryosphaeria* occur on this host family, with different conidial connections in both *Phyllosticta* and *Dothiorella*. [p. 44]

16. **Phyllosticta concentrica** Sacc. - Fig. 5a

Sphaeria taxi Fr. - Obs. mycol. *2:* 183. 1515; Syst. mycol. *2*: 500. 1823 = *Phyllostictina taxi (Fr.)*Wollenw. & Hochapfel - Z. ParasitKde *12*: 192. 1942 [non *Phyllosticta taxi* Hollós - Annls Mus. nat. Hungar. *8*: 3. 1910].
Phoma ilicis Desm. - Annls Sci. nat. Bot. Sér. 2, *19*: 335. 1843 pro parte = *Phyllosticta ilicis* (Desm.) Allesch. in Rabenhorst - Kryptog. Fl. *6*: 49. 1898 = *Macrophoma ilicis* (Desm.) Oudem. - Ned. Kruidk. Archf, Sér. 3, *2*: 247. 1901 = *Phyllostictina ilicis* (Desm.) Petrak & Syd. - Phaeospore Sphaerops.: 198. 1927 [non *Phyllosticta ilicis* Oudem. - Ned. kruidk. Archf, Sér. *3, 2: 226.* 1901.
Phyllosticta concentrica Sacc. - Nuovo G. bot. ital. *8*: 203. 1876 = *Phyllostictina concentrica* (Sacc.) Höhnel - Hedwigia *62: 64.* 1920.
Sphaeropsis ilicicola Cooke & Ellis -Grevillea *6*: 3. 1877 = *Phyllosticta ilicicola* (Cooke & Ellis) Ellis & Everh. - Fungi Columb.: 70. 1893 = *Phoma ilicicola* (Cooke & Ellis) Sacc. - Syll. Fung. *3*: 106. 1884 = *Phyllostictina ilicicola* (Cooke & Ellis) Höhnel - Ber. dt. bot. Ges. *36:* 315. 1918 [non *Phyllosticta ilicicola* Pass. - J. Hist. nat. *4*: 54 1885]
Phoma hysterella Sacc. - Michelia *2*: 275. 1881 = *Phyllostictina hysterella* (Sacc.) Petrak in Petrak & Sydow - Phaeospore Sphaerops.: 206. 1927.
Phyllosticta maxima Ellis & Everh. - J. Mycol. *4*: 123. 1888 = *Phyllostictina maxima* (Ellis & Everh.) Petrak - Hedwigia *74*: 56. 1934.
Phyllosticta prini Peck -A. Rep. N.Y. St.Mus. *43*: 72. 1890.
Phyllosticta concentrica Sacc. var. *sparsa* Ellis & Everh. - N. am. Fungi: nr. 2936.1893.
Phyllosticta decipiens Ellis & Everh. - N. Am. Phyllost.: 55.1900.
Phyllosticta kobus P. Henn. - Bot. Jb. *37:* 162. 1905 = *Phyllostictina kobus (P.* Henn.) Petrak - Sydowia *4*: 28. 1950.
Phyllostictina concentrica(Sacc.) Höhnel var. *lusitanica* D'Almeida - Contrib. Mycofl. Port.: 29. 1903.
Strasseria camarae Dias & Texeira - Agron. lusit. *24*: 36.1962.
Phyllostictina hederae Bose, Roy & Jain - Prog. Hort. 2, 1: 75. 1970.

Ascigerous state: **Guignardia philoprina** (Berk. & Curt.) van der Aa, comb. nov. -Figs. 1, 2

Sphaeria philoprina Berk. & Curt. -N. Am. Fungi 917. 1859 (basionym) = *Physalospora philoprina* (Berk. &Curt.) Sacc. - Syll. Fung. *1: 440.* 1882 = *Botryosphaeria philoprina* (Berk. & Curt.) v. Arx & Müller - Amerospore Pyrenom.: 40. 1954.
Sphaeria ilicis Schleich. in Ellis -N. Am. Fungi: nr. 196. 1879 = *Physalospora ilicis* (Schleich.) Sacc. - Syll. Fung. *9*: 595. 1891 = *Discothora ilicis* Höhnel - Ber. dt. bot. Ges. *36*: 315. 1918.
Physalospora gregaria Sacc. var. *foliorum* Sacc. - Syll. Fung. *1:* 435. 1882 = *Pyreniella foliorum* (Sacc.) Theiss. - Annls mycol. *14:* 411. 1916 = *Melanops foliorum* (Sacc.) Petrak - Kryptog. Forsch. *2*: 165. 1931 = *Botryosphaeria foliorum* (Sacc.) v. Arx & Müller - Amerospore Pyrenom.: 42. 1954.
Sphaerella rhodorae Cooke – Grevillea *13*: 99.1885 = *Laestadia rhodorae* (Cooke) Berl. & Vogl. in Saccardo - Addit. Syll. Fung.: 69. 1886; Syll. Fung. *9*:583. 1891 = *Discochora rhododae*(Cooke) Höhnel in Weese - Mitt. bot. Inst. techn. Hochsch. Wien *8*: 1931 = *Guignardia rhodorae* (Cooke) Davis -Mycologia *38: 48.* 1946 = *Botryosphaeria rhodorae*

(Cooke) Barr - Mycologia *62:* 381. 1970.
Laestadia ilicis Jaczewski - Bull. Soc. vaud. Sci. nat. *28,* 107: 85-86. 1892 = *Guignardia ilicis* (Jaczewski) Schrantz - Bull. Soc. mycol. Fr. *76: 327.* 1960.
Physalospora gregaria Sacc. f. *taxi* Feltgen - Vorstudien Pilze Fl. Luxemb. *4*: 56. 1905.
Physalospora diedickei Jaap -Verh. bot. Ver. Brandenb. *61*: 82. 1914.
Physalospora ilicella Tengwall - Sinensia *7*: 511. 1936.
Physalospora ilicella Tengwall var. *minor* Tengwall – l.c..
Guignardia oosperma Kirschst. - KryptogamenFl. Mark Brandenb. 7, *3*: 320. 1938.
[p. 45]

Spermatial state: Leptodothiorella spec. - Fig. 3

Pycnidia amphigenous or epiphyllous, occurring in leaf spots or on dead leaves, often in concentric rings, single, unilocular, 100-250, often about 120-150 µm in diameter, globose, depressed or tympaniform, the upper region firmly grown together with the epidermis, flat or papillate with a single pore 10-25 µm in diameter. *Stroma* sometimes developed, prosenchymatous, more abundant around the upper region of the pycnidia. *Wall* 1-6 cells (5-30 µm) thick, composed of rounded, isodiametrical or irregular, brown, usually thin-walled cells, 8-15 µm in diameter, with darker and thicker walls around the pore; hyaline, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-10(-20) x 1.5-4 µm, sometimes hardly differentiated from the flat inner wall-cells. *Conidia* one-celled, obovoidal, short cylindrical or almost globose, pyriform or clavate, when young with a truncate base, broadly rounded apically, indented or somewhat umbilicate, measuring 8-20 x 4-14, usually 10-15 x 7-10 µm, surrounded by a thick slime layer, containing rather coarse guttules and sometimes a large, bright, central vacuole; with an apical appendage often as long as the conidium but sometimes up to 35 µm long, very slender, hardly widening at the base. *Appressoria* clavate, straight or curved, yellowish brown to dark brown, one-celled or 1-2-septate.

Ascigerous state: Ascomata on living and dead leaves, 120-300, often about 200-275 µmin diameter, globose, depressed or tympaniform, firmly grown together with the epidermis, flat or indistinctly papillate, ostiolate at maturity. *Stroma* usually restricted to the subepidermal region or lacking. *Wall*1-5 cells (15-30 µm) but up to 8 cells (50 µm) thick in the upper part, composed of an outer region with rounded or irregular, rather thick-walled brownish to almost blackish cells and an inner region with subhyaline and thin-walled, often flattened cells. *Asci* 40-80 x 10-17, usually about 60 x 15 µm, cylindrical or clavate, with a broadly rounded apex, sessile or with a short stalk and 8-spored. *Ascospores* 1-3 seriate, ovoidal, ellipsoidal or biconical, sometimes curved, one-celled, 14-24 x 5-12, usually 16-20 x 6-9 µm, containing numerous small greenish guttules and a large, bright vacuole, at one or at both ends; covered with a hyaline, rounded or conical slime cap. *Paraphysoids* numerous or scarce, persistent or disappearing at maturity.

Spermatial state: Spermogonia and pycnidia almost similar; in the early stages of development both conidia and spermatia can be formed in the same cavity. *Spermatiogenous cells* long, slender, 4-35 x 1-2 µm, densely lining the cavity. *Spermatia* cylindrical or dumb-bellshaped, 6-15 x 1.5-3 µm, exuding in clear tendrils.

Cultural characters: Colonies grow slowly and when freshly isolated attain a diameter of 4-5 cm in 15 days and 8-10 cm in 25 days on oatmeal and cornmeal agar at about 20°C,but when subcultured from older strains about 3-4 cm in 25 days; at first greenish, soon turning black, the surface somewhat wrinkled, the margin lobed, the whole colony having a radiating [p. 46]appearance. Submerged mycelium very dense, brownish to almost black, aerial mycelium absent in freshly isolated strains. *Stromata* prosenchymatous to pseudoparenchymatous, cylindrical or subglobose, sometimes clustered or coralloid, 200-500 µm in diameter, 200-800 µm high; coralloid complexes sometimes up to 1cm high, composed of brownish to blackish, usually thin-walled, isodiametrical or irregular cells, forming pycnidial, spermatial and perithecial cavities in the upper parts. Some strains only produce the ascigerous state, but conidial and spermatial states appear after several transfers; other strains form only imperfect states. Usually a number of stromata remain sterile, normally developed but form subhyaline or faintly brownish pseudoparenchymatous cells which secede easily, superficially resembling conidia. Pycnidial cavities often are multilocular and multiostiolate.

Host plants: Taxus baccata (Taxaceae); *Rhododendron maximum, R. carolinianum, R. catawbiense, R. nudiflorum, R. ponticum* and numerous hybrids (Ericaceae); *Ilex aquifolium, I. opaca, I. verticillata* (Aquifoliaceae); *Hedera helix* and *Heptapleurum venulosum* (Araliaceae); *Magnolia* spec. (Magnoliaceae).

Material examined

Herbarium specimens

On *Taxus baccata: Physalospora gregaria* var. *foliorum,* Herb. P. A. Saccardo, on fallen leaves, Padua, Italy(PAD); immature perithecia and spermatia. *Phyllostictina hysterella,* Mähr. Weisskirchen, garden, leg. F. Petrak, Oct. 1925 (ZT). On dead leaves and partly living twigs, Baarn, July 1968, coll. H. A. v. d. Aa 650; do. Baarn, Maarschalksbos, 1 Sept. *1969,* coll. H. A. v. d. Aa 1869; do. Baarn, garden, 12 May 1969, coll. H. A. v. d. Aa 1690 (all in CBS); from the two latter localities many collections with perithecial, conidial and spermatial states.
On *Rhododendron:* On dead leaves of *Rhododendron,* Baarn, Groeneveld, Aug. 1966, coll. J. A. von Arx; on dead and withering leaves of *Rhododendron* spec. cult., Baarn, Cantonspark, 10 Aug. 1969, coll. H. A. v. d. Aa 1745, 1750 and many other collections of this locality, with perithecial, conidial and spermatial states in all stages of development (all in CBS).
On *Ilex: Physalospora ilicis,* Herb. P. A. Saccardo, on leaves of *I opaca,* N. America (PAD); immature perithecia and spermatia. *Sphaeria hederae* var. *ilicis,* Desmaziéres 1863, 1290 on dry leaves of *I. aquifolium;* holotypus (PC). *Guignardia ilicis [Laestadia (ricini?) ilicis (Fr.)],* Chillon, Suisse, 29 Dec. 1891, leg. J. Jaczewski; holotypus (PC). On dead leaves of *I. aquifolium,* Leiden, Nieuweroord, 23 June 1963, coll. R. A. Maas Geesteranus (L). Leaf spots on *I. aquifolium,* Baarn, 9 July *1967,* coll. H. A. v. d. Aa 96; do., Valkenswaard, 23 July, *1967,* coll. H. A. v. d. Aa 106; on fallen leaves of *I.aquifolium,* Baarn, 3 July 1969, coll. H. A. v. d. Aa 1737, 1774 and many other collections (1969-1972) of this locality, with conidial and spermatial states and only unripe ascomata (all in CBS).
On *Hedera helix: Phyllosticta concentrica,* Saccardo, Mycoth. veneta nr. 362 on withering leaves, Padua, Italy, July 1875, syntype (L); D. Saccardo, Mycoth. ital. 1325 (L); Roumeguère, F. gall. exs. 2535 (L); on dead leaves, Su Cologone near Oliena, Sardinia, 31 Aug. 1970, leg. W. Gams (CBS). *Phyllosticta concentrica* var. *sparsa,* N. Am. Fungi, 2nd Ser. no 2936, Vineland, N.J., April 1893, syntype (L). *Phyllostictina concentrica,* Herb. F. Petrak, Albania, Oct. 1918 (ZT); coll. J. Bremer (ZT).
On *Heptapleurum venulosum: Guignardia bidwellii,* on living leaves, Castle Rock, Goa, India, 24 April 1963, coll. P. G. Patwardhan (CBS). [p. 47]
On *Magnolia: Phyllosticta kobus,* on leaves of *Magnolia kobus,* Omiya, July 1904, coll. N. Nambunr. 301; holotypus (B).

Living strains

CBS 356.52 isol. fr. *Ilex* by C. H. Driver.
CBS 373.54 isol. fr. *Ilex* by M. A. Rosinski.
CBS 647.66 isol. fr. dead leaves of *Rhododendron* spec., Baarn, Groeneveld, Aug. 1966, by J. A. von Arx.
CBS 346.67 isol. fr.*Ilex aquifolium,* leaf spot, Baarn, 9 July *1967,* by H. A. v. d. Aa.
CBS 447.68 isol. fr. needles of *Taxus baccata,* Baarn, July 1968, by H. A. v. d. Aa.
CBS 587.69 isol. fr.dead leaf of *Ilex aquifolium,* Aug. 1969, Baarn, by H. A. v. d. Aa.
CBS 901.69 isol. fr.dead leaf of *Rhododendron* spec. cult., Baarn, Cantonspark, 10 Aug. 1969, by H. A. v. d. Aa.
CBS 937.70 isol. by H. A. v. d. Aa fr. dead leaves of *Hedera helix,* Sardinia, Su Cologone near Oliena, 31 Aug. 1970, leg. W. Gams.
CBS 616.72 = DSM 11.887 isol. fr.*Ilex aquifolium,* W.Germany, 1972, byR. Schneider.

Discussion

Guignardia philoprina is known from *Rhododendron, Ilex* and *Taxus,* and is considered by von Arx & Müller (1954) and Müller & von Arx (1955) as an intermediate form between *Guignardia* and *Botryosphaeria.* They concluded that the fungi on *Rhododendron* and *Taxus* were conspecific and called them *Botryosphaeria foliorum;* this species was regarded as different from *Botryosphaeria philoprina* on *Ilex* because of its larger ascospores. On many collections of the fungus on *Taxus, Ilex* and *Rhododendron,* ripe ascospores measured between less than 18 µm and up to 24 µm in length. In pure culture the ascospores are generally somewhat smaller. No other useful character has been found to separate these species.

Guignardia hederae (Fr.) Wollenweber & Hochapfel (Z. ParasitKde *12*: 216. 1941) is a different species with ascospores of 7-9 x 3-4 μm. So the oldest name for the ascigerous state seems to be *Sphaeria philoprina* Berk. & Curt.

For the conidial state some old names are excluded for reasons of nomenclature. Wollenweber & Hochapfel (1941) pointed out that the fungus issued in Scleromycetes Sueciae exs. 22 sub *Sphaeria taxi* Fries (1815) is the same species, but a new combination would result in a later homonym of *Phyllosticta taxi* Hollós (l.c.), a different species, not related to *Phyllosticta. Phoma ilicis* Desm. (l.c.) is a 'nomen ambiguum': on the type collection a *Phyllosticta* and a *Phomopsis* species occur. The *Phomopsis* was chosen by von Höhnel (1918b) and he changed the name to *Phomopsis ilicis* (Desm.) Höhnel. On the other hand *Phyllosticta ilicis* (Desm.) Allesch. (1898) was based on the same collection. It is impossible to make a selection in accordance with the description given by Desmaziéres, and according to Art. 70 of the Code (Stafleu & al., 1972) this name cannot be used again. Therefore the name *Phyllosticta concentrica* Sacc. is regarded as the correct name for the conidial state.

The spermatial state was observed on *Taxus baccata* by Petrak & Sydow (1927: 207) and was considered to be related to *Asteromella.* Davis(1946) [p. 48]and Barr (1970) collected the spermatial state on *Rhododendron* and found some names for it, amongst which the oldest is apparently *Phyllosticta saccardoi* Thüm. (Contr. mycol. Lusit. 3; Instituto Coimbra *28:* 48. 1881), a name change for *Phyllosticta rhododendri* Sacc. (Michelia *2:* 531. 1879) [non *Phyllosticta rhododendri* Westend. -Bull. Acad. r. Belg. Cl. Sci.*1*:399. 1851]. This species was placed in *Asteromella,* as *A. saccardoi* (Thüm.) Petrak (Hedwigia 74: 54. 1934)·Examination of a syntype and several secondary collections made by de Thümen proved that this classification is correct: it is not the spermatial state of *a Guignardia* but of *a Mycosphaerella* species. *Phyllosticta rhododendri* Westend. (holotype at BR) appeared to be a synonym of *Colletotrichum gloeosporioides* Penzig. No other suitable name could be found for the spermatial state of *Guignardia philoprina.*

Since the fungus can cause diseases, its host relationships are of interest. On *Taxus* the fungus attacks the living needles, especially the terminal ones. Soon after the development of the conidial state, the needles become yellow and die. Pycnidia are present during the whole year on dead needles, but only during spring and summer on living needles. Needles and small twigs, killed by the fungus, remain on the tree for a long time. The spermatial state can be found from about July till winter; in mild winters or during periods without frost they can be active. Perithecia may ripen within about three months after the first symptoms have appeared, but usually they ripen in spring only after overwintering. During the warm, dry summer of 1969the fungus completed its whole life-cycle within three months in several localities in Baarn. In this short time the small hanging, terminal twigs of the affected trees were killed over a length of 10 to 60 cm, with a very sharp border between affected and healthy parts of the branch.

Observations on the *Guignardia* disease of *Rhododendron* are in accordance with those described by Davis(1946). The leaf spots often begin from the margin or the tip of the leaf but also occur on other parts of the leaf and are brownish, often with some shade of purple and surrounded by a sharp border. They enlarge at intervals, giving the older spots a concentric pattern. Finally the whole leaf can be invaded by the fungus. After that, the leaves can remain on the plant for about one year. Perithecia are amphigenous but mostly epiphyllous, ripening both on living and dead leaves. This is different from the situation on *Taxus,* where the ripe perithecia are only seen on dead leaves. As on *Taxus* perithecia can ripen within three months after leaf infection. At some localities in Baarn, ripe perithecia can be found on living leaves from July until the first frost in winter and on dead leaves in spring after overwintering.

On *Ilex* spots are brownish, turning pale, extending over large areas of the leaf. On living leaves the pycnidia are epiphyllous; the spermatial and ascigerous states, which are amphigenous, were only observed on the fallen leaves, but the ascigerous state was never

seen in a ripe stage. The only ripe perithecia on *Ilex* were observed on the type collection of *Guignardia ilicis.*
On *Hedera* only one fresh collection of the fungus was studied, which showed the characteristic spots with the pycnidia in a marked concentric arrangement on old, fallen leaves. According to Petrak (1927) and Bose & al. [p. 49] (1970), leaf spots are also formed on living leaves. In Europe the form on *Hedera* seems to be restricted to the mediterranean area.
On *Heptapleurum venulosum* the fungus occurs with both perithecia and pycnidia on living leaves and was identified as *Guignardia bidwellii* by Pande *(1969).* Kvartskhava (1968) reported a fungus as *Guignardia bidwellii* on *Fatsia japonica,* another genus of the Araliaceae, which, according to the description, is also *Guignardia philoprina.*

17. **Phyllosticta concinna** (Syd.) van der Aa, comb. nov. -Fig. 5b

Phyllostictina concinna Syd. - Annls mycol. *24*: 406. 1926 (basionym).
Caudophoma ehretiae Patil & Thirumalachar - Sydowia *20*: 36(1966) 1968 = *Phyllostictina ehretiae* (Patil & Thirumalachar) Petrak - Sydowia *21:* 241. (1966) 1968.

Ascigerous state: **Guignardia concinna** (Syd.) van der Aa, comb. nov.

Melanops concinna Syd. - Annls mycol. *24:* 373. 1926 (basionym).

Spermatial state: Leptodothiorella concinna Syd.

Leptodothiorella concinna Syd. - Annls mycol. 24: 407. *1926.*

Leaf spots circular or subcircular, not sharp in outline or with a somewhat yellowish border, later turning paler, becoming necrotic, leaving holes in the leaves. *Pycnidia* epiphyllous, single and unilocular or appearing to be multilocular when clustered; 200-330 µm in diameter, globose or depressed, the upper region firmly grown together with the subepidermal stroma, flat or indistinctly papillate with an irregularly shaped or angular pore, 8-20 µm in diameter. *Stroma* well developed, prosenchymatous at the edges, plectenchymatous towards the subepidermal region. *Wall* sometimes not well delimited from the stroma, especially in the upper regions, few or many cells (about 20, sometimes up to250 µm) thick, composed of brown to brownish black, isodiametrical or flattened cells, 8-20 µm in diameter, darker and thick-walled around the pore, by line and very flat towards the conidiogenous region. *Conidiogenous cells* short cylindrical, 6-10 *x* 1.5-2.5 µm,often not differentiated from the inner wall-cells. *Conidia* one-celled, short cylindrical, obovoidal or pyriform, seldom almost globose, somewhat clavate when young with a truncate base, broadly rounded and slightly indented apically, 12-20 x 7-10 µm, surrounded by a thick slime layer, containing numerous greenish guttules and often a large bright vacuole; with an apical appendage of which only a small, shrunken residue was seen. Germ tubes occasionally with one-celled, globose, pyriform or clavate, brown *appressoria,* 13-22 x 7-15 µm or about 13-15 µm in diameter.

