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ALATE APHID (HEMIPTERA: APHIDIDAE) SPECIES COMPOSITION AND RICHNESS IN NORTHEASTERN USA SNAP BEANS AND AN UPDATE TO HISTORICAL LISTS

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ABSTRACT

Recent aphid-vectored viruses in the northeastern U.S. led to extensive surveys of aphid (Hemiptera: Aphididae) species composition. We report the species composition and richness of alate aphids associated with processing snap bean (Phaseolus vulgaris L.; Fabales: Fabaceae) agroecosystems from field surveys conducted during 5 yr in New York and 3 yr in Pennsylvania. Rates of species accumulation were similar between the 2 states, and asymptotic, suggesting reasonably adequate sampling intensity. Our results suggest that about 95 to 100 aphid species are present as alates within these agroecosystems, a surprisingly high percentage (~14 to 18%) of the total aphid richness. Host records suggest that 61% of the alate aphid species we collected from pan traps placed within snap bean fields were dispersing through this agroecosystem, originating from woody plants in the surrounding landscape. We compiled this information with a recent study of aphid species composition from peach orchards and an exhaustive inspection of museum samples, and present an updated list of the aphid species in Pennsylvania.

Key Words: Aphis glycines, host, pan traps, peach, Phaseolus vulgaris, virus-vectors

RESUMEN

Los virus recién transmitidos por áfidos (pulgones) en el noreste de los EE.UU. resultó en un sondeo amplio de la composición de las especies de los áfidos (Hemiptera: Aphididae). Se reporta la composición y riqueza de especies de áfidos alados asociados con el agroecosistema de la habichuela procesada (Phaseolus vulgaris L.; Fabales: Fabaceae) de estudios de campo realizados durante 5 años en Nueva York y durante 3 años en Pennsylvania. La tasa de acumulación de especies fue similar entre los 2 estados y asintótica, lo que sugiere la intensidad del muestreo fue razonablemente adecuada. Nuestros resultados sugieren que aproximadamente 95 a 100 especies de áfidos están presentes como alados dentro de estos agroecosistemas, un porcentaje sorprendentemente alto (~14 a 18%) de la riqueza total de los áfidos. Los registros de los hospederos sugieren que el 61% de las especies de áfidos alados que recogimos en las trampas de caída colocadas dentro de los campos de habichuela se dispersaba a través de este agroecosistema, procedentes de plantas leñosas en el área alrededor. Hemos recopilado esta información con un reciente estudio sobre la composición de especies de áfidos en los huertos de durazno y una inspección exhaustiva de especímenes depositados en museos. Se incluye una lista actualizada de las especies de áfidos en Pennsylvania.

Palabras Clave: Aphis glycines, hospedero, trampas de caída, durazno, melocotón, Phaseolus vulgaris, vectores de virus

Aphids are a small, but diverse group of insects with an origin in the Jurassic and a total of 4800 species world-wide (Grimaldi & Engel 2005; Dixon 1985a; Dixon 1985b). They are primarily phloem feeders and when present in high densities can damage their host plant. Aphids excrete excess carbohydrates from their diet of phloem sap, providing a nutrient-rich
substrate for sooty mold fungi to grow. Sooty mold can be a major problem in a number of agricultural crops because the mold can either render produce unmarketable or reduce plant quality of the commodity. Aphids are also important vectors of viruses that can kill their host plant or substantially reduce crop yield and quality (Agrios 2005). Some viruses are transmitted by aphids in a non-persistent, stylet-borne manner. They are obtained quickly by their aphid vector during short tasting probes, adhere to the stylet lining by binding to helper component proteins or directly to the stylet, and remain there until they are flushed out during another tasting probe (Ng & Falk 2006). Non-persistently transmitted viruses can be vectored by alates, sometimes by multiple aphid species (Gildow et al. 2008) regardless of whether or not there is reproduction on the plant host, and the epidemiology of these viruses can be influenced heavily by the alate aphid community.

Several viruses of this type have been introduced recently, or increased in frequency, in the northeastern U.S. One, plum pox virus (PPV), threatened the stone fruit industry following its arrival in the U.S. This virus causes shank disease in parts of Europe and South America where it is endemic (Roy and Smith 1984; Rosales et al. 1998). Type D isolates were detected in the U.S. in Pennsylvania in 1999 (Damsteegt et al. 2001), and surveillance and eradication efforts of this invasive species included destruction of about 23% of the non-cherry stone fruit orchards of Pennsylvania (Wallis et al. 2005). As part of these efforts, studies were conducted to determine the potential aphid species that might serve as reservoir or route of transmission in the region where this virus was first detected (Wallis et al. 2005). Soon thereafter, in the early 2000s, Northeastern and Midwestern U.S., snap bean crops (Phaseolus vulgaris L; Fabales: Fabaceae.) had virus-like symptoms (leaf mosaic and blistering, deformed pods) and experienced dramatic yield loss (Larsen et al. 2002). Among the viruses detected were alfalfa mosaic virus, bean common mosaic virus, bean pod mottle virus, bean yellow mosaic virus, clover yellow mosaic virus, clover yellow vein virus (CyYVV), cucumber mosaic virus (CMV), tobacco streak virus and white clover mosaic virus (Grau et al. 2002; Larsen et al. 2002; Shah et al. 2006). CMV was the most prevalent virus detected in these snap bean fields (Larsen et al. 2002; Shah et al. 2006). As is the case with PPV, CMV is transmitted by aphids in a non-persistent, stylet-borne manner (Nault 1997). CMV-infected plants were often found in clumps in snap bean fields, which were consistent with aphid-initiated virus epidemics (Shah et al. 2005). CMV epidemics also occurred more frequently in New York than in Pennsylvania. The CMV epidemics coincided with the appearance of a newly invasive aphid, Aphis glycines Matusmura (Nault et al. 2009), and was the case with stone fruit, the threat of viral epidemics led to extensive surveys of the alate aphids species composition in the affected crop.

These recent surveys of aphid collected from snap bean fields in Pennsylvania and New York, and peach orchards in Pennsylvania, were quite extensive. Also from Pennsylvania, J. O. Pepper specialized in aphid identification and actively collected them for most of the 20th century. His collections centered at his home in central Pennsylvania (State College) and included much of the surrounding forest and farmland. The bulk of his collection is housed in the Frost Entomological Museum (University Park, Pennsylvania), and he also contributed slides to the United States National Collection (Beltsville, Maryland). Pepper (1965) reported 345 species in a published list of the aphids of Pennsylvania and their host plants. To date, this is the most comprehensive published list of aphids for the state. However, since taxonomy and systematics are in flux, the names that Pepper published are currently out of date and in need of revision.

