

***Rhinoncomimus latipes* (Coleoptera: Curculionidae)  
As A Biological Control Agent  
For Mile-a-minute, *Persicaria perfoliata* in New Jersey.**

**Annual Report  
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Photo by Patrick Natale

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## INTRODUCTION

Mile-a-minute (MAM), *Persicaria perfoliata*, also known as “Devil’s tail tear thumb” is an herbaceous annual trailing vine in the buckwheat family (*Polygonaceae*) (Gerlach 2004). The plant is native to India and Eastern Asia, and was accidentally introduced into York, Pennsylvania on nursery stock (probably from Japan) in the late 1930’s and is now established throughout the northeastern United States (Flanders 2004). MAM produces prodigious amounts of seed and is most likely to establish along clear cuts, power lines, wood edges, stream banks, and roadsides (Figures 1 and 2). Seed dispersal is mainly by birds and water. MAM is also a problem in untilled agricultural areas such as Christmas tree farms and reforestation seedling plantations because of its’ characteristic ability to climb over and shade out seedlings. The United States Department of Agriculture’s (USDA) decision to use classical biological control, to reduce MAM infestations, was based on the lack of effective chemical and environmentally sound control methods. (Flanders 2004).

In the spring of 2004, the New Jersey Department of Agriculture’s (NJDA) Phillip Alampi Beneficial Insect Laboratory (PABIL) entered into a cooperative agreement with the USDA-Forest Service to establish and monitor mile-a-minute test sites, for the purpose of gathering field data; using the “Mile-a-Minute Monitoring Protocol” developed by Dr. J. Hough-Goldstein of the University of Delaware, Newark, DE. Four field sites were set up, three in Southern New Jersey; including two at Floodgate Road in Greenwich, Gloucester County, one at DOD Ponds WMA in Pilesgrove, Salem County, and one in Central New Jersey at Pinelands Water and Wastewater Co. in Vincentown, Burlington County.



**Figure 1. Growth habit of mile-a-minute**  
Photos by M. Mayer



**Figure 2. Mile-a-minute seedlings**

### Mile-a-Minute

Mile-a-minute has a reddish stem and alternate, triangular leaves in the shape of an equilateral triangle. Both the stem and the underside of the leaves are armed with downward pointing barbs that aid the plant in climbing and supporting itself on other plants as well as serving a defensive purpose. Mile-a-minute can grow up to six inches per day with mature plants reaching six feet (Figure 3) or more in height, and can out-compete native plants for space and sunlight. Mile-a-minute has the ability to tolerate partial shade, but needs 63-100% of the available light and uses its climbing ability to achieve this requirement (Gerlach 2004).



**Figure 3. Mile-a-minute in April (left) and August (right).**

Photos by M. Mayer

Mile-a-minute typically shades out other plants greatly reducing the plant's ability to photosynthesize, weakening and possibly killing it. In areas where rare native plants are sparse, the native plants could be eliminated entirely (Gerlach 2004). Mile-a-minute prefers to colonize open and disturbed areas, preferably with high soil moisture. Germination usually occurs in April and continues until July with growth lasting until first frost. Early germination gives mile-a-minute an advantage over native plants, allowing it to out-compete them for soil nitrogen and other nutrients.

Mile-a-minute has distinctive circular cup-shaped leafy structures called ocreas that surround the stem at undefined intervals. Buds, flowers and seed heads emerge from these ocreas. The flowers are small, white and generally unnoticeable. Mature fruits, are metallic blue and segmented with each segment containing a single achene (Gerlach 2004). Mile-a-minute is primarily self-pollinating and reproduces until the first frost with each plant capable of producing 50-100 seeds, which can remain viable in the seed bank for three years (Hough-Goldstein 2004a). Birds and water disperse the seeds with the seeds remaining buoyant for 7-9 days. This buoyancy is an important factor in seed dispersal that allows seeds to travel great distances (Gerlach 2004). Mile-a-minute has been observed throughout New Jersey and appears to be expanding its range. The heaviest populations found in NJ are in Salem, Gloucester, Burlington, Bergen, Warren and Mercer counties. Mile-a-minute has not been observed in Essex, Passaic, Ocean, Atlantic or Cape May counties.

