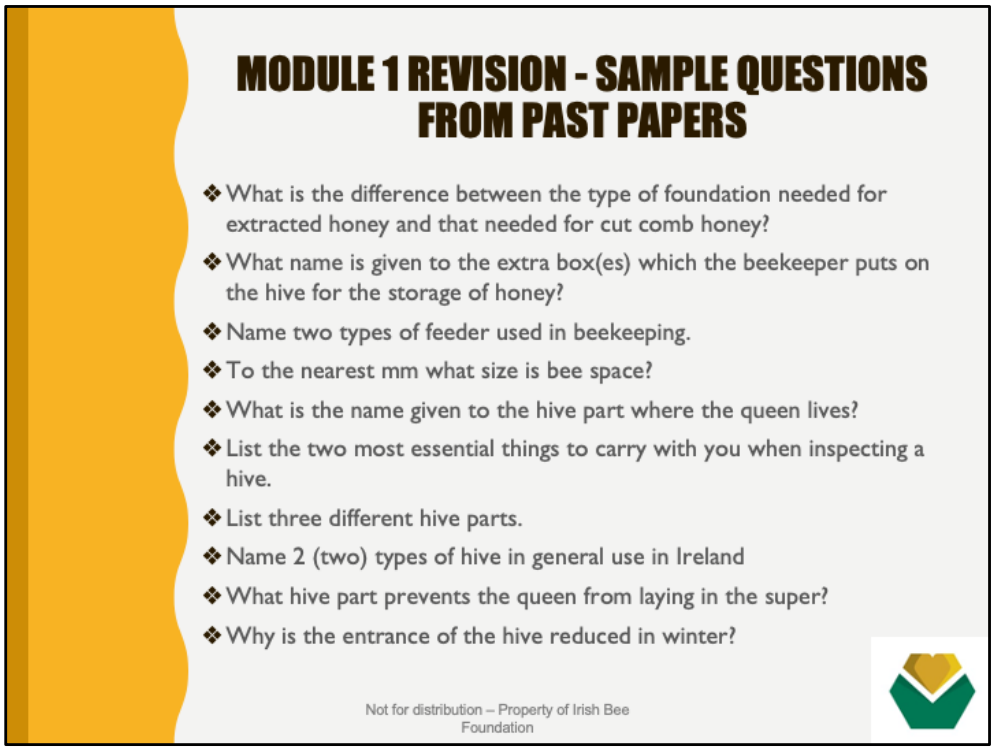
Grade 1 –

Introduction to beekeeping

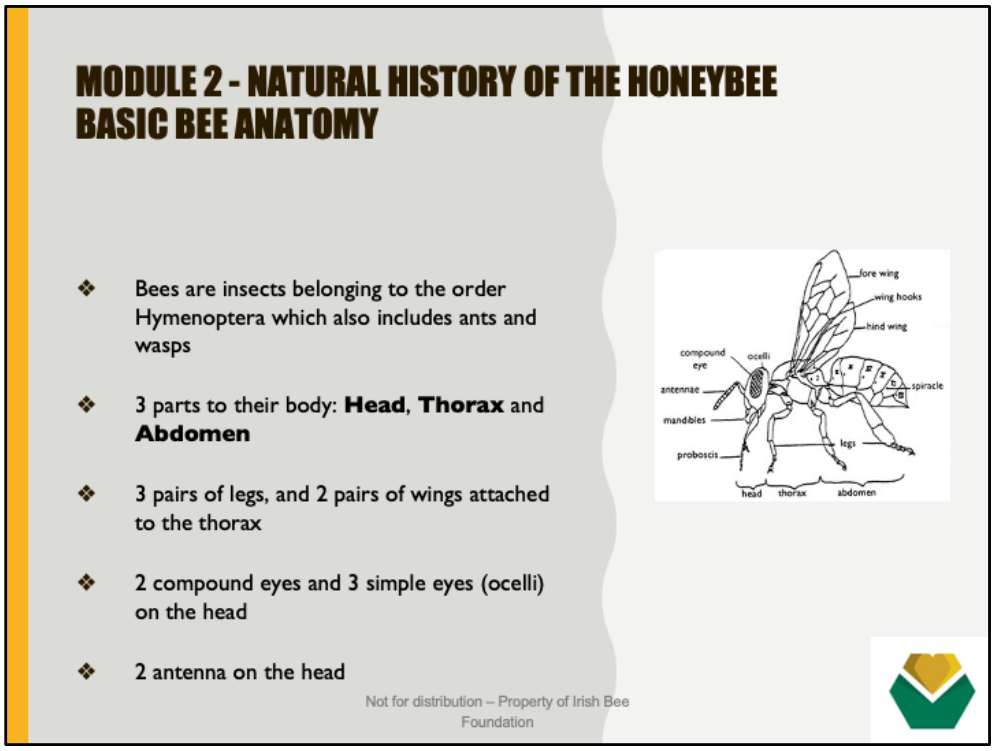
Irish Bee Foundation

PROTECTING PRESERVING PROMOTING



Before diving into the natural history of honeybees, it's important to review foundational knowledge from Module 1, as it covers essentials like hive structure and bee management tools. Key questions may include:

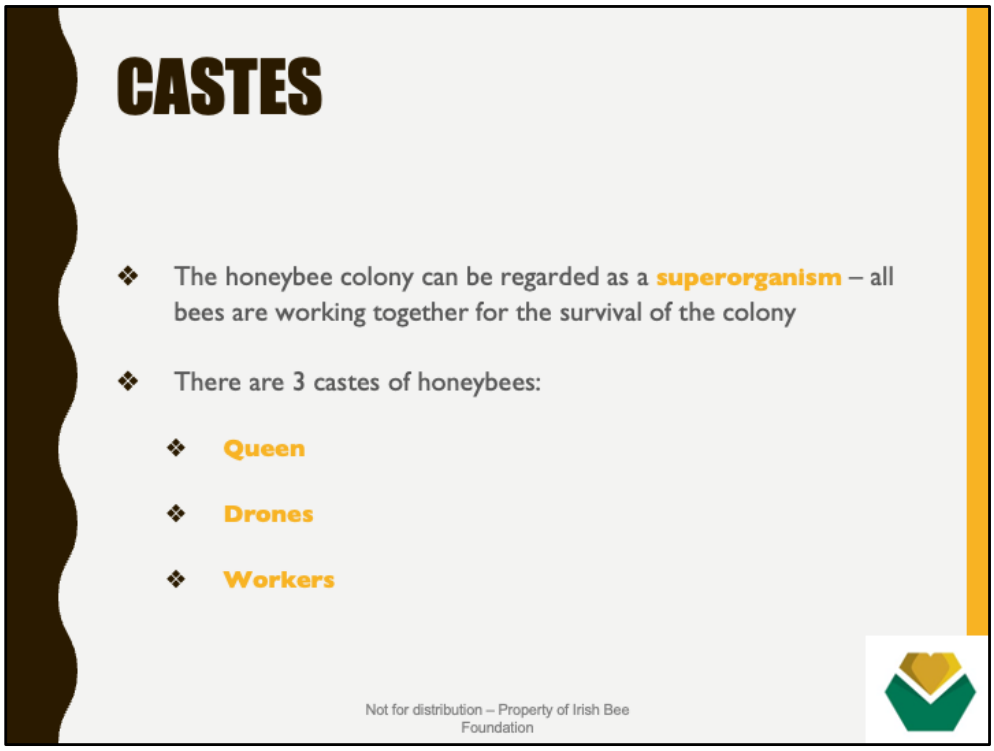
- Differences in foundation types for honey production (extracted vs. cut comb)
- Hive components and their functions, such as the honey super and queen excluder
- The purpose of various feeders
- Understanding bee space and its importance in hive design



Honeybees are insects belonging to the order Hymenoptera, which also includes ants and wasps. Their anatomy is divided into three main parts:

- Head: Contains sensory organs, such as two large compound eyes, three simple eyes (ocelli), and two antennae. Compound eyes help bees detect movement and colors.
- Thorax: Houses three pairs of legs and two pairs of wings. The thorax is the bee's center of movement.
- Abdomen: The largest section, containing digestive organs, reproductive organs, and the stinger in females.

These features support honeybees in complex tasks like foraging, defense, and colony communication.

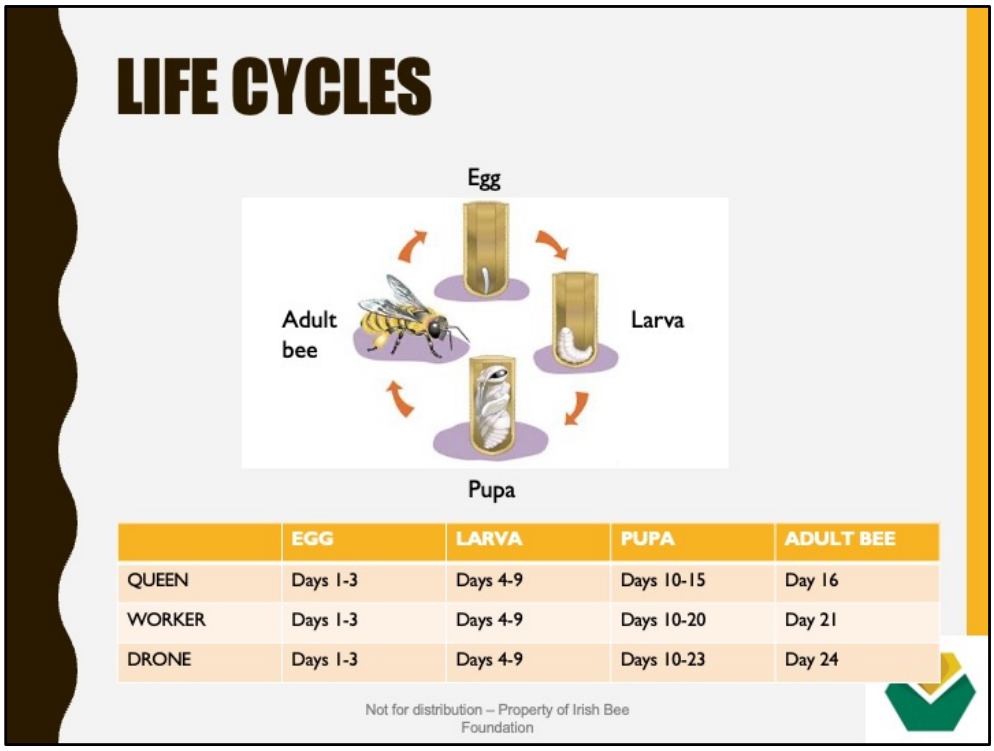


Slide 3: Castes in a Honeybee Colony

The honeybee colony functions as a superorganism with each bee working to ensure the colony's survival. There are three main castes:

- Queen: The sole reproductive female, responsible for laying eggs. The queen's pheromones help maintain colony harmony.
- Drones: Male bees whose primary role is to mate with a virgin queen. Drones do not gather food or participate in hive duties.
- Workers: Non-reproductive females who perform all hive tasks, from nursing larvae to foraging.

Each caste has a unique role, critical to the colony's overall function and health.



