Diseases of trees Iᒪᒪ

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EVROPSKÁ UNIE

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

OP Vzdělávání pro konkurenceschopnost

evropský sociální fond v ČR

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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

Diseases of stem

- Vascular mycoses
- Wood destroying fungi
- Disease of kambium - cancers

Pathogens of vascular tissues on spruce

- *Erwinia cancerogena*
- *Ophiostoma sp. div*
- *Valsa sp., Cytospora sp.*
- *Leptographium*
- *Graphium*

Connection with bark beetles!

Ophiostomoid fungi

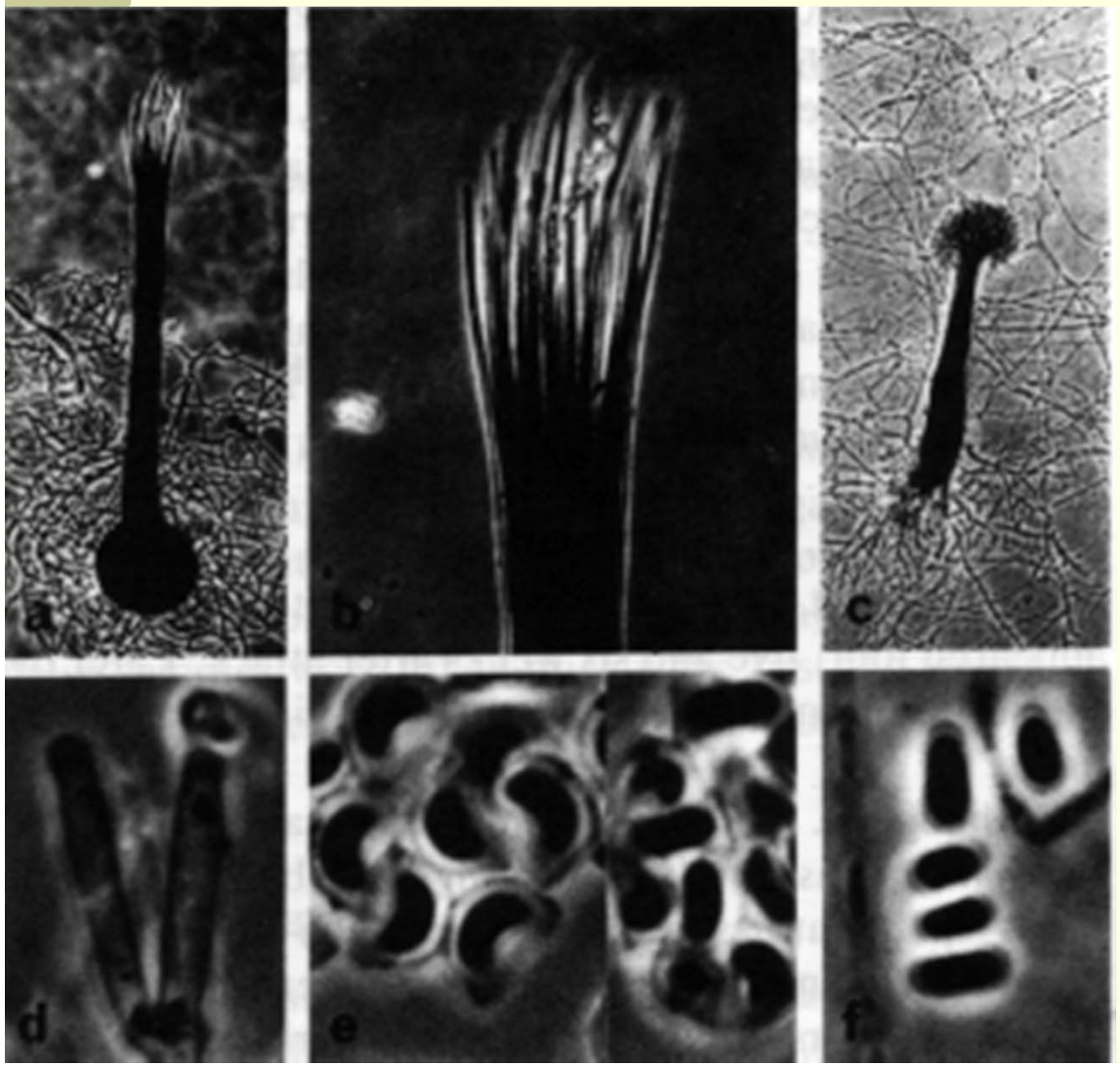
- *Ophiostoma polonicum* H.Syd and H. Syd.
- *O. bicolor* Davids. and Wells,
- *O. europhioides* (Wrigh et Cain) H. Solheim,
- *O. penicillatum* (Grosm.) Siem. A
- *O. minus* (Hedgc.) H.and P. Syd.(*Ceratocystiopsis minuta)*
- *Ophiostoma ainoae*
- *Ophiostoma cuculatum*
- *Ophiostoma flexuossum*
- *O. tetropii,*
- *Graphium pycnocephalum*
- *Leptographium wingfieldii* Morelet (on Pine)
- Leptographium lundbergii

Vascular mycoses of spruce

Vascular mycoses of spruce

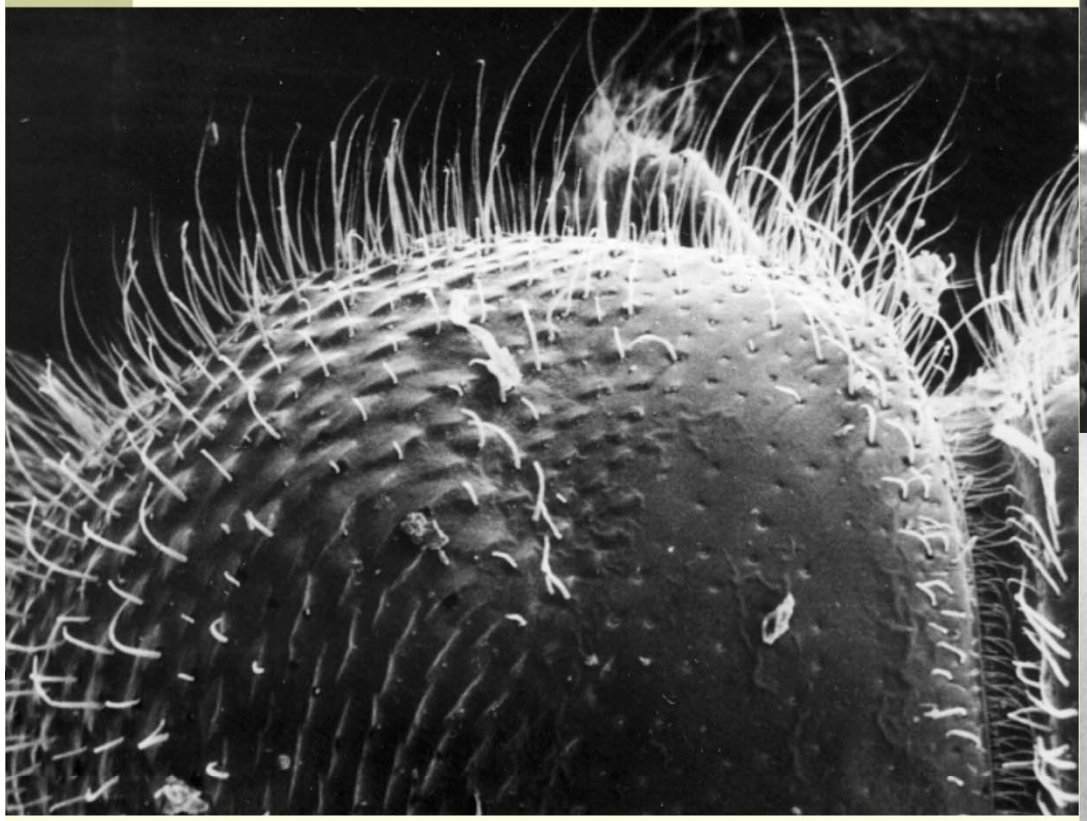
Vascular mycoses of spruce

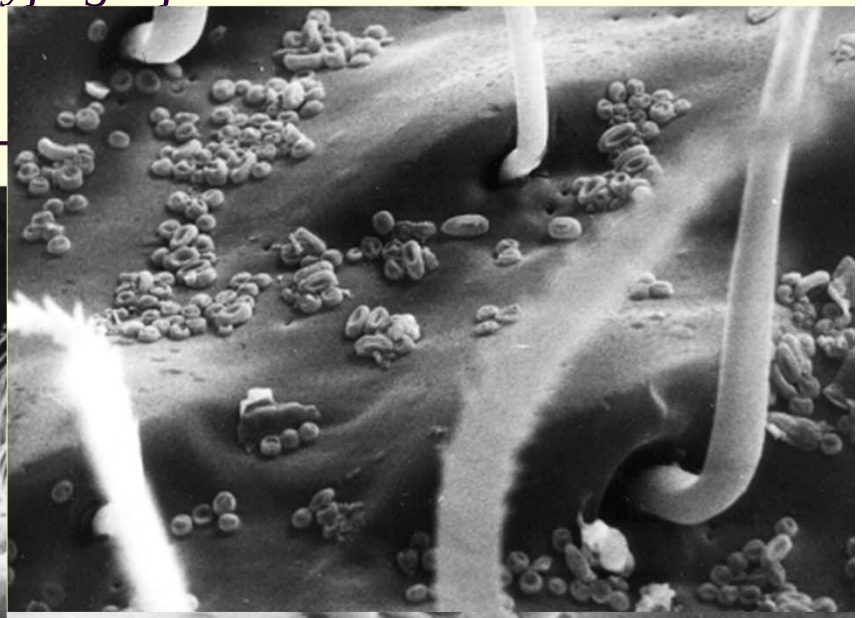
Ophiostoma cucullatum

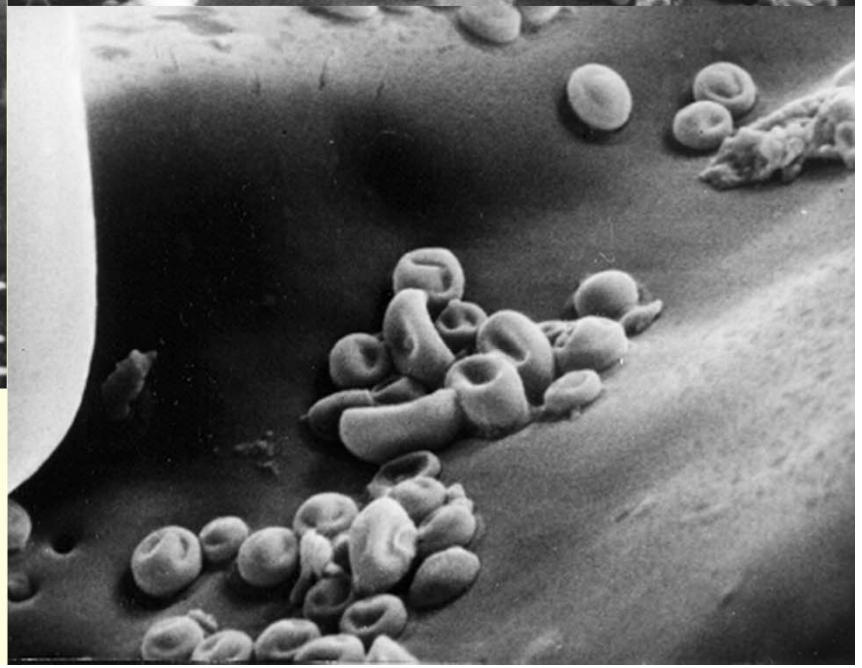


Ophiostoma cucullatum a. fruitbody, b. neck, c. synnema, d. conidiophor, e. ascospores (after Solheim 1987)

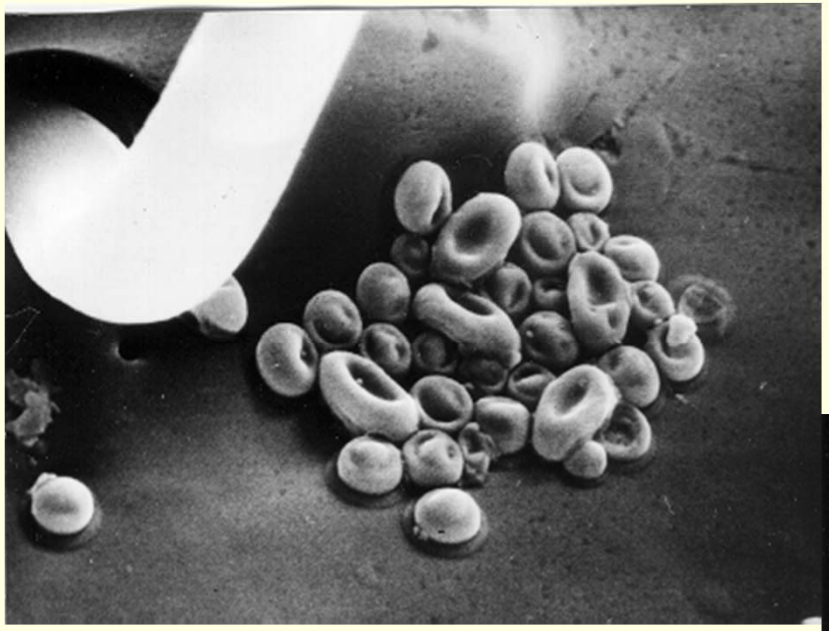
Associated mycoflora of bark beetle *Ips typographus*

