Pocket Guide to the Native Bees of New Mexico

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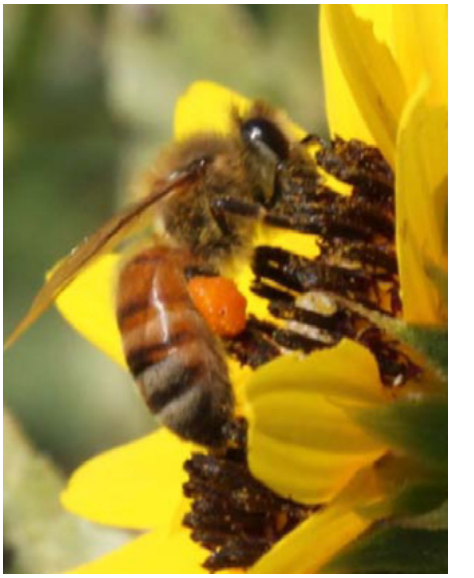
Introduction

Honeybees and wild native bees pollinate approximately 75% of the fruits and vegetables grown in the US. In recent years, however, honeybee populations have declined in many parts of the world due to the phenomenon known as Colony Collapse Disorder. Research indicates that native bees can often fill the 'pollination gap' when honeybees are scarce, and there is increasing interest in growing flowering plants to help sustain our native bees, honeybees, and other beneficial insects. New Mexico State University and the Natural Resources Conservation Service's NM Plant Materials Center are collaborating in testing more than 200 species of (mostly native) plants for their survival, ease of cultivation, and ability to attract and sustain pollinators and other beneficial insects. This publication, funded by the Western Integrated Pest Management Center, is intended as an introductory guide to the main groups of native bees that you might expect to see visiting such plants. Information on techniques for enhancing bee habitat is also included.

Native bees and how they differ from honeybees

The familiar European honeybee (*Apis mellifera*), as its name suggests, is not native to the US, but is a semi-domesticated species introduced to provide honey and pollinate crops. Large-scale fruit and nut growers often rent hives of honeybees to ensure pollination of their plants, and the fact that honeybees can form large 'social' colonies makes them well-adapted to transport and intensive management of this type. Most native bees, in contrast, are either 'solitary' species that nest and raise their brood alone or form only relatively small colonies (e.g., bumble bees (*Bombus* spp.)). Some species show intermediate, 'gregarious' nesting behavior, whereby each female forms their own nest but in close proximity to the nests of other females of the same species.

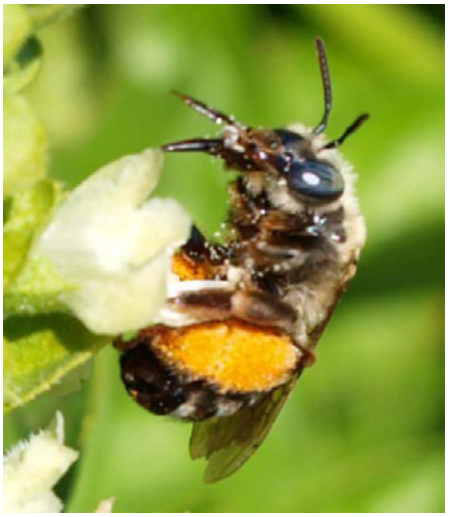


Honeybee on *Helianthus petiolaris* (top) and native bee on *Phacelia integrifolia* (bottom).

Ground nesting native bee on *Gaillardia pinnatifida* (left) and entrance to her nest (right).

Preferred nesting sites vary: some native bees nest in the ground, excavating tunnels that may reach a foot or more below the soil surface, while others use existing holes in dead wood or hollow plant stems, eventually plugging the entrance with mud or finely chewed plant material. The so-called 'carpenter' bees (*Xylocopa* spp.) excavate their own tunnels in dead wood, but can be deterred from damaging wooden structures by applying paints or stains. The bees typically provision each 'brood cell' (chamber) in the nest with a ball of nectar and pollen on which their larvae feed and develop.

