



# Scientific Experiments



Thermal Imaging



**Thermal regulation in Carpenter Bees**



Two carpenter bees on a coneflower



Carpenter bees may in some cases cause damage by boring holes in wooden house structures, but they play an important role as pollinators. With climate change, global warming, and pesticide usage, decline in pollinator populations has become a concern worldwide. It is important that, as home-owners, we understand the merits and threats posed by these beautifully designed insects and learn to coexist.

There are four different species of carpenter bees reported in New York State. The most abundant species in the home ‘patch’ is Eastern Carpenter Bee. These carpenter bees are very active in the summer, providing us an opportunity to understand their physiology, behavior and needs (Fig. 1). Our study began in July of 2021, and we plan to expand it over the coming years. Here are some preliminary observations

By mid-summer, carpenter bees are on purple coneflowers (*Echinacea pupura*), butterfly weed (*Asclepias tuberosa*), bee balm (*Monarda*) and sweet pepperbush (*Clethra alnifolia*). The bees sleep on the blossoms or on nearby leaves. As the temperature rises in the morning, they start to become active. We measured the thorax and body temperatures of several bees of different sizes with an FLIR camera. Example optical and thermal images of a bee are shown in Fig. 1. Ambient temperature was measured on a nearby blossom with similar reflectivity.

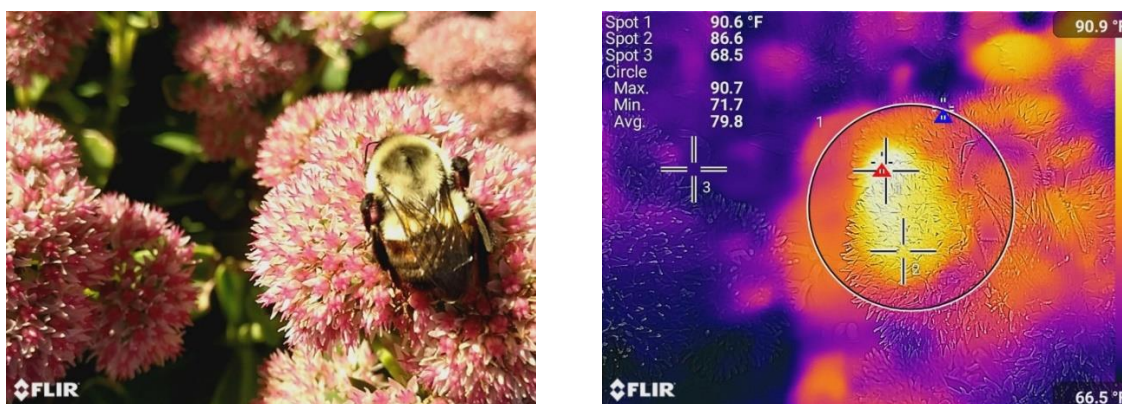


Fig. 1. Optical and thermal images of a carpenter bee on an ‘Autumn Joy Sedum’ blossom. Spot 1 is on thorax, spot 2 on body and spot 3 on a nearby blossom. Maximum, minimum and average temperature within Circle 1 are indicated. Note that there is an offset in the optical and thermal images because of the location of the two lenses.

Thorax temperatures of different bees in the active and at rest states are plotted as a function of ambient temperature in Fig. 3. When the bees are either asleep or waking up, the thorax temperature is close to ambient temperature. When the bees are active, the thorax temperature on average is 10° C (18° F) higher than ambient. Data were collected in the ambient temperature range from 12° C to 33° C.

Do the bees continue to heat up as the ambient temperature rises higher? We will continue these studies in the next season to explore further.

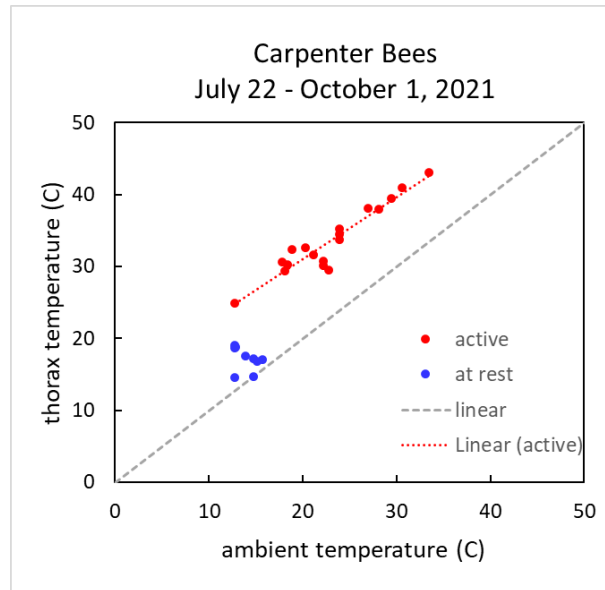


Fig. 3. Carpenter bee thorax temperatures vs. ambient temperature. Dashed line shows 1:1 relationship between thorax and ambient temperatures.