

**Biological Control of the Mexican Bean Beetle
Epilachna varivestis (Coleoptera: Coccinellidae)
Using the Parasitic Wasp
Pediobius foveolatus (Hymenoptera: Eulophidae)**

2010



Mexican bean beetle adult



P. foveolatus on larva

Prepared by:

**George Robbins
Wayne Hudson
Thomas Dorsey
Mark Mayer
Lauren Bronhard**



**Phillip Alampi Beneficial Insect Laboratory
Division of Plant Industry
www.state.nj.us/agriculture/plant/biolab.htm**

SCOPE AND COVERAGE

The Mexican bean beetle (MBB) *Epilachna varivestis* (Coleoptera: Coccinellidae) biological control program underwent changes for the second time in two years. In 2009, nurse plots were discontinued as a cost saving measure due to staff shortages and the cross utilization of Phillip Alampi Beneficial Insect Laboratory (PABIL) personnel, by the Gypsy Moth Suppression Program. However, in 2010 PABIL staff decided to resume the nurse plot system to better measure and treat MBB populations. The number of nurse plots was reduced from years' past to one per grower unless a targeted "hot spot" was left without coverage.

MATERIALS AND METHODS

A total of 27 strategic nurse plot locations were selected by field staff to maximize the effectiveness of the parasitoid releases. All of the selected areas had a history of Mexican bean beetle pressure. The vast majority of the sites were in the inner coastal plain which is located from Salem and Cumberland Counties through Monmouth and Middlesex Counties. The adult parasitoid, *Pediobius foveolatus* (Hymenoptera: Eulophidae), was released into the plots where female wasps "oviposit" into all larval instars (1st through 4th) of the Mexican bean beetle. A single female deposits an average of 25 eggs within each MBB larva. After five to seven days the parasitized larvae die, forming dark brown "mummies" (**Figure 1**). An average of 25 wasps (70% -75% female), successfully develop and emerge from each parasitized MBB larva. Newly emerged female wasps mate and readily disperse from the release sites and search for MBB larvae in adjacent soybean fields.

Release decisions were based on monitoring the nurse plots two times per week; the sampling unit within each plot consisted of 125 plants with 25 plants examined in each of five locations where MBB feeding was observed. *P. foveolatus* releases were based on initial egg sighting (**egg release**) and larval counts (**trigger release**). Since 1985 egg releases have consisted of a total of 6,000 parasites with the first release of 3,000 *P. foveolatus* made at the first observation of a Mexican bean beetle (MBB) egg cluster. The second egg release of 3,000 parasites is made two to three days later; trigger releases began when larvae were first observed. The initial trigger release was divided into two releases, two to three days apart. If the MBB larval count increased seven days after the initial trigger release, then a second single trigger release was made.



Figure 1. Mexican bean beetle larva and parasitized larva ("mummy")

RESULTS AND DISCUSSION

Table 1. shows the number of parasites released into nurse plots by county. During 2010, a total of **104,000** *P. foveolatus* adults were released directly into those plots, averaging 4,000 wasps per plot. In **Figure 2.** nurse plot release sites are indicated on the map by the black dots; the stars indicate areas where direct field releases were made.

Direct field releases were made into soybean, snap bean and lima bean fields throughout New Jersey, wherever MBB were observed. The purpose of the field releases is threefold: 1) to suppress the MBB in areas where it could potentially reach damaging levels, 2) to reduce the over wintering MBB population and 3) to utilize surplus *P. foveolatus* laboratory stocks. Mercer and Sussex County field releases were in those areas that had high Mexican bean beetle populations in snap beans. All of the release farms in Mercer and Sussex counties were organic and had extremely high, economically damaging Mexican bean beetle populations

South of Mercer county, the stars in **Figure 2.** indicate releases in strategic areas where potential Mexican bean beetle population may develop. These additional field releases totaling (**Table 2**) were made to keep pressure on the Mexican bean beetle population as in past years. Using *P. foveolatus* as a biocontrol agent has resulted in substantial savings to the growers in reduced insecticide costs and environmental pollution.