Native bees vary in the structure and length of their mouthparts and the degree to which they specialize on particular flowers. Some flowers (often those with a tubular shape) have nectaries inaccessible to so-called 'short-tongued' bees and are pollinated by species with longer mouthparts. Some bees are 'generalists' in their foraging and will visit the flowers of many different plants, while others specialize on a much more limited range of species. When planting for pollinators, try to include a broad range of flower shapes, sizes, structures, and colors to benefit as many species as possible. Native plants are excellent since our wild bees are already adapted to them. Species that bloom in spring or autumn are particularly valuable, as floral resources are often scarce at these times.



Not all flowers are equally accessible to all bees: flowers of *Baptisia* (top) and basil (*Ocimum basilicum*) (bottom).

Habitat enhancement for bees

Any garden can be made more inviting for bees and other beneficial insects. Remember that even organically approved insecticides can be toxic to such species, so minimize their impact by practicing integrated pest management (IPM) and by not spraying flowering plants when pollinators are active. Some systemic insecticides (e.g., imidacloprid) can move within the plant and reach damaging concentrations in nectar, so try to avoid such products.

Provide a source of clean water, for example by filling a shallow plant saucer with pebbles and adding water until they are partly submerged. The exposed parts of the pebbles provide landing sites for bees and other insects. To avoid encouraging mosquitoes, empty the container every few days and allow it to dry out for several hours before refilling.

Water dish with pebbles (top) and honeybees drinking at drip-irrigation tape (bottom).

A homemade 'bee house' and close-up of bamboo nesting tubes: some have been sealed with mud, others with chewed leaf material.

Nesting habitat for ground-nesting bees can be provided by maintaining areas of bare soil that remain undisturbed all year (such bees usually overwinter in their subterranean nests). Habitat for species that nest in holes or plant stems can easily be provided by drilling holes in old tree stumps, untreated logs, or scrap lumber. Holes should be 4-5 inches deep and with a variety of diameters from 3/32 to 3/8 inch. Four- to 5-inch lengths of bamboo (with similar diameters), cut with one end open and one closed (i.e., cut just below a joint) can be packed into an open container (open end outwards) and used in a similar way; place the packed container horizontally 3-4 feet above ground in an east-facing site.

Male long-horned bee on *Cosmos bipinnatus*. Females of this species have much shorter antennae.

Principal bee families of New Mexico

More than 4,000 species of native bees occur in the US, classified into 6 major families (although there are more elsewhere). Representatives of most of the US families are found in New Mexico, although the species are so diverse in size and appearance that it is sometimes difficult for non-specialists to discern the basis on which they are assigned to different families. Bee identification is further complicated by the fact that, in many cases, the female of a species can look very different from the male. Nevertheless, all species within a family share certain characteristics (although some can only be seen with a microscope), and these distinctive features form the basis of their classification.

Family: Andrenidae ('Miner' bees) (various species)

All of the bees in this family nest in the ground (usually in sandy soil), giving them the common name of 'miner bees'. They vary greatly in size and general appearance, although all have velvety patches of hair (facial foveae) between their eyes and the bases of their antennae. This family includes some of the earliest species to emerge in spring (e.g., the *Andrena* species shown on chokecherry, above right). In many species, the adults are active for only a few weeks and the rest of the life-cycle is spent below ground. Sizes of Andrenid bees vary greatly, from approximately 16 mm in length down to the tiny *Perdita* bees (right), that can be just a few millimeters long. Bees in these two genera (i.e., *Andrena* and *Perdita*) make up more than 80% of US Andrenid bees.

***Andrena* sp. on *Prunus virginiana* (top) and *Perdita* sp. on *Layia platyglossa* (bottom).**

Family: Apidae

This is the largest and most diverse bee family and is divided into 3 subfamilies. It includes honeybees and bumble bees as well as less well-known groups of native bees such as long-horned bees, digger bees, and squash bees. The life-histories of these bees are correspondingly diverse, with solitary, social, and gregarious nesters all represented; some nest above ground in cavities (e.g., in dead wood), others below ground. Some species are even 'cleptoparasites' ("cuckoo bees"), taking over the nests of other bees for their own offspring.

