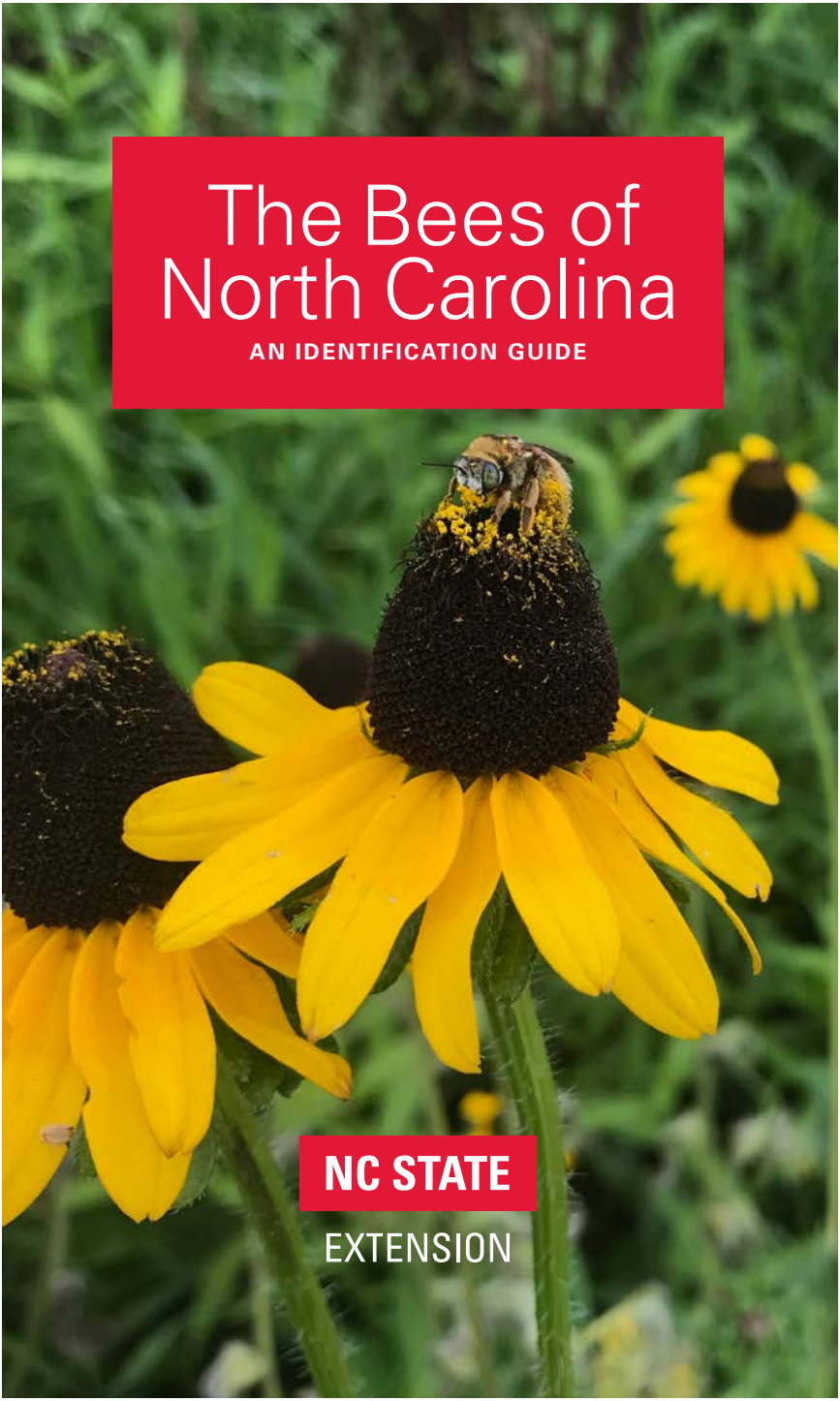
The Bees of
North Carolina
AN IDENTIFICATION GUIDE
NC STATE
EXTENSION

Note to Readers

We originally created this identification guide as part of a day-long workshop during which other materials were included. As such, the guide is meant to be an overview of the different bee groups commonly found in North Carolina, not an all-inclusive document.

The bee families are organized in an order closely following the evolutionary history, with Apidae saved for last, as it is one of the hardest families to generalize about. Within each family section, we discuss only the most common genera, including some key characteristics for identification. This guide will be most useful to users who have specimens that can be viewed with magnification, and the guide requires some basic knowledge of bee anatomy. (For help, see Appendix B: Anatomical Diagrams and "Common Anatomical Comparisons.") Some of the characteristics for identification will be hard to see on bees "on the wing." With practice observing these minute features with a magnifier or microscope, readers will also learn to recognize bees based on their overall appearance, which is difficult to define in a guide.

By compiling information specific to North Carolina and by emphasizing the groups of bees that we most often encounter here, we hope this guide will be a useful supplement to the more detailed (but geographically broader) identification resources listed in the "Resources" section.

We developed this guide with these uses in mind:

- A beginner's key to identifying native bees
- A "cheat sheet" to help with quick, general identifications

Notes

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The Bees of North Carolina

AN IDENTIFICATION GUIDE

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Bees in Action photos:
Anthidium: "Wool Carder Bee (Anthidium manicatum)"
by Frank Vassen, Flickr, CC BY 2.0
Heriades: "Resin Bee @ insect-hotel"
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Contents

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Introduction

Identifying a bee provides access to a wealth of information about its biology: its geographic range, preferred plants, economic importance, nesting habits, and perhaps even whether its populations are stable or declining. But putting a name on a bee can be tricky, with more than 500 species in North Carolina alone. Precisely sorting these species with a taxonomic key requires examination of minute features—such as shapes of individual hairs and patterns of wing veins—under a microscope.

But it's also true that many bees, or groups of bees, can be recognized on the wing, and bee biologists can be vague about how they do this. In the field, it's a *Ceratina* because it looks like one—not because we can see the wing veins or clypeus to confirm that it's not a *Lasioglossum* of the same size and color. It's an *Augochloropsis* because its body looks more robust than an *Augochlorella's*—not because we can see the tegulae to confirm that they are D-shaped instead of oval.

Figure 1. Another small dull-metallic bee. What could it be?

With experience, anyone can make this transition from identifying bees under a microscope to identifying them on the wing: By examining specimens carefully and appreciating the minute differences used in their taxonomy, one also develops a sense of their general appearance that aids recognition in the field. That knowledge, in turn, can be applied to understand the biology of the bees being observed, or the ecosystem in which they are found. Ecologically, bees are often grouped according to variation in three key life-history traits: social organization, nesting substrate, and floral specialization.

Social organization

Cooperation among bees occurs along a continuum, the two extremes of which are "solitary" and "highly eusocial." The most common state is solitary, including about 90 percent of bee species. An individual female bee creates a nest, provisions each nest cell with pollen and nectar (or sometimes oil), and deposits an egg. The female seals the cells and dies without ever meeting her offspring.

At the other end of the spectrum are the highly colonial (eusocial) bees, of which there are no native examples in North America. Honey bees and tropical stingless bees represent this strategy.

In between are an array of conditions termed primitively eusocial, semisocial, subsocial, and communal. Detailed descriptions of each of these forms of cooperation can be found in *The Bees in Your Backyard* and *The Bees of the World* (see the "Resources" list at the end of this guide). A given species may display different social behaviors depending on environmental conditions. However, bumble bees in the genus *Bombus*, as well as many sweat bees, are reliably primitively eusocial: Each year, queens establish nests on their own. Then their first generation of daughters takes over foraging and brood care while the queen focuses on egg-laying. These colonies last one season.

Figure 2. Bumble bee (Bombus impatiens) *queen and workers inside the colony; the queen is circled.*

Finally, some bee species are parasitic—they neither construct their own nests nor forage to provision their offspring, but instead lay their eggs in other bees' nests.

Nesting

A mother bee's choice of where to nest determines where her offspring will develop and spend most of their lives—out of sight during all but the few weeks or months that they forage at flowers.

About 70 percent of bee species dig nest tunnels in the ground. Few studies have measured bees' preferences for different soil characteristics. Those studies that exist suggest that depth of organic matter, soil texture (sand, silt, or clay), moisture, and sun exposure all matter—but different species have different preferences.

The remaining species nest in wood, hollow stems, pithy stems, or pre-existing spaces such as rodent burrows or bird nests. Wood-nesting

and stem-nesting bees often accept artificial "bee hotels" for nesting, allowing closer observation and even management as crop pollinators. Finally, a few species, such as some leafcutting bees, may be flexible in whether they dig a tunnel in the ground or occupy a hollow stem.

Floral preferences

Nectar is the primary carbohydrate source for bees and the primary flight fuel for adult bees. Few bees are picky about their nectar sources, although they may be limited to certain kinds of flowers by their body size, tongue length, or seasonality.

Figure 3. Nest of Augochlora pura *in soft, rotten wood.*

Pollen is the primary protein source for larval bees and is also consumed by young adults and egg-laying females. Bees display a range of specialization on pollen sources, from "narrow oligoleges" that collect pollen from one or a few closely related species of plants, to "broad polyleges" that often have long flight seasons and forage on many kinds of plants. Because oligolectic bees are limited to habitats that include their focal plants, it is possible to attract and support them with targeted plantings.

Keys

Look for these identifying symbols next to names of bees:


STEM NEST


GROUND NEST


CAVITY NEST


WOOD NEST


PARASITIC


SPECIALIST

Shading denotes flight seasons, with the peak months shaded darkest:

JAN FEB MAR APRIL MAY JUNE JULY AUG SEPT OCT NOV DEC

Size ranges are shown at the bottom of each page compared to a penny, which is 19 mm in diameter:

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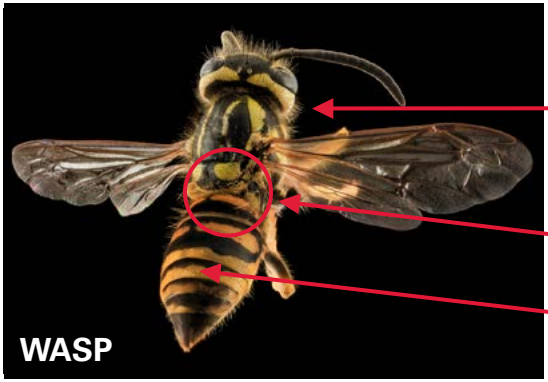
Bee, Wasp or Fly?

Complex branched hairs spread over the body.

Bees usually have pollen-collecting hairs on hind legs or underside of abdomen.



Wasps have a skinny, smooth appearance overall, but some species can be hard to distinguish from bees.

"Wasp waist" is not obvious on every kind of wasp.

Hairs are simple and straight.

Flies' eyes can be very large relative to the head.

Antennae are short and threadlike.

Flies have only two wings.

