ČESKOSLOVENSKÁ
VĚDECKÁ SPOLEČNOST
PRO MYKOLOGII

ČESKÁ MYKOLOGIE

ROČNÍK
38
ČÍSLO
2

ACADEMIA/PRAHA

KVĚTEN 1984

ISSN 0009-0476

ČESKÁ MYKOLOGIE

Časopis Čs. vědecké společnosti pro mykologii k šíření znalosti hub po stránce vědecké i praktické

Ročník 38 Číslo 2 Květen 1984

Příspěvky zasílejte na adresu výkonného redaktora: 115 79 Praha 1, Václavské nám. 68, Národní muzeum, telefon 269451—59.

1. sešit vyšel 10. února 1984

OBSAH

ČESKÁ MYKOLOGIE

ČASOPIS ČESKOSLOVENSKÉ VĚDECKÉ SPOLEČNOSTI PRO MYKOLOGII
ROČNÍK 38 1984 SEŠIT 2

Ecology and Evolution of Puccinia graminis Pers.

O ekologii a evoluci Puccinia graminis Pers.

Zdeněk Urban and *Jaroslava Marková*

In the area of the secondary evolutionary gene center of wheat (the Mediterranean) as well as in the regions of the primary gene centers the "graminicolous facies" of the wheat stem rust, *Puccinia graminis* subsp. *graminis* seems to play a significant role. Similarly as in the Mediterranean also in Asia the "ruderal facies" is combined with that of sexual hybridization on barberry ("montane facies"). Future studies envisage the following: 1) study of the rust ecology in the evolutionary centers, determination of geographic distribution of the individual physiologic races and populations and investigation into the urediospore long distance spread; 2) in search after the gene sources of resistance using of stem rust resistant grass populations indigenous to the evolutionary centers is preferred; 3) to protect natural ecosystems embracing barberry within the evolutionary centers and thus ensure the existence and further development of wild and cultivated grass populations possessing a high degree of nonspecific (general) stem rust resistance or tolerance.

V oblasti druhotného vývojového centra (Středozemí) jakož i v krajinách prvotních center se vyskytuje a silně uplatňuje „graminikolní facie" rzi travní pšeničné, *Puccinia graminis* subsp. *graminis* f. sp. *tritici*. Podobně jako ve Středozemí i v Asii se kombinuje „facie ruderální" s facií pohlavní hybridizace na dřišťálu („facie horská"). Do budoucna je třeba: studovat ekologii rzi ve vývojových centrech, stanovit areály jednotlivých ras a populací, sledovat přenos urediospor na velké vzdálenosti. Při hledání zdrojů odolnosti vybrat populace trav, které jsou odolné vůči rasám rzi travní, jež jsou domácí ve vývojových centrech. Chránit oblasti přirozeného rozšíření dřišťálu ve vývojových centrech a tím zajistit existenci a vznik jedinců planých i kultivovaných trav s vysokou obecnou resistencí nebo tolerancí.

The present study concludes the first part published already before (Urban and Marková 1983) where also the methods of urediospore treatment can be found. The authors are indebted to Prof. Dr. Z. M. Azbukina, Vladivostok, Dr. Gro Gulden, Oslo (O), Dr. D. M. Henderson, Edinburgh (E), Prof. Dr. V. I. Uljaniščev, Baku (BAK) and Prof. Dr. G. Viennot-Bourgin, Paris (P) for their kindly supplying the material.

The basic features of the evolution of *Puccinia graminis* Pers. s. l. were outlined and submitted to discussion earlier (Urban 1968, 1969 and 1980; Urban and Marková 1980; Savile and Urban 1982). Basing on the ideas of N. I. Vavilov, T. Săvulescu, E. Leppik and T. Johnson a new original theory on the origin of cerealicolous stem rust fungus as a relatively recent taxonomic unit was developed: it evolved gradually and jointly (co-evolution) with the evolution of cereals (in the first place wheat and barley) from their wild ancestors. The evolution of both the host and the rust fungus occurred from the very beginning in the primary and secondary evolutionary gene centers. Considering the long history of ancient agriculture in Eurasia and in the Mediterranean, *Puccinia graminis* subsp. *graminis* which parasitizes on a. o. wheat, is assumed to develop in the course of 6—8 thousand years. For this time co-evolution of wheat and its rust fungus has been lasting whereas the evolution of the whole stem rust fungus complex (*P. graminis* s. l.) is far longer being connected with the phylogeny of certain grass groups, in the first place of the subfamily *Festucoideae* (=*Pooideae*) as well as with the evolution of the genus *Berberis* (+*Mahonia*) or the family of *Berberidaceae*. This evolution assumably did not occur outside the natural habitats of both the mono- and dicaryophyte hosts but within such plant communities (or close neighbouring ones) in which the grasses and the alternate host grow together in sufficient quantity.

From this aspect we tried to explain the reasons of the existence of small spored subspecies *graminicola* Urban in Czechoslovakia at localities rich in barberry (see Urban and Marková 1983). Later study of the material mentioned and additional data from literature prompted us to further considerations on general evolution of *Puccinia graminis* s. l. Arithmetic means x of urediospore length and width and $x_L:\bar{x}_W$ ratios are given in Table (p. 71—79).

The shape of the summer spores is evaluated similarly as in the preceding paper (Urban and Marková 1983).

A. Evaluation of the material

In the regions of primary (Azerbaijan, Iran, Near East) and secondary (Albania, Morocco, the Iberian peninsula) evolutionary gene centers appear physiologic races (specialised forms?) with large urediospores, mostly oblong ellipsoid, more rarely ovoid, on cultivated cereals *(Triticum, Hordeum, Secale, Avena)*. In Israel only oblong ellipsoid spores are found on cultivated *Triticum, Hordeum, Secale* and *Avena*. Similarly also in the Azerbaijan S.S.R. there are only oblong ellipsoid spores on *Avena, Triticum* and *Secale;* a rust specimen on *Triticum aestivum* from the botanical garden in Baku, in which the urediospores taken from the blade are small ovoid to small oblong, is exceptional. Broadly ovoid urediospores were observed in a few collections from Iraq, Albania *(Triticum)*, Morocco *(Triticum, Secale)* and on *Avena fatua* from the Sierra de Gredos in Spain. Yet on *Triticum* and *Hordeum* in Morocco also oblong ellipsoid spores were found.

Large urediospores were observed, however, in the above countries on numerous wild grasses. These are in the first place the grass species and genera which are already known from literature to harbour sporadically cerealicolous f. sp. *tritici* and others, e. g. f. sp. *secalis*, f. sp. *avenae*. Among them are e. g. several species of *Agropyron (A. aucheri, A. caucasicum, A. cristatum, A. repens)* on which the summer spores are mostly oblong ellipsoid or ovoid. On *A. repens* from Azerbaijan the spores are conspicuously oblong ellipsoid; the collections come from the submontane area of S. E. Caucasus. On the other hand, collections on other species from Iran — from the Demavend slopes and the environment of Tabriz — have large, broadly ovoid spores. In Morocco, in the Middle Atlas, the stem rust was several times collected on *Agropyron marginatum*; its urediospores are both oblong ellipsoid and ovoid. From the same mountain range comes a collection on *A. festucoides* with oblong ellipsoid spores. In Iraq in the desert west of Ramádí ovoid spores were observed on *Eremopyrum bonaepartis* which is closely related to *Agropyron*.

Relatively many collections were evaluated on wild *Hordeum* species. In the Azerbaijan S.S.R., again in the submontane area of S. E. Caucasus, ovoid and oblong ellipsoid urediospores were collected on *Hordeum bulbosum* and *H. geniculatum*. The spores collected on *Hordeum fragile* (Demavend) and *H. murinum* (Hamadan) in Iran were oblong ellipsoid. Spores of the same shape were stated on *Hordeum bulbosum* from Turkey (Maras — Göksun in E. Taurus) and on *H. murinum* from Israel (Jerusalem). Many collections on *Hordeum bulbosum* and *H. murinum* come from Morocco from the maritime lowlands and from the Middle and High Atlas. The spores are mostly ovoid (10×), oblong ellipsoid (2×) and of transient shape (3×). Only four times small ovoid and subovoid, i. e. somewhat smaller, yet still distinctly globose spore forms were stated. Similar small ovoid spores are recorded by Guyot (1967) on *Hordeum murinum* from the Somosierra Mts. north of Madrid in Spain. Guyot reports that according to the teliospore structure the specimen resembles rather the subsp. *media* Guyot, which is graminicolous, than the subsp. *major* Guyot, which is cerealicolous.

Further genera the species of which are hosts for large-spored races in the evolutionary gene centers are *Bromus* and *Aegilops*. From the submontane area of S. E. Caucasus in the Azerbaijan S.S.R. come the collections on *Bromus variegatus* and *Bromus* sp., with conspicuously oblong ellipsoid urediospores. On the other hand, the collection on *Bromus ramosus* (Pirzevan, Zakatal'skij district at the Caucasus foothill) has small oblong spores. In Iran in the Haraz valley N. E. of Teheran, from 1000—2000 m altitude, races with ovoid spores were collected on *Bromus ramosus* subsp. *benekenii* and *B. munroi*. The specimen on *B. ramosus* subsp. *benekenii* was collected in a forest. Broadly ovoid are also the spores collected on *Bromus biebersteinii* from N. E. Turkey from the Anadolu Daglari Mts. on the road from Rise to Ispir. There are relatively numerous Moroccan data originating from the maritime lowlands through the Middle and High Atlas on the following grass species: *Bromus lanceolatus*, *B. macrostachys*, *B. mollis*, *B. ramosus* subsp. *benekenii*, *B. rigidus* subsp. *gussonii*, *B. squarrosus* and *B. tectorum*. Most urediospores are ovoid or transitory to oblong ellipsoid. From the Iberian peninsula two specimens on *Bromus fasciculatus* possessing ovoid spores (from the east in Sierra de Albarracin west from Teruel and in the north between Aranda de Duero and Burgos) are recorded. They were collected by Guyot (1967) who made experiments with urediospores collected in the surroundings of Teruel and obtained a very strong degree (IV) of infestation on wheat, *Agropyron marginatum* and *Aegilops crassa*, degree III on *Aegilops ventricosa*, II+ and II on *Festuca triflora*, *Hordeum maritimum* and *H. bulbosum*. Rye and oats were negative; according to this Guyot assumed that it was the f. sp. *tritici* which passed to the above annual species of *Bromus* causing strong infestation of its sheaths, leaves and inflorescences. The other specimen cited was determined by Guyot also as subsp. *major* (he considers it also a cerealicolous race).

As for *Aegilops* there are records from Israel on *A. longissima*, *A. ovata* and *A. variabilis*. The urediospores are large, pronouncedly oblong ellipsoid. From north Africa, from the Middle and High Atlas, there are records on *Aegilops ovata*, *A. triaristata*, *A. triuncialis* and *A. ventricosa*. Ovoid or transitory to oblong ellipsoid shapes prevail. Only one specimen (*A. ventricosa*) has spores of a transitory shape from small ovoid to ovoid. In the Iberian peninsula ovoid urediospores were collected on *Aegilops ovata*, *A. triaristata* and *A. triuncialis* (Sierra de Gredos, west of Madrid and in the north between Aranda de

Duero and Burgos). Guyot (1967 p. 205) classifies all three Spanish collections as subsp. *major* Guyot which embraces mostly cerealicolous forms.

There are relatively numerous data as regards wild growing oats *(Avena* sp. div.) from Morocco. These are collections from the maritime lowlands and Middle and High Atlas on the following grass species: *Avena alba, A. alba* var. *barbata* f. *genuina, A. bromoides, A. jahandiezii, A. sterilis* and *A. sterilis* subsp. *macrocarpa*. Ovoid spores prevail, several times oblong ellipsoid spores were recorded. In the High Atlas and on Djebel Hebbri (2000 m) in the Middle Atlas small ovoid spores were collected on *Avena sterilis* and *A. sterilis* subsp. *macrocarpa*. No literature data or own measurings on wild oats are available from other countries. Anikster and Wahl (1979) report var. *avenae* as the most frequent variety on wild *Avena* species, yet they do not give measurements of summer spores.

Large, ovoid or oblong ellipsoid spores are so far known on following grasses:

Alopecurus myosuroides — Azerbaijan S.S.R.
Poa bulbosa — Iraq, mountains of Kurdistan
Taeniatherum caput-medusae — Iran; Morocco, Middle Atlas; Spain, between Aranda de Duero and Madrid, considered subsp. *major* Guyot
Festuca elatior — Iran, near Hamadan
Lolium perenne — Iran, near Tabriz; Israel, Beersheba — the Dead Sea
Arrhenatherum elatius — Morocco, Middle Atlas
" *erianthum* — Morocco, Middle Atlas
Dactylis glomerata — Morocco, Middle and High Atlas
Festuca triflora — Morocco, Middle Atlas
Dasypyrum hordeaceum — Morocco, Middle and High Atlas
Lagurus ovatus — Morocco, Middle Atlas
Trisetum flavescens — Morocco, Middle Atlas
Vulpia litardiana — Morocco, Middle Atlas
Trisetum velutinum — Spain, Sierra Nevada, 2600 m

Let us mention already here that Arthaud, Guyot and Malençon (1964) report (basing on their own observation as well as experiments) survival of the specialised form *tritici*, in the first place on *Agropyron marginatum* and *Dasypyrum hordeaceum*, in the Middle and High Atlas. Further the following grass species proved also highly susceptible to the above specialised form: *Agropyron panormitanum, Bromus ramosus* subsp. *benekenii* and *Festuca triflora*. An inoculum from these grasses, characterized by large urediospores and belonging thus to the subsp. *major* Guyot var. *tritici* Guyot gave a very high degree of infection on wheat.

As regards the taxonomy of *Puccinia graminis* we consider all the above large-spored collections subspecies *graminis*. To make the morphologic characteristic more precise it would be useful to undertake a systematic and reliable search after the number of germ pores and shape and size of the verruculous spines. Previous unsufficient data available so far indicate that the cerealicolous specialised forms have mostly 4, sometimes up to 5 germ pores. The data from north Africa for *Agropyron repens, Aegilops, Avena* spec. incult., *Bromus, Hordeum* spec. incult. vary between 2—4, only rarely 5 for *Agropyron repens*. In routine treatment of the studied material 4—5 germ pores were found in the *Agropyron* species originating from Iran, with the prevalence of 4 germ pores. The same was stated for *Triticum aestivum* from Iran and Iraq. On *Aegilops* from Israel the spores possessed most frequently 4 germ pores. Four to five germ pores were found on *Hordeum bulbosum* and *Bromus biebersteinii* from Turkey. Similarly, on *Bromus* species from Iran there were 4—5, rarely

6 germ pores *(B. munroi)*. More rarely up to 6 germ pores (4—5) were counted on *Eremopyrum bonaepartis* from Iraq. *Poa bulbosa* stem rust with 4 (5) germ pores comes from the Iraqui Kurdistan.

In conclusion of the evaluation of large-spored collections let us emphasize that without inoculation experiments it would be impossible to determine to what extent *Puccinia graminis* found on wild grass is a cerealicolous race or a specialised form. The experience so far namely does not exclude the existence of large-spored graminicolous specialised forms or races. This assumption is further supported by the fact that e. g. Guyot and Massenot described in 1957 f. sp. *agropyri-repentis* which they characterized by large urediospores ($\bar{x} = 29$—30×17—$18\ \mu m$), ovoid to oblong ellipsoid (see Arthaud, Guyot and Malençon 1964, Document annexe (4) and (5), where the range of arithmetic means is conspicuously broader). Another example is the characteristics of a few collections on *Dactylis glomerata* (Arthaud, Guyot and Malençon l. c.) from the Moroccan Atlas: $\bar{x} = 29.5$—30.5×17.5—$21.0\ \mu m$, urediospores being large, ovoid to oblong ellipsoid, belonging to a so far closer undescribed specialised form. As last example let us mention the collections on *Lolium multiflorum,* again with large urediospores, which the authors (l. c.) hesitantly ascribe to f. sp. *lolii* (yet this f. sp. originally ought to be small-spored!). However, there may even exist a transfer of f. sp. *avenae* or f. sp. *secalis* to *Lolium*. After all, the above specialised form *secalis* is known also from *Agropyron* sp. div. and f. sp. *avenae* can parasitize on *Dactylis glomerata* (l. c.).

Study of the material originating from the primary and secondary evolutionary gene centers of cereals and their rust fungi revealed that collections with large, ovoid and oblong ellipsoid urediospores prevailed.

Small ovoid or transitory to small oblong urediospores were observed in:

Azerbaijan S.S.R. – on *Dacytlis glomerata, Lolium perenne*
Iran – on *Poa angustifolia*
Turkey — on *Lolium persicum,* Göksun in the eastern Toros Daglari Mts.
Morocco – on *Anthoxanthum odoratum,* Middle Atlas, classified by Guyot as subsp. *minor* Guyot
– on *Cynosurus echinatus,* Meknes in Middle Atlas, on the edge of a wheat field strongly infested with *Puccinia graminis.* Simultaneously strongly infested were: *Aegilops ventricosa* and *Hordeum murinum.* Guyot and Malençon (1957) assume an incidental passing over of cerealicolous f. sp. *tritici* or f. sp. *avenae* to wild grass species
– on *Dactylis glomerata,* 5 collections from the Middle and High Atlas
– on *Lolium multiflorum* subsp. *italicum,* in the High Atlas. This collection is considered with some doubts a graminicolous f. sp. *lolii* Guyot et Massenot (1947–1948)
– on *Lolium rigidum,* considered f. sp. *lolii*
– on *Poa pratensis,* cultivated at the Debbag farm
– on *Poa* spec., High Atlas, Djebel Toubkal; 3(4) germ pores approximately equatorial
Algeria – on *Agropyron repens,* near Algiers; 4 (sometimes 3, rarely 5) germ pores
Spain – on *Arrhenatherum elatius,* northern slopes of Sierra Nevada, 2–4 equatorial germ pores
– on *Dactylis glomerata*
– on *Festuca granatensis,* northern slopes of Sierra Nevada, 2–4 equatorial germ pores. It is the f. sp. *festucae – granatensidis* Guyot which, according to experiments, does not infect *Triticum, Secale, Avena* or *Lolium temulentum* giving, on the other hand, infection type IV and III on *Festuca granatensis, Arrhenatherum elatius, Avena bromoides* and *Dactylis glomerata* (Guyot 1967).
– on *Hordeum murinum* – mentioned already above, p. 67

Northwestern Portugal — on *Dactylis glomerata*, Braga: Guyot (1967) designates this collection as subsp. *media* Guyot "living on numerous wild grasses yet in no case on cultivated cereals".

The survey clearly reveals that the small-spored stem rust appears most frequently on *Dactylis glomerata*, *Lolium* sp. div. and *Poa* sp. div. In all cases it is the subspecies *graminicola* Urban which evidently affects also other grass genera as e. g. *Anthoxanthum*, *Arrhenatherum*, *Avena sterilis*, *Bromus squarrosus* etc.

Let us complete the preceding conclusion (see p. 69): in Transcaucasia, Iran, Iraq, Israel, Turkey and the western Mediterranean, i. e. in the primary and secondary evolutionary gene centers, *Puccinia graminis* appears as subsp. *graminis* with large ovoid to oblong ellipsoid urediospores embracing cerealicolous as well as graminicolous physiologic races (f. sp.?). Some cerealicolous races successfully pass to and survive on wild growing grasses and, on the contrary, cereals can by infected from the grasses. The other taxonomic unit, subsp. *graminicola* Urban, seems to be in the first place graminicolous, characterized by small, ovoid urediospores. Within both subspecies as well as between them hybridizing takes place. In both subspecies the ovoid shape of spores is considered phylogenetically older.

As already mentioned the material studied is not sufficient. The same applies to further, additional material not originating from evolutionary centers. Especially French authors (Guyot 1946, 1951, Guyot and Massenot 1958a, b, Viennot-Bourgin 1949, 1951, Arthaud, Guyot and Malençon 1964) give biometrical data of summer spores from various wild grasses from eastern, southeastern and southern France. On *Agropyron* (*A. caninum*, *A. repens*) prevail oblong ellipsoid (or also ovoid) spores. On other genera, on the other hand, small ovoid or small oblong spores which seem to indicate prevalence of graminicolous races (spec. forms?) are mostly found. This concerns the collections on *Anthoxanthum odoratum*, *Briza media*, *Cynosurus cristatus*, *Deschampsia flexuosa*, *D. cespitosa*, *Festuca arundinacea*, *F. sylvatica*, *Hordelymus europaeus*, *Lolium perenne* and *Poa alpina*.

Very rarely ovoid and oblong ellipsoid spores were stated on *Festuca arundinacea* and *Hordelymus europaeus*.

There is a useful observation by Viennot-Bourgin (1949 p. 8) from the département Isère in the Sarennes gorge, 1496—1800 m. Abundant growths of *Berberis vulgaris* bear infections; under them uredia and telia are found on various grasses. According to the size and shape of urediospores Viennot-Bourgin divides the findings into two groups, viz. 1) *Arrhenatherum elatius*, *Agropyron glaucum*, and *Poa nemoralis* with narrow oblong spores (according to our classification: small oblong and oblong ellipsoid) and 2) *Anthoxanthum odoratum*, *Dactylis glomerata* and *Phleum pratense* with ovoid or ovoid globose (= small ovoid) urediospores. Except the distinctly oblong ellipsoid spores on *Arrhenatherum elatius* ($\bar{x} = 28.0 \times 14.8$ μm) all the other collections belong into the subsp. *graminicola*.

Graminicolous physiologic races (f. sp.?) on *Agrostis stolonifera*, *Anthoxanthum odoratum*, *Dactylis glomerata* and *Festuca pratensis* were collected in Austria at Lunz am See and in Tirol (Brandenburger 1969, 1974). Their spores are small ovoid, the smallest ones on *Agrostis*. All belong to the subsp. *graminicola* Urban.

Puccinia graminis — urediospore measures

Host Plant	Locality	$\bar{x}_L \times \bar{x}_W$ (μm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
	Azerbaijan S.S.R.:				
Avena sativa	Dolljar, Šamchorskij region	27.60 × 17.03	1.62	ovoid	from leaf blade
Avena sativa	Dolljar, Šamchorskij r.	28.00 × 15.73	1.78	oblong ellipsoid	from sheath
Avena sativa	Baku, Apšeronskij r.	29.15 × 16.63	1.75	oblong ellipsoid	from sheath
Avena sativa	Pirvant, Kubinskij r.	29.85 × 16.10	1.85	oblong ellipsoid	from sheath
Hordeum bulbosum	Kuba, Kubinskij r.	28.55 × 18.00	1.59	ovoid	from sheath
Hordeum geniculatum	Šemachinská observatoř	27.33 × 15.35	1.78	oblong ellipsoid	
Secale cereale	Slavjanka, Kedabekskij r.	29.30 × 15.15	1.93	oblong ellipsoid	from sheath
Triticum aestivum	Botaničeskij sad, Apšeronskij r.	26.40 × 16.60	1.59	small ovoid	from leaf blade
Triticum aestivum	Lenkorani, Lenkoranskij r.	27.65 × 15.13	1.83	oblong ellipsoid	from leaf blade
Triticum aestivum	Slavjanka, Kedabekskij r.	30.95 × 17.03	1.82	oblong ellipsoid	from sheath
Triticum durum	Zakataľskij region	30.70 × 16.68	1.84	oblong ellipsoid	from sheath
Agropyron repens	Kuba, Kubinskij r.	28.28 × 15.73	1.80	oblong ellipsoid	from sheath
Agropyron repens	Šemacha, Šemachinskij r.	28.48 × 14.65	1.94	oblong ellipsoid	
Agropyron repens	Šemachinská observatoř	28.68 × 13.63	2.10	oblong ellipsoid	
Agropyron sp.	Kirovka, Šemachinskij r.	28.75 × 13.88	2.07	oblong ellipsoid	
Alopecurus myosuroides	Bjul'-Bjuli, Apšeronskij r.	24.35 × 15.28	1.59	small ovoid	from leaf blade
Alopecurus myosuroides	Bjul'-Bjuli, Apšeronskij r.	28.35 × 17.40	1.63	ovoid	from sheath
Bromus ramosus	Pirzevan, Zakatal'skij r.	24.83 × 14.75	1.68	small oblong	from leaf blade
Bromus sp.	Šemachinská observatoř	28.85 × 15.48	1.86	oblong ellipsoid	
Dactylis glomerata	Afinkend, Chanlarskij r.	26.48 × 16.18	1.64	ovoid	from stem
Elymus sibiricus	Botaničeskij sad, Apšeronskij r.	27.05 × 14.10	1.92	oblong ellipsoid	from leaf blade
Elymus sibiricus	Botaničeskij sad, Apšeronskij r.	28.20 × 14.33	1.97	oblong ellipsoid	from sheath
Lolium perenne	Pirzeven, Zakataľskij r.	22.28 × 14.80	1.51	small ovoid	from leaf blade
Lolium perenne	Pirzevan, Zakataľskij r.	24.75 × 15.85	1.56	small ovoid	from sheath
Zerna variegata	Derk, Konachkendskij r.	30.70 × 16.93	1.81	oblong ellipsoid	from stem
	Iran:				
Avena sativa	Lorestan, Kermanshah	36.77 × 16.97	2.17	oblong ellipsoid	
Triticum vulgare	Elburz Mts.: Orim, Nezva Kuh	31.03 × 20.32	1.53	ovoid	
Agropyron aucheri	pentes de Damavand	31.20 × 18.40	1.70	ovoid to oblong ellipsoid	
Agropyron aucheri	Darli above Panjab, Mazanderan, Haraz valley	33.53 × 22.13	1.51	ovoid	
Agropyron caucasicum	Darli above Panjab	26.26 × 17.16	1.53	ovoid	
Agropyron cristatum	Darli above Panjab	28.75 × 19.81	1.45	ovoid	

