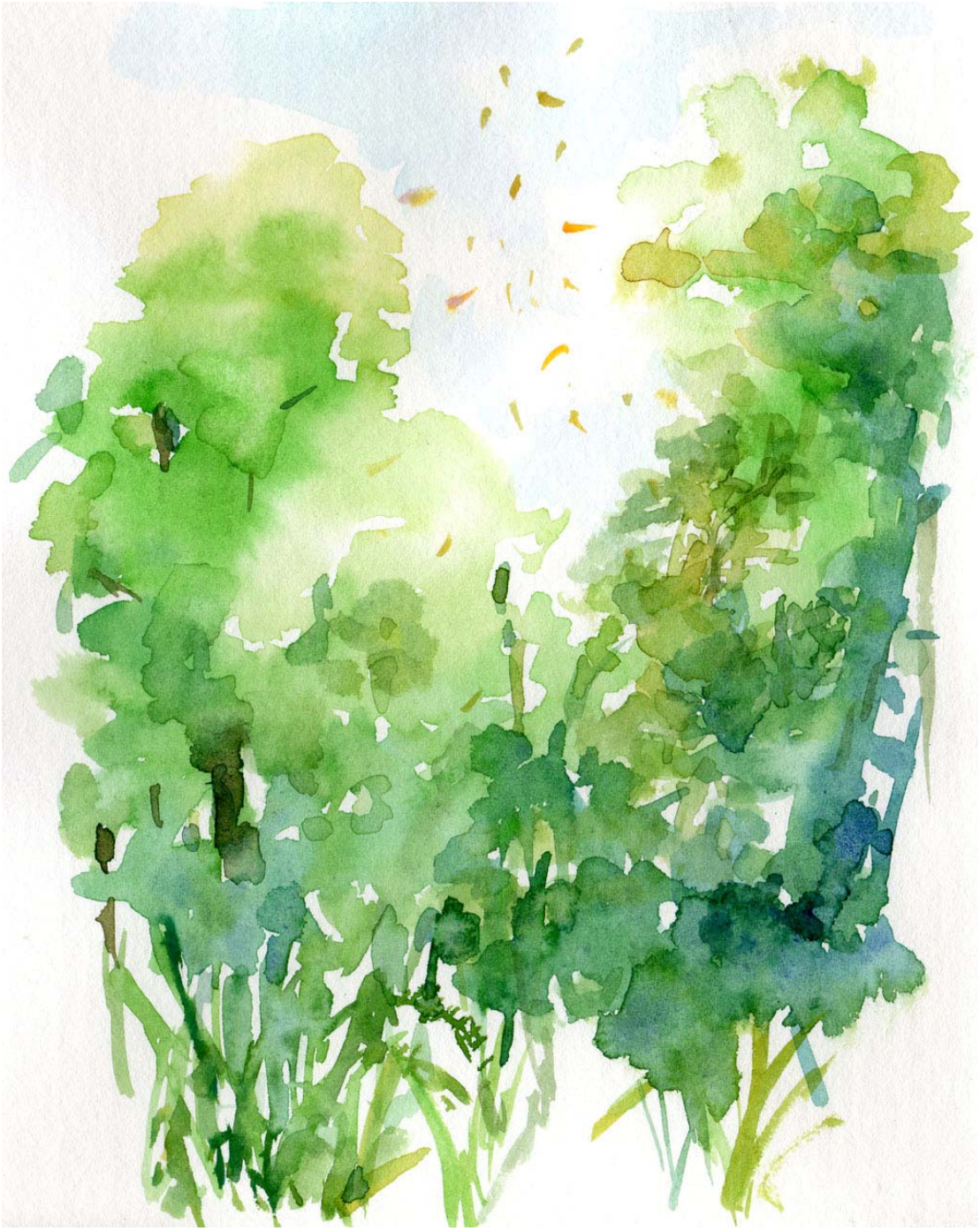
A TALE OF A QUEEN BEE

—Honey bees' Disorder from the Perspective of Honey Bee 1—



There lived a colony of honeybees in a hive box.

