



# 4H Beekeeping Manual



Name: \_\_\_\_\_

Age: \_\_\_\_\_

Club Name: Beekeeping Club

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Edition: 2009

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Welcome to beekeeping. I hope you enjoy it as much as I have. The bees have been good to me, and I hope they will do the same for you.

Regards, Brian Rowe – Club Leader & Author

## Getting Started

A new beekeeper should make sure he has all equipment and an empty structure set and on hand (not on order) before his bees arrive. Essential equipment consists of veil, gloves, hive tool, smoker, and overalls.

A veil is most important and should always be worn when handling bees. It prevents getting stung in the face and neck. An effective veil should be two things, bee entry proof and should not blow against the face in the wind. Many veils are zippered to the jacket / overalls.

Gloves will give a great deal of confidence and security when putting hands in contact with the inner hive. Hands and wrists are the nearest areas of skin bees can sting when you open their hive. Even professional beekeepers use gloves, though not all.

A hive tool is necessary to lever the parts of the hive apart as bees use propolis to glue things together. Screwdrivers or chisels should not be used as they will damage the hives. Hive tools have broad flat blades. Most importantly they are thin and wide.

The smoker is necessary to keep the bees calm. A good one should last a life time, so this is not a place you cut costs. Large ones will need less refueling. A cage on the outside keeps hands from getting burnt, and often has a hook.

Overalls / jackets are not absolutely necessary, but bees get entangled in ordinary cloths like woolly sweaters. Dark clothing will make them aggressive, while light will calm. So, white smooth-textured overalls are the best.

The last critical item needed is the empty hive structure and its location selected and cleared. It is also prudent to understand state and local laws regarding beekeeping. Some towns have local ordinances that prohibit it.

When starting a hobby such a beekeeping one should be aware of why people keep bees. The primary reasons are collecting honey and crop pollination. People also enjoy getting out doors and working with nature. It should also be mentioned that bees are kept for medical purposes. People with Multiple Sclerosis (MS) get regular bee stings, known as Bee Venom Therapy (BVT). BVT has enabled people with MS to walk without a cane (Norris, 1997). BVT is not limited to MS and shows great promis. Royal Jelly, Pollen and even raw honey have shown in some way to help people with medical conditions.



# The Hive Structure

## Structure History

Bees have been kept for honey production in many structures. Egyptians used straw skeps. Some even used old tree stumps. Each had its advantage. The different advantages are to the beekeeper, not the bee. Modern structures included W. B. C., Smith, Langstroth, Dadant, National, and British Standard. (Hooper)

In 1853, the Rev. L.L. Langstroth published a book called "The Hive and the Honey Bee" which changed beekeeping in a very profound way.



Lorenzo Langstroth  
(1810-1895)

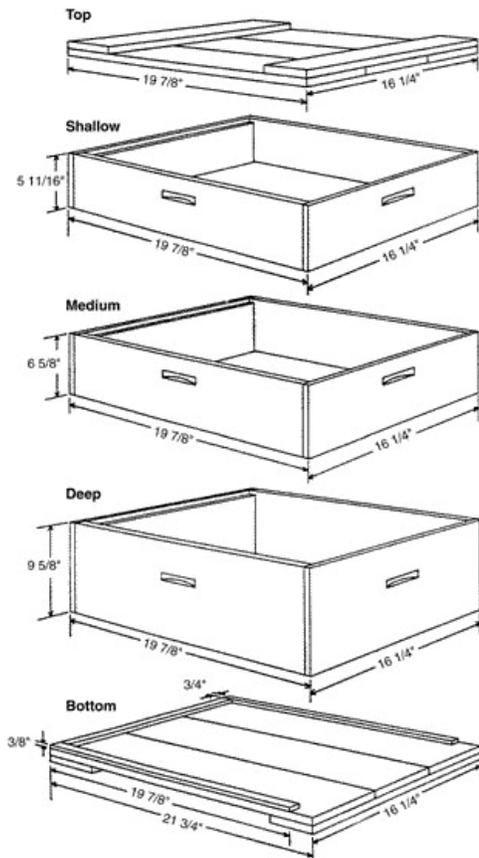
Our focus will be using the modern bee hive as we know it today. The Langstroth bee hive is now the standard and most popular bee hive used in many parts of the world. (Hooper)

Shown here is a cut away view of the inside of a Langstroth hive. We see the bottom board on which the boxes sit, a bottom deep hive body called the brood chamber, a medium honey hive body called a "super", and a comb honey section hive body called a "comb honey super". Above the comb honey super is an inner cover and a top outer cover would be placed over everything to protect the hive from weather. Within the hive boxes are removal frames that hold the comb built by the bees. (Hooper)

What makes this hive so remarkable is not that Langstroth discovered hanging frames (that was done earlier), or that he used a box to put frames into (that was done earlier as well). Langstroth recognized that bees failed to build burr comb between spaces of 1/4 to 3/8 of an inch. If the space was smaller the bees would use propolis to glue it up, and if it was larger the bees would build comb into the space. Thus frames in a box must be at least 1/4 of an inch from the side of the box and not more than 3/8 of an inch from the side of the box. The space must also be provided between

boxes, and the inner cover. If this space is violated, the bees will cement everything together, making it very difficult to remove frames for examination, or the removal of boxes. (Hooper)

Today the 10 frame hive body is considered standard. There are other sizes, but you will find that parts are not interchangeable.



## Bottom Board

The bottom board serves as the floor of the colony and as a takeoff and



landing platform for foraging bees. Since the bottom board is open in the front, the colony should be tilted forward slightly to prevent rainwater from running into the hive.

### ***Hive Bodies***

Hive bodies are the year round home for bees. Northern states with colder winters favor a wood thickness of 7/8". However, in the southern states 3/4" will work just as well. The corners are dovetailed or "box jointed". Rabbet joints do not have enough strength. A full hive body can way over 60lbs. Hives normally have two bodies. A beekeeping looking to make extra splits the following spring would add a third body.

### ***Honey Supers***

Honey supers, also referred to as a medium, are where you'll be harvesting honey. Shallow honey suppers are normally used for comb honey production. As they are smaller they are lighter than deeps, but hold less honey.



### ***Inner Cover***

Elevates the top outer cover, increases hive ventilation and insulation through an extra layer of dead air.



### ***Outer Cover***

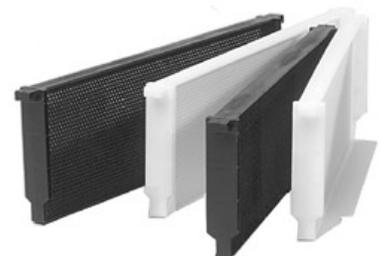
Primary roof protects from rain, wind, snow and sun. Light outer covers need to be weighted down to not blow away in the wind.



### ***Frames***

#### **One Piece**

Hive and foundation are one solid piece of plastic dipped or sprayed in bees wax. No assembly required- Strong and solid- Can be recovered if wax moths attack; hold up better when mice invade.



#### **Wooden Frames with Foundation**

Wood square frame uses metal wire to hold a wax foundation. The wax foundation will have a similar mold to the one piece frame. The bees build their comb on this wax hex molded base.



## *Other Hive Components*

### **Triangle Escape Board**

Removes bees from honey supers you want to harvest. The most stress free way to remove bees. The board is placed between the supers and the brood chamber. The bees can leave the supers but cannot find their way back in. Bees navigate based on rules. When a bee reaches an obstruction, it will always travel to the right and follow that obstruction till its end. So bees can leave through the 3 exits but not return.

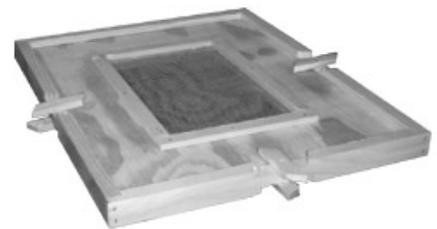


Place triangle side DOWN when placing on the brood chamber.  
(We have shown it triangle side up for demonstration purposes only).

### **Double Screen**

Enables a two queen hive system

Mastering a two queen hive is very challenging.

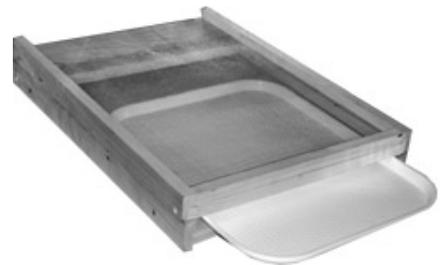


### **Queen Excluder**

Keeps queens out of honey supers and in the brood

### **Varroa Screen**

Integrated Pest Management (IPM) controls waste and parasites. Typically it's made of a screen over a tray or sticky board. The tray is sufficient and superior as it catches the hive waste. When a mite falls into the tray through the screen, it will just sit there waiting for the next bee to come by. It will then hitch its next ride. By falling through the screen the 'next ride' is prevented from coming in contact with the mite. Sticky boards are similar to one sided fly paper. They catch the mites, and need to be replaced periodically.



### **Slatted Rack**

Improved swarm prevention through increase space between broods equating to less crowding.



### **Hive Stand**

Hive Stands elevate the hive keeping it away from mice and other animals as well as ants. Most importantly it keeps the wooden bottom board off the wet ground.

## Hive Location

The site for your hive should be carefully chosen and planned long before you have bees to be installed. Once a hive is established, moving it to a better location can be difficult. Although beekeepers in the pollination business regularly transport their colonies over long distances, it is not an easy task.



In considering the location of a hobby hive or two, one must be aware of climatic conditions such as wind, shade, and the time the sun hits the hive each morning. Additionally, the location of a hive must take into consideration people, pests, and pets. Both city and county ordinances may specify special requirements for those who wish to keep backyard hives. Neighborhoods increasingly have "restrictive covenants" which may not allow you to park a boat in your driveway or keep bees in your back yard. Check where applicable and follow any requirements.

The situation with the backyard hive is unique in that even when complying with all the necessary rules and regulations, one may encounter resistance from neighbors. Each individual must decide if neighbors need to be specifically informed. Many beekeepers follow 'don't tell unless asked' policy. Sometimes these restrictive ordinances are not in existence till a neighbor finds out there's a bee hive next door. Still, educating others is one of the missions of this beekeepers group. Many of us have neighbors who have heard of pollination problems and are eager to learn about honey bees. Sometimes, when a golden, gleaming jar of honey is left on the doorstep it makes neighbor relations a lot sweeter.

