Using Odor-baited Traps to Capture Immigrating Plum Curculios

Jaime Piñero, Ronald Prokopy, and Starker Wright
Department of Entomology, University of Massachusetts

To determine extent and timing of plum curculio (PC) immigration from woods (overwintering sites) into apple orchards, we have focused in recent years on the development of different types of unbaited (1997-1998) and baited (1999) traps. We have found that black pyramid traps (mimicking tree trunks) and clear Plexiglas panels (for capture of flying PCs) baited with some components of the odor of unripe plum or apple fruit may hold considerable potential as devices for monitoring immigrating PCs.

Here, we present findings of a 2000 study aimed at determining the response of PCs to these two trap types baited with the most attractive synthetic fruit volatiles evaluated in previous years (each in combination with grandisoic acid, a synthetic male-produced pheromone that is attractive to adults of either sex) or pheromone alone.

Materials & Methods

The study was performed in an unsprayed section of a commercial apple orchard at the University of Massachusetts Horticultural Research Center (Belchertown, MA). We evaluated two trap types: (a) clear Plexiglas panels (2 x 2 feet) coated with Tangletrap on the woods-facing side and attached vertically to a wooden post (5.5 feet) secured in the ground (Figure 1), and (b) black pyramid traps (24 inches wide at base x 48 inches tall) capped with an inverted screen funnel (boll weevil trap top). Our purpose in deploying these two types of traps was to capture adults immigrating from woods by flight (panel traps) or crawling (pyramid traps), as PC adults may exhibit either flight or crawling as means of displacement during orchard colonization (depending largely upon weather conditions).

Each trap was baited with one dispenser containing pheromone and one of the following six synthetic fruit

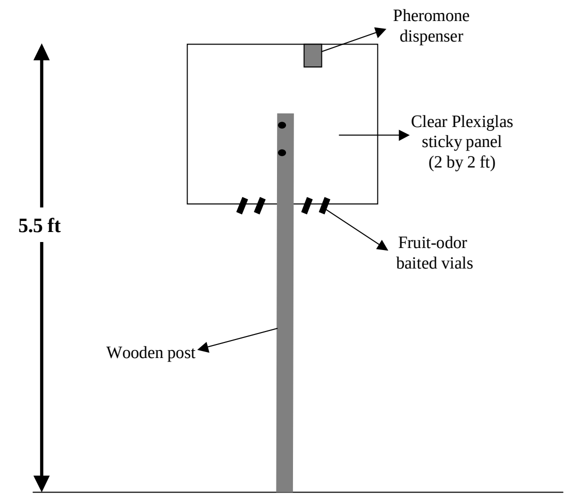

Figure 1 Schematic illustration of a baited panel trap.

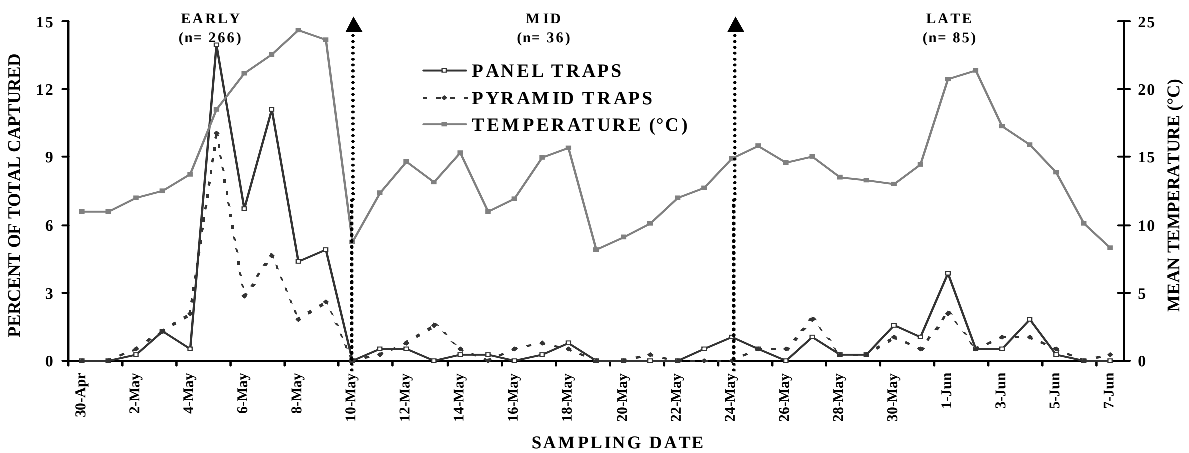

Figure 2. Percent of seasonal total number of adult PCs captured per day by baited panel and pyramid traps. Mean temperature at study site is lso shown.

