Diseases of trees IV

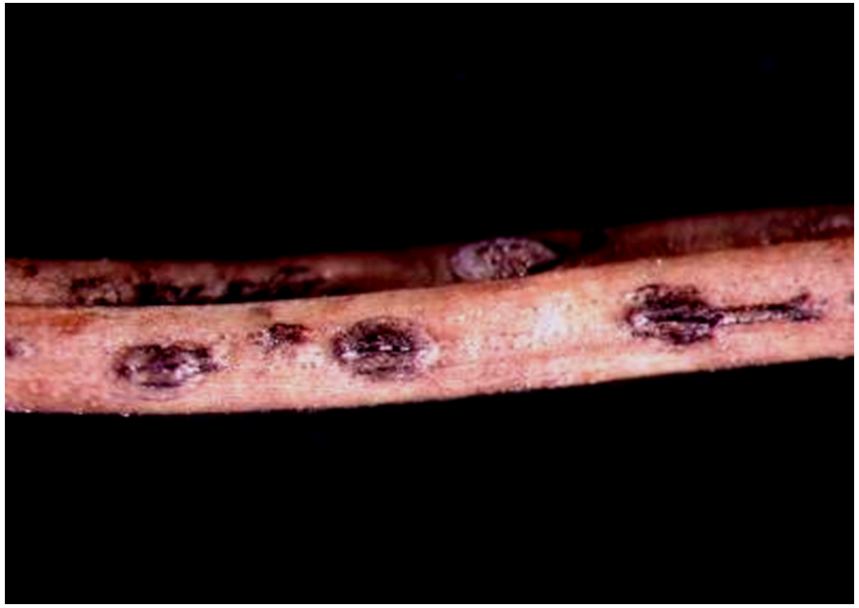
Shoot and needle diseases

Tento projekt je spolufinancován Evropským sociálním fondem a Státním rozpočtem ČR InoBio – CZ.1.07/2.2.00/28.0018

The diseases of spruce

- **The diseases of needles and shoots**
  - ***Needle cast (Lophodermium abietis, Lophodermium macrosporum (Lirula macrosposra)***
  - ***Chrysomyxa abietis - Kuusenneulasruoste***
  - ***Botrytis cinerea***
- **The diseases of seedlings**
  - **Strangulation of seedlings - *Pestalotia hartigii***
  - **Dumping of - *Pythium, Fusarium, Verticillium***
  - ***Thelephora terestris***
- **Other diseases**
  - **Cone rust *Thekospora areolata***
  - **Disease of seeds - *Alternaria, Cylindrocarpon, Fusarium, Pythium, Trichoderma lignorum***
  - **Yellowing discoloration of spruce - RLO (?), MLO (?)**

Lophodermium abietis



Lirula macrospora

Kuusenjuovakariste


Lirula macrospora

Chrysomyxa rhododende

C.ledii

C. abietis

Chrysomyxa abietis

Chrysomyxa abietis

Bud blight fungus *Gemmamyces piceae*

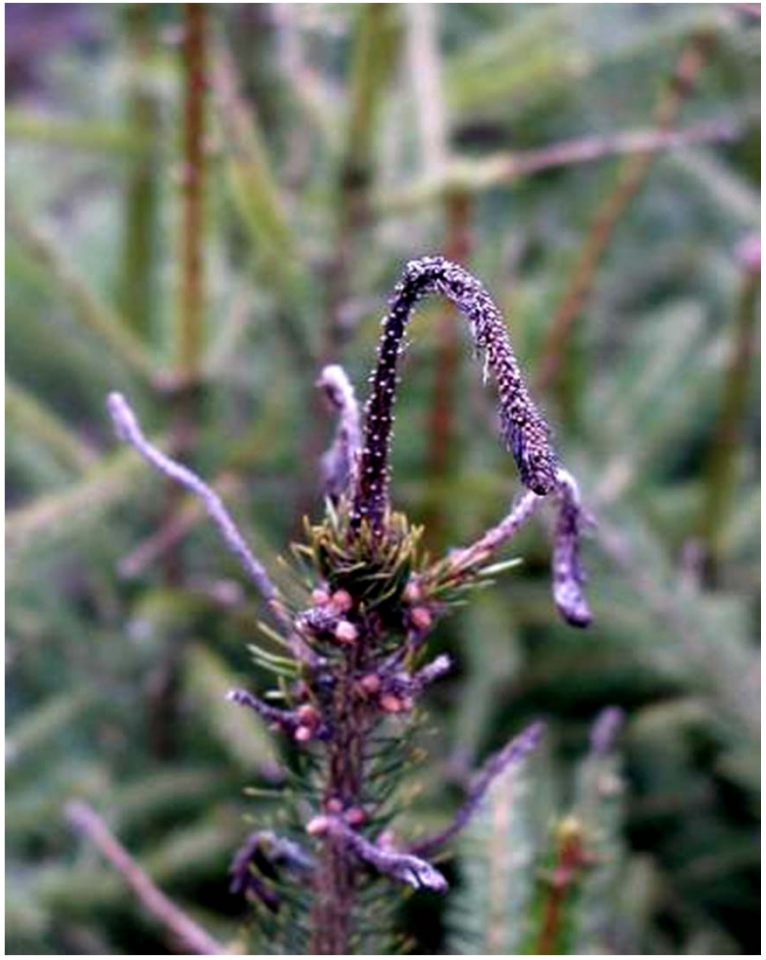
Bud blight fungus *Cucurbitaria piceae*

Bud blight fungus *Gemmamyces piceae*

Ascochyta piniperda

Herpotrichia coulterii

Botritis cinerea



Injury of spruce plants

herbicide + heat

Injury of spruce plants

herbicide + heat

Melampsorella caryophyllacearum

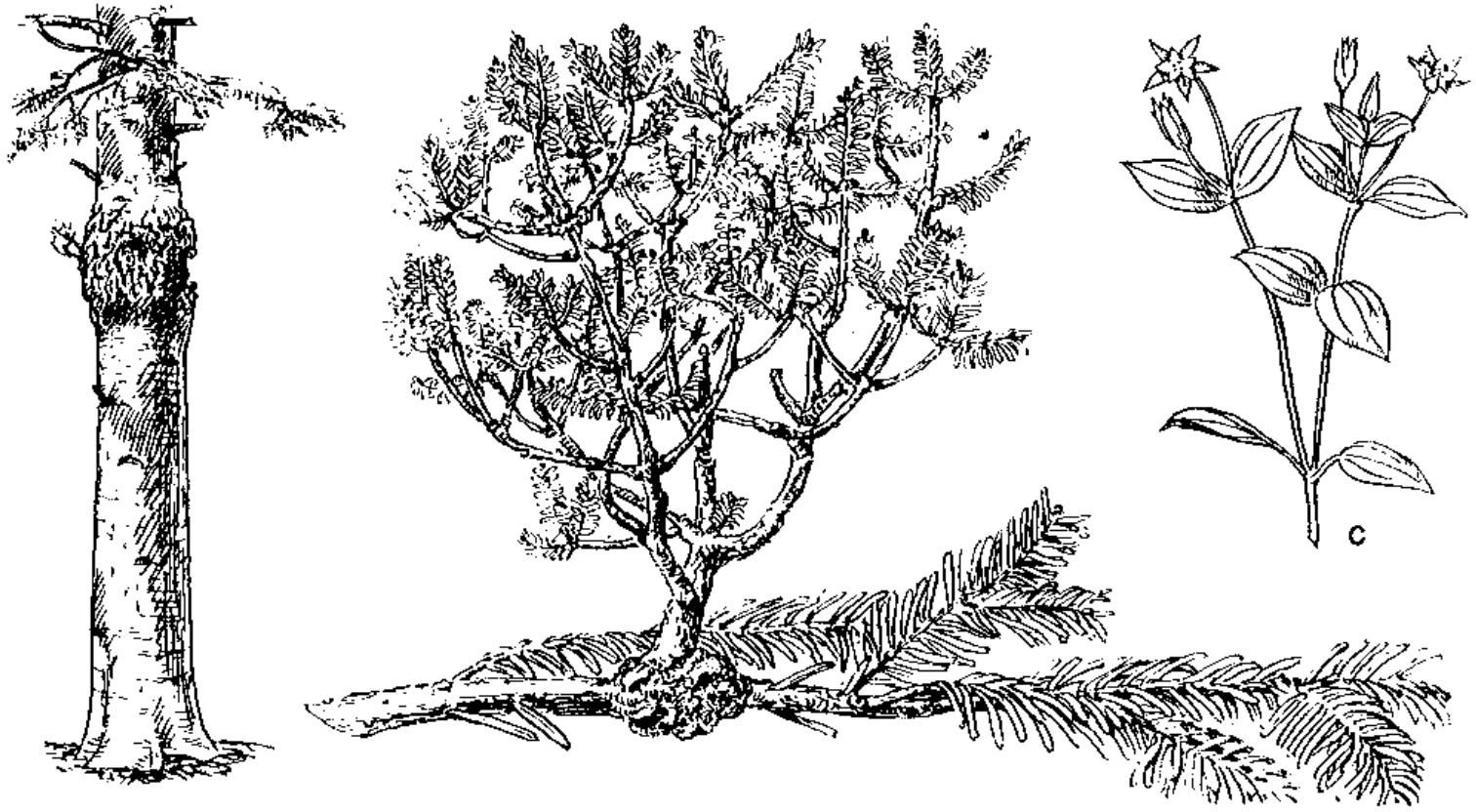


Fig. 118 *Melampsorella caryophyllacearum*. **a** symptoms on the stem of a European Silver fir ('Rädertanne'), **b** Silver fir witch's-broom; **c** *Moehringia trinervia* as a dikaryotic-phase host

Melampsorella caryophyllacearum

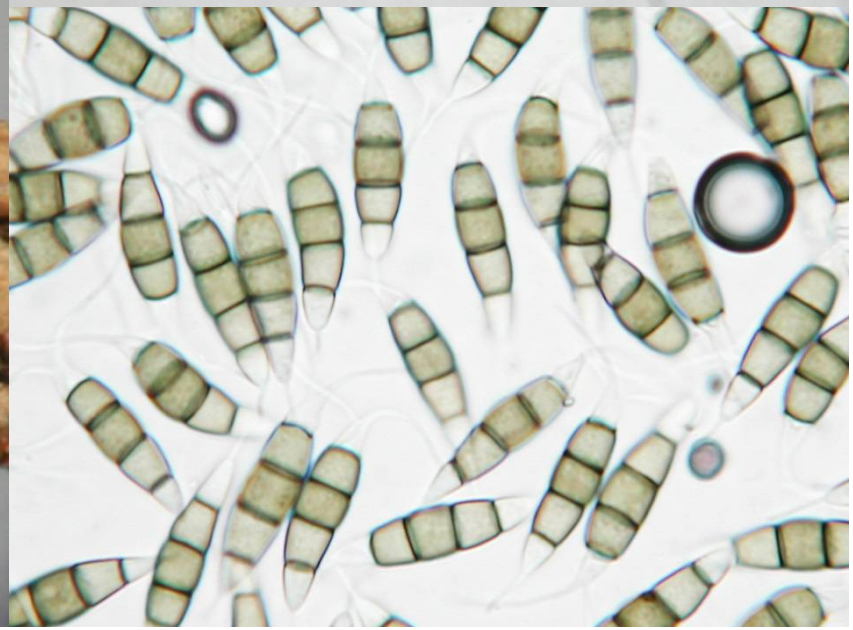
Melampsorella caryophyllacearum

Melampsorella caryophyllacearum

The diseases of fir needles

- *Pestalotia*
- *Valsa*
- *Cytospora*
- *Rhizosphaera*
- *Pucciniastrum*
- *Kabatina abietis*

Pestalotia funerea



Valsa friesii

Valsa friesii

Pucciniastrum epilobii

Phaeocryptopus nudus

Kabatina

The larch diseases

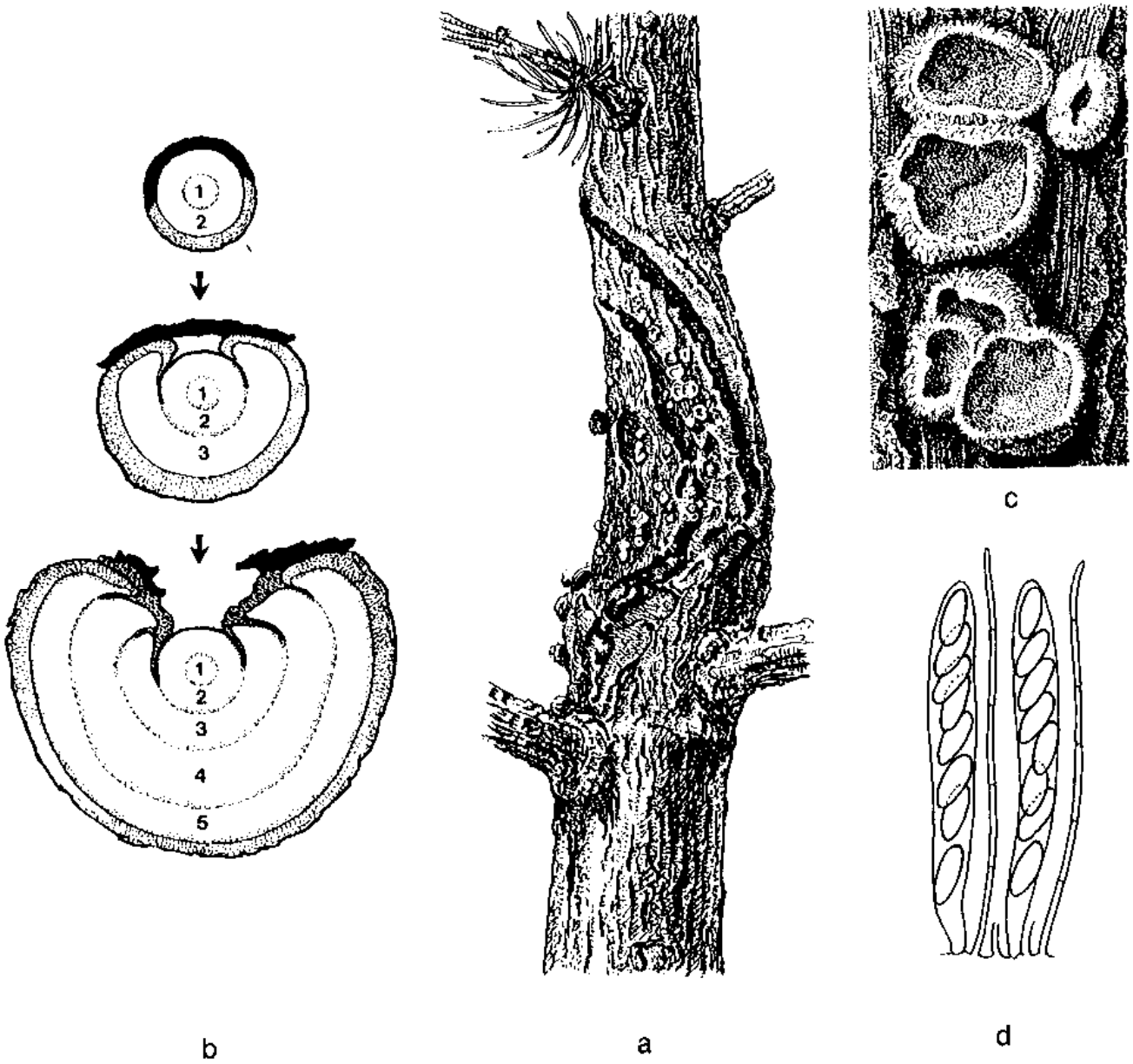


Fig. 70 *Lachnellula willkommii*. **a** canker formation on a small stem of European larch, **b** cross-sections through various stages in the development of larch canker, **c** fruit bodies (apothecia) on dead bark, **d** asci with ascospores and paraphyses

