EFFECT OF PLANTING *COLEUS BLUMEI* ON INSECT POPULATIONS IN TARO (*COLOCASIA ESCULENTA*) FIELDS IN AMERICAN SAMOA

A. M. VARGO, K. FRUEAN, S. FA'AUMU, I. PATEA AND R. AIETI

American Samoa Community College
P. O. Box 2609, Pago Pago, American Samoa

Abstract

In a Rapid Rural Appraisal Survey, conducted in American Samoa in November, 1990, farmers reported that planting *Coleus blumei* (*pate* in Samoan) with taro (*Colocasia esculenta*) kept armyworms (*Spodoptera litura*) and/or planthoppers (*Tarophagus proserpina*) from their taro fields. Two experiments were conducted at the Land Grant Station in American Samoa from May to November, 1991 and February to August 1992, respectively, to test this hypothesis.

In the first study, semi-monthly insect counts were made on two fields, one planted with *Coleus blumei* in the center and one without the *Coleus*. Insect data were collected from each of eight quadrates surrounding the *Coleus* and at three distances away from the center of the field. There were no significant differences in pest incidence between *Coleus* and non-*Coleus* fields. Results indicated a slight trend toward fewer armyworms and planthoppers in the field planted with *Coleus*.

A second study compared insect incidence in eight taro plots, four with and four without a border of *Coleus*. Insect counts were collected semi-monthly. No statistical differences were found between insect incidence in the two types of plots. There was a trend toward more armyworms in the non-*Coleus* plot. Future studies will focus on examining other environmental factors that might influence taro pest and/or parasite incidence, as well as modifications in experimental design.

Introduction

The first objective of the Low-Input Sustainable Agriculture (LISA) project was to document traditional methods of pest management, soil fertility, and soil conservation practiced by taro growers throughout the United States-affiliated islands of Yap, Saipan, Pohnpei, Palau, Hawai'i, Guam, and American Samoa. A Rapid Rural Appraisal was held in American Samoa in November, 1990 to conduct this documentation at this location. One method of pest control reported by surveyed farmers was to plant Coleus blumei (*pate* in Samoan) with taro. Farmers believed that planting this ornamental would keep away the taro armyworm *Spodoptera litura* and/or the taro planthopper *Tarophagus proserpina*. This paper will report on two experiments conducted to test this hypothesis.

Methods and Materials

In the first experiment, conducted from May to November, 1991 at the Land Grant Station in Malaeimi, two fields (10 m x 9 m) were planted with taro at a 1 m x 1 m spacing. At the center of each field, a circular area (1.2 m in diameter) was marked and designated to be either planted or not planted with cuttings of *Coleus* at a separation distance of 0.45 m. Taro and *Coleus* were planted at the same time. Taro was planted throughout the non-*Coleus* field.

Each field was divided into eight quadrates by ribbons radiating from the center of the field. In order to determine if distance from the *Coleus* affected insect populations, each quadrate was further subdivided into three sections, indicating distances (1, 2, or 3 m) from the center of the field. Areas were designated C, M, and E, respectively.

Every two weeks, insect counts were made on 18 plants in each of the eight quadrates: three from the C area, three from the M area, and three from the E area. Both pest and beneficial species were noted. Armyworm egg masses, armyworm caterpillars, hornworm eggs, and aphids (within a 3-cm radius around the point where the stem inserts into the petiole) were counted on the most recently and third most recently opened taro leaves. Planthopper adults and nymphs were counted on the same leaves and corresponding petioles.

A second experiment was conducted from February to August, 1992 at the Land Grant Station in Malaeimi. Four plots were planted with and four plots planted without a border of *pate* in a split plot design. Each plot was 17 m square and separated from each other by 20 m. There were 36 taro plants in each plot. Every two weeks, insect data was collected from ten randomly selected plants in each plot, following methods described above.

Results

In Experiment 1, with *Coleus* in the center of the field or not, armyworm incidence and damage was low throughout the entire experiment. Statistical analysis indicates that there were no significant differences between populations of armyworms, hornworms, aphids, and planthoppers in the two fields. However, some trends could be seen.

From 60 to 110 days after planting, there were more armyworm larvae present in non-*Coleus* fields. It is also interesting to note that the number of egg masses peaked early in both fields, never really reaching this same abundance throughout the whole experiment.

