Honey bees and Other Pollinators,

Plus their foraging habits and requirements

Brief History of Honey bees

- Have existed for approximately 30 million years
- Upper Paleolithic rock art, as old as 25,000 years, depicts “robbing” of hives.
- There is evidence that humans started trying to manage them about 8,500 years ago in the Anatolian region.
- Below, a honey seeker is depicted in an 8000 year old cave painting in Spain

One of the oldest pictures painted by man shows…..

Honey seeker depicted on 8000 year old cave painting near Valencia, Spain gathering honey.

Honey bees have been recorded throughout history in many ways. Honey gathering came before bee keeping. Honey was a valued food and a natural sweet.

It is still considered a natural sweet. Unlike sugar, it has not been chemicalized to be produced. Honey in the honey comb has never been manufactured or copied. There is no artificial honey – Honey can be considered pure or virgin if it comes directly from the comb but nothing can be called pure honey that is not honey.

History of Honeybees in the United States

- Introduction to the U.S.
- Economic influence
- Genetic pool development/diversity
- Import restrictions
- Africanized bees
- Development of artificial insemination

Humans' Dependence on Bees and other Pollinators

- ➢ Crops pollinated by bees make up 35% of global food production.
- ➢ The global crop production pollinated by bees is valued at $577 billion. Pollinators contribute $24 billion to the U.S. agriculture industry, making up a third of the food consumed by Americans.
- 139 counties in key agricultural regions of California, the Pacific Northwest, the upper Midwest and Great Plains, west Texas, and Mississippi River valley, which appear to have most worrisome mismatch between falling wild bee supply and rising crop pollination demand. These counties tend to be places that grow specialty crops like almonds, blueberries and apples—that are highly dependent on pollinators. Or they are counties that grow less dependent crops like soybeans, canola and cotton—in very large quantities.
- ➢ Of particular concern, some crops most dependent on pollinators including pumpkins, watermelons, pears, peaches, plums, apples and blueberries appeared to have the strongest pollination mismatch, growing in areas with dropping wild bee supply and increasing in pollination demand.

The flowers' reproduction depends on the transport of pollen from pistils to the stamens.

Honey bees produce:

➢ **wax, propolis, royal jelly, and honey. The sting also produces venom which is used by some for health care.**

Honey is a word with many meanings. But all are positive and indicate something of great value.

Did you know that Napoleon Bonaparte, the Emperor of France, used golden bees on his coronation robes and a bee on his flag.

"T. M. Davies, an American archaeologist, came across a jar of honey when he opened the tomb of the parents of Queen Tyi in Egypt. The jar had been in the tomb for over 3,000 years. It was still edible!"

Did you know that honey has been used for embalming?

It is true.

➢ **It is an antiseptic and includes various acids including formic acid.**

A body can be preserved for years if placed in honey.

In fact, at one time in history bodies were returned home from battle to be buried and during the voyage were placed in a container surrounded by honey.

Germs can not live in honey

Honey is hydroscopic -- meaning it absorbs moisture.

Honey has many medical uses. It is used for sore throats, digestive disorders, ointments, nervous disorders and is quickly digested and assimilated by the body.

For centuries, honey, bee pollen, and bee venom have been used to treat a number of ailments that vary between chronic pain such as arthritis to Multiple sclerosis.

Wax

Wax is darkened by travel stain over the comb by the bees as well as from brood raised in the comb. Most wax has a lemon yellow color but dark brown wax is valuable just as well. Wax melts at 147.9 degrees.

- New beeswax is almost pure white.

- It is used in candles and many products use beeswax in their formulation.

But during World War II wax was in such a high demand that beekeepers were exempt from the draft and were given ration coupons for tires, sugar and gas which were highly rationed to other citizens of the U.S.

Wax was extremely important to protect metal parts in military equipment in the Asian theater of the Second World War.

Honey Comb

Pollen:

Collected from various flowers.

The diversity of the pollens gathered by the bees proves their role as pollinators.

Pollen stored in cells of comb

Pollenating services:

The life blood of many commercial crops, and of commercial beekeeping

The beekeepers of today migrate their hives, following the the seasons and the flowering periods.

In an orchard of flowering almond trees in the south of France, two beekeepers inspect a hive. Because they bloom early in the year, the bees are the only pollinators of almond trees. The tree depends 100% on the bees to bear its fruit. Each pollinated flower will produce a good-sized and and quality almond.

Typical rates for 2 weeks in an almond orchard are in the range of $200.00 per hive.

Random Honey bee Facts

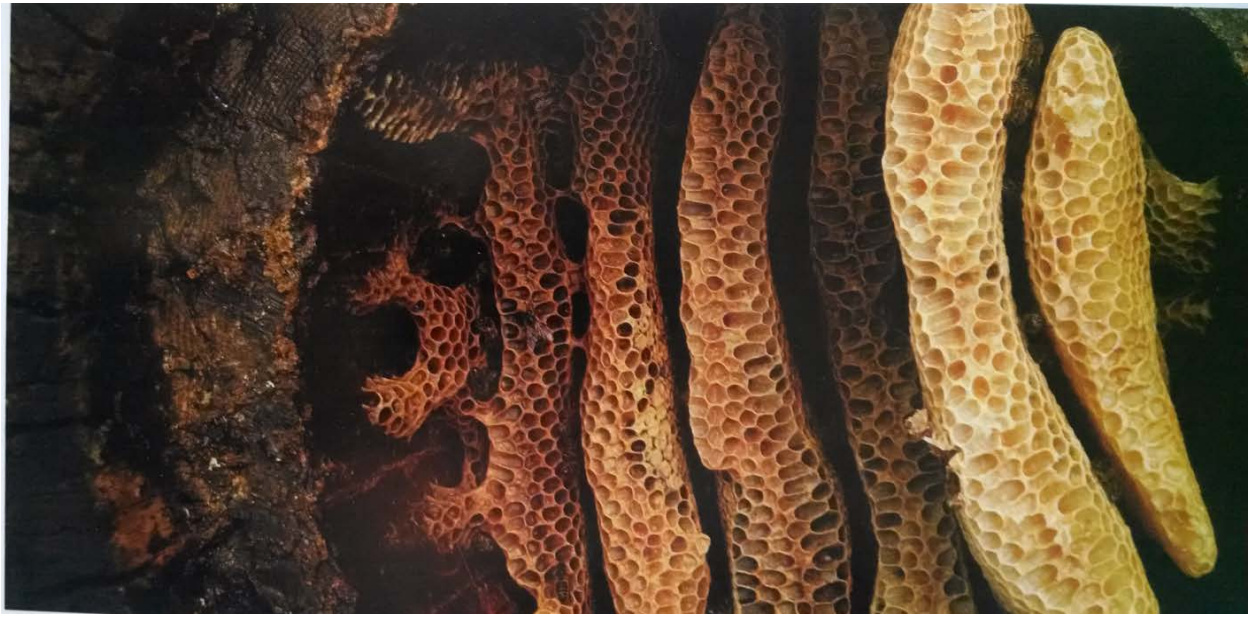
- The Honey bee…
- 1. Is the only insect that humans raise for food and medicine.
- 2. Pollinates over 50% of the top 100 food crops used for human consumption.
- 3. Makes only 1/12th of a teaspoon of honey in its lifetime. To make a pound of honey, honeybees need to visit up to 2,000,000 flowers. Each cell of a capped honeycomb contains the nectar from about 1,000 flowers.
- 4. One ounce of honey would power a bee for a flight completely around the earth
- 5. Has hair on its eyes to help keep its eyeballs clean. The hair catches dirt and pollen.
- 6. Has an incredibly acute sense of smell. It is being studied by scientists to detect and track down illegal drugs and explosives hidden by terrorists. It can even sniff out the scent of a cancer tumor to help give early diagnoses.
- 7. Is able to regulate the temperature of their hive. In cold weather, the bees huddle together and vibrate their wing muscles to generate heat. When it's hot, they fan their wings to improve air circulation or even collect water for evaporative cooling.
- 8. Makes slightly more than 200 beats per second with their wings, creating their infamous buzzing sound. A worker bee in the summer lasts 6 to 8 weeks. A common cause of death is wearing out their wings.
- 9. Is capable of complex visual processing and learning tasks that are more common in vertebrates. It is able to discriminate and remember. It can remember one human face from another, a capacity likely helpful for foraging, navigation and identifying flowers.
- 10. Performs Waggle dances and creates airborne sounds to communicate the locations of nectar and pollen.
- 11. Has a highly sophisticated communication system and a phenomenal collective intelligence that has been studied and applied to many organizations trying to learn effective management and leadership styles.
- 12. Has a grass-seed sized brain that is able to calculate foraging distances and energy expenditure, and find out the shortest route to the targeted flowers, a complex mathematical/mapping problem.

Types of Hive “abodes”

- Feral bees and their hives
- Skeps
- Development of bee husbandry and the requirement for removable frames
- Variations in current hive box designs


ARKive
www.arkive.org
Stephen Dalton / www.photoshot.com

Feral colonies in tree cavities



Skeps (Illegal in the U.S.)

Current Hives come in a wide variety of colors and styles

The modern hives with removable frames first appeared in 1850.

Top-bar Hive

Cathedral Hive

Warre Hive

Langstroth Hive

Essential Hive characteristics

- Brood chamber, including primary pollen and honey storage areas (The heart of the hive)
- Main entrance
- Ventilation flow path (generally including a secondary opening)
- “Supplemental” Honey storage area


How can we have any flowers...if we don't have any bees?

All “modern” hives have removable frames.