Ascigerous state: Ascomata globose, somewhat flattened above, indistinctly papillate, 80-350 µm in diameter. *Wall* 15-40 µm thick, composed [p. 50]of thin-walled isodiametrical or flattened, brownish cells, 8-20 µm in diameter, darker towards the papilla, where they form a raised ring. *Asci* 50-80x 18-24 µm, cylindrical or clavate, attenuated at the base into along or short stalk, 8-spored. *Ascospores* 1-, 2- or 3-seriate, ellipsoidal or rhomboidal, straight or somewhat curved, rounded at the end, 14-20 x 7.5-10 µm, according to Sydow (l.c.) with a hyaline slime cap at the base. *Paraphysoids* scarce, usually disappearing at an early stage.

Spermatial state: Fructifications similar to those of the conidial state, developed in the same stromatic tissue and ripening at the same time. *Spermatiogenous cells* long, slender, 8-25 x 1-1.5 µm, lining the cavity at maturity in a regular pattern and forming spermatia in long, persistent chains. *Spermatia* one-celled, hyaline, elongated cylindrical or dumb-bellshaped, biguttulate, 6-9 x 1-1.5 µm.

Host plants: Cordia ferruginea, Ehretia aspera (Boraginaceae).

Material examined

Melanops concinna, Fungi exot. exs. 645, on living leaves of *Cordia ferruginea,* Costa Rica, San José, 6 Jan. 1925, leg. H. Sydow, 'in consortio status conidici: *Phyllostictina concinna* Sydow et *Leptodothiorella concinna* Sydow'; syntype, lectotype for the genus *Leptodothiorella* Höhnel sensu Sydow (U 178462B); idem (L.)

Discussion

Guignardia concinna resembles some other species, particularly *Guignardia philoprina,* which has equally sized fruit bodies and similarly shaped appressoria and slime caps on the ascospores. It differs from *G. philoprina* by a more abundantly developed stroma and by shorter apical appendages on the conidia. Some of these characters however have to be verified on fresh material. *Caudophoma ehretiae* Patil & Thirumalachar is placed into the synonymy with *Guignardia concinna* on the basis of the original description and the comments of Petrak (l.c.) and Subramanian & Reddy (1973).

18. **Phyllosticta cyamopsidicola** van der Aa, nom. nov. -Fig. 5c

Macrophoma cyamopsidis Syd. - Annls mycol. *11:* 405. 1913 (replaced synonym) _ *Phyllostictina cyamopsidis* (Syd.) Syd. *apud* Petrak & Sydow - Phaeospore Sphaerops.: 195. 1927 [non *Phyllosticta cyamopsidis* Vasant Rao - Mycopath. Mycol. appl. *28:* 19: 1966*;* non *Phyllosticta cyamopsidis* Pandotra & Sastry - Proc. Indian Acad. Sci., Sect. *B, 69* (4): 211. 1969].

Pycnidia not in distinct spots, epiphyllous, densely crowded on slightly discoloured, later necrotic parts of living leaves; unilocular or appearing multilocular when clustered, 75-150 µm, usually about 100 µm in diameter, [p. 51] globose or lenticular, firmly grown together with the epidermis or with the subepidermal stroma, flat or papillate, with a single, rather small, up to about 10 µm wide pore. *Stroma* prosenchymatous, composed of brownish hyphae, but more pseudoparenchymatous towards the epidermis and composed of irregular, brownish cells. *Wall* 1-2 cells (5-20 µm) but near the papilla up to 5 cells (50 µm)thick, composed of irregular, brown to brownish-black cells, mostly thin-walled but darker and with thicker cell-walls around the pore and hyaline and very flat towards the conidiogenous region. *Conidiogenous cells* often cylindrical or conical, 6-15 *x* 1-3 µm, sometimes, however, not well differentiated from the inner wall-cells. *Conidia* ovoidal, cylindrical, seldom somewhat reniform, clavate when young, with a truncate base, rounded apically and conspicuously indented, 8-12 x 4.5-7.5 µm, surrounded by a thick slime layer, containing coarse greenish guttules, with a short tongue-like apical appendage, up to 8 µm long, which soon disappears.

Host plant: Cyamopsis psoraleoides (Leguminosae).

Material examined

Macrophoma cyamopsidis, Herb. H. Sydow, on leaves of *Cyamopsis psoraleoides,* Los Baños, Philippines, 20 Aug. 1913, S. A. Reyes 1625; holotype (S).

19. **Phyllosticta dioscoreae** Cooke - Fig. 5d

Phyllosticta dioscoreae Cooke - Grevillea *6*: 136. 1878 = *Phyllostictina dioscoreae* (Cooke) Petrak - Annls mycol. *38*: 255. 1940.
Septoria dioscoreae Cooke - Hedwigia *1878:* 38.
Phyllosticta dioscoreacearum Baccarini - Nuovo G. bot. ital., N.S. *12:* 697. 1905.
Phyllosticta graffiana Sacc. - Annls mycol. *11:* 316. 1913.

Ascigerous state: Guignardia dioscoreae Pande

Discosphaerina dioscoreae Petrak - Annls mycol. *29:* 201. 1931.

Guignardia dioscoreae Sawada ex Katumoto - J. Jap. Bot. *40*: 193. 1965 (without indication of the rank of the taxon and without indication of a type); [non *Guignardia dioscoreae* Sawada - Spec. Publ. Coll. Agric.

Taiwan *8*: 58. 1959 (without latin diagnosis)].
Guignardia dioscoreae Pande - Sydowia *22*: *367.* (1968) 1969.

Leaf spots subcircular, reaching a diameter of about 1 cm, at first brownish, later turning whitish and surrounded by a dark, brown or purple, slightly elevated rim, similar on both sides of the leaf but more distinct on the upper side. *Pycnidia* epiphyllous, loosely scattered over the spots, single, unilocular, 60-130 µm in diameter, globose or somewhat depressed, flat or slightly papillate with a rounded or irregular pore 8-15 µm in diameter. *Stroma* prosenchymatous, pseudoparenchymatous under the epidermis and composed of thin-walled, globose cells, up to 20 µm in diameter. *Wall* 1-4 cells (9-20 µm) [p. 52] thick, composed of brownish, irregularly shaped cells, thick-walled, darker and compressed in the upper region, and surrounding the pore as a raised, ring-like wall, hyaline and very flat towards the conidiogenous region. *Conidiogenous cells* cylindrical, 4-11 x 1.5-3 µm. *Conidia* one-celled, obovoidal or globose, somewhat pyriform when young or clavate with a truncate base, apically broadly rounded and indented, 6-9 x 5-7 µm or about 6-7 µm in diameter, surrounded by a thick slime layer, containing numerous coarse guttules, with an apical appendage of which only 3-6 µmlong remnants could be seen in the herbarium specimens.

Ascigerous state: Ascomata on necrotic parts of living leaves, globose or somewhat depressed, 60-130(-150) µm in diameter, papillate, with a pore of about 20 µm diameter. *Wall* usually 2-3 cells (12-15 µm) thick, composed of irregularly shaped, brownish-black pseudoparenchymatous cells. *Asci* numerous, usually arising from a cushion-shaped basal region, which is composed of small, thin-walled, hyaline cells; the central asci sessile, the outer ones stalked, clavate, bitunicate, 32-55 x9-15 µm.*Ascospores* 2-3-seriate, ovoidal, ellipsoidal or rhomboidal, straight or slightly curved, containing 2-4 large and numerous smaller greenish guttules, 8-16 x 4-9 µm, usually 10-15 x 5-6 µm, often with a hyaline slime cap at one or at either end.

Host plants: Dioscorea villosa (type host), *D. esculenta* (Petrak, 1940), *D. fasciculata* (Saccardo, 1913), *D.* spec. (Sydow & Petrak, 193l) (Dioscoreaceae).

Material examined

Phyllosticta dioscoreae, Ellis & Everhart, N. Am. Fungi 3255; on leaves of *Dioscorea,* Mts of W. Va., 1.300 ft. alt., leg. L.W. Nuttall (L).
Phyllosticta graffiana, Sydow, Fungi exot. exs. 425; on leaves of *Dioscorea fasciculata,* Ins. Philippinenses, Manila, leg. P. W. Graff (isotypes in L and U).
Phyllostictina dioscoreae, Mycoth. gen. 1956; on leaves of *Dioscorea esculenta,* Luzon, Prov. Rizal, Antipolo, August 1921, leg. M. Ramaz (ZT).

Discussion

The above list of synonyms for the conidial state has already been proposed by Petrak (1940).
There are some differences in the ascospore measurements, observed by Sydow & Petrak (I93I), Katumoto (1965) and Pande (1969),but all the other characters agree with each other and with observations on the collections cited above. Both ascigerous and conidial states occur on the type collection of *Phyllosticta graffiana* Sacc., where the ascospores measure 13-16 x 4.5-6 µm.
The name *Guignardia dioscoreae* Sawada (l.c.) has not been validly published and refers probably to *Glomerella cingulata* (Stonem.) Spaulding & v. Schrenk (cf. Katumoto, 1965). *Guignardia dioscoreae* Sawada ex Katumoto [p. 53] is based on other collections, according to the descriptions and figures containing both *Guignardia* and *Phyllosticta dioscoreae,* but it has not been validly published.

20. **Phyllosticta encephalarti** van der Aa, spec. nov. -Fig. 5e

Maculae foliorum oblongae, ovales, 3-10 cm longae, zonatae, demum maximam partem folii occupantes. Pycnidia quina ad dodecena acervata in stromate per fissuram epidermidis erumpente, uni- vel plurilocularia, 80-120 µm diam., apice plano vel inconspicue papillato, ostiolato. Paries e singulis vel numerosis cellulis compositus, 5-9 µm, prope basim ad 75 µm crassus, a stromate basilari non distincte limitatus, e cellulis

brunneis, crassitunicatis, rotundatis 5-15 µm diam., consistat. Cellulae conidiogenae cylindricae vel conicae, 4-12 x 15-3 µm. Conidia obovata, ellipsoidea, pyriformia, primum clavata et deorsum truncata, apice late rotundato et medio depresso, recta vel modice curvata, plerumque bis vel ter longiora quam crassa, 10-15 x 3.5-6 µm, plasmate granulato et vacuola magna translucida repleta, strato mucido tenui circumdata, appendice apicali 6-10 µm longo, in conidiis maturis saepe invisibili praedita.
Habitat in foliis Cycadacearum, typice in *Encephalarto laurentiana.* Typus U 180437 B, leg. K. B. Boedijn in insula Java.

Leaf spots ovoidal or ellipsoidal, 3-10 µm long, most often developed near the main veins or at the leaf tip, later spreading over large areas of the leaf, greyish-brown, later pale, zonate, not sharp in outline. *Pycnidia* epiphyllous, often 5-8, seldom up to 12 together in an erumpent stroma, single loculi 80-120 µm in diameter, more often multilocular when clustered, apically flattened or slightly papillate with an irregular or subcircular pore of variable diameter. *Stroma* prosenchymatous to pseudoparenchymatous, at first subepidermal, soon erumpent, exposing the pycnidia in elongated slits of the leaf. *Wall* 1-numerous cells or 5-9, up to 75 cm thick at the base and at the joint with the stroma, composed of brownish, mostly thick-walled spherical cells, 5-18 µm in diameter, hyaline and isodiametrical towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-12 x 1.5-3 µm. *Conidia* one-celled, obovate, ellipsoidal, cylindrical, pyriform, clavate when young with a truncate base, broadly rounded apically and conspicuously indented, 10-15 x 3.5-6 µm, usually 2-3 times longer than wide, surrounded by a rather thin slime layer, containing a mass of partly coarse, partly fine guttules and generally one large, bright vacuole; with an apical appendage, 6-10 µm long, which is shrunken in the herbarium specimens, and soon disappears at maturity.

Host plants: Encephalartos laurentiana, Zamia skinneri (Cycadaceae).

Material examined

Sphaeropsidales indet., Herb. K. B. Boedijn, on leaves of *Encephalartos laurentiana,* Java, Hortus Bogoriensis, April, 1950, leg. K. B. Boedijn (U 180437B); holotype and slides [p. 54] H. A. van der Aa nr. 1947(CBS); *Phyllosticta* spec., Herb. K. B. Boedijn, on leaves of *Zamia skinneri,* Java, Hortus bogoriensis, Jan 1949 leg. van Hoof (U 160835B) and slide H. A. van der Aa nr. 2004 (CBS).

Discussion

This species differs from all the other *Phyllosticta* species in the characters of the stroma and conidia and represents an intermediate form between *Dothiorella* and *Phyllosticta.* The arrangement of the pycnidia in the erumpent stroma is a character more often occurring in *Dothiorella* than in *Phyllosticta.* The shape of the conidia and their thin slime layer also suggests *Dothiorella* rather than *Phyllosticta.* However, the conidia have an apical appendage, most are less than 3 times as long as wide and therefore fall within the range of *Phyllosticta.*
Amongst numerous Sphaeropsidales, described on these or related host plants, this species is only comparable with *Phyllosticta cycadis* Ahmad (Sydowia *2*: 77. 1948) with conidia of 11-19 x 4.5-6 µm, but without the well developed stroma. The name is a later homonym of *P. cycadis* da Camara & Gomes (Agron. lusit. *1*: 51. 1939)which is not a *Phyllosticta,* having conidia 2.5-3.5 x 2-2.5 µm.

21. **Phyllosticta flevolandica** van der Aa, spec. nov. -Figs. 5f, 9

Coloniae lente crescunt, mycelium submersum olivaceo-nigrum vel brunneo-nigrum, mycelium aerium sparsum, brunneo-nigrum, margo exigua grisea abrupte delimitata. Stromata sparsa, 200-300 µm diam., 250-400, raro ad 750 µmalta, in parte superiore unum vel numerosa pycnidia globosa vel lageniformia papilla complanata et poro 20-60 µmdiam. praedita ferunt. Paries 15-35 µm crassus, extus prosenchymaticus, medio pseudoparenchymaticus e cellulis rotundatis, tenuitunicatis, brunneis, 6-14 µm diam., intus isodiametricis et hyalinis compositus. Cellulae conidiogenae cylindricae vel conicae, 8-12 x 2-3.5 µm. Conidia obovata, ovata, pyriformia, raro

fere globosa vel irregularia, continua, raro medio septata haud constricta, 11-14 x 7-9 µm, bicellularia 12-15 x 7-10 µm,strato mucido crasso circumdata, guttulis conspicuis viridulis repleta.
Isolatus a terra nuper desiccata inculta, Z. Flevoland, antea 'Zuiderzee', Hollandia. Typus CBS 998.72.

Colonies growing slowly, reaching 1.6-2 cm diameter in 14 days at 20°C on PDA, cornmeal or oatmeal agar, pale at first, soon turning greenish and later almost blackish with a small whitish border, sharp in outline. Submerged mycelium consists of green to brownish-black hyphae; aerial mycelium loose, brownish-black or greyish, initially with a tinge of blue. *Stromata* at first prosenchymatous, soon becoming pseudoparenchymatous in the upper region, globose or broadly cylindrical, 200-300 µm in diameter, 250-400, seldom up to 750 µm high, in their upper region developing one to several pycnidial cavities. *Pycnidia* seldom single, usually clustered, the single ones globose, pyriform or bottle-shaped, unilocular, the clustered ones giving rise to multilocular cavities, apically flattened, not papillate, [p. 55] with a 20-60 µm wide pore. *Wall* 15-35 µm thick, the outer region prosenchymatous, composed of closely dark-brown hyphae, the inner region pseudoparenchymatous, several cells thick, composed of dark brown, roundish, thin-walled cells, 6-14 µm in diameter, hyaline and isodiametrical towards the conidiogenous region and darker around the pore. *Conidiogenous cells* cylindrical or conical, 8-12 x 2-3.5 µm, on branched conidiophores in immature cavities and lining the cavity regularly at maturity. *Conidia* one-celled, seldom 1-septate near the middle, without constrictions, ovoidal, ellipsoidal to almost globose, when young pyriform or clavate with a truncate base, apically broadly rounded, surrounded by a rather thick slime layer, containing numerous coarse greenish guttules, one-celled conidia 11-14 x 7-9 µm,two-celled conidia 12-15 x 7-10 µm. Germtubes without *appressoria.*

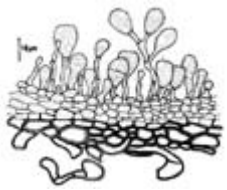


Fig. 9. *Phyllosticta flevolandica,* part of the pycnidial wall, conidiogenous cells and developing conidia.
CBS 998.72 = type strain.

Material examined

CBS 998.72 *Phyllosticta flevolandica,* isolated from sandy, freshly reclaimed polder soil, at 5 cm depth, from the southern slope of the Knardijk, near post 12/8, Zuidelijk Flevoland, Netherlands, by Mrs. B. Evelo-Punselie (H. A. van der Aa nr: 575, slides and dried subcultures in herb. CBS).

Discussion

This is the only *Phyllosticta* species isolated from soil known so far. The occasionally septate conidia suggest an intermediate position between *Phyllosticta* and *Botryodiplodia* or *Lasiodiplodia.* The development and structure [p. 56]of the pycnostromata, the conidiogenesis and the thick slime layer surrounding the inevitably hyaline conidia and the cultural characters agree with those of other *Phyllosticta* species.

22. **Phyllosticta gaultheriae** Ellis & Everh. - Fig. 5g

Phyllosticta gaultheriae Ellis & Everh. - J. Mycol. *1:* 153. 1885.
Phyllosticta gaultheriae Ellis & Everh. *f. shallon*Dearness - Mycologia *16:* 159. 1924.

Ascigerous state: **Guignardia gaultheriae** van der Aa, spec. nov.

Ascomata in foliis mortuis, matura tantum in vitro visa, complanate globosa vel tympaniformia, 150-220 µm diam., paene papillata, matura ostiolata. *Paries* 15-25 µm crassus e cellulis fuscis, crassitunicatis, rotundatis vel irregularibus pseudoparenchymaticis, 5-9 µm crassis constat. *Asci* in strato basilari pulviniformi formata, clavati, sessiles vel breviter pedicellati, apice rotundati, bitunicati, 8-spori, 35-90 x 15-24 µm. *Ascosporae* uni- vel biseriatae, continuae, ellipsoideae vel rhomboideae, utrinque attenuatae et rotundatae, 14-16 x 4·5-7 µm, muco circumdatae,

paraphysoides cito disparent.
In foliis putrescentibus *Gaultheriae humifusae,* una cum conidiis et spermatiis; typus CBS 447.70 (H.A. van der Aa nr. 1941) cultura desiccata.

Spermatial state: Leptodothiorella spec.

Leaf spots subcircular, on the upper side of the leaf with a dark, slightly elevated margin, up to 5 mm in diameter, at first reddish-brown, becoming ash-grey to white. *Pycnidia* epiphyllous on the living leaves, usually scarce, amphigenous on the dead and fallen leaves and densely scattered, single, unilocular, 70-120 µm, usually about 100 µm in diameter, tympaniform, the upper region firmly grown together with the epidermis, flat or slightly papillate with a subcircular or angular, 12-15 µm wide pore. *Wall* usually 1-2 cells (10-17, seldom up to 25 µm) thick and composed of irregularly rounded, thin-walled, purple-brown cells, 6-12 µm in diameter, darker around the pore, hyaline, isodiametrical or very flat in the conidiogenous region. *Conidiogenous cells* short cylindrical, caducous, 4-12 x 1.5-2.5 µm. *Conidia* one-celled, ovoidal or globose, rounded at either end, 4-9 x 4-7 µm, or 5-9 µm in diameter, surrounded by a thick slime layer, containing a rather homogeneous mass of coarse greenish guttules and usually a large, bright, central vacuole, which sometimes fills the whole conidium; with an apical appendage, 2-6 µm long, only observed in fresh conidia. Germ tubes forming globose or clavate, one-celled, seldom 1-2-septate, olivaceous-brown *appressoria.*

Ascigerous state: Ascomata on dead leaves, depressed globose or tympaniform, firmly grown together with the epidermis, 150-220 µm in diameter, slightly papillate, ostiolate at maturity. *Wall* 15-25 µm thick, composed of dark brown, mostly thick-walled, rounded or irregular pseudoparenchymatous [p. 57] cells, 5-9 µm in diameter. *Asci* arising from a cushion-shaped basal tissue composed of hyaline, thin-walled, rounded cells, clavate, with a short stalk or sessile, truncate at the base, broadly rounded apically, bitunicate, 8-spored, 35-90 x 15-24 µm. *Ascospores* 1-2 seriate, one-celled, ellipsoidal or rhomboidal, sometimes faintly curved, tapering towards the rounded ends, 14-16 x 4.5-7 µm and surrounded by a slime layer. *Paraphysoids* only distinct in early stages of development, soon disappearing.

Spermatial state: In vivo and in vitro ripening simultaneously with the conidial state, with similar fructifications. *Spermatiogenous cells* long and slender, 4-15 x 1-2.5 µm, in the early stages of development found on septate and branched, up to 35 µmlong spermatiophores. *Spermatia* cylindrical or dumb-bellshaped, straight or somewhat curved, swollen, guttulate at one or at either end, 4-9 x 1-2.5 µm.

Cultural characters: Colonies growing slowly on various media, reaching a diameter of 6-8 cm at about 20°C in day light in 20 days, but at 25^{o}Cunder near UV up to 10 cm; at first greenish, turning greenish-black to black, with an irregular, lobed margin. Submerged mycelium very dense and greenish-black; aerial mycelium thin and greyish black. *Stromata* formed after 6-10 days, globose, cylindrical, often branching at the base, forming coralloid complexes, 220-450 µm wide, 500-800 µm high, prosenchymatous to pseudoparenchymatous, some stromata remaining sterile, forming apically a loose tissue of thin-walled, hyaline cells, 5-15 µm in diameter, which easily fall apart and superficially resemble conidia, while others form conidial, spermatial and perithecial cavities in the upper part.

Host plants: Gaultheria procumbens, G. shallon (Seaver, 1922; Dearness, 1924) and *G. humifusa* (Ericaceae).

Material examined

Herbarium specimens

Phyllosticta gaultheriae, Ellis & Everh., N. Am. Fungi 1619, on leaves of *Gaultheria procumbens* L.*,* Newfield, New Jersey, syntype (L.); N. Am. Fungi 1966, idem (L).*Guignardia gaultheriae,* Herb. H. A. van der Aa 1941, on living and fallen leaves of *Gaultheria humifusa,* PerryCreek near Seattle, Washington, September 1969, leg. J. A. von Arx (herb. H. A. van der Aa 1941, CBS).