The purpose of this study was to identify the species composition and estimate aphid species richness in snap bean agroecosystems in the northeastern states from field surveys, and generate a current list of aphid species in this region using field survey data, literature, and an examination of the J. O. Pepper aphid collection.

**Materials and Methods**

Detailed methods for alate aphid collection in snap bean fields in Pennsylvania and New York were published in Nault et al. (2009). To summarize, we used water pan traps baited with a green ceramic tile (Webb et al. 1994) and filled with a 20% propylene glycol solution in snap bean fields in both states from 2002 – 2006 in NY and 2004 – 2006 in PA. Traps were installed in a total of 56 fields in western NY (12 each yr, except for 2004 which had 8 fields) and 18 fields in Centre county PA (6 each yr). The traps in Centre County formed an approximately 30 mile transect in the southern portion of the county roughly following state routes 45 and 192. The traps were checked weekly for aphids from the early trifoliate stage (early to mid Jul) until field harvest. Collection methods in the peach (Prunus persica (L.) Stokes; Rosales: Rosaceae) orchard are documented in Wallis et al (2005), and also used the water pan traps baited with a green tile. Trapping occurred during 2 yr in 2 orchards in central Pennsylvania.

For both studies, aphids were removed from pan traps and then stored in 70% etha-
TABLE 3. NEW APHID RECORDS FROM PENNSYLVANIA REPORTED IN NAULT ET AL. (2009) AND/OR WALLIS ET AL. (2005), BUT NOT FOUND IN PEPPER (1965).

| Species                                      | Nault et al. | Wallis et al. |
|----------------------------------------------|--------------|---------------|
| Acyrthosiphon kondoi                         |              |               |
| Aphis glycines                               |              |               |
| Aphis lugentis                               |              |               |
| Aphis (Protaphis) middletonii                |              |               |
| Aphis pulchella                              |              |               |
| Nearctaphis clydesmithi                      |              |               |
| Tetraneura nigriabdominalis                  |              |               |

TABLE 4. SPECIES IN SIX SUBFAMILIES OF THE FAMILY APHIDIDAE OCCURRING IN PENNSYLVANIA.

