

Do Lygus Cause Economic Damage to Potatoes?

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REPORTING PERIOD: March 1, 2018 – January 1, 2019 (2018 Growing Season)

ACCOMPLISHMENTS:

Two species of Lygus were found predominately on potatoes, and there was some variability by location, but the most prevalent species is *L. hesperus* in the majority of the Washington Columbia Basin while *L. elisus* is common, but typically in a smaller proportion. *L. elisus* appears to be more common when flowering seed crops are close to potato fields.

We were able to design a method by which to cage Lygus in plots that are large enough to perform studies on the economic impact of Lygus and other insect pests. Damage to potato plants that is associated with Lygus feeding occurred in infested cages. In plots where Lygus were introduced, overall yield was not impacted, but potato quality was reduced, mostly in terms of specific gravity and tuber greening. Future studies hope to further quantify the impact Lygus feeding has on potato quality.

PROCEDURES:

Species Identifications

Hypothesis: Lygus species vary by growing location and nearby host crops.

Lygus were collected from various commercial fields during the growing season and species will be determined, with the growing region and potato cultivar noted.

For this objective, 18 fields were selected across the Columbia Basin, and the collections occurred. Adult Lygus were collected using a bucket sampling method whereby the tops of potato plants were shaken over an 8.5-inch diameter, two-gallon plastic bucket. The specimens were then kept on ice and shipped next day to the USDA Wapato laboratory for morphological identification. For some specimens, the morphological features presented subtle nuances making identification difficult. For those specimens, Dr. Cooper's lab performed molecular analysis to determine the species. A voucher of the collected specimens is stored at the USDA facility in Wapato.

Economic Injury

Hypothesis: Lygus cause economic damage to potato crops in the Columbia Basin.

We will evaluate if Lygus impact yield and quality of potatoes grown in the Columbia Basin. Lygus populations will be documented for the growing season, and the yield and quality of the tubers assessed at the end of the growing season.

Field cages were constructed with input from several sources in three commercial fields near Plymouth, WA, at the WSU Research Farm in Pasco, and at the USDA Station in Wapato, WA. Cages were 8.5 feet wide and 25 feet in length and consisted of a wood base frame with ¾ inch pvc pipe arches. The frame was covered with a mesh fabric (0.03 by 0.03 Mesh high density polyethylene netting AgFabrics, Vista, CA) that allowed water and light to infiltrate but would not allow entrance or exit of larger bodied insects (those larger than thrips), including Lygus. The fabric was attached to the frame with lath and staples, and a door fashioned on the end to

allow entry for infestations and sampling of insects. Three rows of potatoes (Umatilla Russet cv.) were grown in each cage, with the yield and quality measurements taken on fifteen feet of the middle row. For the commercial field, there were three treatments 1) Caged plots infested with *Lygus* beginning at bloom, 2) Caged plants with no *Lygus* and 3) Uncaged plots. At the WSU and Moxee sites, there were three treatments 1) Caged with no *Lygus*, 2) Caged with *Lygus* introduced at bloom (10 per cage 4 times), and 3) Caged with *Lygus* introduced at tuber bulking (10 per cage 3 times). The plots near Plymouth were harvested September 7, 2018, the Pasco plots were harvested October 3, 2018 and the Moxee plots were harvested October 19, 2018. The only complications with the cages were birds and aphids, both were dealt with in a rapid manner.

RESULTS/DISCUSSION:

Species Identifications

295 *Lygus* from 18 different field locations were identified mostly by morphology and a handful of specimens by molecular analysis. Overall, 77% were identified as *L. hesperus*, 20.5% as *L. elisus*, and the remaining 2.5% were *L. robustus*. In the Northern Columbia Basin of Washington, two instances occurred where *L. elisus* was the predominant species, and two instances contained a nearly 50:50 ratio of the two species (Figure 1). *L. hesperus* represented more than 50% of the population at the remaining 14 sites, and oftentimes represented 85 to 100% of the species collected (Figure 1). The difference in species ratios could be the result of numerous factors including nearby adjacent plant species, when during the season the specimens were collected, and collection methods. At the North Columbia Basin sites where *L. elisus* was the predominant species collected, flowering seed crops were near the potato field. In the sites where *L. hesperus* was the predominant species, fields were mostly surrounded by potatoes and various weedy habitats. It does not appear that potato cultivar has an impact on species constituency. Further assessments will be conducted in 2019.