Trichoscyphella willkommii

Melamsora salicina, Melampsora larici-populina

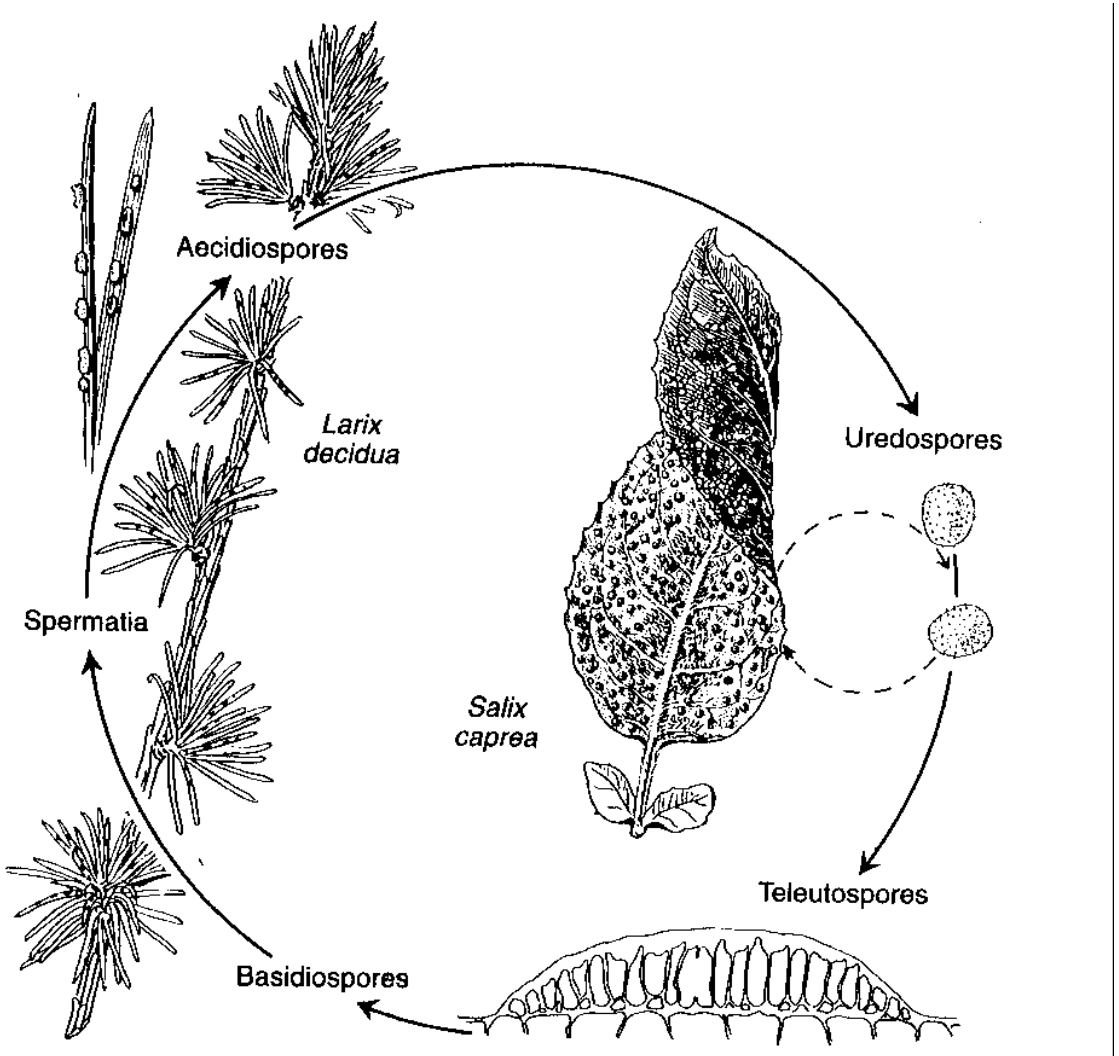


Fig. 50 Willow leaf rust. The 1-year life cycle of *Melampsora salicina* on a leaf of *Salix caprea* and needles of *Larix decidua* (from Butin 1960).

Rhabdocline pseudotsugae

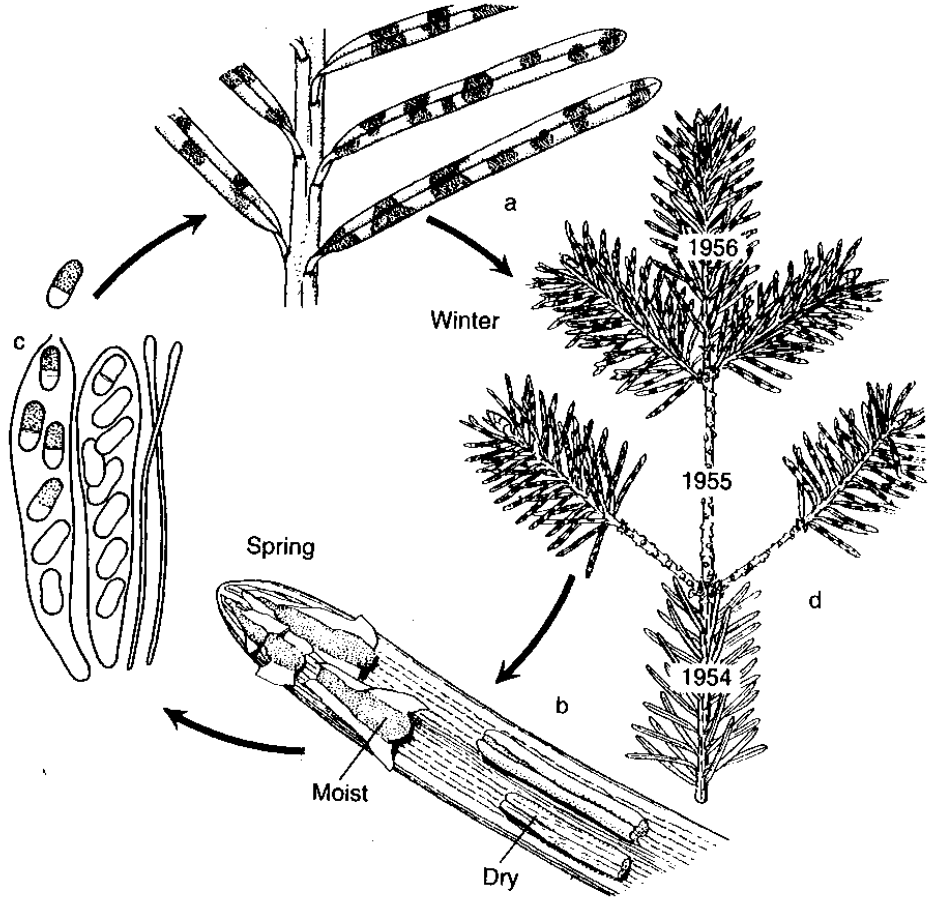


Fig. 17 The 1-year life cycle of *Rhabdocline pseudotsugae* on needles of Douglas fir. **a** development of flecks, **b** formation of fruit bodies, **c** asci and ascospores with paraphyses, **d** symptoms after the loss of a whole year's needles

Rhabdocline pseudotsugae

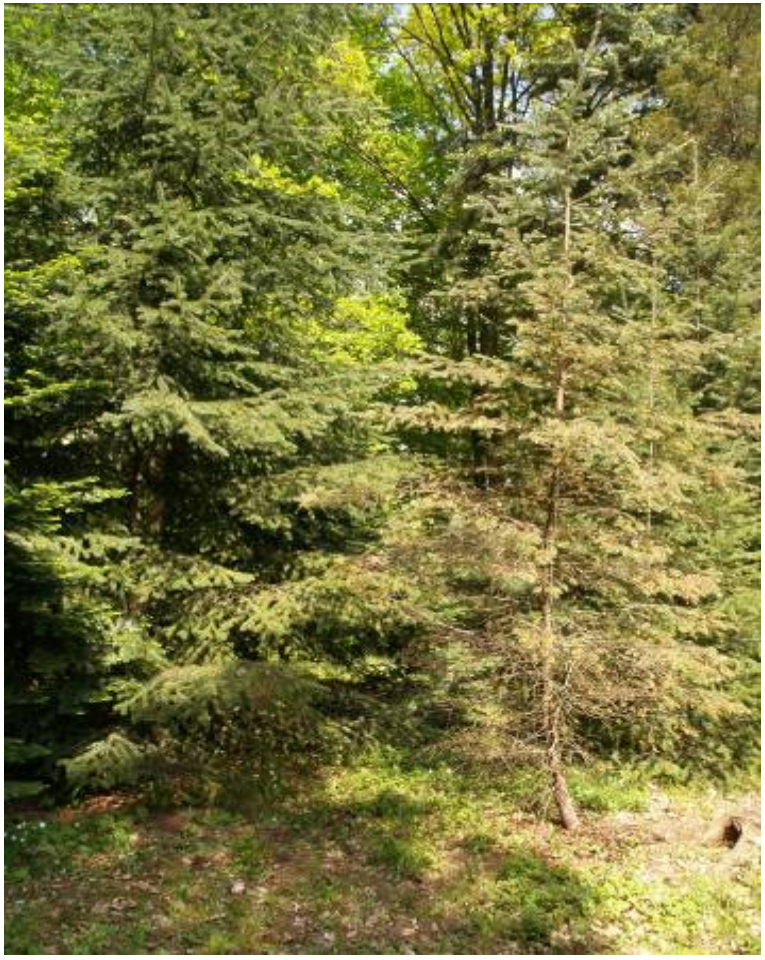
Rhabdocline pseudotsugae

Rhabdocline pseudotsugae

Rhabdocline pseudotsugae

Rhabdocline pseudotsugae

Scots needle cast



Rhabdocline pseudotsugae

Scots needle cast

Phaeocryptopus gaumannii

Swiss needle cast

Phaeocryptopus gaumannii

Swiss needle cast

Desication

Gileetela coolei

The diseases of pine needles

- Rust fungi
- Needle cast
- Sucking insects
- Deficiency diseases

Coleosporium sp. div.


Coleosporium sp. div.

Coleosporium senecionis

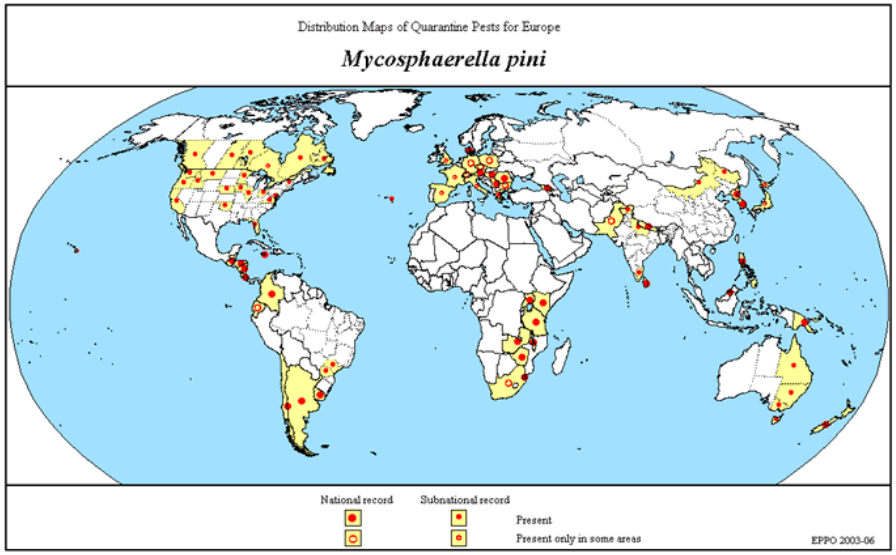
Dothistroma needle blight

Dothistroma septosporum

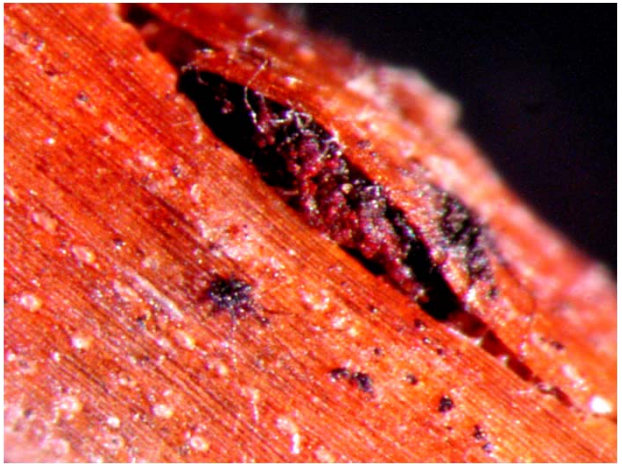
Mycosphaerella pini **E. Rostrup apud Munk,**

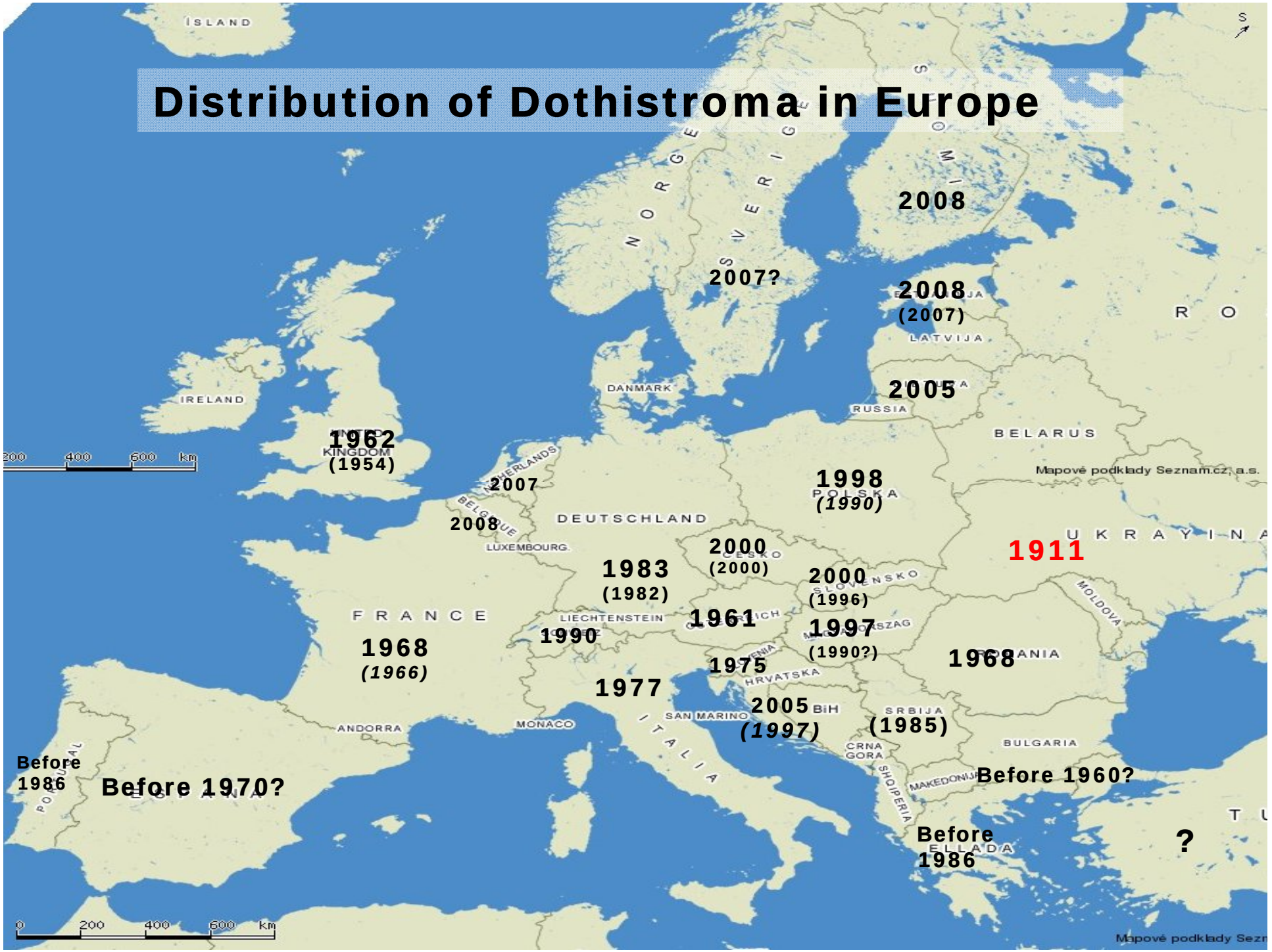
syn. ***Scirrhia pini*** **Funk & Parker,** ***Eruptio pini*** **(Rostr. apud Munk) M. E. Barr,**

anamorph
Dothistroma septospora **(Dorog.) Morelet,**
Dothistroma pini **Hulbary,**
Cytosporina septospora **G. Doroguine,**
Actinothyrium marginatum **Sacc.,**
Septoriella septosporum **(Dorog.) Sacc.**



