New Jersey Department of Agriculture
Phillip Alampi Beneficial Insect Rearing Laboratory

Mexican bean beetle larvae

P. foveolatus on larva

Introduction

The cultivation of food, one of the most essential of human endeavors is, by far one of the riskiest. Unfavorable weather conditions and pest infestation can undermine the diligent efforts of even the most experienced farmer, damaging or destroying fruits and vegetables, and lowering yields. New Jersey farmers lose $290 million annually from direct crop loss or damage caused by agricultural pests, or the costs to control those pests.

Half of the major insect pests in the United States have been introduced from foreign countries. Approximately 1,065 to 1,118 plant species, or nearly 62 percent of plant species in New Jersey, have been introduced from continents other than North America, mostly from Europe and Asia. When foreign insects and weeds are accidentally transported into this country, they often arrive without the natural enemies that keep their populations in check in their natural ranges. Native parasites tend to be very host specific and not adapted to attack an introduced species.

Pests are prolific and adaptable, and build resistance to pesticides. But, unlike the weather, pest damage can be controlled through the use of both biological and chemical methods. The U.S. Department of Agriculture (USDA) estimates that the average cost to control agricultural pests is approximately 34 percent of a farmer's variable crop production costs.

One of the New Jersey Department of Agriculture's primary goals is to safeguard the state's agricultural and natural resources from injurious pests and diseases. The Department of Agriculture has been developing and implementing biological control programs to help farmers control plant pests since the 1920's, starting with the Japanese beetle.

Peristenus stygicus attacking Tarnished Plant Bug nymph

Biological control is the use by humans of beneficial insects such as predators and parasitoids, or pathogens such as fungi and viruses, to control unwanted insects, weeds, or diseases. Biological control dates back to 324 BC, when Chinese growers were recorded using ants to feed on citrus pests.

Non-native insect pests such gypsy moth and hemlock woolly adelgid have had dramatic impacts on New Jersey's forests, forested residential communities and recreational areas. Tree losses in New Jersey's forests due to infestations by these two insects alone cause major ecological changes. The forest canopy provides habitat and food vital to wildlife. Lack of forest canopy promotes soil erosion and increased siltation of streams, and/or the drying out of the soil duff layer increasing the danger of forest fire.

The plant species most likely to survive in declining hemlock stands are mainly hardwoods and non-native invasive species that do not provide the habitat or ecological functions of eastern hemlock. Hemlock ravines are noted for the dense shade provided by mature trees. The temperature and flow of streams in hemlock dominated watersheds or riparian areas will probably become more variable and warmer, threatening brook trout.

Non-native invasive weeds have altered natural areas and wetlands. Invasive weeds out-compete native trees and plants because of the absence of predators, diseases, and competitors that they evolved with in other ecosystems. Vines topple trees, and dense invasive grasses prevent the growth of native trees and shrubs.

Patterns of water flow and erosion can change as wetlands and stream banks are invaded by species like purple loosestrife. Purple loosestrife can quickly out-compete native plants that are important food sources for a variety of wildlife, including the endangered bog turtles.

Municipalities spent $ 2.475 million to control gypsy moth in 2007; 50% of which was reimbursed through federal funds. Property owners bear the costs of removing dead or dying trees to prevent safety hazards posed by falling tree limbs; dead mature trees may cost upwards of $5,000 a piece to remove, and the loss of trees may reduce property values by 15 percent or more. Defoliation by gypsy moth can increase utility bills for air conditioning in residential and commercial buildings by 15-50 percent.

Figure 9. Stand mortality at High Point SP

Studies of real estate sales in towns in Sussex County have shown that every 1.0 percent increase in the level moderately defoliated hemlocks decreases housing prices by 0.95 percent.

Chemical controls for hemlock woolly adelgid are available; in 2007 the State of Michigan paid $50,000 to treat five acres of native hemlocks with imidacloprid to prevent hemlock woolly adelgid from establishing a foot-hold in its forests.

However chemical control is neither feasible nor appropriate to protect environmentally sensitive forested glens and ravines such as the Ken Lockwood Gorge or Tillman's Ravine, where scenic rivers and brooks, big rapids, calm pools, and tall hemlocks dominate the banks.