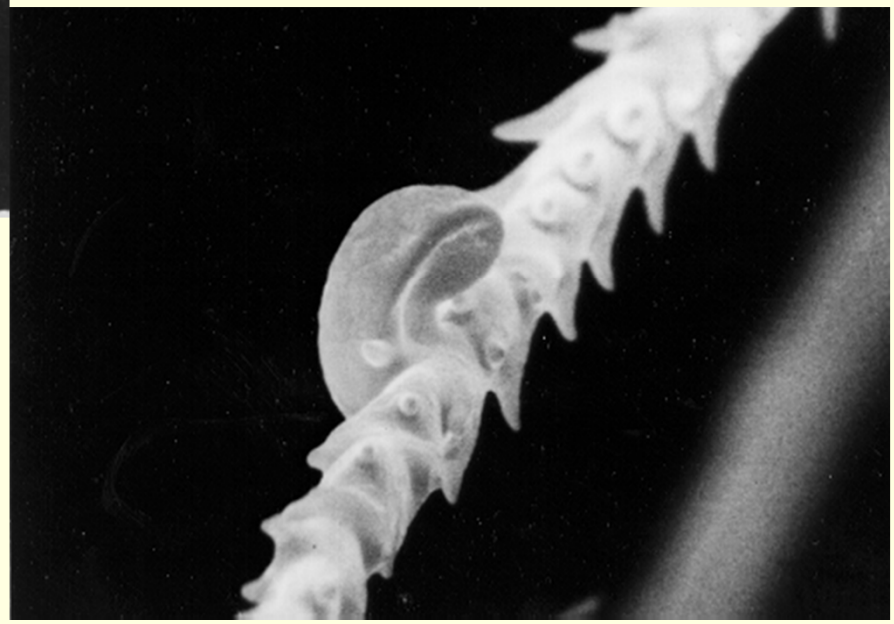




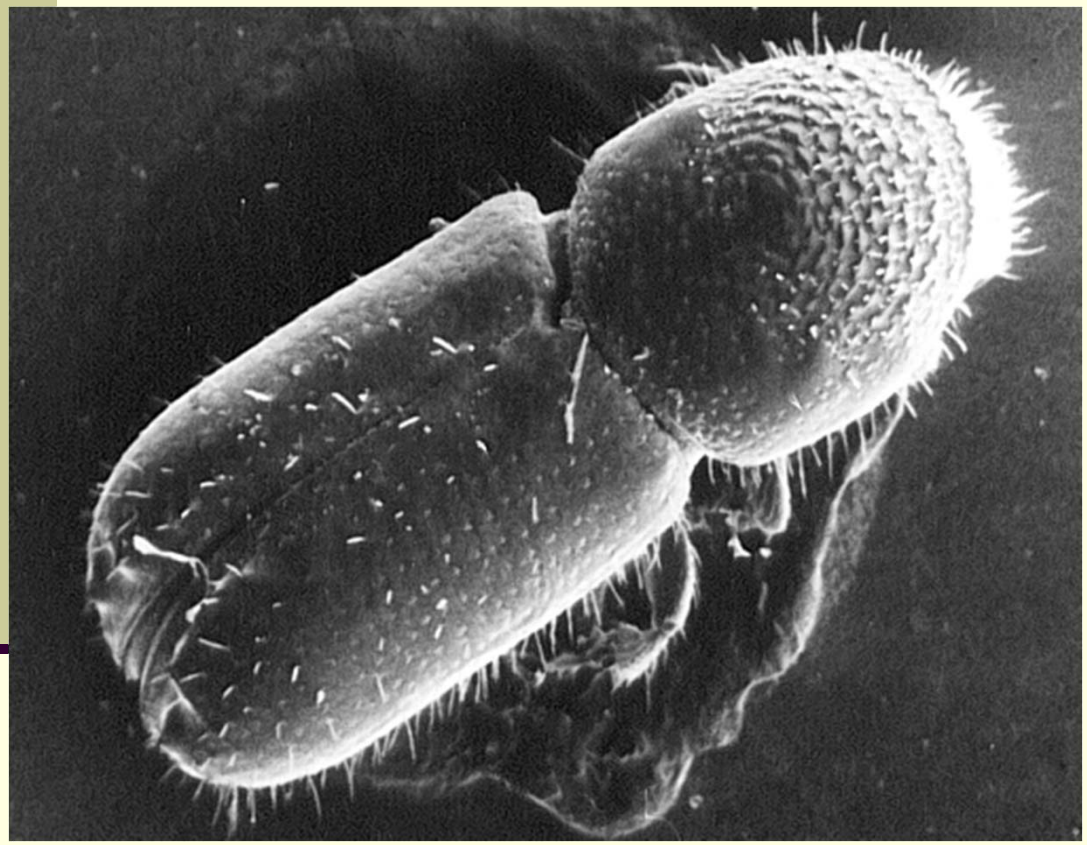


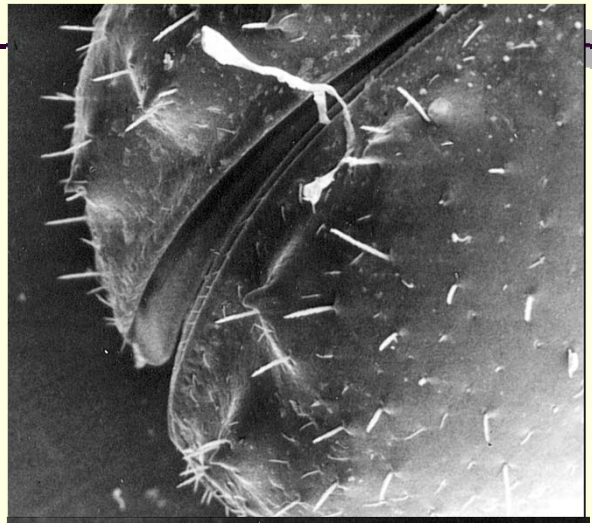
Associated mycoflora of bark beetle *Ips typographus*

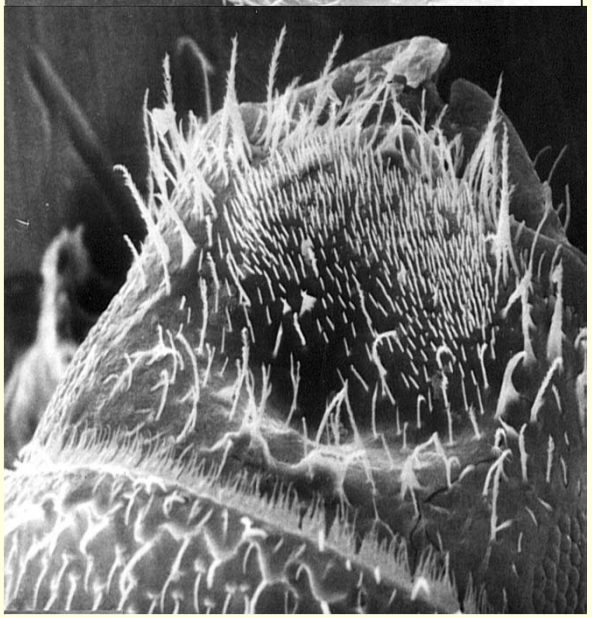




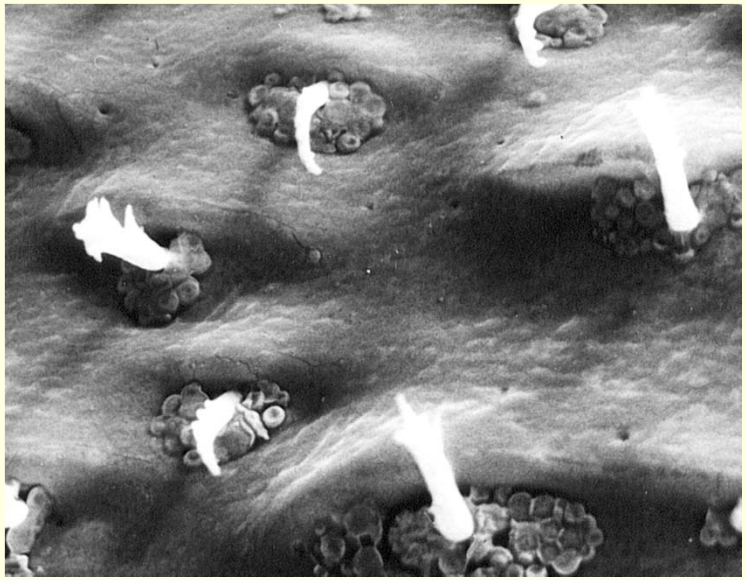
Doprovodná mykoflóra *Pityogenes chalcographus*

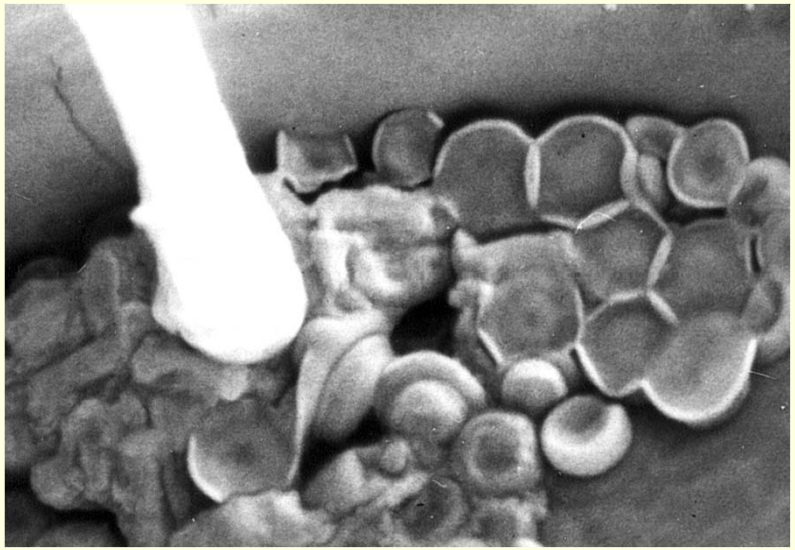




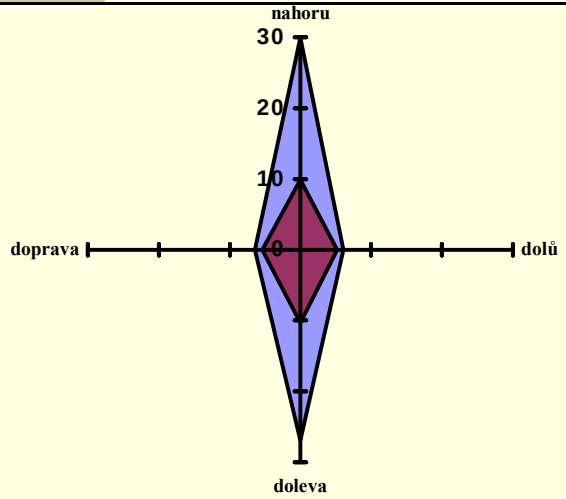


Doprovodná mykoflóra *Pityogenes chalcographus*

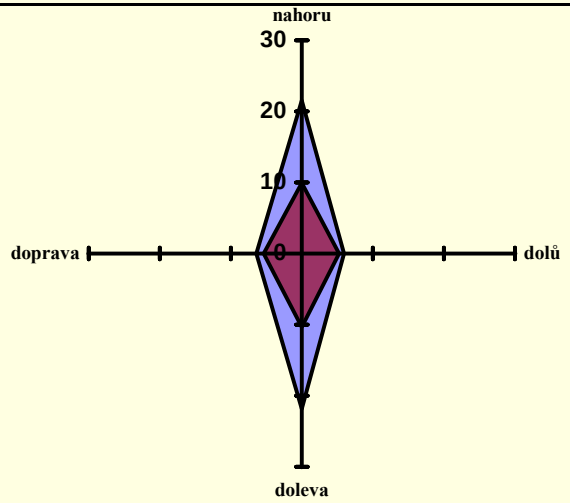




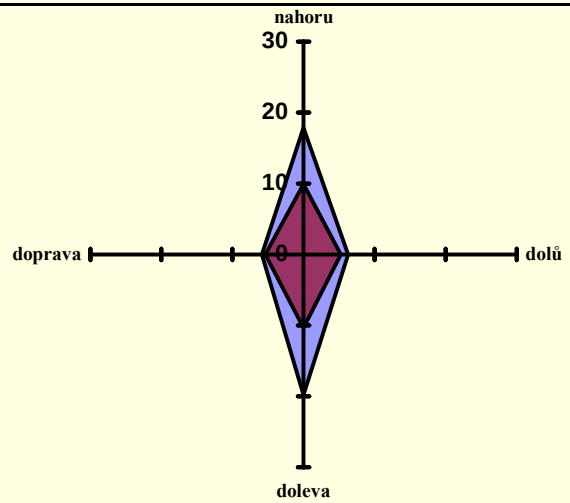
Wound reaction around artificial infection using bark beetle imagoes threated by diferent fungicide (1999)



Obr. *1* Průměrná reakce v okolí infekce neošetřeným imágem. Ve středu vyznačena kontrola.



Obr. *2* Průměrná reakce v okolí infekce imágem.ošetřeným Fundazolem. Ve středu vyznačena kontrola.



Obr. *3* Průměrná reakce v okolí infekce imágem.ošetřeným Ibefunginem. Ve středu vyznačena kontrola.

The diseases of spruce III

Secondary parasitical wood decaying fungi

The decay of stems

Onnia circinata	*honeycomb rot, resinosis*
Phellinus chrysoloma	*honeycomb rot*
Postia stiptica	*brown rot, bases of stems*
Tyromyces ptychogaster	*brown rot, bases of stems*
Climacocystis borealis	*cubic decay, 1x1 mm*
Coniophora piceae	*Brown rot, symbiosys with ants Campanotus sp.*
Stereum sanguinolentum	*White rot folowing wounds by stripping, the most important wood decaying fungi*
Fomitopsis pinicola	*Brown rot; very distinctive fruitbodies*

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum

Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum
Verinahakka

Stereum sanguinolentum

Stereum sanguinolentum
Verinahakka

Some other wound parazite on spruce

- Amylostereum areolatum
- Amylostereum chailetii
- Nectria fuckeliana
- …..

Pleurotus dryinus

Neonectria fuckelia

www.forestimages.com, www.nahuby.sk

Amylostereum areolatum
A. chailetii

- Mostly saprophytes on stumps
- Cooperation with wood wasps – *Sirex* spp., *Urocerus* spp. – connection to wood nematode
- Sprading by spores (generatively) and by wood wasp (vegetatively)
- Wood wasp was introduced to other regions eg. South Africa and South America – great problems for Pine plantations
- No problems in areas of natural distribution of wood wasps mostly

Amylostereum areolatum

www.nasehouby.cz

Trichaptum abietinum

Fomitopsis pinicola

Kantokääpä

Fomitopsis pinicola

Fomitopsis pinicola

Fomitopsis pinicola

Coniophora puteana

Connection with ants *Campanotus* spp.