Dothistroma septosporum




Distribution of Dothistroma in Europe
2008
2007?
2008
(2007)
2005
1962
(1954)
2007
2008
1998
(1990)
1911
2000
(2000)
1983
(1982)
2000
(1996)
1961
1997
(1990?)
1990
1968
(1966)
1975
1968
1977
2005
(1997)
(1985)
Before
1986
Before 1970?
Before 1960?
Before
1986
?
ISLAND
IRELAND
DANMARK
RUSSIA
BELARUS
LATVIJA
POLSKA
DEUTSCHLAND
LUXEMBOURG
FRANCE
LIECHTENSTEIN
HRVATSKA
SRBIJA
BiH
SAN MARINO
MONACO
ANDORRA
ITALIA
BULGARIA
CRNA GORA
SHQIPERIA
MAKEDONIJA
ELLADA
MOLDOVA
Mapové podklady Seznam.cz, a.s.
0 200 400 600 km

- **Noted about 80 hosts generally**
- **In the CR it was identified as hosts of 21 species of pines, 4 species of spruces and Douglas fir**

1. ***Picea abies L. Karst.,***
2. ***Picea pungens Engelm.,***
3. ***Picea omorika (Pančić) Purkyně***
4. ***Picea schrenkiana Fisch. & C. A. Mey***
5. ***Pinus aristata* Engelm.,**
6. ***Pinus attenuata***
7. ***Pinus banksiana* Lamb.,**
8. ***Pinus cembra* L. var. *sibirica* (Du Tour) G. Don,**
9. ***Pinus contorta* Douglas ex Loudon,**
10. **Pinus x digenea Beck (=*P. rotundata x P. sylvestris*)**
11. ***Pinus heldreichii* H. Christ,**
12. ***Pinus heldreichii* H. Christ var. *leucodermis* (Antoine) Markgraf ex Fitschen, syn. *Pinus leucodermis* Ant.,**
13. ***Pinus jeffreyi* Grev. et Balf,**
14. ***Pinus mugo* Turra,**
15. ***Pinus nigra* Arnold,**
16. ***Pinus ponderosa* Douglas ex Lawson,**
17. ***Pinus pungens* Lambert,**
18. ***Pinus rigida* Miller,**
19. ***Pinus rotundata* Link = *Pinus mugo* nothosubsp. *rotundata* (Link) Janchen & Neumayer,**
20. ***Pinus strobus* L. var. *sibirica***
21. ***Pinus sylvestris* L.,**
22. ***Pinus tabuliformis* Hort. ex Carrière,**
23. ***Pinus taeda* L.,**
24. ***Pinus thunbergii* Parlatore, syn. *Pinus thunbergiana* Franco,**
25. ***Pinus wallichiana* A. B. Jackson**
26. ***Pseudotsuga menziesii***

Dothistroma needle blight


Mycosphaerella pini E. Rostrup

Mycosphaerella pini E. Rostrup

Development of symptoms.

July/September

The first symptoms occuring during July, August or September like white spots on needles.

August/September

The killing of needles from the top, present rare black dots in needles.

September/November

In the dead tissue of needles start formation of black dots or thin black strips without formation of konidia of *Dothistroma* stage. The konidial stage of *Asteromella* should be present.

October/November

In dead needles start formation of red strips with acervuli.

October/November

In the point of black dots start formation of red strips with acervuli.

March/April

Within next spring are symptoms clearly visible, red strips with acervuli are abundant.

March/April

The bases of needles are still living, althought the top of needles is dead with numerous red strips.

Symptoms in needles

White spots and dead tips as a first non specific symptoms

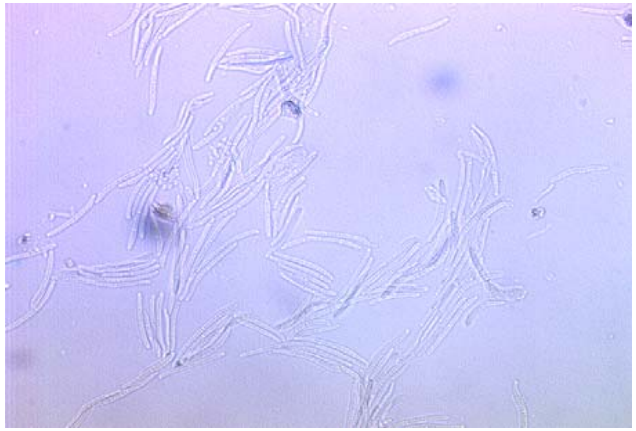
Black spots in needles with iniciation of acervuli formation

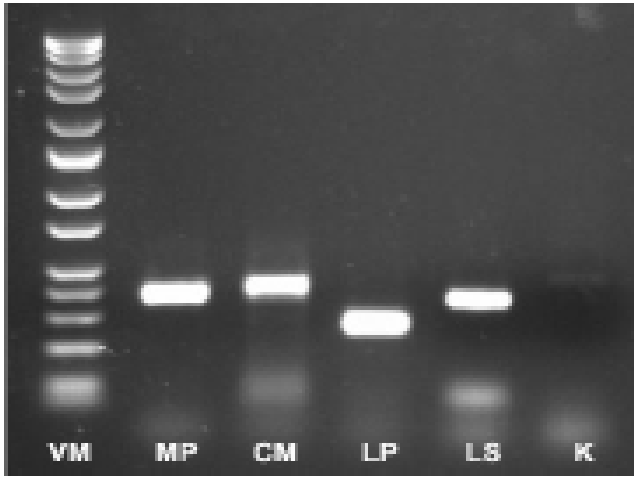
Black spots in needle

Acervuli in needle

- The second half of May until the end of June is the critical period for infection under climatic conditions in the Czech Republic.
- The incubation period lasts about 2-4 months depending on climatic conditions.
- The first symptoms on needles infected in the current year appear in August being clearly expressed from September to November

Mycosphaerella pini E. Rostrup - identification





Elektroforetogram - detekce houbových patogenů pomocí PCR z DNA extrahovaných z jehlic *Pinus nigra*. PCR je jednou z rychlých a především přesných metod detekce patogenů bez nutnosti získání fruktifikačních orgánů. Legenda: VM – velikostní marker; MP – *Mycosphaerella pini*; CM - *Cyclaneusma minus*; LP - *Lophodermium pinastri*; LS -*Lophodermium seditiosum*; K – kontrola. Foto J. Šmerda.

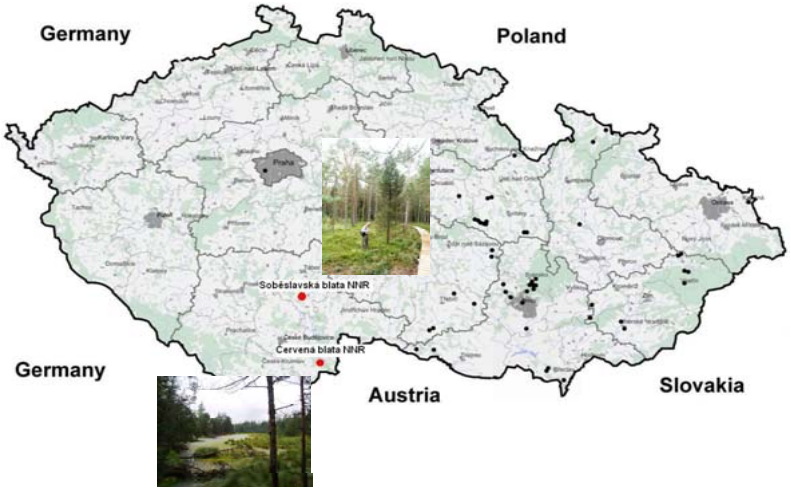
Dothistroma, Pieksamaki July 2008

Dothistroma, Jyvaskyla July 2008

Dothistroma, Jyvaskyla July 2008

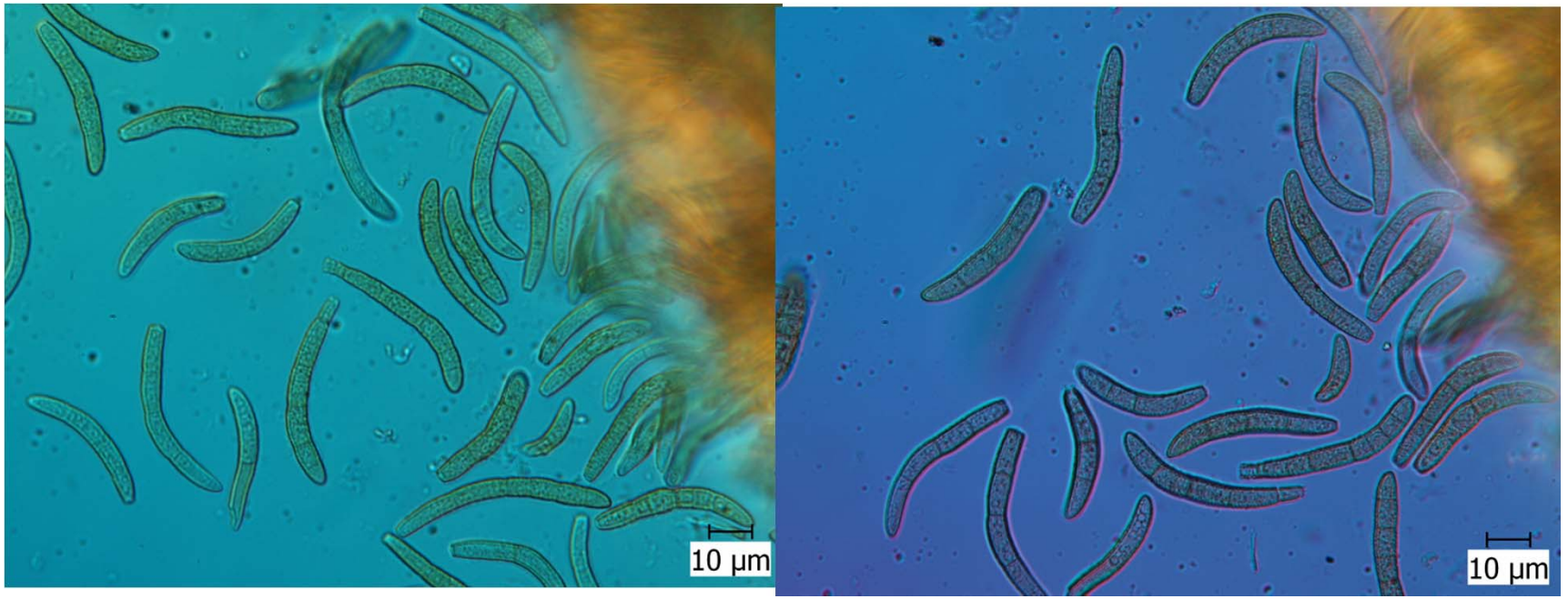
On spruce…..

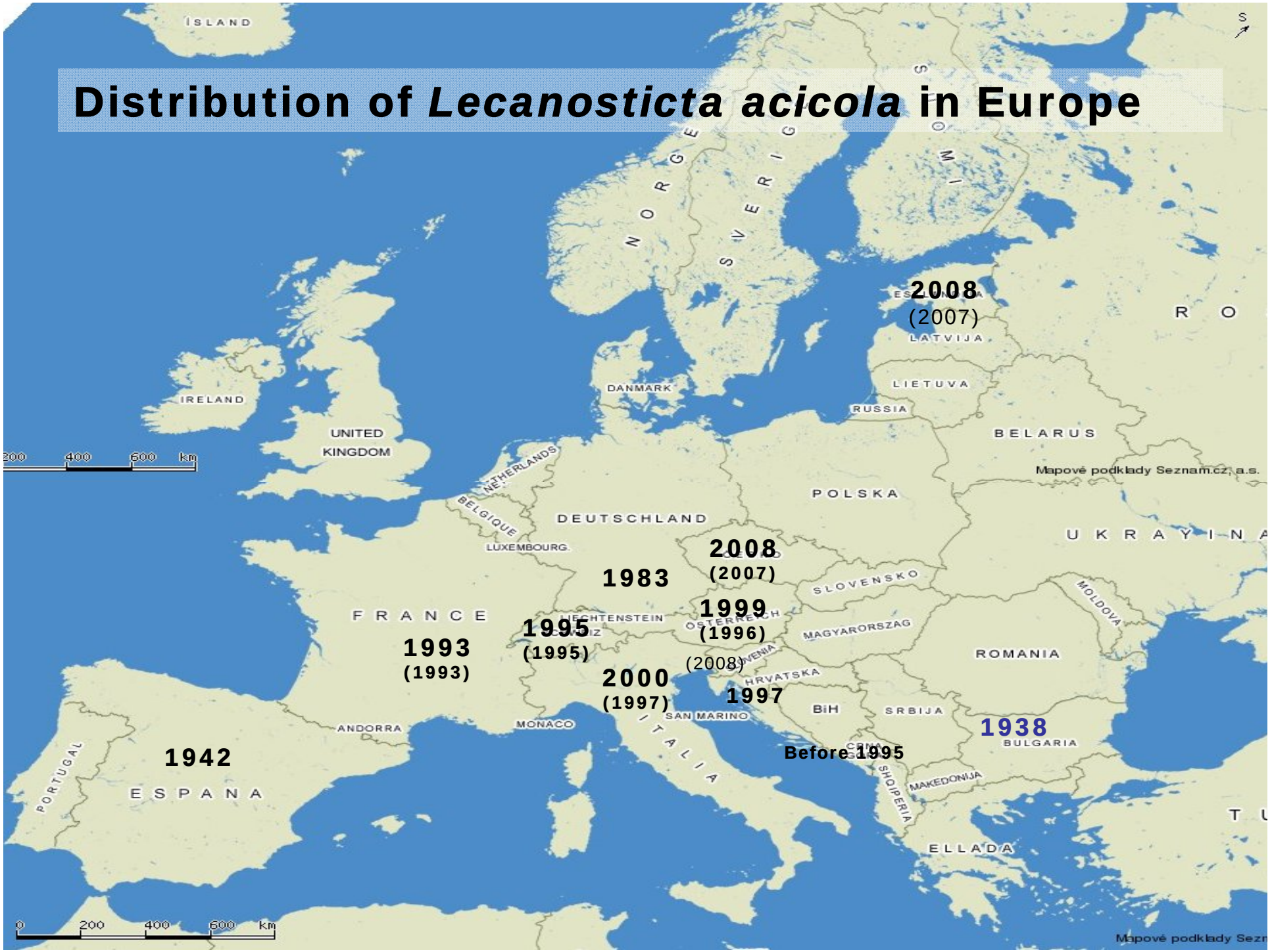
Lecanosticta acicola



Lecanosticta acicola

Lecanosticta acicola




Distribution of *Lecanosticta acicola* in Europe
ISLAND
IRELAND
UNITED KINGDOM
DANMARK
NORGE
SVERIGE
SUOMI
LATVIJA
LIETUVA
RUSSIA
BELARUS
POLSKA
NETHERLANDS
BELGIQUE
LUXEMBOURG
DEUTSCHLAND
UKRAYINA
SLOVENSKO
MOLDOVA
FRANCE
LIECHTENSTEIN
OSTERREICH
MAGYARORSZAG
ROMANIA
SLOVENIA
HRVATSKA
BiH
SRBIJA
SAN MARINO
MONACO
ANDORRA
ITALIA
PORTUGAL
ESPANA
BULGARIA
MAKEDONIJA
SHQIPERIA
ELLADA
2008
(2007)
1983
2008
(2007)
1999
(1996)
1995
(1995)
1993
(1993)
(2008)
2000
(1997)
1997
1938
1942
Before 1995
0 200 400 600 km
Mapové podklady Seznam.cz, a.s.

