GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Sirex noctilio***

Sirex noctilio **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Hymenoptera	Siricidae

Common name Sirex woodwasp (English), European woodwasp (English), steel blue (English), woodwasp (English), svartfotad vedstekel (Swedish, Sweden), horntail (English), sartfottreveps (Norwegian, Norway), avispa barrenadora de los pinos (Spanish), avispa taladradora de la madera (Spanish), Sirex wasp (English), wood wasp (English), sirex (Portuguese), vespa-da-madeira (Portuguese), Blaue Fichten (German, Germany), Holzwespe (German, Germany), sortfodet træhveps (Danish, Denmark)

Synonym

Similar species

Summary Sirex noctilio (or Sirex woodwasp) is a high risk invasive species native to Europe and parts of Asia that has proven devastating to many commercial pine plantations, with mortality rates as high as 80%. It is capable of inflicting billions of dollars in damages. International, national and state agencies have conducted much research on Sirex noctilio and remain focused on its control and containment.

view this species on IUCN Red List

Species Description

Sirex noctilio is a Siricid woodwasp, or Horntail. Adults have a long cylindrical body lacking the typical narrow petiole \"waist\", two sets of transparent wings, and a spear-shaped plate (cornus) at its tail. Females are generally larger measuring about 15-35mm long, having a metallic blue head and body, orange legs, and a pointed projection at the tail to protect the ovipositor. Males measure about 13-32mm and have a metallic blue head and thorax, an orange abdomen with a dark tip, and orange front and thickened, black rear legs. Larvae are creamy white with a cylindrical body, identifiable head, three pairs of short legs and a spine at the posterior end (Zondag, 1977; King, 2005).
Please see PaDIL (Pests and Diseases Image Library) Species Content Page Wasps: Sirex woodwasp for high quality diagnostic and overview images.

Lifecycle Stages
Eggs of *Sirex noctilio* are deposited in shafts drilled into the xylem of the host tree, along with a toxic mucus and arthrospores of the symbiotic fungus *Amylostereum areolatum* by female adults. Females excrete the mucus from glands and release arthrospores from their mycangium, pockets on either side of the fold between the first and second abdominal segments which carry the symbiotic fungal spores. They both travel down to the ovipositor where they are placed in the tree along with eggs. Female larva also possess these spores. Optimal eclosion (hatching) occurs after 10-12 days at about 25° C. Exposure to carbon dioxide, which is produced by the fungus, is shown to accelerated development and emergence from the egg. Larvae emerge and feed on the fungal mycelium by secreting saliva that dissolves nutrients so they may be ingested. They bore galleries throughout the tree leaving frass (waste) behind. *S. noctilio* typically goes through six or seven larval instars (phases), but they may have 5-12. The first instar moves about a centimeter up. In the second, they acquire mycelium nutrients and store it in hypopleural organs. By the end of the third, it will only have moved about 2cm. The fourth and fifth instars turn towards the heartwood at the center of the tree boring its way up a meandering path. It eventually turns toward the surface to pupate. The final gallery is usually about 12-15cm long. Natural development of most larvae takes 10-11 months, and mature larvae pupate close to the barks surface, emerging about 3 weeks later through holes about 3-7mm in diameter. About 25% of larvae don't emerge until the next season, taking two years to develop. Adults emerge sexually mature, males emerging first. Adults live a maximum of 12 days surviving on stored fat. Often, actively ovipositing females live only 3-4 days. (Madden, 1981; Haugen, 2005; Zondag, 1977, Borchert, 2006).

Habitat Description
The female sirex woodwasp bores deep into living trees and deposits eggs with its ovipositor along with a symbiont fungus (*Amylostereum areolatum*) and toxic mucus. The mucus inhibits the defences of the tree, allowing the white rot fungus to grow. The larvae then bore galleries throughout the tree, feeding on the fungus. *Sirex noctilio* is primarily attracted to stressed, sick, and suppressed trees with intermediate moisture content. Some softwoods (conifers) and all species of pine are believed to be at risk of infestation (Madden, 1974; Madden, 1981; NYSDEC, 2007).

