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Northern-Most North American Flower Visitation Records of the Introduced Flower Fly, *Syritta Flaviventris* (Diptera: Syrphidae) and Comparisons With Sympatric Species, *Syritta Pipiens*

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Northern-Most North American Flower Visitation Records of the Introduced Flower Fly, *Syritta flaviventris* (Diptera: Syrphidae) and Comparisons With Sympatric Species, *Syritta pipiens*

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Abstract

We report for the first time the syrphid fly, *Syritta flaviventris* (Macquart), collected in Lancaster County, Pennsylvania, as the northern-most record for this introduced Mediterranean species. In total, 3 male specimens and 1 female specimen were net collected on three flower species (*Verbena hastata, Eryngium yuccifolium* and *Asclepias incarnata*), at a single site of 11 monitored farm sites in southern Pennsylvania. Floral records for the similar introduced sibling species, *Syritta pipiens* (L.), are presented as well. Passive monitoring with colored pan traps used to monitor bee populations at these sites was not effective in collecting either species of *Syritta*. Our study suggests that increased active net sampling of *Syritta* species may provide more information about this genus' distribution in the New World and support future research efforts examining *Syritta* biology and life history.

The flower fly, *Syritta flaviventris* Macquart (Diptera: Syrphidae), has a cosmopolitan distribution (Perez-Banon and Marcos-Garcia 2000, Lyneborg and Barkemeyer 2005). Its Old World distribution ranges from the northern Mediterranean (Spain to Turkey) and south throughout Africa (Thompson et al. 1990). It is also found in the South Atlantic on the island of Saint Helena midway between Africa and South America. Its first New World discovery was in Brazil in 1954, and soon after it was found in both Chile and Argentina (Thompson 1972). Thompson et al. (1990) reported the movement of *S. flaviventris* from Mexico to Texas, and additional unofficial records place it in Florida and California, (http://bugguide.net/node/view/124554) Virginia, Georgia, Mississippi, and Kansas (http://eol.org/pages/752308/maps). Here we report the northernmost U.S. records for *S. flaviventris* in Lancaster Co., Pennsylvania USA with specimens found in 2012-2013.

There are 23 known *Syritta* species worldwide, but little is known of their basic biology and life history. The best studied species, *S. pipiens* has been anthropogenically spread throughout the Palearctic, Nearctic and Oriental regions (Perez-Banon and Marcos-Garcia 2000, Lyneborg and Barkemeyer 2005) and, until recently, was the only species with described immature stages and life history. Available information indicates that these hover flies are not aphid feeders as are many other species in this family, but are saprophagous and occur in various types of decaying plant and animal matter as well as manure, but not in aquatic environments (Thompson et al. 1990, Perez-Banon and Marcos-Garcia 2000). Perez-Banon and Marcos-Garcia (2000) were the first to describe the larvae and pupal stages of *S. flaviventris* and found them feeding on decaying vegetation of the prickly pear cacti (*Opuntia maxima* Miller) alongside the more numerous *S. pipiens*.

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Materials and Methods

Samples were collected from floral provisioning strips that were being evaluated for the conservation and supplementation of pollinators and other beneficial insects important in tree fruit production in Lancaster County, Pennsylvania. In total, 11 such floral provisioning sites were evaluated weekly throughout the season by passive pan traps and active net collections from plants in bloom starting in 2009. Net collections of 30 minutes duration were made at each site during the biweekly visits and host associations were recorded. Additionally, 8 commercial apple orchards were monitored with the same type of pan traps from 2007-2013. Trapping was performed weekly from pre-bloom (March) until the end of the growing season (mid-October). Weather forecasts were used to place traps when the weather was favorable for pollinator foraging. A pan trap station was comprised of a triangular, unpainted plywood platform that held three 355 mL plastic bowls recessed into holes; one canary yellow, one white, and one dark blue (Solo®, Lake Forest, Illinois, USA) to attract arthropod species with different color preferences. Edges of the pans were within 5 cm of each other. Bowls were filled with unscented, water-detergent solution (blue Dawn® dish soap; Procter and Gamble, Cincinnati, Ohio, USA) and placed in the orchard between 900 hr and 1200 hr then collected 24 hours later to encompass a full bee flight day. In each orchard, five pan trap stations were placed in a transect running parallel to apple rows at increasing distances from the edge of the forested patch adjacent to the orchard. Trap stations ranged from 0-200 m from the forest-orchard interface, and each transect was replicated for a total of 10 pan trap stations per orchard.

