Impact of temperature on psyllid survival

By Nabil Killiny and Steve Futch

Adult Asian citrus psyllids have been shown to survive temperatures below freezing for several hours.

Citrus growers frequently inquire if Florida temperatures in the summer or winter are sufficiently high or low enough to control or suppress the Asian citrus psyllid (ACP). This question is the subject of this short article.

The reason growers pose the question about how temperature impacts psyllids is because ACP is a phloem feeder that vectors citrus greening or huanglongbing (HLB). When HLB-infected psyllids feed on the citrus plant, they introduce the bacteria into the tree. The level of HLB spread is directly related to the distribution and population level of the infected ACPs within a given area. Any factors that may suppress or control ACPs would be beneficial to citrus growers to minimize the spread of HLB.

The two major factors that have a significant impact on the development of psyllid populations and their survival are the availability of new growth flush for female ACPs to lay their eggs onto and temperature. During Florida winters, the citrus tree normally goes somewhat dormant and the incidences of new growth greatly decrease, thereby reducing the opportunity for ACP reproduction on new flush. Subsequently, the ACP populations decline naturally. During the summer, hot temperatures may likewise reduce ACP reproduction rates due to suboptimal temperature conditions.

Field observations and laboratory studies conducted by David Hall have shown that ACP can survive sub-zero temperatures as low as 21 F for several hours.

SURVIVING A FREEZE

ACPs are widely distributed in southern Asia, thus the name Asian citrus psyllid. The pest has also become widely distributed in many other tropical and subtropical regions around the world, including the Americas. ACPs have been

Psyllid nymphs produce white, waxy secretions.

found in many southern states in the United States and even as far north as the Carolinas. While some locations where ACPs have been found will have numerous freezing temperature events during the winter, cold stress in these locations has not eliminated the pest, even in the more northern colder regions where ACPs have been detected.

Field observations and laboratory studies conducted by David Hall have shown that ACP can survive sub-zero temperatures as low as 21 F for several hours. While the air temperature in a grove may decrease into the low 20s for a short period of time during a freeze event, ACP may survive inside the tree canopy where temperatures are slightly warmer than the surrounding air temperature. In Florida, air temperatures are commonly measured in the grove via a standard thermometer mounted approximately 4 feet above the soil surface, which will be colder than inside the protected tree canopy.

In the laboratory, keeping psyllids in the freezer (-4 F) for up to 30 minutes causes lethargy and anesthesia-like symptoms for a few minutes. However, this low temperature will not have a long-term negative effect on the pest because once it warms back up, normal behavior resumes. This brief exposure to freezing temperature has been used to help acclimate ACP prior to a variety of laboratory treatments.

In other laboratory studies, it was observed that approximately 50 percent of the ACP population can tolerate low temperatures at or below freezing (32 F) for up to one day, and even temperatures below freezing (21 F) for several hours. These temperatures are below Florida's normal winter temperatures.

HIGHER TEMPS HAVE GREATER IMPACT

In other studies, it has been noted that both high and low temperatures decrease ACP survival. In a study conducted at the Citrus Research and Education Center in Lake Alfred, Florida, ACP adults were subjected to 10 temperatures ranging from 32 F to 114 F. Considerable differences in survival under the different temperatures were observed. In the study, optimal ACP survival was between 68 F and 77 F as compared to the higher (114 F) or lower (32 F) temperatures.

It was also observed that approximately 50 percent of the adult ACPs could survive low temperatures of 32 F and 41 F for two and four days, respectively. However, when ACPs were subjected to higher temperatures of 104 F and 114 F, the survival rates decrease by 95 percent and 100 percent, as compared to the control. Therefore, it would appear that as temperatures increase or decrease from the optimum temperature range of 68 F to 77 F, the rate of ACP mortality is affected. The impact of higher temperatures has a greater effect on the death rate than exposure to lower temperatures.

CONCLUSION

It is highly unlikely that our typical Florida summer temperatures are high enough or winter temperatures low enough and sustained for a long enough duration to have a significant impact on ACPs.

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