

PUTATIVE SOURCE OF THE INVASIVE *SIREX NOCTILIO* FUNGAL SYMBIONT, *AMYLOSTEREUM AREOLATUM*, IN THE EASTERN UNITED STATES AND ITS ASSOCIATION WITH NATIVE SIRICID WOODWASPS

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ABSTRACT

The white rot basidiomycete fungus *Amylostereum areolatum* is carried by females of *Sirex noctilio* in mycangia at the base of their ovipositors and inserted into pine trees when eggs are deposited. *S. noctilio* and *A. areolatum* are native to Europe but have been introduced throughout many areas in the Southern Hemisphere where pines have been planted (pines are not native to the Southern Hemisphere). *S. noctilio* was first trapped in North America in 2004 in New York State, near Lake Ontario. This constitutes the first time that *S. noctilio* and *A. areolatum* have become established in an area where pines are native and where there are native siricids. In Europe, there are four species of *Sirex*, while in northeastern North America, there are three species of *Sirex*, based on a recent revision of this genus by Dr. Henri Goulet. Before *S. noctilio* arrived in North America, it was thought that *A. areolatum* did not occur here; thus, all North American *Sirex* species were thought to be associated with *A. chailletii*, which also occurs in Europe in association with some *Sirex* species.

We collected *Sirex noctilio* and native *Sirex* species from New York State, Pennsylvania, and Maine. We isolated *Amylostereum* from female mycangia for DNA extraction or extracted fungal DNA directly from female mycangia. We compared the sequences of the intergenic spacer regions (IGS) of the fungal DNA from our samples with IGS sequences from samples from both Europe and the Southern Hemisphere (Slippers et al. 2002). The IGS

region demonstrates that there is variability among isolates of *A. areolatum* both in Europe and North America (Nielsen et al. 2009). However, only one IGS strain (AB) has been identified from the Southern Hemisphere. The AB strain was also found in Denmark but was not found in North America, which suggests that the *S. noctilio* and *A. areolatum* that have become established in northeastern North America probably did not originate from the Southern Hemisphere.

From our North American samples, we found that two strains of *A. areolatum* are present in northeastern North America (Nielsen et al. 2009). We cannot say whether this means that there were one or two introductions, but we know that two strains of *A. areolatum* can occur in the same log. Therefore, it is possible that although there are two strains, only one introduction resulted in the present infestation. One of the strains we identified in North America was previously found in Germany (D). We found that two individuals of the North American native *Sirex edwardsii* that emerged from the same piece of a pine tree as *S. noctilio* carried the same fungal strain as that *S. noctilio*. Before this, it was assumed that *S. edwardsii* carried *A. chailletii*. However, there are some questions in the older literature about just how specific siricid species are about the fungal species they will carry (*A. areolatum* versus *A. chailletii*). We also found that the native North American *S. nitidus* from Maine (where *S. noctilio* does not occur) carried a new IGS strain of *A. areolatum* (BE). This also refutes

previous assumptions that North American native *Sirex* species all carry *A. chailletii*. We assume the BE strain is native to North America.

Our studies of vegetative compatibility groups of these fungi mostly agreed with molecular work on the strains of *A. areolatum*. All different IGS strains of *A. areolatum* were incompatible except the strain that is used to mass produce the *S. noctilio*-parasitic nematode (*Deladenus siricidicola*) for biological control in Australia (BDF).

Literature Cited

- Nielsen, C.; Williams, D.W.; Hajek, A.E. 2009. **Putative source of the invasive *Sirex noctilio* fungal symbiont, *Amylostereum areolatum*, in the eastern United States and its association with native siricid woodwasps.** Mycological Research. 113: 1242-1253.
- Slippers, B.; Wingfield, D.; Coutinho, A.; Wingfield, M.J. 2002. **DNA sequence and RFLP data reflect geographical spread and relationships of *Amylostereum areolatum* and its insect vectors.** Molecular Ecology. 11: 1845-1854.