

Field Assays of 3D Printed Asian Citrus Psyllid (*Diaphorina citri*) Trapping Systems

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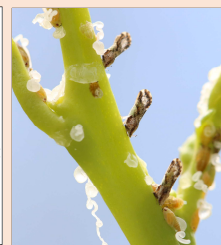


Non-technical Summary

Asian citrus psyllid (ACP) traps were created using 3D print technology to improve ACP-target catch, eliminate sticky card mess, and preserve ACP for identification and qPCR testing for HLB pathogens. Print technology allows researchers to quickly create prototypes that incorporate the latest research into their design schemes. Developments in trapping design have improved success rates in trapping this vector of citrus greening disease.

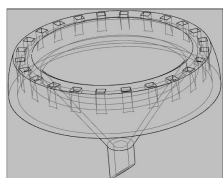
Introduction

3D-printed trap prototypes which preferentially capture and preserve psyllids were designed and tested. High-quality genetic material is optimal for determining incidence of *Liberibacter*. An alternative to sticky cards, which do not preserve genetic material, is needed for monitoring programs. Trap prototypes are ACP-specific, reduce non-target bycatch, preserve specimens for longer, and yield higher-quality genetic material when compared to standard yellow sticky traps. 3D-printed traps enable easy on-site microbial detection with units such as the BioRanger (Diagenetix.com). Early detection of ACP remains a significant challenge, especially in areas where HLB-associated *Liberibacter* species are not widespread, such as in California.



Methods & Materials

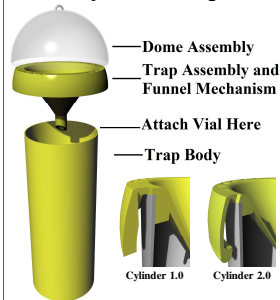
Trap models were designed using computer-aided design software (Rhino3d.com) and 3D-printed on LulzBot Taz 5 & 6 (Aleph Objects, Inc.) using PolyLite polylactic acid (PLA) plastic filaments.



Propylene Glycol



Cylinder Traps



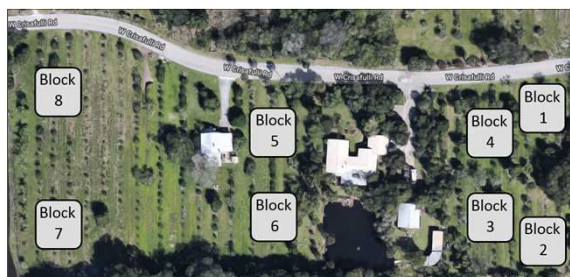
Stem Trap



Experimental design followed randomized complete block design. A total of eight blocks were designated at each of two sites (right) near observable psyllid activity. Treatments consisted of 3D printed prototypes and Alpha Scent yellow ACP sticky traps.

Within each block, 5 m treatment plots were labeled A, B, C and D. Traps were rotated within each plot during subsequent replications. Traps were hung at breast height and positioned on trees that had new growth, active psyllid feeding, and optimal sunlight during the day. Traps and sticky cards were deployed weekly for 5-9 days from May 1—December 19, 2018. The number of psyllids collected during each deployment cycle were counted.

Merritt Island, FL



Ocklawaha, FL



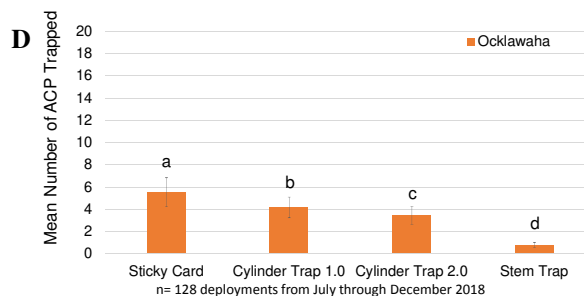
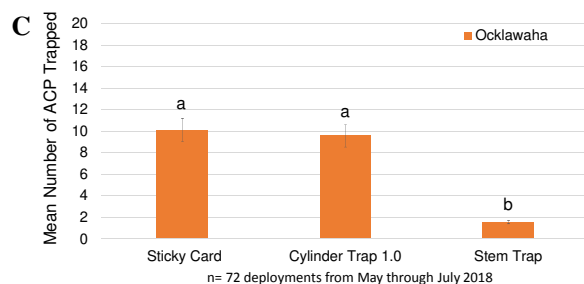
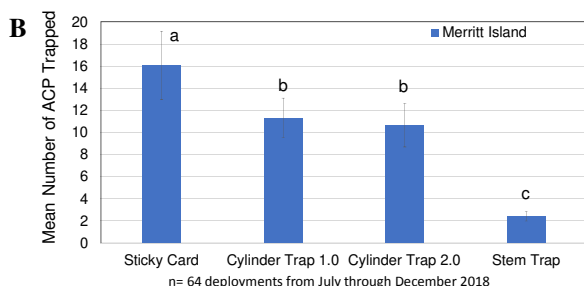
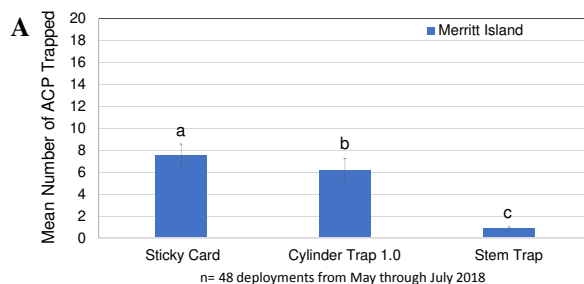
Results & Conclusions

Cylinder traps caught as many psyllids as the sticky cards at the Ocklawaha site (Fig. C). The mean number of ACP trapped by both Cylinder 1.0 and Cylinder 2.0 were both greater than that of the Stem Trap. Cylinder traps cost less, require less material to print, and capture more psyllids than stem trap designs. At the Ocklawaha site no significant difference between Cylinders 1.0 and 2.0 was detected (Fig. B).

The effective catch rate of the stem trap was far less than that of both cylinder traps or sticky card. This suggests cylinder trap designs to be a suitable candidate for further experimental design iterations.

3D-printed ACP traps meet all project requirements:

- Capture large amounts of psyllids
- Eliminate most bycatch
- Preserve specimens for tissue analysis



Mean number of ACP trapped with standard error bars. Means topped by the same lowercase letters are not significantly different ($P > 0.05$).

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Florida Department of Agriculture and Consumer Services Nikki Fried, Commissioner