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (μm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Agropyron orientale	Lighvan, Tabriz	28.90 × 22.12	1.31	ovoid	
Agropyron sp.	Schemilan	30.17 × 20.37	1.48	ovoid	
Agropyron sp.	Damavand	30.40 × 18.57	1.64	ovoid	
Agropyron sp.	near Lighvan, Tabriz	32.25 × 20.27	1.59	ovoid	
Bromus benekenii	Darli above Panjab	28.10 × 18.85	1.49	ovoid	
Bromus munroi	Darli above Panjab	29.01 × 21.27	1.36	ovoid	
Elymus caput-medusae	Rezaiyeh→Khoy	28.55 × 15.52	1.84	oblong ellipsoid	
Festuca elatior	near Hamedan	30.22 × 20.92	1.44	ovoid	
Hordeum fragile	pentes du mont Damavand	28.67 × 16.15	1.78	oblong ellipsoid	
Hordeum murinum	near Hamedan	32.32 × 18.52	1.74	oblong ellipsoid	
Lolium perenne	Bostanabad→Sarab, Tabriz	27.37 × 19.27	1.42	ovoid	
Poa angustifolia	Panjab	24.71 × 16.51	1.50	small ovoid	
	Iraq:				
Triticum cf. *aestivum*	Girdabar, Kurdistan	33.75 × 21.87	1.54	ovoid	
Eremopyrum bonaepartis	Romadi desert	29.35 × 19.85	1.48	ovoid	
Poa bulbosa	Sarcal, Kurdistan	28.75 × 19.40	1.48	ovoid	
	Turkey:				
Hordeum bulbosum	Maras-Göksun	33.13 × 18.65	1.78	oblong ellipsoid	
Bromus biebersteinii	Rize-Ispir road	30.65 × 23.42	1.31	ovoid	
Lolium persicum	Göksun	25.55 × 18.30	1.40	small ovoid	
	Israel:				
Avena sativa	Rehovot	32.32 × 18.70	1.73	oblong ellipsoid	
Hordeum distichum	Beersheba, mer Morte	32.05 × 18.05	1.78	oblong ellipsoid	
Hordeum murinum	Jerusalem	29.05 × 16.50	1.76	oblong ellipsoid	
Hordeum vulgare	Kiboutz Gat	31.95 × 16.05	1.99	oblong ellipsoid	
Secale cereale	Rehovot	31.35 × 16.67	1.88	oblong ellipsoid	
Secale cereale	Dalia	31.82 × 17.35	1.83	oblong ellipsoid	
Triticum dicoccum var. *dicoccoides*	Rosh Pinna	30.10 × 16.42	1.83	oblong ellipsoid	
Triticum durum var. Nursi		35.85 × 17.57	2.04	oblong ellipsoid	
Triticum vulgare var. Morocco	Yowne	31.72 × 17.20	1.84	oblong ellipsoid	
Triticum sp. var. Étoile de Choisy	Gat, Negev	34.25 × 15.85	2.16	oblong ellipsoid	
Triticum var. cult.	Beersheba, mer Morte	35.47 × 17.92	1.98	oblong ellipsoid	
Aegilops longissima	Beersheba, mer Morte	36.02 × 20.35	1.77	oblong ellipsoid	

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (μm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Aegilops ovata	Meiron, Tsefat	33.10 × 18.45	1.79	oblong ellipsoid	
Aegilops variabilis	Tsefat	32.47 × 18.92	1.72	oblong ellipsoid	
Aegilops variabilis	Beersheba, mer Morte	34.25 × 19.85	1.73	oblong ellipsoid	
Lolium perenne	Beersheba, mer Morte	32.95 × 16.17	2.04	oblong ellipsoid	
	High Caucasus:				
Agropyron repens	Teberda	28.11 × 15.56	1.81	oblong ellipsoid	
Agrostis stolonifera	Teberda	26.15 × 14.52	1.80	oblong ellipsoid	
Poa pratensis	Teberda	26.31 × 14.65	1.80	oblong ellipsoid	
	Crimea:				
Aegilops cylindrica	Sel-Buchra, Prochladnoe	27.98 × 16.68	1.68	ovoid	
Agropyron repens	Prochladnoe	28.32 × 14.22	1.99	oblong ellipsoid	
Agropyron cf. *repens*	Sel-Buchra, Prochladnoe	30.47 × 16.06	1.90	oblong ellipsoid	
	Algeria:				
Agropyron repens	Maison-Carrée près Alger	25.8 × 16.5	1.56	small ovoid	*
	Morocco:				
Avena alba	Djaba, Moyen Atlas	29–32 × 17.5–19		ovoid to oblong ellipsoid	*
Avena alba var. *barbata*	Marrakech-Asni, Grand Atlas	28.2 × 18.7	1.5	ovoid	*
Avena bromoides	Ifrane, Moyen Atlas	27.9 — 30.4 × × 18.1 — 18.3		oblong ellipsoid	*
Avena jahandiezii	Ifrane→Immouzer, M. Atlas	28.2 × 18.8	1.5	ovoid	*
Avena jahandiezii	Ifrane, M. Atlas	28.8 × 19.3	1.49	ovoid	*
Avena sterilis	Ouirgane près Asni, Grand Atlas	24.1 × 17.4	1.38	small ovoid	*
Avena sterilis	Djebel Hebbri, Moyen Atlas	24.7 × 18.1	1.36	small ovoid	*
Avena sterilis subsp. *macrocarpa*	Djebel Toubkal, Grand Atlas	25.7 × 17.6	1.46	small ovoid	*
Avena sterilis	environs de Meknès	28.2 × 18.1	1.55	ovoid	*
Avena sterilis	route Meknès→Azrou	28.9 × 17.5	1.65	ovoid	*
Avena sterilis	maquis des dunes de Mogador	29.3 × 17.4	1.68	ovoid	*
Avena sterilis	entre Arzila et Larache	30.1 × 17.6	1.71	oblong ellipsoid	*
Avena sterilis	route Rabat→Meknès	31.0 × 18.0	1.72	oblong ellipsoid	*
Avena sterilis	entre Ito et El Hajeb	32.6 × 18.4	1.77	oblong ellipsoid	*
Hordeum bulbosum	entre Arzila et Larache	26.4 × 19.0	1.38	small ovoid	*

Host plant	Locality	x̄L × x̄W (µm)	x̄L : x̄W	Shape	Notice
Hordeum bulbosum	Tétouan	26.5 × 18.8	1.40	small ovoid	*
Hordeum bulbosum	Meknès→Azrou	27.7 × 20.2	1.37	ovoid	*
Hordeum bulbosum	entre Arbaoua et Souk el Arba du Rharb	29.1 × 16.9	1.72	oblong ellipsoid	*
Hordeum murinum	Azrou-Midelt, Moyen Atlas	26.8 × 18.4	1.45	small ovoid	*
Hordeum murinum	Oukaimeden, Grand Atlas	27.2 × 19.1	1.42	ovoid	*
Hordeum murinum	Tétouan	27.9 × 16.8	1.66	ovoid	*
Hordeum murinum	Ifrane-Boulemane, Moyen Atlas	28.0 × 19.8	1.41	ovoid	*
Hordeum murinum	col de Tadment, Grand Atlas	28.3 × 17.3	1.63	ovoid	*
Hordeum murinum	Ouirgane, Haut Atlas	28.8 × 20.0	1.44	ovoid	*
Hordeum murinum	Rabat-Meknès	29.4 × 17.9	1.64	ovoid	*
Hordeum murinum	Michliffen, Moyen Atlas	29.6 × 19.0	1.55	ovoid	*
Hordeum murinum	Ouirgane, Grand Atlas	30.2 × 19.2	1.57	ovoid	*
Hordeum murinum	Agadir-Ouarzazate	30.2 × 19.4	1.55	ovoid	*
Hordeum murinum	près Asni, Grand Atlas	30.2 × 19.6	1.54	ovoid	*
Hordeum murinum	El Hajeb-Azrou, Moyen Atlas	30.3 × 18.1	1.67	ovoid	*
Hordeum murinum	Tizi n'Tretten, Moyen Atlas	31.2 × 18.3	1.70	ovoid	*
Hordeum murinum	Dayet Ahoua, Moyen Atlas	32.0 × 19.0	1.68	ovoid	*
Hordeum murinum	vers Djebel Toubkal, Grand A.	32.5 × 18.2	1.78	oblong ellipsoid	*
Hordeum murinum	près Meknès	33.0 × 18.6	1.77	oblong ellipsoid	*
Hordeum sp. (cult.)	Salé	32.5 × 17.7	1.83	oblong ellipsoid	*
Secale cereale	Salé	30.9 × 20.0	1.54	ovoid	*
Triticum sp. (cult.)	Tarjiat→Ouarzazate	31.9 × 19.5	1.63	ovoid	*
Triticum sp. (cult.)	Ito-El Hajeb	33.1 × 18.5	1.78	oblong ellipsoid	*
Triticum sp. (cult.)	Asni, Grand Atlas	36.8 × 16.7	2.20	oblong ellipsoid	*
Aegilops ovata	route Ifrane→Boulemane, Moyen Atlas	30.6 × 17.9	1.70	ovoid	*
Aegilops ovata	Djebel Toubkal, Grand Atlas	31.4 × 18.5	1.69	ovoid	*
Aegilops ovata	Tizi n'Tretten, Moyen Atlas	36.2 × 17.3	2.09	oblong ellipsoid	*
Aegilops triaristata	col de Tadment, Grand Atlas	29.2 × 17.4	1.67	ovoid	*
Aegilops triuncialis	Atlas marocain	28.1 × 17.3	1.62	ovoid	*
Aegilops ventricosa	Dayet Ahoua, Moyen Atlas	27.0 × 19.0	1.42	small ovoid	*
Aegilops ventricosa	près Meknès	27.3 × 18.4	1.48	ovoid	*
Aegilops ventricosa	près Meknès	30.4 × 19.3	1.57	ovoid	*
Agropyrum festucoides	oued Mikdane, Atlas marocain	31.3 × 17.8	1.75	oblong ellipsoid	*
Agropyrum marginatum	à 6 km d'Ifrane, Moyen Atlas	28.8 × 18.6	1.54	ovoid	*
Agropyrum marginatum	Ifrane-Boulemane, Moyen Atlas	29.9 × 19.8	1.51	ovoid	*
Agropyrum marginatum	Michliffen, Moyen Atlas	30.4 × 16.8	1.80	oblong ellipsoid	*

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (µm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Agropyrum marginatum	Trik Adjir, Moyen Atlas	31.2 × 19.2	1.62	ovoid	*
Agropyrum marginatum	Ifrane-Boulemane, Moyen Atlas	31.6 × 16.7	1.89	oblong ellipsoid	*
Agropyrum marginatum	Djebel Hebbri, Moyen Atlas	38.5 × 17.5	2.20	oblong ellipsoid	*
Anthoxanthum odoratum	Ifrane-Azrou, Moyen Atlas	24.6 × 17.6	1.40	small ovoid	*
Arrhenatherum elatius	près Ifrane, Moyen Atlas	27.8 × 18.5	1.50	ovoid	*
Arrhenatherum elatius	Ifrane-Azrou, Moyen Atlas	30.7 × 20.8	1.47	ovoid	*
Arrhenatherum erianthum	Ifrane, Moyen Atlas	22.4 × 19.4	1.15	small ovoid	*
Arrhenatherum erianthum	Djebel Hebbri, Moyen Atlas	27.0 × 17.6	1.53	small ovoid	*
Arrhenatherum erianthum	route Ifrane-Boulemane, Moyen Atlas	28.2 × 18.1	1.55	ovoid	*
Bromus lanceolatus	Djebel Toubkal, Haut Atlas	28.7 × 13.4	1.55	ovoid	*
Bromus macrostachys	Ifrane, Moyen Atlas	31.1 × 18.9	1.64	ovoid	*
Bromus mollis	environs de Tétouan	31.0 × 18.2	1.70	ovoid	*
Bromus ramosus subsp. *benekenii*	Djebel Hebbri, Moyen Atlas	30.3 × 18.0	1.68	ovoid	*
Bromus ramosus subsp. *benekenii*	Ifrane-Azrou, Moyen Atlas	30.9 × 18.5	1.67	ovoid	*
Bromus rigidus	col de Tadment, Haut Atlas	32.5 × 19.2	1.69	ovoid	*
Bromus rigidus subsp. *gussonii*	Ifrane-Immouzer, Moyen Atlas	30.0 × 18.8	1.59	ovoid	*
Bromus cf. *squarrosus*	Azrou-Midelt, Moyen Atlas	26.9 × 17.9	1.50	small ovoid	*
Bromus squarrosus	Michliffen, Moyen Atlas	30.6 × 18.9	1.61	ovoid	*
Bromus tectorum	Atlas Marocain	30.0 × 18.0	1.66	ovoid	*
Bromus sp.	Tizi n'Tretten, Moyen Atlas	25.4 × 18.6	1.36	small ovoid	*
Cynosurus echinatus	près Meknès	25.0 × 18.0	1.38	small ovoid	*
Cynosurus echinatus	El Hajeb	27,2 × 18,5	1,47	ovoid	*
Dactylis glomerata	Trik Adjir, Moyen Atlas	25,5 × 17,3	1,47	small ovoid	*
Dactylis glomerata	clairière de cédraie près Michliffen, Moyen Atlas	25.6 × 16.5	1.55	small ovoid	*
Dactylis glomerata	Djebel Hayane, Moyen Atlas	25.8 × 16.6	1.55	small ovoid	*
Dactylis glomerata	Tanaout, Grand Atlas	26.4 × 18.8	1.40	small ovoid	*
Dactylis glomerata	Ifrane	26.5 × 17.8	1.48	small ovoid	*
Dactylis glomerata	Djebel Hebbri, Moyen Atlas	27.1 × 17.0	1.59	ovoid	*
Dactylis glomerata	Michliffen, Moyen Atlas	27.7 × 18.2	1.52	ovoid	*
Dactylis glomerata	Ifrane, Moyen Atlas	28.7 × 19.0	1.51	ovoid	*
Dactylis glomerata	col de Tadment, Grand Atlas	29.2 × 18.8	1.55	ovoid	*
Dactylis glomerata	Tadment, Grand Atlas	30.0 × 17.3	1.73	oblong ellipsoid	*
Dactylis glomerata	environs de Tanaout, Grand A.	30.6 × 18.2	1.68	ovoid	*
Elymus caput-medusae	Trik Adjir, Moyen Atlas	28.8 × 18.1	1.59	ovoid	*
Festuca triflora	Michliffen, Moyen Atlas	29.6 × 16.4	1.80	oblong ellipsoid	*
Festuca triflora	Ifrane-Boulemane, Moyen Atlas	30.0 × 18.0	1.66	ovoid	*

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (µm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Festuca triflora	Ifrane, Moyen Atlas	31.2 × 17.2	1.81	oblong ellipsoid	*
Festuca triflora	Ifrane-Azrou, Moyen Atlas	31.3 × 18.2	1.71	oblong ellipsoid	*
Haynaldia hordeacea	Trik Adjir, Moyen Atlas	27.3 × 17.2	1.58	ovoid	*
Haynaldia hordeacea	col de Tadment, Grand Atlas	28.1 × 18.7	1.50	ovoid	*
Haynaldia hordeacea	Dayet Ahoua, Moyen Atlas	29.3 × 18.2	1.60	ovoid	*
Haynaldia hordeacea	Djebel Hebbri, Moyen Atlas	29.6 × 18.8	1.57	ovoid	*
Haynaldia hordeacea	Ifrane-Azrou, Chénaie, Moyen A.	30.7 × 18.0	1.70	ovoid	*
Haynaldia hordeacea	Michliffen, Moyen Atlas	30.7 × 18.4	1.66	ovoid	*
Haynaldia hordeacea	Michliffen, Moyen Atlas	32.2 × 18.4	1.75	oblong ellipsoid	*
Haynaldia hordeacea	Djebel Hayane, Moyen Atlas	35.2 — 39.0 × × 16.4 — 17.1		oblong ellipsoid	*
Lagurus ovatus	Dayet Ahoua, Moyen Atlas	31.8 × 17.0	1.87	oblong ellipsoid	*
Lolium multiflorum subsp. *italicum*	Asif Aït Mizane, Haut Atlas	23.9 × 16.6	1.43	small ovoid	*
Lolium rigidum	without locality	25.3 × 17.4	1.45	small ovoid	*
Poa pratensis (cult.)	farm Debbag	24.5 × 15.5	1.58	small ovoid	*
Poa sp.	Djebel Toubkal, Asni, Grand A.	23.7 × 17.4	1.36	small ovoid	*
Trisetum flavescens	Ifrane-Azrou, Moyen Atlas	32.8 × 20.2	1.62	ovoid	*
Vulpia litardiereana	Aïn Nokra, Moyen Atlas	29.7 × 21.0	1.41	ovoid	*
	Albania:				
Triticum cf. *aestivum*	Korča	30.85 × 20.35	1.52	ovoid	
	Spain:				
Avena fatua	Sierra de Gredos entre Madrid et Oropesa	28.0 × 17.4	1.60	ovoid	*
Hordeum murinum	entre Aranda de Duero et Madrid	26.0 × 17.3	1.50	small ovoid	*
Aegilops ovata	Burgos→Aranda de Duero	28.6 — 29.2 × × 17.2 — 17.6		ovoid	*
Aegilops triaristata	Sierra de Gredos, Madrid→Oropesa	29.2 × 17.2	1.69	ovoid	*
Aegilops triuncialis	Burgos→Aranda de Duero	29.1 × 18.3	1.59	ovoid	*
Arrhenatherum elatius	north slopes of Sierra Nevada	24.3 × 19.4	1.25	small ovoid	*
Bromus fasciculatus	Burgos→Aranda de Duero	28.8 × 17.3	1.66	ovoid	*
Bromus fasciculatus	à 30 km au nord de Teruel	28.8 × 19.6	1.46	ovoid	*
Dactylis glomerata	environs de Lérida	24.8 × 18.4	1.34	small ovoid	*
Elymus caput-medusae	entre Aranda de Duero et Madrid	29.0 × 18.0	1.61	ovoid	*

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (µm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Festuca granatensis	north slopes of Sierra Nevada	25.2 × 17.1	1.47	small ovoid	*
Festuca granatensis	north slopes of Sierra Nevada	25.5 × 17.4	1.46	small ovoid	*
Trisetum velutinum	Dornajo, Sierra Nevada	30.0 × 24.0	1.25	ovoid	*
	Portugal:				
Dactylis glomerata	Braga	22.6 × 19.2	1.17	small ovoid	*
	France, south + south-east:				
Avena fatua	Sainte Maxime, Var	25.8 × 18.1	1.42	small ovoid	*
Avena fatua	Saint Tropez, Var	27.4 × 17.1	1.60	ovoid	*
Avena fatua	près Montpellier, Hérault	27.6 × 18.4	1.50	ovoid	*
Hordeum murinum	Malaucène près Vaison, Vaucluse	27.8 × 17.6	1.57	ovoid	*
Agropyrum caninum	Pic de Séüze près Gap, Hautes Alpes	26.0 × 16.3	1.59	small ovoid	*
Agropyrum caninum	près Colmars, Basses Alpes	29.2 × 18.4	1.58	ovoid	*
Agropyrum caninum	bords du Verdon près Colmars	29.3 × 15.7	1.86	oblong ellipsoid	*
Agropyrum glaucum	Bourg-d'Oisans, Alpe d'Huez, Isère	25.6 × 14.0	1.82	small oblong	*
Agropyrum cf. *glaucum*	Pic de Séüze près Gap, Hautes Alpes	30.4 × 14.5	2.09	oblong ellipsoid	*
Agropyron repens	Pic de Séüze près Gap, Hautes Alpes	29.0 × 14.4	2.01	oblong ellipsoid	*
Agropyron repens	bords du Verdon près Colmars, Basses Alpes	30.6 × 15.5	1.97	oblong ellipsoid	*
Anthoxanthum odoratum	Bourg-d'Oisans, Alpe d'Huez, Isère	26.8 × 19.8	1.35	small ovoid	*
Arrhenatherum elatius	Bourg-d'Oisans, Alpe d'Huez	28.0 × 14.8	1.88	oblong ellipsoid	*
Briza media	près Colmars, Basses Alpes	23.4 × 16.3	1.43	small ovoid	*
Cynosurus cristatus	Sainte Maxime et Saint Tropez, Var	20.8 × 17.7	1.17	small ovoid	*
Cynosurus cristatus	Sainte Maxime, Var	23.2 × 15.9	1.45	small ovoid	*
Dactylis glomerata	Barcelonette, Basses Alpes	22—26 × 15—17		small ovoid	* 12 samples
Dactylis glomerata	Barcelonette, Basses Alpes	23.8 × 17.4	1.36	small ovoid	*
Dactylis glomerata	Bourg-d'Oisans, Alpe d'Huez	25.7 × 18.0	1.42	small ovoid	*
Festuca arundinacea	Sainte Maxime, Var	23.7 × 18.6	1.27	small ovoid	*
Festuca arundinacea	Sainte Maxime, Var	25.0 × 18.4	1.35	small ovoid	*
Festuca arundinacea	près Montpellier, Hérault	25.2 × 17.2	1.46	small ovoid	*

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (μm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Festuca arundinacea	Palavas, Hérault	26.3 × 16.1	1.63	small oblong	*
Festuca arundinacea	Sainte Maxime, Var	26.5 × 15.6	1.69	small oblong	*
Festuca arundinacea	Saint Laurent du Var près Nice, Alpes Maritimes	28.6 × 18.5	1.54	ovoid	*
Festuca arundinacea	Colmars, Basses Alpes	29.2 × 16.6	1.75	oblong ellipsoid	*
Lolium perenne	Colmars, Basses Alpes	23.8 × 15.1	1.57	small ovoid	*
Lolium perenne	Sainte Maxime, Var	24.5 × 15.6	1.57	small ovoid	*
Lolium perenne	près Montpellier, Hérault	24.9 × 14.9	1.67	small oblong	*
Phleum pratense	Bourg-d'Oisans, Alpe d'Huez, Isère	24.7 × 16.7	1.47	small ovoid	*
Poa alpina	Mt. Pelvoux, Hautes Alpes	23.0 × 19.6	1.17	small ovoid	*
Poa nemoralis	Bourg-d'Oisans, Alpe d'Huez	23.4 × 12.6	1.85	small oblong	*
	France, east:				
Aira caespitosa	Plombières, Vosges	25.1 × 15.0	1.67	small oblong	*
Aira flexuosa	without locality	21.4 × 14.7	1.45	small ovoid	*
Anthoxanthum odoratum	Grand Ballon d'Alsace	22.7 × 19.2	1.18	small ovoid	*
Elymus europaeus	forêt de la Joux, Jura	24—27 × 16—17		small ovoid	*
Elymus europaeus	Haute Savoie, St. Jean de Sixt	29.8 × 16.4	1.81	oblong ellipsoid	*
Festuca sylvatica	forêt de la Joux, Jura	21.2 × 16.0	1.32	small ovoid	*
	France, central:				
Festuca arundinacea	Grignon, Seine-et-Oise	29.8 × 16.8	1.77	oblong ellipsoid	*
	Austria:				
Agrostis stolonifera	Berwang-Ausserfern	23.2 × 18.7	1.25	small ovoid	*
Anthoxanthum odoratum	Berwang-Ausserfern	26.3 × 18.1	1.46	small ovoid	*
Dactylis glomerata	Lunz a. See	27.3 × 17.8	1.53	ovoid	*
Festuca pratensis	Lunz a. See	25.6 × 17.3	1.48	small ovoid	*
	Lithuanian S.S.R.:				
Avena sativa	Vilniaus	28.9 × 18.6	1.55	ovoid	*
Hordeum distichon	Vilniaus	28.6 × 17.5	1.63	ovoid	*
Hordeum jubatum	Vilnius-Antakalnis	25.08 × 13.83	1.81	small oblong	
Hordeum jubatum	Vilnius	26.6 × 14.2	1.87	oblong ellipsoid	*
Triticum aestivum	Anykščin	27.6 × 16.3	1.69	ovoid	*

Host plant	Locality	$\bar{x}_L \times \bar{x}_W$ (µm)	$\bar{x}_L : \bar{x}_W$	Shape	Notice
Agropyron caninum	Vilniaus	27.7 × 16.4	1.68	ovoid	*
Agropyron repens	Tauragės	25.9 × 16.8	1.54	small ovoid	*
Agropyron repens	Vilniaus	26.5 × 16.1	1.64	small oblong	*
Agropyron repens	Vilniaus	26.9 × 17.0	1.58	small ovoid	*
Agrostis canina	Vilniaus	21.2 × 15.3	1.38	small ovoid	*
Agrostis stolonifera	Vilniaus	23.3 × 15.6	1.49	small ovoid	*
Anthoxanthum odoratum	Švenčioniu, Vilniaus, Traku	24.4 × 17.4	1.40	small ovoid	*
Calamagrostis epigeios	without locality	25.3 × 17.3	1.46	small ovoid	*
Deschampsia cespitosa	Tauragės	22.4 × 16.5	1.35	small ovoid	*
Deschampsia cespitosa	Juodkrante, Kuršin	23.2 × 16.2	1.43	small ovoid	*
Elymus arenarius	Vilnius, botanical garden	27.58 × 15.30	1.80	oblong ellipsoid	*
Lagurus cylindricus	Vilnius, botanical garden	27.7 × 15.9	1.74	oblong ellipsoid	*
Phleum pratense	Dotnuva	25.49 × 16.01	1.59	small ovoid	*

* literature data

On the Baltic coast of the Lithuanian S.S.R. Minkevičius (1982) reports ovoid spores on *Avena sativa* and *Hordeum distichon;* on *Triticum aestivum* transitory ovoid to oblong ellipsoid urediospores were found; on *Hordeum jubatum* and *Lagurus cylindricus* (in Vilnius, Botanical Garden) the author stated pronouncedly oblong ellipsoid spores. Clearly, the last mentioned collections represent cerealicolous races or specialized forms of the subspecies *graminis.* Collections on *Agropyron caninum* (a transitory ovoid to oblong ellipsoid shape) and on *A. repens* (transitory small ovoid to either ovoid or small oblong shape) are heterogeneous as to their shape and size. Without experimental verification no collection on *Agropyron* can be held for only cerealicolous or graminicolous race. They seem to be rather hybrid populations. Genuine small ovoid spores were stated on *Agrostis canina, A. stolonifera, Anthoxanthum odoratum* and *Deschampsia cespitosa.* Somewhat larger small ovoid spores were found on *Calamagrostis epigeios* and *Phleum pratense* (Minkevičius 1937). All small-spored collections belong to the subsp. *graminicola* Urban.

Only informative material was available from Crimea (leg. J. Marek) and from northern slopes of the High Caucasus from the State National Reserve Teberda in the R.S.F.S.R. (leg. J. Marková). Two Crimean collections on *Agropyron* sp. div. have distinctly oblong ellipsoid spores, on *Aegilops cylindrica* urediospores are transitory from ovoid to oblong ellipsoid. All collections were made in the same area in the vicinity of Prochladnoje — 10 km south of Simferopol.