Living strain

CBS 447.70, isol fr. *Gaultheria humifusa.*

Discussion

The complete cycle of this species was developed in 6-8 week-old pure cultures. On leaves, which were kept for some weeks in moist chambers, only the conidial, spermatial and unripe ascigerous states were found. At [p. 57]the beginning of ascus development the leaves had been decomposed by bacteria and yeasts.
The germ tubes form appressoria, sometimes very close to the conidium and of similar shape and size as the conidia but olivaceous-brown, sometimes some distance away when they are more or less clavate, one-celled or seldom 1- or 2-septate. Germ tubes can enter the leaves at any place where appressoria are formed.
Barr (1970) mentioned *Gaultheria procumbens as* a host plant of *Guignardia (Botryosphaeria) vaccinii.* This species resembles *Guignardia gaultheriae* in its ascigerous state, but the conidial states are easily distinguished: in *Phyllosticta vaccinii* the conidia are seldom globose, more than 10 µm long and have a well developed apical appendage, up to 15 µm long.
Phyllosticta gaultheriae is comparable with *Phyllosticta pyrolae,* which has similar small, almost globose conidia and differs only in the apical appendage which is reduced to an inconspicuous cap.

23. **Phyllosticta ghaesembillae** Koorders - Fig. 5h

Phyllosticta ghaesembillae Koorders - Verh. K. Akad. Wet., Sec. 2, *13, 4:* 205. 1907 =*Phyllostictina ghaesembillae* (Koorders) Petrak - Annls mycol. *26:* 440. 1928.
Phyllosticta codiaei Died. - Annls mycol. *14*: 62. 1916 = *Phyllostictina codiaei* (Died.) Petrak - Annls mycol. *27:* 356. *1929.*
Phyllosticta codiaei Sacc. - Atti Acad. veneto-trentina Istr. *10:* 71. 1917; [non *Phyllosticta codiaei* Stevens & Young - Bernice P. Bishop Mus. Honolulu, Hawaii Bull. *19:* 129. 1925; non *Phyllosticta codiaei* Frag. & Cif. -Boln R. Soc. esp. Hist. nat. *26*: 196. 1926 = *Phyllosticta hispanicola* Cif. & Frag. -Estac. agron. Moca, Set. B, Bot. *8:* 40. 1927].
Phyllostictina euphorbiae Petrak - Sydowia 7: 115. 1953.

Leaf spots indistinct. *Pycnidia* in rather dense groups of about 5 mm diameter, epiphyllous, single, unilocular, 100-180 (-200) µm in diameter, globose or somewhat depressed; apex flat or slightly papillate with a roundish pore of about 10 µm diameter. *Wall* usually about 3 cells (10-18 µm) thick, composed of partly thick-walled, partly thin-walled, brownish, 3-11 µm wide cells, hyaline, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-6 x 2-3 µm. *Conidia* one-celled, ovoidal, ellipsoidal, seldom pyriform, reniform or even globose, somewhat truncate at the base only when young, broadly rounded apically and slightly indented, 6-12 x 5-7 µm, surrounded by a thick slime layer, containing coarse, greenish guttules; with an apical appendage of which only shriveled remains could be observed.

Host plants: Antidesma ghaesembilla, Codiaeum spec. (Diedicke, l.c.), *Codiaeum variegatum* (Saccardo, l.c.), *Euphorbia* spec. (Petrak, l.c.), (all belonging to the Euphorbiaceae). [p. 59]

Material examined

Phyllostictina ghaesembillae, two collections in Philipp. Fungi 504 and 6164, on leaves of *Antidesma ghaesembilla,* Tarlac, Prov. Luzon, March 1923 (ZT).

Discussion

Petrak (Sydow & Petrak, 1928) compared the specimen 504, cited above with the type specimen. Several other *Phyllosticta* and *Phyllostictina* species are described on hosts of the Euphorbiaceae. *Phyllosticta codiaei* Died. and *Phyllosticta euphorbiae* Petrak, of which no material could be studied, are included in the synonymy of *P. ghaesembillae* on the basis of the descriptions. *Phyllosticta portoriciensis* Young (Mycologia 7: 147. 1915) and *Phyllosticta putranjivae* Sydow (Annls mycol. 14: 182. 1916) have comparable conidial measurements, but only the latter has been studied on the type material and differs from *P. ghaesembillae* in its well developed apical appendage of about 7.5 µm length and smaller pycnidia, which are hardly 100 µm in diameter. *Phyllosticta aleuritidis* Cif. & Frag, occuring on *Aleuritis* species (Euphorbiaceae), has conidia smaller than 10 µm,whereas in the other species conidia

usually exceed 10 µm. *Phyllosticta heveana* Saccas, the causal agent of a disease on *Hevea,* is kept separately, but morphologically it is similar to *P. ghaesembillae.*

24.**Phyllosticta hamamelidis** Cooke - Fig. 5 i

Phyllosticta hamamelidis Cooke *apud* Ravenel & Cooke - F. americ. exs. 511. 1881 (herbarium name) = *Gloeosporium hamamelidis* Cooke - Grevillea *12: 26.* 1883 = *Phyllostictina hamamelidis* (Cooke) Petrak & Syd. - Phaeospore Sphaerops.: 196. 1927. *Phyllosticta hamamelidis* Peck - A. Rep. N.Y. St. Mus.*39*: 44. 1887.

Leaf spots subcircular or irregular, dark brown, visible on both sides of the leaf, but paler below, with a definite, narrow, dark purple margin. *Pycnidia* epiphyllous, single, unilocular, 70-140 µm, often about 100 µm in diameter, globose, indistinctly papillate, with a roundish, 10-14 µm wide pore. *Wall* 1-4 cells (4-12 µm)thick and composed of brownish or subhyaline, thin-walled cells, 4-10 µm in diameter, of irregular shape or compressed at maturity, darker around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, usually 5-9 x 2-4 µm, but sometimes hardly differentiated from the inner wall-cells. C*onidia* one-celled, ovoidal, short cylindrical, sometimes inequilateral or somewhat curved, with a truncate base when young, usually broadly rounded at both ends, with an indistinct apical dent, 9-15 x 6-10 µm, surrounded by a thick slime layer, containing numerous fine greenish guttules, without apical appendage.

Host plant: Hamamelis virginiana (Hamamelidaceae). [p. 60]

Material examined

Phyllosticta hamamelidis Peck in Kabát & Bubák, Fungi imperf. exs. 802, on living leaves *of Hamamelis virginiana,* London, Ontario, Canada, 19 Aug. 1910, coll. J. Dearness (U). *Phyllostictina hamamelidis,* Herb. F. Petrak, on leaves of *Hamamelis virginiana,* Ashville, N. Car., June 1928 (ZT).

Discussion

No type specimen was available, but the collections mentioned agree well with the description. The synonymy is in accordance with Seaver (1922), Petrak & Sydow (1927)and von Arx (1970).

25. **Phyllosticta heveana** Saccas - Fig. 5 j

Phyllosticta heveana Saccas - Agron. trop. Nogent *8:* 259. 1953.

Spermatial state: Leptodothiorella spec.

Leaf spots subcircular or irregular, pale brownish to almost white, with a shade of grey at the upper side because of the numerous densely crowded pycnidia, often sharply outlined, up to 10 cm in diameter but usually much smaller. *Pycnidia* epiphyllous, single, unilocular, I10-170 µm in diameter, 75-110 µm high, subglobose, lenticular or tympaniform, flat or papillate above, with a subcircular pore 10-15 µm in diameter. *Wall* 2-3 cells (9-15 µm) thick, composed of thin-walled, pale brown, rounded or irregular cells up to 30 µm in size, smaller around the pore and with darker and thicker walls, but hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, about 4-9 x 2-3 µm, soon disappearing. *Conidia* short cylindrical or pyriform, seldom almost globose, when young somewhat clavate with a truncate base, broadly rounded apically and slightly indented, 6-13 x 5.5-8 µm, surrounded by a thick slime layer, containing numerous greenish guttules and often one or two larger vacuoles, with an apical appendage of which only a 2-5 µm long piece was left on the specimens examined.

Spermatial state: Only some old and almost empty *spermogonia* were found, similar to the pycnidia of the *Phyllosticta* state; *spermatia* dumbbell-shaped, 4-8 x 1-2 µm, sometimes in persistent chains. *Spermatiogenous cells* not observed.

Host plant: Hevea brasiliensis (Euphorbiaceae).

Material examined

Phyllostictina spec., on leaves of *Hevea brasiliensis,* Java, Djasinga, March 1954, coll. K.B. Boedijn (U). [p. 61]

Discussion

The above description agrees with that given by Saccas (1953). Weir (1926) observed also *a Phyllostictina* spec. on *Hevea,* with conidia 7.3 x 6.1 µm in size, probably the same species.

Phyllosticta heveana is very similar to *Phyllosticta ghaesembillae* Koorders (cf p. 58). Several *Guignardia* species have been described on *Hevea* but none of them in connection with *a Phyllosticta* conidial state.

26. **Phyllosticta hymanaeae** (Batista & Vital) van der Aa, comb. nov. -Fig. 5k

Phyllostictina hymanaeae Batista & Vital - Anais Soc. Biol. Pernamb. *23:*194. 1955 (basionym).

Leaf spots subcircular or irregular in shape, sometimes sharply delimited by the veins, 5-10 mm in diameter, pale brown, with a distinct purple margin. *Pycnidia* epiphyllous, single, unilocular, 60-130 µm in diameter, subglobose or tympaniform, sometimes irregularly shaped, the upper region firmly grown together with the epidermis, flat or slightly papillate, with a pore, up to 10 µm in diameter. *Stroma* prosenchymatic, developed directly under the epidermis, forming a thin, continuous layer between the pycnidia. *Wall 3-5* cells (8-20 µm), in the upper region up to 8 cells (30 µm) thick, composed of rounded or compressed, partly thin-walled, partly thick-walled, brownish to dark brown cells, 3-14 µm in diameter, somewhat darker around the pore, hyaline and flattened towards the conidiogenous layer. *Conidiogenous cells* cylindrical or conical, 6-10 x 2-4.5 µm, sometimes hardly differentiated from the inner wall-cells. *Conidia* one-celled, obovoidal, pyriform or subglobose, somewhat clavate when young, with a truncate base, broadly rounded and indented apically, 6-10 x 4-7 µm in size, surrounded by a thick slime layer, containing numerous fine greenish gutrules, with an apical appendage about 6 µm long.

Host plant: Hymanaea martiana (Leguminosae).

Material examined

Phyllostictina hymanaeae, on leaves of *Hymanaea martiana,* Dois Irmaos, Recife, Pernambuco, 23 March 1955, leg. O.S. da Silva, holotype (URM).

Discussion

P. hymanaeae is characterized by rather small conidia and thick-walled, stromatic pycnidia of irregular shape. The description differs from the original diagnosis in some points. The conidia have been described as elliptical [p. 62] to fusiform, biguttulate, 5-7 x 2-2.5 µm, with a slimy appendage, but were illustrated in agreement with the present description. On the type specimen both *Phyllosticta hymanaeae* and *a Phomopsis* species occur, which were apparently confused.

27. **Phyllosticta hypoglossi** (Mont.) Allesch. - Figs. 5l,10

Sphaeropsis hypoglossi Mont. -Annls Sci. nat. Bot., Sér. 3, *12:* 307. 1849 = *Phoma hypoglossi* (Mont.) Sacc. - Syll. Fung. *3*: 162 1884 = *Macrophoma hypoglossi* (Mont.) Berl. & Vogl. - Atti Soc. veneto-trentina Sci. nat. *10*: 192. 1886 = *Phyllosticta hypoglossi* (Mont.) Allesch. *in* Rabenh. KryptogFl. 1, *6*: 163. 1898 = *Phyllostictina hypoglossi* (Mont.) Petrak & Syd. - Phaeospore Sphaerops.: 203. 1927.
Sphaeropsis rusci Thuem. - Revta sci. lit. Coimbra *28:* 35. 1881.
Strasseria rusci Camara & Gomes da Luz - Agron. lusit. *1*: 52. 1939.

Spermatial state: Leptodothiorella spec.

Pycnidia on living and dead cladodes and stems, not in distinct spots, often densely crowded and giving the infected parts of the plant a greyish-silvery colour; globose, somewhat depressed or pyriform, 120-250 µm in diameter, the upper region firmly grown together with epidermis and subepidermal stroma, with a well developed papilla, pierced by a narrow, pseudoparaphysate channel, and with a 10-12 µmwide pore at the apex. *Stroma* subepidermal, prosenchymatous, composed of brown to almost black, closely interwoven hyphae. *Wall* usually 2-4 cells (12-30 µm)thick and composed of rounded or irregular, brown to almost black, mostly thin-walled isodiametrical or flattened cells, 5-11 µm in diameter, hyaline towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-10 x 2-3.5 µm, passing in the upper region into thin-walled, apically rounded or tongue-shaped pseudoparaphyses, which line the inner side of the papilla. *Conidia* one-celled, ovoidal, ellipsoidal or subglobose, when young with a truncate base, broadly rounded apically and often indented, 8-15(-18) x 6-10 µm, surrounded by a slime layer which is thicker in the upper part, containing numerous coarse greenish guttules, with a very caducous, usually tongue-shaped, apical appendage about 10 µm, sometimes very slender and up to 35 µm long. Germ tubes forming globose, pyriform or clavate, sometimes irregularly lobed, brown, occasionally 1- to 2-septate *appressoria* (Fig. 10c).

Spermatial state: Abundant on some fresh collections, densely scattered over the cladodes, sometimes covering large areas without fruit-bodies of the other states. *Spermogonia* similar to the pycnidia; spermatia and conidia are rarely formed together in one young fruit-body. *Wall* generally somewhat thinner than in the pycnidia. *Spermatiogenous cells* slender, cylindrical, 4-15 x 1.5-3 µm. Spermatia cylindrical to dumb-bellshaped, biguttulate, 6-10 x 1.5-3 µm in size (Fig. 10b). [p. 63]



Fig. 10. *Phyllosticta hypoglossi,* a. conidia; b. spermatia; c. germinating conidia with appressoria. Coll. H. A. van der Aa nr. 2572, on cladodes of *Ruscus aculeatus.*

Cultural characters: Colonies growing relatively fast, reaching 2-2.5 cm in diameter, in 15 days at 20°C on oatmeal and cornmeal agar or about 4 cm diameter at 24°C under near UV, flat, greyish or very pale brown, with a yellowish pigment especially on oatmeal agar, which turns dark brown after 18-22 days, sometimes covered by a thin mat of greyish aerial mycelium. *Stromata* scattered over the colony, appearing after 6 to 10 days, 200-800, usually 250-450 µm in diameter, cylindrical or somewhat irregular in shape, bearing several pycnidial cavities in the upper part, conspicuously papillate or flat. Only conidia were seen but many undeveloped stromata suggest the development of other states, which, however, remained immature.

Host plants: Ruscus aculeatus, R. hypoglossum (Liliaceae).

Material examined

Herbarium specimens

Phyllostictina hypoglossi (Mont.) Petrak & Syd., on cladodes of *Ruscus aculeatus,* Mont pellier, France, 10 August 1944 leg. K. H. Rotsinger (ZT).
Phyllosticta hypoglossi (Mont.) Allesch., Herb. H. A. van der Aa nr. 2572, on living and dead parts of *Ruscus aculeatus,* Tacco di Sta. Barbara, Sardinia, 14 May 1971, leg. W. Gams (CBS); nr. *2777,* on cladodes of *Ruscus aculeatus,* New Forest, England, 16 Sept. 1971, leg. H. A. van der Aa (CBS). [p. 64]

Living strains

CBS 423.50, isol, fr. *Ruscus aculeatus,* Bornova-Izmir, Turkey, leg. M. Göbelez.
CBS 101.72, isol, fr. *Ruscus aculeatus,* H.A. van der Aa nr. 2572.

Discussion

The synonymy is partly taken from Petrak & Sydow (1927). No material of *Strasseria rusci* was available, but the description and measurements of of the conidia, clearly point to *Phyllosticta* (cf. Diaz & Camara, 1952: 113and 1954: 11; Lucas, 1956: 118).
The ascigerous state is probably a *Guignardia* species. The unripe perithecia are 115-170 µm in diameter and distinctly papillate. Development of the ascogenous cells, receptive hyphae and their fertilization by spermatia were observed.
The conidia extrude in whitish tendrils which become yellow in dried collections or yellowish to brownish in older cultures due to the numerous appressoria formed by germinating conidia. In old cultures single conidia often become brownish, chlamydospore-like, somewhat rounded off, and they loose their slime layer and appendage.
Phyllosticta hypoglossi is a well delimited species, similar to the conidial state of *Guignardia philoprina* in conidial measurements, appendages and appressoria, but differing in the papillate pycnidia, in the conidia having a thicker slime layer and in the cultural characters.

28. **Phyllosticta loranthi** (Ponnappa) van der Aa, comb. nov. -Fig. 5m

Phyllostictina loranthi Ponnappa - Trans. Br. mycol. Soc. *52:* 504-506. 1969 (basionym).

Spermatial state: Leptodothiorella spec.

Leaf spots, according to Ponnappa (l.c.), brown or dark brown, mostly near the tip of the leaf, sometimes coalescing and forming lesions, 10-15 mm in diameter. *Pycnidia* epiphyllous, later amphigenous, single, unilocular, up to 150 µm in diameter and 90-150 µm high, globose or tympaniform, inconspicuously papillate, with a subcircular pore of about 12 µm diameter. *Stroma* well developed under the epidermis of dead leaves, prosenchymatous, dark brown. *Wall* usually 2-3 cells thick and composed of isodiametrical or compressed, dark brown, mostly thin-walled cells, 6-25, mostly 8-15 µm in diameter, darker around the pore, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, usually 5-12 x 2-4 µm, formed in immature pycnidia on slender, branched conidiophores, but at maturity hardly differentiated from the inner wall-cells. *Conidia* one-celled, obovoidal, ovoidal, seldom reniform, pyriform or even globose, somewhat clavate when young, with a truncate base, apically [p. 65] rounded and slightly indented, 7-12 x 5-7 µm, surrounded by a slime layer of varying thickness, containing a large number of coarse guttules and often 1-2 large vacuoles; with a caducous apical appendage, often 5-6, seldom up to about 15 µm in length.

Spermatial state: Spermogonia resembling pycnidia, globose or tympaniform, papillate, with a 5-10 µm wide pore which is surrounded by very dark, compressed cells. *Spermatiogenous cells* cylindrical or flask-shaped, tapering towards the apex, 4-15 x 1.5-2 µm.*Spermatia* long cylindrical or dumb-bellshaped, 6-10 x 1-1.5 µm.

Host plant: Loranthus longiflorus (Loranthaceae).

Material examined

Phyllostictina loranthi, on leaf of *Loranthus longiflorus,* Chaliyam, Kerala, India, 6 Okt. 1967; *type* IMI 130960 (CMI).

Discussion

The material examined consisted of a dried culture on sterilized *Loranthus* leaf. Small groups of coalescent fructifications of immature perithecia, pycnidia and spermogonia were found, all together in a subepidermal stroma. The perithecium initials are typically tympaniform, somewhat larger than the pycnidia and papillate. The wall is differentiated into an outer layer, composed of dark, thick-walled, often flattened cells, an inner layer of paler, thin-walled cells and a central region with undifferentiated, thin-walled, hyaline pseudoparenchyma.
Until the ascigerous state has been studied, the species must be kept separately from *Guignardia philoprina,* which it resembles in the morphological characters of the conidial and spermatial states.

29. **Phyllosticta melochiae** Yates - Fig. 5n

Phyllosticta melochiae Yates - Philipp. J. Sci., Sect. C, Bot. *13(2):*240. 1918.

Leaf spots subcircular or angular, 3-8 mm in diameter, brown, later turning pale and leaving holes in the leaves, surrounded by a broad, reddishbrown zone in the living tissue. *Pycnidia* epiphyllous, single or growing together in groups, unilocular, 45-90 µm diameter, globose, somewhat depressed or irregularly shaped, flat or inconspicuously papillate with a subcircular pore of 5-13 µm diameter. *Stroma* prosenchymatous, only developed directly under the epidermis. *Wall* 12-15 µm or 1-4, in the upper region up to 8 cells thick, composed of partly thin-walled, partly thick-walled, rounded or irregularly shaped, reddish to blackish-brown cells, 6-15 µm in [p. 66] diameter, darkest around the pore, hyaline and isodiametrical or very flat towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-6 x 2-3 µm, but sometimes reduced and hardly differentiated from the inner wall-cells. *Conidia* one-celled, obovoidal, ovoidal to almost globose, with a truncate base when young, broadly rounded apically, 7-12 x 5-7 µm or about 6-7 µm in diameter, surrounded by a very thick slime layer, containing a large number of coarse guttules, with an apical appendage of which only badly preserved remains could be found.

Host plants: Melochia spec. indet. (type host, cf. Yates, 1918); *M. umbellata* (Buettneriaceae).

Material examined

Phyllosticta melochiae Yates, Herb. K. B. Boedijn, on leaves of *Melochia umbellata,* Dehli, Sumatra, Indonesia, May 1926, leg. v. d. Meer-Mohr (U).

30. **Phyllosticta minima** (Berk. & Curt.) Underw & Earle - Fig. 5o

Sphaeropsis minima Berk. & Curt. - Grevillea *3*: 2. 1874 = *Phyllosticta minima* (Berk. & Curt.) Underw. & Earle - Bull. Ala. Exp. Stn *80*: 168. 1897 = *Phyllosticta minima* (Berk. & Curt.) Ellis & Everh. - N. Am. Phyllost.: *1*. 1900 [non *Phyllosticta minima* Gutsevitch - Izv. Akad. Nauk Armyan. S.S.R., biol. Sci. *15*: 69. 1962].
Phyllosticta acericola Cooke & Ellis -Grevillea *8*: 11. 1879 [non *Phyllosticta acericola* Migula - Cryptog. Germ. Austr. Helvet. Exs. 56 & 57, nr. 392 (after 1933)].

Leaf spots subcircular, rarely exceeding a diameter of 5 mm, pale with a reddish or purplish border. *Pycnidia* epiphyllous, single, unilocular, up to 125 µm in diameter, globose or somewhat depressed, flat or papillate with a pore of 7-12, seldom up to 20 µm diameter. *Wall* 1-3 cells thick, composed of irregular or rounded, brownish, thin-walled cells, 7-16 µm in diameter, darker around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, 2-7 x 1.5-3 µm.*Conidia* one-celled, obovoidal, ovoidal or pyriform, when young somewhat clavate with a truncate base, broadly rounded apically and slightly indented, 7.5-12 x 4.5-8 µm, surrounded by a thick slime layer, containing very coarse greenish guttules, with an apical appendage (not preserved in the herbarium specimens).

Host plants: Acer rubrum (type-host), *A. saccharinum (= A. dasycarpum), A. spicatum* (Seaver, 1922), *A. italicum (= A. x hybridum), A. pseudoplatanus* (Allescher, 1898) (Aceraceae).