Diversity of Apid bees: honeybee (top), bumble bee (center) and cuckoo bee (bottom).

Bumble bee (*Bombus* sp.) 'buzz-pollinating' an eggplant flower: the bee grasps the pollen-bearing anthers with her legs and rapidly vibrates her wings to shake the pollen free.

Family: Apidae
Subfamily Apinae

1. Bumble bees (*Bombus* species)

These familiar large, furry bees are generally black with areas of paler hairs (usually yellow or white, depending on species). Mated queens hibernate overwinter and establish small colonies in the spring, either below ground (e.g., in abandoned rodent burrows) or in places such as old straw bales. Compared to those of honeybees, bumble bee colonies are relatively small – up to a few hundred workers. The queens are active in early spring and the workers until the end of summer. Bumble bees are good pollinators of Solanaceous crops such as tomatoes and eggplant.

Squash bee (*Peponapis* sp.)

Family: Apidae
Subfamily Apinae

2. Squash bees (*Peponapis* species)

As their common name suggests, these bees specialize on flowers of squash, pumpkins, melons, and their wild relatives. They are more effective at pollinating such plants than are honeybees, and are active earlier in the morning. Mating occurs in the flowers, and the males can be found resting in the closed blooms during the day. These bees are brown with a striped abdomen, and are somewhat larger than honeybees (but smaller than bumble bees). They nest underground, often in large aggregations.

Family: Apidae
Subfamily Apinae

3. Digger bees (*Anthophora* species)

There are about 70 species of *Anthophora* bees in the US, with a considerable diversity in New Mexico. Most are relatively large, stout, hairy bees (often grey in color) that fly rapidly between flowers. These so-called 'long-tongued' bees can extract nectar from deeper flowers such as those of some native *Penstemon* species. As their name suggests, they nest in the ground – some will even nest in heavy clay. Like bumble bees (*Bombus* spp.), some *Anthophora* are important pollinators of tomato plants.

Two species of *Anthophora*: on *Physaria newberryi* (top) and *Gaillardia pinnatifida* (bottom).

Male long-horned bee (*Martinapis* sp.) on lavender (left) and a sleeping cluster on *Helianthus petiolaris* (right).

Family: Apidae
Subfamily Apinae

4. Long-horned bees (various species)

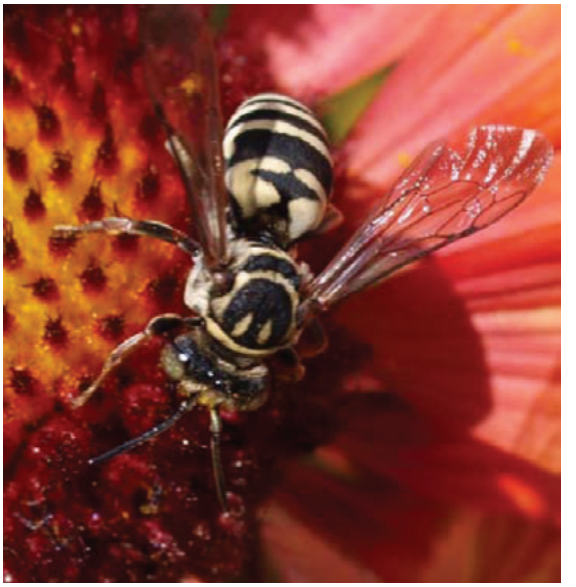
The long-horned bees (tribe *Eucerini*) are so named because the males typically have very long antennae (those of the females are much shorter, so that the two sexes may at first glance be mistaken for different species). Most of these bees nest underground. Some species visit a range of different flowers, while others are more specialized; several species are particularly associated with both wild and cultivated sunflowers. On cool mornings, aggregations of males may sometimes be found asleep on the flowers.

Female *Diadasia* sp. on caliche globemallow (*Sphaeralcea laxa*). Note the pollen carried on the hairy 'scopa' of the hind leg.