For neighborhoods where swimming pools are common, bees must be given water sources so they don't drink from a chlorinated pool. If water is not readily available bees will drown by the hundreds in swimming pools and likely annoy the pool owner. For drinking water, I use a galvanized chicken water feeder. One could use a bird feeder with stones. The stones serve as landing pads and prevent bees from drowning.

When placing a back yard hive, consider the bee's flight path and make sure it does not cross side-walks or paths where people walk. You can use hedges to force bees to fly upwards, or block them from areas where people frequent.

Some pets are compatible with bees, others are not. If dogs live in the bee yard, they generally learn not to snap at bees in flight or wander too close to the hive. Animals that have never been around hives must learn to keep their distance. Turning a large breed puppy into a yard containing a hive may not be wise, although after a few stings even the most stubborn pets usually learn their lesson. Cats generally show no interest in bee hives and backyard chickens know better that to consider a bee on a flower as potential food. Monitor any animal that has access to the hive.

Hives which are placed where wildlife frequent should be fenced or otherwise protected from predators. A healthy strong colony can often protect itself from plundering but weak colonies may not have the numbers to ward off attackers.

The smaller pests which can attack a hive are also a problem when a hive is in poor condition. Here in Somerset County, many beekeepers find a need to protect hives against ants. Ants can swarm into the hive and rob both the stored honey as well as the developing brood. Healthy colonies may avoid the problem because vigilant guard bees detect the fire ants when they first get into the hive. Weak colonies can be cleaned out in less than 24 hours!

The best protection against ants is to keep grass, brush and vines from the area around the hive. The legs of the hive stand can be set in cans filled with cooking oil which will trap any ants attempting to crawl up into the hive. (Agpzolt)

Honey bees can be kept almost anywhere there are flowering plants that produce nectar and pollen. Choose a site for beehives that is discrete, sheltered from winds and partially shaded. Avoid low spots in a yard where cold, damp air accumulates in winter.

It is possible to keep honey bees in crowded suburban areas, on tiny city lots or on rooftops in large or small cities without problems. However, keeping bees successfully in a populated area requires a good understanding of basic bee biology, property rights and human psychology. Beekeepers in suburbs and cities need to manage their bees so they do not become a nuisance to their neighbors. Place hives so that bee flight paths do not cross sidewalks, playgrounds or other public areas.



### ***NJ Regulations***

The NJ Department of Agriculture has developed the following best management practices for beekeepers to reduce potential conflict with neighboring property owners.

1. There must be no more than three hives of honey bees per lot size of one-quarter acre or less.
2. No hive of honey bees will be maintained within 15 feet of a boundary line of the property on which the hive is located.
3. All colonies must be located at least 25 feet from a public sidewalk, alley, street or roads.
4. All apiaries must have on site an adequate source of water within 25 feet of the hive(s) at all times (especially between March 1st and October 31st).
5. A 6-foot high solid fence or hedge must be erected if the colonies are within 10 feet of a neighbor's property.
6. All bee equipment and hives must be maintained in good condition.
7. All colonies must be kept in moveable frame hives in accordance with N.J.S.A.4: 6-10.
8. All colonies must be inspected by the beekeeper or his delegate no less than three times between March 1 and October 1 of each year.
9. A substantial barrier/ fence must be erected to prevent animals and children from coming into close contact with the hives.
10. All Beekeepers who keep bees over the winter are required to register with the state.  
(Agpzolt)

# Apiculture

## Insects

**Insects** (Class **Insecta**) are a major group of arthropods and the most diverse group of animals on the Earth, with over a million described species—more than half of all known living organisms—thus potentially representing over 90% of the life forms on the planet. (Insect)

Insects possess segmented bodies supported by an exoskeleton, a hard outer covering made mostly of chitin. The segments of the body are organized into three regions, or tagmata; a head, a thorax, and an abdomen. The head supports a pair of sensory antennae, a pair of compound eyes, one to three simple eyes ("ocelli") and three sets of variously modified appendages that form the mouthparts. The thorax has six legs (one pair each for the prothorax, mesothorax and the metathorax segments making up the thorax) and two or four wings (if present in the species). The abdomen (made up of eleven segments some of which may be reduced or fused) has most of the digestive, respiratory, excretory and reproductive internal structures. (Insect)

## Honey Bee Breeds

New beekeepers face the difficult decision of which strain or race of bee to order. To determine which race or strain of bee would best suit your operation and environment. Honey bees vary in traits such as temperament, disease resistance, and productivity depending on their breed. New beekeepers often look for gentle temperament as their most desired trait. The environment has a large effect on differences among bee colonies (for example, plants in different areas yield different honey crops), but the genetic makeup of a colony can also impact the characteristics that define a particular group. Beekeepers have long known that different genetic stocks have distinctive characteristics, so they have utilized different strains to suit their particular purpose. (NCSU)

Bee stock refers to a particular group of bees. These groups are often defined by their species, race, region, population, or breeder. These are these stocks while some being popular are not entirely well known. Bee stock popularity rises and falls depending on beekeeper need and productivity. (NCSU)

### Stocks:

#### *Italian – (Apis mellifera ligustica)*

Italian honey bees were brought to the U.S. in 1859. They quickly became the favored bee stock in this country and remain so to this day. Known for their extended periods of brood rearing, Italian bees can build colony populations in the spring and maintain them for the entire summer. They are less defensive and less prone to disease than their German counterparts, and they are excellent honey producers. They also are very lightly colored, ranging from a light leather hue to an almost lemon yellow, a trait that is highly coveted by many beekeepers for its aesthetic appeal.



Despite their popularity, Italian bees have some drawbacks. First, because of their prolonged brood rearing, they may consume surplus honey in the hive if supers (removable upper sections where honey is stored) are not removed immediately after the honey flow stops. Second, they frequently rob the honey stores of weaker or dead neighboring colonies. This behavior may pose problems for Italian beekeepers who work their colonies during times of nectar dearth, and it may cause the rapid spread of transmittable diseases among hives. (NCSU)

### ***The Carniolan - (Apis mellifera carnica)***

The subspecies *A. m. carnica*, from middle Europe (Slovenia Region), also has been a favored bee stock in the U.S. for several reasons. First, their explosive spring buildup enables this race to grow rapidly in population and take advantage of blooms that occur much earlier in the spring, compared to other stocks. Second, they are extremely docile and can be worked with little smoke and protective clothing. Third, they are much less prone to robbing other colonies of honey, lowering disease transmission among colonies. Finally, they are very good builders of wax combs, which can be used for products ranging from candles, to soaps, to cosmetics. (NCSU)

Because of their rapid buildup, however, Carniolan bees tend to have a high propensity to swarm (their effort to relieve overcrowding) and, therefore, may leave the beekeeper with a very poor honey crop. This stock requires continued vigilance to prevent the loss of swarms. (NCSU)



### ***The New World Carniolan***

The New World Carniolan was originally established in 1982 by Susan Cobey and Tim Lawrence in California. Carniolan stock from across the U.S. and Canada was collected, back crossed, and evaluated to establish the foundation population. Instrumental insemination and strict annual evaluation protocol were followed to maintain the NWC breeding program. In 1990 the NWC breeding program was moved to Ohio State University. A cooperative effort between OSU and Strachan Apiaries currently maintains and propagates the stock. (Strachan Apiaries Inc.)



### ***The Caucasian – (Apis mellifera caucasica)***

*A. m. caucasica* is a race of honey bees native to the foothills of the Ural Mountains near the Caspian Sea in Eastern Europe. This stock was once popular in the U.S., but it has declined in regard over the last few decades. Its most notable characteristic is its very long tongue, which enables the bees to forage for nectar from flowers that other bee stocks may not have access to. They tend to be a moderately dark colored bee, are extremely docile. However, their slow spring buildup keeps them from generating very large honey crops, and they tend to use an excessive amount of propolis—the sticky resin substance sometimes called “bee glue” that is used to seal cracks and joints of bee structures—making their hives difficult to manipulate. (NCSU)

However, Turkish scientist studied the chemical properties and antibacterial activity of three types of propolis collected from three different races of honey bees. The propolis made by the Caucasian honey bee showed the highest antibacterial activity. Several Japanese scientists

have shown that propolis inhibits the growth of Leukemia Cells and decreases the growth of Sarcoma Cancer. (Fulton)

### ***The German - (Apis mellifera mellifera)***

The German or "black" bee are not native to the New World, although North America has about 4,000 native species of bees. Honey bees were brought to America in the 17th century by the early European settlers. This stock is very dark in color and tends to be very defensive, making bee management more difficult. One of the German bees' more favorable characteristics is that they are a hardy strain, able to survive long, cold winters in northern climates. However, because of their defensive nature and their susceptibility to many brood diseases (such as American and European foulbrood), this stock lost favor with beekeepers well over a century ago. Although the feral bee population in the U.S. was once dominated by this strain, newly introduced diseases have nearly wiped out most wild honey bee colonies, making the German bee a rare stock at this time. (NCSU)



### ***The Buckfast***

In the 1920s, honey bee colonies in the British Isles were devastated by acarine disease, which now is suspected to have been the endoparasitic tracheal mite *Acarapis woodi*. Brother Adams, a monk at Buckfast Abby in Devon, England, was charged with creating a bee stock that could withstand this deadly disease. He traveled the world interviewing beekeepers and learning about different bee strains, and he created a stock of bees, largely from the Italian race, that could thrive in the cold wet conditions of the British Isles, yet produce good honey crops and exhibit good housecleaning and grooming behavior to reduce the prevalence of disease. Bees of this stock are moderately defensive. However, if left unmanaged for one or two generations, they can be among the most fiercely defensive bees of any stock. They also are moderate in spring population buildup, preventing them from taking full advantage of early nectar flows. (NCSU)



### ***The Russian***

One of the newer bee stocks in the U.S. was imported from far-eastern Russia by the U.S. Department of Agriculture's Honey Bee Breeding, Genetics, and Physiology Laboratory in Baton Rouge, Louisiana. The researchers' logic was that these bees from the Primorski region on the Sea of Japan, have coexisted for the last 150 years with the devastating ectoparasite *Varroa destructor*, a mite that is responsible for severe colony losses around the globe, and they might thrive in the U.S. The USDA tested whether this stock had evolved resistance to varroa and found that it had. Numerous studies have shown that bees of this strain have fewer than half the number of mites that are found in standard commercial stocks. The quarantine phase of this project has been complete since 2000, and bees of this strain are available commercially. (NCSU)



Russian bees tend to rear brood only during times of nectar and pollen flows, so brood rearing and colony populations tend to fluctuate with the environment. They also exhibit good housecleaning behavior, resulting in resistance not only to varroa but also to the tracheal mite. They have excellent winter hardiness.

