

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

2017



Mexican bean beetle adult



P. foveolatus on larva

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SCOPE AND COVERAGE

In 2017, the Mexican bean beetle (MBB) *Epilachna varivestis* (Coleoptera: Coccinellidae) biological control program involved 31 growers and 39 survey locations. Due to the success of the Mexican bean beetle (MBB) nurse plot program in previous seasons and change in the growers' herbicide regimens, the Phillip Alampi Beneficial Insect Laboratory did not plant or monitor nurse plots in 2017. The nurse plots had served as trap crops in the past luring the overwintering Mexican bean beetle to the plots where the parasitic wasp, *Pediobius foveolatus*, was released. Due to an aggressive parasitoid release program over the last 34 years, we now feel confident that we can maintain pressure on the Mexican bean beetle population with direct field releases in the areas most susceptible to the Mexican bean beetle. In 2013, ten out of 25 growers who were surveyed did not want nurse plots because of weed problems and most of the other growers would just as soon do without them. Those growers who did agree to the plots also voiced concerns about the buildup of weeds.

Growers use Roundup® after the soybeans have germinated as Roundup® is more convenient to use than the past herbicide regimens. Most growers have their fields sprayed with Roundup® about three weeks after the nurse plots are planted and oftentimes the nurse plot is accidentally sprayed, killing the snap beans. Without the snap beans the plot's value as a trap crop to attract overwintering Mexican bean beetles is eliminated and hinders the gathering of efficacy data. Little meaningful data from the plots has been obtained since the introduction of Roundup® ready beans. When pre-emergent herbicides were used by the growers in the past, the Phillip Alampi Beneficial Insect Laboratory would get their benefit, as the plots were moved around every year resulting in lower overall weed populations. There is no satisfactory weed control with the currently registered herbicides that are labeled for both snap beans and soybeans.

MATERIALS AND METHODS:

A total of 39 strategic release locations were selected by field staff to obtain the greatest coverage possible in the state. All of the areas selected had a history of Mexican bean beetle pressure and it was hypothesized that releases in these areas would be the most effective way to mitigate the Mexican bean beetle population without nurse plots. The vast majority of the sites were in the inner coastal plain which is located from Salem and Cumberland Counties north through Monmouth and Middlesex Counties. Outside that area, there is little Mexican bean beetle pressure in soybeans. The adult parasitoid, *Pediobius foveolatus* (Hymenoptera: Eulophidae), was released into the sites where female wasps attack or "oviposit" on all larval instars (1st through 4th) of the Mexican bean beetle. A single female *P. foveolatus* deposits an average of 25 eggs within each MBB larva. After 5 to 7 days 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 to search for MBB larvae in adjacent soybean fields.

The goal of the program was to release a minimum of 6,000 parasites, depending on their availability, in each of the field sites. If Mexican bean beetle were observed nearby, either in a community garden or on an organic farm field, then that field received additional releases of *P. foveolatus*.



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

RESULTS AND DISCUSSION

Table 1 shows the number of parasites released in the survey sites. A total of 234,000 *P. foveolatus* were released in those sites during 2017 with 6,000 wasps released per site. In Figure 2 those sites are indicated on the map by the purple stars. The red circles in Figure 2 indicate areas where field releases were made in areas where a Mexican bean beetle population could or had developed. These additional field releases totaling 241,000 parasites (Table 2) were made to maintain the environmental resistance on the Mexican bean beetle population. Direct field releases were also made into snap bean and lima bean fields throughout Central and Southern New Jersey wherever MBB were observed. The purpose of the *P. foveolatus* 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 as well as reduced environmental pollution.

The weakness in the 2017 program was that there were no nurse plots, so it was difficult to determine exactly where and at what levels the Mexican bean beetle populations were in soybeans. The indication from the field surveys is that the Mexican bean beetle population in the state remains low especially in South Jersey because none were observed in any soybean fields.

