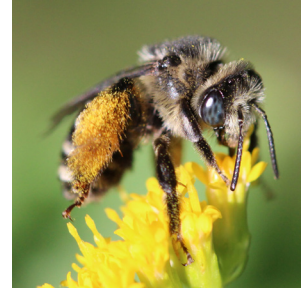


Native Bees, Solitary Bees, and Wild Bees: What are they?



WHEN I EXPLAINED TO MY GRANDFATHER that I was studying native bees, he immediately connected them to Native Americans. “So you’re studying Indian bees?” he said. He was joking, of course, but he actually hit close to the mark. Just like the Native American people lived in America long before the first European settlers arrived, native American bees lived here for millions of years before those settlers brought over the European honey bee. (Before I go further, it should be noted that “native” is a relative term. The honey bee is not native in America, but it *is* a native bee in Europe, Asia, and Africa, where it originated.)

“Solitary bees” is another term you might see used in place of “native”. Solitary bees live on their own, not in colonies with a queen and workers like honey bees and bumble bees. It could be said that each solitary bee is her own queen. She builds her own nest, collects her own pollen and nectar, and lays her own eggs without any help from other bees. Some solitary bees may nest in large groups, but they do not actively help each other.

Most solitary bees are also native, though there are a few exceptions. The European wool carder bee, *Anthidium manicatum*, is an invasive solitary bee that may be detrimental to native bees due to the aggressive, highly territorial males. Likewise, native bees are usually, but not necessarily solitary. Bumble bees are a prime example of a social native bee. Some native sweat bees and carpenter bees are also social.

To avoid confusion due to these slight (but important) differences, the term “wild bees” or “pollen bees” can be used as a general catch-all for basically any bee that is not *Apis mellifera*.

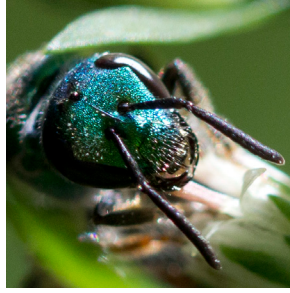
How many are there?

If you are one of the many people who divide “bees” into “honey bees” and “bumble bees”, you might be surprised to learn there are almost 20,000 known species of bees in the world. About 3,500 live in the United States, and in Minnesota, there are probably close to 400. Not even 2% of these are honey bees and bumble bees. The other 98% are those other wild bees we’ve been talking about.



Why are they important?

Aside from being just plain gorgeous?



Pollination.

Honey bees may pollinate most of our crops, but it's up to our wild bees to make sure garden plants, ornamentals, and wildflowers get adequate pollination. We are just now discovering that wild bees are actually better at pollinating a lot of plants than honey bees are. Bumble bees make great tomato and pepper pollinators thanks to their habit of buzzing the flower to shake pollen loose. There are even some wildflowers like the bottle gentian, which can only be pollinated by large bumble bees strong enough to force the petals apart. The solitary blue orchard bee, *Osmia lignaria*, flies early in the spring when it might still be too cold for honey bees, pollinating willows and fruit trees such as apples and cherries. And the squash bee *Peponapis pruinosa* will seek out pumpkins, squash, and other cucurbits to the exclusion of all else, making it a superior pollinator for those plants. The world of native bees is full of examples like this.



Attracting Wild Bees to your Yard or Garden: How can I do it?



Bees have two basic necessities: food and shelter. Flowers provide food for bees in the form of nectar and pollen. Ideally, you should have many different kinds of flowers that bloom at different times of the year, so there is always something available to the bees on any given day. A greater diversity of flowers will naturally attract a greater diversity of bees, and also provide a greater diversity of nectar and pollen. Not all nectar and pollen is equally nutritious, so a variety is important for a healthy bee diet. The more flowers you can plant yourself, the better: wild bees generally have a much shorter foraging range than honey bees, so don't assume they can nest in your yard and get their pollen and nectar "somewhere else".



Bee Lab

www.BeeLab.umn.edu

Written by Joel Gardner. Pictures by Joel Gardner except where indicated.



Bee Squad

The second necessity, shelter, refers to places where bees can nest. Most non-parasitic bees (between 60 and 70%) dig burrows in the ground. These bees prefer dry, sandy soil bare of vegetation, often on hillsides. The main burrow will have several branching tunnels, each containing a lump of pollen and an egg, which usually takes one year to develop into an adult bee and the cycle can begin anew. You can attract ground-nesting bees simply by making sure to leave some spots of exposed, undisturbed soil in your yard. Bumble bees can nest underground too, but use abandoned rodent burrows instead of digging their own.

