MINNESOTA BEE ATLAS

Bumble Bee Survey

Historically, records show 23 species of bumble bees in Minnesota. However, for most species we do not know their current range in the state and for some species we don't know if they can still be found in Minnesota. This guide describes survey methods designed for volunteers with basic bumble bee identification skills to participate in a state-wide survey of bumble bees, which will give us a snap shot of bumble bee populations in MN. This information will become part of the Minnesota Bee Atlas, a citizen science project funded by the Environment and Natural Resources Trust Fund (ENRTF) that maps the diversity and distribution of wild bees in Minnesota. Bumble bee conservation is a global concern and monitoring bumble bee populations will provide important information to inform conservation efforts.

BUMBLE BEE BIOLOGY

Due to their large size and buzzing hum, the beloved bumble bee is one of the more noticeable flower visitors in gardens, fruit crops, prairies, and wildflower patches. Although they do not produce honey, they contribute important pollination services to many commercial crops including tomatoes, blueberries, squash, and watermelon. They also pollinate many native plants and are an important link maintaining healthy ecosystems.

How do bumble bees fit into the world of bees as a whole? There are about 20,000 bee species worldwide, representing seven different families. Most of these bees are solitary, ground-nesting bees. Honey bees and bumble bees both belong to the family Apidae. Worldwide, there are seven honey bee species, none of which are native to North or South America. The only honey bee species found in North America, *Apis mellifera*, has been brought to North America from Europe for honey and wax production and crop pollination. In contrast, there are 240 species of bumble bees globally and over 40 species native to North America. Bumble bee species differ from each other in nesting preferences, floral preferences, foraging behavior, and social behavior as well as things like size, coloration, and geographic range. Although bumble bees are a diverse group of bees, including many species, they all share common life history and biological traits.

Life history

Bumble bees are social insects, which means that many individuals, all biologically related to one another, live together to form a colony. As in most societies, through cooperation and division of labor, the social unit has greater productivity than the sum of each individual's efforts. Although at first it appears as if chaos reigns in a bumble bee colony, there are divisions of labor and rules of organization. The members of the colony are divided into three different castes, each with specialized duties: queen, worker, and male.

Each bumble bee colony begins with one solitary queen. In the spring, the queen emerges from the ground where she has overwintered and searches for a good nesting site. In the early spring, you can often see queens darting low to the ground, investigating potential nest sites. Typical nest sites are small holes in the ground or above the ground in piles of grass, with nest preference varying among species. Bumble bees have been discovered nesting in abandoned bird and rodent nests, rolled up carpets, insulation, underground cavities, wood piles, clumps of grass, and underneath sidewalks. Once she has found a nest site, the queen must also find food to support the development of her ovaries before she can begin to lay eggs. Once in her nesting site, she will build a wax pot in which to store some gathered nectar. She will form the pollen she collected into a ball, then lay a clutch of eggs (usually eight to fourteen eggs per clutch) on this pollen ball, and cover the eggs with wax. Bumble bee queens mate in the fall before hibernation, and store the sperm for use the next year in a special organ called a spermatheca. When queen lays eggs, they may or may not be fertilized by this stored sperm. All fertilized eggs laid by the queen develop into female bees. Unfertilized eggs always develop into males. Through most of colony development, the queen lays fertilized eggs (females). The larvae will develop in a clump under the wax, eventually separating into their own wax cells.

After the first clutch of brood hatch, the queen must continue to forage to supply her young with pollen and nectar. When she is not searching for food, the queen spends time incubating eggs and larvae to keep them warm. Finally the larvae will form their own cocoons and pupate. The queen lays a second batch of eggs after the first batch has pupated. Once these bees emerge as fully formed adults, the queen switches to continuous egg laying. With her young worker-force to aid in the care of her offspring, the queen is now freed from the task of feeding the larvae. She usually stops foraging at this time, allowing her daughters to carry out the task. The queen concentrates her time and energies on laying eggs into wax, cup-shaped egg cells constructed by herself or the workers. The workers gather food, care for the young, and clean and defend the nest. The colony continues to grow during the summer. At the peak of the colony's life cycle, nest populations range from a few dozen to a few thousand bumble bees. *Bombus impatiens*, a common species in the eastern U.S., typically has 200 to 500 workers residing in the colony at its peak.

