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<p>Key Words: <u>Phyllocnistis citrella, citrus, pest management, farmer education</u></p>	

Project Summary

The citrus leafminer (CLM), *Phyllocnistis citrella* Stainton, first found in Puerto Rico in 1994, has become a serious pest in citrus nurseries and new orchards. Population control methods currently used by local island nurseries intensively use traditional crop protection chemicals, often requiring weekly pesticide applications. Unfortunately, some of these pesticides have been shown to be detrimental to CLM's usually effective natural enemies, and in the long run these often lead to leafminer outbreaks. Further, there is great concern that runoff-laden waters from nurseries in the island's mountain regions may constitute an important source of water pollution. There is a critical need for validating and implementing CLM biologically-based population management techniques in Puerto Rico. These systems are new to the local production system, but well researched elsewhere. This project seeks to validate these pest management systems in tree nurseries against the citrus leafminer in Puerto Rico. The proposed project also delivers these systems to producers through demonstrations, training and education programs.

Thus, the purpose of this proposed work is: (1) to conduct validation research for CLM bio-based management tactics in citrus nurseries, using commercially available *Bacillus thuringiensis* (*Bt*) formulations, and other biologically-based pesticides (i.e., abamectin, rosemary oil, and azadirachtin); (2) to determine the effects of these tactics on CLM natural enemies, and those of other pests (e.g., aphids, other lepidoptera.) ; and (3) to prepare demonstration nurseries at two locations that will be used as a platform for farmer's training through presentations, displays, and educational materials.

The project's key personnel include two researchers and an extension educator with appointments in research and extension, respectively. Funds would be distributed as follows: \$47,500 (P.L. 89-106) and \$25,500 (Smith-Lever).

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Project Description

Project Type

The current application is for a joint research-extension project. This activity seeks to validate pest management systems in citrus nurseries against the citrus leafminer in Puerto Rico. These systems are new to the local production system, but well researched elsewhere. The proposed project also delivers these systems to producers through demonstrations, training, and education programs. The project's key personnel include two researchers and an extension educator with appointments in research and extension, respectively.

Problem

The citrus leafminer (CLM), *Phyllocnistis citrella* Stainton, was first found in Puerto Rico in 1994 (W. Gonzalez. Personal Communication. 2005). Originally from eastern and southern Asia, CLM has invaded most citrus producing areas of the world (Vercher et al., 2005). Everywhere, CLM has become a serious pest, particularly damaging in citrus nurseries and new orchards.

Control methods currently used in local island nurseries often require frequent (i.e., \approx weekly) pesticide applications, and use traditional crop protection chemicals intensively. Presently, citrus nurserymen manage CLM using either systemic insecticides (e.g., aldicarb, imidacloprid, acephate), or contact insecticides (e.g., Malathion, diazinon, and methomyl). More environmentally friendly, biologically-based alternatives are often overlooked (Toro, E. former Extension fruit specialist and consultant. Personal Communication. 2005). Unfortunately, some of these pesticides have been shown to be detrimental to CLM's normally effective natural enemies. In the long run, their use often leads to severe leafminer outbreaks (see Peña and Duncan 1993).

Further, citrus nurseries in the island's mountain regions are often in close proximity to small rivers and creeks that lead into drinking water reservoirs. Nurseries' runoff-laden waters, containing chemicals, fertilizers, and residues from other crop operations, often end up in these important waters and constitute an important source of drinking water pollution. (Anonymous 1998).

Background

Introduction

In Puerto Rico, as in most areas invaded by the CLM, this pest often reaches high population levels, and causes extensive damage to new flushes (particularly in young trees, nurseries, and top-worked trees). CLM is a pest of plants in the Rutaceae, where it mines leaves, surface tissue of young shoots and, occasionally, fruit. Often, the lamina of mined leaves dries and rolls, reducing leaf area and photosynthetic activity (Cañete-Bermudez et al., 2004). Larval feeding causes the cover of the mine tunnel (i.e., outer epidermal wall and cuticle) to look as a silvery transparent (Sohi & Verna 1965; Achor, D.S. et al. 1997). Leafminer adults oviposit on young tender leaves, usually in the abaxial surface, and larvae produce serpentine galleries as they feed on the epidermis.

Most of the injury caused by CLM results from mining newly formed leaves. Young leaves curl up, become chlorotic and eventually necrotic (Peña and Duncan 1993). Shaffer et al. (1997) determined that net photosynthesis of lime was negatively correlated with CLM damage. A key study by Peña et al. (2000) determined an economic injury level (EIL) of $\approx 20\%$ of foliage damaged (i.e., 1 active mine per flush leaf) in 'Tahiti' lime from southern Florida. A similar EIL was established by Huang and Li (1989) for oranges in China. A recurring opinion is that susceptibility to CLM seems to be related to seasonal leaf flushing patterns in citrus (Knapp 1995; Jacas et al. 1997).

In nurseries, severe *P. citrella* attacks often damage rootstock material by breaking apical dominance, and by producing spreading plants unfit for proper grafting. Often, CLM attacks severely damage and delay normal growth of grafted material, producing plants of inferior quality and price. In new and young plantations, severe attacks frequently reduce future canopy development for fruit production. Conversely, mature orchard trees seem more tolerant to CLM attacks. Garcia's et al. (2002) 4-yr study found no significant effects of CLM damage on yield on established orchards. Similar conclusions have been reached by Peña et al. (2000) and Huang and Li (1989).

Peña et al. (1996) found that CLM's population density increased from spring through fall, and declined during the colder and drier winter months in southern Florida. Similar patterns have been observed in Australia, China and Spain (Beattie and Smith 1993; Binglin and Mingdu 1996). Studies have shown that CLM's population fluctuations closely follow citrus leaf flush seasonality (Garcia-Mari et al. 2002). Similar patterns are observed elsewhere. It is not known if similar seasonal patterns are also present under the tropical conditions prevalent in Puerto Rico, but reports of this pattern from Costa Rica and Ecuador may suggest that it does (see Elizondo-Solis 1997; and Cañarte-Bermudez 2004).