## Control Measures

Presently, the primary mile-a-minute control method involves the hand removal of young seedlings in early spring and throughout the season, as the seeds continue to germinate. Broad-spectrum herbicides are not practical in areas with a dense varied native plant population because chemicals would affect the native vegetation as well (Hough-Goldstein 2004b). The preferred chemical treatment is a non-systemic herbicidal soap that will “burn back” the foliage. However, it must be reapplied throughout the season to control new mile-a-minute growth (Gerlach 2004). These temporary control measures do not provide sustained seasonal control of this invasive weed. A classical biological control program that uses natural enemies would appear to be the best approach for a long-term control program. The United States Department of Agriculture considered two potential biological control agents, a moth, *Timandra griseata* (Lepidoptera: Geometridae) which was rejected because its host range was too great, and a stem-feeding weevil, *Rhinoncomimus latipes* (Coleoptera: Curculionidae).

## Biology of Beneficial

In 2004, the USDA approved the rearing and release of *R. latipes*, a stem-feeding weevil found in China and introduced into the United States in July 2004. *R. latipes* is approximately two millimeters long and usually black, though it may appear covered by an orange film, which it derives from feeding on mile-a-minute (Hough-Goldstein 2004a). *R. latipes* (Figure 4) feeds on the flower heads (capitula), leaves and ocreas with the females preferring the high protein capitula for egg production. Females deposit an average of 49 eggs over a 30-day period. The males prefer to feed mainly on the ocreas and leaves (Colpetzer et. al. 2004). The eggs are laid on the capitula and leaves; once the larvae hatch, they bore into the stem and feed for three weeks, before exiting and dropping to the ground to pupate (Flanders 2004). The portion of the stem above the feeding area is killed, thereby reducing seed production.



Figure 4. *Rhinoncomimus latipes* adult and larva

## **MATERIALS AND METHODS**

### **Study Sites**

In the spring of 2008, PABIL field personnel continued to monitor four study sites: one control and one release site in Gloucester County established in 2004 as well as one control and one release site established in Salem County in 2005. The 2005 release site was located in the Abbotts Meadow WMA in Elsinboro Township while the control site was located in the Supawana Meadows National Wildlife Refuge in Pennsville Township. The new Salem County sites replaced two 2004 sites that were discontinued due to frequent disturbance from the public and possible chemical control measures.

The sites were used to gather data on mile-a-minute field development and to evaluate the effectiveness of *R. latipes* as a biological control agent. The sites were structured according to the “Mile-a-minute Monitoring Protocol”, developed by Dr. J. Hough-Goldstein of the University of Delaware. Twenty randomly placed one-half square meter quadrats, each at least ten meters apart were arranged throughout the mile-a-minute infestation at each of the four sites. Data was collected in the spring at all sites to assess plant density. In 2006, the monitoring protocol was refined by reducing the number of data collection site visits.

### **Releases**

Since 2004, the PABIL has released a total of 111,227 *R. latipes* adults into eight New Jersey counties (Table 1). In 2008, 46,116 weevils were released into 29 sites, 25 of which were new MAM sites that had not received any previous releases. Four supplemental releases were made in previous release sites with dense MAM, to augment the existing weevil population.

The weevils were brought to the field in Sweetheart® 16oz. hot beverage cups with holes cut into each end. Nylon mesh was secured over the holes and a Pioneer plastics® 7cm by 3cm Petri dish containing a sponge moistened with honey and water was taped to the bottom of the cup.

