Phytophthora on Betula spp. (birch)
Imprint

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**Importance of Betula spp.**

Birch is an important forest tree especially in colder climates. It is monoecious and wind-pollinated species, and it has wind-dispersed seeds. *B. pendula* Roth (silver birch) and *B. pubescens* Ehrh. (downy birch) have both wide distribution in Europe and are also found in northern parts of Asia (Hämet-Ahti *et al*., 1989, Niemistö *et al*., 2008). *B. alleghaniensis* Britton (yellow birch), *B. lenta* L. (sweet birch), *B. papyrifera* Marshall (paper birch) *B. populifolia* Marsh. (grey birch) and *B. nigra* L. (river birch) are species typical for North America (Hämet-Ahti *et al*., 1989; Verkasalo, 1990). In Scandinavia and northern Europe *B. pendula* is an important tree species for forest industry, but also used as amenity trees in parks, alleys and in gardens. *B. alleghaniensis*, *B. lenta* and *B. papyrifera* are also valuable for forest industry. Birches are cold tolerant pioneer species and in southern Europe they are found mainly on higher altitudes. Many *Betula* species such as *B. nana* L. (dwarf birch), *B. pubescens* subsp. *czerepanovii* (Orlova) Hämet-Ahti (arctic moor birch) and *B. utilis* D. Don (Himalayan birch) are typical for treeline. *B. nana* and it's subspecies are shrubs native to arctic and cool temperate regions of northern Europe, northern Asia and northern North America. They are also present in Greenland as well as in mountains in Scotland and the Alps. *B. utilis* is growing as a shrub or tree native to the the Himalayas (Hämet-Ahti *et al*., 1989, http://www.discoverlife.org).

**Phytophthora species**

The following *Phytophthora* species have been isolated directly from roots, stem or wood of birch trees with characteristic disease symptoms:

<table>
<thead>
<tr>
<th><em>Phytophthora</em> species</th>
<th>Disease symptoms</th>
<th>Betula species</th>
<th>Reference</th>
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</thead>
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<tr>
<td><em>cinnamomi</em></td>
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<td><em>B. papyrifera</em></td>
<td>Crandald, 1936</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>bleeding canker</td>
<td><em>B. lenta</em></td>
<td>Anonymous, 1941</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>bleeding canker</td>
<td><em>B. alleghaniensis</em></td>
<td>Howaward, 1942</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>stem lesions</td>
<td><em>B. pendula</em></td>
<td>Lilja <em>et al</em>., 1996</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>decline and bleeding canker</td>
<td><em>B. pendula</em></td>
<td>Thinggard &amp; Lilja pers. communication (2012)</td>
</tr>
<tr>
<td><em>cambivora</em></td>
<td>decline and dieback</td>
<td><em>B. pendula</em></td>
<td>Jung <em>et al</em>., 2009</td>
</tr>
<tr>
<td><em>gonapodyides</em></td>
<td>decline and dieback</td>
<td><em>B. pendula</em></td>
<td>Jung <em>et al</em>., 2009</td>
</tr>
<tr>
<td><em>plurivora</em></td>
<td>decline and dieback</td>
<td><em>B. pendula</em></td>
<td>Jung <em>et al</em>., 2009</td>
</tr>
<tr>
<td><em>pseudogregata</em></td>
<td>decline and dieback</td>
<td><em>B. pendula</em></td>
<td>Jung, pers. communication (2012)</td>
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<td><em>pseudosyringae</em></td>
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<td>Munda, pers. communication (2012)</td>
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<td><em>ramorum</em></td>
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<td><em>B. pendula</em></td>
<td>Webber <em>et al</em>., 2010</td>
</tr>
<tr>
<td><em>Phytophthora</em> sp.</td>
<td>canker on roots of trees showing decline and bleeding canker</td>
<td><em>B. pubescens</em></td>
<td>Thinggaard &amp; Lilja, pers. communication (2012)</td>
</tr>
<tr>
<td><em>Phytophthora</em> sp.</td>
<td>bleeding canker</td>
<td><em>Betula</em> sp.</td>
<td>Vitas <em>et al</em>., 2012</td>
</tr>
</tbody>
</table>

1 – In infection trials *B. pendula* seedlings and detached leaves of *B. alleghaniensis* were infected by *P. ramorum* (Jinek *et al*., 2011, Rytkönen *et al*., 2012).