Phacidium infestans

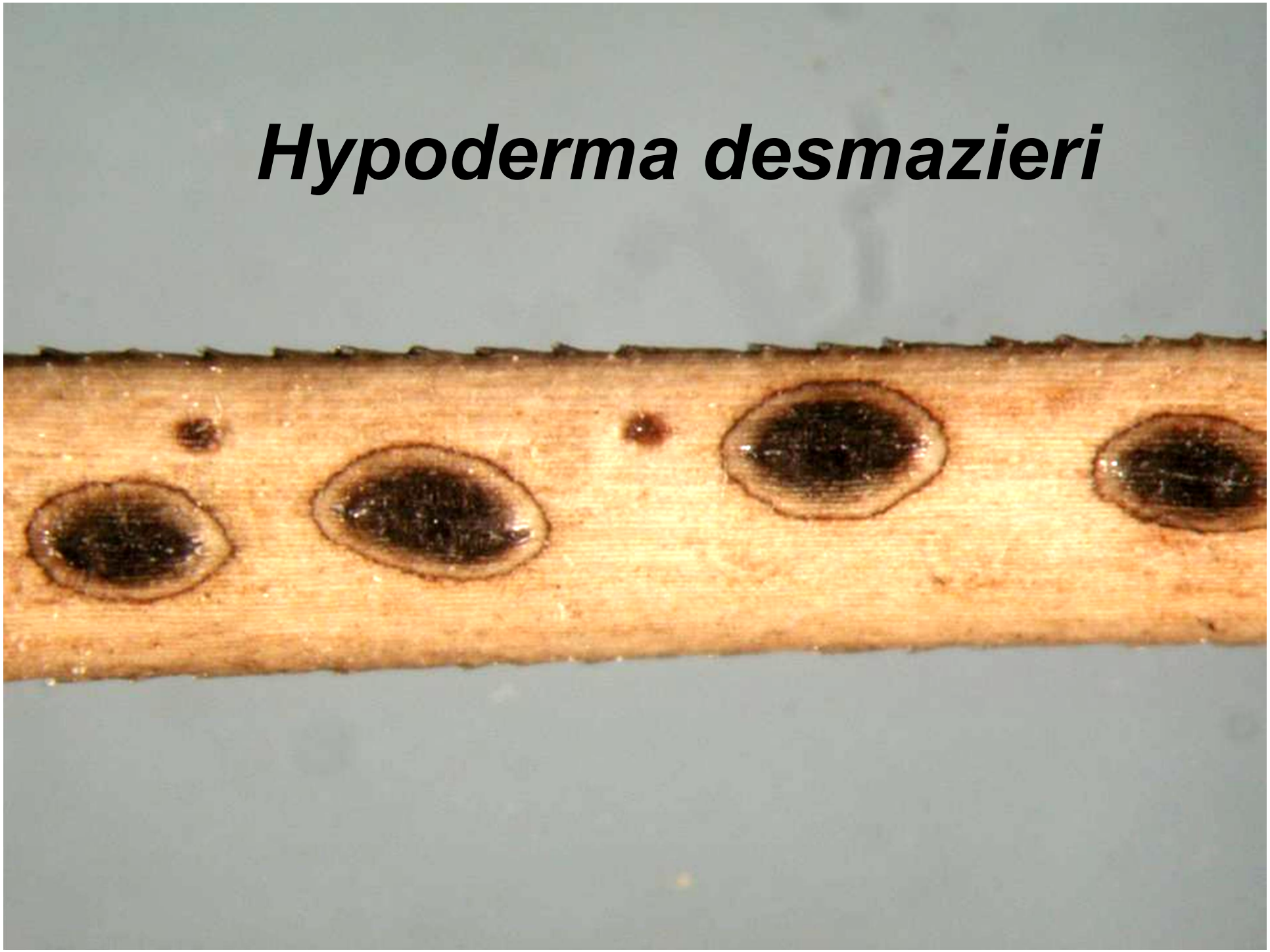
Phacidium infestans

Phacidium infestans

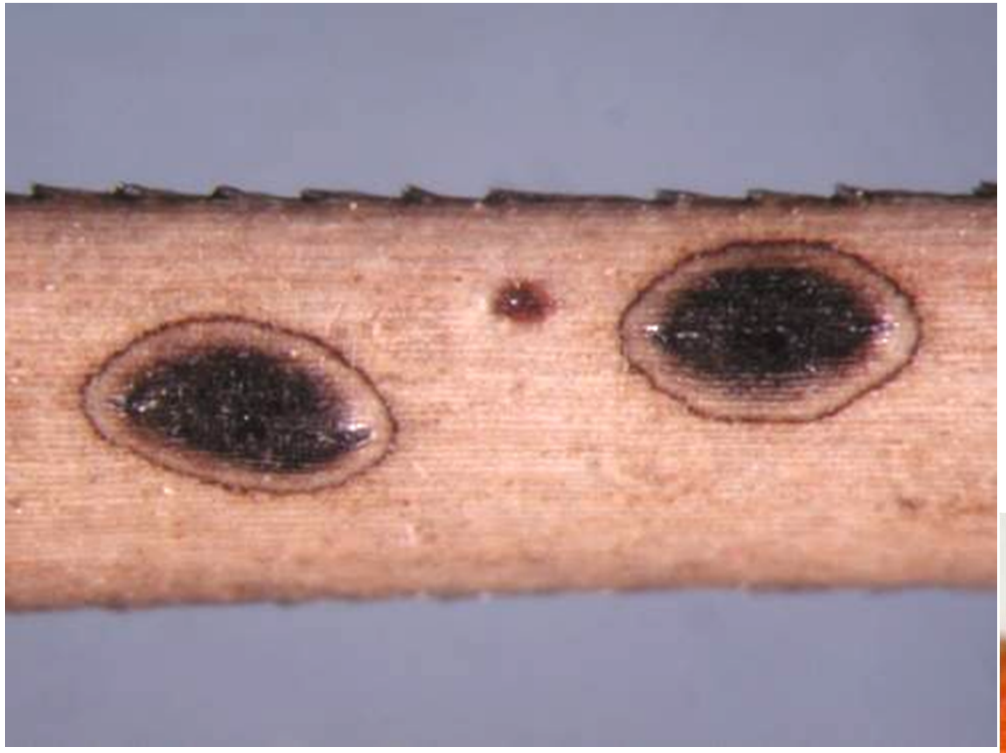
On mountain swiss stone pine

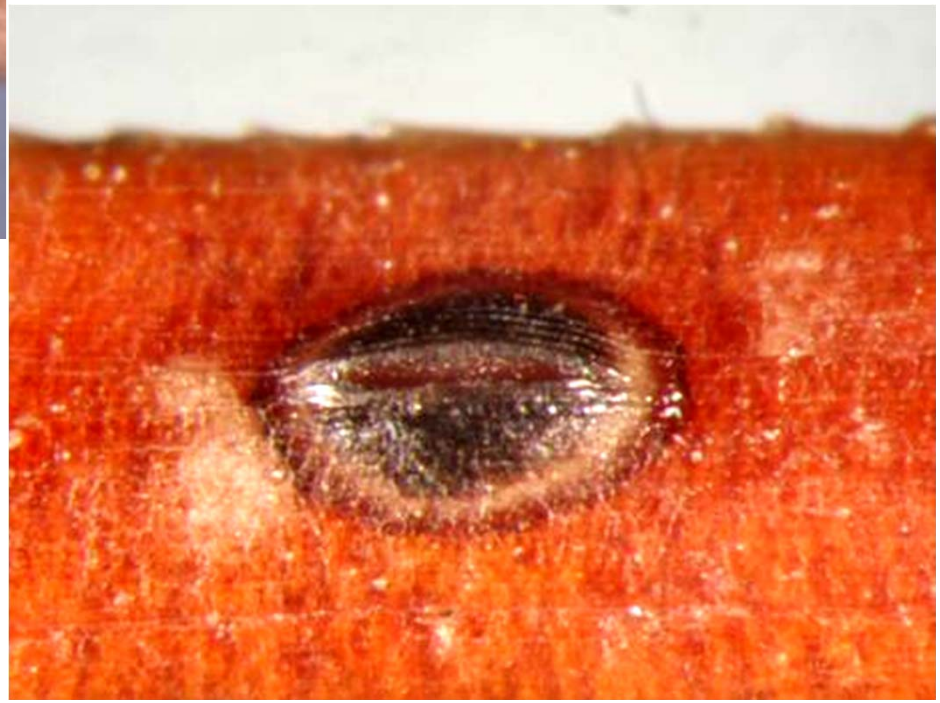
Lophodermella sulcigena
Harmaakariste

Hypoderma desmazieri


Hypoderma desmazieri

Hypoderma desmazieri






Senescency

Diseases of leafs

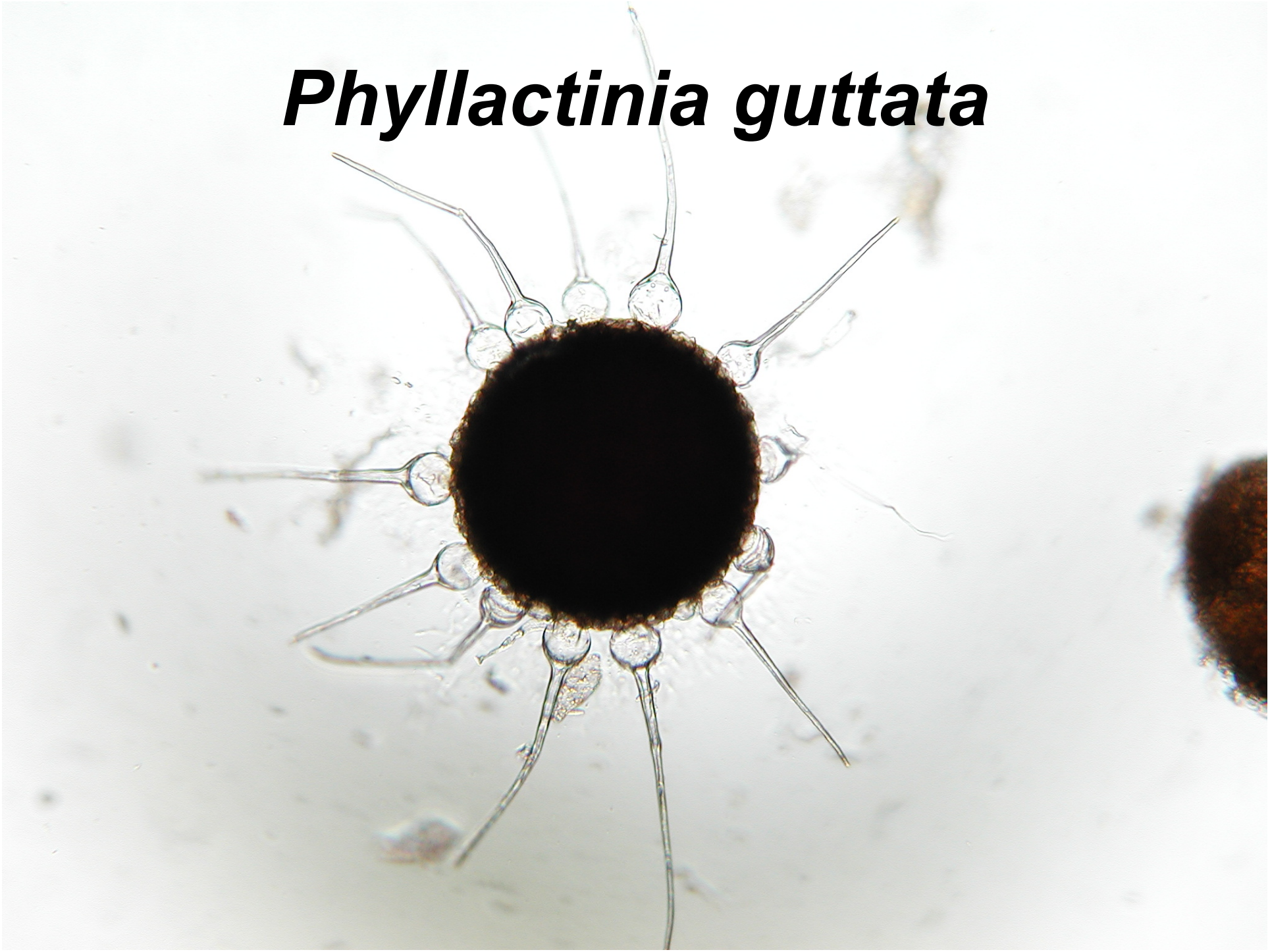
- mildew
- leafspots
- anthracnosis

Microsphaera alphitoides


Microsphaera alphitoides


Phyllactinia guttata

Phyllactinia guttata



Powdery mildews

- Native species
  - ????
- Naturalized species
  - *Microsphaera alphitoides*
  - And others….
- Alien species
  - *Erysiphe elevata*
- (Unknown origin)
  - ……
- Threats
  - …..

Economical impact

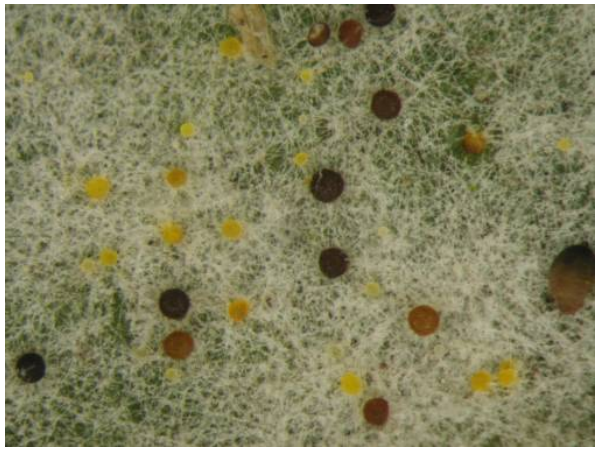
- ***High economical value***
  - ***Podosphaera mors-uvae* (Schwein.) U. Braun & S. Takamatsu**
- ***Economical important***
  - **Erysiphe azaleae (U. Braun) U.Braun & S. Takamatsu**
  - **……**
- ***Environmental impact***
  - **Microsphaera alphitoides Griff.**
  - **…..**
- ***Low impact or not impact***
  - **…….**

Except *Microsphaera alphitoides* powdery mildew they have not serious impact on forestry; important for amenity trees, including shrubs. Should be problem for nurseries.

