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Short communication

Abundance of weed hosts as potential sources of onion and potato viruses in western New York

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ABSTRACT

A season-long survey of common weeds was taken near onion and potato fields located within a large vegetable production region in western New York in 2008 and 2009. The objective was to determine the abundance of weed species known as hosts for *Iris yellow spot virus* (IYSV), a serious pathogen of onion, *Potato leafroll virus* (PLRV) and *Potato virus Y* (PVY), which are major pathogens of potato. Ninety-eight weed species were identified, 17 of which are known hosts for IYSV, PLRV and PVY. Common lambsquarters, redroot pigweed, shepherd's purse, horseweed and dandelion were among the most abundant species known as hosts for these viruses. This information could be useful for studying the role that these weed species have on the epidemiology of the major viruses in onion and potato production systems and for developing future virus management strategies.

1. Introduction

Onion, *Allium cepa* L., and potato, *Solanum tuberosum* L., are two of New York State's most valuable crops, typically grossing $50–60 million (NASS, 2010) and $55–85 million (NASS-NY, 2009) annually, respectively. While nearly all onions grown in NY are grown in highly organic muck soil, a relatively small portion of New York's potato crop is grown in muck. However, muck acreage devoted to potato is highest in the Elba Muck vegetable production region in western New York (NASS-NY, 2008). The Elba Muck region is an area of approximately 2225 contiguous hectares of muck soils and is almost entirely devoted to vegetable crops, especially onion and potato.

Iris yellow spot virus (IYSV) (*Bunyaviridae*: *Tospovirus*) is a yield-reducing pathogen of onion and other *Allium* crops (Gent et al., 2004). IYSV is primarily transmitted to onion by onion thrips, *Thrips tabaci* Lindeman (Kritzman et al., 2001). IYSV is found in many areas of onion production worldwide (Gent et al., 2006), and at least 46 plant species have tested positive for IYSV, many of which are weeds (Smith et al., 2011). For example, redroot pigweed, *Amaranthus retroflexus* L., common burdock, *Arctium minus* Bernh., common lambsquarters, *Chenopodium album* L., chicory, *Cichorium intybus* L., curly dock, *Rumex crispus* L. and dandelion, *Taraxacum officinale* G.H. Weber ex Wiggers have been identified as hosts of IYSV (Sampagni et al., 2007; Hsu et al., 2011) and all occur in New York. These weeds are also hosts for *T. tabaci* (Smith et al., 2011).

Potato leafroll virus (PLRV) (Luteoviridae: *Polerovirus*) and *Potato virus Y* (PVY) (Potyviridae: *Potyvirus*) are the two most important viruses infecting potato crops in the US (Hooker, 1981; Johnson, 2008; Singh et al., 2008; Gray et al., 2010). These viruses are transmitted to potato by many different aphid species (Hemiptera: Aphididae), but the most important vector of both viruses is the green peach aphid, *Myzus persicae* (Selzer) (Harrison, 1984; Sigvald, 1984). There are also common weed species known as hosts for both PLRV and PVY including shepherd's purse, *Capsella bursa-pastoris* (L.) Medik. (Ellis, 1992; Kazinczi et al., 2004), and common lambsquarters (Kazinczi et al., 2004). Redroot pigweed is a host for PLRV (Natti et al., 1953) and other hosts likely exist as well.

Weed species that host IYSV, PLRV and PVY occur where onion and potato are grown in western New York, but their relative abundance in this vegetable producing region is not known. A comprehensive survey of common weed species, including known

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hosts for IYSV, PLRV and PVY, may be valuable for understanding the epidemiology and future management of these viruses in cropping systems where onion and potato are grown. The objective of this study was to estimate densities of the most common weed species in the Elba Muck region of Western New York, and of special importance, species known to be hosts for IYSV, PLRV and PVY.

