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## Natural Topbar Beekeeping

**Course handbook by Les Crowder, edited by Heather Harrell**

When I was 4 years old I liked watching bumble bees and honeybees on the honeysuckle vines in front of our house. I was afraid of their sting but fascinated by their color and buzzing. My mother had tried to keep bees briefly. She ordered all the equipment and the bees, and then the bees left. So we had an empty beehive. Then one day when I was about 15 years old my grandpa came running over to tell me there was a swarm of bees in a pinon tree! “Let’s put them in your mother’s hive!” he said. So we did.

Thousands of bees were balled up in the tree. Many flew around the cluster in erratic orbits. There was a light scent of fresh bread mixed with sharp pine scent of the tree. The bees seemed so calm. I was transfixed. Over the next few days I learned to put on a bee veil, more or less light a smoker, and look in the hive as they built beautiful white beeswax honeycombs. The honeycombs contained honey, pollen, and bee eggs. The bees built something in me as well. I saw them in my grandpa’s garden sucking nectar from a mint plant. I thought, in my 15 year old brain, “We might get to eat some of that nectar when I get some honey from the hive!” The “we” being grandpa and I, he being a kind and gentle organic gardener that I spent many hours with setting up earthworm beds, rooting and planting trees, hunting tomato hornworms, and living in nature.

As I watched the bees work the mint flowers, the sun was rising behind my grandfather in his glowing iris patch. I realized that this was one of the last times that he would tend it, as he was very weak and terminally ill. I had a huge lump in my throat standing there ready to turn a hose on for him. Through the bees, I felt connected to the flowers, the leaves and stems, and the roots, to the soil turned by earthworms, and warmed by the sun. I felt directly plugged into a totally interconnected universe. Yes grandpa was dying and I would miss him dearly, but his mint, his trees, and all the love of nature would continue through the many people who he gave iris and trees to. I would also continue the joyful witnessing of nature’s ways because he had started me so well on that path. It was the bees that gave me that feeling. Bees, with their millions of flights from hive to flower to

water to tree buds and back, weave many of the threads that connect us to everything else in this universe.

## **So why keep bees?**

Most people think you would have to be crazy to keep bees. The truth is that beekeepers do occasionally get stung, and honey is heavy when there is much of it, and it has to be lifted off the beehives in hot weather. Between the propolis, honey and sweat we get pretty messy. And beekeeping can get very expensive if we buy all the gadgets the catalogues tell us we need. Even the “store-bought” hives are intolerably expensive. I won’t buy them anymore. And the economics of honey production and sales is very discouraging if you are keeping bees for bulk honey production. Global competition, high costs, parasitic mites, bee killing insecticides, and antibiotic resistant bee diseases have drastically reduced the number of managed beehives in the USA in the last few decades. Meanwhile the California almonds will need more than two million moveable beehives for their pollination. The hives need to be movable because as soon as the flowers are gone and the bees are not needed, insecticides will kill every unfortunate creature in the many square miles of orchards. So why would anyone want to begin working with bees at a time when beekeepers costs are rising, the price of honey is falling, and modern agriculture needs us a few weeks a year and poisons our bees the rest of the year?

Some people are simply called to be beekeepers. We love bees and we are discovering ways of keeping bees inexpensively and naturally. Rather than force bees into an expensive industrial system, we choose to let bees do what their natural instincts compel them to do. A beehive full of healthy bees can give us many wonderful products that we can sell directly to a customer who can become a friend, someone who gains not only honey, but also a connection to the natural world of bees.

Bees are livestock that feed themselves and us, while pollinating many millions of acres of vegetables and fruits, from apples to zucchini. They put the best burn ointment yet discovered (raw honey) in our pantries. We get propolis from them for infections, sore throats, ulcers and more. Sweet smelling beeswax can light our way, balm our lips, and soothe our skin. Honey contains minerals, enzymes, and complex sugars that enter our blood more slowly than refined sugar, so it doesn’t shock our liver with high blood sugar when we eat it. The astronauts in space eat peaches that were grown on a peach tree in an orchard with earthworms in its roots, and bees in its flowers. The plastic, steel and concrete world is livable only because a teeming natural world sustains it. Maybe we like keeping bees because we like seeing them keep us. Bees are the capstone of our local ecologies. They fertilize, energize, and harmonize our land.

Bees bring sensual beauty to our lives. They are beautiful. When beehives are making honey they fill the evening air with a rich aroma not unlike baking bread. Flowers fill our world with color and scent so that bees will pollinate plants. Bees fill our hands and mouths with soft, warm, juicy, delicious peaches. Bees fill our ears with the sounds of buzzing summer days and birdsong. (Bee fertilizes flower, flower makes seed, bird eats seed, bird sings.)

