Notes

Practical 1

IDENTIFICATION OF HONEY BEE SPECIES

Objective

After completion of this practical you will be familiar with various honey bee species.

Tools/ Equipments/ Material required

Honey bee colonies, protecting clothings, smoker, insect collecting net, insect killing bottle, insect pins, insect collection box, dissection microscope, glass slides, cover slips.

Procedure

1. Visit the habitats of wild honey bees (i.e. forest areas) and apiaries of hive honey bee species.
2. Collect a few live bees of each species.
3. Put them into the insect killing bottle.
4. Pin the bees at the thorax and fix them in an inset collection box.
5. Observe the bees of different species for their size, shape and colour of different body parts.

Observations & Result

1. Complete address of apiary site visited:

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2. Behaviour of comb construction:

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3. Average number of combs in one colony:

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4. Note down the bee species characteristics in the given space to differentiate among different species:

S.No.	Characteristics	*A. dorsata*	*A. florea*	*A. cerana indica*	*A. mellifera*
1.	Body size				
2.	Body colour				
3.	Wings colour and type				
4.	Tongue size				
5.	Comb size and number				

Precautions

1. Use protective clothings and smoker while examining honey bee colonies.
2. Follow recommended techniques for opening and examining hive honey bee colonies.
3. Take the collected samples immediately to the laboratory.

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(Signature of the Instructor)

Practical 2

CASTES OF HONEY BEES

Objective

After completion of this practical you will be able to identify different castes of honey bees.

Tools/ Equipments/ Material required

Honey bee colonies, bee veil, hive tool, smoker, insect collecting net, insect killing bottle, insect pins, insect collection box.

Procedure

1. Visit the apiaries of hive honey bee species.
2. Examine the worker bees, drones, and queen bees and note down their morphological features.
3. Collect a few live bees of each species, put them into the insect killing bottle.
4. Pin them at the thorax and set them and fix them in an inset collection box.
5. Observe their comparative size, shape and colour of different body parts.
6. Press out the sting of worker bee and examine the variation under microscope.

Observations & Result

S.No.	Characteristics	Queen bee	Drone bee	Worker bee
1.	Body size			
2.	Wings			
3.	Head			
4.	Compound eye			
5.	Abdomen			
6.	Pollen collecting legs			
7.	Sting			

Notes

Precautions

1. Use protective clothing and smoker while examining honey bee colonies.
2. Follow recommended techniques for opening and examining hive honey bee colonies.

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(Signature of the Instructor)

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Practical 3

BEE BIOLOGY

Objective

After completion of this practical you will be able to identify and learn the structure of different body parts of honey bees.

Tools/ Equipments/ Material required

Honey bee colonies, protecting clothings, smoker, insect collecting net, insect killing bottle, insect pins, insect collection box, dissection microscope, glass slides, cover slips.

Procedure

1. Collect a few live bees of each caste.
2. Put them into the insect killing bottle, pin them at the thorax and set them.
3. Fix them in an insect collection box to study their comparative size, shape and colour of different body parts.
4. Dissect out their antennae and legs, prepare slides and study their appendages under microscope.
5. Press out the sting of queen bee and worker bee and examine the variation under microscope.
6. Draw a well labelled diagram by observing a worker bee to depict general morphology.
7. Note down the special features of fore leg, middle leg and hind leg of the worker bee and draw well labelled diagrams.
8. Observe wing coupling apparatus at junction of fore and hind wing. Count number of wing hooks on the hind wing and observe marginal fold in the fore wing. Also observe wing venation. Draw well labelled diagrams.
9. Draw a diagram by observing mouth parts of a worker bee under microscope.

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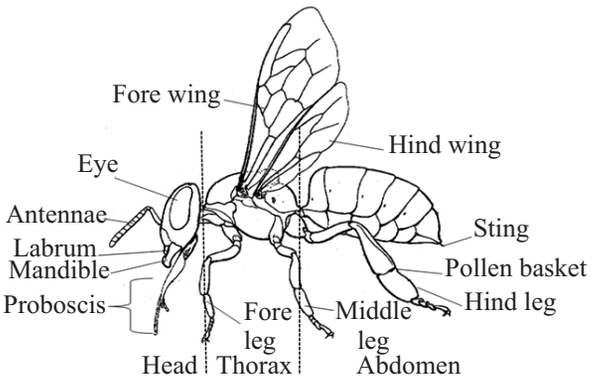
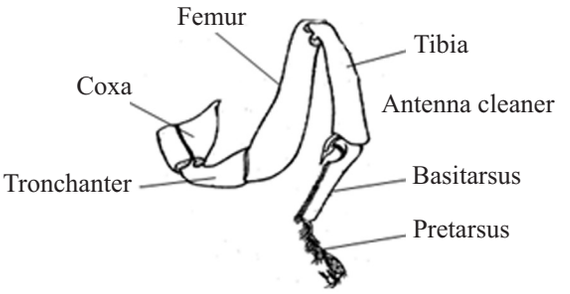
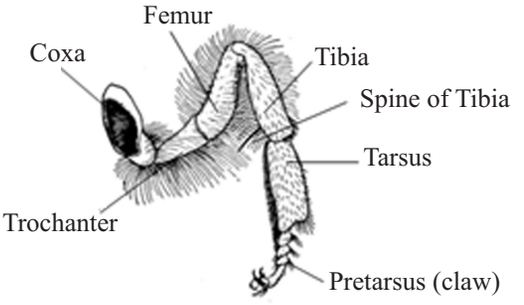
Observations & Result

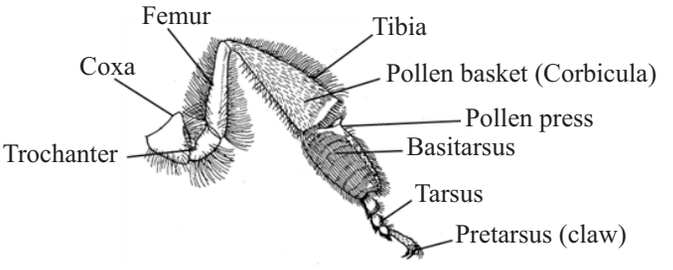
A labelled diagram of a worker bee:



Labelled diagrams of fore leg, middle leg and hind leg of the worker bee:







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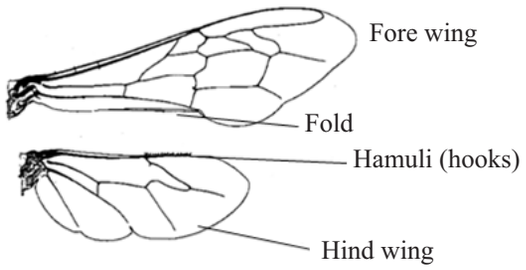
A labelled diagram of bee wings:



Learner's Remarks:

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Precautions

1. Use protective clothing and smoker while examining honey bee colonies.
2. Follow recommended techniques for opening and examining hive honey bee colonies.
3. Take the collected samples immediately to the laboratory.

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(Signature of the Instructor)

Notes

Practical 4

LIFE CYCLE OF HONEYBEES

Objective

After completion of this practical you will be able to demonstrate the life cycle of honey bees.

Tools/ Equipments/ Material required

Honey bee colonies, bee hive, protective clothings, smoker, petri dishes.