2 – In Europe *P. ramorum* and *P. kernoviae* are regulated organisms (see chapter ‘EPPO quarantine recommendation’).

Most of these *Phytophthora* species isolated from diseased birches have a wide host range. That means it cannot be excluded that they attack other tree species in the surroundings.
Disease symptoms (see figures)

Most *Phytophthora* species attack the roots and stem base (soil-borne diseases) which makes it difficult to detect the infection. In mature trees it can take many years before symptoms become visible over the soil surface and on the upper part of the trees. First symptoms when most fine roots are dead are seen as crown transparency with small leaves and dead twigs as well as reduced fruiting, because of reduced water and mineral transport. From roots *Phytophthora* invades stems through vessels and infection can be seen as necrotic lesions, bleeding canker or/and individual spots with bleeding (tarry spots).

Few *Phytophthora* species can also attack stem and crown as well and cause symptoms there directly. In seedlings the infection by *P. cactorum* can be seen rapidly after rain as necrotic lesions on leaves, stems and branches and as top dying.

Possibility of symptom confusion

The disease symptoms presented in the previous chapter are not specific only for *Phytophthora* infection. Insects and mechanical damage and other fungi like *Anisogramma*, *Godronia*, *Phomopsis*, *Armillaria* etc. can also cause necrotic lesions and cankers. It is important to specify the cause of the disease to be able in case of *Phytophthora* infection to prevent it’s spread (see chapter “Diagnosis”).

Disease development

Disease development is very fast in seedlings, but with mature trees it can be very slow and can continue over years. *Phytophthora* species may kill the birch trees but not always. Outcome of an infection depends on the general health determined by climate, nutrient availability, competition etc. Sometimes trees can survive and even recover from the *Phytophthora* attack, but mostly secondary pathogens attack the weakened trees and destroy them.

Disease spread

The most common means of *Phytophthora* spread is through natural movement of infected plant propagules in soil and water (soil water, surface water and rivers) and movement of infested plant material and soil by human activities. Plant trade, out-planting of seedlings, movement of soil by vehicles, equipments, earthworks and recreational activities as hiking and camping are all shown to be sources of infection. Both long and short distance spread is also possible by surface water or rivers.

Diagnosis

It is not possible to identify a *Phytophthora* infection only by disease symptoms. Different diagnostic techniques based on molecular and serological methods help to identify *Phytophthora* as the cause of the tree disease. Isolation and sequencing as well as morphology of isolates help to specify the *Phytophthora* species. Detailed information on *Phytophthora* diagnosis on trees is given for example in [http://forestphytophthoras.org/key-to-species](http://forestphytophthoras.org/key-to-species), [http://www.phytophthoradb.org](http://www.phytophthoradb.org), [http://www.phytophthora-id.org](http://www.phytophthora-id.org) and in Martin et al. (2012).
What to do if trees are suspected to be infected?

Contact your responsible national authorities, for example:

**Austria:**
- Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BWF)
  Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)
  Seckendorff-Gudent-Weg 8, 1131 Vienna, Austria; [http://www.bfw.ac.at/](http://www.bfw.ac.at/)
- Österreichische Agentur für Gesundheit und Ernährungssicherheit
  Austrian Agency for Health and Food Safety, Institute for Sustainable Plant Production
  Spargelfeldstraße 191, 1220 Vienna; [http://www.ages.at](http://www.ages.at)

**Belgium:**
- Département Sciences du Vivant, Centre Wallon de Recherches Agronomiques
  Life Sciences Department, Walloon Agricultural Research Centre
  Rue de Liroux 4, B-5030 Gembloux;
  Anne CHANDELIER | a.chandelier@cra.wallonie.be
- Instituut voor Landbouw- en Visserijonderzoek (ILVO), Eenheid Plant -Gewasbescherming
  Institute for Agricultural and Fisheries Research, Plant Sciences Unit – Crop Protection - Gewas-
  bescherming
  Burg. van Gansberghelaan 96 bus 2, 9820 Merelbeke
  Kurt HEUNGENS | kurt.heungens@ilvo.vlaanderen.be

**Bulgaria:**
- Българска Агенция по безопасност на храните:
  Централна лаборатория по карантина на растенията
- Агробиоинститут, Селскостопанска Академия
  бул 8, Драган Цанков № 8, София 1164
  Biotic Stress Group, AgroBioInstitute, Agricultural Academy
  8 Dragan Tsankov Blvd., 1164 Sofia
  Славчо Славов, sbslavov@abi.bg
  Slavtcho SLAVOV | sbslavov@abi.bg