2. Materials and methods

2.1. Sampling location and period

Weed population densities were recorded from five sites located in the Elba Muck region of New York (43.1N, 78.1W) in 2008 and 2009. Sites were separated from one another by >1.5 km. Each site was a 10 m by 90 m area of fallow land directly adjacent to a muck field that was currently in vegetable production. The same sites were sampled in both years of this study. In 2008, data were collected every 2 wk from 9 May to 30 August and again on 26 September (10 sampling dates). In 2009, data were collected every 2 wk from 18 May through 5 October (11 sampling dates). Data were recorded by the same observer each year. This schedule was chosen to ensure that weed species encompassing all four main growth habits would be encountered in the sampling (e.g. summer annuals, winter annuals, biennials and perennials).

2.2. Weed survey and density/cover estimates

On each sample date, weed densities or percentage cover at each of the five sites were determined for each species by recording the number of individuals or visually estimating the percentage cover in a 0.25 m^2 quadrat every 10 m over a 90 m linear transect for a total of 10 quadrats sampled per sample date at each site (Daubenmire, 1959; Smith et al., 2011). Quadrats were not permanent but were located within permanent transects. Transects at each of the five sites were located <50 m from vegetable crop fields, were parallel to their respective field edges and occurred in the same locations throughout the duration of this study. Plants were categorized as either broadleaf weeds whose density could be easily quantified by counting individual plants or tillers, or plants whose growth habit necessitated quantification on a percentage cover basis. This latter group of species included mostly (but not exclusively) grasses and broadleaf weeds that had cespitose, prostrate or creeping growth habits.

2.3. Weed densities or percent cover data

For each weed species, densities of plants in the 10 quadrats were totaled at each site and again across all five sites on each sampling date. Thus, the total abundance or percent cover of species was divided by the total area sampled per date to estimate the number of plants or % cover per m^2 ($12.5\ m^2 = 0.25\ m^2 \times 10$ quadrats/site $\times$ 5 sites) and per hectare. Values for all sampling dates were averaged to determine the estimated mean plants or percent cover per hectare for each weed species over the course of the season.

3. Results

Ninety-eight weed species were identified in this study, including 37 annuals (summer and/or winter annuals), 7 biennials, 40 perennials (simple or creeping), 12 species known to exhibit more than one life history and 2 unidentified species (Tables 1 and 2). Fifty percent of all species identified were members of the Asteraceae, Brassicaceae and Poaceae, accounting for 22, 9 and 18 weed species, respectively. Species from these families were also among the most abundant. Seven of the 11 most abundant species quantified by individual counts were members of the Asteraceae, including the three most abundant species: dandelion, Canada goldenrod, *Solidago canadensis* L. and Canada thistle, *Cirsium arvense* (L.) Scop. (Table 1). Five of the 10 most abundant species quantified by percent cover were members of the Poaceae, including the three most abundant species: fall panicum, *Panicum dichotomiflorum* Michx, Canada bluegrass, *Poa compressa* L. and timothy, *Phleum pratense* L. (Table 2).

Seventeen of the 98 weed species are hosts of viruses known to infect onion and potato (Table 3). Ten species are hosts of IYSV, four species are hosts for PLRV and at least 13 species are known to be susceptible to PVY. Some of these species are hosts for more than one virus. For example, common lambsquarters is a host for all three viruses. Common lambsquarters, redroot pigweed, shepherd's purse, horseweed and dandelion were among the most abundant weeds observed in this study (Table 1) and are known hosts of one or more of these viruses (Table 3).

4. Discussion

The relative epidemiological importance of these weed species is not known. Factors that likely influence their importance include prevalence of the weed host, abundance and phenology of the vector, dispersal capability of the vector, modes of transmission of the virus and acquisition and transmission efficiencies of the virus by the vector.