FIG. 1: A look inside a *Bombus impatiens* colony. The much larger queen is seen here along with eggs and young larvae under wax, pupae within pupal cocoons, and wax nectar pots. Photo: Elaine Evans

Successful colonies will produce a new generation of queens at the end of the summer once the colony can bring in sufficient amounts of pollen required for the larger queens. Queens and workers are both female and develop from fertilized eggs, but queen production requires a greater quantity of food than worker production. Queens are normally produced later in the season after the colony has a sufficient number of workers to provide the copious amounts of food the hungry queen-destined larvae require. Production of males usually begins around this same time. Seeing queen production in a colony is an indication that the colony is successful. However, it also indicates that the colony will soon disintegrate. Typically, once queen production begins, all subsequent females produced by the colony become queens. Although queens may do some foraging for the colony, they do not perform the duties of the workers. For most colonies, the production of males and new queens signals the end of the colony life cycle. Bumble bee colonies in temperate regions do not usually survive more than one summer.

Both males and queens will leave their home nest to mate, helping to ensure greater genetic diversity. Queens mate once they emerge as young adults from the nest where they were born and raised. Different species of bumble bees have different seasonal cycles, with some colonies producing males and queens in mid-summer while others will not produce new queens until late summer or early fall. After a queen mates successfully, she stores the sperm until the next spring. Some bumble bee queens mate with several males, mixing the sperm in the spermatheca. The sperm stored from this brief mating period is used throughout the queen's life, which usually lasts about one year.

After mating, the queen enters diapause, a form of hibernation. She will find a suitable place and dig herself into the ground, surviving underground through even the coldest months of winter. Bumble bee queens have a chemical in their blood that is equivalent to antifreeze, preventing their cells from freezing in very low temperatures. The mated queens are the only colony members that survive the harshness of winter. The remaining males and workers die off and the nest is abandoned.

Lying dormant under the often frozen ground, these mated queens are the only connection to next summer's buzzing bumble bees. Without them, bumble bees would cease to exist, as these mated queens are the only ones who survive the winter. The entire cycle starts again the following spring when the mated queens from the previous fall emerge from hibernation and begin to form their own colonies.

Conservation

Unfortunately, on a global scale, many bumble bee species are becoming less abundant and are also experiencing dramatic reductions in their geographic ranges. The possible causes of these declines include habitat loss, climate change, pesticides, and pests and pathogens. Since bumble bees are actively foraging from early spring to late fall, providing a constant supply of abundant flowers is an important step in supporting local bumble bees. Proper and prudent use of pesticides will help keep bumble bees safe from their deleterious effects. Careful monitoring of disease and pest prevalence within commercially raised bumble bee colonies, as well as measures to reduce the exposure to wild bees, can reduce the risks of transmission to wild populations. Leaving un-mown, untilled, undisturbed areas can provide nesting habitat for bumble bees. By working to make the landscape around us more bee-friendly, we can keep our bumble bees buzzing.

BUMBLE BEE IDENTIFICATION

Identifying bumble bees can be challenging. Some species are easily separated by color patterns, but often times bumble bee species mimic each other's coloration, making visual identification difficult. In addition, color patterns within a species can vary. Because of this variation, color patterns are not always the most reliable means of separating bumble bee species. However, in Minnesota, we are fortunate that our most common species can be reliably separated based on color. The following keys will rely primarily on color pattern. More detailed information to help with bumble bee identification is available in the book *Bumble Bees of North America* by Paul Williams, Robbin Thorp, Leif Richardson, and Sheila Colla. The website DiscoverLife.org has excellent online keys for bumble bees.

Is it a bumble bee?

Of course, the first step in collecting bumble bees is making certain the insect you are pursuing is indeed a bumble bee. For most people the name bumble bee conjures up an image of a big, fuzzy, yellow and black insect. However, not all big, fuzzy, yellow and black insects are bumble bees and not all bumble bees are big, fuzzy, yellow and black.