Bees of this stock exhibit some unusual behaviors compared to other strains. For example, they tend to have queen cells present in their colonies almost all the time, whereas most other stocks rear queens only during times of swarming or queen replacement. Russian bees also perform better when not in the presence of other bee strains; research has shown that cross-contamination from susceptible stocks can lessen the varroa resistance of these bees. (NCSU)



### ***The Minnesota Hygienic***

This stock has been selected for its exceptional housecleaning ability, significantly reducing the negative effects of most brood diseases. (NCSU) They are bred at the University of Minnesota through selectively breeding Cordovans for hygienic behavior.



### ***The SMR (a.k.a. VMR)***

This stock, referring to "Suppression of Mite Reproduction," also was developed by the USDA honey bee lab in Louisiana by artificially selecting commercial stocks for mite resistance. While not an independently viable stock on its own (because of inbreeding), the SMR trait has been incorporated into other genetic stocks so that these stocks may also express this highly desired characteristic. (NCSU)



### ***The Cordovan (Italian Subspecies)***

This bee is a type of Italian bee that has a very eye catching light yellow color. (NCSU) The cordovan color variation does not constitute a different race. The single recessive gene that determines the cordovan color, works on the same principle that blue and brown eye operates in people.



### ***The Midnight (Hybrid)***

This hybrid bee was developed by crossing the Caucasian and Carniolan stocks, hoping to maintain the extreme gentleness of both strains while removing the excessive propolis of the Caucasians and minimizing the swarming propensity of the Carniolans. (NCSU)

### ***The Starline (Hybrid)***

This was developed from numerous strains of the Italian stock by Gladstone Cale of the Dadant Bee Company. It was once favored by commercial beekeepers because of its tremendous honey yields, particularly in clover, but the popularity of this stock has declined in recent decades. (NCSU)

### ***Wild Caucasian (Hybrid)***

This was developed between blending Russian with Caucasian in the Olympic Wilderness Apiary. During 2002 an SMR queen was introduced. The result is now a triple hybrid. Key traits include strong spring buildup and winter hardy.

The “Smart” strains are crosses between the SMR strain and other stocks, such as Italian, Russian, and Carniolan. (NCSU)

Many breeders do not use artificial insemination. Thus, over time their hives become slightly hybridized and region specific. This is known as having a survivor stock, as it has adapted to survive in their yard’s climate.

It is highly recommendable that all new beekeepers start with a gentile bee. The Italian is the most popular often desired for this reason. Its yellow strips illustrate the common honey bee image.

### ***African - (Apis mellifera scutellata)***

An African race of bees was imported into South America in 1956. These bees are highly defensive—or you could call them aggressive! They are much more likely to sting than other bees. Once disturbed, they will chase people and animals that come near their hive. A single African bee sting is no more venomous than a single European bee sting. Africanized honeybees respond more quickly when disturbed than do EHBs. They send out three to four times as many workers in response to a threat. They will also pursue an intruder for a greater distance from the hive.

However, they are not likely to sting when they are foraging on flowers away from the hive. Africanized bees are now present in some of the southern United States, but are not well adapted to the cold winters of the Midwest and Northeast. They have some traits that make them well adapted to the tropics, such as a tendency for the colony to grow very rapidly and to swarm often. It is not known whether Africanized bees will adapt to our climate by mating with our European races of bees. If this happens, they may become less aggressive. (Petritz)

### ***Cape – (Apis mellifera capensis)***

**Apis mellifera capensis**, the Cape bee is a southern South African sub-species of the Western honey bee. Cape bee workers are uniquely able to lay diploid, female eggs, by means of thelytoky, whereas workers of other honey bee subspecies (and, in fact, unmated females of virtually all other eusocial insects) are able to lay only haploid, male eggs.

The movement by beekeepers of Cape honey bees into northern South Africa, where they do not naturally occur, has created a problem for the region's indigenous populations of *A. m. scutellata*. If a female worker from a Cape honey bee colony enters a colony of *A. m. scutellata*, she is not attacked, partly due to her resemblance to the African bee queen. Now independent from her own colony, she may begin laying eggs, and since *A.m. capensis* workers are capable of parthenogenetic reproduction, they will hatch as "clones" of her,

which will also lay eggs. As a result the parasitic *A. m. capensis* workers increase in number within a host colony. These clones do not forage food or help maintain the hive. This leads to the death of the host colony on which they depend. When the colony dies, the *capensis* females will seek out a new host colony.

**Table 1. Comparison of bees and their traits.**

	<i>Italian</i>	<i>German</i>	<i>Carniolan</i>	<i>Buckfast</i>	<i>Caucasian</i>	<i>Russian</i>
<i>Color</i>	Light	Dark	Black	Medium	Dark	Gray
<i>Disease resistance</i>						
<i>Varroa</i>	-	-	-	-	-	+
<i>Tracheal</i>	-	-	-	+	0	+
<i>AFB*</i>	0	-	+	0	0	0
<i>EFB**</i>	0	0	0	0	0	0
<i>Other</i>	0	0	+	+	-	0
<i>Gentleness</i>	Moderate	Low	High	Low-Mod	High	Low-Mod
<i>Spring buildup</i>	Good	Low	Very good	Low	Very low	OK
<i>Over-wintering ability</i>	Good	Very good	Good	Good	OK	Very good
<i>Excess swarming</i>	OK	OK	High	Low	Low	OK
<i>Honey processing</i>	Very good	OK	Good	Good	Low	OK
<i>Propolis</i>	Low	OK	Low	Low	High	OK
<i>Other traits</i>	Heavy robbing	Short tongue, nice white cappings	Low robbing, good comb builders	Supersedure queens produce defensive colonies	Long tongue	Brood rearing affected by flow, queen cells always present

\* AFB = American foulbrood  
 \*\* EFB = European foulbrood

(NCSU)

## Bee Biology Basics

Honeybees belong to the order Hymenoptera, which includes other bees, wasps, and ants. Most Hymenoptera have two pairs of clear wings, and chewing mouth parts. Some can suck up liquids such as the honey bee. Hymenoptera undergo complete metamorphosis (change in form) during their development. There are four stages of life: (Townsend)

1.



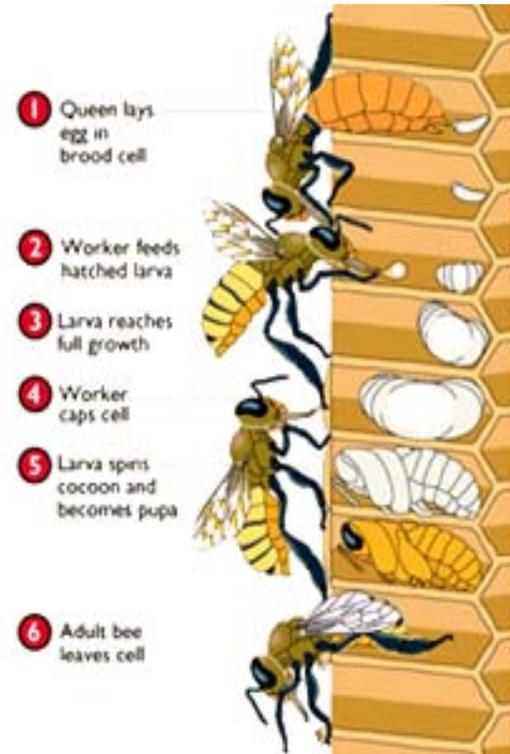
Egg 2. Larva



3. Pupa



4. Adult



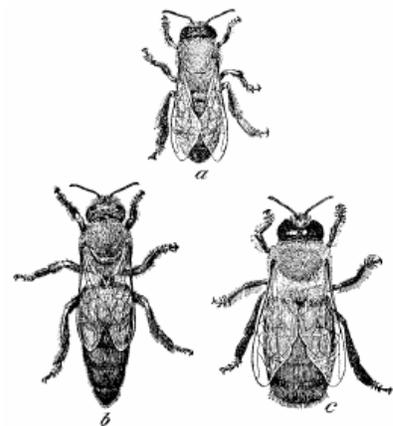
Bees are equipped to collect pollen and nectar. They are covered with hairs that trap pollen as they visit flowers. The pollen is stored in pollen baskets on their hind legs. A tongue like portion of their mouth sucks up nectar. (Townsend)

Honey bees are social insects that live in highly organized colonies. Each member has a specific job and must work together to survive. There are three distinct castes of honeybees in a colony: the queen, the worker, and the drone. (Townsend)

a. Worker b. Queen c. Drone (Townsend)

### *The Queen*

The queen is the longest bee in the hive, but has the shortest wings. She is the mother of all the bees in her hive. Her job is to lay eggs, when she stops the population of the hive quickly



drops. Her productivity is influenced by the amount of food available, empty brood space, temperature, and more. Her workers recognize her mostly by the smell of her pheromones (natural perfume). Queens are born in special cells, queen cells. They look like round balls attached to comb. The location of the queen cell will cause its appearance to vary. Queen cells must be monitored in the spring to prevent swarming. Worker bees make new queens for one of three reasons

1. The former queen left with a swarm
2. The queen is laying increasingly fewer eggs
3. The colony is overcrowded and has no place to expand. (Townsend)

A worker egg (female) will hatch in three days, and then larva is fed special food called royal jelly. After six days the queen cell is sealed. The queen emerges about eight days later, and will live up to 4 years.

