Women University Press
Jayoti Publication Desk
ISBN No. : 978-93-90892-89-1

BASICS OF APICULTURE

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UGC Approved Under 2(f) & 12(b) | NAAC Accredited | Recognized by Statutory Councils

Printed by :
JAYOTI PUBLICATION DESK

Published by :
Women University Press
Jayoti Vidyapeeth Women's University, Jaipur

Faculty of Agriculture & Veterinary Science

Title: Basics of Apiculture

Author Name Dr. Suresh Jakhar

Published By: Women University Press

Publisher's Address: Jayoti Vidyapeeth Women's University, Jaipur
Vedaant Gyan Valley,
Village-Jharna, Mahala Jobner Link Road, NH-8
Jaipur Ajmer Express Way,
Jaipur-303122, Rajasthan (INDIA)

Printer's Detail: Jayoti Publication Desk

Edition Detail: I

ISBN: 978-93-90892-89-1

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Chapter I

APICULTURE: INTRODUCTION, IMPORTANCE AND HISTORY

Insects ar dominant animals on this earth. typically insects ar thought of harmful to man however hardly one per cent of insect species fall within the blighter class. advantages of insects in maintaining economy outweigh the injury inflicted. Honey bees ar one amongst the few insects directly useful to man.

- In the kingdom Animalia honey bees belong to: Phylum-Arthropoda, Class- Hexapoda, Order-Hymenoptera, Superfamily-Apoidea and Family-Apidae.
- Honey is extremely valued food created by honey bees and it's conjointly used as medication. additionally to honey, different product like bees wax, pollen, secretion and bee venom also are created by honey bees.
- More than the producers of those hive products; bees play a vital role in fertilization of plants whereas aggregation their food from flowers within the variety of nectar and spore.
- Pollination is concerned in a very chain of complicated events important to our economy. fertilization by insects as well as honey bees is very important for ecological balance.
- Visitation by honey bees between distant varieties or cultivars promotes hybridisation and facilitate distributed populations to survive. Their mutual dependency has resulted into nice degree of co-evolution.
    - The science of rearing honey bees or apiculture is thought as cultivation.

      We can learn heaps from these very little tremendous creatures. Honey bees ar loved for
    - Their diligence
    - Unity
    - Self sacrifice
    - Tolerance
    - Division of labour
- Even the foremost feared bee stings facilitate in healing muscular pains, rheumatism, inflammatory disease and reduction in sterol level.
    - An ideal hobby
    - Part-time business.
    - Full-time business.

History of apiculture

- Primitive man wont to rob bee colonies found within the cavities of hollow trees or on rocks and in ancient mud homes and this can be still being followed by some tribes
- There was no development in apiculture till sixteenth century.
- Proper apiculture started only if man started offering protection to colonies found within the nature
- Idea to stay bees in log hives has been reportable to come back from the fallen trees that were nested by the cavity nesting bees.
- Development of contemporary apiculture has its origin between 1500 and 1851 once several tries were created to domesticate bees in several sorts of hives however weren't triple-crown as a result of bees hooked up their combs along yet on the walls of hive and combs needed had to be cut for honey.
- The discovery of the principle of bee area in 1851 by L. L. Langstroth in USA resulted in initial really movable frame hive. This bee area was nine.5 millimetre for Apismellifera.

Beekeeping in India

- In India initial commit to keep bees in movable frame hives was created in 1882 in geographic area and so in 1883-84 in geographic area.
- In south Bharat, Rev. Newton throughout 1911-1917 trained many beekeepers and devised a hive for autochthonous bee Apiscerana supported principle of bee area (which was named when his name as “Newton hive”).
- Beekeeping was conjointly started within the Travancore state (now Cochin) in 1917 and in Mysore in 1925.
- In Himachal Pradesh fashionable apiculture with autochthonous honey bee A. cerana started in 1934 at Kullu and in 1936 at Kangra.
- The exotic bee A. mellifera was with success introduced for the primary time in Bharat in 1962 at NagrotaBagwan (then in geographic area state and currently in Himachal Pradesh), as a result of this bee has potentials to supply additional honey.
- At gift each the hive bee species ar getting used in fashionable apiculture and heap of honey is additionally being collected from the wild bees viz. A. dorsata and A. florea.
- India is manufacturing roughly 70000 metric plenty of honey annually from all the four species of honey bees.

Chapter II

DIFFERENT SPECIES OF HONEY BEES

There are four well known species of true honey bees (belonging to genus *Apis*) in the world:

i. Rock bee, *Apisdorsata* F.

ii. Little bee, *A. florea* F.

iii. Asian bee, *A. cerana* F.

iv. European bee, *A. mellifera* L.