While weeds have not been documented as major sources contributing to IYSV epidemics in onion crops, studies of other *Tospovirus* spp. suggest that weeds are likely important sources of inoculum (Groves et al., 2002). Weeds that are important sources for IYSV and other *Tospovirus* spp. must also serve as reproductive hosts for their respective vectors (Culbreath et al., 2003). *T. tabaci* is the primary vector of IYSV in onion fields (Gent et al., 2004, 2006) and is the major pest of onion crops worldwide (Lewis, 1997), including New York. As with all *Tospovirus* spp., IYSV is persistent and propagative in its vector, meaning that individuals remain viruliferous for life and that the virus replicates itself within the vector (Moritz et al., 2004). Due to internal morphological transformations that occur during short periods of their development, *Thysanoptera* spp. can only acquire *Tospovirus* spp. as first instars, and can only transmit as second instars and adults (Ullman et al., 1993; Moritz et al., 2004). As such, an important epidemiological source of IYSV must also be a host of *T. tabaci* larvae. IYSV-susceptible weeds that cannot support populations of *T. tabaci* larvae are said to be epidemiological "dead-ends" as the vector cannot acquire the virus as an adult.

At least six of the ten IYSV-susceptible species reported in our study have been confirmed as hosts of *T. tabaci* larvae, and all six species have been commonly observed in New York (dandelion, common lambsquarters, redroot pigweed, chicory, common burdock and curly dock) (Table 3) (Smith et al., 2011). These six species may be important in the epidemiology of IYSV in the Elba Muck and similar agricultural ecosystems in the Great Lakes region of North America, but factors such as host suitability and transmission efficiency likely impact their role. Weed host suitability for the major thrips vectors of *Tomato spotted wilt virus* (*Bunyaviridae: Tospovirus*) (Groves et al., 2001, 2002; Chatzivassiliou et al., 2007) and their transmission efficiencies (Groves et al., 2002; Stumpf and Kennedy, 2005; Chatzivassiliou et al., 2007) were both important factors in the epidemiology of this disease in solanaceous crops.

In contrast to the relative vector-specificity of IYSV, many species of aphids are known to transmit PLRV and PVY; however, the green peach aphid has been identified as the most important vector of both viruses (Harrison, 1984; Sigvald, 1984). While

Table 1
Density (plants/hectare) of broadleaf weeds listed in descending order, which were recorded in fallow areas adjacent to vegetable crop fields in 2008 and 2009 (and mean) in the Elba Muck region, Genesee and Orleans Counties, NY, USA.[a]

