

SOCIAL BEHAVIOUR:

Social behavior is **defined as interactions among individuals, normally within the same species, that are usually beneficial to one or more of the individuals.**

Social behavior evolved because it was beneficial to those who engaged in it, which means that these individuals were more likely to survive and reproduce.

Social behavior serves many purposes and is exhibited by an extraordinary wide variety of animals, including invertebrates, fish, birds, and mammals. Thus, social behavior is not only displayed by animals possessing well-developed brains and nervous systems.

BENEFITS OF SOCIAL BEHAVIOR:

Social behavior seems to provide many benefits to those who practice it.

1. Many animals are more successful in finding food if they search as a group.
2. If more individuals are cooperating in the search, there is a greater chance one of them will find the clump of food.
3. In some cases, foraging in a group makes it easier to capture a prey.
4. Dolphins are known to surround a school of fish and to take turns darting into the center to eat the fish that are trapped in the middle.
5. Many carnivores will band together when they try to capture large prey. For examples, wolves will hunt together when hunting moose, and lions will hunt together when hunting large prey such as wildebeests.
6. Many animals live in social groups partly for protection.
7. Some animals form social groups to make travel easier.

SOCIAL BEHAVIOUR IN INSECTS:

Social Organization is most developed in insects. Insects are **eusocial** (i.e., have true societies) and their eusociality is exhibited in terms of their following attributes:

1. **COOPERATION:** Members of same species show great cooperation.
2. **DIVISION OF LABOR:** There is distinct division of labor in some colonial insects. A group of individuals of the same colony become only workers and others only reproduce.
3. **OVERLAPPING OF GENERATIONS:** At any stage, at least two generations overlap in a colony of insects.

INSECT SOCIETY:

A social insect has unique features. Although an insect society has thousands of members, but they all constitute one family. Majority of the members are busy in activities that will end into the production of more individuals by the queen. These individuals are moulded into **different casts** by the "feeding action". Insect societies are termed eusocial for the following reasons:

1. They are essentially permanent.
2. They show mutual cooperation among inmates.
3. They contain offspring usually produced by a single female called as queen.
4. They exhibit the overlapping of generations; queen survives over her offspring generations.
5. They include members which are so attached to one another that their existence depends upon the survival of entire colony.

These features are followed by only two groups of insects namely:

1. **Order Isoptera:** Ex: Termites
 2. **Order Hymenoptera:** Ex: Honey bees, wasps and ants.
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I. SOCIAL ORGANISATION IN HONEY BEES:

The social organization of the honey-bees is established by the living of all individuals within the colony and they show the mutual cooperation among the members of the colony, and exhibit the overlapping generations.

At least there is a division of labour among the different types of honey-bees in the colony or hive. **The different forms or types of insects having a particular function live in the colony, called the castes.**

CASTE SYSTEM:

Thousands of bees (50,000 to 1,00,000 or more) which live in a hive are of three different forms:

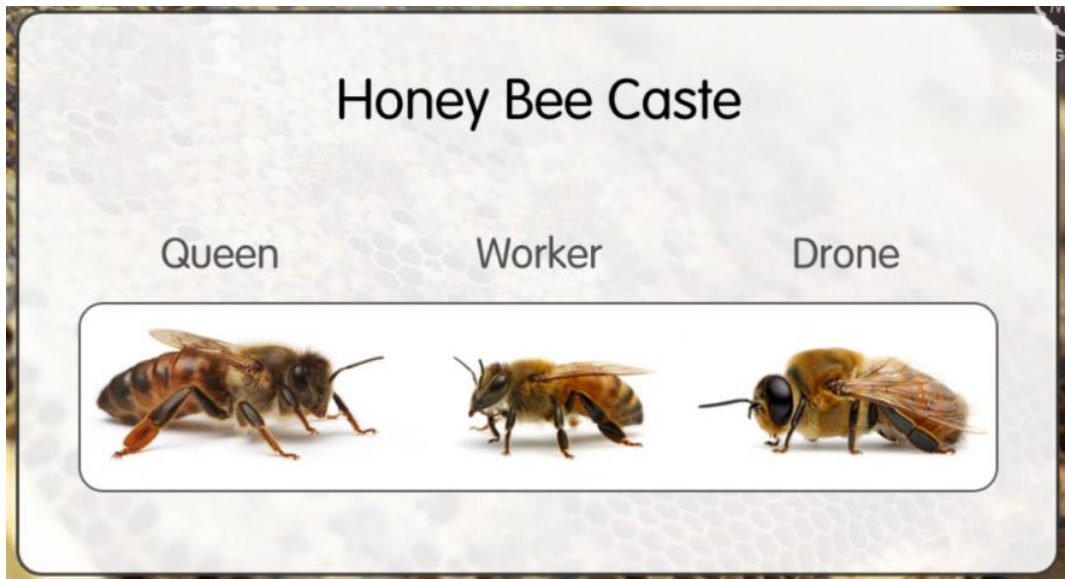
(1) Workers (infertile females)