Syritta pipiens and *S. flaviventris* adults are very similar in overall appearance and size, but can be distinguished by several characteristics as described in a key by Thompson et al. (1990). The easiest characters to differentiate the two species are the silvery white pillinose face, lack of a spurious vein in the wing, and a strong basioposterior ventral spur/tubercle on the male hind femur of *S. flaviventris* versus a golden pillinose face, spurious vein present, and lack of a tubercle on the male hind femur of *S. pipiens* (Figs. 1-3). Additionally, the dorsal 2nd and 3rd abdominal segments of *S. flaviventris* have more extensive orange areas than those of *S. pipiens* (Fig. 1).

Syrphid specimens collected from pan traps were stored in vials with 70% ethanol until pinned and labeled. Syrphids were identified to species by D. Biddinger (Penn State University Department of Entomology) based on voucher specimens identified by Chris Thompson (Smithsonian Collection) and using the keys in Vockeroth (1992) and Miranda et al. (2013). Specimens of *S. flaviventris* were confirmed as new state records by L. Donovall (Pennsylvania Department of Agriculture). Voucher specimens reside at the Penn State Fruit Research and Extension Center, Biglerville, PA and the Penn State Frost Entomological museum, State College, PA.

Results

Out of a total of 4,475 syrphids collected during this study, *Syritta* sp. were relatively rare and consisted of only 20 specimens of both *S. flaviventris* and *S. pipiens* species. Only 4 specimens of *S. flaviventris* were net collected during this period and only from the Lancaster County pollinator garden site: 2 males collected in 2012 on 10 and 21 July, and 1 male and 1 female on 9 and 16 July 2013. Two males were collected from *Verbena hastata* L. (blue vervain), and a single male was collected from *Eryngium yuccifolium* Michx. (rattlesnake master) and the single female was collected from *Asclepias incarnata* L. (swamp milkweed flowers). Of the 16 *S. pipiens* specimens (5 male, 11 female), only a single male specimen was collected from apple orchards and in a white pan trap on 8 October 2009. The remaining specimens were all net collected

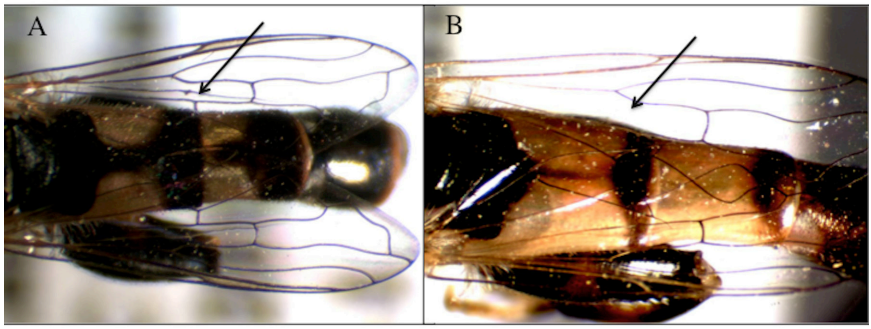

Figure 1. (A) *S. pipiens* spurious vein present and 2nd & 3rd abdominal segments with less orange dorsally, (B) *S. flaviventris* lack of spurious vein and more orange on 2nd and 3rd abdominal segments.

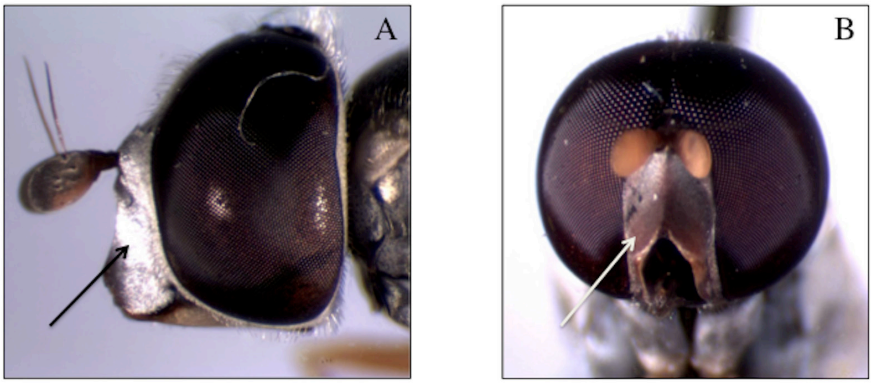

Figure 2. (A) *S. flaviventris* silver pillinose face, (B) *S. pipiens* golden pillinose face

