

Aulacaspis yasumatsui

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Hemiptera	Diaspididae

Common name snow scale (English), Thai scale (English), sago palm scale (English, Hawaii), cycad scale (English, Hawaii), cycad aulacaspis scale (CAS) (English, Florida, Guam), Asian cycad scale (English, Hawaii)

Synonym

Similar species *Pseudaulacaspis cockerelli*, *Pinnaspis strachani*

Summary *Aulacaspis yasumatsui* (cycad aulacaspis scale (CAS)) or the Asian cycad scale, is highly damaging to cycads, which include horticulturally important and endangered plant species. The cycad scale is an unusually difficult scale insect to control, forming dense populations and spreading rapidly, with few natural enemies in most localities where it has been introduced. The scale has the potential to spread to new areas *via* plant movement in the horticulture trade.



[view this species on IUCN Red List](#)

Species Description

All adult female *Aulacaspis yasumatsui* (cycad aulacaspis scale (CAS)) have a waxy outer covering for the protection of themselves and their eggs (the scale) (Weissling *et al.* 1999). The scale of mature females of *A. yasumatsui* are: "white, 1.2-1.6mm long and highly variable in form. They tend to have a pyriform shape with the exuviae at one end, but are often irregularly circular, conforming with leaf veins, adjacent scales and other objects. The ventral scale is extremely thin to incomplete. The scale of the juvenile male is similar to those of other species of Diaspididae, being 0.5-0.6mm long, white and tricarinate, with exuviae at the cephalic end. Scales of males are nearly always more numerous than those of females" (Howard *et al.* 1999). Adult males are orange-brown, and are similar in appearance to tiny flying midges, with one pair of wings and well-developed legs and antennae (Heu *et al.* 2003). Adult females are also orange in colour (Weissling *et al.* 1999).

Infestations of CAS on cycads begin on the undersides of leaflets or at the base of the petiole. As the infestation progresses, scales also infest the upper surfaces of leaflets, the terminal portion of the cycad, the trunk and even roots and seeds/cones (Heu *et al.* 2003; Weissling *et al.* 1999; Haynes, pers. comm.). The leaves of infested cycads have a whitewashed or snow-covered appearance due to the numerous white scales. Plants that have been infested for some time will typically have chlorotic, yellow-brown leaves, as the continuous removal of plant sap by the scale will usually result in the death of the leaves (Heu *et al.* 2003). The scale can eventually form several layers, which include a high proportion of dead as well as live insects. Heavy infestations can consist of up to 3,000 scales per square inch in several layers (Weissling, 1999).

A simple way to tell if a plant has CAS, as opposed to other types of scale, is the speed in which it multiplies and the thickness with which it covers the plant. An infestation usually starts on the petioles near the crown of the plant, and works out from there. The plant will usually be totally covered within a couple of months (Broome, 2004).

Lifecycle Stages

Generally, scale insects initially hatch into a "crawler" stage capable of movement. When they find a suitable spot on a plant, they will insert their stylet (straw-like mouthparts) into the plant and begin feeding. Shortly after this, they will begin to create a covering over themselves, and they stay this way until they die. (IFAS, 2005).

Male cycad scales emerge from their scale shortly before death and fly in search of females for mating before they die. Females remain attached to the plant until their death. (Haynes and Marler, 2005). Most female cycad scales do not live longer than 75 days (Howard *et al.* 1999).

Habitat Description

Aulacaspis yasumatsui (cycad aulacaspis scale (CAS)) is found on plants from the gymnosperm order Cycadales, which consists of three families - Cycadaceae (*Cycas* a genus that contains its preferred host species), Stangeriaceae (*Stangeria*) and Zamiaceae (8 genera). CAS has been recorded on plants of the following genera: *Cycas*, *Stangeria*, *Dioon*, *Encephalartos*, *Ceratozamia*, *Macrozamia* and *Microcycas* (Howard *et al.* 1999; J. Haynes, pers. comm.; W. Tang, pers. comm.). These plants represent a wide variety of geographic origin. At Montgomery Botanical Center in Miami, Florida, the heaviest infestations appeared to be on *Cycas* and *Stangeria eriopus*. The threatened king sago (see [Cycas revoluta in IUCN Red List of Threatened Species](#)) appears to be more susceptible to CAS than most other species (Heu *et al.* 2003). The cycad scale infests pinnae, rachides, strobili, stems and roots of these various species of cycads. It is primarily found on the underside of leaves (Howard *et al.* 1999). In containerised plants, CAS usually aggregates on primary roots (about 10mm in diameter), and singly or in groups of a few on secondary roots (about 2mm in diameter) near the container sides. In the field, CAS has been observed at different depths on primary (3cm in diameter) and secondary roots in groups of a few to several individuals from near the soil surface to a maximum depth of 60cm (Weissling *et al.* 1999).

