

PHYLLACHORA AS THE CAUSE OF A DISEASE OF CORN, AND A GENERAL CONSIDERATION OF THE GENUS PHYLLACHORA

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During the summer of 1915, F. L. Stevens noted in Porto Rico, the occurrence of an apparently undescribed disease of corn, which was widespread and was found in almost every field examined. To what extent crops are damaged by the disease is not known, but since the fungus attacks the leaves of corn before the grain is mature, and since the leaf may be infected to such extent that ten per cent of its area is destroyed, considerable damage must result from the presence of the fungus. The present study is based entirely on herbarium material collected in 1915, and all efforts to culture the fungus have given negative results.

THE DISEASED SPOTS

The disease appears as well defined, conspicuous, sub-carbonaceous spots, averaging about 1.2 mm. in diameter, and slightly roughened on the surface. A sharp line of demarcation separates the healthy from the diseased tissue. The infection is local and so far as observed is confined to the leaf and the leaf sheaths. The spots, due to the formation of fungous stromata in the infected tissue, are scattered irregularly over the entire leaf and are visible from both upper and lower surfaces. They usually are larger and more conspicuous on the upper surface. In form they are round or elongated and have an irregular margin. The stromata tend to grow along a vein, sometimes to a distance of a cm. or more, although the more characteristic spot is round to ovate. The spots are small and numerous or comparatively large and sparsely distributed, and in either case are usually surrounded by a narrow yellowish-brown halo which is more evident on the under side of the leaf.

A fungus which appeared to be *Scolecotrichum graminis* was commonly present on the Porto Rican specimens. This fungus causes dark spots due to dense mycelium and olive brown conidia and is surrounded by a conspicuous light brown halo. When spots due to the disease which is the subject of

this paper are in the centers of light brown apparently sunburnt areas the two diseases are very similar in appearance.

STROMATA

The first indication of the disease is a slight discoloration at the point of infection. The mycelium, which is at first hyaline, very soon develops an amber-yellow color, the contents of the invaded cells disorganize and the infection becomes evident through the color changes, even when a very few cells are involved. The fungus enters the epidermal cells and shows a tendency to grow close to the inside of the walls of these cells. From the epidermal region it proceeds into the mesophyll where it reaches its greatest development. Here the mycelium becomes dense and the host cells broken down. Perithecial cavities form in this region, and a dense mass of mycelium fills the epidermal cells which were not at first destroyed by the fungus, thus forming an incrustation over the stroma. In the development of the stromata the perithecia form earlier than this covering, and at one stage of the development the perithecia are conspicuous under low magnification with transmitted light. The perithecia which in the specimens examined, varied in number from two to thirty in a single stroma, occur either loosely scattered or so closely compacted that the walls coalesce, forming a dense stromatic mass which encloses the perithecia. In a transverse section of the leaf the perithecia occupy a medial position and the stromata usually fill the leaf tissue from one surface to the other before perithecia are formed.

There is considerable variation in size, form, and distribution of the stromata. Mature perithecia were seen in stroma as small as 0.2 mm. in diameter. An area of one hundred and ninety-five square centimeters contained nine large stromata with irregular margins, while a similar area contained eighty-one that were small, round, and regular in outline. The stromata are surrounded by yellowish-brown infected areas forming halos which are usually very narrow but may reach a width of one-third the diameter of the stromata and are generally a little more conspicuous on the under than on the upper side of the leaf.

MYCELIUM

The mycelium in newly invaded tissue is slender and hyaline. In the course of development it becomes amber-yellow and later dark-brown, filling the leaf tissue with a net-work of hyphae, which encloses in its meshes what remains of the broken down host cells. The mycelium is septate and branched, although not profusely so. It varies in thickness from 1.5μ to 4.5μ and in a later stage of development sometimes forms short and comparatively thick, irregularly shaped cells.

PERITHECIA

The perithecia are embedded in the stromata and consist of immersed cavities, subglobose or angled by mutual pressure. They are scattered in the stromata or closely aggregated, thirty being the maximum number in a single stroma. An apparent wall surrounds the loculus made up of dark brown mycelium and bearing at the tip a small ostiole. The ostiole is usually concealed by the epidermis. The perithecia open on both upper and lower surfaces of the leaf, contiguous ones in the same stroma sometimes have the ostiole on opposite surfaces of the leaf. The diameter of the perithecia parallel with the surface of the leaf varied from 171μ to 352μ . The vertical diameter of the perithecia is much greater than the length of the ascii, since they reach up into the perithecial cavity only to about one-third of its height. Long paraphyses extend from the base toward the center of the cavity.

ASCI

The ascii are numerous. They are cylindrical and vary in length from 64.8μ to 91.8μ , and in thickness from 7.2μ to 10.8μ , with a stipe 9μ to 20μ in length.

PARAPHYSES

Copious paraphyses are present extending far beyond the ascii as they sometimes reach a length of 125μ . They are filiform or attenuate from a somewhat thickened base.

SPORES

In each ascus are produced eight unicellular, hyaline, thin-walled spores. They are ovate in form with round ends and vary in length from 7.2μ to 12μ and in thickness from 4.5μ to 7.2μ . Usually they are uniserial but there are occasional exceptions to this arrangement when the ascus is relatively short and the spores biseriate. Stained microtome sections show a very prominent nucleus.

The fungus is obviously of the Dothidiaceae and has been identified by the writer as *Phyllachora graminis* (Pers.) Fuck. which is found on many grasses in this country but has not been reported on corn. It conforms with the description of *Phyllachora graminis* in Saccardo's "Sylloge Fungorum,"¹² and with the description by Winter¹⁵, Lindau¹⁶, Ellis and Everhart¹, and Sydow and Theissen¹³. Boltshauser⁹ describes *P. graminis* as having numerous, small stromata in living tissue and a few relatively large stromata in brown, dead leaves. This variation in the appearance of the stroma, from small and numerous to large and relatively few in number, is not considered by Sydow and Theissen of any importance in classification.