The decrease in the number of egg masses (and subsequently larvae) may be due to the abundance of natural enemies that were present in the fields. Ants, spiders, and cockroaches were suspected of acting as predators on armyworm egg masses. Other natural enemies included *Apanteles* sp., *Euplectrus* sp., and *Chelonus* sp.

In looking at the planthopper population, there was a trend toward more planthoppers in the field with no *Coleus*. The natural control, *Cytorhinus fulvus*, was also present in both fields.

Aphids also peaked early in the field but were soon brought under good control by syrphid fly larvae and ladybird beetle adults and nymphs.

There was a slight trend toward more hornworm eggs and larvae in the non-*Coleus* field. An early abundance of eggs and larvae was followed by a marked decrease in the number of hornworm and eggs. A wasp parasite of hornworm eggs, *Oencrtyes* sp., was noted.

In Experiment 2, where insect incidence was compared in fields with or without a border of *pate*, no significant difference was found between pest incidence in the two fields. However, there was a trend toward more armyworms in the non-*pate* field.

Discussion

The results indicate that in these studies there were no statistical differences in pest populations found between fields planted with or without *pate* (*Coleus blumei*). However, there were trends toward fewer armyworms and planthoppers in taro fields planted with *Coleus*.

Previous studies have suggested that the flowers of *Coleus blumei* attracted nectar-feeding parasites of the armyworm (Braune and Kan 1981; Braune et al. 1981). The presence of more parasites in a field containing the *Coleus* would increase the possibility of the armyworms present being parasitized. It is recognized that the incidence of armyworms was low throughout Experiment 1, making any differences between the two treatments difficult to discern. It is suggested that future investigations also examine the *Coleus* for parasite and pest presence since a number of farmers reported that the taro planthopper tended to congregate in the *Coleus* leaves.

Relatively low numbers of the taro planthopper *Tarophagus proserpina* were noted throughout these experiments. It is believed that the egg-piercing mirid predator *Cytorhinus fuluvs* along with a *Dryinid* wasp parasite keeps the planthopper under good control in American Samoa. A study conducted in 1985 and 1986 (Vargo and Fatuesi 1992) showed that fluctuations in the taro planthopper and predator populations appeared to follow a typical biological control scenario where an increase in the prey population is followed by an increase in the predator population (Fig. 1). After day 75, the increase in the planthopper population corresponded to a decrease and leveling off of the planthopper population. The population dynamics of this complex suggests that *C. fulvus* is actively suppressing the taro planthopper.

A factor to consider in planning future experiments testing the efficacy of *Coleus* is the appropriateness of the experimental design. In experiment 1, the *Coleus* was planted in the center of the field so that differences in insect population that might be affected by the position of the taro plant being upwind or downwind from the *Coleus* would be accounted for. In Experiment 2, individual plots were separated by approximately 15 m. In order to prevent the influence of the *Coleus* from affecting a non-*Coleus* plot, it may be advisable to distance the plots further from each other. However, the problem with increasing the plots is that the resulting environment of each plot may be so different that one may not be able to determine whether results are influenced by the presence of the *Coleus* or by the encompassing habitat.

In conclusion, further studies are warranted to determine the effectiveness of the *Coleus* in suppressing pest populations. Because of periodic armyworm outbreaks, other environmental factors such as amount of rainfall, humidity, and wind must be taken into account. It is not known whether the fecundity, searching patterns, or mating opportunities of natural controls may be adversely affected by environmental factors, inhibiting their ability to suppress the pest populations, or whether these environmental factors interfere with pest reproductive abilities.

References Cited

Braune, H. J. & S. K. Kan. 1981. Species composition and biology of predator-parasite complex of the taro

cluster caterpillar, *Spodoptera litura*, in Western Samoa. Alafua Agric. Bull. Vol. 6(1).

Braune, H. J., S. K. Kan & H. Treviranua. 1981. Studies on the effectiveness of *Apanteles* sp., a larval endoparasite of *Spodoptera litura*. Alafua Agric. Bull. Vol. 6(1) 12-22.