The preferred host genus of CAS is *Cycas*, which is native to Asia, as is *A. yasumatsui*. This suggests that *Cycas* may be the original host (Howard *et al.* 1999). CAS has been identified mainly in the monsoon areas of southeast Asia, and has seldom been found on cycads in rainforest areas. This suggests that the ability of CAS to infest roots may be an adaptation to surviving brush fires, a common occurrence in these monsoon areas (Howard *et al.* 1999).

Reproduction

Female *Aulacaspis yasumatsui* (cycad aulacaspis scale (CAS)) can begin laying eggs within 21-35 days of hatching in warmer weather (Hamon, 2000; in IFAS, 2005). Eggs hatch within 8-12 days and some individuals have been observed to develop to second instars within 16 days, and third instars in 28 days. Mature females lay >100 eggs (Howard *et al.* 1999).

General Impacts

Aulacaspis yasumatsui (cycad aulacaspis scale (CAS)) threatens both ornamental and wild cycad populations. It spreads rapidly and can cover a large cycad within a number of weeks (Haynes & Marler, 2005). It has been observed to kill 100% of a *Cycas revoluta* population in cultivation within one year of infestation (Howard *et al.* 1999).

CAS has the potential to disrupt the horticultural trade in cycads. Cycads are valuable ornamental plants worldwide and the scale detracts from the appearance of plants even after treatment as the dead scales do not readily drop off (Howard *et al.* 1999). CAS also threatens the survival of several rare and already endangered species conserved in botanical collections (Howard *et al.* 1999; J. Haynes, pers. comm).

CAS can be easily spread to new locations *via* the plant trade as one or more fecund females on the plant can easily evade detection. This could threaten native cycad populations in these new locations (Emshousen *et al.* 2004), as is occurring in Guam where CAS is killing off the native cycad (see [Cycas micronesica in IUCN Red List of Threatened Species](#)) at an alarming rate (Haynes & Marler, 2005). It is expected that CAS will spread to other islands in the Caribbean and Micronesia unless strict controls are put in place to restrict its spread *via* commercial cycads. Indigenous cycads in the genus *Cycas* in Micronesia would be at risk should the spread of CAS be left unchecked in these regions (Muniappan, 2005; J. Haynes, pers. Comm). CAS has been reported in the Taitung Cycad Nature Reserve, Taiwan, home of the endemic prince sago (see [Cycas taitungensis in IUCN Red List of Threatened Species](#)). A recent survey conducted in the reserve by the Taiwan Forestry Research Institute found that 90% of prince sago were infected by CAS, mortality was, however, found to be less than 3%.

Management Info

Integrated management: Research has indicated that maintaining *Aulacaspis yasumatsui* (cycad aulacaspis scale (CAS)) populations at a rate that does not threaten the health of plants requires multiple control measures (Wiese and Mannion, undated). The long-term solution may lie in biological control, however, in the short term it is necessary to control the pest on as many plants as possible by treating plants and preventing further spread (IFAS, 2005).

Please follow this link for [management information and control options compiled by the ISSG](#). [The Cycad Aulacaspis Scale Pest Alert](#) notification released by the IUCN SSC Cycad Specialist Group gives details on description, mode of attack, range, vulnerable species, images and control options.

Pathway

Aulacaspis yasumatsui (cycad aulacaspis scale (CAS)) can be transported to new locations by the import of infested cycad plants. There is high potential for CAS to spread in this manner as one or more fecund females hidden in the cycad can easily escape detection (EPPO, 2005).

Principal source: [Howard *et al.* 1999](#). *Aulacaspis yasumatsui* (Hemiptera: Sternorrhyncha: Diaspididae), a scale insect pest of cycads recently introduced into Florida.

Weissling *et al.* 1999. Featured creatures: Cycad Aulacaspis Scale, *Aulacaspis yasumatsui* Takagi.



