Nalomele...
Beekeeping in Hawai‘i

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Beekeeping, the “farming of honey bees”, can be an enjoyable hobby or a lucrative business if one acquires the basic skills and knowledge about honey bee management. Hawai‘i’s moderate climate and abundant plant sources allows for beekeeping to be done year round. This booklet provides a guide to some basic information on honey bees and “how to” on beekeeping.

In using this booklet, a word of caution…there are many ways to keep bees which are probably as diverse as beekeepers themselves. This booklet provides a guide and so the “how to” is ONE way and by no means the only way to keep bees.
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The Honey Bee

The Western honey bee, *Apis mellifera*, is an insect that belongs to the Order Hymenoptera, Family Apidae. In the world, there are other types of bees that are closely related to the honey bee but they do not have the same colony and behavioral characteristics.

The honey bee is a social insect. It lives in a colony that is made up of three classes; one queen, several hundred drones, and several thousand workers.

Beekeepers “keep bees” for several reasons: The primary reason for many is honey, which is usually collected and sold in an extracted form. Other products that can be collected from a honey bee hive are beeswax, which bees use to construct the honey comb cells (used for reproduction and for storage of pollen and honey), propolis, which is plant resins and gums that the bees use as a hive sealant, pollen, which is collected from flowers and used as a food source, and royal jelly, which is a substance fed to young larvae as a food source and is produced by the worker bee.

Can you identify the workers, drone and queen in the photo?

Sealed (ripe) and unsealed (green) honey in cells made of beeswax.

Propolis collected from tree resins and gums used as a sealant by bees in their hive.

Worker bee placing collected nectar into cell and dislodging pollen pellets from basket. Nectar and pollen visible in open cells.
For agricultural purposes, the other main reason for having honey bees is to help with pollination. There are many types of plants and trees that are dependent on insects to help in pollination. Without adequate pollination, fruit set and therefore crop production can be low.

Honey bees are considered good pollinators because when they collect nectar and pollen for their own needs, the pollen, which becomes trapped on their hairy bodies, is passed from flower to flower. Honey bees are very plant specific and only collect pollen from one plant species at a time and that is why they are so efficient at pollination.

Returning worker with compressed pollen grains in corbiculum.

Worker body covered with pollen grains.

Worker bee pollinating flower while foraging for nectar and pollen.

Honey bees pollinate many important agricultural crops in Hawai’i.
Anatomy and Biology

The honey bee has three basic body parts: head, thorax, abdomen. The head has one pair of antennae, one pair of compound eyes, and a set of mouthparts. The thorax has three pairs of legs and two pairs of wings. The abdomen has a stinger in both the queen and worker class but not in the drones.

The queen is a fertile female who lays all the eggs for the colony. She can be recognized because she looks more wasp-like and is longer and larger than the workers and drones. The queen has a barbless stinger that is used only in battles with other queens.

The drones are males who are responsible for mating with the queen. They are relatively large and more rounded in shape than the queen. A drone does not have a stinger and can also be recognized by their comparatively large eyes.
The workers are sterile females that perform the remaining duties of the hive. The workers clean the hive, defend (they have barbed stingers that are attached to a poison gland) and maintain the hive, feed the developing larvae, produce honey comb, and collect food for the hive in the form of pollen and nectar (which they turn into honey).

The eggs of all classes, which are white and somewhat banana-shaped, are laid by the queen who inspects the type of cell and then lays the appropriate type of egg (fertilized or unfertilized) into the cell. If the queen determines that the cell is a worker cell, she will lay a fertilized egg. If the queen determines that the cell is a drone cell, she will lay an unfertilized egg. If the queen determines that the cell is a queen cell, she will lay a fertilized egg. Within three days, the eggs of all three classes will hatch into larvae. The larvae (that are white and wormlike in shape) are fed and cared for by the nurse worker bees of the colony. Larvae of all classes are fed royal jelly which is produced in special glands found in the head of the nurse worker bee. These special glands are most active in worker bees that are between 5 to 10 days old. After three days, larvae that are in drone cells (hatched from unfertilized eggs) and larvae that are in worker cells (hatched from fertilized eggs) are fed a diet of diluted honey and pollen also known as bee bread. This diet is fed to the larvae for the duration of their larval feeding period. Larvae in queen cells (hatched from fertilized eggs) continue to be fed royal jelly for the duration of their larval period.