Coniophora puteana

Coniophora puteana

Onnia circinata

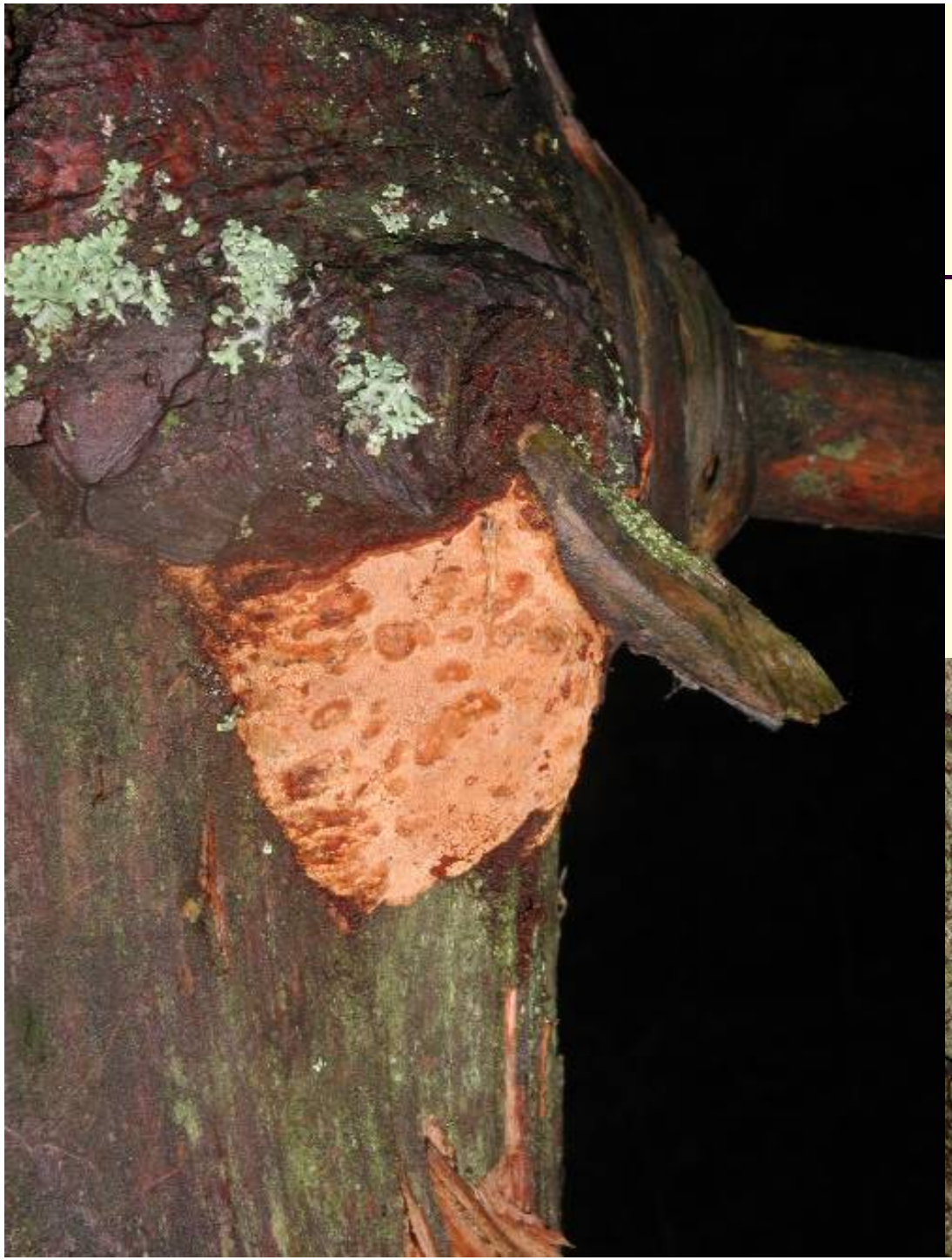
Onnia circinata

Onnia circinata

Phellinus chrysoloma

Phellinus chrysoloma

Kuusenkääpä



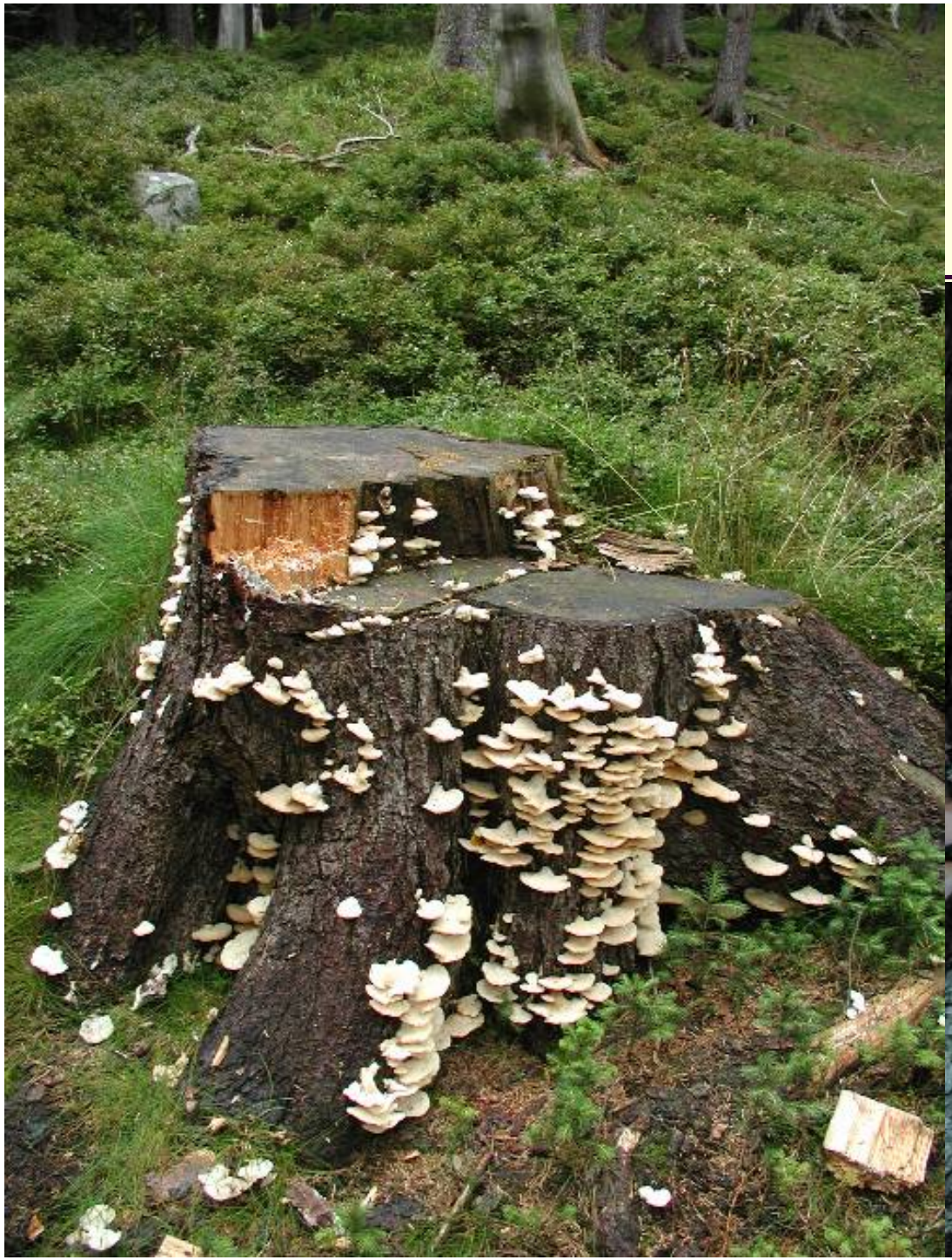
Phellinus viticola

Phellinus nigrolimitatus

Phellinus nigrolimitatus

Phaeollus schweinitzii

Climacocystis borealis



Climacocystis borealis

Climacocystis borealis

Climacocystis borealis

Leptoporus molis

Laetiporus montanus

Laetiporus montanus

Laetiporus montanus

Gloeophyllum sepiarium

Merulius lacrymans

Merulius lacrymans

Merulius lacrymans

Merulius lacrymans

Stem rots of *Abies* spp.

- Butt rots
  - *Phellinus hartigii*
  - *Fomitopsis pinicola*
  - *Pholiota adiposa*

