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Social life in Insect

કીટકોનું સામાજિક જીવન

(I) Social Behaviour (સામાજિક વર્તણૂક)

- In a broader sense , any interaction(પ્રતિક્રિયા) between two or more individuals constitutes social behaviour. Usually , social relationship implies (સૂચવવું) interaction among(સમૂહ માં) member of the same specious. The mere(માત્ર) presence of more than one individual does not mean that the behaviour is social. Various types (વિવિધ પ્રકાર) of associations occur among insect (કીટકોના સમૂહમાં આવા જોડાણો જોવા મળે છે.)

- **(I) Solitary Insects.(એકાકી,એકલું)**

When each individual is more or less independent , insects are called solitary.They forage(ખોરાક) independently and the two sexes come in contact only mate(સવનન).The female deserts (તજીદેવું) her eggs or dies after laying (મૂકવું) , and does not look(સંભાર) after the offsprings (સંતતિ).

Solitary Insects.(એકાકી,એકલું)

Wasps (ભમરી)



- (ii) **Gregarious insect** (સમુહમાં કે જૂથમાં રહેનાર કીટક):
- Many solitary insects are gregarious , that , is they form dense (ગીચતા)but temporary population or aggregations (સામુદાયિક નિર્દેશન, જૂથમાં રહેવું)in response to factors of physical environment or to share certain common needs or tracts. Thus , light at night stimulates large numbers of moths and other insect to collect around it . High humidity under a log causes aggregations of wood lice . Caterpillars (પતંગિયું વગેરેની ઈયળ)of the same or different species may live together and act in mutual cooperation (અરસપરસ નો સહયોગ).Ladybird beetles assemble together for hibernation . Locust and may-flies come out in huge swarms(મોટા ટોળા રૂપે) None of these groups is strictly speaking (આમાંથી કોઈ સાચા અર્થમાં સામાજિક નથી), social.

Gregarious insect (સમુહમાં કે જૂથમાં રહેનાર કીટક):

Lady bird Beetles (લેડીબર્ડ ભમરો)



Gregarious insect (સમુહમાં કે જૂથમાં રહેનાર કીટક): **Locust (તીસ)**



Gregarious insect (સમુહમાં કે જૂથમાં રહેનાર કીટક):

Mayfly (મેફ્લાય)



Ladybird beetles(લેડીબર્ડ ભમરો) assemble together for hibernation(શીતનિદ્રા) . Locust and may-flies come out in huge swarms(મોટા ટોળા રૂપે) None of these groups is strictly speaking (આમાંથી કોઈ સાચા અર્થમાં સામાજિક નથી), social.

Gregariousness being (હોવું)a temporary habit (કામચલાઉ આદત) it does not involve(સમાવેશ થવો) any association (જૂથ,સમાજ)of the parents and the offsprings and has nothing to do with the evolution of the social behaviour among insect

- (iii) **Social Insect:** (સામાજિક કિટક)
- On the other hand , insects of a given species(નક્કી સ્વીકૃત જાતિ ઓ,આદતવાળી) that live together in organised groups (આયોજન કરનાર સમૂહ)or colonies (વસાહત) are known as social insect . In a social organisation many individuals (વ્યક્તિગત)of species live together in an integrated manner (સંગથીત વર્તન)so that each contributes(પોતાનું કામ) in some specialized way to the welfare of all.(એક ચોક્કસ રીતે કરે છે. બધા ના ફાયદા માટે)