The larvae of all classes enter into a non-feeding pupal stage within a few days. During this period, the workers will seal the cell with wax. Within a few more days, the adult will emerge from the cell. The entire period from time the egg is laid to the time of adult emerges from the cell differs among the classes. For the worker, the period is 21 days. The queen takes 15-16 days and the drone takes 24 days.
The Basic Hive

In the wild, honey bee colonies can be found in the hollow of trees or on the outside of well shaded trees, inside structures like houses and sheds, or discarded boxes to name a few. In the past, man has used hollow wooden squares, woven baskets, or logs as artificial houses or hives so that honey could be gathered easier than to search or “hunt” for honey bee colonies in the wild. However, honey comb production is irregular in these hives and much of the comb is destroyed while removing the honey.

Man learned that by placing bees into hives with removable frames (developed by Langstroth), the honey bee colony was more productive and the removal of honey was easier. Today the Langstroth hive is the standard used by beekeepers.

The basic Langstroth hive consists of one to several hive bodies, a bottom board, and a cover. The hive body is a standard dimension of 19¾” x 16¼”. The depth of the hive body is variable and is commercially available at 9¾”, 6¾” and 5½”. These hive bodies can then be stacked one on top of the other.

Free formed comb when no frames are provided within the hive body.

Basic Langstroth hive.
Depending on where the eggs are laid, the hive bodies have different names. The hive bodies that are below the queen excluder (usually the lowest one or two) are thereafter called the brood chamber(s) named for the developing bee larvae. The hive bodies above the queen excluder that are used solely for the storage of honey are commonly referred to as the supers.

In Hawai‘i, an additional roofing is sometimes provided to prevent rain from entering the hive. The hive is also elevated approximately ¾” (with wood shims) under the back end of the hive so that any excess rain water can drain out of the entrance.

In assembling the hive parts, the bottom board is placed first. In Hawai‘i (the Big Island) due to the presence of the small hive beetle, special screened bottom boards are used to trap entering beetles in an oil pan set below the bottom while still allowing the bees to enter the hive.

The hive body is placed on top of the bottom board and then the cover is placed on top of the hive body. When multiple hive bodies are used, a screen called the queen excluder can be placed usually between two lower hive bodies so that the queen cannot move freely through all parts of the hive and the eggs are confined to the bottom hive body since the screen holes in the queen excluder are too small for the queen to pass through.

Adapted screened bottom board with oil pan.

Queen excluder placed between two hive bodies.

Hive body (super) placed above queen excluder.

Roofing (weighted by tiles) to prevent excess rain from entering the hives.

Cover added to top of hive.
The Frame

Beekeepers primarily use removable frames in hive bodies to better manage their honey bee colonies. These frames come in standard dimensions and parts. The following are the basic parts to a frame: The top bar, the bottom bar, side bars, and the ears. The ears are the extensions on the top bar that allow the frame to hang suspended within the hive body.

Bees will build comb cells on the foundation of these frames for storage of honey, pollen, and developing young.

Frames can be made entirely of plastic including the middle portion that is imprinted with a hexagonal shaped pattern on which the bees build the honey comb cells. This type of frame is purchased directly from a bee supply company fully assembled and ready to use.

Another type of frame is made of wooden pieces that must be assembled. The wooden pieces are glued and nailed together then fitted with a beeswax coated plastic sheet.

Bottom to top: frame with foundation, frame with comb cells ready for use, frame filled with honey.