All material from the Teberda S.N.R. was gathered under a *Berberis vulgaris* shrub on *Agropyron repens, Agrostis stolonifera* and *Poa pratensis.* Grasses of the genera *Dactylis, Festuca* and *Phleum* growing together with the above mentioned species were without a trace of infection. Urediospores are significantly oblong ellipsoid, although they are smaller on *Agrostis* and *Poa* approaching thus the small oblong ones.

Urediospores from Crimea possess most frequently 4 but also 5 germ pores. The same character was found in the spores on *Agropyron* from Teberda whereas on *Agrostis* and *Poa* 3—4 germ pores were counted.

Let us attempt to summarize the results from this geographically rather heterogeneous material: in western and central Europe and at the Baltic coast cerealicolous specialised forms with large, ovoid or transitory to oblong ellipsoid, and most often distinctly oblong ellipsoid (*Triticum*) spores are found on cereals. The same type of urediospores can be found, however, also on certain wild grasses *(Agropyron, Avena fatua, Hordeum* sp. incult.); these can be considered as belonging to a certain cerealicolous form (f. sp. *secalis, avenae, tritici);* similar assumption can also be expressed about the findings at special places, as e. g. botanical gardens (*Lagurus cylindricus)* or at experimental plots of plant breeding stations (e. g. *Festuca arundinacea* at Grignon in France, collections from Troubsko near Brno, etc.). Yet the situation is different when large spores are found on grasses growing in more or less natural plant communities (*Arrhenatherum, Festuca, Hordelymus* and others). This concerns also collections from the northern Caucasus (Teberda) on *Agropyron repens, Agrostis stolonifera* and *Poa pratensis* where we are tempted to consider the possibility of interracial hybridization.

All the above mentioned large-spored findings belong to the subsp. *graminis* which evidently includes not only forms (physiologic races) more or less adapted to cereals but possibly also those parasitizing in first place on wild grasses. Among both groups of forms (races) hybridizing undoubtedly takes place.

Puccinia graminis subsp. *graminicola* which has small, rather ovoid urediospores seems to be fairly common in Europe, in the first place on the following grass genera: *Agrostis, Anthoxanthum, Arrhenatherum, Dactylis, Deschampsia, Festuca, Lolium, Poa* and *Phleum*. The physiologic races (specialised forms?) which are included into it probably only exceptionally pass to cereals or *Agropyron* sp. div. or to other closely related grass species and genera. Some of these races (f. sp.?) probably hibernate on the following hosts: *Anthoxanthum odoratum, Deschampsia cespitosa* and *Phleum pratense*. There is, evidently, a much lesser number of wild grass genera and species which host the wheat stem rust *(Puccinia graminis* var. *graminis)* in southeastern and southern France, Central Europe and the Baltic regions as compared with the Mediterranean and the countries of Near and Middle East. It is also evident that in the more or less natural plant formations as well as in the secondary anthropogenic ones originating from them (except the cerealicolous agrophytocenoses) graminicolous races of the subsp. *graminicola* Urban are prevailing.

B. Evolution

Besides the authors mentioned previously the evolution of stem rust was studied by Leppik (1961) and Anikster and Wahl (1979). Especially the latter authors emphasize a greater respect for the co-evolution of hosts (even the wild growing species) with their individual rusts in their considerations. On local scale this requirement is especially underlined and utilized by Urban (1980) and Savile and Urban (1982) who were the first to express a generalizing hypothesis that in the course of polyploidization of some of our cereals also polyploidization in *Puccinia graminis* simultaneously took place. The consequence of bread wheat polyploidy is that its genome embraces various degrees of susceptibility (and resistance) genes of all diploid parent grasses. This resulted in the course of domestication and mass distribution of cereals (in the first place of wheat) in the fact that by natural selection on wheat races and specialised forms of the stem rust were sorted, the genom of which was far more complex than in the original ancestral rust fungus.

The origin of *Puccinia graminis* can be situated into the regions with the greatest infraspecific variability and gene diversity of both the *Berberis* genus as well as the *Festucoideae* subfamily (Leppik 1961). The most frequently mentioned alternate host is *Berberis vulgaris*, sectio *Vulgares* (see Ahrendt 1961) the members of which have a wide distribution from central Europe in the temperate zone reaching over Caucasus, Central Asia and the Himalayas to S.W. and central China (provinces Yun-nan, Sze-chwan, Hu-peh) through the provinces Shen-si, and Manchuria to North Korea, the Amur region and Japan. Alternate hosts are nevertheless found also in other sections, as e. g. sectio *Integerrimae* with its evolutionary centre in Armenia, Transcaucasia and Iran, reaching into Turkestan, Afghanistan and N. W. Pakistan, and sectio *Crataeginae* the representants of which inhabit the Mediterranean (Madeira; N. W. Africa, south of the Iberian peninsula, Corsica, Sardinia, Sicily, Crete, Cyprus, south Italy, Greece, Asia Minor) reaching also into Turkestan. In Transcaucasia also hosts from sectio *Vulgares, Berberis vulgaris* and *B. orientalis* can be found. In central Asia (republics in the south of the U.S.S.R.) in Iran and Afghanistan hosts from the sections *Integerrimae* and *Heteropodae* are encountered. From the Himalayas and their foothill hosts from the sections *Tinctoriae, Asiaticae* and *Polyanthae* are reported. A conspicuous variability in hosts of *Puccinia graminis* is reported from continental China (Cummins and Ling 1950; Wang Jun Chang 1951), mostly from the sections *Wallichianae* and further *Brachypodae, Dasystachyae, Polyanthae, Sinenses, Tschonoskyanae* and *Vulgares*. *Mahonia fortunei* as host is recorded from provinces Hu-peh and Sze-chwan.

As to the evolution of *Berberis* the highest degree of variability is found in the area of the present southeast Asia from where the genus spread to the east, southeast and west. In these regions also originated ancestral *Puccinia graminis* which spread together with its both hosts in similar directions. At the end of his paper on stem rust genealogy Leppik says (p. 400): "The gene-centers of our grain crops, which are the main hosts of the present-day races, are all included in the area of the *Festucoideae* in the northern hemisphere (Fig. 5). This area also could be the ancestral homeland of the present-day stem rust." This idea is not contradictory to ours, yet it does not indicate the way in which the cerealicolous *Puccinia graminis* originated.

According to our assumption the ancestral *Puccinia graminis* spread to new and further places not only via aeciospores and urediospores but its dispersal was also influenced by natural advance of plant communities in which festucoid grasses and alternate host were sufficiently frequent. It is impossible to draw a picture of the history of plant communities and formations through which the stem rust evolution passed, nor is it possible to describe in full the plant communities in the vast Eurasia in which are certainly existing up to now natural stem rust habitats (e. g. in continental China, Indian subcontinent and elsewhere). In the countries where agriculture developed, persists up to now and is further being improved, the situation is always more complicated.

Data on the present-day autecology, phytocenology and distribution of barberry and festucoid grasses in the area of assumed speciation and domestication of cereals give us at least partial glance of the probable evolution of wheat stem rust closely connected with the evolution of hexaploid wheat.

A view of the origin of tetraploid wheat has not so far been definitely established. The assumption of natural hybridization of wild einkorn (*Triticum boeoticum* and its geographical races: *T. aegilopoides* and *T. thaoudar*; = A-genom) with *Aegilops speltoides* (or with *A. longissima, A. bicornis, A. searsii*) is older. A more recent assumption is that *Triticum urartu* (see map in Hammer 1980) is the B — genom donor. Zohary (1971) describes *Triticum boeoticum* as natural component of oak-park forests. This species is frequent in the eastern Mediterranean and Asia Minor penetrating to the Zagros Mts. and to the south of the western and eastern Transcaucasia and N. E. Iran. Zohary mentions also other natural habitats of *T. boeoticum* as e. g. the vast basaltic hillocks and slopes in S. E. Turkey where *T. boeoticum* grows nearly in monoculture. It obviously penetrates secondarily into wheat and barley fields at the edges of which and along roads it often grows in monoculture. Then it is fully dependent on the man-made biotopes. In the following Zohary assumes that wheat evolution could progress further only after the einkorn wheat had been domesticated; in his opinion this occured in countries of mass occurrence of *Triticum boeoticum*, viz. in the highlands on the border of the Syrian Desert and Mesopotamia. Only then tetraploid wild emmer, *Triticum dicoccoides*, originated which nevertheless evolved via domestication into cultivated *Triticum dicoccon*, hulled tetraploid emmer. Tetraploid wheat is a basic crop in the Neolithic and Bronze Age in the Middle East, having spread from this site of its origin over the whole Mediterranean belt. Its wild progenitor, *T. dicoccoides*, occupied a smaller area than the wild diploid einkorn reaching from N. Israel across Jordan to S. Syria. It is an annual on slopes of the Upper Jordan valley (east Galilee and Sammaria, Gilead, Golan Heights, Hauran, and Mt. Hermon) being, together with *Hordeum spontaneum* and *Avena sterilis*, a conspicuous component of the *Quercus ithaburensis* park forest. It shows close affinity, however, to rocky places and relatively rich soils on basalts and hard limestone slopes. Upper Jordan and probably also north and east of the Fertile Crescent (i. e. S. E. Turkey, N. Iraq and W. Iran) are presumed as the area of emmer wheat domestication.

For completion let us add that another group of tetraploid wheats is distinguished by Zohary (l. c.) and designated as *Triticum timopheevi* group; nowadays the latter species is only a rarely cultivated endemic wheat in the W. and E. Transcaucasia (Cvelev 1976). This cultivated wheat is related (interfertility) with wild growing *T. araraticum* which is scattered in the following countries: eastern Asia Minor, Armenian S.S.R, E. Transcaucasia, N. W. Iran and N. Iraq. In Turkey and Iraq it is also a component of the *Quercus brantii* oak park forest belt; further it is common on rocky slopes in Transcaucasia. This group of wheat is genetically markedly separated from the Syrian-Palestinian *T. dicoccoides* group and this is why a quite different genom (G) has participated in its origin.

Nowadays bread wheats, the hexaploid species *Triticum aestivum* with its subspecies, varieties, forms and cultivars have common distribution in the world. In the history of agriculture the following additional hexaploids are mentioned: *T. compactum*, *T. spelta*, *T. sphaerococcum*, *T. macha* and *T. vavilovii*. No wild hexaploid wheat occurs in nature. It is still accepted that cultivated hexaploid wheats are amphiploids originated by hybridization of tetraploids with various forms of *Aegilops tauschii* (donor of D-genom; previously reffered to as *A. squarrosa* auct. non L.). It seems probable that the creation of bread wheats occured only after the establishment of tetraploid wheat agriculture (*T. dicoccon*). Cultivated emmer gradually shifted from the Middle East to the whole Mediterranean. The area of *Aegilops tauschii* with long anthers belonging into subsp. *strangulata* is reproduced in Hammer's paper (1980). Only populations with long anthers are presumed in the origin of hexaploid wheat. The highest genetic diversity of subsp. *strangulata* is found in Transcaucasia the individuals with long anthers being most common in the Azerbaijan S.S.R. This is why Hammer (l. c.) assumes that the above area (possibly also the regions S. W. of the Caspian Sea, see Zohary 1971) is the place of the initiation of hexaploid wheat. This was namely the only area where contact between both parents, i. e. domesticated emmer and *Aegilops tauschii*, took place.

The center of *Aegilops tauschii* distribution is in Transcaucasia, near the S. W. corner of the Caspian Sea and in N. Afghanistan. According to Zohary (l. c.) it is a very variable species not only from the morphological but also ecological point of view. On the Iranian plateau in the pistacio "steppe forest" and the loess belt of N. Afghanistan and Soviet Central Asia slender xeric forms are distributed, whereas more robust populations are found on the more mesic Caspian coast and as weeds in wheat fields. Still other forms inhabited consolidated sand dunes in the rain-soaked Hyrcanic forest belt. Nevertheless, all are agressive weeds in fields of tetraploid wheat. Thanks to agriculture *Aegilops tauschii* spread far beyond the borders of its original center in which spontaneous hybridization with tetraploid emmer and hexaploid wheats is still taking place.

Man-tilled fields of domesticated emmer made conditions for crossing on large--scale and enabled survival and spread of fertile amphiploids (Hammer, l. c.). In the course of thousand years primary hybrids repeatedly mutually crossed which resulted in the present-day great variability and network-like penetration of morphologic, biochemic, ecologic and other characteristics of the earlier and present-day cultivated wheats.

It seems that ancestral *Puccinia graminis* developed in plant formations in which also the alternate host was frequent. An informative picture of the present-day vegetation types e. g. of Iran is presented by Zohary (1963). *Berberis vulgaris* as well as *B. integerrima* are components of some forests in the Hyrcanian province which embraces in Iran the coastal alluvial lowlands of the Caspian Sea and the northern slopes of the Elburz Mts. together with their subalpine meadows. Both barberry species are components of forests belonging into the class *Quercetea macrantherae*. They are rather xeric forests developed especially in mountains between 1600–2000 m (but also lower or higher), with frequent occurrence of other shrubs and various grasses (e. g. *Brachypodium sylvaticum, Poa pratensis, Deschampsia cespitosa* and others). The Zagrosian forest represents a special type of vegetation which is included into the class of *Quercetea brantii*. It occurs in the S. Armenian, Iranian and Iraqi Kurdistan and in the Zagros Mts. in altitudes between 700 and 2000 m. Especially in the north of this mountain range this forest is very variable in the wood species composition whereas towards the east and S. E. the number of species decreases until only *Quercus brantii* is left. The Zagrosian forest is not a dense growth and owing to that the development of many steppe and xerophytic herbs and grasses (among them *Aegilops, Bromus, Elymus, Hordeum* etc.) is facilitated. On its edges the forest is usually bordered with a "šibljak" which belongs phytocenologically into the same class. In both plant ecosystems *Berberis integerrima* and numerous grass species (see above) are significantly represented.

In the Armenian-Iranian forest steppe province which is spread from the Iranian Azerbaijan across the Elburz Mts. up to Kopet-Dagh in the east of Khorasan there are only local forest steppe remnants sometimes called "*Juniperus polycarpos* forest" with a variety of modifications which all together are included by Zohary into the

Junipereto-Pistacietea class. In them, besides of number of other shrubs, *Berberis integerrima* is significantly represented. Most frequent are the following three variants: 1) pistacia forest steppe or forest steppe with *Pistacia-Amygdalus* covering the elevations and mountains in the Central Iranian plateau; 2) *Amygdaletum scopariae* occurring in the S. E. Iran on the slopes of the Zagros Mts. already passing into the hot Nubo-Sindian province; 3) *Juniperus polycarpos* steppe forest in the same regions as mentioned above. All these types of vegetation are remnants of the ancient Tertiary *Juniperus* forest with a rich undergrowth of many grass species belonging to the genera *Agropyron, Bromus, Festuca, Stipa, Secale, Triticum* and others which otherwise occur even in the unforested places.

In his study Zohary repeatedly emphasizes that all formations described by him were secondary, for many thousands of years under human influence, and that there are only very few places which we can consider natural climax plant communities. The most penetrant and destroying factors have always been pasture, exploitation of vegetation for fuel and agriculture.

The same factors have influenced for thousands of years the original vegetation at Crete in the Mediterranean (Zohary and Orshan 1966). In the mountains there grow, at 800—1500 m, various plant communities of the *Aceretea orientalis* class (possessing many species common with the *Quercetea ilicis)* of which the *Cupresseto-Aceretum orientalis* is considered the climax community. In its both modifications *(aceretosum; cupressetosum) Berberis cretica* is considerably frequent. Along with it the frequency of e. g. *Stipa bromoides, Dactylis glomerata, Poa bulbosa, Anthoxanthum gracile, Bromus fasciculatus, B. sterilis* and others is also very high. In lower situated localities — up to 800 m — plant communities of the order *Quercetalia ilicis* predominate of which the *Ceratonieto-Pistacietum lentisci* and *Quercetum pubescentis* are considered the climax phytocenoses. In all of them *Berberis cretica* and the following grasses are very frequent: *Dactylis glomerata, Avena alba, Aegilops biuncialis, Bromus fasciculatus, B. squarrosus, B. sterilis, Lagurus ovatus, Lophochloa phleoides* etc. All plant formations at Crete are influenced by man, yet the largest area is occupied by garrigues of the order *Poterietalia spinosi* with remnants of *Quercetum pubescentis creticum* which like other ones is secondary and with a high frequency of various grass species.

Similar mutual penetration of the alternate host and various grass species is known from the western Mediterranean, from the Middle and High Atlas (see Malençon 1963a). *Puccinia graminis* from *Berberis hispanica* infects the following perennial grasses: *Agropyron marginatum, Dasypyrum hordeaceum, Arrhenatherum elatius, Avena bromoides, Bromus ramosus* subsp. *benekenii, Dactylis glomerata, Festuca triflora, Lolium perenne* etc.

The above fragmentary view of the present-day geobotanical features in the evolutionary centers of hexaploid wheat the ecosystems of which were influenced for thousands of years by man leads to the conception of two simultaneously progressing and mutually penetrating evolutionary lines in *Puccinia graminis*. The life cycle of the ancestral stem rust took place every year first of all in the forest-steppe and in the oak-park forests on grasses growing immediately beneath the barberry shrubs. The possibility of its long-distance spread may have been restricted by the early teliospore formation so that the population remained to be concentrated in the nearer vicinity of the shrubs (see Malençon 1963b). On the other hand, the annually repeating full life-cycle made possible various combination of the virulence and avirulence genes in relation not only to a single but several host species. The rust fungus was small-spored, with ovoid urediospores (see Savile and Urban 1982) and spread together with the incidence of the alternate host and grasses growing in the same plant community. Among them were certainly also species from the genera *Aegilops, Agropyron, Bromus, Festuca, Secale, Triticum* and others.

Man intervened into this evolution 5—6 thousand years B. C. first by random and later by intentional selection and domestication of wheat and barley together with enlarging of their acreage (Urban 1968, 1969a, 1980, Savile and

Urban 1982). Under the influence of pasture the countries of the origin of cereals in the Middle and Near East as well as the secondary evolutionary centers in the Mediterranean and later on also the countries agriculturally exploited by man in Europe underwent profound changes. These concerned not only the areal extent of forests but also the species composition of herbs and grasses in forest remnants and forest-free areas influenced by man (Savile and Urban 1982). There was a certain difference in that in the ancestral homeland of wheat and in the Mediterranean an undisturbed, two-way gene exchange and combination occured between different populations of wheat and closely related genera *(Aegilops, Agropyron* etc.) as well as between different stem rust populations which parasitized on the above and other grass genera. This undisturbed evolution was strongly influenced by such grass genera and species which further persisted in the changing initial plant communities or which became a. o. weeds in field and ruderal ecotopes. Thanks to these circumstances the wheat stem rust in the above countries is genetically only partially, incompletely separated from this part of the stem rust populations which parasitize on wild grasses. The intermittent, yet constantly persisting gene-flow between wheat and some wild grasses (e. g. *Aegilops, Agropyron* and other genera) combined with hybridization of the stem rust biotypes and physiologic races not only on barberry but also by means of somatogamy on common hosts led, especially after the wild emmer, *Triticum dicoccoides (T. monococcum* x *T. boeoticum;* AB genome) became more commonly spread, to the creation of rust races phenotypically differing by their summer spores, which remained ovoid, yet with an increased volume. The process proceeded and was genotypically stabilized by advancing domestication and further spread of wild emmer accompanied by repeatedly arising cultivated emmer, *T. dicoccon.* Continued heteroecy enabled crossing of wheat rust populations with other ones which persisted on more or less wild growing grasses. Polyploidization (Savile and Urban 1982) probably contributed to the origin of large-spored races. Further evolution of these large-spored populations proceeded under the influence of gradual domestication of hexaploid amphiploids (*Triticum dicoccon* x *Aegilops tauschii;* ABD genome). Similarly as in the tetraploid wheat selection man later intentionally selected and domesticated hexaploids which initially also served as hosts for the large-spored heteroecious stem rust currently parasitizing also on wild grasses. Further natural hybridization of domesticated *Triticum aestivum* and its breeding again stimulated evolution and selection of physiologic races which became more and more frequent over large parts of the continent; this development was especially supported by the increasing acreage of cultivated cereals (especially of wheat). Along with it heteroecy, especially in the regions lying outside the evolutionary centers, lost its primary importance. The evolution of these wheat stem rust races which were subject to long-distance spread by wind, was manifested not only by further urediospore volume increase but also by a change of their shape from ovoid to oblong ellipsoid.

On the contrary, the ancestral small-spored *Puccinia graminis* did not undergo an evolution which would be continuously and repeatedly influenced by stem rust populations which gradually had been evolving on cereals. The material studied demonstrates that it persisted in the primary and secondary evolutionary centers in the first place on certain forest or man-introduced grass genera and species *(Dactylis, Poa, Anthoxanthum, Lolium, Festuca).* Nowadays the small-spored stem rust appears on the above and other genera and species, even in regions which had not been considered evolutionary centers of cultivated wheat

(e. g. Western and Central Europe, the Baltic coast but also the Maritime region in the Far East, see Azbukina 1962, 1971). In that regions it evidently advanced together with plant communities the essential components of which were barberry and various grasses *(Anthoxanthum, Briza, Cynosurus, Deschampsia, Festuca, Hordelymus,* and in the Far East also *Calamagrostis* and *Poa)* and very often also just these hemerophilous genera which were introduced by pasture and prevailed there *(Agrostis, Arrhenatherum, Dactylis, Festuca, Lolium, Poa, Phleum).*

The outlined more or less parallelly running evolutionary lines of *Puccinia graminis* s. l. are not so strictly separated in the primary and secondary evolutionary gene centers of cereals and their cerealicolous stem rust fungus; in those countries mutual anastomosing of both evolutionary lines takes place so that there exist physiologic races common to cereals and wild grasses morphologically belonging to the subsp. *graminis* which is separated physiologically and by its urediospore size from the subsp. *graminicola;* the latter subspecies appears, of course, there too. On the contrary, in the parts of the continent which are more distant from the individual evolutionary centers, the gap between the two subspecies is more conspicuous and stressed also by other evolutionary adaptations, as e. g. marked prevalence of the rust in basal leaves of *Anthoxanthum odoratum* or its frequent hibernation on *Deschampsia cespitosa,* etc.

C. Epiphytotics and some suggestions of strategy in integrated disease management

Conception of *Puccinia graminis* as a complex of two subspecies (subsp. *graminis* and subsp. *graminicola)* differing not only from the physiologic and morphologic aspects but also by their history of evolution incites an urgent requirement of reexamination the preconditions for epiphytotics in Europe. Their recent history was briefly reviewed by Zadoks (1965). In North America epiphytotics were studied already before and an ecologically important long — distance migration of stem rust epiphytotics was discovered. Similar subcontinental rust migration was observed in India (Joshi, Saari and Gera 1972; Joshi and Palmer 1973; Negarajan and Singh 1975; Nagarajan, Singh, Joshi and Saari 1976). The problem of epiphytotics in Europe and in the west African Mediterranean was studied by Guyot and Massenot (1959). In their so far most comprehensive study the authors discuss wheat stem rust epiphytotics above all in North Africa and western Europe. In those countries epiphytotics are caused by physiologic races independent of the host alternation and probably hibernating or oversummering in their uredial stage in permanent or temporary foci. Suitable foci are located probably in certain maritime regions of the Mediterranean (Spain, Italy, Greece, Turkey, Tunisia, Morocco) and on its islands (but also at the Canary Islands in the Atlantic). The rust fungus survives on winter crops but also on wild grasses. Further, the French authors describe extensive foci of wheat stem rust *(Puccinia graminis* var. *graminis)* in the Middle (approx. 250 000 ha) and High Atlas (approx. 50 000 ha) where the rust survives the summer in small wheat plantations but also on wild perennial grasses: *Agropyron marginatum, Bromus ramosus* subsp. *benekenii, Dasypyrum hordeaceum,* etc. at 1450—2100 m. Similar foci probably extend further to the north and northeast into Algeria. Local summer migration of the wheat stem rust, the role of barberry and of weed, ruderal, and adventive grasses in Morocco is described in detail by Malençon (1963a). Guyot and Massenot assume that west European epiphytotics are the result of a long-distance spread of urediospores along with the local rust migratory interactions on the species of *Aegilops, Bromus, Hordeum* and other genera. Thus it is a system which in its completeness embraces the already known "grain crops, cerealicolous (triticum)facies" as well as the so far unregistered "ruderal facies" complemented by the "montane facies", thus giving the opportunity for emerging (on barberry) of physiologic races possessing new virulence genes. The two latter aspects can be included into a single one, viz. the "graminicolous facies".

Such a complex interpretation of one of the conditions of the origin and spread of wheat stem rust epiphytotics has not been submitted anywhere else in Europe or the Near East although there are more data about the isolation of cerealicolous races from barberry or wild grasses in Spain (Urries 1952, 1963, Peña 1963), Italy (Sibilia and Basile 1960, 1961a, b; 1963; Sibilia, Basile and Bošković 1963; Basile, Leonori-Ossicini and Zitelli 1963), Yugoslavia (Basile, Špehar and Kostić 1960; Kostić 1963a, b; Špehar 1963; Špehar and Vlahović 1972; Špehar, Vlahović and Korić 1976), Greece (Skorda 1963) and Israel (Gerechter, Minz and Wahl 1961; Gerechter-Amitai and Wahl 1966).

In the U.S.S.R. classical experiments are those conducted by Jaczewski (1910) in the Smolensk region in which he demonstrated that *Agropyron repens, Bromus secalinus, B. inermis* and *Dactylis glomerata* could host f. sp. *secalis; Lolium perenne* and *Agropyron repens* f. sp. *tritici* and *Arrhenatherum elatius, Alopecurus pratensis* and *Avenastrum pubescens* f. sp. *avenae*. Similar results were later published by other authors, as well.

From the Leningrad region are the results published by Šestiperova (1960); according to them barberry is the main cause of rust infection of summer wheat, oats and barley as well as of *Agropyron repens*. The form called *Puccinia graminis* f. *agropyri (secalis)* prevails. This form affects a. o. rye, barley and *Dactylis glomerata*. According to the author this form is not able to pass over directly to wheat or oats; it affects the former crop via barley, the latter via *Dactylis glomerata*.