The three reasons for making new queens relate to three types of queens:

1. Supersede
2. Swarm
3. Emergency

Swarm queen cells are built along the lower edge of comb, often in large numbers as many as 20 at one time. Supersede queen cells, fewer in number are generally about the same age and built perpendicular to the comb surface, they are built at times of high food availability. Distinctive feature of emergency queen cells is their diet and mature time is rushed. You want any queen replacement to be a supersede queen as they have the most time to develop. (Akranakul)

### ***The Worker***

Workers are smaller than queens and drones, but they make up the bulk of the population. Only several hundred are around in the winter, but some hives may reach up to 100,000 workers. Each larva is fed royal jelly for three days then pollen and honey for three more. The larva will molt (shed outer skin) five times during the six days. Just before maturity the bees assigned to nursing duty will cap the cell. The larva then spins a cocoon and becomes a pupa. The adult emerges 12 days later. It takes about three weeks to go from egg to adult worker. They then live 4 to 6 weeks.

### ***The Drone***

Drones are larger than workers, but not as long as queens. However, they can be large and confuse you when you are looking for the queen. A drone has large eyes. Drones do not have stingers, pollen baskets, or glands for producing wax and their mouth parts are too short to gather nectar. Their only function is to fertilize new queens, and they die in the process. Drones require slightly larger cells and develop from unfertilized eggs. It takes 24 days to go from egg to adult drone.

## Observing the Hive Entrance

Please use this section as a reference for you workbook observations.

The hive entrance of a honey bee colony is very much like the front door of your house. Just as you go through it on your way to and from school, the field bees must exit and enter through the hive entrance on their trips to visit flowers. By watching a hive's entrance, beekeepers can learn a great deal about the levels of activity of their bees. Observing the hive entrance not only tells about the honey plants in bloom that are attracting the field bees, but it also tells about the work going on inside the hive. The more nectar and other supplies the field bees bring in, the busier the house bees will be, storing away and using supplies to build new comb and to care for the young bees. What is happening at the hive's entrance can also tell beekeepers about the health of their bees. For example:

- If you are too hot in your house, you may sit outside your front door. Bees do the same thing.
- When you are cold, you close the front door. Although the bees cannot close their hive entrance, they will remain inside, away from the entrance, when they are cold.
- When you do not feel well, you stay inside to rest. Sick bees do not leave their hives, either. However, if they are very sick they will crawl out of the hive and die.

Observe the entrance to a hive, watching closely for at least 15 minutes at least once every three weeks. Do this at different times of the day. Sit as close to the entrance as possible so that you have a clear view of the activities taking place. **Do not** sit in front of the entrance! The bees will become confused if they see you in front and won't know where to go. For each observation period, record what you saw. Describe what they were doing there and what, if anything, they were carrying in or out of the hive. Make certain to include the information listed below in your reports:

- The date and time of day of your observation
- The weather conditions while you were watching
- A summary of the activities you observed at the hive entrance
- The types and approximate number of bees you saw

Refer to the Hive Observation page, in the Workbook part of this manual to store your observations.

# Our First Year of Bee Management

## *Hiving a Package of Bees*

The entrance of the hive should be reduced using the entrance reducer. Do not close the entrance completely because the bees might smother. Hiving late in the afternoon, on a non-windy day is preferred.



Spray the bees or brush on some sugar water on the cage screen before installation. It helps to have the frames in the hive brushed with sugar water too. This is not absolutely necessary, but helps to calm the bees down and inhibits flight until they locate on their new home. It is perhaps more crucial if the wind is blowing and there is a chance the bees that take flight will be blown to another hive or too far away from the new hive to find it.

Setup your hive with 3-4 frames removed from the middle of the hive. Then remove the plywood from the top of the package.



Knock the bees to the bottom of the cage and remove the queen cage. Check to see that the queen is alive in the queen cage and set her aside. If she is dead, put the queen cage back in the hive and call for a replacement. Keep the package in a cool place and feed them every day until you get the new queen.

Using one finger and your hive tool, remove the sugar syrup can. If the bees start emerging from the queen cage opening before you get the can out, knock them down again until you get the can out. Replace the plywood on top of the package. You are now ready to dump the bees in the hive.

Once the can is out, rotate the cage and move it back and forth to get as many bees out as possible.

Immediately put down the cage, and gently put in the missing frames and close the hive. Do not worry about crushing bees with the frames; they will get out of the way.



Now remove the metal disk from the queen cage that is covering the candy and hang the queen cage between two frames near the center of the hive. Make sure the candy end is accessible to the bees and pointing up so the candy will not be blocked by an attendant that might die. Have a hammer and small tack available in case you have to re-attach the disk to the queen cage (or duct tape).

Lean the empty package up against the front entrance of the hive. Feed the bees, but it is important not to disturb the bees unless necessary. Check after 4-7 days. If the bees have not released the queen, you release her by removing the cork. Remove the queen cage and push the frames together. If any extra comb has been built underneath the queen cage, remove it.

### ***Hiving a Nucleus Hive (Nuc)***

Nucleus, or "nuc" hives have fewer frames than a standard beehive. First set the brood with 5 empty (non drawn) frames, sprayed with sugar water. Take the frames from the nuc box and place them in the empty brood box. Alternate nuc frames with blanks for faster comb building, but keep the brood together.

### ***Spring Start***

We are going to assume you have your hive of honey bees started. As your bee colony grows, it will be necessary to add more boxes "supers" for them to expand into. If bees become crowded and there is not enough room for expansion of the brood nest, the bees will swarm (fly off in large numbers along with the queen to start a new colony).



Loss of a swarm may leave the remaining colony too weak to gather enough surplus honey for the winter. When a hive swarms the queen leaves with the bees but before leaving, she lays eggs in special cells called queen cells. These cells (20 or more of them) will be located at the edge or bottom of the frames. What can you do if you see queen cells?

1. First, you can try to cut all of them out and this must be done every six or seven days. Once bees start building queen cells, it is hard to stop them from building more.
2. You can give them more room by putting a new super on the hive. This doesn't always work.
3. You can take several frames with queen cells on them and start a new hive. The new queens will emerge, fight, and the survivor will mate and begin to produce more brood. Don't use this method after mid July. Add new brood frames to the old hive and cut all remaining queen cells.
4. The best thing you can do is just make sure your bees do not reach the critical point of being too crowded.

### ***Summer Flow & Hive Inspections***

A beekeeper should know what his bees are doing. You should examine the hive every 2-3 weeks to make sure they have plenty of room, that the queen is laying eggs, that they are storing honey, and that the bees are free of disease.

You should also keep a notebook of your observations. They will become important as years come and go. Every bee year seems to present us with something different. Your notebook will provide some means of comparison. Our memories seem to fade and are not as reliable as

notes taken at the time an event occurs. Please record this information on the Hive Inspections sheet in the Workbook part of this manual.

## How to open and examine your hive:

You should always wear protective equipment when you work your hive. You should light your smoker before getting started. I have often been asked how I keep my smoker going out. Seems some people have smokers go out just about the time they need them. The key is to take time to get the smoker going before rushing off to the bees. There are many types of smoker fuel. I can remember learning how to build a fire as a boy scout. Start small and then add new material slowly to the fire. Don't dump a lot of smoker fuel onto a newly started fire. You will smother the fire and it will go out. The goal is to have a good cool flow of smoke when you press the bellows on the smoker. Remember to add fuel periodically. Keep a lighter on hand in the event the fire goes out. Wet fuel will not burn as well. One other thing, inspect the hive during the mid part of the day. Select a day when the bees are flying and seem very busy. Avoid cloudy overcast days or days with threatening weather. Follow a flexible schedule, checking the bees no more than two or three times per month.

First, make sure all is ready. Do you have your hive tool? Is the smoker going? What about neighbors? Children?

Approach the hive from the side if possible. Do not stand in front of the entrance. If you do, you will notice a crowd of bees in a holding pattern behind you.

Use your hive tool to remove the top cover. I like to lay the top cover on the ground next to the hive with the bottom side up. Blow a little smoke toward the entrance. Notice that I said a little smoke. You don't need a lot. Avoid excessive smoke blowing into the frames.

Next remove the inner cover. Bees have a tendency to glue this down to the inner side of the hive with propolis, so you may have to pry the inner cover off. Keep your smoker handy.

Once the inner cover is off the top bars of the frames in the top box (super) are exposed. Bees will start to migrate toward the disturbance and you will notice them coming up between the top bars. You can apply a little smoke to calm them down. A few may become air borne and fly about you. Ignore them.

Keep in mind:

1. Move slowly -- avoid quick sudden movement.
2. Don't spend a lot of time with the hive open.
3. Close the hive if you need to leave the bee yard.



Since this is a new hive, you could or should be looking for:

1. Are the bees building new comb on the foundation you put into the hive? New comb is nice and white or slightly yellow. Check the number of blank frames.
2. Are all frames drawn out? This depends on how long the bees have been in the hive. If the comb is drawn out (the bees have made new comb over the foundation), do you have a new super to add to the colony? I like to add a new super when 1-2 frames of the comb are still to be drawn out. The last frames to be drawn out are the ones on the outside of the hive body. The bees will instinctively store honey in these outside frames. Don't take it away from them.
3. Can you recognize brood? It will be located in the center of the frame of comb. It is tan to dark brown in color. It may be hard to see eggs especially in new comb that is demonstrated above, but you should learn how to spot them. They look like little spots of sugar at the bottom of cells. Larva is easier to spot -- they look like pearly white worms coiled within a cell. The capped brood is brownish in color. Older comb turns dark in color. This is because of travel stain and also brood raised in comb turns the comb dark-

-sometimes almost brown/ black. If you can see eggs you do not need to find the queen to know that you have one.

4. Can you recognize capped honey? Capped honey will be found in an arch across the top of the comb. If it is unsealed, it will be a liquid. When sealed, the cappings are a distinct whitish color. You will also see cells that have a yellow or brownish substance in them. These cells contain pollen. A normal hive will have most of the frame filled with brood, a small arch of honey at the top of the frame and some pollen stored between the two. It is not unusual to find a frame which is almost all brood in a strong hive.
5. Get ready to close the hive if you are satisfied that all is well. If you have a feeling that all is not right with the hive, you can email me with some photos and I will try to give you information based upon what I am able to see.



