



A Comprehensive Review on Bee w.s.r to Honey Bee

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ABSTRACT

We come across a number of insects daily, albeit Honey bee plays an important role in life of human beings and became a part of their culture. Now a days Apiculture (domestication & culturing of honey bee for Honey as well as other items like wax) is developing in rural areas through many schemes conducted by KVIC (Khadi and Village Industries Commission), Government of India for employment in the Rural India. A venture has been undertaken in present review to compile detailed information regarding characteristic features of Bee and their types, Origin and types of Honey Bee, its life cycle with special emphasis on Apis Cerana (commonest Bee found in India).

Key Words: Apis Cerana, Bee, Honey Bee, Queen Bee, Worker Bee

INTRODUCTION

All types of bees belong to the series of insects known as hymenoptera, accurately meaning “membrane pinion”. This order consists of some ‘one lakh’ species comprising wasps, ants, sawflies. Among 25,000 or more narrated species of bees, the majority are single bees, mostly laying eggs in tunnels, which they gouge themselves. Bees are flitting creatures having close relationship to wasps and ants and are responsible for pollination and producing honey and bee wax. They are present on every continent except Antarctica, in every habitat containing insect fecundated flowering plants on the planet. Bees are very important for man as ‘Albert Einstein’ quotes “*If the bee disappears from the surface of*

the earth, man would have no more than four years left to live.”

Characteristic Features of Bee¹: Bees are adjusted for sustaining on nectar being an energy source and pollen for protein and as food for larvae. Bees have a long complex tongue enabling them to feed nectar from flowers. They contain antenna comprising of 13 segments in male and 12 in females. Bees have couple of wing the hind pair is smaller of the two. In few species there are comparatively short pinion which make flight hard or impossible but no species are wingless.

Trigona Minima, a stingless bee is the smallest one, whose workers are approximately 2.1mm long and *Megachile Pluto*, a leafcutter bee is the largest one, whose female can sustain a length of 39mm. The commonest type of bees in the



northern hemisphere is sweat bees belonging to the family Halictidae. European Honey bee is the best known species of bee.

Bees may live alone or in various types of groups. Bees are mainly eusocial and semisocial. In few species, cohort of cohabiting females may be sisters and there is cleavage of labour within the group. They are considered as semi social and in addition to division of labour, the group containing a mother and her daughters then it is called eusocial. The mother is the Queen and the daughters are the workers. The eusocial colonies are found among Honey bees, bumble bees and stingless bees².

(A) Eusocial and Semi social bees

1. Bumble bees: (*Bombus terrestris*, *Bombus pratensis*) They are eusocial bees. The Queen starts a nest on her own. Bumblebee colonies typically have 50 to 200 bees at highest citizenry in mid to late summer. The Queen of bumblebees sometimes looks for winter protection in Honey bee hives, whereby many a times found dead in the spring by bee keepers. Bumblebees are foremost wild pollinators but recently have declined enormously.

2. Stingless Bees: They are very assorted in behavior, being highly eusocial. They have composite nest architecture; practicing mass provisioning and perennial colonies.

3. Honey bees: The true Honey bees (genus *Apis*) have arguably, the most complex social behavior among the bees. *Apis Mellifera* is the best known bee species and one of the best known of all insects.

4. Africanized Honey bee: Popularly known as killer bees, are a hybrid strain of *Apis Mellifera* emerged from experiments by Warwick Estevam Kerr to crossbreed European and African bees. A Number of Queen bee escaped from laboratory in South America and has spread throughout America. Africanized Honey bees are more averting than European Honey bees. These bees tend to be nomadic which meant that they readily left man made hives, moved into jungles and establish their own colonies away from human habitation.

(B) Solitary and Communal Bees: Familiar species of bees such as the Eastern carpenter bee (*Xylocopa virginica*), Alfalfa leafcutter bee (*Megachile rotundata*), (*Osmia lignaria*) Orchard mason bee and (*Osmia cornifrons*) the hornfaced bee are lonely in the fact that each female is fertile and routinely inhabits a nest she made herself, devoid of worker bees. Lonely bees routinely produce neither honey nor beeswax. They are safeguarded from acarine and Varroa mites, having their own typical parasites, pests and diseases. Forlorn bees are foremost pollinators, and pollen is collected for provisioning the nest with food for their brood.