The other 30-40%, the cavity-nesting bees, require a bit more effort to draw in. These bees use hollow plant stems or holes in wood left by wood-boring beetles, instead of digging a tunnel in the ground. A nesting bee will use mud, leaves, or another material to build walls and divide the tunnel into a linear series of small, sealed cells. Each cell contains a lump of pollen and an egg, like the burrows of ground-nesting bees, and the complete life cycle usually takes one year.

You can attract cavity-nesting bees by providing tunnels in a man-made structure called a bee house—like a bird house for bees. We will shortly explore the different types of bee houses in depth.

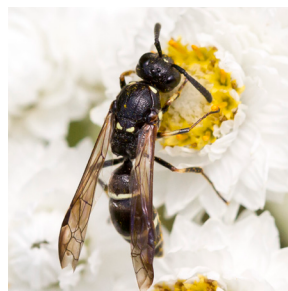


Open nest of a carpenter bee (*Xylocopa*) showing series of divided cells and development from larva to pupa. Carpenter bees carve their own tunnels out of wood with their powerful jaws, but otherwise have similar nesting habits to other cavity-nesting bees.

A note on stinging

When you mention bees, most people will immediately think of stinging. So you might naturally ask, “If I set up a bee house, would the bees sting me or anyone else?”

Answer: No. They are capable of stinging, but they won’t do it even if you open their nest. They may sting in defense of their life if you grabbed one and squeezed—but even then, the sting of solitary bees is very mild compared to honey bees or bumble bees; little more than a pinprick. Solitary wasps, which also frequent bee houses, are gentle, but watch out for social paper wasps that like to build nests in shelter boxes. A person with a hyper-sensitive bee allergy may have cause to be wary, but even in this case, you are at almost the same risk of being stung anywhere else as you are by a solitary bee house.



Right: An aggressive, social paper wasp. Left: A gentle, solitary potter wasp.



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Bee Squad



Building Wild Bee Houses:

The bundle of sticks



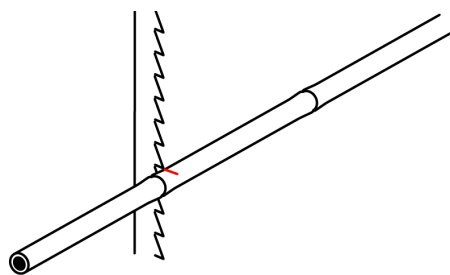
Simplicity: ★★★★★ Accessibility: ★☆☆☆☆ Reusability: ★☆☆☆☆

The simplest type of bee house is the bundle of sticks model. Pretty self-explanatory: just take some number of hollow sticks or reeds, bundle them up, and put them out where bees can find them. Usually, the bundle will be contained in some sort of shelter to keep the sun and rain off, but you can put out plain sticks tied up with wire, too.

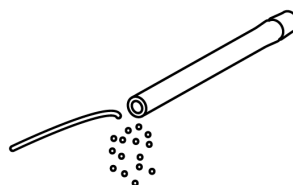
Bamboo is a popular material for its availability and durability. Bundles of first-cut bamboo stakes can be ordered in bulk from garden stores and cut into appropriate lengths for bees. Phragmites is easier to cut than bamboo, but harder to obtain. If you have the right plants, you can even collect dead stems from your garden in the fall or spring for a bee house. Raspberries, bee balm, Joe-Pye weed, cup plant, sumac, certain asters, or anything else with a large hollow stem provides good nesting places for bees.

This type of bee house is good for people without much woodworking experience or access to tools, as the sticks can be cut using only a pair of shears if need be. It is relatively fast and simple to make. However, it is more difficult to keep the tunnels clean or to check for nesting bees, as the contents cannot be accessed without splitting the nest open. Sticks will therefore need to be replaced after one or two years of use to prevent disease buildup. (The presence of a mud, leaf, or resin “cap” at the tunnel entrance is a good indication of whether or not it has been used, although a small fraction of nests will be incomplete and lack a cap.) But for a simple, temporary bee house without any extra frills, the bundle of sticks is a great design.