Species	Common name	Family	Habit[b]	Plants/ha		
				2008	2009	Mean
Taraxacum officinale G.H. Weber ex Wiggers	Dandelion	Asteraceae	P	54,600	66,255	60,427
Solidago canadensis L.	Canada goldenrod	Asteraceae	CP	55,120	26,109	40,615
Cirsium arvense (L.) Scop.	Canada thistle	Asteraceae	CP	39,160	36,073	37,616
Chenopodium album L.	Common lambsquarters	Amaranthaceae	SA	42,960	2182	22,571
Conyza canadensis (L.) Cronq.	Horseweed	Asteraceae	SA/WA/B	42,440	1673	22,056
Amaranthus retroflexus L.	Redroot pigweed	Amaranthaceae	SA	25,920	10,618	18,269
Sinapis arvensis L.	Wild mustard	Brassicaceae	WA/B/P	25,520	7127	16,324
Urtica dioica L.	Stinging nettle	Urticaceae	CP	20,880	10,255	15,567
Erigeron spp.	Fleabane spp.	Asteraceae	SA	10,560	18,400	14,480
Matricaria discoidea D.C.	Pineapple weed	Asteraceae	SA	23,720	218	11,969
Artemisia vulgaris L.	Mugwort	Asteraceae	CP	12,080	9527	10,804
Plantago lanceolata L.	Buckhorn plantain	Plantaginaceae	P	7640	13,891	10,765
Thlaspi arvense L.	Field pennycress	Brassicaceae	WA	9800	8655	9227
Cichorium intybus L.	Chicory	Asteraceae	P	8880	8364	8622
Lepidium virginicum L.	Virginia pepperweed	Brassicaceae	WA	8920	7709	8315
Capsella bursa-pastoris (L.) Medik.	Shepherd's purse	Brassicaceae	WA	12,560	3491	8025
Solidago sp.	Goldenrod	Asteraceae	CP	9360	3418	6389
Ambrosia artemisiifolia L.	Common ragweed	Asteraceae	SA	8640	2036	5338
Daucus carota L.	Wild carrot	Apiaceae	B	5160	4509	4835
Asclepias syriaca L.	Common milkweed	Apocynaceae	CP	6320	2473	4396
Hieracium caespitosum Dumort	Yellow hawkweed	Asteraceae	CP	2680	3345	3013
Solanum ptychanthum Dunal	East. black nightshade	Solanaceae	SA	4120	1600	2860
Ranunculus bulbosus L.	Bulbous buttercup	Ranunculaceae	P	3920	945	2433
Conium maculatum L.	Poison hemlock	Apiaceae	B	2840	1818	2329
Barbarea vulgaris Ait. f.	Yellow rocket	Brassicaceae	WA/B/P	2720	1745	2233
Arctium minus Bernh.	Common burdock	Asteraceae	B	2440	1745	2093
Nepeta cataria L.	Catnip	Lamiaceae	CP	2080	2036	2058
Sonchus arvensis L.	Perennial sowthistle	Asteraceae	CP	3360	291	1825
Oenothera biennis L.	Evening primrose	Onagraceae	B/P	1280	1455	1367
Lactuca serriola L.	Prickly lettuce	Asteraceae	SA/WA/P	2160	0	1080
Sonchus oleraceus L.	Annual sowthistle	Asteraceae	SA/WA	1920	0	960
Alliaria petiolata (M. Bieb) Cavara & Grande	Garlic mustard	Brassicaceae	B	0	1745	873
Mentha x piperita L.	Peppermint	Lamiaceae	CP	160	1455	807
Unidentified	Unidentified	Brassicaceae	–	1360	0	680
Symphyotricum novae-angliae (L.) G.L. Nesum	New England aster	Asteraceae	CP	560	655	607
Saponaria officinalis L.	Bouncing bet	Caryophyllaceae	CP	1200	0	600
Senecio vulgaris L.	Common groundsel	Asteraceae	SA/WA	1040	0	520
Plantago major L.	Broadleaf plantain	Plantaginaceae	P	840	145	493
Descurainia Sophia (L.) Webb ex Prantl	Flixweed	Brassicaceae	SA/WA/B	937	0	469
Rubus spp.	Wild raspberry	Rosaceae	B/CP	320	441	381
Cirsium vulgare (Savi) Ten.	Bull thistle	Asteraceae	B	240	145	193
Amaranthus powellii S. Watson	Green pigweed	Amaranthaceae	SA	0	364	182
Rumex crispus L.	Curly dock	Polygonaceae	P	160	73	116
Verbascum thapsus L.	Common mullein	Scrophulariaceae	B	80	145	113
Hesperis matronalis L.	Dame's rocket	Brassicaceae	B/P	0	218	109
Pastinaca sativa L.	Wild parsnip	Apiaceae	B	160	0	80
Centaurea maculosa Lam.	Spotted knapweed	Asteraceae	CP	160	0	80
Raphanus raphanistrum L.	Wild radish	Brassicaceae	SA/WA	0	145	73
Abutilon theophrasti Medik.	Velvetleaf	Malvaceae	SA	0	145	73
Fragaria vesca Coville	Wild strawberry	Rosaceae	CP	0	145	73
Leucanthemum vulgare Lam.	Oxeye daisy	Asteraceae	CP	80	0	40
Potentilla norvegica L.	Rough cinquefoil	Rosaceae	SA/WA/B/P	80	0	40
Potentilla recta L.	Sulfur cinquefoil	Rosaceae	P	80	0	40
Linaria vulgaris Mill.	Common toadflax	Scrophulariaceae	CP	80	0	40
Sonchus asper (L.) Hill	Spiny sowthistle	Asteraceae	SA	0	73	36
Total: 55	–	16	–	467,298	263,860	365,579

[a] Plants were identified in 50 non-permanent quadrats measuring 0.25 m^2 (12.5 m^2 total) from 5 permanent transects (10 equally spaced quadrats at each of the five 90 m linear transects) on 10 sampling dates in 2008 (bi-weekly from 9 May to 30 August and again on 26 September), and on 11 sampling dates in 2009 (bi-weekly from 18 May to 5 October).