In 1965–1974 Kuprijanova and Antonova (1975) made experiments in Golicyn (Moscow region). Let us mention the most important results: aeciospores from the regions of Moscow and Tula and aeciospores from the Belorussian, Latvian and Estonian S.S.R. gave evidence to absolute prevalence of f. sp. *secalis* whereas f. sp. *avenae* and f. sp. *tritici* were collected only sporadically. Aeciospores infect first and most intensively grasses (eventually rye) growing in close proximity of barberry. This is why not only aeciospores but also urediospores from grasses become the source of infection. The source of f. sp. *secalis* are usually *Agropyron repens, A. caninum* and *A. fibrosum;* f. sp. *avenae* spreads from infested *Arrhenatherum elatius, Dactylis glomerata, Apera spica-venti* and *Beckmannia eruciformis*. As experimentally demonstrated *Alopecurus ventricosus, Agropyron caninum, A. fibrosum, Dactylis glomerata* and *Eremopyrum orientale* could be common hosts for f. sp. *secalis* and f. sp. *tritici*. The overwintered teliospores from *Agropyron* sp. div., *Arrhenatherum elatius* and *Beckmannia eruciformis* were most capable of germination and most infectious. In the Moscow region cerealicolous stem rust fungus does not overwinter either as mycelium or as urediospores. In spring its first source are teliospores from wild grasses growing in close proximity of barberry. Aeciospores reinfect grasses, or rye and oats. The urediospores formed are the cause of local epiphytotics. Nevertheless, also wind-borne urediospores from larger distance use to be the source of infestation.

Later the same authors (Kuprijanova and Antonova 1980) studied the role of barberry in rust infestation of crops. They made observation in the Tula region (district of Plavsk) where during 4 years they studied very heavily affected *Berberis vulgaris* growing along the Moscow-Kursk railway. *Berberis* is there a component of forests in close proximity of fields. In 1975–1977 the stem rust on barberry and grasses included physiologic races identical with those isolated from rye. The rye stem rust spread from barberry and wild grasses to rye. At the localities studied an annually repeating full cycle from barbery to grasses and vice versa was stated; this supported natural variability of physiologic races. The following grass species growing beneath barberry shrubs were most strongly (3th and 4th degrees) and generally (60–100 %) affected: *Dactylis glomerata*, *Agropyron fibrosum*, *A. repens*, *Agrostis alba* and *Lolium perenne*. Overwintering on these grasses was every year successful and teliospores showed very good capacity of germination. The above grass species are hosts for f. sp. *secalis*, sometimes also for f. sp. *tritici* whereas *Dactylis glomerata* can be host also for f. sp. *avenae*. There are additional grass species serving as hosts for the cerealicolous stem rust forms, yet with a minor epiphytotic importance.

Transfer of urediospores from district to district is reported by Suzdal'skaja, Žemčužina, Koroleva, Bukanova and Pugačeva (1980). In the Moscow region they report f. sp. *avenae* collected on *Avena fatua*, *Arrhenatherum elatius*, *Bromus tectorum*, and *Dactylis glomerata*. The populations isolated from these grasses consisted of races identical with those isolated from cultivated oats.

The important role of barberry (*Berberis vulgaris*) and wild grasses in the appearance and distribution of new virulent races of *Puccinia graminis* f. sp. *tritici* was demostrated by Konovalova and Smirnova (1970) who studied in North Caucasus aeciospores and urediospores collected in Stavropol and Krasnodar regions and in North Ossetia. Barberry is there very frequent in the foothill and on the river-banks of Kubaň, Kuma, Podkumka, Mara, Jeja and Čerek. There appear every year aecia infecting wild grasses in close proximity (species are not given). From there the infection spreads to wheat (in second half of June). In 1964—1966 the authors isolated 458 monosporic cultures from aecia and found that 448 isolates belonged to the f. sp. *tritici*. Konovalova, Suzdal'skaja, Žemčužina, Sorokina and Ščekotkova (1970) base on the assumption that the North Caucasus and Transcaucasia are the places of origin of hexaploid wheats together with their *Puccinia graminis* f. sp. *tritici* and that simultaneous occurrence of barberry as well as susceptible grass species is the most important condition for relatively high diversity and variability of physiologic races of the f. sp. *tritici*.

The same opinion is expressed by Smirnova, Anpilogova, Soloveva, Rudanovskaja, Rassadina, Čumakov and Mostovoj (1971) adding that the highest racial diversity can also be found in the Soviet Central Asia. Basing on the findings that most physiologic races are heterozygotes they emphasize that both aeciospore and urediospore populations affecting there simultaneously cereals and wild grasses should be considered the whole gene pool of stem rust; all these populations constitute a source from which new physiologic races are selected and distributed. In the Soviet Central Asia the following species play a significant role in this mechanism: *Hordeum bulbosum*, *Agropyron trichophorum*, *A. repens*, *Aegilops cylindrica*, etc.

Specialised forms in the North Caucasus were determined also by Šikina (1974) in Stavropol region and in North Ossetia. In the aeciospores from *Berberis vulgaris* the f. sp. *tritici* prevailed. The same specialised form was isolated from *Agropyron repens*, *Bromus tectorum* and *B. erectus*. The specialised form *secalis* was isolated from *Agropyron repens*. The following specialised forms were detected more rarely: f. sp. *lolii* (from *Lolium perenne*, *L. temulentum* and *Agrostis alba*), f. sp. *poae* (from *Lolium perenne*, *Poa angustifolia* and *Poa pratensis*), f. sp. *dactylidis* (from *Dactylis glomerata*), and f. sp. *phlei-pratensis* (from *Phleum pratense* and *P. tenue*). The results of experimental infection of 53 North Caucasian grass species demonstrated the highest susceptibility to f. sp. *tritici* in the following grass species: *Agropyron repens*, *A. tenerum*, *A. gracilimum*, *Bromus tectorum*, *Elymus junceus*, *Hordeum bulbosum* and *H. jubatum*.

In the Georgian S.S.R. Konovalova, Jaremenko and Cikaridze (1969) isolated seven physiologic forms belonging to the f. sp. *tritici* from *Berberis vulgaris.* Later Jaremenko (1971) published the results from 1964—1968 of his collections of the f. sp. *tritici* parasitizing on the following wild grass species: *Agropyron repens, Agrostis alba, Dactylis glomerata* and *Hordeum leporinum;* the same specialised form was less frequently collected on various species of *Agropyron, Lolium, Poa* and *Bromus.* Jaremenko assumed that the wheat stem rust passed to wheat from wild grasses. Ecological requirements of the physiologic races most frequent in 1964—1973 were studied by Cikaridze (1975).

In the Soviet Central Asia, in the Uzbek, Tadzhik and Kirgizian S.S.R., *Puccinia graminis* f. sp. *tritici* appears every year in the non-irrigated fields of wheat in the lowlands and in the foothills. Urediospore inoculum is transferred from the mountains where species of *Aegilops, Bromus, Hordeum, Agropyron repens* and *Taeniatherum crinitum* growing beneath *Berberis oblonga* are strongly infested. Mostovoj (1972) describes the above life cycle of the wheat stem rust and indicates wild grasses in the mountains as the sole inoculum and as a bridge across which the infection passes from barberry in the mountains to wheat in the foothill and in the lowlands. According to inoculation experiments conducted by Kuprijanova and Antonova (1980) *Berberis oblonga* belongs to highly susceptible species; along with other, also highly susceptible species, it is distributed in south Kazakhstan and other Soviet Central Asiatic republics at more extensive stands or even in dispersed isolated groups of shrubs. No wonder that in the Alma-Ata region *Puccinia graminis* f. sp. *tritici* is the most serious rust fungus manifesting a very broad specialization. According to Abijev (1972) it was observed there on 13 grass species belonging to 9 genera.

In north Kazakhstan (Kustanai) Ščekočichina (1972) observed overwintering mycelium of *Puccinia graminis* f. sp. *secalis* in tufts of *Agropyron cristatum.* Uredia appeared in the second half of July. Westwards, in the Orenburg region the specialised form *secalis* was frequent in 1970 on rye and simultaneously also on *Agropyron cristatum, A. repens* and barley; no stem rust was present on wheat.

Problems concerning stem rust sources in the U.S.S.R. are reviewed by Gorlenko (1966, 1976). The rye stem rust, f. sp. *secalis,* passes to barley and infects also *Agropyron repens* as well as *A. cristatum* in both of which it overwinters as mycelium in the basal leaves. Very strong and frequent infestation of wheat (f. sp. *tritici)* is usually connected with mass incidence of infested barberry. L. A. Smirnova (1969) submitted a thesis about "gradual development of wheat stem rust epiphytotics" in areas in which barberry occurs. At first aeciospores infect wild grasses whereafter urediospores pass from them to wheat. This is why there exists a relatively long period between the emergence of aecia and the time when the first uredia begin to appear on wheat. Scattered reports on overwintering of living urediospores of f. sp. *tritici* in stubble-fields and on straw are not sufficiently convincing for their role as a source of early spring infections and subsequent epiphytotics (see also Plachotnik 1975).

Attention was repeatedly paid to the same questions in the Far East (Rusakov 1925; Vasil'eva 1951; Čumakov 1951; Azbukina 1951, 1952, 1956, 1962, 1972, 1974, 1980). The authors base on the following facts: a) cerealicolous stem rust fungus has not a full cycle in the Far East. *Berberis amurensis* occurs dispersed in forests or on the sea coast, far from the fields; aecia (most frequently *Puccinia pygmaea* Eriks., more rarely *P. graminis)* appear late in the season; b) uredia on cereals appear already at the end of May, i. e. earlier than on wild grasses; therefore Čumakov's (1951) statement that urediospores from perennial grasses in the rhizomes of which the mycelium hibernates, are the source of infection in spring, is in contradiction with his own as well as later observations; c) earlier hypothesis (Rusakov 1925, 1927; Šitikova-Rusakova 1927) concerning urediospore mass long-distance spread from the south of Primorye and N. E. China (Manchuria) to the Amur region does not seem to be proved; d) the source of spring inoculum of wheat and barley stem rust in Khabarovsk region and in Primorye are urediospores which overwinter on straw and after-crop residues in stubble-fields, in the leaf sheaths and on winter barley and wheat (Pivkina 1951, Vasil'eva 1951, Azbukina 1962). According to Azbukina (1980) this is the sole cause of many epiphytotics recorded in the past (in 1923, 1926, 1948, 1955, 1960, 1964, 1967, 1969).

Besides that, according to Vasil'eva (1951) and Azbukina (1951, 1962) there is in Primorye a second maximum of stem rust urediospore production in October. They observed urediospores on volunteer rye and wheat and on new growing sprouts and leaves of *Agropyron repens* at the time when rye and wheat had already been long harvested. At the same time urediospores were also found on *Hordeum jubatum*. According to the authors volunteer crops urediospores pass to winter rye and wheat; similarly, winter crops are also infected by urediospores formed on wild grasses (*Agropyron repens, Elymus dahuricus, E. sibiricus, Hordeum jubatum* and *Roegneria ciliaris*). Both cerealicolous specialised forms successfully overwinter on winter crops.

Urban's taxonomic conception of *Puccinia graminis* as a complex of two subspecies was later fully accepted by Azbukina (1971, 1972, 1974, 1980) who emphasized again that weed grasses (from genera *Agropyron, Avena, Hordeum, Elymus*) were easily infected by cerealicolous specialised forms (*P. graminis* var. *graminis* and var. *stakmanii*).

The above brief survey of the stem rust situation in the Far East provides nevertheless an impulse to study again the causes of the origin of stem rust epiphytotics there.

Conclusions

On the basis of the above mentioned data concerning ecology and taxonomic diversity of the stem rust the authors present recommendations for further study involving also recommendations for the integrated wheat stem rust management. The authors are in agreement with the present-day general tendencies in crop production technology and its consequences for phytopathology as presented by Guseva (1981): 1) constantly increasing acreage of genetically uniform crops conditioning genetic vulnerability; 2) attempts of taking full adventage of specific and especially non specific resistance naturally encountered with in wild plants; 3) search after adequate gene source of resistance and efforts to develop a suitable method of detecting plant individuals bearing non specific resistance; 4) insufficient knowledge of the geographic distribution of various stem rust biotypes and physiologic races as well as ignorance of all possible ways leading to variability of their populations (see also Metreveli and Michailova 1981 on *Puccinia persistens* var. *triticina*).

Our study gives the first approximate, general picture of stem rust (*Puccinia graminis* s. l.) taxonomy and ecology. As far as the assessment and forcasting of epiphytotics are concerned it seems to be evident that in the secondary (the

Mediterranean) as well as in the primary evolutionary gene centres (Near East, North Caucasus, Transcaucasia, Asia Minor, Iraq, Iran and Soviet Central Asia) the "graminicolous facies" of the wheat stem rust seems to play an important role. Similarly as in the Mediterranean also in Asia the "ruderal facies" goes hand-in-hand with that of sexual hybridization on barberry (the "montane facies") and the role of the two individually as well as their joint effect remain up to now unknown in detail. This necessarily implies:

1) further ecological studies in the above evolutionary centres; studies of the geographic distribution of the individual different populations;

2) study of the mechanism of urediospore long-distance spread from the Mediterranean, North Caucasus, Transcaucasia and Soviet Central Asia.

The stem rust situation in the Far East, a region very distant from the evolutionary centers and where the appearance of epiphytotics can hardly by explained solely by urediospore overwintering on post harvest remnants and winter crop, deserves special attention.

Ideas of d'Oliveira and Samborski (1964) and of Urban (1968) again prove pioneer in character and valuable for the theory of plant breeding. The former authors state: if we want to introduce resistance genes from *Aegilops*, *Agropyron* and other genera into bread wheat it is important to pick out such grass populations that are resistant against their own rust species in their homeland. The same, yet with an emphasis on the variable pathogen (stem rust) populations is stated by Urban, viz. if searching after resistance sources among wild and other plants we must conduct inoculation experiments with such physiologic races of the pathogen which are domestic in the primary and secondary evolutionary gene centres of both wheat and the pathogen.

With respect to the desired greater employment of not only specific but in the first place non specific resistance in technologically efficient bread wheat cultivars there arises, on the basis of our investigation as well as the theory of ecosystem stability, a contradictory requirement, viz. that barberry occurring in the primary (secondary?) evolutionary gene centres should be maintained and protected. The reason for this is to avoid even the slightest disturbance of the original specific diversity providing for the maintenance as well as appearance of new wild and cultivated wheat plant individuals and their related genera bearing high degree of non specific resistance or even tolerance; selected plants will then become the starting point of plant breeding programmes.

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Studies on Hyphomycetes from Cuba II. Hyphomycetes from the Isla de la Juventud

Studie o kubánských hyfomycetech II. Hyfomycety z ostrova Isla de la Juventud

Věra Holubová-Jechová and *Angel Mercado Sierra*

Sixty-eight species or varieties of lignicolous and other saprophytic *Hyphomycetes* belonging to 47 genera are recorded from the Isla de la Juventud (formerly Isla de Pinos). The majority of them are probably common species in subtropic or tropic regions, however, previously unreported from Cuba or adjacent islands in Caribean area. Some infrequent or rare *Hyphomycetes* were also collected and 11 new species are described here.

Šedesát osm druhů nebo variet lignokolních a jiných saprofytických hyfomycetů náležejících do 47 rodů bylo nalezeno na ostrově Isla de la Juventud (dříve Isla de Pinos). Většina z nich jsou pravděpodobně běžné druhy subtropických nebo tropických oblastí, avšak z území Kuby nebo z přilehlých ostrovů v Karibské oblasti nebyly až dosud uváděné. Nalezeny byly také některé nehojné nebo vzácné druhy hyfomycetů a 11 nových druhů je zde popsáno.

Introduction

Isla de la Juventud (Isle of Youth) formerly called Isla de Pinos (Isle of Pines) arose on the Cuban insular platform southwards from the western region of the great island of Cuba, embracing a superficial extension of about 2200 km^2. From the physiographic point of view, it is possible to divide it into two sections: northern and southern, both separated by the depression of Cienaga de Lanier. Isla de la Juventud is greater than other islands of the Antilles such as Guadeloupe, Barbados, St. Vincent, Dominica and Martinique. According to Nuñez Jimenez (1965) the north region of the island is completely different from that of south and both constitute two distinct islands separated by a great marsh.

In the central part of the northern section high hills with abundant small rivers occur. In the southern section, there are no rivers. The climate is characterized by a long-lasting drought which begins in the last two months of the year and has a duration of 8—23 weeks approximately, while the rain period begins, in general, in April and continues until November (Samek 1967). The annual average temperature is 25,3° C and the climate is very similar to that of the central region of Cuba.

According to Samek (1969) pine stands constitute the prevailing plant formation on the northern section of the Isla de la Juventud; they can be divided into two groups of associations: "Paepalantho-Pinetum" (white sands) and "Pinetum tropicale-caribaeae" (hills and hillocks). The first group is ecologically very extreme and rich in local endemics. Broad-leaved woods prevail in the southern section and have mostly xerophytic character. The cover of coastal regions of the island are constituted by vegetation of sandy beaches, mangroves and vegetation of high rocky coast. Especially the natural riparian vegetation is floristically very rich, its spatial structure is most complex, with many climbing wild plants.

The mycological collections were made on species of the tribe *Bambusae* as *Bambusa vulgaris* and others, on *Smilax*, on such species of palms as *Sabal parviflora*, *Roystonea regia*, *Coccothrinax* sp., and *Pritchardia wrightii*. *Hibiscus tiliaceus*, *Cupania americana*, *Ficus* sp., *Cecropia peltata*, *Annona* *glabra* and *Jambosa vulgaris* were found to be abundant among the broad-leaved trees.

The vegetation and phanerogamic flora of the Isla de la Juventud are in general well known. They were studied principally by Britton (1916), Alain (1946), Leon (1949), Samek (1967, 1969). The studies of the mycoflora and other microorganisms of this island are, however, very scanty. Martinez Viera (1967) offerred study on the biological activity of soils by such microorganisms as bacteria, fungi and actinomycetes.

The map of Isla de la Juventud with visited localities.

In the present contribution the authors submit the results of their study of imperfect fungi — *Hyphomycetes*, mostly *Dematiaceae*, collected by them in different parts of the Isla de la Juventud during January 1981.

Collecting excursions were made to nine different and interesting localities of the northern and southern section of the Isle of Youth, with different types of vegetation.

a) In the northern part:
   1. Finca El Abra, at the foot of Sierra de Casas, near Nueva Gerona.
   2. Loma La Cañada and environs.
   3. Los Indios, south-west of La Cañada.
   4. Arroyo de Agua Santa, 400 m of Santa Fe (now La Fe).
   5. La Reforma, south-east of Santa Fe (now La Fe).
   6. Cerro de San Juan, south-east of Santa Fe (now La Fe).

b) In the southern part:

7. 2 km north of Playa Larga, forest at the way from Cayo Piedra to Playa Larga.
8. Carapachibey; on the way from Carapachibey to Cayo Las Piedras.
9. Cayo Las Piedras.

The fungi recorded and described here are mainly lignicolous, collected on dead branches, branchlets, dead rotten wood and bark of different mostly undetermined trees. Also a greater number of species were collected on dead petioles and rachides of various palms.

Sixty-eight species of *Hyphomycetes* were found during our investigation; they belong to 47 genera. Twelve genera and thirty-eight species (*) — including 11 newly described species — are reported here from Cuba for the first time.

Survey of species

* **Acrodictys bambusicola** M. B. Ellis

Mycol. Pap., Kew, 79: 6, 1961.
On dead stems of *Bambusa*. Finca El Abra. 22. I. 1981, coll. A. Mercado 5861 (HAC).

Colonies effuse, brown to dark brown. Conidiophores brown, 80–220 μm thick, tapering to 2.5–3.7 μm at the apex. Conidia brown to pale brown, with 2–5 transverse and 1 or more longitudinal septa, 18–26 μm long, 10–13.5 μm wide in the broadest part, 2–3.8 μm wide at the truncate base.

Known on bamboo from Uganda and Venezuela.

* **Acrodictys fimicola** M. B. Ellis et Gunnell

Mycol. Pap., Kew, 79: 10, 1961.
On dead branch. Cerro de San Juan. 22. I. 1981, coll. V. H.-J. (PRM 831569).

Colonies effuse, black. Conidiophores simple, dark brown, 32–120 μm long, 6–7.5 μm wide at the base, 4–5 μm in the middle, tapering to 2.5–4 μm at the apex. Conidia almost spherical, pale to dark brown, with 1–3 transverse septa and 1–2 longitudinal or oblique septa, 15–23 × 11–15 μm.

Known on bamboo culms from Malaya and Sierra Leone.

* **Acrodictys similis** Hol.-Jech. spec. nova Fig. 1:1.

Coloniae effusae, atrae, velutinae. Conidiophora singula vel 2–3 fasciculata, erecta, recta vel flexuosa, brunnea vel atro-brunnea, septata, crassitunicata, laevia, 80—190 μm longa, ad basin 5–7 μm crassa, ad apicem ad 2–3.5 μm attenuata et proliferata. Cellulae conidiogenae in conidiophora incorporatae, terminales, monoblasticae, proliferationibus percurrentibus formatae. Conidia singula, turbinata, clavata vel pyriformia, pallide brunnea vel brunnea, laevia, septis 3–4 transversalibus et aliquot septis longitudinalibus et obliquis praedita, 17–22.5 μm longa, 9.5–11.5 μm crassa, cellula basali obconica, basi truncata, 1.5–2 μm lata.

Habitat in ramis emortuis *Bambusae*.

Holotypus: Cuba, Isla de la Juventud (=Isla de Pinos), Finca El Abra, at the foot of Sierra de Casas, near Nueva Gerona; on dead branches of *Bambusae*, 22. I. 1981, leg. V. Holubová-Jechová (PRM 831529).

Colonies effuse, dark blackish brown to black, hairy. Conidiophores arising singly or in groups of 2–3, erect, straight, occasionally flexuous, brown to dark brown, septate, smooth, thick-walled, 80–190 μm long, 5–7 μm thick near the base, tapering to 2–3.5 μm at the apex, with a few successive terminal proliferations. Conidiogenous cells integrated, terminal, monoblastic and percurrent. Conidia formed singly at the apex of the conidiophore, turbinate, broadly clavate or pyriform, pale brown to brown, smooth, with 3—4 transverse septa and few longitudinal or oblique septa, often slightly constricted at the septa, 17–22.5 μm long, 9.5–11.5 μm wide in the broadest part; basal cell obconical, truncate at the basal scar and 1.5–2 μm wide.

On dead branches of *Bambusae.*

Acrodictys similis closely resembles *A. elaeidicola* M. B. Ellis 1961 and *A. atroapicula* Wang et Sutton 1982. The chief difference is in the shape, size and colour of conidia. In *A. elaeidicola* conidia are wider, 17—26 × 11—19 μm; in *A. atroapicula* conidia are obovate and wider, 17—26 × 10—15 μm and have upper portion of each conidium dark brown to black and lower portion light brown.

* **Actinocladium rhodosporum** Ehrenb.

Jahrb. Gewächsk. 1: 52, 1819; Fries, Syst. Mycol. 3: 352, 1832.
On rotten wood of dead branch. Loma La Cañada. 20. I. 1981, coll. V.H.-J. (PRM 831562).

This species has previously been reported on decaying wood and bark of various trees from Europe — Germany, Portugal, Great Britain and on *Citrus limmetta* from Sierra Leone, however, hitherto it has not been collected in Cuba.

Allescheriella crocea (Mont.) Hughes

apud Baker et Dale, Mycol. Pap., Kew, 33: 97, 1951.
On rotten wood and bark of an undetermined tree. Cerro de San Juan. 22. I. 1981, coll. A. Mercado 5879 (HAC); V.H.-J. (PRM 831528). – 2 km north of Playa Larga. 21. I. 1981, coll. V.H.-J. (PRM 831545, 831550, 831565).

Colonies pulvinate, rusty coloured. Conidiophores hyaline, branched, 3–5 μm thick. Conidia solitary, obovoid or ellipsoidal to subspherical, aseptate, reddish brown, thick-walled, 14.5–24 × 11.5–17 μm.

Very common on rotten wood of various trees in tropical and subtropical area, also known from Cuba.

Arthrinium anam. of **Apiospora montagnei** Sacc.

Nuovo Giorn. Bot. Ital. 7: 306, 1875.
On dead rachis of the leaf of an unknown palm-tree. Near of Los Indios. 20. I. 1981, coll. A. Mercado 5866 (HAC).

Colonies pulvinate, dark brown to blackish brown. Conidiophores hyaline, up to 40 μm long and 0.5—0.8 μm wide. Conidia lenticular, brown, with a hyaline central band, 5–7.5 μm diam. in face view, 2.8–4 μm thick.

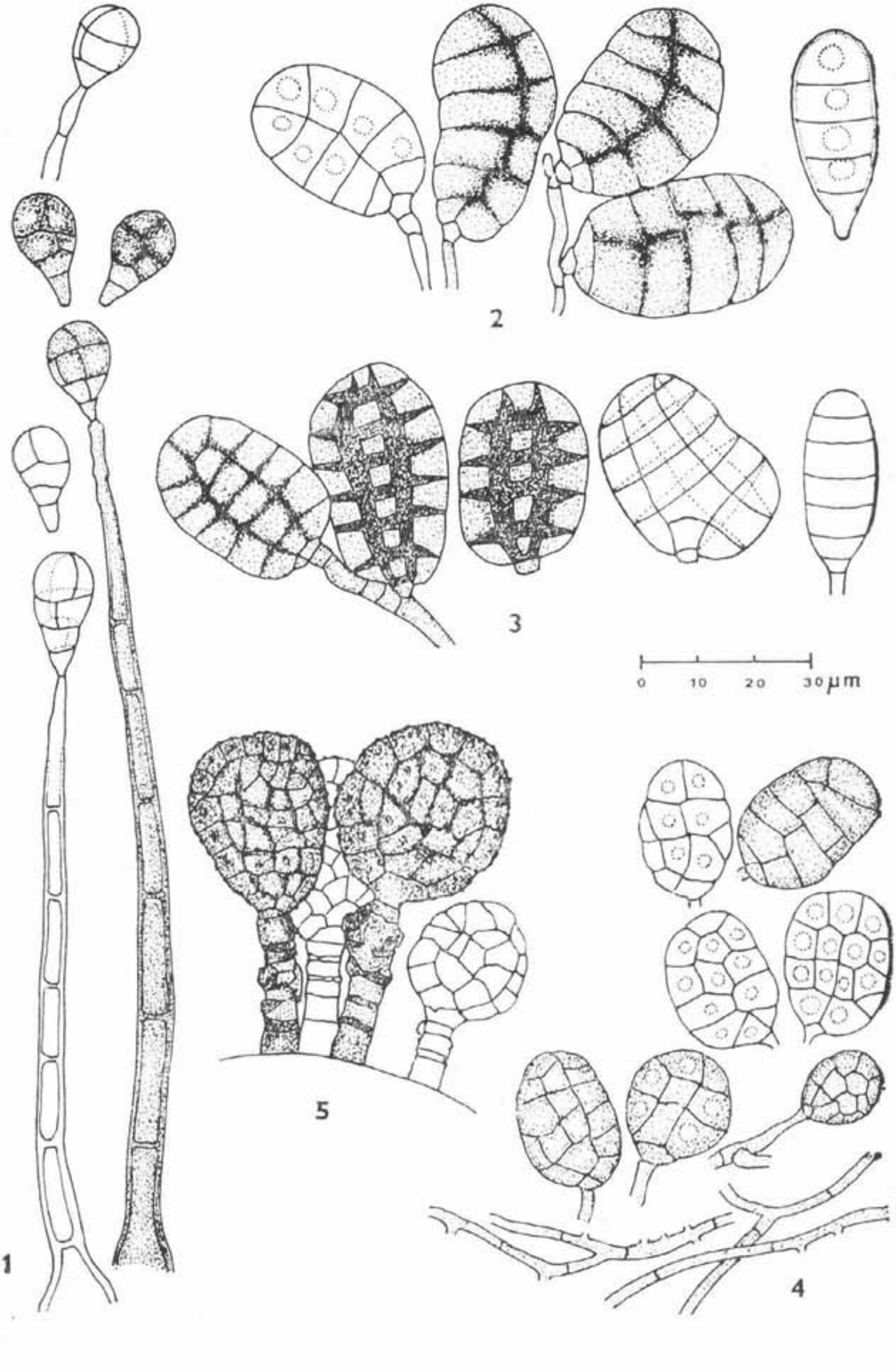
Very common on herbaceous stems and bamboos; its distribution is quite cosmopolitan.