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Common Anatomical Comparisons among Bees

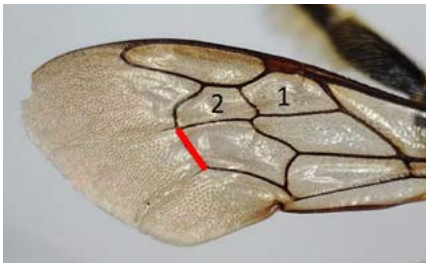
1. Location and nature of pollen-carrying hairs on female bees

Scopa on abdomen

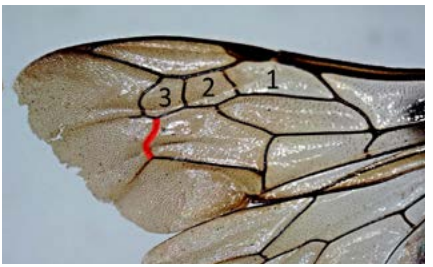
Scopa on hind leg

Corbicula on hind leg

2. Wing venation—submarginal cells and second recurrent vein

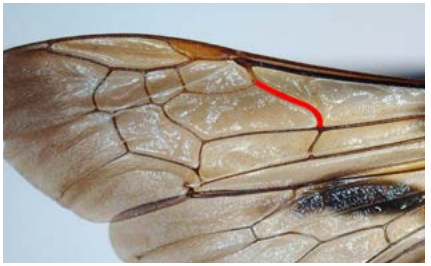


Two submarginal cells
Second recurrent vein straight

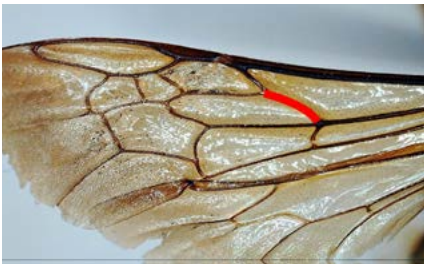


Three submarginal cells
Second recurrent vein S-curved

3. Basal vein



Basal vein arched



Basal vein straight

Male versus Female Bees

1. Sting: Present (but not always visible) in females, absent in males.

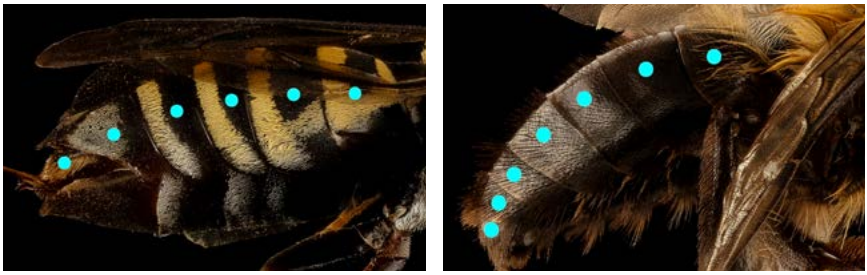
Female bee with sting visible

2. Pollen-carrying hairs: Presence guarantees a female bee; absence is inconclusive.

3. Antennal segments: 12 in females, 13 in males (requires a microscope).

Male bee has 13 segments per antenna (indicated with blue dots).

4. Tergites (abdominal segments on the dorsal side): six in females, seven in males (requires magnification).



Female abdomen with six tergites (left) and male with seven tergites (right); each segment is indicated with a blue dot.

5. Facial markings: Males often have more hair or more extensive yellow markings on the face than do females of the same species. This difference between sexes is not universal, but it occurs often enough to mention.

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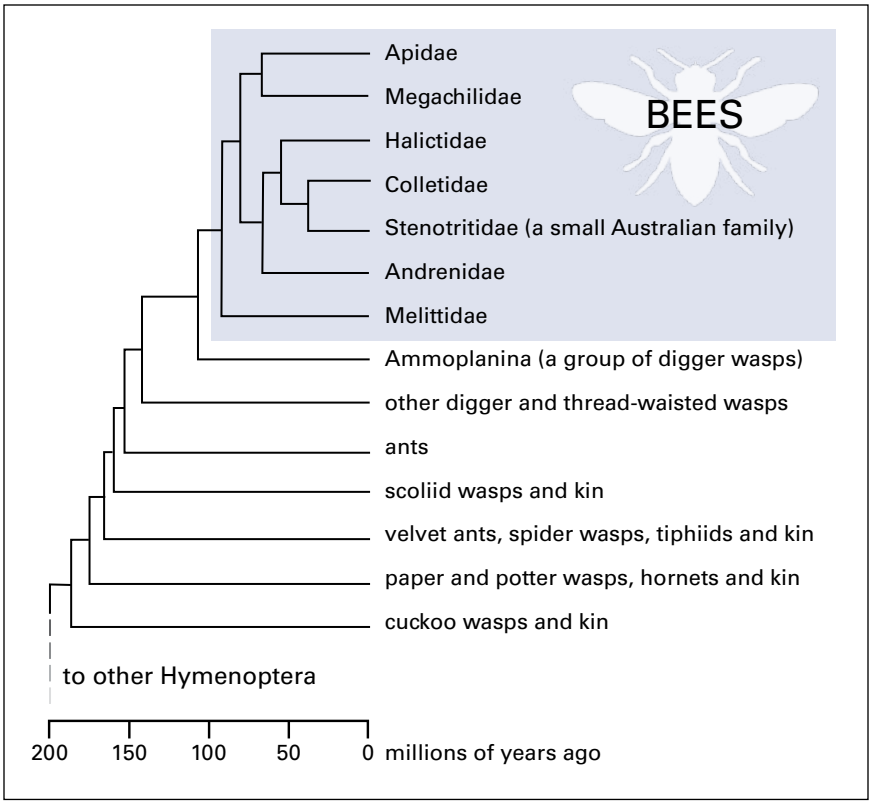
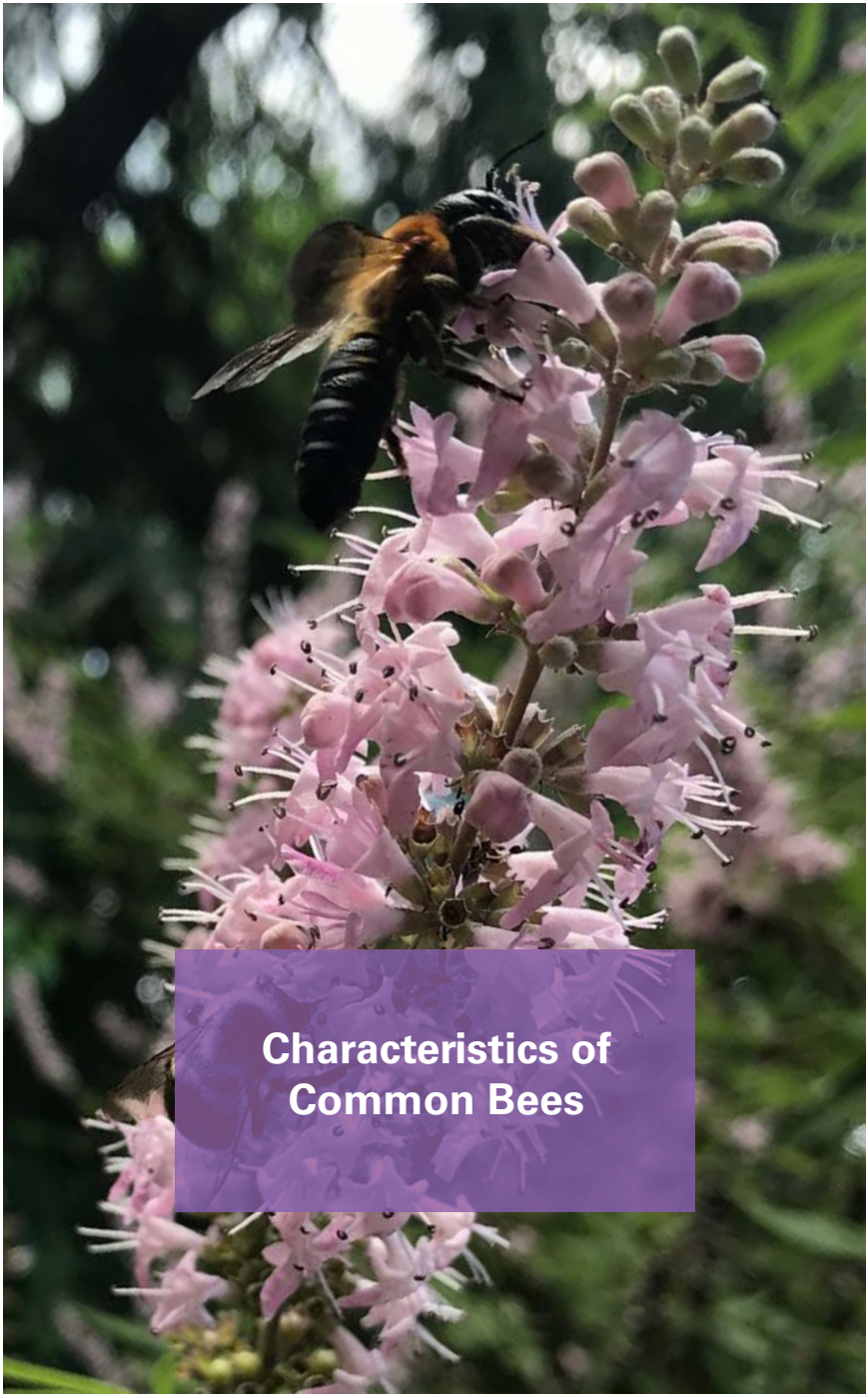
The Bee Tree of Life