Vargo, A. M. & S. Fatuesi. (In press.) Insect pests of taro (*Colocasia esculenta*) and their biological controls in American Samoa. Proceedings of the 1989 Agricultural Development in the American Pacific Project Crop Protection Conference.

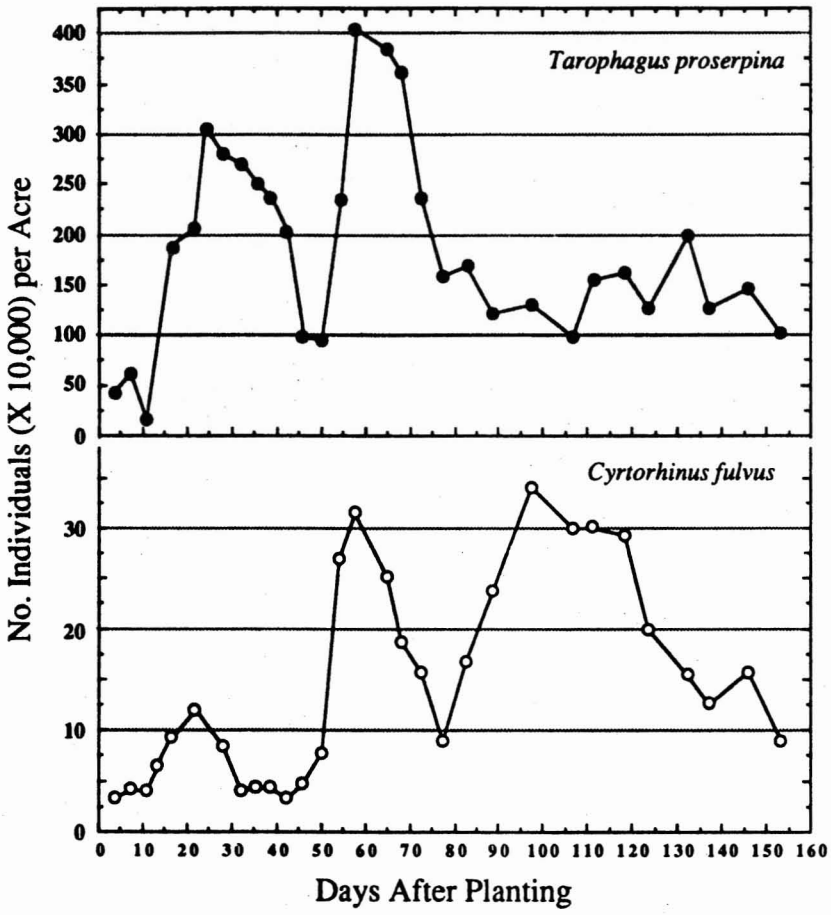

Fig. 1. Comparison of densities of the taro planthopper *Tarophagus proserpina* and the egg-piercing mirid predator *Cytorhinus fulvus* in a taro field.

The Editor

L. Ferentinos is the Project Coordinator of the Taro Production Systems Project at the University of Hawai'i at Manoa.

Jane C. Muench, an independent editor with J.C.M. Office Services, provided technical support.

Publication was supported in part by a grant from the USDA/CSRA Sustainable Agriculture Research and Education Program (formerly called L.I.S.A.). Additional support was provided by American Samoa Community College, College of Micronesia, Northern Marianas College, University of Guam, Yap Institute of Natural Science, and the University of Hawai'i under the Agricultural Development in the American Pacific (ADAP) Project.

The Library of Congress has catalogued this serial publication as follows:

Research extension series / Hawaii Institute of Tropical Agriculture and Human Resources.—001—[Honolulu, Hawaii]: The Institute, [1980–
v. : ill. ; 22 cm.
Irregular.
Title from cover.
Separately catalogued and classified in LC before and including no. 044.
ISSN 0271-9916 = Research extension series - Hawaii Institute of Tropical Agriculture and Human Resources.
1. Agriculture—Hawaii—Collected works. 2. Agriculture—Research—Hawaii—Collected works. I. Hawaii Institute of Tropical Agriculture and Human Resources. II. Title: Research extension series - Hawaii Institute of Tropical Agriculture and Human Resources.
S52.5R47 630'.5—dc19 85-645281
AACR 2 MARC-S
Library of Congress [8506]