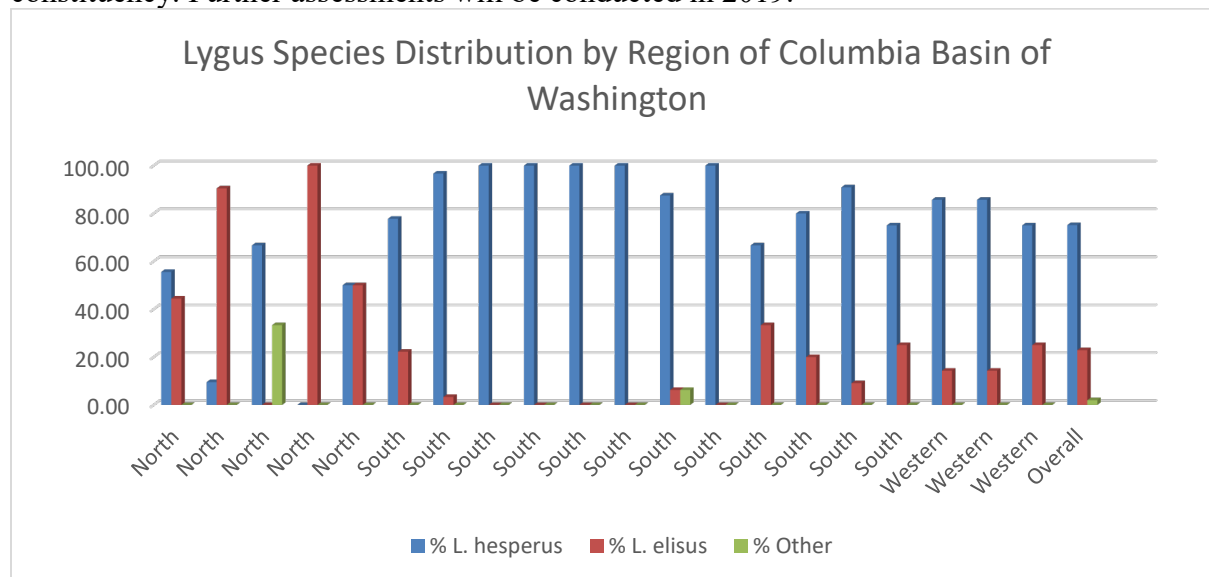


Figure 1. *Lygus* species proportion by collection location. North, South and Western refer to general local within the Columbia Basin of Washington State.

Economic Injury

In the commercial field, caged plots yielded less than adjacent plots that were not caged (Table 1). This result is not surprising due to the interference of light and other environmental factors associated with caging potato plants. Potato quality was adversely impacted by infesting cages with *Lygus* whereby more green tubers were found in cages infested with *Lygus* (Table 1). Specific gravity, tonnage and gross returns were reduced, but not significantly in caged plots with *Lygus* infested compared to caged plots without *Lygus*. These plots were not replicated in an individual field but are data from three fields. Replication within individual fields may have yielded more discernable results. The plots that were free of *Lygus* tended to be green longer than the surrounding field and caged plots with *Lygus* introduced (Figure 2). When the plots were harvested, the soil in the plots that were free of *Lygus* was dry, since the plants had not senesced and were using water more than the surrounding field. It seems likely that if the field had been irrigated longer, these plots would have continued to bulk for much longer than the adjacent areas, likely resulting in greater yield and tuber quality.

Trt.	Specific Gravity	Fry Col. 0	Fry Col. 1	Fry Col. 2	Fry Col. 3	Fry Col. 4	Ext. Def.	Green	Tot. Def.	Mis-shap	Ton/A	Gross \$
No Cage	1.08220a	24.33a	0.50a	0.20a	0.0a	0.0a	1.773a	0.000b	1.867a	10.00a	41.85a	5915a
Cage - Lyg	1.08341a	23.17a	1.83a	0.0a	0.0a	0.0a	1.583a	0.183b	1.657a	22.33a	32.74b	4566b
Cage + Lyg	1.07771a	24.50a	0.50a	0.0a	0.0a	0.0a	3.953a	0.483a	3.953a	21.17a	31.80b	4470b

Table 1. Potato quality and yield data from the commercial field plots. Fry Col=Number of fry slices of 25 test stripes that were in that USDA fry color class. External Defects, green, total defects, and misshapen are all in pounds per sample based on 15 foot of row. Means followed by same letter or symbol do not significantly differ (P=.10, Student-Newman-Keuls).