Reproduction
Oviparous. Sexual, and facultative parthenogenetic. Mating of *Sirex noctilio* occurs in upper tree branches where males swarm on suitable days, which consists of temperatures of at least above 14° C, preferably above 30° C, sunny with intermediate to low humidity. This swarming behaviour by males is triggered by contact with other males and the presence of females. Individual females lay between 25-450 eggs. Mated females produce both male and female progeny, while unmated females yield only males. The typical ratio of males to females is approximately 10:1 (Morgan, 1968; Haugen, 2005). However sex ratio can vary greatly from almost 1:1 to well over 20:1 of males to females. It is possibly influenced by how established *Sirex* is in a particular area, but more work is needed to explain the major variation (B. Hurley, pers. comm.).

Nutrition
Sirex noctilio larvae feed on a symbiotic fungus *Amylostereum areolatum* placed in host trees by ovipositing females. A phytotoxic fungus dries and kills tree cells allowing *A. areolatum* to spread. Larvae feed on this fungus throughout its normally one year developmental cycle. Adults do not feed but live off of stored fat, living only long enough to reproduce (Zondag, 1977).

General Impacts
Sirex noctilio along with its obligate symbiotic fungus *Amylostereum areolatum* pose a serious threat to the pine industry. It has been known to devastate pine stands causing as much as 80% mortality. The USDA Animal and Plant Health Inspection Service (APHIS) added *S. noctilio* to its Regulated Plant Pest List and it was rated a \"very high risk\" pest in pest risk assessment for North America. In its native ranges, *S. noctilio* is considered a secondary pest. Expansive monoculture tree plantations, favourable climate, and lack of natural predators and hyperparasites render invasive ranges highly susceptible to infestation. The sirex woodwasp lays its larvae in conifers primarily *Pinus* spp. along with its symbiotic fungus *A. areolatum* and a toxic mucus which facilitates the growth of the fungus. The mucus causes foliage to wilt and yellow, providing good conditions for *A. areolatum* to grow and spread throughout the tree. The fungus causes the tree to dry out by disrupting water movement. The combined effect of the mucous and fungus most often kills the tree.\r\nEven if the host tree survives, its wood is often degraded value because of resin accumulations or killed zones. Healthy trees are known to resist oviposition by flooding holes with resin or by producing polyphenols that prevent fungal growth. Understandably, ovipositing *S. noctilio* females prefer stressed trees. Research indicates that their sensillae, inner surfaces of the valvulae (sensory receptors on the ovipositor) are capable of determining the tree's levels of resin and moisture content. As they prefer intermediate to low moisture and will withdraw their ovipositor if they pierce a resin duct. *S. noctilio* almost always attacks trees stressed by factors such as drought, overcrowding, physical damage, unrelated fungal infection, or simply inundation with other ovipositions. Infested trees are identifiable by yellow or reddish-brown tree crowns, beads of resin dripping down the bark from oviposition sites, larval tunnels and frass in the wood, and exit holes 3-8mm in diameter. All species of *Pinus* are considered viable hosts as well as some members of genera *Abies*, *Larix*, *Picea*, and *Pseudotsuga*. Notable host species include: Monterey pine (*Pinus radiata*), loblolly pine (*Pinus taeda*), slash pine (*Pinus elliottii*), Scots pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), maritime pine (*Pinus pinaster*), Eastern white pine (*Pinus strobus*), ponderosa pine (*Pinus ponderosa*), red pine (*Pinus resinosa*), Mexican pine (*Pinus patula*), jack pine (*Pinus banksiana*), Carribbean pine (*Pinus caribaea*), lodgepole pine (*Pinus contorta*), shortleaf pine (*Pinus echinata*), longleaf pine (see *Pinus palustris* in IUCN Red List of Threatened Species), pitch pine (*Pinus rigida*), Jeffrey pine (*Pinus jeffreyi*), and Chiapas white pine (*Pinus chiapensis*) (Zondag, 1977; APHIS, 2007; Bean, 2005; Morgan, 1968; Wingfield, 2001; Pollard, 2006).

