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## First Known Records of the Specialist Bee, *Colletes aestivalis* (Hymenoptera: Colletidae), in an Urban Area

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### Abstract

Here we report on the first known records of the *Heuchera* specialist bee *Colletes aestivalis* Patton (Hymenoptera: Colletidae) in an urban area. This bee was found by a participant in a citizen science project in a residential garden in a suburb that abuts St. Louis, Missouri. The females were found only visiting *Heuchera richardsonii*, and the males were seen scouting for females by hovering over the plants. This finding shows that urban areas can support uncommon specialist bees and the utility of engaging non-experts in cataloging biodiversity.

**Keywords:** oligolectic, home garden, *Heuchera*, iNaturalist

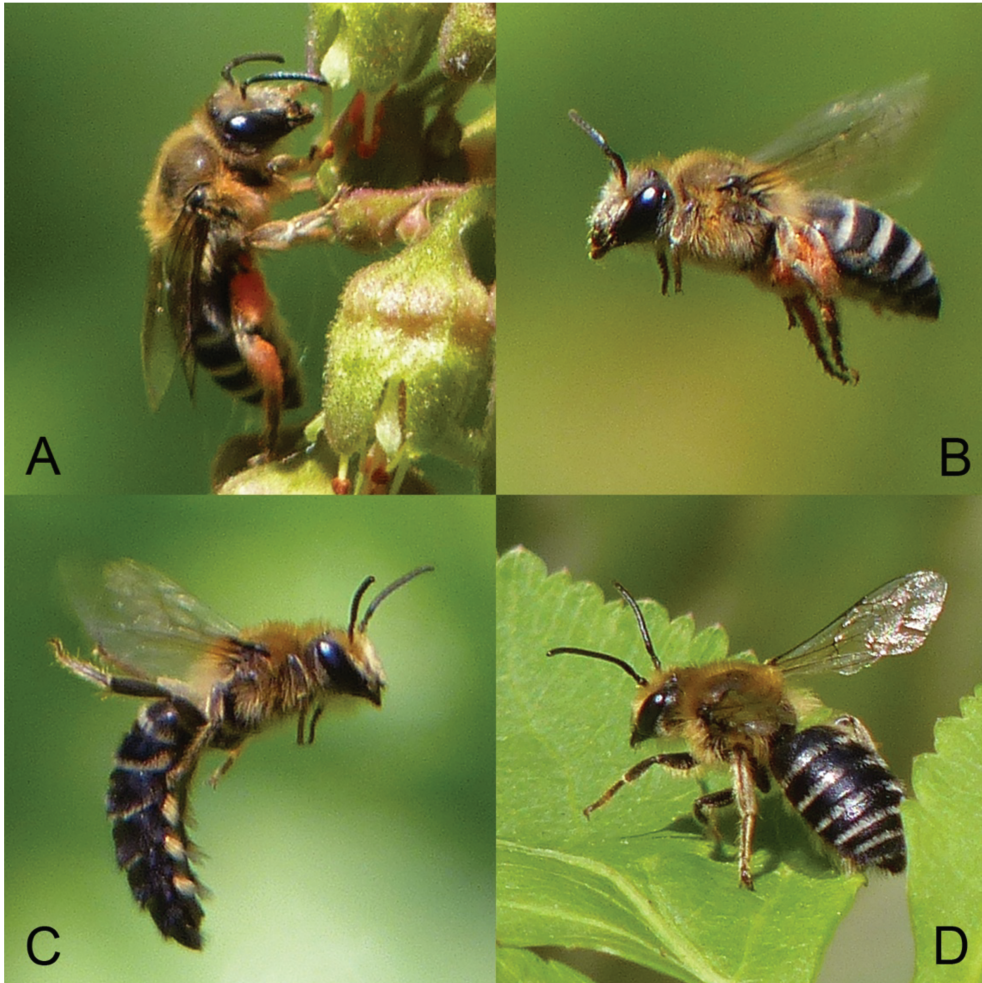
Unlike some other taxa, it has been found that bee diversity is often high within urbanized areas (Hall et al. 2017, Silva et al. 2023). This is because bees can find nesting substrates and food sources in a variety of urban land types such as community and residential gardens, parks, and unmanaged and abandoned acreages (Baldock et al. 2019). However, bee species with generalized diets represent a higher proportion of the total bee diversity in urban areas as compared to remnant and restored areas (Arduser 2010, Buchholz and Egerer 2020). The specialist (oligolectic) species found in urban areas are often broadly oligolectic (e.g., specializing on a species-rich family such as the Asteraceae; Magallon et al. 1999, Fowler 2016) or utilizing a genus often planted for horticultural or agricultural purposes (e.g., hibiscus for *Ptilothrix bombiformis* (Cresson 1878), and squash for *Peponapis pruinosa* (Say 1837); Ayers and Rehan 2021).