Population Management and Control

In all countries invaded by CLM, the initial response has been aggressively use chemical control methods. In part because of the seriousness of initial attacks, and in part because of the hype created by its rapid worldwide expansion, chemical control of CLM became the number one tool for its management. Later evidence, gathered world-wide on *P. citrella*, has demonstrated its great susceptibility to natural biological control from native and introduced parasitoids (Knapp et al 1995; Hoy and Nguyen 1995; Peña et al. 1996; Leon-Gonzalez et al. 1996; Elizondo-Solis 1997; Legaspi et al. 1999; Cañarte-Bermudez et al. 2004; and Vercher et al. 2005). In many areas, indigenous natural enemies have been recruited to this pest, bringing it under natural control within a few years of its introduction (Vercher et al, 2005). Current state of affairs allows for relaxing chemical control tactics in favor of strategies which protect these natural enemies, especially in established orchards.

Anecdotal evidence suggests that a similar trend has occurred in Puerto Rico (W. Gonzalez, Personal Communication. 2005). Four native parasitoids have been naturally recruited by CLM in Puerto Rico. La Salle and Peña (1997) reported three native parasitoids attacking CLM in Puerto Rico, and Schauff (1998) described a new parasitoid species, *Pediobius puertoricensis* (Hymenoptera: Eulophidae) collected by Dr. Alberto Pantoja in the highlands of Puerto Rico. Nevertheless, no systematic effort has been undertaken in the island to collect and to ascertain the relative importance of natural enemies in keeping CLM populations under control.

Unlike established orchards, where natural control appears to be efficient and beneficial, the same does not appear to be happening in nurseries and new plantations. Shapiro, et al. (1998) found that CLM populations built rapidly in the dense foliage conditions of the nursery. Further, common and necessary nursery practices, such as hedging, grafting and heavy fertilization encourage asynchronous flushing of nursery stock. This condition assures continuous leafminer population, where the action of natural enemies is apparently not as effective (Shapiro et al., 1998).

Biologically-based Management

Persuasive evidence indicates that CLM can be effectively managed with the use of biologically-based pesticides. For example, Shapiro, et al. (1998) found that nursery trees treated with *Bacillus thuringiensis* (*Bt*) (0.32%) plus and organosilicone surfactant (Silwet L-77 @ 0.05%) significantly lowered infestations five days after application compared to water controls. However, effective *Bt* rates tend to be higher than those typically used, i.e., 1-2 kg/ha (1-2 lb/a) at 100 gallons per acre. Findings from Shapiro et al. (1998) indicate that experimental doses of close to 3 lb/a are needed to control CLM populations below economically injurious levels in nurseries. These authors also found that the L-77 surfactant was needed to achieve good control levels, probably by enabling penetration of the hydrophobic stomatal environment. However, Khyami-Horani et al. (2002) found *Bt* effective against CLM at recommended rates in Jordan, specially when supplemented with the use of surfactants.

Other bio-based pesticides have also demonstrated their usefulness against *P. citrella*. For example, the use of abamectin is effective in controlling CLM as demonstrated by trials in Florida, Australia, China, and Spain (Peña and Duncan 1993; Rae et al. 1996; Shapiro et al. 1998; and Peña et al. 2000). Rae et al. (1996) found that abamectin plus petroleum oil at a rate of 1.5 lb ai/a provided complete control of CLM with no phytotoxic effects. The use of abamectin has a few drawbacks, mostly concerning toxicity to natural enemies and the development of resistance. For example, Amalin et al. (2000) found that up to 50% mortality of *Hibana velox* spiders, a common spider in citrus orchards, with abamectin plus oil at a rate of 1.0 lb Ai/a. Similarly, Peña et al. (1999) found 100% mortality of lady bug larvae (*Coccinella sanguinea*, a common aphid predator), and up to 50% mortality of *Pnigalio minio* (a common eulophid parasitoid of CLM) due to abamectin. Finally, Knapp (1995) recommended no more than 3 applications per year to manage resistance. Azadirachtin (neem oil) has been recommended for the control of CLM in Florida (Knapp 1995). This pesticide has been found effective against CLM by local organic farmers (A. Segarra, unpublished).

Justification

Puerto Rico's citrus production has steadily increased during the last five years from 10,000 metric tons (mt) in 1999 to 20,120 mt in 2004 (FAOSTAT database 2005). This increase is directly related to actions by the Puerto Rico Department of Agriculture (PRDA), which subsidizes citrus plantings by paying for 80% of seedling costs, fertilizers, and the rental of machinery. Production area in 2004 was 2,390 ha, second in importance behind banana (3,560 ha), and followed by mangos (950 ha). The 2002 Agricultural Census estimated that over 1.2 million bearing and non-bearing trees exist in the island. Citrus farms also increased between 1999 and 2002 from 3,900 to 4,250. Farm gate value for citrus is estimated at \$20.5 million per year (PRDA. 2004 Production Statistics). Current estimates of total annual nursery stock production are not available, but between 150,000 and 300,000 seedlings are produced by the PRDA, and by smaller private sector producers (Mr. W. Gonzalez, Agricultural Experiment Station. Personal communication. 2005).

We contend that there is a great need for validating and implementing CLM biologically-based past population management techniques in Puerto Rico. In this proposal we define biologically-based techniques as the use of bio-pesticides, as principal components of crop protection systems, with the goal of preserving key natural enemies of important pests. Biopesticides are naturally-based microbial and biochemical plant pest and disease controls. Biopesticides fall into three major classes: Microbial pesticides, plant-pesticides, and biochemical pesticides. These bio-based techniques have been successfully developed elsewhere to manage CLM invasions (e.g., Florida, Spain, China, and Australia.) Unfortunately, no research has been conducted in Puerto Rico to validate CLM bio-based population management in citrus nurseries, and to demonstrate its effectiveness to farmers. Island nurserymen, as is the case with other agricultural producers, often need to be engaged with the presentation of newer pest management concepts, usually through clear demonstration, and the formal delivery of data and evidence that is relevant to their unique circumstance.

Thus, the purpose of the proposed work is: (1) to conduct validation research for CLM bio-based management tactics in citrus nurseries, using commercially available *Bacillus thuringiensis* (*Bt*) formulations, and other biologically-based pesticides (e.g., abamectin, rosemary oil, and azadirachtin); (2) to determine the effects of these tactics on CLM natural enemies, and those of other pests (e.g., aphids, and other lepidoptera.) ; and (3) to prepare demonstration nurseries (at two locations) that will be used as a platform for the delivery of farmer's training through presentations, displays, and educational materials.