**Czech Republik:**
- Výzkumný ústav Silva Taroucy pro krajinu a okrasné zahradnictví, v.v.i
  The Silva Tarouca Research Institute for Landscape and Ornamental Gardening, Publ. Res. Insti-
  tute
  Květnové náměstí 391, Průhonice, 252 67, Praha západ
  Matěj PANEK | panek@vukoz.cz

**Denmark:**
- NaturErhvervstyrelsen, Ministeriet for Fødevarer, Landbrug og Fiskeri
  The Danish AgriFish Agency, [http://www.naturerhverv.fvm.dk](http://www.naturerhverv.fvm.dk)
- Skov & Landskab, Det Biovidenskabelige Fakultet, Københavns Universitet
  Forest and Landscape, Faculty of Science, University of Copenhagen
  [http://www.sl.life.ku.dk](http://www.sl.life.ku.dk)
Finland:
- Elintarviketurvallisuusvirasto Evira, Kasvinterveysyksikkö
  Finnish Food Safety Authority Evira, Plant Health
  Mustialankatu 3, FI-00790 Helsinki
  http://www.evira.fi/portal/fi/kasviviljely/ja_valvonta/metsanviljely/valvonta/
- Metsäntutkimuslaitos
  Finnish Forest Research Institute
  P.O. Box 18, FI-01301 Vantaa
  Anna RYTKÖNEN | anna.rytkonen@metla.fi
- Maa- ja elintarviketalouden tutkimuskeskus MTT
  Agrifood Research, MTT
  FI-31600 Jokioinen
  Päivi PARIKKA | paivi.parikka@mtt.fi.

France:
- Services Régionaux de l'Alimentation (SRAL) des Directions Régionales de l'Alimentation, de l'Agriculture et de la Forêt (DRAAF)
  Regional Plant Protection services
  http://agriculture.gouv.fr/suivi-de-la-sante-des-forets
  http://agriculture.gouv.fr/services-deconcentres
- Laboratoire de Santé végétaux, unite de Mycologie, ANSES
  French Agency for Food, Environmental and Occupational Health & Safety (ANSES)- Plant Health Laboratory, unit of mycology
  Domaine de Pixérécourt Bat E., 54220 Malzéville, France; http://www.anses.fr/PNTC01.htm;
  Nathalie SCHENCK | Nathalie.schenck@anses.fr
  Renaud IOOS | renaud.ioos@anses.fr
- Pôle interrégionaux du Département de la santé des forêts:
  Regional forest health survey organisation:
  http://agriculture.gouv.fr/departement-de-la-sante-des-forets

Germany:
- Pflanzenschutzdienstellen der Bundesländer, Adressenliste siehe:
  regional plant protection services, address list see: http://www.jki.bund.de/de/startseite/unser-service/linksammlung.html
- Julius Kühn Institut – Bundesforschungsanstalt für Kulturpflanzen (JKI), Institut für Pflanzenenschutz in Gartenbau und Forst (JKI-GF)
  Julius Kühn Institut - Federal Research Center for Cultivated Plants (JKI), Institute for Plant Protection in Horticulture and Forestry (JKI-GF)
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  Forest Research Institute, 570 06 Vassilika, Thessaloniki, Greece
  http://www.fri.gr, info@fri.gr
- Ινστιτούτο Μεσογειακών Δασικών Οικοσυστημάτων & Τεχνολογίας Δασικών Προϊόντων, Τέρμα Αλκμάνος, 115 28 Ιλίσα, Αθήνα, Ελλάς
  Institute of Mediterranean Forest Ecosystems & Forest Products Technology, Terma Alkmanos, 115 28 Ilisia, Athens, Greece
  http://fria.gr, tsop@fria.gr

Hungary:
- Megyei Kormányhivatalok Növény- és Talajvédelmi Igazgatóságai
  Regional offices of NFCSO, Directorate of Plant Protection and Soil Conservation
  http://www.nebih.gov.hu/elerhetosegek
- MTA ATK Növényvédelmi Intézet
  Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences
  Herman Ottó u. 15, H-1022 Budapest, Hungary;
  József BAKONYI | bakonyi.jozsef@agrar.mta.hu