Material examined

Phyllosticta acericola, Ellis, N. Am. Fungi 534 and Rabenhorst-Winter, F. europ. 3394, on maple leaves, Vineland, N.J., autumn 1878; syntype (L). [p. 67]
Phyllosticta aceris, Herb. W. M. Trelease, on leaves of *Acer rubrum,* Passipany, N.J., July 3, 1884 (L) misidentified.

Discussion

On the old herbarium collections the apical appendage of the conidia was not preserved, but Scot & Rorer (1909) observed a distinct appendage on fresh material.
*Phyllosticta minima*is often confused with *Phyllosticta aceris* (Lib.) Sacc., which is a *Phomopsis* spec. (type in PAD). Seaver (1922) also confused them: his description points to *Phyllosticta aceris* (Lib.) Sacc., but at least two of the exsiccata he cited contain *P. minima.* Saccardo (1884)

and Allescher (1898) called the fungus *Phyllosticta acericola,* but *P. minima* is an older name. *Phyllosticta acericola* Migula (syntype in U) is a later homonym of *P. acericola* Cooke & Ellis. Both varieties distinguished by Migula (a and b) on *Acer platanoides* and *A. pseudoplatanus* are synonyms of *Asteromella platanoides* (Sacc.) Petrak (Hedwigia *65:*254. 1925).
Phyllosticta minima Gutsevitch (1962, l.c.)is a homonym of *P. minima* (Berk. & Curt.) Underw. & Earle (1897) and, according to description and figures, refers to an *Asteromella* spec. on *Cornus mas.*

31. **Phyllosticta minor** Ellis & Everh. - Fig. 5p

Phyllosticta minor Ellis & Everh. - N. Am. Phyllost.: 47. 1900.
Phyllosticta minor Ellis & Everh. var. *monticellica* Sacc. - Annls mycol. *1*: 26.1903.

Leaf spots subcircular, finally covering large parts of the leaf, especially near the tip, at first yellowish-brown, later paler. *Pycnidia* densely scattered over the infected area, epiphyllous, single, unilocular, 70-120 µm in diameter, globose or somewhat depressed, inconspicuously papillate with a pore of 7-12 µm diameter. *Wall* 1-3 cells thick, composed of irregular or rounded, brownish, mostly thin-walled cells, 5-11 µm in size, darker around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, and caducous. *Conidia* one-celled, ovoidal or globose, seldom somewhat tapering to a truncate base, apically broadly rounded, 6-8 x 5-7 µm or about 5-7 µm in diameter, surrounded by a thick slime layer, containing numerous coarse guttules and a single large, bright vacuole, with a badly preserved apical appendage.

Host plant: Vinca minor (Apocynaceae).

Material examined

Phyllosticta minor var. *monticellica, D.* Saccardo, Mycoth. ital. 1117, on leaves of *Vinca minor,* Montello, Treviso, September 1902, leg. Antonia Saccardo; syntype (L). [p. 68]

Discussion

The present description is based on a European collection which agrees in all characters with the descriptions of Ellis & Everhart (l.c.) and Seaver (1922). The species is closely related to *Phyllosticta gaultheriae* and *Phyllosticta pyrolae,* which have similar small conidia.
Strasseria vincae Lucas & Da Camara (Agron. lusit. *16:* 97. 1954), found on a stem of *Vinca difformis,* may also belong to *Phyllosticta,* but is a different species, with conidia 9-13 x 5-6.5 µm in size and provided with a distinct appendage.

32. **Phyllosticta moravica** (Petrak) van der Aa, comb. nov. -Fig. 5q

Phyllostictina moravica Petrak *apud* Petrak & Syd. - Phaeosp. Sphaerops.: 196. 1927 (basionym).
Phyllostictina dorycnii Petrak - Mycoth. gen. 1563. 1940 (herbarium name).

Spermatial state: Leptodothiorella spec.

Pycnidia single or in dense groups on the branches, unilocular, 120-200 µm in diameter, globose or tympaniform, firmly grown together in the upper region with the epidermis, flat or slightly papillate, with an 8-15 µm wide pore. *Stroma* prosenchymatous, composed of very dark brown hyphae, which are best developed under the epidermis. *Wall* 1-3 cells (8-12 µm) but up to 10 cells (-50 µm) thick in the upper part, composed of rather dark brown, partly thin-walled, partly thick-walled cells, 4-12 µm in diameter, almost black around the pore, hyaline, isodiametrical or flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, 3-5 x 1.5-3 µm. *Conidia* one-celled, obovoidal, ellipsoidal or almost globose, rounded at either end, 5-8 x 4.5-5 µm, surrounded by a thick slime layer, containing numerous rather coarse guttules and lacking appendages on the herbarium specimens studied.

Spermatial state: Spermogonia single or coalescent, sometimes fused with pycnidia, depressed or somewhat lens-shaped, 120-180 µm in diameter, comparable in structure with the pycnidia but with the papilla often more prominent. *Spermatiogenous cells* long and slender, reduced in mature pycnidia, cylindrical, 3-20 µm long, mostly about 1.5 µm wide. *Spermatia cy*lindrical or dumb-bellshaped, 4-7 x 1-2 µm, biguttulate.

Host plant: Dorycnium suffruticosum (Leguminosae).

Material examined

Phyllostictina dorycnii, Petrak, Fl. Austr. inf. and Mycoth. gen. 1563, Pfaffstätten, May 1940, leg. F. Petrak; three collections on stems of *Dorycnium suffruticosum,* all in ZT. [p. 69]

Discussion

This species resembles *Phyllosticta hymanaeae,* which occurs on other Leguminosae, in thick-walled pycnidia and usually a well developed subepidermal stroma, but differs in the shape of the conidia. The ascigerous state is undoubtedly *a Guignardia* species; immature ascomata were found on the collections examined. The name *Phyllostictina dorycnii* was never published, because Petrak rediscovered his description of 1927 (cf. Petrak, 1963*)*

33. **Phyllosticta morindae** (Petrak & Syd.) van der Aa, comb. nov. -Fig. 5r

Phyllostictina morindae Petrak & Syd. - Phaeospore Sphaerops.: 200. 1927 (basionym).

Ascigerous state: Guignardia **morindae** (Koorders) van der Aa, comb. nov.

Physalospora morindae Koorders - Verh. K. ned. Akad. Wet. 2, *13*: 190. 1907 (basionym).

Spermatial state: Leptodothiorella spec.

Leaf spots yellowish or greyish to almost black on the upper side, due to the dense fructifications; with a conspicuous concentric pattern and sharp, purple brownish border, about 1-3 cm in diameter, or secondarily larger by the coalescence of several spots. *Pycnidia* epiphyllous, single or a few coalescing, unilocular, 70-120, mostly about 100 µm in diameter, globose or pyriform, seldom somewhat depressed, flat to conspicuously papillate, with a 6-8, seldom up to 15 µm wide pore. *Wall* 1-4 cells (7-12 µm), but in the upper part up to 8 cells (-20 µm) thick, composed of rounded or irregular brownish cells, 5-15 µm in diameter, with thicker cell-walls in the upper part, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, usually 4-9 x 2-3 µm, but sometimes very reduced. *Conidia* one-celled, obovoidal or clavate, but rarely short cylindrical or subglobose, with a truncate base when young, broadly rounded apically and slightly indented, 7-10 x 4-6 µm, surrounded by a thick slime layer, containing rather coarse greenish guttules and often one large, bright vacuole, with a 4-7.5 µm long, rather stiff apical appendage.

Ascigerous state: Ascomata 60-80 µm high, 100-120 µm in diameter, tympaniform, strongly flattened at the upper part which is firmly grown together with the epidermis, flat or inconspicuously papillate. *Asci* clavate or cylindrical, bitunicate, 40-60 x 8-12 µm.*Ascospores* 2-3-seriate, one-celled, ellipsoidal, hyaline, and, according to Koorders (l.c.), 11-13 x 4-5 µm.

Spermatial state: Spermogonia about 100 µm in diameter, similar to the pycnidia but with a somewhat thinner wall, 1-4 cells (6-to µm) thick and [p. 70] composed of rounded, brownish cells of 5-10 µm diameter. *Spermatiogenous cells* long and slender, 5-20 x 1-1.5 µm.*Spermatia* cylindrical or dumbbell-shaped, 6-8 x 1.5-2 µm, with two conspicuous guttules at either end.

Host plant: Morinda citrifolia (Rubiaceae).

Material examined

Phyllostictina morindae, on leaves of *Morinda citrifolia,* Java, Buitenzorg, August 1949, leg. K. B. Boedijn (U); idem, 21 Febr. 19S0, leg. K. B. Boedijn (U). *Physalospora morindae,* on leaves of *Morinda citrifolia,* Krakatau, 'Zwarte Hoek', Nov. 1932, leg. K. B. Boedijn (U).

Discussion

The conidial state can hardly be distinguished from other species with medium-sized conidia which resemble the conidial state of *Guignardia bidwellti.* However, the ascigerous state differs from related species by the smaller perithecia and ascospores.
The taxonomic position of the ascigerous state was doubtful, as Petrak & Sydow (1927) studying the type specimen of *Physalospora morindae* found only the conidial state. They recognized that both the *Physalospora (= Guignardia)* and the *Phyllostictina (= Phyllosticta)* belonged to the life cycle of the same fungus. The collections of Boedijn provided the opportunity to study the whole life cycle, although the ascigerous state was merely seen in an unripe stage.

34. **Phyllosticta murnadensis** (Ponnappa) van der Aa, comb. nov. -Fig. 6a

Phyllostictina murnadensis Ponnappa - Curr. Sci. *36: 526.* 1967 (basionym).

Leaf spots circular or oval, 1-3 mm in diameter, white, sharp in outline, surrounded by a purplish or reddish rim. *Pycnidia* epiphyllous, single or in clusters, unilocular, up to 160 µm (according to Ponnappa, l.c.: 308-336 µm) in diameter, globose or somewhat depressed, conspicuously papillate with a 10-13 µm wide pore. *Wall* 8-20 µm thick, composed of thin-walled, brownish, isodiametrical or irregular cells, 8-20 µm, darker around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, usually 6-12 x 1.5-3 µm or very reduced. *Conidia* one-celled, ovoidal, obovoidal or short cylindrical, seldom globose or reniform, pyriform with a truncate base when young, broadly rounded apically, sometimes distinctly indented, 9-15 x 6-8 µm, surrounded by a thick slime layer, containing numerous fine greenish guttules, with an unstable, often absent apical appendage of about the length of the conidium. [p. 71]

Host plant: Glycosmis pentaphylla (Rutaceae).

Material examined

Phyllostictina murnadensis, on leaf of *Glycosmis pentaphylla,* Murnad-Coorg, Mysore State, India, *5 May 1966,* Coll. K. M. Ponnappa; ex type collection in herb. IMI 120705.

35. **Phyllosticta murrayicola** van der Aa, nom. nov. -Fig. 6b

Phyllostictina murrayae Syd. - Annls mycol. *14:* 186. 1916 (replaced synonym); [non *Phyllosticta murrayae* Frag. & Cif. -Boln R. Soc. esp. Hist. nat. *27:* 328. 1927 non *Phyllosticta murrayae* Chandra & Tandon - Curr. *Sci. 33* : 410. 1964].

Spermatial state: Leptodothiorella spec.

Leaf spots small, up to 5 mm in diameter, subcircular, ochreous, later almost white, with a distinct purple-brownish border. *Pycnidia* epiphyllous, single, unilocular, 75-120, sometimes 200 µm in diameter, globose, somewhat depressed or tympaniform, apically flattened and firmly grown together with the epidermis, inconspicuously papillate, with a pore of about 15 µm diameter. *Wall* 1-3 cells (6-18 µm)thick, composed of brownish, rounded or irregular, thin-walled cells, 5-15 µm in size, darker around the pore with thick-walled cells, hyaline towards the conidiogenous region, and with isodiametrical or flattened cells. *Conidiogenous cells* cylindrical, 5-12 x 2.5-4 µm.*Conidia* one-celled, obovoidal, pyriform, short cylindrical or subglobose, tapering towards the truncate base when young, broadly rounded apically, 7-13 (seldom up to 16) x 5-10 µm,surrounded by a thick and sometimes irregularly granulated slime layer, containing numerous coarse guttules and one or several larger vacuoles, without an apical appendage but sometimes with some apical slime residue.

Spermatial state: Only observed in pure culture, occurring in the same cavities as the conidial state in young stromata or in spermatial cavities, which are similar in shape and size to the pycnidial cavities. *Spermatiogenous cells* cylindrical, slender, 7-16 x 1.5-2.5 µm.*Spermatia* cylindrical or dumb-bellshaped, 5-9 x 1.5-2.5 µm,biguttulate.

Cultural characters: Colonies growing slowly, attaining a diameter of 15 mm after 15 days on malt agar, 10-12 mm on PDA or c. 13 mm on cornmeal and oatmeal agar at 24°C under near UV; at first greenish, soon turning blackish, forming a solid, more or less pulvinate crust, lobed or irregular in outline, with a narrow, whitish, later greenish-black peripheral growing zone. Submerged mycelium abundant, becoming prosenchymatous near the agar surface; aerial mycelium scarce, thin, whitish, not developed on cultures under near UV.*Stromata* in the centre of the colony numerous, clustered, towards the margin of the colony scattered, globose, sometimes [p. 72] pyriform, cylindrical or tympaniform, 200-350 µm high, 80-200 µm in diameter, usually with only one cavity, sometimes multilocular and multiostiolate when clustered. Conidia and spermatia formed after 10-12 days, occasionally in the same cavity in young stromata.

Host plant: Murraya koenigii (Rutaceae).

Material examined

Herbarium specimens

Phyllostictina murrayae Syd., on leaves of *Murraya koenigii,* Debra Dun, India, 30 Aug. 1905, coll. E. J. Butler nr. 1689 ex herb. Sydow; holotype and *type* of the genus *Phyllostictina (S);* on leaves of *Murraya koenigii,* market of Colombo, Ceylon, 27.1.1973, coll. W. Gams, H. v. d. Aa nr. $_{3545}$ (CBS).

Living strain

CBS 363.73 isol. by H. v. d. Aa from leaves of *Murraya koenigii,* Colombo (cf. above).

Discussion

Sydow (Sydow & al. 1916), von Höhnel (1920a) and Petrak & Sydow (1927) based their descriptions on the first mentioned collection. Already von Höhnel pointed out that this species was congeneric with *'Phoma uvicola'* Berk. & Cooke, the conidial state of *Guignardia bidwellii* (see p. 28). The present observations and the discovery of the spermatial state confirm this conclusion. *Phyllosticta murrayae* Frag. & Cif. (l.c.)and *Phyllosticta murrayae* Chandra & Tandon (l.c.) do not belong to the genus *Phyllosticta* but possibly to *Phoma,* according to the descriptions and illustrations.

36. **Phyllosticta musarum** (Cooke) van der Aa, comb. nov. -Fig. 6c

Sphaeropsis musarum Cooke - Grevillea *8*: 93. 1880 (basionym) = *Phyllostictina musarum* (Cooke) Petrak - Annls mycol. *29*: 268. *1931* = *Phoma musae* Sacc. - Syll. Fung. *3*: 163. 1884 [non *Phoma musarum* Cooke - Grevillea *12:* 22.*1884; non Phoma musea*(Joly) Boerema & al. - Persoonia *4*: 63. 1965] = *Macrophoma musae* (Sacc.) Berl. & Vogl. [as *'Macrophoma musae* (Cooke) Berl. & Vogl.'] - Atti Soc. veneto-trent. Sci. nat. 1886: 1871-886.

Phoma musae Carpenter - Rep. Hawaii agric. Exp. Stn 1918*: 39*. 1919.

Ascigerous state: Guignardia musae Raciborski

Guignardia musae Raciborski - Bull. Acad. Sci. Cracovie *1909*: 388. 1909 [non *Guignardia musae Syd.* - Annls mycol. *10*: 80. 1912 = *Guignardia sydowiana* Trotter - Syll. Fung. *24*: 788. 1928; non *Guignardia musae* Stevens -Bull. Bernice P. Bishop Mus. Honolulu *19*: 101. 1925].
Phomatospora musae Yen - Bull. Soc. mycol. Fr. *88: 224.* 1972.
Spermatial state: Leptodothiorella spec. [p. 73]

Spots on leaves and fruits numerous, minute, greyish, brown to dark brown, with black dots in the centre, more or less rounded and indefinite in outline, on fruits somewhat raised, on leaves more

abundant on the upper than on the lower surface. *Pycnidia* prominent under the raised epidermis, mostly epiphyllous, sometimes amphigenous, single or clustered, unilocular, 60-170, mostly about 135 µm in diameter, globose, pyriform or tympaniform, the upper region firmly grown together with the epidermis and the subepidermal stroma, conspicuously papillate, with a 10-30 µm wide pore. *Stroma* prosenchymatous, clypeus-like developed around the upper part of the pycnidia, subepidermal, composed of very dark hyphae. *Wall* in the lower and lateral region hardly developed, only composed of some compressed brownish hyphae or brownish, thin-walled cells, but 1-4cells thick in the upper part, composed of flattened, dark brown cells, darkest around the pore and hyaline towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-11 x 2.5-5 µm.*Conidia* one-celled, obovoidal, ellipsoidal or short cylindrical, pyriform when young, with a truncate base, broadly rounded apically and conspicuously indented, 10-20 x 7-13, usually 15-18 x 9-10 µm, surrounded by a 1-3 µm thick slime layer, containing a rather homogenous mass of coarse, greenish guttules and usually one large bright vacuole; bearing an apical appendage up to 8-16 µm long, very distinct when present but often absent. According to Stover (1972), within 12 h. after germination lobed *appressoria* are formed, usually exceeding 15 µm in diameter.

Ascigerous state: Ascomata globose or somewhat depressed, 70-220 µm in diameter, distinctly papillate. *Wall* 1-12 cells thick, composed of brownish, isodiametrical cells, sometimes flattened at maturity. *Asci* 35-85 x 20-25 µm, cylindrical or clavate, usually with a short stalk, broadly rounded apically, bitunicate, 8-spored. *Ascospores* 1-3 seriate, one-celled, ovoidal or oblongovoidal, 17-22 x 8-10 µm.

Spermatial state: Spermogonia similar to the pycnidia, papillate, with an approximately 20 µm wide pore and the wall only well developed in the upper part. *Spermatiogenous cells* cylindrical, slender, tapering towards the apex, 5-20 x 1-2 µm. *Spermatia* one-celled, cylindrical or dumb-bellshaped, 6-10 x 0.5-2 µm, usually biguttulate.

Host plants: Musa sapientum (= M. paradisiaca), M. textilis (Reinking, 1918 and 1919), *M. cavendishii* (Carpenter, 1919; Yen, 1972)and *M. superba* (Musaceae).

Material examined

Phyllostictina musarum, Petrak, Mycoth. gen. 305, on leaves of *Musa sapientum,* Philippines, Luzon, Prov. Rizal, Navotas, April 1923, M. S. Clemens (ZT);M. S. Clemens, Philippine Fungi 6504, on leaves of *Musa* spec., Luzon, Calumpit, Bulacan, Okt. 192.4 (ZT); idem on leaves of *Musa* spec. June 1924 (ZT); on leaves of *Musa paradisiaca,* Oriente (S. Paulo) 9 May 1947, leg. H. Zogg nr. 892 (ZT).
Phyllostictina musae (Cooke) Petrak (unpublished herbarium name, cited as *Phyllostictina musarum* [p. 74]in Annls. mycol. *29:* 268. 1931), M. S. Clemens, Philippine Fungi 4387, on leaves of *Musa* spec., Bambang, Nueva Viscaya, Prov. Luzon, Jan. 1924 (ZT).
Herb. K. B. Boedijn, on leaves of *Musa* spec., Java, Patjet, September 1949, leg. v. Hoof (U).
On *Musa superba,* Malwan, India, 20 March 1967, leg. P. G. Patwardhan nr. 13 (CBS). *Guignardia musae* Raciborski; in Mus. Horti hot. Univ. Jagellonicae Cracoviensis, on leaves of *Musa paradisiaca,* Bogor, leg. M. Raciborski; two specimens in ZT.

Discussion

On the type specimen *of Guignardia musae* Rac. numerous well developed ascomata are accompanied by scarce spermogonia and old, almost empty pycnidia. Carpenter (1919) had already described the spermatial state, wich he found in the same stromata as the conidial state, though less frequently (cf. Wardlaw, 1935). Recently Yen described and illustrated the ascigerous and conidial state, developed also in the same stroma (Yen, 1972).
Guignardia musae Syd. and *G. musae* Stevens differ by much smaller ascospores and are excluded on the base of the descriptions.
Phyllosticta musarum is well known in the phytopathological literature as the causal agent of the banana-freckle disease or banana-black-spot disease (Wardlaw, 1935, Stover, 1972). It caused serious damage to *Musa cavendishii* in Hawaii (Carpenter, 1919). In the Philippine Islands it occurs on practically all the varieties of *Musa,* but Ocfemia (1927) reported that the disease did not seem to be of economic importance, as the fungus very rarely penetrates deeper than the peel of the fruit.

37. **Phyllosticta phanerura** van der Aa, nom. nov. -Figs. 6d, 11

Macrophoma linderae Miura - Annls mycol. *12:* 162. 1914 (replaced synonym) = *Phyllostictina linderae* (Miura) Petrak & Syd. - Phaeospore Sphaerops.: 199. 1927 [non *Phyllosticta linderae* Ellis & Everh. - J. Mycol. 4: 9. 1888].

Leaf spots indistinct on the living leaves, brownish on the withering leaves. *Pycnidia* densely scattered, epiphyllous, single or clustered, unilocular or imperfectly divided, 160-300 µm in diameter, apically flat and inconspicuously papillate, with a 5-10 µm wide pore. *Wall* about 3 cells thick, composed of brownish-black to violet-brownish, irregular, isodiametrical or rounded, usually thin-walled cells, very dark, thick-walled, compressed around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 2-10 x 2-3 µm.*Conidia* one-celled, sometimes in persistent chains, obovoidal or pyriform, with a truncate base when young, broadly rounded apically, flattened or indented, 9-15 x 6-8 µm, surrounded by a thick slime layer, containing coarse, greenish guttules and sometimes a large, bright, central vacuole, with a distinct, flexible, 12-20(30) µm long apical appendage, about 4 µm wide at the base, tapering towards the tip, sometimes with a distinct slit in the middle at the position of the previous conidium. [p. 75]

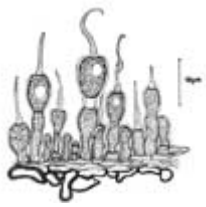


Fig. 11. *Phyllosticta phanerura,* part of the pycnidial wall with developing conidia. Type collection of *Macrophoma linderae,* on leaf of *Lindera glauca.*

Host plant: Lindera glauca (Lauraceae).