Research Objectives

The research objectives of this proposed study are to:

(1) *CONDUCT VALIDATION RESEARCH FOR CLM BIO-BASED MANAGEMENT TACTICS IN CITRUS NURSERIES USING OF COMMERCIALY AVAILABLE BACILLUS THURINGIENSIS (BT) FORMULATIONS, AND OTHER BIOLOGICALLY BASED PESTICIDES.* Studies on biologically-based management options are available, and these studies confirm the usefulness of these techniques in controlling CLM while protecting the pest's main source of natural mortality, i.e., natural enemies. Our goal is to find the most affective and reliable control method that works under the nursery conditions at two locations. We expect to be able to select such a management system, and be able to demonstrate its effectiveness to farmers through demonstrations, training and education.

(2) *CONFIRM AND DOCUMENT, FOR THE PURPOSES OF DEMONSTRATION, THAT THESE BIOLOGICALLY- BASED SYSTEMS DO INDEED CONSERVE CLM NATURAL ENEMIES AND THOSE OF OTHER PESTS (E.G., APHIDS, PSYLLIDS, AND OTHER LEPIDOPTERA) AND THAT SUCH PROTECTION IS NEEDED FOR EFFECTIVE CLM MANAGEMENT IN THE NURSERY.* Only scattered information is available on the identity and importance of natural enemies controlling CLM under nursery conditions in Puerto Rico. By means of systematic sampling for two years, we expect obtain this information, and be able to illustrate, through the preparation of educational materials, their importance. We expect to show that: (a) CLM natural enemies and those of other pests will be conserved by the use of biologically-based systems; and (b) this action will result in effective and reliable control of CLM.

Extension Objectives

The extension objective is to:

(3) *PREPARE DEMONSTRATION NURSERIES AT TWO LOCATIONS THAT WILL SERVE FOR FARMER'S PRESENTATIONS, DISPLAYS AND PRESENTATION OF EDUCATIONAL MATERIALS TO (A) CONVEY THE ADVANTAGES AND CONSTRAINTS OF BIOLOGICALLY-BASED MANAGEMENT SYSTEMS; AND (B) TRAIN EDUCATORS AND FARMERS IN THE IMPORTANCE OF NATURAL ENEMY CONSERVATION.* We expect to train core educators and farmers from two ecologically diverse citrus producing areas by using demonstrations, training sessions, educational materials on biologically-based management of the CLM and other key nursery arthropod pests.

Research: Approach and Procedures

Validation of bio-based CLM management options: Since CLM damage to young foliage in nursery stock is the biggest concern to producers, this study proposes to verify the effectiveness of different bio-based products in managing CLM (and other pests) on young flush in experimental nurseries.

Two locations will be chosen to conduct validation testing for biologically-based management options: the Adjuntas Agricultural Experiment Station (18° 10'31" N and 67° 74'56" at ≈1,930 ft), and the Lajas Agricultural Experiment Station (18° 01'57" N and 67° 04'23" at ≈110 ft). While only 20 miles apart, these are substantially different agroecological environments. The Adjuntas AES, for example, is typical of subtropical moist forest environment; while the Lajas AES is more typical of a subtropical dry savanna milieu. Anecdotal observations, yet to be confirmed, purport that while CLM is a serious problem at Lajas and similarly dry areas, it is almost absent from the cooler and moister Adjuntas. Moreover, other dominant pests vary between these environments.

Five bio-based pesticides, *Bacillus thuringiensis* subsp. *kurstaki*, *B.t.* subsp. *aizawai*, abamectin, rosemary oil, and azadirachtin (all as formulated plus and an organosilicate surfactant), and a water check will serve as treatments. [*Bt* will be applied at 2 lb/a, abamectin at 1 lb/a, rosemary oil at label indications, and azadirachtin at 1% solution]. We have pondered the option of using an additional conventional pesticide as a check (e.g., imidacloprid) but have decided against it because we already know these are normally effective against CLM, and because its use falls outside our goal of demonstrating the effective use of bio-based products.

Four replicates of 15 one-year old plastic-bagged nursery stock trees (grafted to 'Cleopatra' tangerine rootstock) will be arranged in a randomized complete block design, will be placed on the ground at 8 inch spacing between trees and 36 inches between blocks. Separate tests will be simultaneously conducted on 'Encore' tangerines and 'Tahiti' lemons at each of the locations, and the entire experiment will be replicated 3 times.

To ensure new flush we will trim and hedge stock, followed by urea fertilization within 2-3 days. Bio-pesticide sprays will begin 10-15 days later, depending on size of leaf flushes. Prior to the spray application, a count of eggs and larvae will be done. Three randomly selected leaf flushes (~6 inches) will be collected at day 7, 14, and 21 after treatment from each plot, and taken to the laboratory for ascertaining number of eggs and larvae per leaf. Applications will be made with a Black and Decker battery powered hand sprayer at a rate of 145 GPA (or equivalent equipment similarly calibrated). Efficacy will be determined using Abbott's formula (Abbott 1925), and results compared using ANOVA with randomized complete block design. Presence of common predators or other common pests will be determined at day 7 by direct observation. Each block will be searched for 3 minutes by experienced observers, and other pests and common predators (see below) tallied. Application costs will be recorded and a cost-benefit

analysis developed that includes data generated above. Pictures will be taken of each plot 21 days after treatment for documentation and demonstration purposes.

Identification and importance of natural enemies attacking CLM: To insure a continuous source of CLM, plots of 40 one-year old plastic-bagged nursery stock trees (grafted to ‘Cleopatra’ tangerine rootstock) ‘Encore’ tangerines and of ‘Tahiti’ lemons, respectively, will be established at each of the locations. Plants will be placed on the ground at 8 inch spacing. These plots will remain unsprayed, and will serve as reservoir for CLM and natural enemies. Plants will be periodically hedged and fertilized to induce new flushes, or replaced when size becomes unsuitable. Presence of natural enemies will be determined by collecting 10 developing new shoots containing different stages of the CLM each week. Shoots will be placed in plastic bags and brought to the laboratory for examination. Leafminer density (larvae/leaf/flush) will be determined, and susceptible stages (2nd, 3rd, 4th instars and pupae will be observed under a stereomicroscope to detect the presence of parasitoids. Immature parasitoids found in the mines will be isolated in glass vials and placed in climate controlled chambers (25 ± 2°C) at 50-60% RH and LD 14:10). Parasitoids will be allowed to develop to adult stage for identification. Percent parasitism will be determined. Microphotographs, both light and electron will be taken of species found to serve as materials for demonstration.