A box containing the honeybee colony was set at the root of a tree in the midst of about 10 trees in a space at the middle of the mountain, where one could look down on the bright vast rice fields. Behind the hive was Japanese bird cherry, horse-chestnut, holly, acorn, rose, arguta, while further back stood a deep forest of beech trees. Everywhere diverse animals, insects, plants and microbes were all living together in harmony and balance.

Spring has arrived to the moutain. Bees that had flown out first thing in the morning return and start dancing in the dark hive, spreading the scent of flowers. "Facing the sun, it's on the right in that direction, about this far, it’s from the flower with this scent, there is a lot of nectar." As she dances shaking her body scented with flower another honeybee next to her starts to copy her dance and bees around them dance in the same way for a while. Then, with the location and scent vividly memorized, they fly out, one after another. The forager bees repeatedly dive into the flowers to bring back nectar and pollen while helping the flowers pollinate. When the flowers the bees had visited stops producing nectar, they will fly to another location with different flowers. Then the scouts return home to let their sisters know this new location by performing a new dance based on the direction of the sun.

Most of this nectar and pollen becomes food to raise children with. As they are taking care of so many children, they need much food. In the 6-day larva period, after hatching from the egg, the larvae will eat a lot of food – a mixture of honey and pollen – and grow rapidly within their cells. When they become pupas, lids are produced to cover their hexagonal cells and are not opened until the day they become adult bees. The first thing they eat, after having come out of the cell as an adult, is honey. Having eaten nothing as pupa, could you imagine how heavenly their first taste of honey must be which will be the "center of their life as a honey bee".

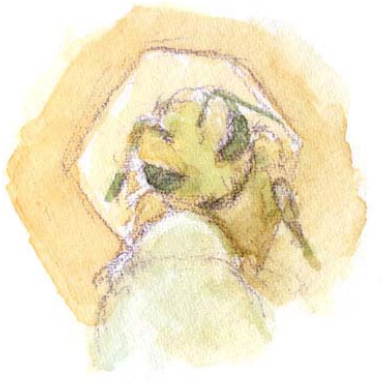
Over the course of their lives, adult bees work on many different jobs, which change according to their age. Their first job is to clean the empty cell in which they grew and emerged from. When the cleaning is done, the queen bee lays an egg in the cell.

The cells are to be used right away for the next generation, and that's why new adult bees clean them thoroughly. With her front legs, the queen bee measures the size of the cell and lays eggs – eggs of drone bees for large cells, eggs of worker bees for smaller cells and eggs of queen bee candidates for cells that are facing downward. This downward-looking cell is called a royal cell – a special room for nurturing queen bees. Their eggs are exactly the same as those of worker bees, but larvae that are fed exclusively with royal jelly grow as queen bees. On the other hand, although the larvae of worker bees are also fed royal jelly for the first 3 days, their food is soon switched to a mixture of honey and pollen. Pollen is for bees what meat and fish is for humans – protein that forms their bodies, while honey is for bees what rice and bread are for us – carbohydrates.

The queen bee is surrounded by worker bees that produce royal jelly. They sometimes touch their queen gently with their feelers, looking happy. They receive the queen's aroma (pheromones). It's then passed on to other bees through "mouth-to-mouth" communication, spreading to the whole hive to maintain a satisfied, peaceful atmosphere. The queen is constantly fed royal jelly mouth-to-mouth by the surrounding worker bees. After laying eggs for about 40 minutes, she has a rest, then resumes, concentrating on laying eggs in each cell one by one. She repeats this cycle. Even after the current worker bees become old and die, new bees will replace them, keeping the balance with the hive and making sure all these diverse jobs are carried out. The worker bees know by the queen's pheromones that the queen is healthy and laying eggs well. Also, they are calm and motivated to work when their children are growing healthily. There is nothing that gives honeybees more happiness than a life in harmony with the nature.

The newly emerged bees are now a little older, and they have started to produce sour royal jelly from the back of their cheeks. They now put their heads in hexagonal cells and feed royal jelly to their newly hatched sisters, a little for each. The queen bee larva grows with royal jelly as her water bed. Although she grows upside down in a downward cell, she does not fall as her body is half embedded in royal jelly.

