

Progress Report to the Maine Potato Board Research Subcommittee

Project Title: Correlating Weather Patterns with Aphid Flight and Potato Virus Y Transmission

Executive Summary: Potato virus Y (PVY) is transmitted by many different aphid species, most of which do not stay on potato plants. As a result, PVY vectors are usually missed by field scouts. Yellow pan traps, sticky yellow cards, and tower vacuum traps catch some of the flying aphids. However, it is unknown how representative are their captures of the total community of aphids moving through a potato field. Also, yellow pans and cards do not catch aphids until they start landing on a crop, while tower vacuum traps only catch aphids that are flying high above the ground. Having a better idea of aphid dispersal through the air will allow a better understanding of their potential role in virus transmission. We built a mast tower with trap stations to capture aphids flying at different heights above the ground. The tower trap was very successful in catching aphids, with most of them belonging to non-colonizing species. Aphids were flying during the entire period of trap deployment, starting in early June and continuing until late October. We observed several peaks of aphid flight throughout the season. Periods of elevated aphid activity followed significant precipitation events.

Investigators: Aaron Buzza, Andrei Alyokhin, and Jim Dwyer

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Background: Potato virus Y (PVY) causes a very damaging disease of potatoes. It is carried by numerous aphid species, most of which do not settle on potato plants. Still, they probe plants to test their suitability as hosts, and, by doing so, transmit virus from infected to healthy plants. Virus transmission often takes only a few seconds, and insecticides do not kill aphids quickly enough to prevent virus spread.

Because of their fleeting nature, non-colonizing PVY vectors are usually missed by field scouts. Yellow pan traps, sticky yellow cards, and tower vacuum traps catch some of the flying aphids that are missed by surveying the plants. However, it is unknown how representative their captures are of the total community of aphids moving through a potato field. Yellow pan traps and sticky yellow cards only catch aphids that are flying close to the ground and are generally ready to land on a plant. Tower vacuum traps used by the University of Maine Cooperative Extension suck in all the flying aphids, but only relatively high above the ground. It is generally unknown what is the best aphid trap, and at what height it should be deployed.

Having a reliable and practical trap for quantifying the number of dispersing aphids is important for both improving our general understanding of PVY epidemiology. Once developed, such a trap will also help specific decision-making by commercial growers.

Accomplishments: A 26-foot high mast was erected on Aroostook Research Farm within 300 feet from the tower vacuum trap maintained by the Cooperative Extension. The mast has trap stations every five feet. Each station accommodates four standard sticky yellow cards (6 by 11 inches) attached at the four compass directions. To allow replacing the cards without climbing, the mast is hinged right below the lowest trap station.

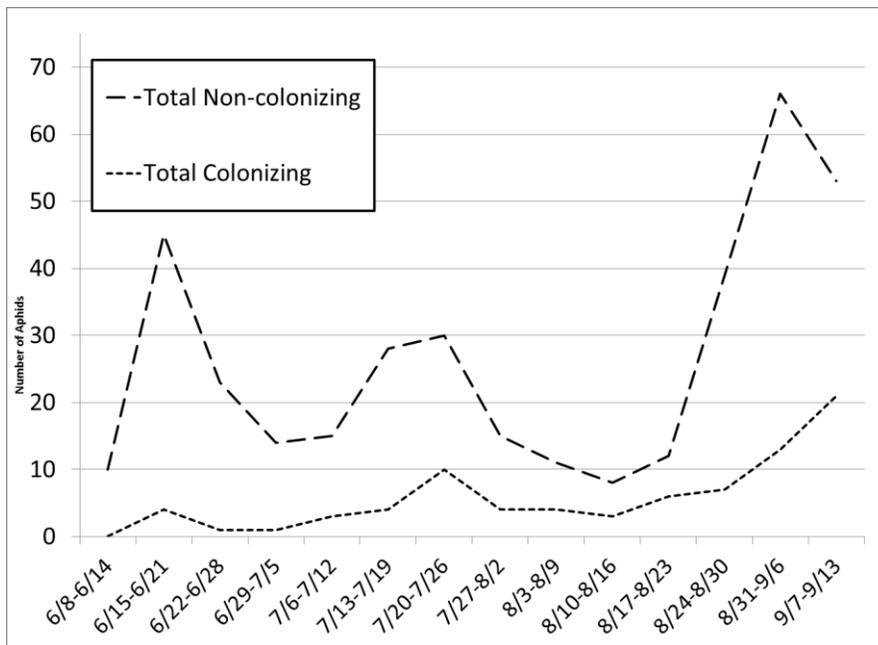
Beginning June 11, 2014 yellow sticky cards were placed on the tower at heights of 6', 16' and 26'. Cards were collected and replaced with new cards every Monday, Wednesday and Friday. There was a total of 15 weeks of aphid collection. The last day that data were collected was on September 12th. Captured aphids were collected and identified to a species (Table 1).