Also, common predators such as lady bugs (e.g. *Coleomegilla* sp.), neuropterans (*Chrysoperla* spp.), and hemiptera (e.g., *Geocoris*, *Orius*) will be collected from these plots after a 10 minute inspection of each plot. Predators will be tallied, and samples collected and sent for identification. In addition, two yellow/white stick board traps will be set within trees (6in above foliage) to ascertain the presence of these and other probable natural enemies in these plots.

Education and Demonstration: Approach and Procedures

Simultaneously with the experimental phase, we propose to begin the preparation of the education and demonstration components of this proposal. This would be the first time that such coordination will exist between fruit extension and research personnel in over 20 years in Puerto Rico. One reason for this lack of coordination between research and extension activities seems to stem from an exemption granted to Puerto Rico and other territories by AREERA [*Agricultural Research, Education, and Extension Reform Act*. P.L. 105-185]. Conversely, strong research-extension coordination is required to all other states by AREERA. We are convinced that the current effort will provide a benchmark for similarly coordinated activities in Puerto Rico. Moreover, we believe that a more sustainable approach for the management of the CLM will be achieved by preparing a comprehensive package of management practices that harnesses the synergy of such coordination.

Thus, the goals of this component are: (1) to promote the adoption and implementation of effective biologically-based management strategies to control citrus nursery insect pests, (with emphasis on the citrus leafminer) by means of educational material and field demonstrations; and (2) to show to producers the advantages of protecting natural enemies and the environment from unnecessary pesticide applications.

A. Educational Materials: To achieve this goal we propose to create educational materials (i.e., a manual and four electronic presentations) about CLM population management (and other nursery pests), under the advisement of a guidance committee (see below). Educational materials will include reference and background information, and educational activities to assist extension agents, educators, and agronomists to train farmers in the management of citrus leafminer. This manual will contain all the necessary resources and information needed for a citrus nursery grower to initiate and carry out a management program for CLM and other common pests. Also, the manual will contain material from each presentation, as follows:

- Managing the citrus leafminer (and other citrus nursery insect pests) using bio-based approaches and cultural management practices.
- Biology and ecology of the citrus leafminer, and other citrus nursery insects (including natural enemies and their protection).
- Types of biologically-based insecticides, mode of action, and field recommendations.
- Application of insecticides, equipment calibration and pesticide safety in the nursery.

The project director and collaborators will compile and integrate all information needed to prepare a CLM biologically-based nursery pest management manual. They will develop an electronic presentation with its corresponding script for each of the topics covered in the manual. The information covered in the manual will ingrain interpretation of our experimental data, and that from other countries similar to Puerto Rico. Finally, one of the likely outputs of this project will be the creation of a Pest Management Strategic Plan (PMSPs) for citrus. No such document is currently available for crops in Puerto Rico. Research and education proposed in this document could be the seed for a PMSP for citrus and other fruit crops in PR. In fact, one of the proposed outputs will result in the preparation of a 'Citrus Profile' for Puerto Rico.

Guidance Committee: At a stage prior to the preparation of educational materials a panel of clients (i.e., extension and agricultural agents, and growers) will be created to serve a guidance committee. The goals and plans of this project will be presented to the panel for their considered opinion. Panel's feedback will serve as a target for the initial preparation of these materials. Once these materials are complete, this panel will serve as primary reviewers and stewards. Identification and recruitment of review panel members will be accomplished using the UPR-College of Agricultural Sciences' research and extension network, and also through contacts with state, federal and private agencies.

B. Workshop and presentations: Following the final preparation of materials, the project director and collaborators will offer workshops for growers, and other agricultural agents

to evaluate and validate the manual, the electronic presentations and the field demonstration project (see below). Three workshops will be prepared to showcase the demonstration: one in Lajas, and two in Adjuntas (i.e., there are more clients there). Participants will include Extension agents, agronomists of the Department of Agriculture and other educators related to the citrus commodity.

During the workshops, project personnel will explain each module topic in detail. Instructional activities will also include a hands-on session on pest identification, monitoring, and decision-making. The University of Puerto Rico will provide training sites and facilities. Other facilities may be rented if need arises. Local extension agents will collaborate in material distribution. A register of educational materials' recipients will provide for evaluation and for future educational activities. Validation analysis will include an assessment of farmers' reactions and opinions, likelihood of implementation, a general interpretation of the results, and a statistical analysis. Results will be used to plan future demonstrations and activities.

C. Field Demonstrations: One of the major functions of Extension workers is in disseminating useful and practical information to producers. One good way to do this is through well-planned and carefully-conducted field demonstrations. On-farm demonstrations serve as one of the most effective Extension education tools ever developed (Hancock, J. 1992). Successful efforts on these farms will motivate other farmers to implement them in their farms.

Demonstrations will seek to compare an unsprayed control and biologically-based management of insect pests in the citrus nursery, with special attention to the citrus leafminer. The object is to show the results of our experimental tests in using biologically-based management tactics in a scale familiar to small nursery producers.

Procedure:

- 200-plant nursery plots of 'Tahiti' lemon and 'Encore' mandarin orange.
- Establish demonstrations in two ecologically different areas: Lajas (dry coastal) and Adjuntas (moist mountain).
- Half will be managed with bio-based insecticides (best treatment for each area), and half will be left unmanaged.
- Records and pictures of protected natural enemies will be available in an on site exhibit.
- Detailed records on the growth; labor expended, total costs, and returns will be available for growers/agent inspections to show the returns on each dollar invested.
- Workshop participants will participate on a discussion of pros- and cons- of the use of biologically-based management tactics.