What’s so bad about sun and sweat? A few bee stings help prevent arthritis and stimulate the auto-immune system. Maybe we are crazy, but at least it’s a pleasant and at times even blissful delusion we are living in. Besides, if the number of modern industrial beehives continues to plummet when we desperately need more bees to pollinate our food

crops, our society may need more pleasantly crazy nature nuts. The industrial agricultural system is eroding train car loads per second of topsoil into the sea, topsoil that will take hundreds of years to regenerate. And that is after mixing that topsoil with insecticides, “fertilizers”, fungicides, herbicides and other chemicals designed to kill “bad” living creatures. The teeming life of the sea and the bees deserve better treatment if they are going to continue to sustain us.

I hope the reason you are reading this is because you are thinking about keeping bees. People keep bees in big busy cities, on quiet little farms, in deserts, in forests, mountains and valleys. Actually, urban and suburban beekeeping is beginning to be more common. People in cities can grow a lot of food. And if there are fruit trees and gardens in our city lots they will need bees to pollinate them.

### **Reasons to reconsider keeping bees.**

Do not keep bees if you know you cannot take the minimal time to care for them. A beehive may require 15 to 30 minutes every two to three weeks during the time of the year when bees are active and flowers are blooming, and an hour or two once or twice a year during harvests. You should not keep bees if you are looking for a scheme to make easy money. If you just don't like bees and are not interested in trying to get to know them you may find that bees don't like you either. If you are allergic to bee stings and can't be desensitized you should probably not keep bees. Many people and even doctors often feel people are allergic to bee stings because they swell when they get stung. Even a lot of local swelling is not an indication of an allergy. Any whole body reaction such as hives, rashes, or swelling of a body part other than the site of the recent sting, or any difficulty breathing is an indication that you are allergic to bee stings. Allergists can test and desensitize people who are allergic to bee venom.

Some people wonder whether honeybees will compete with their local pollinating wasps, bees, and hummingbirds. I was once involved in a hummingbird study in the nearby mountains. A pollination research biologist studied the density of hummingbirds in his study area and measured the nectar in the hummingbirds' favorite flowers. We then brought bees into the area to take the nectar from the flowers. The goal was to see when the nectar levels got low enough to cause the hummingbirds to leave in search of food. But the honeybees ignored the hummingbirds' flowers. The bees made some wonderful honey from the sweet clover blooming in the area. The bees and the sweet clover are both from Europe and are still working together in the Americas. This is not to imply that there is no competition between honeybees and native pollinators but it does indicate that they don't always compete.

### **Reasons to keep bees.**

You should keep bees if you are curious, need pollination for gardens or orchards, or want some of your own beeswax, honey, propolis, or royal jelly. Keeping bees can help you learn not to fear bees. If you think you want to keep bees, keep reading and find a friendly beekeeper to work with and introduce you to bees. If you keep bees for awhile and then decide not to continue, you can pass the bees on to another beekeeper.

In this book I intend to pass on as much of our technique and love for bees and nature as I can. I know I can never give you all the information you will need. I hope to get

you started in an inexpensive, satisfying way. Your own observations with bees will teach you more than any book, web-site, or video. Armchair, couch potato, or virtual beekeeping may have its place in the winter or on rainy days but your bees will teach you more than anything else. If your bees are your best teachers, your second best teachers are local beekeepers. There are beekeepers all over the world, often already organized into associations. These associations are organized to help beekeepers keep bees in the local weather, vegetation, and political and cultural climate.

## **Overcoming the Fear of the Sting**

Most people are afraid of being stung by bees, and this fear keeps them from keeping bees. I was thinking about this one morning when a class of new beekeepers had arrived and we began putting on our bee veils and getting ready to open a beehive. Some of the class members were nervous about opening the hive as they imagined that thousands of bees would suddenly rise up in a cloud and zoom towards them with stingers ready. Yet they had just driven to the beeyard on a freeway. I thought to myself that the chance of them getting hurt or killed opening the beehive was far less than their chance of being hurt or killed in an automobile accident, and yet they were perfectly calm in their cars.

Beekeepers know how to protect themselves from bees and soon learn that bee stings are not as bad as our fear of them would have us believe. Actually bee stings can relieve some ailments. Apitherapy, (the medical use of bee venom) is a growing medical science exploring ways to help people with arthritis, and other chronic conditions.

Honeybees die when they sting. Stinging is not then a good self-defense behavior. Stinging is a self-sacrificing behavior. Honey bees are willing to sacrifice themselves in order to defend the hive. The sting of a honeybee is ingeniously designed to discourage any creature that might threaten the beehive. We humans are made of many cells, and we lose some cells when we scrape our knees. A single individual bee is much like a cell in the body of the hive. The hive is willing to lose some cells of its body, some bees, in order to save itself. The hive contains rich protein (larval bees and carefully stored pollen), and carbohydrate (honey) that many creatures large and small would love to eat. Bees store and must defend their gourmet treasure because the bees need the food to live on during a flowerless temperate winter or tropical rainy season.

