

EXPLORE



4-H BEEKEEPING PROJECT *BEGINNING BEEKEEPING*



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texas4-h.tamu.edu



EXPLORE

TEXAS 4-H BEEKEEPING PROJECT



Description

The Texas 4-H Explore series allows 4-H volunteers, educators, members, and youth who may be interested in learning more about 4-H to try some fun and hands-on learning experiences in a particular project or activity area. Each guide features information about important aspects of the 4-H program, and its goal of teaching young people life skills through hands-on experiences. Additionally, each guide contains at least six learning experiences, which can be used as a project guide, or as

activities for six different 4-H meetings.

Purpose

Texas 4-H is designed to develop the youth of our state into productive adult citizens. The 4-H Program uses a non-formal educational process of engaging youth in a "learning by doing" process. This includes hands-on opportunities, participation in workshops and clinics conducted by volunteer leaders or professionals, as well as competitive experiences which allow 4-H members to demonstrate the knowledge they have gained. Through this entire process, the youth are learning key life skills such as working with others, teamwork, cooperation, and goal setting. Through all experiences, youth get to interact with adult volunteers and county Extension agents.

What is 4-H?

4-H members across the nation are responding to challenges every day in their communities and their world.

As the youth development program of the Cooperative Extension System of land-grant universities, 4-H is the nation's largest youth development organization, empowering six million young people throughout the United States. Cooperative Extension of 1862 and 1890 land-grant universities provide leadership to engage young people in 4-H in all 3,007 counties of the United States. The impact of the Cooperative Extension partnership is profound, bringing together National Institute of Food and Agriculture of USDA, land grant universities and county government to resource learning

opportunities for youth.

Through America's 110 land-grant universities and its Cooperative Extension System, 4-H reaches every corner of our nation—from urban neighborhoods to suburban schoolyards to rural farming communities. With a network of more than 6 million youth, 600,000 volunteers, 3,500 professionals, and more than 25 million alumni, 4-H helps shape youth to move our country and the world forward in ways that no other youth organization can.

Texas 4-H

Texas 4-H is like a club for kids and teens ages 5-18, and it's BIG! It's the largest youth development program in Texas with more than 550,000 youth involved each year. No matter where you live or what you like to do, Texas 4-H has something that lets you be a better you!

You may think 4-H is only for your friends with animals, but it's so much more! You can do activities like shooting sports, food science, healthy living, robotics, fashion, and photography.

Look for 4-H clubs at your school, an after-school program, a community center, or even on a military base or through the reserves for military families.

Texas 4-H is part of the Texas A&M AgriLife Extension Service and the Texas A&M System. Founded in 1908, 4-H is the largest youth development program in Texas, reaching more than 550,000 youth each year.

The 4-H Motto and Pledge

"To Make the Best Better!"

I pledge: My HEAD to clearer thinking, My HEART to greater loyalty, My HANDS to larger service and My HEALTH to better living, For my Club, my Community, my Country, and my world.

Participating in 4-H

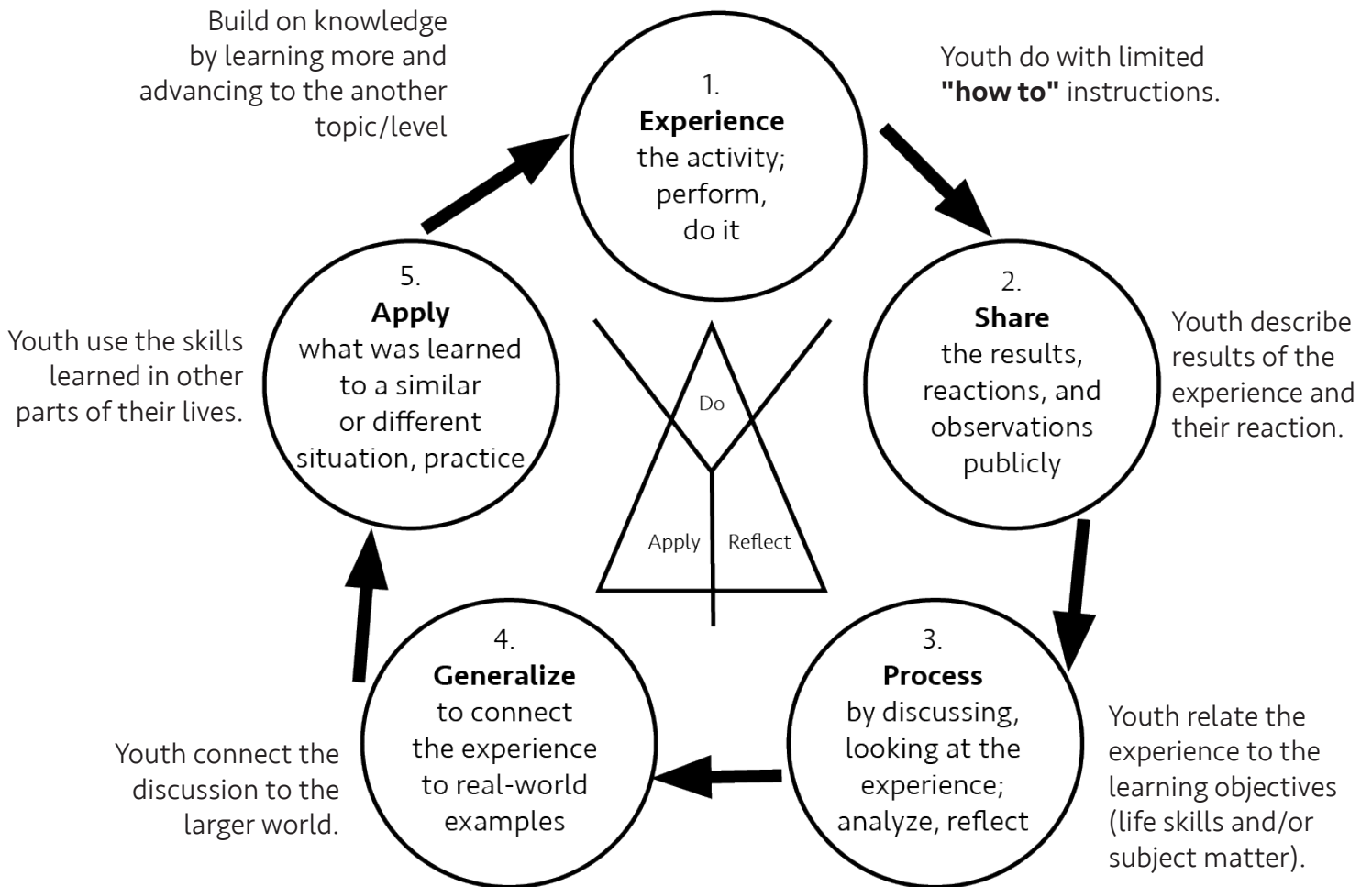
4-H is a great program because it provides options for young people to participate. From a 4-H club located in your community, a SPIN club that focuses on one particular project area, or participating in 4-H through your classroom at school, 4-H allows youth to learn in many different environments. If you are interested in joining 4-H, contact your County Extension Office and ask for a list of the 4-H clubs in your area. If you are a school teacher/educator and would like to use 4-H curriculum or these project guides in your classroom, contact your Extension Office as well for assistance.



