

## Observations of insect visitors to Price's Potato Bean (*Apios priceana*, Fabaceae) in North Alabama, USA

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**Background and aims** – *Apios priceana* is a rare flowering plant that can only be found in parts of the Southeastern United States. Little is known about the reproductive biology of this plant and only a few insect flower visitors have been previously documented. The aim of this study was to further document the insect flower visitors of *A. priceana* in North Alabama.

**Methods** – Cameras and observers recorded flower visitors during the 2014 blooming season of a large North Alabama population of *A. priceana*.

**Key results** – Although fifteen different species of insects were documented on flowers of *A. priceana*, most performed a single or very few visits. Bumble bees (*Bombus* spp.), two species of Megachilidae (*Megachile sculpturalis* and *Megachile campanulae*), and the hummingbird clearwing (*Hemaris thysbe*) were the most common visitors. Interestingly, the giant resin bee, *M. sculpturalis*, is considered to be an invasive species but in this case may be pollinating a native and Federally threatened plant.

**Conclusion** – Although *A. priceana* flowers are visited by numerous insects, *Bombus* spp. and, surprisingly, an invasive species (*Megachile sculpturalis*) are probably the most important pollinators of this plant.

**Key words** – Pollinators, *Apios priceana*, *Megachile sculpturalis*, *Bombus*, Alabama.

### INTRODUCTION

Price's potato bean (*Apios priceana* B.L.Rob.) is a Federally threatened plant that inhabits only a few counties in Alabama. *Apios priceana* has a short blooming period and usually produces fruit in late summer (U.S. Fish and Wildlife Service 1993). The rarity of this plant is thought to be due primarily to habitat destruction but other explanations, such as limited service by pollinators, have been suggested (U.S. Fish and Wildlife Service 1993). The only potential pollinators that have been documented visiting *A. priceana* were honey bees (*Apis mellifera* Linnaeus, 1758), bumble bees (*Bombus* spp.) and the silver-spotted skipper [*Epargyreus clarus* (Cramer, 1775)] in Kentucky (Robinson 1898). However, whether these insects are common visitors in other areas of *A. priceana*'s range is unclear.

The U.S. Fish and Wildlife Service Recovery Plan (1993) recommended that the frequency and timing of insect flower visitation to *A. priceana* should be studied through observations and these visitors should also be collected for positive identification. These data could be used for future management of *A. priceana* by potentially augmenting known pollinator populations or habitat and limiting disturbances during peak pollinator activity.

Cross pollination in *A. americana* Medik., a close relative of *A. priceana*, is accomplished by insects eliciting a “tripping mechanism” on the flower that exposes anthers and pistil (Bruneau & Anderson 1988). Although Westerkamp & Paul (1993) postulated that based on flower morphology this common species of *Apios* should be classified as a myophilous (fly pollinated) plant, Bruneau & Anderson (1988, 1994) showed after studying many populations involving over 100 hours of field observations that no flies visited *A. americana* but rather Megachilidae bees were the probable pollinators. Due to a similar flower morphology, we hypothesized that *A. priceana* would attract similar flower visitors as *A. americana*. Here we present flower visitor observational data from *A. priceana* in North Alabama.

### MATERIALS AND METHODS

Three populations of *A. priceana* in North Alabama were investigated: (1) U.S. Army Redstone Arsenal, (2) Monte Sano State Park, and (3) Sauta Cave National Wildlife Refuge (fig. 1). Despite multiple visits to Monte Sano SP and Sauta Cave NWR, only one flower cluster (with only three flowers) was found at Monte Sano SP and none at Sauta Cave NWR. Because of the lack of flowering at these two sites,

