FLORAL MANIPULATION BY LASIOGLOSSUM ZEPHYRUM (HYMENOPTERA: HALICTIDAE) ENSURES FIRST ACCESS TO FLORAL REWARDS BY INITIATING PREMATURE ANTHESIS OF XYRIS TENNESSEENSIS (XYRIDACEAE) FLOWERS

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FLORAL MANIPULATION BY *LASIOGLOSSUM ZEPHYRUM* (HYMENOPTERA: HALICTIDAE) ENSURES FIRST ACCESS TO FLORAL REWARDS BY INITIATING PREMATURE ANTHESIS OF *XYRIS TENNESSEENSIS* (XYRIDACEAE) FLOWERS

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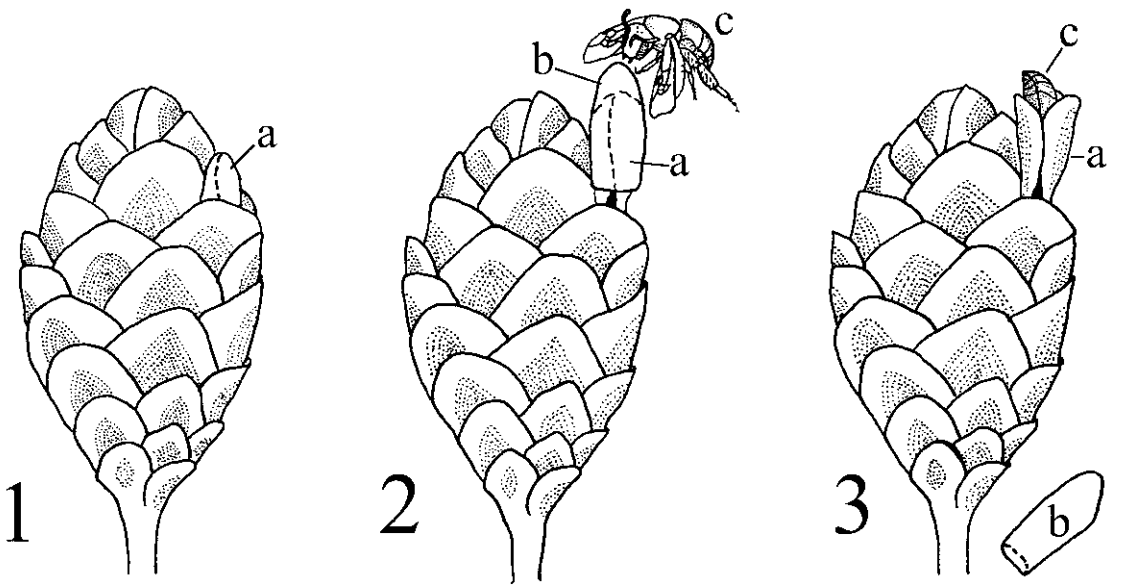
"The early bird gets the worm," is a cliché that often comes to mind when considering cases of exploitative competition in nature. In order to gain first access to pollen in flowers, some bees have been observed to chew holes in unopened flowers and poricidal anthers (Renner 1983; Young 1983; Hurd & Linsley 1963). Here we describe an interesting case of a bee, *Lasioglossum zephyrum* (Smith), manipulating a flower to open prematurely, thus ensuring first access to the floral rewards of *Xyris tenneseensis* Kral.

Xyris tenneseensis is federally listed as endangered (U.S. Fish and Wildlife Service, 1994), and is only known from 14 extant populations. Our observations are restricted to a large population of *X. tenneseensis* located along the edge of a spring-fed pond in Fort McClellan, AL. *Xyris tenneseensis* is perennial, producing one flower (rarely two) per day from a cone-like inflorescence. The flower bud emerges from the inflorescence (Fig. 1a) approximately 45 minutes prior to natural anthesis. At this time a translucent membranaceous sepal sheaths the entire flower bud. As the bud continues to emerge, the flower petals exert outward pressure on the sheath-like sepal. This outward pressure on the sheath-like sepal causes it to slide up the flower bud and form an air-filled membranaceous bubble atop the bud (Fig. 2b). Eventually the pressure exerted by the petals causes the sheath to fall off the flower, allowing the flower to open. The flower stays open for a few hours after which the corolla closes and falls off the inflorescence. *Xyris tenneseensis* flowers produce no nectar and anther dehiscence precedes anthesis.