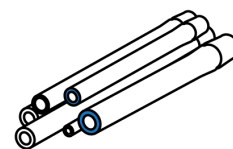
Making Reed Nests



Cut reed into segments just behind the nodes, so only one end of the segment is open.



Remove some of the soft pith filling with a bent wire or drill. (Bees will clean out any remainder.)



Paint some front faces blue or black (optional) and bundle together.



The wood block

Simplicity: ★★★★★ Accessibility: ★★★★★ Reusability: ★★★★★

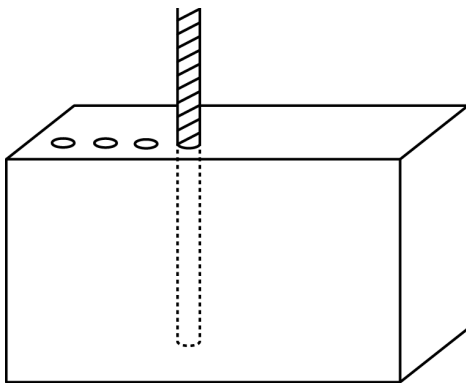
A slightly more advanced type of bee house is the wood block model. This design mimics the holes in trees that cavity-nesting bees will use in the wild. It is simply a block of wood of any size with some deep holes drilled partway through it (this will require a power drill and a very long bit). At that point you could be done, and bees would nest in it, but there are several problems with that. The tunnels in this case are even less accessible than the bundle of sticks, making the block very difficult to keep clean and the bees inside impossible to see.

The solution is to insert disposable paper straws into each tunnel. These can be pulled out to access the bees, and easily be replaced with new straws to keep pathogen levels down. Because drilled holes will all be of uniform size, the straws can be cheaply purchased in bulk or even rolled yourself. Glass or clear plastic tubes may be used instead of paper in order to easily see inside, but this is not recommended except perhaps in very arid places. Glass and plastic do not absorb moisture, creating a damp environment that will facilitate mold growth. Bees will have greater nesting success in paper.

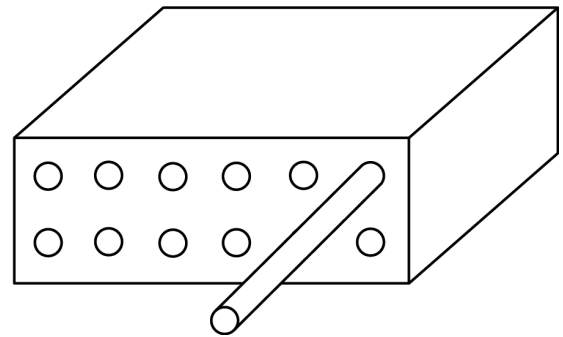
Perhaps the main disadvantage of the wood block model is the lack of variety in tunnel diameters compared with the bundle of sticks. With too little variation, the nest will not attract as many different kinds of bees, though this can be overcome to some extent by using several different sizes of drills. However, if you only want to attract a certain kind of bee (for example, the blue orchard bee for apple pollination), the uniformity of this nest is actually beneficial.

People who raise commercial pollinators for crop pollination often use this design, sometimes with foam blocks instead of wood. Foam is much cheaper than wood and is easily disposed of and replaced.

Making Wood Block Nests



Drill holes partway through wood block with a long drill bit.



Insert paper straws into holes.