***Characteristics of four well known species of honey bees**:*

	Apisdorsata	***Apisflorea***	***Apiscerana***	***Apismellifera***
Nesting	Open nesting. Builds single large comb (ca $1m^2$) attached to branches of trees or rocks etc.	Open nesting. Builds single small comb (ca size of palm of hand) fixed to branches of bushes.	Cavity nesting. Builds many parallel combs in cavities of tree trunks, hollows of rocks, poles and other covered places	Cavity nesting and similar in habits to *Apiscerana* and builds parallel combs.
Distribution in India	Found in plains as well as hills up to 1600 metres above sea level. Highly migratory.	Found in plains up to 300 metres above sea level. Highly migratory.	Found throughout India having 3 subspecies	Exotic bee to India. Introduced successfully in 1962. It has many subspecies (more than 23)throughout world

Size	Biggest honey bee (16-18mm)	Smallest *Apis* bee (9- 10mm)	Medium size (14-15mm)	Medium size (14-16mm)
Swarming/ Absconding	Strong tendency	Strong tendency	Strong tendency	Only in African sub species
Temperament	Furious	Mild	Furious	Gentle except African sub species
Average honey yield per colony/year	40 kg (wild bees; cannot be domesticated)	500 g (wild bees; cannot be domesticated)	5 kg (Hive bees; can be domesticated)	15 kg Hive bees; can be domesticated)
Method of honey extraction	By squeezing (unhygienic)	By squeezing (unhygienic)	By centrifugal honey extractor from the hived bees (hygienic).	By centrifugal honey extractor from the hived bees (hygienic).
Number of cells/10cm comb (worker cells)	18-19	32-36	21-25	17-19

SPECIES AND TAXON OF HIVE BEES

It is vital to understand distinction between a species and taxon. Species area unit reproductively isolated from one another and these cannot hybridize wherever as taxon area unit geographically isolated and might hybridize

Among the 2 domestic bee species, every has several taxon in several components of the planet e.g. Apiscerana has 3 taxon in India:

A. cerana cerana in Himachal Pradesh and Jammu and Kashmir (North India)

A. cerana indica in Kerala, Tamilnadu and state. (South India)

A. cerana himalaya in Nagaland, Manipur, Mizoram, state and Meghalaya. (Eastern components of India)

In addition to higher than 3 taxon, A. cerana japonica has been known from Japan.

A. mellifera has several taxon which may be placed beneath 3 groups:

1. jap taxon
2. European taxon
3. African taxon

Eastern subspecies:

i. Apismelliferaremipes (in Iran)

ii. A. melliferasyriaca (in Asian nation, Israel and Lebanon) These taxon don't seem to be appropriate for contemporary cultivation

European subspecies:

i. A. melliferamellifera (Dark Dutch or German bee)

ii. A. melliferacarnica (Carniolan bee; in Southern Austria)

iii. A. melliferaligustica (Italian bee; Italy)

iv. A. melliferacaucasica (Caucasican bee; USSR)

African subspecies:

Some of the vital taxon are:

i. A. melliferaintermissa (Tellian bee; Morocco and Lybia)

ii. A. melliferalamarckii (Egyptian bee; restricted to the Nile River Valley)

iii. A. melliferacapensis (Cape bee; the sole bee which may rear queen from eggs arranged by workers)

iv. A. melliferaadansonii (African bee; additionally called killer bee)

In India, all the four bee species area unit found. A. mellifera is associate degree exotic bee that was introduced in India for the primary time with success in 1962 at NagrotaBagwan, Himachal Pradesh. Honey yield from this species from stationary cultivation varies from 10-15 kg/colony however through migration yield will increase to 45-60 kg/colony. One granger in Himachal has extracted the maximum amount as 110kg honey from one colony of A. mellifera that is indicative of its potentials.

Other species found in several components of the world: additionally to the four Apis honey bee species, a lot of species are reportable from some components of the planet.

i. Apislaboriosa (from Kingdom of Bhutan, Yunnan and Nepal)

ii. A. breviligula (from Philippines)

iii. A. binghami (from Sulawesi)

Above 3 species agree A. dorsata and area unit wild

iv. A. andreniformis (from China) It resembles A. florea.

v. A. koschevnikovi (from Malaysia)

vi. A. nuluensis (from Malaya, Indonesia)

vii. A. nigrocincta (from Indonesia).

These 3 species (v - vii) agree A. cerana.

Stingless honey bees:

In addition to honey bees of arthropod genus, stingless honey bees additionally give honey that are:

i) Melipona sp.

ii) Trigona sp.

These bees are domesticated, however manufacture very little quantity of honey.

Pollen bees: All the honey bee species area unit sensible pollinators besides being honey producers. additionally to those, there area unit quite 20000 species of different bees that facilitate in fecundation. It ought to be clear that every one bees don't seem to be honey bees. Batra (1992) has even separated non Apis bees in a very separate cluster of ‘pollen bees’ that features all bees except honey bees that facilitate in fecundation.

Chapter III

GENERAL MORPHOLOGY

In honey bees, body components area unit changed as per their food habits and social life. like all insect, body of honey bee will be distinguished in to a few components (Fig. 3.1):

a. Head

b. Thorax

c. Abdomen

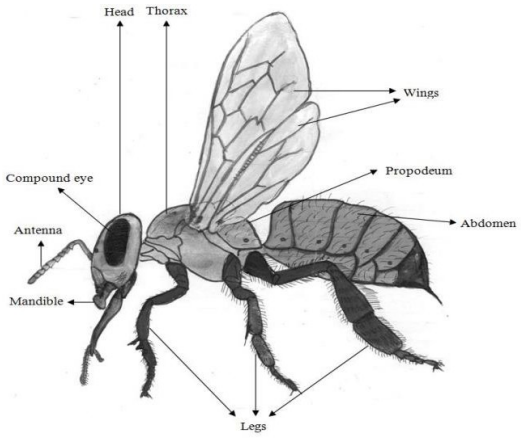


Figure 3.1 General morphology of a worker honey bee

HEAD

- Head Bears a combine of crooked antennae
- Two compound eyes on lateral facet of head. Bees will distinguish totally different colors however area unit red blind and might understand ultraviolet rays
- Head bears three ocelli (simple eyes) on prime portion that understand degree of sunshine