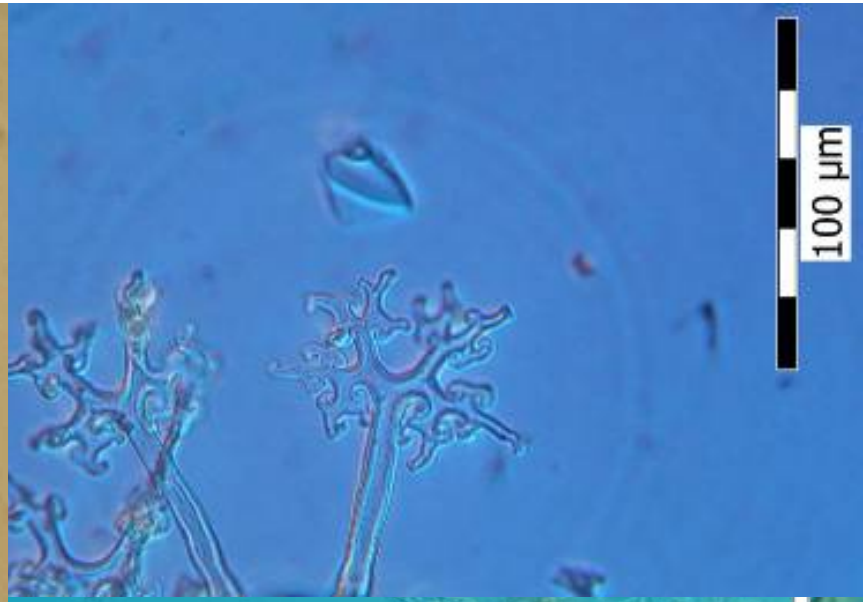
Microsphaera alphitoides var. *alphitoides*

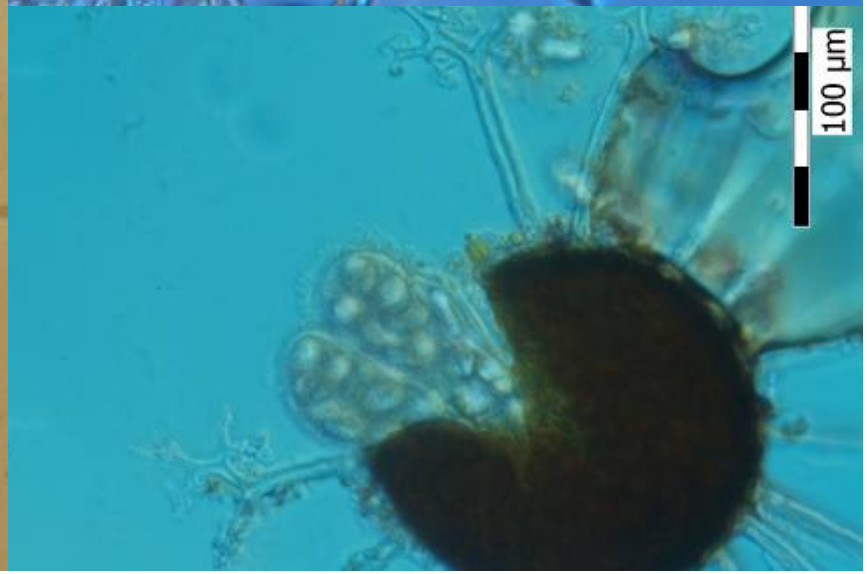
oak powdery mildew

- Asia, N. America, S. America, Africa, Australia, N. Zealand, Europe (all vareties)
- domesticated species in Europe
- reported from Portugal 1876/1877
- Very quick spreading within 1906/1907
- Origin: probably Asia – Limkaisang et al. 2006 confirm genetic similarities with mildews on mango
- High risk of introduction *M.alphiitoides* var. chenyi from China/Asia



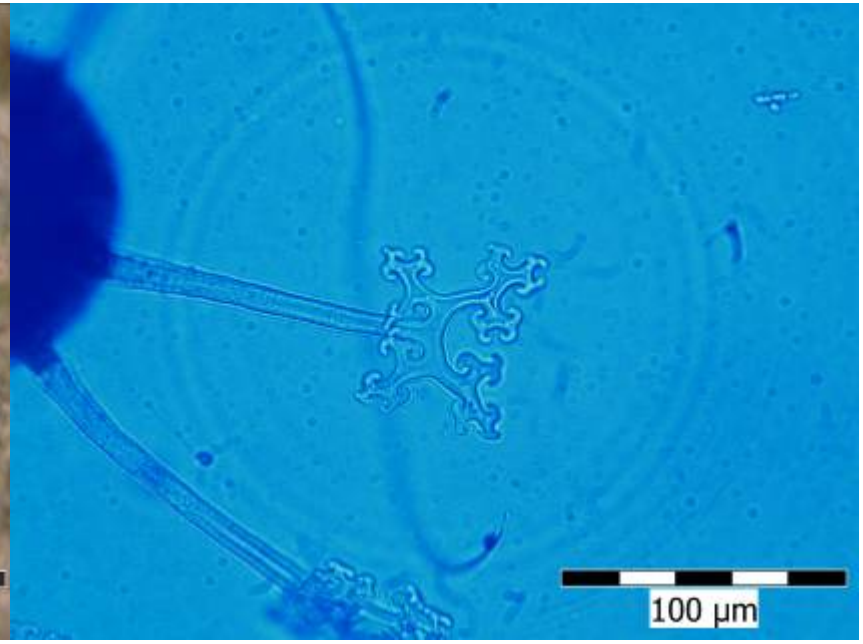
Microsphaera alphitoides var. *alphitoides*





Microsphaera ornata var. europaea

Betula, Alnus, Crataegus



Europe (var. europaea), N. America, Asia, E. Europe (var. ornata)

Microsphaera syringae

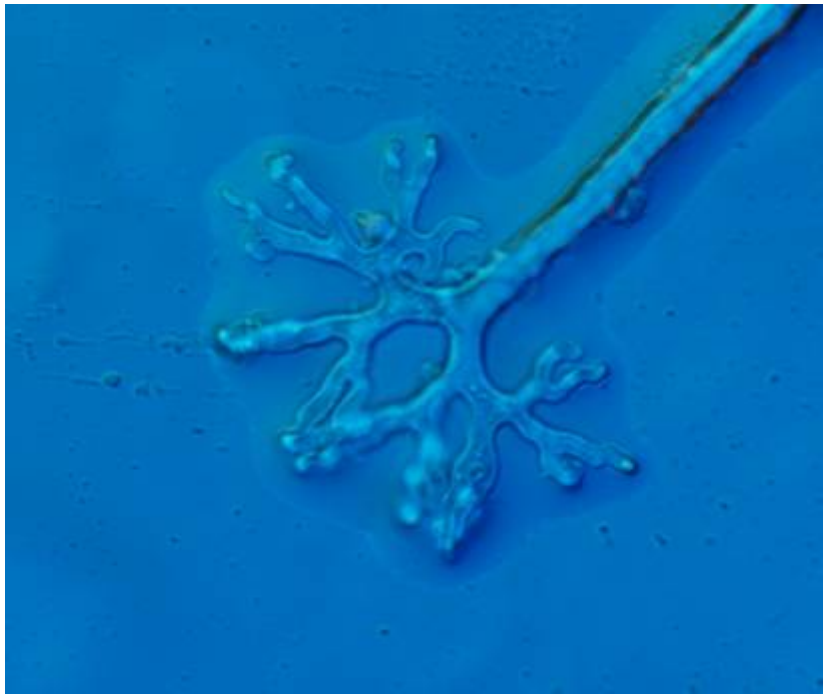
Syringa vulgaris, S. chinensis, Viburnum opulus

- Native probably in North America
- Europe (Central, South, UK), Australia


Microsphaera berberidis

Microsphaera berberidis

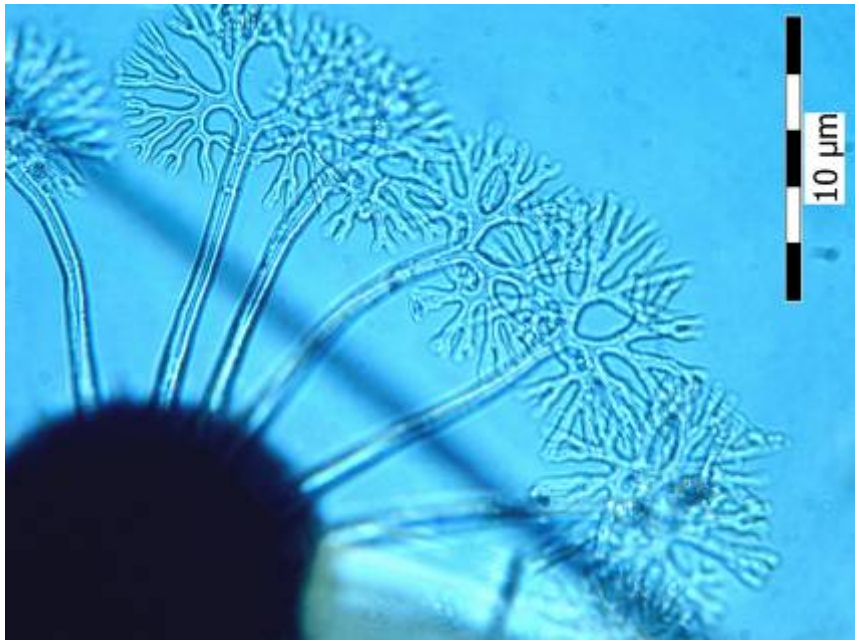
Mahonia aquifolium, Berberis vulgaris, B. thunbergii