In my specimens the position of the asci in the perithecia does not conform to the description of *P. graminis* by Fuckel¹ or by Müller¹⁴, the former claims that the asci grow from the base of the perithecia, the latter that they form an equatorial ring in the shape of a girdling band around the center of the perithecia. My specimens have the asci developing from the base and from the inner basal circular surface, up to about half the interior of the perithecia with the free ends extending toward the center. Microtome sections were made for comparison from available exsiccata. Nine specimens, from different hosts, identified as *Phyllachora graminis* were sectioned and examined. Each one had the asci developing similarly to those of the fungus on corn, and this mode of development seems to be constant. Sydow and Theissen¹³ consider the position of the asci in the perithecia to be of specific import and my specimens agree with their description of *P. graminis* in this regard.

A peculiar distention of the basal centers of the perithecia is sometimes described but was not observed in the material

examined. Sydow and Theissen think that this character is evident only in mature material and only at a definite stage of ripening.

The specimens examined have apparently a conspicuous perithecial wall. The Dothidiaceae are generally characterized by perithecia reduced to mere cells in the stromata, but Brefeld¹ says, "Phyllachora is unusual in that it has a definite perithecial wall." Ellis and Everhart² call the perithecia in *Phyllachora graminis* "ascigerous cells." Jaczewski³ illustrates *P. graminis* by a drawing in which no perithecial wall is shown but in the descriptions of *P. graminis* by Winter⁴, Lindau⁵, Frank⁶, Brefeld¹, and by Kirchner-Boltshauser⁷, a definite perithecial wall is mentioned. Sydow and Theissen⁸ explain the apparent presence of a perithecial wall by the fact that the function of the lacking wall is taken over by the inner stromatic surface surrounding the loculi. For this purpose the stromatic elements undergo special orientation which in *P. graminis* takes the form of a thickening and by reason of a darker color due to this thickening an actual perithecial wall is simulated.

The form of the perithecia varies from oval to angular, being modified by pressure during development. Young and old perithecia grow together in the same stroma, and the number in a single stroma has been considered as a specific character only in extreme cases in the Phyllachoraceae, although it is regarded as a distinguishing character in the Polystomellaceae.

Spore measurements, of use in systematic diagnosis, vary considerably in the species. The following tabulation gives graphically the spore length of measurements made from exsiccati of *P. graminis* on different hosts. A few other species of *Phyllachora* are included for comparison. The solid line represents the minimum and the entire line the maximum spore strength. Where there are double lines, the upper one represents spore measurements taken from Saccardo's "Sylloge Fungorum."

It is noteworthy that *P. cynodontis* and *P. graminis* have identical spore measurements in the "Sylloge Fungorum." The same spore measurements for these species were obtained from herbarium material. *P. sphaerosperma* has the same maxi-

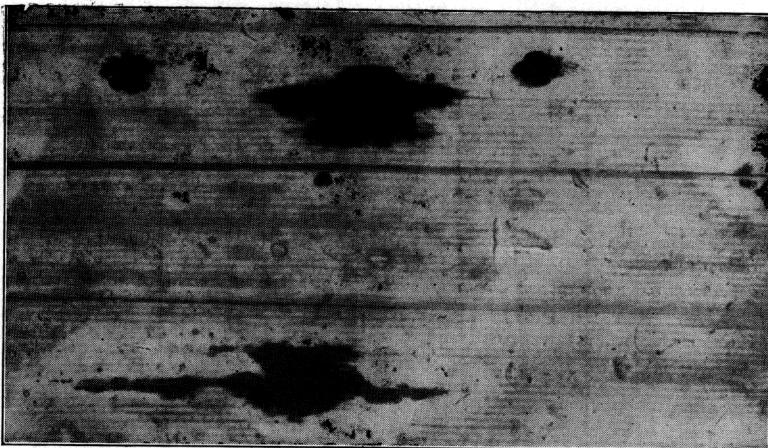


Fig. 2. Portion of leaf of corn showing large scattered stromata

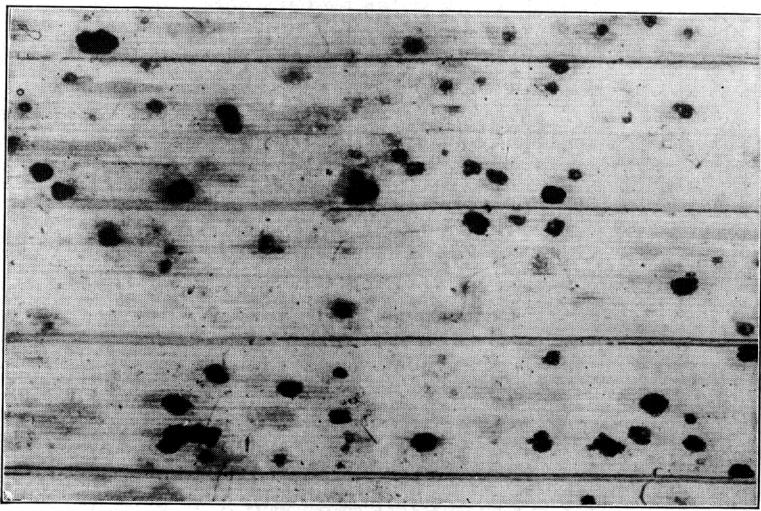


Fig. 1. Portion of leaf of corn showing small aggregated stromata.

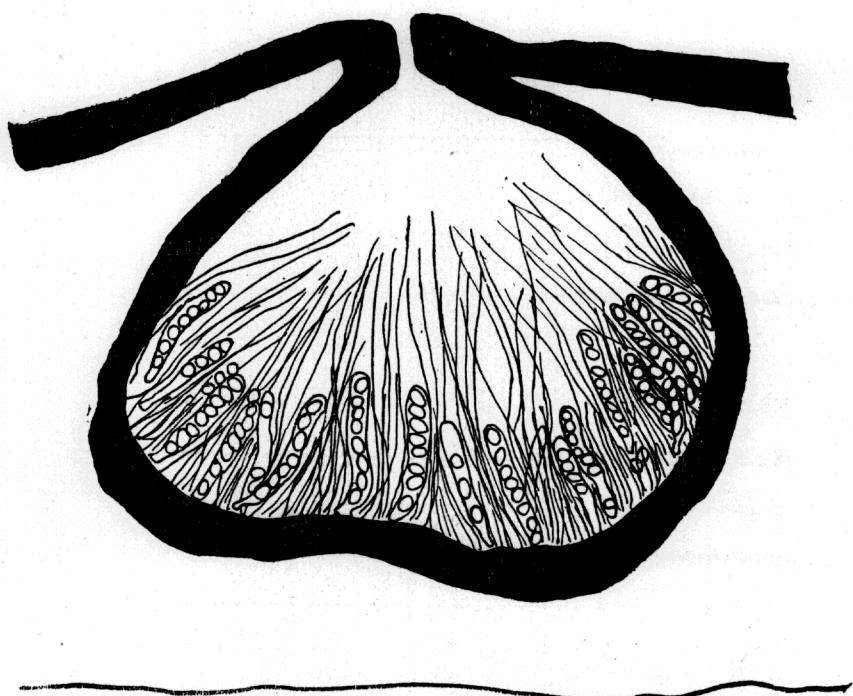


Fig. 3. Perithecia showing position of asci, apparent wall, and clypeus.