Biological control reaps long term benefits

The State of New Jersey has long had the foresight to invest in biological control. Biological control offers tremendous social, environmental, as well as, economic advantages. Biological control can become self-sustaining and integrated in the normal

environment of the control area. Since such controls are expected to continue indefinitely, a high initial expense may prove to be a very low total cost. Biological control is particularly useful where chemical pesticides are not suitable or are impractical in environmentally sensitive areas, or on low-unit-value crops, such as alfalfa or soybeans, where complete control may not be required.

When pesticides were developed in the 1950's, they were potent and relatively inexpensive. However in 1962, the book "Silent Spring," written by Rachel Carson, sounded a widespread warning about the persistence of certain pesticides in the environment and the environmental drawbacks of broad spectrum chemical use. Today's modern pesticides are not as persistent as past pesticides, and are important tools in crop protection. These pesticides can be very expensive, warranting an integrated approach to pest management, which compliments and promotes the use of biological controls.

In 1965, the President's Science Advisory Board concluded that for every $1 spent on biological control research and development, there were $30 in accrued benefits. In 1987, USDA calculated that nationally, biological controls against the alfalfa weevil netted savings of about $48 million annually; research costs were $1 million - for a ratio of return on investment of about 50 to 1. Currently, total grower savings from biological control amount to $2 billion, largely as a result of reduced cost of pesticide applications.

Eleven states currently maintain insect rearing laboratories for biological control: California, Colorado, Connecticut, Florida, Hawaii, Maryland, North Carolina, New Jersey, Oregon, South Carolina and South Dakota. These facilities range greatly in size, but carry out a wide variety of programs to control insect and weed pests of local or regional importance. The New Jersey Department of Agriculture's Phillip Alampi Beneficial Insect Rearing Laboratory supplies/or has supplied beneficial insects to support programs in many of the Northeast and Mid-Atlantic states.

The New Jersey Department of Agriculture's 21,000 square-foot Phillip Alampi Beneficial Insect Rearing Laboratory constructed in 1985. Designed for biological pest control, the facility allows entomologists to develop insect rearing techniques and mass produce beneficial insects to be used to help reduce insect and weed populations.

Construction of Beneficial Insect Rearing Laboratory enables entomologists and technicians to simultaneously mass-produce a variety of beneficial insect species to control many different species of pest insects and weeds. Over the years, the New Jersey Department of Agriculture has introduced hundreds of beneficial insects into forests and crops of New Jersey. Many of the beneficial insects have established and are controlling pest populations, year after year, in thousands of acres.

The Phillip Alampi Beneficial Insect Rearing Laboratory raises two types of insects, those that live through the winter and reappear in the spring (classical) biological control, and those that must be released at the appropriate time each year (augmentative biological control). Because the beneficial insects help control damaging weeds and insects, the amount of pesticides used by farmers and gardeners is reduced.

Classical programs are much like an investment where one buys stock or sets up a savings account and then the interest keeps accumulating every year. The start up might be expensive, but once the insects are established they continue to work. Private companies do not work with classical biological control because there is little, if any, profit in it. Augmentative biological control involves the supplemental release of natural enemies. Relatively few natural enemies may be released at a critical time of the season (inoculative release) or literally millions may be released (inundative release). An augmentive or inundative release program uses the biologicals to control the pest instead of chemicals.

Cost Savings Estimates for Biological Control Programs

Past programs are included in the following analysis. Costs listed are those that would be required for insecticide applications if the biological controls were not available.