Project's Timetable

Objective	Year 1 O N D J F M A M J J A S	Year 2 O N D J F M A M J J A S
<i>I. EFFICACY TESTING & EFFECTS ON OTHER PESTS AND NATURAL ENEMIES</i>	=====	=====
<i>II. COLLECTION AND IMPORTANCE OF NATURAL ENEMIES</i>	=====	=====
<i>III.A. EDUCATIONAL MATERIALS PREPARATION</i>	=====	=====
<i>III.B. EDUCATION & TRAINING</i>		=====
<i>III.C. DEMONSTRATION TRIALS</i>		=====

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Key Personnel

For the execution of this proposal's research and extension components we put forth the following personnel:

- **Alex Segarra (PD)** – Dr. Segarra will be responsible for overall planning, coordination, and execution of research and education objectives with other CO-PDs. He will be responsible for recruiting a graduate assistant to work under him in objective I. He will also hold primary responsibility for project finances, equipment and materials purchasing, and project's progress reporting and publications.
- **Fernando Gallardo (Co-PD)** – Dr. Gallardo will be responsible for conducting, in coordination and collaboration with the PD, all activities related to the search and evaluation of CLM natural enemies. Dr. Gallardo is a biological control expert with experience in leafminer biological control in coffee. He will collaborate with the PD in the preparation of progress reports and publications pertaining to Objective II.
- **Ada Alvarado (Co-PD)** – Professor Alvarado will be responsible for conducting, in coordination and collaboration with the PD, all activities related to preparation of educational materials, course design, and evaluation. Professor Alvarado is an extension specialist responsible for Crop integrated pest management and the preparation of crop profiles for commodities in Puerto Rico. She has experience in the design and preparation of training workshops. She will also be responsible, with the PD, of coordinating the selection of the Guidance committee. Prof. Alvarado will collaborate with the PD in the preparation of progress reports and publications pertaining to Objective III.

BUDGET – FY2007 Research

ORGANIZATION AND ADDRESS Agricultural Experiment Station , Jardín Botánico Sur 1193 Calle Guayacán. San Juan, P.R. 00926-1118			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: <u>12</u>	DURATION PROPOSED MONTHS: <u>12</u>	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
			Funds Requested by Proposer	Funds Approved by CSREES (If different)		
A. Salaries and Wages	CSREES-FUNDED WORK MONTHS					
	Calendar	Academic	Summer			
1. No. Of Senior Personnel						
a. <u>2</u> (Co)-PD(s)		12				
b. _____ Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. _____ Research Associates/Postdoctorates						
b. _____ Other Professionals						
c. _____ Paraprofessionals						
d. <u>0.5</u> Graduate Students				7,000		
e. _____ Prebaccalaureate Students						
f. _____ Secretarial-Clerical						
g. _____ Technical, Shop and Other				2,000		
Total Salaries and Wages →				9,000		
B. Fringe Benefits (If charged as Direct Costs)				296		
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				9,296		
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)				6,000		
E. Materials and Supplies				11,200		
F. Travel				800		
G. Publication Costs/Page Charges				300		
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				2,000		
K. Total Direct Costs (C through J) →				29,596		
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →				29,596		
N. Other						
O. Total Amount of This Request				29,596		
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)		DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

BUDGET – FY2008 Research

ORGANIZATION AND ADDRESS Agricultural Experiment Station , Jardín Botánico Sur 1193 Calle Guayacán. San Juan, P.R. 00926-1118			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: <u>12</u>	DURATION PROPOSED MONTHS: <u>12</u>	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
			Funds Requested by Proposer	Funds Approved by CSREES (If different)		
A. Salaries and Wages		CSREES-FUNDED WORK MONTHS				
		Calendar	Academic	Summer		
1. No. Of Senior Personnel						
a. <u>2</u> (Co)-PD(s)			12			
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals						
d. <u>0.5</u> Graduate Students					7,200	
e. <u> </u> Prebaccalaureate Students						
f. <u> </u> Secretarial-Clerical						
g. <u> </u> Technical, Shop and Other					1,500	
Total Salaries and Wages →					244	
B. Fringe Benefits (If charged as Direct Costs)						
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →					8,944	
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)						
E. Materials and Supplies					3,660	
F. Travel					2,200	
G. Publication Costs/Page Charges					1,100	
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)					2,000	
K. Total Direct Costs (C through J) →					17,904	
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →					17,904	
N. Other						
O. Total Amount of This Request					17,904	
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
NAME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

BUDGET –FY2007 & 2008 Research

ORGANIZATION AND ADDRESS Agricultural Experiment Station , Jardín Botánico Sur 1193 Calle Guayacán. San Juan, P.R. 00926-1118			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: <u>24</u>	DURATION PROPOSED MONTHS: <u>24</u>	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
			Funds Requested by Proposer	Funds Approved by CSREES (If different)		
A. Salaries and Wages			CSREES-FUNDED WORK MONTHS			
1. No. Of Senior Personnel			Calendar	Academic	Summer	
a. <u> </u> (Co)-PD(s)				24		
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals						
d. <u>0.5</u> Graduate Students					\$14,200	
e. <u> </u> Prebaccalaureate Students						
f. <u> </u> Secretarial-Clerical						
g. <u> </u> Technical, Shop and Other					\$3,500	
Total Salaries and Wages					\$17,500	
B. Fringe Benefits (If charged as Direct Costs)					\$540	
C. Total Salaries, Wages, and Fringe Benefits (A plus B)					\$18,240	
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)					\$6,000	
E. Materials and Supplies					\$14,860	
F. Travel					\$3,000	
G. Publication Costs/Page Charges					\$1,400	
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)					\$4,000	
K. Total Direct Costs (C through J)					\$47,500	
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L)					\$47,500	
N. Other						
O. Total Amount of This Request					\$47,500	
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party)						
- Non Cash Contributions (both Applicant and Third Party)						
NAME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
 COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

BUDGET – FY2007 Extension

ORGANIZATION AND ADDRESS Agricultural Extension Service P. O. Box 9031 Mayagüez, PR 00681			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: <u>12</u>	DURATION PROPOSED MONTHS: <u>12</u>	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages			CSREES-FUNDED WORK MONTHS			
1. No. Of Senior Personnel			Calendar	Academic	Summer	
a. <u>4</u> (Co)-PD(s)				12		
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals						
d. <u> </u> Graduate Students						
e. <u>0.5</u> Prebaccalaureate Students					\$2,100	
f. <u> </u> Secretarial-Clerical						
g. <u> </u> Technical, Shop and Other						
Total Salaries and Wages →					\$2,100	
B. Fringe Benefits (If charged as Direct Costs)						
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →					\$2,100	
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)					\$1,000	
E. Materials and Supplies					\$1,000	
F. Travel					\$1,600	
G. Publication Costs/Page Charges						
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)					\$400	
K. Total Direct Costs (C through J) →					\$6,100	
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →					\$6,100	
N. Other						
O. Total Amount of This Request					\$6,100	
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
NAME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