Fig. 4. Ascus and paraphyses

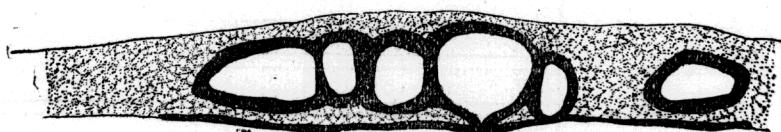


Fig. 5. Perithecia covered by clypeus

mum spore length as *P. graminis*. The measurements for spore length of different specimens of *P. graminis* show as great a variation among themselves as the spore length of *P. graminis* shows when compared with the other five species.

THE SPECIES OF THE GENUS PHYLLACHORA

The determination of the species of this fungus has raised the question of the validity of various of the species now regarded as distinct in the genus *Phyllachora*. For a satisfactory comparison of the species a tabulation was made from Saccardo's "Sylloge Fungorum." The arrangement of this tabulation is in the order of maximum spore length, and the table includes specific name, volume, and specific number of the "Sylloge Fungorum," spore measurements, ascus measurements, the host family indicated by number taken from De Dalla Torro and Harms "Genera Siphonogamarum." The species that are excluded in the revision by Sydow and Theissen are also indicated.

Saccardo lists four hundred and sixty-nine species on eighty-three different host families. A large majority of these are from the tropics. An indication of the very large number given on single families is afforded by the fact that sixty-three species are found on the Gramineae, forty-five on the Leguminosae, twenty-seven on the Moraceae, and twenty on the Compositae. The three species *P. bromi*, *P. maydis*, and *P. graminis* occur on the same host family and are similar in all of the most significant specific characters. It is doubtful if there are sufficient differences here to give these three distinct specific rank.

Of the species listed by Saccardo one hundred and thirty-three were described from immature material without spores and of these nine species were on Gramineae, five on Moraceae, nine on Leguminosae, and nine on Compositae. Such descriptions are, of course worse than valueless.

The presence or absence of paraphyses is regarded as of specific value. Sydow and Theissen even consider this of sufficient systematic importance to be a generic sign. The list by Saccardo, however, contains eighteen species said to be without paraphyses and in the description of two hundred and

fifty-nine species the presence or absence of paraphyses is not mentioned. The stroma does not present sufficient variation to render it of much use for classification. The basis for specific differentiation thus lies chiefly in the character of the asci and spores. There is great variation in size and form of spores. The minimum spore length is 6μ in the species *P. poae*, and the maximum 40μ in *P. dasylirii*. There is also great diversity in spore form since in *P. dolenchogena* the spores are globular, in *P. dentritica* ovate and in *P. lonchotheca* the length of the spore is about six times its width. *P. bum-busina*, *P. stenostoma*, and *P. oxalina* have 1-septate spores, which is an exception to the generic character of continuous spores.

In as many as twenty-five instances two to six species have identical spore measurements. (e. g. *P. astrocaryi*, *P. tropicallis*, *P. bromi*, *P. lagerheimiana*). In some cases species having the same spore measurements are found on the same host family (e.g. *P. asprellae*, *P. pazschkeana*.) In one species only (*P. ficicola*) is there variation from the usual spore number of eight. In this species there are asci having four spores.

In the revision of the genus by Sydow and Theissen¹³ the number of species has been reduced to three hundred and twenty-nine. Form classification based upon the position of the perithecia in the host, fifty-two species have been removed to the genus *Catacauma*, eleven to the Genus *Trabutia* and four to the genus *Bagnisiopsis*, while a large number have been removed to other genera.

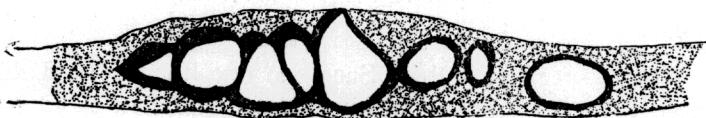


Fig. 6. Perithecia angled by growth pressure.

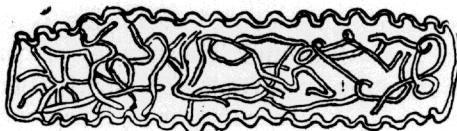


Fig. 7. Mycelium in newly invaded cell.