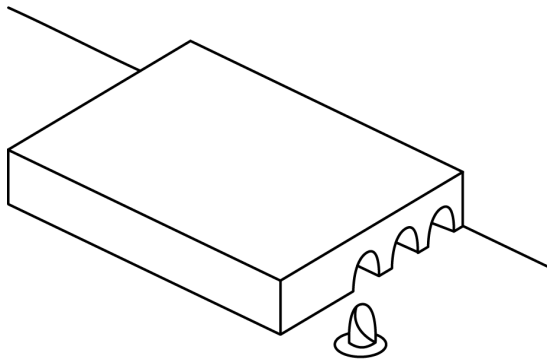
The observation block

Simplicity: ★☆☆☆☆ Accessibility: ★★★★★ Reusability: ★★★★★

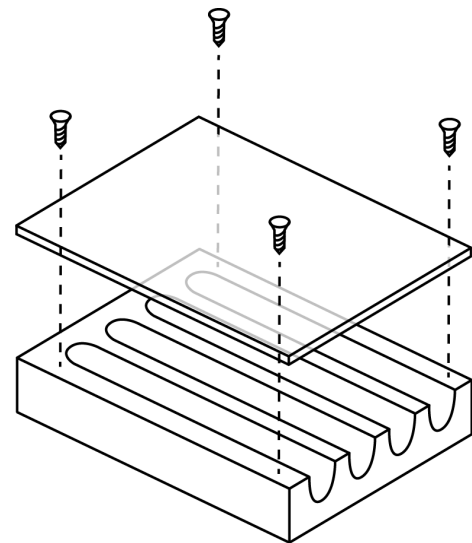
The most complex type of bee house, but the best in terms of convenience, is the clear-topped wood block or observation block. It is similar to other wood block nests, only instead of drilling holes, you use a router to cut U-shaped grooves in the outer face(s) of the block. These grooves are then covered with a transparent lid to make a tunnel for bees to nest in. The nests can be easily seen without opening them, so you can even watch the bees at work during nesting season and monitor their progress. When cleaning is needed, the lids can be removed for easy access to the interior, then replaced when they are ready to be used again.

The main drawback to the clear-topped wood blocks is the difficulty and expense of construction. You will need a router, a circular saw or table saw, and a drill press is useful, too, if you want to secure the lids with wood screws (the other option is glue, which will preclude removing and replacing the lid more than once). As with the solid wood blocks, you also have less variation in tunnel sizes.

Making Observation Block Nests



Cut straight U-shaped grooves in wood with a router.



Attach clear lid using glue or wood screws with countersink.



Tips for making bee houses

No matter what kind of bee house you make, these general tips will help make it a success.

- Tunnels should be open on one end and closed on the other end. Being open on both ends increases exposure to parasites and pathogens. If using a bundle of reeds like bamboo, cut the segments so that one end is closed by a natural node.
- Ideal tunnel depths are between 5 and 8 inches, and diameters from 1/8" to 1/2"; you do not need to be very exact. Variation in tunnel dimensions accommodates more bees of different species and sizes, and also helps bees distinguish their nest from others nearby and remember where it is. If all the tunnels look the same, the bees may become confused and lose track of their nests.
- It should be obvious, but do not use treated wood or aromatic insect-repellent wood (such as cedar) for nest blocks.
- If you are making clear-topped wood blocks, get high-quality wood with as few knots as possible, as knots can weaken the walls between adjacent tunnels. Going across the grain also weakens tunnels.
- To create more nest variation to help the bees orient themselves, paint the tunnel entrances different colors. Blue, black, and unpainted raw wood make a good contrast. Keep in mind that bees cannot see reds.
- Bright, fluorescent blue is highly visible and attractive to bees. Painting parts of your nest or shelter box this color might attract more bees from longer distances.

Tips for setting up bee houses

- Bee houses should be around three to five feet above the ground. Individual stick bundles or wood blocks can be hung up using wire, while metal garden stakes with wood screws work well for holding wooden shelter boxes.
- Watch out for ants and spiders. Keep approaches to the nest lubricated with petroleum jelly, tanglefoot, or a similar product; this makes it difficult for ants and spiders to keep their grip. Keep the immediate area around the nest clear of tall grass and weeds so ants and spiders cannot climb up directly onto the nest. However, nothing is foolproof, and especially in wetter, more thickly grown patches, you will usually need to remove ants and/or spiders that find their way in.
- Ideal locations are recently disturbed, weedy fields in the process of reverting to a more natural state. Abandoned lots, overgrown gardens, railroad right-of-ways, and recently cleared trees are all good bets. Place the nest in a dry spot with low vegetation, if possible. Mason bees need a nearby mud source, but don't put the nest right on top of it.



- Most importantly, make sure there are flowers available throughout the spring, summer, and fall. Ideally, there should be several species blooming at any given time. Maintaining a “pollinator garden” nearby is always a good idea. In addition to flowers, you can also harvest stems for bee houses.
- If possible, put the nest on the eastern side of a tall obstacle such as trees or a building, so that it will receive warm sunlight early in the morning, but be shaded from intense afternoon heat. The nest entrance should face southeast to get more early morning sun.