Life cycle of a colony of honey bees

- Definition of a “super organism”: **A group of distinct organisms working as a single entity;** each individual member is incapable of rearing successful offspring without the collective work of the whole. Examples, beehives, termite colonies, and ant colonies.
- The annual cycle of life and re-production
  - Spring: Pollen flow, Queen begins laying, Swarming (colony reproduction)
  - Summer: Queen laying, Hive buildup, Pollen and nectar collection and honey manufacture
  - Autumn: Decreased Queen laying, worker numbers decrease, “Fat bees”, demise of the drones
  - Winter: Clustering, with cleansing flights, Hive size minimized.

Each with a mission for all

➢ A hive/colony of bees is like a living organism. We usually do not associate an organism as being divided into individual life forms called workers, drone and queen.

It is born, struggles for survival, and dies but over several generations it survives because all parts work together as a single unit – without one of the units – the organism will cease to exist.

In his book, *Honeybee Democracy*, Dr. Thomas D. Seeley makes the following comment:

➢ **"there are intriguing similarities between honeybee swarms and primate brains in the ways that they process information to make decisions".**


Honey bees looking for a new home

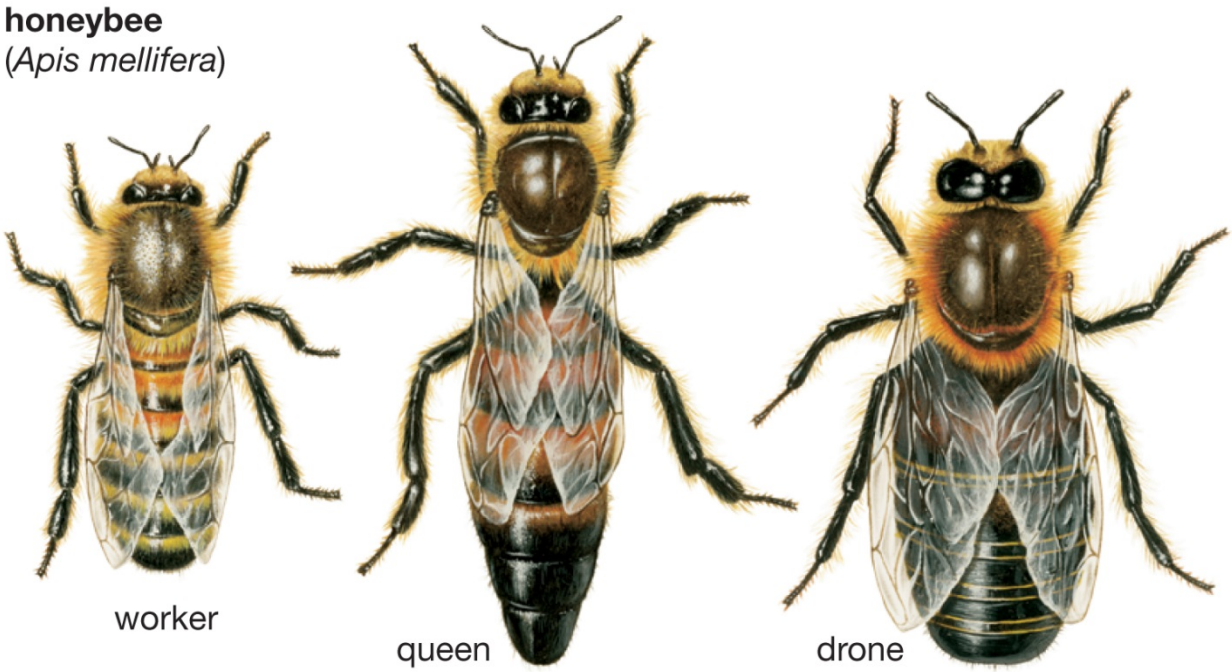
Worker bee John moving the bee packages

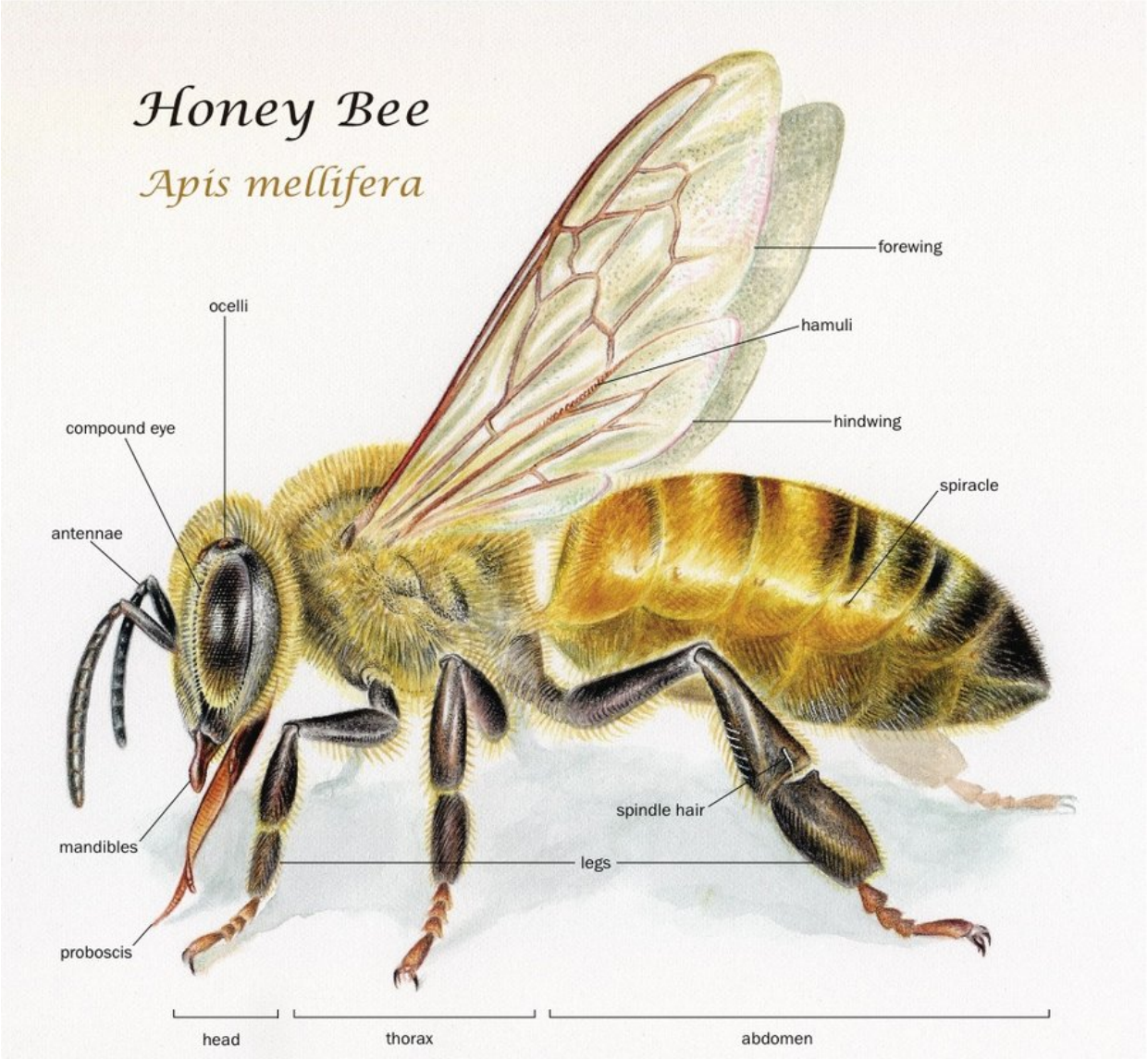
←

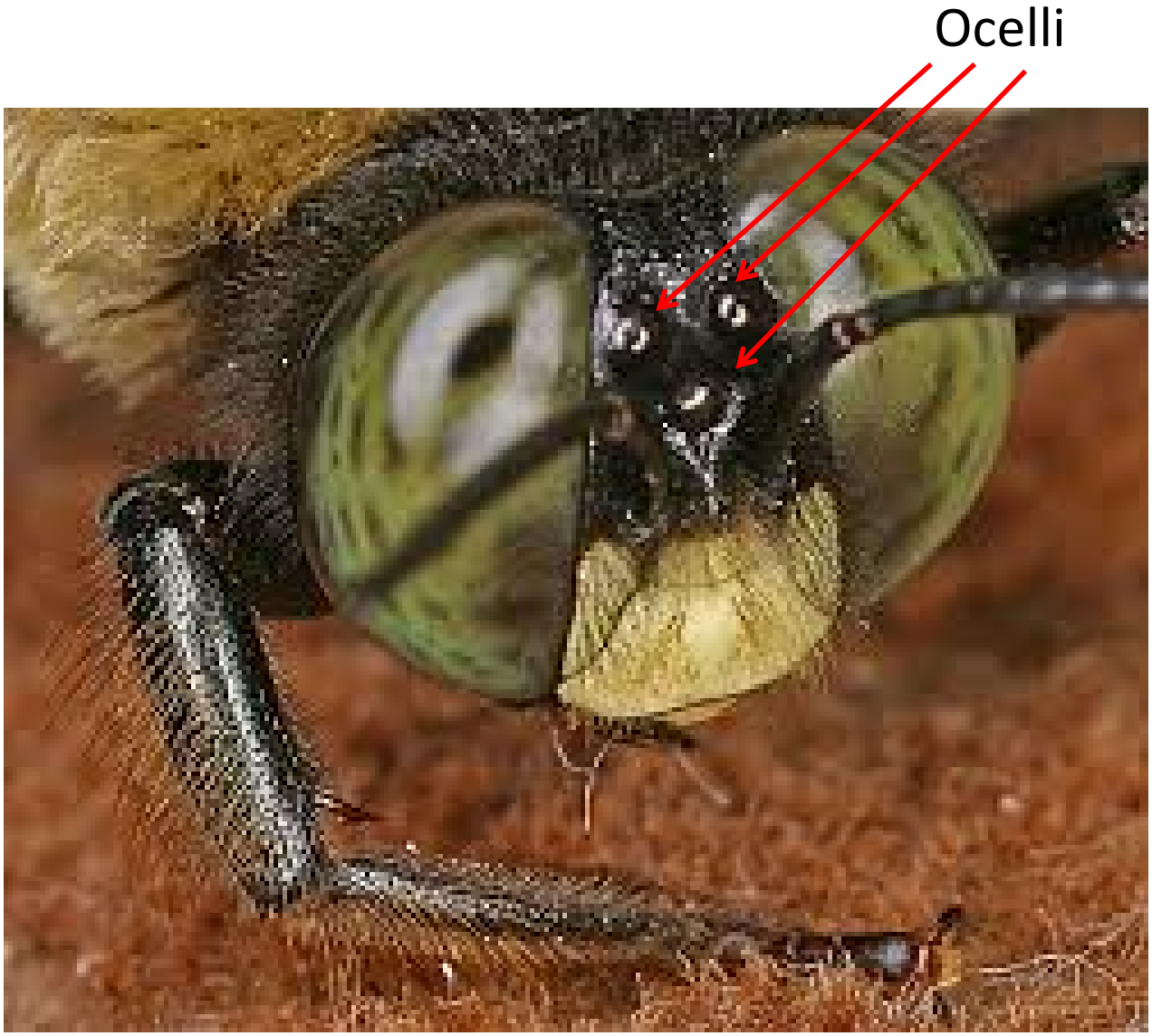
Queen bee in her cage

Life cycle of individual bees

- 3 “castes” of honey bees
  - Queen, her genetics and her life (brief summary)
  - Worker, her genetics and her life (brief summary)
  - Drone, his genetics and his life (brief summary)




Honey Bee
Apis mellifera
forewing
ocelli
hamuli
compound eye
hindwing
spiracle
antennae
spindle hair
mandibles
legs
proboscis
head
thorax
abdomen


Ocelli

Worker Honey Bees have different jobs according to their age

1-2 days old: have the job to clean the cells, and they start with the one they were born in. They also keep the brood warm

3-5 days old: their job is to feed older larvae

6-11 days old: they have the responsiblity to feed the youngest larvae