- Two mandibles area unit hooked up to ventro-lateral a part of head capsule. Mandibles take issue in form in 3 castes (Fig. 3.2). staff use mandibles for grasping and scrapping spore from anthers, feeding of spore and in manipulation of wax scales throughout comb building
- Mouth components of employee bees area unit changed for consumption and covering (Fig. 3.3). Tongue or proboscis (formed by medium lip and 2 lateral maxillae) is employed for ingesting liquids. lip has long median articulator and spoon formed lobe (flabellum) at the tip
- Inside the pinnacle there area unit long whorled strings of tiny lobes referred to as hypopharyngeal glands that secrete organ food referred to as secretion that's fed to queen and young larvae.

Figure 3.2 Mandibles of different castes of honey bees

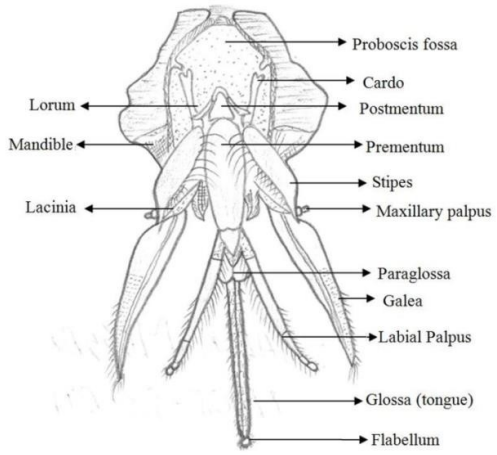


Figure 3.3 Mouth parts of a worker honey bee

THORAX

- It consists of 3 segments: thorax ,mesotmhorax and metathorax, every bears a combine of legs. Meso and metathorax, every bears a combine of wings (Fig. 3.5). Legs and wings area unit locomotory organs. additionally to locomotion legs in honey bees also are changed to perform following functions:
- Prothoracic legs function antenna cleaner. Basal a part of basitarsus incorporates a notch (Fig. 3.4) and alittle lobe comes from distal finish of leg bone (tibial spur). it's found all told the 3 castes.

- On mesothoracic legs, bushy tarsi function brushes for improvement of thorax. Long spine at finish of middle leg bone (Fig. 3.4) is employed for loosening pellets of spore from spore basket of hind limb and conjointly for improvement wings and spiracles. Wax scales also are aloof from wax pockets of abdomen by these legs.
- Hind or metathoracic legs take issue from alternative legs in being larger in size and with broad two-dimensional type of leg bone and basitarsus. In employee bees, swish somewhat cotyloidal outer surface of hind leg bone is fringed with long recurved hairs and forms spore basket or corbicula (Fig. 3.4)
- Two pairs of wings arise from sides of meso and metathorax. Fore wings area unit stronger than hind wings. Series of upturned hooks (hamuli) area unit gift on front margin of every hind wing. retrorse fold on rear margin of fore wing works as coupling equipment for holding hamuli and this end in unity of action of the wings on the wing.

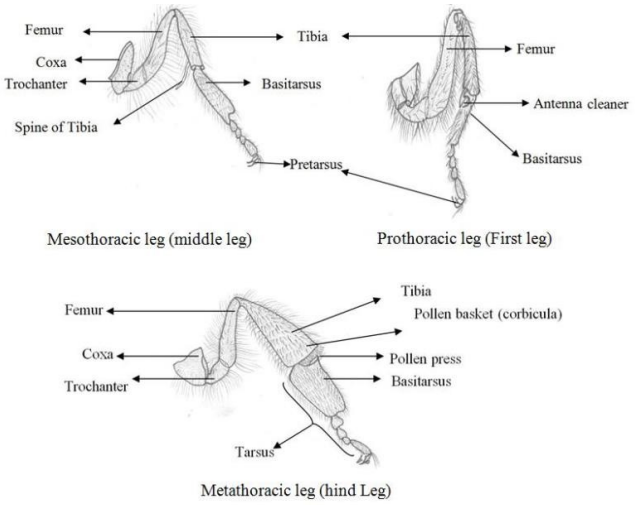


Figure 3.4 The legs of a worker honey bee

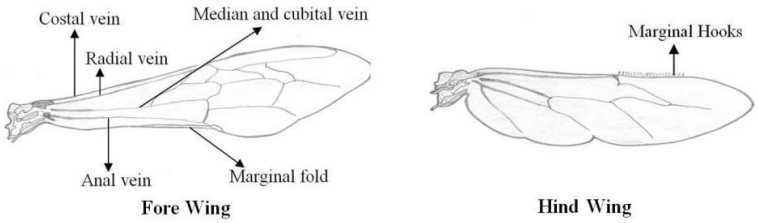


Figure 3.5 The wings of a worker honey bee

ABDOMEN AND ANATOMICAL

Abdomen

- First abdominal phase is united with the metathorax and forms anatomically a district of thorax referred to as propodeum
- Bee fauna has ten abdominal phases however in adult staff abdomen seems vi segmented; segments 8-10 area unit reduced in size and 1st segment (propodeum) is transferred to thorax throughout immature stage
- Abdomen bears sting, wax glands (on sternites four to 7) and scent glands (on last 2 terga) nd reproductive organ additionally to alternative viscus
- In staff giving birth equipment (ovipositor) is changed into sting
- Queen uses organ for giving birth and for stinging rival queen.