Populations of Mexican bean beetle were observed on snap beans in community gardens and on organic farms in Burlington, Somerset, Cumberland and Warren Counties.

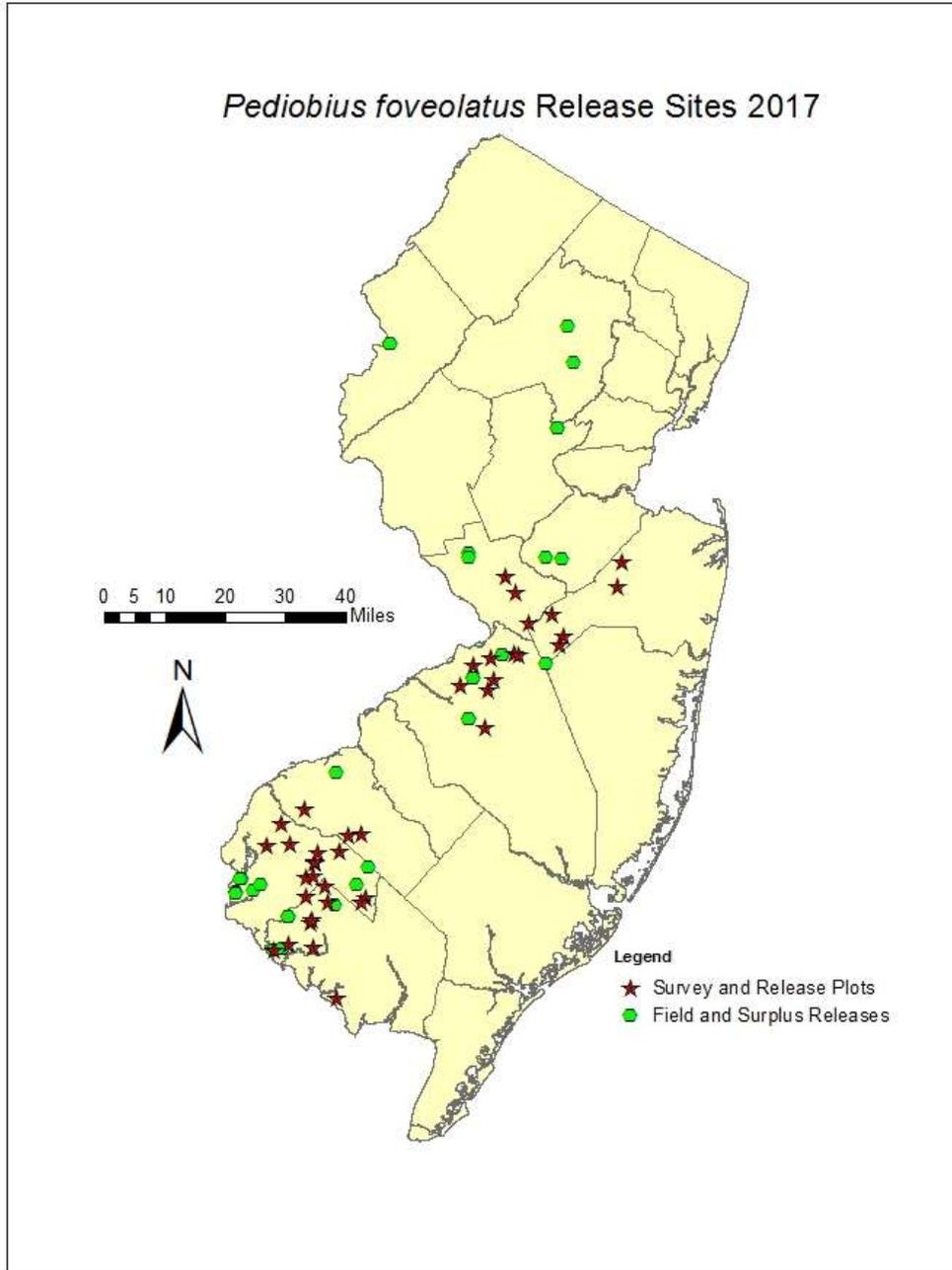
TABLE 1. RELEASE SUMMARY BY COUNTY 2017

County	Total No. of sites	No. of Surveys	Total No. of Parasites Released	Average No. of <i>P. foveolatus</i> Released per Site
BURLINGTON	8	72	48,000	6,000
CUMBERLAND	8	72	48,000	6,000
GLOUCESTER	3	27	18,000	6,000
MERCER	2	18	12,000	6,000
MONMOUTH	6	54	36,000	6,000
SALEM	12	108	72,000	6,000
TOTAL	39	351	234,000	
OVERALL AVERAGE				6,000

TABLE 2. FIELD RELEASE SUMMARY 2017

County	#Field Releases	#<i>P. foveolatus</i> Released
Burlington	8	78,000
Cumberland	6	41,000
Gloucester	1	8,000
Mercer	2	4,000
Middlesex	2	20,000
Morris	2	4,000
Ocean	1	8,000
Salem	8	60,000
Somerset	2	4,000
Warren	2	10,000
TOTAL	34	241,000

Figure 2. *Pediobius foveolatus* Release Sites and Field Releases 2017

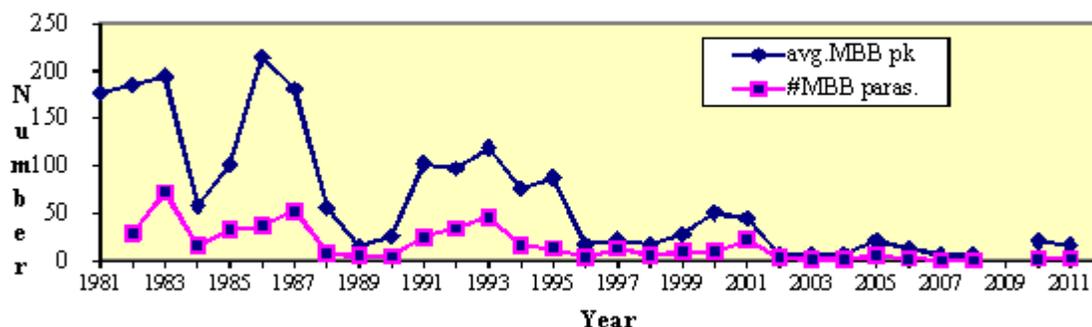


Mexican Bean Beetle (*E. varivestis*) Population Levels

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 1981-2011. Although there is no data, for the 2009, 2012, 2013, 2014, 2015, 2016 and 2017 seasons Figure 3 is included to demonstrate the decline of the in the Mexican bean beetle population over 21 years. 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. The Mexican bean beetle population is still at historic lows and one year without nurse plots should not substantially increase the MBB population.

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. Salem County's increase in the 1990's was possibly due to MBB migration from neighboring states. In the late 1990's the increase was due to population increases in central Monmouth County where no nurse plots or releases had been made in a number of years. The data over the years suggest that *Pediobius* releases by the New Jersey Department of Agriculture have dramatically reduced MBB populations statewide.

**Figure 3. Mexican bean beetle Population and Parasitism
1981-2012**



SUMMARY AND CONCLUSION

Overall in 2017 MBB populations continue to remain low in soybean fields in all counties. The continuing release of *P. foveolatus* should keep MBB populations from returning to levels that growers experienced in the past. The fact that no nurse plots were planted in 2017 should not materially affect the MBB population in 2018.

A total of 475,000 *P. foveolatus* were released in NJ and no grower had to treat soybeans for the Mexican bean beetle.

A portion of the soybean check-off funds reserved for research has been allocated to the NJDA by the New Jersey Soybean Board and is used to offset some of the costs for *P. foveolatus* rearing, field implementation and scouting. MBB populations have been

successfully kept below economically damaging levels in areas where nurse plots were previously 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 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.