Three types of frames (bottom to top): wood frame with wax coated plastic foundation, wood frame with wax foundation, and completely plastic.
The third type of frame is made of wooden pieces as in the previously described frame type but uses foundation made entirely of beeswax that has an imprinted hexagonal shape pattern.

For this third type of frame, metal eyelets must be imbedded into the side bars before the top bar and bottom bar are attached to the side bars. After nailing the four pieces together, horizontal wires are strung through the eyelets in the side bars. The wax foundation is then slipped into the frame and imbedded into the horizontal wires.

Metal eyelets inserted into side bars

Horizontal wired installed

Wax foundation pressed into wire with spur embedder
Beekeepers use special tools to manipulate and inspect a hive for honey readiness and to assess the health of the colony. The basic equipment used is described below: **Smoker**. The smoker is designed to produce smoke that is pumped into the hive before opening it and while the beekeeper is working. The smoke has a calming effect on the bees.

To start a smoker, paper is added to the smoker and lit. After the fire has started, dried leaf material, wood chips, burlap, or rolled up cardboard (examples of materials that can be used) are added on top of the burning paper. The material used to create the smoke should be dense so as to not easily create a fire.

The cover of the smoker is then closed and the bellow side pumped so that air is directed through the burning material in the smoker to smolder and produce smoke. The type of smoke produced should be “cool” smoke in that there is very little heat associated with the smoke and by no means should there be any visible flames that would physically burn the bees.
**Hive Tool.** The hive tool is a multi-functional and essential piece of equipment for the beekeeper.

The hive tool is used as a prying device to open the hive and loosen frames from the sides of the hive body, a scraper to take built up propolis (plant resins and gums that bees use to seal up the hive) off the frames and inside of the hive, and a nail remover.

**Bee Brush.** The bee brush is used to remove bees from the frames and parts of the hive that need to be observed.

It is a light weight brush which when used, should be directed at the 45° angle downwards to prevent the bees from “rolling” due to the brushing motion.

**Frame Grip.** The frame grip is a metal clip that is spring loaded and can be opened and closed manually.

The frame grip is opened and attached to the top bar of the frame and when closed, helps to remove the frame from the hive body. Though not essential, the frame grip helps when gloves are worn.
Protective Clothing

While no clothing is entirely bee sting proof, special clothing has been designed to keep beekeepers as cool as possible while providing a high level of protection from bee stings. The following clothing is recommended:

**Bee suit.** Usually made from cotton/polyester, a bee suit should be worn loosely over the body. When using the complete coverall type of suit, there are two types of **veils** that can be used: 1) a veil that is fitted over a **helmet** made of straw or plastic or 2) a hatless veil which does not need a helmet although a baseball type hat with a brim helps to keep the veil away from the beekeeper's face. The veil can be designed to be connected to the bee suit with a zipper or attached around the body by string.

**Gloves.** Gloves can be made of cloth or leather and have ventilation panels on the sleeve area. The gloves are worn over the hands and lower sleeve portion of the bee suit.

**Covered shoes** are needed when working with bees. When the bees are more aggressive, leg straps or tape to close the pant legs are recommended so that the bees do not crawl into the suit.

Hatless veil type suit (on left) and helmet veil suit (on right)
Inspecting a Hive

With the proper equipment and protective clothing, the beekeeper is now ready to inspect a hive for honey and healthy brood. The basic procedure to check for honey readiness would include the following:

Start smoker and make sure there is adequate material available so that the smoker can be restocked if necessary. The smoker needs to be refilled periodically if hive inspection or honey removal takes a while to complete. Smoke the entrance to hive. Wait several seconds. Using hive tool, pry open the cover and smoke the top of the frames with cover only slightly open. Close cover after smoking and wait several seconds to allow the smoke to penetrate into the hive. Remove hive cover. With hive tool, scrape built up propolis (tree resins and gums used by bees as a sealant) off the hive cover. When inspecting for honey, frames above the queen excluder should be checked as follows: Using a hive tool, remove excess propolis on the top bars and loosen frames. Using frame grip, clamp top bar of one of the frames and remove from the hive body. Check progress of frame to see how much of the honey comb cells are capped. If 75% of both sides of the frame are completely capped, the frame is ready for extracting. Replace frame and check all of the other frames to see how many are ready for extracting. Individual frames that are fully capped or entire hive bodies of fully capped frames can be removed for honey extraction. During the entire inspection process, be sure not to stand directly in front of the hive.
When inspecting a hive for healthy brood, the following procedure should be used: Using a hive tool, separate each of the supers (hive bodies above the queen excluder) and remove one at a time starting with the top super. Remove queen excluder and make sure that the queen is not on the queen excluder. Place queen excluder on side. Using frame grip, clamp onto the top bars of one of the middle frames in the hive body below the queen excluder (brood chamber) and remove from hive body. Use bee brush to gently remove bees from frame so that it can be inspected. To check the health of the younger larvae, look in open cells for white larvae at base of cells. To check for healthy pupae, look at the covering on closed cells. These cells should be completely sealed and slightly domed and there should be groupings of sealed brood. Frames containing brood (eggs, larvae, pupae) should be in the middle frames of the brood chamber. The outer frames will have very little brood and filled with mostly honey and pollen. When inspecting the brood chamber, it is important that the frames be placed back into the hive body in the same positions. Continue to use smoke freely during honey removal or brood inspection. Do not pound or disturb the hive with sudden vibrations during inspection. When done, place all hive bodies back to the original positions.
Checking for queen on queen excluder

Checking frame in brood chamber

Open cells containing white larvae, sealed worker cells

Pollen filled cells on edges of frame in brood chamber
Extracting Honey

When choosing frames from the hive that are ready for extracting, choose ones that have at least 75% sealed (capped) honey cells. Honey is considered “ripe” only when the bees seal the top of the cell with wax. Prior to sealing, the honey is considered “green” and is still in the process of being converted from nectar to honey. If too much “green” honey is extracted, the moisture content of the honey extracted will be too high and the honey will be subject to fermentation.

After the frames have been removed from the hive, excess propolis (tree resins and gums) on the frames is removed with a hive tool. The cells are then upcapped (unsealed) using a hot knife (dipped in hot water) or a specialized uncapping knife.

Frame not ready for extraction; contains less than 75% sealed (capped) honey cells

Frame ready for extraction; contains more than 75% sealed (capped) honey cells

Removing excess propolis and comb from frame prior to extraction

Uncapping sealed honey cells
Once the cells are uncapped, any remaining uncapped cells are opened using a scratcher. The scratcher has long metal prongs that are punched into the uncapped cells to open them up for extraction.

Once all the cells on both sides of the frame are uncapped, the frame is placed into a manual or electric extractor. There are very small extractors which accommodate as little as two frames to larger commercial extractors that accommodate 20 or more frames and even supers. Using centrifugal force, the honey within the cells is drawn out as the extractor spins. Once both sides of the frames are empty of honey, the process is repeated with remaining frames.

The extracted honey is then strained and placed into a holding tank or bucket for settling. The honey should be allowed to settle overnight so that the air bubbles, wax pieces and rubbish that was not strained out initially floats to the top. There are special buckets with draining gates at the bottom which allows the settled honey to be removed without disturbing the debris on the top.

After extraction, the wax cappings can be placed into a colander or strainer to remove the excess honey. This honey can be saved for use but not for commercial purposes. The wax can now be cleaned and processed (see section on wax).

For just a few frames, the uncapped frame can be set onto a wire rack with a tray below and overnight the honey will drain out of the cells. The frame is then turned over to remove the honey from the cells on the other side.

