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Review of the lady beetle genus *Phaenochilus* Weise (Coleoptera: Coccinellidae: Chilocorini) with description of a new species from Thailand that preys on cycad aulacaspis scale, *Aulacaspis yasumatsui* Takagi (Hemiptera: Sternorrhyncha: Diaspididae)

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Abstract

Species of the genus *Phaenochilus* are reviewed, keyed, and illustrated, and an annotated checklist provided. A new species, *Phaenochilus kashaya* **n. sp.,** is described from Thailand. This species feeds on an invasive pest of cycads, the cycad aulacaspis scale, *Aulacaspis yasumatsui* Takagi (Hemiptera: Sternorrhyncha: Diaspididae). The economic importance of cycads and cycad aulacaspis scale is discussed. A taxonomic history of *Phaenochilus* is provided.

Key words: biological control, Cucujoidea, ladybird, pest, predator, sago palm, systematics, taxonomy

Introduction

Cycad aulacaspis scale (CAS), *Aulacaspis yasumatsui* Takagi (Hemiptera: Sternorrhyncha: Diaspididae), is an economically important pest of cycads (sago palms and their relatives). This tiny sap-sucking insect species is highly invasive, and poses a threat to costly ornamental plantings, as well as wild cycad populations and conservation collections around the world (Orapa & Cave 2010). Although native to Thailand (Takagi 1977; Wiese *et al*. 2005), the scale has invaded many other regions through commercial movement of the host plants. CAS is currently reported from Thailand, Hong Kong, Singapore, Taiwan, Guam, Ivory Coast, Barbados, Cayman Islands, St. Kitts, Martinique, Puerto Rico, Vieques Islands, the continental U.S., U.S. Virgin Islands, and the Hawaiian Islands (Hawaii and Oahu) (Germain & Hodges 2007; Haynes 2005).

The first U.S. record of CAS occurred on several species of *Cycas* and *Stangeria* in the Montgomery Botanical Center, Miami, Florida in 1996 (Howard *et al*. 1999). Despite concerted efforts to contain the pest, it spread rapidly throughout the state, killing 80% of the king sago palms in Southern Florida (Woods 2007) and infecting more than 20 other species of cycad in 43 counties (Hodges 2006). Within the continental U.S. it moved from Florida into Alabama, Georgia, Louisiana, South Carolina, Texas, and California (Haynes 2005).

Cycads such as the king sago palm are valued in the U.S. and other countries for their beauty and functionality as landscape and container plants (McKamey 2007). In the U.S. territory of Guam, native forests of 100-year old *Cycas micronesica* serve as prime habitats for many endangered birds, reptiles, bats, land snails, insects, and other wildlife (Haynes & Marler 2005, U.S. Department of Defense, Department of the Navy 2010). Sago palm starch is an important food source for indigenous peoples in the Caribbean, Mexico, Asia, and Africa (Whiting 1963), and the plant also has many modern applications, such as the production of ethanol, glucose syrup, paper, plywood, textiles, and biodegradable plastic (Singhal *et al*. 2008).

Two exotic natural enemies of CAS were cultured and released in Florida in 1998 in an effort to suppress the scale: *Cybocephalus nipponicus* Endrody–Younga (Coleoptera: Cybocephalidae), a minute predatory beetle (Smith

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