| Subfamily       | Tribe          | Species                                      |
|-----------------|----------------|----------------------------------------------|
| Anoeciinae      | Anoeica corni  | Anoeica cornicola                            |
|                 | Anoeica coriocola | Anoeica oenotherae                          |
|                 | Anoeica setariae Gillette & Palmer                    |
| Hormaphidinae   | Cerataphidini  | Cerataphis lataniae (Boisduval)              |
|                 | Hormaphidini   | Hamamelistes spinosus Shimer                 |
|                 |                | Hormaphis hamamelidis Fitch                  |
| Mindarinae      |                | Mindarus abietinus Koch                      |
| Phyllaphidinae  |                | Phyllaphis fagi (L.)                         |
|                 |                | Stegophylla quercicola (Monell)              |
|                 |                | Stegophylla quercifoliae (Gillette)          |
|                 |                | Stegophylla quercina Quednau                 |
| Pterocommatinae | Fullawaya terricola (Hottes & Frison)                |
|                 | Plocanaphis flocculosa Weed                          |
|                 | Pterocomma bicolor                                    |
|                 | Pterocomma medium Baker                               |
|                 | Pterocomma populifoliae (Fitch)                       |
|                 | Pterocomma smithiae                                   |
| Saltusaphidinae | Saltusaphidini | Iziphya flabella (Sanborn)                   |
|                 |                | Iziphya vittata Richards                     |
|                 |                | Strenaphis elongate (Baker)                   |
|                 |                | Allaphis verrucosa (Gillette)                 |
|                 |                | Subsaltusaphis virginica (Baker)              |
|                 |                | Thripsaphis ballii (Gillette)                 |
| Species | Remarks |
|---------|---------|
| Abstrusomyzus phloxeae (Sampson) | |
| Acruticaua solidaginifoliae (Williams) | |
| Acyrthosiphon kondoi | |
| Acyrthosiphon lactucae (Passerini) | |
| Acyrthosiphon malvae (Mosley) | |
| Acyrthosiphon pisum | |
| Acyrthosiphon pseudodirhodum (Patch) | |
| Amphophora agathonica Hottes | |
| Amphophora amplula Buckton | |
| Amphophora rossi Hottes & Frison | |
| Amphophora rubri | |
| Amphophora sensoriata Mason | |
| Aulacorthum solani | |
| Brachycaudus (Prunaphis) cardui (L.) | |
| Brachycaudus helichrysi (Kaltenbach) | |
| Brachycaudus (Serpulaphis/persicae group | |
| Brachycaudus (Brachycaudina) roxadic (Cockerell) | |
| Brachycaudus (Thuleaphis) runexicolaen (Patch) |
| Brachycaudus (Appelia) schwarzti (Börner) |
| Brachycorynella asparagi (Mordvilko) | |
| Brevoiryne brassicae | |
| Cachyrhapha canadensis Hille Ris Lambers | |
| Cachyrhapha serotinae (Oestlund) | |
| Capitophorus carduinus (Walker) | |
| Capitophorus elaeagni | |
| Capitophorus hippophaes | |
| Carolinaia caricis Wilson | |
| Carolinaia (Galbromyzus) howardii (Wilson) | |
| Carolinaia (Glabromyzus) rhois | |
| Catamergus Kickapoo (Hottes & Frison) | |
| Cavariella aegopodii (Scopoli) | |
| Cavariella cicuta (Koch) | |
| Cavariella hensdoni Knowlton & Smith | |
| Cavariella pastinacae (L.) | |
| Cavariella salicis (Monell) | |
| Cavariella theboldi (Gillette & Bragg) | |
| Ceraphis eriophori (Walker) | |
| Ceraphis viridicornis (Gillette) | |
| Cheatosiphon (Pentatrichopus) fragarfolii (Cockerell) | |
| Cheatosiphon (Pentatrichopus) minor (Forbes) | |
| Cheatosiphon (Pentatrichopus) tetrarhodum (Walker) | |
| Coloradoa Rufomuculata (Wilson) | |
| Cryptomyzus ribis (L.) | |
| Decarosiphon corynothrix Börner | |
| Diuraphis (Holcaphis) holci (Hille Ris Lambers) Dysaphis (Pampaphis) plantagineae | |
| Dyaphis tulipae (Mason) | |
| Ericaphis scammelli (Mason) | |
| Ericaphis wakibae (Hottes) | |
| Hayhurstia atropiciceps | |
| Haydaphis foeniculi | |
| Haydaphis (Siphonophyfris) Collinsiae (Pepper) | |
| Haydaphis eriobryae (Tissot) | |
| Haydaphis mitchellensis Smith | |
| Haydaphis sensoriatus (Mason) | |
| Haydaphis humilis (Walker) | |
| Hyperomyzus lactucae | |
| Hyperomyzus (Neonasonovia) nabali (Oestlund) | |
| Hyperomyzus (Neonasonovia) picridis (Börner & Blunk) | |
| Idiopterus nephrelepidis Davis | |
| Illinoia (Masonaphis) rhokalaza (Tissot & Pepper) | |
| Illinoia (Oestlund) rubricola (Oestlund) | |
| Illinoia spiraeocola (Patch) | |
| Linosiphon sanguinarius (Hottes & Frison) | |
| Liosaphis berberidis (Kaltenbach) | |
| Lipaphis pseudobrassicae | |
| Longicaudus trirhodus (Walker) | |
| Macrosiphoniella abrotanii (Walker) | |
| Macrosiphoniella frigidicola Gillette & Palmer | |
| Macrosiphoniella leucanthemi (Ferrari) | |
| Macrosiphoniella ludoviciana | |
| Macrosiphoniella millefolii (De Geer) | |
| Macrosiphoniella (Phalangomyzus) pennsylvanica (Pepper) | |
| Macrosiphoniella sanborni | |
| Macrosiphoniella subterranea (Koch) | |
| Macrosiphoniella tanacetaria (Kaltenbach) | |
| Macrosiphoniella tanacetaria (Kaltenbach) | |
| Macrosiphoniella tapusae (Hottes & Frison) | |
| Macrosiphum adianti (Oestlund) | |
| Macrosiphum californicum (Clarke) | |
| Macrosiphum (Neocorylum) carpinicolens Patch | |
| Macrosiphum (Neocorylum) coryli Davis | |
| Macrosiphum cystopterus Robinson | |
| Macrosiphum euphorbiae | |
| Macrosiphum gaurae (Williams) | |
| Macrosiphum gei (Koch) | |
| Macrosiphum gerani (Oestlund) | |
| Macrosiphum lili (Monell) | |
| Macrosiphum pellidum (Oestlund) | |
| Macrosiphum (Neocorylum) pseudocoryli | |
| Macrosiphum pteroceltis Patch | |
| Macrosiphum rosae | |
| Macrosiphum tiliae (Monell) | |
| Mastopoda pteridis Oestlund | |
| Metopolophium dirhodum (Walker) | |
| Micropsarus desmodiorum Smith & Tuatay | |
| Micropsarus olivaei Smith & Tuatay | |
| Micropsarus singularis (Hottes & Frison) | |
| Muscaphis music Börner | |
| Myzaphis rosarii (Kaltenbach) | |
| Myzodium modestum (Hottes) | |
| Myzus cerasi (Fabricius) | |
| Myzus formosanus Takahashi | |
| Myzus lythri (Schrank) | |
| Myzus ornatus Liang | |
| Myzus (Nectaraphis) persicae | |
| Nasonovia (Kakima) aquilegiae (Essig) | |
| Nasonovia compositeae (Theobald) | |
| Nasonovia (Kakima) cynosbati (Oestlund) | |
| Nasonovia (Kakima) heucherae (Thomas) | |
| Nasonovia (Annakima) purpurascens (Oestlund) | |
| Nasonovia ribisigni (Mosley) | |
| Neartaphis bakeri | |
| Neartaphis cladydsmithi | |
| Neartaphis cratagefoliae | |
| Neomyzus circumflexus (Buckton) | |
| Neotoxoptera formosana (Takahashi) | |
| Neotoxoptera violae (Pergande) | |
| Ovatus crataegarius | |
In snap bean fields in New York and Pennsylvania, a total of 8,821 aphids were identified, with 7,484 from New York and 1,337 from Pennsylvania. We were unable to identify only 254 (2.8%) of the aphids. Of the aphids captured, those species representing 1% or greater of the total number caught in either state are listed in Table 1 (originally published in Nault et al. 2009) with their abundances. A comprehensive list of all aphid species found in Pennsylvania and New York snap bean fields is shown in Table 2 along with their host associations based on Blackman & Eastop (1994, 2000, and 2006). From this host information we estimated that 61 percent of the species dispersing through snap bean fields in both states were most likely coming in from the surrounding forests as their hosts are woody, not herbaceous species (Fig. 1).

Species accumulations followed asymptotic patterns (Fig. 2). Species richness followed asymptotic patterns (Fig. 1). Species richness followed asymptotic patterns (Fig. 1). Table 2: (Continued) Species in the subfamily Aphidinae, tribe Macrosiphini occurring in Pennsylvania.

| Species Name                        | Host Associations                  |
|------------------------------------|------------------------------------|
| Papulaphis sleesmani (Pepper)      | Herbaceous plants                  |
| Phorodon humuli                     | Herbaceous plants                  |
| Pleotrichophorus ambrosiae Hille Ris Lambers | Herbaceous plants                  |
| Pleotrichophorus asterifolii (Strom) | Herbaceous plants                  |
| Pleotrichophorus glandulosus (Kalchter) | Herbaceous plants                  |
| Pleotrichophorus patonkus (Hottes & Frison) | Herbaceous plants                  |
| Pleotrichophorus wasatchii (Knowlton) | Herbaceous plants                  |
| Pseudacaulella rubida Börner        | Herbaceous plants                  |
| Rhodobium porosum                  | Woody plants                       |
| Rhopalosiphoninus latysiphon       | Woody plants                       |
| Rhopalosiphoninus (Myzus) solani (Thomas) | Woody plants                       |
| Rhopalosiphoninus staphyleae (Koch) | Woody plants                       |
| Rhopalomyzus (Judenkoa) lonicerae (Siebold) | Herbaceous plants                  |
| Rhopalomyzus poae (Gillette)       | Woody plants                       |
| Sitobion avenae                    | Woody plants                       |