Important anatomical features:

- Digestive system is exclusive in having gorge with expanded honey abdomen that stores the collected nectar (Fig. 3.6)
- From honey abdomen food goes to pouch through X formed gap referred to as proventriculus, regulation passage of food to pouch. It removes spore from nectar and nectar is maintained in honey sac and spore passes to pouch. Nectar is regurgitated within the comb cells for conversion into honey
- Reproductive organs area unit absolutely developed in queen and drone however greatly reduced in employee.
- Sperms area unit hold on within the queen during a sac like structure referred to as spermatheca. The hold on sperms area unit utilised by queen throughout her life time as she doesn't opt for coupling once starts giving birth.

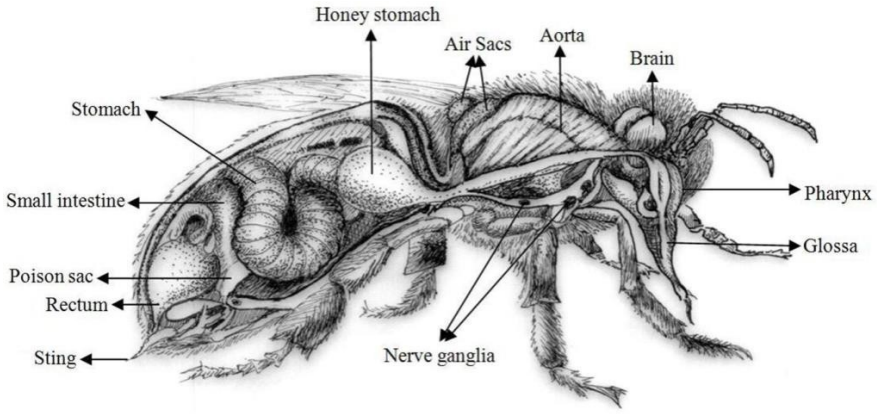
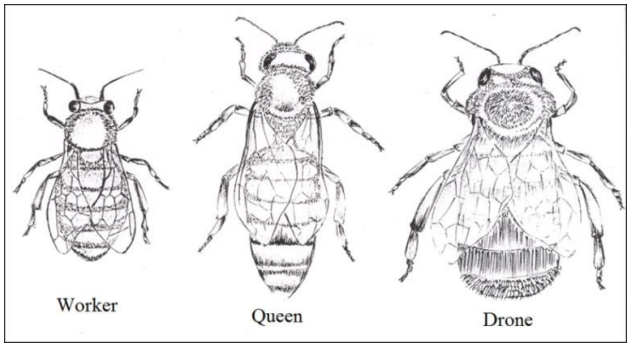


Figure 3.6 Anatomy of a worker bee
(Adapted from Grolier's Multimedia Encyclopedia)

Chapter IV

COLONY ORGANIZATION AND DIVISION OF LABOUR

Honey bees ar social insects and board colonies. a standard colony, throughout active season consists of three styles of individuals: one queen, thousands of employees (10000 to 30000 or perhaps more) and few many drones, that vary in size (Fig. 4.1). additionally, every colony has completely different biological process stages viz eggs, larvae and pupae that ar jointly called brood.

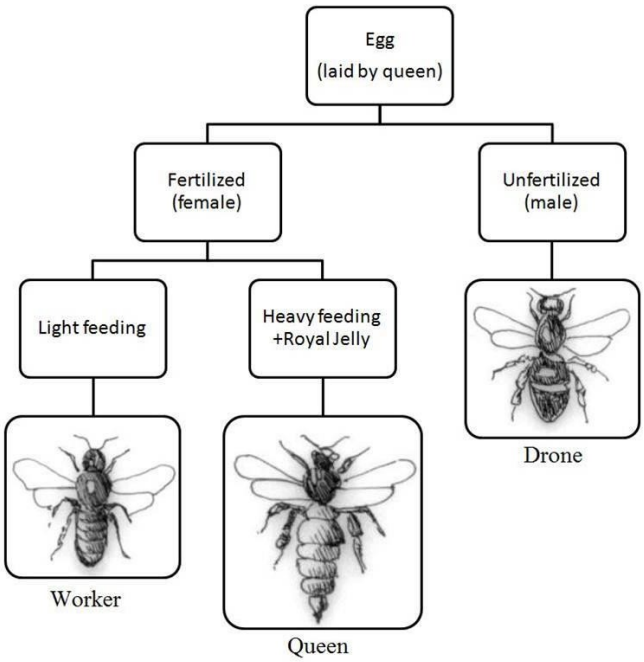


Queen:

- Only one queen is found in an exceedingly colony except beneath supersession or swarming instinct
- She is that the mother of the total colony manufacturing employees and drones and is that the solely absolutely developed feminine member of the colony
- Her perform is to get eggs. She doesn't have motherly instinct or ability to feed the brood. She is fed lavishly by an oversized variety of nurse bees with extremely nutritive food called secretion
- A sensible queen will lay 1500-2000 eggs per day
- A birth queen is that the longest bee within the colony. it's larger thorax than employee and her abdomen gets greatly distended throughout birth
- The queen lays each impregnated and sterile eggs. impregnated eggs turn out employees (also queens) and sterile eggs turn out drones (Figure four.2)
- A sensible mated queen may match satisfactorily for two or additional years, though queens will live eight years or longer. However, in industrial apiculture, queen is replaced per annum to stay high brood rearing in an exceedingly colony.
- Queen releases queen substance (pheromone) that helps within the colony organization. It acts as employee attractant and inhibits ovary development in employee bees yet as raising new queen. Absence of queen secretion is detected once regarding half-hour of queen loss

and colony might begin raising new queen. The pheromones in queen substance stimulate brood rearing, comb building, billboard and hunting in an exceedingly colony and therefore play vital role in traditional operating of a colony.