Material examined

Macrophoma linderae Miura, Herb. H. Sydow, on leaves of *Lindera glauca,* Mt.Hakkoda, Prov. Mutsu, Aug. 1913, leg. M. Miura nr. S48; holotype (S).

Discussion

This species can easily be recognized by its solid and persistent appendage, even on the 60 years old type specimen, noticed already by Miura (l.c.) and Petrak & Sydow (l.c.), who presumed that it was formed at the base of the conidium.

38. **Phyllosticta podophylli** (Curt.) Wint. -Fig. 6e

Ascospora podophylli Curt. - Rep. N.Y. St. Cabinet *23*: 65. 1872 = *Phyllosticta podophylli* (Curt.) Wint. -Bull. Torrey bot. Club 10: *49.* 1883 = *Phyllostictina podophylli* (Curt.) Petrak - Sydowia *7*: 131. 1953. [p. 76]

Leaf spots reaching a diameter of about 1 cm, irregular in form, yellowish or brownish, sometimes marked with concentric rings, surrounded by a slightly elevated, narrow rim. *Pycnidia* occurring in the spots on living leaves but also outside the spots on withering or dead leaves, epiphyllous, single or in small dense groups, unilocular, 80-120 µm in diameter (Petrak, l.c.: 120-160 µm), depressed globose, flattened apically and slightly papillate, with a 12-15 µm wide pore. *Wall* only 1 cell thick, composed of thin-walled, isodiametrical or compressed cells, 5-13 µm in diameter, colourless in the basal and lateral parts of the pycnidium, yellowish or pale brown in the upper part, sometimes darker around the pore, hyaline and very flat towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-10 x 1-3 µm.*Conidia* one-celled, obovoidal or subglobose, pyriform when young, with a slightly truncate base, apically broadly rounded and conspicuously indented, 7-10 x 5-7 µm or 7-8 µm in diameter, surrounded by a thick slime layer, containing numerous fine guttules; with an apical appendage, probably 1-2 times the length of the conidium.

Host plant: Podophyllum peltatum (Podophyllaceae).

Material examined

Phyllosticta podophylli, Ellis, N. Am. Fungi nr. 1156, on leaves *of Podophyllum peltatum,* Ohio, June, 1883, leg. W. A. Kellermann (L).

The original material from M. A. Curtis probably does not exist any more.

39. **Phyllosticta putranjivae** Syd. - Fig. 6f

Phyllosticta putranjivae Syd. - Annls mycol. *14*: 182. 1916 = *Phyllostictina putranjivae (Syd.)* Syd. apud Petrak & Sydow - Phaeospore Sphaerops.: 201. 1927.

Leaf spots indistinct; *pycnidia* scattered over the infected area of the leaf, epiphyllous, single, seldom clustered, unilocular, less than 100 µm in diameter, subglobose or somewhat depressed, flat or slightly papillate, with a pore of approximately 15 µm width. *Wall* 1-3 cells thick, composed of irregular or isodiametrical, brownish to very pale, usually thin-walled cells with a diameter of 5-17 µm, very dark around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical or conical, 4-7 x 2-3 µm. *Conidia* one-celled, ovoidal, obovoidal or cylindrical, seldom subglobose, with a truncate base when young, broadly rounded apically and indented, 9-12 x 5-7 µm, surrounded by a thick slime layer, containing numerous coarse guttules, with a filiform, up to 7.5 µm long apical appendage, easily seen on young conidia and usually disappearing at maturity. [p. 77]

Host plant: Putranjiva roxburghii (Euphorbiaceae).

Material examined

Phyllosticta putranjivae, on leaves *of Putranjiva roxburghii,* Pusa, India, 3 Jan. í909, coll. E. J. Butler nr. 1691, ex herb. H. Sydow; holotype (S); *Phyllostictina putranjivae,* on leaves of *Putranjiva roxburghii,* Benares Hindu Univers., coll. B. T. Lingappa (ZT).

The differences between this and some other species occurring on Euphorbiaceae are discussed under *P. ghaesembillae*

40. **Phyllosticta pyrolae** Ellis & Everh. - Figs. 6g, 12

Phyllosticta pyrolae Ellis & Everh. - J. Mycol. *5*: 145. 1889 = *Phyllostictina pyrolae* (Ellis & Everh.) Petrak - Sydowia *9: 494.* 1955 [non *Phyllosticta pyrolae* (Ehrenb. ex Fr.) Allesch. - Ber. bayer. bot. Ges. *5*15. 1897).

Phyllostictina ericae Höhnel - Hedwigia *62*: 62. 1920.

Spermatial state: Leptodothiorella spec.

Pycnidia scattered on withering and dead leaves *(Erica)* or in distinct leaf spots *(Pyrola). Leaf spots* subcircular, reaching a diameter of 3 mm, reddish-brown, usually surrounded by a slightly elevated, very narrow rim and a darker area which gradually blends into the healthy tissue of the leaf. *Pycnidia* epiphyllous, later amphigenous, single, unilocular, 75-180 µm in diameter, pyriform, subglobose or somewhat depressed, flat or inconspicuously papillate, with a 10-15(20) µm wide pore. *Wall* variable in thickness, 210 cells (7-25 µm) thick, composed of brownish to purplish, partly thick-walled, partly thin-walled, irregular cells, darkest around the pore, hyaline towards the conidiogenous region, isodiametrical or flattened. *Conidiogenous* cells 5-9 x 2-3 µm, cylindrical or short conical. *Conidia* one-celled, broadly ovoidal or globose, rarely slightly truncate at the base, apically broadly rounded or depressed, 4.5-7·5 x 4-9 µm or 6-9 µm in diameter, surrounded by a thick slime layer and an apically adhering slime cap, irregularly spreading over the conidium at maturity; conidia containing numerous coarse greenish guttules and usually a large, bright

vacuole, sometimes in an excentric position. Germinating conidia produce one- or two-celled, brownish, pyriform or clubshaped *appressoria,* 7-9 x 4-5 µmin size (Fig. 12).

Spermatial state: Spermogonia similar to pycnidia, with the wall somewhat thinner and paler. *Spermatiogenous cells* cylindrical, 4-12 x 0.5-2 µm *Spermatia* in long, persistent chains, cylindrical or dumb-bellshaped, 4-6 x 1.5-2 µm, usually biguttulate.

Cultural characters: Colonies growing slowly, attaining a diameter of 4-6 cm in 15 days on oatmeal and cornmeal agar at 20°C in day-light, or at [p. 78] 24°C under near UV, but growing faster on malt and cherry-decoct agar, reaching a diameter of 9 cm. Colonies very compact, blackish, shining, with a dark green growing zone up to 1 cm broad and with a very irregular outline. *Submerged mycelium* usually brownish or very dark greenish, bluish or brownish-black, forming a prosenchyma near the agar surface; *aerial mycelium* scarce, greyish to very dark greenish-black, lacking in fresh isolates under near UV. *Stromata* cylindrical, simple or branched near the base, forming irregular coralloid complexes, 350-700 µm wide, 500-1000 µm high; sometimes globose or irregular stromata occur freely in the aerial mycelium, 200-270 µm in diameter. Conidial and spermatial cavities are formed in the upper part of the stromata but most of the stromata remain sterile.

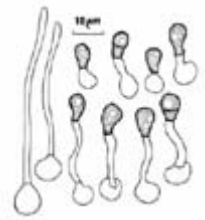


Fig. 12. *Phyllosticta pyrolae,* germinating conidia with appressoria. CBS 997.72

Host plants: Pyrola rotundifolia (type-host), and, according to Parmelee (1958): *P. asarifolia* var. *purpurea, P. bracteata, P. elliptica; Chimaphila umbellata* var. *cisatlantica,* all belonging to the Pyrolaceae; *Erica carnea* (Ericaceae).

Material examined

Herbarium specimens

Phyllostictina ericae, on leaves of *Erica carnea,* Oberbozen, Tirol, June 1918, coll. E. Diettrich Kalkhoff, holotype with slide prepared by von Höhnel (FH).*Phyllosticta pyrolea,* Herb. A. Commons nr. 906 onleaves of *Pyrola rotundifolia,* Centreville, Del., 2 July 1873, holotype (NY); Herb. A. van Luyk nr. 4615, July 1921 and nr. 5094, Dec. 1921, on leaves, dead stems, peduncles and fruits of *Pyrola rotundifolia,* Soesterveen, Netherlands (U); on dead stems and fresh leaves of *Pyrola rotundifolia,* Oostvoorne, [p. 79] near Tenellaplas, Netherlands, 3 April 1971, coll. H. A. van der Aa 2525 (CBS); on leaves of *Erica carnea,* Bergsturz am Eingang des Ötztals, Tirol, Austria, 20 May 1971, coll. W. Gams, herb. H. A. van der Aa 2571 (CBS). *Depazea pirolae* (herbarium name), Herb. Bommer & Rousseau, Arlon, Sept. 1887 (BR).

Living strains

CBS 103.72, isol. fr. *Pyrola rotundifolia,*H. A.van der Aa 2525.
CBS 997.72, isol. fr. *Erica carnea* H. A. van der Aa 2571.

Discussion

This species is characterized by very small, almost globose conidia, each with an apical slime cap; it resembles*P. gaultheriae* where conidia have a short tongue-shaped appendage.
The ascigerous state is *a Guignardia* species but only unripe stages could be found on *Pyrola,* with lens-shaped or tympaniform, slightly papillate ascomata, measuring 75-120 µm on the dead leaves but up to 170 µm on the stems. Development of ascogonia and young, usually club-shaped

asci was observed in moist chambers but no ripe ascospores were obtained. Seaver (1922) stated that 'asci are found in some of the spots, which appear to represent the perfect stage of this fungus', but he gives no further description. Von Höhnel (1920b) supposed that *Phyllostictina ericae* might be the conidial state of an unknown *Guignardia* species, closely related to *Guignardia bidwellii.* This species, however, is easily distinguishable by its larger conidia with well developed apical appendages.
Coleophoma ericae Höhnel (l.c.) was described from the same collection but von Höhnel's suggestion that this fungus might belong to the same cycle as *Phyllostictina ericae* has to be discarded, since *Coleophoma*-likefungi were never encountered in *Guignardia* life cycles.
The name *Phyllosticta pyrolae* (Ehrenb. ex Fr.) Allesch. is a later homonym of *Phyllosticta pyrolae* Ellis & Everh.; it was placed in the synonymy by Parmelee (1958), without studying the type collection; the description does not point to *Phyllosticta.*

41. **Phyllosticta solitaria** Ellis & Everh. - Fig. 6h

Phyllosticta solitaria Ellis & Everh. - Proc. Acad. nat. Sci. Philad. *1895:* 430. 1895.

Leaf spots small, 1-6 mm in diameter, brownish to almost white, surrounded by a dark brown area, usually with one pycnidium in the centre. On the main veins, twigs and fruits numerous pycnidia occur, densely clustered in a stromatic tissue and turning black on fruits and twigs. *Pycnidia* epiphyllous, later amphigenous, unilocular, 75-135 µm in diameter, flat or inconspicuously papillate, with a 9-15 µm wide pore. *Stroma* not developed in leaf spots, more or less abundant on the main veins, twigs and fruits, prosenchymatous, [p. 80] composed of brownish to subhyaline, about 4-6 µm wide hyphae. *Wall 1-3* cells (4-12 µm) thick, composed of thin- to thick-walled, usually compressed, brownish cells, more rounded, with thicker cell-walls and very dark brown around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical, sometimes very slender, 4-11 x 1-3 µm. *Conidia* one-celled, obovoidal, broadly ellipsoidal, seldom subglobose, pyriform when young, with a truncate base, broadly rounded and indistinctly indented apically, 7-11 x 5-8.5 µm, surrounded by a rather thick slime layer, containing a mixture of numerous fine and coarse guttules, with a distinct, 5-15, usually 7-9 µm long apical appendage. According to Scott & Rorer (1909), Lewis (1913) and Guba (1925) no appressoria are formed on the germ-tubes.

Host plants: Malus (Pyrus) coronaria (type host), *Malus sylvestris.* According to Guba (1925) all important varieties of apples in Illinois are suspectible to this pathogen. According to Seaver (1922) also occurring on *Crataegus* spec.

Material examined

Herbarium specimens

Phyllosticta solitaria, on *Pyrus coronaria,* Crawfordsville, Montgomery Co., 7 Oct. 1893, leg. L. M. Underwood. Two capsules both stamped 'typus' and to be considered as one collection; holotype (NY).

Living strain

CBS 25.35, isolated from apple, May 1935, J. A. Mix, Kansas, U.S.A.

Discussion

This species is probably restricted to the eastern parts of the U.S.A., where it causes the *'Phyllosticta* apple blotch', which was extensively studied by Scott & Rorer (1909), Lewis (1913) and Guba (1925). Roberts (1921) stated that this species is morphologically not different from *Phyllosticta congesta* Heald & Wolff (occurring on *Prunus triflora);* however, inoculation experiments on plums, using conidia from pure cultures of *Phyllosticta solitaria* were unsuccessful, while inoculation of plums with conidia of *Phyllosticta congesta* gave positive results. In fact, several species similar to *Guignardia bidwellii,* known to cause diseases on cultivated plants can hardly be distinguished on morphological characters, but they have a restricted host range, usually within one genus.

The ascigerous state of *Phyllosticta solitaria* is not known, but Guba (1925) noticed fructifications on the fallen leaves in spring, resembling unripe ascomata. No spermatial state is known; on the type specimen numerous pycnidia of an *Asteromella* species were found, which were accompanied by initials of an unripe *Mycosphaerella,* but these fungi do not belong to the same life cycle as *P. solitaria.* [p. 81]
The only available strain had been sterile for a long time and was atypical. Inoculation experiments on externally desinfected apples of various cultivars gave only a very restricted brown rot; ripe fructifications of any state of the fungus were never obtained. Reisolation from these spots gave the same, sterile cultures. Cultural characters are extensively described by Guba 1925)

42. **Phyllosticta sphaeropsoidea** Ellis & Everh. - Fig. 6i

Phyllosticta sphaeropsoidea Ellis & Everh. - Bull. Torrey bot. Club *10:* 97. 1883 = *Phyllostictina sphaeropsoidea* (Ellis & Everh.) Petrak - Sydowia *10*: 265. *1957.*

Ascigerous state: Guignardia aesculi (Peck) Steward

Laestadia aesculi Peck - Rep. N.Y. St. Mus. 39: 51. 1885 = *Guignardia aesculi* (Peck) Steward - Phytopathology *6*: 5. 1916 = *Botryosphaeria aesculi* (Peck) Barr - Contrib. Univ. Michigan Herb. *2*: 561. 1972.

Spermatial state: Leptodothiorella spec.

Misapplication: *Asteromella aesculicola* (Sacc.) Petrak - Sydowia *10*: 266. (1956) 1957 [non *Phyllosticta aesculicola* Sacc. - Michelia *1*: 134. 1878].

Leaf spots variable in shape and size, found on living leaves in summer and autumn, characteristically red-brown, angular, at first limited by the veins, later with a broad yellow border, then joining and occupying large parts of the infected leaves. *Pycnidia* epiphyllous, single, unilocular, up to 160 µm in diameter, globose or somewhat depressed, flat or papillate, with a 10-15 µm wide subcircular pore. *Wall* thin, often hardly developed, 1 cell, in the upper part up to 3 cells thick, composed of isodiametrical or compressed, subhyaline to brownish cells, around the pore with thicker and darker cell-walls, inwards with a very thin layer of flattened, hyaline cells. *Conidiogenous cells* cylindrical or conical, 5-10 x 2-3.5 µm.*Conidia* one-celled, obovoidal, ellipsoidal or even globose, when young somewhat pyriform with a truncate base, broadly rounded apically and inconspicuously indented, 10-20 x 9-13 µm, surrounded by a thick slime layer, containing numerous greenish guttules and one large, bright vacuole, with a short tongue-shaped, 6-7.5 µm long, apical appendage, only visible on fresh conidia.

Ascigerous state: Ascomata ripening on dead leaves in spring, 100-150, seldom up to 200 µm in diameter, globose or somewhat flattened, indistinctly papillate. *Asci* subclavate, bitunicate, 5 5-70 x 14-18 µm, 8-spored. *Ascospores* 1-3 seriate, one-celled, ellipsoidal or rhomboidal, straight or slightly curved, 12-18 x 7-9 µm, containing numerous greenish guttules, according to Steward (1916) germinating with appressoria. [p. 82]

Spermatial state: Spermogonia similar to the pycnidia; in vitro conidia and spermatia are often formed in the same cavity. *Spermatiogenous cells* long and slender, on branched spermatiophores in the young cavities, at maturity lining the cavity, 4-35 x 1-2 µm. *Spermatia* oblong cylindrical or dumb-bellshaped, 3-9 x 0.5-2.5 µm.

Cultural characters: Colonies growing slowly, attaining a diameter of about 5 cm on oatmeal and cornmeal-agar and 6-7 cm on cherry-decoct-agar in one month at 20°C, at first greenish-grey, soon turning almost black, with a lobed margin. Submerged mycelium abundant, composed of brownish or greyish, septate, often densely guttulate, 4-8 µm wide hyphae; aerial mycelium very scarce, more abundant in older strains, at first white, soon turning greyish with some shade of greenish-brown or even black in very old cultures. *Stromata* usually cylindrical, up to 500-900 µm high, at first white and composed of thin-walled, hyaline, subglobose cells, 15-40 µm in diameter, forming a soft pseudoparenchyma, later turning blackish, with 1-20 pycnidial and spermatial cavities in the upper part.

Host plants: Aesculus glabra (type host) and numerous other species and varieties *of Aesculus* (Hippocastanaceae) (cf. Seaver, 1922; Grove, 1935; Neely & Himelick, 1963; Neely, 1971).

Material examined

Herbarium specimens

Phyllosticta sphaeropsoidea, Ellis & Everh., N. Am. Fungi nr. 1159, on leaves of *Aesculus glabra* Vineland, N.J., Aug. 1883, leg. E. C. Bidwell (L); Rabenh. & al., Fungi europ. nr. 3988, on living leaves of *Aesculus glabra,* Perryville, Mo., May 1885, leg. C. H. Demetrio (L).
Guignardia aesculi, Herb. mycol. roman. T. Savulescu 35: 1716, on leaves of *Aesculus hippocastanum,* Simeria, Reg. Hunedoara, 26 July 1963, leg. O. Constantinescu (CBS); on living leaves of A. *hippocastanum,* Laren, N.H.,Netherlands, 19 Oct. 1969, coll. H. A.v. d. Aa nr. 1851 and several fresh collections from the same locality during 1969 and 1970; on living leaves of *A. hippocastanum,* Schloss Gössweinstein, Frank. Schweiz, W. Germany, 28 June 1970, leg. W. Gams = H. A. v. d. Aa nr. 2179 (CBS); do, Gerolstein, Eifel, 13 Sept. 1970, coll. H. A. v. d. Aa nr. 2293; do, 15 Sept. 1970, coll. H. A. v. d. Aa nr. 2277; do, near Gemündener Maar, Eifel, W. Germany, 16 Sept. 1970, coll. H. A. v. d. Aa nr. 2275.
As *Phyllosticta aesculi,* on leaves of *A. hippocastanum,* Luzern, 20 July 1955, leg. L. Kalder (ZT).

Living strain

CBS 756.70 isolated from *Aesculus hippocastanum,* Schloss Gössweinstein, W. Germany, H. A. v. d. Aa nr. 2179.

Discussion

This species is a well known and severe pathogen of most *Aesculus* species in Europe and N. America (Steward, 1916; Petrak, 1957; Schneider, 1961; [p. 83] Neely & Himelick, 1963; Neely, 1971). Steward (l.c.) pointed out that isolates from different *Aesculus* species are unable to attack other species than the original host plant. Neely (1971) found that 5 out of 41 *Aesculus* species and subspecies appeared to be completely resistent.
The conidial state is often named *Phyllosticta paviae* Desm. (Annls Sci. nat. Bot., Sér. 3, *8*: 32-33. 1847) (Seaver, 1922; Grove, 193S). Steward (1916) and Petrak (1957) also discussed this name without having studied the type collection and excluded it as doubtful. Examination of the holotype (PC) justified their prudence: it contains several leaves of *Aesculus parviflora,* collected in the autumn, without the characteristics of the *Guignardia* infection, but containing several other fungi which fulfilled the meagre description of Desmazières (1847) and his small drawings on the label; among them are *Colletotrichum gloeosporioides* Penzig, *Phoma exigua* Desm. and an unripe *Mycosphaerella* species. The name *Phyllosticta paviae* Desm. therefore has to be rejected as being a nomen ambiguum.
Phyllosticta aesculicola Sacc. is, according to the description, the *Asteromella* state of *a Mycosphaerella* species. Several *Mycosphaerella* species can occur on leaves of *Aesculus,* even in the same leaf spots as the *Guignardia.* Saccardo collected and described *Phyllosticta aesculicola* in the last century in Italy, whereas the *Guignardia* disease was originally a North American disease, only known in Europe during the last decades.

43. **Phyllosticta subeffusa** (Ellis & Everh.) Tehon & Stout - Fig. 6j

Phyllosticta smilacis Ellis & Martin var. *subeffusa* Ellis & Everh. - Publs Columbian Field Mus. nat. Hist. 9, bot. Sér. 1(2): 104. 1896 = *Phyllostictina subeffusa* (Ellis & Everh.) Petrak & Syd. - Phaeospore Sphaerops.: 205. 1927 = *Phyllosticta subeffusa* (Ellis & Everh.) Tehon & Stout - Mycologia *21*: 186. 1929.
Phyllosticta pallidior Peck - Bull. N.Y. St. Mus.*105*: 26.1906 = *Phyllosticta cruenta* (Kunze ex Fr.) Kickx var. *pallidior* (Peck) Davis -Trans. Wis.Acad. Sci. Arts Lett. *27:* 865. 1914 = *Phyllostictina pallidior* (Peck) Petrak & Syd. - Phaeospore Sphaerops.: 204. 1927.