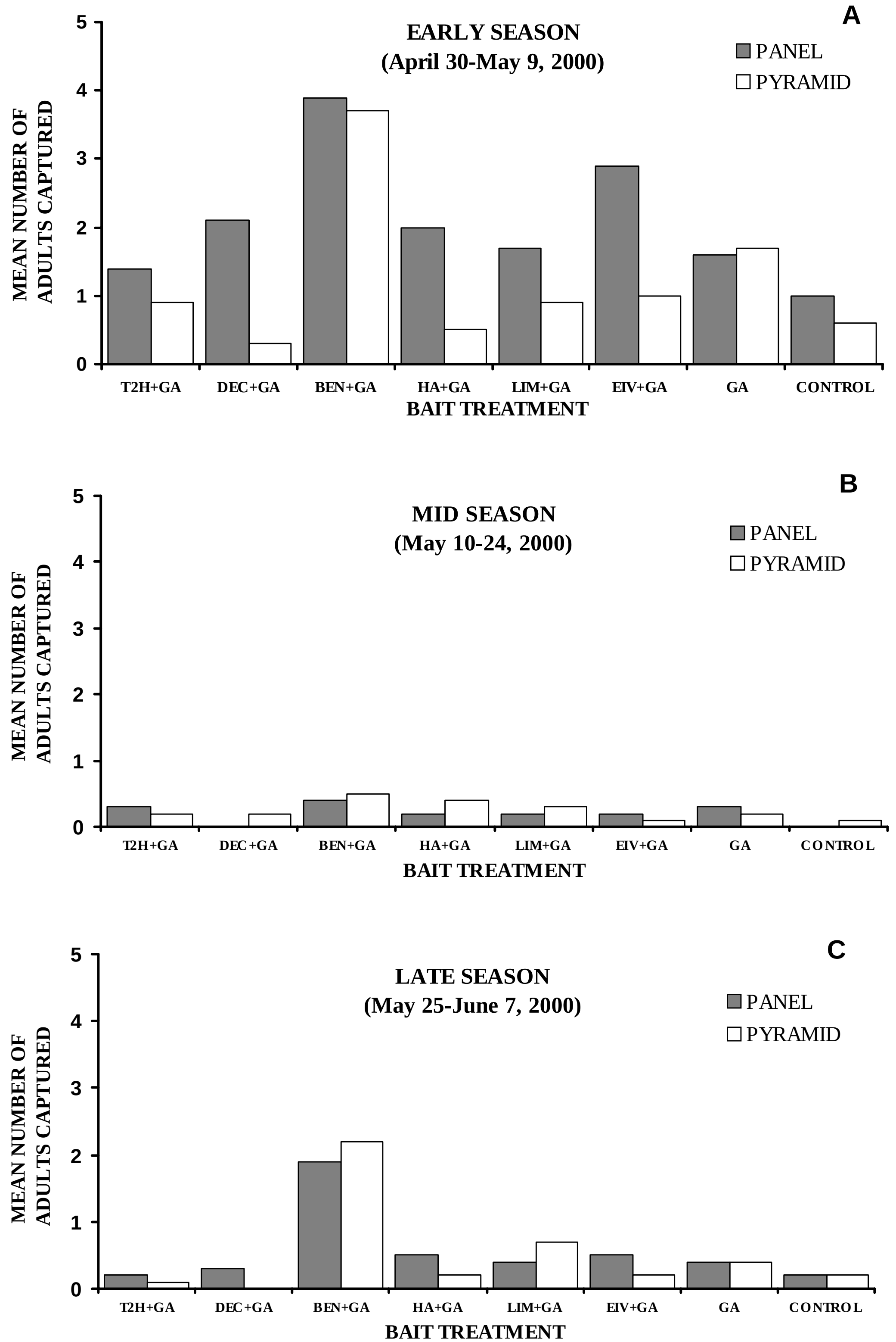

Figure 3. Number of adult PCs captured by baited or unbaited panel and pyramid traps during: (A) early season, (B) mid season, and (C) late season.