BUDGET – FY2008 Extension

ORGANIZATION AND ADDRESS Agricultural Extension Service P. O. Box 9031 Mayagüez, PR 00681			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: _12__	DURATION PROPOSED MONTHS: _12__	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
			Funds Requested by Proposer	Funds Approved by CSREES (If different)		
A. Salaries and Wages	CSREES-FUNDED WORK MONTHS					
1. No. Of Senior Personnel	Calendar	Academic	Summer			
a. <u> 4 </u> (Co)-PD(s)		12				
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals						
d. <u> </u> Graduate Students						
e. <u> </u> Prebaccalaureate Students						
f. <u> </u> Secretarial-Clerical						
g. <u> </u> Technical, Shop and Other						
Total Salaries and Wages →				\$2,100		
B. Fringe Benefits (If charged as Direct Costs)						
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				\$2,100		
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)				\$3,000		
E. Materials and Supplies				\$5,000		
F. Travel				\$3,000		
G. Publication Costs/Page Charges						
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				\$6,300		
K. Total Direct Costs (C through J) →				\$19,400		
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →				\$19,400		
N. Other						
O. Total Amount of This Request				\$19,400		
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
NAME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

BUDGET – FY2007 & 2008 Extension

ORGANIZATION AND ADDRESS Agricultural Extension Service P. O. Box 9031 Mayagüez, PR 00681			USDA AWARD NO.			
PROJECT DIRECTOR(S) Alejandro E. Segarra			DURATION PROPOSED MONTHS: <u>24</u>	DURATION PROPOSED MONTHS: <u>24</u>	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
Funds Requested by Proposer			Funds Approved by CSREES (If different)			
A. Salaries and Wages	CSREES-FUNDED WORK MONTHS					
1. No. Of Senior Personnel	Calendar	Academic	Summer			
a. <u>2</u> (Co)-PD(s)		12				
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals						
d. <u> </u> Graduate Students				\$4,200		
e. <u>0.5</u> Prebaccalaureate Students						
f. <u> </u> Secretarial-Clerical						
g. <u> </u> Technical, Shop and Other						
Total Salaries and Wages →				\$4,200		
B. Fringe Benefits (If charged as Direct Costs)						
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				\$4,200		
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)				\$4,000		
E. Materials and Supplies				\$6,000		
F. Travel				\$4,600		
G. Publication Costs/Page Charges						
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				\$6,700		
K. Total Direct Costs (C through J) →				\$25,500		
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →				\$2		
N. Other						
O. Total Amount of This Request				\$150,000		
P. Carryover -- (If Applicable) Federal Funds: \$			Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
NAME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
 COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

BUDGET – FY2007-08 Research & Extension

ORGANIZATION AND ADDRESS Agricultural Experiment Station , Jardín Botánico Sur 1193 Calle Guayacán. San Juan, P.R. 00926-1118			USDA AWARD NO.			
			DURATION PROPOSED MONTHS: 24___ Funds Requested by Proposer	DURATION PROPOSED MONTHS: ___24_ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
PROJECT DIRECTOR(S) Alejandro E. Segarra						
A. Salaries and Wages.....		CSREES-FUNDED WORK MONTHS				
		Calendar	Academic	Summer		
1. No. Of Senior Personnel						
a. <u> 2 </u> (Co)-PD(s).....			24			
b. <u> </u> Senior Associates						
2. No. of Other Personnel (Non-Faculty)						
a. <u> </u> Research Associates/Postdoctorates						
b. <u> </u> Other Professionals						
c. <u> </u> Paraprofessionals.....						
d. <u> 0.5 </u> Graduate Students					\$14,200	
e. <u> 0.5 </u> Prebaccalaureate Students.....					\$4,200	
f. <u> </u> Secretarial-Clerical.....						
g. <u> </u> Technical, Shop and Other.....					\$3,500	
Total Salaries and Wages →					\$21,900	
B. Fringe Benefits (If charged as Direct Costs)					\$540	
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →					\$22,440	
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)					\$10,000	
E. Materials and Supplies					\$ 20,860	
F. Travel					\$6,000	
G. Publication Costs/Page Charges					\$1,400	
H. Computer (ADPE) Costs						
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)						
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)					\$10,700	
K. Total Direct Costs (C through J) →					\$73,000	
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)						
M. Total Direct and F&A/Indirect Costs (K plus L) →					\$73,000	
N. Other						
O. Total Amount of This Request..... →					\$73,000	
P. Carryover -- (If Applicable) Federal Funds: \$		Non-Federal funds: \$		Total \$		
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)						
Cash (both Applicant and Third Party) →						
- Non Cash Contributions (both Applicant and Third Party)						
AME AND TITLE (Type or print)			SIGNATURE (required for revised budget only)			DATE
Project Director						5 Dec. 2005
Authorized Organizational Representative						
Signature (for optional use)						

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Budget Narrative

FY2007 Research

Line 1, a & b The salaries of Professors Fernando Gallardo and Alex Segarra (PD) are paid in full from state funds, thus their services are available at no cost to this grant.

Line 2, d. The PD intends to hire a graduate assistant for half of an assistantship at an annual salary of \$14,000 each (proposed \$7,000). Starting on October 2007, this graduate student will work with bio-based pesticide evaluations, including effects on CLM, other pests and natural enemies. Part of his/her tasks includes rearing parasitoids from CLM and other pests, documenting their importance, and preparing photographic materials for demonstrations.

Line2, g. The proposal calls for \$2,000 to cover wages for farm laborers tending experimental and demonstration plots at Lajas and Adjuntas. This amount corresponds to 1/12th laborer-year divided between both sites.

Line B. Fringe Benefits: The University of Puerto Rico offers all laborers unemployment insurance (1.4%), State worker's compensation insurance (1.55%), Social Security (6.2%) and Medicare (1.45%). These benefits amount to 10.6% of wages. The University also offers a Christmas bonus of \$1,050 which for the purposes of this proposal is prorated for one month (0.08 or 1/12th). Total asked is \$296.