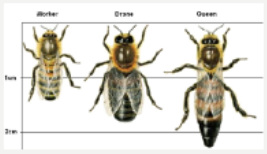
Honeybees go through four stages of development:

- Egg: Laid by the queen; develops into a larva within three days.
- Larva: Fed by worker bees with royal jelly and then bee bread. They undergo several molts.
- Pupa: The larva spins a cocoon and undergoes metamorphosis.
- Adult Bee: Emerges fully formed and begins its role in the colony.

The life cycle is completed in about 21 days for worker bees and differs slightly for queens and drones.

ANATOMICAL DIFFERENCES QUEEN VS WORKERS

- Queen has longer legs than the workers
- Queen has longer, more pointed abdomen than the workers
- Drones are slightly larger and much more burly than the workers. The end of their abdomen is square and they have two large compound eyes.

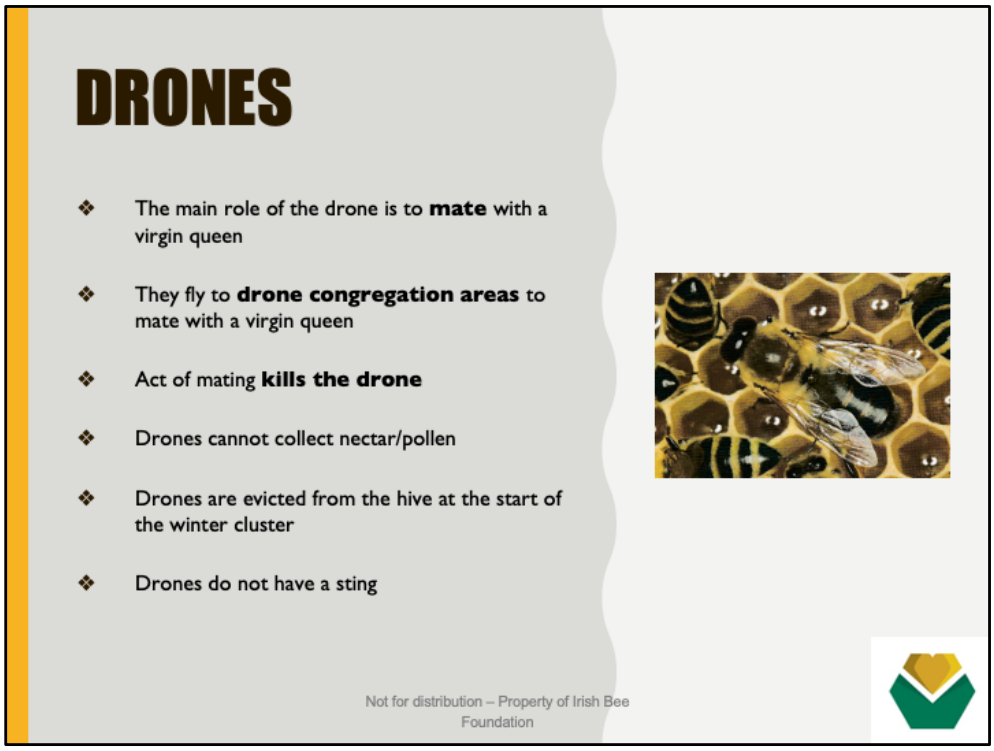


The queen is essential for the colony's survival. Key characteristics:

- Egg Laying: The queen can lay fertilized (female) or unfertilized (male) eggs. A healthy queen may lay up to 1,500 eggs daily during peak season.
- Pheromones: Her pheromones signal colony unity, preventing worker bees from raising new queens.
- Longevity: Queens can live 4-5 years but are often replaced earlier through a process called supersedure.
- Sting: Unlike workers, the queen’s sting is only used to eliminate rival queens.

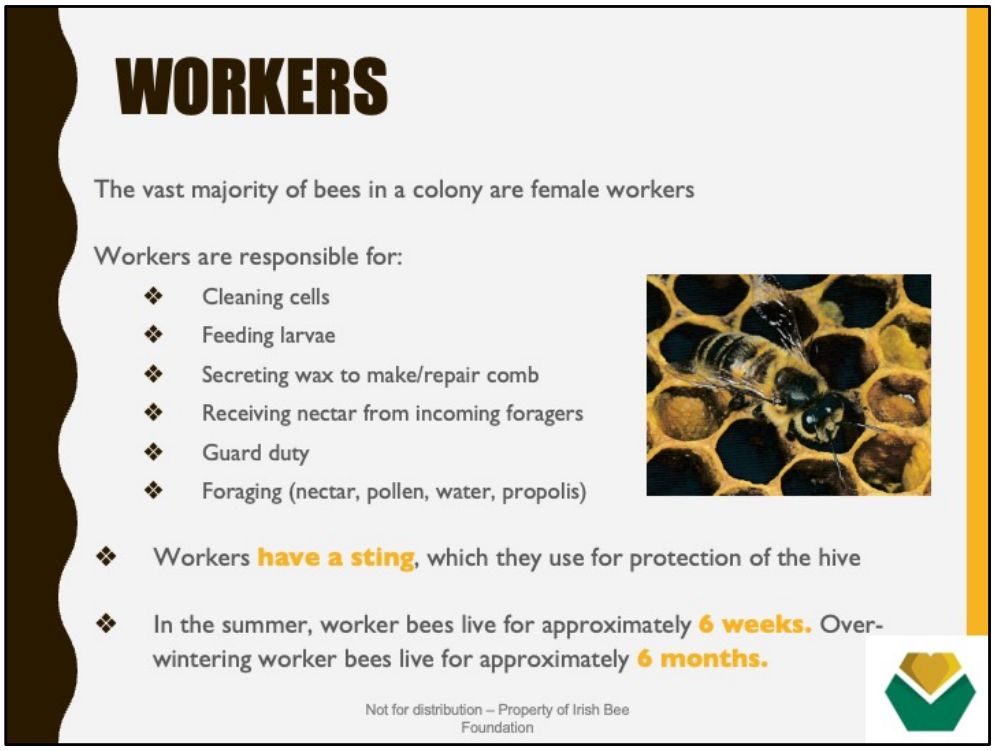
The queen is essential for the colony's survival. Key characteristics:

- Egg Laying: The queen can lay fertilized (female) or unfertilized (male) eggs. A healthy queen may lay up to 1,500 eggs daily during peak season.
- Pheromones: Her pheromones signal colony unity, preventing worker bees from raising new queens.
- Longevity: Queens can live 4-5 years but are often replaced earlier through a process called supersedure.
- Sting: Unlike workers, the queen’s sting is only used to eliminate rival queens.



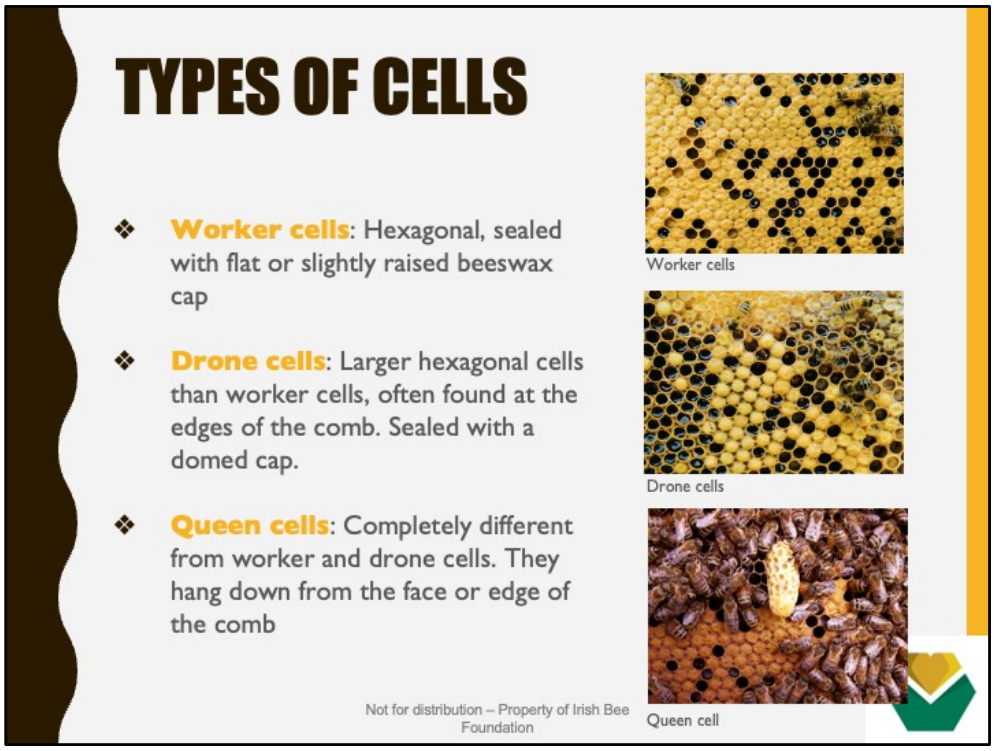
Drones have a specialized role in the honeybee colony:

- Mating: Drones leave the hive to gather in drone congregation areas, where they await virgin queens. Mating ends the drone's life.
- Dependence: Drones do not collect food and are fed by worker bees. They are evicted from the hive in late autumn to conserve resources.
- Lack of Sting: Drones have no stinger and cannot defend the hive.



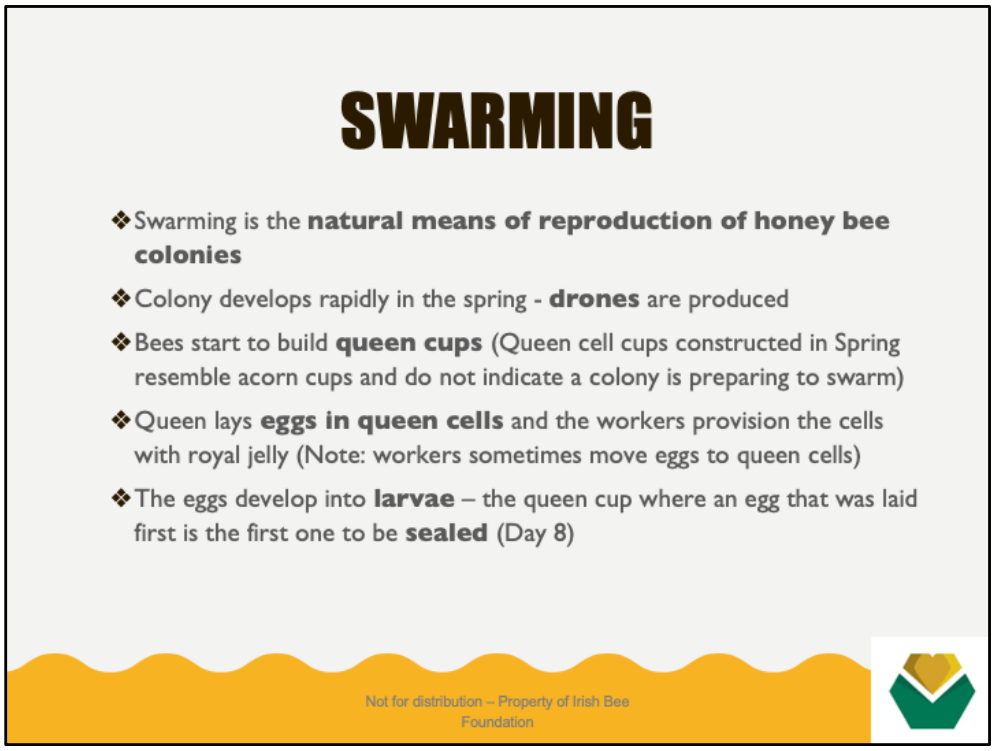
Worker bees make up the bulk of the colony and are responsible for nearly all tasks:

- Hive Maintenance: Clean cells, build and repair comb.
- Brood Care: Feed and nurse larvae with royal jelly and bee bread.
- Guarding: Protect the hive entrance and sting intruders if needed.
- Foraging: Collect nectar, pollen, water, and propolis.
- Lifespan: Summer workers live 6 weeks, while winter workers live 4-6 months to support the hive through colder months.



Cells in the hive serve various purposes:

- Worker Cells: Hexagonal cells with flat caps, used to rear worker brood.
- Drone Cells: Larger hexagonal cells with domed caps, found on comb edges.
- Queen Cells: Special elongated cells hanging down, reserved for raising new queens.



Swarming is the colony's natural way of reproducing:

- Queen Cups: Workers build queen cups, which the queen lays eggs into.
- Larvae Development: Selected larvae are fed royal jelly to become queens.
- Swarm Formation: The old queen and half the colony leave to find a new home, while a new queen takes over.

Swarming usually occurs in late spring to early summer.

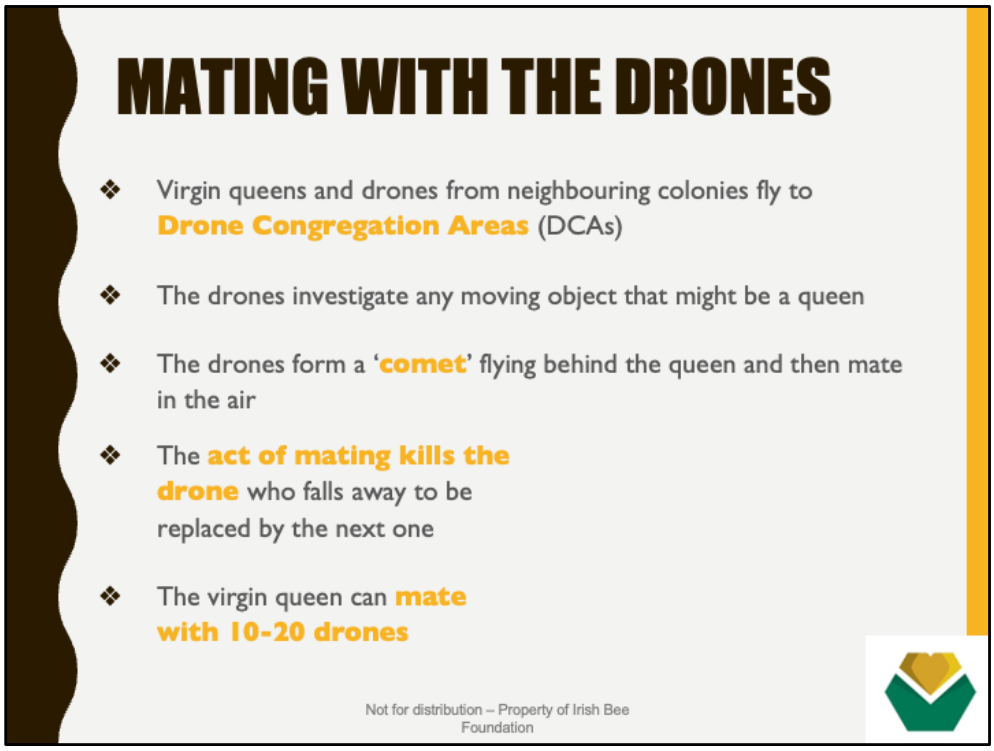
THE PRIME SWARM

- The **prime swarm does not fly far at first**. They may gather in a tree or on a branch only a few meters from the hive, where they **cluster** around the queen
- The most experienced foragers, '**scout bees',** are sent out to find suitable new nest locations
- The swarm can only survive for about **three days** on the honey on which they gorged themselves before leaving the hive
- When around 80% of the scouts have agreed upon a single location, the whole cluster takes off and flies to it. A swarm may fly **a kilometre or more** to the scouted location