Management Info
Preventative measures: *Sirex noctilio* is a high risk invasive species and many actions have been taken to prevent its spread. Restrictions on the movement of timber and firewood have been imposed in most invasive ranges. The USDA APHIS (Animal and Plant Health Inspection Service) inspectors remain vigilant and have successfully intercepted foreign siricids in international US ports on over 100 occassions. APHIS also has a Plant Protection and Quarantine (PPQ) division which is working hard to prevent further spread in the US by informing the public and wood industry and conducting extensive trapping surveys.
In 2002, United Nation FAO's (Food and Agriculture Organization) Interim Commission on Phytosanitary Measures imposed a global standard for treating wood packaging International Standard for Phytosanitary Measures No. 15 to stop the spread of invasives including *S.noctilio*. Although, implementation has proven difficult. Similarily, New York State the Department of Conservation has imposed recommended treatment protocols for all wood products over 2.5cm thick. Silvicultural management is another important means of preventing *S. noctilio* infestation. Since, the Sirex woodwasp attacks stressed trees, healthy and vigorous trees properly maintained by good silviculture practice, including routine surveilliance, pruning, and appropriate watering and spacing of trees, will assist in preventing new infestations and to control present populations. Recently, aerial multispecteral imagaing technology has been employed to detect infected trees in large pine plantations of KwaZulu-Natal, South Africa. Another use of technology employs computer modeling by programs like CLIMEX to render a predictive modeling of potential invasive ranges (Hoebeke, 2005; NAPPO, 2007; Keiran, 2005; NYSDEC, 2006; Fernandez-Ahrex, 2005; Ismail, 2007; Carnegie, 2006).
Biological: Biological control agents have been the most popular and successful means of managing *Sirex noctilio*. Many species of parasitic wasps have been employed including: *Megarhyssa nortoni, Rhyssa persuasoria, Rhyssa hoferi, Ibalia leucospoides*, and *Schlettererius cinctipes*. Of these *M. nortoni*, *R. persuasoria*, and *I. leucospoides* have been the most effective, employed in New Zealand, Australia, South America, and South Africa. These wasps find *S. noctilio* larvae, then bore into the tree, paralyze them, and deposit their eggs on them. Sirex larvae are then consumed by the newly hatched parasite larvae. However, the most effective means of control has been from parasitic nematode *Deladenus siricidicola* (also =*Beddingia*). This nematode has an almost perfectly designed life cycle to control Sirex woodwasps. Its first stage feeds on fungus *Amylostereum areolatum* while the second invades the larvae collecting in their reproductive organs. Females are sterilized while males spread the nematode further. This agent has been successful in South America, South Africa, Australia, and especially New Zealand in which few *S. noctilio* remain. The US is currently in experimental phases of introduction. The nematode may be raised in laboratory conditions and trees are inoculated with a gel medium in which they are suspended (Hurley, 2007; Haugen, 2005; Hocking, 1968; Bain, 2005; Bedding, 1974; SSPR, 2006).

Principal source: Hurley, B.P., Slippers, B., and Wingfield, M.J. 2007. A comparison of the control results for the alien invasive woodwasp, *Sirex noctilio*, in the southern hemisphere. Agricultural and Forest Entomology. Vol. 9: 159-171.
SSPR. 2006. *Sirex*Science Panel Report. Indianapolis, IN.
Haugen, D.A. and Hoebeke, R.E. 2005. Pest Alert: Sirex woodwasp-*Sirex noctilio* F. (Hymenoptera; Siricidae). USDA Forest Service Northeastern Area State and Private Forestry, 11 Campus Boulevard, Suite 200, Newtown Square, PA 19073.

