

Mini data sheet on Thousand cankers disease (*Geosmithia morbida* and *Pityophthorus juglandis*)

Geosmithia morbida and *Pityophthorus juglandis* were added to the EPP0 A2 List in 2015. A full datasheet will be prepared, in the meantime you can view here the data which was previously available from the EPP0 Alert List (added to the EPP0 Alert List in 2014-deleted in 2015).

Thousand cankers disease (*Geosmithia morbida* and *Pityophthorus juglandis*)

Why: In the USA, widespread branch dieback and mortality of *Juglans nigra* (black walnut) has been occurring since the mid-1990s. In 2008, this mortality was determined to be the result of a combination of feeding damage by *Pityophthorus juglandis* (Coleoptera: Scolytidae - walnut twig beetle), and subsequent canker development around beetle galleries caused by a newly described fungal symbiont of the beetle, *Geosmithia morbida*. As the number of cankers formed on branches and trunks is very high, the disease has been called thousand cankers. In the USA, this disease is now widespread in the Western states causing extensive tree mortality on *J. nigra* (and to a lesser extent on some other *Juglans* species), and has also established in several states in the Eastern part of the USA where *J. nigra* is a native species. At the end of 2013, thousand cankers disease was reported for the first time in Italy on a small number of *J. nigra* trees. Considering the risk that this disease may present for walnut trees (*Juglans* spp.) which are widely grown in the EPP0 region, the Secretariat decided to add *G. morbida* and its vector, *P. juglandis*, to the EPP0 Alert List.

Where: Until its recent introduction into Italy, thousand cankers disease was only recorded in the USA. *G. morbida* is a recently described fungal species and it is not known whether it is native to North America. The vector, *P. juglandis*, is considered to be native from Western USA, but its spread to Eastern USA probably started a few decades ago. The distribution below is given for the pathogen. The distribution of the insect vector, *P. juglandis*, is the same with the addition of Mexico (in this country, *P. juglandis* is reported to occur but not *G. morbida*) and of Lombardia region in Italy (in this region, *P. juglandis* was caught in a trap in July 2014 but *G. morbida* was not found).

EPP0 region: Italy (Veneto region). In September 2013, both *G. morbida* and *P. juglandis* were detected on *J. nigra* trees of different ages (80-years old trees in a garden, and 15-years old trees in a nearby walnut plantation for timber production). Under eradication.

North America: Mexico (insect vector but not *G. morbida*), USA (Arizona, California, Colorado, Idaho, Nevada, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Utah, Virginia, Washington).

On which plants: *Juglans nigra* (black walnut) is the most severely affected host plant in the USA. The disease has also been observed on *J. californica* (Southern California black walnut), *J. hindsii* (Northern California black walnut), *Juglans* hybrids (e.g. *J. hindsii* x *J. regia*), and occasionally on *J. cinerea* (butternut). On *J. major* (Arizona walnut), *G. morbida* causes small, superficial cankers but no extensive dieback. Finally, *J. regia* (English walnut) has exhibited symptoms only in rare cases. Susceptibility studies carried out in the USA have shown that all tested walnut species (*J. ailantifolia*, *J. californica*, *J. cinerea*, *J. hindsii*, *J. major*, *J. mandshurica*, *J. microcarpa*, *J. nigra*, *J. regia*) were susceptible but at different levels. In these experiments, *J. nigra* was the most susceptible species, and results obtained for other *Juglans* spp. corroborated many of the field observations made so far in the USA. In these experiments, inoculated *J. regia* developed cankers but susceptibility varied between experiments.

Historically, *P. juglandis* was mainly reported on *J. major* in Arizona and New Mexico where it was considered as a minor pest. Observations in Arizona and New Mexico suggested that *P. juglandis* restricts its damage primarily to shaded or weakened branches and twigs in the upper crown. However, the expansion of the beetle's range to *J. regia* planted in urban

landscapes in the Western USA (i.e. outside the native range of *J. regia*) appears to have taken place during the last 20 years. On *J. nigra*, the beetle activity seems to be more aggressive than on native Western American walnuts (e.g. *J. major*).