4-H "Learning by Doing" Learning Approach

The Do, Reflect, Apply learning approach allows youth to experience the learning process with minimal guidance from adults. This allows for discovery by youth that may not take place with exact instructions.

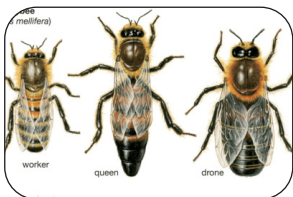
EXPLORE THE CONTENT Introduction of the topic, overview and exploration of content, and review of objectives



4-H BEEKEEPING PROJECT *Lessons*



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AgriLife Extension, Texas
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and Texas Beekeepers
Association under SARE
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EXPLORE

Introduction to Beekeeping

**TIME:**

- 6 Hours

MATERIALS NEEDED:

- Device with internet access
- Notebook
- Pen

OBJECTIVES:

The 4-H member will: attend a local beekeeping club meeting, identify a mentor beekeeper and do a hive inspection with the beekeeper.

EXPLORE THE CONTENT:

The U.S. honey bee industry plays a valuable and important role in the overall agricultural economy and there continues to be an increased interest in beekeeping nationwide, both in urban and rural areas. According to the United States Department of Agriculture's National Agricultural Statistics Service (USDA NASS), in 2020, there were more than 2.7 million colonies of bees producing 148 million pounds of honey in the U.S. Pollination and other income from honey bees were \$254 million and \$55.8 million, respectively. In 2020, Texas reported 157,000 honey producing colonies (worth \$17 million), making it the 6th largest state in both number of colonies as well as value of production. According to TBA, there are approximately 300 commercial (operations with more than 300 hives) beekeeping operations in Texas that typically produce honey or transport bees to pollinate tree fruit and other crops both in Texas and California. Currently, there is an estimated 5,000 small-scale producers (operations with less than 25 hives) in Texas and the numbers are growing. Approximately 700 beekeepers are referred to as "sideliners" (operating 25 to 300 hives but do not consider beekeeping their primary income).

DO:

1. Find a local beekeeping club and attend a meeting.
<https://texasbeekeepers.org/local-beekeeper-associations/>
2. Identify a mentor beekeeper and schedule a time to meet up with him/her to do a hive inspection.
3. Write a summary paragraph about what you learned.

REFLECT:

- What was the most interesting part of your experience?
- Were you surprised by what you saw?
- On a scale of 1-10 how interested would you be in having your own hives someday with 1 being not at all and 10 being extremely interested?

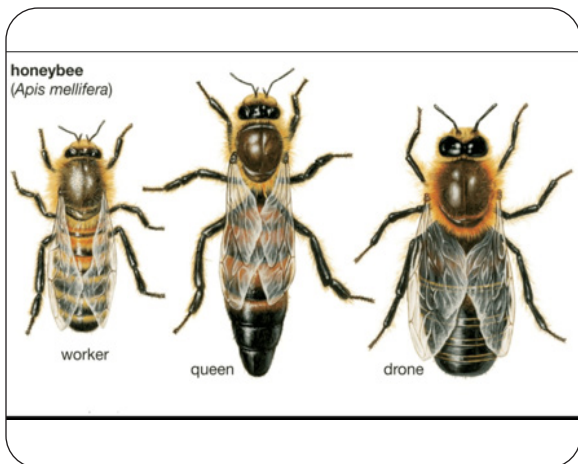


I MET A
BEEKEEPER



Summary of Your Experience

Honey Bee Biology



EXPLORE THE CONTENT:

Honey bees have one of the most unique biological systems in the insect world. These insects are considered to be social insects, meaning that the bees in the colony work together to complete tasks that make the colony thrive. As a beekeeper it's important to understand honey bee biology so you can better understand how your colony is growing, ensure healthy bees, and ultimately have a productive hive. This lesson will introduce you to the different types of honey bees in a colony, the lifecycle of a honey bee, and the lifecycle of the entire hive.