Table 1. Annual Pesticide Savings in Cost of Chemical Control

Target Pest	Crop Protected	Acres [1]	Acres Benefited [2]		Chemical Control Cost/Acre [3]	Savings [4]
			%	#		
Alfalfa Weevil	Alfalfa	30,000	95%	28,500	$19.00	$541,500
Mexican Bean Beetle	Soybeans	95,000	80%	76,000	$16.00	$1,2168,000
	Snapbeans	4,000	80%	3,200	$6.00	$19,200
Cereal Leaf Beetle	Oats	2,500	80%	2,000	$15.00	$5,400
	Wheat	42,000	80%	36,000	$15.00	$540,000
Tarnished Plant Bug	Alfalfa	30,000	50%	15,000	$19.00	$285,000
Musk Thistle	Pasture	90,000	10%	90,000	$15.80	$158,000
Gypsy Moth [5]	Hardwoods	1,200,000	66%	800,000	$39.50	$31,600,000
Euonymus Scale	Ornamentals	171,766 plants	23%	39,506 plants	$7.50 /plnt	$296,295
Hemlock [6] Woolly Adelgid	hemlock	26,000	25%	6,500	$10,000	$65,000,000
Purple Loosestrife	Various	53,000	30%	5,300	$65.00	$1,033,500
Total				**1,062,500**		**$101,226,895**

[1] Current number of crop acres in NJ.
[2] Average amount of the crop that benefits from the beneficial insect program in any given year.
[3] Average amount spent/acre to control damage to that crop if the beneficial insects were not present.
[4] Cost to control the pest insect without biological control.
[5] The balance of the susceptible forestland in NJ **NOT** requiring treatment due to beneficial insect control.
[6] The cost of control in woodlands with soil injection of imidacloprid, 2007 Michigan Dept. Agriculture

NOTE: The acreage figures above were obtained from the New Jersey Department of Agriculture 2006 Annual Report and Agricultural Statistics newsletter. Costs of insecticide application per acre were developed from current dealer price quotes for the insecticides used for the various pests, calculation of the proper rates using Rutgers Pesticide Recommendations. The costs include the cost of application. The estimates assume that no beneficial organisms have been released.

Major successes

In 2007, the **Mexican bean beetle** program avoided over $1.2 million in pesticide costs in New Jersey, and eliminated the need to apply nearly 60,800 pounds of pesticide. No New Jersey soybean growers have had to spray to control Mexican bean beetle since 1985, avoiding the need to apply over 1 million pounds of pesticides in the environment over the course of this program.

In 1996 a program was initiated to control purple loosestrife. **Purple loosestrife** (*Lythrum salicaria* L.) is an invasive weed in wetlands that is native to Eurasia. Since its accidental introduction to North America in the early 1800s, purple loosestrife is found in all contiguous states of the United States (except Florida) and all Canadian provinces. Two species of beetles native to Europe were obtained from scientists at Cornell University to rear beetles for release to control loosestrife in our infested wetlands. The following year, the New Jersey Department of Agriculture and the New Jersey Department of Environmental Protection, Division of Fish and Wildlife cooperated in a pilot project to release the beetles within five Wildlife Management Areas.

Figure 7. Columbia Lake 1998

Figure 8. Columbia Lake 2006

Photos by M. Mayer and T. Scudder

The program was expanded to include known bog turtle sites in 1998. The bog turtle, *Clemmys muhlenbergii*, is an endangered native species that is adversely affected by purple loosestrife. From 1998 until the project ended in 2004, the New Jersey Department of Agriculture, working with the Division of Fish and Wildlife, Endangered and Nongame Species Program released 722,464 beetles in 36 bog turtle sites over the project's seven-year existence.

Since 1997, approximately 1.7 million beetles have been released at 101 sites in 17 New Jersey counties. Purple loosestrife is no longer a dominant plant in many of the study sites. The natural dispersal of beetles into other loosestrife infestations continued in 2006 with the discovery of 39 new sites inhabited with the beetles. As populations of beetles continue to rise in release sites, their dispersal into more and more areas of new loosestrife infestations can be expected. This eventually should lead to a corresponding reduction of purple loosestrife throughout the state.

In addition, releases have been made at a number of sites including National Park Service lands, and sites managed by Natural Lands Management, The Nature Conservancy of NJ, Mercer County Park Commission, Union County Park System, Allentown Borough, Rider University, property managed by the NJ Meadowlands Commission, a number of mitigation sites and private landowner properties**.**

Also, 770,400 beetles have been shipped to other states including Maine, Massachusetts, Rhode Island, New York, Delaware, Pennsylvania, Tennessee, Michigan and New Hampshire in an effort to establish field colonies within those states.

