The BEE book

WASHINGTON MASTER BEEKEEPERS

APPRENTICESHIP CURRICULUM

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The BEE Book

An Apprentice Level Curriculum

Kris Urv-Wong, Master Beekeeper
Washington Master Beekeepers
With
Brandon K. Hopkins, PhD
Washington State University

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Dedicated to all those who love the honeybee and to my first mentor, Alicia Halbert.

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CHAPTER I THE HONEY BEE

SCIENTIFIC CLASSIFICATION

Introductions. *Meet Apis mellifera, the honey bee. The earliest A. mellifera pollinated Pliocene period plants 2.5 million years ago. By that time, native honey bees roamed Europe, Africa, and Asia. The North American story of the honey bee is, however, much more recent, coinciding with the arrival of the pilgrims. The pilgrims brought colonies of honey bees to their colony in the New World.*

Chapter I provides a broad overview of honey bee basics, expanded in later chapters, i.e., taxonomy, anatomy, and colony organization; communications; and hive production. Enjoy.

The honey bee is an insect CLASS Insecta), we most all learn that in elementary school. Additional honey bee taxonomy is dictated by the physical characteristics and behavior of *Apis mellifera*., *Apis mellifera* falls into the classification illustrated in Table I.

Table I HONEY BEE TAXONOMY illustrates the bee's scientific classification, based upon physical characteristics and behaviors. Table I begins with the most inclusive classification category for the bee,

KINGDOM: Animalia; honey bees are animals, like horses, pig, and dogs. The bee falls into the

TABLE I

HONEY BEE TAXONOMY

KINGDOM **Animalia**	animals
PHYLUM **Arthropoda**	Exoskeletons Jointed legs
CLASS **Insecta**	Exoskeletons Jointed legs Compound eyes Antennae 3-part bodies
ORDER **Hymenoptera**	"Membranous wing Undergo metamorphosis Bent antennae
FAMILY **Apidae**	2-pair of wings
GENUS **Apis**	Latin "Bee" Honey production and storage, wax construction i hives
SPECIES **Mellifera**	*Latin "Honey bearing"*

SUB-SPECIES* popular with beekeeper
Apis mellifera ligustica
Apis mellifera carnica
Apis mellifera caucasia

PHYLUM: Arthropoda. Surprisingly, Arthropoda includes lobsters and spiders. Bees and lobsters? Both have exoskeletons and jointed/segmented legs.

Moving down the hierarchy, we arrive at

CLASS: Insecta. Insects. Now, this make more sense. Insects, one of the most populous CLASS of animals include butterflies and dragonflies, staghorn beetles, fleas, lice, ants and termites and honey bees.

ORDER Hymenoptera captures the insects: ants, hornets and wasps (in addition to the honey bee).

The FAMILY Apidae encompasses social and solitary bees: honeybees, bumblebees, carpenter bees, cuckoo bees, and stingless bees, almost 5,700 species

GENUS Apis further refines membership to bees that store honey and build their homes from wax.

SPECIES: Mellifera, our final step, differentiates the European honey bee, Apis mellifera, from the Asian honey bee, Apis cerana, and the Giant honey bee, Apis dorsata.

ANATOMY

The honey bee is an insect because it has three distinct body parts: head, thorax, and abdomen; the requisite six legs; an exoskeleton; antennae; and compound eyes.

Evolution has equipped the female honey bee with wondrous glands. One produces the wax which bees use to build their comb; another set of glands produce pheromones which help the bees communicate and influences their behavior; yet another produces nutrients.