Procedure

1. Visit the nearby apiaries of hive honey bee species.
2. Open the bee hive and observe the eggs, larvae and pupae.
3. Observe different stages of development of bee brood.
4. Place different developmental stages of honey bees in petri dishes for identification.

Observations & Result

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Precautions

1. Use protective clothing and smoker while examining honey bee colonies.
2. Follow recommended techniques for opening and examining hive honey bee colonies.

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(Signature of the Instructor)

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Practical 5

ASSEMBLING A BEEHIVE

Objective

After completion of this practical you will be able to assemble a beehive.

Tools/ Equipments/ Material required

Apron, headwear, gloves, pre-cut sides of bottom board and supers/ hive boxes, water proof glue, galvanized nails-65mm x 2.8mm, tool kit (rubber mallet, hammer, piler, etc.), rag/ waste cloth, enamel paint (preferably white), paint brush, turpentine oil (for removing enamel paint from paint brush and hands), water, soap, towel, First Aid kit.

Procedure

1. Collect all the materials at the workplace.
2. Wear protective clothing.
3. Lay the first end-piece handle side down and put sufficient water proof glue.
4. Fit the two side pieces.
5. Make the joints fit together and tap in the joints with the help of rubber mallet after placing the rag to interlock the joints.
6. Take the remaining end pieces and fit it handle side up onto the two side pieces, fitting the joints together and interlocking them by tapping with rubber mallet or hammer after placing the rag over them.
7. Nail the joints together by driving the nails through the holes into the adjoining pieces, with the help of rubber mallet of hammer.
8. Paint the assembled hive boxes with an enamel or latex paint from outside.
9. Clean and place the tools in the tool box.
10. Wash your hand with soap and water and dry with clean towel.

Notes

Observations & Result

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Precautions

1. Buy only standard size parts of a bee hive.
2. Interlock the joints with the help of a rag and rubber mallet and do not use a hammer.
3. Do not leave any part unpainted from outside.
4. Do not paint the inside portion of the hive boxes.
5. Be careful while using sharp tools.
6. Always keep First Aid Kit handy while working with tools.

Suggested Activity

Dissemble the different parts of beehive and assemble them again.

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(Signature of the Instructor)

Notes

Practical 6

BEEKEEPING EQUIPMENTS

Objective

After completion of this practical you will be familiar with different equipments used in beekeeping.

Tools/ Equipments/ Material required

Various beekeeping equipments.

Procedure

1. Collect all the bee keeping equipments at your workplace.
2. Identify various bee equipments.
3. Observe and note down the material of which the various bee equipments are fabricated.
4. Learn the application and working of these equipments.

Observations

(a) Measure and write down the dimensions (in cm) against the under mentioned beekeeping equipments:

1. Hive tool

(i) Length

(ii) Breadth

2. Honey extractor

(i) Diameter

(ii) Height

(iii) Combs holding capacity

(iv) Type (Tangential/Radial)

(v) Any other

Notes

3. Queen excluder

(i) Type (sheet type or wire type)

(ii) Length

(iii) Breadth

(iv) Distance between two adjacent longitudinal wires

(v) Total number of longitudinal wires

4. Comb foundation

(i) Length

(ii) Breadth

(iii) Thickness

5. Uncapping knife

(i) Length

(ii) Breadth

(iii) Any other

6. Queen bee cages

(i) Type (rectangular wooden type/hair roller type)

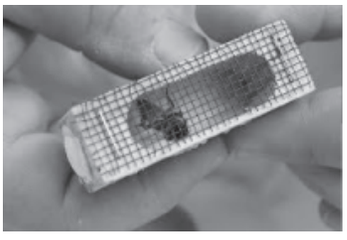
(ii) Length

(iii) Breadth / diameter

7. Any other

(b) Identify and label the equipments given below:

(a)  .....

(b)  .....

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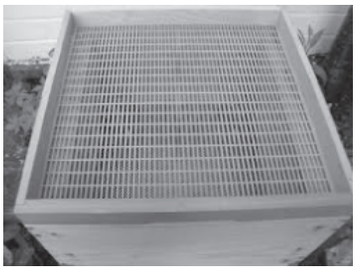
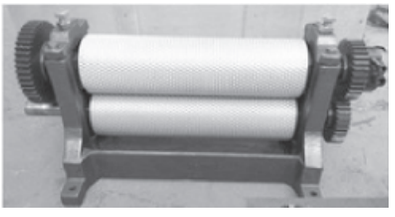
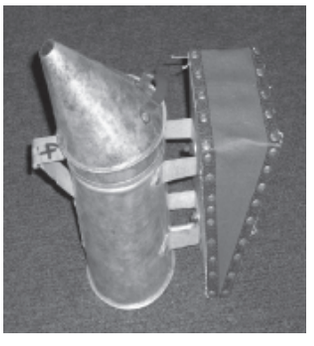
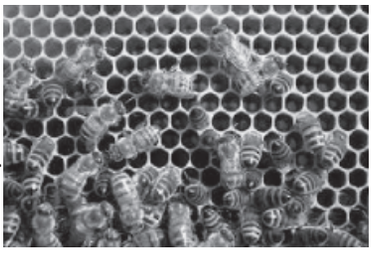
(c)  .....

(d)  .....

(e)  .....

(f)  .....

(g)  .....

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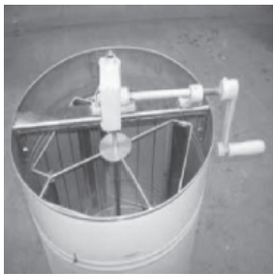
(h)  .....

(i)  .....

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(Signature of the Instructor)

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Practical 7

LIGHTING A SMOKER

Objective

After completion of this practical you will be able to light a smoker.

Tools/ Equipments/ Material required

Overall, beeveil, gloves, smoker, newspaper, green leaves, dry grass, matchbox, First Aid kit, water, soap & towel.

Procedure

1. Arrange all the materials at the workplace.
2. Wear protective clothing.
3. Crumple a piece of newspaper and light it.
4. Rush the lighted newspaper into the fire box of the smoker.
5. Pump the bellows a few times. When the paper is flaming up slowly add green and dry leaves to the smoker.
6. Continue pumping the bellows until the fuel stays lit.
7. Put some more green leaves on top of the fuel to cool the smoke and close the fire box.
8. Pump the bellows a few times and use the cool smoke at the entrance of the hive to drive away the bees.

Observations

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Notes

Result

Smoke is lightened to calm down the bees and perform various beekeeping activities.

Precautions

1. Do not put too much of dry matter in the smoker, otherwise it will not generate cool smoke.
2. Be careful while handling hot smoker, otherwise you may burn your hands.
3. Always keep water and First Aid kit handy when working with smoker.
4. Clean and store the smoker properly after use.

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(Signature of the Instructor)

Notes

Practical 8

CATCHING A STRAY SWARM FROM A POST OR TREE

Objective

After completion of this practical you will be able to catch a stray swarm from a post or tree.

Tools/ Equipments/ Material required

Overall, bee veil, gloves, rubber boots, swarm basket, hive tool, sugar syrup, smoker, pen, knife, string, hessian cloth, decoy bee hive, cow dung cake and wood shavings for smoker, match box, first aid box, water & ladder.