The New Jersey Department of Agriculture has released 39 species of biological control agents to help in the battle against **gypsy moth**; 10 have established. In 2007, while over 320,000 acres of the 2.2 million forested acres in New Jersey experienced heavy or severe defoliation by gypsy moth, assays showed that approximately 50% of the individual eggs in the egg masses were parasitized and did not hatch, preventing an even greater devastation.

The process

The New Jersey Department of Agriculture works closely with federal and other state departments of agriculture and university researchers in developing biological control programs. These researchers travel abroad locate and collect natural enemies in a pest's native area, which are maintained in a laboratory and evaluated for their effects on indigenous species of flora and/or fauna.

The natural predators and parasitoids must pass a rigorous quarantine process, to ensure that no unwanted organisms (such as hyperparasitoids) are also introduced; and receive approval from the United States Department of Agriculture for introduction into the US. Only then do the beneficial insects come to the Phillip Alampi Beneficial Insect Rearing Laboratory for rearing. This process may take several years.

The beneficial insects are then reared in the laboratory or in field insectaries, ideally in large numbers, and released. Follow-up studies are conducted to determine if the natural enemy successfully established at the site of release, and to assess the long-term benefit of its presence.

The choice of which beneficial insects can be used in a control program is limited to what insects are adaptable to a practical biological control program. Beneficial insects are not easily adaptable for biological control of every insect or weed pest infesting crops in New Jersey. The pest control program must also be compatible with current grower practices. A beneficial insect must have the ability to adjust to a new environment and, in the case of an augmentation approach, must lend itself to laboratory production.

Programs Directed Against Insect Pests

ALFALFA WEEVIL feeds on foliage, a heavy infestation can significantly reduce crop yield. Several kinds of wasps native to Europe have been established in New Jersey. They control the pest by attacking and killing both larval and adult weevils. Before the introduction of the parasites, most of the 25,000 acres of alfalfa produced in New Jersey each year required chemical treatment to control this pest. Since the establishment of the beneficial insects, chemical spraying for this pest has been reduced by over 95%. The Department continues to monitor the presence of the parasites.

► Status of biological control agents: 4 species released, 4 established. This is a classical biological control program in which four parasites have been released and all four have established.

APHIDS feed on the sap of many ornamental plants, fruits, vegetable, and field crops. Weakened plants produce lower yields and may even die. In addition, aphids can transmit a variety of diseases to plants. Since 1989 several kinds of European ladybugs and more recently, a hover fly have been reared in the Phillip Alampi Beneficial Insect Rearing Laboratory and released throughout the state to reduce the aphid population.

► Status of biological control agents: 4 species released, 2 established. This is a classical biological control program in which three predators and one parasite have been released and two have established.

SCALE insects suck the sap from stems and leaves, much as aphids do. Euonymus scale and alatus scale feed on ornamental euonymus bushes, causing them to drop their leaves. This is a particularly serious problem for commercial nurseries. One species of scale-eating beetle was released in the late 1980s. Another species of beetle that feeds on various species of hard shell scales is being reared in the state's beneficial insect laboratory and released throughout the state on scale-infested euonymus plants and hemlock trees.

► Status of biological control agents: 6 species released, **3** established, a predator beetle is now being reared in the laboratory.

MEXICAN BEAN BEETLES feed on the foliage of soybeans, snap beans and lima beans, reducing the crop yield. This is an inundative release program where *Pediobius foveolatus* (a wasp) is used to control the Mexican bean beetle in soybeans. These very small wasps, known as parasitoids, attack and kill Mexican bean beetle larvae. The parasitoids cannot over-winter in New Jersey, and must be reared in the Laboratory each winter and released into soybean fields during the summer. The wasp has been released in New Jersey soybean fields annually since 1980. A total of 174,000 parasites were released into 55 nurse plots in 2006. No New Jersey soybean growers have had to spray to control Mexican bean beetle since 1985.

► Status of biological control agents: 1 species released yearly, now being reared in the laboratory; none established.