TABLE 1. RELEASE SUMMARY BY COUNTY 2010

County	Total No. of sites	No. of Surveys Per site	Total No. of Parasites Released	Average No. of <i>P. foveolatus</i> Released per Site
BURLINGTON	4	24	19,000	4,750
CUMBERLAND	7	24	21,000	3,000
GLOUCESTER	2	24	10,000	5,000
MERCER	1	24	4,000	4,000
MONMOUTH	5	24	32,000	6,400
SALEM	8	24	18,000	2,450
TOTAL	27	144	104,000	
OVERALL AVERAGE				~ 4,000

TABLE 2. FIELD RELEASE SUMMARY 2010

FIELD RELEASES		
County	#Field Releases	#<i>P. foveolatus</i> Released
Atlantic	4	40,000
Burlington	5	48,000
Camden	2	20,000
Cumberland	4	50,000
Gloucester	1	10,000
Hunterdon	2	30,000
Mercer	4	116,000
Monmouth	2	30,000
Ocean	1	2,000
Salem	5	60,000
Sussex	5	84,000
Warren	1	14,000
TOTAL	36	504,000

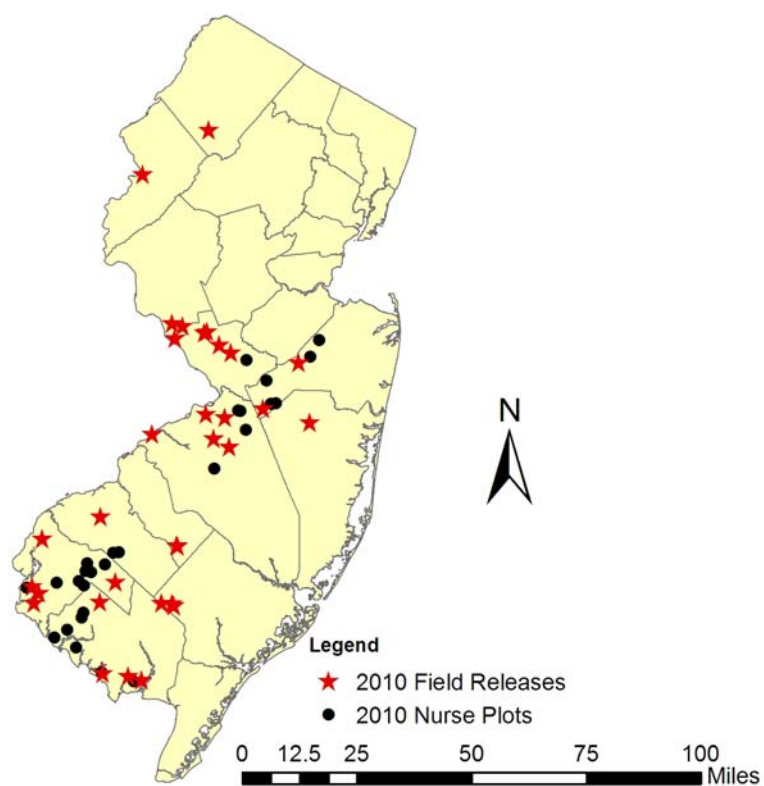


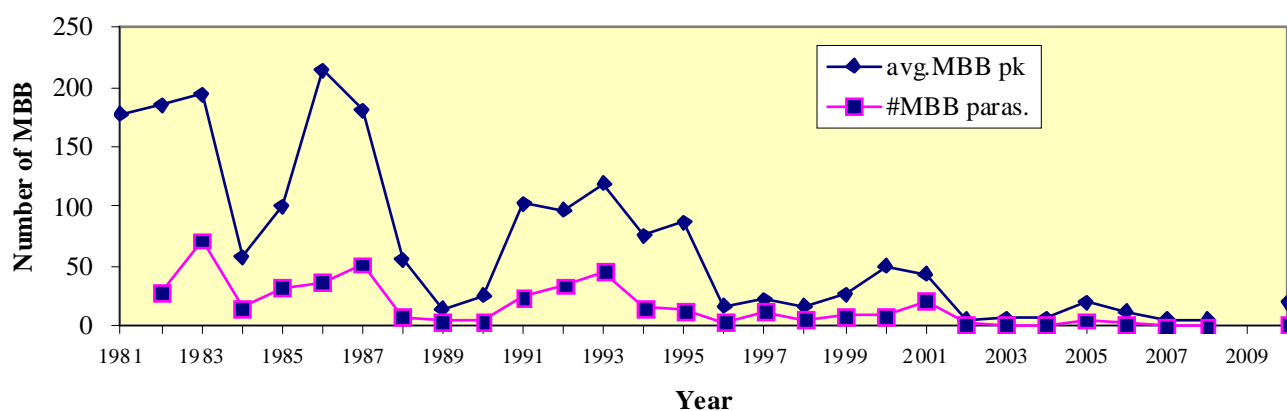
Figure 2. 2010 Survey and Release Sites

Mexican Bean Beetle (*Epilachna varivestis*) Population Trends

Figure 3. shows the "host peak" (a measure of the Mexican bean beetle population) and the number of hosts parasitized in the nurse plots for the years 1981-2010. Although there is no 2009 data (due to staff shortages) the figure is included to demonstrate the variability in the Mexican bean beetle population. There have been fluctuations in *E. varivestis* populations since 1981 and the number of *P. foveolatus* released has closely followed this trend. Insect populations are cyclical and the MBB populations shown in **Figure 3.** are no exception. The key observation is that peak MBB populations in the 1990's were 50% of what they were in the 1980's and the present populations are roughly 12-13% of the pest populations of the 1980's. This graph indicates that the MBB population is still at historic lows, although there was a slight increase in the MBB population in 2010, ostensibly from the lack of nurse plots the previous year.