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TABLE 6. SPECIES IN THE SUBFAMILY APHIDINAE, TRIBE APHIDINI OCCURRING IN PENNSYLVANIA.

| Species                                      | Subspecies/Species                      | Origin |
|----------------------------------------------|-----------------------------------------|--------|
| Aphis angelicae Lee & Seo                   | Aphis (Protaphis) knowltoni Hottes & Frison |        |
| Aphis asclepiadis Fitch                      | Aphis lugentis                          |        |
| Aphis caliginosa Hottes & Frison            | Aphis maculatae Oestlund                |        |
| Aphis carduella                              | Aphis (Protaphis) middletonii           |        |
| Aphis cephalanthi                            | Aphis nasturtii                         |        |
| Aphis coreopsidis (Thomas)                  | Aphis neilliae Oestlund                 |        |
| Aphis cornifoliae Fitch                     | Aphis nerii Boyer de Fonscolombe        |        |
| Aphis craccivora                             | Aphis (Bursaphis) oenotherae Oestlund   |        |
| Aphis debilicornis Gillette & Palmer        | Aphis oenotherae sanborni               |        |
| Aphis decepta Hottes & Frison               | Aphis oestlundi                         |        |
| Aphis fabae                                  | Aphis pawneepae Hottes                  |        |
| Aphis farinosa Gmelin                        | Aphis poni                              |        |
| Aphis feminea Hottes                         | Aphis pulchella                         |        |
| Aphis folsomii Davis                         | Aphis rubicola Oestlund                 |        |
| Aphis forbesi Weed                           | Aphis rubifodi                         |        |
| Aphis frangulae Kaltenbach                  | Aphis rumicis                          |        |
| Aphis gerardiae (Thomas)                    | Aphis sambuci (L.)                     |        |
| Aphis glycines                               | Aphis spiraecola                       |        |
| Aphis gossypii                               | Aphis spiraephiha Patch                 |        |
| Aphis hamamelidis Pepper                     | Aphis (Bursaphis) varians Patch         |        |
| Aphis hederae                                | Aphis vernoniae Thomas                  |        |
| Aphis illinoisensis Shimer                   | Aphis viburniphila                      |        |
| Aphis impatientis Thomas                     |                                        |        |

Hyalopterus pruni
Hysteroneura setariae
Pseudasiphonaphis corni (Tissot)
Rhopalosiphum cerasifoliumae (Fitch)
Rhopalosiphum enigma Hottes & Frison
Rhopalosiphum maidis
Rhopalosiphum musae (Schouteden)
Rhopalosiphum nigrum Richards
Rhopalosiphum nymphaeae
Rhopalosiphum oxyacanthae
Rhopalosiphum padi
Rhopalosiphum parvae Hottes & Frison
Rhopalosiphum rufulabdominale
Rhopalosiphum sanguinarium McVicar Baker
Sanbornia juniper Pangende ex Baker
Schizaphis graminum
Schizaphis nigra (Baker)
| Tribe            | Species                                                                 |
|-----------------|------------------------------------------------------------------------|
| Calaphidini     | Betulaphis quadrituberculata (Kaltenbach)                              |
|                 | Calaphis alni Baker                                                    |
|                 | Calaphis betulecolaens (Fitch)                                         |
|                 | Calaphis betulella Walsh                                               |
|                 | Calaphis leonardi Quednau                                              |
| Panaphidini     | Chromaphis juglandicola (Kaltenbach)                                   |
|                 | Eucallipterus tiliae (L.)                                              |
|                 | Hoplochaitophorus heterotrichus Quednau                                |
|                 | Hoplochaitophorus quercicola (Monell)                                  |
|                 | Lachnochaitophorus obscurus (Tissot)                                   |
|                 | Melanocallis caryaefoliae (Davis)                                      |
|                 | Monellia caryella                                                      |
|                 | Monellia hispida Quednau                                               |
|                 | Monellia microsetosa Richards                                           |
|                 | Monelliopticus bisselli Quednau                                         |
|                 | Monelliopticus caryae (Monell)                                         |
|                 | Monelliopticus nigropunctata (Granovksy)                                |
|                 | Myzocallis alhambra Davidson                                            |
|                 | Myzocallis (Neomyzocallis) asclepiadis (Monell)                        |
|                 | Myzocallis (Neomyzocallis) punctata (Monell)                           |
|                 | Myzocallis (Neomyzocallis) spinoa Boudreaux & Tissot                   |
|                 | Myzocallis (Neomyzocallis) tuberculata Richards                         |
|                 | Myzocallis (Neomyzocallis) walshii (Monell)                            |
|                 | Myzocallis (Agrioaphis) castanicola Baker                              |
|                 | Myzocallis coryli (Goetze)                                             |
|                 | Myzocallis (Lineomyzocallis) discolor (Monell)                         |
|                 | Myzocallis (Lineomyzocallis) exultans Boudreaux & Tissot               |
|                 | Myzocallis (Lineomyzocallis) frisoni Boudreaux & Tissot               |
|                 | Myzocallis (Lineomyzocallis) granovksyi Boudreaux & Tissot             |
|                 | Myzocallis (Lineomyzocallis) longiiunguis Boudreaux & Tissot           |
|                 | Myzocallis (Lineomyzocallis) melanocera Boudreaux & Tissot             |
|                 | Myzocallis (Lineomyzocallis) multisetis Boudreaux & Tissot             |
|                 | Myzocallis (Lineomyzocallis) punctata (Monell)                         |
|                 | Myzocallis (Lineomyzocallis) spinosa Boudreaux & Tissot                |
|                 | Myzocallis (Lineomyzocallis) asclepiadis (Monell)                      |
|                 | Myzocallis (Neomyzocallis) punctata (Monell)                           |
|                 | Myzocallis (Neomyzocallis) spinoa Boudreaux & Tissot                   |
|                 | Myzocallis (Neomyzocallis) tuberculata Richards                         |