Because bumble bees have a stinger to defend themselves, many animals have learned to avoid them. Other insects mimic the shape and coloring of bumble bees to gain protection from potential predators. Even though these other insects don't have a stinger, many predators leave them alone, simply because they look like something that could sting. Among these impersonators are flies, moths, and other bees that strongly resemble bumble bees. These are called mimics.

To avoid collecting mimics, closely examine the insects you catch. Make sure that they have two pairs of wings; front wings, and hind wings on each side. This inspection will eliminate the possibility of collecting a fly, as flies only have one pair of wings. Flies also have short antennae. To avoid collecting a moth, look closely at the tongue of the insect when it is not feeding. Moths coil their long tongue into a roll, whereas bees fold their tongue and tuck it under the mouth. Some other bees appear similar to bumble bees. Many of these other bees will be smaller and less hairy than bumble bees. Also, the hind legs of other bees will be different.

FIG. 2: Bumble bee mimics. These bumble bee mimics are all flies. Note the large eyes and short antennae. Photos: Heather Holm

Bumble bees have a clearly visible concave area on the third pair of legs (hind legs), called a "pollen basket," for collecting large balls of pollen. If the pollen basket is full of pollen, you will see the brightly colored pollen attached to their hind legs. Some other bees will collect pollen on their hind legs but if you look closely you will see that this pollen is sticking to brushes of hair on the legs, rather than the pollen being packed into a pollen basket. Once

you become familiar with the color patterns of your local bumble bees, you will recognize if another insect you capture does not match any of these patterns.

TABLE 1: Bumble bee or not bumble bee

INSECT	WINGS	MOUTHPARTS	ANTENNAE	POLLEN CARRIED	BODY HAIR
BUMBLE BEE	2 PAIR, CLEAR	LONG TONGUE	LONG ELBOWED	IN BASKETS	VERY HAIRY
HONEY BEE	2 PAIR, CLEAR	LONG TONGUE	LONG ELBOWED	IN BASKETS	LESS HAIRY
OTHER BEE	2 PAIR, CLEAR	VARIABLE	LONG ELBOWED	IN BRUSHES	VARIABLE
FLY	1 PAIR, CLEAR	SHORT	SHORT	SCATTERED HAIRS	VARIABLE
BUTTERFLY	2 PAIR, SCALES	COILED	STRAIGHT,CLUBBED, HOOKED	SCATTERED HAIRS	VARIABLE
BEETLE	HARD WINGS	SHORT	VARIABLE	SCATTERED HAIRS	VARIABLE
WASP	2 PAIR, CLEAR	SHORT TONGUE	LONG ELBOWED	SCATTERED HAIRS	LESS HAIRY

Is it a male or a female?

The first step in bumble bee identification after deciding that what you are looking at is indeed a bumble bee is to determine the sex of the individual. There are separate keys for identification of male and female bumble bees due to differing color patterns between the sexes. The majority of bumble bees you will see will be females, particularly earlier in the season. Later in the season, males may be abundant. First look to see if your bee has pollen on the hind legs. Male bumble bees do not collect pollen. If your bee is carrying pollen on her legs, it's a female. If your bee is not carrying pollen you will need to look more closely to see whether she has empty baskets or if she is actually a male. The basket structure on the hind legs of females makes their legs appear wider than males' legs. There are several other key differences between males and females. Females have six abdominal segments, while males have seven. Females have 12 antennal segments, while males have 13. It will be difficult to impossible to count these segments while in the field, but these differences are easier to see than it may sound. In addition to being one segment longer, male abdomens also often come to a more narrow point, while female abdomens are more rounded. Not only are male antennal segments one segment longer, but the whole antenna is often proportionally longer when compared to females. Males also have long hairs on their mandibles forming a beard. Patterns vary among species, but many males have hairier faces and abdomens than females of the same species. Once you are familiar with the color patterns of local species, you will more easily pick out the males that are distinguishable based on color patterns.

