

# Bee Dependent

## Our unrequited relationship

IN THE EARLY 1600s, English settlers in colonial Jamestown were struggling to stay alive. Colony resident William Strachey (1572–1621) recorded that between 1607 and 1610, more than 80 percent of the migrants had died of disease and starvation. Attempts to establish a European agrarian economy were largely unsuccessful in the beginning. The winter of 1609–10 was known as the “Starving Time.” There were several problems facing the desperate settlement. Jamestown was built on a low-lying peninsula along the tidal James River and early settlers described the water as saline and “full of slime and filth.” In summer, the settlement was swampy and mosquito-plagued. The settlers had unknowingly brought with them the Old World mosquito *Aedes aegypti*. Supply ships had not arrived. And relations with the surrounding indigenous people verged on open warfare much of the time. By the year 1624, only about 1,100 of the 7,500 migrants had survived.

One of the migrants’ major problems—although they did not realize it—was that they had brought over domesticated food plants from Europe, but the plants could not reproduce without European pollinators, especially honey bees (*Apis mellifera*). A turning point in this process was the importation of honey bees from England. In 1621, Jamestown received the shipments described in this letter:

‘We have by this Ship and the ship Discovery sent you divers sorts of seeds, and fruit trees, as also Pid-

geons, Connies [rabbits], Peacocks, Mastiffs, and Beehives, as you shall by the invoice perceive, and the preservation and increase whereof we [require] of you.’

Without honey bees, many European economic plants could not reproduce. The seeds planted by the colonists would grow, but the plants could not set fruit or produce viable seeds because they were not pollinated. Many European staples of the time, including such fruits as apples, plums, pears, mulberries, and figs, depended on bees, as did cucumbers, carrots, beets, turnips, radishes, and cabbage. Some of these vegetables would grow, but the seeds they produced were sterile. One colonist noted, “The earth hath not yielded her increase according to our expectation; much of our seed hath perished in the ground.” The introduction of bees solved some of these problems. Other plants that are self-pollinating or pollinated by wind, such as grapes and wheat, were cross-pollinated by bees and aided by nitrogen-fixing plants, such as white clover (*Trifolium repens*), which is native to Europe and pollinated by honey bees. The bees adapted very quickly. Bees and clover

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spread across North America faster than the colonists themselves. Plymouth Colony leader Edward Winslow (1595–1655) observed, “The bees that have been transported hither thrive exceedingly, and the increase of honey among us is evident.” In just a century after the introduction of European honey bees, Virginia was exporting 156,000 kilograms of beeswax a year.

There were already many species of endemic bees in the Americas, well adapted to the local flora. The European economic plants, however, had coevolved for thousands of years with European honey bees. So while the indigenous people of eastern North America had seen bees before, they had never tasted honey; the local bees did not store it. In Central America, the great Mesoamerican civilizations kept bees of the species *Melipona beecheii* and used the small amounts of honey they produced primarily for medicines and ritual uses. In his work on the medicine of the indigenous people of Mexico from 1574, Francisco Hernández (ca. 1515–1587) wrote, “the bees of this land are different from those of Spain, being smaller and without stings, yet they produce a honey that is sweet and medicinal,



European honey bees (*Apis mellifera*) pollinating a fruit tree. MakroBetz/Shutterstock

used by the natives for curing various ailments.” The introduced species did cause a decline in many native species of bees, and some extinctions.

The European honey bee stands out from the 20,000 other bee species for the large quantity of honey it produces. Beekeepers have encouraged and selected for honey production since people began domesticating bees more than 5,000 years ago. Modern European bees of the species *A. mellifera* evolved in Eurasia and Africa, but are now found in most parts of the world. They produce about sixty liters of honey per colony per year (compared to one or two liters for the stingless American bees). This

preserved food allows the bees and their larvae to survive long winters. Honey bees also range more widely from their hives than most bee species, sometimes pollinating plants six kilometers away. Worker females collect nectar and store pollen in special structures on their legs and then process the pollen and nectar into honey, adding enzymes and acids, which preserve it. The preservatives also give honey its anti-inflammatory, antioxidant, and antibacterial properties; it is one of the oldest medicines. Luckily for archaeologists, the chemical composition of beeswax depends on the species of bee that created it. If the honeycomb and honey were stored

in pottery vessels, a unique chemical signature is preserved, indicating not only that the vessel held honeycomb but what species of bee made it.