Honey bee colonies are made up primarily of worker bees that live in a hive. All worker bees are females and are responsible for completing a variety of tasks to ensure a functioning and successful colony. A hive can also have male bees, which are called drones. Drones do not complete any tasks within the hive, rather they are cared for by the worker bees and their only purpose is to mate with a queen bee. Every honey bee colony has one queen, whose sole responsibility is to lay eggs. The worker bees care for her to make sure she stays healthy and protected. Honey bees are considered holometabolous insects, meaning that as they develop from egg to adult, they go through a complete transformation. This cycle starts off with the queen laying

TIME:

- 30 minutes

MATERIALS NEEDED:

- Device with internet access

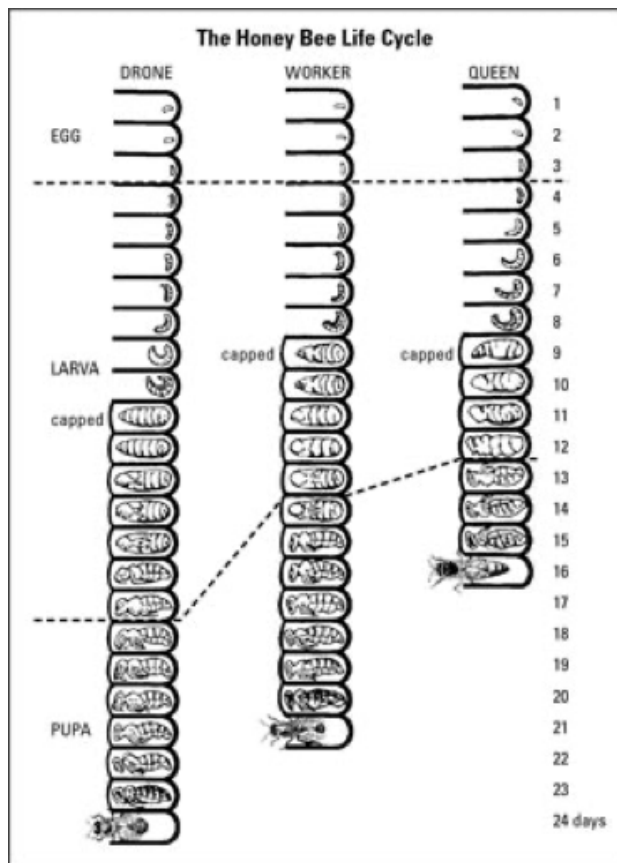
OBJECTIVES:

- The 4-H member will become familiar with honey bee biology, castes and life cycle.

an egg in the back of a cell in the wax comb. The egg hatches into a small larva, which grows in size over a period of a few days. At a certain point a worker will cap the cell with wax while the larva continues its transformation. Once the cell is capped, the larva turns into a pupa, and starts to look like a honey bee. Finally, the pupa will develop into an adult bee.

Once the adult is ready to emerge from its cell, it will chew the wax capping, crawl out of the cell, and soon start its tasks in the colony. All bees in the colony (workers, drones, and the queen) go through the same development process, however they each vary in their developmental time. Workers take 21 days to develop from egg to adult, drones take 24 days, and queens take about 16 days.

A honey bee colony also has a life cycle. Several changes occur through the seasons at the colony level. In the spring, a colony's worker population will start to grow, workers will begin to collect nectar to turn into honey, and pollen to feed to the developing brood (brood is another word for the eggs, larvae and pupae). The queen will start laying eggs to produce more workers, as well as start to produce drones.



These drones will fly out of the hive to go mate with other honey bee queens in the area. The colony may also produce queen cells with the goal of swarming. Swarming is reproduction at the colony level and is the ultimate goal of the colony. When a hive swarms, the original queen will leave with half of the worker population to go start a new hive. The bees remaining in the original hive will raise a new queen and will continue to grow.

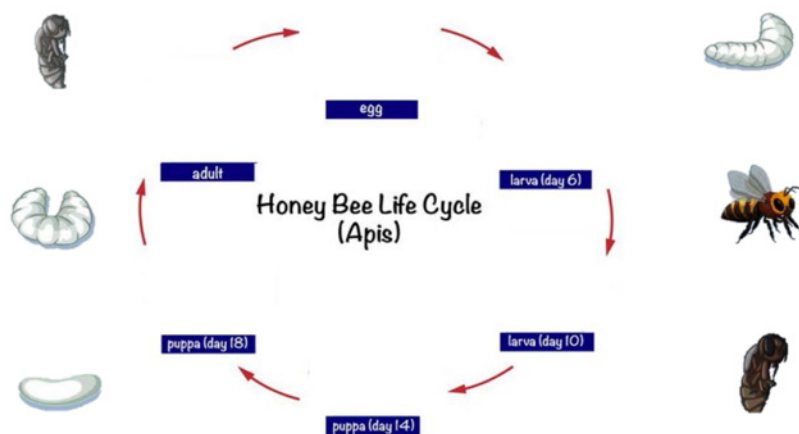
In addition to the changing population of the colony, the amount of honey and pollen stored in a colony will also change throughout the year. The amount of natural resources available to bees in the surrounding area change through the seasons. Beekeepers will notice when their bees have found a good nectar resource by an increase in the amount of honey being stored in the hive. There are also times where there are limited resources available, and that's when you will notice either a pause in honey production, or a decrease as the bees rely on their honey stores to survive the slower months. These honey stores are especially important for a honey bee colony to survive resource dearths, which most commonly occurs during the winter months. A 'dearth' is a season when there is not much pollen or nectar to be found. During the winter season, temperatures drop causing the bees to hibernate in the hive. They cluster together to stay warm and rely on their honey stores to survive until spring. In preparation, a beekeeper must make sure that enough honey is left for the bees to eat during the winter months.

DO:

1. Review the Biology of a Honey Bee Lifecycle on the Texas Beekeeping 101 page at <http://www.texasbeekeeping101.com/honey-bee-biology>
2. Watch the Lifecycle of a Honey Bee video <https://youtu.be/f6mJ7e5YmnE>
3. Draw lines to match each of the stages of a honeybee life cycle to its name and development time in the diagram below.