There are other forms of honey such as creamed honey that uses extracted honey which is further processed so that the consistency of the honey is more like butter or jam. Beekeepers can also make chunk or comb honey which uses special frames and boxes and is sold with the honey still in the comb. Materials for this type of honey comb production can be ordered from a bee supplier or manufacturer.
Beeswax is produced by worker bees that are about two weeks old in age. These worker bees consume large amounts of honey and then hang onto frames motionless upside down while four pairs of wax glands on the underside of the abdomen produce wax scales. These wax scales are then picked up by the legs of the bee and placed into its mouth. The wax is then softened and used to build hexagonal shaped cells onto the frames. In addition, beeswax is also used to seal the tops of cells when the process of turning the collected nectar to honey is completed.

Research studies have shown that the average amount of honey consumed for every pound of wax produced by worker bees is about 8 pounds. Thus, beekeepers should try to recycle as much comb as possible so that the bees can produce more honey. In the process of extracting honey (see section on extracting honey), the wax cappings are separated from the extracted honey. The wax cappings can then be cleaned and melted for use. Cleaned beeswax can be used in the making of such value added products as candles, cosmetics, and artwork.
There are different methods for melting wax: solar wax melter, sack method and simple straining.

**Solar wax melter.** The solar wax melter is an apparatus that can be constructed with simple materials. It does not extract a large percentage of the wax from the cappings (about 30-40%) but it requires very little labor. The solar wax melter consists of a large glass covered wooden box with a metal bottom. The wax cappings are placed into the box on the metal plate. The box is then closed and directed towards the sun. The wax from the melted combs moves down the plate through a metal sieve and into a container which can be removed. The container is periodically changed as it fills and allowed to cool to form a hardened wax block.

**Sack Method.** In the sack method, the cappings are placed into a burlap or other cloth sack. The sack is submerged into a tank of hot water. With a stick, the bag is continuously stirred which releases the melted wax from the bag into the water. When the sack is empty of cappings and only the rubbish parts are left in the sack, the sack is removed and the water/wax mixture is allowed to cool. The wax layer will harden on the top of the water layer and can be removed.

**Simple straining.** The cappings are added to hot water and the mixture strained for rubbish. The solution is allowed to cool and the wax layer will harden on the top.

Separating honey from wax cappings through a strainer
Swarms

A swarm is a collection of bees that have left its original hive. It is composed of several thousand bees and a queen. It is nature’s way of producing more hives and colonizing bees into new areas.

There are several reasons why swarming occurs that includes lack of space, improper ventilation of the hive or poor egg laying capabilities of the queen.

Once a swarm leaves its hive, it will search for a permanent home. The swarm may move several times, staying a few hours to a few days, in a temporary location until the scout bees have located a permanent site or another temporary location. When the bees are at a temporary location, they mainly cluster around one another forming what looks like a “ball of bees”. As they move from location to location, they move in mass that appears to be a thick cloud of bees all moving in the same direction.

Prior to swarming, the queen of the original hive will lay a series of eggs in queen cells and in most cases just prior to the emergence of the new queen, the original queen will leave with a portion of the workers. The first newly emerged queen will kill off the developing queens in the other cells and take over the original colony.

Signs that a hive is preparing to swarm include: large numbers of bees clustered at the entrance and a large number of developing queen cells at the bottom of the frames in the brood chamber. To prevent swarming, the beekeeper must make sure that there is adequate space and ventilation in the brood chamber and that the queen is very productive.

Capturing a swarm is an easy way to get started with a hive if you do not have access to a strong hive to make a split. A cardboard box or burlap bag large enough to slip over the swarm is needed. If the swarm is on a branch of a tree with no extending branches, the bag or box can be placed directly below and with a sudden motion downward of the branch, the bees are dislodged from the branch and the box or bag closed. If there are branches or other objects in the way, clip and remove as much as possible to insure that most of the swarm is directly below the box or bag. Most of the bees should be in the bag or box after shaking and can be transported to the desired site.
The captured swarm should then be transferred to a Lanstroth hive fitted with a queen excluder on top of the bottom board and then a hive body with cover. If available, a frame of honey and young brood should be placed in the hive to help the swarm get started. The young brood helps the colony establish itself should the queen be missed or killed during the transport procedure.