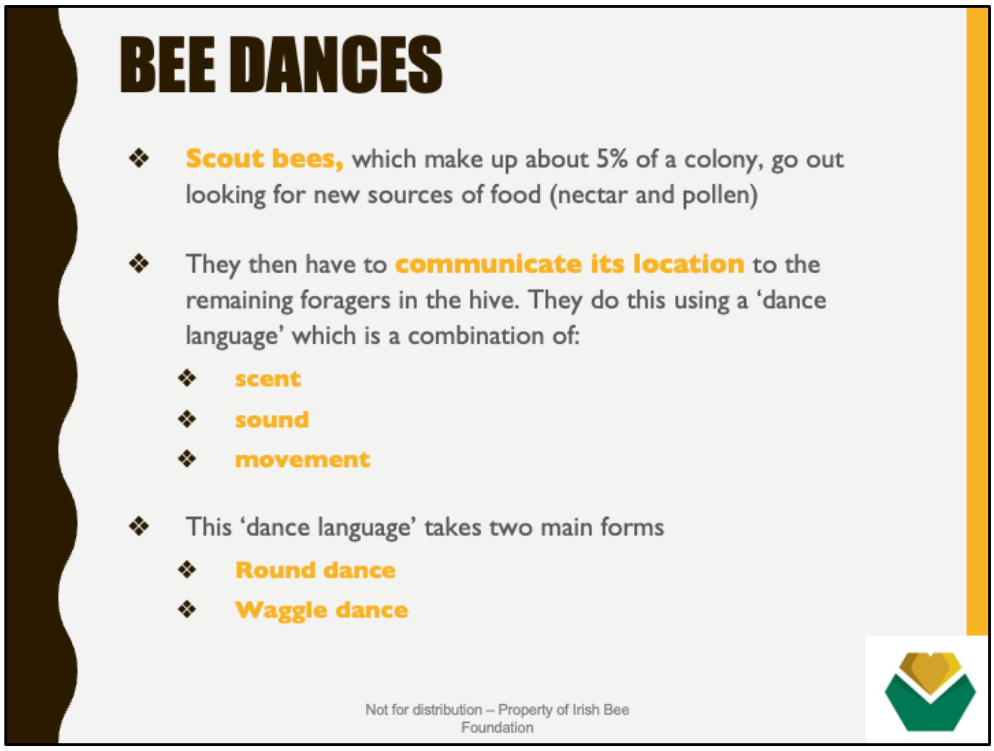
The prime swarm is the first swarm a colony produces. It gathers nearby while scout bees search for a new nesting site. Scout bees communicate their findings, and the swarm moves once they've decided on a location. This process can take up to three days, sustained by honey reserves.

Virgin queens are produced under specific circumstances like swarming or supersedure. Key points:

- Development: Workers feed larvae royal jelly, and the queen emerges after about 16 days.
- Mating: After maturing, the virgin queen must mate within three weeks.
- Supersedure: Colonies may raise new queens to replace an aging queen without swarming.



Mating occurs in Drone Congregation Areas (DCAs), where drones gather. Drones form a comet-like shape following the queen, mating mid-air. Each queen typically mates with multiple drones, ensuring genetic diversity within the colony.



Scout bees use dances to communicate food locations:

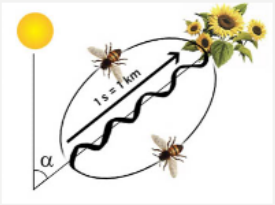
- Round Dance: For food within 10 meters; the bee moves in circles to direct others nearby.
- Waggle Dance: For food over 100 meters away; includes a “waggle” and return phase. The dance communicates distance, direction, and quality of the source.

ROUND DANCE

- In this dance, the scout bee runs around in a circle, and on completing the circuit, turns and runs back the other way
- Her followers pick up the scent of the forage source from her waxy exterior
- Her simple instruction is *'go out and find this within a radius of **10 metres**'*
- Bees perform the round dance when taking syrup from a feeder – which can initiate robbing
- Variations of the round dance indicate food sources up to 100m from the hive

WAGGLE DANCE

- This dance communicates the **direction**, **distance** and **nature** of food sources that are over **100 metres** away from the hive
- The bees which have followed the dance receive a **sample** of nectar or will smell the pollen load

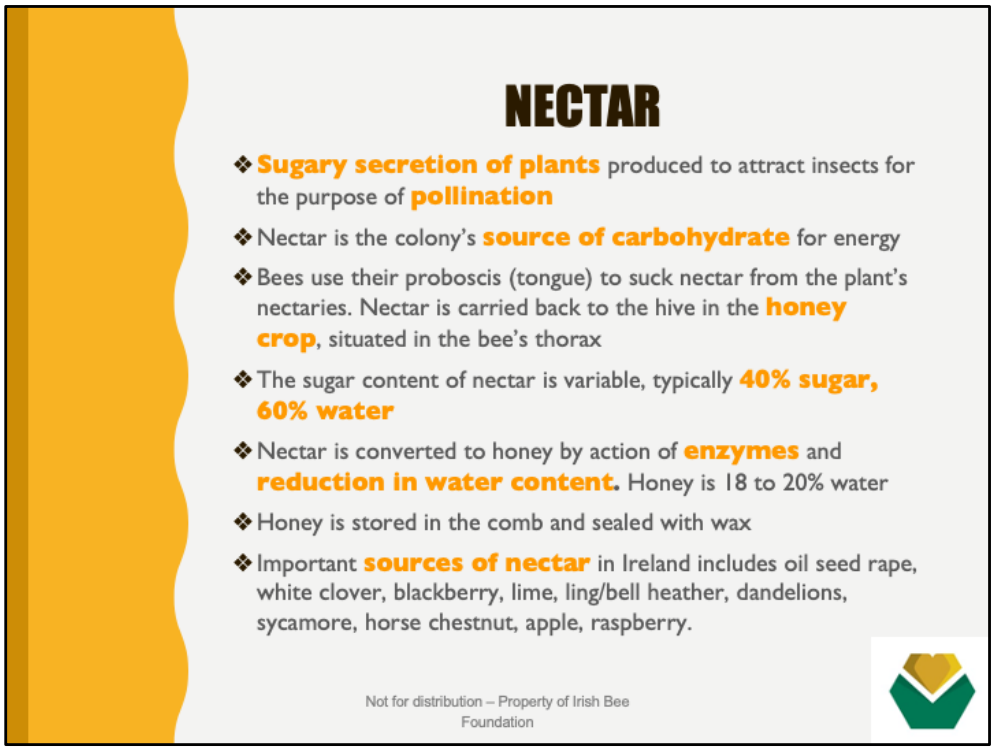


- A waggle dance consists of a series of circuits, each of which consists of two phases: the **waggle phase** and the **return phase**. A worker bee's waggle dance involves running through a small figure-eight pattern: a waggle run (waggle phase) followed by a turn to the right to circle back to the starting point (return phase), another waggle run, followed by a turn and circle to the left

