BEEKEEPING:
AN ADDITIONAL SOURCE OF INCOME

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INTRODUCTION

Honeybees are one of the most useful insects for human beings. Honey is a nutrient-rich abrosia for life, bees produce several other products that are equally useful for humans. The bee by-products like beeswax, bee pollen, royal jelly, propolis, bee venom, bee bread and honeycomb are all produced by bees for various purposes. Since ancient times, people all over the world have been using these products to treat illnesses, and they continue to be the good options for boosting immunity in the natural way. Apitherapy or alternative therapy using products derived from honeybees was practiced by ancient Egyptians, Greeks, Romans, and Chinese, among others. Conditions like arthritis, allergies, immune or neurologic diseases, thyroid, gingivitis, etc., were commonly cured using bee products. Bees are said to have evolved from hunting wasps that ususually vegetarian. Bees presumably appeared on the earth at the same time as flowering plants in the Cretaceous period, 146 to 74 million years ago, according to fossil evidence. Trigona prisca, the oldest known fossil bee, was discovered in the Upper Cretaceous of New Jersey, USA, and dated from 96 to 74 million years ago. Fossils of the authentic Apis were first unearthed in Western Germany during the Lower Miocene (22 to 25 million years ago). Honey bees are eusocial flying insects belongs to the Apis genus of the bee clade, all of which are native to Eurasia. Albert Einstein is commonly misquoted as saying. "If bees vanished from the face of the earth, man would only have four years left to live". In 2021, the Indian honey market was worth INR 21.1 billion. Looking ahead, International Market Analysis Research (IMARC) Group forecasts that the markets will reach INR 3803 billion by 2027, growing at a CAGR of 10.31% from 2022 to 2027. There are just eight extant honey bee species, with a total of 43 subspecies, despite the fact that traditionally 7 to 11 species were recognized.

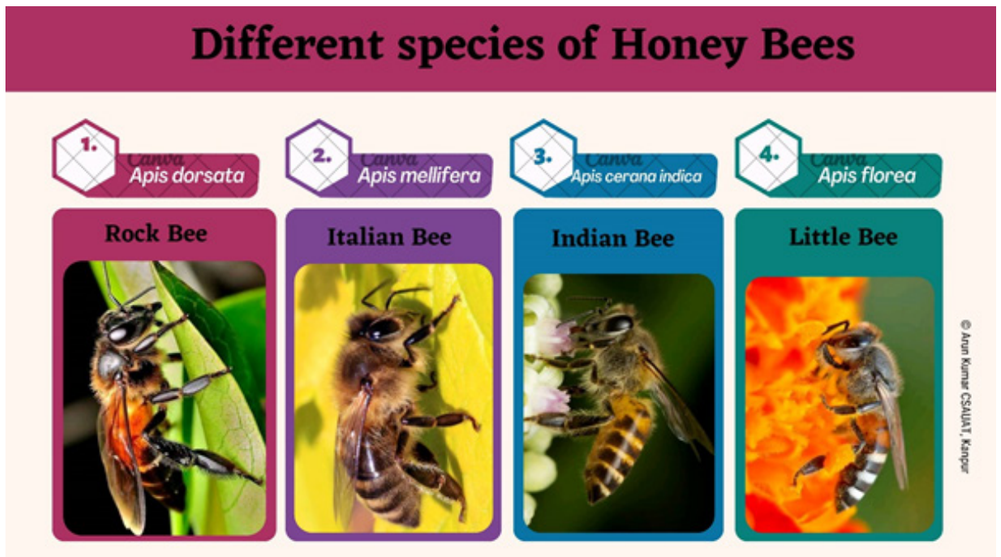
CURRENT SCENARIO:

As per the recent data from the National Bee Board, the country total honey production reported in 2019 - 2020 was 1.05 lakh metric tonnes (MTs). With international demand for honey growing, India exports 50 per cent of the commodity and, in the last 12 years, exports have increased by 207 per cent. In Indian nation, Punjab is the major state in beekeeping, with around 35,000 beekeepers delivering around 15,000 metric tonnes of honey. This is more than 39% of the nation's total honey production. Next to that, Karnataka has produced 1200 tonnes of honey approximately as updated of 2019. West Bengal, Uttar Pradesh, Punjab, Jammu and Kashmir and Bihar, contribute about 61% of India's total honey production. Jammu and Kashmir is also a noticeable name in honey production of India. Kashmir has a potential to invite 120,000 bee colonies for honey production.