**Table 1 – List of flower visitors that entered *Apios priceana* flowers on the US Army Redstone Arsenal between 29 June and 14 July 2014.**

| Order       | Family               | Genera/Species   | # of visits | Specimen collected |
|-------------|----------------------|--|-------------|--------------------|
| Hymenoptera | Apidae               | <i>Bombus</i> spp., including <i>B. bimaculatus</i> Cresson, 1863 and <i>B. pennsylvanicus</i> (De Geer, 1773) | 46          | x                  |
|             | Halictidae           | <i>Augochlora/Augochlorella</i>  | 5           |                    |
|             |                      | <i>Lassioglossum</i> spp.  | 3           |                    |
|             | Megachilidae         | <i>Megachile campanulae</i> Robertson, 1903  | 10          | x                  |
|             |                      | <i>Megachile sculpturalis</i> Smith, 1853  | 25          | x                  |
|             | Vespidae (Eumeninae) | Unknown  | 1           |                    |
| Lepidoptera | Hesperiidae          | <i>Epargyreus clarus</i> (Cramer, 1775)  | 2           | x                  |
|             |                      | <i>Thorybes pylades</i> (Scudder, 1870)  | 1           | x                  |
|             | Lycaenidae           | Unknown  | 1           |                    |
|             | Sphingidae           | <i>Hemaris thysbe</i> Fabricius, 1775  | 11          | x                  |
| Coleoptera  | Cerambycidae         | <i>Typocerus</i> sp.   | 1           |                    |
|             | Coccinellidae        | <i>Harmonia axyridis</i> (Pallas, 1773)  | 1           | x                  |
|             | Mordellidae          | Unknown  | 2           |                    |
| Diptera     | Syrphidae            | Unknown  | 1           |                    |

we focused our monitoring efforts on the Redstone Arsenal population. Between 29 June and 14 July 2014, insect visitors to *A. priceana* were documented through the use of digital video cameras (Sony HD Handy Cam) attached to tripods and visual observations. The first observations were started when the first blooms opened and the last observations were

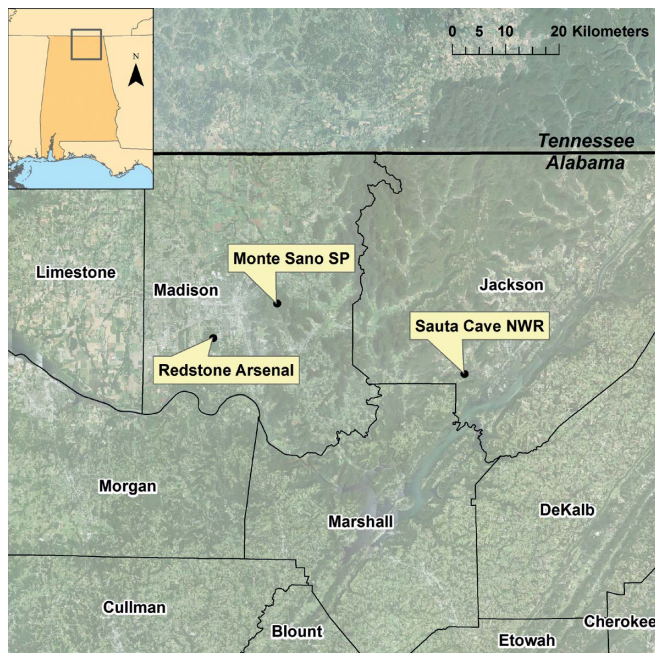
made when most inflorescences had senesced, thus covering the whole flowering season of the species. Representative insect visitors were collected (when possible) for identification purposes. During the *A. priceana* blooming period, observations and recordings were made on six different days when weather did not impede insect activity (e.g. heavy rains, strong winds, etc.). Camera recordings and/or observations were made between 9:00 a.m. and 5:30 p.m. Depending on weather conditions, cameras were left on for up to 1.5 hours of continuous filming.

## RESULTS

During the two-week blooming season, nearly 17 hours of video and 20 hours of visual observations were made. A minimum of fifteen different species (table 1) of insects were found to visit flowers of *A. priceana* accounting for 110 individual visits. Bumble bees (*Bombus* spp.) were the most common visitors (42% of total visits) followed by *Megachile sculpturalis* Smith, 1853 (23% of total visits). Other common visitors included *Megachile campanulae* Robertson, 1903 (9% of visits) and the hummingbird clearwing *Hemaris thysbe* Fabricius, 1775 (10% of visits). Bumble bees spent on average 68% of the time inside a flower once they landed on an inflorescence. *Megachile sculpturalis* spent 76% of flower visitation time inside a flower and *M. campanulae* spent over 92% of the time inside a flower. When not inside a flower, the bees either hovered or walked over flower clusters seemingly searching for flowers with rewards (accessible pollen/nectar).