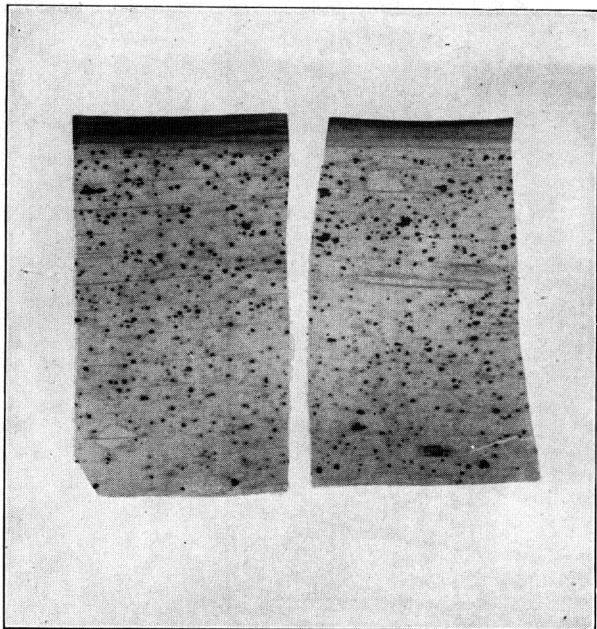


Fig. 9. Upper surface of leaf showing large and small stromata

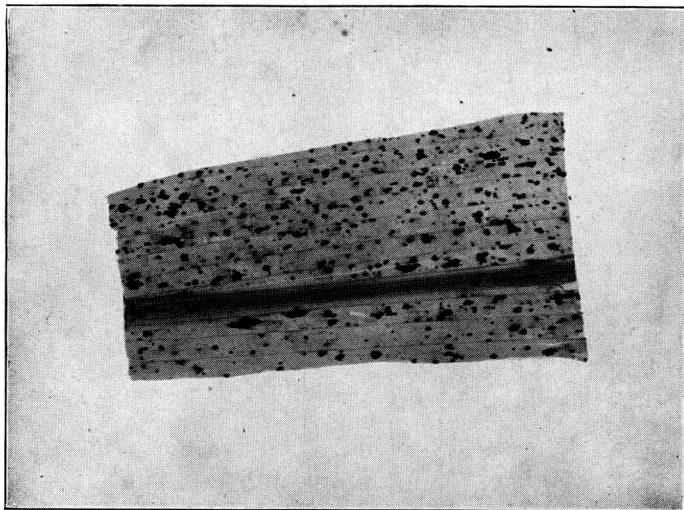


Fig. 8. Upper and lower surface of leaf showing stromata.

**TABULATION OF SPECIES OF PHYLLACHORA FOUND IN
"SYLLOGE FUNGORUM" ARRANGED IN THE ORDER
OF SPORE LENGTH**

The following tabulation is presented with the hope that it may be of service to those who study the genus, or have need to classify species within the genus.

NOTE: Column 1 contains vol. of the "Sylloge Fungorum" in which the species is described, and species number.

Column 2: specific name.

Column 3: spore length and breadth in microns.

Column 4: ascus length and breadth in microns.

Column 5: host family given by number taken from De Dalla Torre and Harm's "Genera Siphonogamarum."

The sign (*) indicates that the species is excluded from the genus Phyllachora by Sydow and Theissen*.

Vol. & specie number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
* 2:5122	euglypta	5=	50=	
2:5136	poae	6=3		19
*17:2910	macrospioniae	6-8=5-6	55-65=9-11	270
1 9:4064	japonica	7-8=4		233
* 2:5120	nitidissima	7-8=2-5		
* 9:4104	leptostromoidea	8=3		.1
22:4718	corallina	8=4	70-80=5-6	137
17:2879	manaosensis	7-9=5-6	45-60=12-18	128
*14:2532	pestis-nigra	8-9=5-6	75-90=8	141
	(var. caracaensis)			
14:2555	topographica	7-10=7-8.5	41-50=12	64
22:4733	parkiae	7-10=5-6	45-70=8-12	128
				19
22:4781	eleusines	8-10=6-7	65-80=6-7	126
17:2885	lungusaensis	8-10=3.5-4	35-40=10-18	128
* 2:5099	millepunctata	8-10=	70=	233
				.1
* 2:5153	pteridis	8-10=5-6	640=14	91
9:4041	balansae	8-10=67	55-60=10-12	140
				145
9:4058	pestis-nigra	8-10=3.5	40-50=10-12	141
				128
*11:2264	frigida	9-10=2.5-3.5	25=20	20
14:2535	desmodii	9-10=6-7	43-46=6-7	128
14:2571	olyrae	9-10=4.5	50=7	19
* 2:5112	ficum	9-10=7-9	45-60=13-18	64
* 2:5144	junci	9-10=3-3.5	60-85=6-7	36
22:4750	globispora	10=10	75-100=10-12	147
9:4103	sphaerospora	10=10	80-100=15	19
9:4090	luzulae	10=5		36
9:4052	melianthi	10=6	60=20	167
9:4047	opaca	10=4-4.5	80-85=6-8	222
9:4033	michelii	10=8-9	90-100=9-10	128
2:5128	tragiae	10=		147
2:5126	dolichogena	10=10		128
* 2:5094	demersa	10=		95
11:2277	triumfettae	10=6-7	60-80=10-15	174
11:2289	dendritica	10=7	70=9	145

Vol. & species number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
14:2546	<i>psychotriæ</i>	10=5	90=6-7	270
14:2553	<i>euphorbiaceæ</i>	10=5	60-75=10-12	147
14:2570	<i>boutelouæ</i>	10=7	90=9	19
				147
17:2899	<i>crotonis</i>	7-11=5.5-7	42-55=7-9.5	61
:	(var. <i>parvula</i>)			19
17:2923	<i>arthraxonis</i>	8-11=4-5	35-45=8-12	117
22:4732	<i>luzonensis</i>	8-11=3.5-4	60-80=5-6	128
14:2575	<i>cynodontis</i>	8-11=5-6	40-50=7-10	
:	(var. <i>chlorides</i>)			
16:2204	<i>millettae</i>	8-11=5-6	30-45=10-15	128
22:4778	<i>oplismeni</i>	9-11=4.5-6	38-45=6-11	
17:2921	<i>chionachnes</i>	9-11=6.5-7.5	45-48=10-11	19
17:2918	<i>vossiae</i>	9-11=4.5-5.5	55-66=9-11	19
*16:2192	<i>cudrani</i>	9-11=7-8	45-65=	64
*2:5091	<i>ulmi</i>	10-11=5	60-70=8	63
16:2206	<i>marmorata</i>	10-11=10	70=12	64
22:4754	<i>fici fulvae</i>	10-11.5=8-11	60-80=8-11	64
9:4069	<i>ruprechtiae</i>	11=6-5	60-65=8-12	
*22:4783	<i>grammica</i>	8-12=6-7	60-70=8-10	
*22:4758	<i>merrilli</i>	8-12=4-6		64
22:4745	<i>ardisiae</i>	8-12=5-6	65-80=8-10	236
*17:2902	<i>caseariae</i>		60-90=10-12	199
17:2900	<i>sunabae-cedronis</i>	8-12=5-6	50-80=15-26	138
2:5132	<i>graminis</i>	8-12=4-5	78-80=7-8	
2:5134	<i>cynodontis</i>	8-12=5-6	65-75=12-15	19
*11:2294	<i>karnbachii</i>	9-12=7-8	50-62=10-15	64
17:2898	<i>maprouneæ</i>	9-12=7-9	60-100=12-20	147
22:4756	<i>devriesei</i>	10-12=7.8-5	60-80=10-12	64
22:4737	<i>vernycosa</i>	10-12=5-6	60-70=12-14	102
*22:4735	<i>paulensis</i>	10-12=7-8	70-80=15	128
*22:4729	<i>biguttulata</i>	10-12=5-5.5	50-65=8-10	
17:2916	<i>serialis</i>	10-12=5-6	75-80=12-15	19
9:4076	<i>lucida</i>	10-12=7	55-65=10-14	128
*	<i>trifolii</i>	10-12=5		
9:4039	<i>nitidula</i>	10-12=4-6	80-100=12	258
*	<i>musae</i>	10-12=7		
*	<i>graminis</i>	10-12=5-6	60-75=8-12	19
	(var. <i>tupi</i>)			
*16:2191	<i>ulcerata</i>	10-12=5	65-70=10	
9:4065	<i>sinik-lagaraik</i>	11-12=7-8	65-72=11-13	236
14:2568	<i>cordobensis</i>	12=5-6	70=1^	19
14:2567	<i>scanica</i>	12=6		19
*14:2565	<i>caricis</i>	12=4.5	50=12	20
	(var. <i>brasiliensis</i>)			247
14:2549	<i>aspidospermatis</i>	12=6	75=15	153
*14:2547	<i>randiae</i>	12=5	50-60=10-12	270
14:2545	<i>physalosporoides</i>	12=7	70=10	280
14:2530	<i>anonaceæ</i>	12=6	90=12	98
*11:2284	<i>leviuscula</i>	12=6	45-50=12	270
9:4094	<i>brachypodii</i>	12=6-7	24=6-7	19
9:4082	<i>biareolata</i>	12=5	90-95=6-9	
*9:4059	<i>dispersa</i>	12=5	90-110=10-14	
*9:4055	<i>ficum</i>	12=6-8	45-65=10-20	64
	(var. <i>spinifera</i>)			
*9:4054	<i>infectoria</i>	12=5		64
*9:4050	<i>intermedia</i>	12=5	50=10	165
				222