REFLECT:

- Can you identify a honey bee versus other yellow stripey things?
- Can you tell the difference between a queen, drone, and worker bee?
- What do honey bees eat?
- Can you explain to someone how a honey bee forages for pollen and nectar and what happens when the bee returns to the hive?



Beekeeping Equipment

**TIME:**

30 minutes

MATERIALS NEEDED:

- Pencil
- Device with internet access

OBJECTIVES:

The 4-H member will become familiar with equipment used in beekeeping.

EXPLORE THE CONTENT:

The beekeeping community uses a variety of tools and equipment, however when starting out, there are only a few items that every beekeeper needs. This lesson will cover the basic protective equipment to wear and use when working a honey bee colony, as well as the hive equipment needed to maintain a hive.

At the most basic level, every beekeeper needs a hive tool, a smoker, and a veil. A hive tool is necessary for opening a hive and moving frames within the hive. A smoker helps keep the bees calm as a beekeeper works the hive. The smoke produced masks the alarm pheromone that bees exchange, and this prevents the colony from becoming agitated. The smoke also helps move the bees away from areas where a beekeeper may place a hive tool or when stacking hive boxes. A veil helps protect the beekeeper's face from potentially being stung. Depending on the comfort level of the beekeeper, beekeeping jackets and suits may be worn, as well as gloves, for added protection. There are several different types of hive bodies available on the market, but the most common form is called the Langstroth hive. The Langstroth hive consists of boxes with frames of wax comb that stack on top of each other. There are three sizes of boxes available: deep, medium, and shallow. In general, the bottom box is a deep box and is where the queen lays eggs. This is referred to as the "brood chamber". The bottom box sits on top of a bottom board, which provides extra protection and stability. The bottom board can either be solid or screened, depending on the beekeeper's preference. On top of the brood chamber, additional boxes can be stacked to provide more space for the colony as it grows through the seasons. Beekeepers will often set a medium or shallow box on top, providing the bees space to store honey. These boxes are often called "supers" or "honey supers". To help ensure that the queen does not lay eggs in the honey super, beekeepers may sometimes place a queen excluder between the bottom box and the supers. Workers are small enough to crawl through the excluder, but the queen's abdomen is too large and prevents her from passing through. On top of the box(es) is a lid. The lid helps protect the colony from the weather and provides complete darkness inside the hive. There are two different types of lids to choose from: telescoping and migratory. The telescoping lid has a lip on all four sides, whereas the migratory lid only has a lip on the two short sides. Migratory lids are typically used in commercial beekeeping operations since the lack of a lip on the long sides of the lid allows the hives to sit close to each other on a pallet used for transportation.

There are other hive configurations, tools, and gadgets available on the market, but all a beekeeper needs to start out is simple protective equipment, a hive body and some bees!

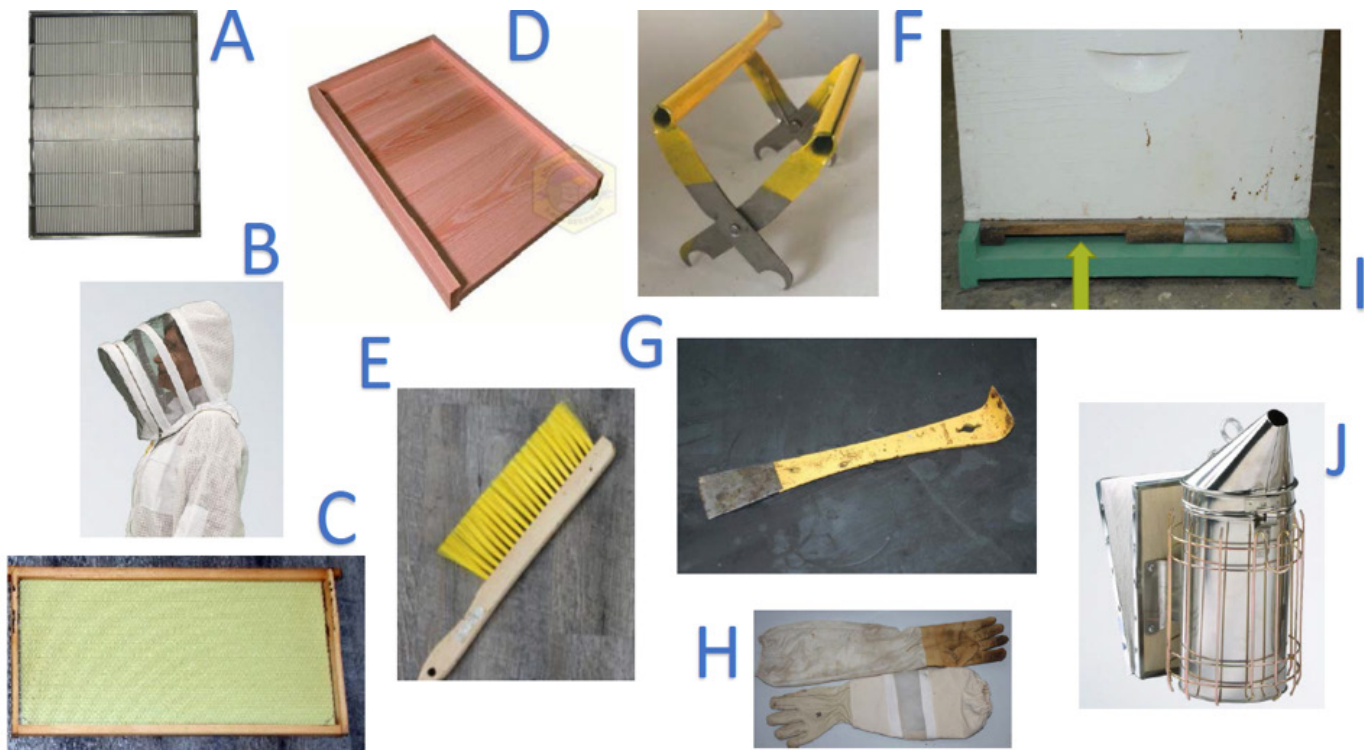
DO:

1. Review the Equipment Section of the Texas Beekeeping 101 page at <http://www.texasbeekeeping101.com/equipment>
2. Label each of the beekeeping equipment pieces on the following page.