(C) Cleptoparasitic Bees: Cleptoparasitic bees are routinely called "cuckoo bees" due to their similar behaviour to cuckoo birds, found in several bee families, albeit the nomenclature is technically best applicable to the apid subfamily Nomadinae. Females amongst these bees are devoid of pollen collecting parts (the scopa) and do not made their own nests.



(D) Nocturnal Bees: Four bee families (Andrenidae, Colletidae, Halictidae, and Apidae) consist of few species which are crepuscular (may be either the spertine or matinal type). These bees possess elongated ocelli, which are exceptionally sensitive to light and dark, albeit incapable of forming images. Most of them are flower pollinators which themselves are crepuscular, such as evening primroses, and some live in desert areas where daytime temperatures are exceptionally high.

Ayurvedic Review of Makshika³: Acharya Sushruta described Makshikas in Kalpa Sthan chapter 8 i.e Keetakalpam adhaya whereby he has mentioned 6 types of Makshikas: *Kantarika, Krishna, Pingala, Madhulika, Kashayee, Sthalika*. Out of these 6 types, Sthalika and Kashayee are Asadhya.

Symptoms of their bites: At the site of bite person feels itching (Kandu), swelling (Shopha), burning sensation (Daha) and pain (Ruja). Apart from these general symptoms, Acharya Sushruta specifically mentioned symptoms of Kashayee and Sthalika as grayish black Pustules or furuncles and fever like upadravas (shyaav pidika utpatti). Acharya Charak and Acharya Vagbhata mentioned Sthagika instead of Sthalika and termed it as praanhar.

Symptoms of Makshika Damsha given by Acharya Charak- Grayish black Pustules or furuncle (shyaav pidika) appears and there is immediate secretion (sadhye prasravini) from the site of Makshika Damsha just after the sting, burning sensation (daha), fainting (murcha) and

fever (jwara) like symptoms also follows.

Honey bee⁴- Honey bees are social and cooperative insect. Honey bee is a type of bee belonging to the genus *Apis*, mainly characterized by the production and storage of honey. Honey bees are famous for construction of perennial colonial roost out of the wax. Honey bees represents part of approximately 20,000 recognized bee species.

Honey bee belonging to the family of social bees including Bumble bees and the tropical Stingless bees of genus *Meliponinae*. Single fertile female is the head of colonies made by social bees, the Queen which is generally the only egg layer in the colony. For aging nectar, feeding the Queen and the larvae, cleaning brood cells and removing debris are performed by worker bees. Pollen and honey are stored and larvae are nurtured in cells made from wax secreted by the worker bees.

Honey bees are characterized by building a vertical comb of hexagonal cells, fabricated symmetrically from a midrib, using mainly the wax secreted by worker bees. The cells are multi-skilled being used repeated for nurturing the larvae and for the storage of pollen and honey. Gradual feeding of larvae is performed by the younger bees with food made by glands in the head of the bee from honey and pollen. A Queen bee may lay 2000 eggs per day during spring built up, but she can also lay 1000 to 1500 eggs per day during the foraging season, mainly to replace routine casualties however these casualties are workers dying of old age rather than predation. Among forlorn and earliest social bees, however eternity



reproduction is among the lowest of all insects as it is not uncommon for females of such species to produce fewer than 25 off-springs.

The citizenry value of bees depends partly on the discrete proficiency of the bees, but also on the citizenry itself, while bumblebees are about ten times more efficient pollinators or cucurbits.

Two traits of Honey bees essential to their expansion and biology are their clustering behavior and their ability to cool the shelter by evaporation of water collected outside. These traits enable them to achieve a remarkable degree of temperature maintenance within the nest irrespective of external temperature. The genus *Apis* was thus validated to colonize a variety of environments, varying from tropical to cool temperature.

Origin of Honey bees: Fossil corroboration is sparse but bee likelihood appeared on the planet at the same time as flowering plants in the cretaceous period about 146 to 74 million years ago. The primitive known fossil bee is *Trigona prisca*, a stingless bee found in the upper cretaceous of New Jersey USA. The near relatives of modern Honey bee are bumble bee and stingless bee. Main species have primitively been cultured or at least exploited for honey and bee wax by humans.