The hive always posts its meanest bees near any holes or entrances into the hive. If these guard bees see, smell, or feel the thumping of any creature that might threaten the hive, they release an alarm pheromone into the hive and then harass or attack the intruder. The alarm pheromone in the hive acts much like adrenaline in our bodies. It instantly makes tens of thousands of bees in the hive ready themselves for trouble. Some of the bees begin filling with honey in case the battle goes badly for the hive. They may be able to leave with enough honey to start a new hive somewhere else. But other bees immediately join the ranks of the guard bees. They get ready to sting any intruder.

The sting is located inside the tip of a bee's abdomen alongside the intestinal outlet. It protrudes out of the abdomen only when the bee feels the hive is threatened. It consists of two close-fitting barbed lances with a groove between them. The groove lets venom from a venom sac through the lances and into the skin of the victim. The venom creates a burning sensation and swelling in the victim's skin. The barbs hold the stinger into the skin even if the bee is removed or removes herself. (\*Male bees don't have stingers). When the bee is removed, the stinger, and some of the intestine, stick to the victim's skin. The bee will soon die of intestinal problems and bleeding. The stinger is equipped with muscles that

continue to work the lances in deeper and contract the venom sac. Even after the bee is long gone, the stinger is injecting more venom deeper into the victim's skin.

Most untrained people will swat at a bee if it lands on them. This crushes the bee and drives the stinger and the venom all the way in. Scraping the bee and the stinger off with fingernails is much wiser. An alarm pheromone is deposited on your skin when you are stung and may cause other bees nearby to attack you. If you are not keeping bees and accidentally approach a hive or a hornet's nest hidden in a wall or tree, and get threatened or stung you should run directly away from the area while protecting your nostrils and eyes with your hands. All flying stinging insects have a tendency to sting their victim's eyes, nose and mouth. Teach children not to stay in one place and swat at stinging insects. Run away looking through your fingers. Run straight inside a building. Most bees will not follow you in, and the few that do will become disoriented and fly to the lights or windows. Until you become an expert beekeeper you should NEVER ATTEMPT TO DESTROY A NEST OR HIVE OF FLYING STINGING INSECTS YOURSELF with insecticide sprays, fire, or any other method. Get trained beekeepers, or exterminators, to help you if a hive of bees is located in an inconvenient place.

## **Protection**

If you are going to keep bees, you need to protect yourself while working with the open beehive. Protection comes from knowing. Know what kind of bees to keep, where to keep bees, when to open beehives, how to dress, how to use smoke, how to move and breathe near open beehives, how to react if you do get stung, and you will be able to enjoy the time you spend with your little buddies. We need to lose our fear, but never our respect for bees.

## **The Kind of Bees to Keep**

Some bees are more easily incited to attack than others. The tendency to sting is variable among races. An example of variability within races has been demonstrated by the Brazilian beekeepers. They have selected for the gentler bees within the notoriously defensive Africanized honeybee race. They now have a very workable strain of bee that they prefer to the European honeybees in their tropical climate. We don't keep mean bees any more than we would keep a mean dog that constantly bit our visitors and ourselves. Keeping mean bees could cause the people who live near your bees to demand that you get rid of the bees. Bee breeding has provided us with some bees that are a joy to work with. Your local beekeepers can probably help you find relatively calm bees. If one of your hives gets mean, you should requeen it with a queen of a gentler lineage (see requeening).

## **Where to Keep Bees**

Bees in the wrong place can be a nuisance. They can also be placed under stress. I'm amazed at the many creative places people keep bees in many urban, suburban, and rural areas. In the Northern Hemisphere, bees prefer a southeastern facing entrance and in the Southern Hemisphere they prefer northeastern facing entrances. Entrances should not face into a strong prevailing wind. Windbreaks can help them. Bees prefer to construct their hives several meters above the ground but that may not be convenient to a beekeeper. Bees like to be in full sun unless the climate is very hot and sunny and then afternoon shade is

better for the bees and the beekeeper. In cities a rooftop location might be excellent because the bees will be out of the way. A hedge, screen, or wall around the hives keeps the bees from seeing activity in a garden, or play area.

Not all places have enough flowers of the right kind to feed bees. Planting even a few acres of flowers may help but won't be enough. If honeybees exist in your area, then you know bees can at least survive. Local beekeepers will be the most knowledgeable about your local bee forage. Some years bee forage is better than others depending on the weather and plant pests. Areas that are commonly sprayed with insecticides are bad for bees.