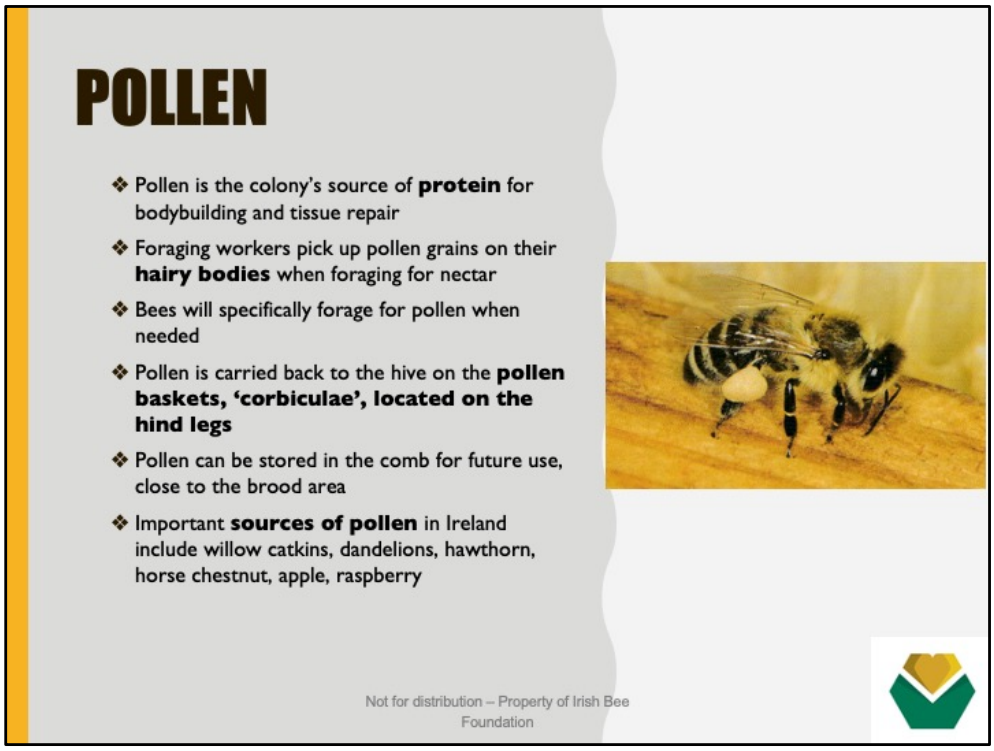
Worker bees forage for:

- Nectar: Main carbohydrate source, converted into honey.
- Pollen: Source of protein for brood rearing.
- Propolis: A resin used to seal hive cracks and polish cells.
- Water: For digestion, humidity control, and hive cooling.

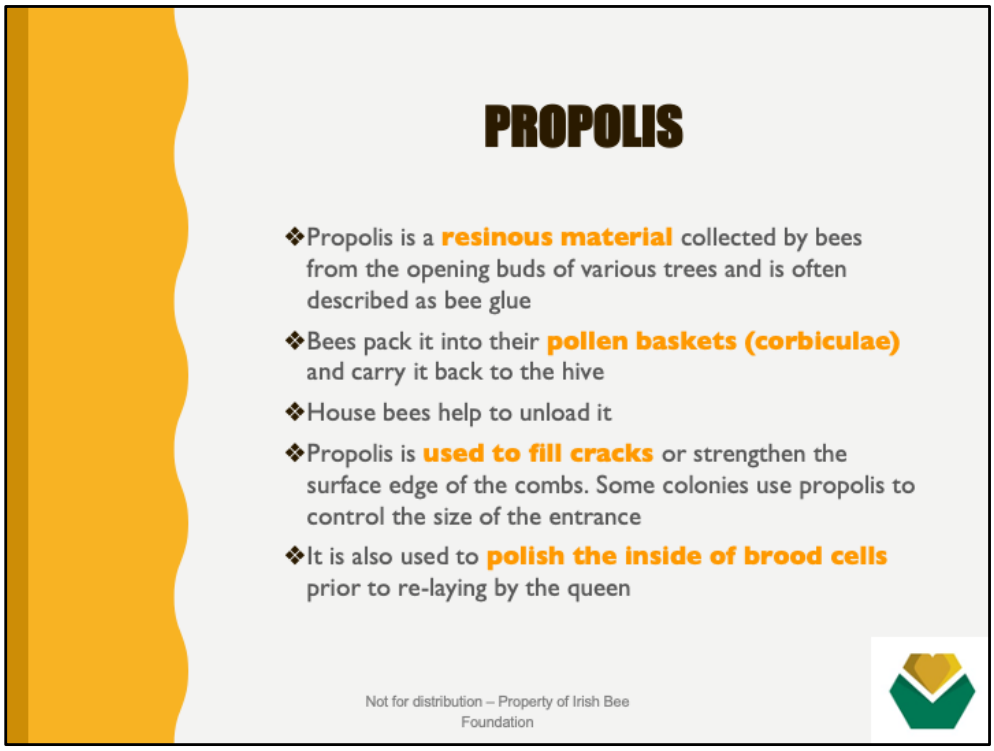
Each foraging material plays a unique role in maintaining hive health.