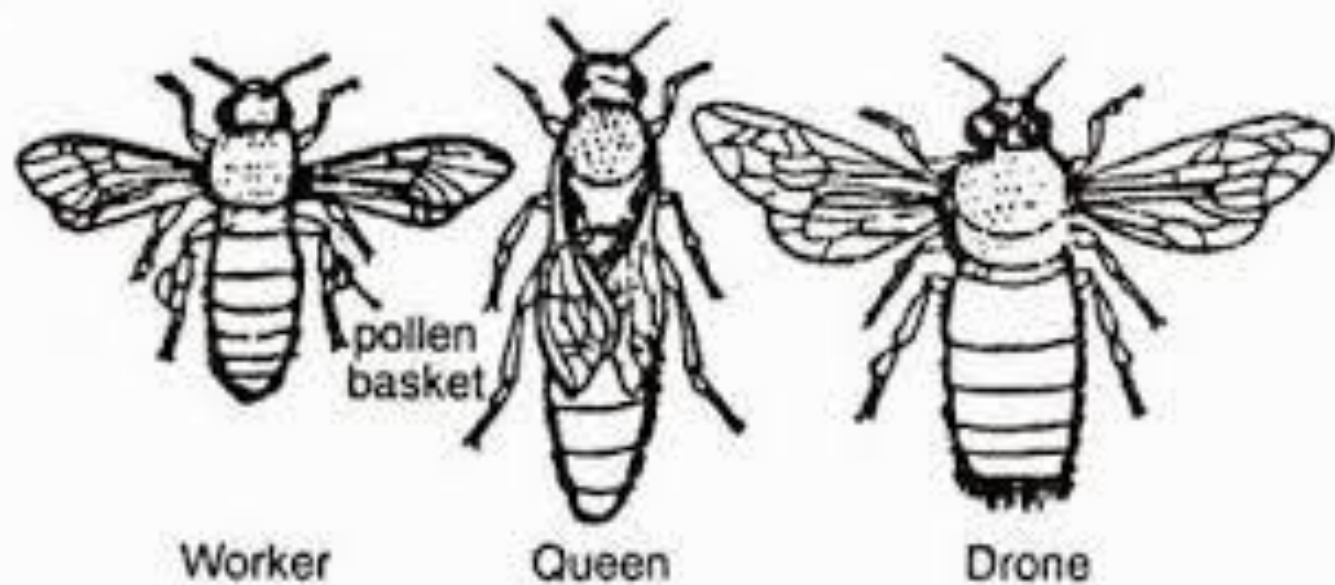


Fig. 5.29 : The various castes of honey-bee (*Apis mellifera*)



Drone

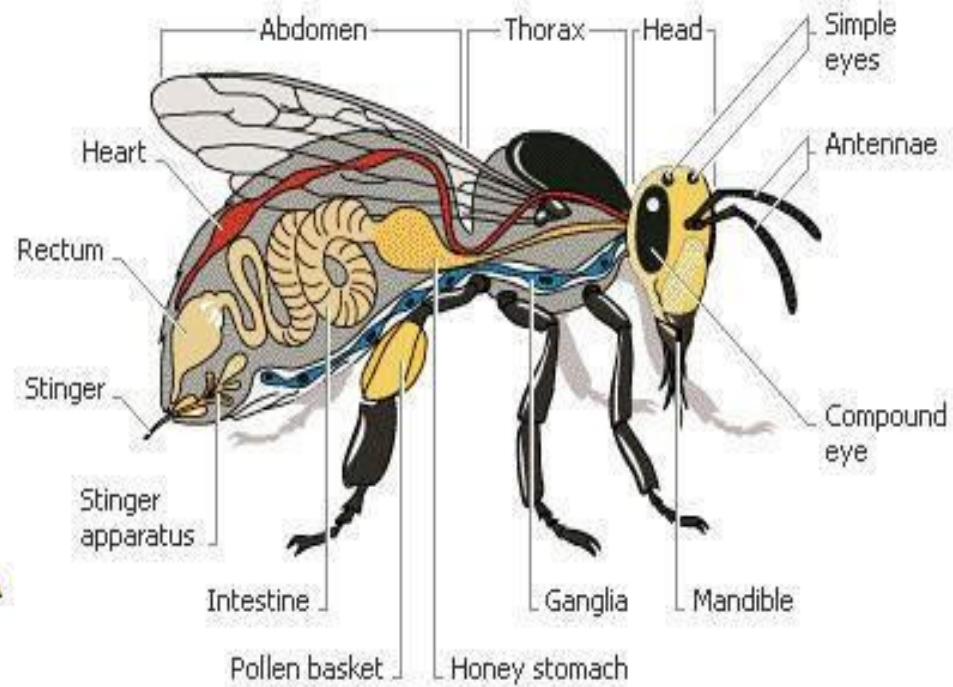


Worker



Queen

Worker Bee







(II) Evolution of Social habit

(સામાજિક આદત ની ઉત્ક્રાંતિ)

- Among the oldest and most highly developed societies in the animal kingdom are those of insects. Three hundred million years ago these societies were already in existence (અસ્તિત્વ). Social habit has arisen (ઉત્પન્ન થવું) independently in several orders (શ્રીણી) of insects. Transition from solitary to social life in these usually short-lived animals was made possible by the prolongation (લંબાણ, લાંબી પ્રક્રિયા) of adult or parental life and increasing parental care. First the progeny depended on the parents, then the parent on the progeny (સંતતિ).