Bees need water. They benefit from clean water in sand, gravel, or vegetation. They can't swim in open water, and will drown if there is not a good surface for them to alight on. I have kept bees where it is hot and dry and have had thirty beehives consume 55 gallons of water in seven days. If there are no clean sources of water near your bees, the bees could become a nuisance to your neighbors. They might swarm around animal water tanks or bowls, swimming pools, dripping hoses or water lines, or even wet laundry. In areas that are routinely sprayed with insecticides, particularly in areas where standing water is sprayed for mosquitoes, the open water could be contaminated and sicken the bees. We supply our bees with water by filling a large tank with water that has a short hose connected to a float valve in a shallow gravel-filled pan, or a bucket or tank of water with floating boards drilled full of holes or sticks that give the bees a dry safe place to land and drink the water. If we knew that somebody was going to spray the area and we couldn't stop them, we would cover the pan to keep the insecticide out of the water.

## **When to Open Beehives**

Bees are most docile when many bees are out foraging on flowers. Cold (less than 50 F), extremely hot (105+ F) or stormy weather brings the foraging bees into the hive and makes the hive more defensive. Opening hives during bad weather conditions can chill or overheat the hive. The bees will try to stop you from committing such an inconsiderate blunder. If the weather is pleasant but no flowers are blooming, the bees can be easy to work with, providing you don't spill or expose honey. When no flowers are blooming, bees from other hives will smell the exposed honey and start "robbing" honey to take to their hives. The bees from the open hive may start fighting with "robber" bees and soon the bees will get angry at anything that moves. If no flowers are yielding nectar in your area, only open the hives if necessary and take care to quickly cover honey you expose or spill. With experience you will become familiar with the moods of honeybees. If the hive seems to be in an unusually bad mood, try working with them a little later. Maybe a predator recently bothered them and they are still mad.

## **How to Dress**

The best clothing is a bee veil, a long-sleeved light colored plain shirt, and long light colored plain pants. Dark colors antagonize bees, especially black or red. Fuzzy materials or hair tangles bees up and get them angry. Wool bothers them. Smooth cotton is good. I find gloves a hindrance because I don't feel bees under my fingers and accidentally crush bees when wearing gloves. When bees are crushed, the other bees get mad. With bare fingers I can feel the bees under my fingers and gently bump them out of my way. I am used to feeling bees crawl on my hands and even up my sleeves. When you lift combs out of a hive, some bees fall to the ground and crawl up your shoes and legs, sometimes inside your pants. The higher up your legs they get, the more tender and private the skin they might

sting. Boot laces, string, rubber bands, or pants tucked into cotton socks keep the bees out of your pants. Bee suits are available that can zip you up into a one-piece bee armor. Much of your “protection” is your own confidence and calm respect for bees. Clothing can help you feel more confident. As you gain more experience you may decide to shed gloves or overalls in order to keep cool.

## **The Bee Veil**

Once bees decide to attack a human, they usually first try to sting the eyes, nose, and mouth. When bees are afraid of an intruder that is disrupting the tranquility of their hive, they get mad at the smell of mammalian breath and fly to our nose or mouth. Bees also get angry with and tangled up in hair. So the main part of our body that bees want to attack is our most vulnerable part, our head. A bee veil protects our head. Beekeeping without a veil can be frustrating or dangerous. Mosquito netting around the head and over a hat works well. We use our veils a lot and like a high quality commercial veil and hat that are comfortable and fairly easy to take off and put on. The veil should cover over your head and down to below the collar of your shirt. As you are working your bees, an occasional bee will fly up to your face and bounce off the veil and then often give up and leave you alone. Without the veil, you would have had to quit or take a sting. A sting in the eye could possibly destroy your eye. A veil is important!

## **How to Approach and Open Your Beehive**

**SMOKE.** The first thing that should alert the bees to your coming should be smoke. Smoke has an effect on bees that is not totally understood. I think that bees, often tree-dwellers in the wild, respond to smoke with a desire to fill with honey in case a fire is about to destroy the hive (they have no fire departments). The “thought” of leaving with as much honey as possible puts the bees in the swarm mode of behavior. The hive may not be defendable in a fire and they must survive with as much honey as they can carry until they can set up a new hive. Also when completely filled with honey, bees cannot bend over to sting easily. Smoke may also interfere with the alarm pheromone transmission or reception. People have known for many thousands of years that smoke makes bees much less apt to sting.

Many people discontinue keeping bees because they cannot consistently keep a good source of smoke readily at hand. The bee smoker is an excellent device for this purpose, but it must be ignited properly with a good fuel source. The fuel should be something dry and porous that smolders well and does not produce any toxic, acrid, or hot fumes. Fuels that pack tight will not let air through the smoker and will not produce smoke consistently.