Leaf spots elliptical, streched along the axis of the leaf, about 10 x 4-7 mm, secondarily enlarged by coalescence, especially at the border of the leaf, pale brown, soon becoming necrotic, leaving a hole in the leaf surrounded by a sharp, often thickened purple-brown rim. *Pycnidia* epiphyllous, scattered or in dense groups, unilocular, 90-150, usually 120-140 µm in diameter, globose or somewhat depressed, firmly grown together with the epidermis in the upper region, papillate, with a subcircular, 7-15 µm wide pore. *Stroma* prosenchymatous, subepidermal, composed of brownish, 4-7 µm wide, septate and strongly twisted hyphae. *Wall* 1-3 cells (5-16 µm) thick, composed of pale to very dark brown, isodiametrical or irregular cells, 5-14 µm in diameter, darker around the pore, hyaline and usually compressed towards the conidiogenous region. *Conidiogenous cells* short cylindrical or conical, 5-8 x 3-4.5 µm. *Conidia* one-celled, ovoidal or [p. 84] subglobose, pyriform with a truncate base when young, broadly rounded and slightly indented apically, 7-13 x 7-10 µm or about 7-9 µm in diameter, surrounded by a thick slime layer, containing numerous coarse guttules; with a caducous, usually 5-7, seldom up to 15 µm long apical appendage.

Host plants: Smilacina racemosa, S. stellata; Smilax rotundifolia, S. hispida and *S. herbacea* (Liliaceae).

Material examined

Phyllosticta cruenta var. *pallidior,* on leaves of *Smilacina racemosa* and *S. stellata,* Wild Rose, Wisconsin, 9 July 1918, leg. J. J. Davis, both ex herb. F. Petrak in herb. A. v. Luyk (U).
Phyllostictina pallidior, in J. F. Brencle, Fungi Dakot. 278, on leaves of S. *stellata, Ny*lands Grove, Lamoure Co., N. Dakota, 6 July 1914 (ZT); F. Petrak, Mycoth. gen. nr. 1995, on leaves of *S. stellata,* Mazomanie, Wisconsin, June, 1928, leg. J. J. Davis (S).
As *Phyllosticta convallariae* Pers. *(P. pallidior),* U.S. Dep. Agric. exs. nr. 1899, path.-mycol. collect., on leaves of *S. racemosa,* Black Pond, Fairfax, C. H., Va., 18 June 1923, coll. W. W. Diehl (U).

Discussion

The *Phyllosticta* species described from various related Liliaceae were discussed under *Phyllosticta cruenta (p.* 26). The species occuring on *Smilax* and *Smilacina,* which were considered to be different by Petrak & Sydow (1927), are here reduced to one well delimited species, which resembles *Phyllosticta cruenta* particularly with regard to the leaf spots, but differs in having smaller conidia, which are covered with a thick slime layer.

44. **Phyllosticta toxica** Ellis & Martin - Fig. 6k

Phyllosticta toxica Ellis & Martin - Am. Nat. *16:* 1002. 1882.

Leaf spots subcircular, reaching a diameter of 5 mm, at first dark brown, soon turning white, surrounded by a rather broad brownish, purple or blackish zone. *Pycnidia* epiphyllous, single or clustered, unilocular, 65-100 µm in diameter, globose or somewhat depressed, distinctly papillate, with a subcircular or irregular, 9-15 µm wide pore. *Wall* 1-3 cells (3-10 µm), but in the upper part up to 9 cells thick, composed of rounded, sometimes compressed, brown to dark brown, thin-walled cells, very dark and with thicker cell-walls around the pore, hyaline and very flat towards the conidiogenous region. *Conidiogenous cells* caducous; only badly preserved cylindrical remnants, 5-6 x 2 µm, could be observed. *Conidia* one-celled, broadly ellipsoidal or subglobose, somewhat truncate at the base when young, broadly rounded and indistinctly indented apically, 6-10 x 5-7.5 µm, or about 6-8 µm [p. 85] in diameter, surrounded by a thick slime layer, containing numerous greenish guttules, with a distinct, only 3-5 µm long, tongue-shaped apical appendage.

Host plant: Rhus (= Toxicodendron) radicans (Anacardiaceae).

Material examined

Phyllosticta toxica, Ellis, N. Am. Fungi 1162, on leaves of *Toxicodendron radicans,* Decorah, Iowa, Aug. 1882, leg. E. W. Holway, syntype (L).

45. **Phyllosticta vaccinii** Earle - Fig. 6l

Phyllosticta vaccinii Earle - Bull. Torrey bot. Club *24*: 31. 1897 = *Phyllostictina vaccinii* (Earle) Shear - Mycologia *15:* 131. 1923.
Phyllosticta sparsa Bonar -Mycologia *20:* 292-297. 1928.
Phyllostictina vaccinii Demaree & Wilcox - Phytopathology *37*: 292. 1947.

Ascigerous state: Guignardia vaccinii Shear

Guignardia vaccinii Shear - Bull. Torrey bot. Club *34*: 316. 1907 = *Botryosphaeria vaccinii* (Shear) Barr - Mycologia *62:* 379. 1970.
Mycosphaerella oxycocci Dearness & House - Bull. N. Y. St. Mus.*243-244*: 76. 1923

Leaf spots subcircular, reaching a diameter of about 10 mm, reddish-brown, indefinite or bounded by a narrow, dark line, more or less zonate, paler on the under surface; infected fruits blackish. Pycnidia epiphyllous, single, densely crowded on the fruits in a stromatic crust, 80-175, usually 100-120 µm in diameter, globose or somewhat depressed on the leaves, pyriform on the fruits, flat or conspicuously papillate with a subcircular or irregular 5-18 µm wide pore. Stroma prosenchymatous, composed of 3-7 µm wide, septate, brownish or subhyaline hyphae, more abundant and darker on the fruits. *Wall* 1-8 cells (8-20 µm), in the upper part up to 15 cells (25-40 µm) thick, composed of brownish to almost blackish, partly thin-walled, partly thick-walled, rounded or compressed cells, 4-10 µm in diameter, subhyaline to hyaline towards the conidiogenous region and isodiametrical or flattened. *Conidiogenous cells* cylindrical, 5-19 x 2-4 µm. *Conidia* one-celled, ellipsoidal or obovoidal, seldom cylindrical, reniform or subglobose, when young pyriform with a truncate base, broadly rounded apically and inconspicuously indented, 8-12 x 5-8 µm, surrounded by a thick slime layer, containing a mixture of fine and coarse guttules, usually with a 4-8, seldom up to 17 µm long apical appendage. According to Shear (1907b), no appressoria are formed.

Ascigerous state: Ascomata single, unilocular, 95-180 µm, globose or somewhat depressed, flat or papillate. *Wall* 1-4 cells thick, composed of [p. 86] brownish to opaque, usually thick-walled, often compressed cells, 5-18 µm in diameter. *Asci* oblong or clavate, with a short stipe or sessile, bitunicate, 60-80 x 9-12 µm, 8-spored. *Ascospores* 1-3 seriate, short ellipsoidal to rhomboidal, 13-17 x 6-7 µm, containing numerous coarse greenish guttules.

Cultural characters (mainly based on literature): *Mycelium* on different media at first thin, floccose, white, becoming bluish grey within a few days, in older cultures spreading concentrically and becoming greyish-brown. *Stromata* appear after 4-8 days and mature conidia after 12-18 days. The stromatic bodies form a more or less continuous layer on the surface of the somewhat felty subiculum formed by the mycelium. In about 20 days old cultures Shear (1907b) observed both conidia and ripe ascospores.

Host plants: Vaccinium arboreum (type host), *V. ovatum* (type host of *P. sparsa), V. ashei, V. corymbosum, V. macrocarpum, V. oxycoccus, V. australe, V. atrococcum* and *V. pallidum x atrococcum* (Ericaceae).

Material examined

Herbarium specimens

Phyllosticta vaccinii, Flora of Alabama, on leaves of *Vaccinium arboreum, 25* April 1896, Auburn, Lee Co., coll. F. S. Earle and L. M. Underwood; three capsules, stamped ‘type’ (NY); on *Vaccinium arboreum,* Warpresboro, Mins., 28 April 1921, coll. L. E. Miles 308 (NY).

Living strain

CBS 126.22 *Guignardia vaccinii,* sent to the CBS in April 1922 by C. L. Shear. (Substituted for a strain from 1913 which had become sterile).

Discussion

This species is known only from N. America and was described as the causal fungus of ‘blast or blight of flowers and young fruits’ or ‘early rot of fruits in storage’ on cranberries. Halsted (1889) described and illustrated the fungus without giving a name. Earle (l.c.) described and named the conidial state and Shear (1905) first described, and in 1907 named the ascigerous state. Shear (1907 a and b), Schwarze (1917) and Shear & al. (1931) described both states more extensively. Demaree & Wilcox (1947) gave a very detailed description of *Phyllostictina vaccinii* Demaree & Wilcox, creating a homonym of *Phyllostictina vaccinii* (Earle) Shear.
Barr (1970) also placed *Sphaerella andromedae* Tracy & Earle (Bull. Torrey bot. Club. *22:* 176. 1895 [non Auerswald, 1896]) in the synonymy of *Botryosphaeria (= Guignardia) vaccinii.* Within the host family of the Ericaceae, however, it is rather difficult to judge the identity of this species on one state only (cf. discussion under *P. gaultheriae).*[p. 87]

46. **Phyllosticta zimmermannii** van der Aa, spec. nov. -Fig. 6m

Misapplied: *Dothiorella holstii (P.* Henn.) von Arx - Verb. K. Akad. Wetensch., Afd. Natuurk. *2, 51 (3):* 93. 1957 [non *Gloeosporium holstii P.* Henn. - Bot. Jb. *38:* 17. 1905] = *Phyllostictina holstii* (P. Henn.) von Arx - Proc. K. ned. Akad. Wetensch. C, *66*, 2: 180. 1963.

Maculae foliorum fere rotundae, 4-19 cm diam., rubro-brunneae, pallescentes, purpureo-fuscae cinctae. Pycnidia epiphylla, 80-160 µm diam., globosa vel modice compressa, applanata vel indistincte papillata, poro subcirculari, 8-18 µm diam., perforata. Paries 1-3 cellulas (10-16 µm) crassus, constat e cellulis isodiametricis vel irregularibus, plerumque fuscis, 7-18 µm diam., fuscissimis circa porum, hyalinis et complanatis versus pattern conidiogenam. Cellulae conidiogenae cylindricae, caducae, 5-8 x 1-2 µm. Conidia continua, ellipsoidea, breviter cylindrica, obovoidea vel pyriformia, raro fere globosa vel reniformia, primum ad basim truncata, deinde utrinque rotundata, sursum modice depressa, 10-18 x 7-10 µm, strato mucido circumdata, guttulas numerosas continent et appendicem distinctum, 6-11 µm, raro ad 25-30 µm longum portant.
Typus sub *Gloeosporium holstii P.* Henn. in foliis Tabernaemontanae holstii, Usambara orient., leg. A. Zimmerman no. 301, Jan. 1903 (B).

Leaf spots subcircular, 4-10 cm in diameter, at first reddish-brown, finally very pale, surrounded by a purple-brown border. *Pycnidia* epiphyllous, 80-160, usually about 120 µm in diameter, globose or somewhat depressed, firmly grown together with the epidermis in the upper part, flat or slightly papillate, with a subcircular pore, secondarily enlarging irregularly and 8-18 µm wide. *Wall* 1-3 cells (10-16 µm) thick, composed of isodiametrical or irregular, partly thin-walled, partly thick-walled, usually dark brown cells, 7-18 µm in size, very dark around the pore, hyaline and flattened towards the conidiogenous region. *Conidiogenous cells* cylindrical, caducous, with only 5-8 x 1-2 µm large remnants on the over-ripe collection examined. C*onidia* one-celled, ellipsoidal, short cylindrical, obovoidal or pyriform, seldom almost globose or reniform, when young with a truncate base, later rounded at either end, apically slightly indented, 10-18 x 7-10 µm, surrounded by a slime layer, containing numerous fine guttules; with a usually distinct, long and slender, seldom short tongue-shaped apical appendage, often about 6-11 µm, occasionally up to 25-30 µm long, broadened at the base and apically tapering into a thin thread.

Host plant: Tabernaemontana holstii (Apocynaceae).

Material examined

Gloeosporium holstii P. Henn., on leaves of *Tabernaemontana holstii,* Eastern Usumbara; Wilhelmsal., Jan. 1903, coll. A. Zimmermann nr. 301, holotype (B).

Discussion

Von Arx (1957 and 1963)discovered and described this *Phyllosticta* species on a part of the typecollection of *Gloeosporium holstii.* This collection [p. 88] is very rich and shows a mixture of several fungi, a.o. *Colletotrichum gloeosporioides* Penzig and its ascigerous state *Glomerella cingulata* (Stonem.) Spauld. & v. Schrenk, which are very abundant, in all stages of development. Judged from the description and the drawings of Hennings on the label of this specimen, it is clear that Hennings studied only the *Colletotrichum* and not the *Phyllosticta.*
Phyllosticta zimmermannii differs from *P. tabernaemontanae* (Syd.)van der Aa by its larger conidia which are usually over 12 µm long, whereas in *P. tabernaemontanae* theyare shorter than 12 µm.

10. Revision of the species described in Phyllostictina

By January 1973 84 combinations in the genus *Phyllostictina* had been published, some as new species and some as new combinations. All are listed here in alphabetical order. If the species has been discussed in the preceeding part, only the correct name is given. Several species have only been collected once and not all the type collections could be studied.

Phyllostictina africana Pandotra & Husain → *Phyllosticta africana.*

Phyllostictina aleuritidis (Cif. & Frag.) Bondarzeva-Monteverde *apud* Vassiljevskij - Not. syst. Sect. Crypt. Inst. Bot. Acad. Sci. U.S.S.R. *5*: 9. 1940 → *Phyllosticta aleuritidis* Cif. & Frag. *apud* Fragoso & Ciferri - Publnes Estanc. agron. Moca, Set. B, Bot. *8:* 40. 1927= *Phyllosticta aleuritidis* Saccas & Drouillon - Agron. trop. 6: 240. 1951.
Ascigerous state: **Guignardia aleuritidis** (Vassiljevskij) van der Aa, comb. nov. = *Melanops aleuritidis* Vassiljevskij l.c.: *9*. 1940 (basionym). Host plants: *Aleurites moluccana (= triloba), A. fordii, A. cordata, A. montana* (Euphorbiaceae).
Classification of this species in *Phyllosticta* isjustified from descriptions and illustrations given by Fragoso & Ciferri (l.c.) and Saccas & Drouillon (l.c.), and since Bondarzeva-Monteverde (l.c.) pointed out that *Melanops aleuritidis* isthe ascigerous state. No material was available.

Phyllostictina annonicola Batista & Vital - Boln Sec. Agric. Pernambuco *19*: 213. 1952. Host plant: *Annona muricata* (Annonaceae).
According to the description this species may belong to *Phyllosticta,* but several taxa described on this and related hosts should be considered. One of them is *Phyllosticta canangae* Frag. & Cif. - Publnes Estanc. agron. Moca, Sér. B, Bot. *8*: 35. 1927, of which no material was available.

Phyllostictina anthocephali Agarwal & Sahni - Mycopath. Mycol. appl. *27:* 143. 1965.Host plant: *Anthocephalus indicus (= A. cadambra)* (Rubiaceae). [p. 89]

The type collection, IMI 104609, on leaves of *Anthocephalus indicus,* Jabalpur, India, leg. S. K. Hasija, Febr. 1963, shows only few spots, up to 1 cm in diameter, rounded or delimited by the major veins, brownish and zonate, with some sterile fructifications, which resemble immature *Phoma.* No conidia could be observed and, according to the description, these are much smaller than in *Phyllosticta.*

Phyllostictina arecae (Höhnel) Petrak *&* Syd. *apud* Petrak → *Phyllosticta arecae.*

Phyllostictina artocarpina (Syd. & Butler) Syd.*apud* Petrak & Sydow → *Phyllosticta artocarpina.*

Phyllostictina banosensis Petrak → *Phyllosticta arecae.*

Phyllostictina bignoniacearum Batista -Anais Reun. anu. Soc. bot. Brasil.*5* 131. 1956. Host plant: *Mansoa (?)* spec. (Bignoniaceae).

No material in URM. The conidia are described as elliptical, biguttulate, 4-5.5 x 2-2.5 µm, hyaline, with one cilium up to 6.5 µm long; therefore the species does not belong to *Phyllosticta.*

*Phyllostictina bokensis (*P. Henn.) v. Arx → *Phyllosticta bokensis.*

Phyllostictina buxi Da Costa & Da Camara - Port. Acta biol. *4*: 338. 1954. Host plant: *Buxus sempervirens* (Buxaceae). No material could be obtained. According to the description and figures → *Sarcophoma miribelii* (Fr.)Höhnel - Sber. K. Akad. Wissensch. Wien, math. nat. Kl. 116, 1 : 637. 1907 (cf. *Phyllostictina confusa).*

Phyllostictina calamagrostidis Wehmeyer - Mycologia *56:* 46.1964. Host plant: *Calamagrostis compacta* (Gramineae).
The type collection was not studied; from the description it can easily be excluded from *Phyllosticta,* because the conidia are 'small, one-celled, hyaline, bacillar, 3.5 x 1.5 µm'.

Phyllostictina carpogena Shear - Mycologia *15:* 129. 1923 - **Phyllosticta carpogena**(Shear) van der Aa, comb. nov. Host plant: *Rubus* spec. (Rosaceae).
This species causes fruit-rot on dew-berries in N. America. It is a characteristic *Phyllosticta* with rather thick-walled pycnidia and subglobose conidia, 5-7.5 x 4.5-6 µm in size, with a distinct apical appendage. In these characters it resembles *Phyllosticta solitaria* and *P.congesta,* but these species are host-specific on other genera of the Rosaceae (Roberts, 1921). Shear (l.c.) discussed an ascigerous state developed on dead vines, which is probably the *Guignardia* state of *Phyllosticta carpogena.* Dodge (1923) observed a spermatial state in fructifications similar to the pycnidia which is without doubt the *Leptodothiorella* state of the same fungus. No material could be obtained. [p. 90]

Phyllostictina celastrina (Died.) Petrak & Syd. → *Phyllosticta celastrina.*

Phyllostictina choisiae (Siemaszko) Petrak *apud* Petrak & Syd. - Phaeospore Sphaerops.: 193. 1927 = *Coniothyrium choisiae* Siemaszko - Acta Soc. Bot. Pol. *1*: 7. 1923. Host plant: *Choisia ternata* (Rutaceae).
This species is *a Phyllosticta,* similar to *Phyllosticta murrayiola,* in which conidia have no distinct apical appendage; it resembles *Phyllosticta citricarpa,* in which the stroma is usually well developed and the conidia have an apical appendage. From Petrak's description it is impossible to make a choice.

Phyllostictina citricarpa (McAlpine) Petrak → *Phyllosticta citricarpa.*

Phyllostictina clemensae Petrak → *Phyllosticta ampelicida.*

Phyllostictina cocoicola Batista (as *'coccoicola')* - Boln sec. Agric. Pernambuco *19:* 214. 1952. Host plant: *Cocos nucifera* (Palmaceae).
No material could be obtained; according to the description the conidia are cylindrical, unicellular, hyaline, 4-5 x 2-2.5 µm, uniciliate, up to 2-4 µm long; it therefore is doubtfully a *Phyllosticta.*

Phyllostictina codiaei (Died.) Petrak → *Phyllosticta ghaesembillae.*

Phyllostictina concinna Sydow → *Phyllosticta concinna.*

Phyllostictina concentrica (Sacc.) Höhnel → *Phyllosticta concentrica.*

Phyllostictina confusa (Petrak) Petrak *apud* Petrak & Sydow - Phaeospore Sphaerops.: 191. 1927 = *Sclerophoma confusa* Petrak - Annls mycol. *20*: 23. 1922 → *Sarcophoma miribelii (Fr.)* Höhnel - Hedwigia *60:* 129-209. 1918. Host plant: *Buxus sempervirens* (Buxaceae).
Petrak & Sydow (1927) listed *Macrophoma miribelii (Fr.)* Berl. & Vogl. *f. ramicola* Oudem. - Ned. kruidk. Arch, Ser. *3, 2:* 734. 1902 as the oldest name for *Phyllostictina confusa.* The type specimen, on dead twigs of *Buxus sempervirens,* Nunspeet, 10 March 1900; coll. Beins nr. 209 and 210 (L) and several other collections from Oudemans' herbarium agree in all characters with the description given by Petrak & Sydow (1927). The species is characterized by tympaniform pycnidia, firmly grown together apically with the epidermis, at first papillate, soon opening with a wide crateriform pore and surrounded by the raised remains of the epidermis. Conidia formed by a budding process on broadly cylindrical conidiogenous cells. Conidiogenous cells as described by Morgan-Jones (1971: 1924) could not be seen. Conidia are ovoidal, thick-walled, apiculate at the base, 8-16 x 4.5-7.5 µm, containing a conspicuous, bright, central vacuole.
Numerous synonyms of this species are listed by von Höhnel (1918,b), where the correct spelling of the epithet is also discussed. [p. 91]

Phyllostictina cordylines (Thüm.) Petrak & Syd. - Phaeospore Sphaerops.: 194. 1927 = *Sphaeropsis cordylines* Thüm. - Revta scient. litter. Coimbra *28:* 36.1881 - *Phyllosticta cordylinophila* Young *apud* F. L.Stevens -Bull. Bernice P. Bishop Mus. Honolulu, Hawaii *19:*133. 1925 [non *Phyllosticta cordylines* Sacc. & Berl. - Atti Ist. VenetoSci. Lett. 6, Ser. 3: 711-712. 1885]. Host plants: *Cordyline australis* and C, *terminalis* (Liliaceae).
No material could be obtained. According to Petrak & Sydow (l.c.) who studied a scarce, badly developed secondary collection, and according to Young (l.c.), the pycnidia are globose, 80-160 µm in diameter with a 15-30 µm, but up to 60 µm thick wall in the upper part, merging with the

subepidermal stroma. Conidia one-celled, broadly ellipsoidal or ovoidal, 7-12 x 5-7,5 µm (de Thümen: 13-15 x 6-8 µm), containing numerous coarse guttules.

Phyllostictina cyamopsidis Syd. apud Petrak & Syd. → *Phyllosticta cyamopsidicola.*

Phyllostictina davisii (Ellis & Everh.) v. Arx - Proc. K. ned. Akad. Wetensch. Amsterd., C, *66*: 180. 1963 = *Gloeosporium davisii* Ellis & Everh. - Proc. Acad. nat. Sci. Philad. *1893:* 167.1893 - **Phyllosticta davisii** (Ellis & Everh.) van der Aa, comb. nov. Host plant: *Vicia americana*(Leguminosae).
According to von Arx (l.c.), pycnidia are subglobose or broadly conical, 150-230 µm in diameter, 100-140 µm high, apically ostiolate. Wall 10-30 µm thick, composed of isodiametrical, thin-walled cells. Conidia one celled, hyaline, 7-11 x 3-4 µm in size.

