

RESEARCH REPORT

NOVEMBER 2022

The PSHB remains of concern to older pecan trees, but its impact can be reduced through proper light management

by Wilhelm de Beer, Gerda Fourie, and Shawn Fell

Forestry and Agricultural Biotechnology Institute, University of Pretoria

The Polyphagous Shot Hole Borer (PSHB, *Euwallacea fornicatus*) is an ambrosia beetle native to Southeast Asia. In 2017 this pest was detected on London Plane trees in KwaZulu-Natal. Its presence has since been confirmed in multiple locations in all provinces of South Africa except the Limpopo province. The beetles attack a wide range of exotic and indigenous trees in urban, agricultural and natural landscapes. An updated list of confirmed host trees in South Africa can be viewed at www.fabinet.up.ac.za/ps hb/.

The beetle has a symbiotic relationship with the fungus *Fusarium euwallaceae*, which serves as a food source for the adults and their larvae. The fungal symbiont therefore plays an important role in the reproductive success of the beetle. Trees in which the beetle is able to breed and multiply are referred to as 'reproductive host trees'. 'Non-reproductive host trees' are attacked by the beetle, but the beetles do not establish galleries (tunnels) or breed in these trees. The fungus may, or may not cause disease in non-reproductive hosts and these trees are generally not expected to die. In trees where the fungus can cause disease (susceptible trees), it causes a disease called Fusarium dieback, which can lead to dying branches and tree death.

PSHB on Pecan in South Africa

PSHB was first detected on pecan trees in South Africa in Jan Kempdorp orchards in 2017. To date it has been found on a few urban pecan trees in other parts of SA, but not in other commercial orchards. The primary focus of the initial research project conducted for SAPPA from 2018 to 2021 by the team of the University of Pretoria, was to determine the risk of PSHB to the pecan industry in South Africa. The main conclusions were the following:

- The source of the PSHB beetle outbreak in Jan Kempdorp was mature oak trees at the Agricultural High School. These trees has since been removed.
- Beetles are present and active throughout the year, but peak activity is in the hotter months.
- The ability of the fungal symbiont to cause disease on Pecan trees was tested by five inoculations per branch. Only streaking of the sapwood around inoculation points were observed with no visible symptoms of disease over the following year. After 12 months no living culture could be retrieved from inoculated branches.
- The presence of fungal symbiont, *F. euwallaceae*, was confirmed from infested branches during each field survey. The beetle was also confirmed to be the same haplotype (H33) as the beetle that was first detected in 2018.

PSHB reproduction and disease in older, hedged pecan trees

1. Broken branches with dark beetle galleries (tunnels) is the easiest sign of PSHB to detect.
2. Lower, shaded branch, dying back from the tip with drought symptoms. The branch is stressed by too much shade and becomes susceptible to beetle infestation and fungal infection.
3. Emergence holes surrounded by white frass (powder) indicate that beetles are reproducing in this branch.
4. Beetle tunnels and fungal stain are visible in split branches, and living beetles and larvae are often present.
5. Many beetles emerge from the dying branch, and attack adjacent, healthy branches, that will also start dying eventually.
6. Signs of fresh beetle attacks, usually at the base of healthy branches.
7. The first sign of attack is a wet spot surrounding the entrance hole of the beetle.
8. The sap of the initial wet spot dries and become a white mark on the branch, similar to bird droppings.



However, during a routine visit to Jan Kempdorp in October 2022, reproduction of the beetle in an orchard with 18-year-old trees were observed for the first time. This is very different from initial observations on younger trees. We now see large, lower, shaded branches dying with hundreds of beetles emerging from them. The impact of mass breeding and mass attacks of PSHB on Pecan is currently being monitored.

In August 2022, a trial using four different treatments, consisting of registered fungicides and insecticides, and a control was conducted. Reproductive branches identified during the previous surveys were cut at the base of the infestation and the wounds sealed with one of the treatments. The removed branches were stacked and solarized under black plastic to prevent the spread of PSHB from the removed limbs. The overall aim of this trial is to determine if the wound seal treatments can eliminate beetles remaining behind in cut wounds after sanitation of orchards. To determine this, beetle emergence from treated wounds and re-infestations of healthy adjacent branches will be monitored. Assessment will take place in November 2022 as well as in March and May in 2023.

Current impact and risk on Pecan trees

Trees younger than 15 years old:

- Low levels of infestation and trees usually recover completely.
- Risk is minimal.

Trees older than 15 years old:

- Lower shaded branches (2 cm and thicker) of trees that was hedged with dense crowns, can become heavily infested.
- PSHB reproduce and multiply. Beetles that emerge from dying branches attack adjacent healthy branches.
- The increased numbers of beetles attacking healthy branches may eventually also kill these branches.

Management options

- Monitor farms and areas adjacent to farms for heavily infested reproductive host tree species (like oak, plane, and kasterolie), especially in warmer months.
- Cut down infested reproductive host trees and solarize the wood.
- Remove and solarize infested Pecan branches.
- Careful light management needs to be done in trees, especially after hedging, to ensure that lower branches do not become overshadowed and stressed.



Shawn Fell, the first student in the world to complete a detailed study of the impact of PSHB on pecan trees, handing a copy of his MSc thesis to Hardus du Toit of SAPPA. On the left is Ivan Schubach, also from SAPPA, and on the right Prof. Wilhelm de Beer, primary supervisor of the study.



Solarization of PSHB infested wood

Wood infested with PSHB from pecan and other trees (like oak or London plane), should NOT be moved to other areas to prevent the beetle from spreading. Infested wood should be solarized on site to kill all beetles, larvae and eggs in the wood, as follows:

1. Cut infested branches as close to the main stem as possible.
2. Cut the infested parts of the branch (usually 3 cm or thicker) in 1 meter lengths. The thinner, uninfested parts branches can be chipped or discarded.
3. Stack the cut branches neatly, with as little space between them as possible.
4. Piles should be in full sun and not be more than 1 meter high. Smaller piles are more effective than larger piles.
5. Cover each pile tightly with black builders plastic, making sure no holes are pierced in the plastic.
6. Put enough soil on the sides to seal properly, and leave in the sun for 6 months. All beetles and larvae will die in high temperatures under the plastic.
7. Wood can then be used as firewood or chipped or disposed of.