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Purple Top, BLTVA, and Leafhoppers: An Update

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Many scientists, growers, and consultants have put a lot of effort into understanding the purple top/BLTVA/leafhopper situation during the past year. Much has been learned, but much more knowledge is needed to provide the best recommendations to industry. This article summarizes accomplishments of the past year, and what can be learned from the experiences of growers and consultants during 2003.

As reported in *Potato Progress* last year, early on in this project, evidence gathered during the 2002 season led us to conclusively determine that the "potato yellows" (a.k.a. purple top) disease is caused by a phytoplasma (phytoplasmas are plant- and insect-parasitic bacteria). Test results were consistently showing phytoplasmas in affected plants. This led us to concentrate most of our efforts during the 2003 research season on phytoplasmas and the potential leafhopper vectors found in the region.

Extensive work was completed on testing methodologies for the phytoplasma in question. Numerous samples of symptomatic potatoes from around the Columbia Basin were tested for the presence of phytoplasma by polymerase chain reaction (PCR). Some of these PCR products were subjected to DNA sequence analysis. Results indicate that the phytoplasma belongs to "Group VI" and is closely related, or identical to, the beet leafhopper-transmitted virescence agent (BLTVA) or the clover proliferation phytoplasma. A similar phytoplasma has been reported in potatoes and alfalfa in Canada, and from potatoes in Korea. Aster Yellows phytoplasma has not been detected in samples tested so far. In Mexico, the primary phytoplasma associated with "purple top" is in the Aster Yellows group.

PCR tests were conducted for phytoplasma and potato leafroll virus (PLRV) on 35 symptomatic samples from the Paterson and Moxee areas. Plants showing "severe purple top" symptoms were positive for phytoplasma about half the time. About a third of the samples were positive for PLRV, but mixed infections of phytoplasma and PLRV occurred in only 1 of 14 samples with "severe purple top." Plants showing "mild purple top" symptoms rarely were positive for phytoplasma, but the majority were positive for PLRV. Plants showing leafroll symptoms, with or without mild purple top symptoms, were positive for these pathogens about 20% of the time. **These results confirm that the range of symptoms produced by the phytoplasma and PLRV overlap and that confirmatory tests are needed for accurate diagnosis.** Many of the symptomatic samples were negative for phytoplasma and PLRV. This suggests that (i) the pathogens are not evenly distributed in the plants, (ii) they are present in very low concentration, or (iii) there may be another pathogen or disorder which causes similar symptoms.

Many leafhoppers were collected with sticky cards, sweep nets, and a malaise trap. Leafhoppers

were trapped with yellow sticky cards in conjunction with the aphid trapping route in Oregon, by the regional IPM project in Washington, and by a member of industry. All told, 20,662 leafhoppers were trapped and tallied on the yellow sticky cards from all three trapping programs. Data were also collected on psyllids trapped on the cards. Some locations had large populations of psyllids moving through. Some phytoplasmas have been shown to be transmitted by psyllids. The psyllid species trapped were almost all not potato psyllid, *Paratrioza cockerelli*. The leafhoppers and psyllids trapped are displayed in Table 1.

Of these leafhoppers, none have been tested for competency as a vector of BLTVA other than the beet leafhopper. An important point about these leafhoppers is that some are almost certainly **not** vectors because they do not feed on plant phloem – the home of the phytoplasma. Species of *Dikraneura* and *Empoasca* belong to groups that do not feed on phloem, and so are probably **not** vectors. We hope to test the remaining species in the list for vector capability soon. The major stumbling block to testing these species is gathering or culturing enough individuals to run meaningful tests. Leafhopper species are long-lived (relative to aphids, for example), with complex and largely unknown host plant requirements and breeding habits.

Table 1. Most common leafhopper and psyllid species trapped from three yellow sticky card trapping programs in the Columbia Basin of WA, 2003. Species determinations by Stuart McKamey, Systematic Entomology Laboratory, USDA-ARS.

Leafhopper or Psyllid Name	**Total**
Beet Leafhopper (*Circulifer tenellus)*	8794
Exitianus exitiosus	3809
Ceratagallia (various species, relatives of clover leafhopper)	1516
Macrosteles (*Macrosteles cristatus* and probably others – relatives of aster leafhopper)	1353
Empoasca (various species)	1314
Dikraneura (various species)	1076
Amblysellus (*A. grex* and possibly others)	857
Paraphlepsius (possibly undescribed species)	658
Ballana venditaria	243
Other leafhoppers	2800
Psyllids (almost all not potato psyllid, and not yet identified)	2704

Some of the trapping data from Hermiston for total leafhoppers and beet leafhopper are presented graphically in Figure 1. **In terms of disease transmission, the most important time of year is early in the season.** We did not start trapping until the last week of May. Beet leafhopper was the most common species, and had well-timed flight peaks in June. This is the time we expect that most disease transmission occurs – a conclusion based on anecdotal information from the grower community.