HONEY BEE SPECIES AND THEIR CASTES SYSTEM:

The major species include two domestic hive bees, *Apis mellifera* Linn. and *Apis cerana* F. and three well-known wild species, *Apis dorsata F., Apis florea F.* and *Apis karinjodian*. India is a country where all the four major species are present and the fifth *A. mellifera* was introduced from European countries. The other honey bee species are *A. koschevnikovi*, *A. andreniformis* and *A. laboriosa*.

- ✓ The rock bee (*Apis dorsata*)
- ✓ The European or Italian bee (*Apis mellifera*)
- ✓ The Indian bee (*Apis cerana indica*)
- ✓ The little bee (*Apis florea*)
- ✓ The Indian Black Honey bee (*Apis karinjodian*)



Rock bee (*Apis dorsata*):

- ✓ They are giant bees.
- ✓ Found all over India in sub-mountainous regions.
- ✓ They construct single vertical comb.
- ✓ Often, they shift the place of the colony.
- ✓ Ferocious and difficult to rear.
- ✓ It produces upto 37 kg. honey/hive/year.

The European or Italian bee (*Apis mellifera*):

- ✓ It is introduced species of bees from Italy by Dr. A. S. Atwal in 1960 (Punjab).
- ✓ It is highly domesticated in nature.
- ✓ They construct multiple parallel combs.
- ✓ It yields highest honey.
- ✓ It produces 45-180 kg. honey/hive/year.

Indian bee (*Apis cerana indica*):

- ✓ They are the domesticated species, construct multiple parallel combs.
- ✓ They are native of India/Asia.
- ✓ They are more prone to swarming and absconding.
- ✓ Low honey yielder (5-10 Kg of honey/comb/year).

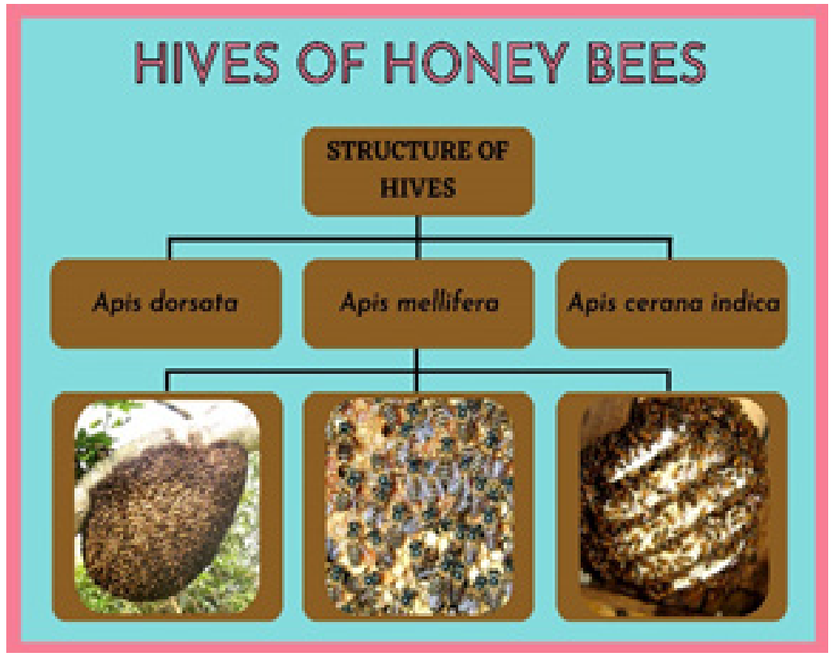
Little bee (*Apis florae*):