Family: Apidae Subfamily Apinae

5. Mallow, sunflower, or cactus bees (*Diadasia* species)

There are about 30 species of *Diadasia* in the US, mainly in the western states. Different species are associated with different flowers, specializing to a greater or lesser degree. Some species are important pollinators of commercial sunflower crops. Size and coloration vary, some are uniformly pale, while others have pale bands on their abdomens, giving them a striped appearance. All are ground-nesting, and some protect the entrance to their nest by constructing short, bent 'towers' of soil particles. The species shown here is often found on flowers of globe-mallows (e.g., *Sphaeralcea laxa* and *S. ambigua*).



Cuckoo bees on *Gaillardia pulchella* (left) and *Machaeranthera pinnatifida* (right).

Family: Apidae Subfamily Nomadinae

6. Cuckoo bees (e.g., species of *Epeolus* & *Triepeolus*)

The subfamily Nomadinae is comprised only of cleptoparasitic 'cuckoo bees' that take over the nests and stored pollen of other bees for their own offspring. Since these bees do not collect pollen, they lack the specialized structure (scopa) that other female bees possess for this purpose (dense patches of modified hairs on the legs or beneath the abdomen). The Nomadinae are generally less hairy than most bees, and can look more like wasps than 'typical' bees.

Carpenter bee (*Xylocopa* sp.). Note shiny abdomen.

Family: Apidae Subfamily Xylocopinae

7. Carpenter bees (*Xylocopa* species)

These are very large bees that look at first glance like bumble bees, but have a shiny abdomen with relatively few hairs. Males can be territorial and 'buzz' around humans, but cannot sting. The females create nesting holes in dead wood by chewing out tunnels, but can be prevented from damaging wooden structures by painting or staining the timber. They produce only a few, very large eggs—perhaps 8 or less in their lifetime—but show a greater degree of maternal care than do most native bees.

***Hylaeus* sp. on *Melampodium leucanthum* (left) and in front view showing yellow 'face' (right).**

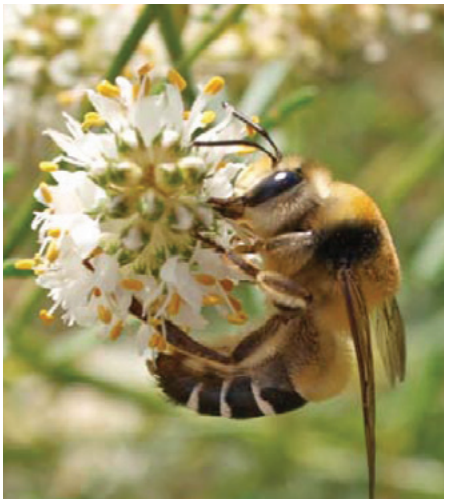
Family: Colletidae

1. Yellow-faced bees (*Hylaeus* species)

The Colletidae is a small, relatively primitive family of bees that includes species with very different appearances, although all of them have eyes that slant slightly toward the mouth (when viewed from the front), giving them a slightly 'heart-shaped' face. Within the Colletidae, the yellow-faced bees (*Hylaeus* species) are small, nearly hairless bees, mostly black in color with yellow or white markings on the legs, face, and thorax (just behind the head). They look superficially similar to small wasps. Most of these species nest in hollow stems or twigs.

Family: Colletidae

2. Plasterer bees (various species)
Other members of this family nest below ground and line their brood chambers with a glandular secretion that makes it waterproof. Some *Colletes* species are highly specialized foragers, visiting only a few plant species. One New Mexico species 'buzz pollinates' the flowers of tomatillo (*Physalis philadelphica*) by grasping the pollen-bearing structures (anthers) with her legs, then rapidly vibrating her wings to shake the pollen free.



Two Colletid bees: *Caupolicana yarrowi* on *Dalea candida* (top) and a *Colletes* sp. buzz-pollinating a tomatillo flower (bottom).