- The virgin queen mates with variety of drones (5-7) inside 5-10 days of emergence within the air (not within the hive) and spermatozoa ar keep in spermatheca. keep sperms ar used to fertilize eggs throughout her life until exhausted.



Worker:-

- Workers ar imperfect females. they're unable to mate although might begin birth if a colony remains queen less for long amount
- The employees perform all the helpful add the colony
- Duties of employees include: cleansing of the hive, feeding of larvae, raising queen cells once needed, ventilate hive, guard the hive entrances, secrete bees wax, construct the combs, collect the nectar and convert it into honey (Fig. 4.3), assortment of spore, water and propolis, turn out a digestible food of secretion for feeding queens and young larvae and exploratory survey for a brand new nest website throughout swarming. The employees conjointly feed the drones however once not required, they're thrown out of hive.

Age of Worker Bee	Duties performed
a) Till 3rd day of emergence	Maintain wax cells in sanitary state, cleaning their walls and floors after the emergence of young bees.
b) From 4th-6th day of emergence	Feed older larvae with mixture of honey and pollen and making flights around the hive for getting layout of the hive, (play flights or orientation flights)?
c) From 7th-11th day of emergence	Hypopharyngeal glands (food glands) get developed and start secreting royal jelly and feed younger larvae.
d) From 12th to 18th day	The bees develop wax glands and work on building of comb, construction of cells etc., Receive the nectar, pollen, water, propolis etc., from field gatherers and deposit in the comb cells and help in keeping the brood warm.
e) From 18th to 20thday	Perform guard duty
f) From 20th day onwards	The worker bees take the duty of field i.e. exploring or foraging for nectar and pollen; collecting water and propolis.

Worker bees unharness alarm secretion on stinging from lining of sting chamber and it assists in defense of the colony by alerting alternative colony members of the threat.

- A employee has a mean lifetime of solely 40-50 days throughout honey flow season (active period) and her life might extend up to six months throughout off season
- Laying workers: beneath queenless conditions for an extended length, ovaries of a number of the employees begin developing and that they will lay even eggs however since these ar sterile , make to solely drones. The eggs set by the birth employees have haphazard pattern and lots of eggs ar set in every cell of the comb. The colonies with birth employees ultimately decease. A. melliferacapensis is that the exception wherever even from the eggs of birth employees queen and employees ar raised by the bees.

Drone:

- Drones neither perform any duty within the hive nor do they collect food from flowers. every drone is fed by three to four employee bees. A colony rears and tolerates the drones solely throughout breeding season once new queens ar being made and ar later driven out of the colony to die of starvation. the only real perform of a drone is to mate once that prices him his life. most lifetime of drone honey bee in summer is fifty nine days

LIFE CYCLE

Queen deposits egg at the bottom of cell and fastens with sticky secretion. once three days egg hatches and employees give pearly white food during which "C" formed fauna floats. Cell is sealed once fauna is grownup. within the sealed cell it turns into insect from that adult emerges. fauna sheds skin 5 times throughout development. The sealed cells containing employee and drone brood and honey are often differentiated on the idea of look.

Development: The biological process stages of honey bees are: egg, larva, insect and therefore the adult.

In a comb, employees rear brood within the central half wherever temperature will simply be maintained and honey is keep within the higher and peripheral half. spore is keep around brood space in order that it's simply accessible for rearing brood. Drone brood space are often differentiated from employee brood because the sealed brood cells within the former case ar raised.

Caste	**Egg period (days)**		**Larval Stage(days)**		**Pupal Stage (days)**		**Total (days)**	
	A. cerana	***A. mellifera***	***A. cerana***	***A. mellifera***	***A. cerana***	***A. mellifera***	***A. cerana***	***A. mellifera***
Queen	3	3	5	5	7-8	8	15-16	16
Worker	3	3	4-5	5	11-12	12-13	18-20	21
Drone	3	3	7	7	14	14	24	24

Chapter V

SOCIAL BEHAVIOUR OF HONEY BEES

INTRODUCTION

Among totally different insect orders, solely eight are recognized by insect taxonomists that have some communal life. Out of those eight orders solely 2 orders viz. order Isoptera and Hymenoptera have well developed scheme. Even in Hymenoptera, solely 2 families specifically Halictidae and arthropod family of arthropod family contain absolutely social species. Most of alternative bees live solitary life.

Social behaviour

Honey bees square measure among the absolutely social insects having overlap of the many generations within the same nest. The colony may be a well organized group having division of labour in terms of parturition of eggs, nursing, comb building, guarding, food assortment and its storage. they need well developed communication system through differing types of dances yet as trophallaxis.

Biological communication may be outlined as AN action on the a part of one organism that alters the likelihood pattern of behavior in ANother organism in an reconciling fashion. reconciling means the signal or the response or each that are genetically programmed to some extent by action.