* **Berkleasmium caribense** Hol.-Jech. et Mercado spec. nova Fig. 1:2.

Sporodochia punctiformia, pulvinata, atra. Mycelium immersum, e hyphis ramosis, septatis, hyalinis vel pallide brunneis, laevibus, 1.5–2.8 μm crassis compositum. Conidiophora macronemata, mononemata, simplicia vel ramosa, hyalina vel pallide brunnea, laevia, usque 25 μm longa, 1.5–4 μm crassa. Conidia solitaria, acrogena, elliptica vel subrotundata, complanata, muriformia, brunnea, laevia, 25—45×15—29×(9.5–)12—16 μm, cum (3–)4—6 septis transversis et 1 septo longitudinali, atris, crassis praedita; cellula basali conica, hyalina vel subhyalina, 3—5 μm in diam.

Habitat in ramo putrido deiecto trunci ignoti.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), Cerro de San Juan,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south-east of Santa Fe (now La Fe); on dead rotten branch, 22. I. 1981, coll. V. Holubová-Jechová (PRM 831526).

Sporodochia punctiform, pulvinate, black, shining. Mycelium immersed, composed of hyaline to pale brown, smooth, branched, septate, 1.5–2.8 μm thick hyphae. Conidiophores macronematous, mononematous, simple or branched, hyaline to pale brown, smooth, up to 25 μm long, 1.5–4 μm thick. Conidia solitary, acrogenous, elliptical to subrounded, flattened, muriform, brown, smooth, 25–45 × 15–29 × (9.5–)12–16 μm, with (3–)4–6 transversal and one longitudinal thick, dark septa, with wall slightly constricted at septa, basal cell conical, hyaline to subhyaline, 3–5 μm in diam.

On dead rotten branch of an unknown tree.

Other specimens studied:

Cuba: Isla de la Juventud (= Isla de Pinos), 2 km north of Playa Larga (forest at the way from Cayo Piedra to Playa Larga); on dead rotten branch, 21. I. 1981, leg. V.H.-J. (PRM 831566). – Provincia Pinar del Rio, Guanahacabibes (tropical forest); rotten stem of palm-tree, 31. I. 1973, leg. M. A. Bondarceva et C. L. Orpis (LE). – Provincia Santi Spiritus, Cayo Caguanes; on dead rotten branch, 13. II. 1981, leg. M. A. Bondarceva et S. Herrera (LE).

* **Berkleasmium pulchrum** Hol.-Jech. et Mercado spec. nova Fig. 1: 3.

Sporodochia punctiformia, pulvinata, atra. Mycelium immersum, e hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus, 2.5–4.5 μm crassis compositum. Conidiophora macronemata, mononemata, simplicia vel ramosa, hyalina vel pallide brunnea, laevia, usque 25 μm longa, 2–5 μm crassa. Conidia solitaria, acrogena, late elliptica vel parum irregularia, complanata, muriformia, brunnea, laevia, 31–41(–46) × 21–28(–32) × 13–16 μm, cum (3–)4–5(–7) septis transversis et 2 septis longitudinalibus, atris, crassis praedita, cellula basali conica, hyalina vel subhyalina, 3–5 × 2.5–5 μm.

Habitat in ramo putrido deiecto trunci ignoti.

Holotypus: Cuba: Isla de la Juventud (= Isla de Pinos), Cerro de San Juan, south-east of Santa Fe (now La Fe); on dead rotten branch, 22. I. 1981, coll. V. Holubová-Jechová (PRM 831528).

Sporodochia punctiform, pulvinate, black, shining. Mycelium immersed, composed of pale brown to brown, smooth, branched, septate, 2.5–4.5 μm thick hyphae. Conidiophores macronematous, mononematous, simple or branched, hyaline to pale brown, smooth, up to 25 μm long, 2–5 μm thick. Conidia solitary, acrogenous, broad elliptical or slightly irregular, flattened, muriform, brown, smooth, 31–41(–46) × 21–28(–32) × 13–16 μm, with (3–)4–5(–7) transverse and 2 longitudinal thick, dark septa, basal cell conical, hyaline to subhyaline, 3–5 × 2.5–5 μm.

On dead rotten branch of an unknown tree.

Other specimen studied:

Cuba: Isla de la Juventud (= Isla de Pinos), 2 km north of Playa Larga (forest at the way from Cayo Piedra to Playa Larga); on dead rotten branch, 21. I. 1981, leg. V.H.-J. (PRM 831566).

1.–1. *Acrodictys similis* Hol-Jech. – conidiophores with conidia. – 2. *Berkleasmium caribense* Hol.-Jech. et Mercado – conidia in face view, one conidium in side view. – 3. *Berkleasmium pulchrum* Hol.-Jech. et Mercado – conidia in face view, one conidium in side view. – 4. *Pithomyces cinnamomeus* Hol.-Jech. – conidia and fertile repent hyphae. – 5. *Stigmina asperulata* Hol.-Jech. – conidia with conidiophores.

Del. V. Holubová-Jechová

The new species, *Berkleasmium caribense* and *B. pulchrum*, are different from all known species of this genus by the shape and size of their conidia. *B. pulchrum* is distinguished by very distinct, dark and thick septa, mostly by 2 straight longitudinal septa, in which the wall is only very slightly constricted. Conidia of *B. caribense* have only one longitudinal septum which is mostly not straight.

Brachysporiella dennisii Crane et Dumont

Canad. Journ. Bot. 56: 2613, 1978.
On dead branches. 2 km north of Playa Larga. 21. I. 1981, coll. A. Mercado 5833 (HAC).

Colonies effuse, black, hairy. Conidiophores erect, dark brown, branched at the apex, 350–750 μm long, 14–21 μm wide. Conidia obclavate, dark brown, 12–20-septate, 70–200 × 12–18 μm.

The fungus was hitherto collected in Venezuela (Crane and Dumont 1978) and in Cuba (Mercado 1982) on different decaying branches and herbaceous stems.

Brachysporiella gayana Batista

Bolm. Secr. Agric. Ind. Com. Est. Pernambuco 19: 109, 1952.
On dead rotten trunk of an *Eucalyptus* sp. and on dead branch of an undetermined tree. Loma La Cañada. 20. I. 1981, coll. V.H.-J. – 2 km north of Playa Larga. 21. I. 1981, coll. V.H.-J. (PRM 831566).

Colonies effuse, brown to black, hairy. Conidiophores erect, dark brown, with branches at the apex, up to 250 μm long, 5—7 μm wide in the middle, at the base 8–12 μm. Conidia clavate, brown to dark brown, 3-septate, 20—33 x 11—17 μm, 3—4 μm wide at the base, thick-walled.

Common on wood and various palms in the U.S.A., Brazil, Ghana, Sierra Leone; known also from Cuba (Mercado 1981).

Catenularia cubensis Hol.-Jech. anam. of **Chaetosphaeria cubensis** Hol.-Jech.

Mycotaxon 15: 278–280, 1982.
On dead trunk of a deciduous tree and an undetermined palm-tree. Finca El Abra. 22. I. 1981, coll. V.H.-J. – In the forest near the village Cayo Las Piedras. 22. I. 1981, coll. V.H.-J. (PRM 825347 – Holotypus).

Colonies effuse, hairy or velutinous, dark, composed of phialophores, capitate hyphae and scattered perithecia. Perithecia 120—200 μm in diam., with slightly conical ostiolar region, wall 15—22 μm thick. Asci unitunicate, cylindrical, 60—80 ×4.5—7 μm. Ascospores ellipsoidal to fusiform with rounded ends, 3-septate, hyaline, 12—18 × 2.5—3.5 μm. Phialophores brown to dark brown, 3—7 septate, 85—200 μm long, 5—9 μm wide at the base, 3.5——5 μm wide above the basal part. Collarette funnel-shaped, pale brown to dark brown, 1.5—2 μm deep and 3—4 μm wide at the distal end. Capitate hyphae present, 60—160 μm long, 3.5—4.5 μm wide, with a rounded apex. Phialoconidia aseptate, rounded-obconic, truncate at the basal scar, rounded or flattened at the apex, slightly angular with 2 or 3 blunt corners when viewed from above, brown, thick-walled, smooth, 5.5—9 μm long, 3.5—5.5 μm wide at the distal end and 1.5—2.5 μm wide at the flattened base.

Catenularia cubensis differs from the known species of *Catenularia* in the small conidia.

*** Chloridium atanagildae** Hol.-Jech. spec. nova Fig. 3: 1.

Coloniae effusae, olivaceo-cinereo-brunneae, pilosae. Hyphae basales immersae vel superficiales, pallide brunneae vel brunneae, ramosae, septatae, 2–3.5 μm latae. Conidiophora erecta, recta vel flexuosa, non ramosa, pallide brunnea vel brunnea, sursum pallidiora, laevia, 30–130 μm longa, 2.5–3.5 μm lata, ad basin 3–6 μm lata. Phialides ad 1 μm paulatim angustatae, deinceps proliferatae. Phialoconidia in capitulis mucidis aggregata, hyalina, aseptata, plerumque falcata, plus minusve symmetrica, ad apicem attenuata et acuta, ad basin attenuata, cicatrice obtusa notata, 5–6 × 1.5–1.8 μm, multiguttulata.

Habitat in ligno putrido deiecto *Fici* sp.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), Atanagilda near Nueva Gerona; on dead rotten trunk of *Ficus* sp., 20. I. 1981, coll. V. Holubová-Jechová (PRM 831525).

Colonies effuse, olivaceous grey brown to brown, hairy. Basal hyphae partly immersed, partly superficial, pale brown to brown, branched, septate, 2—3.5 μm wide. Conidiophores erect, straight or flexuous, unbranched, pale brown to brown, in the upper part paler, smooth, 30—130 μm long, 2.5—3.5 μm wide, 3—6 μm at the base. Phialides gradually tapering to 1 μm and expanding in a flaring collarette, 2—2.5 μm wide and 1.5—3 μm deep. Phialides successively proliferating, giving sometimes a geniculate appearance to the conidiophore. Sometimes the phialide can proliferate laterally through the basal part of the collarette and this collarette remains laterally on the base of the new phialide. Phialoconidia in slimy heads, hyaline, aseptate, mostly curved, slightly symmetrical, tapering to a pointed distal end, basal end tapering, with a blunt scar, 5—6 × 1.5—1.8 μm, multiguttulate.

On decaying wood of *Ficus* sp.

Chloridium atanagildae differs by the shape and size of its conidia from all known species of *Chloridium* having curved to lunate conidia. Its conidia, resemble those of *Dictyochaeta* Speg. (= *Codinaea* R. Maire), however, a proliferation of conidiophores is percurrent, only seldom sympodial. The fungus is classified in the genus *Chloridium* also regarding its very small conidia. Conidia are produced from a single conidiogenous locus and therefore the species belongs into the section *Gongromeriza* (Preuss) W. Gams et Hol.-Jech. It is close to *Chloridium reniforme* Matsushima which variety *minor* was recently described from Cuba (Holubová-Jechová 1983). *C. reniforme* has conidia curved up to reniform, with both ends rounded and 3.5—5.5 × 2—3 μm; var. *minor* has conidia 3—4 × 1.2—1.8 μm.

Cladosporium oxysporum Berk. et Curt.

Journ. Linn. Soc. 10(46): 362, 1868.
On dead petiole of *Roystonea regia*. Cerro de San Juan, 22. I. 1981, coll . V.H.-J. (PRM 831580).

Common and widespread in the tropics on dead parts of woody and herbaceous plants. From Cuba reported by Fernandez (1973) and Mercado (1981).

*** Corynespora aterrima** (Berk. et Curt. ex Cooke) M. B. Ellis

Mycol. Pap., Kew, 76: 19–21, 1960.
On dead branches of *Smilax* sp. Cerro de San Juan, 22. I. 1981, coll. V.H.-J. (PRM 831554).

Colonies effuse, dark brown. Conidiophores 12—56 μm long, 3—5.6 μm thick, brown, thick-walled, darker and usually inflated to 5.5—8 μm at the apex, with up to 4 barrel-shaped proliferations. Conidia obclavate, rostrate, 3—4(—5)-septate, lower part dark brown and verrucose, upper part pale brown to hyaline, smooth, 33—65 μm long, 7—8.5 μm thick in the broadest part, tapering to 1—2.5 μm at the apex, 3—4 μm wide at the basal scar.

The species is known from the U.S.A. and S. Africa (M. B. Ellis 1960).

*** Corynespora cubensis** Hol.-Jech. spec. nova Fig. 2: 1

Coloniae effusae, velutinae, fuscae. Mycelium immersum, e hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus, 2.5—5 μm crassis compositum. Stromata immersa vel partim superficialia, brunnea, 40—100 μm lata usque effusa. Conidiophora singula vel fasciculata, erecta, simplicia vel interdum dichotome ramosa, recta vel leniter flexuosa, pallide brunnea vel brunnea, septata, 40—240 μm longa, 3.5—5 μm crassa. Conidia singula vel 2—3 in catenulam singulam conjuncta, recta vel curvata, subcylindrica, obclavata vel fusiformia, interdum rostrata, pallide brunnea vel atroferruginea, utrinque cum extremis pallidioribus, 6—15-septata, cum septis atrobrunneis et 2—2.5 μm crassis, (25—)40—80(—120) μm longa, 8—11.2 μm crassa, laevia vel ad medium leviter asperata, apice rotundato, basi cum cicatrice plana et 2.5 μm crassa praedita.

Habitat in petiolis emortuis *Coccothrinacis* sp.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), 4 km south-east of Santa Fe (now La Fe); on dead petiole of palm *Coccothrinax* sp., 22. I. 1981, coll. V. Holubová-Jechová (PRM 831527).

Colonies effuse, velvety, dark blackish brown. Mycelium immersed in the substratum, composed of branched, septate, pale brown to brown, smooth-walled, 2.5—5 μm hyphae. Stromata immersed or partly superficial, brown, 40—100 μm wide, sometimes effused. Conidiophores arising singly or in fascicles, erect, simple or occasionally dichotomously branched, straight or somewhat flexuose, pale brown to brown, septate, 40—240 μm long, 3.5—5 μm wide. Conidia forming singly or in unbranched chains of 2—3 through a pore at the apex of the conidiophore, straight or curved, subcylindrical, obclavate or fusiform, sometimes rostrate, pale brown to dark rusty brown, with both ends paler, 6—15-septate, with dark septa about 2—2.5 μm thick, (25—)40—80(—120) μm long, 8—11.2 μm wide, smooth or slightly roughened in the middle part, apical end rounded, occasionally with a distinct porus, basal end with a flat scar 2.5 μm wide.

On dead petioles of palm *Coccothrinax* sp.

Of the species hitherto fully described and illustrated in *Corynespora* Güssow, *C. cubensis* bears the most resemblance to *C. hansfordii* M. B. Ellis, however, the conidiophores of the latter species are simple, darker coloured and more wider, 6—8.5 μm thick, at the base up to 12 μm, conidia 70—100 × 9—13 μm and becoming distinctly rostrate and 7—10-pseudoseptate.

Dendryphiopsis atra (Corda) Hughes anam. of **Microthelia incrustans** (Ellis et Everh.) Corlett et Hughes

Canad. Journ. Bot. 31: 655, 1953; New Zeal. Journ. Bot. 25: 360—362, 1978.
On dead wood. Finca El Abra. 22. I. 1981, coll. A. Mercado 5864 (HAC).

Colonies effuse, black, hairy. Conidiophores up to 350 μm long, 8—9 μm thick, with a few branches. Conidia 2—3-septate, dark olivaceous brown; 28—50 × 14—18 μm.

Common on rotten wood in Europe, North America, Africa and New Zealand; recently also collected in Cuba (Mercado 1981).

Endocalyx melanoxanthus (Berk. et Br.) Petch

Ann. Bot. 22: 389, 1908.
On dead petioles of a palm-tree. Arroyo de Agua Santa. 22. I. 1981, coll. A. Mercado 5885 (HAC); V.H.-J. (PRM 831575).

Conidiophores basauxic, hyaline, 1–1.5 μm thick. Conidia dark brown or black, lenticular with a longitudinal germ slit, 13–16.5 × 10–13 μm.

Common on palms in tropical areas, also in Cuba (Fernandez 1973, Mercado 1982).

* **Endophragmiella socia** (Ellis) Hughes

New Zeal. Journ. Bot. 17: 153, 1979.
On dead wood. Finca El Abra. 22. I. 1981, coll. A. Mercado 5864 (HAC).

Conidiophores brown, 50–100 μm long, 4.6–5.5 μm thick. Conidia navicular, 6–9 (mostly 7)-septate, brown to mid brown, with end cells paler, 20–42 × 7.7–10 μm.

Up to now it was recorded on dead branches in Europe and Canada.

* **Gonytrichum macrocladum** (Sacc.) Hughes

Trans. Brit. Mycol. Soc. 34: 565–568, 1951.
On dead rotten trunk of *Ficus* sp. Atanagilda near Nueva Gerona. 20. I. 1981, coll. V.H.-J. (PRM 831525, 831568).

Common on decaying wood and herbaceous plants in Europe, North America, New Zealand and various tropical areas.

Gyrothrix circinata (Berk. et Curt.) Hughes

Canad. Journ. Bot. 36: 771, 1958.
On rotten wood of an undetermined tree, on dead petioles of *Roystonea regia* and an unknown palm-tree. Arroyo de Agua Santa. 22. I. 1981, coll. V.H.-J. (PRM 831556). – Cerro de San Juan. 22. I. 1981, coll. V.H.-J. (PRM 831535). – Cayo Las Piedras. 21. I. 1981, coll. V.H.-J. (PRM 831536, 831560).

Colonies dark brown, velvety, effuse. Conidiopores micronematous, only as polyblastic conidiogenous cells, lageniform, solitary up to 8 μm long. Conidia aseptate, subcylindrical to fusiform, straight or slightly curved, hyaline, 8—15 × 1.5—1.8 μm. Setae brown, repeatedly subdichotomously branched and verrucose.

Common on fallen leaves in North America, Africa, Indonesia and recorded from Cuba (Mercado 1981).

Haplotrichum caribense (Hol.-Jech.) Hol.-Jech.

Česká Mykol. 30: 3, 1976; 23: 218–220, 1969.
On dead rotten trunk of *Pinus tropicalis*. Sabana near El Colony, near Siguanea. 19. II. 1967, coll. F. Kotlaba (PRM 670954).

* **Haplotrichum curtisii** (Berk.) Hol.-Jech.

Česká Mykol. 30: 4, 1976.
On dead rotten trunk of an undetermined tree. 2 km north of Playa Larga. 21. I. 1981, coll. V.H.-J. (PRM 825362).

* **Helicoma muelleri** Corda anam. of **Thaxteriella pezizula** (Berk. et Curt.) Petrak

Corda, Icon. Fung. 1: 15, 1837; Petrak, Sydowia 7: 110, 1953.
On dead wood and bark of *Eucalyptus* sp. Loma La Cañada, 20. I. 1981, coll. V.H.-J. (PRM 825407, 831540).

On decaying wood and bark of deciduous trees and on dead herbaceous material in Europe, North America and Africa (Ellis 1971, Pirozynski 1972).

Helicorhoidion botryoideum (Cooke) Hughes

Canad. Journ. Bot. 36: 773, 1958.
On dead wood. Finca El Abra. 22. I. 1981, coll. A. Mercado 5883 (HAC); V.H.-J. (PRM 831559).

Colonies olive brown, velvety. Conidiophores pale brown, flexuous, branched or unbranched, 30–120 × 3–6 μm. Conidia helicoid, very tightly coiled, multiseptate and constricted at the septa, 17–32 × 13.5–21 μm.

On decaying wood in North America and Cuba (Ellis 1971, Mercado 1981).

* **Helicosporium aureum** (Corda) Linder

Annals Missouri Bot. Gard. 16: 279, 1929.
On dead rotten cone of *Pinus caribaea.* Loma La Cañada. 20. I. 1981, coll. V. H.-J. (PRM 831553).

Colonies yellow-citrine up to olivaceous brown, loosely cottony. Conidiophores erect, bristle-like, with lateral branches in the upper part almost at right angles to the main rhachis, 300–600 μm long, 4.5–6.5 μm wide at the base, tapering to 2 μm. Conidia pleurogenous on hyaline to pale brown bladder-like projections, 5–8 × 3–5 μm, produced laterally on the lower parts of the conidiophores, citrine-yellow in mass, 2 1/2–3 times coiled, septate, 1–2 μm thick; diameter of a coiled conidium about 15–22 μm.

Occurring on decaying wood and bark from many localities in North American Continent.

Helicosporium griseum Berk. et Curt.

Grevillea 3: 51, 1874.
Syn.: *Helicosporium lumbricoides* Sacc., Michelia 1: 86, 1877; corr. Matruchot, Recherches sur le développement de quelques mucédinés, 5–37, 1892.
On dead wood and bark of *Eucalyptus* sp. Loma La Cañada. 20. I. 1981, coll. V.H.-J. (PRM 831534).

Conidia hyaline, septate, 2 1/2–2 3/4 times coiled, 18–23 μm in diam., the conidium filament 1.8–2(–2.5) μm wide.

Common on dead herbaceous material and wood in Europe, Asia, North and South America and South Africa (Linder 1929, Holubová-Jechová 1980); recently recorded from Cuba (Mercado 1982).

Helicosporium pannosum (Berk. et Curt.) R. T. Moore

Mycologia 49: 582, 1957.
On dead branches of an undetermined tree. Finca El Abra. 22. I. 1981, coll. A. Mercado 5859 (HAC); V.H.-J. (PRM 831557).

Colonies effuse, olivaceous brown, hirsute. Conidiophores stout, setiform, mostly unbranched, pale brown, 50–200 μm long, 5.5–7.5 μm thick, with lateral peg-like denticles 3–8 × 2.5–4 μm. Conidia subhyaline to pale olivaceous brown, minutely echinulate, 30–60-septate, very variable in shape and size, 1 1/2–4 times coiled, 40–200 μm in diam., conidial filament 3.5–10 μm thick.

Known from rotten wood in U.S.A., Tanzania and New Zealand; from Cuba recently recorded as *Helicosporium nematosporum* Linder (Mercado 1982).

Helminthosporium mauritianum Cooke

Grevillea 12(61): 38, 1883.
On dead branches. 2 km north of Playa Larga. 21. I. 1981, coll. A. Mercado 5826 (HAC).

Colonies effuse, dark blackish brown, hairy. Conidiophores brown to dark brown, 250–850 μm long, 7.5–14 μm thick. Conidia obclavate, 3–7-pseudoseptate, pale brown, 30–55 × 9–13 μm.

On dead wood and decaying herbaceous plants in tropical and subtropical areas; also in Cuba (M. B. Ellis 1971, Fernandez 1973).

* **Helminthosporium palmigenum** Matsushima

Microfungi of the Solomon Islands and Papua-New Guinea. Kobe. P. 30, 1971.
On dead rachis of *Coccothrinax* sp. Near Loma La Cañada. 20. I. 1981, coll. A. Mercado 5855 (HAC).

Colonies effuse, black, hairy. Conidiophores brown to mid brown, 75–230 μm long, 7–8 μm wide at the base, tapering to 4.7–5.7 μm at the apex. Conidia obclavate, pale brown, 4–8 (mostly 5–6)-pseudoseptate, 22–40 × 7–11 μm.

Hitherto probably known only from the type collection.

Holubovaea roystonicola Mercado

Acta Botanica Cubana (in press).
On dead petioles of *Roystonea regia*. Loma La Reforma. 22. I. 1981, coll. A. Mercado 5884 (HAC). — Cerro de San Juan. 22. I. 1981, coll. V. H.-J. (PRM 831555). – 4 km south-east of La Fe. 22. I. 1981, coll. V.H.-J. (PRM 831538). – Finca El Abra. 22. I. 1981, coll. V.H.-J. (PRM 831558).

Colonies effuse, black, hairy. Conidiophores in fascicles, brown, 140–650 μm long, 4.5–5.5 μm thick, expanded to 6.7–7.6 μm at the apex with numerous minute pores. Conidia cylindrical, with slightly extended and rounded base and apex, 2–3-septate, 15–30 × 6–7.5 μm, the apical cell paler and thin-walled, sometimes with a colapsed wall.

* **Leptodontium elatius** (Mangenot) de Hoog var. **ovalisporum** de Hoog

Stud. Mycol., Baarn, 15: 50–53, 1977.
On dead petiole of an undetermined palm-tree. Los Indios. 20. I. 1981, leg. V.H.-J. (PRM 831551).

Conidiophores single or aggregated, dark brown, paler towards the apex, thick-walled, 150–200 μm long, 2.5 μm thick. Conidia subhyaline to very pale brown, smooth to very finely verruculose, obovoid, papillate at the base, with a conspicuous basal scar, 3.2–6 × 2–2.5 μm.

On dead wood and bark of various trees in Europe and North America.

* **Melanocephala** australiensis (Beaton et Ellis) Hughes

New Zeal. Journ. Bot. 17: 169, 1979.
On dead rotten branch of an undetermined tree. Cerro San Juan. 22. I. 1981, coll. V.H.-J. (PRM 831570).