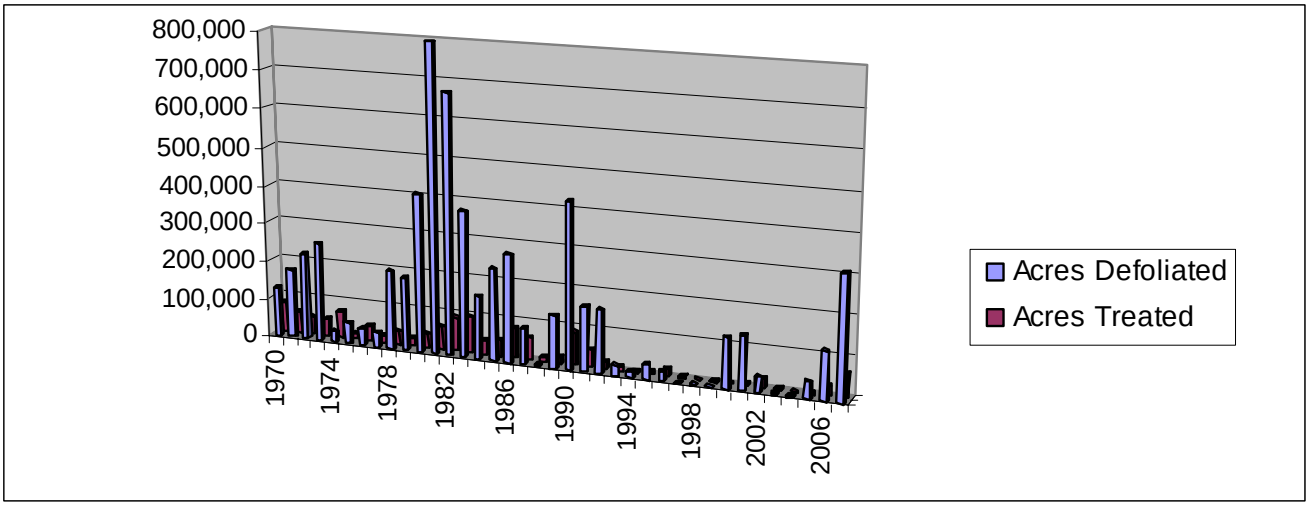
Small grain crops, such as wheat and oats, are attacked by **CEREAL LEAF BEETLE** whose feeding habits can seriously damage those crops and cause lower yields if not controlled. A parasite which feeds on the eggs of this pest has been laboratory-reared by the USDA and shipped to New Jersey where it has been released in grain fields and monitored for its effectiveness by NJDA entomologists. Most growers do not spray for this insect because the parasites keep it below thresholds. Without the parasites, the growers would be spraying yearly.

► Status of biological control agents: 4 species released, 3 established.

GYPSY MOTH is the most damaging insect pest of forest, fruit and shade trees in New Jersey and the eastern United States; oak-forested areas are particularly at risk of losses of trees due to repeat feeding damage by gypsy moth caterpillars (larvae).

This is a classical program where the beneficials hold the population of gypsy moth significantly below past levels. Gypsy moth populations are cyclical, during the 1950's and 1960's the cycle peaked about every four to five years, since the 1970's the cycle is about seven to eight years. In the late 1970's to early 1980's the gypsy moth population reached its zenith with 798,790 acres defoliated (see below). During that period the Department reared massive amounts of parasites to control the gypsy moth in New Jersey. The highest levels of defoliation since then was in the early 1990's at 411,975, and again in 2007 at 325,000 acres or about half the amount prior to the parasite release program. A fungus disease has also exerted tremendous effects on the gypsy moth population, but it is totally weather dependent; the fungus has been largely ineffective during the last 5 years accounting for the tradition cyclical population build-up.

As mentioned previously, in 2007, while over 320,000 acres of the 2.2 million forested acres in New Jersey experienced heavy or severe defoliation by gypsy moth, assays showed that approximately 50% of the individual eggs in the egg masses were parasitized



and did not hatch, preventing an even greater devastation. There is less gypsy moth pressure due to the presence of the beneficials than there would be otherwise. This results in less stress for the homeowner, less tree mortality and an increase in the quality of life for which one cannot assign a dollar value.

► Status of biological control agents: 39 species released, 10 established.