**TABLE 7. SPECIES IN THE SUBFAMILY CALAPHIDINAE OCCURRING IN PENNSYLVANIA.**

| Tribe            | Species                                                                 |
|-----------------|------------------------------------------------------------------------|
| Calaphidini     | Calaphis (Cepegillettea) myricae (Patch)                               |
|                 | Callipterinella calliptera (Hartig)                                    |
|                 | Euceraphis betulae Koch                                               |
|                 | Euceraphis gilletti Davidson                                           |
|                 | Euceraphis lineata Baker                                              |
| Panaphidini     | Chromaphis juglandicola (Kaltenbach)                                   |
|                 | Myzocallis (Lineomyzocallis) bella (Walsh)                             |
|                 | Myzocallis (Lineomyzocallis) castaneae (Fitch)                         |
|                 | Myzocallis (Agrioaphis) castanicola Baker                             |
|                 | Myzocallis coryli (Goetze)                                             |
|                 | Myzocallis (Lineomyzocallis) discolor (Monell)                         |
|                 | Myzocallis (Lineomyzocallis) exultans Boudreaux & Tissot               |
|                 | Myzocallis (Lineomyzocallis) frisoni Boudreaux & Tissot               |
|                 | Myzocallis (Lineomyzocallis) granovksyi Boudreaux & Tissot             |
|                 | Myzocallis (Lineomyzocallis) longiiunguis Boudreaux & Tissot           |
|                 | Myzocallis (Lineomyzocallis) melanocera Boudreaux & Tissot             |
|                 | Myzocallis (Lineomyzocallis) multisetis Boudreaux & Tissot             |
|                 | Myzocallis (Neomyzocallis) punctata (Monell)                           |
|                 | Myzocallis (Neomyzocallis) spinoa Boudreaux & Tissot                   |
|                 | Myzocallis (Neomyzocallis) asclepiadis (Monell)                        |
|                 | Myzocallis (Neomyzocallis) tuberculata Richards                         |

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individuals (Figs. 2 and 3, at 1,250 individuals there would be 45 species sampled in Pennsylvania and 50 in New York). Based on the historical collections reported by Pepper, there are approximately 350 aphid species in Pennsylvania. Historical reports in Leonard (1963) suggest that there are approximately 430 aphid species in New York.

Combining the list of aphids collected from snap bean fields, peach orchards and those published by J. O. Pepper in 1965, we developed a new, more comprehensive list of the aphids present in Pennsylvania. We found 7 species present in our collections that were not present in the slide collection housed in the Frost Entomological Museum (University Park, Pennsylvania) or published in Pepper (1965) (Table 3). One of these aphids, *Aphis glycines* Matsumura, was introduced to the US around the turn of the 21st century and is now widespread throughout the Midwest, Northeast and southeastern Canada (Ragsdale et al. 2011).

**DISCUSSION**

Our passive trapping in snap bean fields alone yielded a surprisingly high percentage of the species present throughout Pennsylvania and New York (~14% and ~18% respectively). Our sampling method concentrated on only one habitat (commercial snap bean fields), but did intercept aphids moving from the surrounding forests and hedgerows. The high degree of landscape heterogeneity and crop diversity in the trapping areas includes plant species that serve as hosts for many of the aphid species that represented less than 1% of the total capture (Pfleeger et al. 2006). These aphids were captured in very small numbers (mostly singletons), and are not important contributors to the plant virus epidemics reported by Wallis et al. (2005) and Nault et al. (2009).

Of the aphids we captured, 2 species were especially notable; *Therioaphis trifolii* Monell, which comprised 31.8% of the identified aphids, and *A. glycines* which represented 18.2% of the identified aphids. Both of these aphids were

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**Table 8. Species in the subfamily Chaitophorinae occurring in Pennsylvania.**

| Tribe            | Species                                      |
|------------------|----------------------------------------------|
| Chaitophorini    | Chaitophorus longipesi                      |
|                  | Chaitophorus nigricentrus Richards           |
|                  | Chaitophorus populicola Thomas               |
|                  | Siphina elegans del Guercio                  |
|                  | Sipha flavus                                 |
| Chaitophorinae   | Chaitophorus nigricentrus Richards           |
|                  | Chaitophorus populicola Thomas               |
|                  | Chaitophorus populifolia Hottes & Frison    |
| Siphini          | Sipha glyceriae                              |

**Table 9. Species in the subfamily Drepanosiphinae occurring in Pennsylvania.**

| Drepanaphis      | Drepanaphis nigricans | Drepanaphis spicata Smith |
|------------------|-----------------------|--------------------------|
| acerifoliae      | carolinensis          | carolinensis platanoidis |
| Drepanaphis      | parva Smith           | Shenahweum minutum (Davis) |
| carolinensis     | D. parva Smith        | Sh. minutum (Davis)      |
| monelli Davis    | D. monelli Davis      | Sh. minutum (Davis)      |

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### TABLE 10. SPECIES IN THE SUBFAMILY ERIOSOMATINAE OCCURRING IN PENNSYLVANIA.

| Tribe       | Species                                      | Species                                      |
|-------------|----------------------------------------------|----------------------------------------------|
| Eriosomatini| Colopha graminis (Monell)                    | Eriosoma lanigerum                          |
|             | Colopha ulmicola (Fitch)                     | Eriosoma (Mimaphidus) lanuginosum (Hartig)   |
|             | Eriosoma americanum (Riley)                  | Eriosoma mimicum                          |
|             | Eriosoma crataegi (Oestlund)                 | Eriosoma rileyi                            |
|             | Remaudière                                   | Tetraneura nigriabdominalis                 |
|             | Colopha ulmicola (Fitch)                     | Tetraneura ulmi (L.)                        |
|             | Eriosoma graminis (Monell)                   |                                              |
|             | Eriosoma (Mimaphidus) lanuginosum (Hartig)   |                                              |
|             | Tetraneura nigriabdominalis                  |                                              |
|             | Tetraneura ulmi (L.)                         |                                              |

| Tribe       | Species                                      |
|-------------|----------------------------------------------|
| Fordini     | Forda marginata Koch                         |
|             | Geoica ultricularia group                    |
|             | Melaphis rhois                               |
|             | Smynthurodes betae Westwood                  |

| Tribe       | Species                                      |
|-------------|----------------------------------------------|
| Pemphigini  | Gryllacryptophilus imbricator (Fitch)        |
|             | Pemphigus populittransversus                 |
|             | Prociphilus longianus Smith                  |
|             | Procephilus (Palvius) provosceus (Sanborn)   |
|             | Thecabius affinis (Kaltenbach)               |
|             | Thecabius (Parathacubius) gravicornis (Patch) |
|             | Prociphilus (Paracoeceus) tessellatus (Fitch) |
|             | Thecabius (Parathacubius) gravicornis (Patch) |