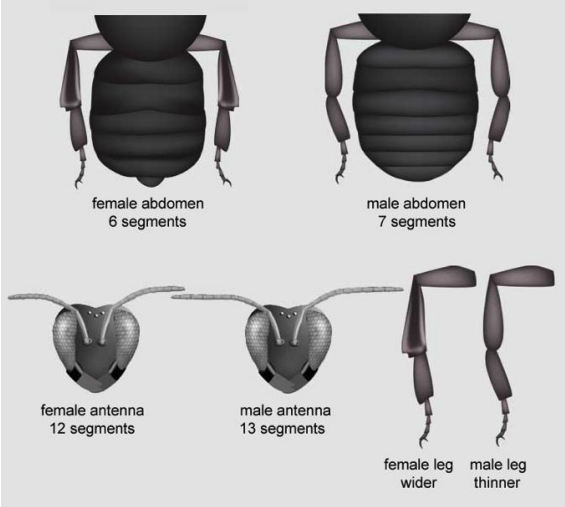

FIG. 3: Distinguishing males from females. Illustration: Elaine Evans

Using keys for MN bumble bees

Now that you know what you have is a bumble bee and you have determined its sex, start the identification process by looking at the red sections on either the male or female version of the *Guide to Minnesota Bumble Bees* to determine which section describes your bee. Next, look at the numbered characteristics under the red description to further narrow your identification. Look at the picture and read the fine print to see if it still matches. The sizes of the bees on the keys represent the average relative size. Bumble bees vary greatly in size within a species, but these relative sizes can sometimes be helpful in field ID.

BUMBLE BEE SURVEY PROTOCOLS

Why: We need your help

Quantitative surveys, surveys that tell us not only which bumble bees are where, but also which bumble bee species are decreasing in abundance, are needed to document the status of Minnesota bumble bees. The state is too big for the handful of bee biologists working in the state to reach all the areas we need to visit. With volunteer citizen scientists like you documenting bumble bees statewide, we can get much more resolution to the picture of how bumble bees are faring in Minnesota. In addition, by participating in the bumble bee survey, you will become more knowledgeable about the plight of bees in Minnesota and how you can be part of their conservation. It will take many people taking small actions to reverse the declines we are seeing in bumble bee populations.

When: Late June to Early August

Bumble bee survey volunteers will conduct three surveys each season. The surveys are timed to coincide with maximum population sizes for different Minnesota bumble bee species. Early emerging species, such as *Bombus bimaculatus*, will reach peak colony size by early July and will decline soon after. Other later emerging species such as *Bombus griseocollis*, will not reach peak colony size until late July. The first survey will take place in the third or fourth week of June. The second survey will take place in the second or third week of July. The third and final survey will take place in the first or second week of August. You can pick a day that suits your schedule, but find one with little or no precipitation, temperatures greater than 60 F, and little strong wind to ensure maximum bumble bee activity. If it rains the day before, let the sun come out and dry things off before starting. Surveys should take place between 10 a.m. and 6 p.m., the times of maximum colony activity. Anytime within a few days before each survey, even immediately before, drive your route to note locations of flower patches as well as turns and road conditions. Locate floral patches along the roadside that are within ~500 feet of the stopping point. Locations of floral patches may change from one survey to next or certain areas may be mowed.

Where: Throughout MN

Volunteers will choose from available routes on the Bee Atlas website. Although each route covers 25 miles on the map, you will use 10 miles for your bumble bee survey. Volunteers will stop every ~1 mile and survey bees in roadside vegetation. Unless you are able to obtain permission from private land holders, stay within the road right of way

(approximately 20 feet from the edge of the road) and avoid collecting in areas like State Parks or Wildlife Management Areas.

How: Survey protocols

Thanks to your previous scouting, each route stop should have a patch of flowers on your survey day. Before beginning your survey, observe your flower patch for several minutes. If you see bee activity of any kind on the flowers (honey bees or other bees visiting flowers), this is a suitable flower patch. If you see no bee activity, move to the next route stop ~1 mile down the route. Continue until surveys have been conducted at five sites or you reach the end of your route. If you are unable to conduct five surveys due to a lack of flower patches with bee activity along your route, contact Bee Atlas staff for recommendations.