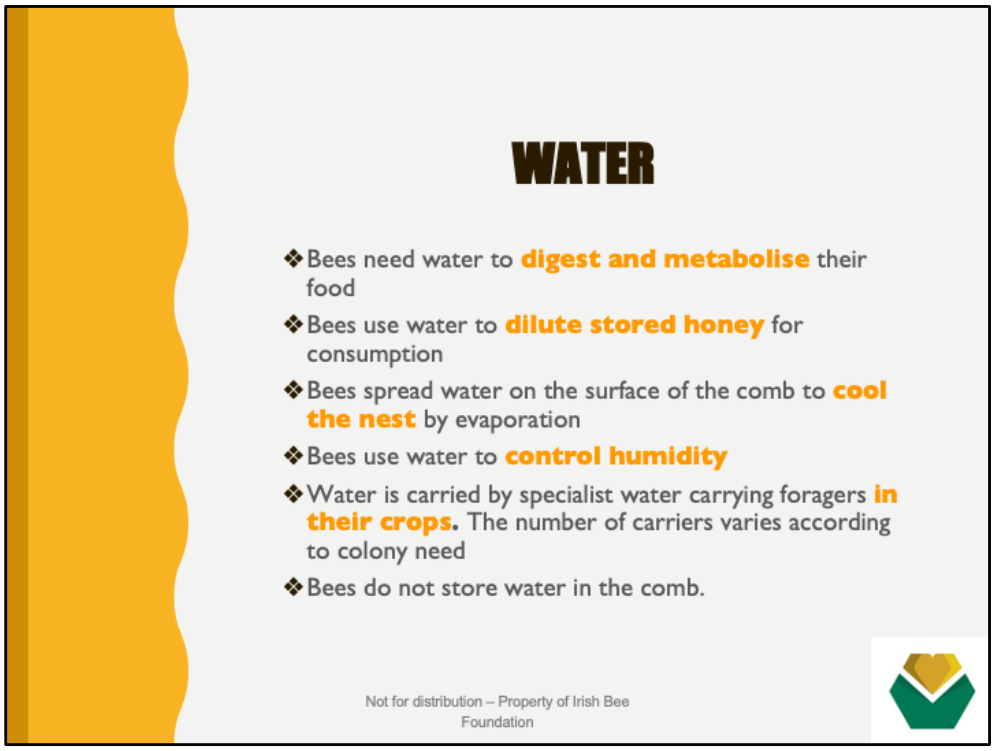
Nectar is a sugary plant secretion that bees collect for energy. Bees use their proboscis to collect nectar, storing it in their honey crop. Once back in the hive, enzymes convert nectar into honey, reducing water content until it's about 18-20% water. Common nectar sources in Ireland include clover, blackberry, heather, and dandelions.



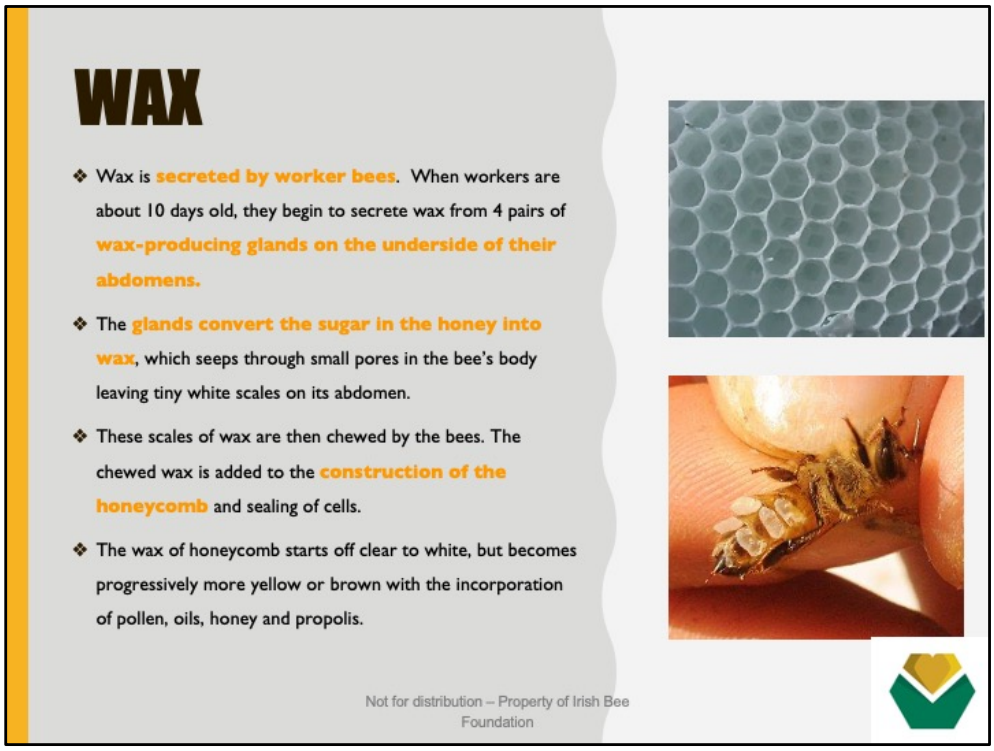
Pollen provides essential proteins and fats. Bees gather it on their corbiculae (pollen baskets on hind legs) and store it close to the brood. Pollen sources in Ireland include dandelions, horse chestnut, and apple trees.



Propolis, or bee glue, is a sticky substance bees collect from tree buds. They use it to fill cracks, strengthen comb edges, and polish brood cells, preventing disease. Propolis has antimicrobial properties, making it vital for hive hygiene.



Water is essential for colony functions. Bees use it to dilute honey, cool the hive, and control humidity. Specialized foragers collect water and distribute it as needed.



Worker bees secrete wax around 10 days of age from glands on their abdomen. The bees chew wax flakes, shaping them into hexagonal cells. Wax darkens over time due to contact with honey, pollen, and propolis.

PREPARED BY THE IRISH BEE FOUNDATION EDUCATION TEAM:
Brendan Murray, Daniel Hiney, Donal Cooper, Jim Agnew, Mairead Dineen Love, Michele O'Connor Connolly