(III) Orders of Social Insects

સામાજિક કિટકોની શ્રેણી

- Social species of insects belong to seven orders , namely
- (1) Orthoptera – (ortho- straight, ptera- wing)
 - Cockroaches , gryllotalpa
- (2) Dermaptera – (derm –skin,ptera-wing) Earwing
- (3) Isoptera- (isos – equal,ptera-wing) termite
- (4) Embioptera – (Embia – genus name,ptera-wing)
 - web spinners
- (5) Psocoptera – (psocos- gnawed,ptera-wing) booklice
- (6) Coleoptera – (Koleopteros- sheath,ptera –wing)beetles
- (7) Hymenoptera – (humen – membrane ,ptera –wing)
 - Bees , wasp and ants.

- About 6.000 species of insect in all exhibit social insects , including nearly 500 species of bees , 800 species of wasp and 1000 species of termites and 3500 species of ants

(IV) Gradation of Social behaviour

સામાજીક વર્તુણક ના ક્રમો(વર્ગીકરણ)

- Various gradation between the two extremes (આદિ અને અંત) of solitary and social insects are evident(સ્પષ્ટ) in existing species.(હાલની અસ્તિત્વ ધરાવતી જાતિમાં)
- **Solitary insects** (એકાકી,એકલું) , such as mosquitoes and dragonflies , drop their eggs anywhere and go about their business . Butterflies and flesh flies lay their eggs on food suitable for the young. Solitary digger wasp digs a hole (ખાડો ખોદી કાઢવો), Provisions (તયારી કરી રાખવી)it with food such as paralysed (લકવાગ્રસ્ત)caterpillars and spiders , seals the entrance and depart, never to see its offspring which later hatches(સેવન થઈ ને ઈંડા માંથી બહાર આવવું) out and grows independently.

- Butterfly



flesh fly



- Spider



caterpillar(εχιδνα)



- **Sub-social insects**(ઉપ સામાજિક કિટક) represent (પ્રતિનિધિત્વ) a further (આગળ) step towards (ની દિશામાં) social habit. They provide a mass of food for each egg but remain (તે જગ્યાએ રહેવું) to guard the nest or young. In some species of dung beetles (હંગાર પર રેહનારો ભમરો) female collects and rolls a ball of dung, excavates a burrow (દર બનાવવું, ખાડો ખોડવો), drop the ball in , lays eggs and depart (જતા રહેવું). In other species , the male assist (સહાય) by guarding (રક્ષણ) the dung balls while female excavates (ખાડો ખોડવો)



- dung beetles(હંગાર પર રેહનારો ભમરો)



- In still (હજી પણ)another species , both the sexes dig chamber (ખાડો ખોદીને ગુહા જેવું દર બનાવે છે.) stock (જથ્થો ભરવો)them with dung on which the female lays eggs , then guard them until the eggs hatch. At this time all disperse(વેર વિખેર થવું).
- A Female earwig guards her eggs and later the young.Cockroaches , crickets , some bugs ,web spinners , and book lice do likewise.

- **True social insect** (સાચા સામાજિક કિટક) , on the other hand , forage for food (ખોરાક ભેગો કરવો)for the colony continuously (સતત), the two parents live longer so as to come in association with many generation of their progeny , and the young's cooperate in caring for the next generation. Only a few insect species have been able (સમર્થ) to develop social habit completely . Most highly developed and complex of insect societies are found in termite (Isoptera) , and the ants , bees and wasp(hymenoptera)