Procedure

1. Prepare equipment and supplies.
2. Wear overall, bee veil and gloves.
3. Take a swarm basket and pour some sugar syrup on it.
4. Place the basket underneath a decoy beehive hanging to a branch of a tree or post.
5. Push the bees inside the basket with hand.
6. Once the bees enter the basket, close the mouth of the basket with a hessian cloth and tie with string.
7. Remove the roof, supers and queen excluder of a hive.
8. Take the swarm basket to a new brood chamber and transfer them into the chamber by shaking. The bees will get dislodged and drop down in a lump over the brood by frames.
9. Replace the super chamber and the roof in their original position.
10. Feed the swarm on sugar syrup or a mixture of 2/3 honey and 1/3 water.
11. Do not allow the bees to go out for at least 24 hours by sealing the entrance of the hive with some dry grass.

Notes

12. Allow the bees to leave the hive after 24hrs by opening the entrance in the evening. If the bees have accepted their new home, they will be seen bringing nectar and pollen into the hive.

Observations & Result

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Precautions

1. Wear bee gloves, overall, bee veil and rubber boots before catching a stray swarm.
2. Capturing should be done before 9.00a.m. during summer and after 9.00a.m. during winters.
3. Capturing should be done during good breeding season i.e., February, March and April.
4. At least two persons should be involved in catching a stray swarm.
5. Be careful while handing the smoker.
6. Do not keep the hive top feeder on the ground.
7. Do not remove the queen from the old hive.
8. Apply ant proofing like used grease on the hive stand so that ants do not enter the hive.

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(Signature of the Instructor)

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Practical 9

INSTALLING PACKAGED BEE COLONY

Objective

After completion of this practical you will be able to install a packaged bee colony.

Tools/ Equipments/ Material required

Overall, bee veil, gloves, rubber boots, packaged colony of bees (The queen bee comes in her own package with one hole in the end that has cork in it and a screen on the top. While in the box, the bees feed the queen through the cage. When you take the queen and place her into the hive, be sure to replace the cork in the hole), hive (without colony), frames, hive tool, sugar syrup (Sugar: water in ratio of 1:1 i.e., 100gm sugar in 100ml water), smoker, cow dung cake and wood shavings for smoker, match box & used grease.

Procedure

1. Wear overall, bee veil, gloves and rubber boots.
2. Prepare equipment and supplies in advance.
3. Check the package of bees to see if there is enough syrup in the feeder can.
4. Spray the bees with sugar syrup before removing them from the package.
5. Now remove the feeder can and the queen.
6. Check the queen to see if she is still alive.
7. Place the queen into the hive hanging between the two middle frames.
8. When your bees get into the hive they will eat the candy and the queen will be able to get out.
9. Shake the bees from the package over the queen.
10. Spray the inside of the hive with sugar syrup.
11. Once the bees have been transferred, put in the remaining frames and immediately close up hive and reduce entrance of hive.

Notes

12. After 3 days check to see if the queen has been released.
13. Continually feed the bees with sugar syrup until they draw out all foundation in deep super.
14. Place second brood chamber super on the hive when 7-8 frame are drawn out.
15. When adding another brood chamber with bees, take a frame or two of drawn comb from the first chamber or super and place in the center of the second super. This will make it easier for the bees and the queen to begin laying eggs in the second brood chamber.

Observations & Result

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Precautions

1. On arrival of the package of bees, keep them in a cool shaded place.
2. Prepare some super syrup by mixing 1 kg sugar in 1 litre solution as new bees will need to be fed while they are getting used to their new surroundings.
3. A feeder can be placed in the entrance to the hive, but you must be careful that other bees do not steal the syrup
4. Bees can consume large amounts of syrup during this initial stage, so check the syrup level regularly.
5. While lifting bee hives you should follow the following steps of bending for preventing any problem of back ache:

Steps for Bending

(a) Maintain good back posture.

(b) When standing and bending for long periods, shift weight from foot to foot.

(c) Stand with feet shoulder-width apart, one foot slightly in front of the other.

(d) Keeping back straight, move down to a squatting, keeping body balanced.

(e) Turn feet and arms, not back, to reach for objects.

(f) Do not stay in any one position for more than a few moments.

(g) Take frequent stretch breaks to avoid overuse of muscles.

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(Signature of the Instructor)

Notes

Practical 10

TRANSFERRING NUCLEUS TO HIVE BOX

Objective

After completion of this practical you will be able to transfer nucleus to hive box.

Tools/ Equipments/ Material required

Overall, bee veil, gloves, rubber boots, Nucleus (Nuc), hive (without colony), frames, hive tool, sugar syrup (sugar: water in ratio of 1:1 ie.,100g sugar in 100ml water), smoker, cow dung cake and wood shavings for smoker, match box, used grease

Procedure

1. Prepare equipment and supplies in advance.
2. Wear overall, bee veil, gloves and rubber boots.
3. Setup a base on the hive stand beside the nuc to be transferred
4. Face the entrance of the hive in the same direction as the entrance of the nuc.
5. Place a hive box on the base. Remove 6 frames from the hive as other 4 frames will come from your nuc. This will give you a total of 10 frames in the new hive
6. Put 3 of your 6 empty frames of comb or foundation back into your ive against the side of your hive box farthest from the nuc. Put the other 3 empty frames outside the hive, but close by.
7. Gently smoke the entrance of your nuc. Make sure that the smoke is cool and that it blows into the nuc. Wait a few seconds.
8. Using your hive tool lift the lid up a bit. Blow a few puffs of smoke under the lid and over the frames. Remove the lid and place it upside down on the hive stand. Do not put it on the ground.
9. Using your hive tool, gently lift the outside frame out of the nuc. Hold it over the nuc box so that if the queen falls off she will fall back into the nuc.
10. Place this frame into the new hive box and push it to the far side up against the 3 empty frames that are already there.
11. Repeat this with the 3 remaining frames. Place them into the new box in the same order and direction as they were in the nuc. Examine both sides of each frame for the queen.

Notes

12. Once all 4 frames have been transferred place the remaining empty frames one at a time into the new box. Slide them up against the frames from the nuc.
13. There will be some bees still in the nuc box. Using brush transfer the remaining bees out of the nuc box into the hive.
14. Slide or move the hive into the same place on the hive stand where the nuc had been. Spray some smoke over the frames of the hive. When the bees have gone down into the hive carefully put the lid on.
15. Leave the nuc box on the stand next to the entrance of the hive for a few hours of until all of the bees have left and gone into the hive.
16. Inspect the hive in 10 to 14 days to make sure that the queen is laying eggs and the bees have started moving onto the empty frames.

Observations & Result

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Precautions

1. On arrival of the nuc, keep them in a cool shaded place.
2. Prepare some sugar syrup by mixing 1 kg sugar in 1 litre solution as new bees will need to be fed while they are getting used to their new surroundings.
3. A feeder can be placed in the entrance to the hive, but you must be careful that other bees do not steal the syrup.
4. Bees can consume large amounts of syrup during this initial stage, so check the syrup level regularly.

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(Signature of the Instructor)

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Practical 11

BEE COLONY INSPECTION

Objectives

After completion of this practical you will be able to

- inspect a bee colony;
- record the performance of bee colonies.

Tools/ Equipments/ Material required

Gloves, mask, smoker, hive tool, bee brush, bee veil, bucket of washing soda solution to clean your gloves and hive tools, and a sealed container for scrap wax.