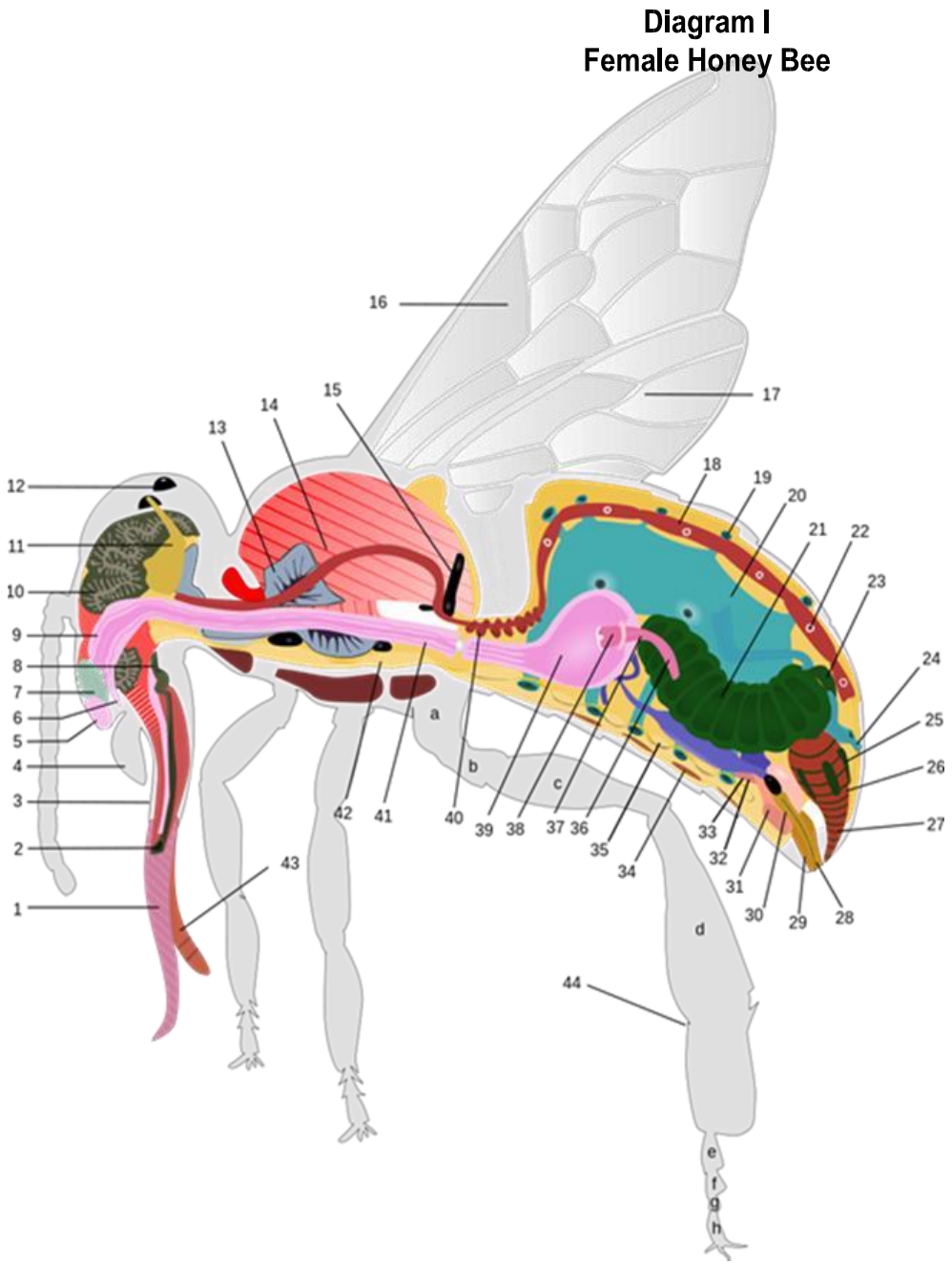


Figure 1 Bee Anatomy

1	Tongue	14	Chest Muscle	27	Anus	40	Heart Loop (Aorta)
2	Proboscis	15	Flight Braces	28	Stinger	41	Esophagus
3	Lower Jaw - Maxillae	16	Forewing	29	Stinger Sheath	42	Nerve Fiber
4	Mandible	17	Hindwing	30	Sting Canal	43	Jaw
5	Upper lip	18	Heart Tube	31	Poison Sack	44	Pollen Brush
6	Lower Lip	19	Stigmas	32	Small Gland	a	Coxa - Hip
7	Mandibular Gland	20	Aerial Bag	33	Seminal Vesicle	b	Trochanter
8	Pharynx	21	Midgut	34	Wax Glands	e	Meta Tarsus
9	Upper Throat / Gland	22	Heart Flaps	35	Belly Mark	f	Tarsus
10	Hypopharyngeal gland	23	Small Intestine	36	Intestinal Valve	g	Tarsus Joint
11	Brain	24	Nasonov Gland	37	Valve Funnel	h	Claws
12	Simple Eye	25	Abdomen Gland	38	Stomach Entrance		
13	Saliva Gland	26	Excrement Bubble	39	Honey Stomachs		

SPECIAL GLANDS

Find Wax Glands on Diagram I, Number 34 pinpoints the location of the honey bee's wax glands on the underside of her abdomen. The wax glands convert the sugar in honey into wax.

