# Spotted Lanternfly and Tree of Heaven: Monitoring Using Drones

Kushal Naharki and Yong-Lak Park

Division of Plant & Soil Sciences, Entomology Program, West Virginia University, Morgantown, WV

## INTRODUCTION

The spotted lanternfly (*Lycorma delicatula*) is an invasive pest native to China which was introduced to the United States in 2014 (Barringer et al. 2015). As of 2023, the spotted lanternfly was detected in seven counties of WV. Currently, no effective trapping methods for spotted lanternflies are available, and pest managers are solely relying on the ground survey to detect trees of heaven (*Ailanthus altissima*), the most preferred host plant of the spotted lanternfly (Uyi et al. 2021). During the past ten years, drones have been used in detecting invasive plant species and plant protection (Kim et al. 2021), which can be used potentially for the detection of the tree.

## OBJECTIVE

- To develop an aerial survey method for detecting and mapping tree of heaven using drones

## MATERIALS AND METHODS

- Site Location: Morgantown and Kearneysville, West Virginia
- Aerial survey was conducted throughout the year targeting different phenological stages of tree of heaven.
- Aerial images were collected with rotary-wing drones equipped with optical sensors.
- After flights, aerial images were downloaded from the drones, and Pix4DMapper (Pix4D, Prilly, Switzerland) was used to stitch and georeferenced aerial imagery (Fig. 1)
- Tree of heaven were identified with their key characteristics from stitched aerial images.
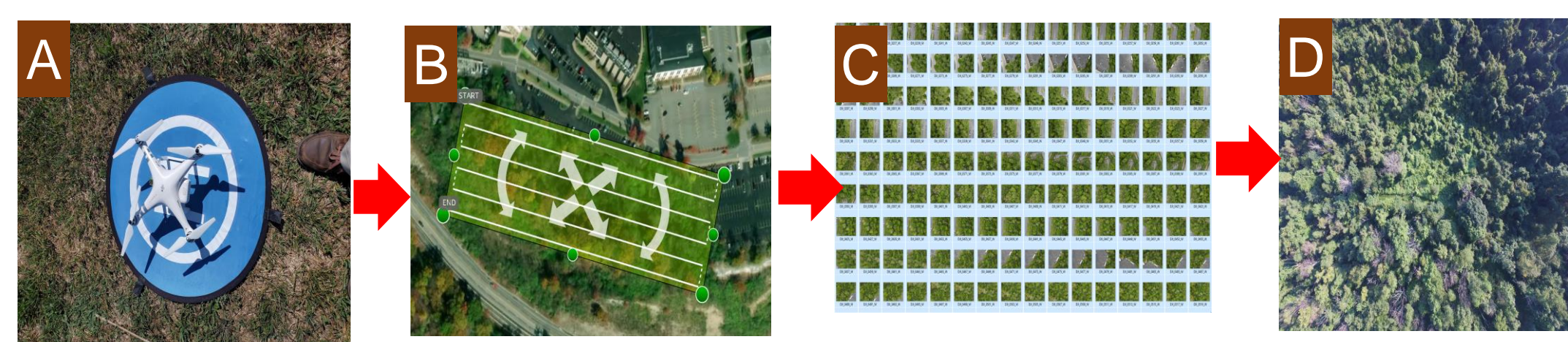