Honey-bee

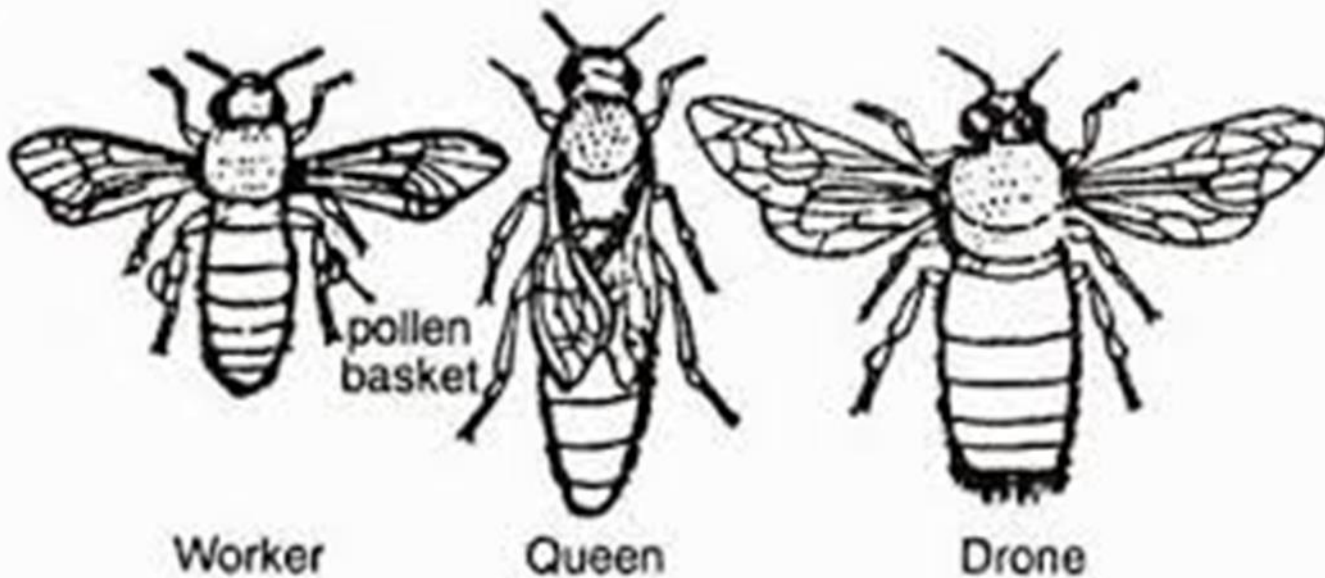
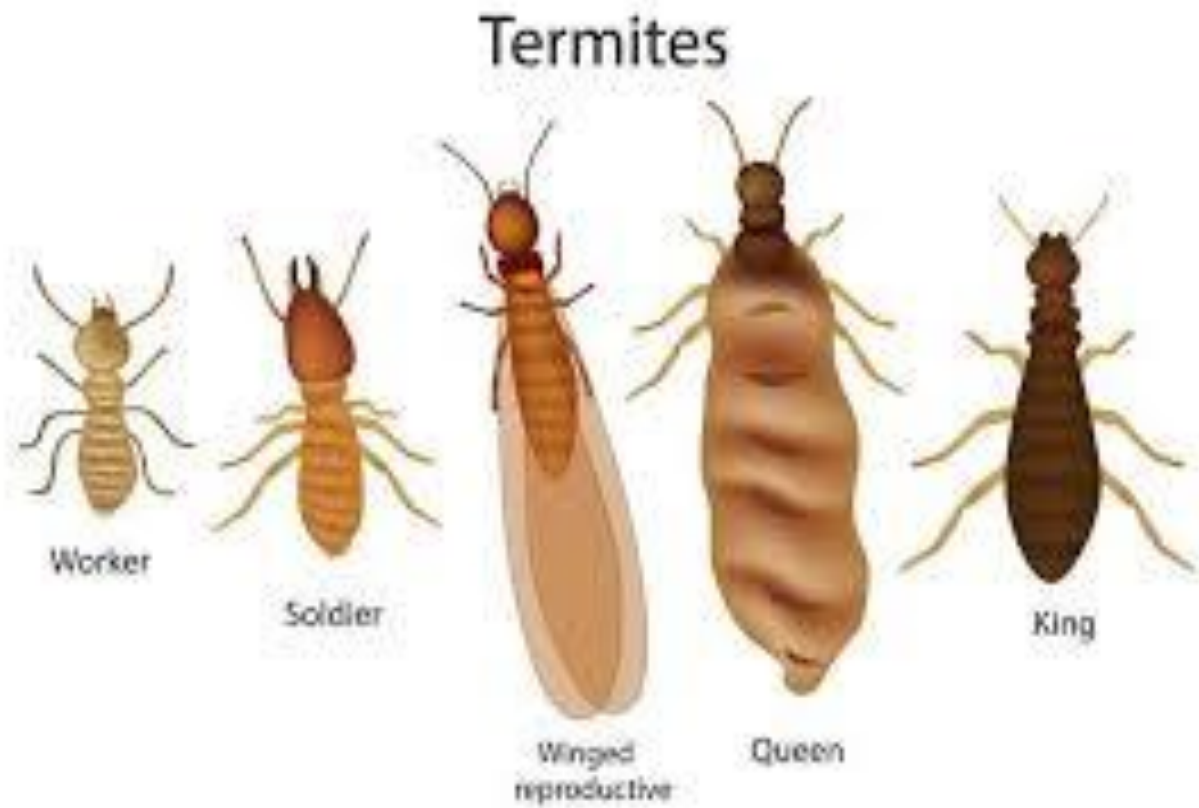


