FOREST PEST SPECIES PROFILE

November 2007

Sirex noctilio Fabricius, 1793

Other scientific names: *Sirex melanocerus* Thomson, 1871; *Paururus noctilio*
Order and Family: Hymenoptera: Siricidae
Common names: European woodwasp; sirex; sirex woodwasp; steel-blue horntail

Sirex noctilio is a major global threat to forests and the forest sector causing considerable damage and costs for control. In 1900, this pest was reported from New Zealand which represented the first time it was recorded outside of its native range. Since then it has gradually spread around the globe – to Australia in the 1960s, Latin America and the Caribbean in the 1980s, Africa in the 1990s and North America in this decade.

Adult sirex woodwasps – male (L), female (R) (Photos: David R. Lance, USDA APHIS PPQ, Bugwood.org)

DISTRIBUTION

***Native*:** Europe, Asia, northern Africa (Algeria, Morocco, Tunisia)

***Introduced*:**
Africa: South Africa (1994)

Asia and the Pacific: Australia (1961), New Zealand (1900), Tasmania (1952)

Latin America and the Caribbean: Argentina (1985), Brazil (1988), Chile (2001), Uruguay (1980)

North America: Canada (2005), US (2004)

IDENTIFICATION

Eggs are cylindrical, creamy white and approximately 0.30-0.35 mm wide and 1.35-1.56 mm long (Ciesla, 2003b). Larvae are creamy white in colour, legless with a distinctive dark spine at the posterior end (TPCP, n.d.). Length varies but larvae can reach up to 30 mm in length.

Adult wasps are metallic blue-black in colour with two pairs of clear yellow membranous wings, black antennae and an upturned, spear-shaped spine or plate (cornus) at the end of the abdomen (TPCP, n.d.; Walker, 2006). They are large, robust insects ranging in size from 10 to 44 mm in length (Walker, 2006). Females are uniform in colour with a prominent robust ovipositor located beneath the cornus, orange legs and black feet (Haugen and Hoebeke, 2005; Walker, 2006). Smaller than the female, the male wasp has orange middle abdominal segments and orange legs except for the hind legs which are thickened and black (Haugen and Hoebeke, 2005; Walker, 2006).

HOSTS

Sirex noctilio has a wide host range and is primarily a pest of *Pinus* spp. such as *P. attenuata*, *P. banksiana*, *P. brutia*, *P. canariensis*, *P. caribaea*, *P. contorta*, *P. densiflora*, *P. echinata*, *P. elliottii*, *P. halepensis*, *P. jeffreyi*, *P. kesiya*, *P. muricata*, *P. nigra*, *P. nigra austriaca*, *P. nigra calabrica*, *P. palustris*, *P. patula*, *P. pinaster*, *P. pinea*, *P. ponderosae*, *P. radiata*, *P. resinosa*, *P. strobus*, *P. sylvestris* and *P. taeda* (Carnegie *et al*., 2006; USDA-APHIS, 2007). *Pinus radiata, P. taeda* and *P. patula* are particularly susceptible (Carnegie *et al*., 2006). Species of *Abies*, *Larix*, *Picea* and *Pseudotsuga*, particularly *Pseudotsuga menziesii*, have also been attacked (USDA-APHIS, 2007).

BIOLOGY

The sirex woodwasp attacks living pines and is particularly attracted to stressed or dying trees with low sap pressure. Adult females drill into the wood of trees using her ovipositor, depositing eggs (20-500) as well as toxic mucus and a fungus (*Amylostereum areolatum*) which effectively kill the host tree (Hurley, Slippers and Wingfield, 2007). The movement of water and sugars within the tree trunk is impeded by the mucus causing foliage to wilt and creating suitable conditions for the fungus (Matthews, 2005). *Amylostereum areolatum* relies on *S. noctilio* for dispersal and inoculation into trees and the wasp larvae rely on the fungus for wood breakdown and food (USDA-APHIS, 2007).

Unfertilized eggs develop into males whereas fertilized eggs produce females (Haugen and Hoebeke, 2005). Larvae can hatch as early as nine days after oviposition and can remain dormant for several months, particularly in cooler climates (Ciesla, 2003b). They feed in the wood, constructing large galleries and thus degrading wood quality. Once feeding is complete, the larvae enter prepupal and pupal stages; pupation lasts 16 to 21 days (Ciesla, 2003b). Adult wasps bore their way out of host trees leaving perfectly round exit holes. Males emerge before the females. The lifespan of adult woodwasps can be up to 12 days however females that have deposited all their eggs may only live for three to four days (Ciesla, 2003b). Each generation takes between ten months and two years, the latter primarily in cooler climates.

Damage caused by *Sirex noctilio* (Photos: Bugwood.org – Left & Right: P. Klasmer, Instituto Nacional de Tecnologia Agropecuaria; Centre: D. Haugen, Bugwood.org;)

SYMPTOMS AND DAMAGE

Resin droplets and oviposition scars on the bark of trees are the first signs of infestation by sirex (Ciesla, 2003b). Tree crowns and foliage wilts and turns from green to yellow to reddish brown. Larvae tunnel in the

wood creating galleries full of very fine frass, which significantly damages the wood. Round exit holes, approximately 3-8 mm in diameter, appear when the adult insects emerge.