As survey volunteers, you will collect bumble bees for a total of 10 minutes at each site. Collect bees off flowers using vials as demonstrated during training. Note the flower species bees are collected from, keeping the bees collected from different flowers separate. Some bee surveyors use aprons with pockets to keep bees from different flowers separated. If you cannot ID the flower, take a photo showing the flower head and the leaves. You can look up the flower species in a field guide later or submit the photo to the website and mobile app iNaturalist. After creating a user name and password, you can submit the photo, selecting "ID Please" and other citizen scientists will review the photo and add identification. Approximately every three minutes, you should stop your stop watch and place all captured bumble bees in a cooler. If you are collecting from several different flowers at one route stop, keep your bees organized according to what flower you collected them from. You can use plastic bags in your cooler to keeps piles of bees from different flowers separated. Return to collecting until you reach 10 minutes of total collection time. Also stop your stop watch if you are walking between flower patches. Only time looking for bees at flower patches counts as collection time.

After 10 minutes of collecting, take your bumble bees out of the cooler one at a time. If the bumble bee is readily identified, enter the sex and species onto your data sheet and then release it. However, these species should always be photographed before release: *B. affinis, B. terricola, B. pensylvanicus,* and *B. bohemicus.* If you know the flower it was collected from, please note that as well. The bee may take a few minutes to warm up before it flies off. If the bee does not fly out of the vial, place it in a shaded area away from you a bit. They may crawl around before flying and you don't want them crawling onto you. Do not leave bees in the direct sun. They can easily overheat. It is estimated that 90% of the bumble bees will belong to these readily identifiable species: *Bombus impatiens, B. bimaculatus, B. griseocollis, B. ternarius,* and *B. citrinus.*

If the individual is not readily identifiable you will return the bee to the cooler. After the bee has chilled, you will photograph the individual and record the photo ID onto your data sheet before releasing it. See guidelines for bumble bee photos. Bees likely to need photographs are: *B. fervidus, B. borealis, B. affinis, B. terricola, B. vagans, B. sandersoni, B. auricomus, B. pensylvanicus, B. perplexus, B. rufocinctus, B. insularis, B. flavidus,* and *B. bohemicus.* If you are confident in your identification some of these bees may be released without photos. If you have determined a bee is either *B. vagans* or *B. sandersoni* but are not sure which one, include a photo of the face. Similarly, if you are not sure if a bee is *B. auricomus, B. terricola,* or *B. pensylvanicus,* include photos of the face, the hindmost leg,

and the end of the abdomen. **The following species MUST be photographed, even with confident identification, due to their conservation status: *B. affinis*, *B. terricola*, *B. pensylvanicus,* and *B. bohemicus*.**

In a nutshell:

Conduct three surveys: late June, mid July, early August

- Observe flower patch for bee activity. If there is no activity, move ~1 mile down road.
- If there is bee activity, begin survey.
- Bring data sheet, cooler, camera, and bee collecting vials to flower patch
- Note start time, weather, and location on data sheet
- Start timer and collect bumble bees from flowers into vials.
- Pause timer to place bees in your cooler or walk between flower patches. Place vials in cooler within 2 minutes of collecting.
- Continue collecting until you reach 10 minutes of collecting time
- Record end time on data sheet
- Record and release individuals of all identifiable species
- Photograph and record individuals of unidentifiable species as well as the flower patch
- Add any additional notes to data sheet
- Collect any accidentally damaged bumble bees to submit as voucher specimens
- Repeat until data has been collected at five locations
- If you reach the end of your ten mile route, but have fewer than five collection sites, contact the Minnesota Bee Atlas at beeatlas@umn.edu for instructions
- Submit your data to Minnesota Bee Atlas website after each survey at www.z.umn.edu/bumblebeesurvey.

Occasionally, there may be mishaps causing bumble bee death. Collect these individuals in a collecting vial with a voucher label, freeze, and mail to the Bee Atlas staff at the end of the season for curation. They will be become part of the U of MN Insect Collection. Due to its status as an endangered species, accidental death of a *B. affinis,* the rusty patched bumble bee, must be reported immediately to Elaine Evans, at evan0155@umn.edu. Photograph the specimen immediately to record the condition.

