Bees, their lives and beekeeping

1 Solitary and social Bees (1)

- The most familiar bees are the social ones.
- The honeybees, the bumble bees, the stingless bees, which provide man with honey and wax, etc.
- But, these social bees are in minority and form only about 5 % of a total of well over 25,000 bee species.

1 Solitary and social Bees (2)

- The female of the vast majority of bee species makes her own nest or nests without help from any of her kind.
- These solitary bees are found throughout the world from the Arctic Circle to the tip of South America.

1 Solitary and social Bees (3)

- There is much variation in the type of site that solitary bees choose for a nest.
- Most nest in the ground, digging tunnels with lateral branches in which the young develop.
- Favorable sites for such species may contain as many as 1000 nests in close proximity, but the females do not co-operate at all in their activities.

An egg of Andrena almas on pollen ball

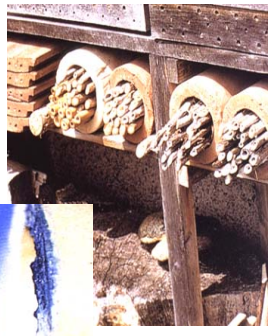
Colletid bee and the aggregation nest

Female make her nest singularly

1 Solitary and social Bees (4)

- Other common solitary bee species burrow almost exclusively in plant material, including dead branches and stems of living plants.

Osmia bee use a bumble stem as the nest



1 Solitary and social Bees (5)

- Having excavated her nest, each female sets about provisioning it.
- She visits flowers to collect loads of pollen, and different species of bee often have favorite flowers.
- Numerous hairs on her body facilitate the collection of pollen.

1 Solitary and social Bees (6)

- She carries back to her nest on special pollen-carrying hairs on her rear legs or beneath her abdomen.
- Many of her hairs are branched.
- After coming back to her nest, she deposits the pollen and on it she lays an egg.
- She seals off the cell and repeats the process.

1 Solitary and social Bees (7)

- When the egg hatches, the larva feeds on the pollen, which has to last throughout its entire developmental period.
- After they have finished feeding, the larvae enter a resting phase for overwintering.
- Others overwinter as pupae or adults.

1 Solitary and social Bees (8)

- Ordinarily, the mother bee dies before her young have matured into adults(= solitary).
- Once she has laid eggs she has no more contact with her progeny.
- She is indeed a “solitary” bee.

1 Solitary and social Bees (9)

- Some of the solitary bees are known for pollinating important bees as well as social bees.
- Megachilidae Osmia, Megachile

2 Bumblebees (1)

- Bumblebees are largest and colorful bees.
- They are at an evolutionary stage which in midway between that of the solitary bees and their more advanced relatives the honeybees.
- Most social insects occur much more abundantly in tropical climates, but bumblebees are mostly found in temperate zones as far north as the Arctic Circle and as far south as the tip of S, America.

Foraging of bumblebee

2 Bumblebees (2) Queen select nest

- Bumblebee colony begins in the spring with the emergence from hibernation of young females (queen) that were reared and mated the previous year.
- After the queen visits flowers to feed on nectar and pollen, she search for nest site.
- The site that a queen selects often contains the deserted nest of a mouse or other small mammal.

2 Bumblebees (3)
Colony initiation

- When the queen found a suitable nest, she begins to collect nectar and pollen.
- As a result of consuming nectar, the queen begins to produce wax, which issues as thin sheets from between the vsegments of her abdomen.
- When egg laying is complete, the queen uses the wax to build a canopy that completely encloses the pollen lump and eggs.

Foraging of bumblebee

2 Bumblebees (4)
Brood development

- When the tiny, white larvae hatch from the eggs they immediately start to feed on the pollen.
- The queen has to provide nectar and pollen for her larvae as well as for herself.
- This is “temporary breaches”.
- When fully grown the larvae cease to feed, and spins a silken cocoon round itself.

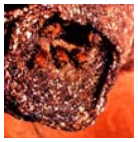
2 Bumblebees (5)

- Usually all the first batch of bees produced are workers.
- The workers soon begin to perform tasks, including wax secretion, building and feeding the brood, previously done by the queen alone.
- This stage is called social in which a few workers and their mother co-operate for the common good becomes.

2 Bumblebees (6)
Colony growth

- In contrast to the queen honeybee, the queen bumblebee continues to help her workers feed and incubate the brood and perform other tasks within the nest.
- After the queen's second batch of eggs has hatched, the workers produced from the first batch are ready to help their mother to look after the new larvae.
- The colony increases in size, some will rear 300–400 workers during the season.

