

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

2008



Mexican bean beetle adult



P. foveolatus on larva

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SCOPE AND COVERAGE

In 2008, the Mexican bean beetle (MBB) *Epilachna varivestis* (Coleoptera: Coccinellidae) biological control program involved 28 growers and 55 nurse plots. To insure that snap beans would germinate in adequate time to attract overwintering MBB adults, nurse plot planting started on May 2 and was completed on May 28. All nurse plots were treated at planting with the preemergence herbicides Pursuit and Dual at Rutgers recommended rates.

MATERIALS AND METHODS: Nurse Plots and Releases

One-eighth acre nurse plots were planted in areas adjacent to soybean fields with a mixture of 15 lbs. of snap beans and 5 lbs. of soybeans (Figure 1). The early germinating snap beans serve as a “trap crop” luring overwintering MBB adults into the plot where they feed, mate and deposit eggs. Once the snap beans are consumed, the later germinating soybeans hold the beetles within the plot. The adult parasitoid, *Pediobius foveolatus* (Hymenoptera: Eulophidae), is released into the plot where female wasps attack or “oviposit” upon 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 5 to 7 days parasitized larvae die, forming dark brown “mummies” (Figure 2). 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 nurse plot and search for MBB larvae in adjacent soybean fields.



Figure 1. Planting of and germination in a nurse plot

Release decisions were based on weekly nurse plot monitoring. The sampling unit, within each nurse plot, consisted of 125 plants with 25 plants examined in each of five locations where MBB defoliation was observed. *Pediobius* releases were made at initial MBB egg sighting (egg release) and larval counts (trigger release). Egg releases consisted of a total of 4,000 parasitoids with the first release of 2,000 *P. foveolatus* made at the first sighting of a Mexican bean beetle (MBB) egg cluster, within a plot, followed by a second egg release of 2,000 parasitoids, two to three days later. Trigger releases began when MBB larvae were first observed. If MBB larval counts increased 7 days after the initial trigger release, a second release was made (Table 1).

In 2008, “egg releases” were in the form of parasitized Mexican bean beetle larvae or “mummies”. The “mummies” were placed in 3”x 6” x 1.75” brown paper bags, with holes punched to allow adults to emerge freely, and secured with twist ties to the underside of the bean plant (Figure 3). A total of 40 “mummies” (equivalent to 1,000 adults) was set out in each bag. The bio-degradable paper bags were left in the field.



Figure 2. Mexican bean beetle larva and parasitized larva (mummy)



Figure 3. Mummy release bag in beans

TABLE 1. *Pediobius foveolatus* Parasite Release Decision Table

Peak Larval Count ¹	Total <i>Pediobius</i> Release (Adults)	First Trigger		Second Trigger	
		#Adults	#Screens/bags	#Adults	#Screens/bags
1-150	2,000	2,000	2		
151-225	4,000	2,000	2	2,000	2
226-300	10,000	6,000	6	4,000	4
301-375	14,000	8,000	8	6,000	6
376-450	18,000	10,000	10	8,000	8
451-525	22,000	12,000	12	10,000	10
526+	26,000	14,000	14	12,000	12

¹Total number of all larvae (1st – 4th instars) in 125-plant nurse plot sample.

RESULTS AND DISCUSSION

Mexican bean beetle Population Levels, Parasitoids Released and Levels of Parasitism

The peak percent parasitism in the nurse plots averaged 10.4%. Only 38.2% of the nurse plots required egg releases while trigger releases were required in 20% of the plots. A total of 126,000 adult parasitoids were released into the nurse plots with an average of 3,740 per plot. MBB populations developed in 38.2% of the plots and parasitoid releases were made in 21 of the 55 nurse plots (Table 2).

No participating soybean grower had to spray for Mexican bean beetle control nor was there any need for preventive applications in any nurse plots.