Previous studies indicate that the first visitor to a flower often gets a disproportionate amount of available floral resources (Harder 1990; Buchmann & Cane 1989). Due to the pre-anthesis presentation of pollen within the flowers of *X. tenneseensis*, the first floral visitor has access to all the floral rewards. Individuals of *L. zephyrum* (Fig. 2c) were seen to land on *X. tenneseensis* flower buds during the "bubble" stage (Fig. 2b). The bee would nip at the bubble using its mandi-



Figs. 1-3. Inflorescence of *Xyris tennesseensis*. 1. Emerging flower bud (a). 2. Flower bud with sheath being approached by *Lasioglossum zephyrum*. 3. Flower being visited by *L. zephyrum* after removing sheath (a = developing flower, b = floral sheath, c = *L. zephyrum*).

ble, eventually clasping the sheath with its legs and taking flight. After dropping the sheath (Fig. 3b), the bee would return to the flower and collect pollen (Fig. 3c). These normally blackish bees would depart the flower covered in masses of yellow pollen. We suggest that this novel behavior has arisen to ensure first access to floral rewards.

To indirectly quantify the importance of sequence in attaining floral rewards, we timed the duration of each *L. zephyrum* floral visit to 13 marked stems of *X. tenneseensis*, making note as to the sequence of the visit for each flower. The duration of visits reflects the time spent by the bee while in contact with anthers and does not include time spent removing the floral sheath. There was a significant effect of sequence rank on visit duration (ANOVA: $F_{6,55} = 6.6$, $P < 0.001$). The first visit to a flower was significantly longer than all following visits to the same flower (Fig. 4, Fisher's PLSD, $P < 0.001$ for all comparisons). Length of subsequent visits do not differ significantly from one another (Fig. 2, Fisher's PLSD, $P > 0.45$ for all comparisons). From a qualitative standpoint, "clean" bees visiting previously visited flowers left carrying noticeably less pollen than the first visitor to the flower.

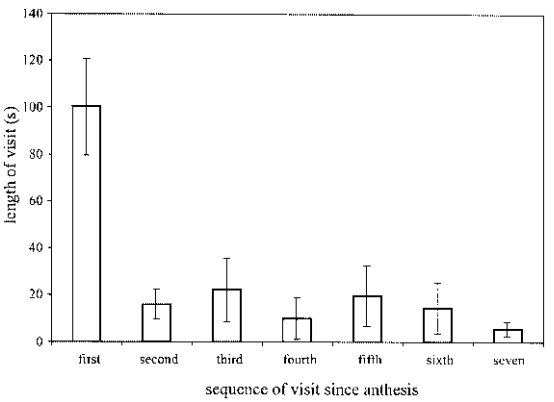


Fig. 4. Relationship of rank in a sequence of visits to a flower and length of the visit.

Our observations and data suggest that by developing a search image for developing flower buds and manipulating flowers to initiate premature anthesis, individuals of *L. zephyrum* are able to exploit a floral resource prior to its competitors. This behavior was not observed in other species of bees (e.g., *Apis mellifera* L., *Augochlorella striata* (Provancher), *and Bombus* sp.) visiting *X. tenneseensis*. All other species of *Xyris* possess a sheath-like sepal (Kral 1966) and thus may be similarly exploited by *L. zephyrum*.

Summary

Lasioglossum zephyrum ensures itself first access to the floral rewards of *X. tenneseensis* using a unique behavior that initiates premature anthesis of the flower without damaging the flower. First visits to flowers are significantly longer than subsequent visits and appear to result in greater pollen acquisition.

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