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Data Sheets on Quarantine Pests

Cryphonectria parasitica

IDENTITY

Name: *Cryphonectria parasitica* (Murrill) Barr
Synonyms: *Endothia parasitica* (Murrill) P.J. & H.W. Anderson
Taxonomic position: Fungi: Ascomycetes: Diaporthales
Common names: Chestnut blight or canker (English)
Chancre de l'écorce du châtaignier (French)
Kastanienkrebs (German)
Chancro del castaño (Spanish)
Bayer computer code: ENDOPA
EPPO A2 list: No. 69
EU Annex designation: II/A2

HOSTS

Chestnuts (*Castanea* spp.), particularly *C. dentata*; *C. mollissima* shows resistance but may also become infected (Headland *et al*., 1976). Also *Quercus* spp., *Castanopsis*, *Acer*, *Rhus typhina* and *Carya ovata*.

Within the EPPO region, *Castanea* spp. (especially *C. sativa*) are the main hosts.

GEOGRAPHICAL DISTRIBUTION

C. parasitica was introduced into North America from the Far East at the end of the nineteenth century and spread within the next five decades throughout all the main chestnut areas. In 1938, the pathogen was first discovered in Europe as an isolated focus near Genova, Italy. Once again, the fungus spread very rapidly and at the end of the 1960s most parts of southern Europe where chestnuts are cultivated were affected by the pathogen.
EPPO region: Austria, Belgium, Bosnia-Herzegovina, Croatia, France, Germany, Greece, Hungary, Italy, Macedonia, Poland, Portugal, Russia (Black Sea coast (widespread), Caucasus), Slovakia, Slovenia, Spain, Switzerland, Tunisia, Turkey, Ukraine, Yugoslavia.
Asia: China, Georgia, India (Uttar Pradesh), Japan (Honshu), Korea Democratic People's Republic, Korea Republic, Taiwan, Turkey.
Africa: Tunisia.
North America: Canada (British Columbia, Ontario), USA (widespread).
EU: Present.
Distribution map: See IMI (1994, No. 66).

BIOLOGY

Conidia and ascospores of *C. parasitica* are spread in wind and rain, but are also transmitted by beetles (*Agrilus* spp.) and birds. Entry into wood is via wounds produced by the insect vectors. Spread within the host is rapid unless cankers form which temporarily restrict the fungus. The fungus can exist as a saprobe on broad-leaved trees beyond its parasitic host range. Fan-shaped, buff-coloured mycelial wefts form in the inner bark and cambium. Reddish perithecia are produced in groups. Long, coiled tendrils of conidia exude from pycnidia in wet weather. For additional information see Anderson & Rankin (1914), Boyce (1961), Darpoux *et al.* (1975).

Mycelium can live for up to 10 months in dried bark (Hepting, 1974). On fruits, the fungus is associated only with the nutshell and apparently does not affect seed germination or seedling growth (Jaynes & DePalma, 1984).

Although insect vectors are not thought to play a very important role in the transmission of the disease, it is noteworthy that chestnut blight cankers have a very large and diverse fauna. In trapping experiments in the USA, 495 insect species were captured on old blight cankers. A considerable number of insects spent parts of their life cycle on cankers and nearly 69 species were found to carry inoculum of *C. parasitica* (Russin *et al.*, 1984).

DETECTION AND IDENTIFICATION

Symptoms

Cankers may enlarge so rapidly that the stem becomes girdled without callus formation. Callusing may occur, as a healing phenomenon, temporarily limiting fungal spread. Regions above the point of invasion die; the leaves wilt and turn brown but remain hanging on the tree. At this stage, chestnut blight is easily confused with ink disease (caused by *Phytophthora cambivora*). However, *C. parasitica* causes a definite canker or dead patch on the stem or trunk, below which the branches have healthy foliage; after a short time, adventitious shoot production is stimulated on the stem below this dead patch. With ink disease, on the other hand, the tree will be found to be dead down to ground level and below.

On young, smooth-barked branches, blight-infected patches are bright brown, in contrast to the olive-green colour of normal bark. On older stem infections, the discoloration is less obvious. When the cambium is killed rapidly a sunken area results, but where disease progress is slower new layers of bark form under the affected areas and there is a certain amount of swelling and subsequent cracking of the outer bark. Masses of yellow-orange to reddish-brown pustules, the size of a pin-head, develop on infected bark and exude long orange-yellow tendrils of spores in moist weather. Characteristic pale-brown mycelial fans form in the inner bark and may be exposed by cutting away the outer bark. For more information see Anderson & Rankin (1914), Boyce (1961), Darpoux *et al.* (1975).