Phellinus hartigii

Phellinus hartigii

Phellinus hartigii

Phellinus hartigii

Phellinus pini

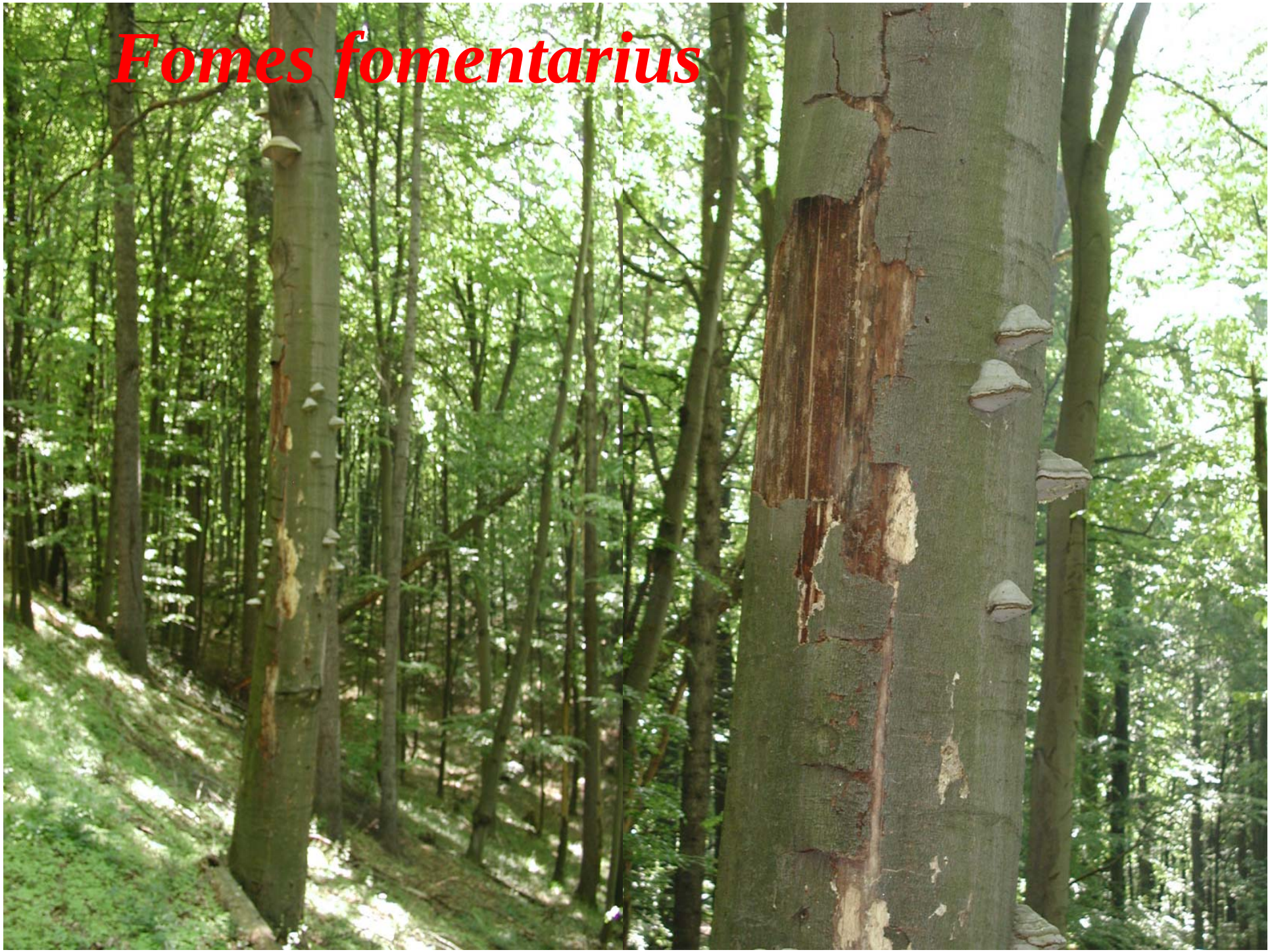
Diseases of brodaleaved

Stem rots

Vascular mycosis

Pathogen of cambium

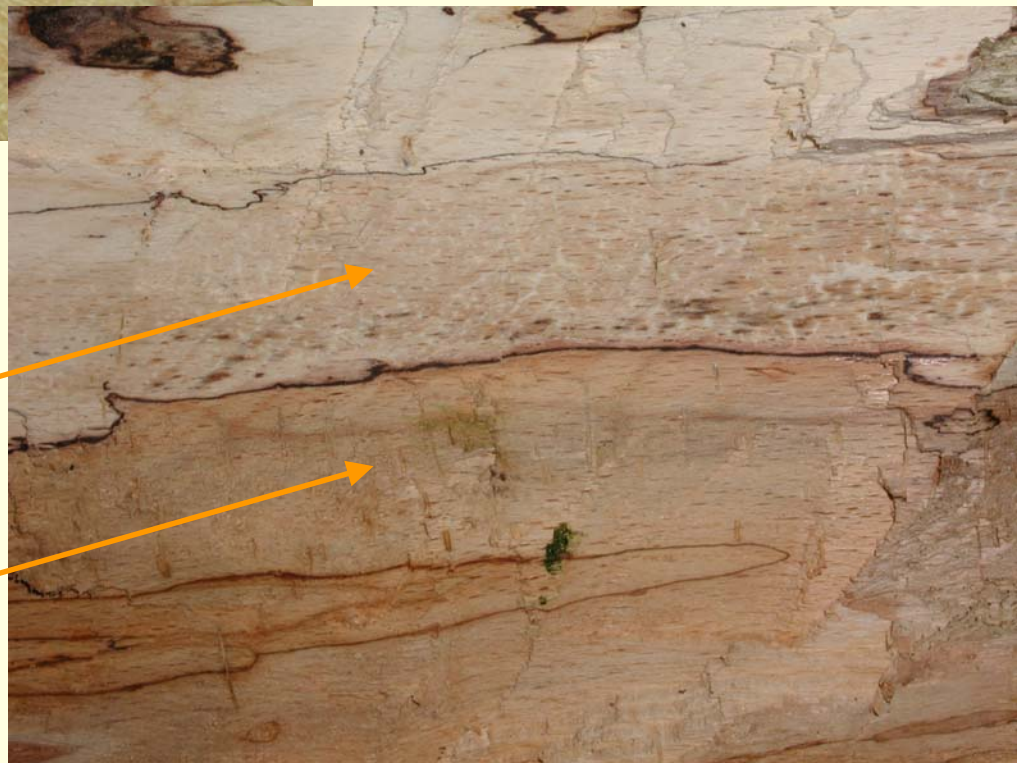
Fomes fomentarius



Fomes fomentarius

Fomes fomentarius

Fomes fomentarius



Fomes fometarius

Fomitopsis pinicola

Fomitopsis pinicola

Fomitopsis pinicola

Ganoderma applanatum

Ganoderma adspersum

Ganoderma lucidum

Ganoderma lucidum

Ganoderma lucidum

Ganoderma resinaceum

Inonotus obliquus

Inonotus obliquus

Inonotus obliquus

Inonotus obliquus

Inonotus obliquus

Inonotus cuticularis

Inonotus cuticularis

Inonotus cuticularis

Inonotus nidus-pici

Inonotus nidus-pici

Inonotus nidus-pici

Inonotus nidus-pici

Inonotus nidus-pici

Inonotus hispidus

Inonotus hispidus

Inonotus laevis

Foto Tomas Majek, Athenes 2008

Inonotus radiatus

Pleurotus ostreatus

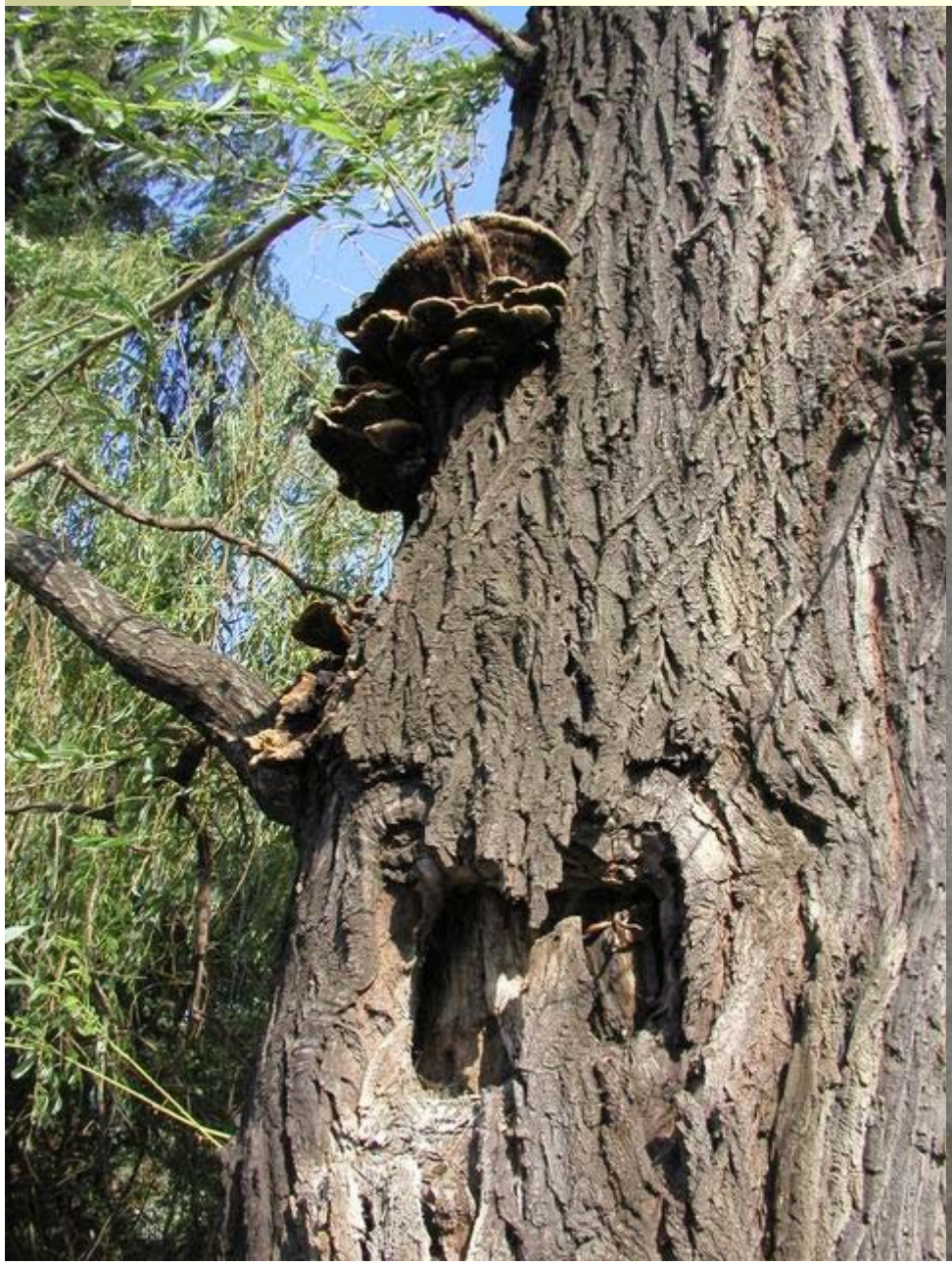
Pleurotus ostreatus

Polyporus squamosus

Laetiporus sulphureus

Laetiporus sulphureus

Laetiporus sulphureus



Laetiporus sulphureus

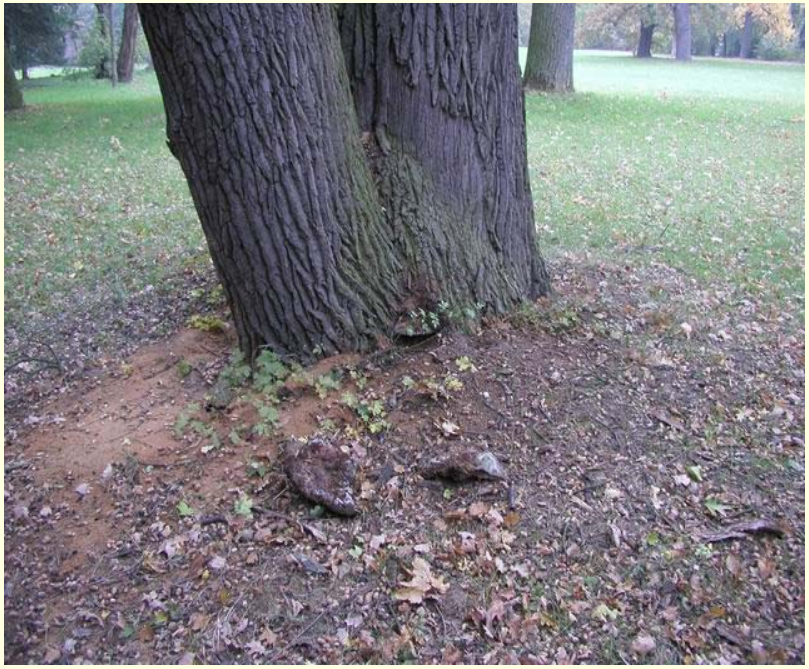

Fistulina hepatica

Fistulina hepatica

Inonotus dryadeus

Inonotus dryadeus

Inonotus dryadeus



Inonotus dryadeus

Inonotus dryadeus

Phellinus robustus

Phellinus robustus

Phellinus robustus

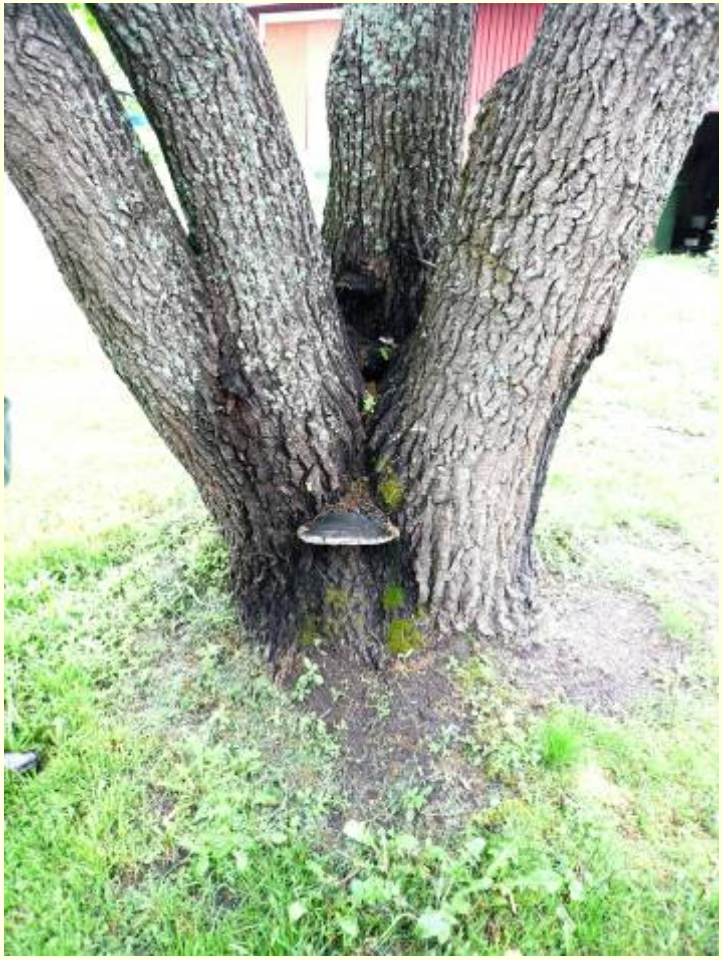
Species in Scandinavia

- *On broadleaved*
  - *Phellinus igniarius – Salix* spp.
  - *Phellinus alni – Sorbus* spp., *Betula* spp., *Ulmus* spp., Alnus spp….
  - *Phelinus cinereus* – on *Betula* spp.
  - *Phellinus lundelii* – on *Betula* spp.
  - *Phellinus tremulae – Populus tremula*
  - *Phellinus populicola – Populus spp.*
  - *Phelinus pilatii – P. alba*
- *Species on conipherous*
  - *Phellinus chrysoloma – on spruce*
  - *Phellinus pini – on pine*
  - *Phellinus nigrolimitatus - on spruce*
  - *Phellinus viticola – on spruce*
  - *Phellinus vorax – on pines, larches,*

Phellinus igniarius

Phellinus igniarius

Phellinus alni



Phellinus alni

Phellinus alni

Phellinus lundelii (?)

Phellinus cinereus (?)

Phellinus tremulae

Phellinus populicola

Phellinus tuberculosus

Phellinus punctatus

Piptoporus betulinus

Piptoporus betulinus

Fomes fomentarius

Pholiota aurivella

Pholiota destruens

Stereum hirsutum

Stereum rugosum

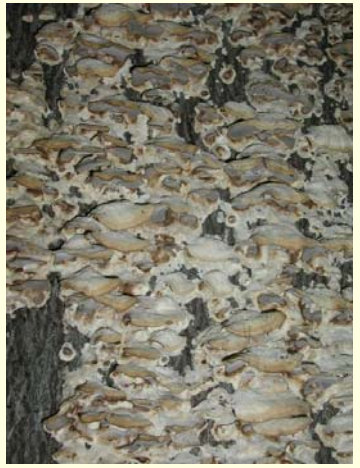
Stereum subtomentosum

Trametes versicolor

Trametes hirsuta

Trametes gibbosa

Bjerkandera adusta



Schizophyllum commune

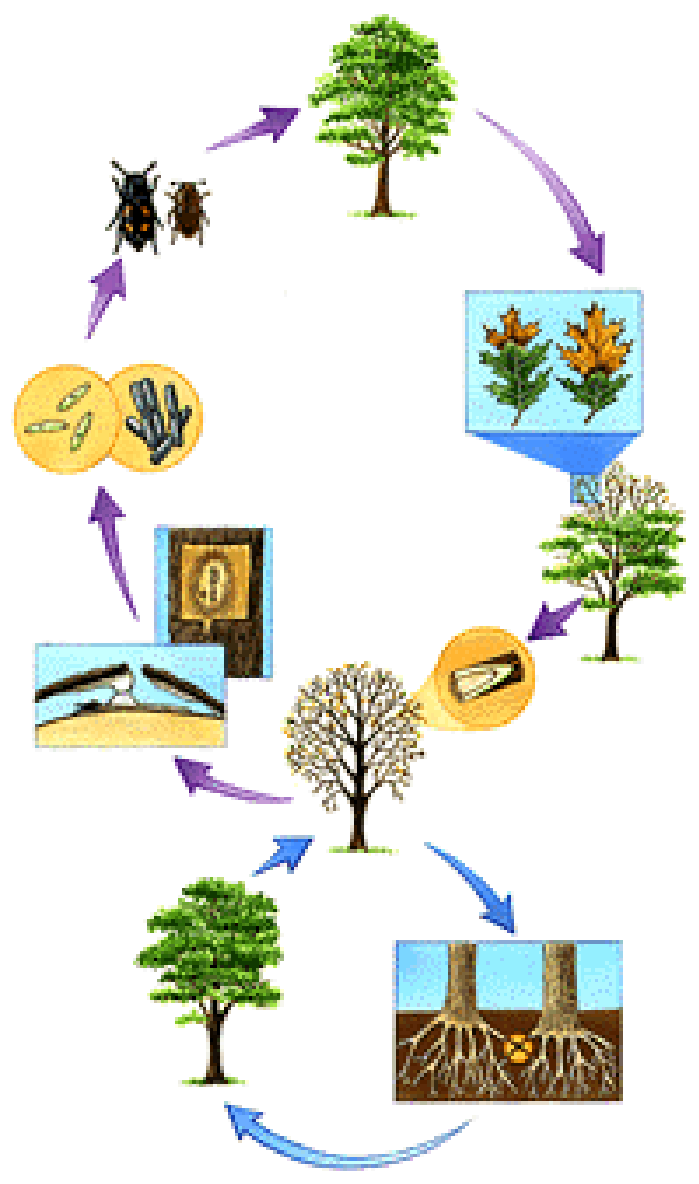
Withches brooms

Taphrina betulina

Taphrina betulina

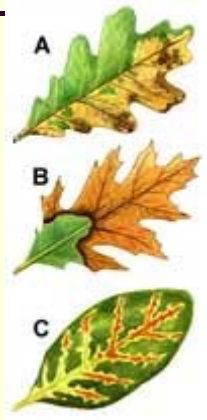
Vascular mycosis

- Ophiostomoid fungi
  - Obligate parasite
    - *Ophiostoma ulmi*, *Ophiostoma novo-ulmi*
    - *Ceratocystis fagacearum* (anam. *Chalara quercina*)
  - Facultative parasite
    - Ophiostoma sp. div., Ceratocystis sp. div.
    - Leptographium sp. div.
- *Verticillium, Fusarium* ….
- *Cytospora, Valsa* …
- Basidiomycetes – *Schizophyllum commune*



Ceratocystis fagacearum

Chalara quercina

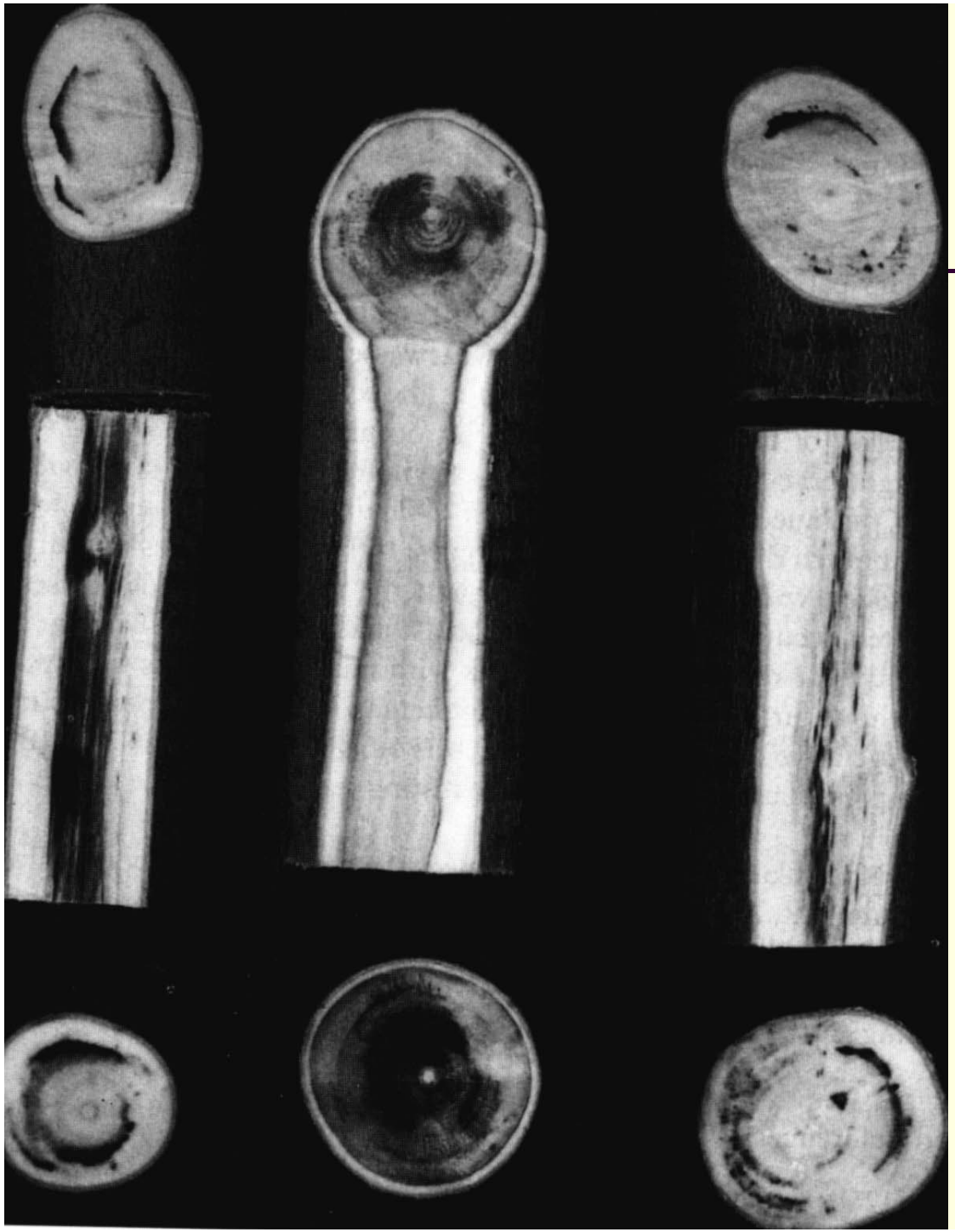


Ophiostoma ulmi, Ophiostoma novo-ulmi

Ophiostoma ulmi, Ophiostoma novo-ulmi

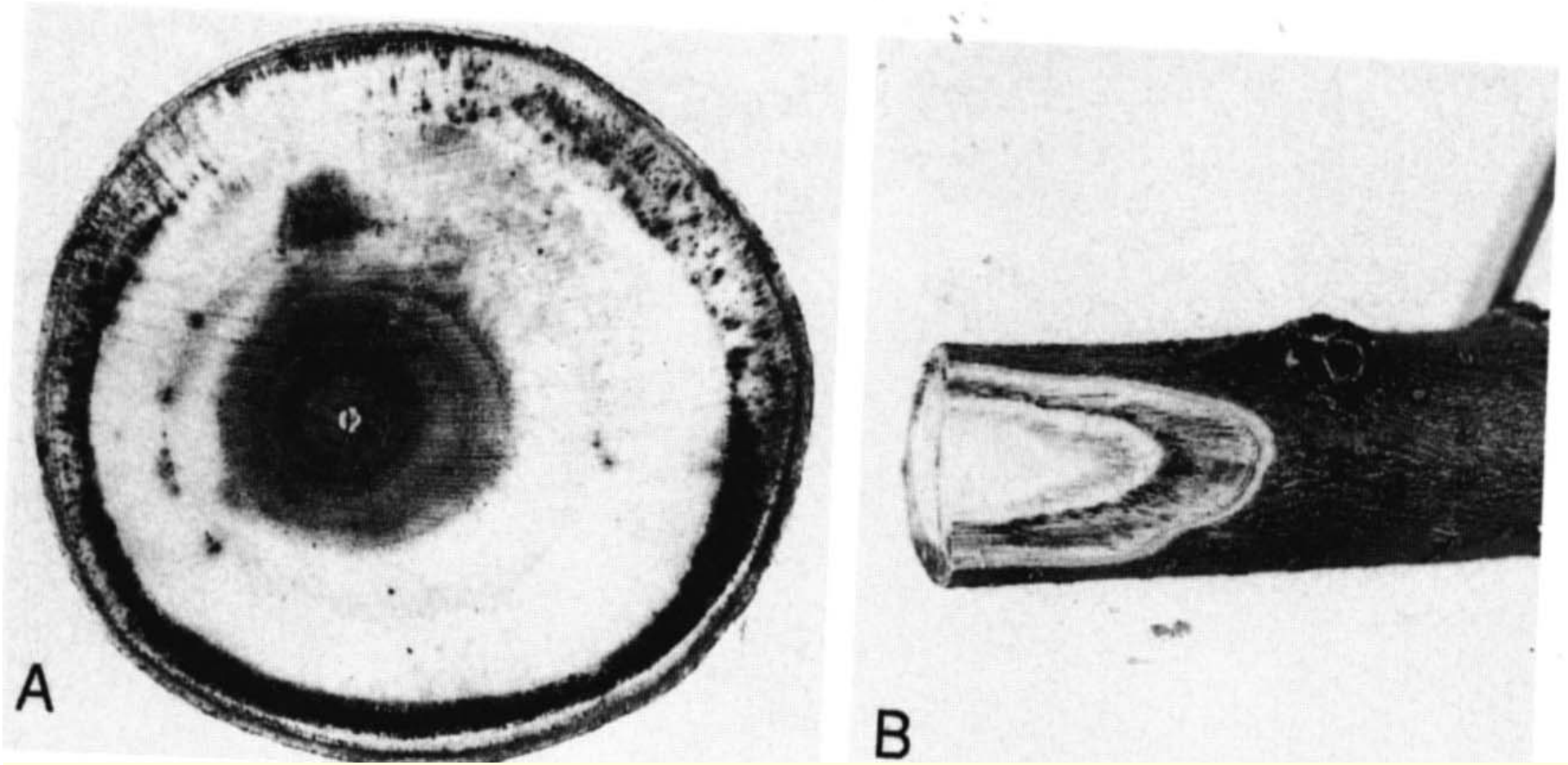
Cytospora sp.