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Aulacaspis yasumatsui*

Compiler: IUCN/SSC Invasive Species Specialist Group (ISSG) with support from the Terrestrial and Freshwater Biodiversity Information System (TFBIS) Programme ([Copyright statement](#))

Review: F. W. Howard, Ph.D. Associate Professor of Entomology, University of Florida, IFAS.
Fort Lauderdale Research & Education Center Florida USA
Jody Haynes, Secretary & Webmaster, [IUCN Cycad Specialist Group](#), Miami, FL, USA

Publication date: 2010-01-10

ALIEN RANGE

[1] CAYMAN ISLANDS	[1] COTE D'IVOIRE
[1] FRANCE	[1] GUAM
[1] HONG KONG	[1] NEW ZEALAND
[1] NORTHERN MARIANA ISLANDS	[1] PALAU
[2] PUERTO RICO	[1] SINGAPORE
[3] TAIWAN	[37] UNITED STATES
[1] VIRGIN ISLANDS, U.S.	

Red List assessed species 5: EN = 3; VU = 1; LC = 1;

[Cycas micronesica](#) EN

[Cycas revoluta](#) LC

[Cycas saxatilis](#) VU

[Cycas taitungensis](#) EN

[Pteropus mariannus](#) EN

BIBLIOGRAPHY

52 references found for *Aulacaspis yasumatsui*

Management information

[Animal and Plant Health Inspection Service \(APHIS\). 2002. Control of Cycad aulacaspis scale, *Aulacaspis yasumatsui* \(Homoptera:Diaspididae\): Environmental Assessment](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/EA-for-Cycad-Scale-Final-13-JUN-02.pdf> [Accessed 26 June 2009]

This environmental assessment was prepared by USDA, APHIS, Environmental Analysis and Documentation, and Plant Protection and Quarantine Units (all at USDA, APHIS, Riverdale, MD).

[Bailey, R. 2005. Potential of *Cybocephalus binotatus* Grouvelle for biological control of cycad scale, *Aulacaspis yasumatsui* Takagi, in Taiwan. Abstract of poster presented at the International Symposium on Biological Control of Aphids and Coccids, 25-29 September 2005, Tsuruoka, Japan.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Bailey-Biocontrol-of-CAS-in-Taiwan-2005.pdf> [Accessed 26 June 2009]

[Bailey, R. 2005. Update on CAS Research in Taiwan. Unpublished.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Update-on-CAS-Research-in-Taiwan.pdf> [Accessed 26 June 2009]

[Broome, T. 2004. Horticulture: the Asian cycad scale.](#)

Summary: This article discusses the effects of the cycad scale on cycad plants, and outlines some management options. Available from: <http://www.plantapalm.com/vce/horticulture/asiancycadscale.htm> [Accessed 21 July 2005]

[Caldwell, D.L. 2003. The cycad aulacaspis scale, *Aulacaspis yasumatsui*: Management approaches and pesticide trial updates. Proceedings of the Florida State Horticulture Society 116:347-350.](#)

Summary: Available from: http://www.cycadsg.org/publications/CAS/fshsCALDWELL_2003.pdf [Accessed 26 June 2009]

[Cave, R.D. 2005. Biological control of *Aulacaspis yasumatsui*. The Cycad Newsletter 28\(5\):8-9.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/TCS-Cave.pdf> [Accessed 26 June 2009]

[Cave, R.D. & P.S. Duetting. 2004. Predatory Coleoptera on king sago \(Cycadaceae\) in south Florida. Poster presented at the Entomological Society of America meetings, 7-11 November 2004, Salt Lake City, UT.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/ESA-04-poster.pdf> [Accessed 26 June]



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Aulacaspis yasumatsui*

[Cave, R.D., R. Nguyen, V. Manrique & P.B. Avery. 2009. New research on two natural enemies of the cycad aulacaspis scale. *Cycad Newsletter* 32\(2/3\):22-23.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Cave-et-al-2009-TCN.pdf> [Accessed March 8 2010]

[Chao, Jung-Tai ., 2005. CAS Status Update in Taiwan. Personal communication Jody Haynes Cycad Biologist, Montgomery Botanical Center](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/CAS-Status-Update-in-Taiwan.pdf>[Accessed 26 June 2009]

[Duke, E.R., A.B. Lorenzo & F.W. Howard. 2003. Survival of the cycad aulacaspis scale in northern Florida during sub-freezing weather. *Proceedings of the Florida State Horticulture Society* 116:345-347.](#)

Summary: Available from: http://www.cycadsg.org/publications/CAS/fshsDUKE_coldTOLERANCE_2003.pdf [Accessed 26 June 2009]

Emshousen, C., Mannion, C. and Glenn, H. 2004. Management of cycad aulacaspis scale, *Aulacaspis yasumatsui* Takagi. *Proceedings of the Florida State Horticultural Society*. 117: 305-307.