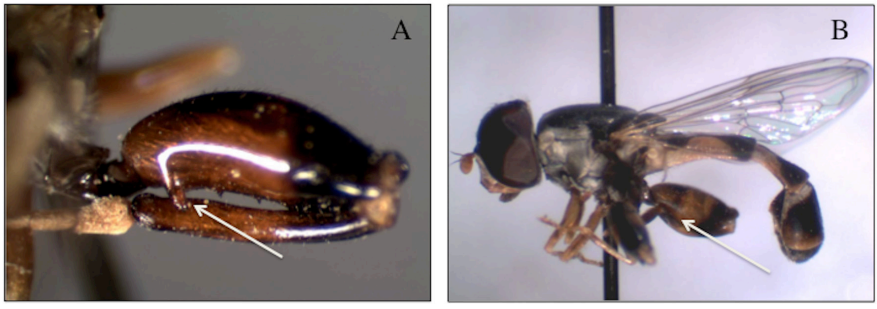

Figure 3. (A) *S. flaviventris* tubercle on male hind femur, (B) *S. pipiens* male without

from flowers in the floral provision strips (5 individuals) and the garden plot in Lancaster County (9 individuals). The specimens collected from floral provisioning strips were collected on the following flowers (with total indicated in parentheses): *Potentilla recta* L. (Rough-fruited Cinquefoil) (2), *Daucus carota* L. (Queen Anne's lace) (1), *Erigeron strigosus* Muhl. ex Willd (daisy fleabane) (1), and *Cornus obliqua* Raf. Silky Dogwood (1); but the majority were from the Lancaster County garden site on: *Eryngium yuccifolium* Michx. (rattlesnake master) (4), *Pycnanthemum muticum* (Michx.) Pers. (clustered mountain mint) (2), *Monarda fistulosa* L. (wild bergamot (1), *Veronicastrum virginicum* (L.) Farw. (Culver's root) (1), *Achillea millefolium* (yarrow) (1), and *Doellingeria umbellata* (Mill.) Nees (flat-topped aster) (1). In the collection of D. J. Biddinger are three additional specimens of *S. pipiens* specimens (1 male, 2 females) that were net collected on *Rubus idaeus strigosus* (red raspberry) blossoms on July 17, 2002 in Juniata County, Pennsylvania. All 4 specimens of *S. flaviventris* were collected in mid-July as were 11 of the 16 *S. pipiens*. Of the remaining *S. pipiens* specimens, 2 were collected in June, 1 in August, 1 in September, and the pan trapped specimen in October as mentioned previously.

Discussion

While passive pan trap monitoring methods are effective for some bee and syrphid species, it appears from our study that they are ineffective for capturing *Syritta* sp. The majority (95%) of our *Syritta* spp. samples were collected by active net collecting from flowers. It is likely we would have missed recording *S. flaviventris* if we had relied only on passive pan trap monitoring.

It is possible that new records *S. flaviventris* and *S. pipiens* can be obtained through active collecting in other regions to better understand the distribution of these two anthropogenically spread species. In the Old World it appears that *S. flaviventris* and *S. pipiens* are sympatric only in the Mediterranean Basin area of southern Europe and northern Africa (Lyneborg and Barkemeyer 2005), but it would appear that both species currently co-exist throughout the southern U.S., at least as far north as southern Pennsylvania. Based on plant hardiness zones for the U.S. and Europe and Africa, it would appear that *S. flaviventris* is presently only found in growth zones 7–10 in the Old World, which suggests that southern Pennsylvania, at a growth zone 7, may be approaching its northern limit in North America.

Previous North American floral visitation records for *S. flaviventris* were limited to *Schinus, Serjania* and *Polygonium* (Thompson et al. 1990), but this study has added 3 new floral records for *S. flaviventris* and some additional floral hosts for *S. pipiens*. Adults of both species not only feed on flowers, but also search for mates at floral sites (Gilbert 1986). Collectively, this information can be used to improve collection of *Syritta* species which can be used to initiate further study into the biology and life history of this understudied syrphid fly genus.

Acknowledgments

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