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Brett P. Hurley, Forestry and Agricultural Biotechnology Institute (FABI) University of Pretoria, South Africa

Pubblication date: 2007-11-23

ALIEN RANGE

[1] ARGENTINA **[5]** AUSTRALIA

[1] BRAZIL
[1] CHILE
[1] SOUTH AFRICA
[1] URUGUAY

[1] CANADA
[1] NEW ZEALAND
[5] UNITED STATES

BIBLIOGRAPHY

39 references found for **Sirex noctilio**

Managment information
Bain, J. 2005. *Sirex noctilio* (Hymenoptera: Siricidae)- The New Zealand experience. Forest Biosecurity and Protection, Forest Research, Private Bag 3020, Rotorua, New Zealand.
Summary: This is a publications summarizing *Sirex noctilio s* presence in New Zealand.
Available from:http://www.fs.fed.us/ne/newtown_square/publications/technical_reports/pdfs/2005/337papers/bain337.pdf [Accessed 11 October 2007]
Bedding, R.A. and Akhurst, R.J. 1974. Use of the nematode *Deladenus siricidcola* in the biological control of *Sirex noctilio* in Australia. Journal of Australian Entomology Society. Vol. 13: 129-135.
Summary: A journal article describing the use of nematode *Deladenus Siricidcola* in the biological control of *Sirex noctilio* in Australia.
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. Vol. 63: 119-128.
Summary: This journal article uses computer programs like CLIMEX to identify potential *Sirex noctilio* invasive ranges.
FABI. *The Sirex Website* [Accessed January 27, 2010]
Summary: A detailed website containing literature and links to the latest information on the biology and control of *Sirex noctilio*.
Fernandez-Arhex, V. and Corley, J.C. 2005. The functional response of *Ibalia leucospoides* (Hymenoptera: Ibaliidae), a parasitoid of *Sirex noctilio* (Hymenoptera: Siricidae). Biocontrol Science and Technology, Vol. 15 No2: 207-212.
Summary: This journal article examines the wasp parasite *Ibalia leucospoides* and its interaction with host *Sirex noctilio*
Available from: http://www.fabinet.up.ac.za/pdfs/SirexLIT/Fernandez-Arhex&Corley2005BioconSciTech.pdf [Accessed 17 October 2007]
Haugen, D.A. and Hoebeke, R.E. 2005. Pest Alert: Sirex woodwasp-*Sirex noctilio* F. (Hymenoptera; Siricidae). USDA Forest Service Northeastern Area State and Private Forestry, 11 Campus Boulevard, Suite 200, Newtown Square, PA 19073.
Summary: A pest alert advisory on *Sirex noctilio* published by the Northeastern Area USDA Forest Service.
Hocking, H. 1967. A native Ichneumonid, *Certonotus tasnamiensis* Turn. Parasitizing *Sirex noctilio* F. (Siricidae) in Tasmania. Journal of Australian Entomological Society. Vol. 6: 57-60.
Summary: A journal article concerning *Certonotus tasmaniensis* parasitizing *Sirex noctilio* in Tasmania.
Hocking, H. 1968. Studies on the biology of *Rhyssa persuasoria* (L.) (Hymenoptera: Ichneumonidae) incorporating an X-ray technique. Journal of Australian Entomological Society. Vol. 7: 1-5.
Summary: This journal article provides information on the parasitization of *Rhyssa persuasoria* on *Sirex noctilio*.
Hoebeke, R.E., Haugen, D.A., and Haack, R. A. 2005. *Sirex noctilio*: Discovery of a Palearctic Siricid Woodwasp in New York. Newsletter of the Michigan Entomological Society. Vol. 50. No. 1&2: 24-25.
Summary: A newsletter publication by the entomologist who identified the first *Sirex noctilio* speciemen in New York
Available from: http://ncrs.fs.fed.us/pubs/jrnl/2005/nc_2005_Hoebeke_001.pdf [Accessed 8 October 2007]
Hurley, B.P., Slippers, B., and Wingfield, M.J. 2007. A comparison of the control results for the alien invasive woodwasp, *Sirex noctilio*, in the southern hemisphere. Agricultural and Forest Entomology. Vol. 9: 159-171.
Summary: This is an excellent source detailing available information concerning *Sirex noctilio* and its introductions to invasive ranges in the southern hemisphere.
International Plant Protection Convention (IPPC), 2002. International Standards for Phytosanitary Measures (ISPM) No. 15 (2002) with modifications to Annex I (2006) Guidelines for regulating wood packaging material in international trade (PUBLICATION)
Summary: Available from:
https://www.ippc.int/servlet/BinaryDownloaderServlet/133703_ISPM15_2002_with_Ann.pdf?filename=1152091663986_ISPM_15_2002_with_Annex1_2006_E.pdf&refID=133703 [Accessed November 20]
Ismail, R., Mutanga, O., and Bob, U. 2007. Forest health and vitality: the detection and monitoring of *Pinus patula* trees infected by *Sirex noctilio* using digital multispecteral imagery. Southern Hemisphere Forestry Journal. Vol. 69 No. 1: 39-47.
Summary: This journal article discusses the use of multispecteral imagery to identify trees that have been infested by *Sirex noctilio* in South Africa.
Keiran, M and Allen, E. 2004. Keeping forest pests from moving around the world. Unasylva 217, Vol. 55: 29-30.
Summary: This publication addresses preventative measures for the spread of forest pests.
Available from: http://www.fao.org/docrep/007/y5507e/y5507e09.htm#TopOfPage [Accessed 10 October 2007]
NYSDEC. 2007. Sirex woodwasp status report. New York State Department of Conservation.
Summary: A report updating the statues and presence of *Sirex noctilio* in New York State.
Available from: http://www.dec.ny.gov/animals/7533.html [Accessed 16 October 2007]
Pollard, 2006. Sirex woodwasp *Sirex noctilio* (F.). Forest Health Alert. Ontario Ministry of Natural Resources.
Summary: A profile on *Sirex noctilio* by the Ontario Ministry of Natural Resources.
SSPR. 2006. *Sirex* Science Panel Report. Indianapolis, IN.
Summary: This is a published report of the Sirex Science Panel Meeting consisting of Sirex specialists from around the wolrd offering accounts and updates concerning *Sirex noctilio*.
Available from: http://www.aphis.usda.gov/plant_health/plant_pest_info/sirex/downloads/sap12-14-06.pdf [Accessed 11 October 2007]