12-17 days old: they are producing wax, carrying food, building combs and have undertaker duties

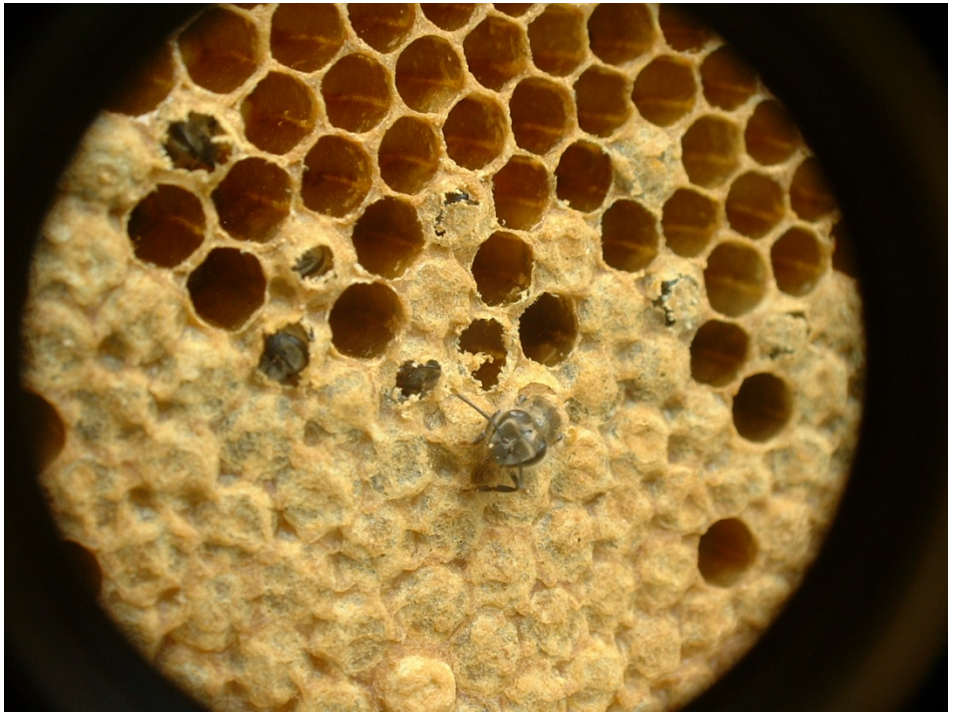
18-21 days old: they are protecting the hive entrance and have guard duty

From 22 days to the end of their life (at around 40-45 days): they fly from the hive and collect pollen, nectar, water etc.

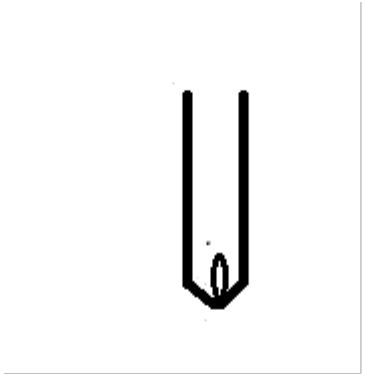
www.beekeepingbasic.com


ARKive
www.arkive.org
© B. Borrell Casals / www.flpa-images.co.uk


METRIC
1
2



The honey bee undergoes something called metamorphosis. The transformation of an egg into an adult bee occurs in stages.



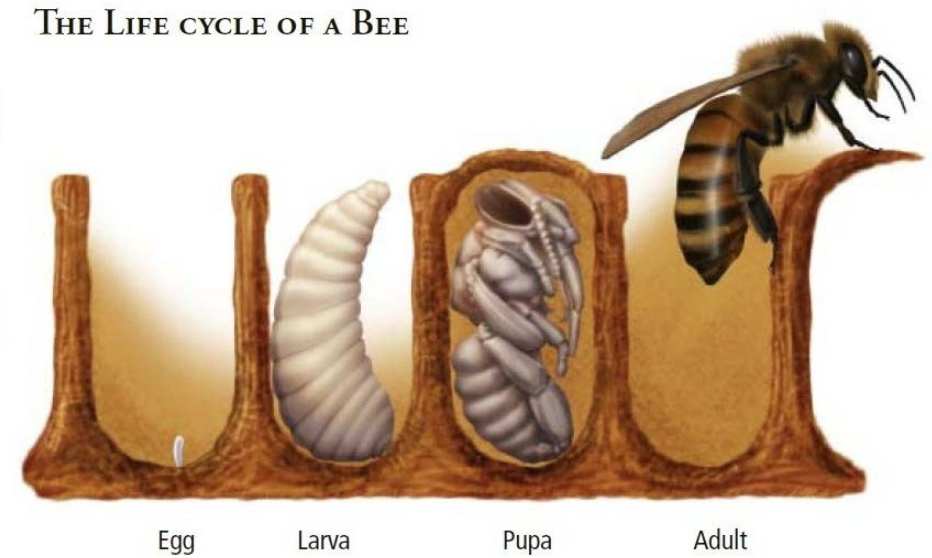
The stages are: egg, larvae, pupa and adult

Queen bees develop from an egg in 16 days.

Worker bees develop from an egg in 21 days.

Drone bees develop from an egg in 24 days.

The Life Cycle of a Bee



A Honey bee life cycle has four main distinct stages or phases, egg, larva, pupa and finally an adult. Honey bee colonies are generally perennial, unlike that of bumble bee and paper wasp colonies. The colonies of bees consist of three castes, Queen Bee, worker bee and drones (males). Queen bees lay eggs, worker bees are non-egg producing bees and drones, whos primary function is mating, and so ensuring the survival of the queen's genetic code.

Developmental time for honey bees

The total developmental time for a Queen bee is 16 days, 21 days for worker bee and approximately 24 days for drone or male bee. The four distinct honey bee life cycle stages can be summarized as following.

Egg stage

First stage of development in the life cycle is egg stage. Eggs are very minute and have appearance of poppy seeds in shape. Every egg has an opening on the broader side that enables a sperm to penetrate in. Hatching of eggs normally occurs three days after it is laid.

Larva stage

During this stage, hatched larva begins life almost microscopic in size without legs and eyes. Larva is fed on a diet known as royal jelly for initial two days. As the third day progresses larvae that are destined to develop into queen bees continue to fed on royal jelly, while worker larvae feed on honey, water and pollens. Larval stage for queen bee lasts for 5.5 days, 6 days for worker bees and 6.5 days for drones.