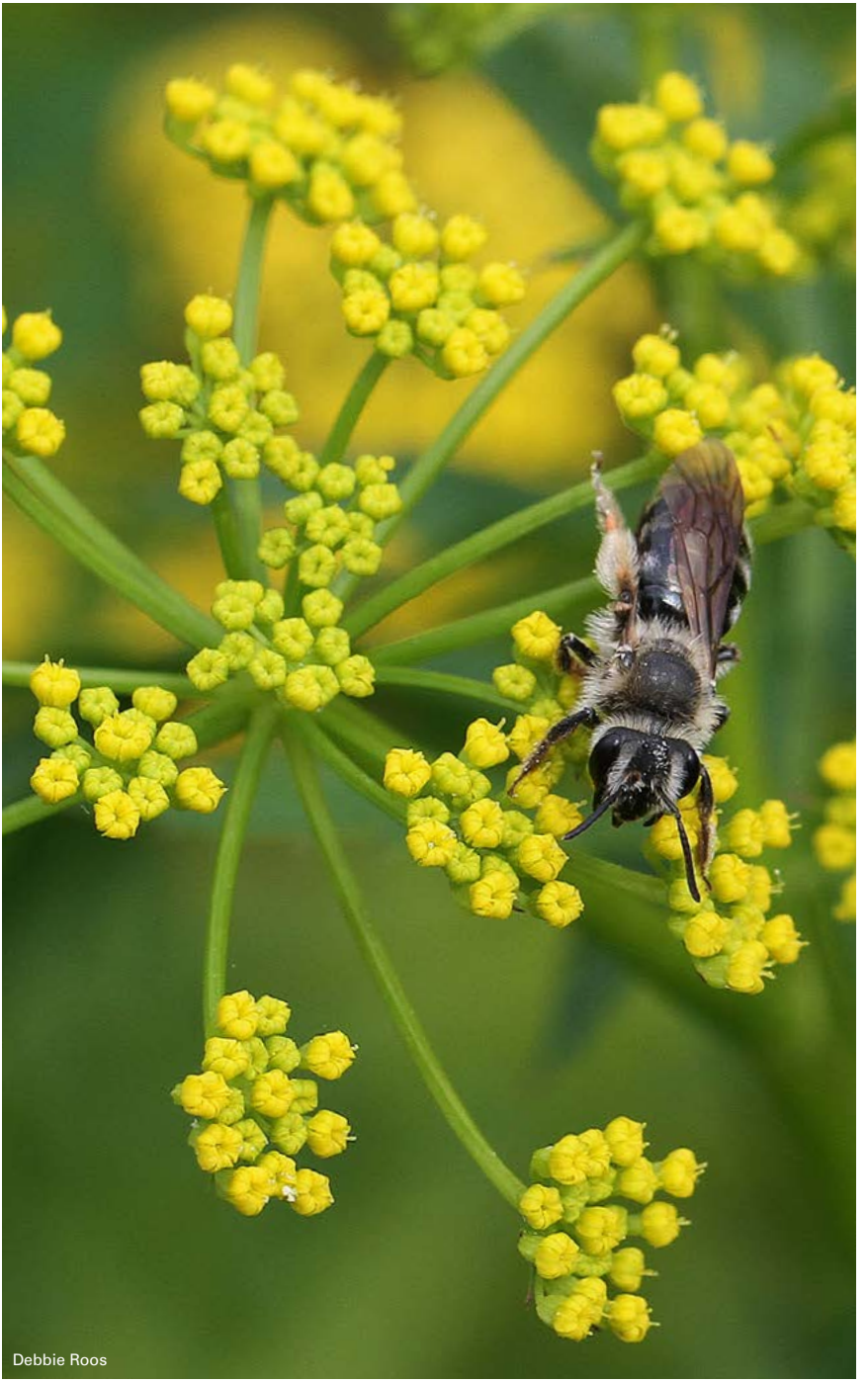


Bees are vegetarian wasps. They are members of the order Hymenoptera, which includes sawflies, wasps, and ants. Bees' closest relatives are digger wasps in the group Ammoplanina, which feed their offspring by hunting thrips on flowers. At some point during the Cretaceous period, some of these wasps probably switched from hunting pollen-eating thrips to collecting pollen. Over time, this group diversified to produce the seven families and more than 20,000 species of bees known in the world today.

Note: To simplify the tree, some groups of digger wasps are not shown.



Characteristics of Common Bees



Debbie Roos

Family Andrenidae

Andrena
Calliopsis

- **Genera in NC: 5**
- **Species in NC: 130**
- Wide range of sizes.
- Can nest in large aggregations.
- Many emerge in early spring.

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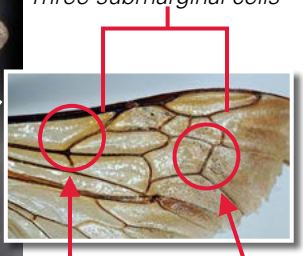
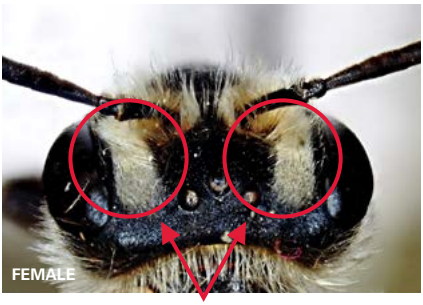
Genus *Andrena*: Mining Bees

- Species in NC: 98
- Most species-rich genus in NC.
- Solitary ground nesters.
- May form large nest aggregations in the early spring.
- Easily confused with other genera, especially *Colletes*.





Facial foveae are lined with velvety hairs (a distinguishing characteristic compared to **Colletes***, which is bare).*

On their faces, males have extensive hair, yellow markings, or both.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

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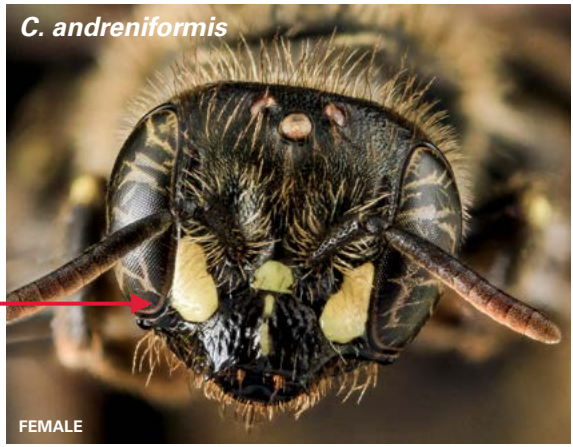
Genus *Calliopsis*: Panurgine Mining Bees

- Species in NC: 2
- Small, about the size of a *Lasioglossum*.



Females have three ivory or yellowish stripes on the face.

Males have bright yellow legs.

Males have an entirely bright yellow face that protrudes from the head.

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Elsa Youngsteadt

Family Colletidae

Colletes
Hylaeus

- **Genera in NC: 3**
- **Species in NC: 39**
- Wide range of sizes.
- Can nest in aggregations.
- Some species line their nest with a cellophane-like substance to water proof it.

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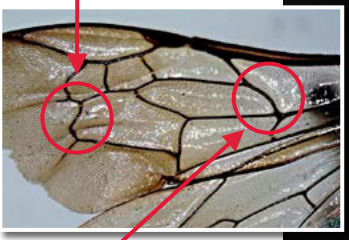
Genus *Colletes*: Cellophane Bees

- Species in NC: 25
- Can form large aggregations in early spring, but many species are active in the fall.
- Diverse genus, but many are superficially similar to *Andrena*.
- Common names include cellophane, plasterer, or polyester bee because they waterproof their nests.

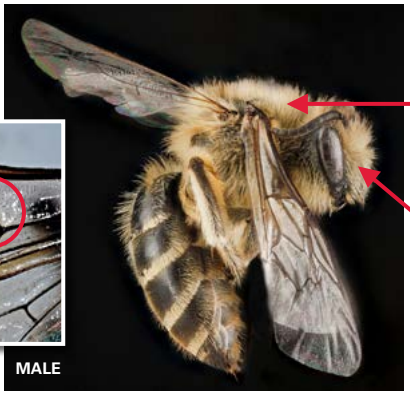
Heart-shaped face

Facial foveae are smaller then those of **Andrena** *and not lined with velvety hairs.*

S-curved second recurrent vein



Straight basal vein



Hair can be white or light-yellow to orangish.

Males can have extensive hair on face.

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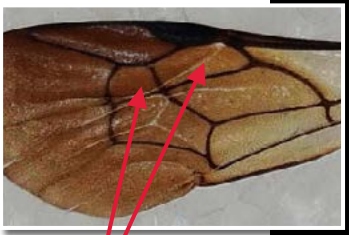
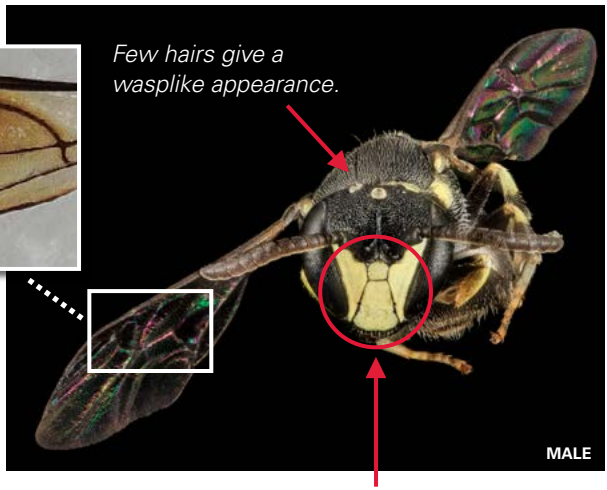
Genus *Hylaeus*: Yellow-faced Bees

- Species in NC: 13
- Small, about the size of a *Lasioglossum*.
- Carry a mixture of pollen and nectar in their stomachs back to their nests.
- No pollen-collecting hairs, which gives a wasplike appearance.



Two submarginal cells



Lower face can be almost entirely yellow.

Facial markings can also be smaller than shown above, particularly in females.

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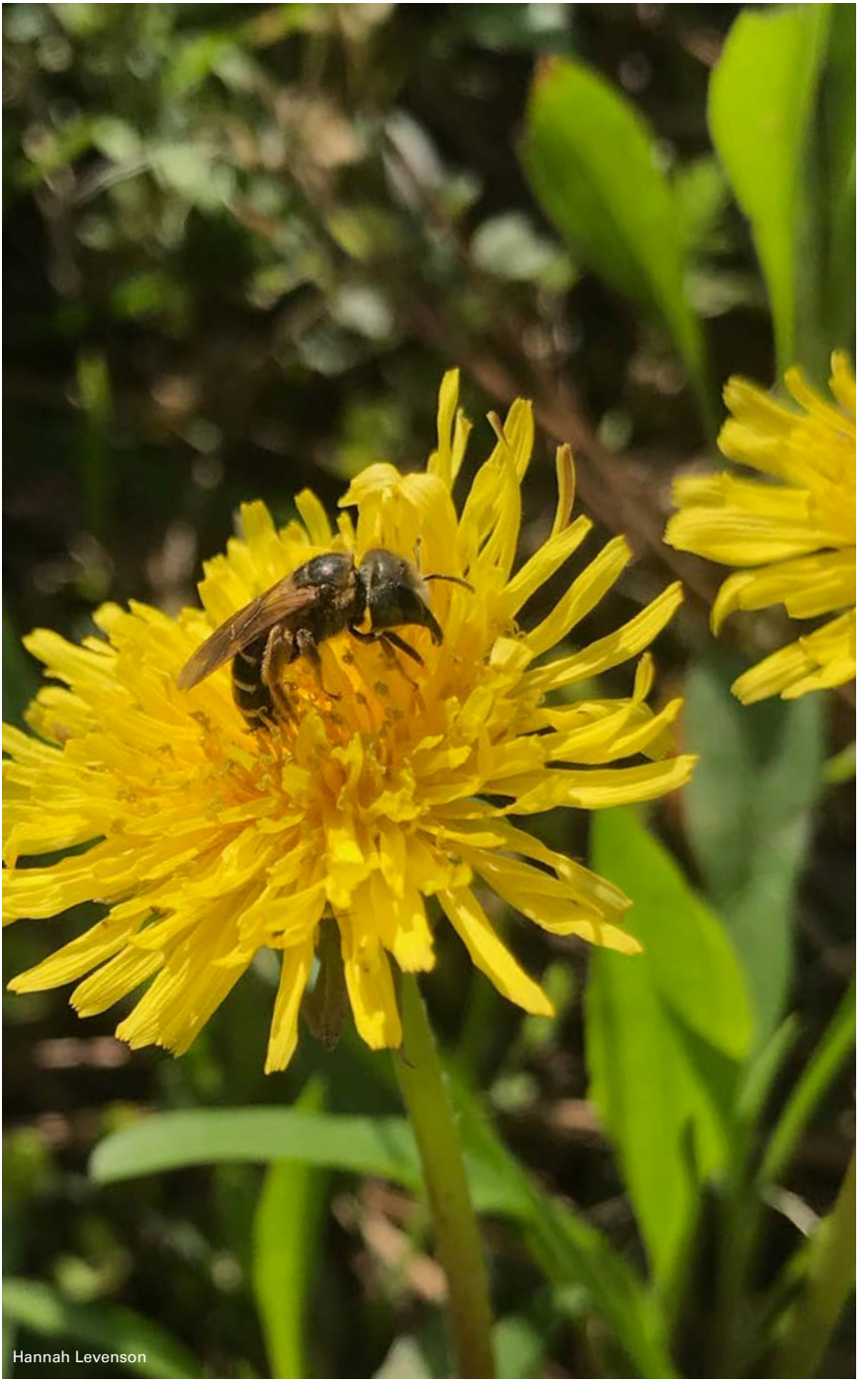


Hannah Levenson

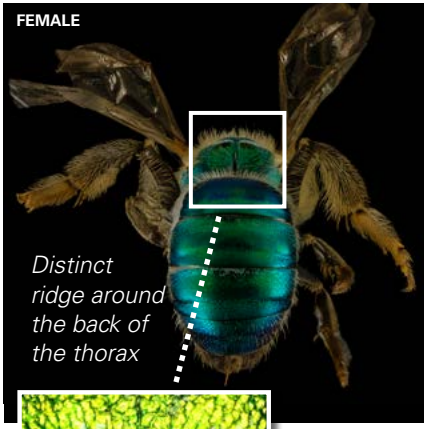
Family Halictidae

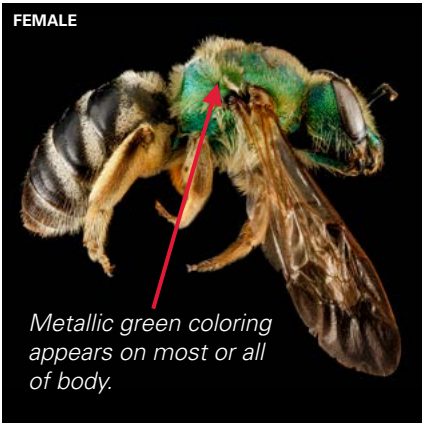
Agapostemon
The "Augos"
Halictus
Lasioglossum
Sphecodes

- **Genera in NC: 9**
- **Species in NC: 133**
- Called "sweat bees" because they will drink sweat for the salt content.
- Diverse sociality within the family.
- Three submarginal cells.
- Arched basal vein.
- Less 'precise' pollen collection.