(2) Drones (males)

(3) Queens (fertile females)

The phenomenon of existence of several morphological forms with separate functions in a species is known as **polymorphism**. So, honey-bees are well known as social and **polymorphic insects**.

Both queen and workers are female and diploid. Drones are males and haploid. A strong or healthy colony is called when the maximum number of workers is found in the colony.

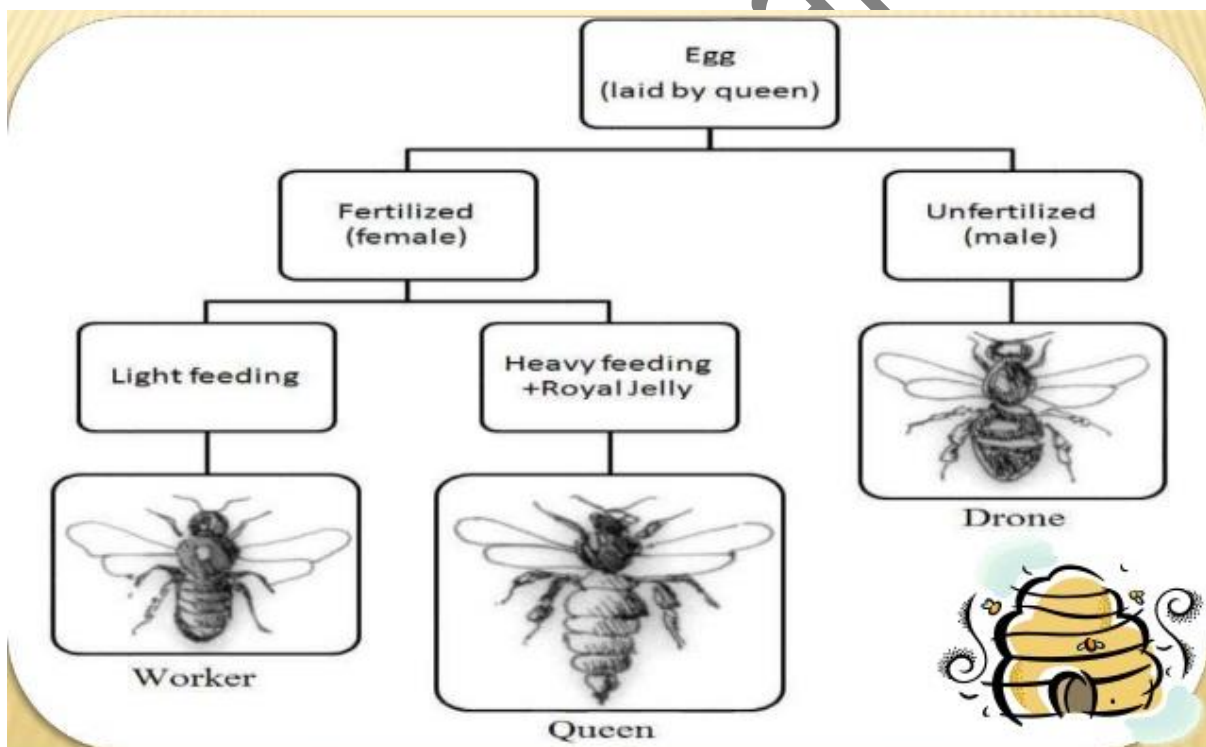


QUEEN BEE:

Generally, a single matured queen is present in each hive. The size of the queen is nearly 2.5 times longer than that of a worker bee. It is characterized by the long tapering abdomen, well-proportioned body, short and golden coloured wings and colour of the legs. They are 2.8 times heavier than the worker bees.