Trophallaxis is food transmission (exchange of food) that is common between employees and conjointly from employees to queen and drones. it's a form of communication concerning accessibility of food and water and conjointly a medium for transfer of secretion.

In honey bees, recruit communication is extremely necessary mode of communication that is outlined as a communication that brings nest mates to some purpose in area wherever work is needed. Dances of honey bees square measure necessary recruit communication.

DANCES OF HONEY BEES

It was Father Spitzner in 1788 WHO for the primary time represented bee dances as technique of communication among inmates of the hive concerning volume of honey flow and place of supply of nectar. These observations remained unnoticed until Frisch (1920) revealed his observations. Karl von Frisch got noble prize in 1973 (under physiology & medication, WHO shared it with 2 alternative animal behaviourists) on the premise of his work revealed in 1946.

Types of dances: In honey bees there's a well developed accomplishment system to extend forage potency. a number of the forage force (5-35%) acts as scout bees/searcher bees. These bees could travel several kilometers. Average forage radius of a colony is simply few hundred metres in agricultural areas and concerning 2km in wooded areas. Scouts communicate distance, direction and quality of flowers through differing types of dances that successively leads to accomplishment of alternative employees to forage on the simplest on the market sources.

The scout bees perform 2 styles of dances

i) Round dance

ii) Wag-tail dance

ROUND DANCE

This type of dance is performed if food supply is close (within100 metres just in case of A. mellifera and ten metres during a. cerana). The activity bee takes fast short steps and runs around in slender circles on the comb; once to right and so left and so continuance for many seconds. The dance excites the bees and that they bit the entertainer with their antennae and so leave the hive in search of supply of food. during this dance there's no indication of direction of food and therefore the foragers search among one hundred metres all told direction exploitation floral odour clinging to furry body of scout bee as cue yet as from the sips of nectar that they receive from the performing arts bee.

WAG-TAIL DANCE

This dance is performed once the gap of food supply is quite one hundred metres from the hive. during this dance the bee starts performing arts on the comb creating a 0.5 circle to 1 aspect and so takes a pointy flip and runs during a line to place to begin. thenceforth takes another 0.5 circle on the alternative direction to finish one full circle. once more the bee runs during a line to the place to begin. within the straight run the performing arts bee makes squirming motion together with her body that's why this dance is understood as wag-tail dance. Location of food is indicated by direction of straight run in reference to line of gravity. If the food is in line with the sun, bee wag-tails upwards and if faraway from the sun, it performs downward. If the food supply is to the left of the sun the bees dance at AN angle counterclockwise to the road of gravity whereas, if it's to the proper of the sun the bees dance to the proper of the road of gravity.

The distance is indicated by the number of straight runs per 15 seconds as given below:

of food from hive (metres)	Number of straight runs/15 sec.
100	9-10
600	7
1000	4
6000	2

As a social unit a bee colony maintains its hive temperature between 32-35^{O}C in the brood area. Queen substance 9-oxo-2-decenoic acid (9-ODA) from the queen bee, alarm pheromone and alarm odour from worker bees play important role in the welfare of the colony and help in the social organization.

Chapter VI

BEE KEEPING EQUIPMENT

BEE HIVE

L.L. Langstroth discovered the principle of bee area in 1851 within the U.S.A. This area permits free passage for employee bees and is just too tiny to create a comb by bees or large for depositing bee glue i.e. propolis. we are able to say that bee area is optimum distance between 2 surfaces in a very bee hive essential for traditional movement and functioning of bees. This principle was a giant discovery for contemporary cultivation. the trendy hive has been designed on the bases of principle of bee area during which frames is simply affected. The bee area measures nine.52 millimeter for A. mellifera and this was changed for A. cerana to be between seven and nine millimeter.

Stand: To support bottom board.

Bottom board: It's floor of the hive having AN entrance for bees. On this board brood chamber rests.

Brood chamber: Chamber used for rearing of brood. Frames ar placed during this chamber on that bees raise combs. the size and variety of frames vary with the kind of hive. A wood dummy board is employed to limit the scale of brood chamber and is placed at the tip of brood frames.

Frame: every frame consists of a prime bar, 2 aspect and a bottom bar. Inner facet of the highest bar contains a groove for fixing comb foundation sheet. aspect bar has four holes for wiring the frame. The frame holds a comb.

Dimensions of hive: normally for A. melliferawe use Langstroth hive (named once L.L. Langstroth) and for A. cerana, BIS (Bureau of Indian Standard) hive A and B kind. In 1995, BIS introduced C-type hive supported Langstroth hive, for A. melifera. Well seasoned wood of “Kail, “Toon”, teak or rubber is used for creating smart quality bee hives. Wood having sturdy smell isn't used. Dimensions of various varieties of bee hives being employed in Asian country ar given below:

Super: Dimensions could also be same as that of brood chamber or half it (depending on kind of bee hive). this can be the chamber wherever bees store surplus honey.

Inner cover: A board that acts as a partition between brood/super chamber and also the roof .

Top cowl: a sort of lid acting as roof placed over inner cover.

Other instrumentality

Nucleus hive: tiny bee hive for keeping 4-6 frames. These ar used for conjugation of queens and division of colonies (Fig. 6.3).

Observation hive: tiny hive with glass sides therefore on observe movements and behavior of bees.