Summary: This evaluation of the management options examines the different methods of chemical control for cycad scale in Florida.

[European and Mediterranean Plant Protection Organisation \(EPPO\). 2005. EPPO Alert List: *Aulacaspis yasumatsui*.](#)

Summary: This fact sheet produced by the European and Mediterranean Plant Protection Organisation outlines some of the more important information about *A. yasumatsui*.

Available from: http://www.eppo.org/QUARANTINE/Alert_List/insects/AULSYA.htm [Accessed 3 July 2005]

Gill, George, pers. comm., Jan 2006 Senior Adviser - Surveillance & Incursion Response, Post-clearance Directorate, Biosecurity New Zealand.

[Hara, H. Arnold; Ruth Y. Nilno- DuPonte; Christopher Jacobsen; Stacey Chun; Ty MacDonals; Walter T. Nagamine; Ron A. Heu. 2005. Cycad Scale on Sago Palm. UH-CTAHR Co-operative Extension Office](#)

Summary: Available from: <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/ip-23.pdf> [Accessed March 10 2010]

[Haynes, J. and Marler, T. 2005. Exotic invasive pest insect critically threatening Guam s vulnerable flora, fauna and island ecosystem.](#)

Summary: This paper outlines the arrival of the cycad scale in Guam, and its subsequent spread and effects.

Recommendations for management and prevention of further spread are also discussed.

Available from: <http://www.cycadsg.org/publications/CAS/Haynes-Marler-Guam-CAS-Overview.pdf> [Accessed 26 June 2009]

Haynes, J.L. Undated. Cycads in the South Florida Landscape . Institute of Food and Agricultural Sciences, University of Florida.

Summary: This paper gives information about the types of cycads found in Florida, and gives basic details about the pests and diseases which afflict them, including *A. yasumatsui*.

Heu, R.A., M. Chun & W.T. Nagamine. 2003. Sago palm scale, *Aulacaspis yasumatsui* Takagi (Homoptera: Diaspididae). State of Hawaii Department of Agriculture New Pest Advisory No. 99-01.

[Hodges, G., Howard, F.W. and Buss, E.A. 2003. Update on management methods for cycad aulacaspis scale.](#)

Summary: This paper provides an overview of some of the management methods available to control the cycad scale in Florida, including cultural methods.

Available from: <http://www.doacs.state.fl.us/pi/enpp/ento/aulacaspis.html> [Accessed 16 July 2005]

[Howard, F.W., Hamon, A., McLaughlin, M., Weissling, T. and Yang, S-L. 1999. *Aulacaspis yasumatsui* \(Hemiptera: Sternorrhyncha: Diaspididae\), a scale insect pest of cycads recently introduced into Florida. *Florida Entomologist*. 82 \(1\): 14-27.](#)

Summary: This paper covers some general information about the biology of *A. yasumatsui*, as well as outlining its spread in Florida in the late 1990s, and some possible management options.

Available from: <http://www.fcla.edu/FlaEnt/fe82p14.pdf> [Accessed 26 July 2005]

[IUCN/SSC Cycad Specialist Group. 2005. Pest Alert Cycad Aulacaspis Scale](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Cycad-Aulacaspis-Scale-Pest-Alert.pdf> [Accessed 26 January 2009]

[IUCN/SSC Cycad Specialist Group. 2009. Cycad Aulacaspis Scale Information Page](#)

Summary: This page was created as a clearinghouse for information related to cycad aulacaspis scale (CAS), *Aulacaspis yasumatsui* Takagi (Hemiptera: Diaspididae)

Available from: <http://www.cycadsg.org/pages/CAS.htm> [Accessed 26 June 2009]

[IUCN/SSC Cycad Specialist Group ? Subgroup on Invasive Pests. 2005. Report and Recommendations on Cycad Aulacaspis Scale, *Aulacaspis yasumatsui* Takagi \(Hemiptera: Diaspididae\).](#)

Summary: This report summarizes findings and recommendations related to this serious pest, based on the following specific tasks: 1. Determine how to control the current CAS outbreaks; 2. Determine how to anticipate and, more importantly, stop the spread of CAS; 3. Determine how to preserve the gene pool of species that are already affected by CAS or may become affected; and 4. Undertake an analysis of the current distribution of CAS and identify high risk areas/species.