- The function of the queen is reproduction and lays about 1000- 2000 eggs every day depending upon seasonal variation and seasonal factors.
- The eggs may be either fertilized or unfertilized.
- Depending on the type of food supplied to the newly developed larvae by the nursing workers the eggs may develop either queen or workers.
- The drones or males are produced by the laying of unfertilized eggs (i.e. parthenogenetically).
- The queen deposits each egg in a cell prepared by the worker bees. After three days the eggs hatch into small larvae.
- The larva which is fed with a special food called '**royal jelly**' develops into queen.
- **The royal jelly is a high protein substance produced by the hypopharyngeal glands of the workers.**
- The larva which is selected to become queen is taken before the third day of development in a special chamber, called **queen's chamber**.
- The queen lives five to eight years on average and her fertility decreases with the increase of age.

- **The queen secretes a kind of chemical substance with hormonal properties from the mandibular glands, called pheromone or queen substance which inhibits the growth of ovaries of workers and control the activities of all bees within the hive.**
- She can attract the workers towards the queen and stimulates the workers to build wax cells for worker bees and drones but prevents in the building of queen cells.
- When the queen becomes matured, she leaves the hive with some drones and takes several nuptial flights and mates with a drone.
- The queen after copulation returns in her old hive and is looked after by nurse workers, known as her retinue.
- With the increase of the age, the egg laying capacity of the queen loses, the workers choose a three-day old egg. This egg after hatching into larva is fed with royal jelly and it develops a new queen in about 16 days. At that time the old queen leaves the hive along with some workers to establish a new colony.



DRONES:

- The drones are the male members of the bee colony and are haploid each genetically.
- The drones take 24 days to develop from the egg to adult.
- They have no food (pollen and nectar) collecting organs.
- So, the drones are totally dependent on worker bees for food.
- The main function is to fertilize the queens.

WORKERS:

- The size of worker bee is small but they constitute the majority in a hive.
- They are produced by the fertilized eggs laid by the queen.
- It takes 20 days from egg to adult and life span is about 6 weeks.

Functions of workers:

- All the time in their lives is spent for the maintenance of the hives and caring for their members.
- Workers are involved in hive construction, clean the cells of the hives collect the nectar, pollen and water and store within the cell properly.
- They repair the cracks in the walls of the comb.
- The workers also maintain the optimum temperature within the hive by fanning during summer.

NUPTIAL FLIGHT AND COPULATION:

- About a week after emergence from her chamber, the new queen flies in air with many drones.
- The copulation takes place in the air with a drone and the queen receives the spermatophores from the drone.
- After copulation, the drone dies immediately.
- The flight of one queen with several drones in air for copulation is called nuptial flight.

HIVE OR COMB:

The worker bees construct hive with the help of wax secreted from the wax secreting glands of the abdomen. There are 5 types of cells in the hive. They are;

1. **Queen cells:** These are a very few in number in a hive. They are larger than the other cells and vase-shaped, and are situated at the margin of the comb. These cells are used for queen rearing.
2. **Drone cells:** There are about 200 drone cells in each hive and are smaller than the queen cells. The drones are reared in these cells.
3. **Worker cells:** Majority number of cells is worker cells and each cell is about 5 mm across. The workers are reared in these cells.
4. **Brood cells:** The larvae of the honey bee are reared in these cells.
5. **Storage cells:** These cells are meant for the storage of honey and pollen.

II. SOCIAL ORGANISATION IN TERMITES:

The Termites are commonly known as white ants. They belong to **Class- Insecta, Order- Isoptera** and are widely distributed in tropical, subtropical and temperate regions of the world. **These are small, hemimetabolous, soft bodied, cellulose eating, nocturnal, social and polymorphic insects having two pairs of similar wings.** Ecologically, termites are good decomposers of dead wood and vegetable products and aid in agriculture by enriching the soil with their faecal matter and by making the soil permeable to air and moisture, like earthworms.

These are very significant pests damaging wooden structures. They live together in very large colonies or communities. **There are more than 1,700 species of termites and a few hundreds to as many as 70 lakhs individuals of same species form a colony.** The colonies are matriarch. A colony's population is initiated and maintained by a queen that may live for as many as 50 years in some species. All members of a colony are the offspring of a single female and hence all have similar genotype. The colony reaches its maximum size in approximately 4 to 5 years.

COLONY STRUCTURE AND POLYMORPHISM IN TERMITES:

A termite community includes two forms:

- (i) Reproductive form or Fertile Caste,
- (ii) Sterile form or Caste.

