Macropis nuda – a rare and fascinating "oil bee"

By Bryan Danforth, Ph.D.

In July 2021, members of the Danforth lab from Cornell University conducted research on a rare and fascinating bee at the Huyck Preserve. *Macropis nuda* (family Melittidae) is one of three species of the genus *Macropis* in New York. Macropis bees are "oil bees" which require floral oils from specific host plants to line and provision their brood cells. In the case of *Macropis*, these oils are collected exclusively from plants in the genus *Lysimachia* (fringed loosestrife and relatives; family Primulaceae), which grow abundantly in humid, saturated soils in the eastern U.S. The flowers of *Lysimachia ciliata* have specialized oil-producing glands located at the center of the flower. Female *Macropis* have specialized mops and sponges located on their fore-, mid-, and hind-legs for rupturing the plants' oil glands and transporting these floral oils back to the nest. Female *Macropis* nest along the banks of streams, ponds and lakes in relatively wet soils, and the floral oils serve to waterproof their below-ground brood cells. The oils are also mixed into their pollen provisions as food for the larvae.

Female Macropis nuda *resting on a flower with a load of pollen and oil. ©Bryan Danforth*

Macropis, including *Macropis nuda*, are exceptionally rare bees known from just a handful of sites in New York and across the Northeast. The nest site at the Huyck Preserve has been present for at least 40 years and has been the focus of previous studies by entomologists at the American Museum of Natural History and Cornell (Rozen and Jacobson 1980, Cane et al. 1983).

Our studies, funded by the National Science Foundation, focus on understanding what role microbes (including bacteria and fungi) play in the biology of these fascinating bees. A diverse microbial community in the pollen/nectar provisions of many solitary bees is thought to play an important role in larval nutrition as well as in preservation of the pollen provisions. We suspect that a unique set of bacteria and fungi may be associated with the uniquely oily provisions of *Macropis*.

We collected samples of pollen provisions, adult bees, larvae, and host plant flowers for microbial amplicon sequencing—a gene sequencing technique that is commonly used to characterize microbial diversity. We were cautious to sample just a portion of the known nests at the Huyck Preserve in order to preserve these bees and their nesting site for the future. Rachel Fordyce, Nathalia Flores, Mark Buckner, Jordan Kueneman, Joe Giulian, and Bryan Danforth were all present at the Huyck Preserve for at least part of July. Our samples are now being sequenced at the Host Microbe Systems Biology Core at UC Davis, and we are looking forward to examining the results.

At the same time as we conducted our field research on *Macropis nuda* at the Huyck Preserve, graduate student Mark Buckner was surveying additional sites across New York and the Northeast for other *Macropis* localities. Based on a predictive model built on previous collection records for *Macropis nuda*, Mark identified regions of the Northeast with high habitat suitability for *Lysimachia* and *Macropis*. Mark spent weeks camping out in the rain, but his soggy travels both verified his predictive model and uncovered additional localities where the three *Macropis* species occur. He also identified records of *Macropis patellata*, the rarest of the three *Macropis* species, and *Macropis ciliata*.

The studies we conducted this summer will help provide a better understanding of the biology of *Macropis* "oil bees" and will hopefully lead to a better assessment of their conservation status. We are grateful to the staff at the Huyck Preserve for facilitating our research.

Bryan Danforth, Ph.D. has taught at Cornell University since 1995. His work on solitary bees began in graduate school at the University of Kansas while working at the Southwestern Research Station in Portal, AZ. For more information on solitary bees, have a look at Bryan's 2019 book, *The Solitary Bees: Biology, Evolution, Conservation*.

Photo: Brian Danforth, Ph.D. (right) at the Huyck Preserve with Matthew Schlesinger, Ph.D. (left) of the NY Natural Heritage Program and Huyck Preserve Scientific Advisory Board