Thayer, C.L. 2007. *Amylostereum areolatum* (Fr.) Boidin Sirex-Fungus Pest Fact Sheet. APHIS Centerfor Plant Health Science and Technology.
Summary: This a good source focused on *Amylostereum areolatum* detailing its relationship with *Syrex noctilio*and some of their parasites.
Available from: http://www.aphis.usda.gov/plant_health/plant_pest_info/sirex/downloads/sirexfungus.pdf
USDA Animal and Plant Health Inspection Service (APHIS)., 2007. *Sirex noctiolio* (Sirex Woodwasp).
Summary: A profile on *Sirex noctilio* and its threat to North America.
Available from: http://www.aphis.usda.gov/plant_health/plant_pest_info/sirex/background.shtml [Accessed 8 October 2007]
Walker, K. 2006. Sirex woodwasp (*Sirex noctilio*) Pest and Diseases Image Library. Updated on 30/07/2006 12:25:57 PM.
Summary: PaDIL (Pests and Diseases Image Library) is a Commonwealth Government initiative, developed and built by Museum Victoria s Online Publishing Team, with support provided by DAFF (Department of Agriculture, Fisheries and Forestry) and PHA (Plant Health Australia), a non-profit public company. Project partners also include Museum Victoria, the Western Australian Department of Agriculture and the Queensland University of Technology.
The aim of the project is: 1) Production of high quality images showing primarily exotic targeted organisms of plant health concern to Australia. 2)Assist with plant health diagnostics in all areas, from initial to high level. 3) Capacity building for diagnostics in plant health, including linkage developments between training and research organisations. 4)Create and use educational tools for training undergraduates/postgraduates. 5) Engender public awareness about plant health concerns in Australia.
PaDIL is available from : http://www.padil.gov.au/aboutOverview.aspx, this page is available from:
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=524 [Accessed 14 october 2007]

