

FHP Special Technology Development Project Progress Report  
(Enclosure 3)

Project Status: Continuing

Project Number: NA-1998-01

Project Title: Development of Efficient Rearing Techniques and Evaluation of Alternative Food Sources for *Pseudoscymnus tsugae* (Col.:Coccinellidae), Predator of Hemlock Woolly Adelgid, *Adelges tsugae* Annad (Hom.:Adelgidae)

Subject: Biological control of an exotic pest of eastern hemlock

Project Objective: To develop an efficient mass rearing technique for the hemlock woolly adelgid predator *P. tsugae*.

FHP Lead Person: Brad Onken, Entomologist, FHP, Northeastern Area

Cooperators: Mark McClure, CT Agricultural Exp. Station  
George Koeck, NJ Forest Service  
Bob Chianese, NJ Dept. of Agriculture, Beneficial Insect Laboratory

Project Description: Laboratory rearing of *P. tsugae* began in the spring of 1997 when 100 adult beetles were provided by the CT Agric. Experimental Station to the NJ Dept. of Agriculture to serve as a backup colony. At the start of this STDP project (Oct. 1, 1998) the NJ colony had increased to 600 beetles. Beetle reproduction is synchronized with the time when HWA is active (Oct-July) and tapers off when HWA enters its aestivation period. During this time beetles continue to feed on the aestivating adelgids but reproduction ceases. The NJ beetle colony is supported by field collections of HWA infested hemlock branches which are cleaned of other insect and arachnid predators and prepared as hemlock sprigs. The sprigs are kept fresh by inserting the twigs into floral foam and placed in the beetle cages which are kept in a room where temperature and humidity are maintained at desirable levels. Periodically during the reproduction period, beetles are separated, counted and moved to other cages. This prevents overcrowding and minimizes cannibalism. At this point beetles are either "stored" awaiting field releases or maintained to continue the reproduction process.

Because rearing *P. tsugae* has required field collection of host material, one goal is to find a food substitute that will replace or reduce the need for field collected host material. To this end, several laboratory prepared food substitutes have been evaluated and containerized hemlock seedlings have been grown which will be inoculated with HWA to evaluate the potential for maintaining a host reservoir on site.

Accomplishments, Results and Direction of Continued Work :

1. During year one of this STDP project, good progress was made in developing a practical and labor-efficient rearing technique that produced 85,000 *P. tsugae* from the stock of 600 individuals. Beetle reproduction began in October of 1997 and peaked between January and June with a yield of 5,000-7,000 beetles per week. Of the 85,000 beetles produced, 75,000 were released for field evaluations in NJ, 5,000 in CT and 5,000 were held as rearing stock to be used when the beetle's oviposition begins again in October as the adelgid emerges from summer dormancy.

The direction in year two of this project will be to repeat and hopefully enhance the production rate on a larger scale.

2. The laboratory was successful in developing a storage technique that requires minimal maintenance and provided 100% survival of the stored beetles. Some of these beetles were stored up to five months.

The focus in year two will be to determine the longevity of beetles in storage and identify possible limitations.

3. One of the most labor intensive aspects of rearing *P. tsugae* in the lab has been during the collection process of newly emerged and stored beetles. Previously, the foliage of each hemlock sprig had to be searched for these "poppyseed" size beetles. A new method has now been developed involving the manipulation of temperature to induce the beetles to leave the foliage. This process provides for easy and rapid aspiration of the beetles that collect on the walls of the rearing enclosure.

This methodology has been demonstrated efficient and will be continued in year two.

4. Efforts to reduce the need for field collected host material to support the laboratory-reared colony of *P. tsugae* has lead to the establishment of 2,000 potted seedling hemlocks. These hemlock seedlings have now grown from an average of 4 inches to 18-inch plants and inoculation of HWA was initiated this fall.

The direction in year two will be to utilize the HWA infested seedlings and determine if this method is an efficient means of supplying host material.

5. A number of alternative food sources has been screened within the context of developing a mass rearing technique. To date, a mixture of undiluted honey, casein, yeast extract, sugar and water has been used as a food supplement and readily eaten by both larvae and adult *P. tsugae*. This supplement has been used in all stages of the rearing procedure but the extent to which it is essential to achieving the current level of production has yet to be determined.