Family: Halictidae (Sweat bees) (various species)

The Halictidae – another very diverse group of bees–includes some of New Mexico's most colorful species. Most nest in the ground, although some of the metallic green or blue species nest in rotting wood. This family includes important pollinators of alfalfa seed crops, commercial sunflowers, and watermelons. Species in one genus (*Sphecodes*) are cleptoparasites – i.e., they act as cuckoo bees, laying their eggs in the nests of other Halictid species. The family gets its common name from a few species that are attracted to human sweat for its salt content.

Top to bottom: Halictid bees on skunkbush sumac (*Rhus trilobata*), goldenrod (*Solidago* sp.), and Emory's baccharis (*Baccharis emoryi*). Not all halictids are this colorful.

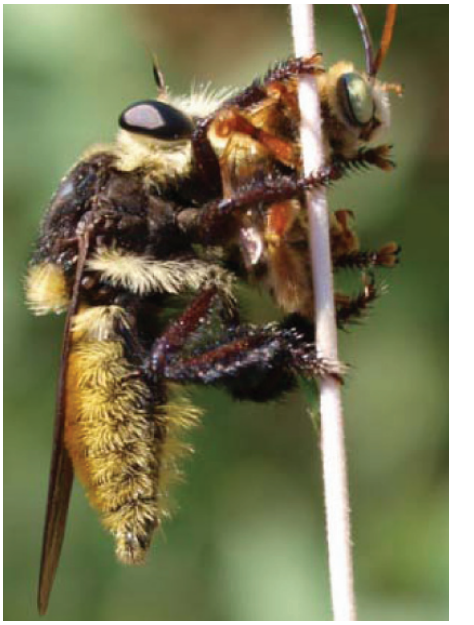
Family: Megachilidae (Leaf-cutter, mason, carder, and blue orchard bees)

Most members of this family nest in holes in dead wood or in hollow twigs; they get their common name because they use chewed leaves or mud to construct and seal their nests (a partial protection against predators and parasites). Some of these species cut neat, almost circular holes from the edges of cottonwood or rose leaves (above right); generally, though, this damage is not sufficient to affect the growth of the plant. A unique feature of this family is that the females collect pollen not on their legs but on the hairy undersurface (scopa) of the abdomen.

Cottonwood leaf damaged by leaf-cutter bee (top) and female Megachilid on *Baccharis emoryi* (bottom). Note the pale pollen-collecting hairs (scopa) beneath the abdomen.

***Coelioxys* female on goldenrod (*Solidago* sp.) (left) and a carder bee (*Anthidium* sp.) on *Machaeranthera pinnatifida*.**

Several members of the Megachilidae are cleptoparasites, taking over the nests of other solitary bees. This includes the *Coelioxys* species shown above (left), which can be recognized by its distinctive pointed abdomen. The family also includes the blue orchard bee (*Osmia lignaria*) (a more efficient pollinator of fruit trees than the honeybee) and the so-called 'carder' bees (*Anthidium* spp.) (above right) that line the brood cells of their nests with hairs combed or 'carded' from plant leaves. *Anthidium* species somewhat resemble small wasps, but lack complete bands of color across the abdomen.



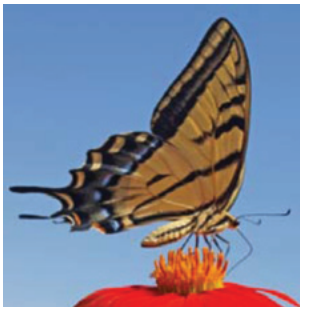
A bee-mimicking robber fly waiting for prey (left) and with captured long-horned bee (right).

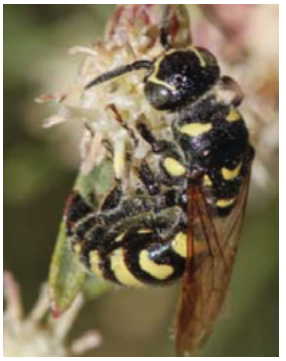
Predators and parasites of New Mexico bees

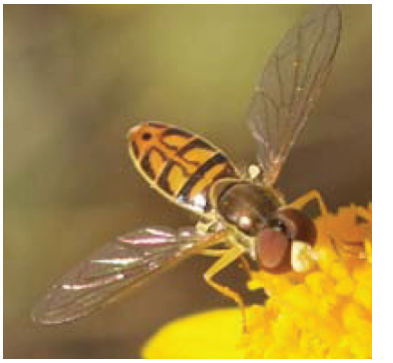
When bee numbers increase as a result of providing habitat for them, their natural enemies are likely to increase as well. The robber fly (family Asilidae), shown above may look superficially like a bee, but has only one pair of wings and is a bee predator. It perches close to flowers and can intercept bees in flight.