Available from: <http://www.cycadsg.org/publications/CAS/CSG-Report-on-Cycad-Aulacaspis-Scale.pdf> [Accessed 26 June 2009]

Mannion, C. Undated. Community Integrated Pest Management (IPM): Commercial landscape. Management of cycad aulacaspis scale (*Aulacaspis yasumatsui*).

Summary: This paper evaluates some of the insecticide treatment options for the control of cycad scale.

[Marler, T. 2008. CAS Confirmed on Palau. December 2008.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/CAS-Confirmed-on-Palau.pdf> [Accessed 11 March 2010]

[Marler, T. 2009. Rota Update. 28 April 2009.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Rota-Update-Apr-2009.pdf> [Accessed 11 March 2010]

[Marler, T. 2010. Guam Update. 19 January 2010.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Guam-Update-Jan-10.pdf> [Accessed March 8 2010]

Marler, T. March 13 2004. Alien insect attacking Guam s native flora. *Pacific Daily News*, Lifestyle section, p 20.

Summary: This newspaper article was written to publicise the arrival of the cycad scale in Guam

Moore, A. 2005a. Evaluation of emergency insecticide treatments for conservation of Guam s endemic cycad, *Cycas micronesica*, during invasion by the Asian cycad scale, *Aulacaspis yasumatsui*. Draft proposal.

Summary: This proposal for further research outlines the background of the cycad scale in Guam, and discusses some management options.

Moore, A. 2005b. Cycad scale, *Aulacaspis yasumatsui* (Homoptera: Diaspididae). Micronesian Invasive Insect Survey website.

[Moore, A. 2009. UOG Entomologist Helps Palau with their Cycad Scale Infestation. Western Pacific Tropical Research Center.](#)

Summary: Available from: <http://www.wptrc.org/article.asp?artID=112> [Accessed 11 March 2010]

Muniappan, R. 2005. Foreign exploration for natural enemies of the cycad scale, *Aulacaspis yasumatsui* (Homoptera: Diaspididae). University of Guam.

Summary: A proposal for the exploration for natural enemies of the cycad scale in its native Southeast Asia.

[Muniappan, R. & C.A. Viraktamath. 2006. The Asian cycad scale *Aulacaspis yasumatsui*, a threat to native cycads in India. *Current Science* 91\(7\):868-70.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Muniappan-Viraktamath-2006.pdf> [Accessed 11 March 2010]

[Paice, K.L.; J.E. Richmond.; S.J. Bennett.; H.G. Pearson.; and G.S.C. Gill., 2004. Detection of scale insects \(Hemiptera: Diaspididae\) in 2004: *New Zealand Plant Protection*, Volume 58, 2005](#)

Summary: Abstract available from: http://nzpps.org/journal/58/nzpp58_323.pdf [Accessed 8 February 2008]

[Palmer, C. 2005. Efficacy of Flagship 25WP, Safari 20SG, Talus 40SC, and Tristar 20WSP for Managing Scale Insects. IR-4 HQ, Rutgers University.](#)

Summary: Available from: http://ir4.rutgers.edu/ornamental/ORNDrafts/05-002a_scale.pdf [Accessed March 8 2010]

Palmer, D. & J. Hoffman. 2005. Asian cycad scale (*Aulacaspis yasumatsui*) information page. University of Florida/Hillsborough County Extension website.

[Reddy, G.V. 2008. Biological control of cycad aulacaspis scale in Guam. University of Guam UOG Station.](#)

Summary: Available from: <http://www.reeis.usda.gov/web/crisprojectpages/210492.html> [Accessed March 8 2010]

[Smith, S. 2007. Quick action and cooperative efforts help save the cycads on Guam. USDA Forest Health Protection Region 5 Trip Report, 23-26 April 2007.](#)

Summary: Available from: http://www.fs.fed.us/r5/spf/fhp/hawaii/Trip%20Report_Guam_April_2007.pdf [Accessed 11 March 2010]

[Smith, T.R. & R.D. Cave. 2005. Life Cycle of *Cybocephalus nipponicus* Endr?dy-Younga, a Predator of the Cycad Aulacaspis Scale, *Aulacaspis yasumatsui* Takagi. Poster presented at 2005 Entomological Society of America Annual Meeting, 15-18 December 2005, Ft. Lauderdale, FL](#)