MBB population "hot spots" can still occur and are usually located in areas where nurse plots have not been planted and maintained for several years or where there have been no *Pediobius* releases. All New Jersey soybean growing counties, with the exception of Salem, have not had economically damaging MBB populations since the mid 1980's. Salem County's increase in the 1990's was possibly due to MBB migration from neighboring states. Data over the years suggest that *Pediobius* releases by the New Jersey Department of Agriculture have dramatically reduced MBB populations statewide in soybeans. There were "hot spots" in Sussex and Mercer Counties although the population increase was attributable to organic farms which do minimal or no insecticide spraying.

**Figure 3. Mexican bean beetle Population and Parasitism
1981-2010**



SUMMARY AND CONCLUSION

In 2010 MBB populations continue to remain low in all counties where nurse plots were planted. A total of **507,852 *Pediobius*** adults were released in New Jersey and no grower had to treat a soybean crop for the Mexican bean beetle.

Plans for the upcoming season (2011) are to keep parasite pressure on developing MBB populations by planting and maintaining nurse plots throughout the affected counties. If the MBB population significantly increases in the future, the number of plots will also be increased. Field releases will continue to be made on organic farms to prevent MBB population explosions.

A portion of the New Jersey Soybean Board's "Soybean Check-Off" funds allocated for research have been awarded to the NJDA's Mexican bean beetle biological control program. MBB populations have been successfully maintained below economically damaging levels in areas where nurse plots are maintained. Many more acres of soybeans and snap beans are protected due to the widespread dispersal of the parasitoid. Additionally, there has been no economic impact on the growers from the more damaging second-generation MBB population. Peak Mexican bean beetle populations have continued to decline over the past quarter century and over the same time period, pest populations have been held at a manageable level as a direct result of the New Jersey Department of Agriculture's biocontrol program.