The dwellers of a Honey bee colony are divided into three specialized types of bees: One type of male i.e. Drones and two types of females viz. Workers and Queen bee.

1)Queen Bee: (Figure 1) Queen bee is an adult female bee, lives in Honey bee colony or hive. Queens are prospered from larvae hand-picked by

Worker bee. There is mainly one adult, mated Queen in a hive. Queen bee is the barely erotically productive female in the colony and thus is the matriarch of all Drones, Workers and future Queens. The Queen does not directly control the hive; its main function is reproduction. A Queen can impute about 2000 eggs daily during spring. It is more than her own body weight. Queen is surrounded by worker bees who give her food and dispose off her wastes.

Anatomically the Queen is different from drones and the workers, her framework is long with elongated abdomen than a worker bee, her mandibles or jaws contain serrated cutting teeth whereas her progeny have toothless jaws. Queen has undulated, smooth stringer that she can use frequently without endangering her own life. The average life span of Queen is one to three years.



Figure 1 Queen Bee

2)Worker Bee (Figure 2) The major part of the bee hive's citizenry consists of worker bees. Workers are all female bees but lacks full reproductive capacity. They are smaller with short abdomen. They have pollen baskets on hind legs used mainly to transport pollen back from the area. Nearly summers the worker bees build the nest and care for the brood. They build the nest from



wax serrated from the glands in their abdomen. The hexagonal cells or compartments made by the workers are exhibited in a lattice structure known as the comb. It is called as honey comb and bees employ the cells to store food (honey and pollen) and to house the progeny (eggs. Larvae, pupae) worker bee perform various important tasks , they clean the comb, removes the dead brood and bees feed and care the developing larvae, attend the Queen bee, collect nectar and pollen, controls humidity and temperature of the hive, produce bee wax, guard the hive. The worker Honey bee are accoutered with straight, based stingers so that when a worker stings, the based , needle serrated organ remains firmly harboured in the flesh of its victim. In attempt to extract the stinger the bee shred its internal organs and dies shortly thereafter.



Figure 2 Worker Bee

3)Drones (Figure 3) Drones are the male bees in the colony. About 15% of the hive's citizenry is made up of drones. They develop from eggs that have not been fertilized and they cannot sting. Anatomically they are featured by eyes that are double the size of worker bees and Queen. Their body size is greater than worker bees but usually smaller than Queen Bee. Their antennas have specialized receptors enabling them to locate a

Queen. Drones only purpose is to copulate with new Queens. Bee mating occurs outside the hive in midflight 200-300 feet high in the air.



Figure 3 Drone Bee

Life cycle of honey bee²: It goes through 4 basic stages viz. Egg—Larva—Pupa—Adult (Table no. 1)

Colony life: Life cycle of a Honey bee is perennial. There are 2 castes of Honey bees in the hive; male – Drones and females – Queen and Worker bees. Queen bee is the only reproducing female in the hive. Queen lays eggs singly in the comb cells. Larvae concoct from eggs in 3 to 4 days. They are then fed about 1300 times a day by worker bees and develop from several stages in the cells. Cells are restricted by worker bees when the larva changes into pupa. Queens and Drones are bigger than workers and require larger cells to develop. Ten thousands of individuals constitute a colony.

Few colonies stays in hives provided by humans called wild colonies, mainly prefer a nest area that is clean, dry, safeguarded from weather, about 20 liters in volume with a 4 to 6 cm² entrance about 3 meters above the ground and mainly facing south or south-east or north or north-east.

Development: Evolution from egg to growing bees varies among Queen, Workers and Drones. Queen evolves from their cells in 16 days, workers



in 21 days and drones in 24 days. Generally one Queen is present in a hive. In enlarged cells new maiden Queens develop through differential feeding of royal jelly by workers. When the subsisted Queen ages or dies or the colony is enlarged a new Queen is raised by the worker bees. The maiden Queen takes one or numerous marital flights and once she is established, starts laying eggs in the hive.

A fecund Queen is able to lay fertilized or unfertilized eggs. Each unfertilized egg comprises

a typical combination of fifty percent of the Queen's genes and develop into haploid drone. The fertilized eggs mature into either workers or maiden Queens.

The standard life span of a Queen is three to four years. Drones usually die after copulation or are expelled from the comb before winter and workers may live for a few weeks in the summer and several months in areas with an extended winter season.