Comb foundation mill: accustomed print natural cell size of desired comb foundation sheet for A. mellifera and A. cerana.

Bee veil: Used for preventing bee stings on face and neck.

Smoker: accustomed quiet down the bees whereas gap the hive.

Uncapping knife: massive sized knife accustomed uncap the frames before honey extraction.

Hive tool: AN iron strip used for gap of hive and its cleanup.

Queen cell protector: A spring like structure for safeguarding queen cells.

Queen cage: accustomed introduce a queen to new colony and conjointly to move the queen.

Bee brush: To brush the bees from frames.

Feeders: differing kinds of feeders ar used for feeding syrup to the bee colonies. These is (i) slow feeder (friction prime pail feeders) {in that|during which|within which} holes ar created within the lid and also the feeder is placed inverted within the hive (ii) quick feeder (division board feeder) which is of the scale of an everyday frame and also the trough contains a wood float within the cavity.

Swarm basket: Basket to catch bee swarm.

Queen excluder: Perforated metallic element sheets or spherical wires assembled in such the simplest way that employees will tolerate them and queen cannot (perforation size is four.20mm for A. mellifera whereas employee thorax size varies from three.33 to 3.50mm). it's used throughout honey flow season to limit queen to brood chamber and thereby preventing birth within the super. it's conjointly utilized in maintaining multiple queen system in a very colony.

Honey extractor: it's a machine to centrifuge out the honey from uncrowned frames.

Wax melter: Double walled chamber for melting of bees wax for creating comb foundation sheets.

Pollen trap: For stable gear corbicular spore of returning bee foragers. For A. mellifera

pollen stable gear screen has holes of four.7 to 5mm. and for A. cerana 3.5 to 3.7mm.

Bee escape: to supply a way passage to bees.

Chapter VII

HANDLING OF A HONEY BEE COLONY AND MAINTENANCE OF APIARY RECORD

SELECTION OF APIARY SITE AND BEE SPECIES

The key to success of cultivation lies chiefly in 3 things:

A. sensible shed website.

B. Good bee.

C. correct management.

What is associate apiary?

Apiary is that the place wherever the bee colonies area unit unbroken.

Selection of fine shed site:

- The shed {site|website|web website} ought to be made in bee flora which can give forage for many components of the year and additionally there ought to be sensible density of honey flow sources close to the shed site. For aggregation twenty kilo of honey, one colony desires one hundred blooming trees or 2-4 acres of blooming crop
- The shed website ought to be simply accessible by road
- There ought to be convenience of contemporary running water close to the shed
- The shed website ought to have natural or artificial wind breaks to shield the bees from strong/chilly winds
- The website ought to receive morning and afternoon sunshine. throughout summer provision of shade (either exploitation artificial structures or exploitation shade of the trees) ought to be created.

Selection of fine bee:

Beekeeping are often preoccupied with either of the 2 domesticated honey bee species (Apiscerana and A. mellifera). However, in cold areas e.g. high hills, A. cerana being cold hardy performs higher than A. mellifera. a lot of} this bee is more economical and will well even in areas, that aren't terribly made in bee flora. Farmers WHO area unit incapable of creating a lot of investment in bee keeping with A. melliferacan use A. cerana, since it desires less investment.

EXAMINATION OF A BEE COLONY

Success of cultivation additionally depends upon correct understanding of bee behaviour and manipulating the colonies consequently. For manipulation of colonies in trendy hives, as per desires of the bees, examination is usually needed.

Handling of bee colonies:

- For management of honey bees in trendy cultivation, examination of colonies forms one amongst the vital aspects. however whenever we tend to quote examination of bee colonies, there's general concern of stinging by bees. it's to be created clear here that if we tend to area unit attentive to bee behaviour, stinging are often prevented. Bees sting just for their own protection and when stinging they die. If all the precautions area unit taken before examination of colonies we will avoid stinging by bees.

Aim of examination of bee colonies: A bee colony is examined to examine its operating and to see its necessities at a specific time, since these vary throughout completely different components of the annual cycle of a bee colony. once a bee colony is opened, create the subsequent observations:

- Whether a bee colony has adequate food or it desires artificial feeding. every colony, relying upon its strength, ought to invariably have a minimum of 2-5kg of stores all the time
- Whether the queen is gift or not? If gift whether or not birthing satisfactory. If absent colony desires a replacement queen.
- Whether there area unit adequate combs for birth by the queen and to store nectar or not. If not give a lot of frames.
- Whether there area unit any of the enemies or diseases within the colony. If yes, manage them consequently.

Honey bees don't like a lot of of interference since it affects their traditional operating. Therefore, the colonies ought to be disturbed as very little as doable. it's steered {that throughout|that in} settled amount of the colony it's examined once per week whereas during off-seasons just the once or double a month.

Requirements for examination of bee colonies:

Hive tool, bee veil, shed record register, measure scale or grid, smoker

Precautions:

- Before handling bee colonies it's higher to wear a bee veil.
- Do not wear black or dark covering as bees area unit furious to black color.
- Any quite fragrance or robust smelling hair oils or metals like ring, watch etc which might induce bees to sting, ought to be removed before handling the bees.
- Do not be shaky whereas handling bees. beware and avoid fast and jerking movements.
- If a bee stings, don't get nervous. Gently pull out the sting with the sharp fringe of hive tool or finger nail from the bottom and not from the highest while not compressing the venom out of it. Rub some grass on the injured space to mask the smell of alarm secretion that differentwise induces other staff to sting therein space.
- Do not crush any bee whereas confiscating or putt the frames back during a colony.
- Be careful regarding queen and avoid crushing it.
- Hive shouldn't be opened on a windy, chilly day or the amount once bees aren't operating outside the hive

MAINTENANCE OF APIARY RECORDS

Observations: Keep the record of every colony and enter your observations whenever the colony is examined. These observations can be made in the given proforma.

