BIOLOGICAL CONTROL OF CYCAD SCALE, *AULACASPIS YASUMATSUI*, ON *CYCAS MICRONESICA*

TO BE INITIATED IN FISCAL YEAR 2025

Project Title: BIOLOGICAL CONTROL OF CYCAD SCALE, *AULACASPIS YASUMATSUI*, ON *CYCAS MICRONESICA*

Proposed Target Amount: $251,354.00

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Background:

Fadang or Micronesian cycad (*Cycas micronesica*), an endemic plant found on the islands of Guam and Rota, was the dominant plant and the most abundant 'tree' in Guam's forests in 2000. The invasion of the cycad scale *Aulacaspis yasumatsui* in 2003 and the butterfly *Luthrodes pandava* (formerly known as *Chilades pandava*) in 2005 initiated an epidemic mortality of plant populations such that *C. micronesica* was listed as threatened under the U.S. Endangered Species Act by the US Fish & Wildlife Service (USFWS) in 2015.

The CAS insect, *Aulacaspis yasumatsui*, was originally described from specimens collected on a *Cycas* sp., in Bangkok, Thailand, in 1972 (Takagi 1977). In Thailand, this armored scale is considered a pest of cycads, but is usually maintained in low densities by parasitoids (Tang et al. 1997).

The evidence is that the invasion by the *A. yasumatsui* scale insect is the primary cause of extinction risk. Establishment of a complex of effective biological control agents is being examined to develop a long-term strategy for protecting these plants.

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[The following is from Cave, March 2022]

Efforts to suppress CAS populations with biological control in Guam began in 2004 (Moore et al. 2005b), when about 100 adults of the lady beetle Rhyzobius lophanthae (Blaisdell) (Coleoptera: Coccinellidae) were collected in Hawaii and shipped to Guam. This predatory beetle, commonly called the purple scale predator, was selected for introduction in Guam because it was easily collected in Hawaii, where it apparently suppresses CAS populations effectively. Beetles were mass reared and released in Guam National Wildlife Refuge at Ritidian Point beginning in February 2005. By July 2005, adult beetles were found in abundance on cycads at Urunao Beach, 1 km from Ritidian Point. Following establishment of R. lophanthae at Ritidian Point, more than 7,000 beetles were released on cycads at 115 sites throughout Guam.

Survival of mature C. micronesica appeared to improve after establishment of R. lophanthae, yet the overall population of the cycad was not recovering because seeds and seedlings were being killed by the cycad aulacaspis scale and other causes (Marler and Terry 2011). Marler et al. (2013) showed that predation rates by R. lophanthae are significantly lower on plants close to the ground. The preference for mature trees is not completely understood, but Marler and Marler (2018) showed that volatile chemical cues are a contributing factor.

*In August 2005, about 500 adults of the parasitic wasp Coccobius fulvus (Compere and Annecke) (Hymenoptera: Aphelinidae) (**Figure 4**) were taken from a laboratory colony (original stock from China) in Florida and brought to Guam (Moore et al. 2005b). About 250 of these wasps were placed in a cage with a CAS-infested king sago palm; the remaining wasps were released on C. micronesica at Marbo Cave. This site was chosen because R. lophanthae was not yet present in the area. An additional 250 C. fulvus received in September 2005 were released at Marbo Cave, as attempts to culture the parasitoid in the laboratory were not successful. Unfortunately, C. fulvus failed to establish in the field (Moore et al. 2005b).*

In a second attempt to establish feral populations of C. fulvus in Guam, G. V. P. Reddy of the University of Guam (UoG) imported adults from a laboratory colony in Florida (original stock from Thailand). Attempts to establish a laboratory colony failed again. Several of the imported wasps were released on C. micronesica in Talofofo in 2008 (G. Reddy personal communication to Aubrey Moore, 2022), but there was no subsequent indication that the parasitoid became established.

In a third attempt to establish C. fulvus in Guam, A. Moore imported specimens collected in Florida by R. Cave in September and October 2014. Creation of a laboratory colony was again unsuccessful. Half of both shipments were released at Ritidian Point, but no evidence was found to verify establishment in the field. Why establishment of C. fulvus in the field did not occur after three attempts is unclear. Possibilities are that insufficient quantities of the parasitoid were released, or parasitized scales were eaten by R. lophanthae, or the released wasps were not adequately vigorous to reproduce and disperse.

About 100 adults of the parasitic wasp Aphytis lingnanensis Compere (Hymenoptera: Aphelinidae), or a cryptic species very similar to it, arrived in Guam in 2012 (A. Moore, personal communication, 2022) from Hawaii where they had been reared from CAS collected from king sago palms. This parasitoid causes high parasitism rates that appear to significantly suppress CAS populations in Hawaii; severely infested king sago palms apparently survive the effect of the pest when the parasitoid is present (M. G. Wright personal communication, 2022). Aphytis poss. lingnanensis also attacks CAS in southern Texas (Flores and Carlson 2009), but its effect on scale populations is undocumented. In Guam, the wasps were put into a cage with scale-infested C. micronesica leaves. All detectable R. lophanthae adults and larvae were removed from these leaves, but apparently undetected beetle eggs and tiny larvae beneath scale covers consumed all the scales before any adult A. lingnanensis could emerge. Therefore, a laboratory colony was not established, and no field releases were made.

*G. V. P. Reddy imported into Guam the parasitic wasp Arrhenophagus chionaspidis Aurivillus (Hymenoptera: Encyrtidae) (**Figure 5**) from a laboratory colony in Florida,*

and field releases were made during 2008 (G. Reddy personal communication to A. Moore, 2022). High - 6 - parasitism rates at Ritidian Point were observed in February 2013 (A. Moore personal communication, 2022).

Brief Description of Anticipated Work:

The Recipient shall:

1. develop a long-term strategy for protecting *Cycas micronesica* from A. *yasumatsui*
2. collaborate with partners conducting CAS predator surveys in the Marianas to understand what species are currently present and their efficacy and mechanism of controlling CAS
3. identify potential biological control agents to combat the *A. yasumatsui* scale insect.
    a. The biological control agents shall include a suite of species with life history traits and CAS control mechanisms addressing a range of CAS vulnerabilities and complementary to that of existing control agents (e.g. *Rhyzobius lophanthae*); and
4. identify the procedures needed for rearing and introduction of new biological control agents on Guam and Tinian

This is not a solicitation for applications or proposals, and any submittals to the DON in response to this letter will not be reviewed.

If your organization is interested in this upcoming project or has questions, please direct any inquiries by <u>April 1, 2025</u> to: Thelman Fontenot, Grants Officer, NAVFAC Marianas at <u>e-mail</u>: thelman.m.fontenot.civ@us.navy.mil.