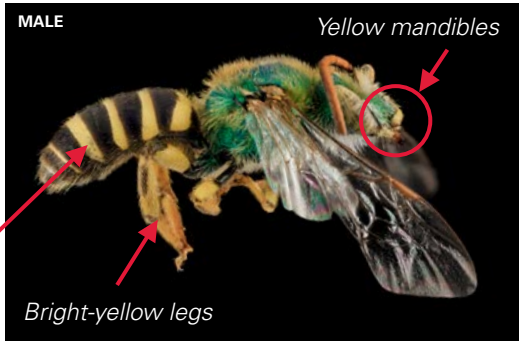
Genus *Agapostemon*: Metallic Green Sweat Bees

- Species in NC: 4
- Although solitary, females of some species will share a nest entrance.





In most species, females have entirely green abdomens, while in **A. virescens** *(right) they are black and striped.*



Males have black and yellow stripes on abdomen.

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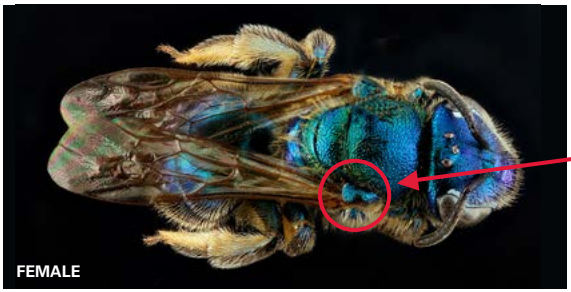
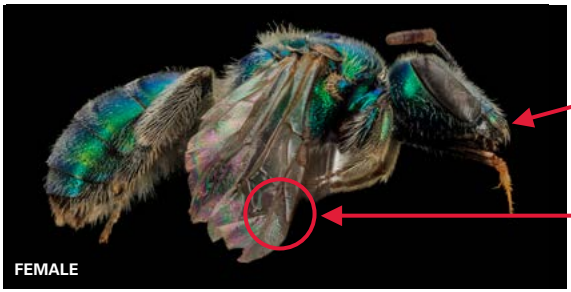
The Augos – *Augochloropsis, Augochlorella, Augochlora*: Metallic Green or Blue Sweat Bees

- Species in NC: 7 (3 *Augochloropsis*, 3 *Augochlorella*, and 1 *Augochlora*)
- *Augochlora* is solitary, while the other two Augos can be social.



Augochloropsis *has a D-shaped tegula; the other Augos have oval tegulae.*



Mandibles are mitten-shaped.

Augochlorella *has the tip of the marginal cell pointed; in the other two Augos, it is squared off.*

Augochlora *has the tip of the marginal cell squared off.*

Mandible tip is forked into two pointed, roughly equal teeth.

Augochloropsis *Augochlorella* *Augochlora*

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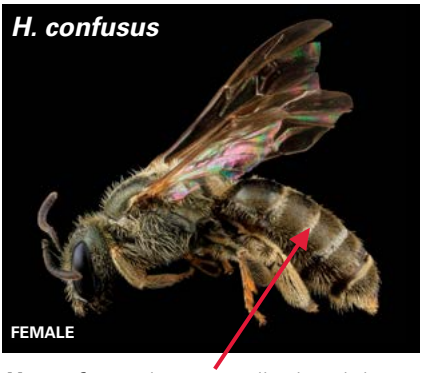
Genus *Halictus*: Sweat Bees

- Species in NC: 5
- Sociality of some species can change depending on environmental conditions.

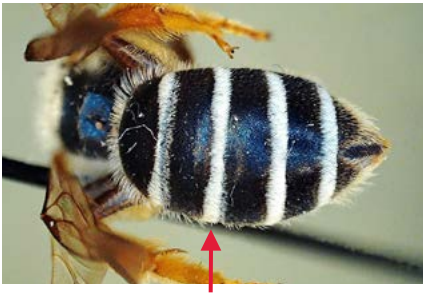
H. ligatus *and* **H. poeyi** *are morphologically identical but can be distinguished from other species by the spine on the back of the female's cheek.*

Males often have bright-yellow "moustaches," antennae and legs.



H. confusus *has a smaller head than* **H. ligatus** *and is dull metallic.*

H. rubicundus *and* **H. parallelus** *are similiar to* **H. confusus,** *but larger and not metallic.*



Halictus *is distinguished from* **Lasioglossum** *by hair bands on the outer rim of the terga rather than coming from underneath.*

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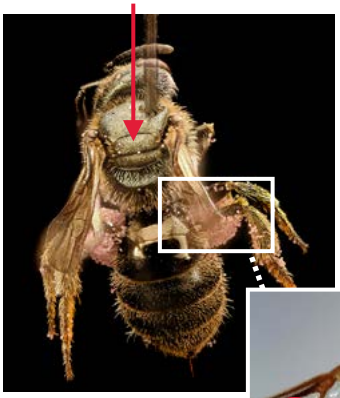
Genus *Lasioglossum*: Sweat Bees

- Species in NC: 84
- Very diverse and hard to identify.
- Sociality of some species can change depending on environmental conditions.
- Some people place all dull metallic *Lasioglossum* into a group called *Dialictus.*

Distinguished from **Halictus** *by hair bands coming from underneath terga rather than sitting on the bottom edge. Bands can be sparse in some species.*

Can appear dull and metallic



Strongly arched basal vein

Veins bordering the third, and sometimes second, submarginal cells are weakened. This makes the veins look like they consist of a single line under the microscope, rather than two lines as in a "strong" vein.

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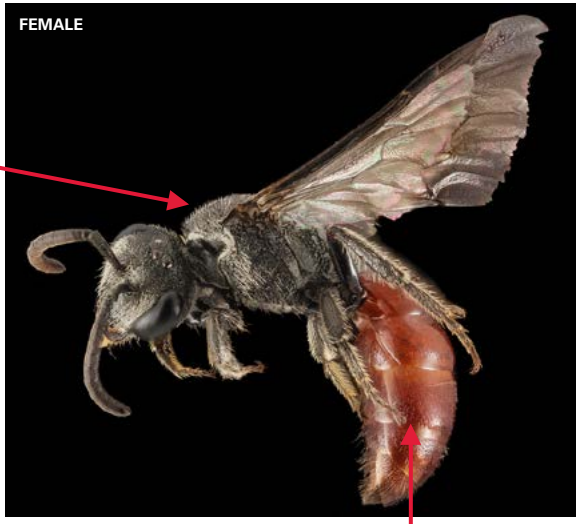
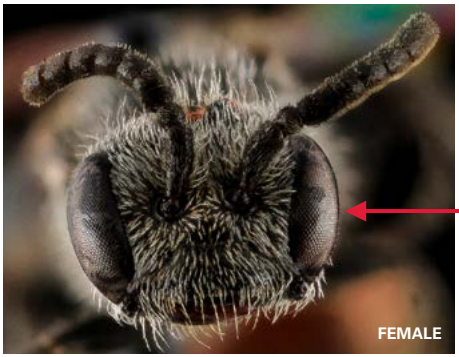
Genus *Sphecodes*: Blood Bees

- Species in NC: 29
- Parasitic on *Lasioglossum, Halictus,* and *Andrena.*
- Common name is blood bees because of their red abdomen.

Similar in size and shape to **Lasioglossum** *except never metallic and never has weakened transcubital veins. Coarsely sculpted thorax contrasts with polished abdomen.*



Red abdomen is shiny and smooth.



Round face

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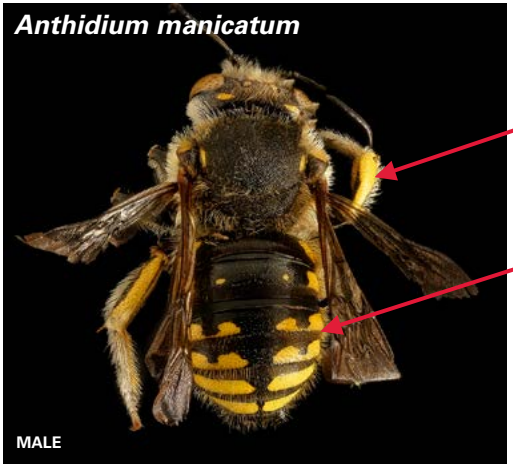
Family Megachilidae

Anthidium
Anthidiellum
Coelioxys
Heriades* and *Hoplitis
Megachile
Osmia
Stelis

- **Genera in NC: 14**
- **Species in NC: 104**
- Straight basal vein.
- Two submarginal cells.
- Pollen-collecting hairs are located on the underside of the abdomen.

Genus *Anthidium*: Wool Carder or Potter Bees

- Species in NC: 2
- Only one species is native.
- Common names include wool carder or potter bees because they use plant hair, mud, or conifer resin to build nests.
- Males claim territories around flowers and defend from other bees.



The Europeam wool carder bee, an invasive species, is the more common **Anthidium** *species in NC.*

Distinct ivory to yellow banding does not meet in the middle.

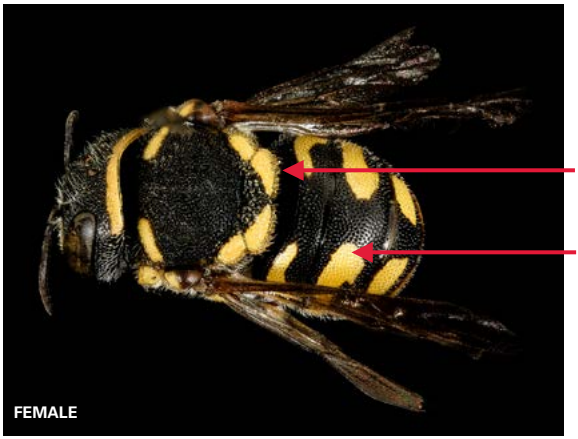
Males have a yellow clypeus.