Number 24 identifies the Nasonov Gland. This gland produces pheromones (scent) that female worker honey bees (except the queen) use to call to other worker bees. If you have ever seen a newly swarm hived, with the workers spread out on the hive's landing board. Their abdomens in the air, frantically fanning their wings; they are exposing their Nasonov Gland. By exposing their gland, Nasonov Gland pheromones release to "call" to members of the swarm.

The specialized Hypopharyngeal Gland (10) produces royal jelly. During the first three days of life, all bee eggs and larva are drench in (egg) or feed (larva) Royal jelly. A queen larva receives royal jelly exclusively.

EYESIGHT

Honey bee eyes are compound. Compound eye have a multifaceted surface providing the honey bee a prism-like view of the world. The prism view does little for attaining a fine focus; however, they are effective at sensing movement.

Honeybees view their world through an ultraviolet filter. Ultraviolet sight is advantages to the honey bee; numerous plant species evolved ultraviolet markings that act as a beacon to the honey bee, “come drink my nectar, and by the way, pollinate me.”

Figure 2 Queen and her retinue Credit KU-W)

THE COLONY

SOCIAL ORGANIZATION

The FAMILY Apidae includes social and solitary bees (Mason bees). Apis mellifera are social; they live in large groups called colonies. Each honey bee has a role (usually, based on age), adhere to a ridged caste system (based on gender), and a complex matriarchal (ruled by females) social order. They communicate by pheromone scent, by dancing, and by physical head butts.

WHO’S WHO IN THE COLONY

Diagrams 1 - 3 I illustrate the nature of the hive and the role of the different castes of bees[iii]. Three distinct castes or types of honey bees constitute the colony: a queen, workers, and drones. The Queen, despite her name does not rule the colony. The workers, major of the hive population, produce and lead the queen to “decisions.”

The workers are the true decision makers in the colony: they decide when to swarm; decide when a queen is past her prime (pheromones fading) and coldly build a new queen to “supersede” the old, failing queen. If a newly hatched queen seems reluctant to make her mating flights, the workers push her to go.

Table II Honeybee Eggs

	EGG	LARVA	WAX CAP SHAPE	PUPA	EMERGE ON:
QUEEN	3 days	4 days	Peanut shell	8-9 days	Day 16
WORKER	3 days	6 days	Concave	12 days	Day 21
DRONE	3 days	6 days	convex	15 – 16 days	Day 24

The Queen may lay up to 2,000 eggs each day which nurse bees immediately tend (worker and drone eggs).

Workers and drone eggs and larva receive Royal jelly (produced by the nurse bee's Hypopharyngeal Gland) for three days, after that they receive beebread (a mixture of pollen, honey, and bee saliva).

Figure 3 - Drone at various stages of development

The nurse bees cap the cells and wait for the pupa stage to finish and a new bee to emerge.

Worker bees are the strength of the hive. Summer worker honey bees, flying after nectar and pollen wear out their wings and may only live for six weeks. Their wings in tatters, unable to return to the hive, workers find a warm sidewalk or wall to wait out their end.

They are critical pollinators for our economy; a third of what we eat is linked to honeybee pollination. Other key pollinators include butterflies, bats, solitary bees (like mason bees), flies, midges, moths, and ants.

Table 1

WORKER

NUMBERS: *Thousands; 85% - 90 % of colony population*

GENDER: *Female*

SIZE: *Smallest bee in the colony*

ROLE: Field bees* are pollinators and a major force in US agricultural economy

Hive Duties d dependent on age. (Emergencies may demand reverting to previous roles)

- Nurse Bee – *care & feeding of larva, cleaning cells of newly hatched bees*
- Housekeeping Bee – *cleaning detritus & debris out of the hive*
- Mortuary Bee - *Cleaning dead bees from the hive*
- Comb building Bee – *Builds comb*
- HVAC Bess – Keeps the hive warm or cool as needed; ensure ventilation
- Meet & Greet Bees - take pollen, nectar or water from incoming field bees
- Guard Bees - patrol the hive entrance, menacing anything not of the hive.
- *Field Bees - gather pollen, nectar, and water; pollinate 1/3 of everything we consume
- Scout Bees - search for new homes prior to swarming

Table 2

Drone

NUMBERS: *Hundreds; 10% - 15 % of colony population*
GENDER: *Male*
SIZE: *Smaller than the Queen; larger than the worker*
ROLE: *Mate with Queens*

DO NOT: pollinate, gather nectar/pollen; defend the hive (no stinger); conduct any work; must beg food from the workers; ousted from the hive in the fall.