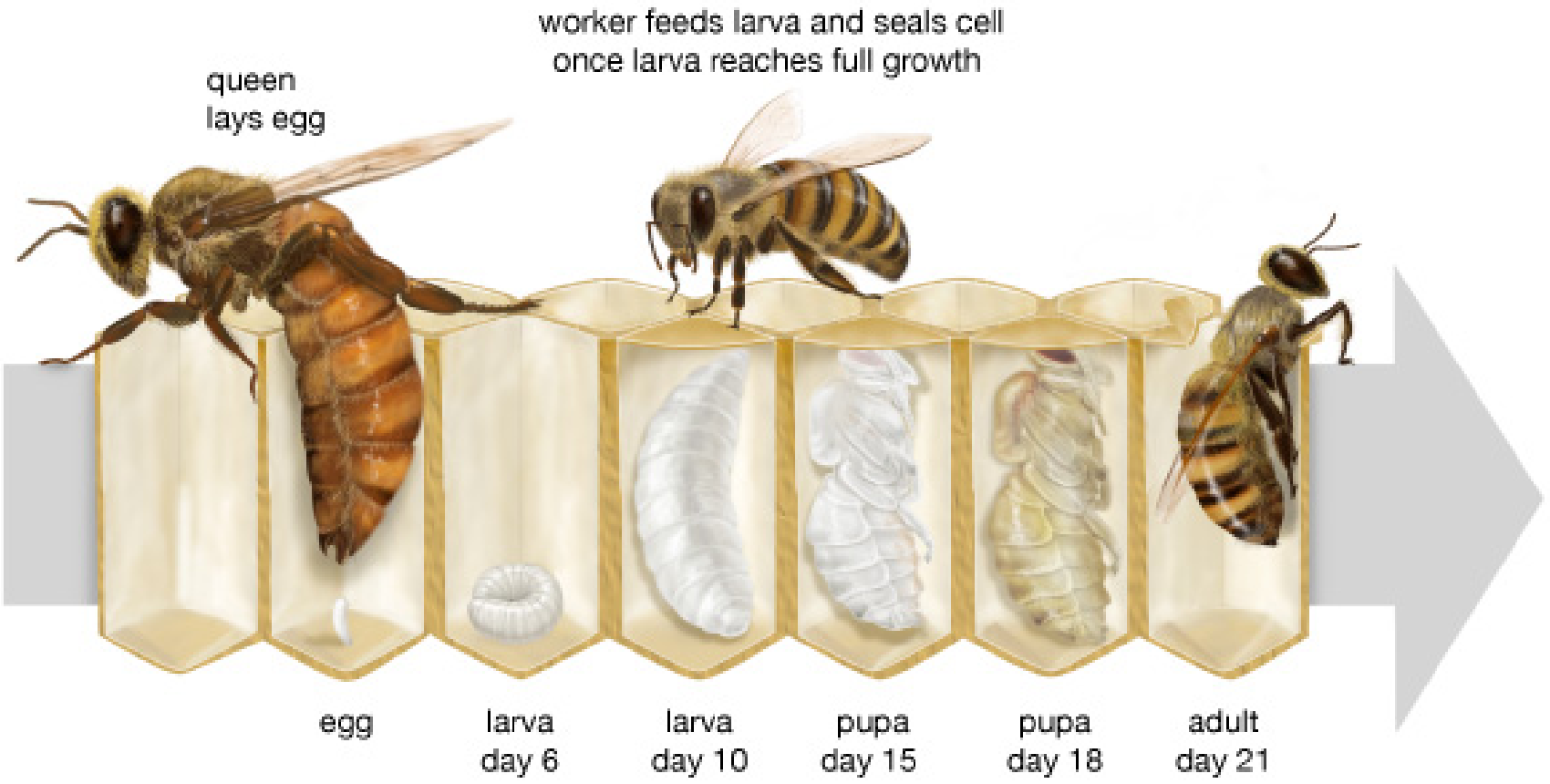
Pupa stage

Reorganization of tissues massively takes place during pupal stage. The worm-like body now develops three distinct parts of the body. This stage usually lasts for 7.5 days for queen bee, 12 days for worker bee and 14.5 days for drone bee (male bee).

Adult Stage

All three types of bees are now fully grown and are (almost) ready to accomplish their tasks. A typical colony of honey bee consists (in the summer) of 50,000 to 60,000 worker bees, 600 to 3000 drone bees and only 1 queen bee.

Life cycle of honeybees




ARKive
www.arkive.org
© Scott Camazine / gettyimages.com


ARKive
www.arkive.org
© Scott Camazine / gettyimages.com


ARKive
www.arkive.org
© Kim Taylor / naturepl.com

Larvae being fed by adult nurse bees; also a few cells of capped brood.


ARKive
www.arkive.org
© Stephen Dalton / www.photoshot.com


ARKive
www.arkive.org
© John B Free / naturepl.com

Capped Queen Cell: Supersedure or Swarm?


ARKive
www.arkive.org
© John B Free / naturepl.com

Beekeepers are usually aware of the honey bee dance that bees use to communicate the location of a nectar source.

Communication

A queen bee produces many odors. A subset are often referred to as the queen substance. Honey bees can detect several separate odors in various amounts to determine a number of things about the queen.

This is an interesting pdf from the Faculty of Agriculture, University of South Bohemia, Ceske Budejovice, Czech Republic, with a lot of info about honey bee pheromones.

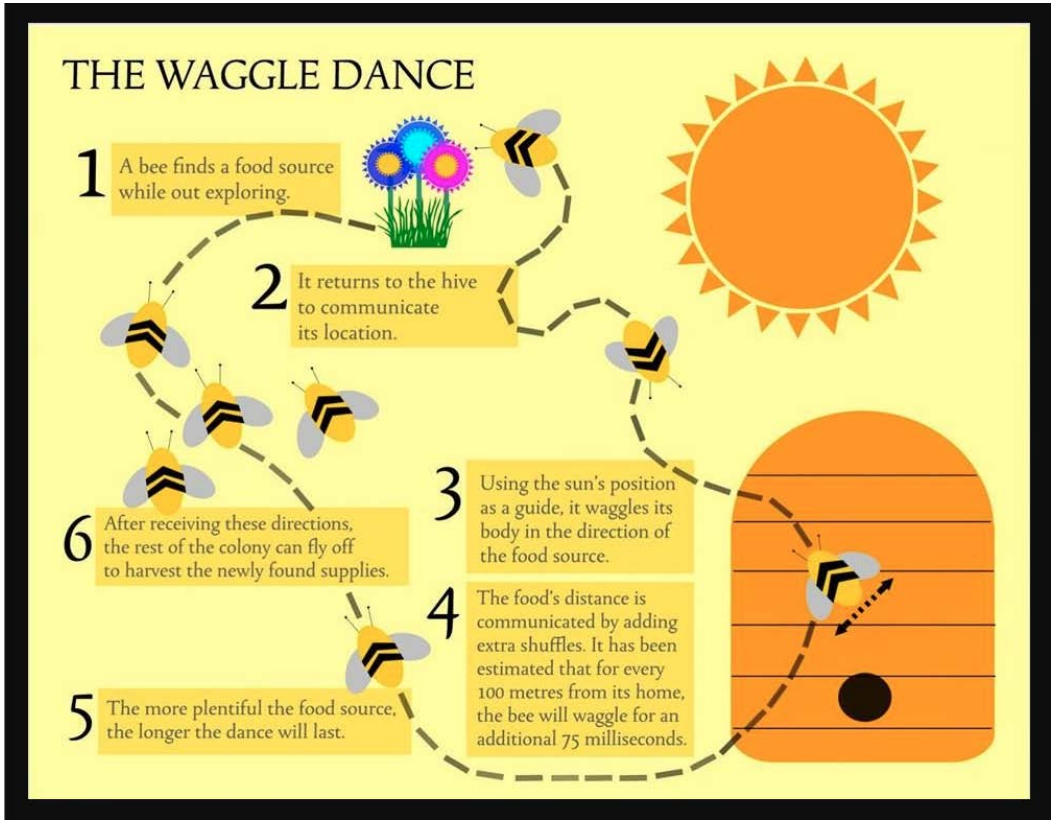
http://vri.cz/docs/vetmed/56-6-265.pdf

Communication

"The whole fabric of honey bee society depends on communication – on an innate ability to send and receive messages, to encode and decode information." "Bees use chemical, tactile, auditory, and visual messages.

"Only by speaking the same language from the outset can a colony of as many as 60,000 short-lived individuals coordinate its efforts and avert chaos"

Quotes from: The Honey Bee by J. Gould and C. Gould published by Scientific American Library.