Procedure

A. Opening the hive

1. First remove the top cover of beehive and place it on the side of beehive.
2. Before removing inner cover give puff of smoke by smoker. Wait for 30 to 60 seconds, and then lift the inner cover slightly.
3. Remove supers if any and place them close to the front of the hive – they will tend to attract the returning bees and make inspection easier.
4. Carefully remove the queen excluder and check to ensure that the queen is not on it.
5. Clean up any brace comb or propolis on the queen excluder at this stage so that you are able to quickly re-assemble the hive if necessary.
6. Make sure that any brace or burr comb is placed into a sealed container that you can take away with you – do not discard it on site as it can set up robbing and is an agent for spreading wax moth infestation.
7. Carefully remove either an end frame, or dummy board if there is one, to give space to easily remove or move the other frames without damaging the bees. After inspecting to see if the queen is on it, place it in a safe place at the side of the hive preferably not in direct sunlight.

Notes

Fig. 11.1: Opening of beehives

B. What to look for and what to do

1. Examine each comb thoroughly for the presence of brood, queen, honey, pollen and presence of any disease or enemy.
2. Always replace combs in the same sequence and same orientation as they were at the start of the inspection.
3. The top and side bars of each comb should be kept clean by scraping off any wax or burr comb.
4. Unless you are moving frames to the outside of the brood box with a view to remove them from the hive at the next inspection, do not split the brood.
5. Any new, undrawn frames that need to be added should be placed in the centre of the hive.
6. If you suspect disease is present in the colony make certain that you do not cross infect another colony. Clean up your gloves and all hive tools – change your gloves if necessary.
7. If the disease is noticed, reduce the entrance to minimise robbing by bees from other colonies and follow the management practices.

Fig. 11.2: Examination of bee colony

Notes

C. Closing up

1. Re-assemble the hive making sure that frames are tightly pushed up together to provide correct bee space.
2. Ensure that the hive is stable on its stand or the ground and that it is properly assembled with no gaps between boxes.
3. Check that the site is clean and tidy and make the notes on your record card before leaving the site.

Observations & Result

Inspection report of bee colony

Date: **Site:**

Bee colony	No of bee frames	No of brood frames	Brood area		Queen	Egg/ larva	Honey		Pollen	Pest/ disease
			Sealed	unsealed			Sealed	unsealed		
1.										
2.										
3.										
4.										
5.										

Precautions

1. Be quick, calm and methodical throughout your examination of the colony avoiding any sudden or sharp actions.
2. Always have a reason for examining the colony.
3. Keep colony records and consult them prior to examining the colony so that you know the priority actions and can arrange suitable equipment in advance.
4. Keep a bucket of washing soda solution to clean your gloves and hive tools between frames or colonies, and a sealed container for scrap wax.
5. Be certain that all circumstances are suitable to examine the colony. Do not start your examination if the weather is likely to be adverse or if there are people or animals in the vicinity.
6. Before opening the colony, make an assessment from the outside (e.g. are the flying bees behaving normally, are there significant numbers of dead bees outside the hive, is pollen and nectar being brought in).
7. Before opening the colony, know where all of the hive parts to be kept and where all the equipment you will need are present.

Notes

8. Light the smoker away from the hive and ensure that your veil is not likely to be affected by any sudden flare up from it whilst lighting.

9. Use smoke sparingly to control the bees rather than "let them know you are coming" – smoke from the top downwards rather than from the bottom (smoking from the bottom drives the bees upwards).

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(Signature of the Instructor)

Notes

Practical 12

DIVIDE/MULTIPLY THE BEE COLONIES

Objective

After completion of this practical you will be able to divide/multiply the bee colonies to increase number of colonies.

Tools/ Equipments/ Material required

Empty bee box, wax frame, protective clothing, all handling tools, bee colony, smoker.

Procedure

Bee colony division is a technique for making a new bee colony by dividing the existing bee colony. An existing colony is divided into two colonies, each containing more or less equal number of bees during breeding season i.e. February-March and October-November. The simple division of a colony can be done in two ways: (i) by separation of chambers, and (2) by separation of frames.

Separation of chambers

1. In this method, simply divide the existing hive by separating various chambers into a separate colony.

Separation of frames

1. Divide all the frames with brood and bees, equally in two or more colonies.
2. Keep them in separate chambers with bottom.
3. Usually one frame each with egg, sealed brood, pollen and nectar are placed in each new colony.
4. Rest of the space is filled with new frames with fitted comb foundation and fed properly.

Observations & Result

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Notes

Also, visit few apiaries and note down the following:

Sr. No.	Name of bee keeper visited	No. of bee colonies at the end of previous years	No. of bee colonies at present	Methods used for multiplication
1.				
2.				
3.				
4.				
5.				

Precautions:

1. Handle the smoke carefully.
2. Do not puff too much of smoke on the honeybees.
3. Handle the frames carefully so that the bees do not drop on the ground.

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Practical 13

UNITING THE BEE COLONIES

Objectives

After completion of this practical you will be able to:

- To unite weaker colonies to make them stronger.
- To unite queenless colony with queen right colony.

Tools/ Equipments/ Material required

Overall, bee veil, gloves, rubber boots, hive(with weak and strong colony), hive tool, sugar syrup (sugar: water in ratio of 1:1 ie.,100g sugar in 100ml water), smoker, cow dung cake and wood shavings for smoker, match box, newspaper, queen excluder, First Aid box, water

Procedure

1. Wear the protective clothing
2. Move the two colonies close together taking all the steps for moving bees carefully
3. Smoke three to four puffs on the entrance of the hives to be united
4. Remove the queen from the weak colony
5. Remove supers shaking the bees into their brood box
6. Place a single sheet of newspaper over the queen less colonies brood box. Ensure that there are no gaps and use two overlapping sheets if necessary
7. Make two or three holes or slits with the hive tools to give the bees a starting point
8. Place the queen right colony on top of the queen less brood box
9. If you have to remove supers and there are still some bees in them it is safer to put them above the top brood box with a queen excluder and another sheet of paper.

Notes

Observations & Result

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Precautions

1. Handle the smoker carefully.
2. Do not puff too much of smoke on the honeybees.
3. Handle the frame carefully so that the bees do not drop on the ground.
4. Do not use damp newspaper.

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Practical 14

DISEASES AND PESTS OF HONEYBEE

Objectives

After completion of this practical you will be able to:

- identify the disease and pests of honey bees.
- manage the diseases and pests of bees.

Tools/ Equipments/ Material required

Infected bee colonies, insect trap, hand gloves, plastic jars, magnifying glass, hand sprayer.

Procedure

1. Arrange a visit the bee unit.
2. Identify the different disease and pests present in bee colonies.
3. Collect the infected samples in a jar.
4. Bring it into the laboratory.
5. Identify the diseases or pests.

Observations & Results

Sr. No.	Name of disease/Pests	Infected part	Intensity of damage	Suggested management measures
Diseases				
1.				
2.				
3.				
4.				
5.				

Notes

Sr. No.	Name of disease/Pests	Infected part	Intensity of damage	Suggested management measures
Pests				
1.				
2.				
3.				
4.				
5.				

Precautions

1. Use hand gloves while collecting infected sample of disease or pest.
2. Take the collected samples immediately to the laboratory.

Note: Teacher should guide the learners regarding management of diseases and pest affecting honeybees.

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Practical 15

PESTICIDE POISONING IN HONEY BEES

Objective

After completion of this practical you will be able to identify the cause and symptoms of poisoning in bees.

Tools/ Equipments/ Material required

Bee unit, protection tools.