Look! The worker bees are putting their heads into a royal cell, adding royal jelly and taking care of it.Maybe the royal cell is already giving off queen pheromones? They are showing affection to their new baby queen, warming her and touching her with their antenna. There are four royal cells in total – some of them already have a white queen-shaped pupa in them, with lids on, while others have a big, fat larva inside, and yet others have only an egg. Each royal cell has one queen growing inside. Oh, from an egg in a royal cell, another queen candidate has hatched. She was the last one to hatch – a young queen, we might call her. It's the birth of the main character of our story. The worker bees around her receive the sign of birth, and, as in their hive, honeybees not only dance, they also communicate through pheromones. The young worker bees who caught the sign amass on the royal cell to warm it, and inserting their heads one after another, they give royal jelly to the queen. The still young queen larva grows larger and larger, eating and floating in royal jelly with her stoma, through which she breathes, facing up. Actually, larvae also talk and sing, in a voice we cannot hear, but a queen bee larva would never say she's hungry – how can she, always floating on food!

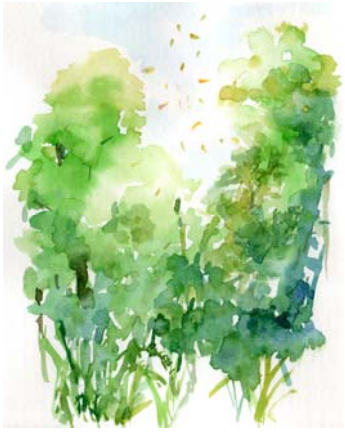


As days go by, a lid is created on the royal cell of our queen, who has now grown large and healthy. There, at the lower part of the larva's body, a head with eyes forms. She is taking the shape of a brilliant queen bee with a strong chest and large stomach. Slowly, slowly – in the safe environment of the hive, fixed upside down – she grows to become an adult queen bee.

Towards the end of her pupa phase, the body color of the baby queen bee changes from white to the color of a honeybee. At the same time the stomach of the mother queen bee becomes slimmer and slimmer. The season for the colony to swarm has come. On a sunny morning right before the emergence of a new queen, half of the colony's worker bees, with their stomachs full of honey, fly from the hive with the mother queen bee, who is now in better shape to fly, in order to find a new home. Two days later, the first queen bee – the eldest daughter – emerges. Her wings are wet at first, but they soon dry, making her ready to fly. Then, half of the worker bees that remained in the hive fly off with

this queen with their stomachs full of honey. Next, the new queen and the one after that, in the same way, fly off with the half of the remaining worker bees.

As the hive becomes much smaller, "our last queen bee candidate" emerges. She is going nowhere and will be living in the hive. On the fifth day since her emergence, in the early afternoon with clear air, worker bees bring the queen to the gate, where many worker bees are flying around. She receives honey from worker bees as energy, then at once, off she goes, flying high from the hive. She is joined by the guarding worker bees, and flies higher and higher.



A place with tall trees and dense greenery comes into her sight, and high above many male bees (drones) from different hives are flying. Drones are born only during this season. Bright, honest and pure – longing for romance, drones had been waiting for this sunny afternoon, in which they come to this social space in the sky and literally put their lives on the line. The queen flies into the drone bees and they all chase her. One brave drone dodges the guardian worker bees and catches our baby queen, inserts his petasma, and at the very moment fertilization is successful, his stomach is torn – he is dead and falling. One can only wonder if this excellent drone, who beat other drones to catch the queen, had time to greet her.

Soon, "our small, but proud queen bee", who was the youngest daughter, copulated with more than ten drones during her marriage flight, storing within her enough sperm for all worker bees that she will give birth to in her lifetime. She is relieved, as she is now able to control whether to lay fertile eggs for female worker bees or infertile eggs for drones.

After that day, the queen bee stays inside the hive The worker bees know what to do, and they start to clean cells around the center of the hive – thoroughly one by one.
The inside of the cell is now shiny, and the new queen, just like her mother did, measures the diameter of each cell with her front legs and antenna, then lays an egg inside.

A wave of relief fills the hive. It is the moment they have waited for so badly. Eggs are laid orderly - one egg in one cell. Once the queen starts laying eggs it means she is now officially the new, queen bee. Accompanying worker bees surround her to celebrate, and the whole hive is filled with joy and peaceful liveliness. Worker bees offer their queen royal jelly, and receive the queen's pheromones in return, all satisfied and dreamy, looking really happy. They touch the queen gently with their antennae, surrounding her but still keeping a little bit of distance, like planets going around the sun.