Fig. 5.29 : The various castes of honey-bee (*Apis mellifera*)

Termite



Ant



wasp(hymenoptera)



(v) Characteristics of social insects

સામાજીક કિટક ની લાક્ષણિકતા

- All the social insect possess (ધરાવે છે) certain characteristics in common , which are as follows:
- 1) Large population (colonies):

Many individuals of a species of social insects live together in an integrated manner(સંગૃહીત રીતે) in a comparatively large group or population which is not gregarious. Term “colony” is commonly applied to the complex society they form. Number of individuals forming a colony ranges from 35,000 to 50,000 in honey bees , up to 60,000 in ants and several millions in termites. Colonies are matriarch , i.e. All members of a colony are the offspring of a single female and hence(આને લીધે) all have very similar genotypes (આનુવાંશિક રૂપ સરખું હોય છે .)

- Ordinary (સામાન્ય) , a society of social insect does not accept members from other colonies of the same species.

2) Elaborate (જટિલ રચનાવારું) nests:

Social insects construct more or less elaborate nests for protection , storage of food and maintenance of broods(સંતતિ જાળવણી). Some interesting habits of bees , ants and termites regarding (ની બાબતમાં)their nest and broods are summarized (ચાદરાખવું)in the adjacent table(નજીક નજીક નો ક્રમ).

- 3) Extra population of nest:

Some small crustaceans , mites , beetles and other insects are attracted by the high temperature and surplus food of the nests of the ants and termites and get protection from their enemies.They live in close symbiotic relationship with the hosts. Guests or the outsiders feed upon the debris (કચરો)or waste of nest and the dead bodies of the host.

Slave-making ants brings egg , pupae and adults of other ants and take from them functions of slaves.

ગુલામ બનાવતી કીડીઓ અન્ય કીડીના ઈંડા,પ્યુપા અને પુખ્ત પકડીને લાવે છે,અને તેના પાસે ગુલામીનું કાર્ય કરાવે છે.

- Intruders (ધુસણખોર) or thieves (ચોર) rob (છીનવી લેવું) the social insect of their food and brood. Some beetles (e.g. *Atemeles*) live in brood chambers of the ants, where the beetle larvae eat the ant larvae with impunity (સજા). Both larvae and adult of the beetle secrete pheromone (પેરોમોન) like substances which serve to appease (શાંતપાડવું) the aggressive (આક્રમક) tendencies (વલણ, વૃત્તિ) of the ants.
- Predator (શિકારી) insects prey (શિકાર) upon the social insects, staphylinids attack wasps and bee, while bee moth attacks the wax of honey bee hives (શિરસ).

Polymorphism(Caste System)(બહુરૂપતા)

- Typically social insects have a division of labour . Members are differentiated into distinct castes (ચોક્કસ જાતિ તફાવત) , which are specialized in structure , function , (Reproduction , feeding , guarding , etc.) and behaviour. Principal castes are the reproductives (King and queen) and the sterile members (Worker and Soldiers). Worker are the smallest in size . Queen is the largest with a long abdomen and lays egg. It lives for several years. Male are intermediate in size and develop parthenogenetically (સ્વજનન, અનીષેક જનન, જન્ય) from unfertilized eggs. In Social wasps , bees and ants workers are sterile female . In termite and some higher ants , workers and soldiers belong to both sexes.

- In termites , a special soldiers – caste exists (હોલ્ડી), called the nasute(નાસ્યુટ) , with an elongated projection on the head .The greatest diversity of castes (Polymorphism,બહુરૂપકતા) is found among (સમુદાય)ants , and all forms may have large and dwarf individuals.
- Castes determination (નિશ્ચિત કરવું) depends upon a number of factors. In Hymenoptera (bees , wasp and ants) , genetics and nutrition form the basis of differentiation. Males are haploid and developed parthenogenetically (સ્વજનન,અનીષેક જનન,જન્ય) from unfertilized eggs.
- Queens , workers and soldiers are diploid females which develop from fertilized eggs. Differences between queen and worker are mainly due to differences in the quantity and quality of their food.