Charcoal burns too hot and doesn’t produce enough smoke. Plastic or poisonous plants might poison the bees or the beekeeper. Some excellent fuels are dry horse or cow manure, juniper bark, corncobs, and coconut husks. Keep a supply of dry fuel somewhere where it won’t get wet in the rain.

Use a piece of paper or some dry grass and weeds to ignite the smoker fuel. Put enough chipped fuel beside the smoker to fill it. Carefully light the paper or grass and drop the flaming material into the smoker while puffing on the bellows. If you do this at night you will see that some flame is leaping out of the open top of the smoker. These flames could ignite your hair, clothing, or any dry grass or brush near you and start a terrible fire so you must be careful when lighting your smoker. Drop in the smoker fuel slowly (between puffs) and carefully. If you pack it in quickly the igniter material will go out. Keep puffing.

Get the smoker fuel thoroughly ignited on the bottom and completely burn out the igniter material. Add more smoker fuel as needed. If you are working on bees all day, you may need to occasionally empty out the ashes where they will not start a fire and put the hot coals in the bottom of the smoker with more fuel on top.

Smokers get very hot when in use. Some smokers are made with a shield around the burn chamber to keep you or a curious onlooker from accidentally touching the burn chamber and searing some skin. These smokers are well worth some extra expense. Be careful, when lighting, using or putting out your smoker not to start a wildfire. I repeat myself a bit about being careful not to start fires because some beekeepers have had very bad and expensive experiences with fires. A mist of water sprayed on bees can be used as an alternative in very fire-sensitive areas. I know a woman who uses water with calming essential oil of lavender and is very happy with the result.

Smokers need an occasional cleaning. Tar builds up in them just like it does in the lungs of a cigarette smoker. It is easiest to pry and scrape the tar out when it is hot after using it. I find the conical topped smokers easiest to clean out.

So once you've put on your veil, light your smoker, and then gently but confidently approach the hive from the rear and puff 5 to 10 good thick puffs of smoke at the guard bees at the entrance of the hive. If there is more than one hole in the hive they all need some smoke, as the hive will have guards posted at all possible entrances. Then take the top off the hive. Smoke any holes where bees could get out through the topbars. Then pry up the very back topbar and puff 3 or 4 puffs of smoke into the hive. Then you can remove the back 3 or 4 topbars and puff more smoke into the hive through the gap where the topbars were.

From the bees perspective, all was peaceful and the air was circulating normally and it was dark in the hive until you arrived and banged on the hive, tore off part of the roof and made a huge draft, and let the sunshine in. The opening of the hive is when the bees are most disturbed. That is when you should use the most smoke and move slowly and try to be gentle. Human breath is antagonistic to them at this time and you should not breathe or talk right down into the open beehive. Bees are very fast paced and quickly adapt to new conditions so the state of heightened alert will usually diminish quickly. As you are working with the combs, move slowly, especially between the bees and the sky. A motion that is slow to humans is so slow to bees that they may not even notice the motion, much like we don't see the motion of the minute hand of a clock. If you drop something and crush some bees, or for whatever reason the bees suddenly seem to become extra angry, just back off in a cloud of smoke, compose yourself and go back in a moment. Our fear makes the bees mistrust us.

The one time that it is hard to move slowly is when a bee is stinging you. With all the best precautions it can still happen. With experience you will get used to a few stings. To be really comfortable keeping bees, you need to lose your fear of stings. The ideal way to react to a bee sting is to calmly set down combs or tools in your hand and then use the hive tool, your fingernails or something to gently scrape the stinger off of your skin. Then puff some long puffs of smoke on the area of the sting to erase the mad bee smell on your skin.

Many beekeepers first approach their beehives with fear and trepidation, and then realize that they were overly fearful of their bees. Then there is a risk of becoming over-confident and losing our respect for the bees. After working bees successfully many times, we become careless about the bees' defensive behavior. We decide to "take a quick look in the hive" without smoke or maybe even without a veil, and it's late and a storm is brewing and suddenly our normally docile hive stings us many times. I've known long-time

beekeepers that knew better and then got stung severely (50 to 150 stings) and contemplated giving up beekeeping. The veil, the smoker, and decent weather are important. A beehive can contain 50,000-80,000 bees and 500 to 1000 bee stings can kill anybody. Respect them.

## The Life of the Honeybee

Honeybees are social insects. They have to live in a group. Individual honeybees, even the queens, are hopeless and soon die. Each individual is like a cell in the “super organism” we call the hive. We have cells in our bodies that move air, circulate blood, transmit information, etc. Individual bees perform many of these same tasks for the hive. There are three castes of bees in a hive. There are many workers, one queen and from zero to a few thousand drones depending on the time of the year.