Swarm trap boxes are also available commercially and are used to lure swarms. The cardboard box is fitted with a removable cover and an entrance hole. Queen pheromone, comb material, or honey is placed inside the box and the box is secured or hung on a tree or other structure. The box should be checked weekly and if a swarm is found in the trap box, a Langstroth hive should be set up for transfer.
Splits

A split is a procedure by which the beekeeper takes one hive and "splits" it to make two hives. The basic purpose to making a split is to acquire more hives. Other ways of acquiring more hives, in addition to dividing an existing hive or buying one, is to find swarms and wild hives but these are not always available.

Prior to doing a split, order a caged queen.

The basic procedure in making a split is to have a hive box with bottom board ready next to the hive that will be split. Select a hive that is very strong and has a large number of bees. Remove two to four frames of brood with bees and place it into the new hive box. Make sure that the queen is not on any of the brood frames that are placed into the new box. An additional frame of pollen with honey can also be placed into the new hive box. Replace empty frames into hive from which the brood and pollen frames were removed. Place the caged queen between two frames of brood, screen side exposed, and place new hive in desired location, preferably more than two miles away. Recognizing that a percentage of bees will return to the original hive if the location of the original hive is less than two miles, more bees should be taken with the new hive. Within a few days, the queen will be released from the cage and begin egg-laying. It also helps queen acceptance if a honey flow is in progress or the beekeeper can simulate a honey flow by scratching some of the capped honey open.

If no caged queen is available, a mature queen cell (usually there are a few always present in a hive at some stage of development) from another hive can be used in its place but there will be a longer time needed before egg-laying occurs and there is a chance that something might happen to the newly emerged queen in which case, the process of finding a new queen will have to be attempted again.

Another method is a two day process but when doing many splits at once this becomes much more efficient. Remove two to four frames of brood from a strong hive one story high. Place a queen excluder on top of the existing hive body and place a new hive body on top. Shake all the bees off the frames in front of the entrance and place the clean brood frames into the new hive body which had been placed on top of the existing hive. Place the cover on the new hive body such that the set-up looks like a two-story hive and return the next day. The new hive body with the two to four brood frames should have an adequate number of bees without a queen. Remove the new top hive body and place a bottom board underneath and transport to desired location. Remove queen excluder from existing hive and place another cover on top. Now place a caged queen or mature queen cell as described in the one day system method.
Requeening

The process of requeening is designed to replace the existing queen with a new one because she is failing or the bees of the hive are not performing satisfactorily. In most places, requeening is done in early spring so that the queen is established and ready for later spring build-up. However in Hawai’i, requeening can be done during a longer time period. A new queen is purchased from a queen company. She arrives in a cage with several attending workers and is ready for egg laying.

When the new caged queen arrives, the existing queen in the hive must be found. If a queen excluder is used, she will be located below the queen excluder. If confined to the brood area, the queen is most likely on or near the frames in the middle of the hive body. Continue the process of looking for the queen until she is found. Once the queen is located, most beekeepers will use their fingers to kill her though there is a special metal device called a queen catcher that can be used to retrieve and remove the queen from the hive. After killing the queen, inspection of all brood frames to destroy all existing queen cells is conducted.

The cage (with the queen) is then introduced after the cork on the candy filled end is removed and a hole is made through the candy to facilitate the exiting of the queen. The cage is placed between two frames of brood with the screened side exposed so that the queen can be attended to by the worker bees in the hive thereby helping to spread her pheromone throughout the hive prior to her release from the cage. The candy filled tube portion of the cage should be directed slightly downward to allow any melted candy to drip to the hive floor instead of on the queen.

Within a few days the queen should be released from her cage and inspection of the brood frames after 7 days for eggs is the sign that she has been accepted by the colony and is egg-laying properly.
Year Round Hive Management

Hawai‘i’s climate is relatively mild throughout the year and therefore there is usually some type of plant in flower at any given time. However, most of the large nectar flows occur during the spring. Thus, beekeepers fall into two categories: 1. migratory beekeepers move their hives to accommodate the flowering seasons of crops while 2. non-migratory beekeepers do not move their hives.