Procedure

1. Visit an apiary.
2. Identify the causes of poisoning. Few causes are as follows:
    - Pesticide application during crop bloom.
    - Drift of toxic chemicals to flower, pollen and nectar.
    - Bees feeding on contaminated food and water sources.
    - Use of broad spectrum insecticides (chlorinated hydrocarbons, synthetic pyrethroids).
    - Type of formulation used like dust, EC which are more harmful than WP and granules.
    - Types of spray, fineness of spray, stage of crop, weather condition and age of the colony.
    - Use of insect growth regulators may inhibit brood production.
    - Herbicides indirectly affect through damage to the foliage.
3. Observe the symptoms of bee poisoning. Few symptoms are as per follows:
    - Excessive numbers of dead bees in front of hives.
    - Lack of the usual numbers of foraging bees (if not weather-related).
    - Bees in front of hives that appear disoriented and are unable to fly.
    - Dead bees on the top of frames or bottom board.

- Lack of recognition of guard bees.
- Aggressiveness.
- Fighting among bees.
- Paralyzed bees crawling on nearby objects.
- Sudden decline in food storage and brood rearing.
- Dead and deserted brood in the hive.
- Poor recognition of pollen and nectar by bees.
- Depleted population of the colony.
- Contaminated of bee products.

Fig. 15.1: Symptoms of poisoning in beehives

Observations & Results

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Precautions

1. Use pesticides judiciously.
2. Inform the bee keepers in advance about the spray programme.
3. Use less hazardous, selective and repellent (methyl Salicylate, R-874) insecticides.
4. Spray a pesticide in the evening when the bee activity subsides.
5. Prefer granules or EC rather than dusts.
6. Avoid formulations with attractants like Sevidol during crop bloom period.
7. Bee strain tolerant to toxic effects of pesticides may be developed.
8. Addition of adjuvant Sylgard 309 silicone surfactant will reduce the bee mortality.

Notes

Most bee poisoning incidents occur when insecticides that are highly toxic to bees and that have a residual hazard longer than 8 hours are applied to bee-pollinated crops during the bloom period. The residue is the amount of pesticide that remains on the plants after they have been sprayed. The residue decreases over time as the pesticide degrades and the rate of decrease depends on the pesticide and environmental conditions. Identification of causes and symptoms of poisoning may reduce the mortality in bees.

Less hazardous insecticides

1. Granules and dusts: Phorate and lindane
2. EC: Phosalone, fluvalinate, menazon

Highly hazardous insecticides

1. Dust: Diazinon and fenvalerate
2. Granules: Carbofuron
3. EC: Chlorpyriphos, cypermethrin, deltamethrin, diazinin, dichlorvos, dimethoate, ethion, fenitrothion, fenthion.
4. Soluble liquid SL: Imidacloprid
5. Emamectil benzoate
6. Indoxacarb

Moderately toxic to honey bees insecticides

1. Demeton
2. Malathion
3. Methyl parathion

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Practical 16

HARVEST A HONEYCOMB

Objectives

After completion of this practical you will be able to harvest a honeycomb.

Tools/ Equipments/ Material required

Overall, bee veil, gloves, rubber boots, uncapping knife, smoker, hive tool, stainless steel vessel, bee brush/feather.

Procedure

1. Put on your protective clothing.
2. Arrange all the materials at the workplace.
3. Load your smoker, and puff some smoke gently around the hive for a few minutes. Wait a few more minutes, then puff smoke around the entrance hole.
4. After puffing the smoke, open the lid.
5. Knock the top bars to see which of them have combs, they will sound heavier than empty ones.
6. Use the knife or hive tool to remove the first bar from one end of the hive.
7. Puff smoke gently into the gap to drive the bees to the other side of the hive.
8. Start removing the frames from the super one by one, until you get to the first comb, which will be white and new. It may be empty or it may contain some unripened honey. Replace it and leave the comb for the bees to develop.
9. Remove only the capped or partly capped combs, which will be quite heavy. Use a brush or feather to sweep and bees back into the hive.
10. Cut the comb off, leaving about 2 cm for the bees to start building on again. Put the comb in a container and replace the top bar.
11. Carry on harvesting until you come across a brood comb, which will be dark in colour and contain pollen too. Leave this honey for the bees.
12. Start the process again at the other end of the hive.
13. Close the hive carefully, replacing the lid.
14. Transfer the containers containing the honey combs to the extraction room.

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Observations & Result

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Precautions

1. Harvesting of comb should be carried out in the evening or early morning.
2. Ensure that the comb taken out for extracting the honey do not contain the queen bee.
3. Extraction should be done in a well-lighted and ventilated room.
4. Clean thoroughly all the utensils and equipment with water before using them for extracting honey.
5. The placement of the combs for extracting honey should be well balanced to avoid damage to the comb and the extractor.
6. Rotate the extractor very slowly in the beginning and then increase the speed.
7. After extracting the honey, immediately put it in a glass container with an air tight cap as honey is highly hygroscopic.
8. Clean the utensils and other equipment thoroughly after use.
9. Dry the utensils and other equipment before storage.

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Practical 17

EXTRACTION OF HONEY FROM HONEYCOMB

Objective

After completion of this practical you will be able to extract honey from honeycomb.

Tools/ Equipments/ Material required

Apron, disposable gloves, headwear, mask, beehives having sealed honey, hive tool, uncapping knife drip tray, honey extractor (radial or tangential)

Procedure

1. Wear apron, disposable gloves, mask and headwear.
2. Smoke the colony or super before removing frames.
3. Remove the combs with sealed honey only. Select only those combs in which more than 70% of cells are capped. Do not select honey combs having sealed/unsealed brood.
4. Gently brush them off the comb.
5. Keep the removed honey frames separately in an empty chamber and cover it.
6. Honey extraction process should be done in a closed room or in a tent made of fine mesh netting away from the apiary.
7. Uncap the wax seals on both sides of the honey-filled combs with uncapping knife by placing the combs in the drip tray. Knives are heated before uncapping the sealed honey in the hot water. Usually two knives are used by putting one for heating while second one is used to uncap the wax capping. The capping can also be removed by steam operated or electrical uncapping knife (Fig. 17.1). First uncap one side, then turn the frame and uncap the other side.
8. Place uncapped honey combs in the honey extractor (Fig.17.2) and rotate it to force the honey out of the combs by centrifugal force. To harvest honey tangential or radial types of honey extractors are used. In tangential honey extractor after extracting

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honey from one side, it is required to reverse the combs by hand to extract the honey from the other side of the comb. In radial honey extractors both sides of the comb are extracted simultaneously as the combs are rotated, the centrifugal force acting radially across the face of the comb.

9. Rotate the extractor slowly at first. If the extractor is turned too rapidly, the weight of the honey may break the combs. The combs should not be damaged during extraction as they are to be reused and are quite costly for man and the bees to produce.

10. The extracted honey is passed through the muslin cloth or wire mesh for straining the extraneous material and wax capping.

11. During honey flow season queen excluder should be used to restrict the queen within brood chamber.

12. After honey extraction empty combs should be given back to the honey bee colonies (as many as were drawn out from every colony).