Line D. Non-expendable equipment: Due to the need for controlled experimental conditions for possible CLM behavioral studies and parasitoid rearing, the PD intends to acquire a Percival Incubator with temperature, humidity and photoperiod controls. Currently, our station lacks this much needed precision equipment for rearing insects and other organisms. The list price for this incubator, plus shipment to Puerto Rico, and extended warranty is \$2,300. Work will also require the acquisition of a precision drying oven for slide preparations and other tasks that require drying specimens or plant material at a price pf \$1,200 (includes shipping and extended warranty). Finally, we are proposing to acquire a laptop computer (with MS Office software licenses) for Dr. Gallardo for work on project related analyses documentation. Currently, Dr. Gallardo's computer is an obsolete 7 yr-old computer (\$1,100). We also propose to acquire a laser printer for the PD (\$1,000) for project related documents. We also plan to acquire Black and Decker sprayers for each location. These are list priced at close to \$200 in Puerto Rico (total \$400). The total requested for non-expendable equipment is \$6,000.

Line E. Materials and Supplies: Field experiments using fruit trees, particularly those involving nursery manipulations and insecticide testing are expensive. The experiments and demonstration plots will require close to 3,000 lemon and tangerine seedlings during the course of the proposed work. We propose to acquire these at \$2.85 each, for a total of \$8,200 the first year. Similarly, insect rearing often expend resources materials rearing, for nursery maintenance and repair, and buying the required experimental pesticides. Funds required to buy these are as follows:

Pesticides and application supplies	\$950
Nursery supplies and materials	\$800
Laboratory and insect rearing supplies	<u>\$1,250</u>
Total	\$3,000

Total for Materials and supplies is \$11,200

Line F. Domestic Travel: Funds for local transportation and per diem meals are set aside for the PD and Dr. Gallardo. No other domestic travel is planned for the first year. No foreign travel is planned for 1st year. Total cost of domestic and foreign travel is \$800

Line G. Publications Costs: \$300 are budgeted for publication during the first year.

Line J. All Other Direct Costs. (AODC)

Services: We are budgeting \$950 for arthropod identification services. We have found that CABi in England has extensive experience in identifying arthropods of the Caribbean and their fees are high. We have also budgeted \$1,000 for greenhouse nursery usage and maintenance at Lajas AES and Adjuntas (\$500/yr per site). In addition, we budget \$50 for Fed-Ex and postage charges. Total AODC \$2,000

FY2008 Research

Line 1, a & b The salaries of Professors Fernando Gallardo and Alex Segarra (PD) are paid in full from state funds, thus their services are available at no cost to this grant.

Line 2, d. The PD intends to continue to hire a graduate assistant for half of an assistantship at an annual salary of \$14,400 each (proposed \$7,200). This graduate student will continue his/her work with bio-based pesticide evaluations, including effects on CLM, other pests and natural enemies. As with FY2007, part of his/her tasks continue to include rearing parasitoids from CLM and other pests, documenting their importance, and preparing photographic materials for demonstrations.

Line2, g. The proposal calls for \$1,500 to cover wages for farm laborers tending experimental and demonstration plots at Lajas and Adjuntas. This amount corresponds to 1/12th laborer-year divided between both sites.

Line B. Fringe Benefits: The University of Puerto Rico offers all laborers unemployment insurance (1.4%), State worker's compensation insurance (1.55%), Social Security (6.2%) and Medicare (1.45%). These amount to 10.6% of wages. The University also offers a Christmas bonus of \$1050 which for the purposes of this proposal is prorated for one month (0.08 or 1/12th). Total asked is \$244.

Line D. Non-expendable equipment: No equipment will be bought this fiscal year.

Line E. Materials and Supplies: Field experiments using fruit trees, particularly those involving nursery manipulations and insecticide testing are expensive. The experiments and demonstration plots will require close to 3,000 lemon and tangerine seedlings during the course of the proposed work. We propose to acquire these at \$2.85 each, for a total of \$2,400 the second year. Similarly, insect rearing often expend resources materials rearing, for nursery maintenance and repair, and buying the required experimental pesticides. Funds required to buy these are as follows:

Pesticides and application supplies	\$700
Nursery supplies and materials	<u>\$560</u>
Total	\$1,260

Total for Materials and Supplies requested for FY2008 is \$3,660.

Line F. Domestic travel: Funds for local transportation and per diem meals are set aside for PD and Co-PDs (\$800). Domestic travel is budgeted for 2 trips: One for Dr. Fernando Gallardo, and one for Dr. Segarra. The purpose of these trips will be to present results of CLM research at the annual meetings of the Entomological Society of America in 2008 [\$1,000 each.]. Total cost of domestic travel would be \$2,800.

Foreign travel: We plan to present results of the joint project at the annual Caribbean Food Crops Society (CFCS) meeting. The CFCS is an excellent place to exchange results with colleagues of other Caribbean island nations. We budget \$400 for this event. Total cost of domestic and foreign travel is \$3,200.

Line G. Publications Costs. \$1,100 are budgeted for publication in peer-reviewed journals during the second year.

Line J. All Other Direct Costs. (AODC)

Services: We are again budgeting \$950 for arthropod identification services. We have found that CABI in England has extensive experience in identifying arthropods of the Caribbean and their fees are high. We have also budgeted \$1,000 for greenhouse nursery usage and maintenance at Lajas AES and Adjuntas (\$500/yr per site). In addition, we budget \$50 for Fed-Ex and postage charges. Total AODC \$2,000

FY2007 Extension

Line 1, a & b The salaries of Professor Ada Alvarado is paid in full from state funds, thus her services are available at no cost to this grant.

Line 2, e. We propose to hire an undergraduate student for forty-one weeks at 10 hours per week, (maximum allowed by UPR undergraduate hiring regulations) at \$5.15 per hour

(proposed \$2,100). This student will assist Professor Alvarado in searching, collating and preparing information needed for the confection of CLM training manual and citrus crop profile. The student will also help Professor Alvarado with coordination and preparations of Guidance Committee Meetings. Total for pre-baccalaureate students is \$2,100.

Line D. Non-expendable equipment: We are proposing to acquire a laptop computer (with MS Office software licenses) for Professor Alvarado that will be used to prepare reports and the CLM manual. Currently, Professor's Alvarado computer is obsolete thus we budget \$1,000 for its requisition. The total requested for non-expendable equipment is \$1,000.