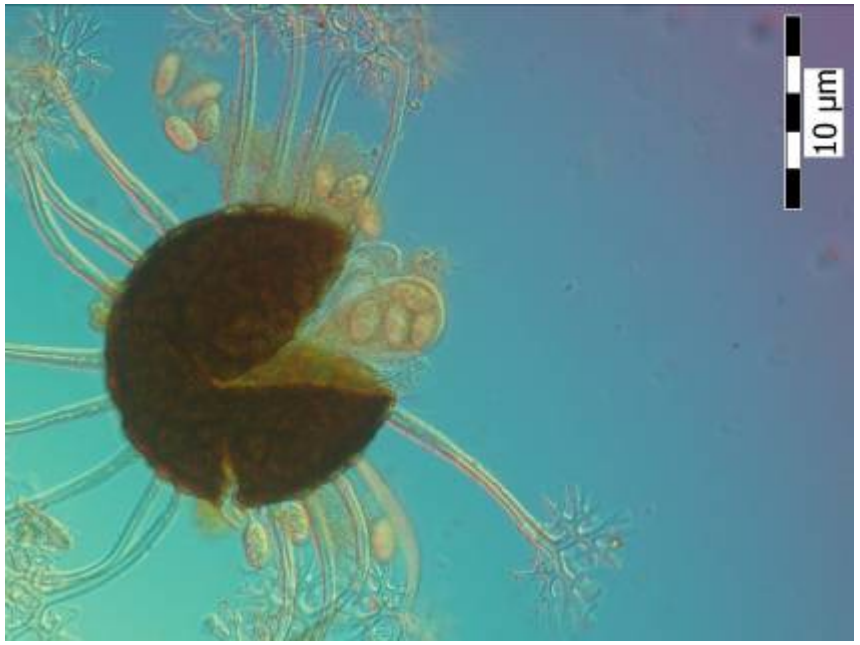


•Europe, Central Asia, Turkey, Iran

Microsphaera vanbruntiana var. sambuci-racemosae

Sambucus racemosa

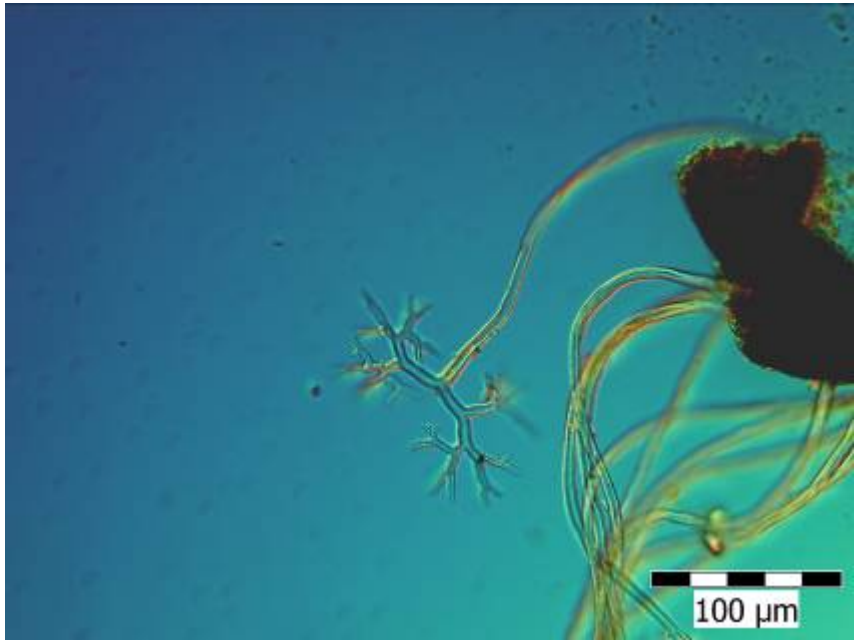




•Europe, Far East, N. America

Microsphaera euonymi

Euonymus europaeus



•Europe, central Asia, Turkey

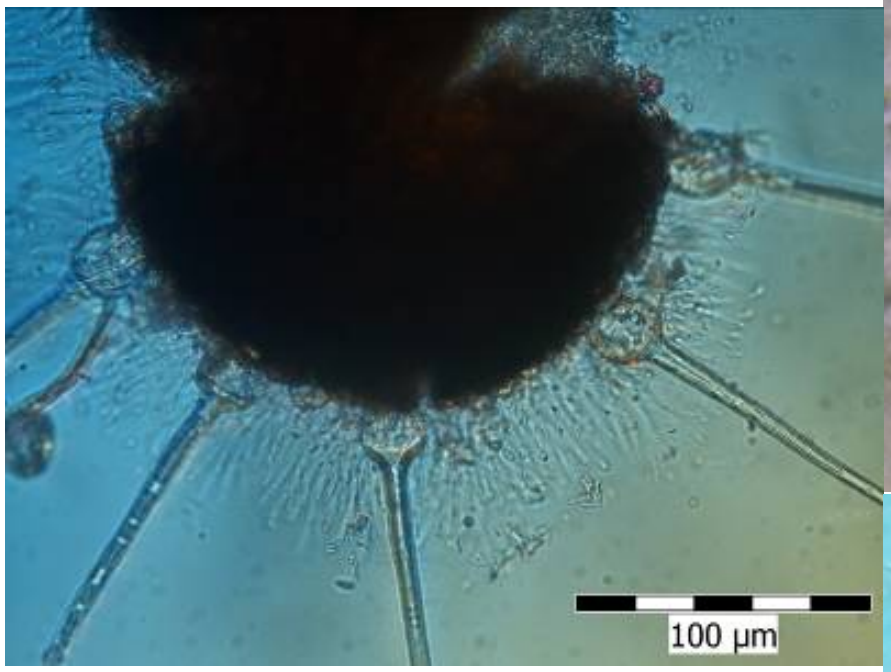
Microsphaera tortilis

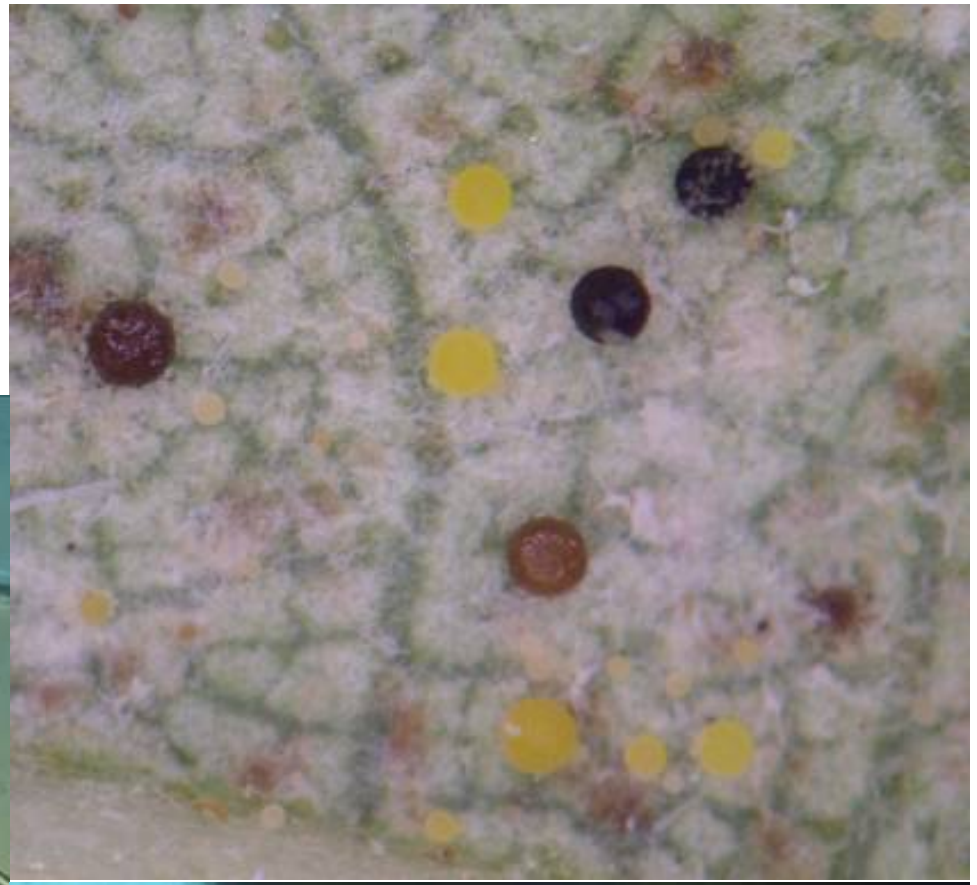
Cornus sa

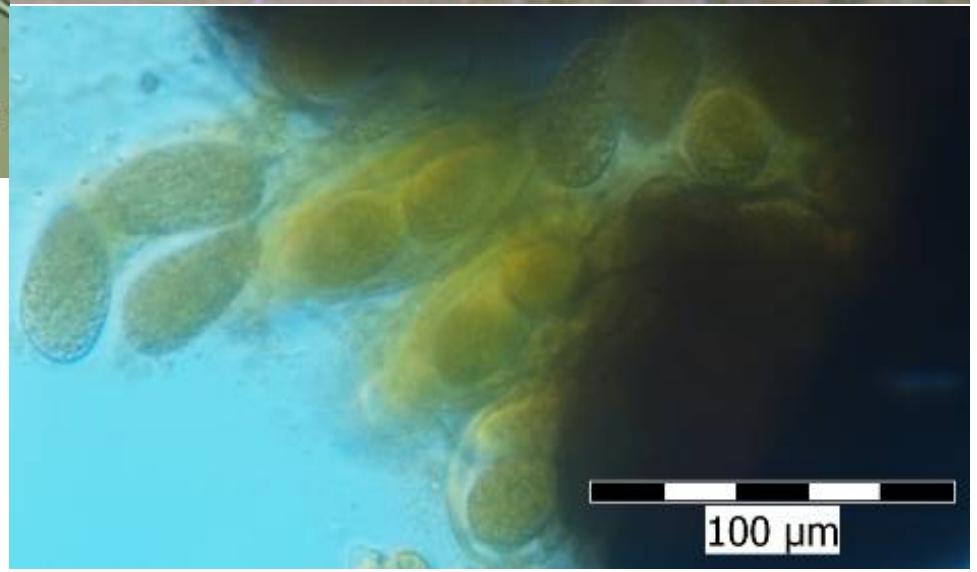
•Europe, Armenia, Iran, Greece

guttata

Fagus,Corylus,Betula,
Fraxinus, Alnus, Carpinus
…







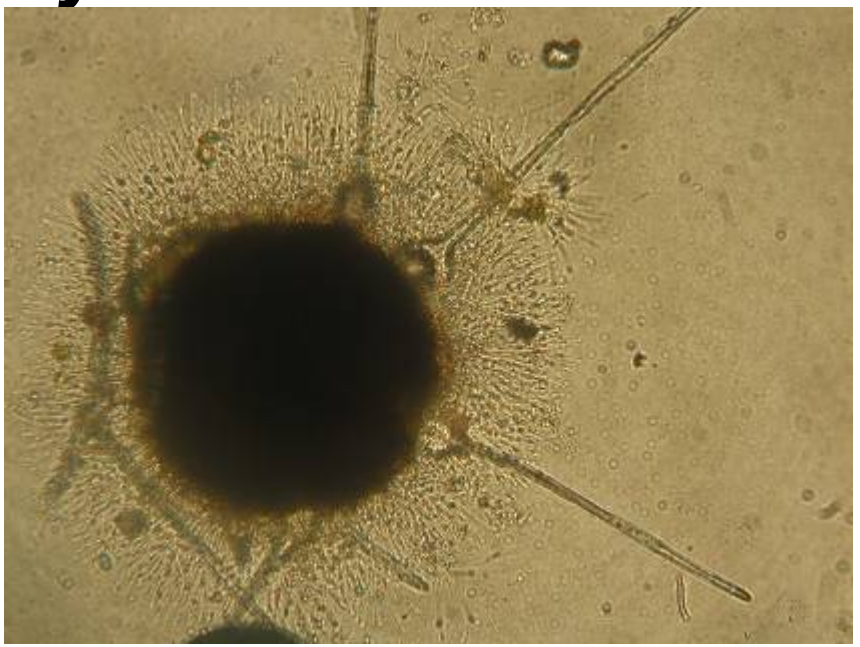
- Worldwide distribution

Phyllactinia fraxini (DC.) Fuss

- **Europe, Asia, N. America, N. Africa**

Phyllactinia fraxini

Fraxinus excelsior, F. angustifolia, Oleaceae family



- **Europe, Asia, N. America, N. Africa**

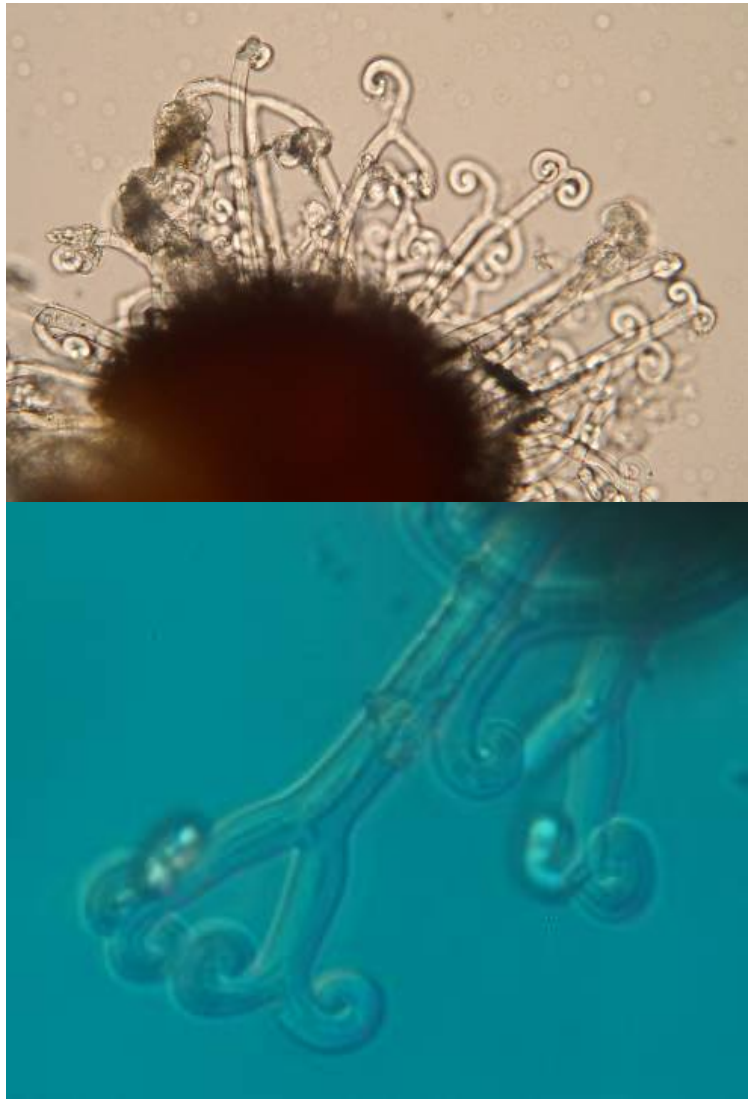
Podosphaera tridactyla

Padus avium, Rosaceae,

•Europe, Asia, N. America, S. America, Australia

Sawadaea bicornis

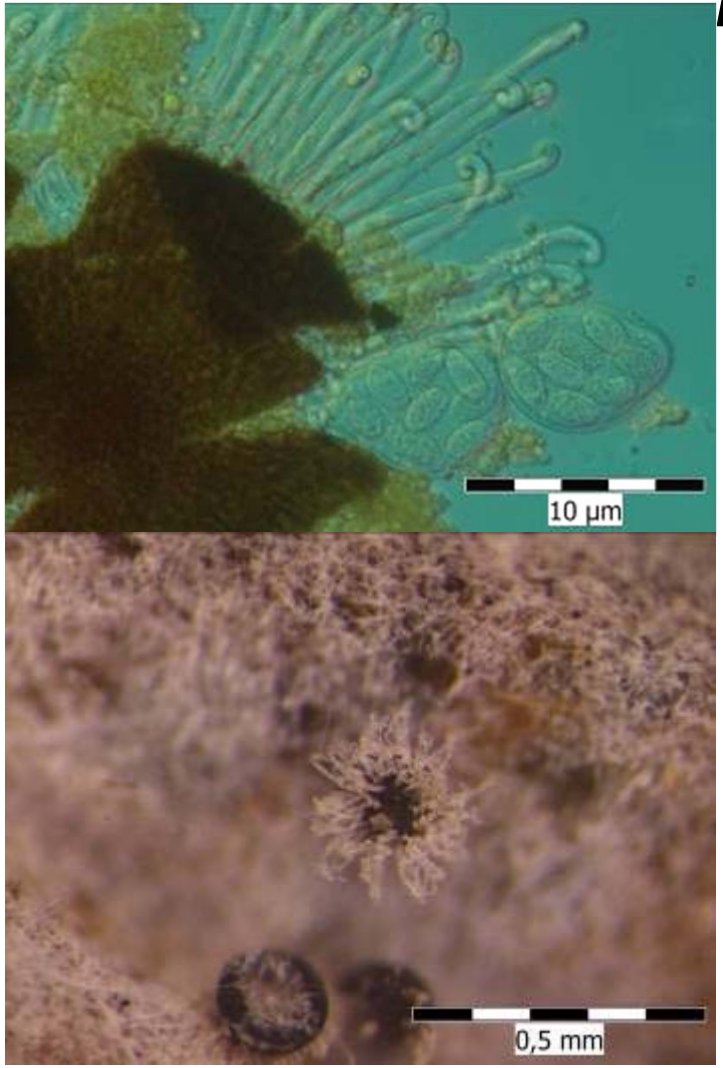
Acer platanoides, A.. pseudoplatanus, A. campestre



•Europe and Asia only

Sawadaea tulasnei

Acer ginnala, A. palmatum 'Disectum', A. platanoides



- **Europe, Asia**

Alien species of Powdery Mildews

- New records within past 10-15 yers
- Many local records published in NDR from Europe actually
- Spreading - results of trade with plant material? Climatic changes?

List of Alien species of powdery mildews reported from the CR

Erysiphe azaleae (U. Braun) U.Braun & S. Takamatsu ***Microsphaera azaleae*** U. Braun	Asia (?)	2003
Erysiphe carpinicola (Hara) U. Braun & S. Takam., *E. arguata*?	East Asia, Japan,China	2006
Erysiphe elevata (Burrill) U. Braun & S. Takam.	North America	2003
Erysiphe euonymi-japonici (Vienn.-Bourg.) U. Braun & S. Takamatsu	Asia	1931 Piskoř, Herbarium specimen at Munchen, recently not confirmed
Erysiphe flexuosa (Peck) U. Braun et S. Takamatsu syn. *Uncinula flexuosa*	North America	2003
Erysiphe palczewskii Braun & Takamatsu Syn. *Microsphaera palczewskii*	Asia	2006
Erysiphe syringae Schwein. ***Syn. Microsphaera syringae*** (Schwein) H. M	Asia ?	2005
***Microsphaera alphitoides* var. *alphitoides* Griffon & Maubl.**	Asia ?	1907 ?
Erysiphe vanbruntiana var. ***sambuci-racemosae*** (U.	Asia ?	2005

Erysiphe flexuosa (syn.Uncinuliella flexuosa)

Aesculus pavia, A.hippocastanum, A x carnea

Origin

• N. America have believed… (Braun 1987, Farr et al. 1989), Balcan has also been suggested (Ing & Spooner 2002)

•Distribution in Europe

Germany (Ale-Agha *et al.* 2000), Switzerland (Bolay 2000), England (Ing & Spooner 2002), Slovakia (Zimmermannova-Pastircakova *et al.* 2002), Hungary (Kiss, Vajina, Fischl, 2004), Slovenia (Milevoj 2004) Italy (Nali 2006),


Erysiphe elevata
(syn. *Microsphaera elevata*)

Erysiphe elevata
(syn. *Microsphaera elevata*)