**WHEN EARLY** American colonists brought bees to Virginia, it was not because they understood the pollination issues. They were only interested in the honey and beeswax the bees produced. The way that sexual reproduction worked in plants, and how insects played a part, had been suspected for millennia but was not yet understood. Five thousand years ago, Assyrian and Egyptian priests performed rituals in which they took the male flowers of date palms and



A bee keeper at his apiary colony on a farm in Pengzhou, China—the world’s largest producer of honey. ©Lei Xu/Dreamstime.com STIME.COM



Relief from the Egyptian tomb of Pabasa, ca. 650 BCE. Wikipedia Commons



Asian honey bees (*Apis cerana*) and queen larvae on honeycomb in India. Channel M2/Shutterstock

“blessed” the pistils of a female plant by sprinkling them with male pollen, directly pollinating them. This act ensured a good harvest of dates. The Greek philosopher Aristotle (384–322 BCE) and his student Theophrastus (ca. 371–287 BCE) surmised that there had to be a parallel between plant reproduction and the sexual reproduction of animals, but were confused by the way some plants, such as dates, are either male or female, while others plant species have both male and female parts in the same individual plant. Many kinds of flowers contain both male stamen and female pistils, and can self-pollinate, such as corn. And still other plant species could reproduce asexually, just as potatoes can be grown from planting their “eyes.” It wasn’t until the Scientific Revolution of the mid-1600s that this question was sorted out. In 1694, botanist Rudolf Jakob Camerarius (1665–1721) identified the mechanism of sexual reproduction in plants, and a

century later the naturalist Christian Sprengel (1750–1816) showed how critical insects were to pollination. Sprengel wrote, “every aspect of plant anatomy and physiology is related to the peculiarity of structure and behavior of the insects which visit and pollinate flowers.” And honey bees are a species that flowering plants depend on heavily.

The ancient Egyptians understood the importance of bees for successful planting seasons. The Nile runs 6,650 kilometers from south to north, and for much of that length the valley is like a linear oasis running through the desert. The ancient Egyptians found it most effective to move their beehives up and down the river as the seasons progressed, so that there were always bees to pollinate the flowering crops (while producing large amounts of honey). The Egyptians were also aware of the medicinal qualities of honey. The Ebers Papyrus from about 1550 BCE

describes hundreds of medicines and potions for a variety of ailments, many of which feature honey as a key ingredient. People have used honey for the treatment of wounds and burns nearly everywhere, and it is still used to help reduce the bacterial load around infections and promote the growth of healthy skin.

*Apis cerana*, the Asian honey bee, is the world’s other great honey producer. It is native to south and southeastern Asia, and has been kept by people for thousands of years in India, China, and throughout eastern Asia. Today, China is the world’s largest producer of honey by far. The Asian and European bees are closely related and look alike, but do not hybridize. Although Asiatic bees have smaller colonies and produce less honey per colony, they have some advantages over European honey bees, including resistance to the varroa parasite and defenses



Medieval Beekeepers with basketry-masked faces, by Pieter Bruegel the Elder, ca. 1568. Wikimedia Commons

against Asian giant hornets (*Vespa mandarinia*). The large hornets are completely enveloped by the bees who beat their wings rapidly, raising the bees' body temperature to a level that kills the hornet, but doesn't hurt the bees.

The biggest determinant of the flavor and sweetness of honey from either the Asian or European honey bee is the source of the pollen. Honey made by bees collecting pollen from lavender or thyme tastes very different from honey based on sage or wildflowers. Honey can even take on the hallucinogenic properties of the pollen used to make it, as in the "mad honey" of Nepal and Turkey. This was mentioned by the ancient Greeks and is still used.

Humankind has put a lot of pressure on these two species of bees, and placing so great a reliance on a few

species leaves us and them vulnerable. Bees suffer from many diseases and parasites, and because they are social creatures, a disease can destroy a whole colony. Colony Collapse Disorder is an example of honey bees' vulnerability. It is not caused by a single disease or parasite, but shows that a combination of stressors can cause a colony to die. These include infestations of the parasite *varroa* that lives in the trachea of bees, or another intestinal parasite called *nosema*. There are also bacterial, fungal, and viral infections that plague colonies. The biggest threat to bees, however (as well as most insects and similar animals), is the use of herbicides and pesticides on an industrial scale, a widespread practice in the United States.

Our relationship with bees has been close for the last 10,000 years,

especially as we have grown more and more dependent on domesticated flowering plants. Bees pollinate the majority of the plants on which we depend. Without them, we and most domesticated animals would starve. However, although we have transported honey bees around the world, we are inconsequential to their needs. We should keep in mind the advice from the Roman farmer Columella (4–70 CE), who in his twelve-volume treatise on farming said, "Bees are not so much born to us as borrowed from the flowers and trees, and they require the gentlest of hands."

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