Cytospora sp.



Verticillium dahliae

Fusarium oxysporum



Pathogens of cambium

- cankers
  - *Cryphonectria*
  - *Nectria*
  - *Giberella*

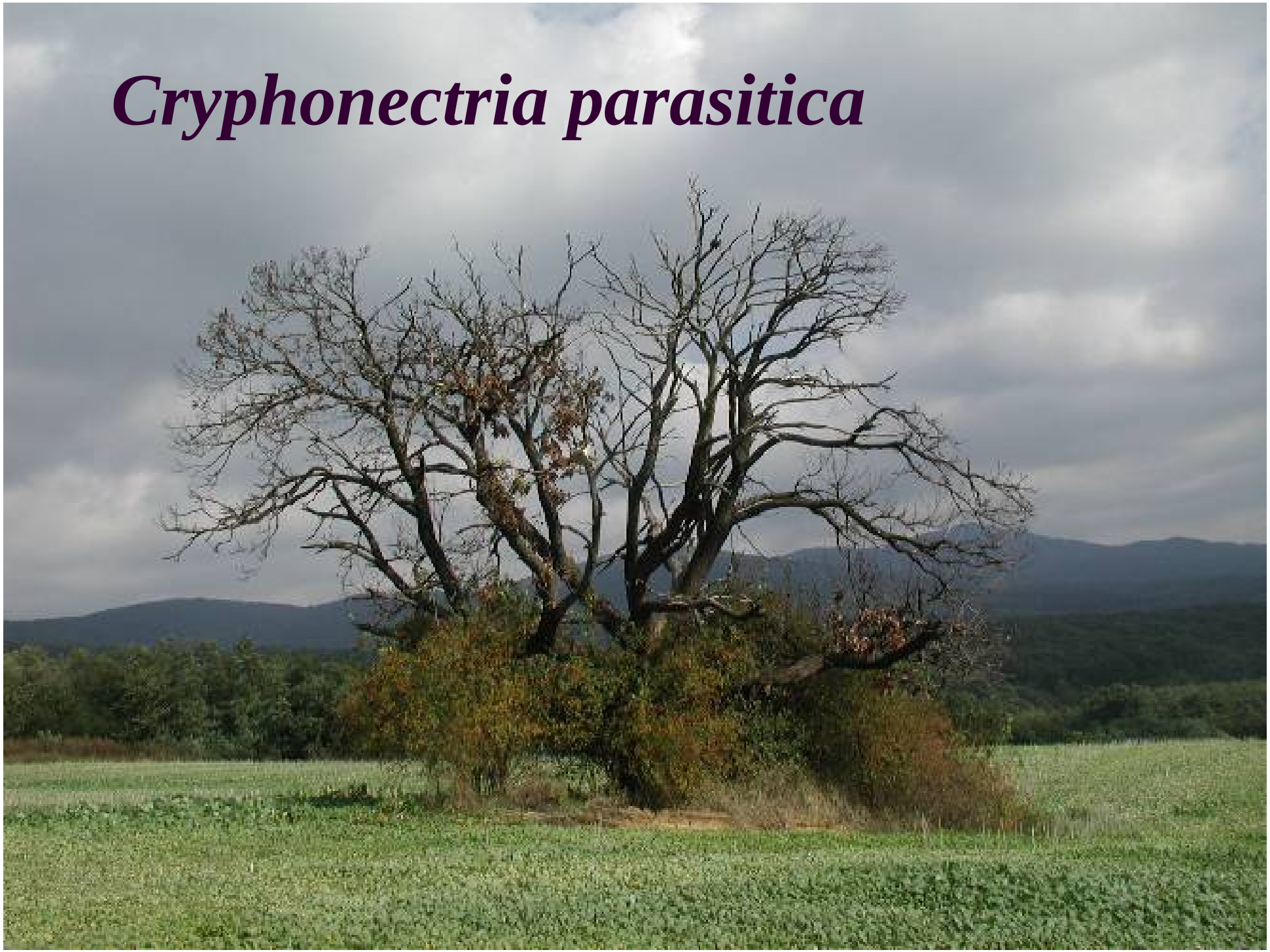
Nectria galligena

Nectria galligena

Target cancers – Nectria spp.

Target cancers – nectria spp

Target cancers – Nectria spp.


Cryphonectria parasitica

Cryphonectria parasitica Murr

symptoms of infection

- ***Withering of crowns or its parts***
- ***Similar symptoms . Frost injury, infection by ink diseases Phytophthora cambivora and Phytophthora cinnamonii, extreme drought or other abiotic phenomena***

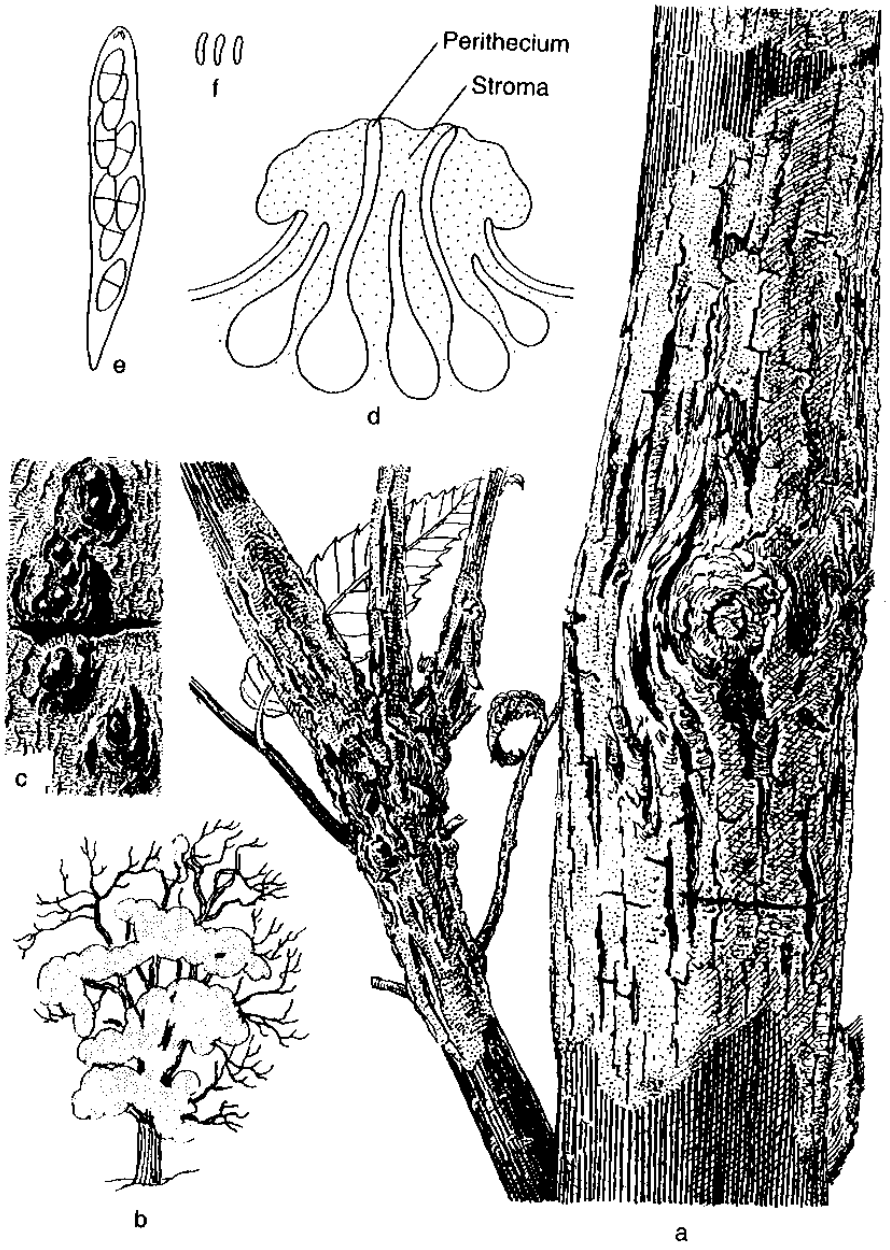


Fig. 76 *Cryphonectria parasitica*. **a** symptoms on stem and branches of Sweet chestnut, **b** general view of a diseased tree, **c** perithecia and pycnidia bursting through the dead bark, **d** section (diagrammatic) through a part of a stroma with perithecia, **e** ascus with ascospores, **f** conidia