Tips for maintaining bee houses

- You wouldn't like to live in a house that is never cleaned, and neither do bees. Nests should be cleaned or replaced at least every two years. Longer than that, and pathogens such as chalkbrood and hairy-fingered mites can build up to high enough levels that the nest becomes more like a bee death trap. Having so many tunnels close together makes it easy for pathogens to spread through the whole nest if left unchecked.
- Nests can be sterilized with a 50% or higher bleach/water solution. Obviously, you will want to remove any bees inside first. If you have a wood block nest with paper straws or a removable lid, you can remove the bees manually and release them when they are ready to fly next season, or else it can be accomplished with the aid of an “emergence chamber”.
- An emergence chamber is a dark, sealed box with one small hole on the bottom big enough for a bee to fit through. You can put any occupied nests in it, put the emergence chamber outside, and wait for the bees to emerge naturally. When they do, they will see the light from the exit hole and crawl out, but they are not likely to find their way back in. Thus, no bees will nest in the used tunnels, and they will be ready for cleaning as soon as all the bees emerge. Ideally, you would have fresh nests set up outside the emergence chamber for the new bees to find. In this way, you can cycle two different nests in and out of use while keeping them clean.
- Over the winter, keep bees in refrigerated cold storage (around 4° C) or an unheated garage or shed. Wild bees can survive outside winter temperatures (they wouldn't still be here if they couldn't), but direct exposure to extreme lows will likely result in some deaths.
- In early spring, when the first flowers start blooming, take the bees out of storage and wait for them to emerge. This might happen almost immediately (with mason bees) or take a few months (with leafcutter bees).





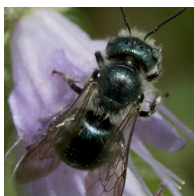
Common Visitors to Wild Bee Houses



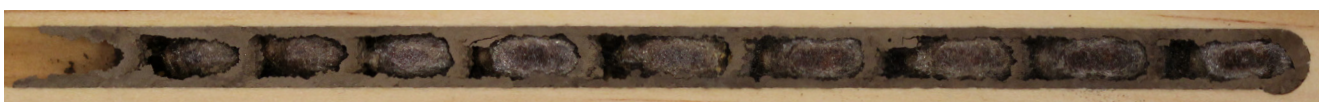
So you're ready to build a bee house and set it up somewhere. What can you expect to get in it?

This is a summary of the different kinds of bees and wasps I found during 3 years of nest surveys in Minnesota and North Dakota. Depending on where you live, you might get totally different species. Give it a try!

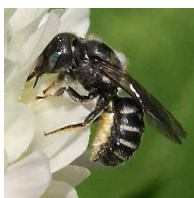
Bees



OSMIA (MASON BEES) fly from early spring to early summer. Nests are highly variable depending on the species. Most construct cells with mud or leaf pulp, but sand, gravel, resin, wood chips, or flower petals may also be used. The adults are dark, bulky bees, often with a metallic blue sheen, and are easily recognizable but rarely seen due to their fast flight.



Osmia lignaria cocoons separated by mud walls.

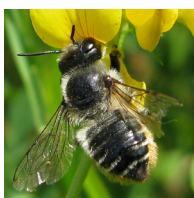


HOPLITIS fly from mid-spring to early summer. They are closely related to mason bees and have similar habits. Nests can be made out of leaf pulp or mud. The adults look like mason bees, except somewhat more slender and usually without any metallic sheen (one Southern species is brilliant bright green or purple).

Photo courtesy Diane Wilson, www.bugguide.net



Hoplitis albifrons prepupae in cells separated by leaf pulp.



MEGACHILE (LEAFCUTTER BEES) fly all summer. Nests are variable depending on the species, but most use cut leaf fragments to build fully enclosed cells, from which the bees get their common name. Certain *Megachile*, called resin bees, use only plant resins, and leaf pulp or mud may also be used in other species. The adults are dull black with white, yellow, orange, or black hair often forming stripes, and their stout body shape is recognizable with practice. Some males have strikingly broad, pale front legs.



Megachile relativa cells made of leaf fragments, each containing a larva and pollen provisions.





HERIADES fly all summer. A small group, there are just two common species in the Midwest (11 in all North America), and both use plant resin to construct cells. These are small, black bees with short white hair, easily overlooked in the wild. Close up, their bodies are very distinctly sculptured with round pits like a golf ball.



Heriades carinatus prepupae in cells made completely of hardened plant resin.