REFLECT:

- What are the two primary types of hive bodies and which one is most used in Texas?
- List the top 5 most important items a beekeeper should have in order of importance.





A _____

B _____

C _____

D _____

E _____

F _____

G _____

H _____

I _____

J _____

Setting Up an Apiary



EXPLORE THE CONTENT:

Before a beekeeper even acquires a hive of bees, he or she must find a good spot to put them! There are several different factors to consider when choosing an apiary location.

The first factor to consider is whether the apiary will be located in a rural or urban environment. A rural location means that there is a lower risk of the bees interacting with other humans and animals. In an urban environment, a beekeeper must consider the human and animal activity that may occur in the surrounding area and take steps to prevent their bees from becoming a nuisance. A good apiary location will also have early morning sun exposure to help warm up the hive sooner.

A beekeeper should also consider the availability of nectar and pollen resources in the surrounding area. Are these resources available to the bees throughout the year? When are there strong nectar flows? These questions will tell a beekeeper when they can expect to have honey to extract, and when they may need to feed their bees when resources are lacking.

Believe it or not, bees also need water! They use water to cool their hive down when temperatures are soaring. A good apiary location will have a reliable source of water, such as a pond or a birdbath, that the bees can use to thermoregulate their hive. A beekeeper should monitor the level of water in the local source, and refill as needed to prevent their bees from visiting other water sources (like a neighbor's pool or a livestock water trough). On the other hand, too much water in an apiary can be a problem! When choosing an apiary location, a beekeeper should consider whether there is a risk of flooding when it rains. An apiary that floods could lead to a loss of the hives, damaged equipment, and an inability to access the hives when needed.

Finally, how easy will it be to access and work the hives? A good apiary location will be accessible to the beekeeper at any time. It should also have enough space for the beekeeper to move around when inspecting hives, as well as room to place boxes and other equipment as needed. An apiary that is easy to access and move around in means that the beekeeper will most likely visit the bees more often.

Management of an Apiary

Once you have picked out your apiary location, it's important to maintain it! Proper maintenance of an apiary will mean fewer pest problems, easier to get around in, and healthier bees. Maintaining an apiary involves:

- Mowing regularly to control the growth of weeds and grass
- Removing dead hives
- No dumping of wax or dead bees in the apiary
- Proper disposal of any old or unused equipment
- Proper disposal of pest treatments

TIME:

- 15 minutes

MATERIALS NEEDED:

- Pen
- Notepad

OBJECTIVES:

The 4-H member will understand the differences in keeping bees in a rural vs. urban environment and how to determine the best place to set up an apiary based on availability of necessary resources.

DO:

- Review the content in the Bee Yard Set up and Safety section of the Texas Beekeeping 101 curriculum at <http://www.texasbeekeeping101.com/bee-yard>
- List 3 of the most important things to consider before setting up an apiary.

REFLECT:

- Did you know that there were state and local laws specific to beekeeping?
- Did you realize that you can be a beekeeper even if you live in a city?
- If you were going to set up an apiary where you currently live right now, is there a space that you have in mind?
- Does it meet the criteria discussed in the content you reviewed?

Inspecting a Hive and Hive Management



EXPLORE THE CONTENT:

It's important for a beekeeper to regularly inspect their hives to make sure their bees are healthy and productive. It's best to open hives on a sunny and warm day, with temperatures above 55 degrees Fahrenheit. If the hive is opened in colder temperatures, there is a risk that the honey bee cluster will break and the bees will be chilled.

An inspection starts when you walk into the apiary. Take note of what is happening at the entrance of each hive, and check to see if there are any dead bees or activity on the ground just outside the hive entrance. If honey supers are present, do a quick check to see how much honey has been stored, as well as if you see any nectar present.

The bulk of a hive inspection will take place in the brood chamber. It's important to check at least two brood frames on each inspection. The status of the brood is a strong indicator of how healthy the colony is. Before any frames are removed, quickly take note of how many frames look like they are covered with bees. To do so, simply count the number of top bars that are covered with bees. This can give you an indication of the approximate population size. A colony's population will fluctuate through the seasons, so the number of frames covered with bees will change over the year. Next, pull out some brood frames and start by looking at the bees that are on these frames. The workers should look healthy and be moving about the frame.

TIME:

30 minutes

MATERIALS NEEDED:

- Device with internet access
- Printer
- Pen/Pencil

OBJECTIVES:

The 4-H member will learn how to inspect a hive and proper hive management skills.

Any bees that have twisted wings or look shiny and hairless could mean that there is a pest issue, but we would need to check for other symptoms before reaching a final conclusion.

Next, let's zoom in slightly and take a look at the brood pattern. A healthy brood pattern should look mostly even, but may have a few empty cells. If the pattern looks spotty, this could mean there is a health issue going on in the hive and we will need to look for other symptoms to determine the issue.

Let's zoom in again and take a closer look at the developing brood. When looking at brood frames, check to see if there is brood at all stages (eggs, larvae, and capped brood). The presence of eggs will indicate that there is a queen present in the hive. The larvae should look pearly white and be in a C-shape in the back of the cell.

Finally, the cappings of the brood should look slightly convex with no pinprick holes in the wax. Any variations from these descriptions could mean that there is an issue with the queen, or presence of a pest or disease.