### TABLE 11. SPECIES IN THE SUBFAMILY LACHNINAE OCCURRING IN PENNSYLVANIA.

| Tribe       | Species                                      |
|-------------|----------------------------------------------|
| Eulachnini  | Cinara atlantica                             |
|             | Cinara juniperivora (Wilson)                 |
|             | Cinara taedae Tissot                         |
|             | Cinara banksiana Pepper & Tissot             |
|             | Cinara laricifex (Fitch)                     |
|             | Cinara laricis (Hartig)                      |
|             | Cinara watsoni Tissot                        |
|             | Cinara canatra Hottes & Bradley              |
|             | Cinara larcis (Hartig)                       |
|             | Essigella pini                               |
|             | Cinara costata (Zetterstedt)                 |
|             | Cinara pilicornis (Hartig)                   |
|             | Eulachnus agilis (Kaltenbach)                |
|             | Cinara (Cupressobium) cupressi (Buckton)     |
|             | Cinara pinea (Mordvilko)                     |
|             | Eulachnus americus Takahashi                 |
|             | Cinara forncula Hottes                      |
|             | Cinara pinea (Mordvilko)                     |
|             | Eulachnus rileyi                             |
|             | Cinara gracilis (Wilson)                     |
|             | Cinara puinosa (Hartig)                      |
|             | Schizolachnus parvus (Wilson)                |
|             | Cinara harmonia Hottes                      |
|             | Cinara spiculosa Bradley                     |
|             | Schizolachnus piniradiatae (Davidson)        |
|             | Cinara juniperi De Geer                     |
|             | Cinara strobe Fitch                          |

| Tribe       | Species                                      |
|-------------|----------------------------------------------|
| Lachnini    | Lachnus allegheniensis McCook                |
|             | Tuberolachnus salignus (Gmelin)              |
|             | Longistigma caryae (Harris)                  |

| Tribe       | Species                                      |
|-------------|----------------------------------------------|
| Tramini     | Trama rara Mordvilko                         |
### TABLE 1. ALATE APHID SPECIES REPRESENTING > 1 % OF THE CAPTURE FROM WATER PAN TRAPS IN COMMERCIAL SNAP BEAN FIELDS IN PENNSYLVANIA (2004–2006) AND NEW YORK (2002–2006). DERIVED FROM TABLE 1 IN NAULT ET AL. (2009).

| Species                        | New York |          | Pennsylvania |          | Overall |          |
|-------------------------------|----------|----------|--------------|----------|---------|----------|
|                               | Total    | Percent of Total | Total     | Percent of Total | Total    | Percent of Total |
| Therioaphis trifolii (Monell) | 2,274    | 30.4     | 535         | 40.0     | 2,809   | 31.8     |
| Aphis glycines Matsumura      | 1,475    | 19.7     | 131         | 9.8      | 1,606   | 18.2     |
| Acyrthosiphon pisum (Harris)   | 1,106    | 14.8     | 28          | 2.1      | 1,134   | 12.9     |
| Rhopalosiphum maidis (Fitch)   | 685      | 9.2      | 75          | 5.6      | 760     | 8.6      |
| Pemphigus populicaulis Fitch   | 239      | 3.2      | 0           | 0.0      | 239     | 2.7      |
| Aphis craccivora Koch         | 179      | 2.4      | 123         | 9.2      | 302     | 3.4      |
| Aphis gossypii Glover         | 130      | 1.7      | 201         | 15.0     | 331     | 3.8      |
| Hayhurstia atriplicis (L.)    | 128      | 1.7      | 1           | 0.1      | 129     | 1.5      |
| Lipaphis pseudobrassicae (Davis)* | 128  | 1.7      | 0           | 0.0      | 128     | 1.5      |
| Myzus persicae (Sulzer)       | 97       | 1.3      | 26          | 1.9      | 123     | 1.4      |
| Capitophorus eleagni (Del Guerica) | 79    | 1.1      | 7           | 0.5      | 86      | 1.0      |
| Aphis sp.                     | 77       | 1.0      | 0           | 0.0      | 77      | 0.9      |
| Rhopalosiphum padi (L.)       | 77       | 1.0      | 45          | 3.4      | 122     | 1.4      |
| Aphis fabae Scopoli           | 15       | 0.2      | 14          | 1.0      | 29      | 0.3      |
| Anoea sp.                     | 1        | <0.1     | 14          | 1.0      | 15      | 0.2      |
| Brachychaeta persicae (Passerini) | 2       | <0.1     | 15          | 1.1      | 17      | 0.2      |
| Unknown                       | 216      | 2.9      | 38          | 2.8      | 254     | 2.9      |
| Others                        | 576      | 7.7      | 84          | 6.3      | 660     | 7.5      |
| Total                         | 7,484    | 100.0    | 1,337       | 100.0    | 8,821   | 100.0    |