Temperature control in a hive

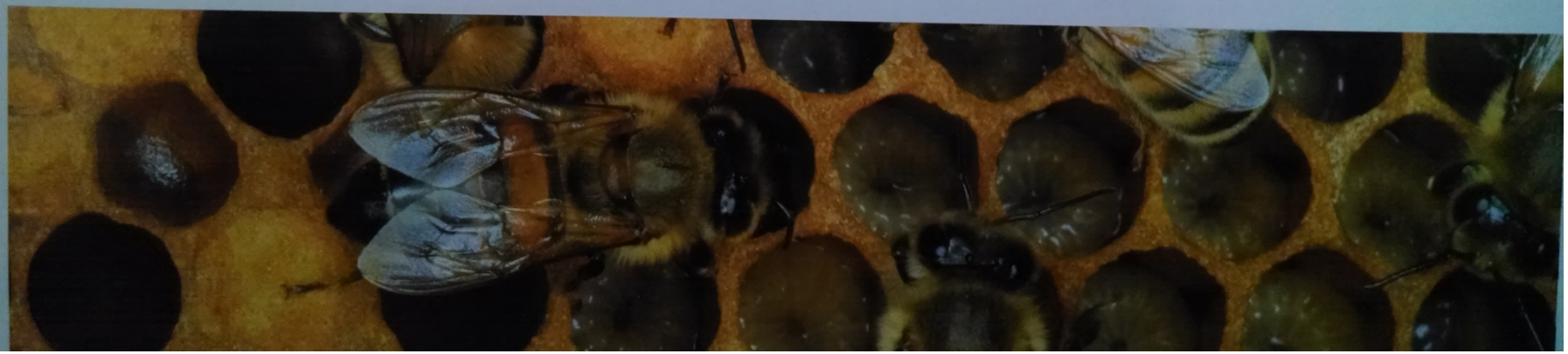
- 1. ➢ Honey Bee Brood develops best at 94 deg. F body temperature.
- 2. ➢ The brood body temperature ideally varies less than 1 deg. F.
- 3. The brood is deformed if it falls outside of the body temperature range of 82 deg. F to 98 deg. F prior to emerging. Those hatched honey bees will have malformed wings, mouth parts, abnormal behavior and short lives.
- 4. ➢ Honey bees warm the brood two ways.
  - a. Lie on top of a cool spot, dislocate their wings and flex their wing muscles and generate about 104 deg. F body heat.
  - b. There are heater holes located in the brood area. The worker bees go down into the hole, dislocate their wings and flex their wing muscles and generate about 104 deg. F body heat.
- 5. The honey bees heat the brood or the cluster not the hive.
- 6. Honey bees would like to have at least about 1.5 cubic feet of space, or one ten frame hive body.
- 7. When the honey bees go into a cluster they form layers.
  - a. Outer layer – brings the ambient temperature up 45 deg. F
  - b. Second layer – raises the ambient temperature from 45 deg. F to 65 deg. F.
  - c. IF they have brood: -- Inner layer – brings the ambient temperature up to 95 deg. F.
- 8. Honey bees begin to cluster when the temperature inside the hive drops below 64 deg. F.
- 9. Should there be no brood the temperature at the center of the cluster drops to 64 deg. F body temperature. The outer edge drops to 50 deg. F body temperature or below.
- 10. The bees at the outer edge will remain at this temperature for about twelve hours. The warmer honey bees will drag the colder honey bees into the center.
- 11. If the body temperature of the honey bee drops below 64 deg. F they can't fly

Temp. Control in a hive, cont.

- 12. If the honey bee body is chilled to less than 50 deg. F they become immobile. They enter into a chill coma. If not warmed within forty-eight hours they will die.
- 13. If the ambient temperature of the cluster drops to 14 deg. F the honey bees become immobile and enter the chill coma.
- 14. If the honey bee cluster is formed at 64 deg. F ambient temperature and the cluster temperature drops to 14 deg. F the cluster shrinks 5 times the original size.
- 15. How much honey is needed to keep the honey bee cluster alive?
  - a. aprox. 2.2 pounds of honey per week to warm the cluster.
  - b. About 35 to 100 pounds of honey is need for wintering.
  - c. It takes approximately 100 pounds of nectar to produce 40 pounds of honey.
- 16. Once the cluster is formed and the body temperature stays below 64 deg. F the cluster will usually not split.
- 17. In search of honey the cluster will generally move vertically.
- 18. The honey bees are only interested in heating the cluster, and brood but not the hive.
-
- Cooling
- 1. ➢ The brood could die if the body temperature exceeds 98 deg. F.
- 2. Beeswax comb will start to get soft and collapse when 105 deg. F ambient temperature is exceeded.
- 3. Adult honey bees will die if the ambient temperature is greater than 113 deg. F.
- 4. ➢ It has been tested that a hive temperature of 95 deg. F to 97 deg. F can be maintained for an ambient temperature up to about 140 deg. F.
- 5. The honey bees will start to ventilate the hive when the inside temperature starts to exceed 96 deg. F.
- 6. ➢ If fanning fails to reduce the temperature then the honey bee will use evaporation by placing water on the surface of the brood.
- 7. Another way the honey bees reduce inside temperatures is to go outside. This is called bearding.

In summer, a colony counts 60,000 to 80,000 bees.

The population is made up of an fertilized queen bee that lays close to 2,000 eggs per day, a few hundred male bees called drones and the thousands of female worker bees.
The queen's pheromones permeate the whole colony and inhibit the other bees' fertility.
The workers' jobs vary according to their age and follow their physiological development.
From birth they perform the functions of cleaner, nurse bee, house bee, wax producer, guard, water collector and finally a pollen gatherer. As a forager she will die of exhaustion within 2 - 3 weeks.
The scout bees are experienced foraging bee that search for sources of food.
During the swarming, they participate in the choice of a new habitat by communicating to the other colony members the size, location, orientation and quality of the site they have found.



Foraging

Some interesting facts:

➢ A honey bee will visit a thousand flowers or more to gather the load of nectar which may weigh as much as 85% of the weight of the bee.

The duration of a trip depends on the species of flowers visited and nectar abundance.

While nectar is exchanged with a house bee, the antennae of both bees are in continual motion. At the same time the house bee may stroke the "cheeks" of the field bee which stimulates the unloading behavior.

Did you know a foraging bee returning to the hive with nectar and pollen will return to the hive and unload the pollen load into a cell and exchange the nectar with several house bees. A honey bee may make as many as 24 trips in a day. The average trips recorded are between seven and 13 with from 27 to 45 minutes per trip.