Phyllostictina dioscoreae (Cooke) Petrak → *Phyllosticta dioscoreae.*

Phyllostictina diospyri (Ellis & Everh.) v. Arx → *Phyllosticta arxii.*

Phyllostictina divergens Petrak & Syd. - Phaeospore Sphaerops.: 190. 1927. Host plant: *Bambusa vulgaris* (Gramineae).
No material could be obtained; according to the description it is a *Phyllosticta,* characterized by pycnidia grouped in a stroma, often arranged in rows, uni- or multilocular, up to 400 µm in diameter. The conidia are ellipsoidal or ovoidal, 10-12 x 7-8 µm, surrounded by a thick slime layer. In these characters the fungus resembles *Phyllosticta encephalarti,* which occurs on Cycadaceae. In other genera several fungi, occurring on *Bambusa* have been described, with characters similar to *P. divergens;* before these have been compared it would be premature to create a new name.

Phyllostictina ehretiae (Patil & Thirumalachar) Petrak → *Phyllosticta concinna.*

Phyllostictina elodea Syd. - Annls mycol. *30:* 110. 1932 → **Phyllosticta elodea**(Syd.) [p. 92] van der Aa, comb. nov. Host plant: *Bruguiera conjugata* (Rhizophoraceae).
No type specimen is known to be preserved. According to Sydow, pycnidia are epiphyllous, depressed globose, 140-200 µm in diameter, apically ostiolate. Wall hardly developed, composed of flattened cells, firmly connected with the host tissue, darker around the pore. *Conidia* one-celled, broadly ellipsoidal or ovoidal, 7-11 x 5-7*µm,* surrounded by a thick slime layer, containing numerous coarse guttules. An apical appendage is not mentioned.

Phyllostictina ericae Höhnel → *Phyllosticta pyrolae.*

Phyllostictina euphorbiae Petrak → *Phyllosticta ghaesembillae.*

Phyllostictina evernia Syd. - Annls mycol. *35:*234. 1937 → **Phyllosticta evernia** (Syd.) van der Aa, comb. nov. Host plant: *Garcinia livingstonii* (Guttiferae).
No material could be obtained. According to the description the fungus is *a Phyllosticta* with reddish brown, later pale leaf spots, sharp in outline. Pycnidia single or in rows, depressed, 100-i50 µm in diameter, slightly papillate. Wall 12-20 µm, but up to 5 0 µm thick in the upper part, composed of thin-walled, isodiametrical or irregular, greyish-black cells, 6-15 µm in diameter. Conidia long-ovoidal, ellipsoidal, rounded at both ends, 9-12 x 4-5 µm. The fungus was accompanied by unripe ascomata and a socalled *Phoma* state, which may represent the *Leptodothiorella* state.

Phyllostictina ghaesembillae (Koorders) Petrak → *Phyllosticta ghaesembillae.*

Phyllostictina glochidii Syd. - Annls mycol. *29: 269.* 1931 → **Phyllosticta glochidii**(Syd.) van der Aa, comb. nov. Host plant: *Glochidion luzonense* (Euphorbiaceae).
Type not known to be in existence. According to Sydow (l.c.), *leaf spots* are red-brown, sharp in outline. *Pycnidia* single, unilocular, globose or somewhat depressed, 60-90 µm in diameter, distinctly papillate, with a 8-10 µm wide pore. *Wall* one cell (about 5 µm) thick. *Conidia* broadly ellipsoidal, ovoidal or almost globose, 6-8 x 4-6 µm,surrounded by a thick slime layer, containing numerous coarse guttules.
The species differs from other *Phyllosticta* species on Euphorbiaceae by the small conidia and the structure of the pycnidium.

Phyllostictina graminis Ahmad - Biologia, Lahore *17*: 22*.* 1971.
Host plant: Lasiurus hirsutus (Gramineae). No material could be obtained.
It is doubtful whether this species belongs to *Phyllosticta,* since the conidia are described as

‘ellipsoid-oblong or ellipsoid, narrowed towards one or both ends, 6-9 x 3.5-4 µm, hyaline, 1-celled, with a mucilaginous envelope’. [p. 93]

Phyllostictina hamamelidis (Cooke) Petrak & Syd. → *Phyllosticta hamamelidis.*

Phyllostictina hederae Bose & al. → *Phyllosticta concentrica.*

Phyllostictina holstii (P. Henn.) v. Arx →*Phyllosticta zimmermannii.*

Phyllostictina hymanaeae Batista & Vital → *Phyllosticta hymanaeae.*

Phyllostictina hypoglossi (Mont.) Petrak & Syd. →*Phyllosticta hypoglossi.*

Phyllostictina hysterella (Sacc.) Petrak →*Phyllosticta concentrica.*

Phyllostictina ilicicola (Cooke & Ellis) Höhnel → *Phyllosticta concentrica*

Phyllostictina ilicis (Oudem.) Petrak & Syd. → *Phyllosticta concentrica.*

Phyllostictina jambosae Petrak - Sydowia *7*: 406. 1953→ **Phyllosticta jambosicola**van der Aa, nom. nov. [non *Phyllosticta jambosae* Batista & Vital - Boln sec. agric. Pernambuco *19*: 37.1952]. Host plant: *Jambosa* spec. (Myrtaceae).
No material could be obtained. According to Petrak (l.c.), pycnidia are 160-250 µm in diameter, distinctly papillate, with an approximately 10 µm wide pore. Wall about 12 µm thick and composed of irregular or isodiametrical cells, 5-10 µm in size. Conidia ovoidal or ellipsoidal, 9-13 x 6-7.5 µm, surrounded by a 0.5 µm thick slime layer and containing numerous guttules.

Phyllostictina kobus (P. Henn.) Petrak →*Phyllosticta concentrica.*

Phyllostictina linderae (Miura) Petrak & Syd. →*Phyllosticta phanerura.*

Phyllostictina loranthi Ponnappa →*Phyllosticta loranthi.*

Phyllostictina mangiferae Batista & Vital →*Phyllosticta anacardiacearum.*

Phyllostictina maxima (Ellis & Everh.) Petrak →*Phyllosticta concentrica.*

Phyllostictina mecranii Petrak & Cif. -Annls mycol. *28:* 416. 1930 →**Phyllosticta mecranii** (Petrak & Cif.) van der Aa, comb. nov. Host plant: *Mecranium amygdalinum* (Melastomataceae).
No material could be obtained. According to the description, the pycnidia are formed on dark purple, gall-like swellings of the leaf. Pycnidia globose, 120-200 µm in diameter. Wall 2-3 cells (about 10 µm) thick, composed of prismatic or flattened, black-brownish cells, 5-10 µm in diameter. Conidiogenous cells cylindrical, 5-9 x 2-2.5 µm. Conidia one-celled, ovoidal or cylindrical and often elongated, 10-15 x 4.5-7 µm, surrounded by a thick slime layer, containing numerous coarse guttules. [p. 94]
Petrak & Ciferri (l.c.) considered this species to be the conidial state of *Melanops multipunctata* (Wint.) Syd. - Annls mycol. *28*: 88. 1930 = *Physalospora multipunctata* Wint. -Grevillea *15:* 88. 1887 = *Vestergrenia multipunctata* (Wint.) v. Arx & Müller -Amerospore Pyrenom.: 75. 1954 occurring on various Melastomataceae.

Phyllostictina moravica Petrak → *Phyllosticta moravica.*

Phyllostictina morindae Petrak & *Syd.* → *Phyllosticta morindae.*

Phyllostictina murnadensis Ponnappa →*Phyllosticta murnadensis.*

Phyllostictina murrayae Sydow →*Phyllosticta murrayicola.*

Phyllostictina musae (Cooke) Petrak → Phyllosticta musarum.

Phyllostictina musarum (Cooke) Petrak → *Phyllosticta musarum.*

Phyllostictina paederiae Petrak - Acta Horti Gothoburg. 17*:* 149. 1949 → **Phyllosticta paederiae**(Petrak) van der Aa, comb. nov. Host plant: *Paederia scandens* (Rubiaceae).
No material could be obtained; according to the description leaf spots are brown to almost white,

3-7 mm in diameter. Pycnidia on or near the main veins, globose, slightly papillate with a 10-15 µm wide pore. Wall 1-3 cells (6-10 µm) thick, composed of irregularly isodiametrical or flattened, thinwalled, blackish-brown cells. Conidia one-celled, ovoidal, ellipsoidal or almost globose, broadly rounded at both ends, 5-8 x 3,5-5 µm, surrounded by a thick slime layer and containing coarse guttules.

Phyllostictina pallidior (Peck) Petrak *& Syd.* → *Phyllosticta subeffusa.*

Phyllostictina plumbaginis Ponnappa - Mycologia *62:* 395-397.1970 → *Phyllosticta plumbaginicola* Vasant Rao - Publs Inst. Micol. Recife *383:* 6. 1963.Host plant: *Plumbago zeylanica* (Plumbaginaceae).
According to the descriptions given by Ponnappa (l.c.) and Vasant Rao (l.c.), this fungus occurs on typical leaf spots, about 1 cm in diameter. Pycnidia 70-120 µm in diameter. Conidiogenous cells cylindrical, 9.5 x 3.5 µm. Conidia one-celled, obovoidal, short cylindrical or subglobose, 9.25-11.25 x 5.50-7.50 µm according to Ponnappa, but according to Vasant Rao 8.4-10.5 x 5.25-6.3 µm, surrounded by a slime layer and with a distinct apical appendage.

Phyllostictina podophylli (Curt.) Petrak →*Phyllosticta podophylli.*

Phyllostictina pratima Chowdhury - Lloydia *21*: 153. 1958. Host plant: *Premna bengalensis* (Verbenaceae).

No material could be obtained. The conidia are illustrated as ellipsoidal [p. 95] and bi-guttulate, contrary to the description, which is too short for an adequate interpretation of the generic position.

Phyllostictina psidiicola Petrak - Sydowia *7*: 406. 1953 →**Phyllosticta psidiicola** (Petrak) van der Aa, comb. nov. Host plant: *Psidium guajava* (Myrtaceae).
No material could be obtained; according to the description given by Petrak, the pycnidia are 150-200 µm in diameter, slightly papillate, with a 10-12 µm wide pore. Wall thin, composed of cells with a diameter of 5-10 µm. Conidiogenous cells 7-10 x 1-1.5 µm; conidia one-celled, broadly ovoidal, 7-10 x 4-6.5 "in, containing numerous guttules.

Phyllostictina putranjivae Sydow *apud* Petrak & Sydow → *Phyllosticta putranjivae.*

Phyllostictina pyriformis Cash & Watson -*Phyllosticta capitalensis. Phyllostictina pyrolae* (Ellis & Everh.) Petrak → *Phyllosticta pyrolae.*

Phyllostictina raphionacmes Sydow *apud* Petrak & Sydow - Phaeospore Sphaerops.: 202. *1927.* Host plant: *Raphionacme alata* (Asclepiadaceae). Type not known to be in exsistence. Sydow described this species from an immature collection; it may belong to *Phyllosticta.*

Phyllostictina sapotae (Sacc.) Petrak & Syd. - Phaeospore Sphaerops.: 502. 1927 → *Phyllosticta sapotae* Sacc. - Annls mycol. *10*: 312. 1912. *Host plant: Achras sapota* (Sapotaceae).
The type specimen could not be obtained from PAD, but Petrak & Sydow (l.c.) examined it and found the pycnidia measuring seldom over 80 µm in diameter, slightly papillate, with a 12-15 µm wide pore. Wall thin, composed of blackish-brown, thin-walled, irregular or isodiametrical cells, 4-7 µm in size. Conidia broadly ellipsoidal, ovoidal or subglobose, 7-10 x 5-6 µm (Saccardo l.c.: 10-12 x 5.5-6 µm), surrounded by a slime layer, containing numerous coarse guttules.

Phyllostictina serjaniicola Petrak & Cif. -Annls mycol. 30: 295. 1932. → **Phyllosticta serjaniicola**(Petrak & Cif.) van der Aa, comb. nov. Host plant: *Serjania polyphylla* (Sapindaceae).
No material could be obtained. According to Petrak & Ciferri the pycnidia are depressed globose, 90-140 µm in diameter, papillate, with an approximately 10 µm wide pore. Wall about 7 µm thick, composed of olivaceous, irregular or isodiametrical cells, 4-10 µm in size. Conidiogenous cells cylindrical, 4-7 x 2-2.5 µm. Conidia ovoidal, ellipsoidal, rarely subglobose or pyriform, tapering towards the truncate base, broadly rounded apically, 9-12.5 x 6-8 µm, surrounded by a thick slime layer, containing numerous greenish guttules.

Phyllostictina solieri (Mont.) Petrak & Syd. - Phaeospore Sphaerops.: 211. 1927 [p. 96] = *Ascospora solieri* Mont. -Annls. Sci. nat. Bot., Sér. *3, 11:* 4818 49 - *Phoma solieri* (Mont.) Sacc. - Michelia *1:* 525. 1879. Host plants: *Asphodelus microcarpus, A. albus, A. cerasifer* (Liliaceae).
According to Müller (1958) this species is the conidial state of *Didymella asphodeli* Müller - Sydowia *12:*245*.* 1958.
Pycnidia globose, in vivo up to 200 µm, in vitro up to 350 µm in diameter, papillate, with a 20-45 µm wide pore, lined with papillate, hyaline cells. Wall 2-3 cells thick, composed of rounded,

isodiametrical or flattened, brownish cells, 15-24 µm in diameter, very dark and thick-walled around the pore, but hyaline and isodiametrical towards the conidiogenous region. Conidiogenous cells spherical or short cylindrical, forming blastoconidia which are abstricted with a wide or narrow base. Conidia one-celled, cylindrical, seldom somewhat truncate at the base, 13-20 x 5-7.5 µm(on the host plant) or 16-33 x 6.5-10 µm (in pure culture) containing numerous guttules of varying size. This fungus is no *Phyllosticta* and fits best in *Phoma,* where it has already been described as *P. solieri* (Mont.) Sacc.

Material examined

Herbarium specimens:
Phyllostictina solieri, on *Asphodelus albus,* Tessin, 20 May 1956*;* leg. K. H. Rikle (ZT); on *Asphodelus cerasifer,* Massif de la Ste Baume, Pilon, France, 4 June 1959, leg. E. Müller (ZT);on *Asphodelus ramosus,* Su Cologone near Oliena, Sardinia, 4 May 1971, leg. W. Gams, in herb. H. A. v. d. Aa nr. 3031 (CBS).

Living strains:
CBS 375.62,isol. fr. *Asphodelus albus,* Tende, Val Minière, Alpes Maritimes, 26 June 1961, by*E.* Müller.
CBS 499.72, isol. fr. *Asphodelus ramosus,* Sardinia (cf. v. d. Aa nr. 3031).

Phyllostictina sphaeropsoidea (Ellis & Everh.) Petrak → *Phyllosticta sphaeropsoidea.*

Phyllostictina steironematis (Dearness & House) Petrak - Annls mycol. *38:* 257·1940; Sydowia *10*: 303. (1956) 1957 →*Phyllosticta steironematis* Dearness & House - Bull. N. Y. St. Mus.*188:* 38. 1916. Host plant: *Steironema ciliatum (= Lysimachia ciliata)* (Primulaceae).
According to the descriptions given by Petrak (1940 and 1957), Dearness & House (1916) and Seaver (1922), this fungus has to be classified in *Phyllosticta.* It causes small leaf spots. Pycnidia amphigenous, scattered or densely grouped, globose, 70-150 µm in diameter, slightly papillate, with a 6-12 µm wide pore. Wall one cell (5-8 µm) thick, composed of brownish black, irregular cells, 5-15 µm in diameter. Conidia broadly ovoidal, ellipsoidal or subglobose, broadly rounded at either end, 5-8 x 4.5-6 µm or about 5-6.5 µm in diameter, surrounded by a slime layer and containing numerous greenish guttules.

Phyllostictina stigmatophylli Petrak & Cif. -Annls mycol. 30: 296. 1932 → *Phyllosticta stigmatophylli* Chardon -Farlowia *2:*469*.* 1946. Host plant: *Stigmatophyllon lingulatum* (Malpighiaceae). [p. 97]
No material could be studied. The descriptions of both species agree in the main characters. Pycnidia are depressed globose, 100-140 µm in diameter, papillate, with a 8-10 µm wide pore. Wall usually one cell (about 8 µm) thick and composed of greyish to bluish-black cells, 4-10 µm in size. Conidiogenous cells cylindrical, 5-15 x 2 µm. Conidia one-celled, broadly ellipsoidal, ovoidal or subglobose, 7-11 x 5-7.5 µmor 7-8.5 µm in diameter, surrounded by a slime layer, containing numerous coarse guttules.

Phyllostictina subeffusa (Ellis & Everh.) Petrak & Syd. → *Phyllosticta subeffusa.*

Phyllostictina tabernaemontanae Syd. - Annls mycol. *26*: 442. 1928 →**Phyllosticta tabernaemontanae** (Syd.) van der Aa, comb. nov. Host plant: *Tabernaemontana pandacaqua* (Apocynaceae).
No material could be obtained. According to Sydow (l.c.) the pycnidia are 60-100 µm in diameter, papillate, with an irregular pore. Wall 2-3 cells (6-10 µm) thick and composed of irregularly rounded or compressed, thin-walled, olivaceous to blackish-brown cells, 7-12 µm in size. Conidia one-celled, ovoidal or broadly ellipsoidal, 7-12 x 2-7.5 µm, surrounded by a slime layer and containing numerous coarse greenish guttules.

Phyllostictina taxi (Fr.) Wollenweber & Hochapfel → *Phyllosticta concentrica.*

Phyllostictina theicola (Siemaszko) Petrak *apud* Petrak & Syd. - Phaeospore Sphaerops.: 207. 1927 = *Macrophoma theicola* Siemaszko - Acta Soc. Bot. Polon. *1*: 6. 1923[non *Macrophoma theicola* Petch - Ann. R. bot. Gard. Peradeniya *6*: 234. 1917] →**Phyllosticta theacearum** van der Aa, nom. nov. [non *Phyllosticta theicola* Curzi - Atti Ist. bot. Univ. Pavia, Sér. 3, *3*: 63. 1926]. Host plants: *Thea sinensis* and probably other Theaceae.
According to Petrak & Sydow (l.c.) and Petch (1923), leaf spots are red-brown, later pale, sharply delimited. Pycnidia globose, 100-140 µm in diameter, papillate, with a 12-15 µm wide pore. Wall 2-3 cells (10-12 µm) thick, composed of isodiametrical, thin-walled, olivaceous to blackishbrown

cells, 6-12 µmin diameter. Conidiogenous cells short cylindrical, 4-6 x 2-2.5 µm. Conidia one-celled, ovoidal, ellipsoidal or somewhat pyriform, 8-12.5 x 5.5-7 µm, surrounded by a slime layer, containing numerous coarse guttules, with a slimy apical appendage. The ascigerous state is *a Guignardia* species. Several names for this state were discussed by Petch (1923). Kvartskhava (1968) considered it as identical with *Guignardia bidwellii.*

Phyllostictina tinosporae Syd. - Annls mycol. *30:* 11*.* 1932→ **Phyllosticta bombayensis** van der Aa, nom. nov. [non *Phyllosticta tinospora* Gäumann - Bull. Jard. bot. Buitenz., Sér. 3, *2*: 9. 1920]. Host plant: *Tinospora cordifolia* (Menispermaceae).
No material could be obtained. According to Sydow this species occurs on [p. 98] dead leaves. Pycnidia 70-150 µm in diameter, papillate, with an approximately 8 µm wide pore. Wall 1-3 cells (7-12 µm) thick, composed of isodiametrical, olivaceous, thin-walled cells. Conidia one-celled, ovoidal, ellipsoidal or subglobose, 7-11 x 5-6 µm, surrounded by a slime layer, containing numerous fine guttules and one large vacuole. The fungus was accompanied by a spermatial state belonging to *Leptodothiorella.*

Phyllostictina tussilaginis Petrak *apud* Petrak & Syd. - Phaeospore Sphaerops.: 207. 1927 →*Stagonospora tussilaginis* (Fuckel) Died. - Annls. mycol. *10*: 482. 1912. Host plant: *Tussilago farfara* (Compositae).
On the type specimen numerous unripe fructifications of both the conidial and perithecial states are present. Pycnidia tympaniform, with a conspicuous ring-wall-like structure surrounding the pore. Inner region at first consisting of pseudoparenchymatous cells, which easily separate, then resembling conidia of *Phyllosticta.* On another collection, identified by Petrak, and several freshly collected specimens the complete development could be studied. The identity of the ascigerous state is not yet known. Perithecial initials collected during winter and the following spring on dead leaves never matured. Those on almost decayed leaves, collected in May and June were in the same stage of developement as those on living leaves.

Material examined:
Phyllostictina tussilaginis Petrak, in Fl. Bohem. Moray. exs., Sér. 2, 1, Pilze, 43, nr. 2129; on leaves of *Tussilago farfara,* Mähr. Weisskirchen, Sept. 1920, coll. F. Petrak (S); Fungi suecici, on leaves of T. *farfara,* Jämtland, Are, 9 Sept. 1933, coll. A. G. Eliasson, det. F. Petrak (S). Several collections made by the author in the Netherlands and W. Germany; H. v. d. Aa nrs 1792 and 3361 (CBS).

Phyllostictina urenae Syd. - Annls mycol. *37:*237.1939 →**Phyllosticta urenae**(Syd.) van der Aa, comb. nov. Host plant: *Urena lobata* (Malvaceae).
No material could be obtained. According to Sydow the species grows on dead stems with single or clustered, somewhat depressed pycnidia, 90-160 µm in diameter, papillate, with a 10-15 µm wide pore. Wall several cells thick, composed of irregular or isodiametrical, olivaceous to black-brownish, thin-walled cells, about 5-15 µm in size. Conidia one-celled, ovoidal, ellipsoidal or subglobose, 7-12 x 5-7 µm or about 7 µm in diameter, surrounded by a thick slime layer, containing numerous fine guttules. The fungus was accompanied by perithecial initials of a *Guignardia* (according to Sydow a *Melanops* spec.).