**Table 1. *Rhinoncomimus latipes* Releases and Recoveries in NJ**

<b>County</b>	<b>Location</b>	<b>Dates</b>	<b>Number Released</b>	<b>2008 Recovery</b>	
<b>2004 Releases</b>					
Gloucester	Floodgate Road	*shipped from the University of Delaware	7/28	200*	Y
<b>2005 Releases</b>					
Salem	Mason Point Rd. & Money Island Rd.	Abbott's Meadow WMA	4/22-9/9	6,976	Y
Mercer	Washington Crossing State Park,	near open air theater	5/13-5/18	652	Y
Mercer	Washington Crossing State Park,	near Delaware River	5/18	270	Y
Gloucester	Floodgate Road		6/17-8/29	3,297	Y
Salem	DOD Ponds WMA		10/12	600	Y
<b>2005 Total</b>			<b>11,795</b>		
<b>2006 Releases</b>					
Burlington	Pinelands Water Co.		4/28	2,260	Y
Burlington	Taylor's Farm		5/5	1,066	Y
Gloucester	Floodgate Road by Lake		5/12	800	Y
Salem	Supawana Meadows NWR for U.S. Fish & Wildlife Service		6/9-9/29	14,667	Y
Salem	Mesogianes Farm		9/1	1,025	Y
Hunterdon	Hunterdon County Park		10/13	600	N
Hunterdon	Round Valley Rd		10/13	397	Y
Hunterdon	Pine Bank Rd		10/13	600	Y
Mercer	Washington Crossing State Park,	near open air theater	5/19	600	Y
Mercer	Washington Crossing State Park,	near Delaware River	5/19	450	Y
<b>2006 Total</b>			<b>22,465</b>		
<b>2007 Releases</b>					
Salem	Fort Mott & Lighthouse Road hedge heading toward Ft. Mott		5/4	1,202	Y
Salem	Supawana Road 3 locations NWR "stakes" and 2 Neighbors		5/4, 5/11	3,364	Y
Gloucester	Davidson Road		5/11	1,800	Y
Hunterdon	Dreahrook Road		5/18	1,800	Y
Salem	Killcohook spoils off Finns Point access road		5/25	4,500	Y
Hunterdon	Railroad Avenue		5/18	600	Y
Salem	Harris Road 5 locations on Hancock farm		6/1	1,800	Y
Salem	Mesogianes Farm		6/1	827	Y
Middlesex	Rutgers Horticultural Farm		6/15	719	Y
Salem	Gant Farm		6/29	1,802	Y
Salem	Pennsville-Auburn Road		7/13	1,161	Y
Salem	Pinyard Road		7/20	2,049	Y
Salem	Fort Mott Road		8/3	1,400	Y
Salem	DOD Ponds WMA parking lot		8/9	671	Y
Union	Watchung Reservation		8/16	1,894	Y
Salem	Hook Road		8/24	1,514	Y
Bergen	Overpeck Preserve		8/30	741	Y
Hunterdon	Pine Bank Road (field collected from Floodgate site)		9/13	200	Y
Hunterdon	Pine Bank Road (lab weevils)		9/14	300	Y
Hunterdon	Route 29 one year old weevils		10/5	159	N
Salem	Park Avenue		9/5	351	Y
Warren	Columbia Lake WMA main road		7/27	400	Y
Warren	Columbia Lake WMA Delaware Lake		7/27	800	Y
<b>2007 Total</b>			<b>30,651</b>		

**Table 1. *Rhinoncomimus latipes* Releases and Recoveries in NJ cont.**

<b>County</b>	<b>Location</b>	<b>Dates</b>	<b>Number Released</b>
<b>2008 Releases</b>			
Bergen	Palisades Park Greenbrook Sanctuary	5/16	1,768
Bergen	Palisades Park near headquarters	5/16	1,866
Bergen	Overpeck Preserve, Leonia	6/27	2,129
Gloucester	600 Route 130 Waste Mgmt.	8/1	1,355
Gloucester	Pennsylvania Ave Franklin Twp. recreation area	8/15	1,561
Hunterdon	Pine Bank Road	5/22	1,900
Hunterdon	Route 29 north of Stockton	6/20	892
Hunterdon	South Ridge, Round Valley Reservoir	7/18	1,069
Middlesex	Rutgers Display Gardens	9/12	1,199
Middlesex	Davidson's Mill Pond Park	9/12	995
Monmouth	Creamery Road	8/27	2,158
Monmouth	Thompson Park Site 1	5/8	1,788
Monmouth	Thompson Park Site 2	5/8	1,108
Morris	Joy B's Farm	6/6	2,012
Salem	Lehigh Road Power lines Supawna Meadows NWR	4/25	1,000
Salem	Lehigh Road end of dirt lane Supawna Meadows NWR	5/2	1,645
Salem	Straugh's Mill Road	7/24	1,022
Salem	Church Landing Road	8/8	1,078
Salem	Mesogianes Farm	8/22	1,321
Salem	Pointers-Auburn Road	9/18	1,506
Salem	Swedesboro Road	9/25	1,581
Salem	Route 130 mile marker 85	10/9	1,540
Salem	Route 49 Connective Deepwater Generating Station	10/16	1,706
Sussex	Minisink Island DWGNRA	5/30	4,715
Warren	Shiloh Road off of Route 519	6/13	1,002
Warren	Columbia Lake WMA (no name lake)	7/11	960
Warren	Columbia Lake WMA (main road)	7/11	2,022
Warren	Honey Run WMA	9/5	1,019
Warren	Flitcroft Brookhollow Farm	10/2	2,199
<b><i>2008 Total</i></b>			<b><i>46,116</i></b>