**Fig. 1.** Drones equipped with optical sensor (A), Path for aerial survey using autopilot mode (B), Downloading aerial images from drone (C), Pix4DMapper stitching image to generate orthomosaic image (D)
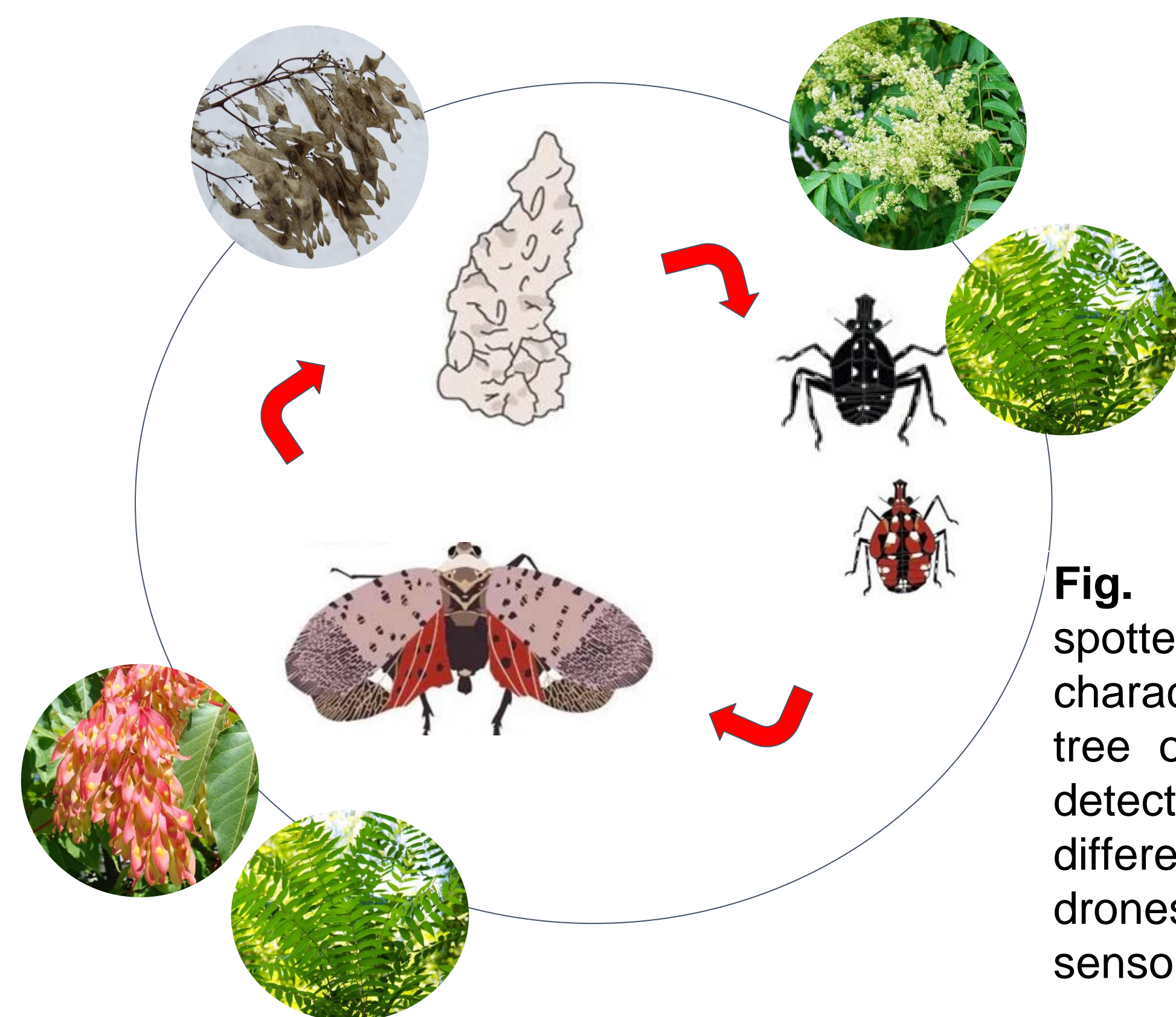


**Fig. 2.** Life cycle of spotted lanternfly with characteristics feature of tree of heaven used to detect the tree at their different life stages using drones equipped with sensors.



**Fig. 3.** Example composite image with tree of heaven (arrows) in winter



**Fig. 4.** Example composite image with tree of heaven (arrows) in spring



**Fig. 5.** Composite image with tree of heaven (arrows) in summer at organic farm, WVU

## RESULTS & DISCUSSION

- Different life stages of spotted lanternfly can be monitored by detecting different characteristics of tree of heaven (Fig. 2).
- White colored seed clusters in winter (Fig. 3), yellow-colored flowers and leaves in spring (Fig. 4) and red to yellow-colored fruits and leaves (Fig. 5) of tree of heaven can be through stitched drone images.
- Being the major host of spotted lanternflies, tree of heaven can be used for the monitoring and management of spotted lanternflies in large or hard-to-access areas using drones (Fig. 6).



**Fig. 6.** Drone flying above tree (A), Aerial image of tree of heaven (B), spotted lanternflies on tree of heaven (C) and spotted lanternfly adult (D)

## CONCLUSION

We found that drones could accurately detect tree of heaven during different seasons of the year. This result will help develop a field protocol for the detection of tree of heaven with aerial surveys. This study demonstrated that detection of the tree of heaven would be possible with aerial surveys with drones equipped with optical sensors, which can help in the early response and prioritize the efforts on spotted lanternfly management.

## LITERATURE CITED

Barringer, L. E., L. R. Donovall, S. E. Spichiger, D. Lynch, and D. Henry. 2015. The first new world record of *Lycorma delicatula* (Insecta: Hemiptera: Fulgoridae). Entomol. News. 125: 20–23.

Kim, J., C. D. Huebner, R. Reardon, and Y. L. Park. 2021. Spatially Targeted Biological Control of Mile-a-Minute Weed Using *Rhinoncomimus latipes* (Coleoptera: Curculionidae) and an Unmanned Aircraft System. J. Econ. Entomol. 114: 1889–1895.

Uyi, O., J. A. Keller, E. Swackhamer, and K. Hoover. 2021. Performance and host association of spotted lanternfly (*Lycorma delicatula*) among common woody ornamentals. Sci. Rep. 11: 1–10.

## ACKNOWLEDGMENT

WEST VIRGINIA UNIVERSITY.
DAVIS COLLEGE OF AGRICULTURE, NATURAL RESOURCES AND DESIGN