- Bee larvae destined (નક્કી હોવું) to become queens are fed in royal jelly a few days and then are fed bee bread (honey and pollen) . Bee larvae destined to become workers and drones (કામકરનાર , નર) are fed entirely (સંપૂર્ણપણે) on bee bread (honey and pollen).
- In Isoptera (termites) , determination (નિશ્ચિત કરવું) of castes is due to extrinsic factor (બાહ્યલક્ષણ) rather than to genetical ones. Reproductives and soldiers secrete ectohormones containing inhibitory substances (અવરોધક પદાર્થ). when fed to nymph (અપરિપક્વ) , these substance prevent them from developing into like forms (soldiers and reproductives).

Cohesiveness of conoy (વસાહત ની સુસંગતા)

Division of labour or sepration of function requires great coordination , (કાર્યની વહેચણી માટે સંકલનની જરૂરિયાત ખુબ જરૂરી છે.) for the group must perform as a biological unit.(જ્યારે તે સમૂહ જીવવિજ્ઞાન એકમ તરીકે કામ કરી રહ્યો હોય).All the members of an insect society live in an integrated or cohesiveness manner (સુસંગત રીતે) , Subordinated to the life of the community.(સમાજ જીવન માટે આ ગોંણ છે.). As a result , various castes , which differ in structure and physiology , can not live indepndently. They work in cooperation and with mutual benefit.(પરસ્પર એકબીજના સહકારથી). For instance(દાખલા રૂપે) , many females mutually cooperate so that one worker looks after an egg(larva) laid by another female (queen) and so on.

- Success with them is measured in term of the colony and not of the individual. Different castes are bound (બંધન કરતા, જોડી રાખવું) toghther by chemical and physiological mechanisms rather than structure.

Parental care

- Basis for the family relationship is the provision (જોગવાઈ) of shelter (આશ્રય – સ્થાન), food and defence (સરક્ષણ) for the young. Thus (આમ) social life in insects is correlated (સંકરાયેલું) with the lengthening (લંબાવું) of the adult or parental life and increasing parental care. It provides greater association of parents and young. Parental care includes various activities such as provisioning of food , cleaning and feeding of young and queen , removal of debris (કચરો) and bodies , taking away and putting eggs in proper chambers (ચોગ્ગ ગુહા), cooling of chamber in summer and protecting queen from winter by clinging and clustering (સમુહમાં) about her , by workers. Parental care is instinctive behaviour. (સહજ, કુદરતી)

Progressive provisioning of food (પ્રગતિશીલ,બચાવ(વ્યવસ્થા) ખોરાકની

- Stingless bees and potter wasp lay their eggs singly or in small group and provide sufficient mass of food at the same time for the complete development of the larvae which hatch out from the egg.(ઈંડા માંથી સેવનની પ્રક્રિયા થઈ ને દિમ્મ બહાર ન આવે ત્યાં સુધી).This is known as mass provisioning of food. But true social insects (bees,ants and termites) feed their young extensively (વ્યાપક) and continuously(સતત) from day to day until they metamorphose in to the adults. This is known as progressive provisioning of food.

- Ants show a progression(પ્રગતિ) of food habits such as probably occurred in man's history (માણસ માં કદાચ આવું જોવા મળે છે.). Lowest kinds (army ants) hunt (શિકાર)insects or flesh(માંસ). Pastoral(પશુપાલક) ants feed on the honey dew produced by aphids (માંકડ). They carry these “ant cows” (aphids) into over(પૂરો) wintering (શિયાળો) quarters (નિવાસ)and protect(રક્ષણ) them from predators(શિકારી). Harvester (કાપણી કરનાર) ants gather and store seeds in summer to tide them through the winter. Finally(છેલ્લે) the leaf-cutter or fungus growing ants(Atta) grow their own pure crops of fungi in underground gardens fertilized with organic debris. These ants cut leaves and carry them underground to serve as substrate for growing pure strains of fungi on which they feed .

- A young queen , upon setting Out to find a new colony , carries a seed stalk of fungal hyphae in a pouch below the mouth.