PERIODICAL COLONY INSPECTION RECORD

Colony Number:

Date of inspection	Total number of frames	Number of frames covered by bees (Bee strength)	Brood area (sq.cm.) L x B	Pollen area (sq.cm) L x B	Honey/ nectar stores (g)*	Presence of queen and its working	Remarks (date & amount of sugar feeding, drone rearing, honey extraction, temper etc.)

***Estimation based on assumption that each fully sealed Langstroth type frame of honey contains 2kg and BIS Type A&B about 750g of honey**

Chapter VIII

COLLECTION AND PRESERVATION OF BEE PASTURE

Honey bees collect nectar and spore from a spread of plants that square measure referred to as bee flora or bee forage or bee pasture or nectar and spore plants. Nectar is supply of honey, meeting the supermolecule needs of honey bees, wherever as spore is supply of macromolecule. Bee pasture may be selected as build up, honey flow and dearth amount flora betting on amount of convenience with regard to development of bee colonies. The flora of a region is characteristic of its agro atmospheric condition and per se varies from place to put. This flora is additionally a food base for big variety of pollinators. Out of 3,52,000 species of flowering plants within the world nearly three,08,000 species (87.5 per cent) square measure pollinated by animals (including insects, birds, bats, etc.). Bees fertilise an oversized majority of those plants. pollenation is associate degree scheme service provided by the bees that's nearly always taken without any consideration. In easy terms bees build additional fruits and seeds for US by assembling nectar and spore then the amount of honey they create. Hence, it's essential to grasp numerous styles of bee flora and their blooming phenology ina given area to conserve

List of important bee flora:

Sr. No.	Common name	Botanical name	Family
1.	Stone and pome fruits	*Prunus&Pyrus spp.*	Rosaceae
2	Bramble	*Rubusellipticus*	Rosaceae
3	Barberry	*Berberislycium*	Berberidaceae
4	Honey suckle	*Loniceraangustifolia*	Caprifoliaceae
5.	Yellow clover	*Medicagodenticulata*	Leguminosae
6.	White clover	*Trifoliumrepens*	Leguminosae
7.	Egyptian clover	*Trifoliumalexandrinum*	Leguminosae
8.	Hirad	*Terminaliachebula*	Combretaceae
9.	Jamun	*Syzygiumcumini*	Myrtaceae
10.	Eucalyptus	*Eucalyptus* sp.	Myrtaceae
11.	Bottle brush	*Callistemon lanceolatus*	Myrtaceae
12.	False acacia	*Robiniapseudoacacia*	Leguminosae
13.	Gulmohar	*Jacaranda mimosaefolia*	Bignoniaceae

14.	Bird's foot treefoil	*Lotus corniculatus*	Leguminosae
15.	Daru	*Punicagranatum*	Punicaceae
16.	Toon	*Toonaciliata*	Meliaceae
17.	Sunflower	*Helianthus annuus*	Compositae
18.	Shisham	*Dalbergiasissoo*	Leguminosae
19.	Wild rose	*Rosa moschata*	Rosaceae
20.	Ber	*Zizyphusjujuba*	Rhamanaceae
21	Ohi	*Albiziachinensis*	Mimosaceae
22	Khair	*Acacia catechu*	Mimosaceae
23	Bhang	*Cannabis sativa*	Cannabaceae
24	Maize	*Zea mays*	Graminae
25	Shain	*Plectranthusrugosus*	Labiatae
26	Cruciferous oil seeds	*Brassica spp*	Cruciferae
27	Wild cherry	*Prunuspuddum*	Rosaceae
28	Rubber	*Heveabrasiliensis*	Euphorbiaceae
29	Soapnut	*Sapindusspp*	Sapindaceae

Qualities of a Decent Bee Flora

For business cultivation, massive crop surface area with smart floral qualities is needed. A granger should have the main points regarding the provision and quality of bee flora. Following square measure the qualities of fine bee flora:

- Long flowering amount
- High density of flowers per unit of the plants
- Good quality of nectar with high concentration of sugars
- Easy accessibility of the nectaries to the honey bees and ease in assortment of nectar
- Availability of flora within the shut neighbourhood of the shed

IMPORTANT HONEY FLOW SOURCES IN INDIA

Flora secreting abundance of nectar and having massive plantations is thought as honey flow supply. however to avail honey flow colonies ought to have peaked their population by now. a number of vital honey flow sources are:

- Eucalyptus,
- Brassica (sarson&toria)
- Toon
- Soapnut
- Citrus
- litchi
- Berseem
- Rubber
- Cotton
- Plectranthus
- Jamun
- Buckwheat
- Sunflower
- Shisham
- Acacia etc

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(Only Speed Post is Received at University Campus Address, No. any Courier Facility is available at Campus Address)

Pages	: 26
Book Price	: ₹ 150/-

Women University Press

Jayoti Publication Desk

Year & Month of Publication- 3/9/2021