

# New Research on Two Natural Enemies of the Cycad Aulacaspis Scale

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The cycad aulacaspis scale (CAS), *Aulacaspis yasumatsui* Takagi, continues to be a severe pest of cycads throughout the world. Chemical control can be expensive and provide inconsistent results. Therefore, research continues to examine natural enemies that may contribute to the overall biological control of the scale. No less than four species of parasitic wasps (*Coccobius fulvus* [Compere and Annecke], *Arrhenophagus chionaspis* Aurivillius, *Aprostocetus purpureus* [Cameron], and *Aphytis* sp.) attack the scale in Asia and North America, and at least 20 species of predatory beetles have been observed feeding on the pest (Cave, 2006). However, nearly all these natural enemies appear to be ineffective at providing satisfactory control.

According to a report developed by the IUCN/SSC Cycad Specialist Group, a major priority should be to promote research to identify new biological control agents for CAS (Tang *et al.*, 2006). With this goal, Dr. Ronald D. Cave of the University of Florida and Dr. Ru Nguyen of the Florida Department of Agriculture and Consumer Services embarked on travel to Asia in 2006 and 2007 to discover unknown natural enemies of the scale. Their journeys took them to southern China, northern Vietnam, and Thailand. Funding was provided by the Eastern and Western Region Offices of USDA Animal and Plant Health Inspection Service, Plant Protection and Quarantine.

During exploration in Thailand in October 2007, a bright orange lady beetle (Coccinellidae) was observed causing devastation to CAS populations on *Cycas siamensis* Miq. in a forest near Sub Tao (Fig. 1), 7 km from the Sakaerat Environmental Research Center. Predation by beetles on infested plants in this area was widespread. Numerous larvae, pupae, and adults were shipped to Florida where colonies are now maintained in quarantine in Gainesville and Fort Pierce. According to Dr. Natalia Vandenberg (USDA taxonomist), the species belongs to the genus *Phaenochilus* but is new to science; she and graduate student Adriano Giorgi (University of Georgia) are formally naming and describing the species. The adults are bright reddish orange (Fig. 2), about 4 mm long, and have large eyes. Females lay their eggs singly on scale-infested leaflets and the rachis. The larva (Fig. 3) passes

through four instars, and pupation occurs on the plant. Mean larval development time at 27 C is 19.3 days.

Adults and larvae of *Phaenochilus* n. sp. have been exposed to other armored scales, soft scales, whitefly nymphs, aphids, mealybugs, psyllids, thrips, and citrus leafminer larvae. Predation was noted only on other armored scale species and a few whitefly nymphs; no feeding on other insects was observed. Due to its host specificity and voracious and preferential consumption of cycad aulacaspis scales, it is a good candidate for biological control of the pest. A petition for field release of *Phaenochilus* n. sp. is in preparation and will be submitted to APHIS PPQ in early 2009.

Current research is also examining an entomopathogenic fungus that has been shown to be an effective control agent of many insects, but is essentially untested against armored scales. *Isaria fumosorosea* (Wize) is a geographically widespread pathogen of several insect species (Samson, 1974; Smith, 1993; Luangsa-ard *et al.*, 2005); it is frequently found in soil (Tigano-Milani *et al.*, 1992). Since 1974, numerous studies have looked at developing this ubiquitous fungus as a biopesticide of various insect pests. It has been found to be one of the most common fungal pathogens of whitefly nymphs and adults (Humber, 1992; Lacey *et al.*, 1993; Zimmermann, 2008).

Two strains are currently available as blastospore formulations for research in the United States, PFR97™ (Certis USA, Columbia, MD) and ARSEF *Ifr* 3581 from USDA/ARS, NCAUR in Peoria, IL (Jackson *et al.*, 1997). PFR97™ is commercially registered in California as PFR97 20% WDG®, but is in the process of becoming registered in the rest of the United States. It is registered for use and sold in Europe and Japan.

Preliminary studies were conducted to examine the potential use of *Isaria fumosorosea* to control CAS in the laboratory (Castillo, 2008). Results showed that first and second instars of the scale became infected with the fungus (Figure 4). High mortality was recorded when two concentrations were used at 20 and 30° C (70-90% infection at the highest concentration). *Isaria fumosorosea* has several characteristics that warrant further evaluation for controlling CAS. It is a cosmopolitan organism, it causes high mortality of nymphs (Castillo, 2008), and it is compatible with natural enemies

and non-target organisms (Sterk *et al.*, 1995a, b; Avery, 2002; Avery *et al.*, 2008). *Phaenochilus* n. sp. and *I. fumosorosea* may offer a “one-two punch” to suppress populations of CAS, but much more needs to be known about these natural enemies before botanical gardens, homeowners, and landscapers can use them to save their cycads.

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Fig. 1. Forest near Sub Tao, Thailand where *Phaenochilus n.sp.* was discovered. Photo by R. Cave.



Fig. 2. Adult n.sp. on *Epicycas siamensis* at Sub Tao, Thailand. Photo by R. Cave.



Fig. 3. Larva of *Phaenochilus n. sp.* Photo by V. Manrique.

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Fig. 4. Nymphs of the cycad aulacaspis scale infected by *Isaria fumosorosea*. Photo by J. Castillo.

## Cycad Society of South Africa

The Cycad Society of South Africa is a nonprofit international organization based in South Africa. It is devoted to education and conservation of cycads. Its quarterly magazine, *Encephalartos*, is sent to members by airmail and *inter alia* contains information on the discovery of new cycad species. Please contact one of the following correspondents:

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