

Conifer-killing beetles use smell of beneficial fungus to select host trees

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Pupae of the European spruce bark beetle (*Ips typographus*) in the bark of a Norway spruce tree (*Picea abies*) recently killed by a bark beetle attack. Credit: Dineshkumar Kandasamy/[CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

Eurasian spruce bark beetles (*Ips typographus*) burrow into the bark of Norway spruce (*Picea abies*) trees where they mate and lay their eggs. Major outbreaks in Europe have decimated millions of hectares of conifer forests. The beetles preferentially attack trees that are already infected with symbiotic fungi (such as *Grosmannia penicillata*), which is thought to weaken host trees and break down their chemical defenses, allowing the beetles to successfully develop in the bark.

To investigate the chemical signals that the beetles use to identify [host trees](#) infected with the fungus, the researchers performed a series of laboratory experiments on captive [bark beetles](#) and samples of Norway spruce bark. They found that the fungus breaks down chemicals in tree bark resin, known as monoterpenes, into new compounds, including camphor and thujanol.

After 12 days of infection, these fungus-produced compounds dominated the chemical mixture emitted by bark samples. Single cell recordings of sensory neurons in the beetles' antennae showed that they can detect camphor and thujanol, and in behavioral experiments, bark beetles were attracted to bark containing the fungus-produced compounds.



Spore stalks and mycelia of *Endoconidiophora polonica*, a fungal symbiont of the European spruce bark beetle (*Ips typographus*) that is closely associated with beetles during attacks on trees. In this study, we found that beetles locate *E. polonica* and other fungal symbionts using volatile signals produced by fungal metabolism of tree resin. Credit: Dineshkumar Kandasamy and Veit Grabe/[CC BY 4.0](#)

Tree-resin derived compounds produced by the fungus may allow bark beetles to assess the presence of their symbiont, helping them to identify suitable sites for feeding and breeding. The authors say that understanding the role of these compounds in bark beetle attacks could

be useful for pest-management strategies to protect European conifers from epidemic outbreaks.

Gershenzon adds, "The bark beetles currently killing millions of spruce [trees](#) every year in Europe are supported in their attacks by fungal associates. We discovered that these fungi convert [volatile compounds](#) from spruce resin to products, which may serve as cues for bark beetles to find them."

The study is published in the journal *PLoS Biology*.

More information: Kandasamy D. et al, Conifer-killing bark beetles locate fungal symbionts by detecting volatile fungal metabolites of host tree resin monoterpenes, *PLoS Biology* (2023). [DOI: 10.1371/journal.pbio.3001887](#)

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