General information

Bean, Dick. 2005. The European wood wasp, *Sirex noctilio*, is the January Invader of the Month. Maryland Department of Agriculture.
Summary: This source is part of an Invader of the Month series containing good information about *Sirex noctilio*.
Available from: http://www.mdinvasivesp.org/sirex_noctilio.pdf [Accessed 11 October 2006]
Borchert, Daniel. 2006. 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) Boiden. USDA-APHIS-PPQ-CPHST-PERAL
Summary: A publication of risk assessment in the US by the USDA APHIS Plant Protection and Quarantine division
Available from: http://www.aphis.usda.gov/plant_health/ea/downloads/sirexnoctilio-0307.pdf [Accessed 9 October 2007]
Canadian Food Inspection Agency. 2007. *Sirex noctilio*(Fabricius) - Sirex woodwasp.
Summary: A brief profile containing good pictures of *Sirex noctilio*
Available from: http://www.inspection.gc.ca/english/plaveg/pestrava/sirnoc/tech/sirnoce.shtml [Accessed 8 October 2007]
CONABIO. 2008. Sistema de informaci&#65533;n sobre especies invasoras en M&#65533;xico. Especies invasoras - Insectos. Comisi&#65533;n Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.
Summary: English:
The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.
Invasive species - insects is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
Spanish:
La lista de especies del Sistema de informaci&#65533;n sobre especies invasoras de m&#65533;xico cuenta actualmente con informaci&#65533;n aceca de nombre cient&#65533;fico, familia, grupo y nombre com&#65533;n, as&#65533; como h&#65533;bitat, estado de la invasi&#65533;n en M&#65533;xico, rutas de introducci&#65533;n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p&#65533;gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci&#65533;n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci&#65533;n novedades, para conocer los cambios.
Especies invasoras - Insectos is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
Crop Protection Compendium. Undated. *Sirex noctilio* Fabricius, 1973.
Summary: A comprehensive list of common names accessed through CABI Compendeum.
Available from: http://www.cabicompendium.org/NamesLists/CPC/Full/SIRXNO.htm [Accessed 16 October 2007]
Davies, R.K. 2006. Sirex woodwasp letter to the forest products industry and recommended protocols. New York State Department of Environmental Conservation.
Summary: This is a letter from the director of the Division of Lands and Forests of the New York State Department of Environmental Conservation to forest products companies urging precautions to control *Sirex noctilio*.
Available from: http://www.dec.ny.gov/animals/7531.html [Accessed 17 October 2007]
Dunkle, R.L. 2006. National Plant Board State Plant Regulatory Officials SPRO Letters
Summary: Letters written by the APHIS PPQ Deputy Administrator advising the SPRO of updates concerning *Sirex noctilio*
Available from: http://www.nationalplantboard.org/laws/spro.html [Accessed 15 October 2007]
King, J. 2005. Sirex wood wasp. Queensland Government Department of Primary Industries and Fisheries.
Summary: A brief profile on *Sirex noctilio* by Queensland s Department of Primary Industries and Fisheries
Available from: http://www2.dpi.qld.gov.au/forestry/8096.html [Accessed 8 October 2007]
Madden, J.L. 1974. Oviposition behaviours of the woodwasp *Sirex noctilio* F. Australian Journal of Zoology, Vol. 22:341-351.
Summary: This journal article offers a detailed description on oviposition and reproduction of *Sirex noctilio*.
Available from: http://www.publish.csiro.au/paper/ZO9740341.htm [Accessed * October 2007]