[b] SA = summer annual; WA = winter annual; B = biennial; P = perennial; CP = creeping perennial. For creeping perennials, counts refer to number of vegetative shoots. Combinations indicate that multiple life histories are known to occur.

acquisition and transmission of PLRV and PVY are not strictly linked to the life stages of aphids, nymphs and apterous adult *M. persicae* are more efficient at transmitting PLRV than alatae (Robert, 1971), while alatae appear to be more efficient at spreading PVY than apterae (Ragsdale et al., 1994).

PLRV is persistent but not propagative in its vectors (Eskandari et al., 1979), and acquisition of PLRV increases with longer periods of feeding on infected hosts (Leonard and Holbrook, 1978). Transmission of this virus is subject to a latency period of at least 8 h (Tanaka and Shiota, 1970). PLRV-infected plants are known to induce sustained feeding (Castle et al., 1998; Alvarez et al., 2009), which is beneficial to its epidemiology. Important sources of PLRV would potentially include susceptible plants that are abundant in the landscape such as common lambsquarters and redroot pigweed

Table 2
Percent cover of grasses and broadleaf species listed in descending order, which were recorded in fallow areas adjacent to vegetable crop fields in 2008 and 2009 (and mean) in the Elba Muck region, Genesee and Orleans Counties, NY, USA.[a,b]

Species	Common name	Family	Habit[d]	% cover[c]		
				2008	2009	Mean
Panicum dichotomiflorum Michx.	Fall panicum	Poaceae	SA	–	5.6	5.6
Poa compressa L.	Canada bluegrass	Poaceae	P	–	4.7	4.7
Phleum pratense L.	Timothy	Poaceae	P	–	3.9	3.9
Persicaria maculosa L.	Ladysthumb	Polygonaceae	SA	0.8	5.8	3.3
Medicago lupulina L.	Black medic	Fabaceae	SA/B/P	3.8	2.7	3.3
Bromus tectorum L.	Downy brome	Poaceae	WA	–	3.0	3.0
Echinochloa crus-galli (L.) P. Beauv.	Barnyard grass	Poaceae	SA	–	2.3	2.3
Parthenocissus qinquefolia (L.) Planch.	Virginia creeper	Vitaceae	P	4.1	0.1	2.1
Malva neglecta Wallr.	Common mallow	Malvaceae	WA/B/P	2.0	2.2	2.1
Polygonum convolvulus L.	Wild buckwheat	Polygonaceae	SA	1.6	2.5	2.1
Galium aparine L.	Catchweed bedstraw	Rubiaceae	SA/WA	2.5	1.5	2.0
Polygonum pensylvanicum L.	Penn. smartweed	Polygonaceae	SA	2.0	1.0	1.5
Lamium purpureum L.	Purple deadnettle	Lamiaceae	WA	2.0	0.1	1.0
Silene alba (Mill.) E.H.L. Krause	White campion	Caryophyllaceae	SA/WA/B/CP	0.1	1.8	1.0
Poa annua L.	Annual Bluegrass	Poaceae	WA/SA	–	0.9	0.9
Trifolium pratense L.	Red Clover	Fabaceae	P	0.8	0.9	0.8
Dactylis glomerata L.	Orchardgrass	Poaceae	P	–	0.7	0.7
Unidentified	Unidentified	Poaceae	–	–	0.7	0.7
Lotus corniculatus L.	Birdsfoot trefoil	Fabaceae	P	0.3	1.0	0.7
Bromus inermis Leyss.	SmoothbBrome	Poaceae	P	–	0.6	0.6
Panicum capillare L.	Witchgrass	Poaceae	SA	0.5	0.7	0.6
Toxicodendron radicans Kuntze	Poison ivy	Anacardiaceae	P	0.6	0.5	0.5
Calystegia sepium (L.) R. Br.	Hedge bindweed	Convolvulaceae	CP	0.2	0.8	0.5
Phragmites australis (Cav.) Trin. Ex Steud.	Phragmites	Poaceae	CP	–	0.5	0.5
Setaria glauca (L.) Beauv.	Yellow foxtail	Poaceae	SA	–	0.4	0.4
Polygonum scabrum Moench.	Green smartweed	Polygonaceae	SA	0.0	0.7	0.4
Cerastium fontanum Baumg.	Mouseear chickweed	Caryophyllaceae	P	0.0	0.7	0.3
Elytrigia repens (L.) Gould	Quackgrass	Poaceae	CP	–	0.3	0.3
Oxalis stricta L.	Woodsorrel	Oxalidaceae	SA	0.6	0.0	0.3
Bromus secalinus L.	Rye brome (Cheat)	Poaceae	WA	–	0.3	0.3
Lamium amplexicaule L.	Henbit	Lamiaceae	WA	0.5	0.0	0.3
Stellaria media (L.) Vill.	Common chickweed	Caryophyllaceae	SA	0.0	0.5	0.3
Digitaria sanguinalis (L.) Scop.	Large crabgrass	Poaceae	SA	–	0.2	0.2
Setaria viridis (L.) P. Beauv.	Green foxtail	Poaceae	SA	–	0.2	0.2
Cyperus esculentus L.	Yellow nutsedge	Cyperaceae	CP	0.0	0.3	0.2
Trifolium repens L.	White clover	Fabaceae	CP	0.1	0.3	0.2
Vitis labrusca L.	Wild (Fox) grape	Vitaceae	P	0.2	0.0	0.1
Glechoma hederacea L.	Ground ivy	Lamiaceae	CP	0.2	0.0	0.1
Bellis perennis L.	English daisy	Asteraceae	CP	0.0	0.1	0.0
Avena fatua L.	Wild oat	Poaceae	WA	–	0.0	0.0
Setaria faberi Herrm.	Giant foxtail	Poaceae	SA	–	0.0	0.0
Portulaca oleracea L.	Common purslane	Portulacaceae	SA	0.0	0.0	0.0
Polygonum aviculare L.	Prostrate knotweed	Polygonaceae	SA	0.0	0.0	0.0
Total: 43	–	13	–	22.9	48.2	47.6