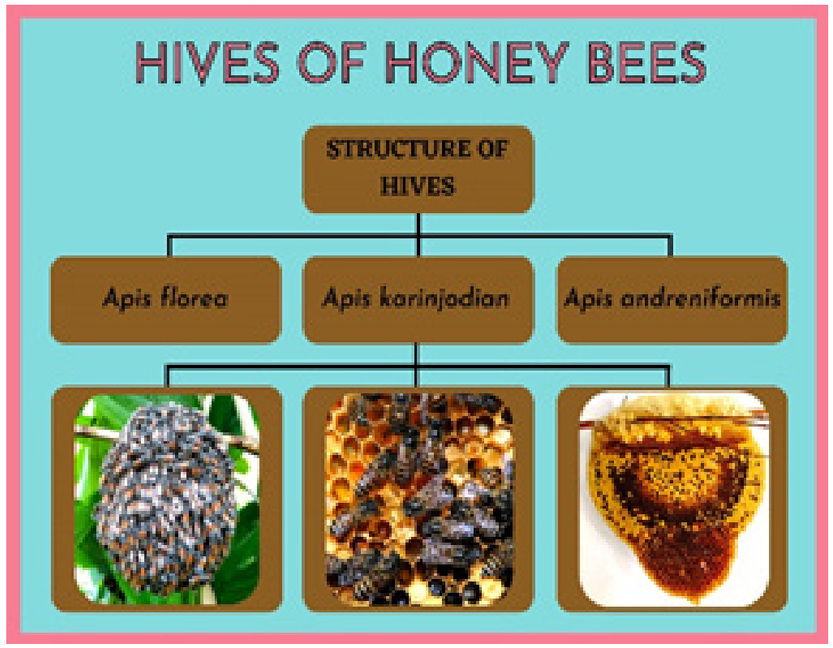
- ✓ Smallest honey bee's species.
- ✓ They build single vertical combs.
- ✓ The bees are very prone to swarming.
- ✓ Poor honey yielder (0.5Kg/comb/year).

The Indian Black Honey bee (*Apis karinjodian*):

- ✓ *Apis karinjodian* has evolved from *Apis cerana indica.*
- ✓ It is new honey bee species discovered in India.
- ✓ They are native of India (Central Western Ghats and Nilgiris to the Southern Western Ghats).
- ✓ They are the domesticated species, construct multiple parallel combs.

STRUCTURE OF HIVES OF VARIOUS SPECIES OF HONEY BEES:



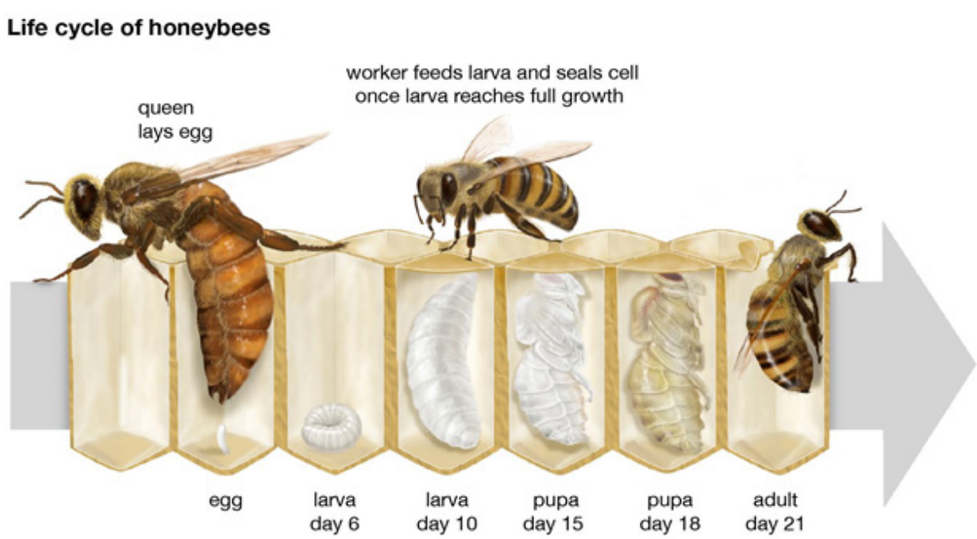


LIFE CYCLE (BIONOMICS):