## RESULTS AND DISCUSSION

### Impact of *Rhinoncomimus latipes*

The Gloucester County site located at Floodgate Road received a total of 3,497 *R. latipes* from 2004 to 2005. The weevils at this location quickly established and increased their population size so readily that the MAM was completely defoliated. MAM populations were undetectable in 9 of the 10 quadrats at the study site by the end of the 2008 season. Figure 5 shows the potential long term effect of *R. latipes*. In the three photos, the site has gone from an area completely covered by MAM in 2005, to an area where the MAM is reduced substantially, to an area where plant diversity has increased in 2008. The overall MAM population at this site has changed over the four survey seasons to where MAM is no longer the dominant plant species.



**July 2005**



**October 2006**



**October 2007**



**October 2008**

**Figure 5. Mile-a-minute at Floodgate Road from July 2005 to October 2008 after *R. latipes* feeding**

Figure 6. shows a close-up of the weevil feeding damage at the Gloucester County site. Field personnel were able to easily collect 50-100 weevils, in less than a minute, by simply beating defoliated mile-a-minute vines gently with a gloved hand.



**Figure 6. Defoliated Mile-a-minute.**

The release site established at Abbott's Meadow WMA in Salem County was specifically set up to study the potential impact that large numbers of weevils could have on MAM. This site was inundated with 6,976 weevils in 2005. The plants at this site were heavily defoliated early in the 2005 and 2006 season by the high weevil populations. At that time the Abbott's Meadow site had no weevils in the quadrats due to the dense coverage of barnyard grass, which prevented germination of the MAM early in the season. However, as barnyard grass senesced MAM density increased but weevil populations remained low. The site continues to have a low MAM population in 2008.

Weevil counts can be problematic and misleading because of the weevil's tendency to drop from the plant when disturbed. This behavior occurs when handling the plants during the survey process; causing the weevil population to be potentially undercounted or unobserved.

Table 2 shows the average number of stems at the release and control sites since 2005. The number of stems increased in 2007 and then declined in 2008 in the release sites but the numbers remain below the 2005 stem counts indicating that the weevils continue to have an impact. There was no control data at Floodgate in 2007 and 2008 as the weevils overwhelmed the control site by dispersing from the release site. In 2008, the weevils have reached the control site at Supawna Meadows but that site will continue to be monitored.

**Table 2. Average Number of Stems at Release and Control Sites**

Site	Release Number in 2005	Spring 2005	Spring 2006	Spring 2007	Spring 2008
Floodgate Release	3,297 <i>R. latipes</i>	288.1	132.0	207.6	31.5
Control		349.3	161.6	--	--
Abbott's Meadow					
Release	6,976 <i>R. latipes</i>	401.0	30.0	93.3	8.1
Control		484	505.2	457.4	192.8*

**\**R. latipes* have reached the control site**

The data in Table 3 is quite impressive, and shows the percent cover of mile-a-minute in each quadrat. The percent cover in the spring has decreased in the two monitored release sites and had increased in the control site by 2007. In 2008 the percent cover dropped precipitously in both of the release sites and in the recently weevil-infested control site. It is evident both visually and quantitatively; that three years of feeding pressure from *R. latipes* had reduced plant density.

**Table 3. % Cover of Mile-a-minute at Release and Control Sites**

Site	Release Number in 2005	Spring 2005	Spring 2006	Spring 2007	Spring 2008
Floodgate Release	3,297 <i>R. latipes</i>	55.5	47.0	35.4	12.1
Control		60.0	52.0	--	--
Abbott's Meadow					
Release	6,976 <i>R. latipes</i>	45.0	4.2	9.4	1.8
Control		60.5	66.9	77.5	37.6*