Cryphonectria parasitica

Cryphonectria parasitica Murr

symptoms of infection

Cryphonectria parasitica Murr

symptoms of infection

Cryphonectria parasitica Murr

symptoms of infection

Cryphonectria parasitica Murr

symptoms of infection

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symptoms of infection

Cryphonectria parasitica Murr

symptoms of infection

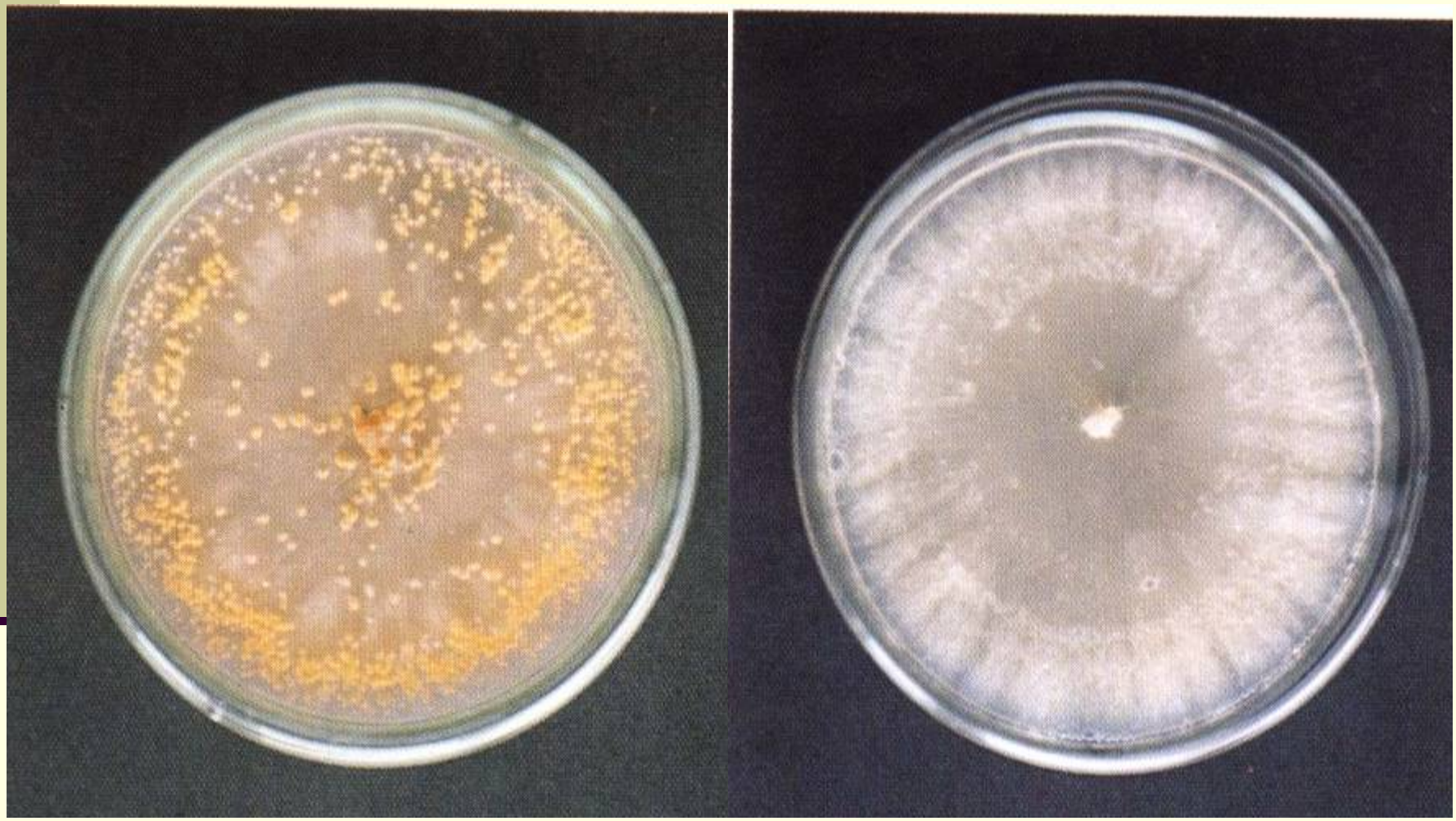
Cryphonectria parasitica

Cryphonectria parasitica Murr

symptoms of infection

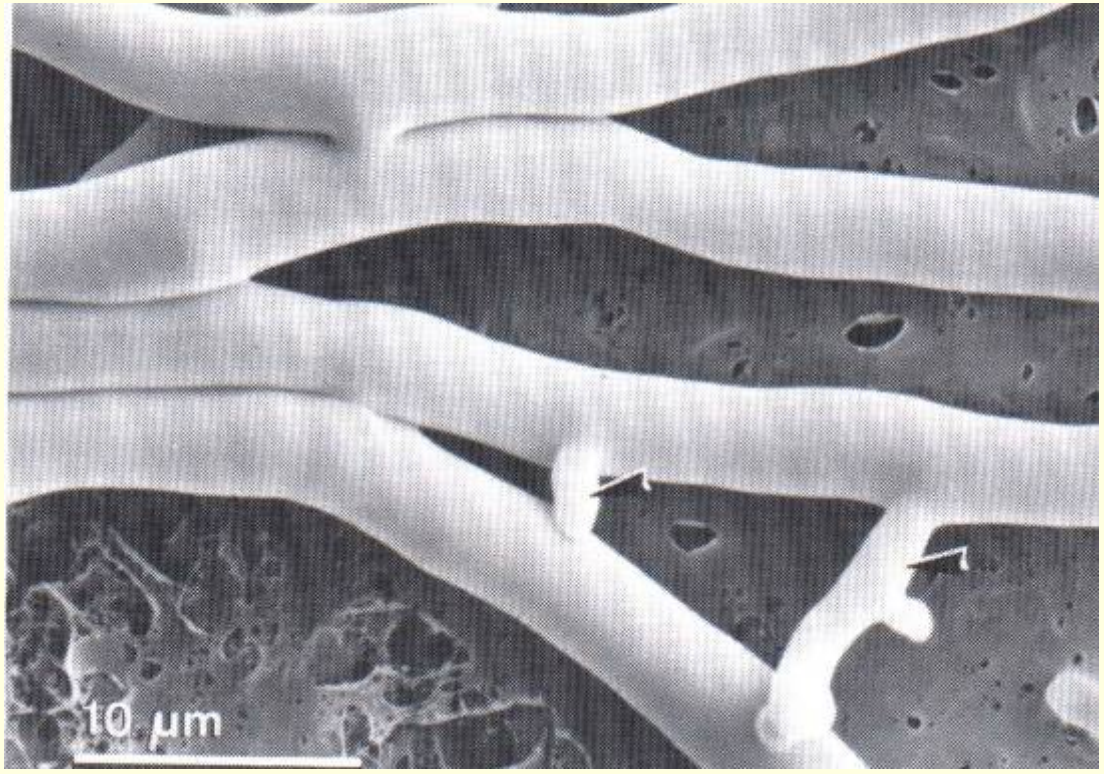
Cryphonectria parasitica Murr

mycelium in the culture



- Virulent strain
- Hypovirulent strain

Cryphonectria parasitica Murr




Ash dieback

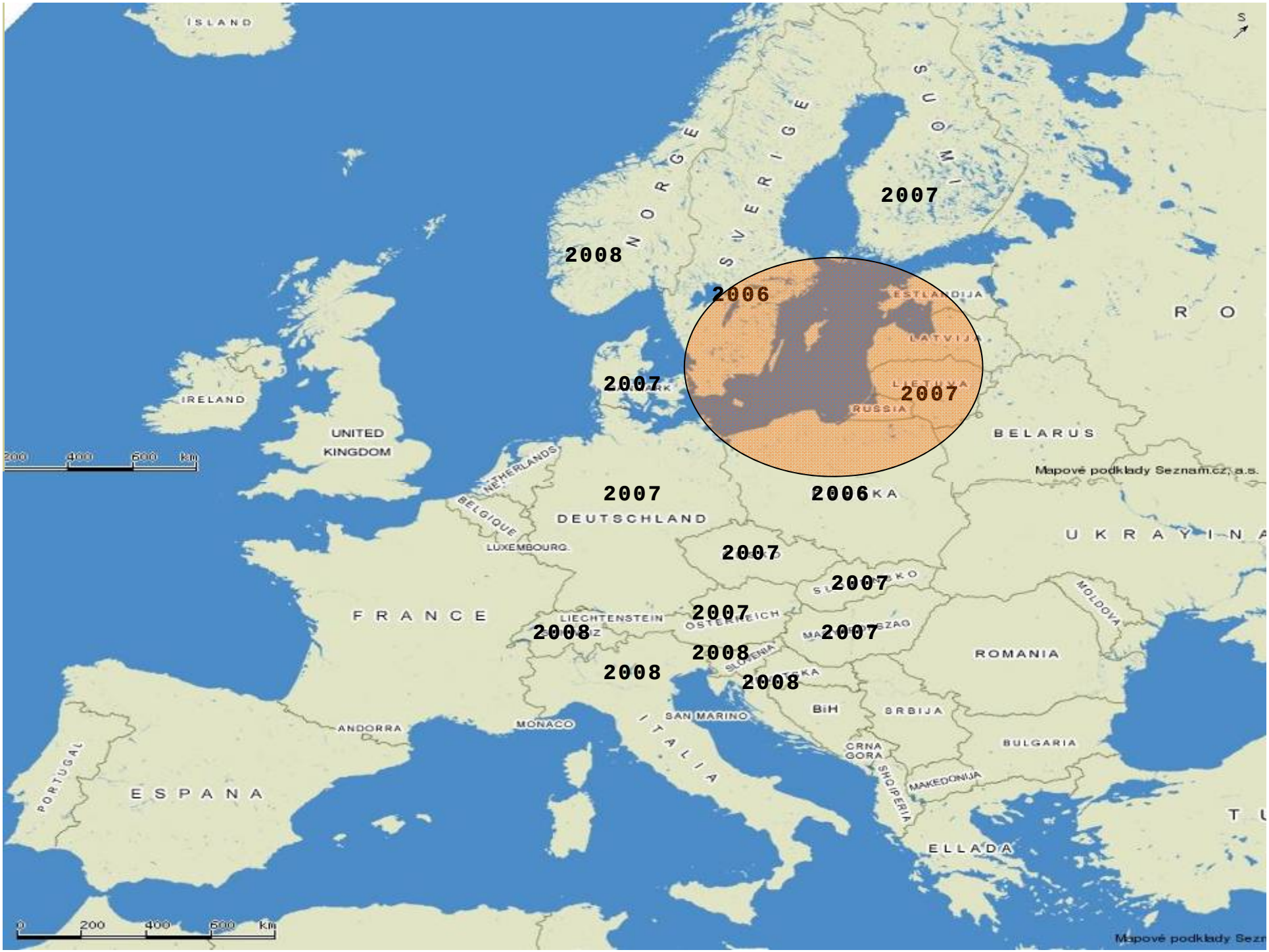
- Ash decline – complex disease
- Ash yellows – phytoplasma
- Ash dieback – *Chalara fraxinea*

History of Ash Dieback

- 90`s – first reports about Ash decline from Lithuania, Poland, from middle of 90` s from Latvia and Estonia from 2000 - Germanz, Denmark, Sweden
- 2006 - *Chalara fraxinea was described bz Kowalski from Poland as a possible originator of Ash dieback*,
- 2007 - EPPO allert list (EPPO 2007)
- Confirmation of *Ch. fraxinea* from other countries
- 2009 Hymenoscyphus albidus was decribed as a teleomorphic stage of Chalara fraxinea

Distribution of *Chalara fraxinea* in Europe

- Germany (Schumacher et al., 2007),
- Sweden (Thomsen et al., 2007),
- Lithuania (R. Vasaitis, oral communication),
- Austria (Halmschlager et Kirisits 2008),
- Czech Republic (2007)
- Hungary (Szabo, 2008),
- Norway (Solheim, oral communicatio; EPPO 2008),
- Finland (EPPO 2008).
- Switzerland (Holdenrieder 2008, oral communicatio),
- Italy
- Slovakia.
- Slovenia
- Croatia


ÍSLAND
NORGE
SVERIGE
SUOMI
2007
2008
2006
2007
2007
IRELAND
UNITED KINGDOM
RUSSIA
BELARUS
Mapové podklady Seznam.cz, a.s.
NETHERLANDS
BELGIQUE
LUXEMBOURG
2007
2006
DEUTSCHLAND
UKRAYINA
2007
2007
2007
FRANCE
LIECHTENSTEIN
2008
2007
2008
2008
2008
ROMANIA
MOLDOVA
SLOVENIJA
BiH
SRBIJA
SAN MARINO
MONACO
ANDORRA
CRNA GORA
BULGARIA
MAKEDONIJA
SHQIPERIA
PORTUGAL
ESPANA
ELLADA
0 200 400 600 km

Symptoms

- Dieback of new shoots
- Lesions and necroses on shoots and stems
- Cancers on old branches
- Formation of proventive shoots.

Hosts

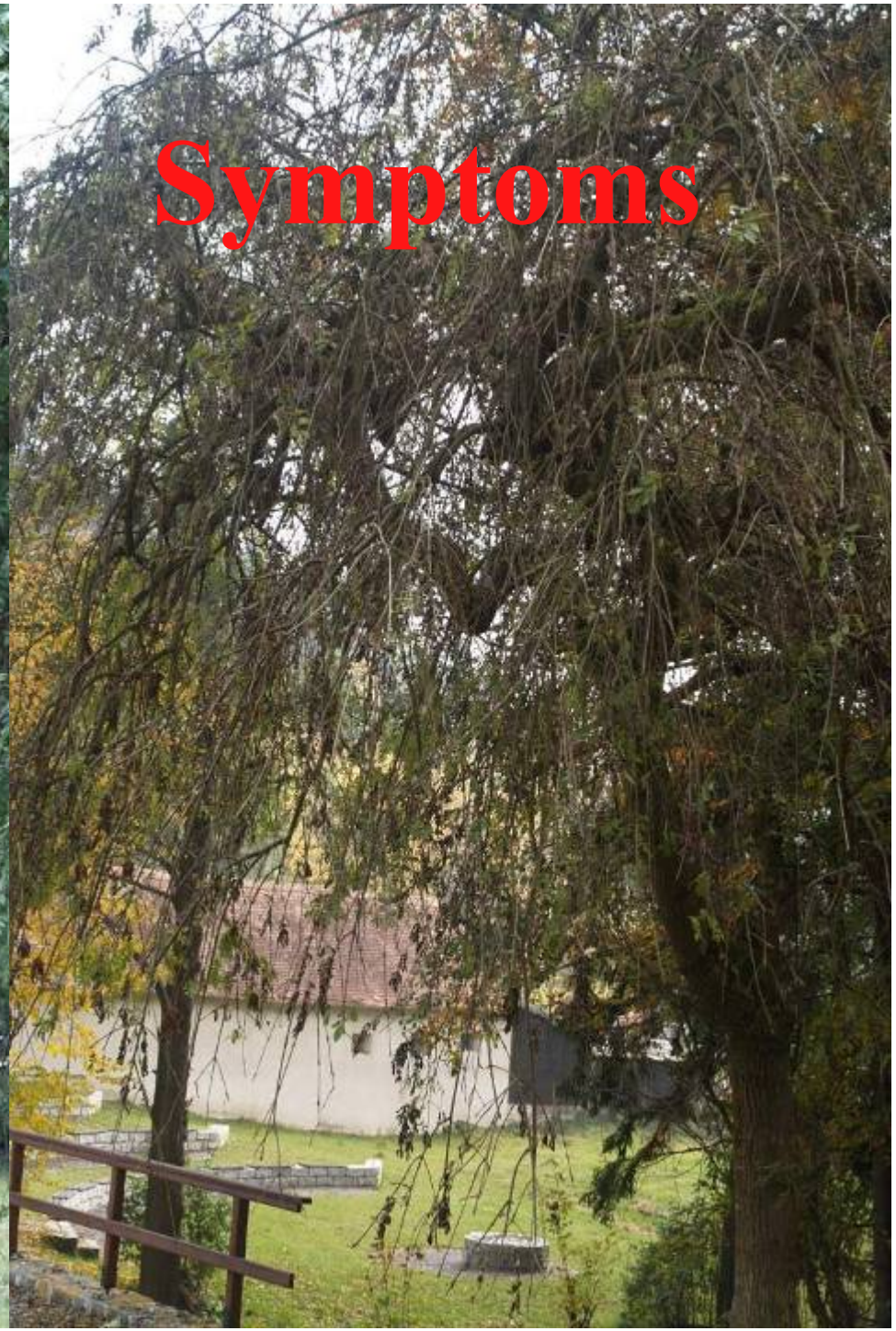
- *Fraxinus excelsior*
- *Fraxinus angustifolia*
- *Fraxinus ornus* (?)