New hives benefit greatly from supplemental feeding. Pollen patties and sugar syrup speed up the building of comb. It is essential to feed new hives. Feeding will be discussed shortly.

### ***Late Summer Honey Bee Management***

It is not unheard of for a package of bees put on new foundation to have surplus honey. A number of factors determine the amount of honey a hive of honey bees can gather.

- Favorable weather
- Nearness of nectar honey plants
- Your management of the bees
- How much you feed your new colony to get it going
- The honey bee population of the hive



### **Favorable Weather**

Favorable weather is important. People who have kept bees over a period of time can tell you that honey crops fluctuate from year to year. Bees do much better when the weather is warm and dry. Cold wet weather keeps the bees in the hive. They must be able to go out of the hive in order to gather a honey crop. Bees also need to eat and when the weather is cool and wet, the bees just maintain themselves (use what they gather not building surplus). It takes one frame of honey and pollen to produce one frame of bees. How much honey and pollen a hive uses during the year to produce brood depends on the quality of the queen. A very productive queen will lay a lot of eggs. These eggs need feed. On the other hand, if the bees have ample nectar supplies and can fly on a daily basis, the large population of bees produced by the hive will also result in more honey being brought back to the hive.

### **Honey Plants/Honey**

For the bees to produce surplus honey, they must have a nectar source. Bees are known to fly up to two miles or more to find nectar but if nectar sources are close to the hive, less time is spent flying to get the nectar and a honey bee can make more trips to forage for nectar in a day's time. Commercial beekeepers place hives in honey locations. A honey location can be identified as a place that has acres and acres of a plant that produces nectar in large quantities for the honey bee to gather. One example is the miles of Yellow Sweet Clover that

exist in some areas of the U.S. Commercial beekeepers often tell of hives that gather an average of 200 pounds of honey or more per hive in an area like this. On the other hand, many beekeepers are limited to their back yards and the bees are limited to the area that extends two miles out from that yard. As a result, most hobbyist beekeepers have hives that gather 30 to 50 pounds of honey per season. If the area is a good area, the bees might bring in 100 pounds of surplus honey.

## **Management of Hives**

Much of the planning that goes into producing a honey crop has to do with timing. Did you get your honey supers on the bees at the right time? Are your bees strong when the honey crop is to be gathered? Are you inspecting your hive for swarming? Do you have a productive queen? All of these things are the duties of a beekeeper that wants to get a honey crop.

## **Feeding a New Hive of Bees**

Feeding a hive of bees especially one just started on new foundation helps the bees immensely. They need to build new comb, raise brood, and store food for those days they cannot gather nectar. However, there will come a point when the feeding should stop. I have been asked, "Why not let the bees convert the sugar syrup into honey? The sugars that make up the honey will not be honey sugars. Second, these sugars from cane or sugar beets can be identified if they are put to scientific test. Third, it is illegal to sell altered honey as pure honey. Why not just go mix corn syrup with honey? It is not the same thing. It is a degraded product!

### *Sugar Syrup (used in top feeders)*

You should feed your bees in the Spring and in the Fall. January and February are often too cold for a bee to fly up into the feeder. The warmest day in the first week of March the feeders should go out, to prevent the bees from starving should they run out of food. April - May (Spring) you should feed a 1:1 ratio of sugar to water. In the Fall (starting Sept./ Oct.), you should use a 2:1 ratio.

When medicating, medications are added to the sugar and then the water is added to form syrup. The syrup is then stirred and cooled as usual.

### **1:1 Syrup**

1:1, or One-to-One syrup can be used for supplemental spring feeding and encourage the drawing of comb.

5 – 8 lbs sugar & 4 gal water = ~ 5 gal syrup

Simply stir sugar into room temperature water until all the sugar has dissolved to produce the desired quantity. The dissolving process will be sped up with hotter water, just be sure not to boil the sugar solution. One volume of water plus one volume of sugar when prepared equals roughly 1.5 volumes of syrup.

### **2:1 Syrup**

2:1, or Two-to-One syrup can be used for fall feeding after the last honey harvest, or if the bees do not have a sufficiently large store of honey.

9 – 13 lbs sugar & 4 gal water = ~5 gal syrup

The two parts sugar will not dissolve quickly in room temperature water. Because of this mixing difficulty it is advisable to mix the sugar into near-boiling water. Then add to remaining water. Do not allow the sugar mixture to boil, as this will give the chance for some of the sugars to caramelize, creating a partially indigestible and possibly even toxic solution as far as the bees are concerned. Be sure to let the solution thoroughly cool before feeding it to the bees. It was once common practice to add cream of tartar (tartaric acid) to 2:1 syrup to prevent re-crystallization of the sugars, fermentation and formation of black mold. However this must be done in moderation or it may shorten the life spans of the bees that consume it.

During the warmer the day, the mold may build. Add ½ teaspoon of Cream of Tartar (to the sugar) for each gallon of syrup being made. This will greatly reduce mold. However, too much cream of tartar may shorten the life span of the bees.

If your bees had built 2 broods of comb, built up enough honey for winter stores, and were starting to collect honey that you plan to harvest, then you would stop feeding the sugar water. You do this to prevent the bees from storing the sugar water in the honey supers. If this were the case you'll only harvest sugar water when you extract. So do not feed sugar water when planning to extract honey.

### *Pollen Patties*

Patties serve to supplement the protein part of the bee diet. Patties can be made of soy, brewer's yeast, pollen or a mixture of these. The most common pollen patty will have 90-93% soy powder with 7-10% pollen. The addition of real pollen will attract bees and increase the rate of consumption.

### **Dry Pollen Substitute**

Dry pollen substitute can be placed directly into the hive or used in bird feeders to attract local bees.

3 parts (by weight) Soy Flour (powder) (expeller-processed soybean flour)

1 part (by weight) Brewers Yeast

1 part (by weight) Nonfat Dry Milk (Not instant milk)

Simply integrate the powders together and use. Occasionally bees may refuse to eat pollen substitute, most often when fresh pollen is available. It is however possible to trick bees to take the substitute when necessary by integrating a small amount of **Vitamin C** into the mixture.

Often 1 teaspoon per 5 cups can be added. If a powdered form is not available, it is possible to crush a Vitamin C tablet for integration.

### **Pollen Patty**

To make a pollen patty, bind the **Dry Pollen Substitute** with enough **2:1 Syrup** to make a putty or dough like consistency. Caution – do not add liquid too quickly.

Or, [soy powder: powder sugar: pollen] (Ratio 4:2:1) mixed with ~ ¼ cup of water per 1 cup dry mix

## ***How and when do I get "Surplus" honey?***

A hive of bees stores honey for a reason. They put it away for later use during the winter. Honey bees do not hibernate. They remain active even on cold days. It is estimated that a hive of honey bees will consume 60 to 90 pounds of honey during the winter. You will notice during warm days during the winter season that bees will leave the hive to take a flight. This is necessary because the bee holds its waste until it can leave the hive to get rid of it. Honey bees do not generally defecate in their hive. They are born house broken unlike dogs. You must leave enough honey for the bees to survive the winter season. As a beginner I would suggest that you error on the side of leaving surplus verse not enough honey. A new hive should have at least a double brood chamber with one of the boxes completely full of honey and the lower one should have the outside frames filled with honey. So the minimum is 20 filled out frames well packed with honey. Even with 20 frames there is a chance they will run out of food by March 1<sup>st</sup>.

## ***When is it time to remove the honey?***

Honey can be removed from a hive almost anytime provided that the honey is fully capped over. "Capped over" means at least 7/8ths of the frame has been capped. If you try to take unripe honey (honey in cells not capped over), you will run into a serious problems with your honey spoiling because it has too much moisture in it.

Most beekeepers remove honey just before Labor Day or shortly after Labor Day. It can be done later, but extracting (taking the honey out of the comb) is difficult when the temperature turns cold and honey is stiff and will not flow well. It is necessary in that case to warm the honey supers to 80 degrees or so before extracting.

The cardinal rule is: Always leave enough honey for the bees!! Take only what they can spare!

## ***How to take the honey supers off the hive***

You will follow the same procedures you have used to examine a hive in the past. One can remove honey supers and get the bees out in several ways. Mentioned in bee books is a method called using bee escapes. This is nothing more than placing a bee escape in the hole of the inner cover. Then move the inner cover under the super of honey to be removed. Wait until the bees leave the super (a few days), and remove the honey super. This works better when the days are cooler.

Another method involves using a liquid chemical to drive the bees from the honey super. It works much faster. One can either make or buy a fume board. This like a top cover placed over the honey super. The chemical is sprinkled on the cloth inside the fume board and then set on the bee hive. All you need to do is remove the hive cover, inner cover and position the fume board in place. One bee catalog describes this chemical as "pungent". The chemical forces the bees out of the supers in 3 to 5 minutes. If you leave it on too long, you can drive the bees right out of the hive. The chemicals that do this go by the trade names of "Honey Robber" and "Bee Go".

Most of the honey bees should be out when you take the super from the hive. If they are not, you can remove each frame and brush them off. It is necessary to protect the super from robbing honey bees. Take the super to a secure place where honey bees cannot enter. Bees are attracted to honey! Another word of caution: Honey is sticky. When supers are removed from a hive, comb is often broken and the honey that was in that comb begins to drip and leak. Putting the super in a plastic garbage bag will contain the honey to the inside of the bag and also prevent bees from getting to it.