TARNISHED PLANT BUGS feed on the sap of many plants, including forage crops, small grains, fruits and vegetables. They can reduce crop yields and scar fruit. A wasp that develops in and kills plant bug nymphs was laboratory-reared by the USDA and shipped to New Jersey in the mid-1980s and established in Warren and Sussex Counties. The wasp is monitored for its effectiveness by USDA and NJDA entomologists, and continues to spread throughout the northern counties.

The Phillip Alampi Beneficial Insect Rearing Laboratory received another related wasp species of Mediterranean origin from the USDA, Beneficial Insect Research Laboratory, in Newark, Delaware to investigate its potential use in southern New Jersey counties to control tarnished plant bug. The Laboratory has made significant progress in parasitoid wasp production by rearing plant bug nymphs utilizing an artificial egg-based diet. The Laboratory produces 2,000 – 3,000 parasitoid wasps weekly.

► Status of biological control agents: 2 species released, 2 established, a parasitoid wasp is now being reared in the laboratory.

With the increasing threat of **MOSQUITO**-borne illnesses such as West Nile virus and eastern equine encephalitis, that affect humans and economically important animals, the Phillip Alampi Beneficial Insect Rearing Laboratory cooperates with the New Jersey

Department of Environmental Protection, Office of Mosquito Control Coordination, to develop a biological control program for mosquitoes breeding in standing water. Copepods, which are nearly microscopic crustacea, are efficient mosquito larvae predators. At the request of the Office of Mosquito Control Coordination, New Jersey Department of Agriculture's Phillip Alampi Beneficial Insect Rearing Laboratory established cultures of various native species of copepods, and evaluated procedures for mass-production.

The Laboratory collected and established cultures of copepod species native to New Jersey thought to be of value for inclusion in a mosquito biological control program. A mass production method for copepods and their associated food organisms was developed, to initiate field trials. In 2006, the Alampi Laboratory produced mass cultures of the predatory copepods, *Macrocyclops albidus* and *Acanthocyclops vernalis,* two important species used in other successful programs to control mosquitoes in discarded tires and other containers in subtropical climates. The Laboratory is currently cooperating with the Office of Mosquito Control Coordination and the Mosquito Control Commissions of Mercer, Hunterdon, Monmouth, and Morris Counties in field trials.

► Status of biological control agents: 1 species released, 1 established, 2 being reared in the laboratory.

The **HEMLOCK WOOLLY ADELGID** is a small sap-sucking insect which is killing hemlock trees throughout the state and region. In cooperation with the USDA Forest Service and Connecticut Agricultural Experiment Station**,** the Phillip Alampi Beneficial Insect Rearing Laboratory mass reared a predatory beetle that feeds on **Hemlock woolly adelgid,** Sassaji*cymnus (=Pseudoscymnus) tsugae.* Since 1998, more than 272,000 beetles have been produced and released in 69 sites in New Jersey, and an additional 387,500 have been distributed among the eight northeastern states. In addition, starter colonies and the technology necessary to raise the beetles has been made available to private companies, universities and other government agencies.

In 2005, the Laboratory switched production to rear another a predator of hemlock woolly adelgid, a newly described beetle from China, *Scymnus sinuanodulus*. New Jersey has become the primary producer of *S. sinuanodulus,* and has provided 18,000 of the predators for release in the state and to four other states (West Virginia, Maryland, North Carolina, and Pennsylvania). New Jersey has also shared its technology for raising the beetles with workers at the University of Georgia and at the North Carolina Department of Agriculture.

In 2006 the Laboratory also began rearing of Laricobius *nigrinus,* a native adelgid predator found in the western US. Experience gained will lay a foundation for mass producing *L. osakanus* when it passes quarantine and becomes available. Any *L. nigrinus* produced, however, will be released in New Jersey's hemlock stands.

► Status of biological control agents: 3 species released, 2 established.

Programs Directed Against Weed Pests

CANADA THISTLE is a persistent weed that spreads by both seed and an extensive underground root system. Unless it's controlled, it can crowd out the crop that was planted in the field. Thistle can be controlled by herbicides, but a small fly is being evaluated for its usefulness in controlling the weed as an alternative to chemicals. The fly lays its eggs only in the stem of Canada thistle plants. When hatched, the larvae feed on the stem, causing the plant to produce a gall, or swelling, on the stem of the plant. The gall weakens the weed by reducing the flow of nutrients, thereby limiting seed production and food storage in late summer. This beneficial fly was released in 1989 and is now established in the state.