**\**R. latipes* have reached the control site**

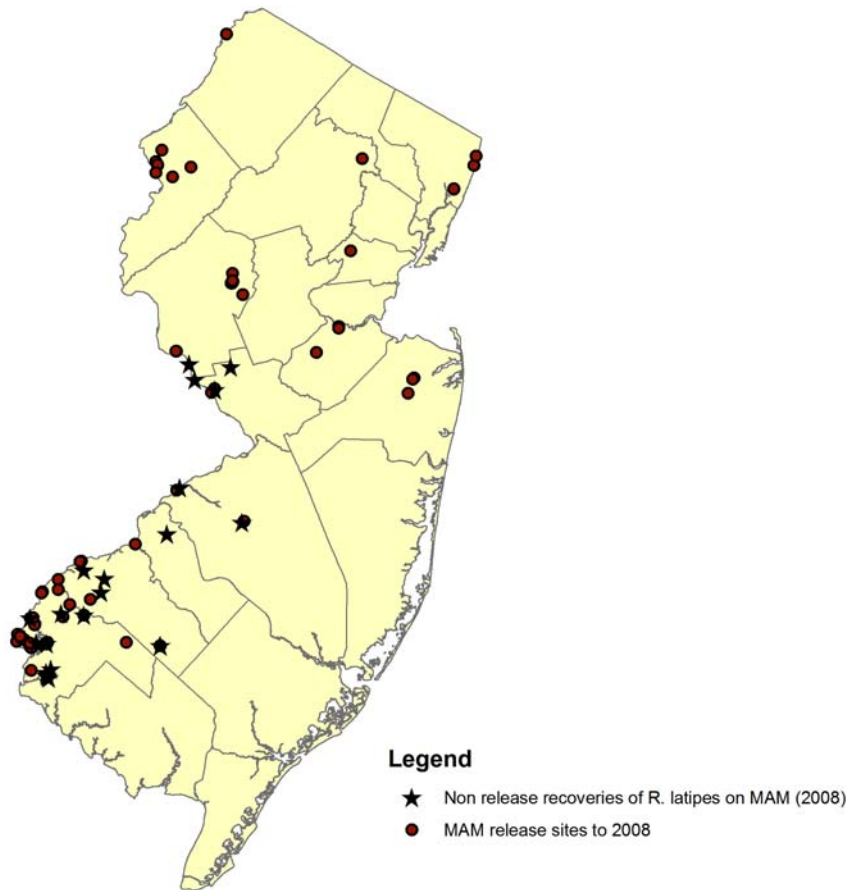
The performance of *R. latipes* over the past four years has been extremely encouraging. The plants are impacted by adult feeding as well as the stem destruction by the larvae. Generally, a biological control agent will take six or more generations to make an impact and the weevils have 3-4 generations per year in New Jersey indicating that the impact of the weevils will be sooner rather than later. Other release sites are demonstrating similar MAM defoliation.

### **Dispersal of *R. latipes***

In 2006 *R. latipes* was recovered 4.0 kilometers from the original release site and by the end of the 2008 season, *R. latipes* was recovered and had caused feeding damage to mile-a-minute 10.3 kilometers from the closest release site. *R. latipes* has dispersed well from and appears to have

no difficulty moving to other mile-a-minute infestations even dispersing across the Delaware River. Figure 7 shows the dispersal and recovery of *R. latipes* through 2008.

**Figure 7. *R. latipes* Releases and Non-release Site Recoveries to 2008.**



## Conclusion

Since 2004, when the PABIL entered into a pilot program with the USDA-Forest Service and the University of Delaware to control the herbaceous annual vine MAM by the stem-feeding weevil *R. latipes*, a total of 111,227 weevils have been released. Improved laboratory rearing and storage techniques, which are crucial to the success of the project, have made more weevils available each year. The recovery of *R. latipes* 10.3 kilometers away from the closest release site this season shows the weevil's ability to disperse well. This dispersal ability is important because MAM is being found more frequently and over a greater range each year in NJ. The data showed that there was a reduction in the number of plant seedlings as well as percent cover at the Abbott's Meadow and Floodgate Road release sites. *R. latipes* has completely defoliated the Gloucester site and there is now a more diverse native plant population.

## 2009 Plans

In 2009, the laboratory will continue to provide weevils for the new site establishment. Field personnel will continue to monitor the release sites for the presence of overwintering adults and evidence of reproduction. The field staff will also continue to monitor these areas for further

distribution of the weevil. New release sites will be located and additional weevil releases will be made. Weevil reproduction, plant reduction, and dispersal trends will be evaluated.

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