*Published in Nault et al (2009) as Lipaphis erysimi (Kaltenbach).*
| Aphid Species                   | Crop Sampled | Snap bean | Peach | Primary Host for Aphid                        | Secondary Host for Aphid | Source |
|--------------------------------|--------------|-----------|-------|-----------------------------------------------|--------------------------|--------|
| Acyrthosiphon kondoi Shinji    |              | PA • NY   | •     | Leguminosae, Trifolae, Loteae                 |                          | AWC    |
| Acyrthosiphon pisum Harris     |              | PA • NY   | •     | Leguminosae, Genistae, Trifolae, Fabae,       | Hedysareae               | AWC    |
| Amorphophora rubi Kaltenbach  |              | PA • NY   | •     | Rubus spp.                                    |                          | HPS    |
| Anoechia corni (Fabricius)     |              | PA •     | •     | Cornus sanguinea                              | Gramineae                | AWT    |
| Anoechia cornicola (Walsh)     |              | •        |       | Cornus spp.                                   |                          | AWT    |
| Anoechia oenotherae Wilson     |              | •        | •     | Cornus spp.                                   | Oenothera biennis        | AWT    |
| Aphis carduella Walsh          |              | •        | •     | Cornus stolonifera                            | Umbelliferae            | AWT    |
| Aphis cephalanthi Thomas       |              | •        |       | Cephalanthus occidentalis                     |                          | HPS    |
| Aphis craccivora Koch          |              | •        |       | polyphagous, Leguminosae                      |                          | AWC    |
| Aphis fabae Scopolii           |              | •        | •     | Euonymous europaeus, Viburnum opulus         | polyphagous              | AWC    |
| Aphis forbesi Weed             |              | •        | •     | Fragaria spp.                                 |                          | HPS    |
| Aphis glycines Matsumura       |              | •        | •     | Rhamnus spp.                                  | Glycine max              | AWC    |
| Aphis gossypii Glover          |              | • •      | •     | Catalpa, Hibiscus, Celastrus, Rhamnus, Punica | polyphagous, cotton, cucurbits all | AWC |
| Aphis hederae Kaltenbach       |              | •        |       | Hedera helix, Araliaceae, Cuscuta             |                          | HPS    |
| Aphis lugensitus Williams      |              | •        | •     | Senecio spp., Erigeron sp.                    |                          | HPS    |
| Aphis (Protaphis) middletonii Thomas |          | •      |       | Compositae, Cruciferae, Umbelliferae, Gramineae |                        | AWC    |
| Aphis nasturtii Kaltenbach     |              | •        |       | Rhamnus cathartica, R. alnifolia              | wide range               | HPS    |
| Aphis oestlundi Gillette       |              | •        |       | Oenothera biennis                             |                          | HPS    |
| Aphis pomi DeGeer              |              | •        |       | Pyroidea                                      |                          | AWC    |
| Aphis pulchella Hottes & Frison|              | •        | •     | Euphorbia                                     |                          | HPS    |
| Aphis rubifolii (Thomas)       |              | •        | •     | Rubus spp.                                    |                          | HPS    |
| Aphis rumicis L.               |              | •        | •     | Rumex spp., Rheum spp.                       |                          | HPS    |
| Aphis spiraeola Patch          |              | •        | •     | Citrus, Spiraea spp., polyphagous             |                          | AWC    |
| Aphis viburniphila Patch       |              | • •      | •     | Viburnum spp.                                 |                          | HPS    |
| Aulacorthum solani (Kaltenbach)|              | •        | •     | Polyphagous                                   |                          | HPS    |
| Brachycaudus (Scrophulaphis) persicae group |          | • •      | •     | Prunus persica, P. armeniaca                  | Scrophulariaceae         | AWT    |
| Brevicoryne brassicae (L.)     |              | •        | •     | Crucefera                                     |                          | AWC    |
| Capitophorus elaeagni (del Guercio) |          | • •      | •     | Elaeagnus spp.                                | tubuliferous Compositae | AWT    |
| Capitophorus hippophaes (Walker)|              | • •      | •     | Elaeagnaceae                                  | Polygonum spp., Persicaria spp. | AWT    |
| Aphid Species                      | Crop Sampled | Primary Host for Aphid                                      | Secondary Host for Aphid | Source |
|-----------------------------------|--------------|-------------------------------------------------------------|--------------------------|--------|
| Carolinaia (Glabromyzus) rhois (Monell) | PA NY PA     | Rhus glabra, R. typhina                                     | Gramineae                | AWC    |
| Chaitophorus populifolii Essig    |              | Populus spp.                                                | AWT                      |        |
| Cinara atlantica (Wilson)         |              | Pinus spp.                                                  | AWT                      |        |
| Drepanaphis acerifoliae (Thomas)  |              | Acer saccharinum, A. rubrum, A. saccharum                    | AWT                      |        |
| Drepanaphis carolinensis Smith    |              | Acer saccharum, A. rubrum                                   | AWT                      |        |
| Drepanaphis nigricans Smith       |              | Acer rubrum                                                 | AWT                      |        |
| Drepanaphis sabriniae Miller      |              | Acer saccharum                                              | AWT                      |        |
| Drepanosiphum platanoidis (Schrank) |              | Acer pseudoplatanus, Acer spp., sycamore                    | AWT                      |        |
| Dysaphis (Pomaphis) plantaginea (Passerini) |              | Malus spp., Pyrus                                           | Plantago spp.            | AWT    |
| Dysaphis tulipae (Boyer de Fonscolombe) |              | many monocots                                               | AWC                      |        |
| Eriosoma lanigerum (Hausmann)     |              | Pyroidea, apple, Crataegus, Coloneaster                     | AWC                      |        |
| Essigella pini (Wilson)            |              | Pinus spp.                                                  | AWT                      |        |
| Eulachnus rileyi (Williams)       |              | Pinus spp.                                                  | AWT                      |        |
| Geoica squamosa Hart              |              |                                                             |                          |        |
| Hayhurstia atriplicis (L.)        |              | Chenopodiaceae, Atriplex, Chenopodium spp.                   | HPS                      |        |
| Hyadaphis foeniculi (Passerini)   |              | Lonicera spp.                                               | Umbelliferae spp.        | AWC    |
| Hyaloctopus pruni (Geoffroy)       |              | Prunus domestica, P. armeniaca                              | Phragmites communis, Arundo donax | AWC    |
| Hyperomyzus lactuea (L.)          |              | Ribes spp.                                                  | Sonchus spp.             | AWC    |
| Hysteroneura setariae (Thomas)    |              | Prunus domestica                                            | Gramineae                | AWC    |
| Illinoia lirodendri (Monell)       |              | Liriodendron tulipifera                                     | AWT                      |        |
| Kaltenbachiella ulmifusa (Walsh & Riley) |              | Ulmus rubra                                                | Labiatae                 | AWT    |
| Lipaphis pseudobrassicae (Davis)   |              | Cruceferae                                                  | AWC                      |        |
| Macrosiphoniella ludoviciana (Oestlund) |              | Artemisia ludoviciana, A. vulgaris                          | HPS                      |        |
| Macrosiphoniella sanborni (Gillette) |              | Dendranthema indicum, morifolium, frutescens, Compositae    | AWC                      |        |
| Macrosiphum euphorbiæ (Thomas)    |              | Rosa spp.                                                   | highly polyphagous, Solanaceae | AWC    |
| Macrosiphum pallidum (Oestlund)    |              | Rosaceae, Rosa spp.                                         | AWC                      |        |
TABLE 2. (CONTINUED) 2 Species of alate aphids with host associations, collected from water pan traps in commercial snap bean fields in Pennsylvania (2004–2006) and NY (2002–2006), and from similar traps in peach orchards in central Pennsylvania (2003–2004, Wallis et al. 2005). Primary and secondary host plant associations for North America taken from Blackman & Eastop (1994 [AWT], 2000 [AWC], and 2006 [HPS]).