Conidiophores single and scattered, occasionally in groups, pale brown, with 1–2 septa and 1–2 successive proliferations, up to 75 μm long and 4.8–6.5 μm wide, with bulbous base, up to 9.5 μm wide. Conidia obovoid to broadly ellipsoidal with a truncate base, 2–(3)-septate, very dark brown to black and opaque, 28–48 × 16–27 μm, with rhexolytic secession.

Other specimen studied:
Cuba: Santiago de las Vegas; en tronco en descomposición de planifolio, 17. IV. 1981, leg. M. A. Bondarceva et S. Herrera (LE).

The material of the fungus collected in the Isla de la Juventud has conidia slightly smaller, 33—40 × 19—24 μm. *M. australiensis* is known from the U.S.A. (Maryland), Australia and New Zealand.

Melanocephala triseptata (Shearer, Crane et Miller) Hughes

New Zeal. Journ. Bot. 17: 171—173, 1979.
On dead rotten wood of a deciduous tree. 2 km north of Playa Larga. 21. I. 1981, coll. V.H.-J. (PRM 831545).

Conidiophores single and scattered or in groups, pale brown to dark brown, septate, with up to 10 successive proliferations, up to 200 μm long, 6–7.2 μm wide. Conidia broadly obovoid, dark brown to black, 3-septate with black bands, 22.4–33.6 × 12.8–17 μm, the basal cell being the smallest and slightly paler.

Known only from the U.S.A. (Illinois), where it was collected on decaying submerged wood. Recently recorded from Cuba (Mercado 1982).

Melanographium selenioides (Sacc. et Paoletti) M. B. Ellis

Mycol. Pap., Kew, 93: 14—16, 1963.
On dead branches of *Similax havanensis* Jacq. 2 km north of Playa Larga. 21.I. 1981, coll. A. Mercado 5876 (HAC).

Colonies effuse, black, bristly. Conidiophores in compacted fascicles forming dark brown synnemata, 770–1150 μm long, brown, septate, smooth, 4.5–6 μm thick and more paler at the apex. Conidia reniform, brown, often with hyaline longitudinal slit, smooth, occasionally to verruculose, 14–20 × 9–15 μm, usually 16.5–12 μm.

Recorded on palms from tropical areas, also from Cuba (Mercado 1981).

Memnoniella echinata (Riv.) Galloway

Trans. Brit. Mycol. Soc. 18: 163—166, 1933.
On dead petioles of *Roystonea regia*. Near Loma La Cañada. 20. I. 1981, coll. A. Mercado 5844 (HAC); V.H.-J. (PRM 831576). — Cayo Las Piedras. 21. 1981, coll. V.H.-J. (PRM 831552).

Colonies effuse, black, pulvinate. Conidiospores dark grey with fascicles of monophialidic conidiogenous cells at the top, 60–100 μm long, 3.2–4 μm thick, phialides 7–9.5 × 3–5 μm. Conidia spherical or flattened, blackish brown, verrucose, 3.5–5.2 μm in diam.

Common on dead plants and of a cosmopolitan distribution.

* **Monodictys** cf. **lepraria** (Berk.) M. B. Ellis

More Dematiaceous Hyphomycetes, p. 44, 1976.
On dead rotten wood of a branch of an undetermined tree. Finca El Abra. 22. I. 1981, coll. V.H.-J. (PRM 831581).

Colonies effuse, blackish brown. Conidia variable in shape and size, mostly elongate to broadly ellipsoidal, occasionally subglobose, mostly rounded at the ends, muriform, dark brown, roughened to coarse verrucose, 24–90 × 24–55 μm.

The Cuban material differs from that species collected on dead branches in Europe by its verrucose walls.

Monodictys sp.

On dead rotten branch. Cerro de San Juan. 22. I. 1981, coll. V.H.-J.

Colonies effuse, dark brown to black. Conidia subglobose, broadly ellipsoidal, obovoid, dark brown to black, opaque, muriform, 16—25 × 12.5—20 μm. It seems, that this species of *Monodictys* is not identical with any of known species, but the collection is not representative for description of a new taxon.

* **Mycoenterolobium platysporum** Goos

Mycologia 62: 171—175, 1970.
On dead branches. Cerro de San Juan. 22. I. 1981, coll. A. Mercado 5883 (HAC); V.H.-J. (PRM 825362, 831548).

Colonies effuse, black, shining. Conidiophores micronematous, 2—4 μm thick. Conidia lobed or variable in shape, flattened, muriform, black, smooth, shining. 47—75 × 65—110 μm.

Known only from decaying wood of *Araucaria* in Hawaii.

Periconia byssoides Pers.

Synop. Meth. Fung. p. 686, 1801.
On dead branches of unknown tree and on dead branch of *Hibiscus* sp. Finca El Abra. 22. I. 1981, coll. A. Mercado 5860 (HAC). — Presa Cristal near Atanagilda. 20. I. 1981, coll. V.H.-J. (PRM 831582).

Very common on dead herbaceous stems, cosmopolitan. From Cuba it was recorded by Fernandez (1973) and Mercado (1981).

* **Periconiella geonomae** M. B. Ellis

Mycol. Pap., Kew, 111: 26—27, 1967.
On dead rachis of *Coccothrinax* sp. Near Loma La Cañada. 20. I. 1981, coll. A. Mercado 5855 (HAC).

Colonies effuse, olivaceous brown, hairy. Conidiophores up to 850 μm long, 3—4.5 μm thick in the middle part of the stipe. Conidia ellipsoidal, aseptate, pale olivaceous brown, verruculose, 4—10 × 2.2—3 μm.

Hitherto found only in leaves of *Geonoma* from Trinidad.

* **Phialophora** cf. **fastigiata** (Lagerb., Lundberg et Melin) Conant

Mycologia 29: 598, 1937.
On dead petioles of *Roystonea regia*. Cerro de San Juan. 22. I. 1981, leg. V.H.-J. (PRM 831547).

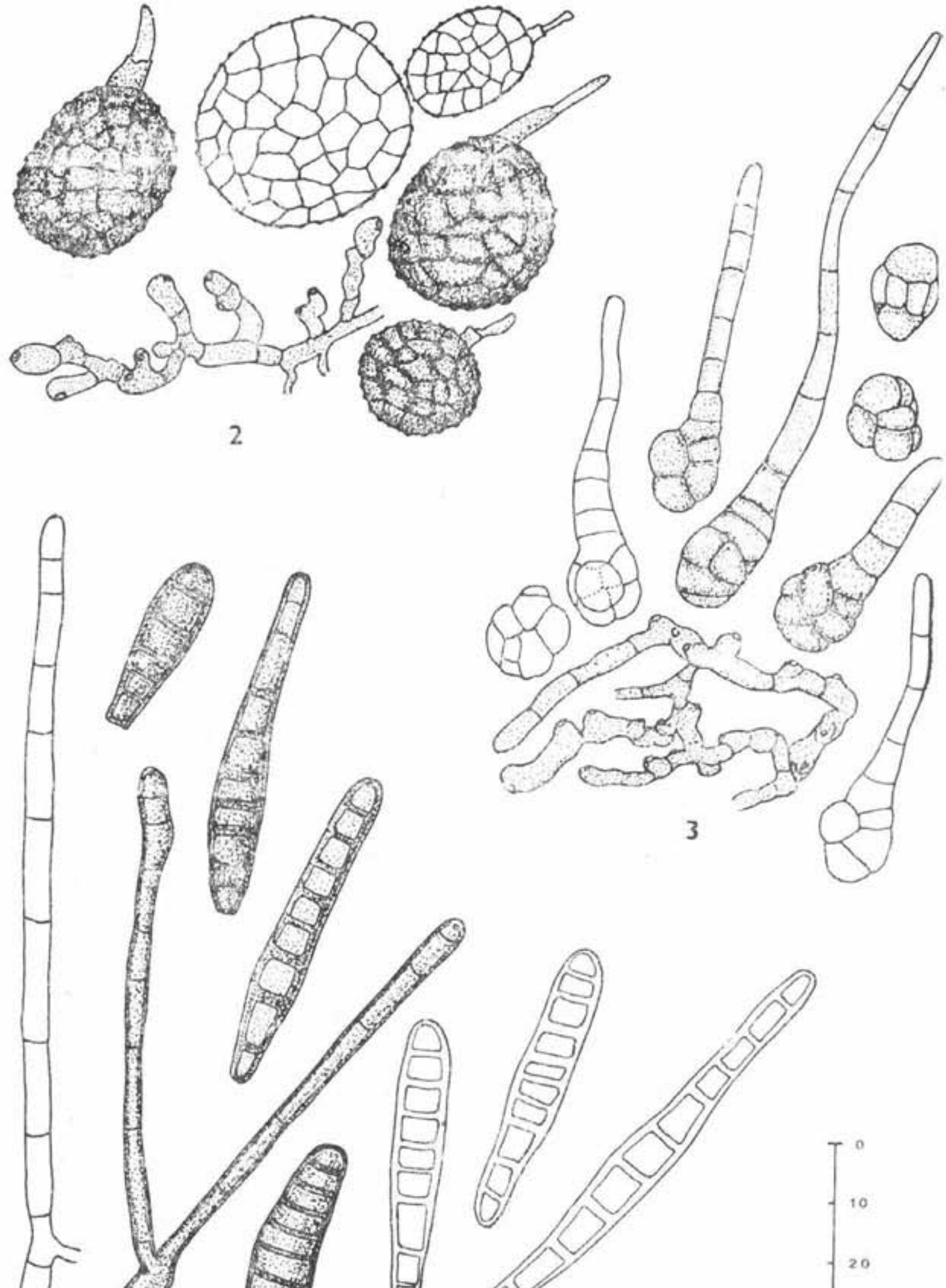
Colonies effuse, olivaceous brown, velvety. Phialides mostly in verticillate clusters, 10—13 × (2—)2.5(—3) μm. Conidia ovoid, broadly ellipsoidal to subglobose, subhyaline to brown, 3—4.5 × 2.2—3.2 μm. Various authors give the size of conidia mostly as 3—7 × 1.5—2.5 μm.

Common on wood in Europe and North America.

Phragmospathula brachyspathula Mercado

Acta Botanica Cubana 5: 2—3, 1980.
On dead rachis of *Roystonea regia*. Finca El Abra. 22. I. 1981, coll. A. Mercado 5884 (HAC).

Colonies effuse, brown. Conidiophores unbranched, brown, 6—12 × 3—5.5 μm. Conidia 3-septate, 20—24 μm long, two central cells brown,


2
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7.2—8.5 μm wide, the apical cell hyaline to subhyaline, small, basal cell spathulate, subhyaline, 6—10.5 × 4—5.7 μm.

* **Piricauda caribensis** Mercado spec. nova Fig. 2: 2.

Coloniae effusae, atro-brunneae, granulosae. Mycelium superficiale e hyphis laevibus vel verrucosis, pallide brunneis, 2.5–3.5 μm crassis compositum. Conidiophora semi-macronemata, mononemata, ramosa, anastomosantia, varie flexuosa, 4–6.5 μm crassa. Cellulae conidiogenae monotreticae, in conidiophoris incorporatae, clavatae vel unciformia, cicatricatae. Conidia singula, sphaerica, subsphaerica vel irregulares, atro-brunnea, muriformia, crassitunicata, rugosa, 19–45 × 16–35 μm, ad apicem cum brevi appendice.

Habitat in ramis emortuis arboris ignotae.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), Finca El Abra, at the foot of Sierra de Casas, near Nueva Gerona; on dead branch of an undetermined tree, 22. I. 1981, coll. A. Mercado 5863 (HAC).

Colonies effuse, dark brown, granulose. Mycelium superficial composed of pale brown, smooth to verruculose, 2.5—3.5 μm wide hyphae. Conidiophores semi-macronematous, mononematous, branched, anastomosing, variously flexuose, 4—6.5 μm thick. Conidiogenous cells monotretic, integrated, clavate or hook-shaped, cicatrized. Conidia solitary, spherical, subspherical or irregular, dark brown, muriform, distinctly rugose with thick-walls, 19—45 × 16—35 μm, frequently with short appendages at the apical part.

On dead branches of an unknown tree. Another authentic material was collected by the Czech author on the same locality and is deposited in Prague (PRM 831533).

This taxon differs from *Piricauda paraguayensis* (Speg.) R. T. Moore and *P. cocchinensis* (Subram.) M. B. Ellis mainly by the form, size and colour of conidia and their apical appendages. It is close to *Piricauda pseudoarthriae* (Hansf.) M. B. Ellis in the from and size of conidia, but conidia in the latter species are dark golden brown, smooth and rarely with apical appendages, while conidia of the new species are dark brown, distinctly rugose and frequently with short apical appendages.

Piricauda cubensis Hol.-Jech. et Mercado spec. nova Fig. 2: 3.

Coloniae effusae, arachnoideae, brunneae. Mycelium superficiale e hyphis repentibus, ramosis et anastomosantibus, pallide brunneis, laevibus reticulatisque compositum. Conidiophora semi-macronemata, mononemata, interdum ramosa et anastomosantia, pallide brunnea vel brunnea, laevia, 2.5–4 μm crassa. Cellulae conidiogenae monotreticae, in conidiophoris incorporatae, interdum cicatricatae, cum cicatricibus conspicuis atris. Conidia solitaria, diversarum formarum; aliqua lato ellipsoidea, ovoidea vel subsphaerica, muriformia, laevia, 7–16 × 6–10 μm, plerumque obclavata, rostrata, 20–55(–65) μm longa, 6–8(–10) μm crassa, cum parte proximali muriforme, brunnea, ellipsoidea vel subglobosa, cum parte distali angustata, septata, pallide brunnea, apice 1.5–2.5 μm lata.

Habitat in ramis emortuis *Smilacis havanensis* Jacq.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), 2 km north of Playa Larga, forest at the way from Cayo Piedra to Playa Larga; on dead branches of *Smilax havanensis*, 21. I. 1981, leg. A. Mercado 5835 (HAC — Typus; PRM 831532 — isotypus).

2.—1. *Corynespora cubensis* Hol.-Jech. — conidiophores and conidia. — 2. *Piricauda caribensis* Mercado — repent hyphae with short conidiophores and conidia. — 3. *Piricauda cubensis* Hol.-Jech. et Mercado — repent hyphae with short conidiophores and two types of conidia.

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Colonies effuse, thin, arachnoid, brown. Mycelium superficial, composed of a network of repent, branched, anastomosing, pale brown, smooth hyphae. Conidiophores semi-macronematous, mononematous, occasionally branched, forming arches, sometimes anastomosing, slightly thicker than the ordinary hyphae, pale brown to brown, smooth, 2.5—4 μm thick. Conidiogenous cells monotretic, integrated, sometimes cicatrized, with prominent dark scars. Conidia solitary, of a different shape; some broadly ellipsoidal, ovoid or subspherical, muriform, smooth, 7—16 × 6—10 μm; more often they are obclavate, rostrate, 20—55(—70) μm long, 6—8(—10) μm wide at the basal broadest part, with a muriform, brown, ellipsoidal to subglobose proximal part, and long, narrow, septate, pale brown distal part, tapering to 1.5—2.5 μm at the apex.

On dead branches of *Similax havanensis* Jacq. mixed with *Sporidesmium asperum* Hol.-Jech.

The new species *Piricauda cubensis* is very close to *P. paraguayensis* (Speg.) R. T. Moore, reported previously from Cuba (Ellis 1971), but differs by considerably smaller conidia. Conidia of *P. paraguayensis* are 25—42 × 20—32 μm, with the beak part up to 120 μm long and 4—6 μm thick tapering to 1—1.5 μm at the apex. *P. cubensis* has the beak part shorter and wider, more septate and the colour of the body of the conidium and the prolongated part is quite the same. Moore (1959) added 30 new names to *Piricauda* Bubák by transfers from other genera and he also described 5 new species. However, most of them seem to be incorrectly placed in this genus by him.

* **Pithomyces cinnamomeus** Hol.-Jech. spec. nova Fig. 1: 4

Coloniae pulviniformes vel irregulares, cinnamomeae. Mycelium superficiale e hyphis ramosis, septatis, anastomosantibus, pallide brunneis vel cinnamomeis, verrucosis, 1,5–3 μm crassis, reticulatis compositum. Conidiophora singula ex lateralibus hypharum oriunda, simplicia, recta, subhyalina vel pallide brunnea, 2—9 μm longa, 1.5—2 μm crassa. Conidia singula in apice conidiophori oriunda, elliptica, ovoidea, subglobosa vel irregularia, plerumque 4–5-transverse septata et aliquoties longitudionaliter septata vel irregulariter muriformia, cinnamomea vel brunnea, laevia, 20–31 × 13–20 μm.

Habitat in ligno putrido rami emortui arborum indeterminatarum.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), 2 km north of Playa Larga; on dead branch of an undetermined tree, 21. I. 1981, coll. V. Holubová-Jechová (PRM 831543).

Colonies cushion-shaped up to irregular, cinnamon-coloured. Mycelium superficial, composed of a network of branched, septate anastomosing, pale brown to cinnamon, verrucose, 1.5—3 μm wide hyphae. Conidiophores borne laterally and irregularly on hyphae, simple, straight, subhyaline to pale brown, 2—9 μm long, 1.5—2 μm wide. Conidia formed singly at the apex of each conidiophore, ellipsoidal, ovoid, subglobose to irregular, mostly with 4—5 transverse septa and with several longitudinal septa or up to irregularly muriform, cinnamon to brown, smooth, 20—31 × 13—20 μm.

On rotten wood of dead branch of an undetermined tree.

Pithomyces cinnamomeus differs from all known species of this genus by the shape, size and smooth walls of conidia.

* **Pithomyces pulvinatus** (Cooke et Massee) M. B. Ellis

Mycol. Pap., Kew, 103: 41—42, 1965.

On dead rotten trunk of *Ficus* sp. Atanagilda near Nueva Gerona. 20. I. 1981, coll. V.H.-J. (PRM 831525, 831528, 831568).

Pithomyces sacchari (Speg.) M. B. Ellis

Mycol. Pap., Kew, 76: 17–18, 1960.
On dead rotten trunk of *Mangifera indica*. Nueva Gerona. 19. I. 1981, coll. V.H.-J. (PRM 831573).

Very common on herbaceous material in tropical and subtropical areas, recently also reported from Cuba (Mercado 1980).

* **Pleurothecium recurvatum** (Morgan) Höhnel

Zentralbl. Bakteriol. Parasitenk., Abt. 2, 60: 26, 1923.
On dead rotten trunk of *Ficus* sp. Atanagilda near Nueva Gerona. 20. I. 1981, coll. V.H.-J. (PRM 831525, 831568).

Common on dead wood and bark of broad-leaved trees; probably a cosmopolitan species.

* **Pseudopetrakia kambakkamensis** (Subram.) M. B. Ellis

Mycol. Pap., Kew, 125: 4, 1971.
On dead wood and bark of *Eucalyptus* sp. and on dead rachis of palm-leaf. Loma La Cañada. 20. I. 1981, coll. A. Mercado 5854, 5856, 5857 (HAC); V.H.-J. (PRM 831534, 831539, 831540, 831544).

Colonies effuse, dark brown, granulose. Conidiophores 4—8 μm wide, rugulose. Conidia ellipsoidal, obovoid to subglobose, muriform, mid to dark brown, rugulose to warted, 25—64(—80) × 17—40 μm, on the upper part bearing 1—6, subulate, sharply pointed black spines, 10—56 μm long and 4—11 μm wide at the base.

This species is known from dead wood only from India. Cuban collections differ in size of conidia from the original description of *P. kambakkamensis*. They are longer and wider and their upper spines are also longer. The size of conidia of this fungus collected in India and described by Subramanian 1957 (in the genus *Petrakia* Syd. et Syd.) is given in dimensions 27—50 × 19—26 μm, with spines 10—25 μm long (Ellis 1971, 1976). The present authors think that the Indian and Cuban material represent the same species which can have a wider range of variation in the size of conidia.

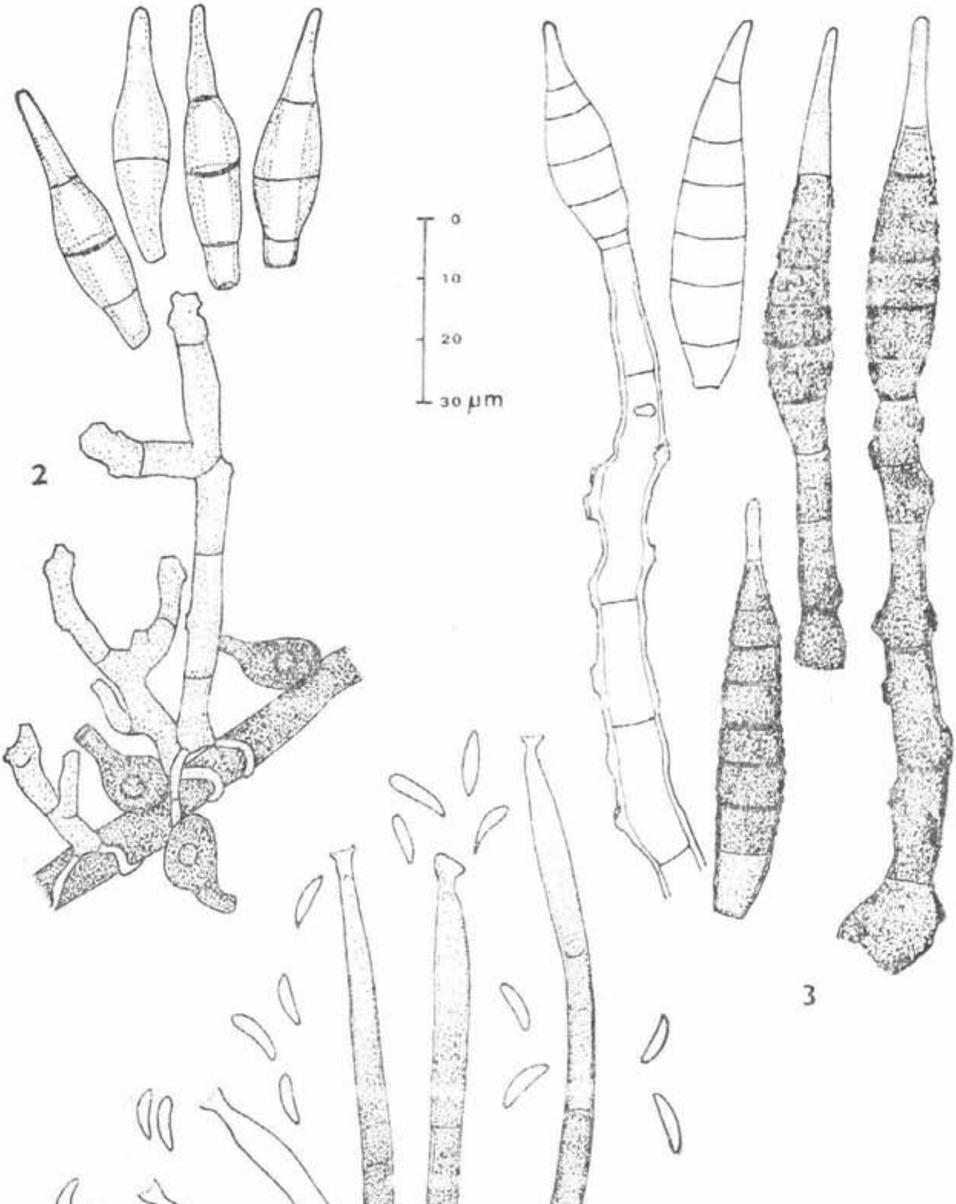
* **Spiropes caribensis** Hol.-Jech. spec. nova Fig. 3: 2.

Coloniae effusae, parvae. Mycelium superficiale, e hyphis ramosis et anastomosantibus, septatis, pallide olivaceo-brunneis, laevibus, 1.5–3.5 μm crassis compositum. Conidiophora singula, erecta vel ascendentia, recta vel flexuosa, pallide brunnea vel brunnea, laevia, septata, 20–240 μm longa, 4–8 μm crassa. Conidia acropleurogena, solitaria, recta vel leniter curvata, obclavata, rostrata, 3-septata, 36–48 μm longa, 9.5–11.5 μm crassa, basi truncata, 4.5–6 μm lata, cellulis intermediis doliiformis, pallide brunneis, laevibus, cellulis extimis angustatioribus, pallidissime brunneis vel hyalinis.

Habitat in coloniis *Meliolae* sp. in foliis vivis palmae incognitae.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), Los Indios, south-west of La Cañada; on *Meliola*, on living leaves of an unknown palm, 20. I. 1981, leg. V. Holubová-Jechová (PRM 831531).

Colonies effuse, small, overgrowing *Meliola* sp. Mycelium superficial, composed of branched, anastomosing, septate, pale olivaceous brown, smooth, 1.5—3.5 μm wide hyphae. Conidiophores arising singly, erect or ascending, straight or flexuous, occasionally branched, pale brown to brown, smooth, septate, 20—240 μm long, 4—8 μm wide. Conidia formed singly, acropleurogenous, straight, seldom slightly curved, obclavate, rostrate, 3-septate, 36—48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(41.5) µm long, 9.5—11.5 µm wide in the broadest part, 4.5—6 µm wide at the truncate base, the central cells barrel-shaped, pale brown, smooth, the cells at each end narrower and very pale brown to almost hyaline.

Overgrowing and apparently parasitic on *Meliola* sp. on living leaves of an undetermined palm-tree.

Spiropes caribensis is close to *S. helleri* (Stev.) M. B. Ellis (Mycol. Pap., Kew, 114: 14—15, 1968), but differs from it by paler and wider conidia, with wider truncate base and more shorter conidiophores. *S. helleri* has conidia 30—50 × × 7—10 µm, with a truncate base 3—4 µm wide, central cells of conidia mid pale brown to brown, smooth or verruculose, conidiophores are up to 600 µm long.

Spiropes dorycarpus (Mont.) M. B. Ellis

Mycol. Pap., Kew, 114: 11—14, 1968.
Overgrowing on *Meliola* sp. on living leaves of an undetermined plant (shrub). Los Indios. 20. I. 1981, coll. V.H.-J. (PRM 831542).

Colonies effuse, small, pale olive, overgrowing *Meliola* sp. Mycelium superficial, yellowish to hyaline, 1—2.5 µm, anastomosing. Conidiophores arising singly or in groups, erect or ascending, straight or flexuose, yellowish to pale brown, smooth, 40—500 µm long, 3—7(4) µm wide. Conidia formed singly, acropleurogenous, straight or slightly curved, obclavate to fusiform, conico-truncate at the base, strongly attenuated at the apex, 3-septate, occasionally 4-septate, yellowish to very pale brown or hyaline, smooth, the central cells slightly darker and sometimes finely verruculose, 25—44 (33) µm long, 5—6 µm wide, 1.5—2 µm at the base.