HYLAEUS (YELLOW-FACED BEES) fly all summer, and are one of the few cavity-nesting bees not in the family Megachilidae. Only Megachilidae use foreign material (leaves, mud, resin, etc.) in their nests; yellow-faced bees make cells out of a thin, clear film that they secrete from glands on their bodies. The adults are tiny, hairless, and glossy black with yellow markings. They are easily mistaken for wasps by the untrained eye.



Hylaeus prepupae in fragile cells of thin, clear waterproof film.



ANTHIDIUM (CARDER BEES) fly all summer. They collect hairs off of certain fuzzy plant leaves and make a wooly substance with which to line their nests. Adults are black with yellow markings, and are easily mistaken for wasps or hover flies, although they have the stout body and long hair of a bee. The most common species is the invasive European wool carder bee, whose males have a distinctive hovering flight as they patrol their territory, chasing away other bees that get too close.



Anthidium manicatum nest cells surrounded by wooly plant fibers. Photo courtesy Peter Hallett.



COELIOXYS AND STELIS are **cleptoparasitic** bees. They do not make nests of their own; instead, they find another bee's nest, destroy the host bee's egg, and sneak their own egg in its place. The host bee can't tell the difference, and the cleptoparasite larva will eat the host's pollen, all without the cleptoparasite mother needing to do any work. Fortunately, cleptoparasitic bees are very rare and do not have a large impact on host populations compared with other factors (such as disease). *Coelioxys* adults resemble leafcutter bees with short hair and a long, sharply pointed abdomen. *Stelis* adults resemble short-haired mason bees or carder bees, often with pale spots or yellow stripes on the abdomen.



Stelis rudbeckiarum photo (bottom) courtesy Diane Wilson, www.bugguide.net



Wasps

Like solitary bees, solitary wasps are much gentler than their social cousins. They will not sting under normal circumstances, even if you open their nests.

Unlike bees, wasps are predators. Instead of provisioning cells with pollen, they will catch prey and bring it back to the nest for the larvae to eat. Solitary wasps visit flowers for nectar and do some incidental pollination, but their main benefit is in keeping pest insect populations down.



ANCISTROCERUS AND EUODYNERUS (POTTER WASPS) fly all summer. Their nests are made out of mud and stocked with small caterpillars or beetle larvae. They have two generations per year, one in early summer and another in late summer. Adults are large, glossy black, with yellow stripes and spots.



Ancistrocerus albophalaterus prepupae in mud-walled cells.



PASSALOECCUS (APHID WASPS) fly in early summer. Nest cells are made out of pine resin and stocked with a couple dozen aphids each. The adults are tiny, black, and unremarkable; perhaps their most distinguishing feature is their large protruding jaws. Due to their efficiency at collecting aphids, they have been considered as a possible aphid biological control agent, something any gardener should be interested in.



Passaloecus prepupae, along with uneaten aphids (6th cell from right) and a parasitic chrysidid wasp (9th from right.)

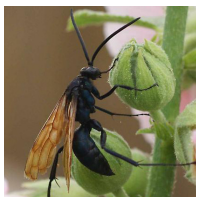


ISODONTIA (GRASS-CARRYING WASPS) fly in mid-summer. As their name suggests, grass-carrying wasps carry grass to build their nests, which they stock with captured tree crickets. No other bee or wasp uses grass as a construction material. Adults are large and solid black, with a distinct narrow “waist” between the thorax and abdomen.



Abandoned *Isodontia* nest with grass filling.





POMPILIDAE (SPIDER WASPS) fly in summer. Most nest in underground burrows, but a few will use solitary bee houses. Nest cells are made out of mud, sometimes in a distinctive pot shape, and stocked with one spider each. Adults vary greatly in appearance, but most species using bee houses are small, black, and slender. If you are lucky, these rarely-seen wasps can help protect your bee house from spiders.

Photo courtesy Diane Wilson, www.bugguide.net



Pot-shaped mud cells of a spider wasp, with a dead adult outside the far right cell.

CHRYSIDIDAE, SAPYGA, EPHIALTES, MELITTOBIA, AND OTHERS are parasitoids that fly at various times depending on host activity. Parasitoid wasps find a host (in this case, a solitary bee or wasp larva) and lay an egg in or on it. The parasitoid larva then hatches and eats the host alive. Parasitoid wasps are extremely diverse and more common than cleptoparasitic bees.

ANTHRAX, a parasitoid fly, also attacks solitary bees and wasps.