| Aphid Species | Crop Sampled | Primary Host for Aphid | Secondary Host for Aphid | Source |
|---------------|--------------|------------------------|--------------------------|--------|
|               | Snap bean PA |                       |                          |        |
| Macrosiphum (Neocorylobium) pseudocoryli (Patch) | * | Ostrya virginiana, Corylus spp. | AWT |
| Macrosiphum rosae (L.) | * | Rosa spp. | AWC |
| Melaphis rhois (Fitch) | * | Rhus spp. (glabra, typhina) | AWT |
| Monellia caryella (Fitch) | * | Coryla spp. | AWC |
| Myzus (Nectarosiphon) persicae (Sulzer) | * | Prunus persica, Prunus spp. | AWC |
| Myzocallis sp. | * | Fabaceae | AWT |
| Nearttaphis bakeri (Cowen) | * | Crataegus, Cydonia, Malus, Pyrus | Leguminosae | AWC |
| Nearttaphis clydesmithi Hille Ris Lambers | * | Crataegus | unknown | AWT |
| Nearttaphis crataegifoliae (Fitch) | * | Crataegus spp | Trifolium spp. | AWC |
| Ovatus crataegarus (Walker) | * | Crataegus spp | Labiatae esp Mentha | AWT |
| Pemphigus populicaulis Fitch | * | Populus deltoides, P. tremuloides | unknown | AWT |
| Pemphigus populitransversus Riley | * | Populus spp. | Cruciferae | AWC |
| Pemphigus populivenae Fitch | * | Populus spp. | Chenopodiaceae | AWT |
| Periphyllus americanus Baker | * | Acer spp. | AWT |
| Periphyllus testudinaceus (Ferni) | * | Acer spp., Aesculus spp. | AWT |
| Phorodon humuli (Schrank) | * | Prunus spp. | Humulus lupulus (hops) | AWC |
| Prociphilus (Meliarhizophagus) fraxinifolii (Riley) | * | Fraxinus spp. | AWT |
| Pterocomma bicolor (Oestlund) | * | Populus spp., Salix spp. | AWT |
| Pterocomma smithiae (Monell) | * | Populus spp., Salix spp. | AWT |
| Rhodobium porosum (Sanderson) | * | Lonicerha alpigena | grasses | AWC |
| Rhopalomyzus poae (Gillette) | * | bulbs (Tulipa, Gladiolus), runners | Gramineae | AWC |
| Rhopalosiphoninus latysiphon (Davidson) | * | Gramineae | AWC |
| Rhopalosiphum maidis (Fitch) | * | Prunus spp. | water plants | AWC |
| Rhopalosiphum nymphaeae (L.) | * | Alus, Pyrus, Cotoneaster, Crataegus, Sorbus | grasses | AWC |
| Rhopalosiphum oxyacanthae (Schrank) | * | Prunus virginiana | Gramineae | AWC |
| Rhopalosiphum padi (L.) | * | Prunus spp. | Gramineae, Cyperaceae, Solanaceae | AWC |
| Rhopalosiphum rufiabdominale (Sasaki) | * | Prunus spp. | Gramineae | AWC |
| Schizaphis graminum (Rondani) | * | Gramineae | AWC |
| Sipha flava (Forbes) | * | Gramineae | AWC |
TABLE 2. (CONTINUED) 3 SPECIES OF ALATE APHIDS WITH HOST ASSOCIATIONS, COLLECTED FROM WATER PAN TRAPS IN COMMERCIAL SNAP BEAN FIELDS IN PENNSYLVANIA (2004–2006) AND NY (2002–2006), AND FROM SIMILAR TRAPS IN PEACH ORCHARDS IN CENTRAL PENNSYLVANIA (2003–2004, WALLIS ET AL. 2005). PRIMARY AND SECONDARY HOST PLANT ASSOCIATIONS FOR NORTH AMERICA TAKEN FROM BLACKMAN & EASTOP (1994 [AWT], 2000 [AWC], AND 2006 [HPS]).

| Aphid Species                              | Crop Sampled | PA | NY | PA | Primary Host for Aphid | Secondary Host for Aphid | Source |
|--------------------------------------------|--------------|----|----|----|------------------------|--------------------------|--------|
| *Sitobion avenae* (Fabricius)              |              | •  | •  |    | Gramineae              |                         | AWC    |
| *Tetraneura nigriabdominalis* (Sasaki)     |              | •  | •  |    | *Ulmus* spp.           |                         | AWC    |
| *Therioaphis* (*Rhizoberlesia*) *riei* (Börner) |              | •  |    |    | *Melilotus* spp.       |                         | HPS    |
| *Therioaphis* (*Pterocallidium*) *trifolii* (Monell) |              | •  | •  |    | *Leguminoseae*         |                         | AWC    |
| *Uroleucon* (*Lambersius*) *anomalae* (Hottes & Frison) |              | •  |    |    | *Aster* *novaeangliae* |                         | HPS    |
| *Uroleucon* *pseudambrosiae* (Olive)       |              | •  |    |    | *Compositae, Lactua* *spp.* |                         | HPS    |
| *Utamphorophora* *crataegi* (Monell)       |              | •  |    |    | *Crataegus* *spp.*     |                         | AWT    |
| *Vesiculaphis* *caricis* (Fullaway)        |              | •  |    |    | *Rhododendron* *spp.*  |                         | HPS    |
introduced to North America (A. glycines from Asia and T. trifolii from Europe) and were quite destructive to crops immediately after their introduction (in soybean and alfalfa, respectively). Aphis glycines continues to cause significant economic damage in soybean (Ragsdale et al. 2011). While not known to colonize Phaseolus spp., both species are competent vectors of the legume strain of CMV (Gildow et al. 2008).

The intermittent appearance of CMV in central Pennsylvania snap bean crops could be influenced by a unique agricultural landscape. Agricultural fields are located in valleys bordered by the low, but steep, forested ridges of the Appalachian Mountains. The ridge and valley system might be acting like a barrier, keeping CMV out for most of the season. We did not search for a CMV reservoir outside of testing a few alfalfa fields, which were also negative for CMV. It is possible, that much like our A. glycines population, legume strains of CMV may be transient. If this is the case, migrating aphids may be scrubbed of virions when they land in one of the many bordering forests containing many non-host plants.

The Pepper (1965) aphid list in addition to the Pepper slide collection allowed us to compile a comprehensive list of the aphids present in Pennsylvania, but the nomenclature was in need of updating. Our efforts to update the nomenclature, and incorporate our more recent sampling efforts, resulted in a modern list of aphids of Pennsylvania that includes recently introduced species.

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