MATING: *After mating with a queen, they die*

Table 3

Queen

NUMBERS *Just one*

GENDER: Only sexually **developed** female - In some cultures caller the "Mother"

SIZE: Largest in the colony; abdomen protrudes well past her wings

MARKS Often marked by a dot of color on her thorax; color is one of five and identifies birth year.

ROLE: Reproduction

Lays up to 2000 eggs/day (selects male/female egg based on comb size)

NOTE: Workers lead the Queen to the size cell they think they need in the colony

BEHAVIOR Mates only once over a period of days with up to 40 drones (avg. 12)

Mates in Drone Congregation Areas (DCA); drone 'hang outs'

Her pheromones:

- keep the colony "Queen-Right",
- regulates worker tasks, and encourages 'retinue' response in workers- grooming & feeding her

Only leaves the hive, 1) her mating flights;

2) with an initial swarm from a colony

SEASONS

The seasons and the weather dictate the honey bee's life. Colony composition and size is determined by health and the time of year. A colony reaches its apex in summer; averaging 40,000 – 60,000 bees with a queen, workers, and drones (males).

Fall finds the honey bees preparing for the coming winter months. The queen stops laying eggs. Almost all drones exit the hive; speed along with physical persuasion from the workers; the colony cannot afford to feed the drones through the winter months. Through winter the colony clusters to warm the queen and each other, the population slowly shrinks.

Late winter finds the queen laying again, the population grows in anticipation of spring nectar and pollen. (More in Chapters Spring; Summer; Fall and; Winter).

COMMUNICATIONS

PHEROMONES

Honey bees come equipped with specialized glands. The pheromones release by the glands "talk" to other honey bees in the hive. Imagine 60,000 honey bees needing to send an emergency message to each other. Scent is the only practical solution.

The Queen also exudes a special pheromone. The worker bees rub against her and spread her scent letting all the bees know that the queen is fine…or not. If the workers find her failing they will take steps to replace her.

When a worker stings they also leave a "ripe banana" scent. This precise scent informs the honey bees that there is a" threat to the hive, and here it is." Beekeepers are fastidious and use smokers at the site of a sting. When beekeepers begin an apiary (the site of your hives), inspection they often smoke each hive to diminish the effect of the honey bee "alarm pheromone". Over 30 different pheromones have been identified, each specific to a critical message.