The colony of bees lives on combs. The bees make the combs out of beeswax. They eat honey or nectar and turn it into beeswax that they exude from glands under their abdomen. The bees fill a hollow space inside a tree or wall or beehive with many close-fitting combs. The “brood nest” is an area in the hive where the cells are cleaned for the queen to lay eggs in. The larvae live in these cells and are fed by their adult sisters. Pollen is stored around the brood nest and honey is stored beyond the pollen.

Most people only encounter worker bees. They are the bees that leave the hive and visit flowers, water, and trees to bring food (pollen and nectar), water, and propolis (a resinous, tar-like substance bees collect from the buds of trees) back to the hive. They are females, although they cannot mate and don't usually lay eggs. Worker bees go through stages of development where they perform different tasks at different times.

A worker bee starts as a female egg, laid in a cell in the brood nest by the queen. Three days after the egg was laid the worker hatches and begins her larval life in the bottom of the cell. Her adult sisters produce a special food in their throats called royal jelly, and deposit some in the cell to feed the little larvae for the first three days of its larval life. The larvae eats a lot of royal jelly and later honey and pollen, grows fast, and should look like a fat white glistening caterpillar. It may have an occasional yellow streak from the pollen in its gut showing through its skin. Only eight days after the egg was laid it is a full grown larva and spins a cocoon, transforming into the stage we beekeepers call “capped brood”. Under its leather-colored cap it is a pupa developing into an adult. The individual cells of capped worker brood are smaller, nearly flat-capped cells compared to the less numerous drone cells or the occasional queen cells.

Twenty-one days from the day the queen laid the egg, the larva chews the cap off and pulls herself out of the cell and wobbles around as a fuzzy weak adult (the number of days spent in the stages of development varies a bit with race of honeybee). For a few days she is fed by her older sisters. She fills out and gathers strength. The glands in her throat develop. The new adult becomes a nurse bee and begins to feed its larval sisters. From there, the jobs are many and slowly graduate to the outdoor work of gathering nectar, pollen, water, and propolis. The indoor work includes: feeding larvae, producing wax, cleaning cells, sealing cells, ripening and depositing nectar, eating pollen, sealing honey, fanning to circulate air, forming beeswax into hexagonal cells, hanging onto each other in curtains and vibrating wing muscles to heat the hive, carrying debris including dead larvae and adult bees out the door, guarding the hive, and things we haven't even figured out yet. Workers are the lungs, digestive tract, and everything in the hive except the reproductive parts. Their brains seem to join together to make decisions for the hive. They decide where the queen should

lay eggs, when to raise drones or new queens, when to swarm and where to swarm to, where to gather pollen and nectar, etc. Once they “graduate” to field bees, they fly as far as 12 miles away but usually just a few miles from home to find and bring home nectar, pollen, water, and propolis.

The queen is a fertile female that can and does mate. She develops from a female egg and is fed royal jelly in great quantities. She develops in a queen cell that is long and often has the appearance of a peanut when it is capped. If the hive is raising a new queen there will be 4 to 12 queen cells with larvae in them. Most of the time there are no “active” queen cells in a hive because the hive does not need more queens. Whereas worker larvae are fed honey and pollen after a few days of larval development, the queen larva is fed lots of royal jelly throughout her development. She develops faster, (16 days from when the egg is laid until the adult hatches from the cocoon), and is physically bigger and more wasp-like in appearance. She is the female reproductive tract of the hive. She has especially well developed ovaries. She hatches and mates with 10-15 drones (in the air) and returns to the hive with lots of semen stored in a sac (spermatheca) in her abdomen. She will not mate ever again and fertilizes the eggs she lays for the rest of her life with this stored semen. She becomes the egg-layer, the mother, of all the bees in the hive. She can lay one to two thousand eggs a day when the hive is large and expanding. If she slows down too much the workers will raise a new queen from one of her daughters to replace her. She cannot feed herself or other bees. She exudes pheromones that the worker bees constantly smell, taste and share with each other. These pheromones keep the workers from laying eggs. Since she is the mother of all the workers and drones, her genetics are very important in determining the color, temperament, disease-resistance, and all other genetic characteristics of the hive. The workers prepare cells for her to lay eggs in. She inspects each cell. In worker-size cells or queen cells, she lays eggs she fertilizes with semen stored in her spermatheca. As she ovulates she can either choose to allow some semen to the egg or not. Fertilized eggs become females.