Not pictured: Females have pollen-collecting hairs on the underside of the abdomen.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

Genus *Anthidiellum*: Rotund Resin Bees

- Species in NC: 2
- Very similar appearance to Anthidium but generally smaller.
- Build nests on the outside of twigs or leaves, instead of on the inside, with isolated single nest cells made of resin.



Distinct shelflike scutellum

Distinct yellow to orange or rust-colored banding

Females may have yellow on the clypeus, and males always do.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

Genus *Coelioxys*: Cuckoo Leafcutter Bees or Sharp-tailed Bees

- Species in NC: 14
- Cleptoparasitic on other bees in Megachilidae.
- Lay their eggs in others' nests, so they have no pollen-collecting hairs.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

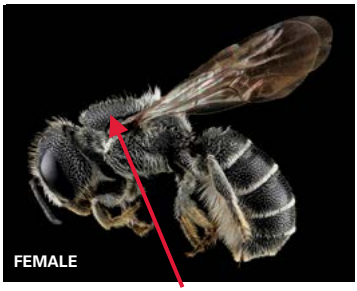
NC STATE EXTENSION

Genus *Heriades* and *Hoplitis*:

Small-headed Resin Bees and Mason Bees

- Species in NC: 10 (3 *Heriades* and 7 *Hoplitis*)
- *Heriades* species use resin to build partitions between nest cells in wooden cavities.
- Some *Hoplitis* species use a mixture of chewed leaves and pebbles to line their nests.
- These two genera are widespread but not often encountered; they can be difficult to tell apart without a microscope.

Heriades



Coarse pitting occurs on thorax and abdomen.

Terminal abdominal segment curls under at rest.

Hoplitis

Slender body has incomplete white banding.

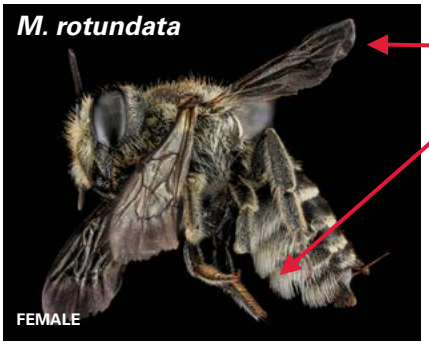
Extensive hair on face

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

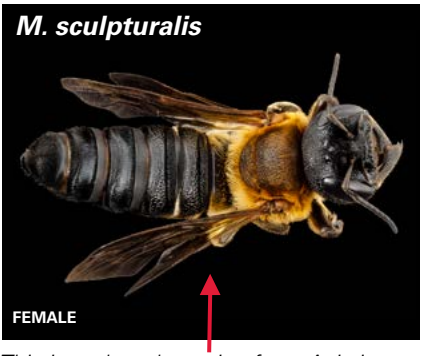
Genus *Megachile*: Leafcutter Bees

- Species in NC: 37
- Common name is leafcutter or leafcutting bees because they cut circles out of petals or leaves to line their nests within hollow stems, cavities, or soil.
- Most species have distinct white hair bands on the abdomen.

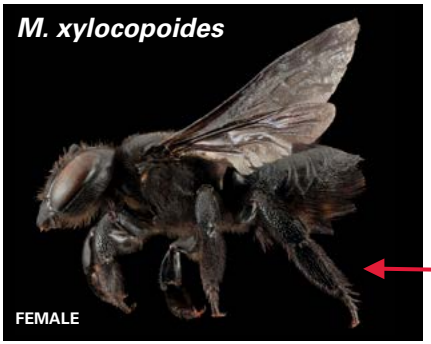


The alfalfa leafcutter bee is an important introduced pollinator.

Hair on underside of abdomen can be white to yellow.



This introduced species from Asia is aggressive to other bees (not people).



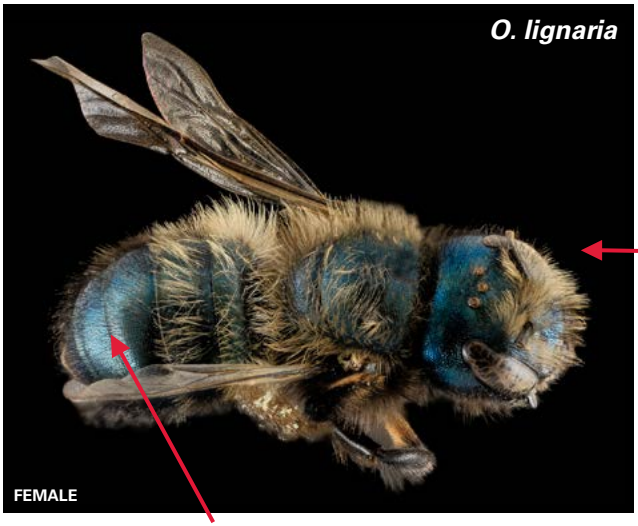
This distinctive species is all black.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

Genus *Osmia*: Mason Bees

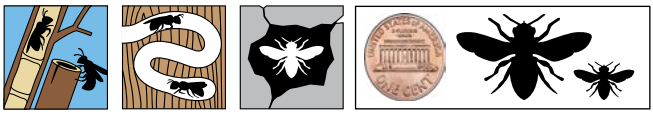
- Species in NC: 22
- All are solitary species that build nests in cracks, hollow stems, cavities, or tunnels in wood created by other insects.
- In NC, all species are metallic blue or greenish.
- Called mason bees because many species use mud in nest partitions.



The blue orchard bee is an important commercial fruit tree pollinator.

Metallic blue color

Males have more extensive hair on their faces.



JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

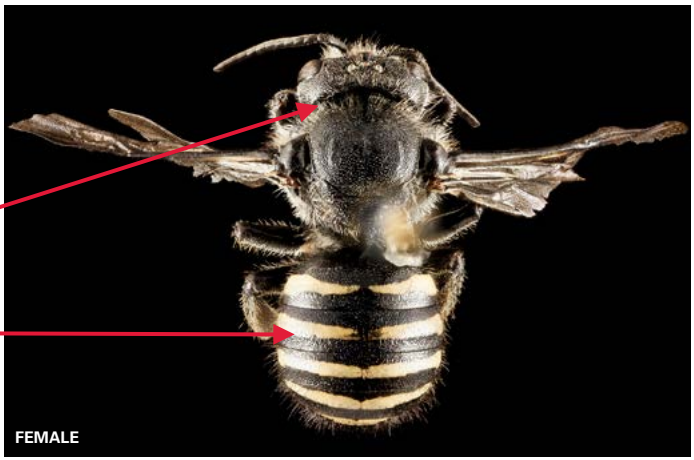
NC STATE EXTENSION

Genus *Stelis*: Cuckoo Bees

- Species in NC: 7
- They are cleptoparasitic on other species in Megachilidae, meaning they lack pollen-carrying hairs.
- Often similar in color to *Anthidium* and *Anthidiellum*, but more slender in build.

Some species have a yellow collar here.

Rounded body shape bears yellow or ivory banding.



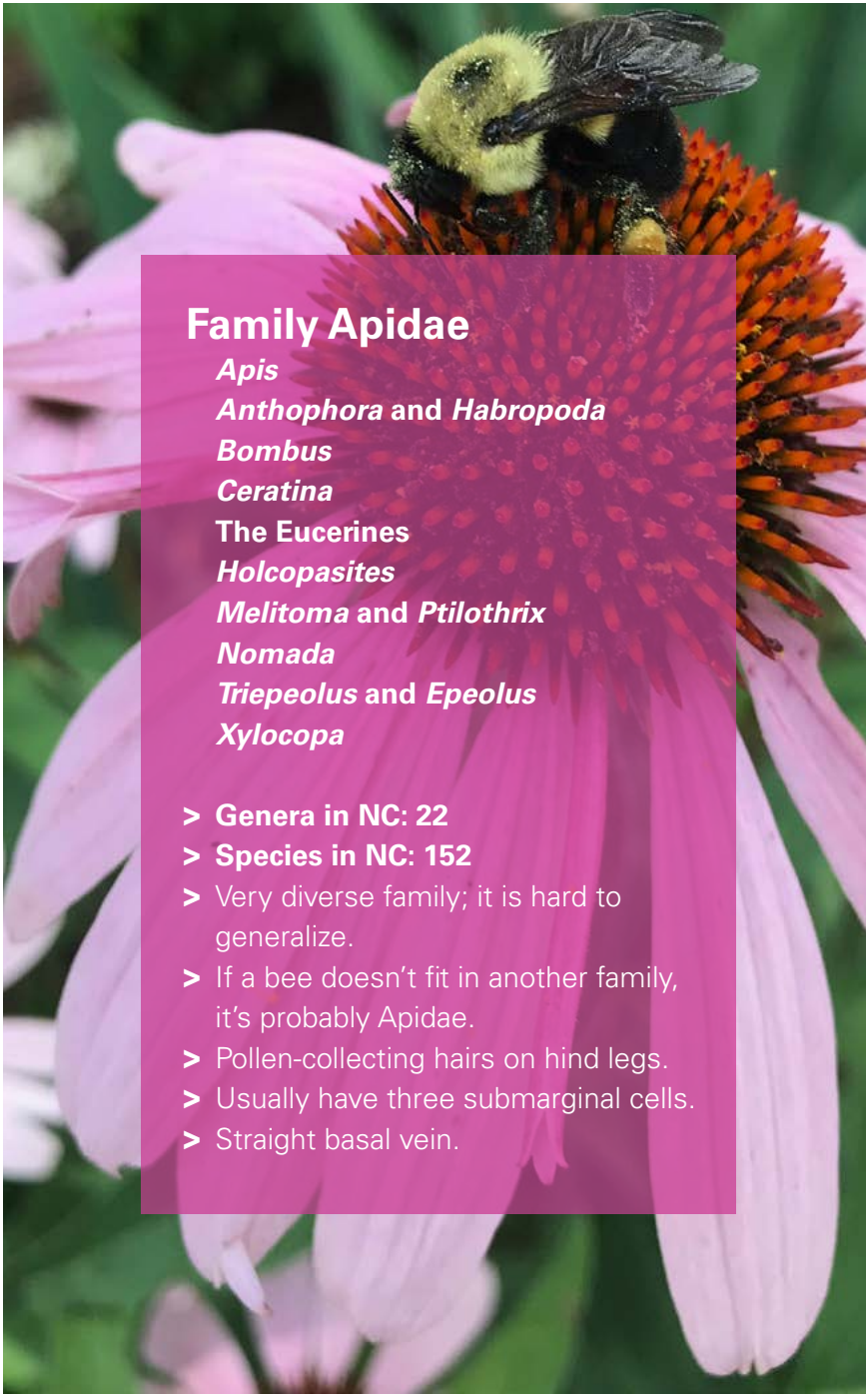
FEMALE

Males have yellow clypeus.

Legs can be brightly colored.

MALE

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC



Family Apidae

Apis
Anthophora* and *Habropoda
Bombus
Ceratina
The Eucerines
Holcopasites
Melitoma* and *Ptilothrix
Nomada
Triepeolus* and *Epeolus
Xylocopa

- **Genera in NC: 22**
- **Species in NC: 152**
- Very diverse family; it is hard to generalize.
- If a bee doesn't fit in another family, it's probably Apidae.
- Pollen-collecting hairs on hind legs.
- Usually have three submarginal cells.
- Straight basal vein.