Symptoms

Symptoms

Symptoms

Symptoms



Symptoms


Symptoms

Symptoms

Phyllactinia fraxini (DC.) Fuss

Symptomy

Symptoms

Symptoms

Symptoms

Symptoms

Symptoms



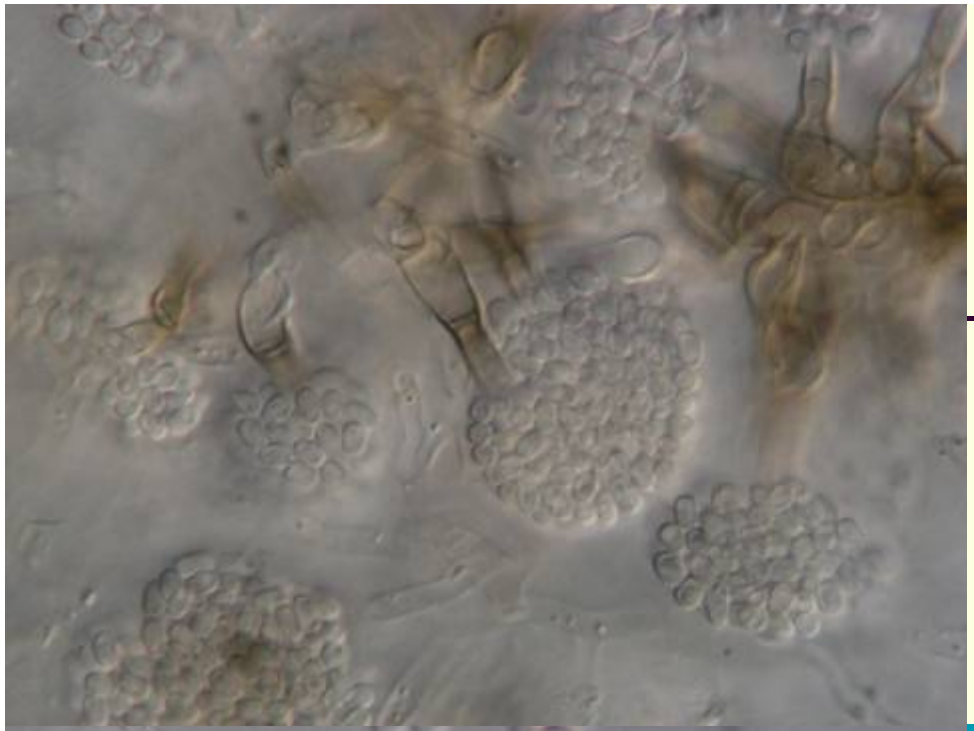




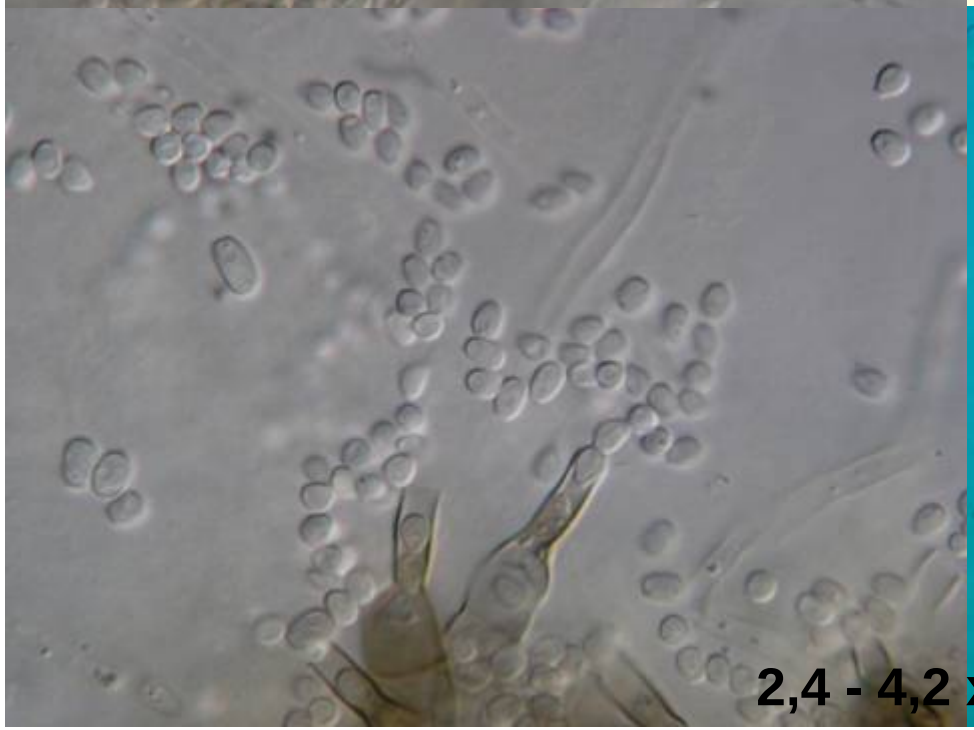
Culture of *Chalara fraxinea*

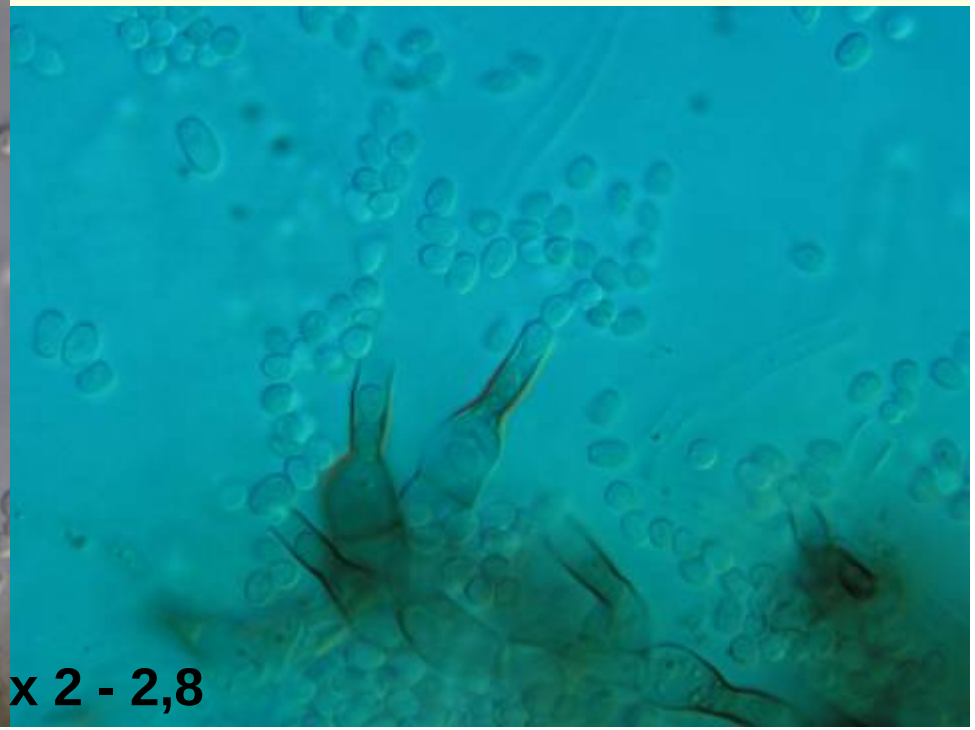
2 weeks

6 months



Conidia of *Ch. fraxinea*

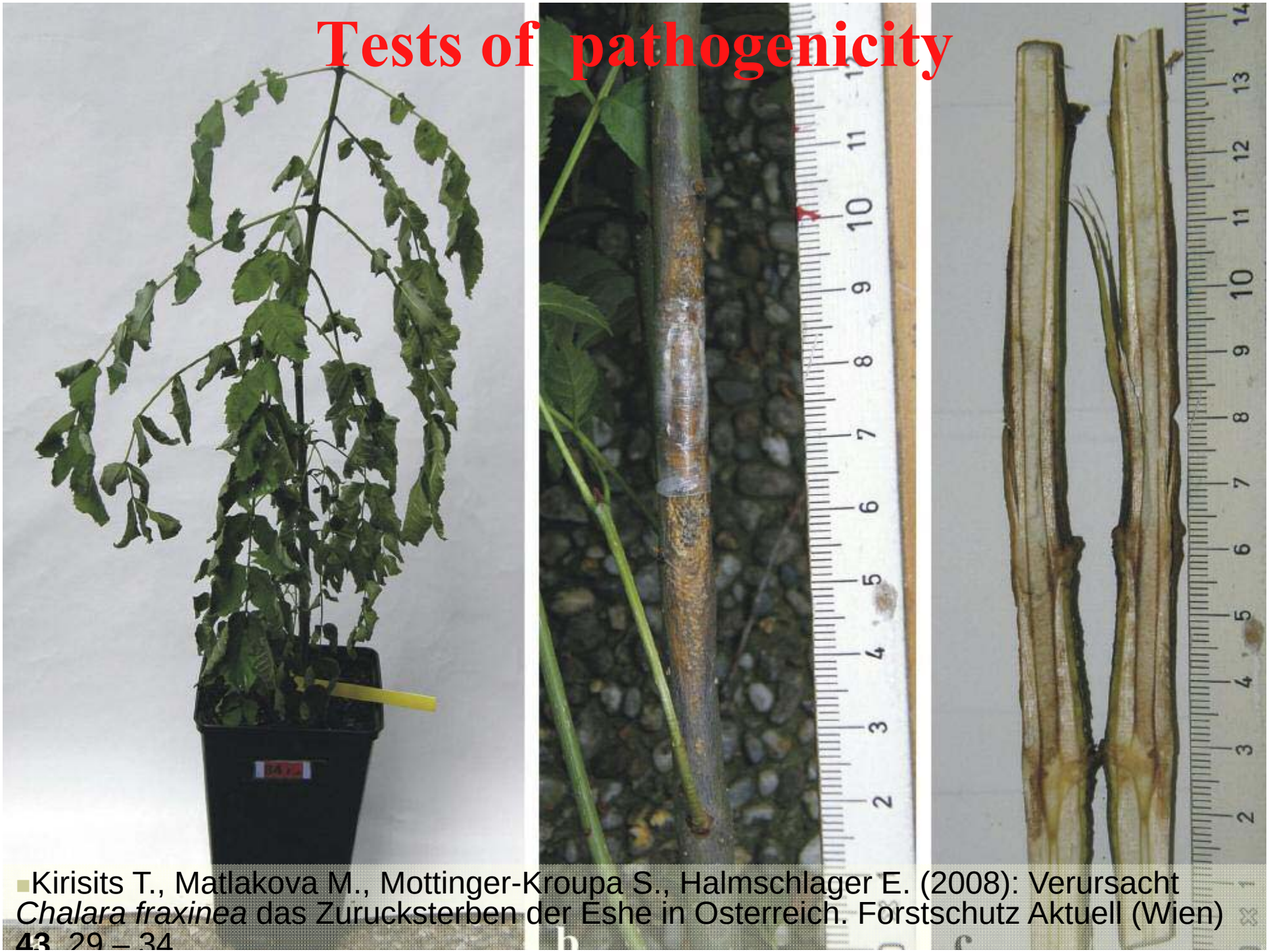




2,4 - 4,2 x 2 - 2,8

Pseudomonas savastanoi pv. fraxini

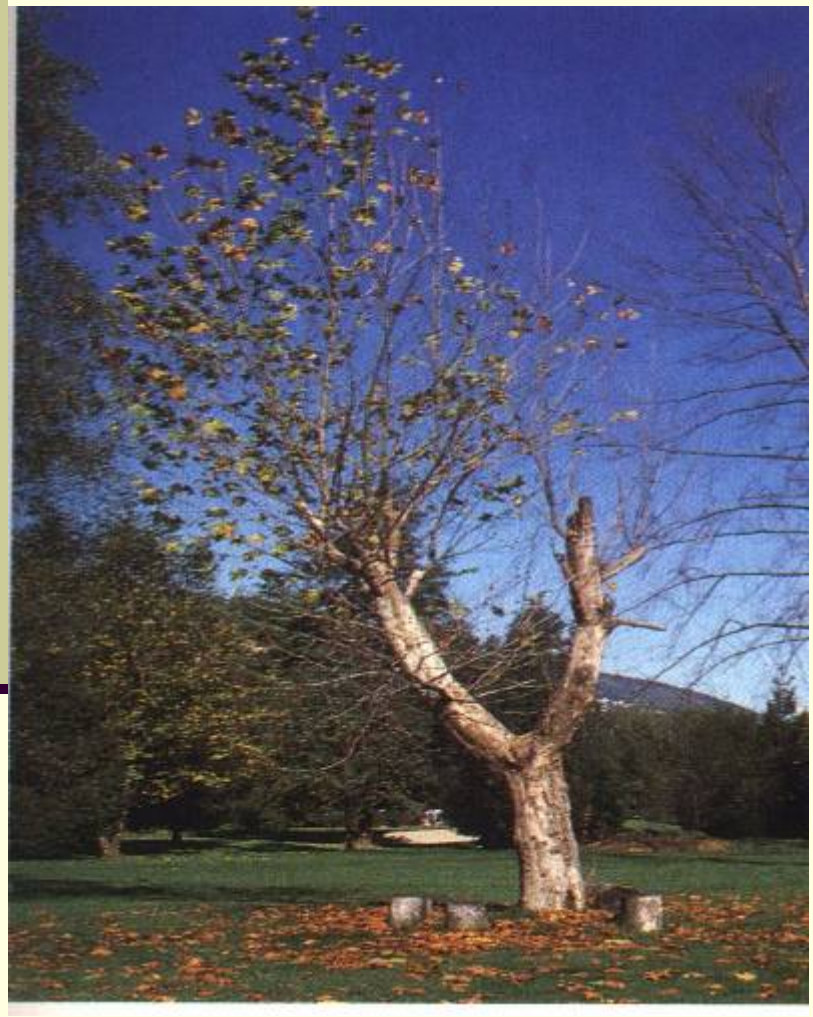
Tests of pathogenicity

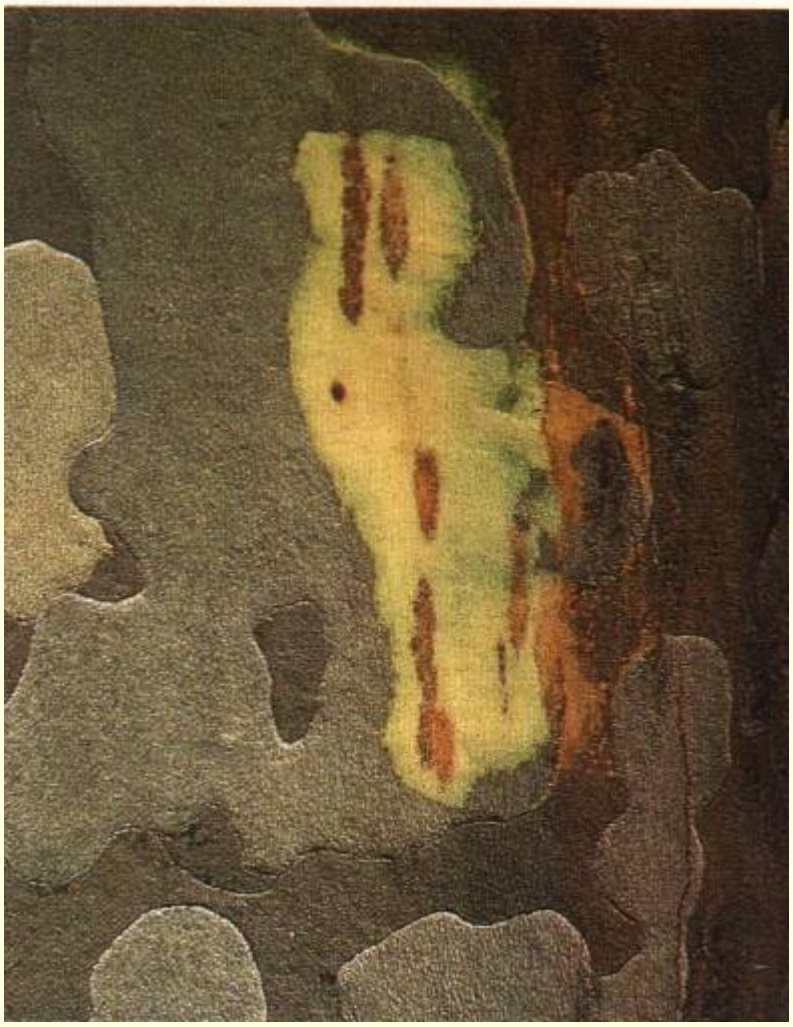


- Kirisits T., Matlakova M., Mottinger-Kroupa S., Halmschlager E. (2008): Verursacht *Chalara fraxinea* das Zurucksterben der Eshe in Osterreich. Forstschutz Aktuell (Wien) **43**, 29 – 34

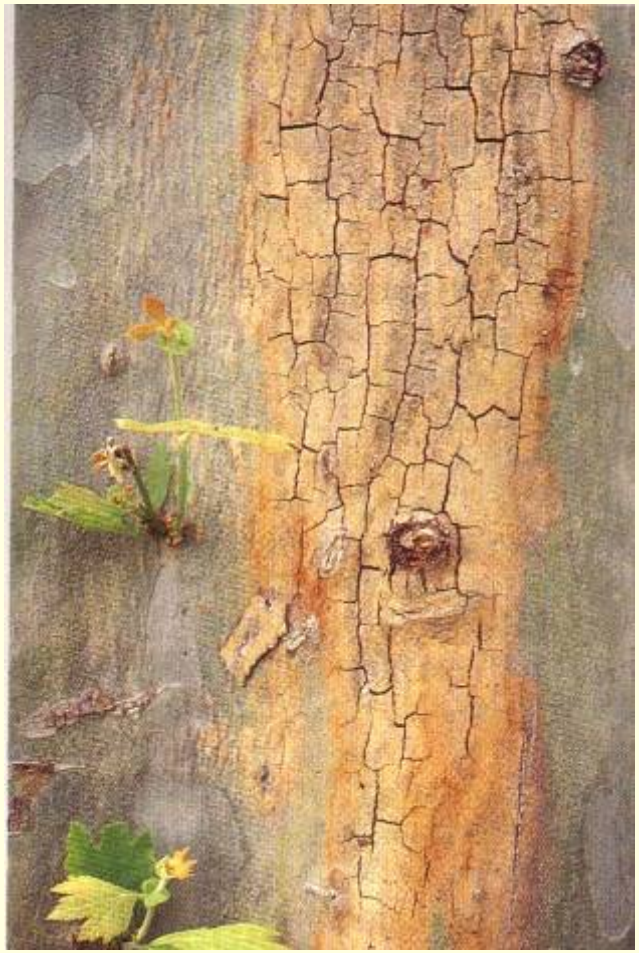
Chalara fraxinea = Hymenoscyphus albidus

Cancer stain of plain
Ceratocystis fimbriata f. sp. platani

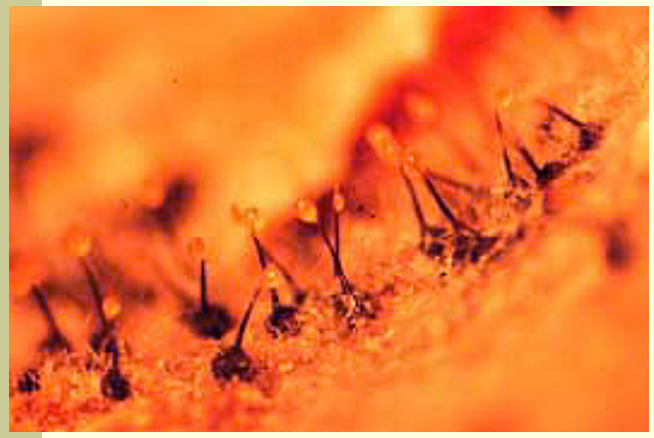




Ceratocystis fimbriata f. sp. platani



Ceratocystis fimbriata



Ceratocystis fimbriata

On family Arecaceae

Ceratocystis fimbriata

Wilting of fig – tree (Ficus)

Ceratocystis fimbriata

Wilting of mango (Mangifera indica)