DISPERSAL AND INTRODUCTION PATHWAYS

Sirex noctilio can spread naturally through flight and wind dispersal. Adults are strong fliers capable of traveling several kilometers in search of suitable host trees. For example, in southwestern South Africa the dispersal rate of *S. noctilio* has been estimated at 48 km per year and rates of 30-40 km per year have been observed in Australia (Carnegie *et al.*, 2006). Other pathways of *S. noctilio* dispersal include movement of nursery stock, untreated pine logs and sawnwood, and untreated packing materials. The woodwasp is believed to have entered Argentina, Australia, New Zealand and South Africa in wooden packaging from Europe or North Africa (Keiran and Allen, 2004).

CONTROL MEASURES

The development of control strategies for *S. noctilio* originated in Australia and they are being used by various Southern Hemisphere countries where sirex has established. Control of this pest is achieved through a combination of silvicultural and biological measures including the restricted movement of infested materials, population monitoring through survey and trap trees, good silvicultural management practices, and the use of biological control agents (Carnegie, Eldridge and Waterson, 2005; USDA-APHIS, 2007). Since stressed trees are a prime target for sirex attack, silvicultural measures which maintain the health and vigour of trees and managing plantations optimally can significantly reduce the risk of sirex attack (Carnegie, Eldridge and Waterson, 2005).

Biological control in South Africa - trunk injection of parasitic nematodes (Photo: G. Allard)

A variety of biological control agents have been applied to target the sirex woodwasp. The most effective is the parasitic nematode, *Beddingia* (=*Deladenus*) *siricidicola*, which infects sirex larvae rendering adult female wasps sterile (Carnegie, Eldridge and Waterson, 2005; Haugen and Hoebeke, 2005). Infected females emerge and lay infertile eggs which are infected with nematodes in trees thereby assisting in the spread of the nematodes. Several parasitic wasps have also been introduced into Southern Hemisphere countries to help control sirex, including *Ibalia leucospoides*, *Megarhyssa nortoni*, *Rhyssa hoferi*, *R. persuasoria* and *Schlettererius cinctipes* (Carnegie, Eldridge and Waterson, 2005).

References

Carnegie A.J., Elderidge, R.H. & Waterson, D.G. 2005. History and management of sirex wood wasp in pine plantations in New South Wales, Australia. *New Zealand Journal of Forestry Science*, 35(1): 3-24.

Carnegie A.J., Matsuki, M., Haugen, D.A., Hurley, B.P., Ahumada, R., Klasmer, P., Sun, J. & Iede, E.T. 2006. Predicting the potential distribution of *Sirex noctilio* (Hymenoptera: Siricidae), a significant exotic pest of *Pinus* plantations. Annals of Forest Science 63:119-128.

Ciesla W.M. 2003b. European woodwasp: A potential threat to North America's conifer forests. *Journal of Forestry*, 101(2): 18-23.

Haugen, D.A. & Hoebeke, E.R. 2005. Sirex woodwasp - *Sirex noctilio* F. (Hymenoptera: Siricidae). Pest Alert NA-PR-07-05, USDA Forest Service. (also available at: www.na.fs.fed.us/spfo/pubs/pest_al/sirex_woodwasp/sirex_woodwasp.htm)

Hurley, B.P., Slippers, B. & Wingfield, M.J. 2007. A comparison of control results for the alien invasive woodwasp, *Sirex noctilio*, in the southern hemisphere. *Agricultural and Forest Entomology*, 9(3): 159-171.

Keiran, M. & Allen, E. 2004. Keeping forest pests from moving around the world. *Unasylva*, 217(55): 29-30.

Matthews, S. 2005. *South America invaded: the growing danger of invasive alien species*. The Global Invasive Species Programme (GISP) Secretariat, Cape Town, South Africa. Edited by Matthews, S. & Brand, K. Available at: www.gisp.org/publications/invaded/gispSAmerica.pdf

Tree Protection Co-operative Programme (TPCP). *Sirex woodwasp*. TPCP Pamphlet, prepared by B.P. Hurley. (available at: www.fabinet.up.ac.za/tpcp/pamphlets/pdf/sirex.pdf)

United States Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS). 2007. *Organism pest risk analysis: risks to the conterminous United States associated with the woodwasp,* Sirex noctilio *Fabricius, and the symbiotic fungus,* Amylostereum areolatum *(Fries: Fries) Boidin*, 45 pp. Available at: www.aphis.usda.gov/plant_health/plant_pest_info/sirex/downloads/sirex-pra.pdf

Walker, K. 2006. Sirex woodwasp (*Sirex noctilio*) Pest and Diseases Image Library. Updated on 30/07/2006 12:25:57 PM. Available at: www.padil.gov.au