In addition to looking at the brood, it's also important to take note of the pollen and honey/nectar stores currently available in the hive. Pollen may be yellow or orange or red in the cells. Nectar will be liquid and shiny. These resources are important for supporting brood production and the overall survival of the colony. If the hive seems to be lacking in either or both resources, supplemental feed options are available to provide additional support.

While the brood chamber is open, this provides an opportunity to sample for Varroa mites, a common yet potentially lethal pest in honey bee colonies. Regularly sampling for Varroa mites helps a beekeeper track their population changes over time and prevent the mites from reaching damaging levels. Also take note of any other pest or disease symptoms that may be exhibited.

It's helpful to maintain a notebook that tracks the status of each hive, as well as the results from each Varroa mite sampling. These notes can help you track changes over time and see what management practices work best for you!

Hive Management

When it comes to managing a honey bee hive, a beekeeper's activities will change with the seasons. Hive management really kicks into gear in the spring when a honey bee colony starts to grow, however the first season we will start with is winter since this is when beekeepers start to prepare for the upcoming spring season.

Winter is a relatively slow time of year for managing a honey bee colony. This provides a beekeeper an excellent opportunity to repair old equipment, purchase and build new equipment, and order new bees and queens to be picked up in the spring. Although temperatures may not always be ideal for a quick hive inspection, it's important to monitor the amount of honey stores the hive has available and provide supplemental feed if needed.

As temperatures start to warm and spring arrives, beekeepers will become more hands on with their hives. This is the time to do a thorough hive inspection, checking on the available stores, the size of the worker bee population, if brood production has started, and if there are any signs of pest or disease damage. The spring is also the time when a beekeeper will pick up any bees and/or queens they may have ordered over the winter and install these bees into a new hive. To jumpstart hive growth, it helps to feed each hive sugar water so the bees have the energy to generate wax and start building new comb. A beekeeper may also feed their hives pollen substitute in the early spring to encourage early brood buildup. As the hive population starts to grow, it's important to keep an eye out for and remove any swarm cells that may develop, as well as ensure that the hive has enough space to grow, meaning the queen has space to lay eggs and the workers have space to store honey and pollen. As the spring progresses, any hives that are strong (i.e. big worker bee population, good brood production, lots of stored resources), then a beekeeper may consider splitting the hives to grow their operation.

The summer in Texas can be a challenging season for honey bees. During this season it's important for a beekeeper to ensure that their hives have a reliable water source. Honey bees use water to cool down their hives and can gather about a gallon of water a day when temperatures are high. The summer can also be a time of nutritional dearth for honey bees. Depending on the location, there may be very little for the bees to forage on, so a beekeeper must continue to monitor the amount of stores available in the hive and feed the bees as needed. A beekeeper should also continue to keep an eye out for signs that the hive may swarm, as well as monitor for symptoms of pests and diseases.



As the year progresses into the fall season, a beekeeper may notice that another nectar flow has begun and that the bees are bringing in natural resources again. This is the time to make sure that the bees have enough space to store the honey. As we move later into the season, the queen will start to slow her laying, and there may be a slight decline in the population size of the hive. The beekeeper will start preparing their hives for the coming winter months. At this point, hives should have low pest and disease levels, enough honey stores to survive the next few months (at least one full super), queen excluders should be removed if they were used, and the entrance to the hive should be reduced. All of these steps help ensure that the bees will be healthy, well-fed, and protected over the winter. Reaching the end of the fall season means that you have completed your first year as a beekeeper!

DO:

- Review the content in the Hive Management section of the Texas Beekeeping 101 curriculum at <http://www.texasbeekeeping101.com/hive-management>
- Complete the worksheet by answering questions on the following page.

REFLECT:

- At this point in our project, do you believe that beekeeping is something you would be interested in doing in the future?
- What are the primary areas of beekeeping that interest you most?
- If you answered, no, what makes it unappealing?



In the two photos above, which one has a healthier population?

LEFT RIGHT

Would you say that the hive on the left is showing healthy populations, why or why not?

YES NO

How many top bars are covered with bees in the photo on the right? _____



In the two photos above, which frame has a healthy brood pattern?

LEFT RIGHT

What could be going on in the frame with a spotty brood pattern? _____

Name three things you should look for when you open the hive?

1. _____
2. _____
3. _____

Are there certain time of the year that you should not open the hive?

YES NO

When does that typically occur?

WINTER
 SPRING
 SUMMER
 FALL

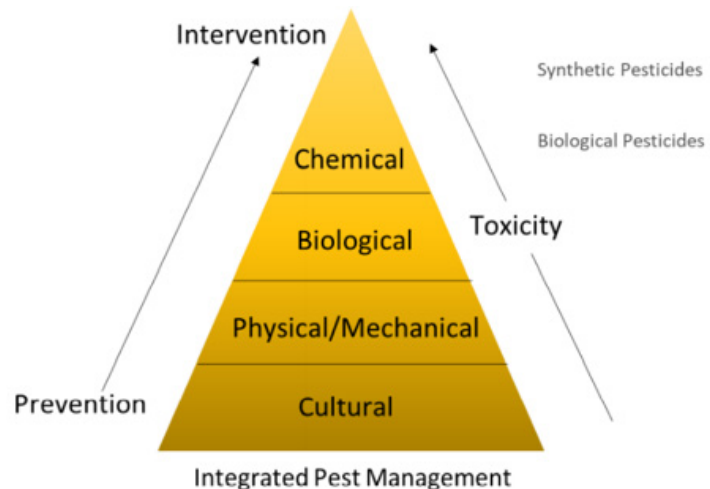
Why? _____

Pests and Diseases



EXPLORE THE CONTENT:

Honey bees have their fair share of pests and diseases that can impact their health, and it's important for a beekeeper to regularly monitor for these issues to ensure the success of their hives. This lesson will introduce you to the practice of Integrated Pest Management (also known as IPM), as well as a handful of pests and diseases that are typically found in honey bee hives across Texas.