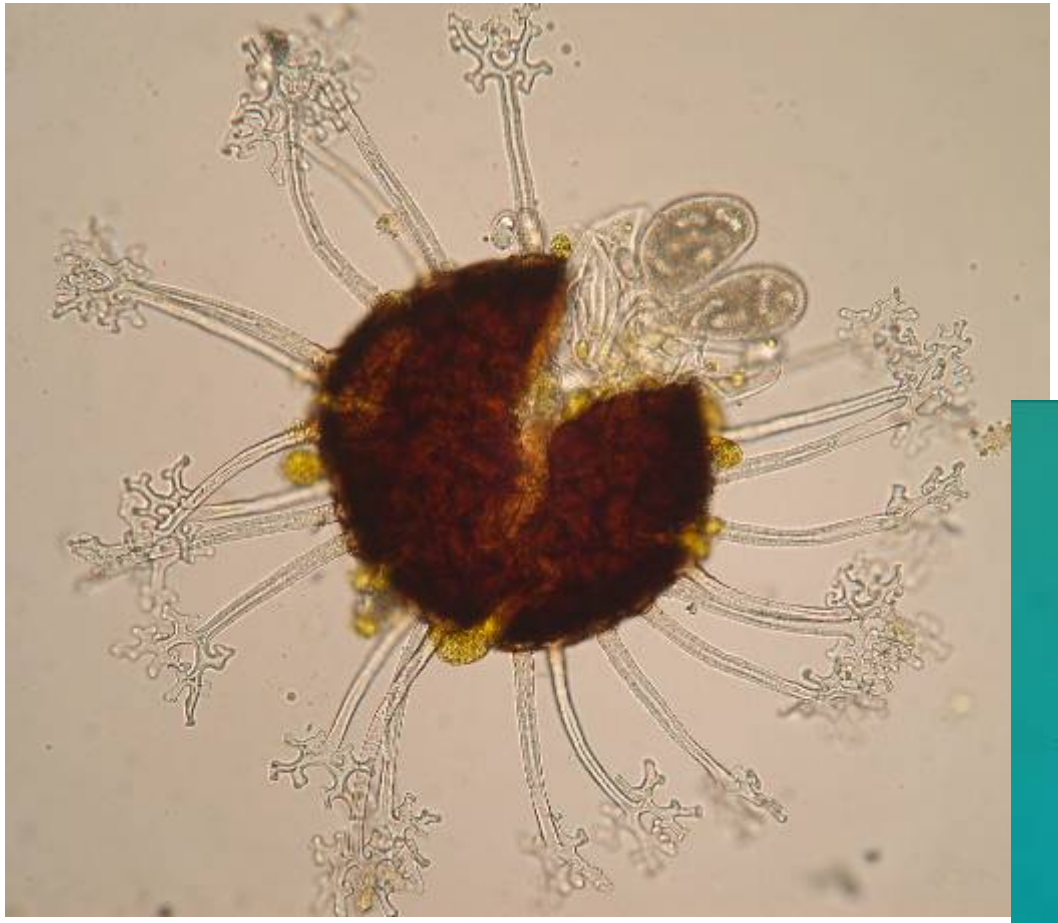
Catalpa bignoides

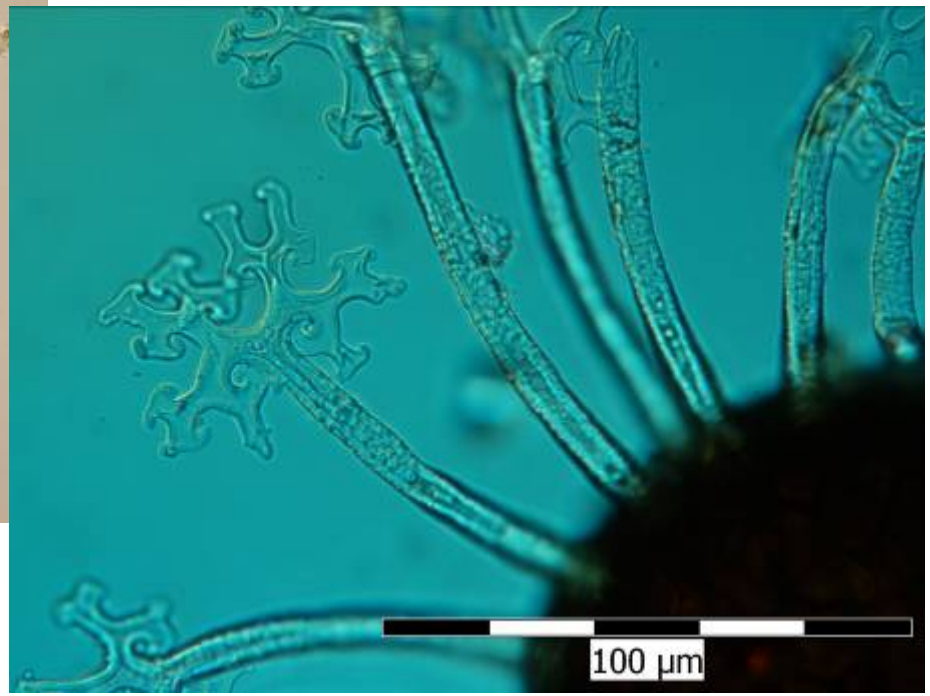
Erysiphe elevata
(syn*. Microsphaera elevata*)
Catalpa bignoides

- Native in the North America on Bignoidaceae, eg. C. speciosa in Canada
- Europe: Germany, Slovakia, Switzerland, Hungary, Poland, Italy, Romania, UK…
- Confused in many countries with E. catalpae (confirmed from Armenia, Germany, Poland, records but not confirmation from Asia (Iraq,Far East of Russia), Caucasus (Georgia), Europe, (Estonia, France, Germany, Italy, Lithuania, the Netherlands, Poland, Romania, UK, the Ukraine, former Yugoslavia) and South America (Argentina))


Erysiphe azaleae
(syn. *Microsphaera azaleae)*

Erysiphe azaleae
(syn. *Microsphaera azaleae*)
Rhododendron spp.





Erysiphe ar

Carpinus betu

Distribution:

Asia (Japan, Transcaucasia), Europe (Germany, Hungary, Ukraine, Poland)

Some findings reported from Europe as *E.carpinicola* was ranked to *E. arcuata* following studies done by Brown et al. (2006)


Guignardia aesculii

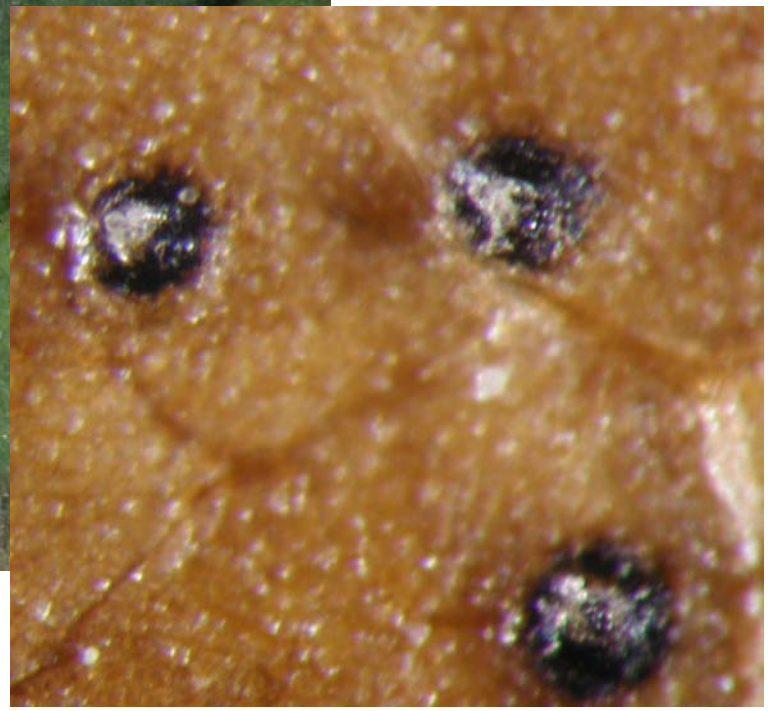
Guignardia aesculii

Guignardia aesculii

Guignardia aesculii

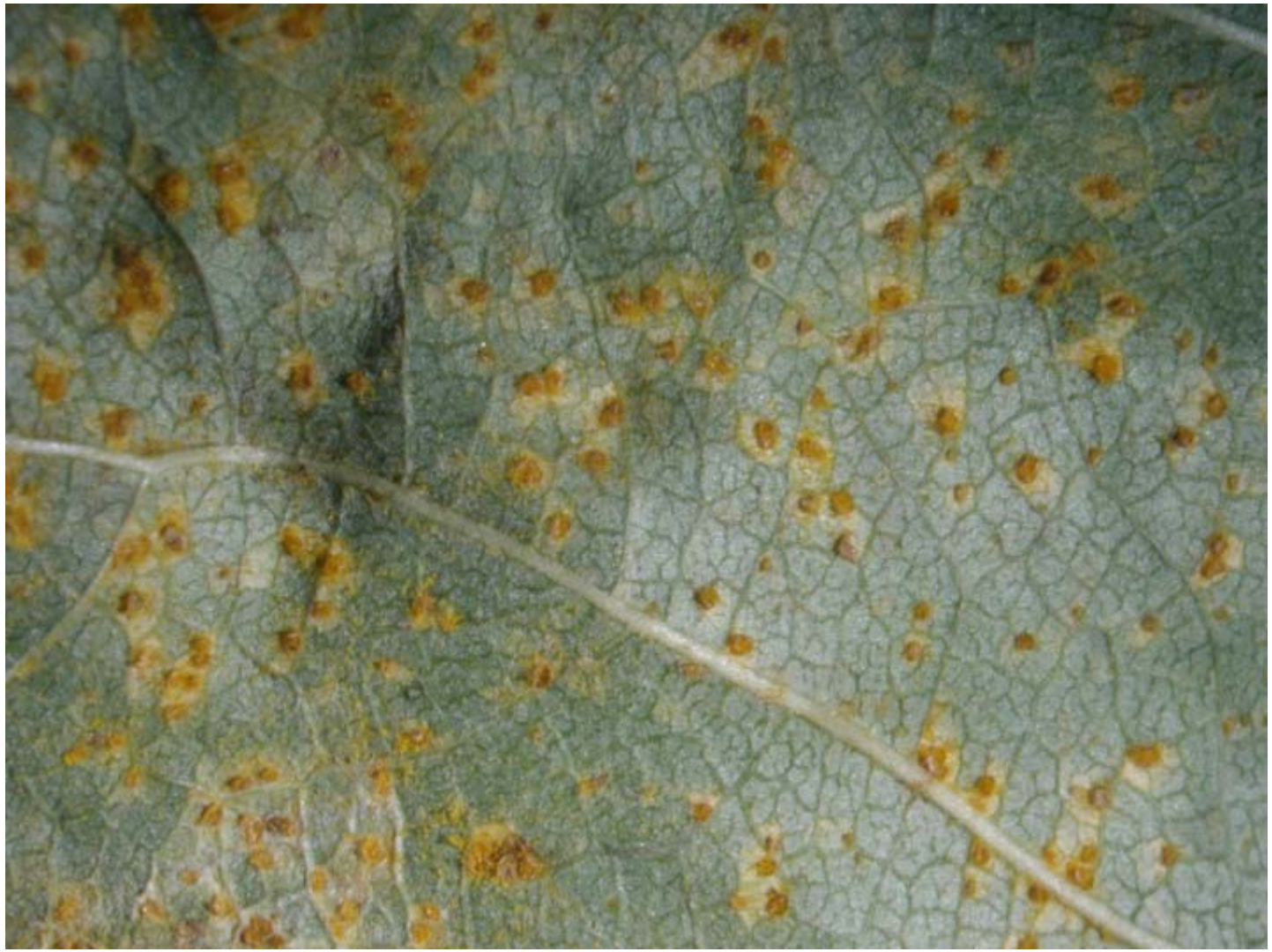
Guignardia aesculii

Guignardia aesculii



Melampsoridium betulinum rust

Melampsora larici-populina



Melampsora larici-populina

Alien species and invasive species on woody plants

Reasons of spreading of alien species

- Introduction of pathogen to new areas and adaptation into new indigene host(s) (Dutch elm disease)
- Introduction of new pest with new host (Douglas firs – Swiss and Scotch needle cast, plane – *Apiognomonia veneta*
- Adaptation of indigene plant pathogen on introduced host (White pine blister rust)
- Changed climatic conditions as a factor shifted climatic barriers (Dothistroma needle blight?)
- Trade with plant material (Powdery mildew, Dothistroma)
- Tourism, incl. scientific meetings (??????)

	hosts	Asie	Europe	North America
Cronartium ribicola **White pine blister rust**	*Pinus (5 jehl.)/ Ribes*		1854 *(P. strobus)* →	→ 1898/1910 (1909)
Ophiostoma ulmi **Dutch disease**	*Ulmus sp. div.*	→	→ 1916 (1958) 1960-1963 ← *(Ophiostoma novo - ulmi)*	→ 1930/1944 ←
Cryphonectria parasitica **Chrstnut blight**	*Castanea sp. div. (Quercus sp. div.)*	→	→ 1938 ←	→ 1900 (?) 1934 (Oregon) ←
Phytophthora cambivora **inkoustová nemoc**	*Castanea,*	? →	→ 1860 ←	← ?
Miscrosphaera alphitoides **Powdery mildew**	*Quercus sp. div.*	1930 ←	← 1877/1907 (?)	
Trichoscyphella willkommii	*Larix sp.*		→	→ 1927
Melampsora medusae	*Larix sp. / Populus sp.*		1925 ←	←
Marssonina brunnea	*Populus*	← 1961	← 1958	← ←
Erwinia amylovora	*Rosaceae*		1957 ←	←

Examples of introduced species

- *Ophiostoma ulmi, O. novo – ulmi*
- *Guignardia aesculi (1940)*
- *Cameraria ohridella (1993)*
- *Phaeocryptopus gaumannii (2003)*
- *Sphaeropsis sapinea (indigenous, activisation in 90`)*
- *Mycosphaerella pini (2000)*
- *Mycosphaerella dearnessii (2003)*
- *Cryphonectria parasitica (2002)*

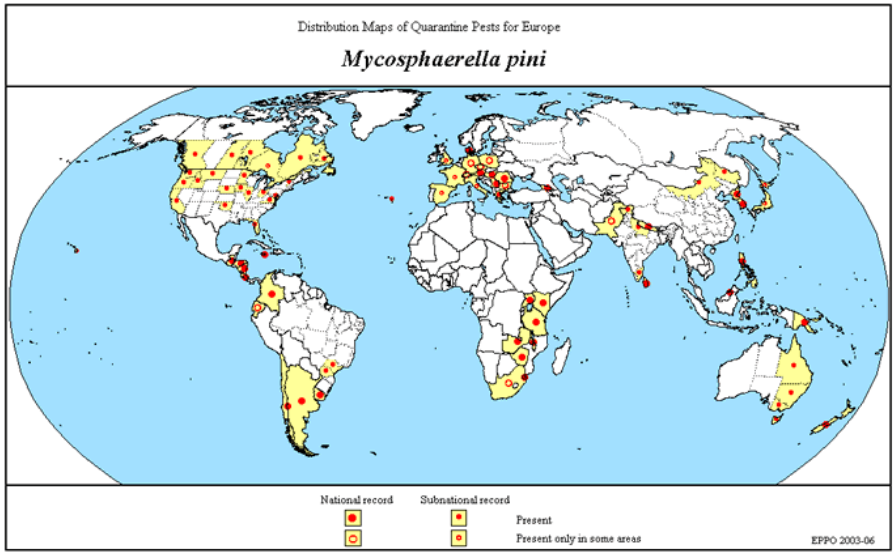
Dothistroma needle blight

Dothistroma septospora

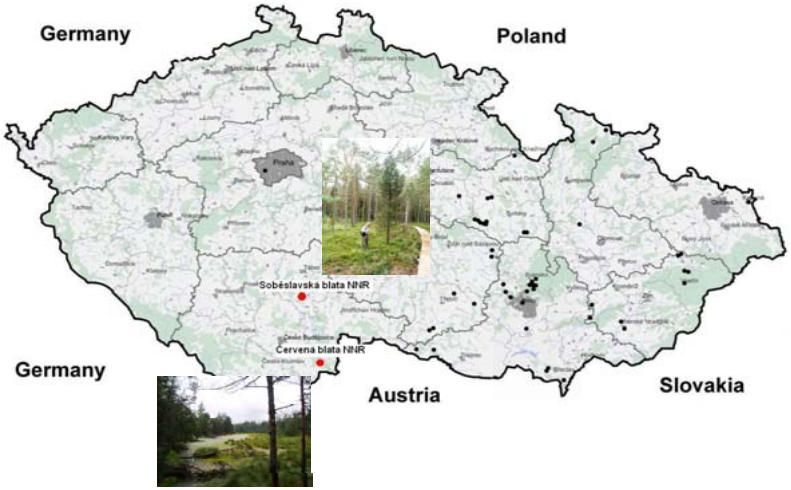
Mycosphaerella pini **E. Rostrup apud Munk,**

syn. ***Scirrhia pini*** **Funk & Parker,** ***Eruptio pini*** **(Rostr. apud Munk) M. E. Barr,**