4. Stingless bees (1)



- Stingless honeybees have attained the very peak of social organisation.
- They occur in tropical and subtropical areas of South America, southern half of Africa and southeastern Asia.
- Colonies comprise 300–80,000 adults.
- They are named from the fact that although they possess stings these are vestigial and cannot be used for defense.

Stingless bees and the nest

4 Honeybees (1)
Species and evolution

- The true honeybees belong to the genus Apis.
- The most well known and most widely distributed species is Apis mellifera.
- It extends throughout the temperate zone as well as to parts of the Tropics and sub-Arctic.
- It is native to Africa, Europe and western Asia.

4 Honeybees (2)
Species and evolution

- Other representative species are confined to southeast Asia.
- Apis cerana: Asian honeybee, resembles to A. mellifera
- Apis dorsata: giant honeybee.
- Apis florea: dwarf honeybee.

4 Honeybees (3)
Composition of colony

- Each colony of the honeybee consists of a single fertile female (queen), several thousand sterile females (workers), and several hundred males (drones).
- Under natural conditions, the home of the colony is a hollow tree or cave.
- It builds a series of parallel wax combs, about 10 mm apart, each comb having a single layer of horizontal hexagonal cells on either side.

Nest of honeybee in the hollow

Each cell of the comb is hexagonal

Eggs, larvae and pupae in the nest

4 Honeybees (4) Composition of colony

Queen

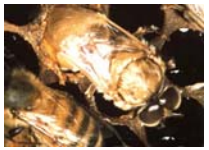
- Queen may lay as many as 2000 eggs per day.
- Unlike the bumblebee queen, she has lost the ability to feed her young, produce wax, build comb or gather nectar and pollen.
- A mature honeybee queen no longer feeds herself but is entirely dependent upon the workers for her food.

Queen and workers

Duties of workers

(inside works: caring the brood)

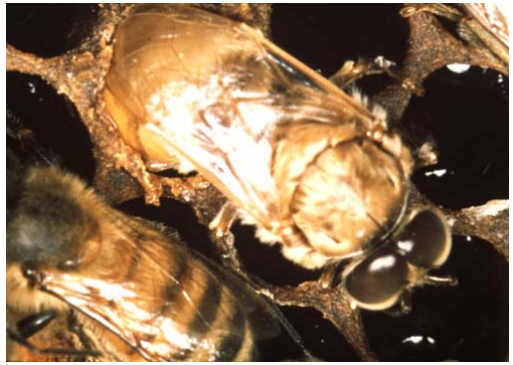
4 Honeybees (5)
Composition of colony



Drones

- Drones are produced in most honeybee colonies from May to June.
- The drone lacks the food-gathering apparatus of the worker but has very large eyes and long antennae, which he uses to locate the queen during mating flights.
- Drones are not permanent residents of the colony, towards the end of the season.

Drones



Drone after mating

4 Honeybees (6)
Composition of colony

Workers

- The workers may live only 4-6 weeks duration in mid-summer, but several months in the winter.
- Each worker usually undertakes a variety of tasks.
- They are linked with its age and physiological condition.

4 Honeybees (7)
Composition of colony

Workers

- These tasks include feeding and caring for the brood produced from the queen's eggs, building new comb and reparing existing comb, defending the colony and foraging for food, water and propolis.
- To perform these tasks their bodies possesses a number of specialized features which are absent in the queen.

4 Honeybees (8)
Colony defense

- The food stores of the honeybee colony are attractive to many potential robbers.
- The guard bee stand or patrol at the hive entrance, and rapidly examine incoming bees with their antennae.
- All the bees belonging to the same colony share the same distinctive odor.

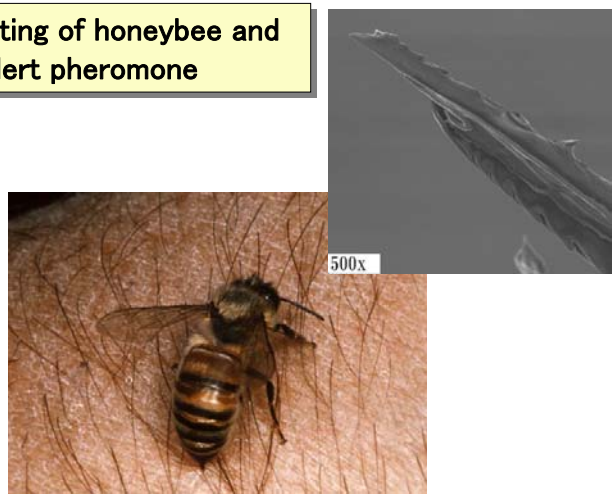
Duties of workers

(inside works: defense)

4 Honeybees (9)
Colony defense

- If a bee trying to enter a hive has a strange smell, and so belongs to a different colony, the guard bees bite and may even attempt to sting it.
- An alert guard bee is also able to communicate alarm to its companions by releasing a pheromone from a gland in its sting chamber.