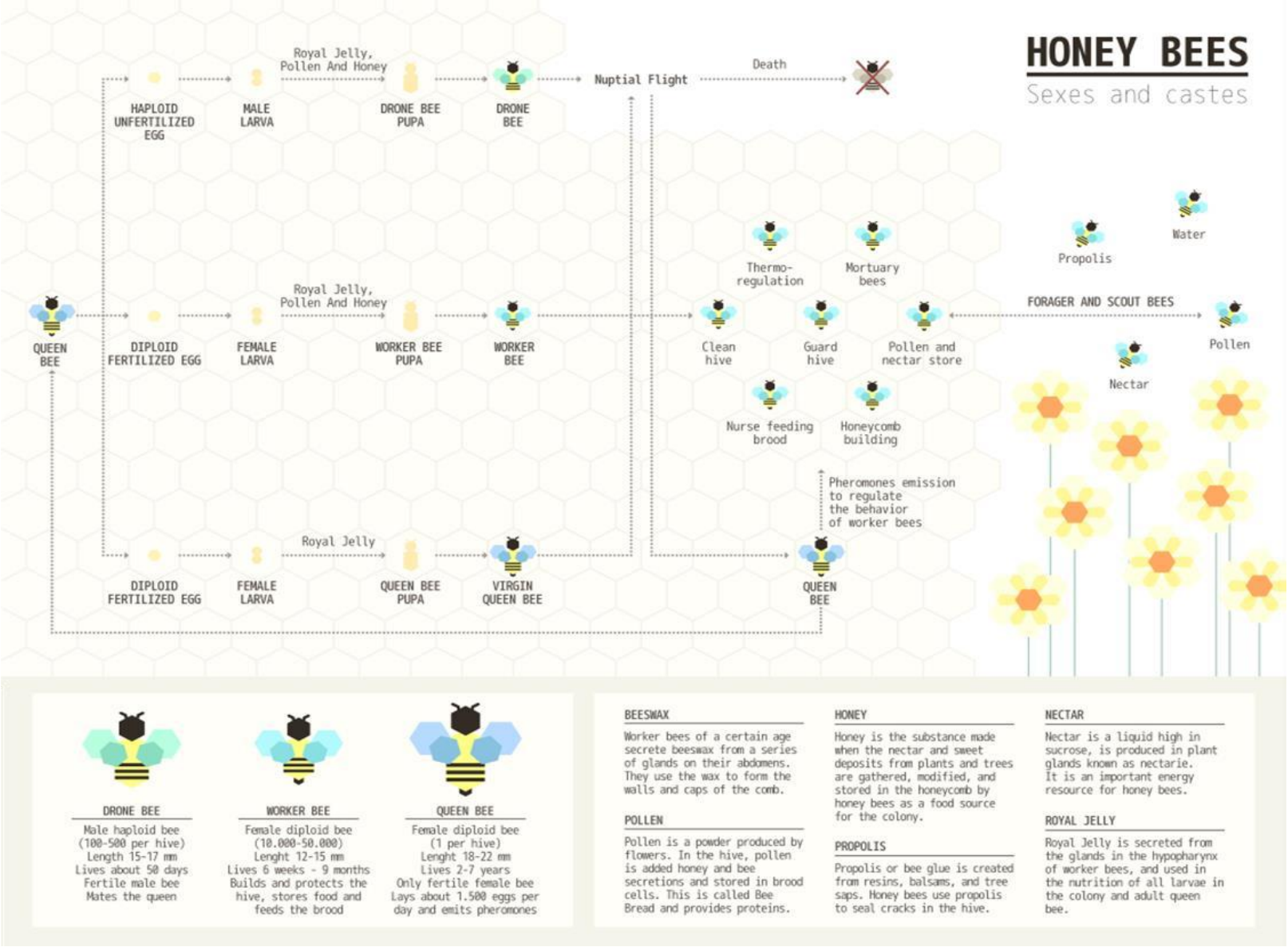
PHYSICAL MOVEMENT

Honey bees are master orienteers. Using the sun's position and visual landmarks they follow a path to nectar, water, and back home. Before any forager bee leaves the apiary area, they conduct an orientation flight, which consists of numerous spiral patterns over the hive. The orientation flight builds a solid memory of the hive and the area for the bee.

All foragers complete their orientation flights; thus, they share a 'map'. The infamous "waggle dance" identifies a nectar or water source; "target". The "waggle dance" is familiar to many. A bee dances and the speed, direction and positioning of their figure-eight moves pin-point the precise distance and the direction of a nectar source, all in relation to the sun.

Honey bees also head butt each other to warn of imminent danger. Honey bees head butt to warn the hive of a threat; the harder they head butt the closer the threat.

iii This image has been created during "Density Design Integrated Course Final Synthesis Studio" at Polytechnic University of Milan, organized by Density Design Research Lab. Image is released under CC-BY-SA license. Attribution goes to "Cecilia Andrea Nunez, Density Design Research Lab". For bee size etc. Sept 18 2016 WIkd Endnote i and ii are used under the following copyright agreement: **Creative Commons**.



PRODUCTION

HONEY

Honey is a bee's source of carbohydrates. Forager bees return with nectar. Meet and greet bees accept the nectar, the bee mixes the nectar with its enzymes, places it in prepared cells, and finally, evaporates the mixture till the moisture content is less than 18%. A higher moisture content would allow the honey to ferment. Bees consume honey, they mix it with pollen and enzymes to produce beebread for their young, and they store it for the winter.

POLLEN

Pollen is a bee's source of protein. Bees bringing pollen to the hive signals that brood is present. Bees pack pollen into prepared cells. It feeds the young (beebread) and is stored for the winter. Pollen makes a colorful mosaic on the frames; the color determined by the plant source.

PROPOLIS

A recipe for propolis includes resin from tree buds or sap, honey bee enzyme (bee saliva) and a little bit of bee's wax. Highly antibacterial, bees use propolis to seal small gaps (less than 3/8 of an inch) between hive boxes, or between the top of frames. Propolis fills almost all spaces in the hive less than 3/8 inches.

WAX

Honey bees build comb; bees' wax extrudes from a worker's wax glands. The bees build incredibly exact hexagonal cells to store honey, pollen, and to act as a nursery to their young. They festoon (join legs together making a living chain of bees) to building comb wherever they find more than a 3/8-inch space. Bee space focuses on order in the hive:

A) Less than 3/8 inches, bees propolize;

B) More than 3/8 inches, bees fill with comb.