Bee assassin bug (left), Chrysidid wasp (top right) and bee fly (bottom right).

The 'bee assassin' bug (above left) is a 'sit-and-wait' predator that ambushes bees as they visit flowers. Both the bee fly (family Bombyliidae) and the brightly colored cuckoo wasp (family Chrysididae) (which resembles some of our metallic bees) are actually parasites, laying their eggs inside the nests of various solitary bees. Adult bee flies are particularly common in late summer and early autumn.





Other visitors to New Mexico pollinator plantings: butterflies (above), predatory wasps (2 species), and a hoverfly (left to right, second row).

Other flower visitors

Pollinator plantings also attract other visitors, such as the butterflies shown above. While not very effective as pollinators, butterflies can add greatly to the enjoyment that such plantings can provide. If trying to create a garden mainly for butterflies, however, remember to include the larval host plants for the species of interest. Of rather more value to gardeners are the various predatory wasps and hoverflies that can help to control pest insects.

Suggested ‘pollinator plants’

In our initial trials, the following plants have been shown to attract honeybees, a variety of native bees, predatory wasps, and some butterflies. A good planting mix should include species that flower at different times of the year, as well as provide a diversity of flower shapes, sizes, colors, and structures. Many of the species below are shown in the photographs of the various bee species.

Spring-flowering shrubs:

Native willows (e.g., *Salix lasiolepis* and *S. irrorata*), skunkbush sumac (*Rhus trilobata*), American plum (*Prunus americana*), New Mexico olive (*Forestiera pubescens*), chokecherry (*Prunus virginiana*).

Summer-flowering annuals:

Prairie sunflower (*Helianthus petiolaris*), Rocky Mountain beeplant (*Cleome serrulata*), Blue-headed gilia (*Gilia capitata*), golden crownbeard (*Verbesina encelioides*), basil (*Ocimum basilicum*).

Summer-flowering perennials:

Firewheel/blanket flower (*Gaillardia pulchella*), red dome blanket flower (*Gaillardia pinnatifida*), whorled mountain mint (*Pycnanthemum verticillatum*), white prairie clover (*Dalea candida*), stiff greenthread (*Thelesperma filifolium*), catmint (*Nepeta cataria*), showy goldeneye (*Heliomeris multiflora*), Mexican hat (*Ratibida columnifera*), fernbush (*Chamaebatiaria millefolium*).

Late summer- and autumn-flowering species:

Globemallows (*Sphaeralcea* species), Emory's baccharis (*Baccharis emoryi*) (especially male plants), sneezeweed (*Helenium autumnale*), native goldenrods (*Solidago nemoralis*, *S. petiolaris,* and *S. speciosa*).

Further reading and other resources

Grasswitz, T. R. (2011). Integrated Pest Management (IPM) for Home Gardeners (Circular No. 655; 4 pp). Las Cruces, NM: NMSU Cooperative Extension Service. Available on-line at: http://aces.nmsu.edu/pubs/_circulars/cr-655/welcome.html

Mader, E., Shepherd, M., Vaughan, M., Hoffman Black, S. and Le Buhn, G. (2011). Attracting native pollinators. 372 pp. Storey Publishing.

Moisset, B. and Buchmann, S. (2011). Bee basics: An introduction to our native bees. 40 pp. Published by the USDA, US Forest Service and Pollinator Partnership. Available on-line at: http://www.pollinator.org/ PDFs/BeeBasicsBook.pdf

New Mexico 'Plants for Pollinators' project website: http://aces.nmsu.edu/ipm/pollinator-project.html

All photographs taken by the authors.

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