Sting of honeybee and alert pheromone



4 Honeybees (10) Foragers

- During the latter part of the lives of worker bees (2-4 weeks old) become foragers.
- In addition to gathering nectar and pollen, some of the foragers of a colony may collect water, to dilute honey or cool their nest.
- During a single foraging trip a bee may visit several hundred flowers to collect its load of nectar or pollen.

Duties of workers

(outside works: foraging)

Foraging of Asian honeybee

4 Honeybees (11)
Attraction to flowers

- Bees are attracted to flowers and recognize them by their color, shape, and scent.
- When working flowers of one color only, they become conditioned to it and do not visit flowers of another color.
- Bees are unable to distinguish red a distinct color, but they are able to perceive ultra-violet.
- Scent is the most important means.

4 Honeybees (12)
Communication of crops

- One of the most remarkable abilities of the honeybee is the communication by a successful forager of the location of favorable sources of nectar or pollen to the other members of its colony.
- When the source of forage is within about 25m of the nest, a foraging bee may perform a round dance on the comb surface.
- When the food source is distant, a waggle dance is performed.

4 Honeybees (13)
Queen production

- When the queen dies or becomes old, the supply of her pheromones is diminished.
- Her workers are no longer completely inhibited and new queens are produced.
- A new queen is reared in special large cell that hangs downward.
- A larva of a new queen feeds on a glandular secretion produced by the workers, royal jelly.

Queen larva feeds on royal jelly

Queen's cell and emergence of a new queen

4 Honeybees (14)
Swarming

- A colony produces young queens when it reproduces by swarming.
- A swarm itself consists of the old queen, and a proportion, usually about half, of the worker and drone population.
- The swarm usually leaves its parent colony a day or so before the young queen emerges.
- The bees come to a rest and cluster together on a tree branch, fence post before they find a new nesting site.

Swarming

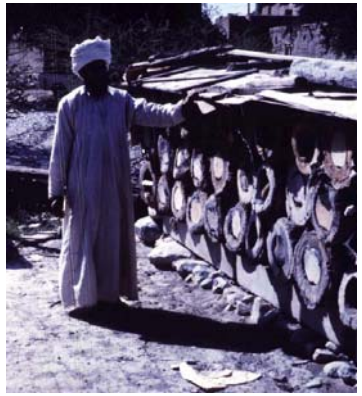
5. Beekeeping (1)
Hunting

- For many thousands of years before man was a beekeeper, he was a honey hunter, and robbed natural nests of honeybees of their accumulated stores of food.
- The honey was the only form of sweetening material.
- The most renowned evidence of honey hunting in prehistoric times comes from a Middle Stone Age, painting in a rock shelter near Valencia in Spain.

5. Beekeeping (2)
Primitive hives

- The nesting place for honeybee colony must provide an upper surface from which bees can suspend their comb, darkness, shelter from wind, rain and extremes of temperature, and an entrance.
- The transition from honey hunting to beekeeping is the construction of special containers or "beehives" for the honeybee colonies.
- Many of the first beehives used by man were of wood, clay or basketry.

Primitive beekeeping using wood



5. Beekeeping (3)
Ancient Egypt

- The earliest beekeeping in Ancient Egypt was about 2500 BC in the Fifth Dynasty.
- They used clay cylindrical hives.
- Honeybee was used as a hieroglyph denoting the King of Lower Egypt.
- Honey was thought to have strong healing powers.
- Migratory beekeeping was practiced in Egypt.

Hieroglyphs in Ancient Egypt, London

Hieroglyphs in Ancient Egypt, Paris

5. Beekeeping (4) in Europe

- When the Romans invaded Britain the dome-shaped hive was of entwined willow or hazel twigs plastered inside and out with cow dung.
- These types of survived in parts of Britain until the 18th century and also used straw skeps.

Old beekeeping straw skep

5. Beekeeping (5) Present

- Movable-frame hives have been developed since 19th century.
- Modern beekeeping practices dictate that the hive should be strong, simple and light.
- Bees are used not only for honey, wax, propolis, royal jelly, but also for pollination of crops.

Modern beekeeping

Artificial nest sheet

Products of honeybee (1)

Honey

Bee wax:

Natural History Museum, London

Products of honeybee (2)

Mead: the first human alcohol