volatiles: benzaldehyde, decanal, E-2-hexenal, ethyl isovalerate, hexyl acetate, or limonene, each contained in polyethylene vials. As reported in the summer 1999 issue of *Fruit Notes*, each of these fruit volatiles has been found to be attractive to PCs when evaluated in association with boll weevil traps placed on the ground beneath host trees. We also evaluated pheromone alone and an unbaited (control) treatment. Depending on the volatile type, a different number of vials (2-5) was needed to achieve a release rate of 10 mg per day. For panel traps, vials containing fruit volatiles were attached to the lower edge of the Plexiglas panels, and one pheromone dispenser was attached to the upper edge. For pyramid traps, vials containing volatiles and one pheromone dispenser were placed inside each boll weevil trap top capping a pyramid trap. Vials containing benzaldehyde and limonene, as well as grandisoic acid dispensers, were replaced on May 24 (beginning of fruit set), because endurance of these compounds under the weather conditions of this study was shorter than that estimated in the laboratory.

On April 30 (tight cluster stage of bud development), 40 clear Plexiglas panels and 40 pyramid traps were positioned in close proximity to woods (overwintering sites adjacent to apple trees) and remained there until June 7 (end of fruit-set stage). Traps were arranged in five groups of 16 traps each (dictated by the combination of eight odor treatments and two trap types) and were deployed in pairs, with one trap of each type (bearing the same odor treatment) placed 1 m apart. Each pair was separated by 10 yards. Traps were inspected every morning (at 7:30 AM) throughout the study.

Results

Based primarily on phenological stage of apple bud and fruit development, PC immigration was divided into early-, mid- and late-season periods (tight cluster to bloom, petal fall, and fruit set, respectively). Overall, 387 PCs were captured by traps during the 39-day study period. First PC captures by traps (3 PCs) occurred on May 2. Peak of adult immigration was observed on May 5 (93 PCs, corresponding to 24% of the season-long total, were captured by traps on this particular day). Periodic peaks of adult captures by traps seemed to coincide with rises in temperature (Figure 2), a factor that has been shown to influence both the emergence of adults after overwintering and the appearance of adults in host trees.

During early-season (April 30-May 9), 266 adults (69% of total) were captured by traps. Over this period, panel traps baited with benzaldehyde plus pheromone or ethyl isovalerate plus pheromone were about four-fold and three-fold, respectively, more attractive to PCs than were unbaited panel traps, and pyramid traps baited with benzaldehyde plus pheromone or pheromone alone were about six-fold and three-fold, respectively, more attractive than were unbaited pyramid traps (Figure 3a).

During mid-season (May 10-24), only 36 PCs (9% of total) were captured by traps, and there was little response of PCs to traps of any type (Figure 3b), possibly on account of prevailing cool weather unfavorable for adult activity.

During late-season (May 25-June 7), 85 PCs (22% of total) were caught by traps. We found that just after replacing vials containing benzaldehyde and pheromone dispensers, panel and pyramid traps baited with benzaldehyde plus pheromone were again much more attractive (six-fold and eleven-fold, respectively) to PCs than any other traps (baited or unbaited) of either type (Figure 3c).

Conclusions

This study represents a step toward development of a more efficient monitoring tool for PC. By placing panel and pyramid traps baited with benzaldehyde in combination with pheromone in close proximity to woods, we were able to determine the first arrivals of PCs in the orchard (during tight cluster), as well as the peak (during full bloom) and possible end (during fruit set) of PC immigration. Benzaldehyde plus pheromone proved to be the most attractive lure during early season and also during late season. We believe that lack of attractiveness of benzaldehyde plus pheromone over the 15 days that comprised the mid-season period could have been due, in part, to impact of low temperatures on level of adult activity but also in part to loss of activity of pheromone and altered activity of benzaldehyde, perhaps during the warm days that characterized the preceding early-season period. If the latter is true, then we need to investigate a better way of dispensing benzaldehyde to ensure stability and longevity at a desired release rate.

We conclude that panel and/or pyramid traps baited with benzaldehyde plus pheromone deployed at borders of plum curculio overwintering sites, particularly near areas of orchards where the greatest plum curculio injury occurs, as determined by previous experience, can be a valuable tool for identifying the pattern of PC immigration. This can aid in accurate timing of insecticide application. The next step will be to work with combinations of odor volatiles, different release rates, and trap placement in order to improve performance of the traps.

Acknowledgments

We thank Russ Fleury, Brad Chandler, Katie Bednaz, Amanda Ross, Tracy Leskey, and Juan Rull for assistance. Funds for this work were provided by a USDA Northeast Regional IPM grant, a Hatch grant, and the New England Tree Fruit Research Committee.

* * * * *