► Status of biological control agents: 1 species released, 1 established.

MUSK THISTLE is another very aggressive weed that causes major problems for farmers who raise animals. Most animals will not feed on musk thistle and the weed quickly spreads, replacing valuable pasture grasses. Three kinds of beneficial insects have been released to attack musk thistle. The larvae of one feeds on the seeds of the weed, while the other a weevil attacks the young plants that emerge in the spring. The seed-eater can be found throughout the state and is reducing the musk thistle population.

► Status of biological control agents: 3 species released, 2 established.

PURPLE LOOSESTRIFE is a foreign, invasive noxious weed that is threatening New Jersey's wetlands. The Department is rearing two leaf eating beetles for release in this effort. All release sites are showing signs of control, and the beetles have naturally spread to other purple loosestrife infested wetlands.

► Status of biological control agents: 3 species released, 2 established.

MILE - A - MINUTE is a foreign, invasive noxious vine that can grow 20 feet in a season. Vines topple trees, and its dense cover crowds out and prevents the growth of trees and shrubs. It produces attractive berries that birds feed upon and spread the seed. It is quickly becoming a problem throughout New Jersey. A cooperative effort was initiated in 2004 with the US Forest Service and researchers at the University of Delaware, aimed at controlling mile-a-minute utilizing a weevil collected in China that feeds on mile-a-minute.

The Laboratory developed and evaluating rearing techniques, and began increasing production levels to allow for releases in New Jersey and other states. In 2006, the Laboratory's production capacity reached a sustained level of 1,000 new weevils emerging each week, permitting 22,462 predators to be released in New Jersey in 2006, with an additional annual total of 6,350 predators released in Pennsylvania, West Virginia, and Maryland. Currently the New Jersey Department of Agriculture is the sole source of these weevils in the United States; every effort is being made to continue

increasing New Jersey's production capacity and to make an increased portion of that capacity available to researchers and mile-a-minute control programs in other states.

► Status of biological control agents: 1 species released, 1 established, now being reared in the laboratory.

Cross-utilization

The staff the Phillip Alampi Beneficial Insect Rearing Laboratory is heavily cross-trained and cross utilized. The entomologists and inspectors of the Laboratory's field operations staff oversee and carry out field surveys to determine pest levels, insect releases and evaluations of beneficial insect activity.

When the growing season is over, this staff is redeployed in support of other New Jersey Department of Agriculture programs. The field staff assists the Bureau of Plant Pest and Disease Control with the annual gypsy moth egg count survey to determine spray treatment blocks; and conducts surveys of out-lying areas assisting in the Department's federal/state cooperative Asian Longhorned Beetle Eradication program.

In Summary

Biological control offers tremendous social, environmental, as well as, economic advantages. New Jersey has long had the foresight to invest in biological control. This investment has provided long term benefits in crop protection and protection of natural resources. The societal impact is the significant reduction in pesticide usage and amount of chemicals introduced into the environment that is a direct result of these programs.

The Department of Agriculture's Phillip Alampi Beneficial Insect Rearing Laboratory is a national leader in biological control and supplies/or has supplied beneficial insects to support programs in many of the Northeastern and Mid-Atlantic states. This is a **non-commercial operation**, developing programs and rearing beneficial insects for insect pests and weeds with federal and state partners where private insectaries have not been successful or profitable. In addition to the financial support provided by the State of New Jersey, the Department of Agriculture receives $250,000 in federal grants and cooperative agreements to support these programs, along with $50,000 in sales of **surplus** insects, covering 35% of the operational costs.

While the ratio of return on investment from biological control ranges from between 30 or 50 to 1 in cost savings to growers; it is generally not feasible to charge individual growers that cooperate directly with the New Jersey Department of Agriculture biological control programs. The predators and parasitoids that are released disperse, and all surrounding growers and homeowners benefit.

Eleven states maintain insect rearing laboratories for biological control. New Jersey should continue its leadership role in the development and delivery of biological control, and invest in the future of the Phillip Alampi Beneficial Insect Rearing Laboratory.