Unfertilized eggs get laid in large diameter drone cells and become male or drone bees. Drones have no father! The drones are the male reproductive part of the hive. They take the longest to develop (23 days). Capped drone cells are dome-shaped. If workers, who can't mate, lay eggs, their eggs all develop into drones. (Workers do not lay eggs unless something is seriously wrong with the queen or she is dead). If the queen loses the ability to fertilize her eggs, all of her eggs will develop into drones and the hive will decline. Drones do not gather resources, nor do they do any of the inside work of the beehive. They are a bit vagabondish and apt to wander from hive to hive. They do not mate with the queen of their own hive. That queen is their mother and is already mated. Drones fly around in “drone congregation areas” and wait for queens from distant hives who are newly hatched and need to mate. They mate in the air and the drone dies after mating. Drones, like queens, do not seem to enter much into the decision-making of the hive.

## The Beehive and The Seasons

A hive of bees in dearth periods, temperate winters or tropical rainy seasons, is a strange reclusive creature, a congregation of bees who live in a cluster, usually inside a hidden cavity. It has carefully stored its food (pollen and honey) throughout the hive. The cluster slowly moves around in the combs by eating its way into stores of honey and pollen during cold winter months. Tropical bees cluster in rain or hot dry weather to protect the brood from wind and drying. The bees only leave during warmer days and will not defecate in the hive (so on warm days, look out!). They live on the scents and tastes of honeys their deceased sisters stored when flowers scented the air and painted the landscape. They "burn" honey in their wing muscles to heat the hive. The first fresh pollen after a long winter or rainy season excites them. They clean up lots of cells for the queen to lay eggs in. The reclusive creature grows quickly but can lose ground quickly. If it gets very cold the bees have to cluster into a tight sphere and let some of the new brood die of cold. If the hive population grows too early and develops an adolescent appetite and the honey stores are low and then the flowers freeze or wash out in lots of rain, the hive may starve to death.

But if the honey lasts and the flowers take over in time, the hive population grows rapidly. By the time the season of flowers has arrived, the hive is feeling its oats. It wants to swarm. It has to swarm in the beginning of flower time because a swarm is the making of two hives from one. Both hives will need to make enough bees and beeswax comb and gather enough honey and pollen into the hive to survive the next all-too-quickly approaching flower-killing winter/rainy season. The swarm urge begins when the bees in charge of storing nectar from the field bees have nowhere to store honey outside the broodnest. When a pupa bee hatches, the broodnest space is filled with honey. Soon the queen has a hard time finding a place to lay new eggs. Many nurse bees have fewer and fewer larvae to feed. The queen is then directed to lay eggs in some cleaned queen cells near the bottom of the combs. The queen larvae that develop in these cells are well fed because the nurse bees don't have many worker larvae to feed. Just before the first new queen hatches she "pipes" a warning sound to her mother. By this time the mother queen has stopped laying eggs and has slimmed down to a flying weight. Mom will answer the warnings of her daughter and then begin gathering a swarm of bees, mostly young hive bees full of honey, to leave with her. If she stays her daughter will kill her.

The swarm flies out in a whirling dust devil of bees and coalesces into a mass of bees on a tree limb nearby. Scout bees go out from the swarm to evaluate possible sites for the construction of a new hive (hollow trees, caves, eaves of roofs, hollow walls, etc.). In a few minutes to a few days, all the best sites are evaluated. The workers in the swarm make a decision and break up the clustered swarm to fly off with the queen to the new home. There new hive begins constructing comb to raise larvae and store honey in.

One important note here that you can read more about in the advantages of topbar hives, is that if bees can build their own comb they build combs that are ingenious works of architecture that fit their needs perfectly. The original hive now has a new queen that will kill any un-hatched queen sisters. She needs to mate and start her egg-laying career. If the swarming urge is strong the first daughter queen to hatch will take an after-swarm out with her and leave the original hive to another daughter queen (her sister). Sometimes if honey is not coming in, the swarm urge is low and the hive will not swarm. Maybe next year they can make a new hive.

During the flowering season, the bees gather and carefully build honeycombs and store honey and pollen to get them through the next dearth season. As flowers fade in the fall or during a rainy or dry season, the workers prepare fewer cells for the queen to lay eggs in so that the population of the hive will diminish, minimizing honey and pollen consumption. Drone production ends and the existing drones are grabbed by wing and leg and forcibly hauled out of the hive. Often the queen stops laying eggs for nearly a month in some areas so that there are just enough bees to keep warm but no so many as to eat up all the honey stores too soon. Winter and rainy or “dearth” seasons will kill some or many beehives. The survivors will try to make up the losses in the next spring or flowering season by swarming, thus producing more hives.