Vol. & species number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
9:4046	guavira	12=5	100-110=6-8	270
* 2:5154	flabella	12=5	90=9	.1
* 2:5143	epitypha	12=4		8
2:5139	fuscescens	12=6-7	60-65=10-12	19
*16:2205	irregularis	12=7		64
9:4038	tenuis	10-13=4-4.5	70-75=10	258
9:4085	engleri	10-13=3-4	50-60=6-7	
11:2281	subtropica	10-13=3-5	100=10-11	147
11:2290	fructigena	10-13=7-9	30-35=18-24	
22:4734	pongamiae	10-13=3.5-4	60-70=8-10	128
14:2551	henningsii	11-13=7-9	80-100=12-14	147
* 9:4072	pirifera	12-13=6-8	70-80=7-12	280
*22 4737	papulosos (var. vernicosa)	12-13=8-9	50-60=16	
22:4739	litseae	12-13=6-8	100-110=10-11	102
*22:4748	randiae (sub. sp. aculeatae)	12-13=7 8	40-60=15-20	270
*22:4749	phyllanthophila var. egregia	12-13=7-9	50-60=20	147
22:4771	boutelouicola	12-13=6	80-90=12-15	19
9:	xanthoxyli	13=3		
11:2276	gratissima	13=9-10	100-110=21	102
11:2299	philodendri	13=6	130=6-7	23
17:2877	monninae	13=6.5-8	75-110=11-13	145
17:2880	schizolobiicola	8-14=4-4.5	50-70=10-14	128
11:2305	asprellae	10-14=6-8	80-110=8-9	19
16:2196	rudgeae	10-14=5-7	80-120=8-10	270
16:2214	pazschkeana	10-14=6-8	60-96=12-18	19
*17:2897	phyllanthophila	10-14=5-7	35-45=12-15	147
17:2915	maydis	10-14=5.5-6.5	80-100=7-8	19
22:4724	peribebuyensis (var. brachycarpa)	10-14=5-7		223
*22:4725	aggregatula	10-14=5-7	40-55=14-18	223
22:4751	blanguiillo	10-14=7-8	60-75=10-15	147
*22:4752	fici-obscurae	10-14=10-11	80-90=10-12	64
22:4757	amanensis	10-14=6-7	100-130=7-10	64
22:4766	cyperina	10-14=3.5-4.5	60-80=6	20
*11:2287	sellowii	10-14=5-6	100-120=7-9	128
* 9:4083	alpiniae	11-14=5-6		46
17:2904	melaleucae	11-14=4.5-6.5	66-84=8-11	222
*16:2201	acaenae	11-14=6-7	35-42=11-13	126
14:2573	graminis	11-14=7-8	86-100=10-12	19
	(var. panicicola)			
14:2570	tricholaenae	11-14=6-8	46-65=14-18	19
*14:2534	dalbergiicola	11-14=7-9	45-55=18-26	128
				247
11:2292	quebrachii	12-14=6-7	80-90=10-12	153
*14:2540	subopaca	12-14=7	75=10-15	222
*14:2560	flavo-cincta	12-14=5-6	100-110=12-15	
14:2563	viridulocincta	12-14=6	75=9	23
17:2881	schizolobii	12-14=5	65-75=12	128
17:2906	vernoniicola	12-14=6-8	70-80=13-15	280
17:2912	astrocaryi	12-14=7-8	80-140=13-16	21
22:4736	goeppertiae	12-14=10	80-100=15-20	
22:4746	ambrosicola	12-14=8-9	80-120=10-16	280