Not all route stops will have bumble bee activity. If you find no bumble bees within your 10 minutes of search time, fill in all the other details on your data sheet and note that no bumble bees were found. Be sure to enter these data on the Bee Atlas website as well.

We estimate that it will take from 3 to 4 hours to complete each of the three days of surveying.

Taking photos of bumble bees

After being in the cooler, bumble bees will slow down, making them easier to photograph. Place them in hollow at the bottom of the bee photo tube and slowly depress the plunger to help hold them still. To properly identify bumble bees it is best to have a photo that shows the top side of the abdomen, the side of the thorax, and the face. Take several photos of each specimen to show these various characteristics.

Point and shoot digital cameras and phones with decent cameras will be the best options for use with the bee photo device. If you have a camera that you are more comfortable with that does not work with the bee photo device, take some test photos before your survey days and send them in to the Minnesota Bee Atlas so we can see if they will work for identifying bees.

All photos must be connected with the proper specimen. On your field survey sheet, each individual will be given a photo specimen number that will be connected with several photos of that individual. Get to know your camera's system for file names. If your camera gives time stamps, write down the times for the photos on your field survey sheet. If your camera assigns file names, write those file names down for each specimen. You will use these file names to ensure your photos are associated with the proper specimen number.

Equipment provided by volunteers

- Digital camera: a point and shoot digital camera, or a higher quality phone camera will be best
- Cooler with ice
- Stop watch: can be stop watch function on a digital watch or on a phone

Equipment provided to volunteers

- Data sheets
- Voucher specimen sheets
- Surveying vials
- Bee photo tube

Specials notes on the endangered rusty patched bumble bee

Special care is needed with handling of all bumble bees, but those surveying in areas where you are more likely to find *B. affinis* should be particularly careful (Fig. 4). If a possible *B. affinis* is noticed during collection it should be photographed and released as soon as possible. A permit covering accidental death of a rusty patched bumble bee is held by Elaine Evans and all discoveries of the rusty patched bumble bee, whether dead or alive, should be reported to Elaine immediately (evan0155@umn.edu). Elaine is responsible for reporting these finds to the U.S. Fish and Wildlife Service.

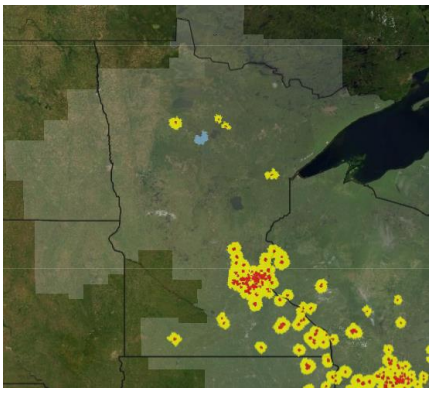

FIG. 4: Likely occurrence of rusty patched bumble bee as of 5-13-2020. Red=high potential. Yellow=possible dispersal. Blue=uncertain. Gray=historic range.
Visit https://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html for updated map.

SPECIAL NOTE FOR 2020 AND COVID-19

While surveying bumble bees can be done while physical distancing, there may be risks associated with volunteering due to COVID-19. Travel may increase the potential for crashes or other injuries and could tax an already-burdened health care system. We encourage volunteers to participate in survey activities near their homes and carefully consider the social interactions associated with travel across the state. Recommendations may change as the situation evolves and we will contact all volunteers with procedural updates as they occur.

PARTING WORDS

Minnesota is home to one of the most diverse bumble bee communities in the U.S., remaining home to several bumble bee species that have disappeared from other parts of their ranges. We need to learn more about where these bumble bees live so we can provide them with what they need to survive and make better recommendations for land owners and property managers. Your hours spent with the bumble bees during the summer will help us form a clearer picture of the status of bees in Minnesota. In addition, we hope that by immersing yourself in the world of bumble bees and flowers, you will get a unique peek into their world of nectar and pollen and the connections among pollinators and their plants. Thank you for your generous donation of time. The bumble bees will be humming your praises.