Fig. 17.1: Uncapping honey comb

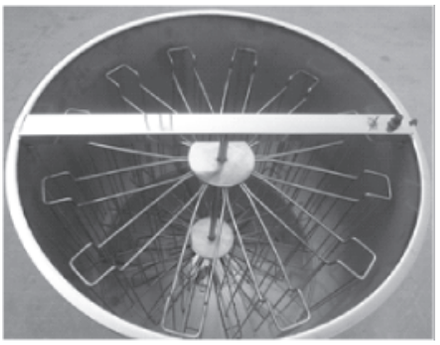

Fig. 17.2: Radial honey Extractor

Observations & Result

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Precautions

1. Remove the combs properly to avoid cell damage.
2. Proper heating of knife in boiling water is necessary for smooth uncapping of combs.
3. Place combs of almost equal weight opposite to each other in the extractor to avoid any imbalance in the movement of the extractor.
4. Take all necessary measures to maintain hygienic conditions during extraction.
5. Wash and dry the honey extractor, utensils and other equipment thoroughly after use.

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Practical 18

PROCESSING OF EXTRACTED HONEY

Objective

After completion of this practical you will be able to process the honey.

Tools/ Equipments/ Material required

Stainless steel utensils, muslin cloth, water bath, thermometer for measuring the temperature, stove, water, airtight bottles.

Procedure

Honey processing refers to the indirect heating of honey at controlled temperature and duration, to liquify it, destroy all the yeast cells to prevent fermentation and delay granulation and reduce excess moisture, besides retaining its natural flavour, colour and taste. At household level/small scale following techniques are used to process the honey:

(i) Sedimentation (ii) Heating

Sedimentation method: The honey is filtered through a double layer of muslin cloth and then kept in a settling tank for 2 to 3 days to allow most of the air bubbles and small foreign particles to rise to the top and mineral and metallic particles to settle at the bottom. The surface scum is removed carefully before bottling (Fig. 18.1). The portion at the bottom with sediment is removed through an outlet at the bottom of the container. Extracted and purified honey thus can be consumed directly.

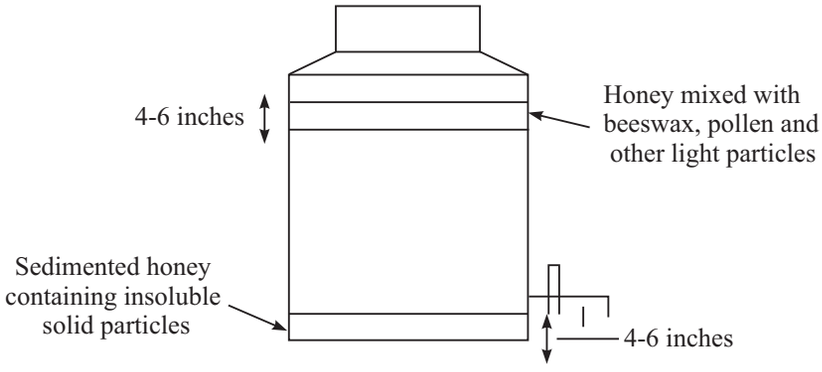

Fig 18.1 Honey sedimentation

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Heating method: Honey is heated to prevent granulation and to increase its flowability for easy filtration & bottling. In the heating method, honey is heated in a water bath to a temperature below 40°C (Fig.18. 2) and then filtered through muslin or steel mesh before cooling and storing in airtight bottles. Heating is also used to evaporate excess moisture and improve the keeping quality.

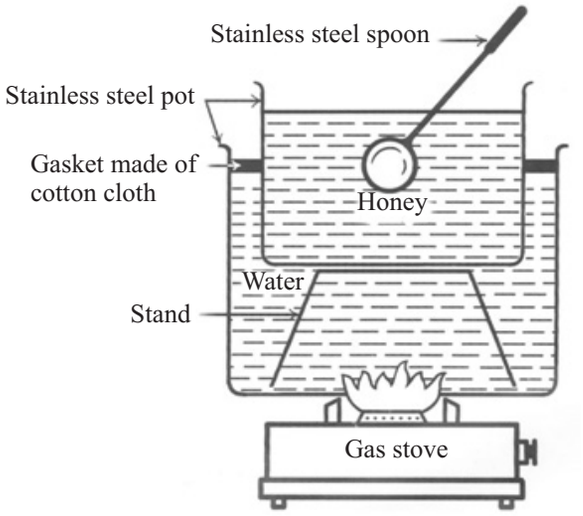

Fig 18.2 Heating honey

Various Honey Processing Plants are available for large scale purification/processing of honey. They involve following steps to purify honey:

1. **Liquification:** Raw honey is liquified in a liquifier at 40°C for 30 minutes to increase its flowability through the system.

2. **Pre-heating and straining:** In the preheating tank provided with a coarse filter (at top) and stirrer, honey is heated at 45°C (wax does not melt at this temperature) and strained through 80-micron strainer to separate wax.

3. **Micro filteration:** Honey is then passed through special polyurethane cartridge type filters (40 micron)/ cloth filters/stainless steel serial sieves to remove almost all suspended solids like dust, bee parts, etc.

4. **Pasteurizing/Processing:** By passing honey through a helically coiled heat exchanger at 60-65°C yeast cells are inactivated.

5. **Moisture reduction:** Honey is then fed to falling-film type heat exchanger at 60-65°C to evaporate water from the honey. Water is then condensed and collected separately.

   Both pasteurization and moisture reduction is carried out under vacuum to reduce heating time and the quantity of HMF (Hydroxy Methyl Furfural) production. The temperature and total time in both these stages is controlled and not allowed to exceed 60-65°C for 15 minutes, thus avoiding the loss of natural qualities of honey.

Notes

6. **Cooling, settling and bottling of honey**: Honey is immediately cooled through another heat exchanger and pumped to air tight storage-cum-settling tank. It is allowed to settle for some time so that air bubbles and foam settles at the top. Pure honey is bottled with the help of vacuum filling machine preventing any human and atmospheric contamination.

Observations & Result

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Precautions

1. Processing should be carried out in a clean, dry environment.
2. The processing area should be closed so that bees can't enter.
3. The utensils used in processing should be made of good quality food grade stainless steel, glass, or plastic, and be clean and dry.
4. Do not use copper, iron or zinc utensils as they dissolve in honey and may affect colour and favour.
5. Honey should not be heated directly. The quality decreases markedly if heated beyond 40°C.
6. Wash and dry all the containers and equipments at least 15 minutes before use.

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Practical 19

PACKING AND STORAGE OF HONEY

Objective

After completion of this practical you will be able to pack and store honey.

Tools/ Equipments/ Material required

Apron, mask, disposable gloves, headwear, water, glass bottles/ food grade plastic bottles

Procedure

1. Wear apron, mask, disposable gloves and headwear.
2. Keep bottles and labels ready.
3. Pour honey into each jar using the spout on the side of the honey extractor.
4. Screw jar lid on tightly.
5. Take a warm, damp cloth and wipe each bottle, including the mouth.
6. Place the label on the bottles.
7. Store in a cool and dry place.

Observations and Record

1. Observe freshly extracted honey as well as old honey having storage period of 6 months, one year and two year etc. Note down the differences in colour, aroma and taste.

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Notes

2. Note down the information given on label of different brands of honey available in the market, grade designation mark and source of honey.

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Precautions

1. Use glass containers with wide mouth for storing the honey.
2. The cap of the container should be made of non corrosive and non reactive materials.
3. An adequate supply of potable water should be available in the extraction room for washing and cleaning of the bottles.
4. Use clean cloth for drying of the bottles.