Vol. & species number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
2:5095	tetrantherae	12-14=		102
2:5105	tropicalis	12-14=7-8	70-75=10-14	222
2:5135	bromi	12-14=7-8	80-98=8-11	186
9:4060	serorcula	12-14=5-7	100-120=	19
9:4061	taruma	12-14=6-7	65-75=10	10-14
9:4070	astronii	12-14=8-9	50=20	153
*11:2269	goyazensis	12-14=8-12	70-90=17-18	222
*11:2274	lagerheimiana	12-14=7-8	90=15	50
11:2273	marginalis	13-14=6-7	18-20=15	
22:4762	coccobae	13-14=6	70-80=10-18	77
9:4044	applanata	14=4.5	90-106=	
9:4048	annuliformis	14=8	10.5-14	137
17:2892	ocoteae	10-15=7-8	60-80=12-20	102
17:2922	graminis	10-15=7-8	60-80=10-14	19
	(var. panici sulcati)			
22:4722	canarii	10-15=3.5-4		
22:4747	macarangae	10-15=5-6	50-70=10-14	147
9:4035	paraguaya	11-15=6-8	50-75=14-18	
*17:2888	mexicana	11-15=6.5-8	80-110=12-15	169
*14:2557	tonkinensis	12-15=9	75=9	
*16:2199	perforans	12-15=5	80=10	128
17:2896	huallagensis	12-15=5-6	50-80=12-15	102
17:2905	cinerea	12-15=5-7	80-100=12-15	258
22:4721	leeae	12-15=7-8	100-140=	
			10-15	170
2:5124	dalibardae	12-15=		126
11:2263	acaciae	12-15=4-5	45-52=14-17	128
*11:2265	machaerii	12-15=4.5-6	88-105=7-9	128
*11:2297	amenti	12-15=5-6	50-60=12-14	
*14:2537	peribebuyensis	12-15=6-7	120=10	
22:4742	noackii	12-15=8-10	85=10	280
				66
16:2193	hakeae	13-15=5-6	90-110=8-10	222
9:4092	setariaecola	13-15=6-6.5	90-95=10-12	19
*11:2291	arrabidaeae	13-15=4.5-5.5	65-87=13-18	169
22:4770	eriochloae	14-15=7	70-80=10-12	19
22:4744	jacquiniae	14-15=8-9	100=14-18	137
9:4079	apiahyna	14-17=7	90-110=12-14	
* 2:5152	aloetica	14-15=9.5		
				280
*17:2925	filicina	14-15=5-6	70=10-11.5	50
16:2197	rubefaciens	15=8	90=15	
14:2544	nidulans	15=8-10	70-80=9-12	280
16:2213	minutissima	15=		19
17:2920	eleusines	15=7	130=12	19
22:4741	nectandricola	15=7-9	100=15-13	
* 2:5096	simillima	15=		128
2:5115	crotonis	15=10		147
2:5133	stenospora	15=		19
11:2279	durantae	15=8	90=21	253
22:4772	cenchricola	15=10	80-90=12-16	19
*11:2295	abyssinica	10-16=7-10	80-120=14-22	64
*17:2874	miryensis	11-16=7-9	60-70=10-18	
* 9:4067	gibbosa	12-16=8-9	90-100=	98

Vol. & species number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
*22:4730	myrrhinii	12-16 = 5-6.5	55-72 = 12-16	222
17:2895	madeirensis	12-16 = 5-6	50-60 = 8-12	102
*17:2878	hammarii	13-16 = 7-9	45-75 = 20-30	128
*22:4753	fici minahassae	13-16 = 5-6.5	45-60 = 10-16	64
14:2550	alyxiae	13-16 = 6-7	80-100 = 10	247
9:4034	enterolobii	14-16 = 6	60-70 = 10-12	128
				222
9:4045	brasiliensis	14-16 = 10	80-18	137
11:2293	crotonicola	14-16 = 10	100-120 = 13-15	147
14:2536	amphidyma	14-16 = 6	100-125 = 7-8	159
				140
22:4769	melicicola	14-16 = 8	120-130 = 10	198
22:4773	chloridicola	14-16 = 7-8	85-100 = 8-10	19
*11:2270	subcircinans	14-16 = 8-10	80-90 = 10-16	222
11:2275	xanthoxyli	14-16 = 7	84-100 = 12-14	137
17:2882	derridis	14-16 = 4-6	55-70 = 12-15	128
14:2552	julocrotonis	14-16 = 8-10	100-120 = 10-12	147
				222
22:4728	ipirangae	15-16 = 8	80-90 = 10-12	222
* 9:	Ph. (?) gracillima	15-16 = 5	50-60 = 10	
16:2203	laurinearum	16 = 8	140 = 12	102
* 9:4063	Ph. (?) menispermi	16 = 8	60-90 = 18-20	
17:2889	pusilla	11.5-17 = 7-10	70-105 = 11-21	
16:2198	centrolobii	14-17 = 8-10.5	82-10 = 14-16	128
22:4777	acuminata	14-17.7 = 5-6.5	100-140 = 9-10	19
14:2574	cornispora	14-17 = 5-7	50-70 = 10-15	19
17:2893	opposita	14-17 = 5	80-100 = 10-12	102
2:5118	brasiliensis	15-17 = 9-11	70-80 = 25-30	
*11:2306	dactylinis	7-18 = 9	108 = 12	
22:4776	heterospora	10-18 = 6-8	50-80 = 10-15	19
17:2917	sacchari	12-18 = 9-12	80-120 = 15-18	19
17:2890	minuta	13-18 = 7-8	80-110 = 15-18	175
17:2911	effigurata	13-18 = 5-6	70-100 = 6-11	64
* 9:4078	exanthematica	13-18 = 6		
				147
*16:2202	huberi	14-18 = 8-10	50-65 = 16-20	145
*22:4760	circinata	14-18 = 5-6	42-60 = 12-15	64
*11:2271	pittospori	14-18 = 10-13	110-150 = 15-25	118
2:5101	incarcerata	14-18 =		98
9:4081	Ph. (?) arechavaletae	15-18 = 5-6	100-110 = 10-14	
* 9:4066	peribebuyensis	15-18 = 6-8	80-90 = 9-11	223
*11:2298	cocoicolae	15-18 = 7-9	100-130 = 13-16	
11:2304	acutispora	15-18 = 5-6	90 = 8	19
14:2556	valsispora	15-18 = 4.5	110 = 12	
14:2559	timbo	15-18 = 5-6		
2:5156	episphaeria	15-18 =		
9:4032	Dalbergiae (var. macroscia)	15-18 = 8	100-120 = 27	128
9:4042	copaiferae	15-18 = 6-8	70-80 = 10-12	128
17:2876	securidacoae	15-18 = 5-7	60-80 = 10-18	
17:2903	baumii	15-18 = 5-7	90-150 = 8-10	239
*17:2913	scirpi	15-18 = 4-5	65-85 = 10-12	20
9:4068	pulchra	16-18 = 8	75-80 = 12-16	239