Summary: Available from: http://esa.confex.com/esa/2005/techprogram/paper_21794.htm [Accessed March 8 2010]



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Aulacaspis yasumatsui*

[Suasa-Ard, W., O. Kern-Asa & W. Tunkumthong. n.d. Cycad scale, *Aulacaspis yasumatsui* Takagi \(Homoptera: Coccidae\) and its natural enemies in Thailand. Unpublished manuscript.](#)

Summary: Available from: <http://www.net.sfsi.co.jp/shoko-travel/symposium/symPDF/S2/Suasa-ard.pdf> [Accessed 16 November 2005]

Tattar, T.A. 2004. Asian cycad scale: new threat to cycads.

Summary: This article outlines a recent incursion of *A. yasumatsui* in California, and describes the treatment method which was undertaken.

[Tattar, T.A. & A. Farran. 2006. Control of Asian cycad scale on *Cycas revoluta* and *C. taitungensis* using Imicide trunk microinjection. P. 97, In: Proceedings of the 17th U.S. Department of Agriculture Interagency Research Forum on Gypsy Moth and Other Invasive Species. General Technical Report NRS-P-10.](#)

Summary: Available from: http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs-p-10/gtr_nrs-p-10_097.pdf [Accessed March 8 2010]

[The Florida Department of Agricultural and Consumer Services \(FDACS\) 2004. Annual report](#)

Summary: Available from: <http://www.florida-agriculture.com/annual/index.htm> [Accessed 20 July 2005]

University of Florida IFAS Extension, 2005. Collier County Horticulture Cycad Scale

[Viraktamath, C.A. 2005. Update on CAS Native Range. Unpublished.](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/Update-on-CAS-Native-Range-14-NOV-05.pdf> [Accessed 10 March 2010]

Wiese, C., Amalin, D., Coe, R. and Mannion, C. 2005. Effects of the parasitic wasp, *Coccobius fulvus*, on cycad aulacaspis scale, *Aulacaspis yasumatsui*, at Montgomery Botanical Center, Miami, Florida. Proc. Fla. State Hort. Soc.

Summary: This research article reports on the effectiveness of the parasitic wasp *Coccobius fulvus* in controlling the cycad scale.

Wiese, C. and Mannion, C. Undated. Managing cycad aulacaspis scale (*Aulacaspis yasumatsui* Takagi) at Montgomery Botanical Center, USA.

Summary: This document discusses the outbreak of cycad scale at Montgomery Botanical Center, and discusses an integrated management plan.

World Trade Organization. 2004. Notification of Emergency Measures document: Import requirements for Cycas in New Zealand.

Summary: This document states the emergency measures put in place following an incursion of *A. yasumatsui* in New Zealand.

General information

[Germain, J.F. & G.S. Hodges. 2007. First report of *Aulacaspis yasumatsui* \(Hemiptera: Diaspididae\) in Africa \(Ivory Coast\), and update on distribution. Florida Entomologist 90:755-756.](#)

Summary: Available from: <http://www.fcla.edu/FlaEnt/fe90p755.pdf> [Accessed March 8 2010]

[ITIS \(Integrated Taxonomic Information System\), 2008. Online Database *Aulacaspis Cockerell*, 1893](#)

Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.

Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=200721 [Accessed 14 January 2008]

[Segarra-Carmona, A.E. & W. P?rez-Padilla. 2008. The cycad scale, *Aulacaspis yasumatsui* Takagi \(Homoptera: Diaspididae\): A new invasive pest to Puerto Rico. Journal of Agriculture of the University of Puerto Rico 92:123-129](#)

Summary: Available from: <http://www.cycadsg.org/publications/CAS/CAS-in-Puerto-Rico-2008.pdf> [Accessed March 8 2010]

[Watson, G.W. n.d. Diaspididae: *Aulacaspis yasumatsui*. World Biodiversity Database: Arthropods of Economic Importance website.](#)

Summary: Available from: <http://ip30.eti.uva.nl/bis/diaspididae.php?menuentry=soorten&selected=beschrijving&id=97> [Accessed 16 November 2005]

Weissling, T.J., Howard, F.W. and Hamon, A. 1999. Featured creatures: Cycad aulacaspis scale, *Aulacaspis yasumatsui* Takagi.