Newborn children start to clatter away. A forager bee returns from the outside with balls of pollen on her legs. She places the pollen into a cell with her head, hardening them for storage. Another forager returns with nectar, and passes it to a worker bee mouth-to-mouth. It's summer outside. Grass and vegetables are growing thick, and honeybees bring back water droplets from the fields. The droplets are used in making the mixture of honey and pollen to feed the children and for sprinkling around the hive to cool down the temperature inside.

Honeybees have lived like this for more than 5 million years. Only 1.5 million years have passed since archanthropine evolved and just 200 thousand since homo sapiens evolved. So honeybees are by far our seniors on this earth.

One day, many of the foragers who went out to collect nectar, pollen and water didn't return. While it is often the case that worker bees, when they get old, die while going out to collect food, that day the younger foragers didn't return either.

The next day many worker bees didn't come back either. As the pace of losing worker bees was much greater than new bees emerging, the once lively hive quickly becomes scarcely populated and there aren’t enough worker bees to warm and take care of the children or brood. The temperature in the hive drops and the children become ill. They are limp, and can’t eat much even when they are fed. Children are dead in their cells. They are rotting and give off an unpleasant smell. Worker bees who were in charge of taking out the dead children from their cells are unable to take care of all of them and in the end the worker bees no longer know how many healthy children they have. As the number of healthy pupae decreases, a parasite called varroa mite starts to appear. These mites enter the cell when the larvae become pupas, and suck body fluid from them in order to feed their own children. As the pupae numbers decline 3 to 4 mites occupy each cell. Parasitized bees, when they emerge, have crinkled wings. They are very weak and unable to work. Soon when there is no developing brood left for the mites to feed on, they start to parasitize adult honeybees, sucking their blood. The worker bees continue to work with mites on their backs which is like they are carrying a large frying pan.

On one sunny day, about a month since "that day", there are only several young worker bees guarding the queen bee. There are many dead bees on the floor of the hive. The hive used to have a shiny clean floor, but there are no worker bees alive to clean it. With nobody taking care of them, the children are either dead or limp. Some are rotted as dead larva, others as pupa. Some starved to death while trying to emerge, sticking out only their heads or tongues.

The queen bee looks out from the hive entrance for the first time since her marriage flight. Under the bright sunshine, nothing seems to have changed. The accompanying worker bees are now getting old, and are running out of royal jelly. They soon die surrounding and guarding the queen. The queen bee has no idea why all this is happening. In her fading consciousness, she only remembers flying in the sky like in a dream. As she kept flying, she found a small hive box in her sight. When she returned home from her marriage flight, worker bees celebrated her arrival in her warm, cozy hive. Forager bees returned with the nectar and pollen they collected, while worker bees

cleaned the hive and took care of the children. One big, happy family was living in harmony. Now the liveliness and the heat are gone and only in her fond memories still lived. The landscape hasn't changed – only the season has shifted from spring to autumn.

A week later, the humans who put the hive here, discover this abnormality. Three worker bees lay dead on top of the queen bee, as if protecting her. She is at the center, having become a small corpse. Humans have named this abnormal phenomenon "Colony Collapse Disorder" and presented it to the world.

Comparing this year with many previous years, they question what exactly has changed in agriculture.

About Pesticides

The honeybee, an insect familiar to us all, does not seem to be capable of detoxifying itself. Plants, when bitten by an insect, give off a substance the insect does not like which makes them unpleasant to eat. This encourages the insect to go to another plant saving the first from suffering too much damage. However, for many plants, the honeybee is a beneficial insect necessary for its survival.

These plants use nectar to attract honeybees to assist with their pollination so there is no reason for the plant to want to reject the bee. Honeybees have scarcely experienced any unpleasant substances and this is the reason why honeybees have not acquired the ability to detoxify pesticides. When honeybees are exposed to pesticides, the whole colony can be wiped out, or the number of worker bees might decrease at an unnatural rate, making the hive weak and prone to diseases.

