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. The genus contains more than 60 taxa including trees and shrubs. 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>Phytophthora species</th>
<th>Disease symptoms</th>
<th>Betula species</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>cinnamomi</em></td>
<td>root rot</td>
<td>B. <em>papyrifera</em></td>
<td>Crandall, 1936</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>bleeding canker</td>
<td>B. <em>lenta</em></td>
<td>Anonymous, 1941</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>bleeding canker</td>
<td>B. <em>alleghaniensis</em></td>
<td>Howaward, 1942</td>
</tr>
<tr>
<td><em>cactorum</em></td>
<td>stem lesions</td>
<td>B. <em>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>B. <em>pendula</em></td>
<td>Thinggaard &amp; Lilja, pers. comm. 2012</td>
</tr>
<tr>
<td><em>cambivora</em></td>
<td>decline and dieback</td>
<td>B. <em>pendula</em></td>
<td>Jung <em>et al.</em>, 2009</td>
</tr>
<tr>
<td><em>gonapodyides</em></td>
<td>decline and dieback</td>
<td>B. <em>pendula</em></td>
<td>Jung <em>et al.</em>, 2009</td>
</tr>
<tr>
<td><em>plurivora</em></td>
<td>decline and dieback</td>
<td>B. <em>pendula</em></td>
<td>Jung <em>et al.</em>, 2009</td>
</tr>
<tr>
<td><em>pseudogregata</em></td>
<td>decline and dieback</td>
<td>B. <em>pendula</em></td>
<td>Jung, pers. comm. 2012</td>
</tr>
<tr>
<td><em>pseudosyringae</em></td>
<td>bleeding canker</td>
<td>B. <em>utilis</em></td>
<td>Munda, pers. comm. 2012</td>
</tr>
<tr>
<td><em>ramorum</em> 1,2</td>
<td>bleeding canker</td>
<td>B. <em>pendula</em></td>
<td>Webber <em>et al.</em>, 2010</td>
</tr>
<tr>
<td><strong>Phytophthora sp.</strong></td>
<td>canker on roots of trees showing decline and bleeding canker</td>
<td>B. <em>pubescens</em></td>
<td>Thinggaard &amp; Lilja, pers. comm. 2012</td>
</tr>
<tr>
<td><strong>Phytophthora sp.</strong></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. *allegheniensis* were infected by *P. ramorum* (Jinek *et al.*, 2011; Rytkönen *et al.*, 2012).
2 – in the European Union *P. ramorum* is a regulated organism (see chapter ‘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 vehichles, equipments, earthworks and recreational activities as hicking 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://www.phytophthoradb.org, http://www.phytophthora-id.org and in Martin et al. (2012).

Please contact your national authorities (see next chapter) for help with diagnosis.
What to do in case 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 безопастност 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. Institute
  Květnové náměstí 391, Průhonice, 252 67, Praha západ
  Matěj PANEK | panek@vukoz.cz

**Denmark:**
- NaturErhvervstryrelsen, Ministeriet for Fødevarer, Landbrug og Fiskeri
  The Danish AgriFish Agency, [http://www.naturerhverv.fvm.dk](http://www.naturerhverv.fvm.dk)
- Institut for Geovidenskab og Naturforvaltning, Det Natur- og Biovidenskabelige Fakultet,
  Københavns Universitet
  Department of Geosciences and Natural Resource Management, Faculty of Science, University of
  Copenhagen | [www.ign.ku.dk](http://www.ign.ku.dk)
Finland:
- Elintarviketurvallisuusvirasto Evira, Kasvinterveysyksikkö
  Finnish Food Safety Authority Evira, Plant Health Mustialankatu 3, FI-00790 Helsinki
  http://www.evira.fi/portal/fi/kasvit/viljely JA_tuotanto/metsanviljely/valvonta/
- Metsäntutkimuslaitos
  Finnish Forest Research Institute
  PO. Box 18, FI-01301 Vantaa
  Anna RYTKÖNEN | anna.rytkonen@metla.fi
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  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 Pflanzenschutz in Gartenbau und Forst (JKI-GF)
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  Forest Research Institute, 570 06 Vassilika, Thessaloniki, Greece
  http://www.fri.gr, Στέφανος ΔΙΑΜΑΝΤΗΣ | info@fri.gr
- Ινστιτούτο Μεσογειακών Δασικών Οικοσυστημάτων & Τεχνολογίας Δασικών Προϊόντων, Τέρμα Αλκμάνος, 115 28 Ιλίσια, Αθήνα, Ελλάς
  Institute of Mediterranean Forest Ecosystems & Forest Products Technology, Terma Alkmans, 115 28 Ilissia, Athens, Greece
  http://www.fria.gr, Παναγιώτης ΤΣΟΠΕΛΑΣ | tsop@fria.gr
- Γεωπονικό Πανεπιστήμιο Αθηνών, Εργαστήριο Φυτοπαθολογίας, Ιερά Οδός 75, 11855 Αθήνα
  Agricultural University of Athens, Laboratory of Plant Pathology, Iera Odos 75, 11855 Athens, Greece
  http://www.aua.gr/index.php, Επαμεινώνδας ΠΑΠΛΩΜΑΤΑ | epaplom@aua.gr
- Benaki Phytopathological Institute, 8 Stefanou Delta Street, Kifissia, Athens, 14561
  http://www.bpi.gr, Ελένη ΒΛΟΥΤΟΓΛΟΥ | j.vloutoglou@bpi.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;
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- Department of Agriculture, Food and the Marine, Horticulture and Plant Health Division
  Backweston Agri-Campus, Celbridge, Co. Kildare, Ireland
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- COSVIR XI - Servizio fitosanitario centrale
  Italian Phytosanitary Service
  cosvir11@pec.politicheagricole.gov.it, http://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPage/2341
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National Reference Centre, NPPO
Netherlands Food and Consumer Product Safety Authority
Ministry of Economic Affairs, Agriculture and Innovation Postbus 9102, 6700 Hc Wageningen,
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  11030 Belgrade, Serbia www.forest.org.rs
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  Institute of Lowland Forestry and Environment, Forest Protection Antona Čehova 13,
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  www.ilfe.org

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  Competence Center of Forest Protection (WSL)
  http://www.wsl.ch/dienstleistungen/waldschutz/index_EN

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- Çankırı Karatekin Üniversitesi, Fen Fakültesi, Biyoloji Bölümü, Çankırı, Türkiye
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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.

Quarantine recommendation

The European and Mediterranean Plant Protection Organization (EPPO) considers *P. ramorum* to be a dangerous organism. It is listed on the EPPO Alert List. For details see [http://www.eppo.int/QUARANTINE/Alert_List/alert_list.htm](http://www.eppo.int/QUARANTINE/Alert_List/alert_list.htm).

In the European Union *P. ramorum* is a regulated organism according to the Commission Decision 2002/757/EU.
Literatur 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 crown of *Betula pubescens* (downy birch) caused by *P. spec.* (3)

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