Suggested activity

Visit a honey processing plant and observe bottling and packing unit.

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Practical 20

QUALITY TESTING OF HONEY

Objectives

After completion of this practical you will be able to test honey for quality.

Following are the few simple tests that can be performed to verify the purity of honey:

Test 1

Tools/ Equipments/ Material required

Honey, water, glass.

Procedure

1. Pour water into a glass.
2. Spoon out a tablespoon of honey sample from the honey jar to test.
3. Place the spoon in the glass of water.
4. Gently shake the glass.

Observations and result

If the honey forms a small lump and sinks to the bottom of the glass, it is pure. Whereas, if the honey starts dissolving and mixes with the water, it's impure and some amount of water has been added to it.

Test 2

Tools/ Equipments/ Material required

Honey, methylated spirit/denatured alcohol.

Procedure

Mix equal parts of honey and spirit in a glass.

Notes

Observations and result

If pure, honey will form a lump and sink. But if it is adulterated, it will dissolve in the spirit and turn it milky white.

Test 3

Tools/ Equipments/ Material required

Honey, a candle, match box.

Procedure

1. Take a candle with a cotton wick.
2. Dip the wick into a small amount of honey.
3. Allow the excess honey to drip off.
4. Now light a match and hold it to the wick.

Observations and Result

If the candle wick burns, the honey is pure. But if it fails to burn, water has been added to the honey.

Test 4

Tools/ Equipments/ Material required

Honey, a blotting paper or a white cloth.

Procedure

1. Drop a few drops of honey on the paper/cloth.

Observations and Result

If the honey is pure, it will remain solid on paper. Impure honey will be absorbed by the paper. With the cloth, try washing off the honey. If it does not stain, it is pure.

Learner's Remarks

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Notes

Precautions

1. Quality testing should be carried out in a clean, dry environment.
2. The utensils used in processing should be made of good quality food grade stainless steel, glass, or plastic, and be clean and dry.
3. Do not use copper, iron or zinc utensils as they dissolve in honey and may affect colour and favour.
4. Always keep First Aid Kit handy while working with tools.
5. Wash and dry all the containers and equipments at least 15 minutes before use.

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Practical 21

BEESWAX EXTRACTION AND PURIFICATION

Objective

After completion of this practical you will be able to extract and purify beeswax from a honeycomb.

Tools/ Equipments/ Material required

Honey comb, warm mater, stove, nylon/jute cloth, steel utensils, rope, jute sack rope, solar wax extractor.

Procedure

1. Direct or hot water method

(i) Wash thoroughly all comb or wax pieces in warm water or keep soaked overnight to remove pollen and any honey remaining in the combs.

(ii) Heat the comb pieces along with equal volume of water in a stainless steel pan with continuous stirring. After the combs have melted, pour the mixture into a long bag made of nylon, jute or other heavy cloth, and tie it tightly.

(iii) Squeeze all the wax out of the bag into clean stainless steel container underneath.

(iv) Brood, pieces of wood, grass and other large particles will remain inside bag.

(v) Leave the bucket with the mixture of hot water and molten wax to cool overnight.

(vi) The wax being lighter than water floats on the surface of water forming a disc of wax on the surface of the water.

(vii) Any particles that have escaped through the bag will settle below the wax layer. Scrape off any material stuck to the underside of the wax disc.

(viii) Keep the clean and dry wax block safely in a plastic bag and store in a clean dry room.

Notes

2. Submerged sack method

(i) The crude beeswax is filled into a jute sack and the open end of the sack is tied with a rope.

(ii) The sac is then submerged in slow boiling water.

(iii) As wax is lighter than water, it will filter through the jute and rise to the surface.

(iv) After all combs have melted, let the pot cool down. The wax solidifies as it cools, forming a block on the water surface.

3. Solar wax extractor

The solar wax extractor (Fig. 21.1) which is the rectangular metal box covered with a (preferably double-paned) piece of glass or transparent plastic is used in this method. The inside of the box should be painted black for maximum heat absorption. It uses the sun's heat to melt the wax.

(i) Pieces of honeycomb are placed on the metal sheet and as they melt, wax runs down the metal slope to a catch tray.

(ii) A screen of wire mesh prevents pieces of comb and debris from slipping down into the container.

(iii) The extractor should be bee-proof. For best results the solar extractor should be used on a hot, sunny and calm day.

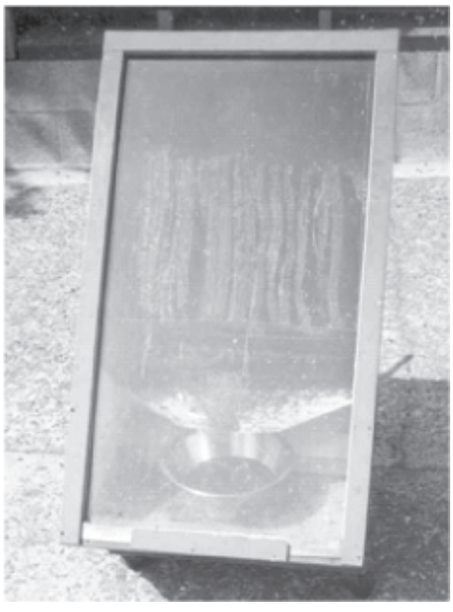

Fig. 21.1: Solar wax extractor

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Observations and Result

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Precautions

1. Wax being acidic should not be heated in containers made of iron, brass, copper and zinc as it reacts with them and turn dark. Stainless steel, aluminium, nickel, tin or unchipped enamel containers are suitable.
2. Combs of the same type should be processed together. Do not mix dark combs with light combs as this will lower the grade of the best wax.
3. Never heat beeswax on a direct flame, always heat it in a container of water because of the fire hazard. Heat slowly and do not boil when melting the wax.
4. Do not heat for longer than necessary as the wax can become discoloured and the scent lost.
5. Cool the melted wax slowly to avoid cracking.
6. Keep the processed wax in air tight containers to prevent attack by wax moth.

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Practical 22

EXTRACTION OF OTHER BEEHIVE PRODUCTS

Objective

After completion of this practical you will be able to extract other beehive products such as propolis, pollen, royal jelly and bee venom from beehive.

Tools/ Equipments/ Material required

Beehive, propolis screen, pollen trap, royal jelly extractor, venom extractor.

Procedures

Propolis:

1. Propolis (Fig 22.1) is collected by bees from resinous exudates of buds, bark and wounds of plants/ trees. It is used by bees for sealing cracks and crevices and foreign material/predators.

2. Screens or special plates (Fig 22.2) with small holes are used in place of inner cover to extract propolis, which simulate cracks in the hive walls. Bees try to seal the holes and thus fill the trap with propolis.

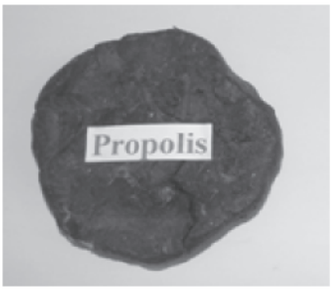

Fig. 22.1: Propolis

Fig. 22.2: Propolis screen

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3. Propolis is removed from traps by cooling the plastic sheets or fly-screens for a few hours in a refrigerator or freezer.