ARKive
www.arkive.org
© Stephen Dalton / www.photoshot.com

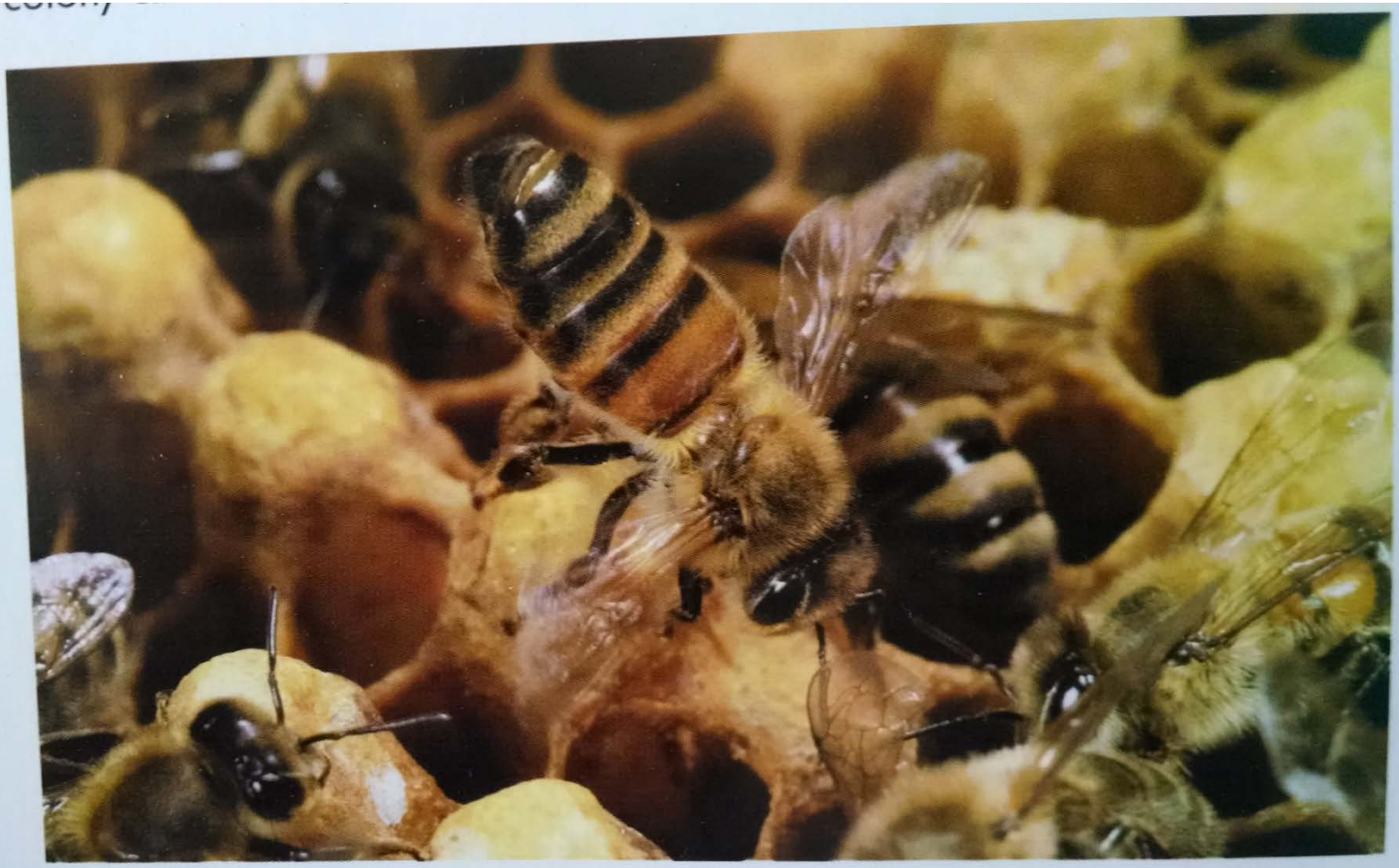

ARKive
www.arkive.org
© N. A. Callow


ARKive
www.arkive.org
© Meul / ARCO / naturepl.com


ARKive
www.arkive.org
© John B Free / naturepl.com

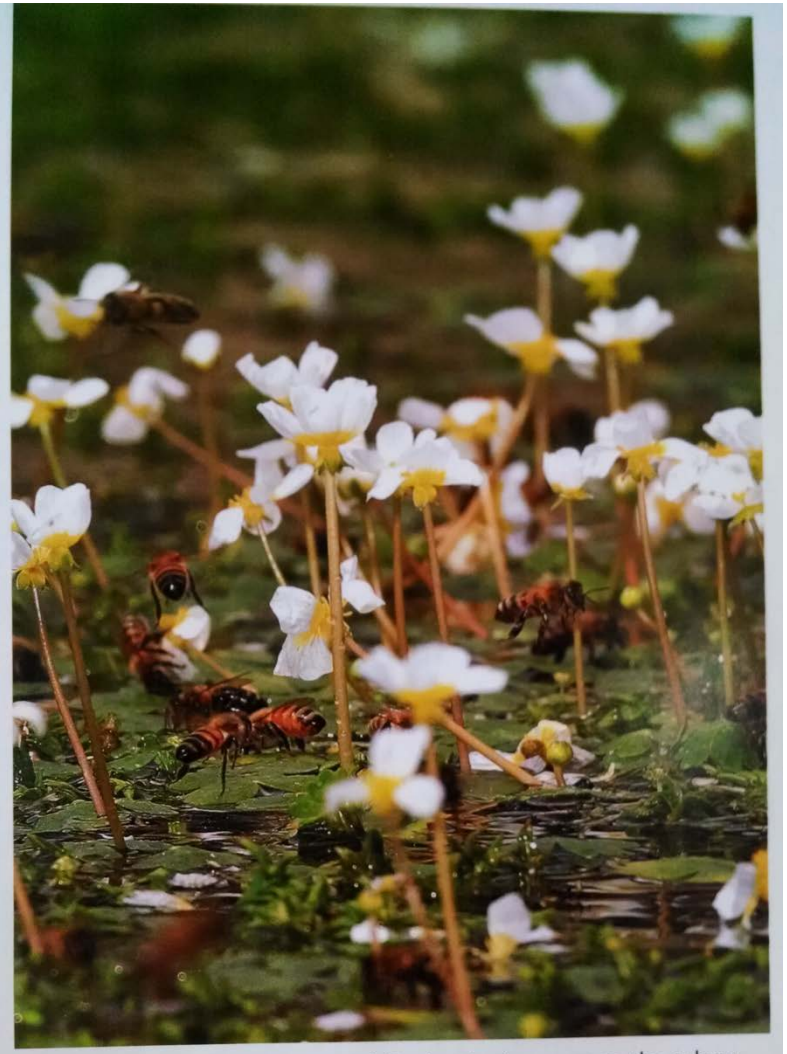

ARKive
www.arkive.org
© Satoshi Kuribayashi / gettyimages.com


123RF



The bees fan to regulate the temperature of the nest and dry the nectar.

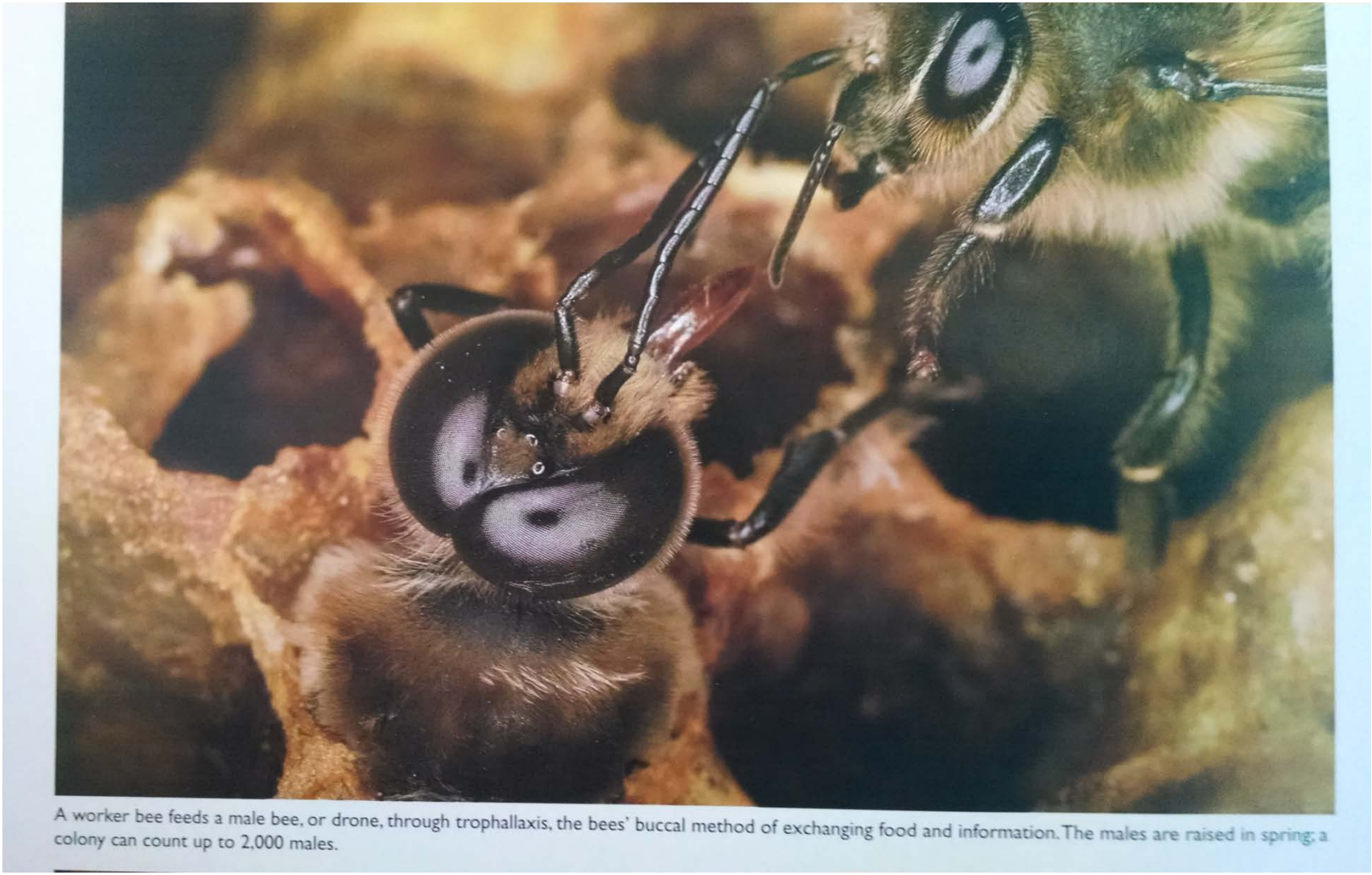
A bee carries a ball of propolis, the antibiotics and antiseptic for the hive.



The proximity of water is essential. During the busy season, the colony needs over a gallon of water per day.

Workers gathering water

worker feeding a drone



A worker bee feeds a male bee, or drone, through trophallaxis, the bees' buccal method of exchanging food and information. The males are raised in spring; a colony can count up to 2,000 males.

