

## Controlling Plum Curculio in Mid-Atlantic Apple Orchards

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**Duration of Project:** One year (April 15, 2022 to April 14, 2023)

### Justification:

For at least 5 years, growers have been noticed increases in plum curculio damage to apple fruit in Pennsylvania and other mid-Atlantic states. Typical plum curculio (PC) injury appears a depressed, c-shaped or fan-shaped scar that is heavily russeted (Fig. 1). We have also noticed that some of the damage attributed to plum curculio was atypical and, while still heavily russeted, consisted of large raised round bumps on the fruit surface (Fig. 2). We think from previous research for SHAP in 2017, that this is from a previously unknown plant bug type pest. At present this new pest fruit damage is relatively minor compared to that of PC, but this bears further study as we know nothing of its biology. In my research plots at the Penn State University Fruit Research & Extension Center, I have also seen around a 10-fold increase of this type of fruit injury. Normally unsprayed controls in pesticide testing trials at the FREC would see 3 -5% damage (2017) but has increased since this time to about 35-40% in 2021 trials (*See tables below*).

These recent high levels of fruit injury are typical of what I would normally see from PC when running trials in Michigan, Ohio, New York, and New England, but damage in PA orchards have always been much less historically. Having worked on apple in most of these states, I think this lower level of PC damage in PA was probably due to differences in spring weather between the regions as cool, wet springs in the northern states support PC populations. Recent extreme weather changes in PA spring are likely causing some of this shift of more PC damage in PA apple orchards, but changes in types of insecticides and use patterns are also to blame. We have also seen corresponding increase in damage from Tarnished Plant Bug (TPB) from around 1% to almost 38% in 2021 (*See tables below*). While generally fruit injury from TPB is mostly cosmetic with only a minor impact on fresh fruit pack-out, this dramatic increase in fruit injury last season is of concern. I think this is due, in part, to the loss of dormant Lorsban sprays whose long residual activity helped to control TPB during its active phase of pink and bloom.

To some extent, the increases in PC & TPB damage are due to the loss of our most effective broadspectrum contact products such as Guthion and Penncap M as the implementation of the Food Quality Protection Act eliminated them about 15 years ago. Litigation by environmental groups and government regulatory actions since 2010 have led to the loss of other compounds such as Calypso and Lorsban that were also very effective on PC. After consolidation into only a handful of large pesticide manufacturers, the pesticide industry has concentrated on developing more target-specific products like Delegate and Altacor for internal worm control (codling moth). While development of these more target selective insecticides has benefited fruit IPM through increase conservation of biological control agents of mites, scale and aphids, as well as increased safety to pollinators, it has left gaps such as effective PC control in pest control programs because of a lack of contact activity.

We believe the only remaining insecticides for effective control of high-pressure PC populations are Imidan and Sevin/Carbaryl, but we have not had high enough populations of this

pest for effective evaluation until recently. Unfortunately, additional restrictions placed upon Imidan after review by EPA imposed much longer re-entry periods and PPE requirements. The most effective times to control overwintering PC adults are at petal fall and 1<sup>st</sup> cover. This coincides with hand thinning of fruit in apple which makes the REI and PPE restrictions on Imidan use difficult to deal with. The use of Sevin/Carbaryl at this time is also a problem as the insecticidal rate is 2-3 times higher than the rate of the same products for use as a chemical fruit thinner. Under the light PC population pressure that we generally had in Pennsylvania orchards until recently, Actara, Assail, and Avaunt were considered to adequately prevent fruit injury at the full label rates with a single application at petal fall, or with an additional application at 1<sup>st</sup> cover if weather conditions and PC damage from the previous season justified it. Many fruit growers define petal fall as when the honey bee hives used for pollination are removed. For those fruit growers that are relying mostly or completely on wild bees for pollination, safety to wild bees in the surrounding landscape requires delaying petal fall sprays till at least 80% petal fall to prevent high bee mortality. First cover sprays are typically for our primary apple pest of codling moth, but our heavy reliance on either Delegate or Altacor, is at best only suppressing PC populations. Pyrethroids are the last tools for controlling PC because first they are not very effective in cool weather and because they are very disruptive to the biological control of mites, woolly apple aphid, and San Jose scale and generally cause massive flare-ups of these secondary pests. Cost is another factor in PC control since a single application of Imidan or Avaunt at full rates runs about \$35/A. Other products such as Belay, Exeril, Verdepryn, Delegate, Venerate, Apta, Rimon, Esteem, and pyrethroids have PC control on their labels for tree fruit, but have not been evaluated under high PC pressure.