(Table 1) Aphid species captured over the entire 2013 season

Bird Cherry Oat - <i>Rhopalosiphum padi</i>	Pea - <i>Acyrtosiphon pisum</i>
Black Bean - <i>Aphis fabae</i>	Potato - <i>Macrosiphum euphorbiae</i>
Buckthorn - <i>Aphis nasturtii</i>	Rose - <i>Macrosiphum rosae</i>
Cabbage - <i>Brevicoryne brassicae</i>	Soybean - <i>Aphis glycines</i>
English Grain - <i>Sitobion avenae</i>	Turnip - <i>Lipaphis erysimi</i>
Green Peach - <i>Myzus persicae</i>	Yellow Clover - <i>Therioaphis trifolii</i>
Lg. Raspberry - <i>Amphorophora idaei</i>	Violet Ornamental - <i>Myzus ornatus</i>
Melon - <i>Aphis gossypii</i>	Willow Carrot - <i>Cavariella aegopodii</i>

The majority of aphids belonged to non-colonizing species that do not live on potato plants, but can still transmit PVY. Peak flight times were similar for colonizing and non-colonizing species (Figure 1), with the first peak observed in late June - early July.

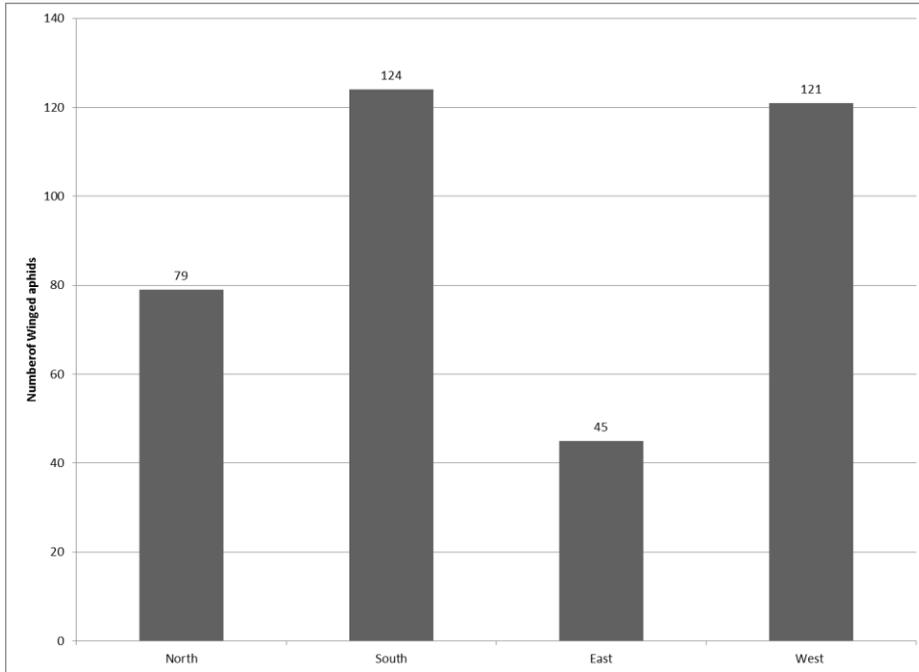
(Figure 1) Number of aphids collected over time



The majority of aphids were caught on westward-facing traps, corresponding to predominant wind direction in the area of study (Figure 2). There was a negative relationship between aphid flight and the amount of rainfall (Figure 3).

Our results highlight the importance of early applications of protective oils. There is considerable flight activity at the time of potato emergence from the soil, and most flying aphids belong to non-colonizing species that are unlikely to be controlled by insecticides.

(Figure 2) Total number of aphids by direction



(Figure 3) Aphid population as related to rainfall