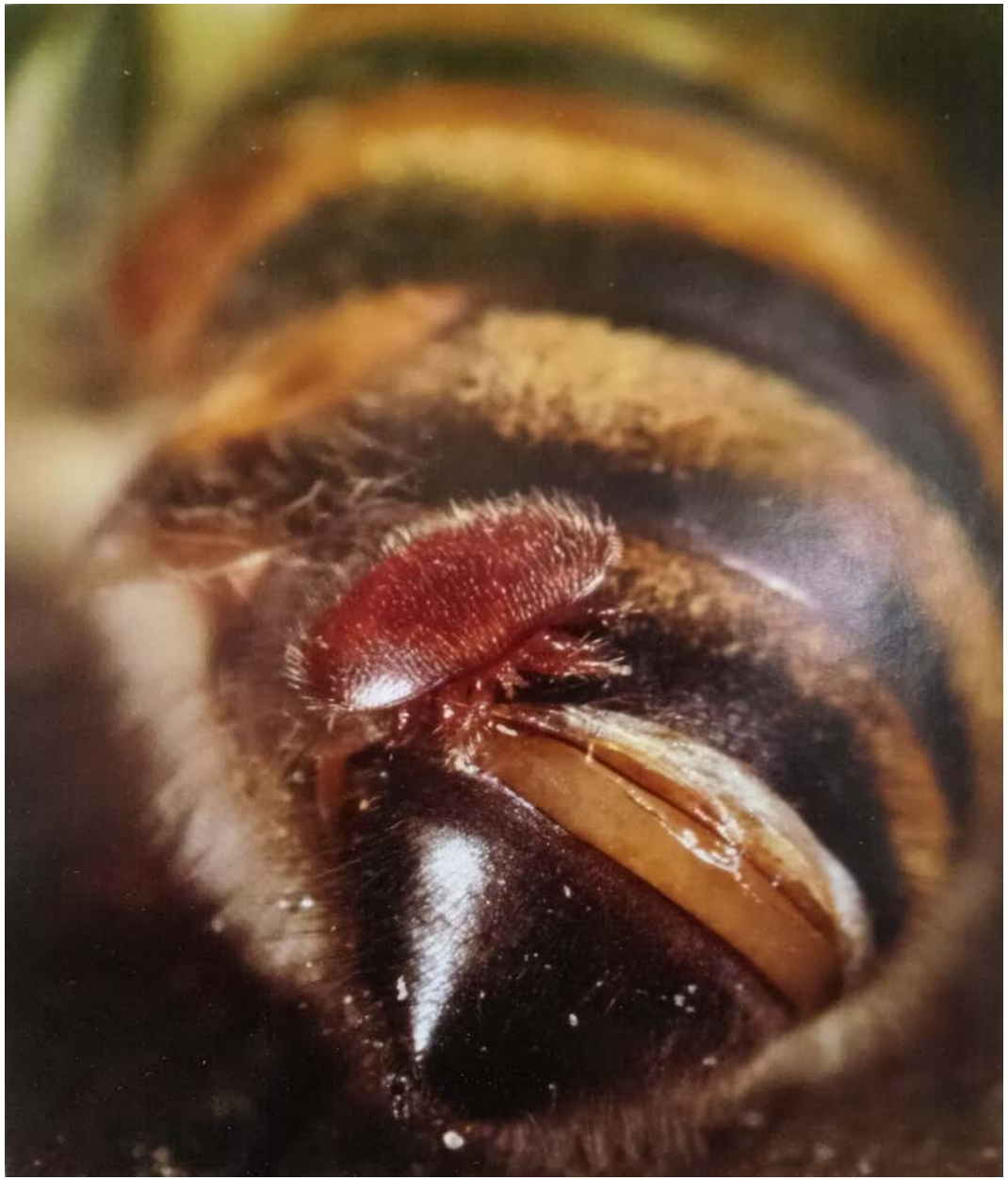

ARKive
www.arkive.org
© John B Free / naturepl.com


ARKive
www.arkive.org
© G. I. Bernard / www.photoshot.com


ARKive
www.arkive.org
© Kim Taylor / naturepl.com


ARKive
www.arkive.org
© Sinclair Stammers / naturepl.com

Varoa Destructor



Pollinators and their forage needs

- ➢ Pollinators include bees, moths, flies, beetles, wasps, desert bats, hummingbirds, and butterflies that transfer pollen from one plant to another while they are collecting pollen or nectar for food.

- ➢ In North America, bees pollinate many billions of dollars' worth of crops annually. Up to one quarter of our diet comes from crops whose production benefits from pollinating bees.

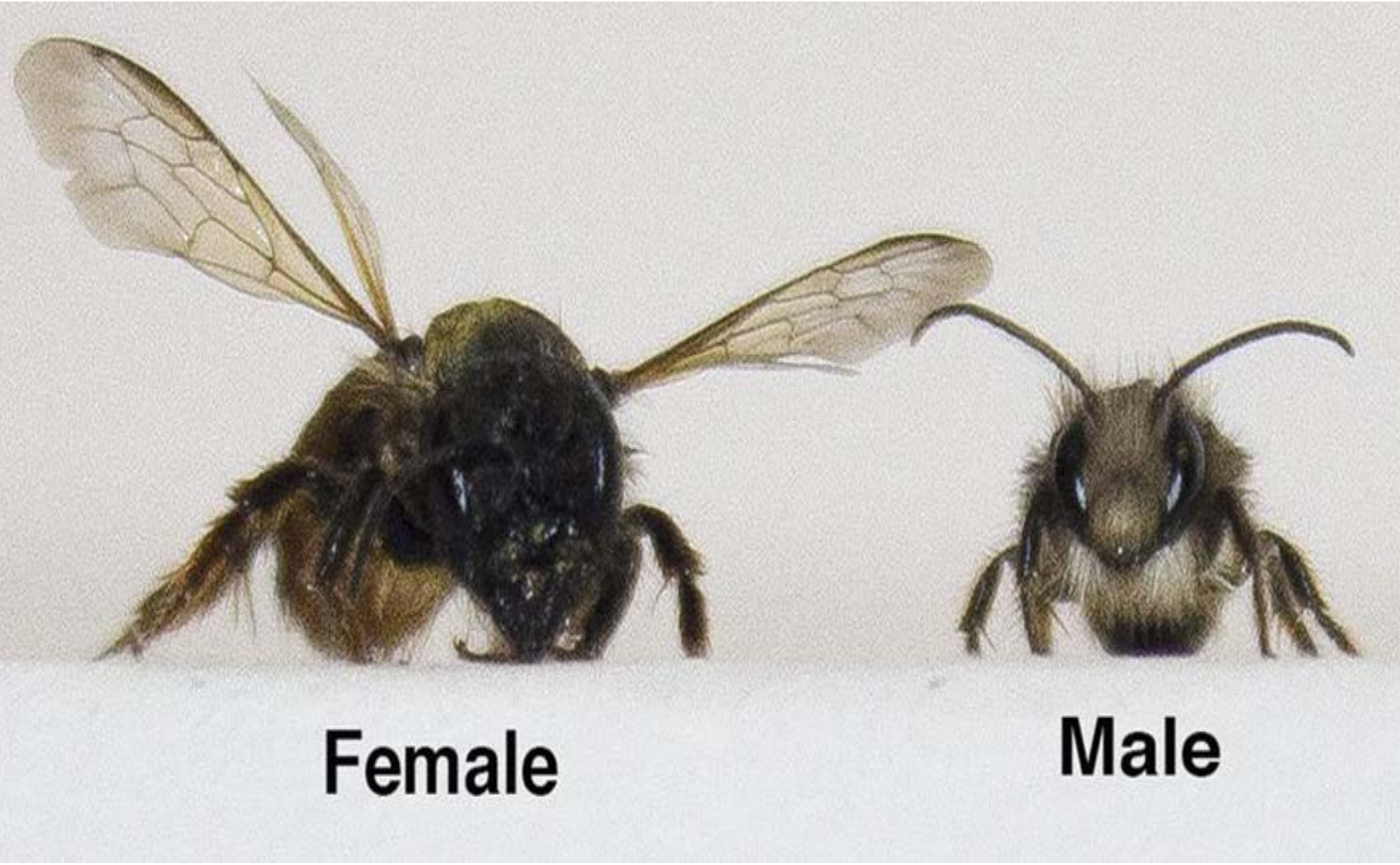
- ➢ The correct mixes of plants that bloom throughout the growing season provide a continuous source of nectar and pollen needed by insects

.

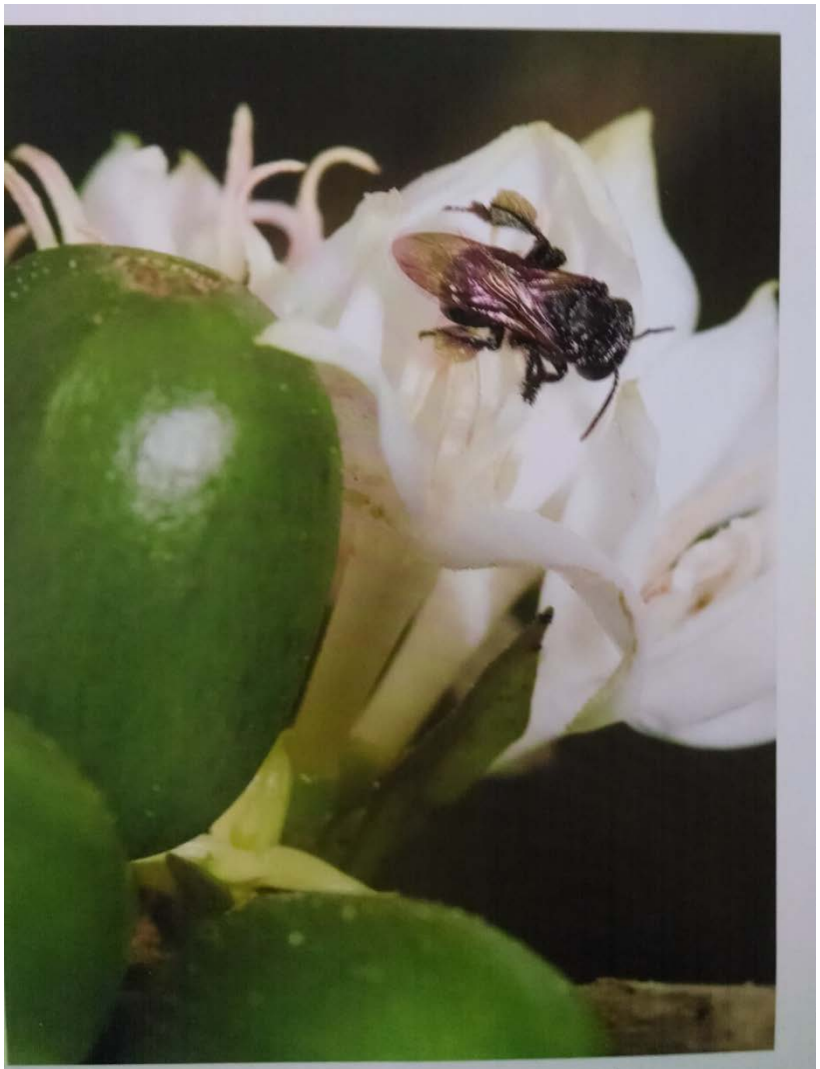
- ➢ An ideal plant mix to support pollinators is one that consists of at least nine species: three that bloom early in the season, three in mid-season and three in late season. In areas with less than 16 inches of mean annual precipitation, nine adapted and commercially produced species may not always be available.

- Source: https://xerces.org/wp-content/uploads/2016/01/nrcstechnote_plantsinlandnw1.pdf

Mason Bee Habitat


Female
Male

Bumble Bee



In Mexico, the best pollinator of the coffee plant is a stingless bee, the *trigona scaptotrigona*.