Vol. & species number	Specific Name	Spores length & breadth	Ascus length & breadth	Host family
9:4051	subrepens	16-18 = 8-9	85-90 = 12-16	165
* 9:4049	laurina	16-18 = 5		102
				128
9:4031	puiggarii	16-18 = 8-9	80-100 = 15-26	280
9:4040	guatteriae	16-18 = 8		98
2:5093	rhytismaoides	16-18 =		128
* 2:5108	repens	16-18 =		
22:4738	parvula	16-18 = 5-6	85-100 = 10-14	102
* 9:4089	fimbristylidis	17-18 = 2-3		20
2:5137	sylvatica	17-18 = 8	90-95 = 15	19
9:4056	vinosa	18 = 8-9	90-100 = 15-25	64
2:5121	lucens	18 = 6		
14:2531	hibisci	18 = 7	90 = 15	175
14:2533	collaeae	18 = 5	70 = 15	126
* 14:2539	feijoae	18 = 10	60 = 25	
14:2566	silvatica brasiliensis	16 = 6-7		19
22:4720	duplex	18 = 10	120 = 15	165
* 11:2296	schweinfurthii	15-19 = 9-11		64
14:2569	chusqueae	15-19 = 7-8	65-90 = 14-20	19
11:2285	symploci	16-19 = 8	80-90 = 2	242
9:4037	amphigena	16-19 = 6-8	50-60 = 12-16	256
17:2875	vochysiae	12-20 = 8-10	70-85 = 12-22	143
2:5130	wittrockii	12-20 = 4-7	70-80 = 6-10	271
* 17:2887	centrolobiicola	12-20 = 8-10	80-90 = 14-20	128
16:2195	physocarpi	12-20 = 6	70 = 16	
* 22:4767	fimbristylicola	14-20 = 4-6	55-60 = 8-10	20
* 11:2286	miconiae	14-20 = 9-10	35-55 = 21-24	
22:4775	bokensis	15-20 = 9-13	80-110 = 16-20	19
2:5142	bonariensis	15-20 = 7-9	65-70 = 12-18	19
9:4057	trivialis	16-20 = 5-7	140 = 150	248
9:4095	andropogonis	16-20 = 6-8	100 = 20	19
9:4043	selenospora	16-20 = 6	90-100 = 14-20	137
14:2554	ficicola	16-20 = 6-8		64
* 14:2564	renealmiae	18-20 = 7-8		
				19
22:4774	urvilleana	18-20 = 4	60-70 = 7-8	165
* 11:2272	gentilis	18-20 = 8-9	120 = 12-14	222
9:4036	sordida	18-20 = 7-9	120-130 =	
			10-12	258
* 2:5150	kniphofiae	18-20 = 5-6		36
16:2210	shiraiana	18-20 = 7-8	90 = 8	19
* 9:4062	Ph. (?) piperacearum	18-20 = 6	80 = 12-14	
9:4080	ulei	18-20 = 5.5	90-106 = 12.5	
* 14:2542	distinguenda	18-20 = 4.5	60-70 = 18	222
* 22:4763	vilis	18-20 = 5	50-64 = 10-12	
9:4087	Ph. (?) palmicola	18-20 = 9	52 = 15-20	21
9:4098	gracilis	18-20 = 7-8	80-90 = 14-18	19
9:4100	Ph. (?) tricuspidis	18-20 = 6-9	90-120 = 10-14	
11:2283	nidulans	19-20 = 10-12	180-200 = 20	280
* 22:4768	sacchariaegyptiaci	19-20 = 7.5-9.5	145-155 =	
			12-14	19
9:4053	aspideoides	20 = 10	100-110 =	
			12-14	64
* 2:5110	aspidea	20 =		64
* 2:5140	muhlenbergiae	20 = 6.5-7.5	60-64 = 17-18	19
16:2209	scleriae	20 = 4	60 = 10	20
* 2:5147	acromomiae	20 = 9-10	80-120 = 15-20	21
9:	lespedezae	20 = 10		

Vol. & species number	Specific Name	Spores length & breadth	Ascus length & breadth	Host family
11:2280	cestri	20=6-7	80-100=23-25	256
9:4088	nervisequia	19-21=7-7.5	87-110=16	66
*16:2194	roupalae	21=9-10		43
*11:2300	glaziovii	15-22=6-9	48-58=10-15	128
11:2303	cocis	16-22=11-14	50-70=15-20	19
14:2543	lehmanniana	17-22=5-6	95-120=12-16	143
14:2538	negeriana	18-22=10-14	100-120=20-33	126
17:2886	diocleae	18-22=4-5	50-60=10-12	128
				.1
*17:2924	pteridiicola	18-22=7-8	90-100=10-15	91
*11:2301	perisporioides	19-22=9-11	40=35	21
22:4743	conspicua	19-22=6.5-8	80-115=15-18	
2:5092	dalbergiae	19-22=5	65-75=14-16	128
* 9:4091	anceps	20-22=6	195=8	20
22:4717	erythroxili	20-22=4	50-60=12-14	134
22:4765	pappiana	22=9	90=10	
17:2908	viticicola	15-23=8-10	65-80=13-20	253
16:2212	cyperi	19-23=6-9	100-107=15	19
17:2919	sporoboli	20-23=10	100=20	19
17:2883	copeyensis	20-23=8-10	65-70=15-17	128
*11:2288	pululahuensis	23=12	100=30	223
22:4779	sorghii	18-24=12	90-130=13-20	19
2:5145	cyperi	21-24=5-6		20
9:4101	cyperi	22-24=5-6	75-80=12-15	19
:	(var. donacis)			
* 9:4075	nyctaginearum	22-24=9	90-110=18-20	80
* 2:5141	gangraena	16-25=3.5-4.5	40-50=10-12	
*22:4727	lindmani	16.5-25=6.5-9		222
				.1
* 9:4105	rhopographoides	19-25=7	106-124=12-5	91
22:4761	simplex	19-25=7	90-115=19-24	77
16:2211	oxyspora	20-25=5-6	96-115=9-10	19
* 2:5125	viventis	20-25=7		128
14:2561	costaricensis	21-25=10-14		
11:2268	maculata	22-25=8	120-130=	222
11:2267	begoniae	22-25=5	15-20	208
*11:2278	escalloniae	23-25=6-7	110-120=20	117
14:2577	hieronymi	18-26=5-7	50-75=15-21	
17:2884	juruensis	20-26=5-6	60-65=10-17	128
16:2215	apiculata	22-26=8-10	100=10-11	19
* 9:4086	mucosa	22-26=10-12	90-95=20-28	
9:4097	infuscans	23-27=	124-142=18-26	
14:2558	tonduzii	25-27=7-10	72-108=20-28	19
16:2208	tjangkorreh	24-28=8	180=20	19
17:2914	eximia	25-28=8-12	125-200=18-25	
* 9:4084	atroiquinans	25-28.5=	10-10.5 62-66=26-27	132
17:2894	socia	20-30=13-15	140-200=18-30	102
22:4782	usteriana	25-30=5-6	60=12-15	
22:4740	lepidia	24-32=7-9	110-140=14-24	102
22:4726	petitmenginiti	26-33=7-8	80-110=20-25	222