## Bee Stings

All honey bee workers are potential stinging insects but usually sting only to defend their colony or themselves. No matter how good a beekeeper you become, occasionally you will accidentally crush a bee. You may visit the hives when the bees are disturbed by a change in the weather, by hunger, or by something else beyond your control. As a result, you may be stung. (Petritz)

To avoid stings, do not pass directly in front of a colony entrance. Work is best done from the side or back. If a bee comes near you or lands on you, remain calm. Swatting at bees aggravates them and increases the chance of being stung. If the bee lands on you brush the bee off as gently as possible, and walk away at least twenty feet to help the bee lose interest in you. (Townsend, 2005)

When a honey bee stings it injects a protein and various other chemical substances. There may be pain lasting about 30 – 60 seconds. When the sting area swells as an allergic reaction to the foreign protein, the swelling may itch similar to a mosquito bite for a day or two. Beekeepers gradually acquire a resistance to stings so that no swelling occurs. Antihistamines are the best treatment for stings. They are easy to put on the sting in a cream form. A rare case of an allergic reaction will show quick and excessive swelling. Medical attention should be sought as quickly as possible. It is possible to have a treatment to desensitize oneself to stings. The process normally involves getting stung in a controlled environment such as a hospital. (Hooper, 1977)

When the bee stings it usually leaves its stinger behind in the person, tearing off the end of its abdominal organs. This causes the death of the honey bee. The venom sac will continue to pump venom. The quicker it is removed, the less venom will be injected. If you grasp the stinger in an attempt to pull it out, you will squeeze all the venom into the wound. Instead, it is best to scrape the sting away with the edge of the hive tool or something similar. (Hooper, 1977)

## Enemies of the Hive

While many are listed here, these are just the major and most common threats to your hive.

### *Disease*

Bees suffer from a number of diseases, but we as beekeepers are only interested in a few. It is only when epidemic diseases occur that we become interested. When hundreds of bees die we have to do something.

Honey bee diseases can be divided into two types: those that affect the adult bee, and those that affect the brood.

**Nosema** – single celled amoeba, *Nosema apis*, is spread via bee waste (poop). It spreads when bees clean out the hive waste. Bee lifespan is cut by 50%. Nosema has the potential to kill the colony; however it is possible to recover from Nosema. The antibiotic Fumidil 'B' may help recovery.

**Paralysis** – is caused by a virus named Chronic Bee Paralysis Virus, CBPV. It appears to have several effects of the individual bee and the colony. The two most common effects are the presence of paralysed bees left on the top bars of the frames after the other bees have been smoked down. Secondly there may be a large quantity of dead bees in the front of the hive. The infected bee will have a flattened appearance, the abdomen may be somewhat bloated, and the wings wider than normal. No known medications can help these bees.

**Dysentery** – is not an infectious disease, but caused by too much water in the stomach. One possible factor towards its cause is a diet of crystallized stores of honey. Recall, honey high in water percentage will crystallize quicker than low water percentage.

**Pesticides** – are an outside factor on the immune system. The bee can be caught by sprays in three ways: when the crop on which it is working is sprayed, when the spray is used on the crop and when the bees are flying over a crop which is being sprayed to reach forage further away. Farmers in New Jersey are required to notify local (registered) beekeepers when they spray their crop. If you find that your bees have been poisoned, collect a sample of 200-300 bees, pack them in a cardboard box. We will send them to the USDA for testing.

**Starvation** – (should never occur!) It will most likely happen when not enough honey was left in the hive to last the winter. Early spring and late fall may have low nectar flow, during these times we feed.

### **Brood Diseases**

**American Foul Brood** – The causing organism is *Bacillus larvae*. As its name suggests it is a spore forming bacterium. The spores are fed by nurse bees to larvae. The bacillus remains dormant until the cell is sealed and the larva is lying along the cell. At this time the bacillus breaks out of

the stomach into the body cavity, quickly killing the larva. The cell will darken in color. Upon the larva's death the cell will be filled with glue like slim. During these cycles the bacillus has multiplied several million times. As the disease progresses, more and more cells will contain scales (seen with a back light), and become patchy. American Foul is the only disease the hive is burned (required by NJ Law).

**European Foul Brood** – This is a very different disease from American Foul Brood. The disease is caused by *Streptococcus pluton* a very small non-spore forming bacterium. The bacterium is in the brood fed to larvae by the nurse bees. Upon entering the stomach the larva proliferates and fills the gut, feeding on food in the larva's stomach. It does not penetrate into the body cavity. The larva may die by starvation.

Field diagnosis is therefore the death of unsealed larvae still in the curled up position. However, this disease may be in the hive for some time without visible symptoms.

**Sac Brood** – Not a bad as other brood diseases, normally only a few larvae become infected. The virus appears to affect the process of molting, preventing the separation of new and old exoskeleton. There is no cure. Some evidence suggests it may be inherited. Requeening has been successful at correcting the problem.

**Chalk Brood** – This disease is the result of larvae eating the spore of the fungus *Ascosphaera apis*. These germinate in the larvae and the mould grows until they have completely interwoven the whole body of the larva. The appearance is fluffy white pieces of cotton. Some will change from white to blue / black. Requeening may correct the situation.

**Stone Brood** – Similar to chalk brood. These turn the larva or pupa into a mummy. This disease can affect birds and humans, so do not breath in the spores.

## **Pests and Predators**

Skunks, Polecats – like to attack the hive, and use the comb as food. They will nest nearby, set traps to remove them.

Mice – like to use the hive as a winter home. They will feed on the hive and make holes in the frames. Remember to install the entrance reducer at the end of the fall.

Bears – When a bear attacks, it is very obvious. Things will be knocked over. Examine the hive and save what you can. Some parts of the hive may need repair, some will not be repairable. Make sure the queen is alive. Resume feeding the hive so that it can replenish its stores for the winter. They tend to be hungry in the spring. Most bears in our area are tagged and tracked. Check with your local police for information. Some beekeepers install electric fences if they know a bear is in the area. If you see a bear call the police, do not attempt to scare it away.

## **Birds**

Woodpeckers – Woodpeckers are always looking for a good meal, especially in the winter. They will drill a hole through the wood. If wood peckers are a problem, cover the hive with a wire mesh / screen.

Sparrows – Can set their sights on a hive. They will use the bees to feed their young.

Blue Jays / Bluetits – will take bees at the hive entrance in the summer. They are more a nuisance, but can be a problem if they eat the queen.

**Insects-**

Dragonfly – can catch bees in the yard or hive entrance, and will take them back to their nest and eat them.

Yellow-Jackets – Are attracted by the sweet honey smell. They will try to rob the sugar water from the feeders. They will attempt to find cracks in the hive structure and rob their honey or sugar syrup.

Wasp – When a wasp nests being to break up the adults go foraging for sugar. The best defense is attack. Find the wasps’ nest and kill them.

Wax Moths – It spins a cocoon in the space between frames. The main damage is to stored comb. The brood is particularly at risk. Two brood chambers can be destroyed in fourteen days.

**Honey**

Honey is the sweet viscous fluid produced by the honey bees. The United States National Honey Board states that, “honey stipulates a pure product that does not allow for the addition of any other substance... this includes, but is not limited to, water or other sweeteners (Board).” Different bees produce honey with different properties.

Honey is sweeter than table sugar, and is well used in baking. Most microorganisms do not grow in honey because of its low water activity (.6). (Honey - Wikipedia)

Honey is stored by bees throughout the spring, summer, and fall. During the winter, bees use their stored honey as their source of energy. (Honey - Wikipedia)

Syrup Type	Fructose	Glucose	Sucrose	Water	Other
Honey	39%	30%	1%	16%	14%
Corn	40%	60%			
High Fructose Corn	55%	45%			
Sugar Beet			60%	40%	
Agave Nectar	90%	10%			
Maple	10%		86%	2%	2%

Honey can be polyfloral or monofloral. Monofloral means the honey had one principal nectar source. Beekeepers of monofloral beehives are in areas of only one flower type. These monofloral areas tend to be large farms. Orange farms are well known for their orange blossom honey. (Honey - Wikipedia)

Honey is stored by bees in honeycomb. It consists of hexagonal cells and is built up on both sides of a central vertical partition, the septum (a. k. a. the foundation). There are basically two sizes of hexagonal cells. Cells for worker larvae are five per inch, and are called worker cells. Drone cells are larger. They are approximately four per inch. Both types of cells can be used to store honey. Comb will darken with time, getting close to black (Hooper, 1977). Old comb is used and considered good by most beekeepers. However, you should consider a period of time when a comb should be redrawn. Old comb makes great swarm bait in swarm traps.

### ***Honey Classification***

**Comb Honey** - Honey sold still in the original bees' wax comb. Comb honey was once packaged by installing a wooden framework in special honey supers, but this labor intensive method is being replaced by plastic rings or cartridges. With the new approach, a clear cover is usually fitted onto the cartridge after removal from the hive so customers can see the product. (Honey - Wikipedia)

**Certified Organic Honey** - according to the USDA, organic honey is quite rare to find because most beekeepers "routinely use sulfa compounds and antibiotics to control bee diseases, carboic acid to remove honey from the hive and calcium cyanide to kill colonies before extracting the honey, not to mention that conventional honeybees gather nectar from plants that have been sprayed with pesticides." (Honey - Wikipedia)

**Raw Honey** - Honey as it exists in the beehive or as obtained by extraction, settling or straining without adding heat above 120 degrees Fahrenheit. Raw honey contains some pollen and may contain small particles of wax. Local raw honey is sought after by allergy sufferers as the pollen impurities are thought to lessen the sensitivity to hay fever. (Honey - Wikipedia)

**Chunk Honey** - Honey packed in wide mouth containers consisting of one or more pieces of comb honey surrounded by extracted liquid honey. (Honey - Wikipedia)

**Strained Honey** - Honey which has been passed through a mesh material to remove particulate material (pieces of wax, propolis, and other defects) without removing pollen, minerals or valuable enzymes. Preferred by the health food trade - it may have a cloudy appearance due to the included pollen, and it also tends to crystallize more quickly than ultra filtered honey. (Honey - Wikipedia)

**Ultra-filtered Honey** - Honey processed by very fine filtration under high pressure to remove all extraneous solids and pollen grains. The process typically heats honey to 150-170 degrees to more easily pass through the fine filter. Ultra filtered honey is very clear and has a longer shelf life, because it crystallizes more slowly due to the high temperatures breaking down any sugar

seed crystals, making it preferred by the supermarket trade. Ultra filtration eliminates nutritionally valuable enzymes, such as diastase and invertase. (Honey - Wikipedia)