Ireland:
- Department of Agriculture, Food and the Marine, Horticulture and Plant Health Division
  Backweston Agri-Campus, Celbridge, Co. Kildare, Ireland
  oliver.mcevoy@agriculture.gov.ie

Italy:
- COSVIR XI - Servizio fitosanitario centrale
  Italian Phytosanitary Service
  cosvir11@pec.politicheagricole.gov.it, http://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/2341
- Dipartimento per la Innovazione nei sistemi Biologici, Agroalimentari e Forestali, Università degli Studi della Tuscia
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Latvia:
- Valsts augs aizsardzības dienests
Netherlands:
National Referentie Centrum,
Nederlandse Voedsel- en Warenautoriteit (NVWA)
National Reference Centre, NPPO
Netherlands Food and Consumer Product Safety Authority
Ministry of Economic Affairs, Agriculture and Innovation
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Venche TALGØ | venche.talgo@bioforsk.no

Poland:
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Research Institute of Horticulture, Dept. of Ornamental Plant Protection
Konstytucji 3 Maja 1/3, 96-100 Skierniewice
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Portugal:
- Instituto de Conservação da Natureza e das Florestas – ICNF
  Institute for Nature Conservation and Forestry - INCF
  http://www.icnf.pt/florestas
- Direcção de Serviços de Fitossanidade e de Materiais de Multiplicação de Plantas
  Directorate of Plant Health and Materials Multiplication of Plants
  Tapada da Ajuda, 1349-018 Lisboa
dsfmmp@dgadr.pt

Romania:
Institutul de Cercetari si Amenajari Silvice - ICAS,
Forest Research and Management Institute
Statiunea Brasov; Closca 13, 500040, Brasov, Romania,
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- Институт за шумарство, Одељење за заштиту шума
  Institute of Forestry, Department of Forest Protection
  Kneza Višeslava 1
  11030 Belgrade, Serbia
  www.forest.org.rs
- Institut za nizijsko šumarstvo i životnu sredinu, Zaštita šuma
  Institute of Lowland Forestry and Environment, Forest Protection
  Antona Čehova 13, 21000 Novi Sad, Serbia
  www.ilfe.org
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Switzerland:
Eidg. Forschungsanstalt für Wald, Schnee und Landschaft (WSL)
Competence Center of Forest Protection (WSL)
http://www.wsl.ch/dienstleistungen/waldschutz/index_EN

Turkey:
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Management and control

For direct control (with chemicals) contact your national authorities (see chapter list above). If feasible, the following measures might help to prevent infection and to keep the trees healthy: prevent stagnant moisture and support optimum nutrition and soil aeration. Twig and branch cutting should not be done in wet periods to enable a quick drying of the wound and a quick periderm development. Injury of the stem, for example by mechanical weed control should be avoided. *Phytophthora* species invade plant tissue actively especially roots but any kind of wounds increases invasion potential. Outplanting material should be healthy to avoid introduction of new *Phytophthora* species to natural environments. Avoid seedlings imported over long distances.

**EPPO quarantine recommendation**

The European and Mediterranean Plant Protection Organisation (EPPO) consider *P. kernoviae* and *P. ramorum* as dangerous organisms. Both are listed on the EPPO Alert List and are regulated. For details see [http://www.eppo.int/QUARANTINE/Alert_List/alert_list.htm](http://www.eppo.int/QUARANTINE/Alert_List/alert_list.htm).

**Literature used**


**Links to further information**

*Phytophthora* in the Forests: [http://forestphytophthoras.org/](http://forestphytophthoras.org/)


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Disease symptoms of *Phytophthora* on *Betula* (birch)

**Disease symptoms on Betula pendula (silver birch) caused by *P. cactorum***

*Left:* Increased crown transparency (3)
*Center:* Top dying of seedling (2)
*Right:* Necrotic stem lesions on seedling (2)

**Examples for bleeding canker on**

*Left:* Betula pendula (silver birch) caused by *P. cactorum* (3)
*Center:* Betula pubescens (downy birch) caused by *P. spec.* (3)
*Right:* Betula utilis (Himalayan birch) caused by *P. spec.* (1)

**Examples for cambium necrosis on stem and root base of Betula pubescens (downy birch) caused by *P. spec.* (3)**

Photos: (1) – A. MUNDA; (2) – A. LILJA; (3) – K. THINGGAARD