Climate change boosts a migratory insect pest

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A nymph-stage potato leafhopper (*Empoasca fabae*, right of center) rests on a leaf of alfalfa (*Medicago sativa*). The discoloration and scarring seen on the leaves is called "hopperburn," and is the result of a toxin contained in leafhopper saliva. Credit: William Lamp

The potato leafhopper is a tiny insect—barely half the size of a grain of rice—with a bright lime green color that helps it blend in against plant leaves. Despite its unassuming appearance, this little pest causes big headaches for farmers across the eastern half of the United States. By feeding voraciously on many crops, including potatoes, green beans and alfalfa, the migratory potato leafhopper causes untold millions of dollars in damage every year.

Now, a study by entomologists at the University of Maryland and Queens College at the City University of New York suggests that climate warming could be making this problem worse. Using data that span more than six decades, the team found that potato leafhoppers arrive an average of 10 days earlier than in the early 1950s, and their infestations are more severe in the warmest years. These effects correspond to an overall increase in years with warmer than average temperatures over the same time period. The results were published online May 13, 2015 in the journal *PLOS ONE*.

"The potato leafhopper is a significant pest in this country, spanning multiple crops across a large area. The scale of influence is huge," said Dilip Venugopal, a research associate in entomology at UMD and co-lead author of the study. "Our results indicate that agricultural systems need to prepare for the effects of climate change on migratory pests. Earlier arrival is just one of the many factors that we need to be ready for."

Potato leafhoppers attack a wide variety of plant species, not just their namesake potato plants. They have a particular taste for alfalfa, which is an important forage crop for livestock. In Vermont, they have been known to go after hop plants, causing trouble for that state's famed craft beer industry. They even feed on non-agricultural plants, such as red maple trees. All told, they cause damage to more than 200 plant species throughout their considerably large range.

The insect's feeding strategy is subtle enough to avoid detection at first. By piercing a plant's leaves and stems with their mouthparts, leafhoppers feed on the sap and other liquids within. Leafhopper saliva also contains a toxin that can cause drying, curling and rotting of plant tissues, resulting in a characteristic syndrome known as "hopperburn."

"Earlier arrival dates make it particularly important for farmers to get out early in the season and scout for leafhoppers," said William Lamp, an associate professor of entomology at UMD and a co-author of the study. "They're tiny, flighty and very hard to see. You don't realize they're even there until you see the damage to the plants, which can take up to a week to manifest. By then it's too late."

The study integrated data on leafhopper arrival

dates and infestation severity from a variety of sources, including reports from state-level agricultural extension programs and published scientific studies. The researchers compared these data with temperature data from the National Oceanic and Atmospheric Administration's National Climatic Data Center. In addition to earlier arrival dates, the leafhopper data also show that years with warmer than average temperatures also had the most severe infestations.

"The historical records on agricultural pests are a gold mine, made possible by decades of hard work by agricultural research and extension personnel who collect this data," Venugopal said. "There has been a decline in data collection activity over the past decade, and we would love to see an effort to ramp this up again."

The researchers note that the potato leafhopper is only one of many migratory pest species that are likely to change their migration and feeding habits in response to climate warming.

"Climate change is not just costly because temperatures and oceans rise, but because it makes it harder to feed ourselves," said Mitchell Baker, an associate professor of biology at Queens College at the City University of New York and co-lead author of the paper. "Increased pest pressure in agriculture is one of the complex effects of continued warming. Predicting arrival time and severity is critical to managing this pest and others like it."

More information: The research paper, "Climate change and phenology: Empoasca fabae (Hemiptera: Cicadellidae) migration and severity of impact," Mitchell Baker, Dilip Venugopal and William Lamp, was published online May 13, 2015, in the journal *PLOS ONE*.

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