4. Once cooled, the propolis becomes brittle and can be removed from the screens by simply flexing and brushing them.

Pollen:

1. The pollen collected by honeybees is usually mixed with nectar or regurgitated honey in order to make it stick together and adhere to their hind legs.

2. It is collected by installing pollen trap (Fig. 22.4) at the entrance of the hive after removing the entrance rod of the wooden hive.

3. While the pollen loaded bees return to the colony through the holes of the pollen trap, the pollen balls attached to the hind legs get dislodged on a mesh behind and are collected in a tray beneath the mesh.

4. Pollen should be cleaned to remove insect parts, wax moth, debris, moulds etc. and dried to less than 10% moisture before storing in refrigerator.

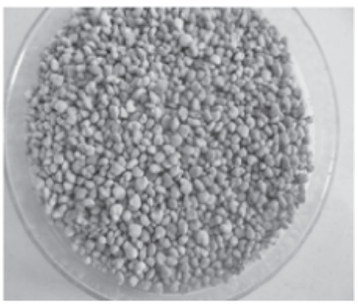

Fig 22.3: Pollen pellets

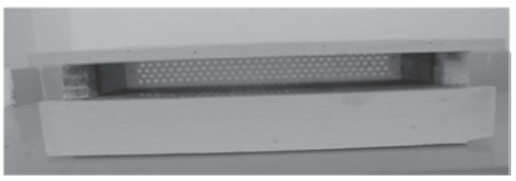

Fig. 22.4: Pollen Trap

Royal Jelly

1. For collection of royal jelly, 24 h old larvae should be grafted into 60-120 strong (20 bee frame strength) queen less colony.

2. Royal jelly be extracted after 72 h of larval grafting manually or using royal jelly extractor.

Bee Venom

1. Bee Venom can be collected from bee colonies by placing an electrically charged grid called as venom extractor (Fig. 22.5) with a thin synthetic material stretched under it on glass plank at the base of the beehive.

2. Bees receive a mild shock when they alight on the device and sting it leaving venom on the plank. .

3. The dried bee venom is later scraped off.

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Fig. 22.5: Venom extractor

Observations & Result

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Precautions

1. Use protective clothing and smoker while examining honey bee colonies.
2. Handle the smoker carefully.
3. Follow recommended techniques for opening and examining hive honey bee colonies.
4. Handle all the tools carefully.
5. Take the collected samples immediately to the laboratory.

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Practical 23

PREPARATION OF COMB FOUNDATION SHEETS

Objective

After completion of this practical you will be able to prepare comb foundation sheet from beeswax.

Tools/ Equipments/ Material required

Wax, wooden/glass plank, soap, water, comb foundation mill, comb foundation press.

Procedure

1. Melt the wax in a wax melting drum placed in hot water.
2. Dip a wooden/glass plank firstly in soap water solution and then two to three times in molten wax to form a thick layer of wax over the plank.
3. Dip the wax coated plank into cold water in a container to cool the wax.
4. Upon cooling, the wax sheets are removed from both the sides of planks. This gives two sheets at a time.
5. Put the wax sheet in soap water and roll the sheet through the rollers of comb foundation mill (Fig. 23.1) for embossing the cell impressions. Comb foundations having worker brood cells impressions will come out of the other side of the machine.

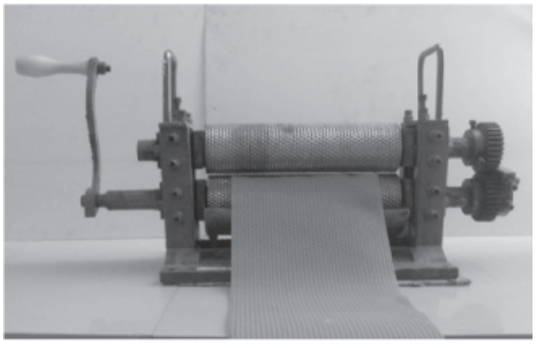

Fig. 23.1: Comb foundation mill

Notes

6. Wash these comb foundations to remove adhering soap solution.

7. The sheets of embossed wax are then cut into the rectangular sizes needed for frame hive beekeeping.

8. Alternately comb foundation press (Fig. 23.2) made up of sand and cement, cemented into a wooden frame can be used for preparing comb foundation sheets. The upper and lower surfaces of press are imprinted deeply with a comb cell pattern. Melted wax is poured onto one side and the frame closed. The solidified sheet can be pulled off the cement base and has a raised pattern of cells on both sides.

Fig. 23.2: Comb foundation press

Observations & Result

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Precautions

1. As a beginner, you should buy only the standard size parts of a frame.
2. Be careful while using hammer and sharp tools.
3. Always keep First Aid Kit handy when working with tools.

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Practical 24

INSTALLING / FIXING AND STORAGE OF COMB FOUNDATION SHEETS

Objective

After completion of this practical you will be able to install and store the beeswax comb foundation into wooden frame.

Tools/ Equipments/ Material required

Prepared or purchased wax comb foundations, pre-wired hive frame, container or burning candle, wire embedder, super chamber, newspaper.

Procedure

Installing/fixing comb foundation sheets:

1. Take either prepared or purchased wax comb foundations of desired bee species.
2. Place pre-wired hive frame flat on the work table (make sure to place the frame with the 3/8 x 5/8 grooved top bar facing up to allow foundation and wedge strip to be inserted).
3. Place wax comb foundation sheet into hive frame and insert its one length wise edge into the groove of top bar of frame. Pour molten bees wax through a container or burning candle on the sheet along the groove to fix it into the frame. To give extra strength fix the wires of the frame attached to the face of the comb with drops of melted wax or by pressing the wire into the comb foundation with a sharp heated knife or hive tool.
4. Wire embedder (small tool with a spur or round wheel on the top) can also be used to fix comb foundation with the frame wires. Now a days, electric wire embedder is also used for this purpose.
5. Foundation is mainly used in the brood chamber and in or just before the honey flow season. If combs are needed in the super of a bee colony, it is best to use stored old combs, or to move honeycombs from the brood chamber to the super and place new comb foundation in the brood chamber.

Notes

6. The frame with foundation can be placed at the centre or side of the hive according to the colony status and season. It should be placed at the side in a strong colony and at the centre in a weak colony.

7. It is better not to provide foundation during the dearth season, but if needed, it should be placed at the side.

8. In a strong colony, old combs or foundation should be added to the super shortly before the honey flow season. Two or more comb foundations can be supplied at the same time to a colony in the honey flow season.

9. Comb foundation can be cut to fit the super chamber if needed.

10. The colony size and external temperature should be taken into consideration when adding comb foundation.

11. During the cold season, the comb foundation or stored old combs should be dipped in warm water before placing in the hive.

Storage of comb foundation sheets

1. In case of newly prepared comb foundation sheets, they should be wrapped in clean newspaper, with individual sheets separated by a piece of paper, and stored safely in a cool dry place for later use.

2. In case of old combs wrap them in newspaper and store safely in a cool, dry place protected from fungi and insects. Make sure they are free from wax moth or other pests before reusing.

3. After opening a packet of old combs, select ones that are reusable and air them in the open for 24 hours in a safe place.

4. Immerse the combs in clean water for a short time, drain the water from the cells on both sides, dry in the shade, and then use.

Observations & Result

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Precautions

1. As a beginner, you should buy only the standard size parts of a frame.

2. Be careful while using hammer and sharp tools.

3. Always keep First Aid Kit handy when working with tools.

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