Line E. Materials and Supplies: We have budgeted \$500 for office materials related to the preparation of the CLM Manual, like Xeroxing, binders, and for Guidance Committee activities. Additional funds (\$500) will be used to buy software for the preparation of educational materials. Total for Materials and Supplies is \$1,000

Line F. Domestic Travel: Funds for local transportation and per diem meals are set aside for Professor Alvarado and members of the Guidance Committee (\$1,600). No other domestic travel is planned for the first year. No foreign travel is planned for 1st year. Total cost of domestic and foreign travel is \$1,600.

Line G. Publications Costs: No publication costs are budgeted for the first year.

Line J. All Other Direct Costs. (AODC)

Services: We are requesting \$350 facilities rental for one stakeholders' meeting with the Guidance Committee. In addition, we budget \$50 for Fed-Ex and postage charges. Total AODC request for the first year is \$400.

FY2008 Extension

Line 1, a & b The salaries of Professor Ada Alvarado is paid in full from state funds, thus her services are available at no cost to this grant.

Line 2, e. We propose to continue the hire of an undergraduate student for forty-one weeks at 10 hours per week, (maximum allowed by UPR undergraduate hiring regulations) at \$5.15 per hour (proposed \$2,100). This student will continue assist Professor Alvarado in searching, collating and preparing information needed for the confection of CLM training manual and citrus crop profile. The student will also help Professor Alvarado with coordination and preparations of demonstration and training sessions. Total for pre-baccalaureate students is \$2,100.

Line D. Non-expendable equipment: We are proposing to acquire one presentation projector to be used during the training sessions. The projector and associated optional gear costs \$3,000, including shipping, handling, and extended warranty. Professor Alvarado will

need this projector to produce training and demonstration sessions. The total requested for non-expendable equipment is \$3,000.

Line E. Materials and Supplies: We have budgeted \$4,000 for publication and presentation materials related to the printing and distribution of the CLM Manual to about 300 participants. Additional funds (\$1000) will be used to buy materials and supplies related with the workshops at Lajas and Adjuntas. Total for Materials and Supplies is \$5,000

Line F. Domestic Travel: Funds for local transportation and per diem meals are set aside for Professor Alvarado, members of the Guidance Committee, and workshop participants (\$2,000). Domestic travel is also requested for 1 trip for Professor Alvarado to present results of CLM education efforts at the annual meetings of the Entomological Society of America in 2008 [\$1,000.]. No foreign travel is planned. Total cost of domestic travel would be \$3,000.

Line G. Publications Costs: No publication costs are budgeted for the second year.

Line J. All Other Direct Costs. (AODC)

Services: We are requesting \$800 for facilities and equipment rental for each of the three workshops (\$2,400). In addition, we are requesting \$3,600 for lunch catering for approximately 300-400 clients expected at the three daylong demonstration workshops. In addition, we request \$300 for Fed-Ex and postage charges. Total AODC request for the first year is \$6,300.

Budget Form for Joint Research-Extension Proposals

Southern Region Competitive Grants Program Budget Form for Joint Research-Extension Proposals

[Biologically-based management of the citrus leafminer, and other key citrus nursery pests in Puerto Rico: A Research and Education Project.] **[FY 2007]**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Senior Personnel	0	0	
Other Personnel	\$2,000	0	\$3,500
Total Salaries and Wages	\$2,000	0	\$3,500
B. Fringe Benefits	\$296	0	\$540
C. Total Salaries, Wages and Fringe Benefits	\$2,296	0	\$4,040
D. Nonexpendable Equipment	\$6,000	\$1,000	\$10,000
E. Materials and Supplies	\$11,200	\$1,000	\$20,860
F. Travel	\$800	\$1,600	\$7,600
G. Publication Costs/Page Charges	\$300	0	\$1,400
H. Computer (APDE) Costs	0	0	0
I. Student Assistance/Support	\$7,000	\$2,100	\$18,400
J. All Other Direct Costs	\$2,000	\$400	\$10,700
K. Total Requested	\$29,596	\$6,100	\$73,000

**Southern Region Competitive Grants Program
Budget Form for Joint Research-Extension Proposals**

[Biologically-based management of the citrus leafminer, and other key citrus nursery pests in Puerto Rico: A Research and Education Project.] **[FY2008]**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Senior Personnel	0	0	
Other Personnel	\$1,500	0	\$3,500
Total Salaries and Wages	\$1,500	0	\$3,500
B. Fringe Benefits	\$244	0	\$540
C. Total Salaries, Wages and Fringe Benefits	\$1,744	0	\$4,040
D. Nonexpendable Equipment	0	\$3,000	\$10,000
E. Materials and Supplies	\$3,660	\$5,000	\$20,860
F. Travel	\$2,200	\$3,000	\$7,600
G. Publication Costs/Page Charges	\$1,100	0	\$1,400
H. Computer (APDE) Costs	0	0	0
I. Student Assistance/Support	\$7,200	\$2,100	\$18,400
J. All Other Direct Costs	\$2,000	\$6,300	\$10,700
K. Total Requested	\$17,904	\$19,400	\$73,000

**Southern Region Competitive Grants Program
Budget Form for Joint Research-Extension Proposals**

[Biologically-based management of the citrus leafminer, and other key citrus nursery pests in Puerto Rico: A Research and Education Project.] **[Cummulative]**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Senior Personnel	0	0	
Other Personnel	\$3,500	0	\$3,500
Total Salaries and Wages	\$3,500	0	\$3,500
B. Fringe Benefits	\$540	0	\$540
C. Total Salaries, Wages and Fringe Benefits	\$4,040	0	\$4,040
D. Nonexpendable Equipment	\$6,000	\$4,000	\$10,000
E. Materials and Supplies	\$14,860	\$6,000	\$20,860
F. Travel	\$3,000	\$4,600	\$7,600
G. Publication Costs/Page Charges	\$1,400	0	\$1,400
H. Computer (APDE) Costs	0	0	0
I. Student Assistance/Support	\$14,200	\$4,200	\$18,400
J. All Other Direct Costs	\$4,000	\$6,700	\$10,700
K. Total Requested	\$47,500	\$25,500	\$73,000

Use a separate form for each year of funding requested and tally the years on a cumulative form.

No carryover of Research or Joint Research-Extension funds is permitted beyond Year 3 of any grant.