**Heat-Treated Honey** - Heat-treatment after extraction reduces the moisture level and destroys yeast cells. Heating liquefies crystals in the honey, too. Heat-exposure does also result in product deterioration, as it increases the level of hydroxymethylfurfural (HMF) and reduces enzyme (e.g. diastase) activity. The heat does also affect sensory qualities and reduces the freshness. Heat processing can darken the natural honey color (browning), too. (Honey - Wikipedia)

**Ultra-sonicated Honey** - Ultrasonication is a non-thermal processing alternative for honey. When honey is exposed to ultrasonication, most of the yeast cells are destroyed. Yeast cells that survive sonication generally lose their ability to grow. This reduces the rate of honey fermentation substantially. Ultrasonication also eliminates existing. Ultrasonically aided liquefaction can work at substantially lower temperatures of approx. 35 °C and can reduce liquefaction time to less than 30 seconds. (Honey - Wikipedia)

## ***Royal Jelly***

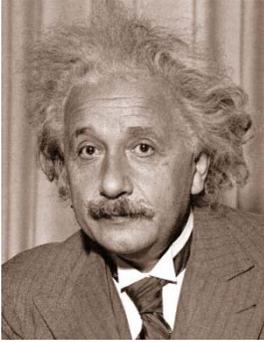
**Royal jelly** is a honey bee secretion that is used in the nutrition of the larvae. It is secreted from the hypo pharyngeal glands in the heads of young workers and used (among other substances) to feed all of the larvae in the colony, including those destined to become workers. If a queen is needed, the hatchling will receive *only* royal jelly - and in large quantities - as its food source for the first four days of its growth, and these rapid, early feeding triggers the development of queen morphology, including the fully developed ovaries needed to lay eggs. Some commercial royal jelly suppliers disseminate misinformation such as "Only queen larvae and adult queens are fed royal jelly"; the fact remains that all larvae in a colony are fed royal jelly, and adult bees do not consume it at all. (Honey - Wikipedia)

People collect and sell royal jelly as a dietary supplement, claiming various health benefits because of components like B-complex vitamins such as pantothenic acid (vitamin B<sub>5</sub>) and vitamin B<sub>6</sub> (pyridoxine); it can also be found in various beauty products. The overall composition of royal jelly is 67% water, 12.5% crude protein (including small amounts of many different amino acids), and 11% simple sugars, also including a relatively high amount (5%) of fatty acids. It also contains some enzymes, antibacterial and antibiotic components, and trace amounts of vitamin C. Contrary to claims by many of those promoting its use, vitamins A, D, and E are absent from royal jelly. (Honey - Wikipedia)

Royal jelly has been reported as a possible immunomodulatory agent in Graves' disease. It has also been reported to stimulate the growth of Glial cells and neural stem cells in the brain, which may relate to claims for its use as a longer-term cognitive enhancer and as a beneficial agent in cases of Parkinson's disease. To date, there is only preliminary evidence that it may have some cholesterol-lowering effects, anti-cancer, anti-inflammatory, wound-healing and antibiotic effects, though the last three of these effects are unlikely to be realized. (Honey - Wikipedia)

## *Pollen*

**Pollen** is a fine to coarse powder consisting of *microgametophytes* (**pollen grains**), which produce the male gametes (sperm cells) of seed plants. The pollen grain with its hard coat protects the sperm cells during the process of their movement between the stamens of the flower to the pistil of the next flower. (Honey - Wikipedia) The transfer of pollen from an anther to a stigma is called pollination.



**Albert Einstein** - "If the [honey] bee disappeared off the surface of the globe, then man would only have four years left to live."

Allergy to pollen is called hay fever. Generally pollens that cause allergies are those of anemophilous plants (pollen is dispersed by air currents.) Such plants produce large quantities of lightweight pollen. This is because wind dispersal is random and the likelihood of one pollen grain landing on another flower is small. This lightweight pollen can be carried for great distances and are easily inhaled, bringing it into contact with the sensitive nasal passages.



**U.S. Food and Drug Administration**



FDA does not allow pollen marketers in the United States to make health claims about their produce, as no scientific basis for these has ever been proven. However, many claims are made in support of pollen's health benefits. (Stephen Barrett)

**Bee pollen** is one of nature's healthiest and most powerful "super-foods." It's been used as a dietary supplement for thousands of years. The early Egyptian and early Chinese civilizations both used it as a physical rejuvenator and medicine. Today natural health practitioners often refer to bee pollen as an herbal "fountain of youth" that can be used for everything from weight loss to cancer prevention. (Schecter)

When you include bee pollen in your diet you may feel a significant increase in your energy. Over time the consistent use of pollen will improve your energy, stamina, and endurance. You'll also probably notice a greater feeling of general well-being. Over the long-term, regular consumption of bee pollen will help alleviate many different health problems, slow down the aging process, and improve your quality of life. (Schecter)

"Bee pollen" is actually pollen from flowers that is collected from bees as they enter the hive or is harvested by other means. Pollen granules stick to the bees' legs and other body parts as they help themselves to nectar (the precursor of honey) inside the flowers. Pollen products are marketed through health-food stores, multilevel distributors, drugstores, mail-order advertising, and the Internet. (Stephen Barrett)

Honeybees collect pollen for their own nutritional purposes because Bee Pollen is incredibly nutrient dense. Bee Pollen provides the honeybee with all of the nutrients that it needs for growth and development. Bee Pollen is approximately 25% protein and very low in fat and

sodium. It contains many minerals and vitamins - notably potassium, calcium, magnesium, iron, zinc, manganese, copper and the B vitamins. (Stephen Barrett)

## **Beeswax**

Beeswax is a natural wax produced in the bee hive of honey bees. Beeswax is produced by young worker bees between 12 and 17 days old in the form of thin scales secreted by glands on the ventral surface of the abdomen. Worker bees have eight wax-producing glands on abdominal segments 4 to 7. The size of these wax glands depends on the age of the worker. The new wax scales are initially glass-clear and colorless (see illustration), becoming opaque after mastication by the worker bee. The wax of honeycomb is nearly white, but becomes progressively more yellow or brown by incorporation of pollen oils and propolis. The wax scales are about 3 mm across and 0.1 mm thick, and about 1100 are required to make a gram of wax. (Beeswax - Wikipedia, the free encyclopedia)

Honey bees use the beeswax to build honeycomb cells in which their young are raised and honey and pollen are stored. For the wax-making bees to secrete wax, the ambient temperature in the hive has to be 33 to 36 °C (91 to 97 °F). To produce their wax, bees must consume about eight times as much honey by mass. It is estimated that bees fly 150,000 miles to yield one pound of beeswax. When beekeepers extract the honey, they cut off the wax caps from each honeycomb cell with an uncapping knife or machine. Its color varies from nearly white to brownish, but most often a shade of yellow, depending on purity and the type of flowers gathered by the bees. Wax from the brood comb of the honey bee hive tends to be darker than wax from the honeycomb. Impurities accumulate more quickly in the brood comb. Due to the impurities, the wax has to be filtered before further use. (Beeswax - Wikipedia, the free encyclopedia)

### ***Historically***

Beeswax was ancient man's first plastic, and for thousands of years has been used as a modeling material, to create sculpture and jewelry molds for use in the lost-wax casting process.]

Lost wax casting was practiced by ancient Greeks and Romans. It involved coating a wax model with plaster, melting the wax out of the resulting mould and filling the space with molten metal. The technique is still used today by jewelers, goldsmiths and sculptors, dentists and even in the industrial manufacture of complex components by casting of metals.

The Romans sent messages on hinged pairs of wooden writing tablets coated with beeswax, the message being written into the smooth wax surface using a stylus. After it had been read the message could be erased, and a reply written and returned.

Beeswax has been used since ancient times; traces of it were found in the paintings in the Lascaux cave and in Egyptian mummies. Egyptians used it in shipbuilding as well. In the

Roman period, beeswax was used as waterproofing agent for painted walls and as a medium for the Fayum mummy portraits. Nations subjugated by Rome sometimes paid tribute or taxes in beeswax. In the Middle Ages beeswax was considered valuable enough to become a form of currency.

## ***Beeswax Composition***

Beeswax is a tough wax formed from a mixture of several compounds.

Wax Content Type - Percent

- Hydrocarbons 14%
- Monoesters 35%
- Diesters 14%
- Triesters 3%
- Hydroxy monoesters 4%
- Hydroxy polyesters 8%
- Acid esters 1%
- Acid polyesters 2%
- Free acids 12%
- Free alcohols 1%
- Unidentified 6%



Melting Point:	145 - 148°F
Discoloration Point:	185°F
Flash Point:	460 - 525°F
Recommended Pouring:	150 - 160°F
Recommended Dipping:	160

## ***Working with Beeswax***

At normal hive temperature of 37C (92F), wax can support a considerable weight and yet still be molded by the bee's jaws. Beeswax melts at 64C (147F). When melting beeswax always use a water bath by placing the container of wax - probably a small saucepan - inside a larger pan of water. Never place a pan of wax directly on a hot plate or gas ring. **Beeswax can easily become damaged by overheating and if it ignites can burn more ferociously than any grease fire.** Beeswax does not boil - it just gets hotter and hotter until it ignites.

The uses for beeswax are many but these days the most common are for quality candles, soap, skin care products, the coatings of sweets and pills, furniture polish, batik art, drawer runners to make them slide smoothly, in quilting and heavy sewing, the polishing of cars, various leather polishes (riding saddle, leather jacket, boots etc.) and particularly for aquatics / sun screen.

Beeswax has a high resistance to the passage of heat but if cooled quickly will become pale in color, more brittle and likely to develop cracks due to rapid contraction. For this reason, wax for exhibition is cooled as slowly as possible to preserve the texture and color. To preserve the aroma of fresh wax it should never be raised more than a few degrees above melting point and then only for a short period. Last year's wax may be left to soak in honey over the winter to retain the honey aroma, fresh wax and low temperatures are an unbeatable combination.

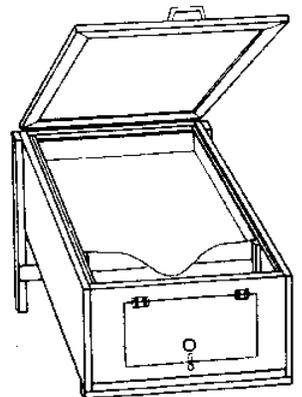
Wax should only be melted in stainless steel, plastic, or tin plated containers. Iron rust and containers of galvanized iron, brass or copper all impart a color to beeswax and aluminum is said to make the wax dull and mud colored. The next time you see a very orange wax in may have been melted in a copper pan.

