Monitoring Asian citrus psyllid populations

By César Monzó and Phil Stansly

Pest management decisions are best made based on knowledge of pest distribution and abundance. Therefore, monitoring of insect populations is an essential crop management practice. Procedures are needed to accurately and consistently describe fluctuations of pest populations. However, precision, accuracy, effort and cost vary among different sampling methods. In general, the greater the reliability, the greater the cost. Thus, the need to balance objectives and resources.

WHY SAMPLE FOR ACP?

Greening disease (HLB), vectored by the Asian citrus psyllid (ACP), is now endemic throughout Florida. Research and grower experience have shown that ACP control is necessary and beneficial, even where HLB incidence is high. Under these conditions, the objective of monitoring ACP is more effective and efficient control. Sampling methods must be rapid and efficient even if that means sacrificing to some degree the sensitivity or accuracy. On the other hand, the objective where ACP is not yet endemic is detection, i.e. looking for the proverbial needle in a haystack, which will require a more sensitive sampling technique. Here we discuss the pros and cons of five sampling methods for ACP: stem taps, yellow sticky traps, suction devices, sweep-net sampling and visual counts, in terms of precision, consistency, implementation and cost.

STEM-TAP SAMPLING

A randomly chosen branch is struck three times with a length of PVC pipe and ACP adults falling on a laminated sheet, clipboard or other recipient held

PSYLLID PHOTO: University of Florida

Table 1. Time invested per sampled tree (1), relative number of ACP adult captures per unit of time with respect to stem taps (2), and ACP adult densities above which stem taps provide the most reliable information for a given effort (3).

Sampling methodology	1) Time invested (seconds)	2) Relative number of captures	3) ACP per tap and (per 50 taps)
Stem taps (random stops)	24	1	***
Sticky traps	427	0.88	> 0.017 (0.85)
Suction	185	4.01	> 0.14 (7)
Sweep net	47	0.89	0
Visual	58	0.21	> 0.007 (0.35)

underneath are quickly counted (Figure 1). The stem tap is widely used to monitor ACP in endemic areas, thanks to ease of implementation and relative reliability. Counts are made on the spot so results are immediately available. Selection of sampled trees at random is most accurate but grouping around random stops is faster. The USDA-APHIS/DPI Citrus Health Response Program (CHRP) uses stem taps to monitor more than 5,000 citrus blocks in Florida every three weeks. Data are reported as number of ACP per 50 taps, 10 from four corners and one from the center of each sampled block (www.flchma.org). The resulting database is huge, providing a tremendous source of information with which to compare regions and gauge progress. Stem taps provide a rapid way to judge ACP infestation levels at a relatively low cost, although some other methods are more reliable at lower ACP densities (Table 1).

STICKY TRAPS

Yellow sticky traps are probably the most used alternative to stem taps for ACP monitoring. Adults are attracted by the yellow color and get caught on the sticky surface. Traps are usually deployed in the canopy of randomly selected trees and replaced every week or two (Figure 2). Collected cards are generally brought inside and inspected under a magnifier. The number of psyllids trapped may vary with height and location around the tree, so consistency of trap location is important. Sticky traps detect ACP at lower densities than stem taps and generally with less random variation. However, material costs and time invested in deploying, collecting and inspecting the cards are much greater. There is also the disadvantage of a minimum one- or two-week time delay in obtaining the data, not to mention the hassle and mess. However, comparative studies suggest that sticky traps provide better data at ACP densities under 0.017 adults per stem tap = 0.85 ACP/50 taps (Table 1). For this reason some growers deploy them around grove perimeters for early warning, and they are widely used in California and elsewhere for early detection.

Figure 1. Stem-tap sampling consists of striking a randomly selected branch three times with a 40 cm length of 2 cm-diameter PVC pipe. ACP adults are counted as they fall on a clipboard covered with a laminated white sheet held horizontally under the branch.

SUCTION SAMPLING

Vacuum devices to capture insects are commonly used in research but have found little commercial application as yet due to cost of the equipment and difficulty using it in the field. However, a cheap and relatively light device can be made from a leaf blower by reversing suction and exhaust and placing a permeable bag (i.e. a nylon stocking) inside the intake tube. The canopy is struck with the end of the tube, and dislodged insects are sucked in (Figure 3, page 14). Comparative studies showed that our suction device captured four times more ACP adults than stem taps in the same amount of time and would be more cost effective at ACP densities below 0.14 adults per tap = 7 per 50 taps. Suction sampling is also useful for detection of sparse populations.

SWEEP-NET SAMPLING

The sweep net is a basic tool for collecting insects. A sturdy net is used to sweep canopy from right to left and back again at about half the depth of the rim (Figure 4, page 14). Trapped adults are counted and removed along with other insects and debris before taking a new sample. Sweep nets are used by some growers and researchers to monitor ACP populations in citrus, but

Figure 2. Yellow sticky card deployed on the south side of the canopy of a Valencia orange tree.

Figure 3. A hand-held suction device made from a 5 lb Husqvarna 125V® leaf blower powered by a 2-cycle engine. The blower was converted to suction by switching the exhaust tube to the intake port. The intake tube was widened by attaching a bottomless plastic flowerpot to increase suction area. A sheer nylon elastic stocking (L'eggs®) was fitted between two sections of the suction tube each time a sample was taken to retain all insects captured.

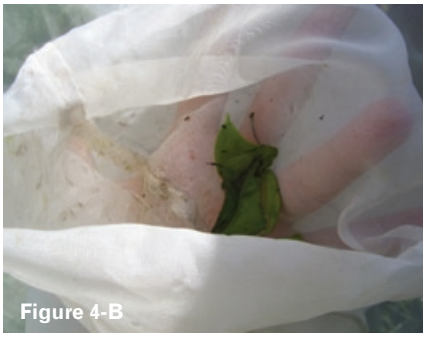

Figure 4. Sweep-net sampling. A) Samples are taken by swinging the net over the canopy of a tree, making a 180° arc backward and forward. B) ACP adults captured are visually counted immediately after collecting the sample.

there is little information on efficiency and precision. A study comparing sweeps to taps one to one resulted in similar performance (Table 1). On the other hand, the sweeping is more laborious than stem tapping and there is also heightened risk of spreading canker, especially when foliage is wet. More work is required to better assess the usefulness of this technique.

VISUAL SAMPLING

Direct observation is key to evaluating crop health and still an important way of assessing ACP populations. This is the only way to find eggs and nymphs found exclusively on flush, and adults are highly attractive to flush as well. Leaf distortion caused by adult and nymphal feeding on flush provides an early warning and permanent record of ACP activity. Nymphs acquire the HLB pathogen, which is later spread as adults disperse to find new flush. Therefore, quantities of infested flush are a certain prelude to HLB spread. On the other hand, a high percentage of infested flush may not represent a significant threat when flush is scarce. Therefore, some measure of flush density is important. Visual sampling for adults requires patience, especially when flush is scarce, but is currently implemented in several Florida groves. The advantages of this technique are similar to stem taps: low cost and rapid assessment. However, visual sampling is much more biased by the ability of the individual scout. We found that well-trained scouts could inspect on one side of a tree for 40 seconds in randomly selected stops more efficiently than stem taps at densities below 0.007 adults per stem tap. This is equivalent to 0.035 ACP per 50 taps, which is lower than average in most groves. However, stem taps are more efficient at the higher ACP densities present in most groves.

César Monzó and Phil Stansly work for the University of Florida-IFAS at the Southwest Florida Research and Education Center in Immokalee.