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History of Biological Control in American Samoa

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Abstract—Biological control has been one of the primary methods of managing pest problems in American Samoa since 1954. Early projects included the introduction of the toad, *Bufo marinus*, for mosquito and centipede control; *Toxorhynchites* sp. for mosquito control; two praying mantids for control of the coconut stick insect, *Graeffea crouanii*; baculovirus of *Oryctes* for the rhinoceros beetle, *Oryctes rhinoceros*; *Tetrasticus brontispae* for the coconut leaf hispa, *Brontispa longissima*; and *Liothrips urichi* for control of the weed *Clidemia hirta*. A major project has been the control of the giant African snail, *Achatina fulica*, by the predatory snails, *Gonaxis kibweziensis* and *Euglandina rosea*. More recent introductions include the predatory beetles, *Nephaspis oculatus*, *N. bicolor* and *Delphastus pusillus*, and the parasitic wasp, *Encarsia haitiensis*, for control of the spiraling whitefly, *Aleurodicus dispersus*. Introductions to control the coconut scale, *Aspidiotus destructor*, include the predatory beetles, *Pseudoscymnus anomalus*, *Rhyzobius satteles*, *Telsimia nitida* and *Chilochorus nigritus*, and a parasitic wasp, *Aphytis* sp. The fungus, *Metarhizium anisopliae*, is being used to control *B. longissima*.

Introduction

Introductions of biological control agents have been widely used on small islands and the Government of American Samoa, in consultation with the Hawaii Department of Agriculture, the South Pacific Commission and the Land Grant Program at the American Samoa Community College has introduced biological control agents for a number of pests. This paper reports on the outcome of those introductions.

Biological Control Introductions

(i) The Surinam toad, *Bufo marinus* L.

In 1954, *Bufo marinus* was introduced to control mosquitoes and centipedes on Tutuila, the largest island of American Samoa. The toads have become well established and populations fluctuate widely over time. Reports from some res-

idents indicate that the toads have been successful in reducing mosquito populations in their area but that, at times, the toad itself becomes a pest.

On Manua, an outer island of American Samoa where the toad has not been introduced, the mosquito biting rate has been noted by the junior author to be noticeably higher than on Tutuila. Residents in Manua, however, have chosen not to introduce the toad.

(ii) *Toxorhynchites* sp.

This predatory mosquito was introduced to Tutuila in 1956 and, although it was reported to have become established in the late 1950s, it has not been recovered in the past 8 years. Several severe hurricanes have ravaged the island during this time and these may have eliminated it. Reintroduction is being considered.

(iii) Praying mantids

Two praying mantids (*Hierodula patellifera* (Serville) and *Orthodera burmeisteri* (Wood-Mason)) were introduced in 1956 for control of the coconut stick insect, *Graeffea crouani* (Le Guillou), a pest of the coconut palm. The mantids have become established and produce moderate control of the stick insect, although severe damage is occasionally noted.

Mantid eggcases, nymphs and adults were found on coconut palms, citrus trees and grape vines during 1991 and 1992.

(iv) Baculovirus of *Oryctes*

This virus was introduced in the early 1970s for control of the rhinoceros beetle, *Oryctes rhinoceros* L. Although it was reported to have become established, confirmation of its continued presence has not been obtained.

(v) *Tetrasticus brontispae* (Ferr.)

This pupal parasitoid of *Brontispa longissima* (Gestro), the coconut leaf hispa, was first introduced in 1973 but establishment was not confirmed at that time.

Further introductions were made in 1984 and 1985 and confirmation of its establishment was made in 1988. However, *Brontispa* continues to be a problem in some areas and recoveries of the parasite has not been made recently. It is possible that *T. brontispae* may not have survived several severe hurricanes of the past 3 years.

(vi) *Metarhizium anisopliae*

Spores of this fungus were found on dead *Brontispa longissima* beetles in Vailoa, Tutuila in the late 1970s by Dr K. Marschall. He produces the fungus commercially and it is currently being used with good success whenever *Brontispa* outbreaks occur (Marschall & Vargo 1993).

(vii) *Liothrips urichi* Karny

Liothrips urichi was introduced in 1974 for control of the weed, Koster's Curse *Clidemia hirta* (L.) D. Don. It has become established and has eliminated the weed in some areas.

(viii) *Gonaxis kibweziensis* (E.A. Smith)
Euglandina rosea (Ferrusac)

Two predatory snails were introduced to control the giant African snail, *Achatina fulica* Bowdich which had resulted in several cases of encephalitic meningitis, the causal agent of which is transmitted by the snail. *Gonaxis kibweziensis* was introduced in 1977, but only minor control was obtained. *Euglandina rosea* was released in 1980, resulting in moderate to good control of the African snail population. Occasional increases in snail population accompany periods of elevated rainfall.

(ix) *Nephaspis oculatus* (Blatchley) (= *N. amnicolor*)
Nephaspis bicolor Gordon
Delphastus pusillus Le Conte
Encarsia haitiensis Dozier

In 1981, *Nephaspis oculatus*, a predatory beetle, and *Encarsia haitiensis*, a parasitic wasp were released for control of the spiraling whitefly, *Aleurodicus dispersus* Russell. Because whitefly populations persisted and establishment of the agents had not been confirmed, the same species, together with *Nephaspis bicolor* and *Delphastus pusillus*, were released in 1984. The establishment of *Nephaspis oculatus* and *N. bicolor* has been confirmed. These predators were also released in 1986 in the Manua islands.

(x) *Pseudoscymnus anomalus* Chapin
Rhyzobius satteles Blackburn (= *R. lophantae*)
Telsimia nitida Chapin
Aphytis sp.
Hemisarcodidae mites
Chilochorus nigritus (F.)

In early 1984, the first 5 species were obtained from Hawaii and released for the control of the coconut scale, *Aspidiotus destructor* Signoret. Later in the year, *Chilochorus nigritus* and *Pseudoscymnus anomalus* were obtained from Vanuatu. Both predators became established and the scale was brought under good control within a year.

At present, small isolated pockets of coconut scale can be found, usually on coconut palm or breadfruit, but damage is minimal and *Chilochorus nigritus* and/or *Pseudoscymnus anomalus* are always present.

Discussion

The history of biological control introductions into American Samoa can be divided into three phases. During the first phase in the 1950's and early 1960's,

introductions into American Samoa were made haphazardly. Consultation was made with only a few outside experts and generally there was no follow-up. In the late 1960's, a second phase began when liaison with the South Pacific Commission and the Hawaiian Department of Agriculture provided consultation, natural enemies and limited follow-up investigations. A third phase began in the 1980's with the establishment of an Entomology Division in the Land Grant Program at the American Samoa Community College. Biological control introductions were preceded by qualitative and quantitative measurements of damage or of pest populations and followed by evaluations. Cooperation and consultation has expanded to include the United States Department of Agriculture; The University of the South Pacific at Alafua, Western Samoa; and the University of Hawaii. In addition, communication with other biological control researchers has been facilitated by the ADAP project (Agricultural Development in the American Pacific).

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References

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