1) REPRODUCTIVE OR FERTILE CASTES:

There are three types of reproductive castes which are fertile males and females. These are as follows:

a) MACROPTEROUS FORMS OR WINGED FORMS OR FIRST REPRODUCTIVE CASTE:

These are sexually perfect males and females. They are ancestors of the community from which other forms have been derived.

- They have two pairs of large, equal-sized wings which project beyond the abdomen at rest.
- Body is chitinised and dark brown.
- Compound eyes are well developed and there is a pair of ocelli.
- Brain and sex organs are larger than in others.

- Males and females leave the nest at maturity, lead a brief aerial life, shed their wings at the basal sutures, then they come together in pairs and mate.
- After that they find a proper place for a new nest. Each pair is a dealated King and Queen or Primary Royal Pair.
- They have stumps of shed wings and they are monogamous. The king and queen are permanently associated.
- The queen becomes large by growth of its abdomen.
- The head and thorax resemble a normal termite but her abdomen is hugely distended, bulbous, long and white.
- She produces up to 2,000 eggs per day. A royal couple can live up to 50 years in some species.

b) BRACHYPTEROUS FORMS OR SHORT WINGED FORMS OR SECOND REPRODUCTIVE CASTE:

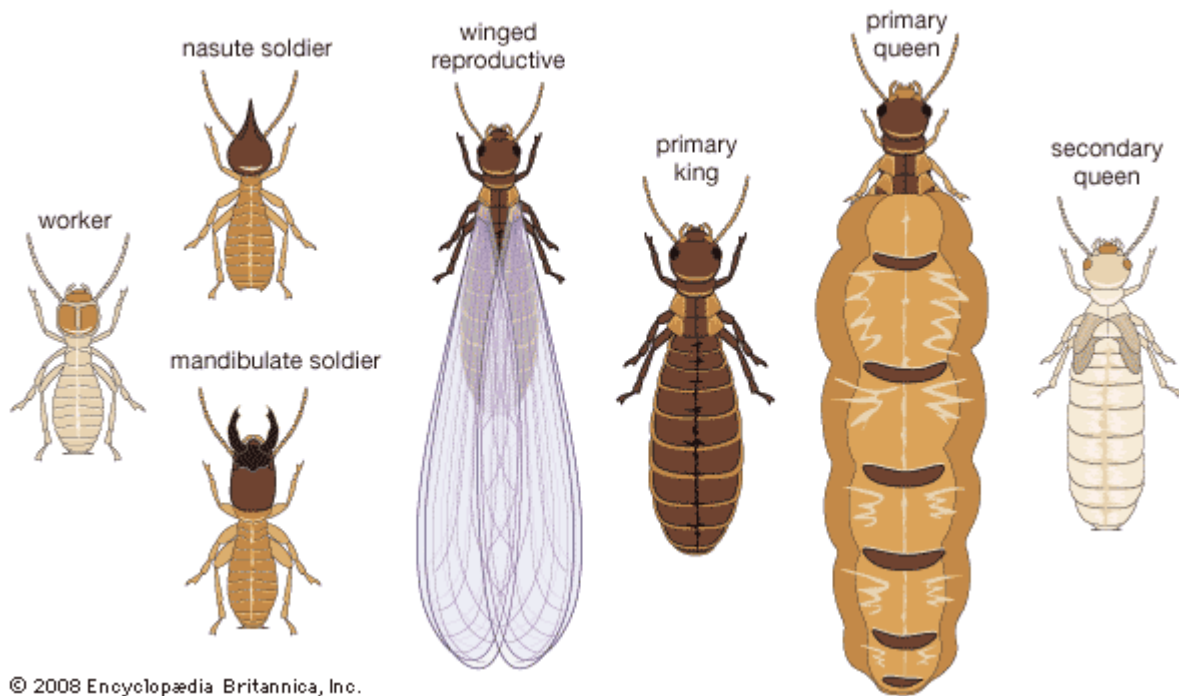
These are sexually mature males and females but they are nymphal in appearance.

- Body is less chitinised, pale coloured and have short wing buds only.
- The brain and sex organs are smaller in size and compound eyes are not dark.
- They do not leave the nest.
- If the primary king or queen dies, its place is taken by brachypterous individuals forming several substitute or complemental king or queen, which are polygamous.
- Such queens produce fewer eggs.

c) APTEROUS OR WINGLESS FORMS OR THIRD REPRODUCTIVE CASTE:

These are rare, found in lower termites only.