Vol. & specie number	specific Name	Spore length & breadth	Ascus length & breadth	Host family
2:5119	fatiscens	30-33 =		
17:2901	tonduz'i	25-35 = 5-6	75-80 = 15-20	236
* 2:5104	lonchotheca	35-6 =	90-100 = 15-20	
* 2:5148	calamigena	35		
* 2:5146	dasylirii	30-40 = 16-18		
17:2891	macrospora	35-40 = 8	140 =	132
16:2207	Ph. (?) megalospora	65-70 = 8-10	220 = 20	177
* 2:5097	rhopalina			20
* 2:5098	microcenta			
* 2:5100	depazeoides			64
2:5102	granulosa			143
2:5103	explanata			140
* 2:5106	mycrocae			222
2:5107	grevilleae			66
2:5109	catervaria			64
2:5111	thwaitesii			64
* 2:5113	decaismeana			64
2:5114	tenuis			128
2:5116	inclusa			
2:5117	phyllolplaca			
* 2:5123	heraclei			128
2:5127	ambrosiae			280
* 2:5129	picea			170
2:5131	melaena			128
2:5138	tritici-gracilis		27 = 3	19
* 2:5149	strelitziae			45
* 2:5151	melanophaca		50 =	38
* 2:5155	anomala			165
2:5137	rhytismoides			
* 2:5158	asteromorpha			61
* 2:5159	impressa			126
* 2:5160	colensoi			240
* 2:5161	orbiculata			
* 2:5162	acervulata			
* 2:5163	rhois			
* 2:5164	latitans			233
* 2:5165	annulata			170
* 2:5166	abortiva			216
* 2:5167	lauri-borboniae			102
* 2:5168	juglandicola			60
* 2:5169	sassafras			102
* 2:5170	melastomatis			223
* 2:5171	subcuticularis			271
* 2:5172	rosae			126
* 2:5173	maculans			
* 2:5174	castaneae			62
* 2:5175	lauricola			102
* 2:5176	polygalae			145
* 2:5177	glycineos			128
* 2:5178	conspurcata			20
2:5179	permeans			222
* 2:5180	xylostei			271
* 2:5181	exculpta			147
* 2:5182	barringtoniae			50
* 2:5183	musae			219
* 2:5184	trifolii			45
				128

Vol. & species number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
* 2:5185	brachystemonis			
5:5186	lespedezae			280
* 2:5187	bullata			280
* 2:5188	xanthii			257
* 2:5189	solidaginum			
* 2:5190	exasperans			
* 2:5191	tragacanthae			128
* 2:5192	morthieri			228
* 2:5193	angelicae			228
* 2:5194	podagrariae			228
* 2:5195	companulæ			276
* 2:5196	punctiformis			
* 2:5197	gentianæ			
* 2:5198	eupatorii			280
* 2:5199	stipata			228
* 2:5200	deusta			175
* 2:5201	phlogis			21
* 2:5202	cinerascens			248
* 2:5203	asclepiadis			248
* 2:5204	impatientis			168
* 2:5205	silphii			280
* 2:5206	dispersa			
* 2:5207	conferta			
* 2:5208	chenopodii			78
* 2:5209	ornans			248
* 2:5210	hibiscicola			175
* 2:5211	phytolaccæ			83
* 2:5212	inelegans			83
* 2:5213	elegans			83
* 2:5214	crustacea			83
* 2:5215	ramosa			78
* 2:5216	polygonati			38
* 2:5217	nodicola			227
* 2:5218	elliptica			254
2:5219	ambrosiae			280
* 2:5220	viticola			170
* 2:5221	hyssopi			254
* 2:5222	effusa			280
* 2:5223	frigoris			271
* 2:5224	chalybaea			233
* 2:5225	demigrans			233
* 2:5226	missouriensis			
* 2:5227	pomigena			
* 2:5228	fructigena			19
* 2:5229	culmicola			19
* 2:5230	aristidae			19
* 2:5231	delicatula			19
* 2:5232	setariae			19
* 2:5233	nigrescens			19
* 2:5234	canaliculata			20
* 2:5235	penicillata			38
* 2:5236	cepae			
* 2:5237	dioscoreæ			43
* 2:5238	panici			19
* 2:5239	lineola			38
* 2:5240	scapincola			38
* 2:5241	thanatophora			205

Vol. & specie number	Specific Name	Spore length & breadth	Ascus length & breadth	Host family
* 2:5242	caricis			205
* 2:5243	musae			280
* 2:5244	filicum			45
* 9:4071	Ph. (?) populi			165
				56
* 9:4073	polemonii			250
* 9:4077	interstilialis			61
* 9:	caricis			
9:4096	sphaerosperma			19
11:2262	cassiae	84-90=10-10.5		84
11:2302	luzulae	10-100=11-15		128
*14:2548	plantaginis			36
*14:2562	Pt. (?) yuccae			280
*14:2576	diplocarpa	50-60=7-8		38
*14:2578	fructicola			128
*14:	tenuissima			
14:	spiegazzinii			
14:	rhytismoides			
14:	winteri			
14:	ambrosiae			
*22:4719	intermedia			165
:	(var. luxurians)			
22:4723	Ph. (?) aberiae	80-100=10-12		
22:4759	dendroidea			64
22:4731	bakeriana			128
22:4764	melanoplaca veratri			38
22:4780	paspalicola			19
16:2200	Ph. (?) tipae			128

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