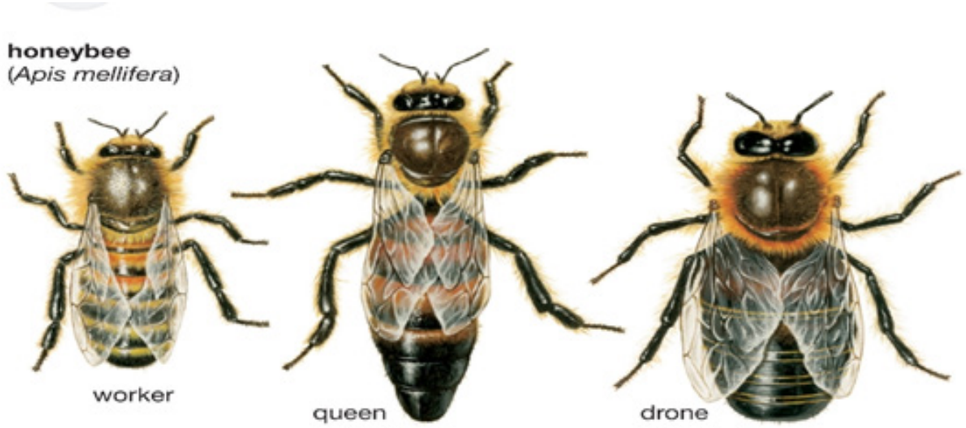
Honey bees are highly social insect which live in a well-organized colony. A colony of honey bees is composed of three castes: a single queen, a few hundred drones and several thousand worker castes. For all three castes of honeybees, eggs hatch in three days and then develop into larvae that are known as grubs. All grubs are fed royal jelly at first, but only the future queens are continued on the diet. When fully grown, the grubs transform into pupae. Queens emerge in 16 days, workers in about 21 days (on average) and drones in 24 days. After emerging, the queens fight among themselves until only one remains in the hive. Queen is a fertile, functional female, worker is a sterile female and the drone is a male insect.

(i) Queen: The only individual which lays eggs in a colony and is the mother of all bees. Unfertilized (Haploid) eggs develop into drones, whereas fertilized (Diploid) eggs develop into females, which may be either workers or virgin queens. After hatching, the virgin queens are fed royal jelly. Its complete their incubation period, larval period and pupal period within 3, 7 and 14 days, respectively. The average life span of a queen is 3-5 years.

(ii) Drones: Male member of the hive whose primary responsibility is to fertilise the queen. They also help in maintenance of hive temperature. They cannot collect nectar/ pollen and they do not possess a sting. Its complete their incubation period, larval period and pupal period within 3, 4-5 and 11-12 days, respectively. The average life span of a drone is 90 days.



(iii) Workers: The worker bees perform household duty which include building comb, cleaning, ventilating and cooling the hive, feeding of older larvae with bee bread, younger larvae with royal jelly, guarding the hive etc. during first three weeks. Later during guarding, the worker bees, in the act of stinging even die, sacrifices for the defence of the colony. Next three weeks, she performs outdoor duty including collecting the nectar, pollen, propolis and water, ripening of honey etc, and it complete their incubation period, larval period and pupal period within 3, 5 and 8 days, respectively. The average life span of a drone is 60 days.



WHAT ARE "VALUE ADDED" PRODUCTS FROM BEEKEEPING?