Bees consider 3/8 of an inch just right for moving about the hive. The concept of bee space allows Langstroth (more in Chapter III) hives to prosper.

QUICK REVIEW – CHAPTER 1

Important Points

1. Apis mellifera is not native to North America
2. Apis mellifera is an important pollinator; honey bees pollinate a third of what we eat.
3. The size of the colony varies by season and colony health
4. Three casts of honey bees live in a colony – The Queen, the workers, the drones
5. Apis mellifera communicates through pheromones and body movements.

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CHAPTER II KEEPING HONEYBEES

HONEYBEE SPECIES

The honeybee is indigenous to Asia, Africa and Europe. The actual origin of the honeybee has puzzled beekeepers and scientists alike, that is, until recently. A group of researchers studying the Apis genome declared that the honeybee seems to have originated in Southeast Asia, countering a long-held belief that they originated in Africa.

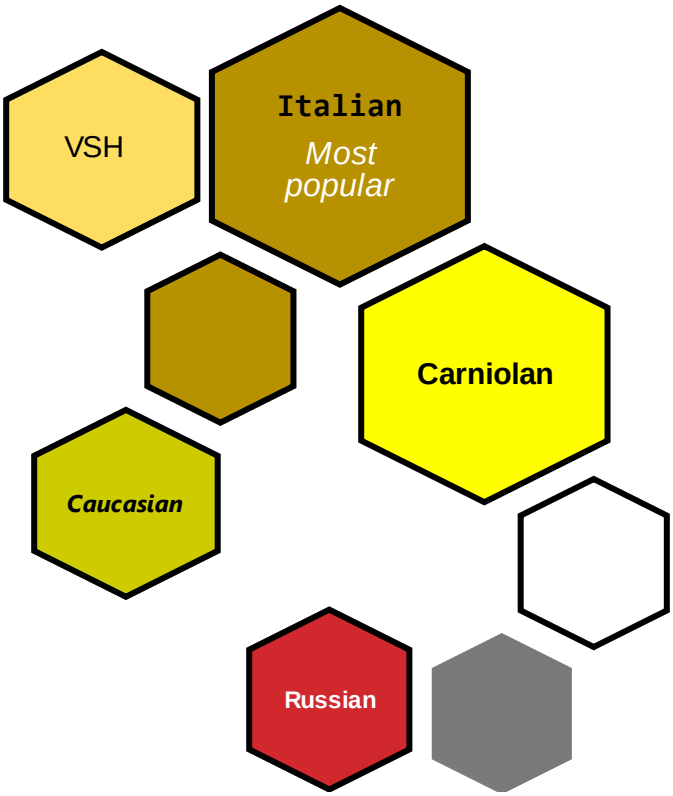

Figure 4 - Popular Honeybee Subspecies

Popular subspecies for beekeepers. The first honeybee the pilgrims brought to the Americas was the European German Black Bee (Apis mellifera mellifera). by default, as the only available bee, the Black Bee became the first favorite of colonial beekeepers. Eventually, other European and Near Eastern sub-species joined the Black Bee in the Americans including: Italians (*Apis mellifera ligustica*), Carniolan (*Apis mellifera carnica*), Caucasian (*Apis mellifera caucasca*). Along with hybrids including Primorsky Russians, and various Carniolan-Italian combinations. These honeybees became American's bees. The Italians being the most often chosen.

With the invasion of Varroa mites, beekeepers eagerly sought Varroa sensitive hygiene (VSH) hybrids (first breed by the ARS Lab, United States Department of Agriculture at Baton Rouge, 2000). Each sub-species, hybrid, or VSH hybrid embodies specific traits that the beekeeper considers when selecting for their apiary.

What influences a beekeeper's choice of bee?

A beekeeper's goal should be the driving factor in choice of bee. Other considerations include: cost, availability, temperament, and the beekeeper's climate. Beekeeping goals such as increased honey production, getting the colonies through a tough winter, increased pollination, queen breeding, or just for the pleasure of watching the bees work, help a beekeeper make their choice.

SUBSPECIES- MAKING YOUR SELECTION

Colony Personality. While each subspecies exhibits the 'personality' quirks or behaviors of their subspecies to some extent. Not all bees embody the behavior and not all to the same degree. The behavior or traits are more like tendencies or 'guidelines' not hard and fast rules. Moreover, beekeepers often claim that more variation may exists between two hives of Carniolans, than between a hive of Italians and Carniolans. Hive behaviors or 'personality' is genetic, but environment and the beekeeper contribute, as well.