Genus *Apis*: Honey Bees

- Species in NC: 1 (introduced)
- Live in large eusocial colonies; feral colonies are now rare.
- Important agricultural pollinator.

A. mellifera *is the only species of this genus in the U.S.*

The corbicula, or "pollen basket," is a flat, smooth area surrounded by a ring of hairs on the hind tibia where pollen is packed. Pollen looks like a pellet, rather than extending all over the leg.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

Genus *Anthophora* and *Habropoda*: Digger Bees

- Species in NC: 5 (4 *Anthophora* and 1 *Habropoda*)
- All are solitary and prefer sandy soils.
- May nest in aggregations.
- Hind legs are hairy, with pollen-collecting hairs instead of pollen baskets.

Distinguished from bumble bees by the following features:

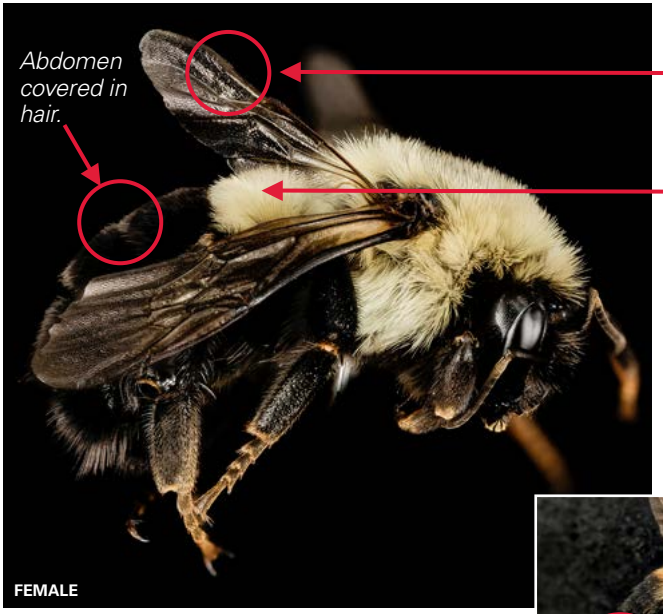
- *wing cells hairless*
- *pollen baskets absent*
- *fast-flying, darting behavior at flowers (some species)*

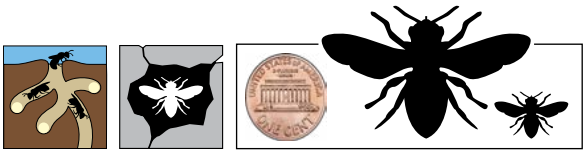
The southeastern blueberry bee is an important specialist pollinator of blueberry plants.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

Genus *Bombus*: Bumble Bees

- Species in NC: 15
- Nest in colonies.
- Can build their colonies underground in rodent burrows and above ground in birdhouses, in wall voids, old mouse nests, or under grass tussocks.
- Use buzz pollination that is important for many plants.



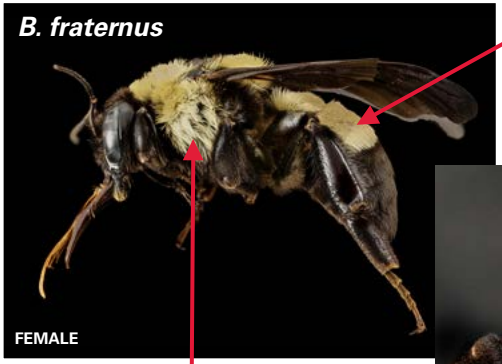


JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

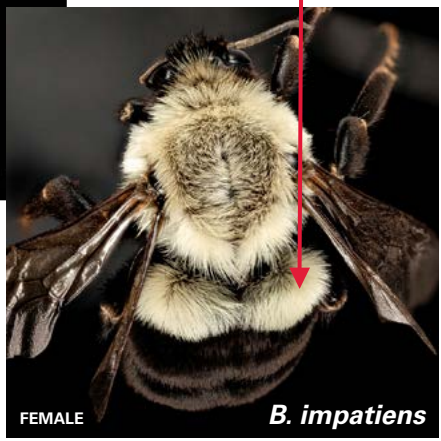
**Note that these images all show female bumble bees. Male hair patterning may differ.*

Common *Bombus* Species

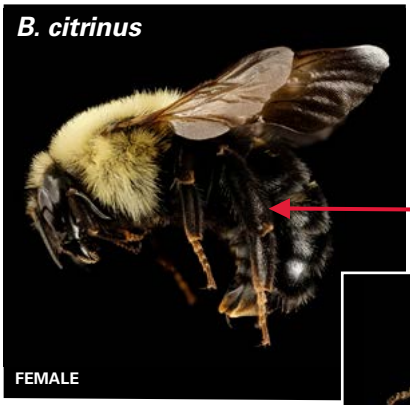


Terga 1 through 3 are covered with yellow hair.

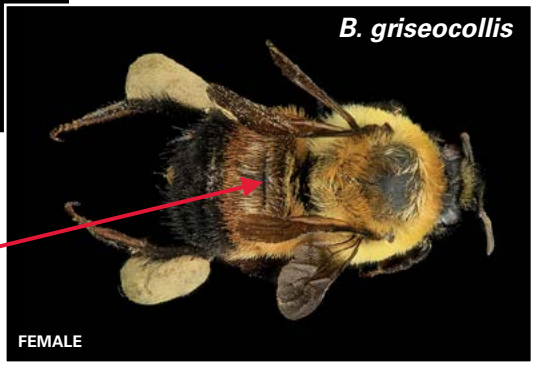
First tergum has ivory to pale-yellow hair.



Area under the tegula covered with mostly yellow hair. **B. pensylvanicus** *looks similar except it has black hair here.*



Less common social parasite of other **Bombus** *species. Hind legs have uniform hair instead of corbiculae since females do not collect pollen.*



First tergum has yellow hair; second tergum has U-shaped patch of brown or rust-colored hair mixed with yellow hair.

B. bimaculatus *is common and similar to* **B. griseocollis** *except it has a yellow* ***W*** *on tergum 2.*

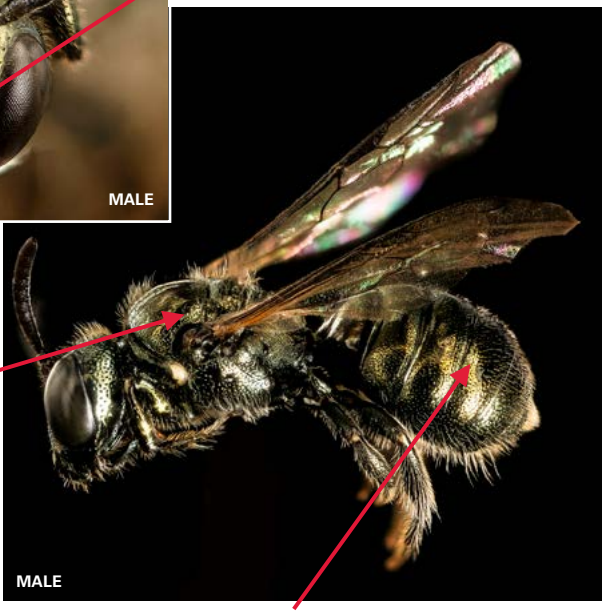
NC STATE EXTENSION

Genus *Ceratina*: Small Carpenter Bees

- Species in NC: 6
- Nest in pithy stems.
- Some species have overlapping generations or maternal care.
- Dull metallic with few hairs.

Clypeus marked with yellow or ivory, even in females. Can be only one central stripe. Best way to distinguish from **Lasioglossum.**

Dull metallic green to blue coloring makes it resemble **Lasioglossum (Dialictus).**



Abdomen is parallel-sided or "barrel" shaped.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

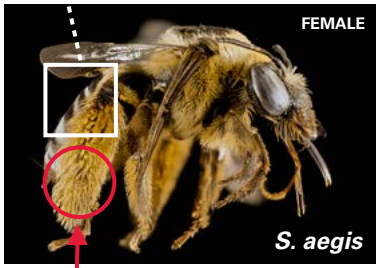
The Eucerines – *Melissodes, Svastra, Peponapis*: Long-Horned Bees

(along with less common *Eucera, Florilegus*, and *Xenoglossa*)

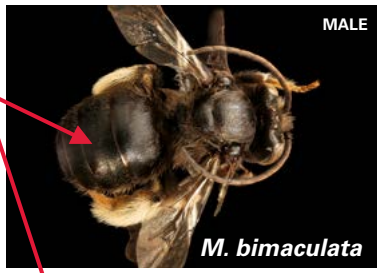
- Species in NC: 27 (21 *Melissodes*, 5 *Svastra*, and 1 *Peponapis*)
- Relatively large bodied.
- Males have extremely long antennae.

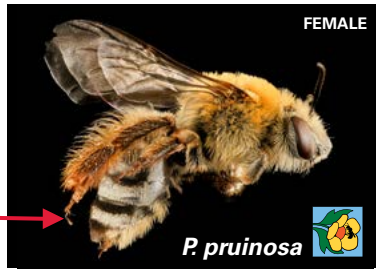
It can be tricky to distinguish between species of these genera.

Svastra *(sunflower bees) are usually larger and have spoon-shaped hairs starting on the second tergum.*



These genera have extensive pollen-collecting hairs on their hind legs.





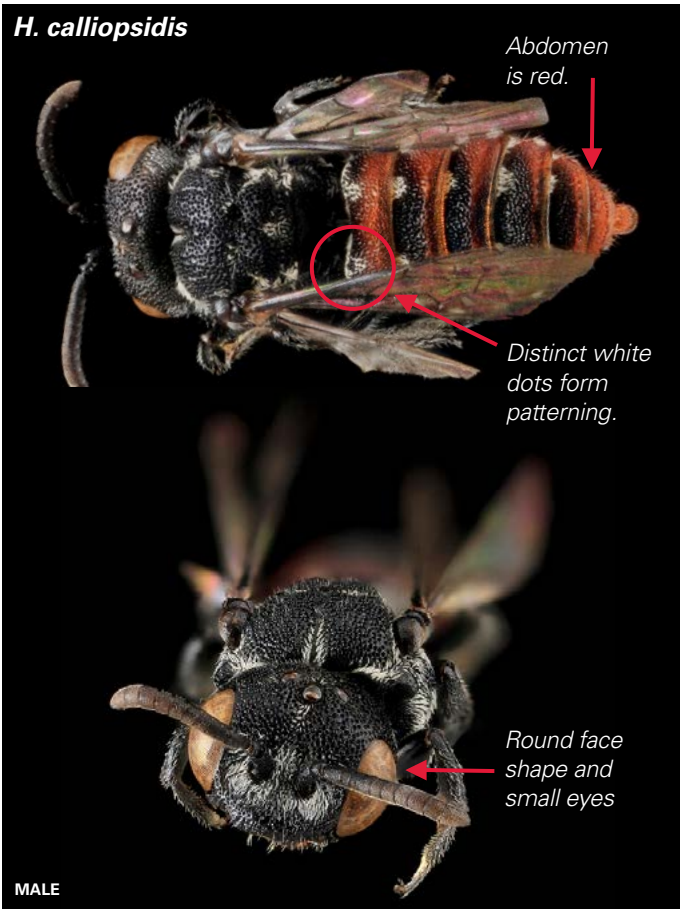
The squash bee is an extremely important specialist pollinator of cucurbit plants.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

Genus *Holcopasites*: Cuckoo Bees

- Species in NC: 2
- Cleptoparasitic on *Calliopsis* bees.
- This genus includes some of the smallest bees in the family Apidae.



JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

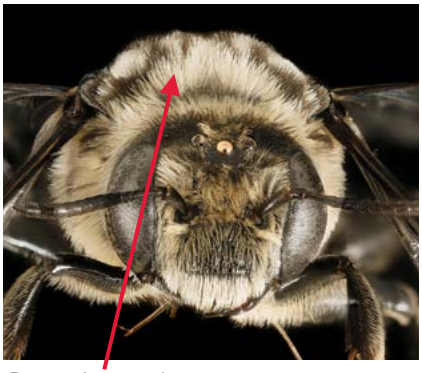
NC STATE EXTENSION

Genus *Melitoma* and *Ptilothrix*

- Species in NC: 1 of each genus
- Common names include morning glory bee for *Melitoma*, rose-mallow or hibiscus bee for *Ptilothrix,* or chimney bee for either.
- These solitary specialists build chimneys at their nest entrances.

M. taurea

Melitoma taurea *is a specialist on morning-glory pollen.*



Patterning on thorax

P. bombiformis

First tergum is uniformly covered with yellow hair.

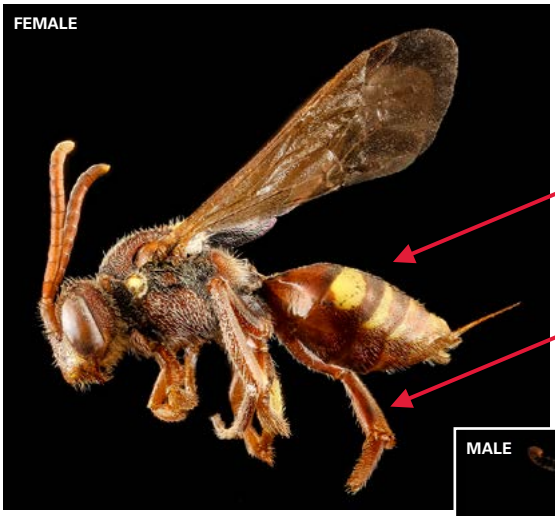
This mallow bee is a specialist on hibiscus pollen.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

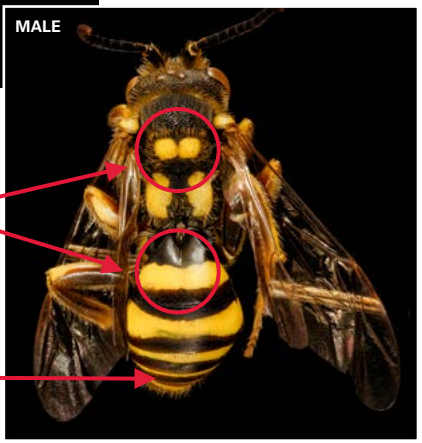
Genus *Nomada*: Cuckoo Bees

- Species in NC: 48
- The most species-rich genus in Apidae and the largest genus of cleptoparasites worldwide.
- Primarily parasitize *Andrena*.



Coloring can vary from almost completely black to almost completely red—usually with extensive yellow stripes, dots, and markings.

Legs can be reddish, yellow, or black.



Yellow markings on thorax and abdomen are important for identification.

Hair is short and compact, giving a wasp-like appearance. However, under a microscope you will still find some branched hairs.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

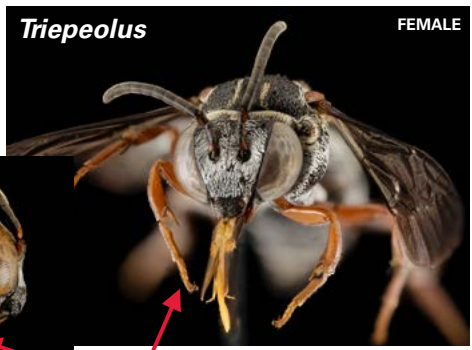
Genus *Triepeolus* and *Epeolus*: Zebra Cuckoo Bees and Variegated Cuckoo Bees

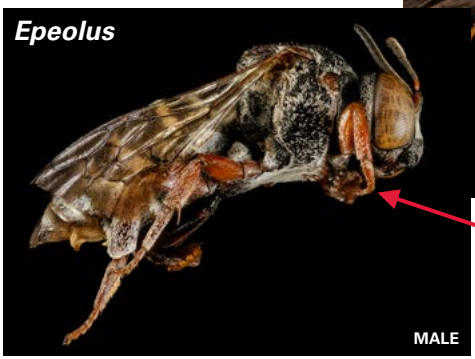
- Species in NC: 31 (18 *Triepeolus* and 13 *Epeolus*)
- *Triepeolus* mostly parasitizes *Melissodes* or *Svastra*, and *Epeolus* mostly parasitizes *Colletes*.

Yellow markings occur on thorax, usually with a double line.

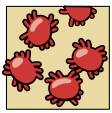
Distinct hair pattern appears on first tergum, usually in either a diamond or a rectangle.

Hair is short and compact, giving a wasp-like appearance. However, under a microscope some branched hairs will still be visible.





Legs can be black, red, or have a reddish tint.



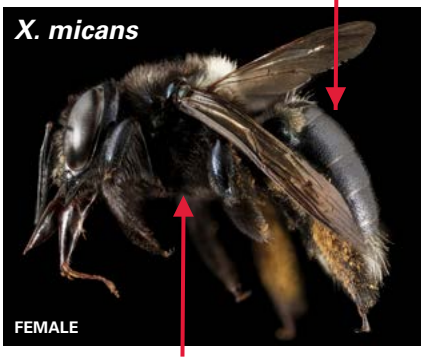
JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

NC STATE EXTENSION

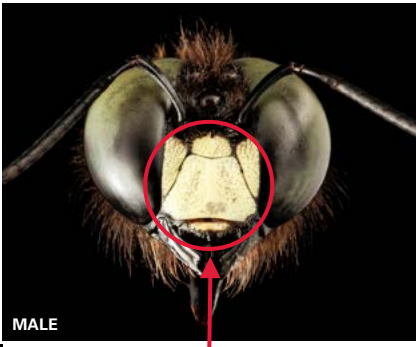
Genus *Xylocopa*: Carpenter Bees

- Species in NC: 2
- Common name is carpenter bees because they build their nests by excavating into dead wood.

Defining characteristic (compared to bumble bees) is that abdomens are relatively hairless and shiny.



Females of this species are all black. Males have ivory to light-yellow hair on their thorax.



Male carpenter bees have a completely ivory to light-yellow clypeus. Females have a completely black one.

Carpenter bees have a long, narrow marginal cell.

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

Useful Resources

- Bees of Georgia pictorial key. Lawrenceville, GA: Georgia Gwinnett College. **http://native-bees-of-georgia.ggc.edu/.**
- BugGuide. Ames, IA: Iowa State University Extension. **https://bugguide.net.**
- Discover Life: **http://www.discoverlife.org/.**
- Burrows, S., et al. 2018. *Exotic Bee ID*. Edition 1. Logan, UT: Utah State University Extension. **http://idtools.org/id/bees/exotic.**
- Embry, P. 2018. *Our Native Bees: America's Endangered Pollinators and the Fight to Save Them*. Portland, OR: Timber Press.
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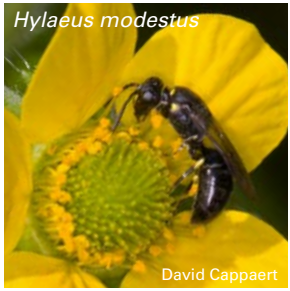
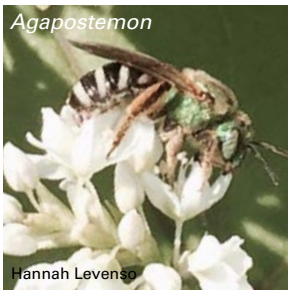
- Michener, C.D. 2007. *The Bees of the World*. 2nd ed. Baltimore, MD: Johns Hopkins University Press.
- Fowler, J., and Droege, S. "Pollen specialist bees of the Mid-Atlantic and Northeastern United States." Online publication. **http://jarrodfowler.com/specialist_bees.html.**
- Wilson, J.S., and Messinger-Carril, O.J. 2015. *The Bees in Your Backyard: A Guide to North America's Bees*. Princeton, NJ: Princeton University Press.

Sources

- Macro photographs of bees courtesy of the U.S. Geological Survey Bee Inventory and Monitoring Lab (USGS BIML): **https://www.flickr.com/photos/usgsbiml/.** Accessed Sep 2018.
- Section photographs courtesy of Hannah Levenson; anatomical photographs courtesy of Elsa Youngsteadt.
- The Bee Tree of Life is a simplification of the one presented by Peters et al. in *Current Biology* (2017) 27:1013–1018, with updates based on Sann et al. in *BMC Evolutionary Biology* (2018) 18:71.
- Seasonal information taken from USGS BIML records for the Mid-Atlantic; patterns may vary slightly in North Carolina: **https://www.slideshare.net/sdroege/bee-genera-phenology-2016.**
- Bee size information is based on the following references:
  Mitchell, T.B. 1960. *The Bees of the Eastern United States*. Technical Bulletin 141. Raleigh: NC Agricultural Experiment Station. **https://projects.ncsu.edu/cals/entomology/museum/easternBees.php.**
  Gibbs, J. 2011. *Zootaxa* 3071: 1-216.
  Gibbs. J., et al. 2013. *Zootaxa* 3672: 1-117.
- Species counts were compiled in December 2018 from Biodiversity Information Serving Our Nation (USGS BISON), Discover Life, the NC State University Insect Museum, and collecting records provided by Sam Droege of the USGS BIML. Counts are still being assembled and validated for North Carolina, and some may be subject to change.