The best-known primary products of beekeeping are honey and wax, but pollen, propolis, royal jelly, venom, queens, bees and their larvae are also marketable primary bee products. While most of these products can be consumed or used in the state in which they were produced by the bees, there are many additional uses where these products form only a part of all the ingredients of another product. Because of the quality and sometimes almost mystical reputation and characteristics of most primary bee products, their addition to other products usually enhances the value or quality of these secondary products. For this reason, the secondary products, which partially, or wholly, can be made up of primary bee products, are referred to here as "value added" products from beekeeping.

Bee products:

- ✓ **Honey**
- ✓ **Bees wax**
- ✓ **Royal jelly**
- ✓ **Bee venom**
- ✓ **Propolis**
- ✓ **Bee bread**

HONEY:

Honey is the natural sweet substance produced by honeybees from the nectar of blossoms or from the secretion of living parts of plants or excretions of plant sucking insects on the living parts of plants. It is a complicated substance produced by bees who consume nector, digest it, and store it in honey combs. Indigenous peoples have collected honey from all live Apis species for food. Only two species, *A. mellifera* and *A. cerana*, have had their honey extracted for commercial reasons.

The uses of honey:

As a food, As a food ingredient, as an ingredient in medicine-like products, products of honey fermentation etc.

Recipes prepared from honey:

Liquid honey, Creamed honey, Comb honey, Mead, Honey beer, Honey liquours, Honey spreads, Honey with fruits and nuts, Honey with pollen and propolis, Honey paste for dressing wounds, Sugar substitution, Fruit marmalade, Honey jelly, Syrups, Rose honey, Caramels, Nougat and torrone, Honey gums, Gingerbread, Marzipan, Honey in bakery products etc.

BEES WAX:

The wax is used to create the comb's walls and crowns. Humans collect beeswax for a variety of reasons, including candle making, waterproofing, soap and cosmetics production, medications, art, furniture polish, and more.

The uses of wax:

In beekeeping, for candle making, for metal castings and modelling, In cosmetics, food processing Industrial technology, textiles, varnishes and polishes, printing, crayons, leather preserves, waterproofing textiles and paper, paint, wood preservative, topical ointment for burns, veterinary wound cream and for adhesive etc.

ROYAL JELLY:

Nurse bees secrete royal jelly from their hypopharynx glands to feed the larvae and the adult queens. It is white, brown, or gray to yellow and has a sour taste due to low pH. The gelatinous and viscous substance that becomes compact over time contains various minerals, vitamins, carbohydrates, amino acids, fatty acids as well as sugars like glucose and fructose. Royal jelly is a honey bee fluid that is used to feed the larvae of honey bees. It's advertised for its apparently beneficial health claims that aren't backed up by evidence. On the other hand, it has the potential to induce severe allergic reactions in some people.

Uses of royal jelly:

Dietary supplement, as ingredient in food products, as ingredient in medicine-like products and ingredient in cosmetics etc.

BEE VENOM:

Honey bee venom is being studied in the lab and in clinical trials for its potential qualities and uses in lowering the risk of bee venom therapy-related side events, rheumatoid arthritis and as an immunotherapy for protection against insect sting allergies.

The uses of venom:

The only legal acceptance for medical use of bee venom in Western European and North American countries is for desensitizing people who are hypersensitive (allergic) to bee venom. Since the early 1980's, pure bee venom has been used for desensitization. In Eastern Europe and in many Asian countries bee venom has been used in official medical treatment of a large variety of ailments for a considerable length of time.

PROPOLIS:

Propolis is a resinous mixture of various amounts of beeswax and resins collected by the honeybee from plants, particularly from flowers and leaf buds. It is utilised as a sealant in the hive to cover off undesired open spots. Although propolis is said to have health benefits (propolis tincture is used as a cold and flu cure), it can trigger severe allergic responses in certain people. Since it is difficult to observe bees on their foraging trips the exact sources of the resins are usually not known.