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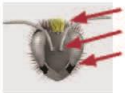
Guide to Minnesota Bumble Bees: Females

UNIVERSITY OF MINNESOTA EXTENSION

This guide is only for females (12 antennal segments, 6 abdominal segments, most bumble bees, most havepollen baskets, no beards on their mandibles). First determine which section your bee is in, then go through numbered characters to find a match. See if your bee matches the description in the text as well as the color pattern. Color patterns can vary. Bumble bees are depicted in relative size. Search for bumble bees with **www.bumbleebeewatch.org**

Ab = abdominal segment C Common E Endangered D Declining



Yellow hairs between wings, 1st abdominal band yellow (may have black spot in center of thorax)

1. Black on sides of Ab 2, yellow or rusty in center

Ab 2 with yellow in middle, black on sides. Yellow often in a "W" shape. Top of head yellow.

Bombus bimaculatus
two-spotted bumble bee (C)

Ab 2 with yellow in middle bordered by rusty brown in a swooping shape. Top of head black.

Bombus griseocollis
brown-belted bumble bee (C)

2. All other Ab black

Light lemon yellow hairs on top of head and on thorax.

Bombus impatiens
common eastern bumble bee (C)

3. Ab 2 brownish centrally surrounded by yellow

Worker. Center spot on thorax with sometimes faint V shaped extension back from middle.

Bombus affinis
rusty patched bumble bee (E)

4. No obvious spot on thorax

Variable color. Often Ab 3 yellow.

Bombus perplexus
confusing bumble bee

5. Ab 2 entirely yellow and ab 3-6 black

Yellow on top of head. Few black hairs on thorax. Elongate cheek (see inset).

Bombus vagans
half-black bumble bee

Variable color. Often black hairs on thorax. More square cheek than vagans (see inset).

Bombus sandersoni
Sanderson's bumble bee

Queen. Black on top of head. Round face. No brownish central patch or extension of black hairs from spot on thorax.

Bombus affinis
rusty patched bumble bee (E)

6. Yellow on front edge of Ab 2. Dark hairs near wing bases

Variable color. Cheek shorter than width of mandible. A few yellow hairs between wings, but often looks like full stripe.

Bombus rufocinctus
red-belted bumblebee

Black stripe between wings. No yellow hairs at wing base.

1. Yellow on Ab 1-4

Black on top and front of head. Sides of thorax yellow.

Bombus fervidus
yellow bumble bee

Yellow on top and front of head. Sides of thorax with brown hairs. 5th ab may be black.

Bombus borealis
boreal bumble bee

2. Orange/red on Ab 2-3

Distinct V shape extending back from center stripe on thorax. Black hairs on face and top of head.

Bombus ternarius
tricolored bumble bee

Yellow hairs on face and top of head. Only in far west MN.

Bombus huntii
Hunt's bumble bee

3. Orange/red on Ab 4-5

Northern range.

Bombus frigidus
frigid bumble bee

Back half of thorax is predominantly black. Hairy abdomen.

1. Large size, long face

Three small eyes lower on face (see inset). Short spine on hind basitarsus.

Bombus auricomus
black and gold bumble bee

Three small eyes higher on face (see inset). Long spine on hind basitarsus.

Bombus pensylvanicus
American bumble bee (D)

2. Small size, round face

Smaller and stouter than many other bumble bees. Fringe of yellow hairs near end of abdomen. Short cheek. Round face.

Bombus terricola
yellowbanded bumble bee (D)

Side view of head

vagans sandersoni

Front view of head

auricomus *pensylvanicus*

Much of abdomen lacking hair, no pollen baskets, wide head (uncommon)

1. Black top of head

Bombus ashtoni
Ashton's cuckoo bumble bee (D)

2. Yellow top of head and top of thorax yellow

Side of thorax mostly yellow.

Bombus citrinus
lemon cuckoo bumble bee

Side of thorax mosly dark.

Bombus variabilis
Variable cuckoo bumble bee

3. Yellow top of head and rear thorax black

Ab 4 yellow.

