Pine Wilt Nematode
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Discussion on Pine Wilt Nematode

In July 2000 following the initial discovery of the Pine Wilt Nematode in Victoria (Feb 2000) further suspect trees were found. A helicopter survey was employed to identify dying trees in suburban areas of Melbourne. Also a foot and drive-by survey was used to identify every pine tree within a 1 km radius of the initial find. In addition a public awareness campaign was used to alert the public and request reporting of dead and dying pines. Suspect trees were tested for nematode presence and positive trees were removed and destroyed by chipping and deep burial. Healthy trees in the area were tested using a core sampler and no nematodes were found.

A total of 226 dead and dying trees were examined. Of these, 93 contained other nematode genera and 31 contained the nematode (s) of concern. Other causes of death included drought, *Sphaeropsis* (most consistent fungus), salt (high chloride), physical wounding (earthworks etc), poison, other fungi and insects. No nematodes have been found in plantation pines (*Sirex* trap trees are being used to monitor for nematodes in plantations).

Taxonomy and Biology

Two suspected exotic species of nematode have been isolated from the dying trees. It is now considered that both species are undescribed. One is possibly a new genus (close to *Ektaphelenchus*, and possibly a secondary pathogen), and the other is a new species of *Bursaphelenchus* (close to *B. hunanensis*, probably the primary pathogen). However, for the purpose of this report I shall call the pine wilt nematodes affecting pines in Victoria *Bursaphelenchus* spn.

Authorities are now confident that the species in question is not *Bursaphelenchus xylophilus*, the Japanese Pine Wilt Nematode, responsible for large pine losses in Japan, China and Korea.

One of the Victorian species is similar to *Bursaphelenchus hunanensis*, which has caused problems in China. *B. hunanesis* is native to North America where it is not a problem. There are only 7 specimens of *B. hunanensis* in collections throughout the world. Nevertheless the genus is easy to identify and *B. hunanensis* has a distinctive pointed tail and spear. Comparison with US specimens show *Bursaphelenchus* spn is close to *B. hunanensis*, but experts disagree as to its exact identity. To date, US and Australian authorities believe it to be a new species. DNA analysis cannot be done with the current known specimens of *B. hunanesis* since the normal method of specimen preservation in formaldehyde destroys DNA.

It is known that *B. hunanensis* has a complex life cycle involving 2 phases: (1) the dispersal phase where nematodes congregate around beetle holes to hitch a ride to a new host; (2) the feeding/reproductive phase where several cycles can occur in a host tree. In the dispersal phase a nematode can survive up to 6 years. Nematodes in the

feeding phase are much easier to recognise and identify because they are more numerous, they are more generally dispersed through the host and there are more males (which are more easily identified). In the dispersal phase nematodes are more concentrated in the host, thus there is a greater chance of missing them during sampling.

The main vector for *B. hunanensis* has not been identified, however *Ips* and the cerambycid *Arhopalus rusticus* are known to carry the nematode in China. *A. rusticus* is now known to be established in Victoria.

In Victoria attempts at identifying and capturing vectors have so far proved unsuccessful (tree examination, light traps and pheromone traps have been used). Queensland has successfully eradicated *Monochamus* sp (Japanese pine sawyer, vector of Japanese Pine Wilt), which was discovered in this state earlier this year.

Exotic or Native?
Initially the nematodes were thought to be exotic. However the possibility of a new species casts some doubt on this. Nevertheless the nematodes were first found on *Pinus halipensis* which is an exotic pine and very susceptible to pine wilt. Also, *P. radiata* is a host.

Pathogenicity
Koch's postulates have not been proved so far, since attempts to grow the nematode in culture have been unsuccessful. Inoculation into trees has failed to produce symptoms and nematodes after 3 months. But the numbers inoculated into test trees were low due to the low availability of the nematode and the critical threshold of inoculum may not have been used.

Symptoms
- Definitely a syndrome with distinct dying symptoms.
- Affected trees are generally old (> 40 years) and large with large canopies.
- They die as a single specimen in a group of trees that are apparently healthy.
- Visual symptoms are similar to drought but death is much faster (around 6 weeks).
- Syndrome exacerbated by drought.

Future Directions
The meeting was divided into two groups, each to discuss: (1) What research needs to be done?; (2) Do we continue with survey and eradication? The meeting was then reconvened to discuss each group's findings and decide on future directions. Conclusions are summarised as follows.

What research needs to be done?
- Taxonomy – formal description of *Bursaphelenchus* spn could be achieved in six months. This could involve liaison with China for comparison with *B. hunanensis*.
- Pathogenicity, culturing technique and biology. Possible PhD study which would involve liaison with China.
- A study to determine background population of nematodes in pines in Australia (Victoria). This would involve sampling healthy and dying pines.

Eradication and Surveys

The precautionary principle was invoked and it was decided to continue with the eradication and containment program for 1 year, with a review at the end of that period. Summer is most crucial for symptom expression as, following knowledge on the biology of *B. hunanensis*, the nematodes are only active at temperatures above 20°C. Thus should no more trees with the syndrome or nematodes be found this summer, then eradication will be considered successful. Should *Bursapelenchus* spn be found during this period then the nematode will be considered as established and further considerations on future directions will need to be made.

Implications for WA

- Up to now all states other than Victoria have been monitoring plantation trees. We have been requested through the meeting to monitor old urban and amenity trees, particularly in the light of the potential drought for this summer in WA. This may be a matter that can be discussed by the FHAC. In respect to FPC and the Dept of Conservation and Land Management responsibilities and estates this is a matter that could easily "fall through the cracks". As Agriculture WA, through its involvement with AQIS, has been assisting in nematode extraction of the samples taken by FPC in plantations, they may be able to assist in such monitoring in urban areas.
- At present, since the nematode has not been found in plantation trees in Victoria, quarantine is not crucial. However should it be found in plantations, it will be an issue. Currently I believe there is no restriction on importation of untreated pine products from the eastern states, although this is not of immediate concern for *Bursaphelenchus* spn, it is certainly of concern with respect to *Sirex*.
- The establishment of *Arhopalus rusticus* in Victoria may also be a quarantine issue. I do not as yet have information on its potential as a pest.

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