The uses of propolis:

In cosmetics, in medicine, traditional use and food technology etc.

Products prepared from propolis:

Ointments, oral and nasal sprays, suntan lotions, propolis syrups or honeys, propolis tablets, propolis shampoo, anti-dandruff lotion, propolis toothpaste, anaesthetic propolis paste, creams, facial masks micro-encapsulation and quality tests for antioxidant activity etc.

BEE POLLEN:

Innumerable stories and even more rumours exist about the mysterious powers of pollen and its nutritional value. Pollen is frequently called the "only perfectly complete food". High performance athletes are quoted as eating pollen, suggesting their performance is due to this "miracle food", just as the "busy bee" represents a role model for an active and productive member of society.

The uses of pollen:

As medicine, as food, in cosmetics, for pollination and for pollution monitoring etc.

Recipes prepared from pollen:

Pollen extract, Beebread, Honey with pollen, Granola or breakfast cereals, Candy bars, Pollen supplements and substitutes in beekeeping, Cosmetics, Pills and capsules etc.

BEE BREAD:

Pollen baskets are used by bees to harvest pollen and transport it back to the colony. Pollen, honey, and glandular fluids are combined by worker bees and fermented in the comb to form bee bread. The item is intended to be used as a health supplement.

The uses of Bee Bread:

Cosmetics, Pills and capsules etc.

IMPORTANCE OF HONEY BEE

1. In India, the total cultivated area is about 129 million hectares and at least one third of the area is under entomophilous crops which require insect pollination.
2. Insect pollination is extremely important as only 5.0 per cent of flowers are self-pollinated and 95.0 per cent cross pollinated
3. Pollination by honeybees significantly increased yield quantity and quality on average up to 62%. The value of bee pollination in crop production in USA has been estimated at US $ 20 billion per year.
4. Situations where absence of insect pollination has resulted in drastic reduction of many soil holding and soil enriching plants
5. Insect pollination is essential link in our ecological global chain.

PRECAUTIONS FOR BEKEEPING

1. The apiary should not be overcrowded with hives and maintain a distance of 3-7m between each other.
2. The bee flora with a wide variety of trees, shrubs, flowering plants as described earlier should be grown in the premises with the radius of 1500 m.
3. The availability of the fresh and clean water is essential to maintain an apiary.
4. The area of the apiculture business should contain bushes, trees or fences to avoid high wind.
5. The apiculture industry should not be in populated area or near the highway.
6. The location of the hive should be termite free, ant free, mite free and sanitized to avoid contamination from the microbes.

PRECAUTIONS FOR BEE KEEPERS

1. Wear full sleeve suit with gloves and boots having a face cover while handling the hive.
2. Avoid the handling during rain, storms, high winds, and muggy weather.
3. Bee keeper should stay calm and make slow movement to approach the hives.
4. If attacked by the honey bee do not pull out the sting as it will damage the poison gland and releases more poison into the body.
5. Use of little smokes on hand before handling is useful to avoid crowding of bees around you so it masks the alarm pheromone.

CONCLUSION:

Honey bees are most famous in all of the beneficial insects as its by-products such as honey, bee wax, propolis are world fame for their use in medicine, treating diseases, production of chewing gums, candies, antibiotic, act as a pollinator etc. Honey bees are the marvelous insects known to the mankind since the ancient times, humans have been aware of the benefits of honey bees. The honey bee colony is fascinating in and of itself; people appreciate them for their hard work, fraternity, self-sacrifice, serenity of mind, tolerance and a spirit of social duty. It contributes significantly to the propagation of several plants growing in nature as well as the pollination of crops, preserving the biodiversity, environmental quality, and ecosystem stability. Additionally, beekeeping is essential for the well-being of agriculture. Additionally, it promotes rural community's independence. It helps the local economy to diversify. So, beekeeping recognized as a low input and high output activity, suitable for rural, tribal and other weaker section of population. Totally honey bees contribute immensely to the welfare and economy.