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Bee Behaviour and Its Communication

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Introduction

Honey bees are far more than producers of honey and wax; they are master communicators. To sustain their hive, foragers have evolved a sophisticated “dance language” to encode precise navigational details about distant resources. This behaviour, first decoded by Nobel laureate Karl von Frisch and later found to include acoustic signals, stands as one of the most intricate non-human communication systems known to science, offering profound insights into animal behaviour, social cooperation, and the evolution of symbolic language.

Bee Behaviour :

Swarming:

Swarming is the reproductive process in which a substantial part of a honeybee colony, led by the old queen, leaves its hive to found a new one. Overcrowding, usually from rapid population growth, is the primary trigger. To prepare, workers build special cells to rear new queens. A swarm includes the old queen, many workers, and some drones, and usually occurs after the main nectar flow in late spring or early summer.

1. **Instinct and Preparation:** Large, healthy colonies develop the natural instinct to swarm in order to reproduce.
2. **Scouting:** Prior to swarming, scout bees begin searching the environment for a suitable new nesting site.
3. **Departure:** Once new queen cells in the original hive are sealed for pupation, the existing queen departs. On a clear morning, she leads approximately one-third to one-half of the colony›s workforce out of the hive.
4. **Initial Cluster:** The swarm initially settles on a nearby object, such as a tree branch, forming a dense, temporary cluster.
5. **Final Migration:** After scouts have finalized the location of the new nest site, the entire cluster flies to establish the new colony.

Emergency Release of Queen

In the event of the queen’s death, the colony undertakes an emergency queen replacement. Worker bees select eggs or very young larvae (one to two days old) that are already present in worker cells. They then modify these cells, enlarging and reshaping them into the distinctive, downward-hanging queen cells. The chosen larva is fed copious amounts of royal jelly, triggering its development into a new queen rather than a worker.

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Multiple emergency queen cells are typically constructed, often positioned in the central area of the comb for protection. The first new queen to emerge will immediately seek out the other queen cells, using her stinger to eliminate the remaining rival queens—whether they are still developing or ready to emerge. Once she has secured her position, the virgin queen leaves the hive for her mating flights. After successfully mating, she returns to the colony as the new, fully fertile queen, capable of laying both fertilized eggs (which become workers or new queens) and unfertilized eggs (which become drones).

Worker Policing and Reproductive Suppression

When a queen is lost and the colony lacks young brood suitable for queen rearing, a different reproductive pathway may emerge. Some worker bees develop active ovaries and begin laying unfertile eggs, which can only develop into drones. This usually occurs in prolonged queenless conditions, often termed a "laying worker" situation.

However, such colonies rarely thrive, as these events also trigger a mechanism known as "worker policing"—in which other workers identify and destroy worker-laid eggs to preserve colony genetic integrity. Laying workers also lay multiple eggs per cell, creating competition among eggs and further reducing colony productivity. Without a queen or young larvae to raise a new one, the colony ultimately declines.

Division of Labor in a Honeybee Colony

Each bee has an age-based job vital to the hive. The queen uses pheromones to keep order, control reproduction, and maintain colony unity.

Blossom Faithfulness

Bees focus on one type of flower until its pollen and nectar run out, then move to another.

Natural Queen Replacement (Supersedure)

Supersedure is a process by which honeybees naturally replace an aging or underperforming queen without swarming or human intervention. This ensures the colony's long-term survival and reproductive health. It typically occurs during active seasons—spring, summer, or early autumn.

When the old queen's egg-laying declines—often producing fewer fertilized eggs—worker bees construct one or a few queen cells, usually in the center or lower area of the comb. After the new queen emerges and mates, she takes over, and the old queen is gradually phased out.

Beekeepers are generally advised not to intervene, as the colony is best equipped to manage its own queen succession. This natural replacement helps maintain colony strength and continuity.

Bees Communication

While many animals rely on body language, eye contact, or vocal calls, honey bees communicate through an extraordinary combination of movement and chemical signals**.**

Two primary methods form the basis of their interactions:

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1. **Movement**
   Bees perform precise movements like the well-known "waggle dance" to share detailed information about the distance and direction of food sources.

2. **Odor & Chemical Signals**
   Using pheromones and scents, they convey messages about colony health, reproduction, and threats, helping maintain hive harmony and organization.

These instinctive, non-verbal communication methods allow bees to share vital information on resources, navigation, and colony needs with remarkable accuracy.

Different types of Bees

Queen: There is only one queen per hive. Her main job is to lay eggs and produce pheromones that keep the colony united. She lives 1–2 years.

Worker: These are all the other female bees. They perform every task in the hive: cleaning cells, nursing larvae, building comb, guarding the entrance, and collecting food. Workers live about 5–7 weeks during active seasons.

Drone: Drones are the male bees. Their only purpose is to mate with a virgin queen from another colony. After mating, they die. Drones that don›t mate are expelled from the hive before winter to conserve resources.

How Honeybees Find Flowers

Bees see differently than humans. They can't see red well, but they can see ultraviolet (UV) light. Flowers often have ultraviolet patterns that act like guides, showing bees where to find nectar and pollen quickly. This helps them work faster and share food locations with the hive

Communication process in Bees are :

Touch : Bees use touch to communicate and sense their environment. They identify nestmates by touching antennae and taste objects with their tongues. Their sensitive antennae and feet help measure comb cells to build perfect honeycombs. Tiny hairs covering their bodies detect vibrations and touch, alerting them to danger.

Dance Language : After finding food or water, a forager returns to the hive and performs a dance to share the location. The most famous is the waggle dance, used for distant sources. Bees dance in the dark, using precise movements to indicate direction and distance—like a living navigation system.

Round Dance : For food sources within about 50 meters, bees perform a round dance. They move in tight circles, sometimes adding a small waggle to indicate the quality of the flowers. This simple movement tells others that food is nearby.

Waggle Dance : For more distant food sources, bees perform the waggle dance in a figure-eight pattern. The duration and angle of the waggle indicate distance and direction relative to the sun. Multiple bees may share different finds, and the hive "votes" by following the most enthusiastic dancer, ensuring the colony chooses the best site.

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Vibration & Sound

Vibration and sound are crucial in bee communication, especially for solitary species:

- Females use buzzing vibrations to attract males.
- Males produce soft buzzes during mating.
- Colonies create a collective, warning buzz in response to threats.
- Loud buzzing near the nest signals danger or agitation.

Odor & Pheromones

Bees use chemical signals called pheromones to communicate within the colony. Different pheromones trigger different responses . Bumblebees use scent instead of dance—they fan their wings to spread flower odors, guiding others to nearby food. This method is less precise than dances but effectively indicates a nearby food source.

Conclusion

Bees are fascinating creatures, and our understanding of them grows daily. Central to this understanding is their dance language—a precise system for communicating the location and value of food sources. While more research is needed to fully decode its complexity, this unique behavior remains their primary method for sharing essential data on a source's quality, profitability, and abundance.

For beekeepers, comprehending this communication is crucial. It not only makes the beekeeping experience more successful and rewarding but also helps ensure the safety and well-being of both the keeper and the hive. Ultimately, such knowledge transforms simple interest into informed practice, guiding anyone inspired by bees toward a deeper and more fulfilling connection with these remarkable insects.

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