Non-migratory beekeepers must pay close attention to the amount of honey removed from each hive to insure that during times when there is very little blooming in their area, the bees have adequate food supply until the next honey flow. Water should be provided in drier areas so that the bees do not end up being a problem in neighboring areas as they search out water sources such as wading pools, decorative water gardens, or leaking hose pipes. Additional hive bodies need to be added when the bees are actively collecting nectar.

Basic fall management includes checking hives for diseases and treatment if necessary. Some beekeepers routinely treat their hives for American Foulbrood but this must be done when there is no honey flow going on. Nosema can also be present and if present needs to be treated. Requeening is done during this time of the year as well.

Spring management includes rotation of the brood boxes so that the queen lays more eggs equally in both brood boxes. This is needed to build up the number of bees per colony. Additional boxes are added during this time if needed and queen excluders are replaced.
Diseases and Treatment

Bee diseases fall into two categories: 1. Brood diseases, affect the larvae and pupae and 2. Adult diseases, affect adult bees.

The primary brood diseases found here in Hawai‘i are American Foulbrood and Chalkbrood. Chalkbrood is caused by a fungus and occurs in the brood area in locations with high rainfall or sites that have high moisture. The most obvious symptom is dead larvae covered with a powdery white or white-black fuzz. Basic treatment is to move the hive to a drier location or widen the entrance to create better air circulation within the hive.

American Foulbrood is caused by a spore-forming bacteria. Basic symptoms include punctured cappings of the sealed brood, scattered brood pattern, foul odor, and sticky dead remains of the larvae in the open cells. Treatment for this disease is burning of the entire hive or treatment with the antibiotic Teramycin.

The primary adult disease found in Hawai‘i is Nosema. Nosema is caused by a microsporidian. It affects all classes of adults. Symptoms include: large numbers of bees crawling around the entrance, lack of stinging ability, and inability to fly. Additionally, Nosema causes decreased egg-laying capacity in the queen and for workers and drones reduced life span. When dissecting an infected bee, the midgut is swollen and white in color. Control is treatment with Fumagillin.

It is always important to be aware of diseased or potentially diseased hives. Equipment used on such hives should be sterilized before being used on a healthy hive to prevent the spread of disease.

White larval remains from Chalkbrood
Pests of the Hive

Presently, there are several important pests of honey bee hives in Hawai‘i. These include the wax moth, the Varroa mite, the small hive beetle, and the little fire ant.

**Wax moth.** The wax moth that accounts for most of the damage to honey comb, either removed or in the hive, is the greater wax moth, *Galleria mellonella*. The larval stage of the wax moth burrow through honey comb cells leaving excrements and silk-like remains resulting in unusable comb for brood and food (pollen and honey) storage. Usually, the wax moth is only present in weakened hives and is a sign that the hive is not thriving. Wax moth is found on all major islands. Several fumigants are available for use; the most common includes the active ingredient paradichlorobenzene and can be purchased from bee supply companies.

**Little fire ant (LFA).** *LFA, Wasmannia auropunctata,* is a small (about 1/16”) orange colored, slow moving ant that can produce painful stings. These ants prefer nesting in trees but are also found on the ground. LFA invades hives for the honey and the brood resulting in the death of the colony when left unattended. This ant was first discovered on the island of Hawai‘i in 1999. At present, LFA is primarily limited to the island of Hawai‘i with small contained pockets on the islands of Maui and Kauai. Moats or physical barriers at the base of stands and chemical ant repellents and baits (covered to prevent honey bee contact) around the hives are the only measures that have been effective.