Morphology

Perithecia in clusters of 10-20. Ascospores hyaline, two-celled, constricted at the septum, 10 x 4 µm. Conidia exuded in yellowish tendrils, straight or slightly curved, hyaline, 2-3 x 1 µm.

MEANS OF MOVEMENT AND DISPERSAL

In international trade, the fungus may be carried by host plants, or on wood or bark. There is a small risk of transmission by fruits or seeds.

PEST SIGNIFICANCE

Economic impact

Between 1904 and 1950, *C. parasitica* caused almost complete destruction of *Castanea dentata* in the eastern USA (Hepting, 1974). There has also been extensive spread on *C. sativa* in Europe from Italy since 1938. However, there is evidence that the pathogen is behaving less virulently in Europe than in the USA; new and healthy coppice shoots arising from stumps originally attacked indicate recovery from the disease. This has been explained by the occurrence in Europe of hypovirulent strains which are vegetatively compatible with virulent strains.

Strains of *C. parasitica* may show vegetative incompatibility, i.e. they may not form hyphal anastomoses (Anagnostakis, 1977). Hypovirulent strains have lost their ability to cross wound periderm before suberization (Grente, 1981). Hypovirulence can be transmitted by hyphal anastomosis to virulent strains of the same vegetative compatibility group (Anagnostakis & Waggoner, 1981). In Europe, relatively few compatibility groups of *C. parasitica* have been observed, thus leading to a wide distribution of single compatibility groups which favours the spread of hypovirulence. In the USA the situation is reversed. There, over 70 compatibility groups have been identified, limiting the distribution of hypovirulent strains.

The fungus is indigenous on species of *Castanea* in China and Japan, where it does little harm.

Control

The use of hypovirulent strains offers some prospect for control (Grente, 1971; Jaynes, 1976). The application of a hypovirulent strain around developing lesions may enable these lesions to recover and can convert the virulent strain into a hypovirulent strain (Grente, 1981). The method has been widely applied in France and Italy.

Considerable progress has been made in the USA towards breeding disease-resistant hybrid chestnuts by making use of the more resistant Asian species. In Switzerland, an extensive selection programme was started in the 1950s to select blight-resistant chestnut cultivars. After over 30 years of research, several clones were found which showed some degree of resistance, but the differences between resistant and susceptible chestnuts seem to be subtle (Bazzigher & Miller, 1991). No tree has been produced which could be planted with confidence to replace present chestnut stands, and it appears unlikely that such replacement is a practical possibility.

Since *C. parasitica* may be transmitted by grafting, the use of wax and fungicides to protect grafts has been investigated (Turchetti *et al.*, 1981).

Phytosanitary risk

C. parasitica is an A2 quarantine organism for EPPO (OEPP/EPPO, 1982), and is also of quarantine significance for NAPPO and IAPSC.

Spread of *C. parasitica* from the southern part of the EPPO region into more northern areas could cause considerable losses. Since the occurrence of relatively low strain variability has limited the losses in infected areas, the introduction of new strains might disturb the European balance between virulent and hypovirulent strains and could have a devastating effect on the remaining chestnut areas of southern Europe.

PHYTOSANITARY MEASURES

EPPO recommends (OEPP/EPPO, 1990) that wood of *Castanea* or *Quercus* from countries where *C. parasitica* occurs should be debarked or come from an area where the disease does not occur. Plants for planting should come from areas considered free from *C. parasitica* and where the disease did not occur during the last growing season. Disinfection in a 5% solution of 40% formaldehyde and a 5% solution of Na-pentachlorphenolate for 5 min should kill the fungus on wood. According to the EPPO specific quarantine requirements, seeds of *Castanea* from countries where the disease occurs should have been treated. Janezic (1964) proposes soaking fruits for 30 min in a 1-2% solution of formaldehyde. However, the EPPO panel on quarantine treatments has recently queried whether such treatments should be required and decided not to prepare an EPPO-approved quarantine procedure for this purpose.

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