- They have both males and females.
- These look like nymphal workers.
- They have no wings, cuticle is colourless, compound eyes are vestigial and ocelli are absent.
- They are known as Ergatoid Kings and Queens.
- They may be several in the colony.



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2) STERILE FORMS OR CASTES:

There are two types of wingless (apterous), sterile castes. These are male and females in which sex organs are rudimentary and non-functional. These are of two types:

a) STERILE WORKERS:

- These are the smallest in size, look like nymphs, their body is pale coloured and their integument is less chitinised.
- Compound eyes and ocelli are absent and the head is wide, pointing downwards.
- The number of workers in a community is very large, about 60,000 to 2,00,000.
- They mature within a year and live from 3 to 5 years.
- With the exception of reproduction and defence, they perform all the duties of the colony.
- Their main duties are looking after the eggs and the young, finding food, planting and cultivating fungi, making nests and feeding the queen and soldiers.
- They also lick and groom each other.
- They have gnawing habit.
- The workers destroy crops, wood and human belongings and cause tremendous loss to man.
- They are xylophagous, feeding on wood.
- They can digest cellulose with the help of intestinal symbiotic flagellates –Trichonympha, which are passed on from generation to generation.

b) STERILE SOLDIERS:

- These are apterous males and females with no sex organs.
- They are less numerous in the colony than workers.
- A soldier has a large, dark coloured, chitinous head and big mandibles.
- The colour of the body is pale.
- They must be fed by the workers because they cannot feed themselves.

Soldiers are of two types:

(i) **Mandibulate soldiers** – have large powerful mandibles but no frontal rostrum.

(ii) **Nasute soldiers** – have small mandibles and median frontal rostrum on the head.

- They defend the community.
- The mandibulate soldiers with their mandibles and nasute soldiers by exuding a viscid repellent fluid through the frontal rostrum.
- At times they plug the opening of the burrow with their heads.

TERMITE NEST OR TERMITARIUM:

- The worker termites construct elaborate nests, the termitaria, for protection, storage of food and maintenance of broods.
- The termite nests vary from simple cavities in soil or wood to vast subterranean complex or elaborate structures that project well above the ground, known as mounds.
- The mounds can be up to 6 meters high and are made of excavated mud wood and excreta mixed with saliva.
- Their walls become hard as rocks.
- The mounds and termitaria have a maze of passages, chambers and special cells for storing food or cultivating fungus gardens.
- There are special chambers for the royal couple.
- The termitaria are provided with very elaborate ventilation system and design that provides for maintenance of constant temperature, canopies that deflect rainwater and other structural adaptations. Termites are best known nest building insects.

OTHER CHARACTERISTICS OF TERMITES:

Various castes of termites work in cooperation and with mutual benefit and live in an integrated manner in the colony. Parental care is well marked in termites –

- The eggs and nymphs develop in fungal chambers or nurseries.
- The queen is fed by workers on saliva and fungal hyphae.

- The workers tend and feed the nymphs on fungus and vegetable matter which are partly pre-digested by the workers. Thus, symbiotic flagellates are transferred to nymphs by trophallaxis.
- For progressive provisioning of food for the king, queen and nymphs, some worker termites cultivate fungus gardens in chambers located near the centre of the nest.
- These are made of a reddish brown, spongy comb produced by the workers from vegetable matter and excreta. On the comb fungal hyphae grow producing white patches.
- Exchange of food between one insect and the other takes place by mouth- Trophallaxis.
- In termites, trophallaxis plays an important role in the regulation and caste determination through ectohormones, containing inhibitory substances, secreted by the reproductive and soldiers.

COMMUNICATION IN TERMITES:

- Termites communicate primarily by secreting chemicals called pheromones or ectohormones.
- Each colony develops its own characteristic odour.
- An intruder is instantly recognized and an alarm pheromone is secreted that triggers the soldiers to attack.
- If a worker finds a new source of food, it lays a chemical trail for others to follow.
- The proportion of termites in each caste within the colony is also regulated chemically.
- Nymphs or immatures can develop into workers, soldiers or reproductive adults depending on colony needs.
- Sound is other means of communication.
- The Soldiers and workers may bang their heads against the tunnel creating vibrations perceived by others in the colony and serving to mobilize the colony to defend itself.
- Mutual exchange of foods enhances recognition of the members.

III. SOCIAL SYSTEM IN PRIMATES:

Sociality is very common among mammals. It predominantly occurs in deer, wolf, cattle, sheep, horse and primates. Of these, **primates (Monkeys and Apes)** show an elaborate social life. Primates show marked socialization.