Melt capping, burr and bridge comb through indirect heat. Pour into bulk mold, through a screen as soon as all wax has turned to liquid. Do not allow wax to continue to cook. It will continue rise in temperature. It may burn or ignite. Never leave the room when melting wax. A candy thermometer can be used to measure the temperature. Some thermometers allow an alarm to be set when a temperature is reached. Once poured into the bulk mold allow to slowly cool for an hour or more before refrigeration. Bulk molds are often cubes or cylinders of wax. It is not necessary to make a bulk mold, but it is a good way to store wax.



Mold wax using filtered wax. Set wick and spray release agent. Wick width should be proportional to your candle thickness. Check that all molds are ready and pour freshly liquefied wax into mold. Set to cool slowly.

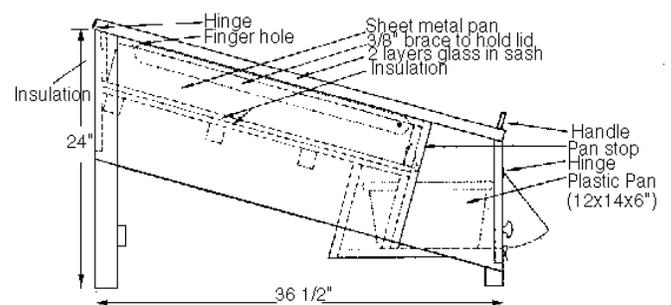
To clean a metallic screen used to filter raw wax, rinse then place in the oven (lowest possible temp.) with aluminum foil set to catch the wax drips. Always lay news paper or drop cloth when working with wax for easy drip clean up. Freezing wax sometimes makes it easier to clean off an item. Finally, scraping and scrubbing remaining waxed items.



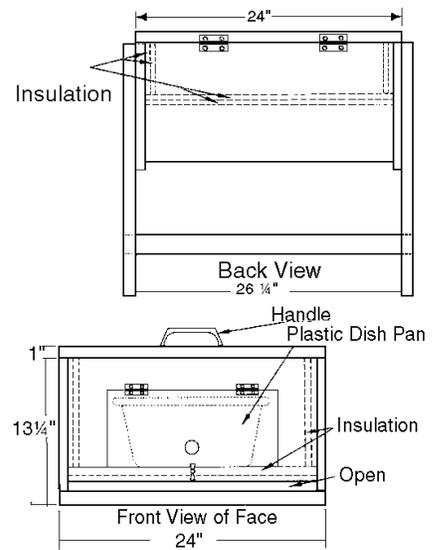
### ***Solar Wax Melter***

A solar wax melter is a glass-covered box that uses the heat of the sun to melt beeswax and separate it from honey and other materials with which it is found in honey-bee colonies. The melter can be used to render old combs, cappings, burr comb, and other hive scrapings containing wax. It is also handy for removing beeswax from excluders. The melter produces wax of high quality and eliminates the need for the sometimes hazardous job of rendering wax in the house.

The sloping top surface of the solar wax melter provides maximum exposure to the sun and allows honey and melted wax to drain quickly into the storage pan. Before use, the entire unit, including the sheet-metal pan, should be painted black for maximum heat absorption. The glass cover with two sheets of double-strength glass about one-fourth inch apart helps to retain the absorbed heat. The cellotex, or fiberboard, insulation also serves the same purpose. Internal temperatures well above the melting point of beeswax (about 145° F.) are maintained on warm, sunny days. Place the melter in a sunny, sheltered spot for best results.

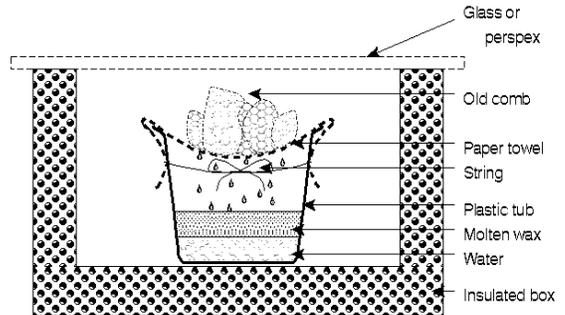


The plan shown is meant to provide ideas on how to build a melter. You need not copy the plan exactly. For this reason, many dimensions are not given, especially the less important ones. A melter of the size illustrated will handle all the wax from up to 60 hives of bees. Modify the dimensions to fit your needs, or the materials available, but beware of making it too small. The sheet-metal pan should be 4 to 6 inches deep and big enough to accept excluders (16¼" x 20") or at least two full-depth frames (19" x 20"). Consider the possibility of making one or more cappings baskets of "expanded" metal that will fit into the sheet-metal pan.



### Low Cost Wax Meltor

I have used melters made according to these plans, and I have found them to work well. If the paper towel hangs over the side of the container, wax will sometimes wick off and drop to the bottom of the chest. This really is no problem, for the wax can be lifted off the bottom when cooled. I use metal coffee cans rather than a plastic tub. That's the beauty of beekeeping and its associated activities: There are so many different ways of doing the same thing.



### Types of candles and molds

Tapper Candle



Votive Candle



Novelty beeswax



Novelty Candle



## Cooking With Honey

If you want to be able to cook sweets without the negative health effects of refined sugar, honey is an excellent option. Among other reasons, honey is metabolized more slowly by your body, meaning that you are less likely to get a sugar “high” after eating something made with honey.



The first challenge that honey presents is that it burns more easily than normal sugar. This problem is usually eliminated by doing your cooking or baking at a slightly lower heat. Store honey at room temperature – your kitchen counter or pantry shelf is ideal. Storing honey in the refrigerator accelerates the honey’s crystallization. Crystallization is the natural process in which liquid in honey becomes solid. Honey can be reliquified by gently warming it.



### *Substituting Honey for Sugar*

Honey is up to twice as sweet as table sugar, so you will need to reduce the amount called for in the recipe by one-third to one-half honey for granulated or table sugar. In addition, since honey is composed of up to 18% water, you will need to reduce the liquid called for in baked goods by about one-fifth.

If you are measuring honey by weight, 1 cup will weigh 12 ounces. Since it has the ability to absorb and retain moisture, honey is used in the industry to keep baked goods moist and fresh. Use honey in baked goods you plan to mail to keep them bakery-fresh.

### *Recipe Examples:*

#### **HONEY CRUNCH PECAN PIE**

4 eggs, slightly beaten  
1 c. light corn syrup  
1/4 c. packed brown sugar  
1/4 c. granulated sugar  
2 tbsp. butter, melted  
1 tsp. vanilla  
1/2 tsp. salt  
1 c. chopped pecans  
1/3 c. packed brown sugar  
3 tbsp. butter  
3 tbsp. honey  
1 1/2 c. pecans halves

In large bowl, combine eggs and next 7 ingredients; mix well. Fold in chopped pecans. Pour into pie shell. Bake in 350 degree oven 50 to 55 minutes. During last 30 minutes of baking, cover edge of pastry with foil to prevent over browning. Meanwhile, in 2 quart saucepan over medium heat, cook 1/3 cup brown sugar, 3 tablespoons butter and honey, stirring constantly, until sugar is dissolved, approximately 2 to 3 minutes. Add pecan halves; stir until well coated. During last 10 minutes of baking evenly spoon pecan mixture over top of pie. Bake remaining 10 minutes or until top is bubbly and golden brown. Cool on rack. Makes 1 (9") pie.



## Honey Mustard Grilled Chicken

- 1/3 cup Dijon mustard
- 1/4 cup honey
- 2 tablespoons mayonnaise
- 1 teaspoon steak sauce
- 4 skinless, boneless chicken breast halves

1. Preheat the grill for medium heat.

2. In a shallow bowl, mix the mustard, honey, mayonnaise, and steak sauce. Set aside a small amount of the honey mustard sauce for basting, and dip the chicken into the remaining sauce to coat.

3. Lightly oil the grill grate. Grill chicken over indirect heat for 18 to 20 minutes, turning occasionally, or until juices run clear. Baste occasionally with the reserved sauce during the last 10 minutes. Watch carefully to prevent burning!



## Honey Vinaigrette:

- 2 tablespoons honey
- 2 tablespoons white wine vinegar
- 1 tablespoon water
- 1 teaspoon canola or vegetable oil
- 1/8 to 1/4 teaspoon Ground Black Pepper
- A Pinch of Ground Nutmeg

Combine all ingredients; mix thoroughly. May serve hot or chilled.

## Honey Lemonade

- 1/3 to 1/2 cup honey
- 1 1/2 cups steaming hot water
- 1 cup fresh lemon juice
- Ice cubes for serving

Combine the honey and hot water and stir until the honey is dissolved. Stir in the lemon juice. Let cool for at least 10 minutes or cover and refrigerate until ready to serve.



## **Appendix**

### **The 4-H pledge**

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.

### **4-H motto**

“To Make the Best, Better”

### **4-H slogan**

“Learn by Doing”

### **Pledge of Allegiance**

“I pledge allegiance to the flag of the United States of America, and to the Republic for which it stands: one Nation under God, indivisible, With Liberty and Justice for all.”

## **4H**

The four "H"s stand for Head, Heart, Hands, and Health.

The official 4-H emblem is a green four-leaf clover with a white 'H' on each leaf standing for Head, Heart, Hands, and Health. White and green are the 4-H colors. The white symbolizes high ideals. The green represents springtime, growth, life, and youth. The 4-H Name and emblem have U.S. federal protection under federal code 18 U.S.C. 707.[]

The foundations of 4-H began around the start of the twentieth century, with the work of several people in different parts of the United States. The focal point of 4-H has been the idea of practical and "hands-on" learning, which came from the desire to make public school education more connected to rural life. Early programs tied both public and private resources together to benefit rural youth.

4-H and related programs exist in over 80 countries around the world. These programs operate independently, as there is no international 4-H organization. However, through international exchanges, global education programs, and communications, they share a common bond in 4-H.

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