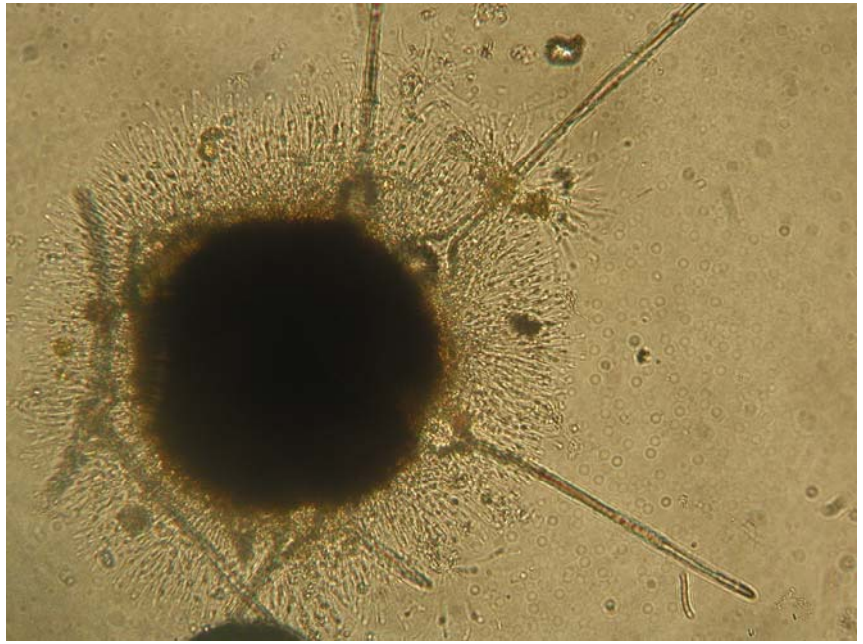
anamorph
Dothistroma septospora **(Dorog.) Morelet,**
Dothistroma pini **Hulbary,**
Cytosporina septospora **G. Doroguine,**
Actinothyrium marginatum **Sacc.,**
Septoriella septosporum **(Dorog.) Sacc.**



Lecanosticta acicola



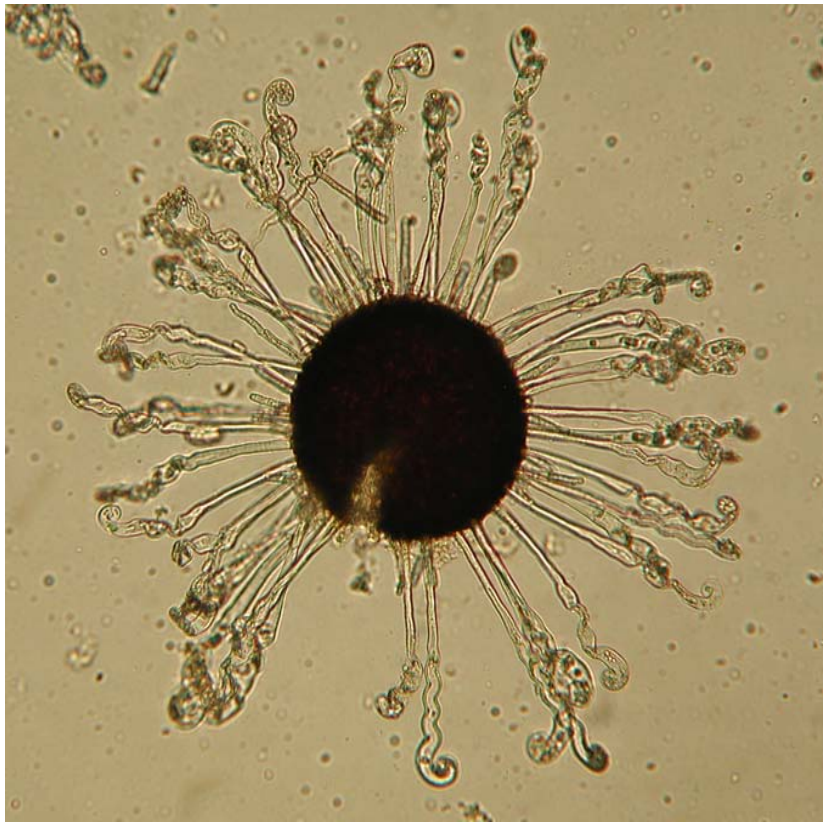
Phyllactinia fraxini



Fraxinus excelsior, F. angustifolia

Uncinuliella flexuosa

Aesculus pavia, A.hippocastanum, A.x carnea

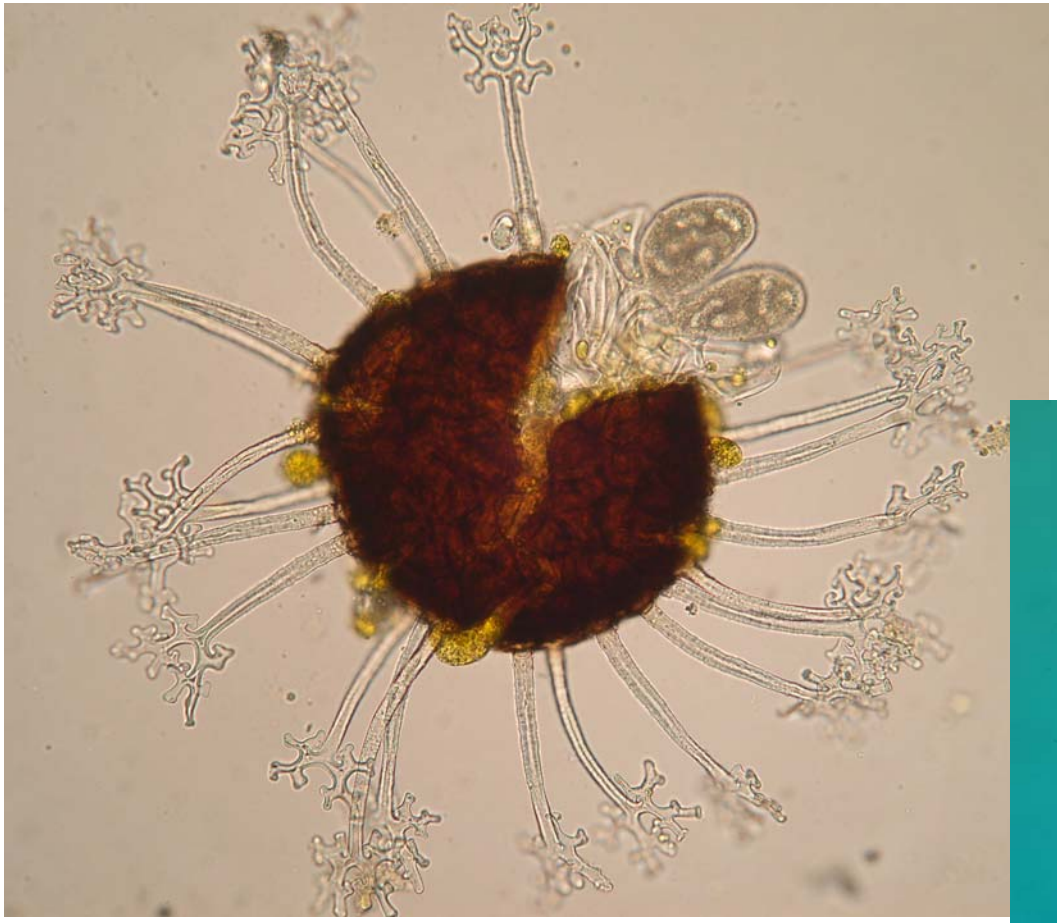


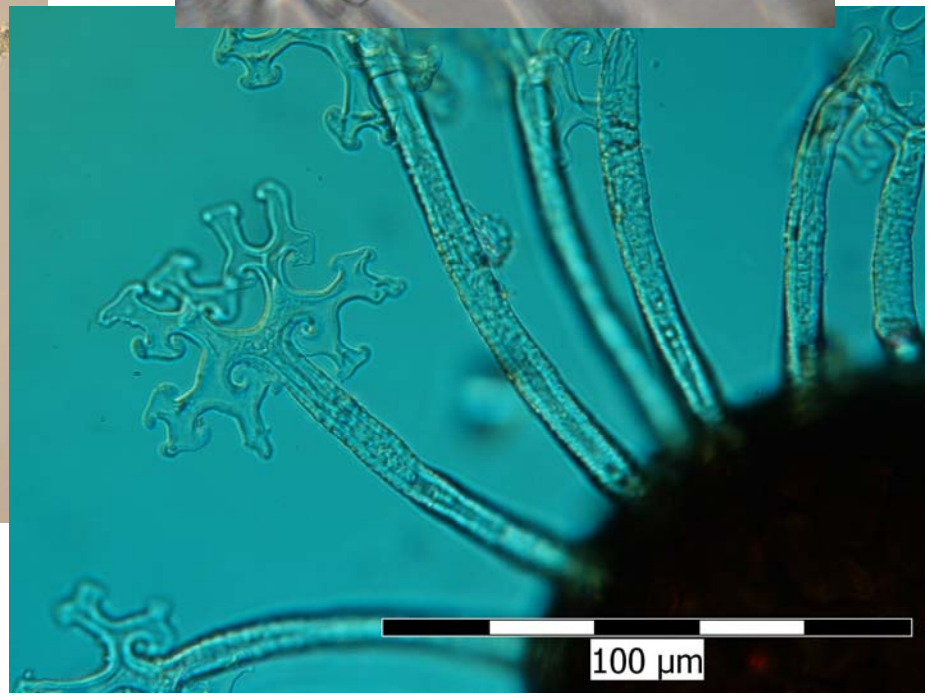
Microsphaera elevata

Catalpa bignoides

Microsphaera azaleae

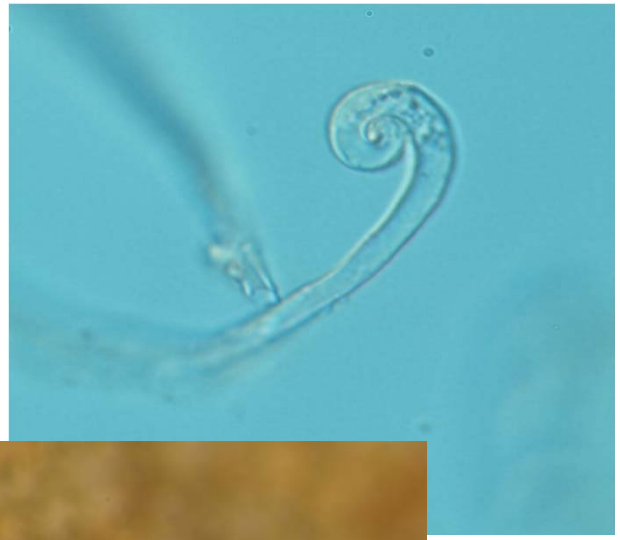
Rhododendron





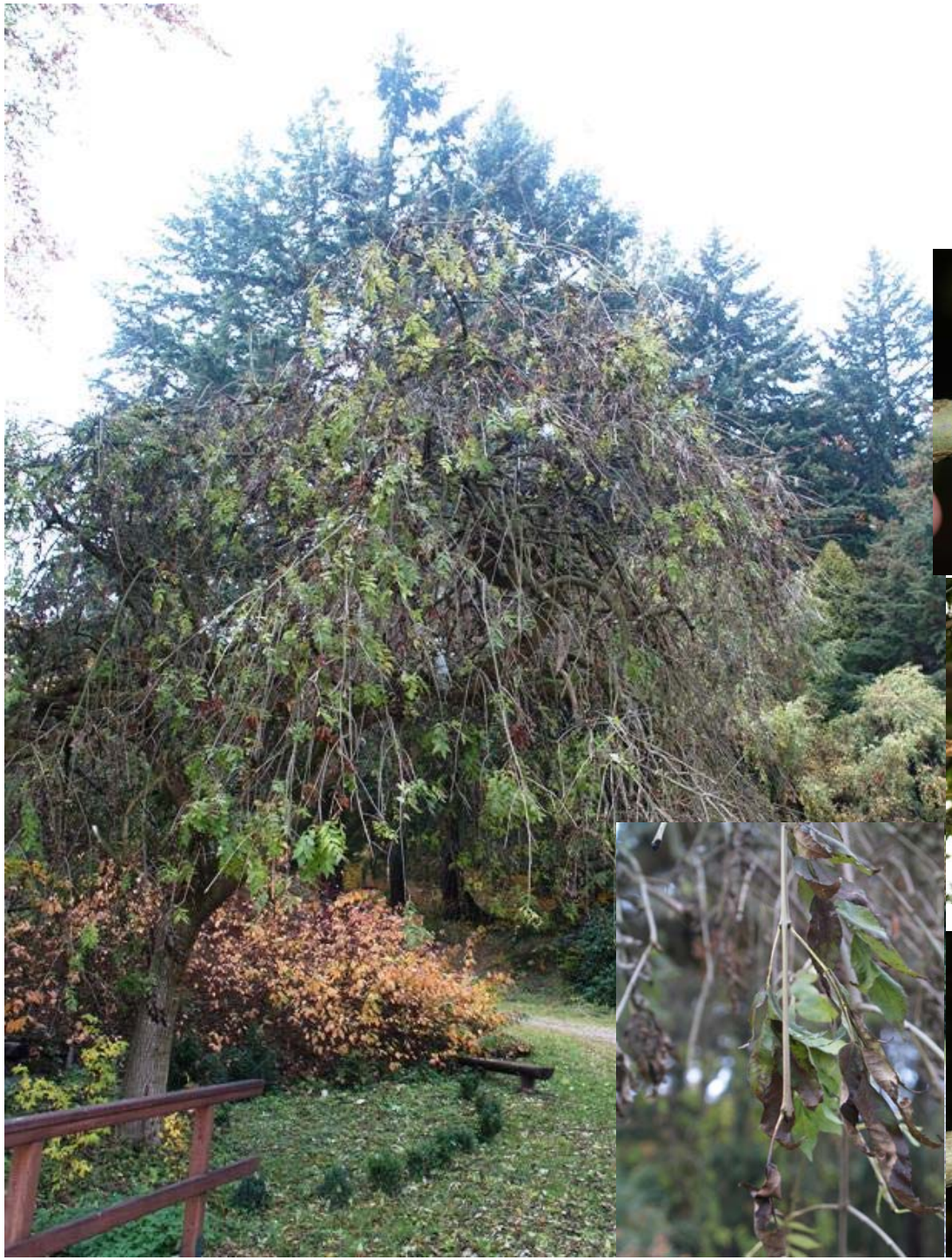
Erysiphe carpinicola

Carpinus betulus



Phaeocryptopus gaumannii

Ash dieback



Anaplophora glabripennis

Conclusions

- Several important alien species of woody plants was introduced within 20th century as a result of changed social, economical and also natural conditions in European landscape.
- Opening of borders and trade after 1989 brought acceleration of spreading of diseases in the area of the CR together with changing of climatic conditions.
- Situation is not differ from other countries in CE actually
- Presented preliminary list include most 30 most important species, including 4 quarantine pests and will by completed.