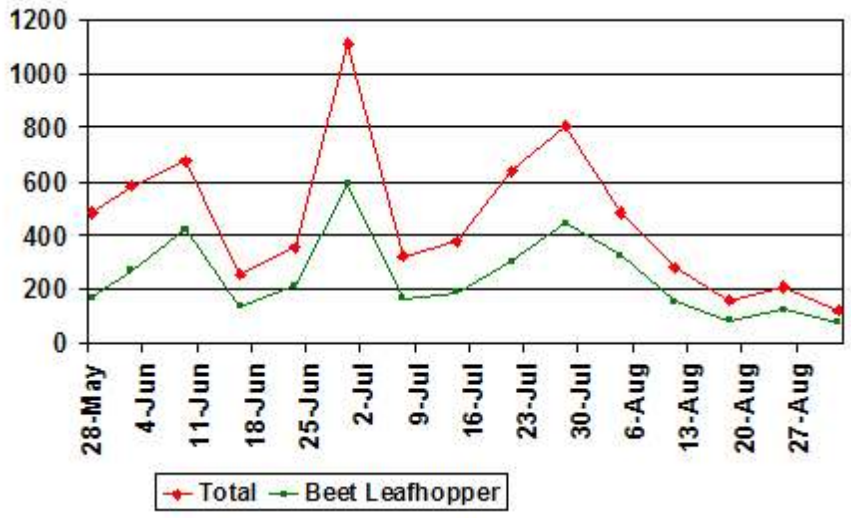

Figure 1. Catches of all leafhoppers and beet leafhopper in the Hermiston area trap route, 2003.

Another species of particular interest early season is *Ballana venditaria* (data not shown). This species reached a peak in flight sometime before trapping began. This flight in May could be critical, if this species turns out to be a vector.

Trap catch varied dramatically on small and large spatial scales. Some traps consistently caught many leafhoppers and/or psyllids, while others consistently caught few. This has practical implications for persons wishing to monitor leafhopper flights for IPM purposes. For example, Figure 2 shows that during a single collecting period – about 4 days – one trap near a potato field caught many leafhoppers, while four other traps surrounding the same field caught very few. The reason for this variability is uncertain, but possible causes could be that leafhoppers might have very localized populations, that minute details about trap placement and surrounding vegetation are important, and/or that some details about weather or wind are critical to leafhopper catch. This sort of trapping variability and differences in species catch using other collecting methods (e.g. sweep nets and suction sampling devices) have lead us to plan further research this season on how best to monitor leafhopper populations.

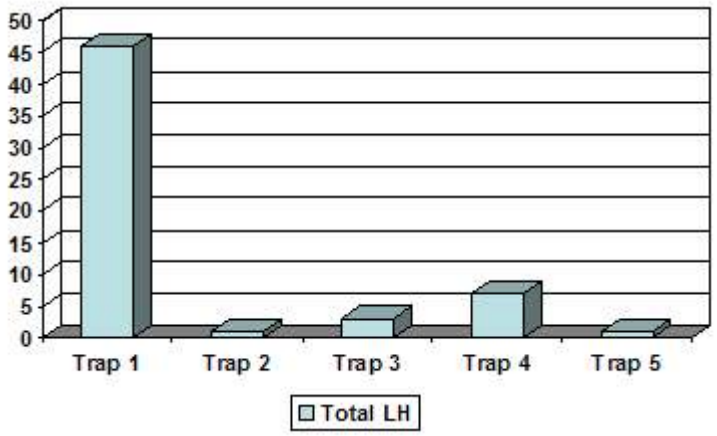

Figure 2. Total leafhopper catch over several days on five yellow sticky card traps surrounding one potato field in Adams Co., June 2003.

On December 16th we convened a meeting of researchers and about 20 consultants and growers to discuss their experiences with this disease in 2003. There were fewer impacted fields to report than in 2002, but there were still several. Impacted fields mentioned in this meeting and visited by the authors generally had either no foliar insecticides prior to mid June, or did not receive any foliar treatments at all. Most affected fields were in southern Basin. For this region it seems that insecticide treatment in late May and the first week of June correlated with disease-free fields. We suspect that for areas around Othello and north the most important season would be mostly in early June (a week or two later than near Pasco and south).

To conclude, there are a few items we can offer as suggestions for the coming season:

- ✔ Early part of the season is most important for infection by our phytoplasma.
- ✔ Track leafhopper populations with more than one method (e.g. sticky traps and sweep nets) inside and outside potato fields.
- ✔ Foliar insecticide treatments in late May through mid-June may prevent serious infection.
- ✔ Reliance on systemic at-plant insecticides is still not recommended for control of this disease.