Damage: Affected trees initially exhibit yellowing and wilting of the foliage followed by progressive branch dieback and crown thinning. Close examination of the bark surface shows pin-hole sized entrance and exit holes of *P. juglandis* adults. Dark wet cankers are often found near these holes. When removing the bark of the cankered areas, several beetle feeding or reproductive galleries, as well as areas of necrotic phloem tissue can be observed. As the beetle and pathogen spread, new cankers form and coalesce, girdling branches. As the upper branches die, the crown of the tree also dies and the tree often re-sprout branches from the trunk. Cankers caused by *G. morbida* are small, but repeated feeding and egg laying by *P. juglandis* beetles on the same tree result in the production of a very high number of cankers (hence the name of the disease) which girdle and kill branches, and ultimately the whole tree. Trees can be killed within 3-4 years of the onset of symptoms.

Adult beetles of *P. juglandis* are small (1.8-2 mm long), reddish-brown in colour. In California, *P. juglandis* has 2 to 3 generations per year. Adults emerge for an initial flight period in April/May followed by a longer second generation flight period from mid-July to mid-September. After flying, male beetles initiate brood galleries on branches often near leaf scars or lenticels. Males produce a pheromone and attract 2 to 3 females which then attract additional beetles to the tree. Females lay eggs in horizontal galleries (across the grain) that are constructed in the phloem and xylem. Small, white, C-shaped larvae hatch and create feeding mines that extend from the egg galleries (usually vertically, along the grain). These galleries are contained in the phloem and filled with dark brown to black boring dust. Larvae complete their development inside the galleries and pupate within a single pupal chamber. Adults emerge and either remain on the same tree or fly to other trees to mate and reproduce. It is thought that beetles inoculate *G. morbida* into the phloem during the construction of feeding or reproductive galleries. Dead tissue is limited to the phloem and cambium and the fungus does not penetrate woody tissues and does not infect the tree systemically.

Extensive tree mortality has been observed in the USA, mainly on *J. nigra* trees planted in urban environments, and is the result of the combined action of the two organisms. The insect or the fungus alone are not considered to be able to provoke tree mortality.

Transmission: Thousand cankers disease appears to be exclusively transmitted by *P. juglandis*. In the natural environment, although *G. morbida* produces large number of conidia that could be airborne, there is no direct evidence that infection occurs anywhere on trees except at *P. juglandis* feeding sites or inside/around galleries. In the literature, it is recorded that *P. juglandis* can fly over distances of 1 to 2 miles (1.6 to 3.2 km). Over longer distances, the disease can be spread by the movement of wood, including logs, sawn wood, firewood, wood chips and wood packaging material. Movement of infested plants for planting can also spread the disease. As *P. juglandis* is reported to be often found on branches with diameters as small as 1 cm, the movement of young nursery plants may be a pathway. Nuts are not considered as a potential pathway, as the fungus does not colonize trees in a systemic way and beetles do not feed on them.

Pathway: Wood and bark (including logs, firewood, sawn wood), wood chips, wood packaging material, plants for planting of *Juglans* spp. from the USA.

Possible risks: In the EPPO region, the most widely grown *Juglans* species is *J. regia* which has long been cultivated for nut production, amenity purposes and wood production. However, its susceptibility to thousand cankers disease remains to be further studied. The most susceptible species, *J. nigra* has been introduced during the 17th Century into the EPPO region, first for amenity purposes and later for the production of high quality wood. More data is needed on its distribution and economic importance. The introduction of both *P.*

juglandis and *G. morbida* into Italy clearly shows that introduction pathways of thousand cankers disease into the EPPO region exist. In addition, this disease probably has the potential to establish and spread if no measures are taken. In the USA, extensive mortality has been observed on *J. nigra* and phytosanitary measures have been taken to protect US states which are still free from the disease (e.g. restrictions on the movement of walnut wood and plants for planting). To prevent spread, infected trees are removed and material is immediately destroyed by grinding or burning. No control methods (chemical, cultural, resistant varieties) are currently available. The introduction of thousand canker disease clearly represents a threat to the cultivation of *Juglans* species, and it is desirable that measures are taken to prevent any further spread.

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