The sociality of primates has been enhanced by the following attributes:

1. enlargement of brain,
2. development of grasping hand,

3. great reliance on vision for exploration and communication and
4. diversity in their arboreal and terrestrial habitats.

TYPES OF SOCIAL BEHAVIOUR IN PRIMATES:

There are 6 different groups under which the social organisation in apes and monkeys can be studied. They are:

- 1) Solitary type.
- 2) Monogamous type.
- 3) Unimale bisexual group or Single male with bonded females and offsprings type.
- 4) Aggregate single male group with bonded females and offsprings type.
- 5) Multimale bisexual groups.
- 6) Diffuse social parties.

i. SOLITARY TYPE:

- Examples. **Orangutan (ape), aye-aye (ape), loris (tree monkey)**, etc.
- This is a type of social behaviour where the primates (monkey and apes) tend to spend their entire life in a confined area. These do not leave their home range and spend almost isolated life.
- Orangutans lead an almost totally solitary life.
- They associate only for mating and an offspring is dependent on its mother.
- They are entirely arboreal and both sexes tend to stay in a home range over which they travel throughout the year following the fruiting of trees.

ii. MONOGAMOUS TYPE:

- Examples. **Gibbons, tree shrews, lemurs, marmosets etc.**
- Monogamy is very rare.
- However, it is perfectly exemplified by the **gibbons** whose life long pair bond between a male and female and their strict territoriality, maintained by **elaborate singing especially at dawn, show remarkable parallels to some birds.**
- Gibbons are found in South America.
- Their groups include 4-8 individuals constituting an adult male and adult female and up to 4 young ones.
- There is not much difference in body size of male and female.
- There exists equal dominance between males and females.
- Both of them (male and female) involve themselves in all activities with same intensity.

- South American **marmosets** and **tamarins**, also have very small groups with often one, or at the most three adults of each sex in the group together with their young.
- Almost all other primates give birth to single offspring, but marmosets always have twins and males help with the care of infants, carrying them for much of the time.
- Monogamous primates are usually smaller in size; they feed on high protein diet, viz. insects, new leaves and ripe fruits.
- The parental investment is equal, the female feeds the young and male carries young on his back.
- Antipredator device involves concealment.

iii. SINGLE MALE GROUPS WITH BONDED FEMALES AND OFFSPRINGS (UNIMALE BISEXUAL GROUPS):

- Examples: **Patas monkey, hanuman langurs, red howler monkey, redd tail monkey, blue monkey, etc.**
- These primates typically live in unimale bisexual groups; their group may have **20 to 100 individuals**, there will be just **one adult; fully grown, big-sized, agile dominant male which is called overlord or resident male.**
- Rest of the group is formed by adult females, subadult females, male and female juveniles, and infants.
- Adult male is the leader and coordinator of group activity.
- He initiates and determines the direction of group movement and activities such as where to go, when to feed, where to sleep, etc.
- **Thus, in male bisexual groups or hanuman langur it is usually the adult male who alone defends the territory.**
- He herds females away from intruding males of all male groups. Generally, he alone indulges in fights. Very seldom females may also participate in the fights.
- The overlord (male) is much larger than females and is dominant over all the members of his group and **there is no dominance hierarchy among females is dominant**
- Male parent investment is almost nil.
- The antipredatory strategy of langur involves climbing up the tree branches with all agility.
- Changing of overlord in a unimale bisexual group is of common occurrence.

iv. AGGREGATE SINGLE MALE GROUP WITH BONDED FEMALES AND OFFSPRINGS:

- Examples. **Baboons.**
- The baboons are large sized primates found in Ethiopia and Somalia; the males have heavy mane around neck and have dog-like muzzle.
- In their social organisation several females are more or less permanently bonded to a single male forming a so-called "**harem group**".
- A number of such groups band together, moving and foraging as a unit, perhaps 40 to 50 strong baboons.
- Thus, baboons form large troops on cliffs to sleep together.
- The troops separate into bands before travelling to foraging areas each morning; bands fragment into one male unit while foraging and then reunite into bands to travel back to the cliff in evenings and nights to sleep together as a large multiple-bisexual group.
- Adult males form temporary consort ship (separate from the group) with females as they enter reproductive phase. Otherwise move generally within the group.

v. MULTIMALE BISEXUAL GROUPS:

- Examples: **Rhesus monkey, gorilla, spider monkey, squirrel monkey, etc.**
- Typically, there are 3-8 adult males in a group, each of which has bonded females who remain with their infants.
- In a way, there are many small units living together thus forming a big group (sometime up to 180 or more individuals).