Spiropes dorycarpus was originally collected in Cuba on *Meliolineae* on leaves of an unknown plant by J.F.C. Montagne as *Helminthosporium dorycarpum* Mont. 1842 (Hist. Phys. Pol. Nat. Cuba, Crypt.: 302; Annals Sci. Nat., 2 Sér., 17: 120). It is very common as overgrowing or parasitic on *Meliolineae* in tropical and subtropical areas (Ellis 1968).

* **Sporidesmium asperatum** Hol.-Jech. spec. nova Fig. 3: 3.

Coloniae effusae, fuscae vel atrae, velutinae vel pilosae. Conidiophora singula, erecta, recta vel leniter flexuosa, septata, atrobrunnea, crassitunicata, usque ad 120 µm longa, plerumque proliferata, 6—9 µm crassa. Conidia obclavata, saepe rostrata, basi conico truncata, 5—8 (plerumque 6)-septata, atro-brunnea, cellula basali et apicem versus pallidiora, laevia vel verrucosa, 52—72 µm longa, 9—11.5 µm crassa, basi 4—5 µm crassa, apicem versus ad 2 µm attenuata.
Habitat in ligno putrido arboris frondosae.
Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), 2 km north of Playa Larga (forest in the way from Cayo Piedra to Playa Larga); on dead rotten branch of a broad-leaved tree, 21. I. 1981, leg. V. Holubová-Jechová (PRM 831524).

Colonies effuse, dark brown to black, velvety to hairy. Conidiophores arising singly, erect, straight or slightly flexuous, septate, dark brown, thick-walled, 35—120 µm long, 6—9 µm wide, frequently distinctly proliferating. Conidia obclavate, often rostrate, conico-truncate at the base, 5—7 (mostly 6)-septate, dark brown, the basal cell and towards the apical cell paler, smooth

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3.—1. *Chloridium atanagildae* Hol.-Jech. — conidiophores with phialoconidia. — 2. *Spiropes caribensis* Hol.-Jech. — conidiophores overgrowing mycelium with mucronate hyphopodia of *Meliola* sp. and conidia. — 3. *Sporidesmium asperatum* Hol.-Jech. — conidiophores with conidia.

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to verrucose, 52—72 μm long, 9—11.5 μm thick in the widest part, 4—5 μm wide at the base, tapering to 2 μm near the apex.

On dead rotten wood of a fallen branch of a broad-leaved tree.

Sporidesmium asperatum is quite distinct from the known species of the genus by the very distinct remains after proliferations of conidiophores. Prominent proliferations are evident mostly in lower or middle parts of conidiophores. Its conidia resemble those of *Sporidesmium verrucisporum* M. B. Ellis which, however, were described only as 4-6-septate and pale olivaceous brown to olivaceous brown (M. B. Ellis 1975).

* **Sporidesmium flagellatum** (Hughes) M. B. Ellis

Mycol. Pap., Kew, 70: 54–55, 1958.
On dead branches of *Smilax havanensis* Jacq. 2 km north of Playa Larga, 21. I. 1981, coll. A. Mercado 5835 (HAC).

Colonies effuse, black. Conidiophores dark brown, 40—100 μm long, 6—7.5 μm thick, with one or more cylindrical or lageniform proliferations. Conidia obclavate, rostrate, 4-8-septate, lower cells dark brown, often verruculose, upper cells subhyaline, smooth, 50—80 × 9—11 μm, 4.5—5 μm wide at the base.

Hitherto known only from dead *Citrus* branch from Ghana and from New Zealand (Hughes 1978).

* **Sporidesmium leptosporum** (Sacc. et Roum.) Hughes

Canad. Journ. Bot. 36: 808, 1958.
On dead leaves of a palm-tree, on dead branches of *Smilax* sp. and an undetermined tree. Atanagilda near Nueva Gerona, 20. I. 1981, coll. V.H.-J. (PRM 831528, 831541). – Cerro de San Juan, 22. I. 1981, coll. A. Mercado 5882 (HAC); V.H.-J. (PRM 831546).

Colonies effuse, dark brown. Conidiophores brown to dark brown, 30—130 μm long, 3.5—6 μm thick. Conidia narrowly obclavate, pale straw coloured, 5—20-septate or pseudoseptate, 23—85 × 5—8 μm.

Common on dead wood and bark and on various herbaceous material in Europe and some tropical and subtropical areas.

* **Sporidesmium macrurum** (Sacc.) M. B. Ellis

Mycol. Pap. Kew, 70: 53–54, 1958.
On dead petiole of an undetermined palm-tree. Arroyo de Agua Santa, 22. I. 1981, coll. V.H.-J. (PRM 831549).

Colonies effuse, black. Conidiophores up to 150 μm long, 5—6 μm thick, slightly swollen at the apex. Conidia obclavate, rostrate, 3—4-septate, 40—55 μm long, 8—9.5 μm wide in the broadest part, 1.5—2 μm near the apex, conico-truncate and protuberant at the base, 3—4 μm wide.

Common on leaves and petioles of palms in tropical regions.

* **Sporidesmium tropicale** M. B. Ellis

Mycol. Pap., Kew, 70: 58–60, 1958.
On dead branches of undetermined trees. 2 km north of Playa Larga, 21. I. 1981, coll. A. Mercado 5828 (HAC). – Cerro de San Juan, 22. I. 1981, coll. V.H.-J. (PRM 831577).

Colonies blackish brown. Conidiophores brown, 50—300 μm long, 4.7—7 μm thick. Conidia obclavate, rostrate, 7—16-septate, brown to pale brown, proximal part darker and verruculose, thick-walled, 65—180 μm long, 11—15 μm wide in the broadest part, 3.5—4.7 μm wide near the base.

Known from tropical and subtropical areas on dead branches of different trees and shrubs.

* **Sporidesmium vagum** C. G. et T.F.L. Nees

Nova Acta Acad. Caesar. Leopold. 9: 231, 1818.
On dead rachis of *Coccothrinax* sp., on dead branches of *Bambusae* and an undetermined tree. Near Loma La Cañada, 20. I. 1981, coll. A. Mercado 5855 (HAC). — Cerro de San Juan, 22. I. 1981, coll. V.H.-J. — Finca El Abra, 22. I. 1981, coll. V.H.-J. (PRM 831571).

Colonies effuse, black. Conidiophores brown, 15—30 μm long, 3—5.6 μm thick. Conidia obclavate, elongated, slightly flexuous, 19—38-pseudoseptate, mid brown, 120—260 μm long, 8—13.5 μm wide.

On dead wood and bark of different trees in Europe and in tropical and subtropical countries, probably a cosmopolitan species.

Sporoschisma nigroseptata D. et P. R. Rao

Mycopath. Mycol. Appl. 24: 82, 1964.
On dead wood. Near Loma La Cañada, 20. I. 1981, coll. A. Mercado 5858 (HAC).

Colonies effuse, black, hairy. Conidiophores dark brown, up to 240 μm long, 8—9.5 μm thick near the base, up to 18 μm wide at the open apex. Capitate hyphae dark brown, paler above, up to 150 μm long, 5.5—8.5 μm at the base, tapering to 4.5—5 μm below the swollen apex. Conidia basipetally endogenous, cylindrical, 5-septate, dark brown, terminal cells subhyaline, 28—42 × 9—13 μm.

Known from dead herbaceous and wooden material from India, Iriomote Island (East-China Sea), New Zealand and Cuba (Rao and Rao 1964, Matsushima 1975, Hughes 1966, Mercado 1982).

* **Stigmina asperulata** Hol.-Jech. spec. nova Fig. 1: 5.

Sporodochia dispersa, punctiformia, atra. Stromata pseudoparenchymatica, usque ad 300 μm lata et 100 μm alta, atro-brunnea. Conidiophora recta vel flexuosa, brunnea, verrucosa vel asperata, 15–35 μm longa, 4.5–7.5 μm crassa, cum numerosis proliferationibus successivis nodosisque. Conidia subglobosa, late ovata vel globosa, multiseptata, muriformia, brunnea, verrucosa, 18–35 × 16–29 μm.

Habitat in petiolis palmarum.

Holotypus: Cuba, Isla de la Juventud (= Isla de Pinos), Los Indios, south-west of La Cañada; on dead petiole of a palm-tree, 20. I. 1981, coll. V. Holubová-Jechová (PRM 831530).

Sporodochia scattered, punctiform, black. Stromata pseudoparenchymatous, up to 300 μm wide and 100 μm high, dark brown. Conidiophores straight or flexuous, brown, verrucose or roughened with elongate irregular warts, 15—35 μm long, 4.5—7.5 μm wide, with numerous successive annellations or nodes. Conidia subglobose, broadly ovoid or globose, multiseptate, muriform, brown, verrucose, 18—35 × 16—29 μm.

On dead petioles of an undetermined palm-tree.

Stigmina asperulata differs from all known species of this genus by subglobose, muriform and verrucose conidia. Conidia of *Stigmina* species may sometimes be verrucose and muriform, but only occasionally they are subglobose; they are mostly ellipsoidal or obclavate.

Taeniolella robusta Mercado

Acta Botanica Cubana (in press)
On dead branches. 2 km north of Playa Larga. 21. I. 1981, coll. A. Mercado 5875 (HAC).

Colonies effuse, blackish brown, velvety. Conidiophores short, 8—15 μm thick near the base. Conidia brown, 3—12-septate, 20—90 × 7—13 μm, mostly 30—60 × 9—11 μm, 2—4 in acropetal chains.

Tetraploa aristata Berk. et Broome

Ann. Mag. Nat. Hist. 2, 5: 459, 1850.
On dead branches of *Bambusae* and on dead leaves of palm-tree. Finca El Abra. 22. I. 1981, coll. V.H.-J. — Atanagilda. 20. I. 1981, coll. V.H.-J. (PRM 831541).

Very common in Cuba and other tropical and subtropical areas on dead wood and herbaceous stems (Ellis 1971, Mercado 1981).

Torula herbarum (Pers.) Link f. **quaternella** Sacc.

Ann. Mycol. 11: 556—557, 1913.
On dead branch of *Hibiscus* sp. Presa Cristal near Atanagilda. 20. I. 1981, coll. V.H.-J. (PRM 831582).

Very common form on wooden and herbaceous material in the tropics, known also from Cuba (Ellis 1971, Mercado 1980).

Tubercularia sp.

On dead petiole of *Roystonea regia*. Cerro de San Juan. 22. I. 1981, coll. V.H.-J. (PRM 831578).

Sporodochia more or less cushion-shaped, sessile, loose, not compact, white to light orange coloured. Conidiophores erect, simple or slightly branched, forming a compact layer. Phialoconidia ellipsoidal to elongate ellipsoidal, hyaline, aseptate, multiguttulate, 3—7 × 1.5—2 μm. No teleomorph is developed on the material.

* **Trimmatostroma cordae** Sharma et Singh

Curr. Sci. 45(8): 302—303, 1976.
On dead rotten branches and wood of undetermined trees. 2 km north of Playa Larga. 21. I. 1981, coll. V.H.-J. (PRM 831574). — Cerro de San Juan. 22. I. 1981, coll. V.H.-J. (PRM 831563).

Sporodochia on the substrate small, pulvinate, often confluent, effuse, irregular, black. Conidia subspherical, ellipsoidal, clavate, irregularly lobed, dark brown, with 2—4 transverse septa and a few longitudinal and oblique septa, 8—23 × 8—15 μm, in basipetal chains, irregularly branched.

The fungus is very common in all regions of Cuba and was collected also in India and Pakistan (according to herbarium collections in IMI). It is very close to *T. betulinum* Corda, from which it differs by verrucose and dark brown conidia.

* **Virgaria nigra** (Link) Nees

Syst. Pilze Schwämme, p. 54, 1817.
On dead rachis and petioles of *Roystonea regia*, on dead branches and trunks of undetermined trees. Loma La Reforma. 22. I. 1981, coll A. Mercado 5840 (HAC). — Cerro de San Juan. 22. I. 1981, coll. A. Mercado 5886, 5881 (HAC); V.H.-J. (PRM 831564, 831567). — Finca El Abra. 22. I. 1981, coll. V.H.-J. (PRM 831561).

Very common on rotten wood and dead herbaceous material in Europe, North America, New Zealand and some tropical and subtropical areas. In Cuba, it was collected by F. Kotlaba 1966—1967 in several localities. In Cuban material also a some smaller form was found, with conidia only 3—4.2 × 2—2.5 μm and conidiophores only 2 μm wide.

* **Virgariella sphaerica** Matsushima

Icones Microfungorum a Matsushima lectorum, p. 163, 1975.
On dead branches. In the way from Carapachibey to Cayo Piedra. 21. I. 1981, coll. A. Mercado 5818 (HAC).

Colonies effuse, black, hairy. Conidiophores dark brown, smooth, 100—350 μm long, 4.5—6.2 μm thick. Conidia subglobose, brown, minutely verrucose, 4—7 × 3.8—6.2 μm.

The fungus was originally isolated from soil in Japan.

Zygosporium masonii Hughes

Mycol. Pap., Kew, 44: 15–16, 1951.
On dead petiole of *Roystonea regia*. Cerro de San Juan. 22. I. 1981, coll. V.H.-J. (PRM 831580).

Very common on dead herbaceous material in tropical and subtropical areas, also in Cuba (Ellis 1971, Mercado 1981).

Zygosporium oscheoides Mont.

Ann. Sci. Nat., Sér, 2, 77: 121, 1842.
On dead petioles and fruit branches of *Roystonea regia*. Near Loma La Cañada. 20. I. 1981, coll. V.H.-J. (PRM 831572).

The commonest species of *Zygosporium* on dead herbaceous material in tropical and subtropical areas; it is known from Cuba, too (Ellis 1971, Mercado 1981).

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Peziza obtusapiculata, a new species related to Peziza apiculata

Peziza obtusapiculata, nový druh z příbuzenstva Peziza apiculata

Jiří Moravec

A latin diagnosis of *Peziza obtusapiculata* J. Moravec spec. nov. is given. This new species is described according to a collection from Czechoslovakia known as *Peziza apiculata* Cooke sensu J. Moravec (1977). Notes to differences from *P. apiculata* and other related species are given.

Je uvedena latinská diagnóza nového druhu *Peziza obtusapiculata* J. Moravec spec. nov. podle nálezu z Československa, který je znám jako *Peziza apiculata* Cooke sensu J. Moravec (1977). Jsou připojeny poznámky k rozlišení nového druhu od *P. apiculata* a od ostatních příbuzných druhů.

Some years ago a new collection of *Peziza apiculata* Cooke was reported from Czechoslovakia (J. Moravec 1977) with some taxonomic remarks. Recently several species of *Peziza* related to *P. apiculata* were recognized. Pfister (1979) after reexaminations discussed and summarized four species with apiculate ascospores in a key. Unfortunately he quite incorrectly considered *P. apiculata* sensu J. Moravec (1977) a fungus not belonging to the genus *Peziza*. Dissing et Sivertsen (1983) described a new species *Peziza prosthetica* which is very similar but different from *P. apiculata* sensu J. Moravec (1977). Both species differ from original description of *P. apiculata* in the form of ascospore apiculi. Therefore, I reevaluated the Czechoslovakian collection and after a personal discussion with Dr. H. Dissing at the occassion of the IMC 3 I decided to describe it as an independent, new species. Dissing et Sivertsen (1983) independently came to similar conclussion and noted that the description of *P. apiculata* sensu J. Moravec (1977) is intermediate between *P. apiculata* and *P. prosthetica*.

Peziza obtusapiculata J. Moravec spec. nov.

Apothecia 10–20 mm diam., sessilia, leniter patellaria dein explanata; thecio primum laete luteo-viride dein olivaceo-viride usque obscure olivaceo-fusco; pars exterior apothecii laete badia usque fusca, subtiliter granulosa, pustulis fuscis obsita, ad marginem continua, obscure olivaceo-fusca. Excipulum externum parte inferiore "textura globulosa" e cellulis globosis vel subglobosis, hyalinis, 14–55 μm diam., parte superiore cellulis pyriformibus, margo excipuli cum hyphis clavatis, septatis. Excipulum parte medulari e cellulis globosis et crasse hyphoideis. Asci 290—300× 13.6–16.3 μm, cylindracei, octospori, operculati, amyloidei. Paraphyses filiformes, 3 μm crassae, simplices, rectae, supra subincrassatae vel non incrassatae, hyalinae vel granulis laete fuscis impletae. Ascosporae ellipsoideae vel fusiformi-ellipsoideae (apiculo inclusive), apiculatae, 16.3–24.5–27×8–9.5–10.2 μm (apiculo inclusive, vel 13.6–18–19.5 μm apiculo exclusive), verrucosae; verrucae regulariter rotundatae, solitariae, rarissime coniunctae, orbiculares, 0.5–1.5–2.2 (–2.7) μm diam. et 0.2–0.7–1.7 μm altae, polis saepe incrassatae usque apiculo crasso instructae; apiculus pustuliformis vel irregulariter orbicularis, saepe cucullatus, obtuse conicus vel campanulatus usque elongato-conicus, apice truncatus vel obtusus, 1.5–3.5–4.5 μm altus. Apiculi et verrucae cyanophili. (Oil immers. 1575×+CB Geigy s. 123).

Holotype: Czechoslovakia, Moravia, Útěchov prope Brno, ad lignum putridum sub corticem trunci (? *Carpinus betulus*) in *Querceto-Carpineto* cum *Betula alba*, 10. V. 1975 leg. Jiří Moravec. Typus PRM 832208 et duplicatum in herbario privato J. Moravecii asservantur.

An English description of this new species together with illustrations including its ascospores was given in J. Moravec (1977) under the name *Peziza apiculata* Cooke. The most outstanding features are the ascospore ornamentation consisting of minute to conspicuously coarse warts and the blunt, campanulate or conical to elongated apiculi having always blunt or rounded apex. *P. prosthetica* differs with smaller isolated regular warts of ascospore ornamentation (Dissing et Sivertsen 1983). *P. apiculata* has pointed, up to 6 µm high apiculi and finely verrucose ascospores (according to Eckblad 1968 and Pfister 1979). Other related species, *Peziza thozetii* Berk., *Peziza elachroa* Berk. et Curt. in Cooke, *Peziza vagneri* J. Mor. and *Peziza bubaci* (Velen.) Svr. differ in ascospore ornamentation and ascospore size. Moreover, the two latter species differ with finger-like apiculate warts or spines on ascospore poles (see also J. Moravec 1976 and Svrček 1976).

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Robert Kühner: **Les Hyménomycètes agaricoïdes** (Agaricales, Tricholomatales, Pluteales, Russulales). Etude générale et classification. Nr. spéc., Bull. Soc. Linnéenne Lyon, 49 Anné, juin 1980, pp. (1)-(18), 1—1027.

Kniha, o níž poněkud opožděně referujeme, neboť se nám dostává až za více než tři roky poprvé do rukou, je moderním, ale svým způsobem již nyní klasickým dílem o třídění lupenatých hub. Je to studie o vyšších systematických jednotkách, a to na úrovni podrodů, rodů, tribů, čeledí a řádů. Obecné otázky jsou probírány většinou ve speciálních kapitolách a důraz se klade na dva základní aspekty: morfologie a chemismus. Ze znaků morfologických autora zajímá vedle makromorfologie (zejména ontogenetické) především mikrostruktura a ultrastruktura (elektronmikroskopická struktura), ze znaků biochemických jsou to především pigmenty, jimž jsou věnovány i zvláštní kapitolky z pera N. Arpina a K. Gluchoff-Fiassonové. Tyto rozbory jsou pak promítnuty do podrobně zdůvodněného návrhu přirozené soustavy lupenatých hub. Jedná se o shrnutí celoživotních zkušeností autora, a to padesáti pěti let práce v tomto oboru. Pohlédneme-li na vývoj studia lupenatých hub, pak v tomto století je největší počet objevů mikroskopických znaků spojen právě se jménem prof. R. Kühnera. Jsou to např. siderofilní (karminofilní) granulace v basidiích, odbarvování stěny výtrusů některých tmavovýtrusných hub v kyselině sírové, objev amyloidity stěny výtrusů (u ornamentiky známa již dříve) u lupenatých hub, metachromatismus stěn hyf a výtrusů v kresylové modři, rozdíly v lokalizaci pigmentů, z poslední doby pak stratifikace stěny výtrusů v elektronovém (transmisním) mikroskopu (ultrastrukturní stratifikace) a oddělování některých vrstev stěny výtrusů růžovovýtrusných hub v louhu draselném a řada dalších. Velký je též objem jeho práce v cytologii jádra, v histologii povrchových struktur, v genetice a fyziologii. Připočteme-li ještě velké taxonomické monografie jako rodu *Mycena* a rodu *Galera* a dále pak studie o rodech *Lepiota*, *Hypholoma* a *Marasmius*, o arktoalpinských lupenatých houbách, vybudování biotaxonomické školy na lyonské univerzitě, pak můžeme prof. Roberta Kühnera (nar. 15. 3. 1903) pokládat za jednoho z nejvýznamnějších a nejúspěšnějších mezi žijícími mykology.

Recenzovaná kniha je sympatická v mnoha směrech, ale zejména tím, že autor zde probírá nejen své oblíbené náměty, ale nevyhýbá se ničemu, co může mít význam pro zpracování tématu. I když nomenklatura není právě autorovým nejmilovanějším tématem, snaží se poctivě vypořádat se všemi problémy, zejména s kontroverzní typifikací starých rodových jmen.

V naší recenzi se nemůžeme dotknout všech otázek, které jsou námětem této tisícistránkové knihy. Není to ani nutné, k tomuto dílu se budou jistě vracet celé generace mykologů. Omezíme se nyní na některé otázky, které recenzenta zaujaly. Dominující ideou, jakýmsi „leitmotivem“ knihy je použití studia ultrastruktury vrstev stěny výtrusů pro systematiku lupenatých hub. Autor se tomuto tématu věnoval spolu se svou školou (např. Besson-Antoine, Capellano) a i ve spolupráci se švýcarskou školou (Clémençon a Keller) v posledních skoro dvaceti letech. I když je určitý terminologický nesoulad mezi Clémençonovým pojetím a koncepcí Kühnerovou, není to nepřekonatelný rozpor (priority však patří pravděpodobně Clémençonovi). Velmi zajímavé je pak vyústění, ke kterému autor dospěl při syntéze všech jím za důležité pokládaných znaků ve vybudování přirozené soustavy lupenatých hub jím nyní navržené. Srovnáváme-li Kühnerův nový systém se Singerovým, pak vidíme mnohé shody, ale i nápadné rozdíly, z nichž nejdůležitější je v tom, že jestliže Singer řadí lupenaté houby do jednoho řádu, rozděleného do většího počtu čeledí, pak Kühner rozlišuje pět základních řádů lupenatých hub a to: *Tricholomatales*, *Agaricales*, *Pluteales*, *Russulales* a *Boletales*. Je zajímavé, že pak se mu v některých případech dostávají někdy za blízké pokládané houby do rozdílných řádů, a to je už dosti velká taxonomická vzdálenost. Tak na příklad rod *Cystoderma* a příbuzné rody řadí přímo do čeledi *Tricholomataceae*, dosti daleko od rodu *Lepiota (Agaricales)*, do jehož blízkosti jej staví Singer. Pokračuje tak v tradici moderní francouzské mykologie (Konrad a Maublanc a jiní), která nikdy nevěřila na příbuzenství rodu *Cystoderma* s bedlami. Izolované typy jako je *Laccaria* (čeleď *Hydnangiaceae)* a *Rhodotus* (čeleď *Rhodotaceae)* jsou oddělovány od vlastních čirůvkovitých *(Tricholomataceae)* na bázi jiné ultrastruktury stěny výtrusů. Na druhé straně je podle recenzentova názoru poněkud nešťastný návrat k myšlence, že druhy rodu *Pleurotus* sensu lato jsou si až na výjimky vzájemně příbuzné a patří z větší části do čeledi *Pleurotaceae*. Nejpozoruhodnější je však zcela nové pojetí, které představuje seskupení čeledí kladených zde do řádu *Pluteales;* zde se znaky ve stratifikaci stěny výtrusů manifestují i v chování stěny v louhu draselném, kdy se odlupují vnější vrstvy výtrusu (po delším působení při vyšších teplotách) a přilnou zase zpět po převedení do kyseliny octové. Do takto definovaného řádu *Pluteales* patří především růžovovýtrusé houby *(Entolomataceae* a *Pluteaceae),* ale i *Macrocystidia cucumis,* houba velmi izolovaného postavení, pro kterou Kühner zde navrhl novou čeleď: *Macrocystidiaceae.* Pozoruhodné je i to, že se potvrdilo, že houby kladené původně do rodu *Rhodopaxillus* jsou si vzájemně zcela nepříbuzné *(Rhodocybe* patří do *Pluteales* a *Lepista* do *Tricholomatales).* Tak došel původně Malençonův objev, rozvinutý později Singerem, plného potvrzení. Důležitým rysem nového systému je využití chemismu pigmentů a jiných látek pro systematiku. To vedlo např. k oddělení rodu *Hygrophoropsis* od čeledi *Paxillaceae* do zvláštní čeledi *Hygrophoropsidaceae.* Na moderní mykologickou systematiku se často útočí ze strany praktiků, že používá různých elektronmikroskopických, cytologických a biochemických znaků, které nemohou mykologové v běžné denní praxi použít. To je ale nedorozumění: jedna věc je systém a jeho výstavba a druhá věc je soustava určovacích znaků: *Macrocystidia cucumis* se snadno pozná podle zápachu rybího tuku, ale zařazena do systému je podle ultrastrukturní stratifikace stěny výtrusů. Tato dvě hlediska nejsou v žádném rozporu! Pro určování musíme najít takové znaky, na základě nichž lze houby poznat, a pro taxonomické zařazení můžeme použít i běžnými metodami zcela nedostupné znaky.

