

## Tiny shot hole borer beetle is causing big problems

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*Polyphagous shot hole borer*

A “perfect invader” — that’s how a team of scientists have described the **tiny ambrosia beetle** native to Southeast Asia that is wreaking havoc on South Africa’s trees.

And the destructive effects of the **polyphagous shot hole borer** (PSHB), which hitches rides on wood-packaging material and garden waste, is only in its infancy, scientists write in a **paper** in the latest issue of the *South African Journal of Science*.

“The PSHB has proven to be one of the most difficult tree pests to manage,” state the authors from

the universities of Stellenbosch, Pretoria, Rhodes and Florida. “This is largely due to its ability to colonise a massive variety of tree species and its ease of long-distance dispersal because of human activity.”

The polyphagous shot hole borer has spread so easily throughout South Africa since its detection in 2017 because of the absence of a rapidly implemented nationally co-ordinated strategy and poor stakeholder and public engagement. The beetle is now found in eight provinces, reaching as far as 1,000km from the first detection site in KwaZulu-Natal, making it the largest current outbreak of this pest globally.

It is, for now, mostly confined to urban environments, where by far the largest proportion of the social cost from polyphagous shot hole borer invasion will be incurred, the paper warns.

“Thus far, it has invaded numerous major cities and, because South Africa is climatically suitable, PSHB is expected to rapidly spread to new areas. Impacts of the invasion are currently only in their infancy and major social and ecological costs are expected in the near future.”

Together with its fungal symbiont, *Fusarium euwallaceae*, the polyphagous shot hole borer can rapidly kill highly susceptible host plants. The authors find that this beetle has been confirmed to infest 130 plant species in urban, agricultural and native ecosystems in South Africa, including 44 previously unreported hosts.

With their minuscule size and cryptic colouration, these invasive beetles are easily missed during routine inspections when hitchhiking on goods and biological material such as nursery stock.

### **Effects on agriculture**

The only agricultural crops affected appear to be pecan and macadamia, “but the effect appears limited”, because they are not reproductive hosts. The polyphagous shot hole borer, too, has been found associated with cherry, apple, citrus, peach, guava, olive, grape vine and prune crops, but it’s not clear if these crops can act as reproductive hosts, because all reports are from urban settings.

“Even so, when grown near reproductive hosts, there is a strong possibility of infection by *F euwallaceae*,” note the authors, who add there are concerns, too, about the threat posed to the forestry industry.

Visual surveys in invaded urban areas of Johannesburg, Knysna, George and Somerset West have

shown that nearly all English oak, box elder and other maples will die when infested by polyphagous shot hole borer. Currently about 50% of London plane trees infested with this beetle in these areas “are in decline and likely to die”.

A recent system dynamics model to estimate the potential economic effects of the polyphagous shot hole borer in local urban environments finds this could be substantial, including effects on stormwater run-off; losses to ecosystem services, carbon dioxide sequestration and reduced shade, contributing to remediation of the **urban heat island effect** and pollution reduction.

There is increasing evidence linking the widespread death of trees in urban environments after pest and pathogen invasions and increased human mortality related to cardiovascular and respiratory tract illness.

And as they succumb, falling trees and branches may affect human safety directly by causing traffic accidents and damaging vehicles and infrastructure, such as buildings, fences and powerlines.

Tree removal possibly reduces property values. “In South Africa this has already resulted in at least one court case where PSHB infestations were not reported to potential buyers.”

## **Mounting costs**

In Somerset West, the cost of tree removal amounted to more than R7 000 a tree in 2019. “With more than 600 trees earmarked for removal in this town alone, the City of Cape Town requested a stipend of R3-million in 2020 to monitor and remove infested trees.” The replacement cost for these trees in the town is estimated to be between R4.5-million and R5.8-million, depending on tree species and labour costs.

There is no empirical data yet on the numbers of trees expected to perish in natural forests. Of the 2 195 trees assessed for polyphagous shot hole borer presence in natural forests in Knysna and George, 217 individuals were infested and 191 showed signs of beetle reproduction, which may lead to dieback and death. “In South Africa, the loss of even a single species from an ecosystem can be catastrophic,” the authors note.

*Virgilia oroboides* is a native reproductive host for polyphagous shot hole borer. “It is an important pioneer forest species in the southern Cape that protects forests from severe climatic fluctuations and fire and houses a large number of native organisms. Elimination of this single species could

have irreversible consequences for native forest integrity,” the scientists write.

Investigations into biocontrol options are being initiated, although no insecticides or fungicides locally that have been evaluated with scientific rigour for efficacy in polyphagous shot hole borer management have been registered for use. As there is no effective means to control pre-existing beetle infestations in a tree, the best alternative is physical removal of highly infested reproductive host trees.

Monitoring and mitigation are crucial. “Even halting the movement of infested wood and wood products will be problematic,” the scientists caution. “Despite the informal urban firewood trade being a widespread and important energy and income security source for many poor urban residents, its prevention is seen as the most effective way to curb long-distance spread.”

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