TIME:

- 30 minutes

MATERIALS NEEDED:

- Device with internet access; scissors, glue, red and blue crayon or colored pencil.

OBJECTIVES:

The 4-H member will understand the importance of IPM in honey bees and be able to identify common pests and diseases.

Overview: Integrated Pest Management

Integrated Pest Management (IPM) is a multipronged approach to pest control that does not solely rely on chemicals to reduce a pest infestation. IPM stresses the idea of prevention when possible, regularly monitoring for pests, and using methods of control when necessary. IPM strategies exist for each pest and disease and consider pest biology, pest-host interactions, and the safety of the environment, people, and the host. Unlike traditional methods of managing for pests and diseases (i.e. calendar-based applications of pesticides), IPM uses a system of monitoring to determine if and when to intervene. IPM stresses the idea that a certain level of pests is acceptable (Figure 1). Only when that pest level exceeds the set action threshold is intervention necessary. An action threshold is the highest population that a pest can reach before damages to the host are likely to occur. By treating only when necessary, the amount of pesticide in the environment is limited, resistance to chemicals is decreased (particularly if chemicals are used in a rotation), and farmers often save money by not buying unnecessary pesticides.

Honey Bee Pests

Varroa Mite (*Varroa destructor*)

Currently, the Varroa mite is considered to be the greatest challenge in beekeeping today. It is a parasitic mite that feeds on honey bees, transmits viruses, and relies on the honey bee brood cycle for its own reproduction. Varroa mites originate from Asia and were first introduced to the United States in the late 1980's. Since then, Varroa has spread across the entire U.S., and is now a pest that each beekeeper must manage in their hives. If the Varroa population in a hive exceeds a threshold, the honey bee colony will be weakened and eventually die. Symptoms of a serious infestation can include: a spotty brood pattern, mites seen crawling on adults, in the cells, and inside



brood cappings, a diminishing adult population, adults with deformed wings, pupae uncapped prematurely, etc. Varroa mites are also associated with Parasitic Mite Syndrome and is often the tell-tale sign of a colony close to collapse. Controlling Varroa populations is key to the survival of a honey bee colony. Several IPM methods have been developed to help prevent Varroa populations from growing and control these populations if they get out of hand. Regularly monitoring Varroa populations in each hive is essential to implementing effective preventative and control methods.

Small Hive Beetle (*Aethina tumida*)

A native of Sub-Saharan Africa, small hive beetles (SHB) are a relatively new pest to the United States. Considered by most to be a secondary pest, SHB pose the greatest threat to already weakened colonies. A beekeeper may spot adult SHB in honey bee hives, but if the colony is strong, the bees will manage these adults and keep them to the outer edges of the hive. If SHB larvae are allowed to develop in a hive, then damage could occur to the honey and pollen stores, as well as the developing honey bee brood. The SHB larvae will tunnel through the colony feeding on pollen, nectar, and brood, causing fermentation of the hive products and the characteristic sliming of equipment. Once equipment is covered in this slime, it becomes unusable by the bees and must be removed and disposed of. The key to preventing SHB from becoming an issue is to maintain a strong, healthy colony, and control SHB at the adult stage. Using an IPM approach to controlling SHB populations within a colony is the best strategy. There are several forms of mechanical control that can be implemented. Placing hives in sunny, well-ventilated areas is recommended. There are also several SHB traps available on the market that are used to trap the adults and can be reused. In addition, maintaining clean apiaries is also essential as old equipment and dead outs are a haven for beetles if left out in a yard.



Wax Moth (*Galleria mellonella*)

Just like SHB, wax moths are considered to be a secondary pest and only cause damage when a honey bee hive is already weakened. Adult wax moths will enter a hive to lay their eggs. Once the eggs have hatched, the larvae will hide in the comb and feed on pollen, wax, and honey. The larvae will pupate in the hive and attach their silk cocoons to the boxes and frames, creating large gauges in the wood. Maintaining a strong and healthy colony is the best defense against the wax moth. Place any infected comb in a freezer to kill the larvae and eggs. When storing supers, crisscross their stacking and expose them to light to deter wax moths from inhabiting them.



Honey Bee Diseases

American Foulbrood (*Paenibacillus* larvae)

While no longer the primary cause of honey bee death in the United States, American Foulbrood (AFB) remains a major threat to honey bees worldwide. This disease, caused by a spore-forming bacteria, is highly contagious and lethal in nature. These spores can persist in wax comb and honey indefinitely. It is these characteristics that make American Foulbrood such a serious problem for beekeepers and is what prompted Texas and many other states to create apiary inspection programs in an attempt to safeguard the industry. This disease primarily affects the pre-pupae and pupal stages of honey bee development. Larvae typically die in the upright position, unlike larvae affected by European Foulbrood, and may be capped over, therefore not visible. The brood pattern will often be scattered and the cappings will appear sunken and punctured. Once dead, the larvae will no longer be pearly white in color, but will turn from brown to black. The larvae will slowly desiccate and will shrink down onto the bottom of the cell. One characteristic of AFB is the "ropy" condition of the infected bee that can be tested by inserting a twig or match into the affected cell, swirling the larvae around and drawing the dissolved larvae out of the cell. The dead larvae will adhere to the cell and can be stretched to at least 2 cm. After a month, the desiccating larvae will dry out completely,

leaving a brittle, black scale attached to the bottom of the cell that is difficult to remove. If the larva has reached the pupal stage before dying, it may leave behind a characteristic “pupal tongue” which protrudes from the dead pupae to the top of the cell. AFB also gives off a characteristic sulfur-like foul smell for which the disease gets its name “foulbrood”.