## Races of Honeybees

There are a few different species of honeybee. The principal species kept by beekeepers is *Apis mellifera*. Only a few species are regularly kept in beehives. *A. cerana* is a small, tropical honey bee. I have no experience with it, but from my reading I see that it has a lot of similarities with *A. mellifera* and could be kept in topbar hives with experimentation to find the right size to build the topbars and the hive boxes. Dr. R.W.K. Punchihewa has done some wonderful research with this species in Sri Lanka. There are tropical stingless bees (*Melipona* and *Trigona*) that produce honey in Central America. Their cultivation in hives by Mayan people was nearly lost but now there are some projects being worked on through collaboration between the USA based The Bee Works and El Colegio de la Frontera Sur in Yucatan, Mexico to revive the art of keeping them.

There are quite a few races of *A. mellifera* that range in their native habitat from Scandinavia through Europe and the Mediterranean, to tropical and temperate Africa and Asia. There are no native *A. mellifera* in the Americas. Each race of this species comes from, and is adapted to a specific region, climate, and floral environment. If you live in an area where a race of *A. mellifera* is native, it is likely that local beekeepers can recommend some good bees to keep in your area.

Importing bees to experiment with can often lead to trouble because you might accidentally import a bee parasite or a race of bee that is not adapted to your region. The importation of the Varroa mite, a minor parasite of *A. cerana*, into Europe and the Americas caused devastating bee losses. The importation of an African race into Brazil caused a difficult change in beekeeping throughout the tropical Americas because that race was much better adapted to the region than the European honeybees beekeepers were used to. The African bees are more swarm prone and their highly defensive behavior earned them the name of “Killer” bee with journalists trying to sell “news”. Beekeepers had to move beehives further from homes and learn to manage the bees differently. Neighbors who are concerned about your keeping “dangerous” insects near their homes don’t like the sound of “killer bees”. Now the Brazilian beekeepers have adapted and actually prefer the Africanized honey bee.

In the Americas there is a confusing and rich variety of honeybees to choose from. All are imports from regions that may or may not be similar to where you are trying to keep bees. Some are stabilized hybrids and some are not at all stabilized. Many bee breeders have bred bees while using antibiotics in the hive on a regular basis and have bred some decent but antibiotic dependant bees. All honeybees kept by beekeepers should be selected for calmness. Beekeepers should not endanger our neighbors or our reputations by keeping

mean bees. Disease resistance and now Varroa mite resistance are necessary traits in natural or organic beekeeping. Part of the difficulty in breeding bees is that the queen mates in the air far from the hive and the beekeeper usually has little control over the origin of the drones she mates with. Again the best recommendation about which bees to try will come from successful beekeepers in your region. Of the varieties available in the USA I can give you these guidelines.

Many beekeepers like the Italian honeybee. It is from a mild Mediterranean climate and maintains a bigger winter cluster than some of the more cold hardy races. They can be very productive if they can get through the winter. They tend to be brightly yellow colored. There is a variety of Italian honeybee that is bright yellow called Cordovan that is used in research because its color makes it stand out and can be used as a genetic marker. Italian honeybees use more honey in the winter and may need to be fed in the spring if there are late frosts.

The Carniolan bee is from the mountains of southeastern Europe (Austrian Alps, northern "Yugoslavia") and it survives the winter in a smaller cluster and uses less honey. Carniolans can be more prone to swarming. They are a calm, dark reddish brown bee.

Caucasian honeybees are from the Caucas Mountains of Eastern Turkey, Armenia, and Azerbaijan. These bees are known to put a lot of propolis in the hive and are good cold winter survivors but have a reputation for high susceptibility to an amoebic parasite Nosema apis. They are calm, and lead grey in color.

There has been an ongoing carefully controlled importation of Russian honeybees into the USA, initially spearheaded by Dr. Thomas Rinderer at the Baton Rouge bee laboratory. They are from southeastern Russia, near the origin of the varroa mite and are apparently able to resist the varroa mite because they groom each other and crush mites they find on their sisters with their mandibles. They are good honey producers, and generally calm, although a small percentage (2-5%) of my Russians get a bit "cranky". They vary in color.

There is a variety of honeybee called the Buckfast bee bred at the Buckfast Abbey in England by the now deceased Brother Adam. They are a stabilized hybrid of European and African races that are winter hardy and productive. They are a reddish leather color. They have a calm, easy-going temperament.

SMR in beekeeping circles stands for Suppressed Mite Reproduction trait. These bees were selected for varroa resistance and have been found to somehow inhibit varroa mite reproduction in their larvae. This trait can be bred into any race of honeybee.

Anyone wishing to keep bees without antibiotics or mitecides should look for bees that have not been raised with those compounds. It was said in the 1990's by a reputable honeybee research scientist, that it would be impossible to breed bees that could resist the varroa mite and that we would be always dependant on mitecides. Fortunately, the Russian beekeepers didn't hear that, and many beekeepers in the USA took that as a challenge and he has since been proven wrong. The varroa mite has shown that it can quickly develop resistance to mitecides. Mitecides are not good for bees, so SMR is a welcome trait in bees.