Table 1 Life cycle of honey bee

Type	Egg	Larva	Cell capped	Pupa	Average development period	Start of fertility	Body length	Hatching weight
Queen	Upto day three	Upto day 8½	Upto day 7½	Day 8 until emergence	16 days	Day 23	18 to 22 mm.	Nearly 200 mg.
Worker	Upto day 3	Upto day 9	Day 9	Day 10 until emergence	21 days (range 18 to 22)	N.A.	12 to 15 mm.	Nearly 100 mg.
Drone	upto day 3	Upto day 9½	Day 10	Day 10 until emergence	24 days	Approx. 38 day	15 to 17 mm.	Nearly 200 mg.

Winter survival of Honey bees

In cold weather Honey bees stop flying and when the temperature drops below 10°C. They rabble into the central area of the nest to form a 'winter cluster'. The worker bees gather around the Queen bee in the middle of the cluster, trembled in order to keep the centre between 27°C in early winter and 34°C once the Queen resumes laying eggs. The worker bees twirl through the cluster from the outdoor to indoor so that no bee gets too cold. The outer edges of the cluster stay at about 8° to 9°C. When the weather is colder outside the cluster becomes more compact. During winters, they take their stored honey to produce body heat.

Types of honey bees⁵: Five important species of Honey bees are as follows.

- 1) The Rock bee – *Apis Dorsata*
- 2) The Indian hive bee – *Apis Cerana Indica*
- 3) The Little bee – *Apis Florae*
- 4) The European or Italian bee – *Apis Meliifera*
- 5) Dammer bee or Stingless bee – *Melliifera Iridipennis*.

The important characteristics of these species are given below:-

1)Rock Bee (*Apis Dorsata*): (Figure 4) They are giant bees present all over India in sub mountainous regions up to attitude of 2700 meters. They build single comb open about 6 feet long and 3 feet deep. They transfer the place of colony often. Rock bees are ferocious and hard to rear. The production of honey is about 36 kg per comb



per year. These are the largest bees among all described above.



Figure 4 Rock Bee

2) Little Bee (Apis Florae): (Figure 5) They construct single vertical combs in open of the size of palm in branches or bushes, hedges, building caves, empty cases etc. They make about half a kg of honey annually per hive. These are the smallest among four Apis species described and smaller than Indian bee. They distribute only in plains and in hills not above height of 450 meters.



Figure 5 Little Bee

3) The Indian Hive Bee (Apis Cerana Indica): They are the subjugated species which build multiple parallel combs with an average honey yield of 6-8 kg per colony per year. These are larger than Apis florae but smaller than Apis mellifera. They are more vulnerable to swarming and absconding. They are native of India or Asia.

4) European Bee /Italian Bee (Apis Mellifera): (Figure 7) They are also alike in behavior to Indian bees, which construct parallel combs. They are larger than all other Honey bee except Apis Dorsata. The mean production per colony is 25-40

kg per year being imported from Europe. They are prone to swarming and absconding.



Figure 6 Indian Hive Bee



Figure 7 European Bee

5) Dammer Bee or Stingless bee (Mellifera Irridipennis): (Figure 8) Apart from true Honey bees, two varieties of stingless or Dammer bees, viz, Melipona and Trigona occur in plenty. These are smaller than true Honey bees and construct asymmetrical combs or wax and resinous substances in cervices and hollow tree trunks. The stingless bees help in the pollination of various food crops. They bite their enemy intruders. It can be subjugated but the honey yield per hive annually is 100 gms.



Figure 8 Dammer Bee

Apis Cerana⁶: Apis Cerana is found in a vast range from Northern India, China, Pakistan, Nepal, Korea, Malaysia, Indonesia, Philippines



and Japan. It is known as the Asiatic or Eastern or the Himalayan Honey bee. It is characterized by a small narrow body than that of western bee and has quite recognizable yellow bands between the abdominal segments. The species habitats range from low land forest to high mountains in Himalayas.

Sub Species- There are eight subspecies of *Apis Cerana* viz.