American Foulbrood is spread from infected colonies to healthy ones via robbing and drifting bees. When a diseased colony inevitably dies, robbers from surrounding colonies rob the boxes of their AFB tainted honey and nectar, transmitting the bacteria to healthy hives. Beekeepers can also be vectors of this disease. Care should be taken when interchanging frames between colonies, ensuring that no AFB is present. The same care should be taken when feeding honey or pollen. If a hive is suspected to have AFB, any equipment (hive tool, smoker, bee suit, etc.) should be sterilized immediately before manipulating other honey bee colonies. Additionally, if AFB is suspected, the beekeeper must contact the state apiary inspection program. Spores can lie dormant for decades and still have the potential to re-infect the colony when conditions are favorable. Generally, the most effective method to prevent the spread of AFB is to seal off and then burn all infected colonies and equipment, including adult bees, brood, wax, honey, frames, inner covers, and bottom boards. Hive bodies can be scraped clean and scorched, however there is no guarantee that all spores will be destroyed using this method.

European Foulbrood (*Melissococcus plutonius*)

While not as detrimental as AFB, European Foulbrood (EFB) is a bacterial disease that has the potential to decimate a honey bee colony under certain conditions. Like AFB, EFB targets and kills young larvae before they reach adulthood. Unlike AFB, however, EFB does not create spores, making this disease more manageable for both bees and beekeepers. Honey bee larvae become infected when nurse bees feed them EFB-contaminated brood food. The bacteria then begin to multiply in the midgut and compete with the larvae for food which causes infected larvae to request a greater than average amount of brood food. Those larvae are often removed from the colony by nurse bees if there is a large enough population. This hygienic behavior allows most colonies to contain an infection or rid the colony of it completely. If larvae aren't ejected from the colony, they will eventually die in the cell, typically at the coiled stage before pupation. Larvae will look twisted and dull and turn from pearly white to yellow to brown. Eventually, the larvae will completely desiccate and form a rubbery scale that can easily be removed. Like AFB, there is a spotty appearance to the brood pattern. EFB also has a distinct sour odor of decay from which the disease gets the name “foulbrood”.

Like AFB, European Foulbrood is spread from infected colonies to healthy ones via robbing and drifting bees. When a diseased colony inevitably dies, robbers from surrounding colonies rob the boxes of their EFB tainted honey and nectar, transmitting the bacteria to healthy hives. Beekeepers can also be vectors of this disease. Care should be taken when interchanging frames between colonies, ensuring that no EFB is present. The same care should be taken when feeding honey or pollen. If a hive is suspected to have EFB, any equipment (hive tool, smoker, bee suit, etc.) should be sterilized immediately before manipulating other honey bee colonies.

European Foulbrood is associated with nectar dearths, high Varroa mite populations, and other colony stresses. Typically, colonies can rid themselves of this disease during a steady nectar flow. If, however the colony seems to be unable to stop the spread of disease, antibiotics may be used or colonies can be requeened. Requeening can add more hygienic behaviors to the colony and creates a break in the brood cycle allowing nurse bees to remove dead larvae and polish the cells.

Parasitic Mite Syndrome

Parasitic Mite Syndrome (PMS) is a widely observed and yet often misdiagnosed disease. PMS is often confused for American foulbrood (AFB), European foulbrood (EFB), and a disease call Sacbrood, as this is a disease that directly targets brood. Incidence of PMS is highly correlated with the presence of Varroa mites. Signs of this disease include rapid decline of the adult population, increased supersedure, lack of eggs and developing larvae, and Varroa mites seen on both bees and comb. Bees are often seen crawling near the hive entrance and it is also common to see



adult bees suffering from deformed wing virus as well. PMS directly affects brood of any age, unlike AFB and EFB. The brood pattern will be very spotty and the brood themselves will appear melted into the bottom of the cell. It is also common to see chewed down brood or prematurely opened cells, both of which are hygienic behaviors intended to abort the brood. Infected brood may become discolored and acquire a smell as secondary bacteria set in. Colonies left untreated for mites will eventually decline in population to the point of collapse. Currently, the only method known to help control Parasitic Mite Syndrome is to maintain low levels of Varroa mites in a honey bee colony.

Management of pests and diseases in a honey bee colony is important for its success. Implementing IPM methods and regularly monitoring each hive will help ensure that your bees stay happy and healthy!

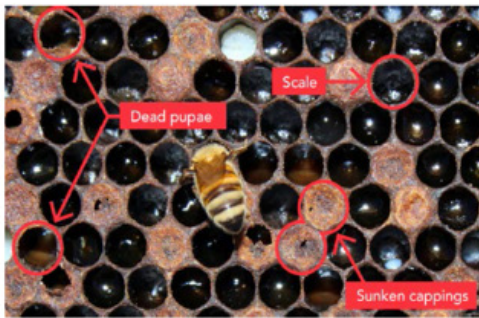
DO:

1. Read the 2 page “Integrated Pest Management for Honey Bee Health” handout published by the Texas Apiary Inspection Service found at https://txbeeinspection.tamu.edu/files/2018/01/IPM_honey-bees.pdf
2. Review the photos and descriptions of common pests and diseases at <http://www.texasbeekeeping101.com/pests-and-diseases>
3. Complete the pest and disease identification activity on the following page. Cut out each of the pest and disease identifiers and glue them onto the correct photo caption. Using a crayon or colored pencil, shade the pests red and diseases blue.

REFLECT:

- What are the five steps in an IPM strategy?
- What is the most detrimental disease found in honey bee colonies which requires the complete destruction of the bees and hives?
- What are some non-chemical measures you can take to prevent infestation of small hive beetles and wax moths?





American Foul Brood

Small Hive Beetle

Sac Brood

Deformed Wing Virus

Wax Moths

Varroa Mites