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Polyphagous shot hole borer detected in Western Australia

The polyphagous shot-hole borer (PSHB) (*Euwallacea fornicatus*) has recently been detected in Perth, Australia. Native to Southeast Asia, this tiny beetle has spread to North and Central America, Israel, South Africa, Europe (Italy, Netherlands, Germany and Poland – greenhouses), Papua New Guinea, Fiji and, and now Australia (Perth) where it is under eradication.

This damaging pest infests more than 400 plant species, mostly woody species and carries a few known symbiotic fungi, including the damaging *Fusarium euwallaceae. Fusarium euwallaceae* infects the vascular tissue of a susceptible tree and can cause dieback and death. The beetle attacks stressed trees primarily but can also attack healthy trees. Plant hosts are divided into two categories: reproductive and non-reproductive. This interaction is dependent on how successful PSHB's fungal symbiont, symbionts colonise the host's tissue. the host's tissue. In a reproductive host, the fungus will establish well allowing the beetle to thrive, while in a non-reproductive host it will not and the beetle does not complete its lifecycle; however, symptoms may develop.

This beetle and its fungus can attack many globally important commercial species, such as avocado, macadamia, acacia, and eucalyptus. It has been reported from pine but only in one instance, in a single stressed pine tree where the beetle, eggs and larvae were found.

Thankfully, there is a pheromone, quercivorol, available for use with traps to help detect and monitor PSHB. However, the beetle remains difficult to eradicate and manage. Any infested wood needs to be cut, removed and destroyed, or treated. Chemical applications of standing trees can be useful on a small scale and biological control options are also being sought.

While it is unlikely that PSHB will routinely attack standing and cut conifers, logs should be inspected and if infested, treated before export. Timber from known reproductive hosts will need to be inspected and treated before being used or transported domestically as the beetle is readily spread by the movement of wood and wood products. Movement of infested live plants should be restricted, especially from nurseries.

Image: © Samantha Bush (FABI)

Polyphagous shot hole borer, Euwallaceae fornicatus*, adult.*

The economic impacts of this pest can be severe. In Israel, PSHB infestations have led to a 100% yield loss in avocado in some areas. In South Africa, the unmitigated baseline social cost of the pest is predicted to be around $27.12 bn or 1% of South Africa's GDP, due to impacts on urban trees. Of concern is a confirmed finding of it from a *Sophora* spp. in Perth, the same genus as iconic Kōwhai trees in New Zealand.

Darryl Herron
Scion

Image: Darryl Herron

Beetle hole on plane tree.