Here we report on the first known records of *Colletes aestivalis* Patton, 1879, (Hymenoptera: Colletidae) a *Heuchera* (alumroot) specialist, in an urban setting. Given the popularity of *Heuchera* species and cultivars in the horticultural trade (Haynes and Bailey 2021), it was surprising to us that we could find no records of *C. aestivalis* within urban areas on GBIF, iNaturalist, or in the published literature. This bee was first photographed by Chris Kirmaier in May 2021 as part of the citizen science project Shutterbee (shutterbee.net) and uploaded to

the platform iNaturalist where it was identified by bee specialist John Ascher (inaturalist.org/observations/101783590). There were subsequent observations in May 2022 and 2023. In May 2023, we collected male and female specimens, and they were confirmed to be *C. aestivalis* by Mike Arduser.

The bee was found in a residential garden that has approximately 375m<sup>2</sup> of native plantings in University City, a suburb in St. Louis County that abuts St. Louis, Missouri. Two-thirds of houses within 500m of the garden were built before 1940 (US Census 2020) and the surrounding 500m is 50% impervious surface (EWGCG 2017). There are no glades nor remnant areas within 5km of the garden, however the host plant was installed over a decade ago as landscaping in a large park that is 2km away (Roman Fox, personal communication).

Male and female *C. aestivalis* were only found foraging on the Missouri native *Heuchera richardsonii* R. Br. (Fig. 1). The homeowner (Chris Kirmaier) installed the *Heuchera* plants in the 1990s and currently has 24 plants that due to the amount of sun they receive, bloom over a few week period. We do not know how long the *C. aestivalis* were present in the garden prior to 2021. Therefore, we cannot determine if these bees are a remnant population, have recolonized the area after extirpation, or represent a colonization event in a novel habitat.



**Figure 1:** Photos of *Colletes aestivalis* in a residential garden. A: Female collecting pollen from *Heuchera richardsonii*; B: Female flying; C: Male exhibiting hovering behavior; D: Male resting

*Colletes aestivalis* has been found across much of the eastern United States, from Massachusetts south to North Carolina, Georgia, and Mississippi, and north and west to Missouri, Illinois, and Michigan (Stephen 1954). It is one of only two *Colletes* species in the United States with the inner eye margins parallel throughout, not converging below in both sexes. The other species, *C. andrewsi* Cockerell, 1906, is also a *Heuchera* specialist but more western in distribution. As far as we know, the two species are only sympatric in northern Illinois (Laura Rericha, personal communication). All known occurrences of *C. aestivalis* that we are aware of have been in or near to remnant or restored habitats, such as recent records from the Mt. Cuba Center

in Delaware, a home garden in a small rural town in Pennsylvania, and Shenandoah National Park. Missouri is the furthest west *C. aestivalis* has been found, and specimens have been collected in recent years in two counties (Franklin and Lincoln) close to St. Louis, as well as areas further west in the Ozarks. They have been found only on calcareous and igneous glades (Nelson 2005), and all have been collected as they visited *H. richardsonii*. Throughout its range all floral associations have been with native species of *Heuchera* (*H. americana* L., *H. hispida* Pursh or *H. richardsonii*). Nests of *C. aestivalis* have not been described, but it is presumably a ground-nester, like all North

American *Colletes* species whose nests are known (Michener 2007).

The photos taken of *C. aestivalis* demonstrate an interesting flying behavior for the males that we have not seen exhibited by other Midwestern *Colletes* species. The males will hover near the plant for minutes at a time, presumably scouting for females. To stay in place, the males appear to drop their abdomen, push their hindlegs backwards, and adopt a position nearly perpendicular to the ground (Fig. 1C). This hovering behavior contrasts with that of males in other groups we have seen, such as some Megachilidae, in which the males patrol an area by flying in circular patterns while maintaining their body parallel with the ground. The physics and morphological adaptation required to allow *C. aestivalis* males to stay flying while exhibiting this novel behavior warrant additional examination, especially because others have observed this behavior only in the brief moments before mating or nectaring (Laura Rericha, personal communication). We did not witness any agonistic interactions between males, even when there were multiple males hovering around the same plant.

This first record of *C. aestivalis* in an urban location many miles beyond any type of natural habitat that the species has been found in previously, highlights three important things. First, this finding adds to the research that shows there is a high diversity of bees, both in their species identities and functional traits within urban areas (Normandin et al. 2017). Further, there is likely unrealized diversity in urban areas due to lack of sampling in a variety of urban habitat types, particularly privately owned and managed gardens (Lerman et al. 2023). For example, common garden plant genera like *Penstemon* and *Echinacea* support specialist bees endemic to the region, and it is feasible these species are present but undetected. Second, this bee was first photographed as part of a citizen science project, which demonstrates the utility of engaging non-experts to record biodiversity (Jones et al. 2019, Skvarla and Fisher 2023) and record novel behaviors (Portman et al. 2021). Lastly, this bee was first identified due to the extensive time bee expert John Ascher spends on iNaturalist. There are likely many other interesting observations that will only be discovered if people with any level of taxonomic expertise contribute to platforms such as iNaturalist by identifying observations (Callaghan et al. 2022, Campbell et al. 2023).

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Sam Droege and Max McCarthy all looked for other urban records. Thank you to the reviewers for their thoughtful suggestions. Nicole Miller-Struttman is the co-creator of Shutterbee and without her work, this bee would have remained undetected.

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