Madden, J.L. 1981. Egg and larval development in the woodwasp, *Sirex noctilio* F. Australian Journal of Zoology, Vol. 29: 493-506.
Summary: A journal article which describes in detail the oviposition and life cycle of *Sirex noctilio*
Available from: http://www.publish.csiro.au/?act=view_file&file_id=ZO9810493.pdf [Accessed 15 October 2007]
Martinez, A.S., Fernandez-Arhex, V., and Corley, J.C. 2006. Chemical information from the fungus *Amylostereum areolatum* and host-foraging behaviour in the parasitoid *Ilbia leucospoides*. Physiological Entomology, Vol. 31: 336-340.
Summary: An examination of the interactions of *Ibalia leucospoides* and *Amylostereum areolatum*.
McCullough, D.G. New invasive woodwasp - let s wait and see. Landscape Alert Newsletter. Integrated Pest Management Resources. Michigan State University.
Summary: Newsletter publication by the Integrated Pest Management Resources of Michigan State describing the capture of a *Sirex noctilio* specimen in Michigan
Available from: http://www.ipm.msu.edu/cat07land/l07-27-07.htm#1 [Accessed 9 October 2007]
Morgan, D.F. 1968. Bionomics of Siricidae. Annual Review of Entomology, Vol. 13 :239- 256.
Summary: This is a publication containing good information regarding many members of Siricidae.
North American Plant Protection Organization (NAPPO), 2005. Sirex wood wasp (*Sirex noctilio*) - confirmation in Southeastern Ontario. North American Plant Protection Organization s Phytosanitary Alert System Official Pest Reports.
Summary: Pest report updating presence of *Sirex noctilio* in Canada.
Available from: http://www.pestalert.org/oprDetail.cfm?oprID=183&keyword=sirex%20noctilio [Accessed 8 October 2007]
North American Plant Protection Organization (NAPPO), 2007. Detection of *Sirex noctilio* Fabricius (Sirex woodwasp) in Iamoille County, Vermont - United States. North American Plant Protection Organization s Phytosanitary Alert System Official Pest Reports.
Summary: Pest report updating presence of *Sirex noctilio* in Vermont.
Available from: http://www.pestalert.org/oprDetail.cfm?oprID=183&keyword=sirex%20noctilio [Accessed 18 October 2007]
Slippers, B. Wingfield, M.J., Coutinho, T.A., and Wingfield, B.D. 2001. Population structure and possible origin of *Amylostereum areolatum* in South Africa. Plant Pathology, Vol. 50: 206-210.
Summary: This journal article is focused on the effects of *Sirex noctilio s* symbiote fungus *Amylostereum arealatum* in South Africa.
Taylor, K.L. 1967. Parasitism of *Sirex noctilio* F. by *Schlettererius cinctipes* (Cresson) (Hymenoptera: Stephanidae). Journal of Australian Entomological Society, Vol. 6: 13-19.
Summary: A detailed study of parasitization of *Sirex noctilio* by *Schlettererius cinctipes*.
USFS. 2006. Sirex woodwasp: Health of pine forests is threatened nationwide. USDA Forest Service.
Summary: Brief account of budgets issues and potential impact of *Sirex noctilio*
Available from: http://www.fs.fed.us/foresthealth/briefs/2007_budget_briefings/sirex_woodwasp.htm [Accessed 24 October 2007]
Wingfield, M.J., Slippers, B., Roux, J., and Wingfield, B.D. 2001. Worldwide movement of exotic forest fungi, especially in the tropics and the southern hemisphere. BioScience, Vol. 51, No. 2: 134-140.
Summary: This journal article investigates the impact of different fungi on timber, including *Amylostereum areolatum* and symbiote *Sirex noctilio*.
Zondag, R. and Nuttall, M.J. 1977. *Sirex noctilio* Fabricius (Hymenoptera: Siricidae), Sirex . New Zealand Forest Service, Forest and Timber Insects in New Zealand No. 20.
Summary: This source contains detailed information about the breeding and life cycle of *Sirex noctilio*.
Available from: http://www.fabinet.up.ac.za/pdfs/SirexLIT/Zondag&Nuttall1977NZ20.pdf [Accessed 16 October 2007]