For example, if hives have regular visits from skunks, they will be aggressive, no matter which book identify them as docile. As in everything else, *caveat emptor*, let the buyer beware.

AFRICANIZED HONEYBEES

A small bee imported from Africa to Brazil the 1950s, Apis mellifera scutellata, was going to 'toughen-up' the existing European honeybee stocks and increase honey production. Things did not go as planned. Since A.m. scutellata escaped, a hybrid of the sub-species has been making its way north, reaching the United States in the early 1990s.

Africanized bees, originating on the Africa savannah, evolved specialized, zealous, and successful defensive behaviors.

The bees bring their savannah developed aggressive defensive tactics to each new environment, including: an extensive perimeter around their nest/hives; hyper-vigilance, easily aroused by the slightest disturbance; and finally, keeping five times as many guard bees on alert, compared to their European cousins. When the alarm pheromone releases, up to half the hive scramble to defend the nest.

The sting of the A.m. scutellata is no more toxic than the European bees'. However, imagine half a hive of bees pursuing a victim, up to a mile; the number of stings may easily overwhelm a victim.

VSH

The Varroa mite (*Varroa destructor*) continues to wrack havoc on honeybees and beekeepers around the world.

Varroa destructor is native to the Asian honeybee (Apis cerana). The Asian honeybee and the mite have a mutual understanding. If the mite tries to get on a bee, the bees have developed a grooming behavior to get rid of it. Thereby giving mites less opportunities to enter the comb cells containing larva (mites enter just before capping takes place.)

Unfortunately, European honeybee have yet to evolve any grooming behavior since the Varroa was not originally a European pest. Now it is.

VSH is a honeybee behavioral trait. Researchers and queen breeders look for colonies that naturally have: 1) low mite counts; and 2) workers with the ability to detect and remove pupae with the mite parasite (see picture below).

Figure 5 Drone Pupae with Varroa mites

HONEYBEE SUB-SPECIES AND THEIR TRAITS				
Traits	*Italian*	*Carniolan*	*Caucasian*	*Russian*
Origin	Southern Italy	Southern Austrian Alps and Slovenia	Sub-Tropics to Cool Temperate	Primorsky Krai region of Russia (Far East)
Original Climate	Mediterranean	Temperate	High mountain Valleys	Siberia: Cold long winters
Coloring	*Light/Yellow*	*Black/Gray/Brown*	*Dark*	*Gray*
Gentleness	*Relatively gentle/calm*	*Exceptionally Gentle/Docile*	*1. Calm on the comb 2. Assertive if aroused*	*Very Assertive*
Honey Processing	*Very Good*	*Good*	*Low*	*OK*
Propolizing	*Little*	*Little*	*High*	*Moderate*
Excess Swarming	*Moderate*	*High*	*Low*	*OK*
Spring Buildup	*Good*	*Rapid*	*Slow*	*OK*
Overwintering	*1. Good in general 2. Poor with long/ cold winters*	*Very Good*	*Good*	*Very Good*
Other Traits	*1. Heavy Robbers 2. Tend to drift 3. Most popular Bee*	*1. Good Comb builders 2. Low Robbing 3. Hardiness*	*1. Tendency to drift 2. Tendency to rob 3. Heavy propolizers*	*1. Queen cells always present 2. Expensive*

OBTAINING BEES

Swarms *Swarming* is a colony's naturally method of reproduction. Colonies often swarm during spring build-up, May – June; but may throw swarms in spring, summer, or fall. On a spring afternoon (May – June)[1], usually between noon and four a colony's queen exits the hive taking between 40% - 60% of worker bees with her. (However, not before the workers have built a replacement queen for the colony.) Following their wild and awe-inspiring flight, the swarming bees settle, surrounding and protecting the queen, waiting for their scout bees to return with news of a new home.

Figure 7 - Honeybee swarm.

Honeybee colonies reproduce through swarming. Swarms also serve beekeepers by helping increase their number of hives (If they catch the swarm). While circumstances vary, there are three ways to obtain a swarm: 1) through luck or skill, find a swarm on your own; 2) intentionally, bait and capture a swarm; and 3) join a local swarm list.