Appendix A: Bees in Action

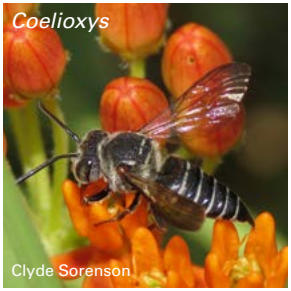





Sphecodes
Hannah Levenson


Anthidium manicatum
Frank Vassen


Anthidiellum
Elsa Youngsteadt


Coelioxys
Clyde Sorenson


Heriades carinata
G. Bohne


Hoplitis
Daniel S. Cooper


Megachile
Hannah Levenson


Osmia
Hannah Levenson


Stelis
Debbie Roos


Apis mellifera
Debbie Roos


Anthophora
Elsa Youngsteadt


Habropoda laboriosa
Clyde Sorenson


Bombus pensylvanicus
Elsa Youngsteadt


Ceratina
Hannah Levenson

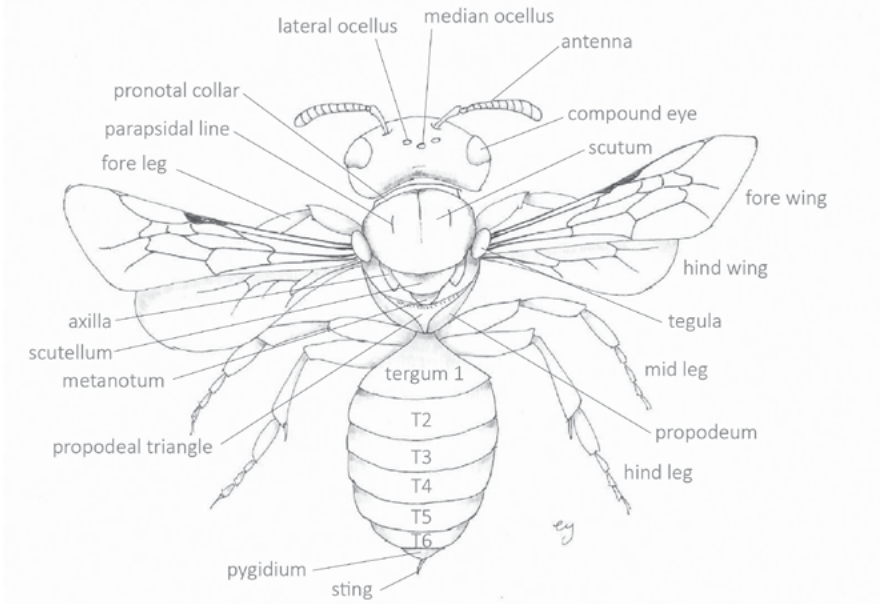

Peponapis pruinosa
Elsa Youngsteadt

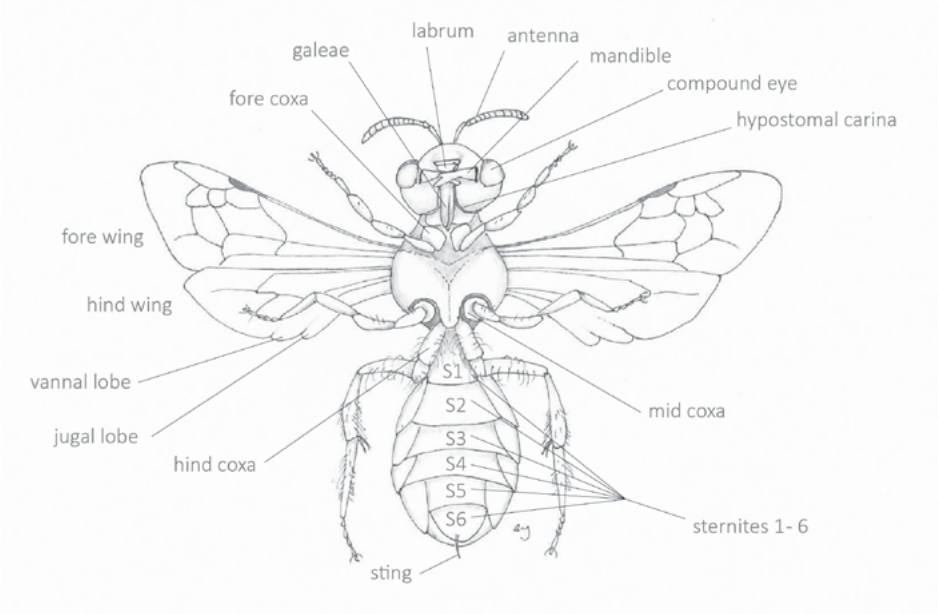

Holcopasites
Hannah Levenson

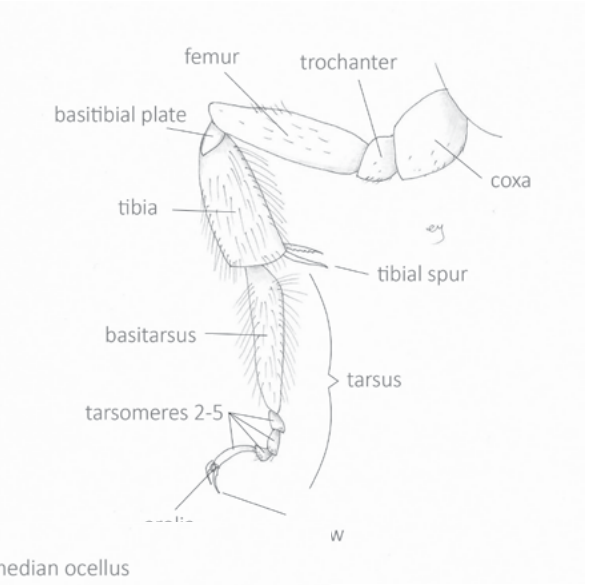

Ptilothrix bombiformis
Elsa Youngsteadt

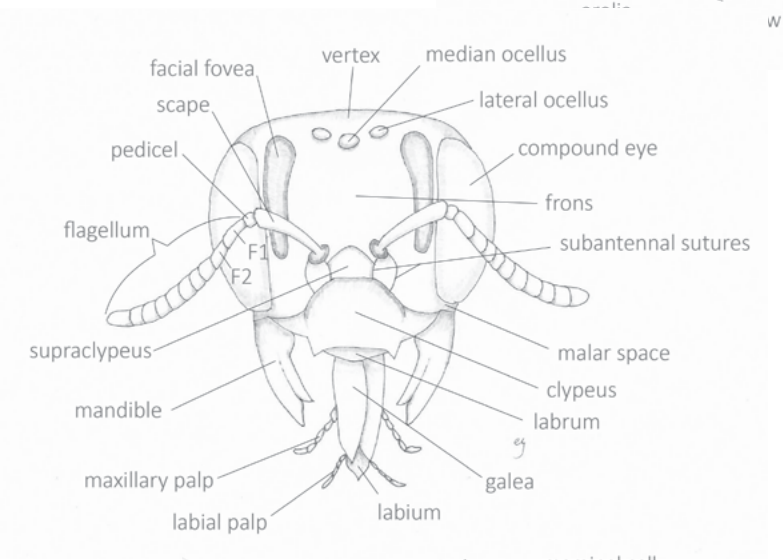

Royal Tyler

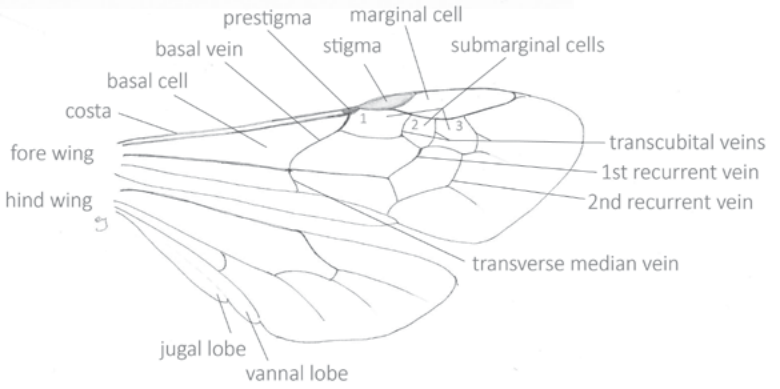
Appendix B: Anatomical Diagrams

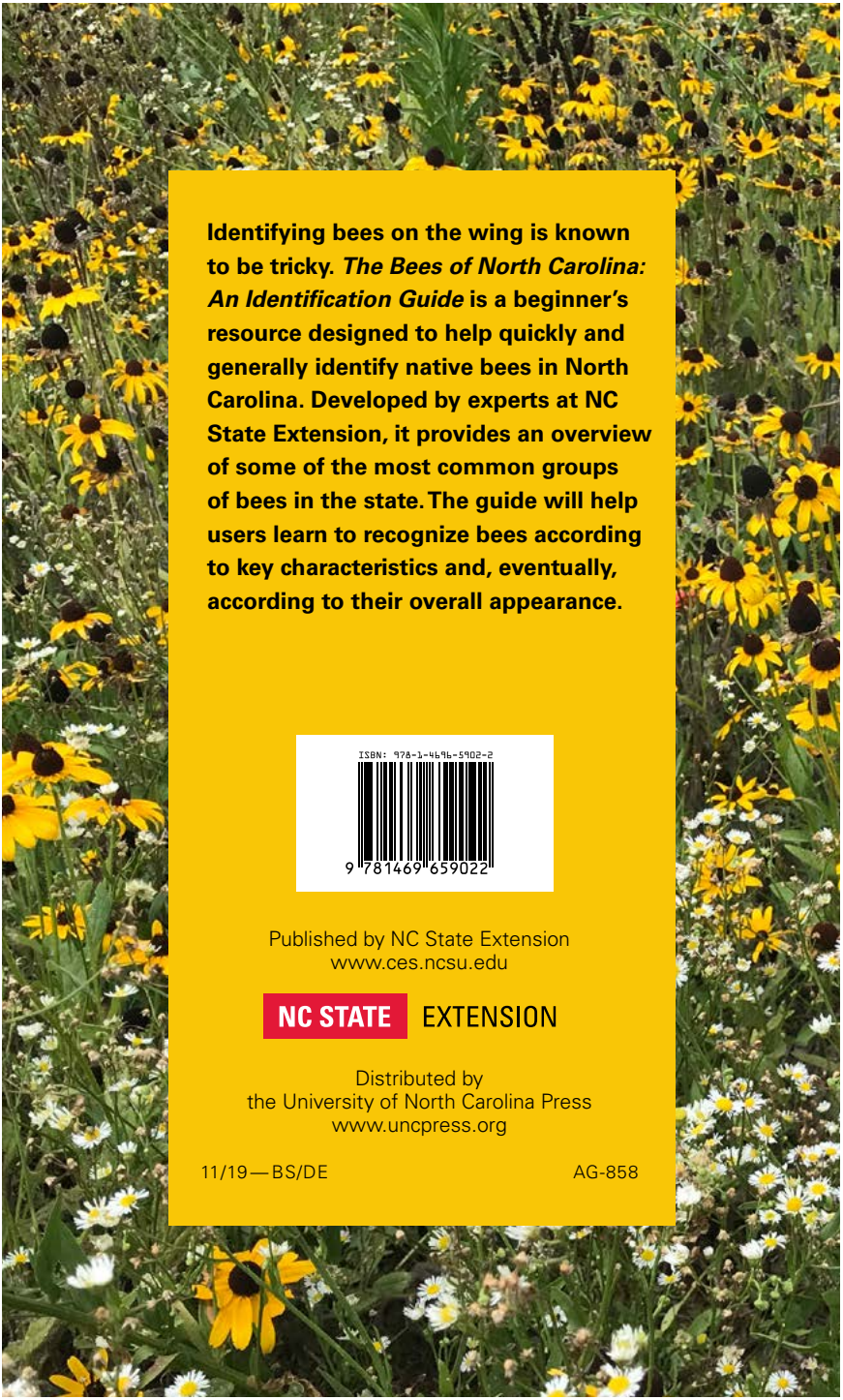





femur
trochanter
basitibial plate
coxa
tibia
tibial spur
basitarsus
tarsus
tarsomeres 2-5


facial fovea
vertex
median ocellus
scape
lateral ocellus
pedicel
compound eye
frons
flagellum
F1
F2
subantennal sutures
supraclypeus
malar space
clypeus
mandible
labrum
maxillary palp
galea
labial palp
labium


prestigma
marginal cell
basal vein
stigma
submarginal cells
basal cell
costa
fore wing
hind wing
transcubital veins
1st recurrent vein
2nd recurrent vein
transverse median vein
jugal lobe
vannal lobe



Identifying bees on the wing is known to be tricky. *The Bees of North Carolina: An Identification Guide* is a beginner's resource designed to help quickly and generally identify native bees in North Carolina. Developed by experts at NC State Extension, it provides an overview of some of the most common groups of bees in the state. The guide will help users learn to recognize bees according to key characteristics and, eventually, according to their overall appearance.

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