[a] Grasses (Family: Poaceae) were present but not recorded in 2008. Average percentage cover for grasses reflects only 2009 data.
[b] Plants were identified in 50 non-permanent quadrats measuring 0.25 m^2 (12.5 m^2 total) from 5 permanent transects (10 equally spaced quadrats at each of the five 90 m linear transects) on 10 sampling dates in 2008 (bi-weekly from 9 May to 30 August and again on 26 September), and on 11 sampling dates in 2009 (bi-weekly from 18 May to 5 October).
[c] "–" indicates that no plants were identified. "0.0" indicates that plants were identified, but cover values <0.05%.
[d] SA = summer annual; WA = winter annual; B = biennial; P = perennial; CP = creeping perennial. Combinations indicate that multiple life histories are known to occur.

(Holman, 2009). Still, weed hosts in the PLRV-potato pathosystem are likely to vary in their effectiveness as sources of inoculum. While hairy nightshade, *Solanum sarrachoides* Sendtn., was not observed in our study area, PLRV is transmitted more efficiently by *M. persicae* from hairy nightshade to potato than from potato to hairy nightshade, or from potato to potato (Alvarez and Srinivasan, 2005; Srinivasan and Alvarez, 2008). Moreover, vector fecundity is greater on hairy nightshade than on potato (Srinivasan et al., 2008), indicating that differences in source effectiveness exist even within genera. Eastern black nightshade, *Solanum ptychanthum* Dun., was observed in modest densities; however, the relative impact of this species on PLRV epidemiology in potato is unknown.