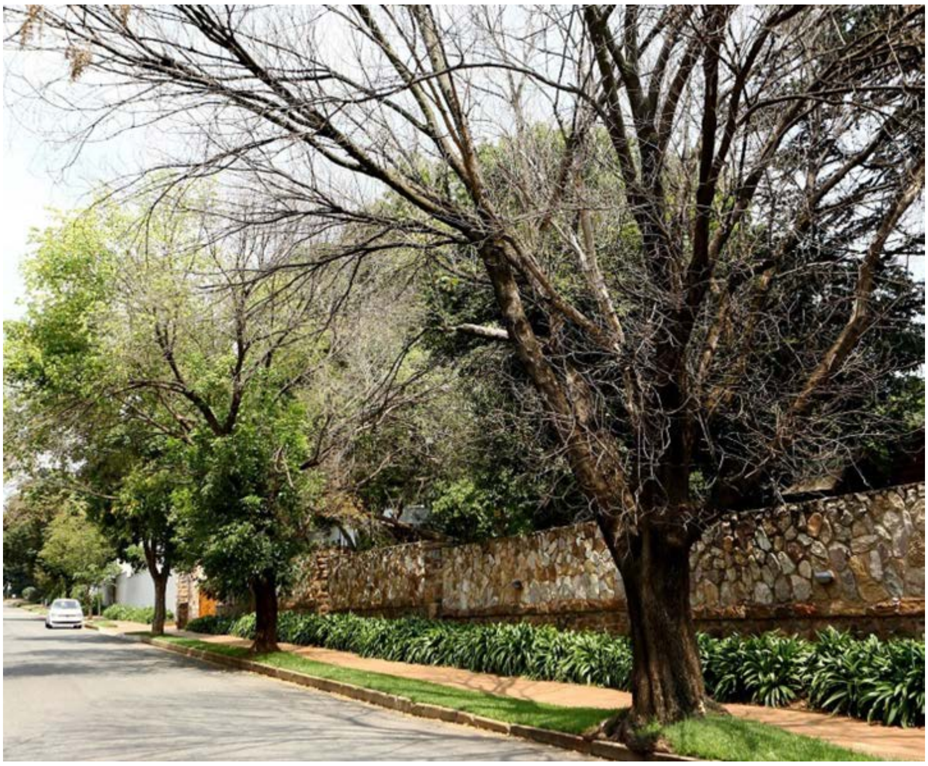

Image: Masi Losi

Dead street box elders.

Blast from the past: the parasitoid of the Douglas-fir seed chalcid

Douglas-fir (*Pseudotsuga menziesii*) is New Zealand's second most economically important plantation conifer after radiata pine. In some situations, however, Douglas-fir can spread beyond managed plantations, adding to the wilding conifer challenge.

In the 1920s, a seed predator by the name of the Douglas-fir seed chalcid, *Megastigmus spermotrophus*, was accidentally introduced to New Zealand, likely within contaminated seed. The Douglas-fir seed chalcid is a seed-feeding wasp from Douglas-fir's native range in North America. The wasp finds an immature Douglas-fir cone in early summer and lays its eggs inside the cone's undeveloped seeds. When the eggs hatch, the larvae hollow out the seeds from the inside. By the following spring, adult wasps emerge and repeat the cycle.

The presence of the Douglas-fir seed chalcid in New Zealand reduced the ability of local foresters to collect their own viable seed. In response, FRI released the parasitoid wasp, *Mesopolobus spermotrophus* from Scotland in 1955 to counter the chalcids' effects on seed production. Mature, unopened Douglas-fir cones were collected in subsequent years and assessed for the parasitoid. These surveys found no evidence of any parasitoid present, so it was concluded that the wasp did not establish[1]. However, in 2019 researchers from Manaaki Whenua Landcare Research found the parasitoid present when they assessed mature open Douglas-fir cones for seed damage and species presence[2]. In fact, they found an overall parasitism rate of 48.5% from 13 sites across New Zealand.

Healthy Douglas-fir seed.

How could the parasitoid have remained undetected for so long? The answer lies in the Douglas-fir cones. The historic Douglas-fir surveys collected only closed mature cones and found no parasitoids, whereas the recent collection of open mature cones led to the discovery of the parasitoid's presence. It is now known that *Mes. spermotrophus* can only parasitize the Douglas-fir seed chalcid when mature cones have opened, as the parasitoid cannot physically access the seeds of closed cones. This simple methodological difference highlights the importance of understanding in detail the ecology of biological control agents that we release.

Overseas, the Douglas-fir seed chalcid can destroy up to 100% of Douglas-fir seeds when conditions are favourable. In New Zealand, seed destruction in the 1940s was up to 20%, but this latest study recorded a maximum of only 0.61% seed destruction, likely influenced by the prevalence of the parasitoid. This incredibly low statistic suggests that the seed chalcid does not reduce seed production of Douglas-fir in New Zealand, and thus may not be a viable option for the management of wilding conifers. Manaaki Whenua Landcare Research have expressed an interest in continuing to look at alternative biocontrol methods to manage wilding conifers.

Mike Davy
Scion

1 Bain, J. (1977). *Megastigmus spermotrophus* Wachtl (Hymenoptera: Chalcidoidea: Torymidae). New Zealand Forest Service, Forest and Timber Insects in New Zealand No. 14.

2 Lee, S., Fowler, S. V., Lange, C., Smith, L. A., & Evans, A. M. (2021). Unexpected parasitism of Douglas-fir seed chalcid limits biocontrol options for invasive Douglas-fir in New Zealand. *New Zealand Plant Protection*, 74(1), 70-77.

Newsletter of the Scion Forest Protection team. Edited by Andrew Pugh and Darryl Herron, Scion, Private Bag 3020, Rotorua 3046, New Zealand. Email: andrew.pugh@scionresearch.com. Website: http://www.scionresearch.com/biosecurity