TABLE 2. NURSE PLOT SUMMARY BY COUNTY 2008

Average No.	No. of	Percent of	No. of	No. of
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County	Total No. of Plots	Total No. of Parasites Released	Total No. of <i>P. foveolatus</i> Released per Plot	Plots with <i>P. foveolatus</i> Releases	Plots with <i>P. foveolatus</i> Releases	Average Percent Parasitism	Plots with Egg Releases Only	Plots with Trigger Releases
BURLINGTON	5	38,000	7,600	5	100	30.5	1	4
CUMBERLAND	16	6,000	375	1	6.3	6.3	0	1
GLOUCESTER	7	20,000	2,857	4	57.2	0	2	2
MERCER	2	10,000	5,000	2	100	0	1	1
MONMOUTH	6	34,000	5,666	5	83.3	25.5	4	1
SALEM	19	18,000	947	4	21	0	2	2
TOTAL	55	126,000		21	38.2		10	11
AVG. LEVELS			3,740			10.4		

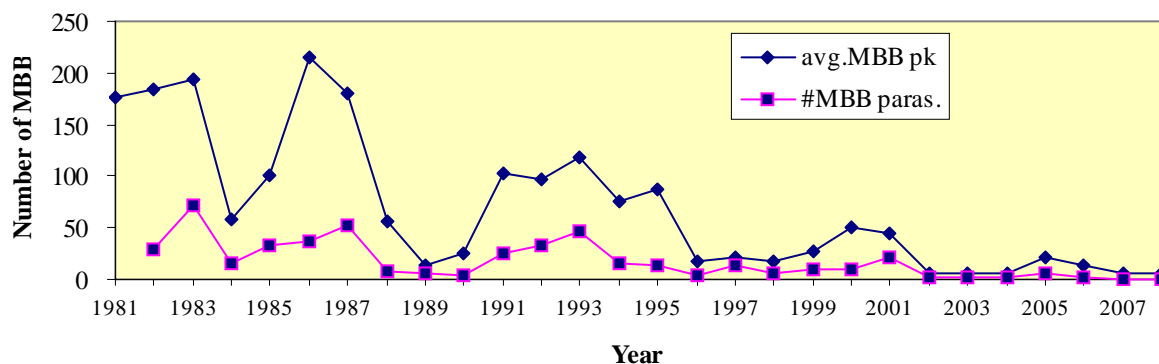
Mexican Bean Beetle (*E. varivestis*) Population Levels

Figure 4 shows the "host peak" (a measure of the Mexican bean beetle population) and the number of hosts parasitized in the nurse plots. The number of parasitoids released is directly related to the MBB 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 4 are no exception. The key observation in 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.

Parasitism data is based on the number of "mummies" found in the plots. However, since "mummies" are often difficult to find as beans mature and leaves drop, parasitism data is underrepresented and is arguably much higher than what is graphically indicated.

MBB population "hot spots" still occur and are located in areas where nurse plots have not been planted and maintained for several years. 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.

Figure 4. Mexican bean beetle Population and Parasitism 1981-2008



Direct Field Releases

In 2008, as in past years, field releases of surplus adult parasites were made to keep additional pressure on the MBB population (Table 3). Direct field releases are made into soybean, snap bean and lima bean fields throughout Central and Southern New Jersey wherever MBB are observed. In 2008, there were 46 direct field releases totaling 262,000 parasites. 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. Using *P. foveolatus* as a biocontrol agent has resulted in substantial savings to the growers in reduced insecticide costs and environmental pollution.

SUMMARY AND CONCLUSION

Overall 2008 was a successful year. MBB populations continue to remain low in all counties. While, parasitism levels have slightly increased. These coupled results will keep MBB populations from returning to levels observed in the past.

A portion of the soybean check-off funds reserved for research has been allocated to the NJDA and is used to offset some of the costs for field implementation and scouting. MBB populations have been successfully kept 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 is no economic impact on the growers from the possibly more damaging second-generation MBB population. The peak populations have continued to decline over the past quarter century and over the same time period, the Mexican bean beetle populations have been held at a manageable level as a direct result of the New Jersey Department of Agriculture's biocontrol program.

TABLE 3. RELEASE SUMMARY 2008

County	FIELD RELEASES		Number of Nurse Plots	NURSE PLOT RELEASES	
	#Field Releases	# <i>P. foveolatus</i> Released		# <i>P. foveolatus</i> Released in Nurse Plots	Total # <i>P. foveolatus</i> Released
Atlantic	0	0	0	0	0
Burlington	14	54,000	5	38,000	92,000
Cape May	0	0	0	0	0
Cumberland	4	28,000	16	6,000	34,000
Gloucester	2	18,000	7	20,000	38,000
Mercer	6	36,000	2	10,000	46,000
Middlesex	1	2,000	0	0	2,000
Monmouth	9	32,000	6	34,000	66,000
Morris	1	10,000	0	0	10,000
Salem	8	74,000	19	18,000	92,000
Warren	1	8,000	0	0	8,000
TOTAL	46	262,000	55	126,000	388,000

Total Parasites Released Statewide including nurse plots= 388,000