Fig. 1 Plum Curculio Apple Fruit Injury



Fig. 2. Fruit injury often classified as coming from plum curculio, but now thought to be either from the apple green bug or possibly a new closely related pest, *Phytocoris conspurcatus*.



**Objectives and Procedures:**

1. Test various PC and TPB effective products on the high-pressure research sites at the PSU FREC in replicated research trials at timings from ½ inch green to pink for TPB and at PF and 1<sup>st</sup> cover for PC. The pesticide industry will provide product and some support for these trials.
2. Evaluate fruit injury at harvest in at least 8 grower orchards to see the commercial impact of PC and correlate control with grower spray programs.
3. Validate Michigan State University Degree Day Model for PA under PA weather conditions to optimize application timing and spray thresholds.
4. Use colored sticky traps, PC pyramid traps, and beating trays to evaluate PC and TPB population levels in the 8 grower orchards and at the FREC.
5. Use this information to update PSU control recommendation in the Tree Fruit Production Guide.

Fig. 3 Visual sticky traps used for monitoring for Plant Bug pests and Plum Curculio Pyramid monitoring trap.



**Budget:**

**Wages (\$8,798)** are requested for summer field workers to conduct summer field evaluations of various trapping methods and fruit injury harvest evaluations.

**Fringe Benefits (\$702)** are requested for the wage payroll at 7.98%. Fringe benefits are computed using the **fixed** rates of **7.98%** applicable to **Category III Salaries and Wages** for fiscal year 2022 (**July 1, 2021, through June 30, 2022**). If this proposal is funded, the rates quoted above shall, at the time of funding, be subject to adjustment for any period subsequent to June 30, 2022, if superseding Government approved rates have been established. Fringe benefit rates are negotiated and approved by the Office of Naval Research, Penn State’s cognizant federal agency.

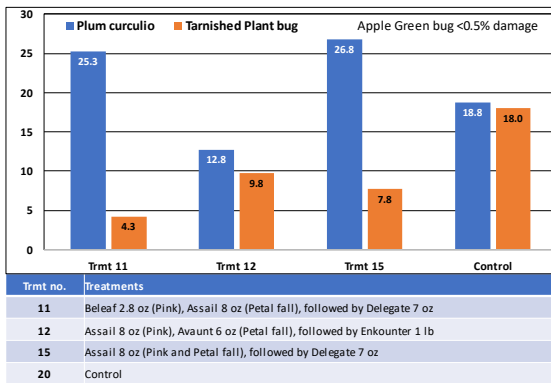
**Domestic Travel (\$1,000)** is requested to cover travel to grower orchards for field evaluations within the 8 orchards in Adams County.

**Materials & Supplies (\$500)** is requested for traps, lures, sampling vials and beating trays for field evaluations.

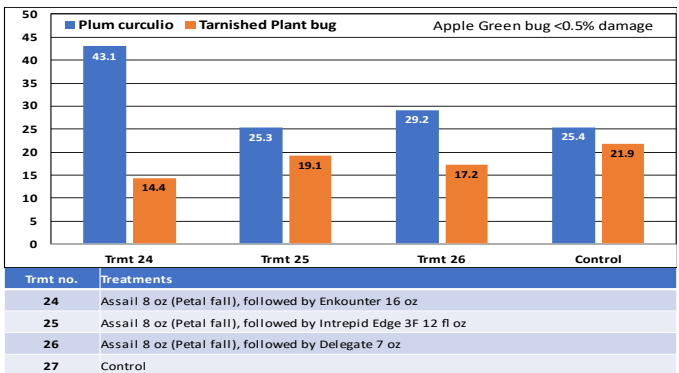
**Total Budget - \$11,000**

**Apple Fruit Injury at Harvest in FREC Research Orchards in 2021.**

PSU-FREC 2021 Exp. 02 Harvest fruit injury evaluation /100 Red Delicious 1-Sep



PSU-FREC 2021 Exp. 03 Harvest fruit injury evaluation /100 Golden Delicious 20-Sep



PSU-FREC 2021 Exp. 14 Harvest fruit injury evaluation /100 Golden Delicious 14-Sep