Weeds bordering potato fields can act as important reservoirs for PVY (Ali et al., 2008; Kaliciak and Syller, 2009). PVY is transmitted in a non-persistent, stylet-borne manner (Nault, 1997). There is no latency period for acquisition and transmission of PVY (Bradley and Rideout, 1953). This means that the virus is carried on the aphid's mouthparts and is transmitted immediately as it probes leaves (Bradley and Rideout, 1953) in search of a suitable host (Kennedy et al., 1962; Powell et al., 2006). Past research also has shown that the presence of PVY in host plants promotes shorter feeding periods and transience, which are behaviors that contribute to the spread of PVY (Alvarez et al., 2009). As with PLRV, the most abundant hosts for PVY in the landscape near potato fields are also likely the most important sources for PVY. Dandelion, common lambsquarters and horseweed are the most likely candidates.

Numerous weed species for IYSV, PLRV and PVY were identified in the Elba Muck agro-ecosystem. These species also may be common in other muck crop producing areas throughout the Great Lakes region of North America. Information generated from this

Table 3
Potential weed hosts of *Iris yellow spot virus* (IYSV), *Potato leafroll virus* (PLRV), and *Potato virus Y* (PVY)[a] detected in 2008 and 2009 in the Elba Muck region, Genesee and Orleans Counties, NY, USA.

Species	Common name	IYSV[b]	PLRV	PVY
Amaranthus retroflexus L.	Redroot Pigweed	Gent et al., 2006	Natti et al., 1953	–
Arctium minus Bernh.	Common Burdock	Hsu et al., 2011	–	–
Capsella bursa-pastoris L. Medik.	Shepherd's Purse	–	Ellis, 1992	Fletcher, 2001
Chenopodium album L.	Common Lambsquarters	Sampagni et al., 2007	Kazinczi et al., 2004	Lichkov, 1987
Cichorium intybus L.	Chicory	Hsu et al., 2011	–	Kaliciak and Syller, 2009
Conyza Canadensis (L.) Cronq.	Horseweed	–	–	Kaliciak and Syller, 2009
Lactuca serriola L.	Prickly Lettuce	Sampagni et al., 2007	–	Kaliciak and Syller, 2009
Lamium purpureum L.	Purple Deadnettle	–	–	Kaliciak and Syller, 2009
Plantago lanceolata L.	Buckhorn Plantain	–	–	Zitter, 2001
Portulaca oleracea L.	Common Purslane	Cosmi et al., 2003	–	Marchoux et al., 1976
Rumex crispus L.	Curly Dock	Hsu et al., 2011	–	–
Senecio vulgaris L.	Common Groundsel	–	–	Lichkov, 1987
Setaria viridis (L.) P. Beauv.	Green Foxtail	Evans et al., 2009	–	–
Solanum ptychanthum Dunal	Eastern Black Nightshade	–	Natti et al., 1953[c]	Jeffries, 1998
Sonchus oleraceus L.	Annual Sowthistle	–	–	de Paz et al., 1997
Sonchus asper (L.) Hill	Spiny Sowthistle	Nischwitz et al., 2007	–	–
Stellaria media (L.) Vill.	Common Chickweed	–	–	Zitter, 2001
Taraxicum officinale G.H. Weber ex Wiggers	Dandelion	Hsu et al., 2011	–	Lichkov, 1987

[a] Of the four main strains of PVY, potato is susceptible to PVY^{O} (common strain), PVY^{C} (stipple streak strain), and PVY^{NTN} (potato tuber necrotic ringspot disease), but is largely asymptomatic when exposed to PVY^{N} (tobacco veinal necrosis) (Radcliffe and Ragsdale, 2002). Hosts listed include the three injurious strains infecting potato.
[b] Dandelion, common burdock, common lambsquarters, chicory, and curly dock have been documented as hosts of *T. tabaci* larvae, indicating potential as a source of IYSV (Smith et al., 2011).
[c] Eastern black nightshade is not known to have tested positive for PLRV; however, susceptibility to this virus is thought to be universal among *Solanum* spp. (Natti et al., 1953).

survey may be used to study the role that selective weed species have in the epidemiology of these viruses in onion and potato production systems, particularly if relative impact and importance in their respective pathosystems can be further elucidated. This information should be useful if virus management strategies are developed that include a weed management component.

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