Sometimes there are following two major types of individuals within multimale bisexual grouping:

1. Those which do not divide in smaller feeding groups, e.g., **gorillas.**
2. Those which divide daily into smaller feeding groups, e.g., **rhesus monkeys.**

IN GORILLAS:

- the group is typically a multimale bisexual type with several males and sever females, all the members remain together.
- The males have dominance hierarchy.
- The most dominant is called **alpha**, then **beta**, **gamma** and so on.
- There is a simple linear dominance hierarchy among the adult males of a troop.
- But there is no clear-cut dominance system among females.

- In a typical group of gorillas of 20 individuals, the oldest and or largest male, develops grey hair on his back and is called silver back.
- He is also most dominant; rest of the males would be lower in status.
- Dominance consists of possession of right to the way on narrow path, or to a resting place or feeding site.
- Surprisingly, in contrast to all other primates, dominant males in gorilla are not very aggressive and all other males also have access to receptive females.
- There is no conflict for the females.

RHESUS MONKEY:

- It is widely distributed in India and lives in large multimale bisexual groups.
- **The males have dominance hierarchy and in them, the bonded females acquire dominance from the males they have been affiliated or bonded with. For example, if the alpha is most dominant male, his bonded females will enjoy high place in dominance hierarchy among females and rest of group members, even their infants acquire that dominance.**
- The dominant males can be identified easily by their confident walk and by their long strides, they carry their tails up and a subordinate male walks carefully and tucks its tail between the hind limbs.
- If the alpha male goes away from the group for a short while the beta male raises its tail and as soon as the alpha returns it again takes the tail down.
- The group may split temporarily into family units for foraging. All family units remain near vicinity and can unite at the time of danger, for day resting and every evening for roosting.

vi. DIFFUSE SOCIAL PARTIES.

- Examples. **Chimpanzee.**
- The chimpanzees represent the living apes, the closest relative of humans.
- Chimpanzees share about 99 per cent of their genetic material with humans.
- Chimpanzees are expert climbers, rest in sitting posture and walk on hind limbs but run on all four limbs.
- Chimps usually live-in groups.
- Males guard territory and restrict entry of males from other groups.
- The whole community searches food but breaks into smaller parties in case when food availability is less, group size of chimpanzees is thus proportional to the food availability.

- Furthermore, in small groups (n =3 to 6), each member has responsibility of searching its own food.

SPECIAL FEATURES OF PRIMATE SOCIALIZATION:

1. Primate groupings are close associations of conspecifics residing in a territorial limit.
2. Each member has access to all kinds of information relating to food, water and danger, within the group and also to activities of neighbours.
3. Group size may vary from two to hundreds of members.
4. Clustering is always avoided and optimum group size matches perfectly to the amount of food and also furnishes adequate sleeping site.
5. The social grouping is based on the basis of rank relations, alliances and rivalries.
6. A close tie exists between near-relatives and loose bonds are found between nucleus and peripheral individuals. This type of social organisation is exemplified by the monkeys.
7. Reproduction is all year phenomenon and young-ones have close relations with male and females of all ages, until they are mature themselves to play distinct ecological and adult roles.
8. The group composition is adapted to life in a certain environment.
9. Primate societies lacks blind following. Instead, all members communicate with each other through sounds and gestures and also by watching the behaviours of others in the group.
10. Each individual is constantly responsive to the posture, movements, gestures.
11. Primates' social organization is meant for constant exploration during daily walks on the basis of memory for the life purposes.
12. Primate societies have distinct division of labour and rank ordering.
13. The task of decision making, child nursing, defence, foraging, exploration of new areas of food and sleep sites are performed by the animals according to status they enjoy in the group.
14. Status, rank ordering or role distribution is based on age, sex and personality of the individual.

ADVANTAGES OF SOCIAL ORGANIZATION:

- 1) A permanent social structure is maintained.
- 2) A complex communication within the group is established which could be easily understood among the members of group.
- 3) Specialization based on division of labour is seen in order to maintain confusion about work distribution.

- 4) Strict cohesion among the members is seen where each member in the group defends for other and fight if needed.
 - 5) Impermeability to conspecifics.
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Manu Vijayanarayan