## DISCUSSION

*Apios priceana* flowers were visited by numerous insects, but insect visitation was dominated by medium to large-sized bees (e.g. *Bombus* spp., *M. sculpturalis*, *M. campanulae*).



**Figure 1** – Location of the U.S. Army Redstone Arsenal, Monte Sano State Park, and Sauta Cave National Wildlife Refuge where *Apios priceana* populations were located. Due to lack of flowering plants at Monte Sano State Park and Sauta Cave National Wildlife Refuge, only plants within the U.S. Army Redstone Arsenal were monitored for flower visitor activity.

Like Robinson (1898), we also documented bumble bees and the silver-spotted skipper but no honey bees. Honey bees were observed in the general area foraging on other flowering plants but did not visit *A. priceana* flowers. As Bruneau & Anderson (1988) noted with *A. americana*, we also found Megachilidae (genus *Megachile*) were common visitors and considered them the probable pollinators of *A. priceana*. These medium to large-bodied bees were observed to visit multiple flowers while foraging and would push their head and much of their thorax into the flower. Due to this behaviour and foraging strategy, they potentially pollinate *A. priceana* rather than simply acting as a flower visitor. Bruneau & Anderson (1988) re-confirmed that some plants of *A. americana* are diploid and others triploid. The reported chromosome numbers for *A. priceana* are only diploid (Seabrook & Dionne 1976). Furthermore, the measured effective pollination (~10%) and fruit set in *A. americana* are very low (Bruneau & Anderson 1988). Because the triploid *A. americana* is usually sterile and most of the plants that yielded fruit from bee pollination were diploid (Bruneau & Anderson 1988), we hypothesize that *A. priceana* (diploid) is more apt to producing fruit from insect visitation.

*Megachile sculpturalis* was observed frequently visiting *A. priceana* throughout the day. This non-native species is relatively large compared to other native Megachilidae and was first introduced into the United States in the early 1990's (Mangum & Brooks 1997). Some researchers suggest that this species is invasive because it utilizes existing cavities for nesting structure, potentially displacing native bees [e.g. Eastern carpenter bee, *Xylocopa virginica* (Linnaeus, 1771)] (Laport & Minckley 2012, Roulston & Malfi 2012). Mangum & Sumner (2003) also noted that this bee may be preferentially attracted to non-native plants and may be aiding their establishment and spread. We observed *M. sculpturalis* patrol around *A. priceana* flowers by flying back and forth near flowers. While this behavior was exhibited, only *Bombus* spp. would attempt to land on flowers. On multiple occasions, *M. sculpturalis* would ram into the side of bumble bees that were visiting flowers but this rarely altered bumble bee foraging.

Despite visiting three populations of *A. priceana* in which numerous (> 20) plants were located, only the Redstone Arsenal had a substantial flowering population. This population is found on the edge of a rocky right-of-way (ROW) within the Redstone Arsenal. The vegetation along the ROW is periodically cut back, maintaining an early successional habitat and acting as a forest gap. The Monte Sano SP and Sauta Cave NWR populations of *A. priceana* are found within a forested habitat that receives much less sunlight compared to the Redstone Arsenal's population. Woods (2005) stated that *A. priceana* populations are found in rocky, open woods, and forest borders. We suspect that in a forested ecosystem this plant requires periodic disturbances that create forest gaps. These gaps allow more sunlight to hit the forest floor which then stimulates flowering and, ultimately, continued survival. Forest gaps could also provide open, early successional habitat that would be attractive to many pollinators which could increase cross pollination. Future research should explore *A. priceana*'s potential need for direct sunlight to stimulate

flowering and focus on the pollen-carrying potential of the numerous insects that visit flowers.

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