The direction in year two will be to evaluate the affect of this food supplement on beetle fecundity, survival and feeding habits.

6. The success of rearing beetles this year allowed for the release of 75,000 beetles at 14 HWA infested sites in NJ. Field observations several months after the release has indicated *P. tsugae* had considerably reduced HWA populations on the release trees and have begun to colonize adjacent infested hemlocks 15-20 meters from the point of release in some locations.

All field releases will continue to be monitored in year two and beyond and changes in HWA population densities and tree health will be evaluated. The number of beetles it takes to successfully establish and sustain an impact on HWA populations in the years following a release is unknown and needs to be addressed. In 1998, beetles were released in various HWA densities to evaluate their effectiveness at reducing adelgid populations.

Evaluation of these sites will continue. Future releases will continue to be made in healthy hemlock stands that contain light to heavy HWA populations in an effort to contain the adelgid population and reduce stress on the trees.

Documentation: A summary of project accomplishments have been posted in the September, 1998 issue of the HWA Newsletter, Northeastern Area Forest Health Protection.

First Year Funded: FY98

Year Scheduled to End: FY99

Actual Year to End: FY00

Previously Identified Products and Due Dates:

1. A Methods Manual on rearing *P. tsugae* will be produced by the NJDA and made available by request in FY99.
2. In FY99, starter colonies of *P. tsugae* will be provided to other state and federal agencies that wish to begin rearing the beetle.
3. In FY99, *P. tsugae* will continue to be produced and inoculative releases conducted to establish the beetle in HWA infested forests in NJ.

Status of Products: This project will require two years to complete before all the information is available for the Methods Manual. Progress of this project is acceptable by the Northeastern Area. Production and releases of *P. tsugae* is on schedule in NJ and beetles will be provided for release and as starter colonies in other states in the spring of 1999.

Funds Obligated From Beginning of Project Through End of FY98:

Fiscal Year	FHP STDP	FHTET	NJDA
98	\$34,315	\$15,547	\$56,685

Funds Carried Over From FY98 to FY99: None

Post-Project Technology Support: The products being developed include: a methods manual on rearing *P. tsugae* (FY99); starter colonies to cooperating state and federal agencies (FY99); and the continued inoculative release of this predator beetle in NJ and other states.

Annual funding when this project is completed is estimated to be \$175,000 to continue the mass rearing of *P. tsugae*. Because of the devastating impact HWA has had on the hemlock resource in NJ, the NJDA is committed to support this effort to the extent

possible. Future funding will also be requested through USDA Forest Service Cooperative Forestry Assistance as needed.

Look to the Future: There is much to be learned regarding how to best utilize *P. tsugae* as a biocontrol agent. The optimum number of beetles to release in a given area to sustain adequate reduction of HWA populations is one question that needs to be addressed immediately. Also, the relationship of hemlock density, HWA population levels and tree health all of which are known to affect HWA populations are also variables that may impact the performance of *P. tsugae* in the field. Predation pressure by native generalist predators that may find *P. tsugae* easy prey is not well understood at this time. Unfortunately, some of these questions may take several years to address.

FHP Special Technology Development Project Progress Report  
(Enclosure 4)

Project Status: Funds are being requested for FY99 to continue the project.

Estimated Completion Date: September 30, 1999.

Project Number: NA-98-01

Project Title: Development of Efficient Rearing Techniques and Evaluation of Alternative Food Sources for *Pseudoscymnus tsugae* (Col.:Coccinellidae), Predator of Hemlock Woolly Adelgid, *Adelges tsugae* Annad (Hom.:Adelgidae)

Additions: None

Changes: None

FY99 Budget:

Item	Requested FHP STDP Funding	Other Sources	Organization Name
Administrative:			
Salary	\$22,804	\$89,959	NJDA
Travel	\$300		
Procurement:			
Supplies	\$1,356		

Total FY99 Budget: \$114,419

New FHP STDP funding needed in FY99: \$24,460

Estimated future funding beyond FY99:	FY00	FY01	Source
	\$10,000	\$10,000	FHP STDP
	\$90,000	\$90,000	NJDA