Figure 2. Commercial Umatilla Russet Field with *Lygus* cages. Left side was kept free of *Lygus* until harvest, while cage on right was infested at bloom stage. Notice surrounding field is similar to the cage on the right.

At the Moxee USDA site, USDA No. 2 fry color was adversely impacted by early *Lygus* introductions at tuber bulking (Table 2). Plots that were infested with *Lygus* early (bloom) also tended to yield less and produced less gross value, but not at a statistically significant level. Specific gravity was significantly reduced in plots that were infested with *Lygus* at tuber bulking (Table 2). It should be noted that yields were extremely low at the Moxee site, and in fact the fry

color scores would have resulted in contract rejection for all treatments. The plots were planted much later than is commercially done and were irrigated with drip irrigation. In 2019, we will correct these issues or plant at a different site that can accommodate more suitable conditions.

Trt.	Specific Gravity	Fry Col. 0	Fry Col. 1	Fry Col. 2	Fry Col. 3	Fry Col. 4	Ext. Def.	Green	Tot. Def.	Mis-shap	Ton/A	Gross \$
- Lyg	1.08853a	6.5a	8.5a	4.0b	3.8a	1.4a	x	x	x	30.8a	17.3a	2451a
+ Lyg Bloom	1.08515a	2.3a	8.8a	9.3a	4.0a	0.4a	x	x	x	36.5a	13.8a	1956a
+ Lyg Bulk	1.07858b	5.3a	7.0a	5.8ab	5.0a	1.4a	x	x	x	29.9a	15.0a	2183a

Table 2. Potato quality and yield data from the USDA Moxee Site. Fry Col=Number of fry slices of 25 test stripes that were in that USDA fry color class. External Defects, green and total defects were not evaluated for these plots mistakenly. Misshapen are in pounds per sample based on 15 foot of row. Means followed by same letter or symbol do not significantly differ (P=.10, Student-Newman-Keuls).

At the Pasco site, overall yield and gross return did not differ significantly by treatment, but the trend of lower yield and return was consistent with the Moxee site (Table 3). Specific gravity was low at this site overall and did not differ significantly, but lowest in the plots that were infested at tuber bulking with Lygus, again mimicking the trend from the Moxee site (Table 3). Fry color was not impacted by treatment.

Trt.	Specific Gravity	Fry Col. 0	Fry Col. 1	Fry Col. 2	Fry Col. 3	Fry Col. 4	Ext. Def.	Green	Tot. Def.	Mis-shap	Ton/A	Gross \$
- Lyg	1.0762a	11.25a	11.88a	1.75a	0.1a	0.0a	3.66a	0.87a	3.73a	26.3a	26.1a	3551a
+ Lyg Bloom	1.0765a	9.88a	10.00a	5.13a	0.0a	0.0a	4.68a	0.23a	4.70a	38.8a	25.8a	3485a
+ Lyg Bulk	1.0756a	13.38a	8.13a	3.50a	0.0a	0.0a	3.21a	0.57a	3.26a	28.5a	27.2a	3604a

Table 3. Potato quality and yield data from the WSU Pasco Site. Fry Col=Number of fry slices of 25 test stripes that were in that USDA fry color class. External Defects, green, total defects, and misshapen are all in pounds per sample based on 15 foot of row. Means followed by same letter or symbol do not significantly differ (P=.10, Student-Newman-Keuls).

With the Lygus cage studies, it was apparent that Lygus impact plant health, and more so when plants were infested at tuber bulking than at bloom. There was some variability from one site to another in regard to which factors were most influenced, but some of those details should be resolved with refinement to the experimental protocol and agronomic practices required to grow potatoes under large cages. We evaluated Lygus populations in the cages, but numbers of nymphs recorded was low. We do find Lygus nymphs in commercial potato fields, but not to the same level that is commonly observed in other host plants such as alfalfa. Many of the adult Lygus would be commonly found at the top of the cages several days after being released. Perhaps Lygus do not prefer to continually inhabit potatoes, but rather feed for a short period of time then migrate to more suitable hosts. The above studies will be repeated, but further studies may focus on the ability of Lygus to reproduce on potatoes in comparison to other hosts and additional infestation timings in order to determine the potato growth stages that are most susceptible to injury from Lygus feeding.

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