Alkali Bee

WSU Research

Habitat Restoration Project

- **Seed Farmers in Touchet,WA**

Monarch Butterfly

Feed on milkweed

Produce 4 generations

- **3 generations live 4-6 weeks**
- **4th generation lives up to 9 months and returns to origin**

Their habitat is threatened

Spring

Dandelion
(Taraxacum offinale)
Pollen and nectar

Mustards
(Brassica ssp.)
Pollen and nectar

Sage (Salvia spp.)
Pollen and nectar

Spring Beauty
(Claytonia Virginica) *Pollen*

Pussy willow
(Salix discolor)
Pollen and nectar

Chick weed
(Stellaria media)
Pollen

Strawberry
(Fragaria spp.)
Wild and garden variety
Nectar

Henbit
(Lamium amplexicaule)
Pollen

Service berry
(Melanchier canadensis)
Pollen

Red maple
(Acer rubrum & spp.)
Pollen

Elm trees
(Ulmus spp.)
Pollen and propolis

Poplar (Cottonwood)
(Populus spp.)
Pollen and propolis

Four seasons of Bee Forage

Bees forage over two miles for:

Pollen: is found in many plants, weeds, and trees. Pollen, a protein, is the key feature of colony nutrition. Pollen is eaten by newly emerged workers for about 10 days and supplies the protein for royal jelly.

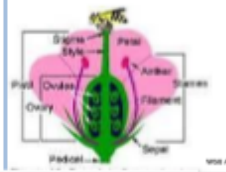
Nectar: a sweet secretion of flowers of various plants. It is a carbohydrate that is dehydrated by hive bees into honey with an 18% water content.

Propolis: **bee glue** -- is a sticky resin with antibiotic, antifungal, antibacterial, antiviral and antimicrobial properties. Bees gather propolis from buds of pine, Norway spruce, alder, willow, horse-chestnut, birch, plum, ash, oak and poplar. Bees use propols to coat the wood in their hive, seal cracks and encase foreign objects—even mice.

Water: Bees need water. If you don't provide a shallow water source, the bees will drink out of your neighbors dog dish or watering tank.

Bees don't FANCY forsythia, lilacs, roses, marigolds, mums, carnations and peonies.

Winter



Not much is blooming in the winter - maybe a dandelion. A good time to study pollination, bee tongue length and baking something with HONEY.

Summer

Vegetables/food crops 1/3 of our food

Fruit blossoms
Apricot, apple, cherry, pear, peach
Nectar

Berries
Blueberries, raspberries, elderberries, black berries
Nectar

Black locust
(Robinia pseudoacacin)
Nectar

Hawthorn
(Crataceous douglasii) *Pollen*

Thistle
Canada, Bull, Musk, Scotch, Globe, Yellow star
Nectar

Linden tree
Aka "Bee Tree"
(Tilia americana) *Nectar*

Clovers
White, Dutch, crimson, alsike, alfalfa, sainfoin. *Pollen*

Fall

Weeds:
Purple Loosestrife, dogbane, burdock, others *Nectar*

Buckwheat
(Fagopyrum esculentum)
Nectar

Aster (Amellus ellus)
Nectar

Herbs essential oils:
Thai basil, mint, thyme, melissa, lavender, coriander-
Help rid Varroa
Nectar/pollen

Goldenrod
(Solidago) *Nectar*

Bees and blooms: How it works!

About March 15, temperature rises in the hive as the Queen lays eggs—Workers begin foraging for 1) Water 2) pollen 3) nectar 4) propolis

Question: When and how do worker bees gather and transport pollen and nectar?

Answer:

First a scout bee finds a source for foraging and communicates its location through dance.

Between 22-45 days old, worker bees forage for nectar (carbohydrate) and pollen (protein sources.)

The worker's body has a positive electrical charge which attracts pollen. The pollen literally jumps toward her body. She then combs the pollen into her pollen basket on her hind legs and flies back to the hive where pollen in collected and stored in hexagonal cells.

It is mixed with nectar where it becomes "bee bread." Workers can carry about 1/3 of their body weight in pollen. Pollen is vital to development of young bees.

Question: How does a worker bee gather and transport nectar?

Answer:

Bees collect nectar using their proboscis, a tube formed by mouth parts. A bee can collect her own body weight, suck it into her honey stomach and fly back to the hive where she regurgitates it into the mouth of a house bee. House bees blow bubbles to concentrate the sugars. It is then stored in the hexagonal comb cells.

One-third of food crops need pollination: tomato, curcubits, fruits, nuts, grapes.

Question: How does a worker bee gather propolis?

Answer:

First: Propolis is like pitch. In fact, a good source is conifer trees. It is used as a cement and to retard deterioration and to sanitize the hive. Bees put it on the interior of the outer wall of the hive.

Next: Bees use their mandibles to bite the glue-like resin of resin-producing plants. Then, the bee chews it like taffy and scrapes it into her pollen basket with her front legs.

When she gets to the hive, she solicits another bee to assist her in removing and placing the propolis where it is needed.

Question: How do bees collect and use water?

Answer:

Bees do not store water. It is needed to dilute honey, feed larvae, to cool the hive if temperatures get too high and to increase humidity.

Bees prefer water that has some odor over pure water. Water foragers do not go long distances to collect water. They may fill their honey stomach quickly at any source—your dog dish or your swimming pool. The workers may remain in the hive as a water storage vessel, if the water is not needed immediately.

References for the information include:

Caron, Dewey M., *Honey Bee Biology*, 2013;
Sanford, Malcolm T. & Bonney, Richard E. *Keeping Honey Bees* 2010;
Johansen, Carl A. & Mayer, Daniel F. *Pollinator Protection* 2014.

-- DJD, MC, WSU Asotin County Master Gardeners 2015

Related .pdf files of possible interest

- 2019_June_Backyard_Cons
- Bee Identifier
- Plants that Attract Bees and Butterflies
- Four Seasons of Bee Forage
- FS174E pollination and Protecting Bees
- PPMCPlants4PollinatorsInTheInPNW
- ID Fish and Game Native Plant List

Resources

- Washington State Department of Agriculture. 2013. 10 Ways to Protect Bees from Pesticides. Washington State Department of Agriculture Pest Management Division. http://agr.wa.gov/fp/pubs/docs/388TenWaysToProtectBeesFromPesticides.pdf.
- www.xerces.org
- https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/newsroom/releases/?cid=NRCSEPRD1405624
- Willmer, P. 2011. Pollination and Floral Ecology. New Jersey: Princeton University Press.
- https://askabiologist.asu.edu/honey-bee-communication
- https://bees.techno-science.ca/english/bees/life-in-a-hive/brood-chamber.php
- National Research Council. 2007. Status of Pollinators in North America. Washington, DC: The National Academies Press.

Contact Information

- John Freeman: Phone: 509/758-6338
- Larry Carey: Phone: 509/566-7214


ARKive
www.arkive.org
© David J Slater / www.djsphotography.co.uk

Pollinators and their forage needs

- ➢ Pollinators include bees, moths, flies, beetles, wasps, desert bats, hummingbirds, and butterflies that transfer pollen from one plant to another while they are collecting pollen or nectar for food.
- Pollinators are critical to the function of terrestrial ecosystems because they enhance plant reproduction. Many of the world's crop species benefit from insect pollination, which is mostly provided by bees.
- ➢ In North America, bees pollinate many billions of dollars' worth of crops annually. Up to one quarter of our diet comes from crops whose production benefits from pollinating bees.
- Pollinators are threatened world-wide by habitat loss, habitat fragmentation, pesticides, disease and parasites. The loss of pollinators has serious economic implications for humans and for maintaining ecosystem diversity and stability.
- Well-chosen forbs, legumes, shrubs and trees planted along farm and ranch borders and within fields attract pollinators and other beneficial insects.
- The correct mixes of plants that bloom throughout the growing season provide a continuous source of nectar and pollen needed by insects.
- ➢ An ideal plant mix to support pollinators is one that consists of at least nine species: three that bloom early in the season, three in mid-season and three in late season. In areas with less than 16 inches of mean annual precipitation, nine adapted and commercially produced species may not always be available.
- Source: https://xerces.org/wp-content/uploads/2016/01/nrcstechnote_plantsinlandnw1.pdf

Pollinator Plants

- • yarrow • rubber rabbitbrush • common sunflower • blue flax • alfalfa • Wyeth’s buckwheat • blanket flower • small burnet • Missouri goldenrod • western mountain aster • fearnleaf biscuitroot • Snake River wheatgrass • Sandberg bluegrass • bluebunch wheatgrass • big bluegrass • Idaho fescue • basalt milkvetch • Carey's balsamroot • arrowleaf balsamroot • Douglas' dustymaidens • yellow bee plant • slender hawksbeard • western prairie clover • threadleaf fleabane • linearleaf daisy • shaggy daisy • Oregon sunshine • little sunflower • Lewis flax • nineleaf biscuitroot • hoary tansyaster • evening primrose • sainfoin • showy penstemon • whiteleaf phacelia • serviceberry • Siberian peashrub • yellow rabbitbrush • sulphur buckwheat

Pollinator Plants, cont.

- • chokecherry • antelope bitterbrush • smooth sumac • Woods rose • purple sage • sticky purple geranium • Lewis flax • Oregon sunshine • black hawthorn • Oregon grape • golden currant • wax currant • Nootka rose • blue elderberry • tall cinquefoil • slender cinquefoil • oceanspray • Lewis' mock orange • snowberry • ninebark • red-stem ceanothus • shrubby cinquefoil • yellow blossom alfalfa • Canada goldenrod • threadleaf fleabane • showy daisy • fireweed • antelope bitterbrush • pink honeysuckle • sitka spruce • vine maple • western hemlock • evergreen huckleberry • red huckleberry • pearly everlasting • Douglas aster • coyote bush • camas • mountain avens • seaside daisy • pacific bleeding heart • coastal strawberry
- Asotin County Conservation District | 720 Sixth St., Suite B, Clarkston, WA 99403-2012 | Main Office: 509-552-8117