Autor věnuje velkou pozornost i některým detailním a speciálním problémům, které mu zřejmě již dlouho leží na srdci: je to například spor se Singerem o ohraničení rodů *Collybia* a *Marasmius* — tato diskuse je velice podnětná zejména pro bohatství nových myšlenek a argumentů. Na některých místech se autor značně odchyluje od názorů anglických mykologů, např. tam, kde šťavnatkovité houby pokládá do určité míry v souladu s Herinkem a Singerem za rodově dosti diferencované a plžatky *(Hygrophorus)* pak považuje za značně odlišné od ostatních (monogenerický tribus *Hygrophoreae).* Překvapující je vyčlenění rodů *Gymnopilus* a *Galerina* z čeledi *Cortinariaceae* a jejich zařazení do čeledi *Strophariaceae.* Pozoruhodné je i nové pojetí rodu *Naucoria,* kam zařazuje kromě *Tubaria, Phaeomarasmius* a *Flammulaster* (= *Naucoria* subgen. *Flocculiaria*) i svůj nedávno odlišený rod *Phaeogalera.* Nanejvýš neuvěřitelnou novinkou je zařazení rodu *Alnicola* do rodu *Hebeloma* a rodu *Simocybe* do rodu *Agrocybe* (v obou případech v hodnotě podrodů). Podle recenzentova názoru je Kühnerovo pojetí rodu v této knize z větší části poněkud příliš široké a téměř polovina podrodů jím rozlišovaných představuje vlastně samostatné rody.

Na tomto místě nesmíme opominout bibliografickou stránku této publikace: vycházela nejprve jako příloha časopisu Bulletin mensuel de la Societé Linnéenne de Lyon (vol. 46, 47, 48 a 49) v letech 1977—1980 pod titulem „Les grandes lignes de la classification des Agaricales, Plutéales, Tricholomatales". Pro nyní recenzované knižní vydání byla obohacena o souhrny, kde jsou uvedeny hlavní výsledky, a to ve francouzštině a angličtině (přes třicet stran, ve vynikajícím překladu Roye Watlinga a Allana Mortona). Pro bibliografické účely je nutno počítat s tím, že se zde jedná o dvě vydání téže práce s jinými daty vydání a jiným titulem (i když sazba je většinou úplně shodná) a je nutno na to pamatovat při citacích.

Z čistě nomenklatorického hlediska je třeba mít na paměti, že pro prioritu nově navržených jmen je podstatné, že prakticky celé dílo vyšlo dříve časopisecky než knižně, snad s výjimkou čísla 7 ročníku 48 (1980) Bulletinu, které vyšlo v září, když o knižním vydání se na poslední nečíslované straně dočítáme, že kniha byla vytištěna 10. 7. 1980. Z knižního vydání by za těchto okolností měla prioritu jména *Hygrophoropsidaceae* Kühner (p. 900, Bull. p. 414) a *Tricholoma singeri* Kühner (p. 992, Bull. p. 418; non *Tricholoma singeri* Kuthan, Čes. Mykol. 36: 10, 1982, což je pozdější homonymum). Nové kombinace uvedené na str. 418 časopiseckého vydání („Grand lignes") jsou platně publikovány výhradně v knižním vydání („Hyménomycètes agaricoïdes") a to i kdybychom připustili možnost, že časopisecké vydání této stránky bylo případně dřívější. Na zmíněné stránce jsou totiž uvedeny pouze bazionymy, ale nově navržená jména jsou uvedena na jiných, specificky citovaných místech v textu. Podle článku 45 Kódu mohou být sice podmínky pro platné uveřejnění jména splněny i na různých místech publikace, ale ta musí být vydána najednou, a to splňuje pouze knižní vydání, které vyšlo vcelku. Je vskutku potěšující, že autor v této publikaci v mnoha případech uspěl v nomenklatoricky platné publikaci jmen rezultujících z nového systému, a to jak vyšších taxonů, tak i nových kombinací a nových jmen. Výjimku tvoří např. jména *Lentinus carbonarius* a *Hydropus laceratus*, která nejsou nikde platně publikována, protože bazionym je citován zcela mylně, a z podobných důvodů v ostatním textu pak není platně publikována ani značná část podrodů a tribů.

Dvacáté století bylo velmi úrodné na kvalitní produkci knih z našeho oboru, ale kdybychom z nich měli označit pět vrcholných děl, pak tato Kühnerova kniha by k nim určitě patřila.

Zdeněk Pouzar

J. L. Harley a S. E. Smith: **Mycorrhizal Symbiosis**. Academic Press, London, New York 1983, str. 1—483, 86 tab., 39 grafů a 14 tabulí. Cena neuvedena.

Profesor J. L. Harley téměř po patnácti letech vydává opět monografii o mykorrhizních symbiózách. Autor je dnes světově uznávanou autoritou v oblasti výzkumu mykorrhizy. V Oxfordu založil vlastní vědeckou školu především v oblasti fyziologie ektomykorrhiz a své dlouholeté a bohaté zkušenosti shrnul do nové souborné publikace, která byla odborníky již dlouho postrádána. Rozsah nové publikace je téměř o polovinu větší, proti publikaci z roku 1969, což svědčí i o zvýšeném zájmu o výzkum v této velmi specializované oblasti. Autorovo velmi široké odborné zázemí a dlouholeté zkušenosti, a to jak z oblasti základního výzkumu, tak i z oblasti aplikací z různých částí světa, je velmi dobře patrné při studiu této výborné publikace. I když z publikace není patrno, které kapitoly zpracoval J. L. Harley, a které kapitoly zpracovala jeho dcera S. E. Smith, předpokládám, že kapitolu pojednávající o mykorrhize typu orchideí zpracovala převážně S. E. Smith a ostatní kapitoly zpracoval převážně J. L. Harley.

Problematika mykorrhizy nabývá v posledních letech na významu, o čemž svědčí nebývalý růst publikací o tomto poměrně úzkém problému výzkumu v nejrůznějších částech světa. Rozšířil se značně zájem o praktické využití ekto- a endomykorrhiz v lesnické a zemědělské praxi, a to především v rozvojových zemích. Během posledních patnácti let vznikla nová centra výzkumu mykorrhizy prakticky ve všech větších zemích světa. Narůstající vědecká obec specialistů bezesporu velice uvítá tuto již dlouho očekávanou publikaci.

Kniha je rozdělena do dvou hlavních částí: Typy mykorrhiz a Úvahy o mykorrhizách. První část sestává ze čtyř kapitol. První kapitola, vezikulo-arbuskulární mykorrhiza, pojednává téměř na 80 stranách o základních aspektech v—a mykorrhiz. Autor zcela jasně definuje pojem houbové symbiózy a v podstatě rozlišuje sedm základních typů mykorrhiz (vezikulo-arbuskulární, ektomykorrhizu, ektendomykorrhizu, arbutoidní, monotropoidní, ericoidní a mykorrhizu typu orchideí). Toto členění je dnes téměř všeobecně uznávané a plně se osvědčilo. Endomykorrhiza vezikulo-arbuskulární je v rostlinném světě mnohem častější než poměrně lépe prozkoumaná ektomykorrhiza převážně se vyskytující u lesních stromů a keřů. Houbový symbiont kořenů vyšších rostlin náleží v podstatě do několika rodů čeledi *Endogonaceae* a zatím není potvrzeno, že by existovala určitá specifita houbového symbionta pro hostitelskou rostlinu, která je na druhé straně poměrně charakteristická pro ektomykorrhizy. Anatomie a morfologie v-a mykorrhiz je velmi dobře propracovaná díky tomu, že v této oblasti vědci pracují více než sto let. Mnohem méně prací se zabývá problematikou fyziologie v-a mykorrhizy, a to vzhledem k určitým metodickým obtížím v experimentálním výzkumu. Autor ale velmi správně věnoval větší pozornost této závažné kapitole, která má rovněž i značný praktický význam. V oblasti minerální výživy a fyziologie mykorrhiz jsou zatím stále značné mezery v našich znalostech, rovněž tak i v oblasti biotechnologie očkovacího materiálu. Z těchto důvodů se zatím nepodařilo v širším měřítku aplikovat umělou mykorrhizaci u zemědělských kulturních rostlin.

V druhé kapitole se autoři zabývají problematikou ektomykorrhiz. Tato kapitola je mnohem rozsáhlejší než všechny ostatní kapitoly, což pramení jednak z toho, že mnohem více materiálu je k dispozici a pravděpodobně také z toho, že J. L. Harley se po celou dobu své vědecké kariéry zabývá problematikou fyziologie ektomykorrhizy. Opět i tato kapitola je velmi logicky členěna. Objasňuje nejprve taxonomické postavení houbových symbiontů, dále se zabývá anatomickou a morfologickou strukturou ektomykorrhizy a největší důraz je kladen především na problematiku transportu a metabolismu uhlíkatých látek a fyziologii příjmu živin a jejich transport k hostitelské rostlině.

Rovněž velmi pečlivě jsou zpracovány další typy mykorrhiz: erikoidní, arbutoidní a monotropoidní. Jsou to typy mykorrhiz, jež mají zvláštní a odlišný vývoj a jsou poměrně úzce specializovány pouze na menší počet rostlinných druhů. Samostatnou kapitolou, které byla věnována zcela mimořádná pozornost, jsou mykorrhizy orchideí.

V druhé části knihy, která je menšího rozsahu, autoři s novým a zajímavým přístupem hodnotí některé problémy současného a hlavně budoucího výzkumu v oblasti mykorrhizy. Upozorňují na „bílá místa“ zejména v genetice mykorrhizních hub, fyziologii uhlíkatých látek a přenosu z houby do vyšší rostliny a zejména v obiasti buněčné biochemie. Nevšední pozornost je věnována rovněž ekologii mykorrhiz, kde zatím bylo vykonáno poměrně málo práce.

Čtenáři bych nejprve doporučoval ke studiu první knihu J. L. Harleye z roku 1969 (The biology of mycorrhiza) a po jejím prostudování teprve toto nové vydání, které je mnohem náročnější a vyžaduje dostatek předběžných znalostí.

Václav Mejstřík

J. Webster: **Die Pilze.** Eine Einführung. (Překlad B. D. Epp) Springer Verlag. Berlin — Heidelberg, New York 1983. Pp. 641.

Kniha je německým překladem druhého vydání známé anglické učebnice (Introduction to Fungi, Cambridge Univ. Press 1980). Čtenář v ní najde základní morfologické a vývojové charakteristiky všech skupin houbových organismů (*Myxomycota, Eumycota*). Kniha je koncipována taxonomicky a vývojově z přístupu tradiční srovnávací morfologie. Obsahuje 332 obrázků, převážně velmi názorných perokreseb. Je napsána srozumitelně, takže se lehce čte, neboť je určena studentům. Avšak rádi po ní sáhnou i graduovaní pracovníci pro základní mykologické informace. Genetické, biochemické ani molekulárně biologické aspekty mykologie v této knize ovšem hledat nemohou, protože jsou zmíněny jen okrajově (i když proti anglickému originálu jsou zde rozšířeny).

M. Hejtmánek

Juan C. Lindquist: **Royas de la republica Argentina y zonas limitrofes.** Instituto nacional de tecnologia agropecuaria, Collection cientifica, Tom 20, 575 stran, Buenos Aires 1982.

Recenzovaná kniha je monografií přibližně 450 druhů (asi 28 rodů) rzí (*Uredinales*) Argentiny a s ní hraničících států: Uruguay, Bolívie, Paraguay, Chile a jih Brazílie. Autor je emeritním profesorem agronomické a přírodovědecké fakulty Národní univerzity v La Plata v provincii Buenos Aires. K přírodovědecké fakultě je organizačně připojeno muzeum s mykologicky významným ústavem „Instituto Spegazzini“. V r. 1974 oslavil prof. Lindquist v plné svěžesti 75. narozeniny. Jeho odborná mykologická orientace, jak se jeví v jeho bibliografii, je orientována na peronospory, sněti a rzi.

První všeobecná kapitola krátce uvádí hospodářskou významnost rzí a z ní se též dovíme, které druhy působí v Argentině a sousedství hospodářské škody. Další část krátce seznamuje s morfologií a biologií rzí a je zakončena dvoustránkovým slovníčkem důležitých odborných termínů. Nejobsažnější 2. kapitola je systematický přehled. Rzi jsou rozčleněny do dvou čeledí: *Melampsoraceae* a *Pucciniaceae.* V každé z nich jsou pak rozpoznávány tribusy. V podstatě se jedná o systém Dietelův z r. 1900.

U každého rodu, kromě popisu a případně i poznámek, je uvedena etymologie a typ jména rodu. Následuje klíč k určení druhů. Při tom jsou druhy seskupovány podle čeledi a tribus hostitele. Při zpracování jednotlivých druhů autor uvádí nejnutnější synonymiku, popis, hostitele a rozšíření ve jmenované části světadílu (vždy provincie a okres nebo název místa). Následují poznámky, které však jsou velmi stručné, bez odkazu na autory a velmi často omezeny na vyjmenování dalšího rozšíření. Téměř každý druh je vyobrazen (výtrusy, jiné detaily). Škoda, že pořadí čeledí hostitelů není abecední.

Bibliografii je věnováno 12 stránek. Velmi obsažná je literatura vztahující se k S. a J. Americe ať již je z péra amerických nebo evropských autorů. Závěr tvoří rejstříky vědeckých jmen druhů rzí a hostitelů.

Recenzovaná kniha i přes velmi četné chyby vzniklé v tiskárně, je velmi cenným pohledem na část flóry rzí v omezené partii ohromného kontinentu, jehož průzkum, zvláště v houbách, je na svém začátku.

Zdeněk Urban

Závěrečná zpráva

přijatá na zájmovém setkání vědců „Věda mezi válkou a mírem", jež se konalo 24. a 25. června 1983 v rámci Světového shromáždění za mír a život, proti jaderné válce, v Praze.

Setkání vědců dospělo k těmto závěrům:

1. Zúčastnění vědci z nejrůznějších vědních oborů z 49 zemí, zastánci různých politických názorů a náboženského přesvědčení, prohlašují, že za nejvýznamnější úkol vědců celého světa považují spojit své úsilí a zabránit použití zbraní hromadného ničení — zabránit konečné katastrofě celé lidské civilizace — a účastnit se mírového hnutí za zmrazení nukleárních zbraní a Kampaně Spojených národů za odzbrojení.

2. Nové akutní nebezpečí vypuknutí nukleární války by mohlo vzniknout plánovaným rozmístěním nové generace amerických střel středního doletu, obzvláště možným selháním elektronických systémů.

3. V nejrůznějších odvětvích vědy bylo dokázáno, že nukleární válka by nevyhnutelně ve svých důsledcích znamenala konec lidstva, konec přírody, konec veškerého života na této planetě.

Proto vědci považují militaristickou myšlenku, že by některá ze zúčastněných stran mohla v nukleární válce zvítězit, za zcela scestnou. Rovněž mylné a absurdní je věřit v možnost omezené jaderné války. Proto se obracejí k vládám zemí, vlastnících jaderné zbraně, aby respektovaly závěry, k nimž dospěli vědci v otázce hrozby nukleární války a aby učinily vše pro to, aby nukleární energie byla používána výhradně pro mírové účely, pro blaho lidstva. Prohlašují, že skutečným úkolem vědy a vědců je budovat, nikoli ničit.

4. Doporučují vládám států, aby přikládaly větší váhu mezinárodnímu právu a podpořily rezoluci Valného shromáždění Spojených národů, jež prohlašuje, že každý stát, který by použil jaderných zbraní jako první v „preventivních" či „obranných" akcích, by se dopustil nejtěžšího zločinu proti lidstvu, který nelze nijak ospravedlnit. Doporučili všem vládám, aby plnily mezinárodní smlouvy zakazující chemické a bakteriologické zbraně a snížily obrovské smrtonosné zásoby vojenských chemických prostředků.

5. Upozorňují na to, že nová etapa zbrojení spolu s růstem vojensko-průmyslového komplexu a úlohy militarismu ve vnitřní a zahraniční politice zvyšují nedůvěru mezi národy, zvláště mezi státy s rozdílnými společenskými systémy a ohrožují mezinárodní stabilitu. Vyzývají nejvyšší představitele, vlády a parlamenty států vlastnících jaderné zbraně, aby snížili nebezpečí vypuknutí jaderného konfliktu mezinárodním jednáním o omezení jaderného zbrojení a o postupném odzbrojení na základě principu stejné bezpečnosti. Zejména plány na vývoj nových strategických jaderných zbraní a přípravy na rozmístění nových jaderných zbraní v západní Evropě vytvářejí celosvětové nebezpečí, jaké dosud nemá obdoby.

6. Považují boj za mír a mírové soužití států s rozdílným společenským zřízením za nejnaléhavější globální problém lidstva. Horečné zbrojení odčerpává obrovské ekonomické hodnoty, lidské úsilí a tak rozhodně oddaluje možnosti řešení problémů, které lidstvu vznikají a jsou nejnaléhavější ve třetím světě. Pouze v míru je možné řešit další naléhavé globální problémy jako jsou chudoba, negramotnost a choroby, zachování zdravého životního prostředí pro všechny vzájemně se podmiňující formy života na Zemi, zajištění potravin a potřebných surovinových zdrojů pro lidstvo a problémy spojené s kulturním, hospodářským, vědeckým a technologickým rozvojem společnosti. Boj za mír je úzce spojen s bojem za demokracii a lidská práva. Právo jednotlivce, národů a států na život v míru musí být v této souvislosti považováno za nejvýznamnější základní lidské právo. Boj za mír je také těsně spojen s bojem za společenský pokrok, hospodářské a sociální požadavky pracujících lidí na celém světě, s bojem za právo na rozvoj a Nový ekonomický řád a za národní osvobození.

7. Účastníci setkání proto navrhují, aby vědci — zastánci nejrůznějších mírových koncepcí a teorií soustředili svou pozornost na to, co sjednocuje zastánce míru na celém světě — na snahu o odvrácení hrozby jaderné války a přednostně na okamžité zmrazení všech jaderných zbraní jako na krok k dosažení všeobecného a úplného odzbrojení.

8. Účastníci setkání navrhují svolat Světový kongres vědců proti válce a zbrojení.

9. Navrhují vytvořit v jednotlivých státech národní výbory vědců za mír, v nichž budou bojovat proti válce společně vědci z oboru přírodních, technických a společenských věd.

10. Účastníci apelují na morální odpovědnost všech vědců světa, aby se zapojili do boje za mír, proti nebezpečí nukleární války. Tato odpovědnost vyplývá ze vztahu vědce k životu a lidstvu a vyžaduje také, aby vedl a vychovával mladou vědeckou generaci ke stejné odpovědnosti. Vědci mohou významně přispět k tomu, aby si lidé lépe uvědomili rizika a potencionální důsledky zbrojení, zejména jaderného zbrojení.

11. Účastníci setkání považují rozvoj široké mezinárodní spolupráce ve výzkumu problémů zajištění míru a odvrácení jaderné války za otázku životního významu. Doporučují, aby UNESCO a všechna mezinárodní vědecká sdružení vědeckých disciplín zařadila výzkum těchto problémů na program jednání příslušných světových kongresů, symposií a konferencí, pokud tak již neučinila — protože jejich řešením by mohla věda přispět k rozvoji mírového soužití.

12. Obracejí se na vědce celého světa s naléhavou výzvou, aby ve svých zemích a na mezinárodní úrovni aktivně vystupovali za uvolnění mezinárodního napětí, mírové soužití států s různými společenskými systémy, proti hrozbě jaderné války a za ochranu života, kdekoli a kdykoli je ohrožen.

ČESKÁ MYKOLOGIE — Vydává Čs. vědecká společnost pro mykologii v Academii, nakladatelství ČSAV, Vodičkova 40, 112 29 Praha 1. — Redakce: Václavské nám. 68, 115 79 Praha 1, tel.: 26 94 51—59. Tiskne: Tiskařské závody, n. p., závod 5, Sámova 12, 101 46 Praha 10. — Rozšiřuje PNS. Informace o předplatném podá a objednávky přijímá každá administrace PNS, pošta, doručovatel a PNS-ÚED Praha. Objednávky do zahraničí vyřizuje PNS — ústřední expedice a dovoz tisku Praha, závod 01, administrace vývozu tisku, Kafkova 19, 160 00 Praha 6. Cena jednoho čísla 8,— Kčs, roční předplatné (4 sešity) Kčs 32,—. (Tyto ceny jsou platné pouze pro Československo.) — Distribution right in the western countries: Kubon & Sagner, P. O. Box 34 01 08 D-8000 München 34, GFR. Annual subscription: Vol. 38, 1984 (4 issues) DM 88,—.

Toto číslo vyšlo v květnu 1984.

Pokyny přispěvatelům České mykologie

Redakce časopisu přijímá jen rukopisy vyhovující po stránce odborné i formální. Přispěvatelé nechť se řídí při přípravě rukopisů těmito pokyny.

1. Česky nebo slovensky psaný článek začíná českým nebo slovenským nadpisem, pod nímž se uvede překlad nadpisu v některém ze světových jazyků, a ta ve stejném jako je abstrakt (popř. souhrn na konci článku). Pod nadpisem následuje plné křestní jméno a příjmení autora (autorů) bez akademických titulů a bez místa pracoviště. Články psané v cizím jazyce musí mít český nebo slovenský podtitul a abstrakt (popř. souhrn).

2. Původní práce musí být opatřeny pod jménem autora (autorů) krátkým abstraktem ve dvou jazycích, a to na prvním místě v jazyku, v jakém je psaný článek. Abstrakt, který stručně a výstižně charakterizuje výsledky a přínos práce, nesmí přesahovat 15 řádek strojopisu (v každém jazyku).

3. U důležitých a významných článků doporučuje se připojit kromě abstraktu ještě podrobnější souhrn na konci práce, a to v témže jazyce, v kterém je abstrakt (a v odlišném než je článek); rozsah souhrnu je omezen na 2 strany strojopisu.

4. Vlastní rukopis, tj. strojopis (30 řádek na stránku po 60 úhozech na řádku, nejvýše s 5 opravenými překlepy, škrty nebo vpisy na stránku), musí být psán černou páskou a normálním typem stroje (ne „perličkou); za každým interpunkčním znaménkem (tečkou, dvojtečkou, čárkou, středníkem) se dělá mezera. Při uvádění makro- a mikroznaků se přidržujte tohoto vzoru: (8–)10,5–12(–13,5) x 4–5 μm (mezery jsou pouze před a za znaménkem „x“ a před zkratkou míry; jen v angličtině se dělají tečky místo desetinných čárek). Nepřipouští se psaní nadpisů a autorských jmen velkým písmeny, prostrkávání písmen, podtrhávání nadpisů slov či celých vět v textu apod. Veškerou typografickou úpravu rukopisu pro tiskárnu provádí redakce sama. Autor může označit tužkou po straně rukopisu části, které doporučuje vysadit drobným písmem (petitem) nebo podtrhnout přerušovanou čarou části vět, které chce zdůraznit.

5. Literatura je citována na konci práce, a to každý záznam na samostatném řádku. Je-li od jednoho autora citovaného více prací, jeho jméno se vždy znovu celé vypisuje, stejně jako citace zkratky opakujícího se časopisu (nepoužíváme „ibidem“). Jména dvou autorů spojujeme latinskou zkratkou et; u prací se třemi a více autory se cituje pouze první autor a připojí se et al. Za příjmením následuje (bez čárky) zkratka křestního jména (první písmeno s tečkou), pak v závorce letopočet vyjití práce, za závorkou dvojtečka a za ní název článku nebo knihy (nikoli podtitul); po tečce za názvem je pomlčka, celkový počet stran knihy a místo vydání. U vícedílných knižních publikací uvádíme před pomlčkou číslo dílu pomocí zkratky vol. (= volumen), pokud není číslo dílu součástí titulu knihy. Stránky knihy citujeme se zkratkou p. (= pagina). U citování prací z časopisů následuje po pomlčce název časopisu (kromě jednoslovných se užívá zkratek), dále číslo ročníku (bez vypisování roč., vol., Band apod.), pak následuje dvojtečka a citace stránek celkového rozsahu práce.

6. Pravidla citování literatury, jakož i seznam vybraných periodik a jejich zkratek jsou zahrnuty v publikacích, které vyšly jako přílohy Zpráv Čs. botanické společnosti při ČSAV – Zpr. Čs. Bot. Společ., Praha, 13 (1978), append. 1: 1–85, et 14 (1979), append. 1: 1–121. (Tyto publikace lze zakoupit v sekretariátu Čs botanické společnosti, Benátská 2, 128 01 Praha 2.)

7. Při citování ročníku časopsiu nebo dílu knihy používáme jen arabské číslice.

8. Druhové latinské názvy se píší s malým písmenem, i když je druh pojmenován po některém badateli, přičemž háčky a čárky se vypouštějí (např. *Sclerotinia veselyi, Geastrum smardae*).

9. Při uvádění dat sběrů píšeme měsíce výhradně římskými číslicemi (2. VI. 1982).

10. Při citování herbářových dokladů uvádějí se zásadně mezinárodní zkratky herbářů (viz Index herbariorum 1981; např. BRA – Slovenské národné múzeum, Bratislava; BRNM – botanické odd. Moravského muzea. Brno; BRNU – katedra biologie rostlin přírod. fakulty UJEP, Brno; PRM – mykologické odd. Národního muzea, Praha; PRC – katedra botaniky přírod. fakulty UK, Praha). Soukromé herbáře citujeme nezkrácneým příjmením majitele (např. herb. Herink) a stejně nezkracujeme herbáře ústavů bez mezinárodní zkratky.

11. Při popisování nových taxonů nebo nových kombinací autoři se musí přidržovat zásad posledního vydání mezinárodních nomenklatorických pravidel – viz Holub J. (1968 et 1973): Mezinárodní kód botanické nomenklatury 1966 a 1972. – Zpr. Čs. Bot. Společ., Praha, 3, append. 1, et 8, append. 1; týká se to převážně uvádění typů a správné citace basionymu.

12. Adresa autora nebo jeho pracoviště se uvede až na konci článku pod citovanou literaturou.

13. Ilustrační materiál (kresby, fotografie) k článkům se čísluje průběžně u každého článku zvlášť, a to arabskými číslicemi (bez zkratek obr., fig., apod.) v tom pořadí, v jakém má být uveřejněn. Fotografie musí být dostatečně kontrastní a ostré, perokresby (tuší) nesmí být příliš jemné; všude je třeba uvádět zvětšení. Text k ilustracím se píše na samostatný list.

14. Separáty prací se tisknou na účet autora; na sloupcovou korekturu autor poznamená, žádá-li separáty a jaký počet (70 kusů, výjimečně i více).

Redakce časopisu Česká mykologie

ČESKÁ MYKOLOGIE

The journal of the Czechoslovak Scientific Society for Mycology, formed for the advancement of scientific and practical knowledge of the fungi

Vol. 38 Part 2 May 1984

All contributions should be sent to the address of the Editorial Secretary: The National Museum, Václavské nám. 68, 115 79 Prague 1, telephone 269451–59. Address for exchange: Československá vědecká společnost pro mykologii, 111 21 Praha 1, P. O. Box 106.

Part 1 was published on the 10th February 1984

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