Phyllostictina uvicola (Berk. & Curt.) Höhnel → *Phyllosticta ampelicida.*

Phyllostictina vaccinii (Earle) Shear →*Phyllosticta vaccinii.*

Phyllostictina vaccinii Demaree & Wilcox → *Phyllosticta vaccinii.* [p. 99]

Phyllostictina villaresiae (Syd.) Syd. apud Petrak & Sydow - Phaeospore Sphaerops.: 208. 1927 = *Macrophoma villaresiae* Syd. - Annls mycol. *15:*147.1917→**Phyllosticta villaresiae**(Syd.) van der Aa, comb. nov. Host plant: *Villaresia congonha* (Icacinaceae).
No material could be obtained. According to Sydow the pycnidia are single or clustered, globose or pyriform, 180-350 µm in diameter, distinctly papillate, with a round pore. Subepidermal stroma well developed. Wall several cells (15-70 µm) thick, composed of blackish-brown cells, 4-7 µm in size. Conidiogenous cells cylindrical, 5-8 x 2-3 µm. Conidia ovoidal, ellipsoidal, with a truncate base, broadly rounded apically, 10-15 x 7-8.5 µm*,* containing numerous coarse guttules. The fungus was accompanied by an unripe ascigerous state, belonging to *Guignardia* (according to Sydow a *Physalospora).*

Phyllostictina viticola (Berk. & Curt.) Petrak →*Phyllosticta ampelicida.*

Acknowledgements

The author is much indebted to all those who contributed to this study by collecting material and by kindly making available herbarium specimens in their keeping. He wishes to express his gratitude to Dr. J. A. von Arx for constant interest, help and criticsm and to Prof. Dr. K. Verhoeff for numerous comments and suggestions. He is much obliged to Dr. W. Gams for friendly and indispensable help in preparing the manuscript and very grateful to Mrs M. Rumonder-Hüner for the accurarcy with which she inked the drawings. Dr. R. W. Warren is acknowledged for correcting the English text.

11. References

Aa, H. A. van der & Kesteren, H. A. van, 1971 - The identity of Phyllosticta destructiva Desm. and similar Phoma-like fungi described from Malvaceae and Lycium halimifolium. - Acta bot. neerl. *20*: 552-563.

Allescher, A., 1898 - In Rabenhorsts Kryptogamenflora: Die Pilze Deutschlands, Oesterreichs and der Schweiz, Abt. *6.* Fungi imperfecti: hyalin-sporige Sphaerioideen, 1. Lieferung: 1-320.

Arnaud, G. & M., 1931 - Traité de la pathologie végétale *1.* 993 pp. - P. Lechevalier & Fils, Paris.

Arx, J. A. von, 1949 - Beiträge zur Kenntnis der Gattung Mycosphaerella. - Sydowia *3*: 28-100.

Arx, J. A. von, 1957 - Revision der zu Gloeosporium gestellten Pilze. - Verb. K. ned. Akad. Wet., Afd. Natuurk., Reeks 2*, 61,* 3: 1-153.

Arx, J. A. von, 1963 - Revision der zu Gloeosporium gestellten Pilze. Nachträge and Berichtigungen. - Proc. K. ned. Akad. Wet., Sect. *C, 66:* 172-182.

Arx, J. A von, 1970 - A revision of the fungi classified as Gloeosporium. 203 pp. - J. Cramer, Lehre.

Arx, J. A. von & Müller, E., 1954 - Die Gattungen der amerosporen Pyrenomyceten. - Beitr. KryptogFl. Schweiz *11*, 1: 434.

Barr, M. E., 1970 - Some amerosporous ascomycetes on Ericaceae and Empetraceae. - Mycologia *62*: 377-394.

Barr, M. E., 1972 - Preliminary studies on the Dothideales in temperate North America. - Contrib. Univ. Michigan Herb. *9*: 523-638.

Boerema, G. H., 1970 - Additional notes on Phoma herbarum. - Persoonia *6*: 15-48.

Boerema, G. H. & Dorenbosch, M. M. J., 1970 - On Phoma macrostomum Mont., an ubiquitous species on woody plants. - Persoonia *6:* 49-58.

Boerema, G. H. & Höweler, L. H., 1967 - Phoma exigua and its varieties. - Persoonia *5*: 15-28.

Bose, S. K., Roy, A. J. & Jain, V. B., 1970 - A new leaf spot disease of ivy, caused by Phyllostictina hederae. - Prog. Hortic. *2*: 74-77

Brewer, J. G. & Boerema, G. H., 1965 - Electron microscope observations on the development of pycnidiospores in Phoma and Ascochyta spp. - Proc. K. ned. Akad. Wet., Sect., C, *68*: 86-97.

Brodrick, H. T. & Rabie, C. J., 1970 - Light and temperature effects on symptom development and sporulation of Guignardia citricarpa, on Citrus sinensis. - Phytophylactica *2*: 157-164.

Byzova, Z. M., Vasyagina, M. P., Deeva, N. G., Kalymbetov, B. K., Pisareva, N. F. & Shwartsman, S. R., 1967 - Flora sporovykh Rastenij Kazakhstana, Tom 5: Nesovershennye Griby Fungi imperfecti (Deuteromycetes) I, Sferopsidnye - Sphaeropsidales. 340 pp. - Izd. 'Nauka' Kazakhskoj SSR, Alma-Ata.

Caltrider, P. G., 1961 - Growth and sporulation of Guignardia bidwellii. - Phytopathology *51*: 860-863

Carpenter, C. W., 1919 - Banana freckle or black spot disease. - Rep. Hawaii agric. Exp. Stn *1918*: 36-40.

Cash, E. K. & Watson, A. J., 1955 - Some fungi on Orchidaceae. - Mycologia *47*: 729-747.
Darnell-Smith, G. P., 1919 - An account of some observations upon the life-history of Phoma citricarpa McAlp. - Proc. Linn. Soc. N. S. W. *43*: 868-882.
Davis, B. H., 1946 - Guignardia rhodorae, the perfect stage of Phyllosticta maxima on Rhododendron. - Mycologia *38:* 40-51.
Dearness, J., 1924 - New and noteworthy fungi III. - Mycologia *16:* 143-176.
De Candolle, A. P. & Lamarck, J. de, 1805 - Flore française *2*. - Librairie Desray, Paris.
De Candolle, A. P. & Lamarck, J. de, 1815 - Flore française *6*. - Librairie Desray, Paris.
Demaree, J. B. & Wilcox, M. S., 1947 - Fungi pathogenic to blueberries in eastern United States. - Phytopathology *37*: 487-506.
Desmazières, M. J. B. H. J., 1847 - Quatorzième notice sur les plantes cryptogames recemment découvertes en France. - Annls Sci. nat., Bot., Sér. 3, *8*: 9-37.
Dias, M. R. de Sousa & Camara, E. de Sousa da, 1952 - Fungi lusitaniae I. - Agron. lusit. *14*: 101-125.
Dias, M. R. de Sousa & Camara, E. de Sousa *da,* 1954 - Fungi lusitaniae VII. - Agron. lusit. *16*: 5-15.
Diedicke, H., 1915 - Pilze VII, Sphaeropsideae, Melanconieae. - KryptFl. Mark Brandenburg *9*. 962 pp. - Borntraeger, Leipzig.
Dodge, B. O., 1923 - Origin of the central and ostiolar cavities in pycnidia of certain fungous parasites. - J. agric. Res. *23:* 743-761.
Dodge, B. O., 1931 - A further study of the morphology and life history of the rose black spot fungus. - Mycologia *23*: 446-462.
Donk, M. A., 1964 - Nomina conservanda proposita. I. Proposals in Fungi, Deuteromycetes. - Regnum veget. *34*: 7-15.
Donk, M. A., 1968 - Report of the committee for Fungi and Lichens 1964-1968. - Taxon *17*: 578-581.
Fawcett, H. S. & Lee, H. A., 1926 - Citrus diseases and their control. 582 pp. – McGraw Hill, New York.
Fragoso, R. G. & Ciferri, R., 1927 - Hongos parasitos y saprophytos de la Republica Dominicana. - Publnes Estac. agron. Moca, Sér. B, Bot. *8*:1-99.
Fries, E. M., 1823 - Systema mycologicum 2. 621 pp. - Lund.
Funk, A., 1964 - Botryosphaeria tsugae n. sp., causing dieback of western hemlock in British Columbia. - Can. J. Bot. *42*: 769-775.
Gäumann, E., 1964 - Die Pilze. 541 pp. - Birkhäuser, Basel.
Gilman, J. C. & Archer, W. A., 1929 - The fungi of Iowa parasitic of plants. - Iowa St. Colt. J. Sci. *3*: 299-507
Grove, W. B., 1935 - British stem-and leaf-fungi (Coelomycetes) 1. 488 pp. – University Press, Cambridge.
Guba, E. M., 1925 - Phyllosticta leaf spot, fruit blotch and canker of the apple, its etiology and control. - Bull. Ill. agric. Exp. Stn *256:* 480-557.
Halsted, B. D., 1889 - Some fungus diseases of the Cranberry. - Bull. N. J. St. agric. Exp. Stn *64*: 1-39.
Higgins, B. B., 1920 - Morphology and life history of some ascomycetes with special references to the presence and function of spermatia I. - Am. J. Bot. *7*: 435-444.
Higgins, B. B., 1929 - do, II. - Am. J. Bot. *16*: 287-296.
Higgins, B. B., 1936 - do, III. - Am. J. Bot. *23*: 598-602.
Höhnel, F. von, 1918a - Über Laestadia, Carlia und Guignardia. - Annls mycol. *16*: 46-60.
Höhnel, F. von, 1918b - Fungi imperfecti, Beiträge zur Kenntnis derselben. – Hedwigia *60*: 129-209.
Höhnel, F. von, 1920a - Mykologische Fragmente 315-333. - Annls mycol. *18:* 71-97.
Höhnel, F. von, 1920b - Fungi imperfecti, Beiträge zur Kenntnis derselben. – Hedwigia *62*: 56-89.
Höhnel, F. von, 1923 - System der Fungi imperfecti Fuckel. - Falck, R., Mykologische Untersuchungen und Berichte *1*: 301-369.
Katumoto, K., 1965 - Notes on fungi from Western Japan. - J. Jap. Bot. *40*: 193-198.
Kendrick, B. (Editor), 1971 - Taxonomy of the Fungi imperfecti. 309 pp. - Univ. Toronto Press, Toronto and Buffalo.

Kickx, J., 1849 - Recherches pour servir à la flore cryptogamique des Flandres, Cent. 4. - Mém. Acad. R. Sci. Lett. Arts Belg. *23:* 22.
Kiely, T. B., 1948 - Preliminary studies on Guignardia citricarpa n. sp. the ascigerous stage of Phoma citricarpa McAlp. and its relation to black spot of Citrus. - Proc. Linn. Soc. N. S. W. *73*: 249-292.
Kiely, T.B., 1949 - Black spot of Citrus. - Agric. N. S. W. *60*: 17-20.
Klebahn, H., 1918 - Haupt- und Nebenfruchtformen der Askomyzeten. 395 pp. - Borntraeger, Leipzig.
Kvartskhava, P. A., 1968 - The identity of some representatives of the genus Guignardia and their imperfect stages in subtropical Gruziya. - Materialy III Zakavkazskoi Konf. spor. Rast., Tbilisi: 114-117.
Lanjouw, J. & Stafleu, F. A., 1964 - Index herbariorum, part 1. The herbaria of the world. - Regnum veget. *31*: 1-251.
Lewis, D. E., 1913 - The control of apple blotch. - Bull. Kansas St. agric. Exp. Stn *196:* 521-574
Lucas, M. T., 1956 - Fungi lusitaniae 14. - Agron. lusit. *18*: 109-122.
Luttrell, E. S., 1946 - Black rot of Muscadine Grapes. - Phytopathology *36:* 905-924.
Luttrell, E. S., 1948 - Physiologic specialisation in Guignardia bidwellii, cause of black rot of Vitis and Parthenocissus species. - Phytopathology 38: 716-723.
MacAlpine, D., 1899 - Fungus diseases of Citrus in Australia and their treatment. 132 pp. - Agric. Dept. Victoria, Melbourne.
Migula, W., 1921 - Kryptogamen-Flora von Deutschland, Deutsch-Osterreich und der Schweiz, 3, Pilze, 4, Abt. 1, Fungi imperfecti: Sphaeropsidales, Melanconiales. 614 pp. - Bermühler, Berlin.
Morgan Jones, G., 1971 - Conidium ontogeny in Coelomycetes I, some amerosporous species which possess annellides. - Can. J. Bot. *49*: 1921-1929.
Morgan Jones, G., Nag Raj, T. R. & Kendrick, B., 1972 - Icones generum coelomycetum I-V. - Univ. Waterloo, Biol. Sér. 3-7.
Müller, E., 1957 - Haupt- und Nebenfruchtformen bei Guignardia Viala et Ravaz. - Sydowia, Beih. *1*: 210-224.
Müller, E., 1958 - Ober die Hauptfruchtform von Phyllostictina solieri (Mont.) Petrak et Syd. - Sydowia *7*: 244-246.
Müller, E. & Arx, J. A. von, 1955 - Einige Beiträge zur Systematik und Synonymie der Pilze. - Phytopath. Z. *24*: 353-372.
Neely, D., 1971 - Additional Aesculus species and subspecies susceptible to leaf blotch. - Pl. Dis. Reptr 55: 37-38.
Neely, D. & Himelick, E. B., 1963 - Aesculus species susceptible to leaf blotch. - Pl. Dis. Reptr *47*: 170.
Ocfemia, G. 0., 1927 - Macrophoma musae (Cke) Berl. & Vogl. and Phoma musae Carpenter. - Philipp. Agric. *15*: 467-469.
Oudemans, C. A. J. A., 1919 - Enumeratio systematica Fungorum *1*. 1230 pp. - M. Nijhoff, Den Haag.
Pande, A. K., 1969 - The genus Guignardia from Maharashtra. - Sydowia *22:* 366-368.
Parmelee, J. A., 1958 - Some foliicolous fungi of the Pyrolaceae. - Can. J. Bot. *36:* 865-881.
Persoon, C. H., 1818 - Traité sur les champignons comestibles, contenant l'indication des espèces nuisibles précédé d'une introduction á l'historie des Champignons. - Paris.
Petch, T., 1923 - The diseases of the Tea bush. 220 pp. - MacMillan & Co, London.
Petrak, F., 1927 - Mykologische Notizen 9. - Annls mycol. *25*: 193-343.
Petrak, F., 1934 - Mykologische Notizen 12. - Annls mycol. *32*: 317-447.
Petrak, F., 1940 - Mykologische Notizen 13. - Annls mycol. *38:* 181-267.
Petrak, F., 1957 - Ober ein verheerendes Auftreten der Blattrollkrankheit der Rosskastanien in der südlichen Steiermark. - Sydowia *10* (1956): 264-270.
Petrak, F., 1958 - Ober die Gattungen Guignardia Viala & Ravaz und Discosphaerina v. Höhnel. - Sydowia *11* (1957) 435-445.
Petrak, F., 1963 - Mykologische Beiträge zur Österreichischen Flora. - Sydowia *16* (1962): 155-198.
Petrak, F., 1968. - Ergebnisse einer Revision der Grundtypen verschiedener Gattungen

der Askomyzeten und Fungi imperfecti. - Sydowia *21* (1967): 240-248.
Petrak, F. & Sydow, H., 1927 - Die Gattungen der Pyrenomyzeten, Sphaeropsideen und Melanconieen. 1. Die Phaeosporen Sphaeropsideen und die Gattung Macrophoma. - Reprium Spec. nov. Regni veget., Beih. *42*: 1-551.
Prillieux, E., 1895 - Maladies des plantes agricoles. 592 pp. - Firmin-Didot et Cie., Paris.
Reddick, D., 1911 - The black rot disease of Grapes. - Bull. Cornell Univ. agric. Exp. Stn *293:* 289-364.
Reinking, O. A., 1918 - Philippine economic plant diseases. - Philipp. J. Sci. Sect. A, *13*: 165-274.
Reinking, O. A., 1919 - Host index of diseases of economic plants in the Philippines. - Philipp. Agric. *8*: 38-54.
Reusser, F. A., 1964 - Ober einige Arten der Gattung Guignardia Viala et Ravaz. - Phytopath. Z. *51:*205-240
Roberts, J. W., 1921 - Plumblotch, a disease of the Japanese Plum, caused by Phyllosticta congesta Heald & Wolf. - J. agric. Res. *22:* 365-370.
Roberts, J. W., 1923 - Plumblotch. - Phytopathology *13:* 461-462.
Roze, M. E., 1898 - Quel est le nom scientifique á donner au black rot? - Bull. Soc. mycol. Fr. *14: 24-26.*
Saccardo, P. A., 1878 - Fungi Veneti novi vel critici, Series 7. - Michelia *1*: 133-221.
Saccardo, P. A., 1884 - Sylloge Fungorum *3*. 860 pp. - Padova.
Saccardo, P. A., 1913 - Notae mycologicae, Ser. 16. - Annls mycol. *11:* 312-325.
*Saccas, A. M.,1*953 - Les principales maladies cryptogamiques de l'Hevea en A. E. F. (fin). - Agron. trop. *8*: 229-285.
*Sawada, K., 1*959 - Descriptive catalogue of Taiwan (Formosan) fungi, 11. - Spec. Publ. Coll. Agric. Taiwan *8:* 1-268.
Schneider, R., 1961 - Das Auftreten der Guignardia-Blattbräune der Rosskastanie in West-Deutschland. - NachrBl. dt. PflSchutzdienst Stuttg. *13*: 188-189.
Schüepp, H., 1961 - Untersuchungen über Guignardia citricarpa Kiely, den Erreger der Schwarzfleckenkrankheit auf Citrus. - Phytopath. Z. *40*: 258-271.
Schwarze, C. A., 1917 - The parasitic fungi of New Jersey. - Bull. N. J. St. agric. Exp. Stn *313:* 1-226.
Scot, W. M. & Rorer, J. B., 1909 - Apple blotch, a serious disease of southern orchards. - Bull Bur. Pl. Ind. U. S. Dep. Agric. *144*: 1-28.
Seaver, F. J., 1922 - North American Flora *6*, 1: Phyllostictales, Phyllostictaceae. - Reprint, Stechert-Hafner, New York, 1961.
Shear, C. L., 1905 - Fungous diseases of the Cranberry. - Fmrs' Bull. U.S. Dep. Agric. *22:* 1-16.
Shear, C. L., 1907a - New species of fungi. - Bull. Torrey bot. Club *34*: 305-317.
Shear, C. L., 1907b - Cranberry diseases. - Bull. Bur. Pl. Ind. U. S. Dep. Agric. *110*: 1-64.
Shear, C. L., Miles, G. F. & Hawkins, L. A., 1909 - The control of black-rot of the grape. - Bull. Bur. Pl. Ind. U. S. Dep. Agric.*155*: 1-42.
Shear, C. L., Stevens, N. E. & Bain, H. F., 1931 - Fungous diseases of the cultivated Cranberry. - Techn. Bull. U. S. Dep. Agric. *258:* 1-58.
Shear, C. L., Stevens, N. E. & Wilcox, M. S., 1924. - Botryosphaeria and Physalospora on currant and apple. - J. agric. Res. *28*: 589-598.
Shear, C. L., Stevens, N. E. & Wilcox, M. S., 1925 - Botryosphaeria and Physalospora in the eastern United States. - Mycologia *17*: 98-107.
Stafleu, F. A. (Editor), 1972 - International code of botanical nomenclature. – Regnum veget. *82*: 1-426.
Stevens, N. E., 1925 - The life history and relationships of Diplodia gossypina. - Mycologia *17*: 191-201.
Steward, V. B., 1916 - The leaf blotch disease of Horse-Chestnut. - Phytopathology *6*: 5-19.
Stover, R. H., 1972 - Banana, Plantain and Obaca diseases. 316 pp. – Commonwealth mycological Institute, Kew, Surrey.
Subramanian, C. V., & Reddy, K. R. C., 1973 - Studies in Phyllostictina Sydow and other related taxa. - Abstr. Intern. Symp. Taxon. Fungi, Jan. 1973, Madras: 41-42.

Sutton, B. C., 1964 - Phoma and related genera. - Trans. Br. mycol. Soc. *47:* 497-509.
Sutton, B. C., & Sandhu, D. K., 1969 - Electron microscopy and conidium development and secession in Cryptosporiopsis sp., Phoma fumosa, Melanconium bicolor and M. apiocarpum. - Can. J. Bot. *47*: 745-749.
Sydow, H., 1926 - Fungi in itinere costaricensi collecti, pars secunda. - Annls mycol. *24*: 283-426.
Sydow, H., 1932 - Novae fungorum species XXI. - Annls mycol. *30:* 91-117.
Sydow, H. & Butler, E. J., 1916 - Fungi Indiae orientalis, pars V. - Annls mycol. *14*: 177-220.
Sydow, H. & Petrak, F., 1928 - Micromycetes philippinenses, series prima. - Annls mycol. *26*: 414-446.
Sydow, H. & Petrak, F., 1931 - Micromycetes philippinensis, series secunda. Annls mycol. *29: 545-279.*
Viala, P. & Pacottet, P., 1904a - Black rot, 1. Sur la culture du black rot. 11 pp. - Bureaux de la Revue Vitic., Paris.
Viala, P. & Pacottet, P., 1904b - Black rot, 2. Sur le developement du black rot. 17 pp. - Bureaux de la Revue Vitic., Paris.
Viala, P. & Pacottet, P., 1912 - Les chlamydospores du black rot. – Annls Sci. agron. fr. *1*: 3-14.
Wager, V. A., 1952 - The black spot disease of Citrus in South Africa. - Sci. Bull. Dep. Agric. For. Un. S. Aft. 303: 1-52.
Wardlaw, C. W., 1935 - Diseases of the Banana and Manila Henp plant. 615 pp. - MacMillan & Co., London.
Weir, J. R., 1926 - A pathological survey of the para-rubber tree (Hevea brasiliensis) in the Amazone valley. - Dep. Bull. U. S. Dep. Agric. *1380:* 1-130.
Wollenweber, H.W. & Hochapfel, H., 1936 - Beiträge zur Kenntnis parasitärer and saprophytischer Pilze, I. Phomopsis, Dendrophoma, Phoma and Ascochyta and ihre Beziehung zur Fruchtfäule. - Z. ParasitKde *8*: 561-605.
Wollenweber, H. W. & Hochapfel, H., 1937 - do, IV. Coniothyrium and seine Beziehung zur Fruchtfäule. - Z. ParasitKde *9*: 600-637.
Wollenweber, H. W. & Hochapfel, H., 1941 - do, V. Diplodia und ihre Beziehung zur Fruchtfäule. - Z. ParasitKde *12:* 165-250.
Yates, H. S., 1918 - Fungi from British North Borneo. - Philipp. J. Sci. *13*: 233-240
Yen, Jo-Min, 1972 - Etude sur les champignons parasites du Sud-Est Asiatique. XVII. Maladies des taches foliaires des Bananiers provoquées, á Formose, par deux nouveaux champignons III. Bull. Soc. mycol. Fr. *88:* 221-225.