Bombus insularis
indiscriminate cuckoo bumble bee

Ab 6 strongly curled under abdomen

Bombus flavidus
Fernald cuckoo bumble bee

Elaine Evans: Department of Entomology | www.beelab.umn.edu | www.befriendingbumblebees.com

Guide to Minnesota Bumble Bees: Males

UNIVERSITY OF MINNESOTA EXTENSION

This guide is only for males (13 antennal segments, 7 abdominal segments, mostly seen in late season, no pollen baskets, beards on their mandibles). First determine which section your bee is in, then go through numbered characters to find a match. See if your bee matches the description in the text as well as the color pattern. Color patterns can vary. Bumble bees are depicted in relative size. Join the search for bumble bees with **www.bumbleebeewatch.org**

Ab = Abdominal band Ant = Antennal segment C Common E Endangered D Declining

Abdominal segments 1-3 yellow, 4-7 black

1. Black spot in center of thorax

Not large eyes. Wide head.

Bombus citrinus
lemon cuckoo bumble bee

Large eyes.

Bombus auricomus
black and gold bumble bee

2. No obvious spot on thorax

Variable color patterns.

Bombus perplexus
confusing bumble bee

Thorax with some yellow near wing base AND 3rd abdominal segment black or orange

1. Black on sides of 2nd Ab, yellow or rusty in center

Ab 2 with yellow in middle, black on sides. Yellow often in a "W" shape. Eyes not large.

Bombus bimaculatus
two-spotted bumble bee C

Ab 2 with yellow in middle, bordered by rusty brown in a swooping shape. Large eyes.

Bombus griseocollis
brown-belted bumble bee C

2. 2nd Ab black

Light lemon yellow hairs on top of head and on thorax.

Bombus impatiens
common eastern bumble bee C

3. 3rd Ab orange

Eyes slightly enlarged. Color pattern variable.

Bombus rufocinctus
red-belted bumble bee

4. 2nd Ab entirely yellow and Ab 3-6 black

Ant 3 is long. Black hair on thorax limited to central spot.

Bombus vagans
half-black bumble bee

Ant 3 is short. Short hairs on back of Ant 2 and 3. Many black hairs on thorax.

Bombus sandersoni
Sanderson's bumble bee

Eyes slightly enlarged. Round face.

Bombus rufocinctus
red-belted bumble bee

5. 2nd Ab brown centrally

Center spot on thorax with sometimes faint V shaped extension back from middle.

Bombus affinis
rusty patched bumble bee E

6. Sides of thorax brown. Wide head.

Ab 2 with yellow in middle, black on sides. Yellow often in a "W" shape. Top of head yellow.

Bombus variabilis
variable cuckoo bumble bee

Thorax with black stripe between wings. Nearly all hairs near wing base are black.

1. Ab 1-4 yellow

Black on top and front of head. Sides of thorax yellow.

Bombus fervidus
yellow bumble bee

Yellow on top and front of head. Sides of thorax with brown hairs. Ab 5 may be black.

Bombus borealis
boreal bumble bee

D

Bombus pensylvanicus
American bumble bee

2. Ab 2-3 orange

Common in northern MN.

Bombus ternarius
tricolored bumble bee

Far western MN

Bombus huntii
Hunt's bumble bee

3. Ab 3 black

Northern MN

Bombus frigidus
frigid bumble bee

Rear half thorax is black

1. Ab 1 black

Smaller and stouter than many other bumble bees. Fringe of yellow hairs near end of abdomen.

Bombus terricola
yellowbanded bumble bee D

Ab seg 1-3 black. Wide head. Uncommon.

Bombus insularis
indiscriminate cuckoo bumble bee

2. Ab 1 yellow

Ab seg 1 yellow. Wide head. Rare.

Bombus bohemicus
Gypsy's cuckoo bumble bee D

Ab seg 6-7 with orange. Variable color. Often with yellow on rear half of thorax. Sometimes Ab 2-3 yellow. Wide head.

Bombus flavidus
Fernalde's cuckoo bumble bee

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