Trophallaxis (ટ્રોફલેક્સીસ)

- Exchange of food between one insect and other is known Trophallaxis . Ants and termite feed one another from mouth to mouth. Young exchange food with the adult . Some ants feed some beetles , coccids and aphids and return imbibe (ચુસીલેવું) a fluid secreted by them.
- In termite , trophallaxis plays an important role in the regulation and detrmiation of castes (નિયમન અને જાતિ નક્કી થવી). Ectohormones containing inhibitory (અવરોધક) substances are secreted by the reproductives in the sodires. During mutual(અરસપરસ) feeding (trophallaxis) , These are passed on the nymphs (ડીમ્બ), and prevent (અટકાવવું)them from developing into individuals of the same sex or caste.

- This tends to keep caste number within bounds. Some undifferentiated nymph may not come under the influence(અસર) of trophallaxis and may become additional (વધારાના) members of the same castes.





Swarming(સમૂહ માં રેહનાર)

- Swarming occurs as means of alleviating (ઓછું કરવું) congestion(ગીચ પણું) in the overcrowded colony. Or as a means of distribution. In many , swarming occurs for feeding , migration, and mating. Mostly mating takes place between the queen and the males during swarming, called the nuptil (લગ્નવિષયક)or marriage flight(પલાયન). Honey bee propagate (પ્રચાર,યુક્તિ ,પ્રયુક્તિ) colonies by swarming. Each swarm consist of an old queen and many workers and produces a new colony.
- C.G. Butler (1961) found that the queen has over her body a so-called queen substance, secreted by her mandibular gland .

- In habitis workers from becoming queens when they share this substance (trophallaxis).Swarming may come about in an overcrowded colony because this substance may not be distributed properly (યોગ્ય રીતે વિસ્તરણ)to all workes.

Protective devices

- Social insects develop several devices . stings (શંખ)are developed in most bees and certain ants. Jaws are highly developed in stingless bees and termites to ward off (સંકટ દૂર કરવું) enemies.Sometimes , a few guards are posted at certain convenient place near the nest.Guards protect the nest and attack the intruders(ધુસણખોર) in a few cases.Nest are also made in protective localities such as ground , hollow trees , mud , paper etc., and have numerous side exits through which rapid (ઝડપી)escape (ભાગીજવું)is possible at the time of danger.

Communication(સંદેશા વ્યવહાર)

- Both social and non-social insect utilize chemical , tactile (સ્પર્શ) , visual and auditory signals as methods of communicating with each other. Chemical communication occurs with help of body secretions called pheromones (stimulate). These are secretions of exocrine glands that pass the out side of the body and play an important role in regulating and coordinating the activities of a colony of the same species (E.O.Wilson , 1965). Pheromones (ઉત્તેજક દ્રવ્યો) include sex attractants , the queen substance and other types whose influences (પ્રભાવ , અસર) are useful to the colony. Substances deposited on the ground by ants returning from a foraging trip serve as a trail (માર્ગ) marker (ચિહ્ન) for other ants. Substances released by the dead body of an ant within the colony stimulate other workers to remove the body.

- In Honey bee , a queen substance produced by the queen's mandibular glands , controls nursing behaviour of the workers , caste determination and swarming . Language (୧୩୩) of the bee (Von Frisch, 1950) represents a most revealing method of communication known among insects. Some aspects (୧୩୩), such as the tail wagging dance , set the honeybee apart from all other social insects.

Comparison of human and insect societies

- Highly evolved (વિકસિત) organization (સમાજ) and cohesiveness (સંયોજકતા) of insect societies often (બારંબાર) prompts (પ્રેરવું) comparison with human societies.
- 1) Similarities:- Some notable similarities are as follows.
- (I) Human Societies originally began (શરૂ કરવું) as discrete (સ્વતંત્ર) families (one female and her offspring), but this is not repeated (પુનરાવૃત્ત) phylogenetically (જાતિયવૃત્તિની દ્રષ્ટિએ) . Insect societies also arise from discrete (સ્વતંત્ર) families and by swarming frequently found (સ્થાપના) new colonies.

- (II) Human societies comprise integrated (એકીકૃત) group of like individuals (castes) that specialize in different trades(સંગઠન) or profession(ધાર્મિક સંગઠન).They benefit both the individuals and the group by their cooperative effort(સહકારપૂરવકના પ્રયત્ન).
- Insect societies also have distinct(ચોક્કસ) castes performing (જાતિય અભિનય)various functions and living together in an integrated (એકીકૃત)manner(વર્તન ,રીતભાત).