**Varroa mite.** The varroa mite, *Varroa destructor*, was first discovered on the island of Oahu in April 2007 and then was discovered on the island of Hawai‘i in August 2008. It is also present on Maui. The mite is an external parasite that affects all stages by feeding on the blood of the larvae, pupae and adults. Detection for the mite can be made by inspecting adult bees or visual checking the brood in open cells or opening capped cells of brood. An alternative method for detection is to use a sticky board placed at the bottom of the hive box. A plastic screen keeps the bees from sticking to the board and mites that fall off of bees in the hive will be trapped on the board. The sticky board can then be removed after a few days, the screen removed and the presence and number of mites can be made on the board.
Once mites are confirmed, treatments can be purchased from bee supply companies or chemical companies (with permit). Other non-chemical treatments (as examples) include the use of powdered sugar sprinkled lightly on the adults to stimulate grooming behavior thereby dislodging the mites and specialized frames and mite screens that can be purchased from bee supply companies.

**Small hive beetle.** The small hive beetle, *Aethinia tumida*, was detected on the islands of Hawai‘i and Oahu in 2010 and was detected on Kauai in 2012. The beetle is approximately ¼” and dark in color. The larvae of the small hive beetle feed on the food supplies within the hive and physically destroy the comb and contaminate the comb with their excrements. The combs become discolored and have a characteristic “slime” appearance. The comb is then no longer usable by the bees for food storage and brood production. Control of this beetle is difficult because it can also use rotting fruit as an alternate host for development. Presently, beetle traps and sanitation are the two most widely recommended measures for reducing small hive beetle populations.
The USDA defines honey as nectar and saccharine secretions from plants which are gathered, modified and stored in the comb containing no more than 25% water. Therefore honey is a “bee-made” product.

There is a beneficial relationship between certain flowering plants and honey bees. As a means to insure pollination and fruit set, plants produce a sweet substance (nectar) that the bees gather for their own needs. As the bees move from flower to flower “gathering” nectar for their own purposes, they move pollen from one flower to flower, thus achieving pollination for the plant.

The forager bee temporarily holds the collected nectar in its “honey stomach” (upper part of the digestive tract) and add enzymes (found in the saliva) to initiate the process of changing the nectar to honey. When the bee returns to the hive with the modified nectar, it adds more enzymes and then passes the modified nectar to another bee that in turn “stores” it into a honey comb cell. At the stage that the modified nectar is stored in the open comb cells it is called “green honey”. Only when the entire chemical process is complete and the moisture content of the “green honey” is below an average of 20% moisture, will the bees seal the top of the cell with wax. At the stage of sealing, the “green honey” is now called “ripe honey”. Whenever you see a plant name associated with a honey, it is because the nectar used to make the honey was collected from that particular plant source.

Worker bees filling cells with nectar

Color differences in honey still in comb.
Pollen and Pollen Traps

Pollen is the male part of a flowering plant. It is usually a small particle that is rich in amino-acids and B vitamins. Flowering plants depend on honey bees to move the pollen from flower to flower in the process of completing pollination. The bees use the pollen as a food source for the developing young.

The pollen grains on the body of the bee is carefully combed out and pressed into a special holding area on the hind legs of the worker bee known as the corbiculum or pollen basket. Upon returning to the hive, the bee removes the pollen pellet and pushes it into an open cell.

Special devices called pollen traps can be attached to the hive so that the pollen pellets on the hind legs of returning bees can be collected before they enter the hive. The entrance to the hive is blocked and the pollen trap is placed above the bottom board. The trap has a specialized entrance that is fitted with screen that allows the bees to enter the hive only after the pollen pellets are removed from their legs. A special drawer below the screen collects the dislodged pollen pellets.

If using a pollen trap, make sure not to leave the trap on for long periods of time since the bees need some pollen for their own needs.
Checklist of Important Skills

Do you know how to..........

Identify all three classes of bees?
Inspect a hive for healthy brood and honey production?
Build frames?
Use beekeeping equipment?
Recognize and extract ripe honey?
Collect a swarm?
Requeen?
Make a split?
Identify bee diseases?
Identify pests of the hive?

If you said yes to each question, you are ready to venture on your own into the exciting world of beekeeping. Good luck!
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