Recent research has discovered that when larvae eat pollen containing pesticides their nervous system is destroyed as they develop. Although they grow into adult bees, when they fly out to collect pollen and nectar, they are not able to return home, as their nerves do not function properly, causing a large loss of these foragers. Also, the number of worker bees drops at an unnatural rate over the winter when bees eat contaminated

pollen in late autumn. We have learned that the mysterious disappearance of honeybees also occurs between winter and early spring.

This contamination of the environment is seriously affecting not only honeybees but also many other living creatures, such as earthworms, which make the soil rich. Have you noticed that many creatures you used to see every day are disappearing? This tendency seems to be even more apparent as neonicotinoid, fipronil, pyrethroid and carbamate pesticides that have osmotic quality replace organophosphorous pesticides more and more. Although they say these new pesticides are safe as they decompose when exposed to light, it is suspected not all of the poison is decomposed in the soil or in body of the plant.

What would happen when even a small amount is accumulated in the body? No sufficient research or investigations have been done on its influence on the human body and nerves (cerebral nerves). In Japan, the restrictions on the use of these pesticides are far more relaxed than in the EU and the U.S.A.

When seeds for crops go through processing in which they are saturated with neonicotinoid pesticides, they can prevent germinated soft leaves and roots from being eaten by insects. In Europe, highly concentrated amounts of pesticides were detected in water droplets on the leaves of neonicotinoid-processed seeds, which resulted in this seed processing method being banned in Italy and France. In some crops they remained until the flowers blossomed.

In contrast to Europe, Japan has a tendency to increase the use of such pesticides. A serious concern is pesticide influence on fetuses in the womb whose brains are still undeveloped.

Compared to other pesticides, neonicotinoids have a weaker repellent effect; it's an osmotic and discreet pesticide, with some being slow-acting. They act on the nervous system of an insect, making it limp and destroying sensitive abilities.

A doctor, who has seen many patients become sick from pesticides, worries that if humans are affected, either acutely or constantly, it could contribute to an increase of mental disorders and suicide. To make things worse, even if one develops a disease decades later from being exposed to pesticides, no one will be able to identify that the pesticides were the cause. Just like the problem of honeybees disappearing in winter because of pesticides used in summer, if one becomes mentally ill because of a pesticide, it's like the tail wagging the dog.

Rather than using strong pesticides a few times with the "Reduced Agrichemical Method", it would be much more preferable to work on innovations that genuinely reduce pesticides and utilize knowledge of organic agriculture, while trying to be as independent as possible.

Neonicotinoids are already being used in a number of other products. If you have a look at the "Chemicals" section in a hardware store, you can see it is not only used in pesticides, but flea remover for pets, insect repellent for building material and so on – it can be used for a wide variety of purposes.

For your garden, in which your beloved children or grandchildren play, you should refrain from using neonicotinoid chemicals and organophosphorous pesticides. Although it's something we cannot see, we should be aware of the dangers and protect our families.

Just as Dr. Yoichiro Kuroda, the counselor researcher in Tokyo Metropolitan Institute for Neuroscience, says "I don't think it's possible that an environment which is harmful for honeybees can have no harmful effects on human beings."

This story was inspired by the U.S. documentary film, "Nicotine Bees". In the film, a beekeeper affected by Colony Collapse Disorder explains, through a process of elimination, that the cause was neonicotinoid pesticides, which have been used on a large scale since 2005. We highly recommend you see the film.

Honeybees are telling us something through their mysterious disappearance.

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Appendix

Royal Jelly： honeybee’s milk; young worker bees make inside their body. They give it to young larvae and the queen bee.

Forager bees：worker bees working to collect nectar, honey dew, pollen, resin and water in the field (resin for propolis)

Pheromones ：chemical substances produced by bees to transfer signals or messages;
These signals indicate the vitality of the queen, direct swarms to their new home or attract drones to a young queen for mating. The purpose is similar to hormones in our body, but these substances are airborne.

Stoma ： very tiny pore; plants use to breathe

Swarm： group of worker bees, drones, and usually the old queen that leaves the parent colony to establish a new colony.
The swarm is the natural method of propagation of the honey bee colony.

Drone： male honeybees