- 1) *Apis Cerana skorikovi* Engel (Himalaya): Central and east Himalayan mountains
- 2) *Apis Cerana cerana* Fabricius (sinensis): Afghanistan, Pakistan, North India, China and north Vietnam
- 3) *Apis Cerana heimifeng* Engel
- 4) *Apis Cerana indica*: Fabricius south India, Sri Lanka, Bangladesh, Burma, Malaysia, Indonesia and the Philippines.
- 5) *Apis Cerana Japonica* Fabricius : Japan
- 6) *Apis Cerana javana* Enderlein
- 7) *Apis Cerana johni* Skorikov
- 8) *Apis Cerana nuluensis*

Scientific Classification:

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Hymenoptera

Suborder: Apoorita

Family: Apidae

Subfamily: Apidae

Genus: *Apis*

Subgenus: *Apis*

Specis: *Apis Cerana*

Binomial name: *Apis Cerana*

Anatomy of Honey bee: The Honey bee is one member of class Insecta, these insects are members of the subfamily Apidae which make and store honey.

Body-The body of Honey bee is segmented. It has stinger, legs, antenna, three segments of thorax and seven segments of abdomen.

Head -The head of Honey bee consists of eyes, antennae and feeding structures.

Eyes- The eyes include paired compound eyes and three simple eyes. The compound eyes are made up of numerous light sensitive cells which help bees to perceive color, light, and directional details from the sun's ultra violet rays. The simple eyes called 'Ocelli' are exhibited in triangular shape on the head which helps in determining the proportion of light present.

A- Antennas: The antennae function is to smell and detect odors and to measure flight speed.

B- Feeding structures: It includes mandible and tongue. The mandible is used in eating pollen, cutting and shaping wax, feeding larvae and the Queen, hive cleaning, grooming and fighting. The tongue or 'proboscis' allows the Honey bee to drink nectar, honey and water. It acts as the forum for food exchange between bees.

Thorax- It consists of pinion, legs and the muscles that manage their movement.

A- Wings-The fore wing is generally bigger than the hind wing and is used as a cooling mechanism and for flight. The hind wings main function is also flight and at times can be attached to the fore wings by hooks called 'hamuli' so that



both pair of wings can beat in synchrony. It is also used as a fan to cool the hive.

B- Legs-The main function of the Honey bee legs is movement and also used to transfer pollen and propolis; a pitchy mixture collected and used as an adhesive in hives. The hair on the legs helps to dust pollen and other substances.

Abdomen-Abdomen has seven portions and bears female genitalia in Queen, male genitalia in Drones and the stinger in both Workers and Queen

Sting -The sting has two lancelets anchored by hard plates, strong muscles bind to a poison gland surrounded by the sting. The function of a sting is defensive albeit Honey bee loses its life after sting. The sting is left in the body of the victim and when pulling away ruptures the abdomen and thus the worker bee dies.

DISCUSSION- Despite the evidence of an enduring reverence for the Honey bee, human beings have an uneasy relationship with it. Honey bees are conventionally mandatory for the production of agricultural crops as they pollinate 1/3rd of what we eat. Honey bees are the subset of bees in the genus *Apis*, mainly characterized by honey production and storage and the building of perennial, colonial nests out of wax. Honey bees are the only abiding members of Apini tribe, all in the genus *Apis*. Presently, there are only seven perceived species of honey bee with a total of 44 subspecies. Honey bees constitute a small fragment of the approximately 20,000 known species of bees. Few types of associated bees produce and store honey, but only members of the genus *Apis* are true honey bees.

Grossly it is divided into 5 types viz. *Apis Cerana*, *Apis Dorsata*, *Apis Mellifera*, *Apis Florae* and *Apis Laboriosa*.⁷

Honey bees are the social bees staying in the colonies headed by one fertile female; Queen, the barely egg layer in the colony. Looking around for nectar and for feeding the queen and the larvae, cleaning progeny and removing debris are done by female workers. Honey and pollen are stored and larvae are nurtured in cells made from wax secreted by the worker bees. Drones are the caste of males in the hive whose function is only mating. They develop from eggs that have not been fertilized and they don't sting.

CONCLUSION

Insects form nearly 3/5th of Anthropods. The branch of Zoology dealing with the study of insects is known as Medical Entomology. Honey bees are the most familiar Anthropods. Honey bees are the useful insects for human beings. They help in pollination of crops on the other hand their bite in human beings can cause life threatening conditions.



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