Ceratocystis fimbriata

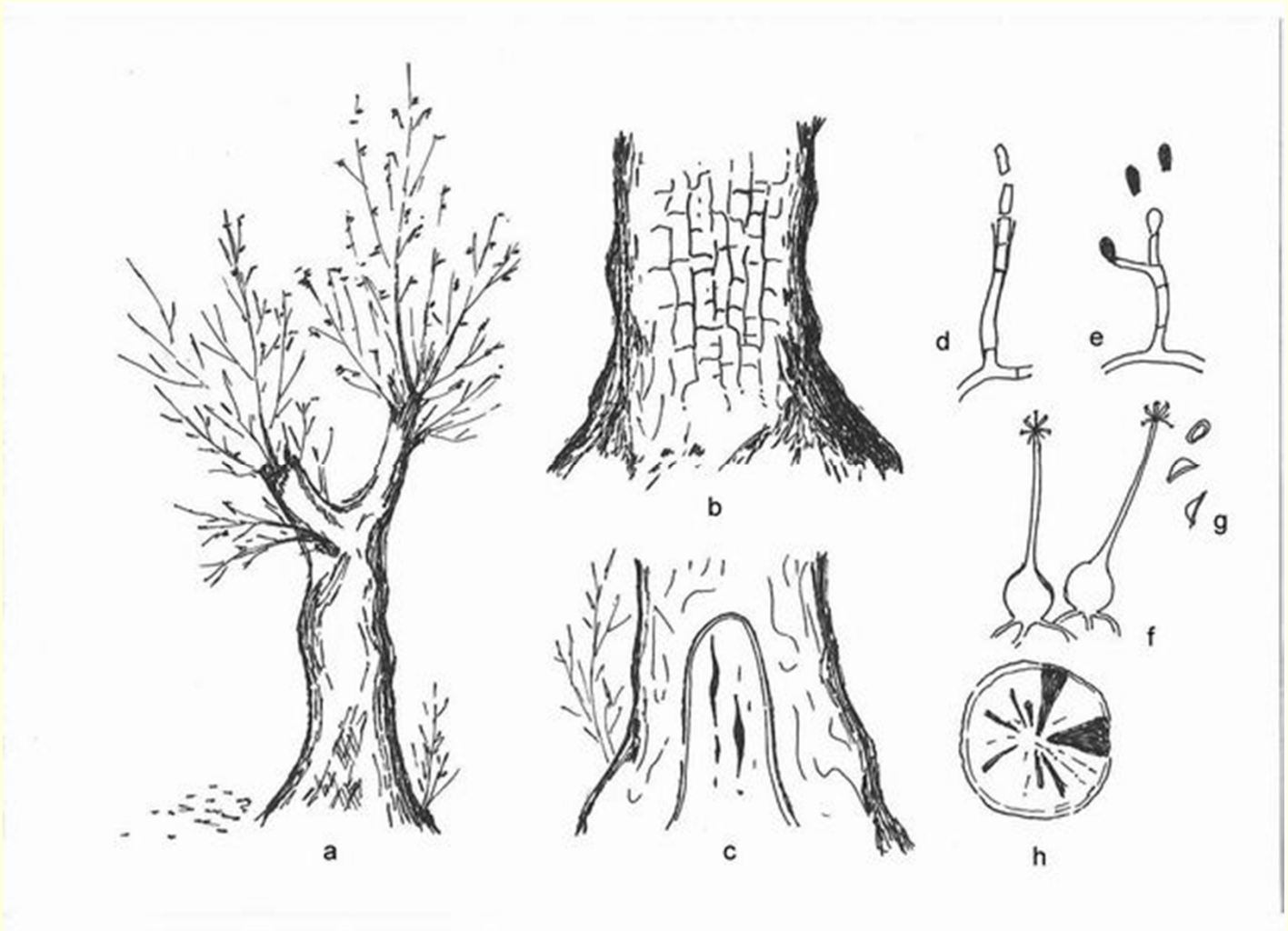
Wilting of coffee tree

Ceratocystis fimbriata

Cancer of Aspem
(Populus tremula)

Ceratocystis fimbriata f. sp. platani

Ceratocystis fimbriata f. sp. platani



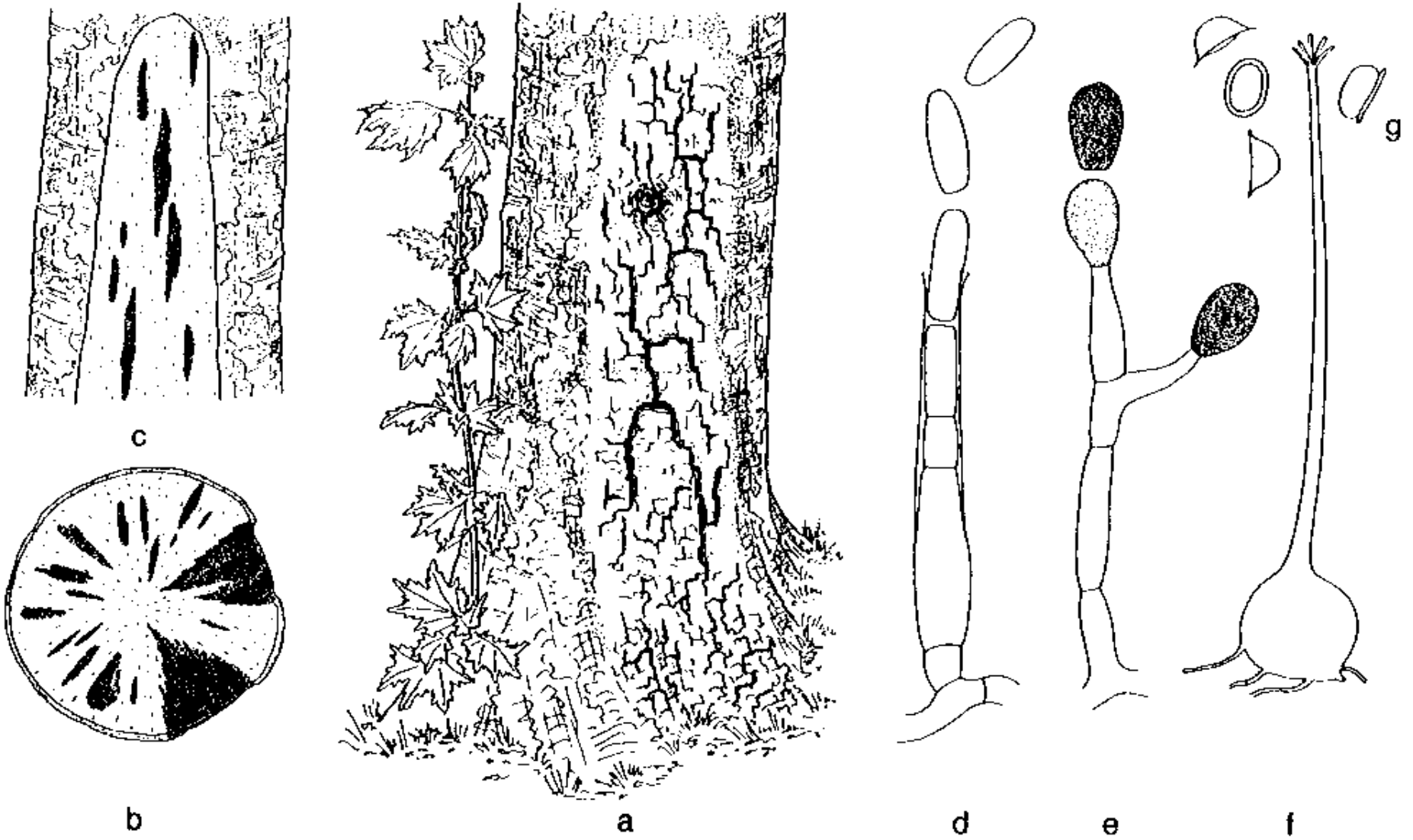


Fig. 78 *Ceratocystis fimbriata* var. *platani*. **a** symptoms on plane, **b** stem cross-section showing stained wood, **c** tangential stem section showing the stain as streaks, **d** phialide with conidia of the *Chalara* imperfect state, **e** conidiophore with chlamydospores, **f** perithecium, **g** ascospores

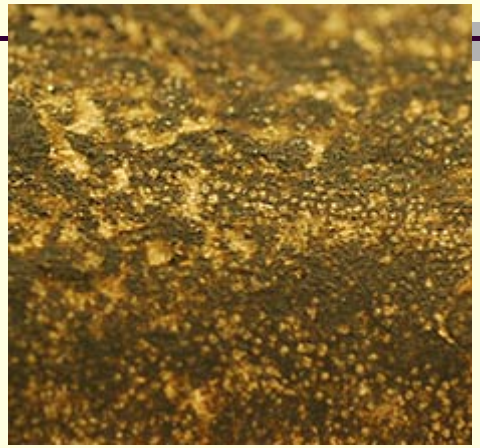
Ceratocystis fimbriata f. sp. platani

Ceratocystis fimbriata f. sp. platani

Ceratocystis fimbriata f. sp. platani

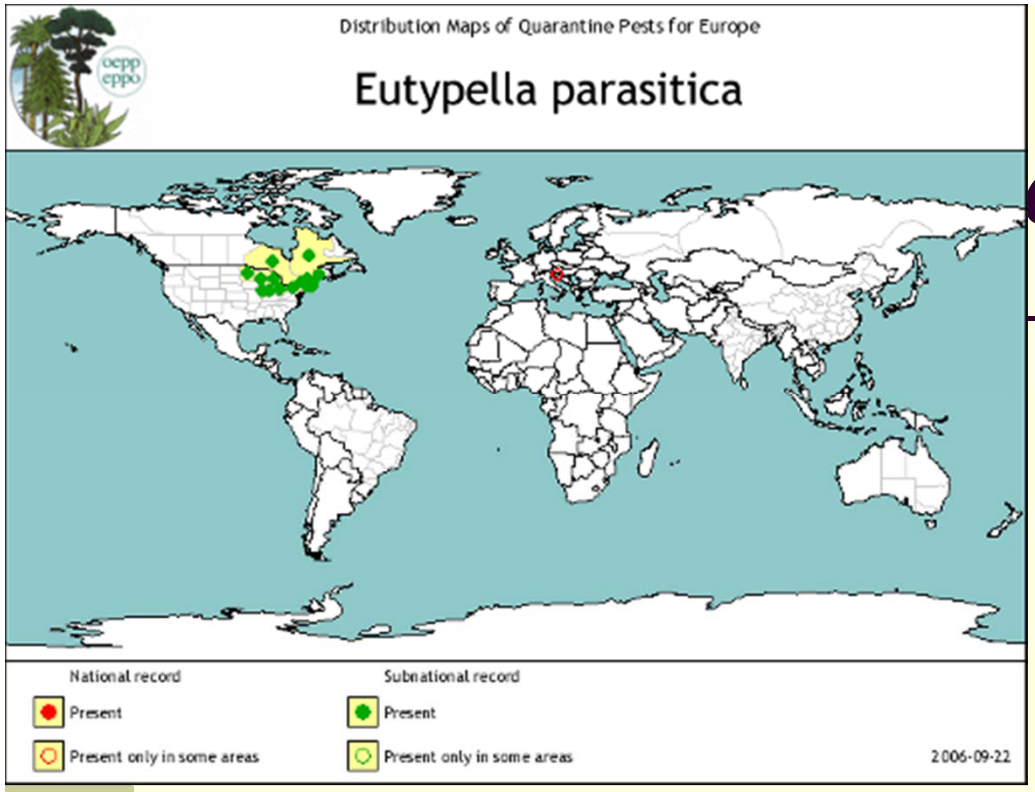
Ceratocystis fimbriata f. sp. platani

Massaria platani



Ceratocystis fimbriata f. sp. platani

treatment


Distribution Maps of Quarantine Pests for Europe
Eutypella parasitica
National record
Present
Present only in some areas
Subnational record
Present
Present only in some areas
2006-09-22

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Eutypella parasitica

Terčová rakovina – Nectria spp.

Terčová rakovina – Nectria spp.

Cryptodiaporthe populea

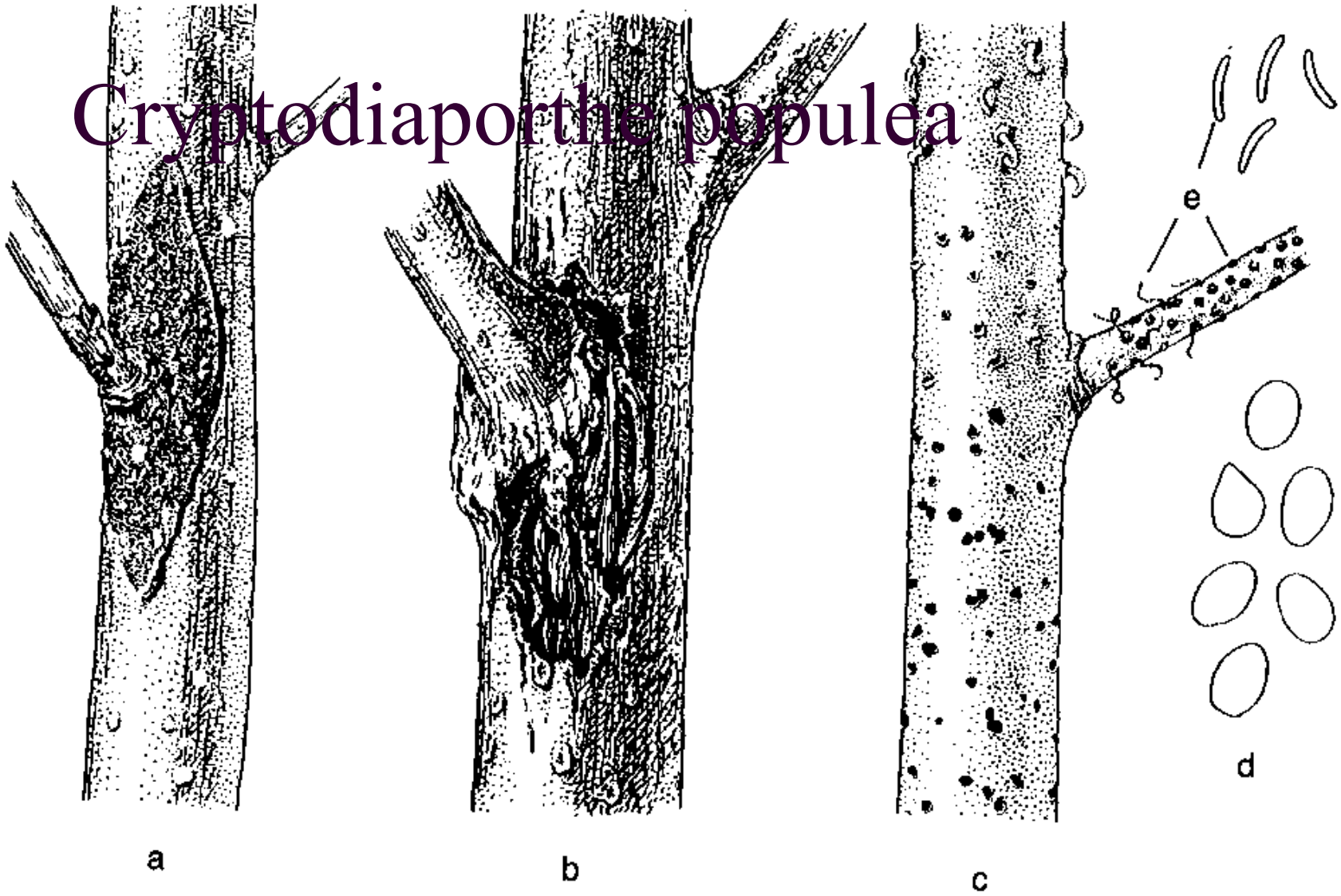


Fig. 77 *Cryptodiaporthe populea*. **a** symptoms on the stem of a young poplar, **b** advanced callusing, **c** dead poplar stem with spore tendrils (above) and empty pycnidia (below) of the imperfect state, **d** conidia; **e** pycnidia, spore tendrils and conidia of *Cytospora nivea*