If you are lucky and find a swarm, few guidelines exist governing swarm ownership[2]. However, if a swarm lands on private property, seek permission avoid trespassing. You might want to carry your bee suit and swarm capture gear in your car. Always be prepared in case you spot a swarm.

A second method, utilizes a bait box. A *'bait box'* is a deep, with or without queen pheromone added, baited with a few frames drawn wax and a frame a honey. Setting the bait box about 7ft high and facing southeast produces an irresistible invitation to swarming bees. NOTE: Do not use all 8 or 10 frames in your bait deep. Bees may find the offered living situation too crowded.

Finally, a third method, and maybe the easiest, involves joining your local bee club swarm list. The list, coordinated by a club member, consists of beekeepers willing to collect swarms. When someone calls in a 'swarm', the swarm list coordinator calls club members near the swarm.[3]

Figure 8 A nuc (Credit KU-W)

BUYING BEES In Washington, many beekeepers buy their bees from migratory beekeepers following the spring California almond pollination. After weeks in the California almond groves, pollinating colonies are bursting at the seams. Migratory beekeepers *'split'* or divide these heavy colonies, and then ship the packages or *"nucs"* nucleus up north. The bees' arrival date is uncertain. Delivery is highly dependent on California weather allowing new queens to mate. If it rains in California, we wait in Washington.

Nucs A nucleus hive or 'nuc' consists of, what appears, as a deep box cut in half. A nuc usually contains four or five frames with drawn comb covered in bees, brood, honey, pollen, and a queen. Nucs will cost more than a package of bees; nucs behave like an established hive. Nucs have a bottom board, body, and an outer cover. They are compact and easy to transport. The nuc entrance must have a secure entrance closure when transporting bees. While majorities of the bees enter the new hive, a few reluctant or stray bees remain with the nuc. Placing the nuc directly in front of the hive entrance allows strays to make their way to the entrance of their new home

.

PACKAGES Packages of honeybees usually contain 3 or 4 pounds of bees, however, 3 is the most common. The bees come from a variety of hives that are "shook" through a funnel into the package This method provides a wide crossection of bees from a particular apiary all in one new colony. The bees are loose inside the package and may cluster during transport. A three pound package of bees includes workers, a queen in a queen cage and a sugar syrup feeder can. Packages of bees tend to behave like a swarm.

Figures 9 shows a package on top of a single deep hive. Figure 10 demonstrates the behavior of older bees on the landing platform standing backward, with butts in the air spreading the Nasanov so all the bees can scent their way home.

Figure 9 Package before installation (Credit KU-W)

QUEENS

Queens can be ordered from spring into fall and from local beekeepers or as far away as Hawaii. . Beekeepers usually have a choice of local breeders who know and respect through their beekeeping clubs. Giving them a firm idea regarding the breeder's reputation for delivering healthy, viable queens. The alternative is to order from a larger regional or national breeder. If a beekeeper orders outside their area, it is helpful to talk with others who may have ordered from that breeder. Alternatively, check chat sites, on-line to gauge the experience of others.

Figure 10 Package after installation (Credit KU-W)

Queens ship in special cages, design to facilitate introducing the queen to a new colonel. The queen may travel unescorted, or if over a greater distance, she is accompanied by her attendants (worker bees who clean and feed her). While acquiring a queen locally is exciting, there is a lasting and certain charm in watching a nervous mail delivery person carry a package marked "live queen" to your door.

QUICK REVIEW CHAPTER 2

KEY POINTS

1. Bee subspecies may differ in their behaviors
2. Italians are the most common subspecies selected by beekeepers
3. Subspecies will produce different amounts of propolis
4. Bees may be purchased or obtained by catching a swarm
5. Africanized honeybees are extremely defensive

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Beginning beekeeping starts with making countless choices. Usually, with never handling bees, you chose where and how your bees will live; selecting how large and what type of hive, comparing the merits of different foundations, finding a tool which suits your style, and buying the all-important bee suit. In the beginning a bee equipment catalogue may seem overwhelming. You ask questions You keep repeating the phrase, “The bee packages arrive in 6 weeks!”

HIVES, IN GENERAL

Wooden Ware

Bee colonies in the wild or in your backyard, all need the same qualities in their dwellings: a defensible entrance, room to expand, 3/8th inch ‘bee space’ protection from wind and cold, and protection from moisture. The design of a modern beehive may say they attempt to mimic the qualities of wild or feral bee dwellings, but in reality modern hive design is a convenience for beekeepers, attending to their beekeeping.

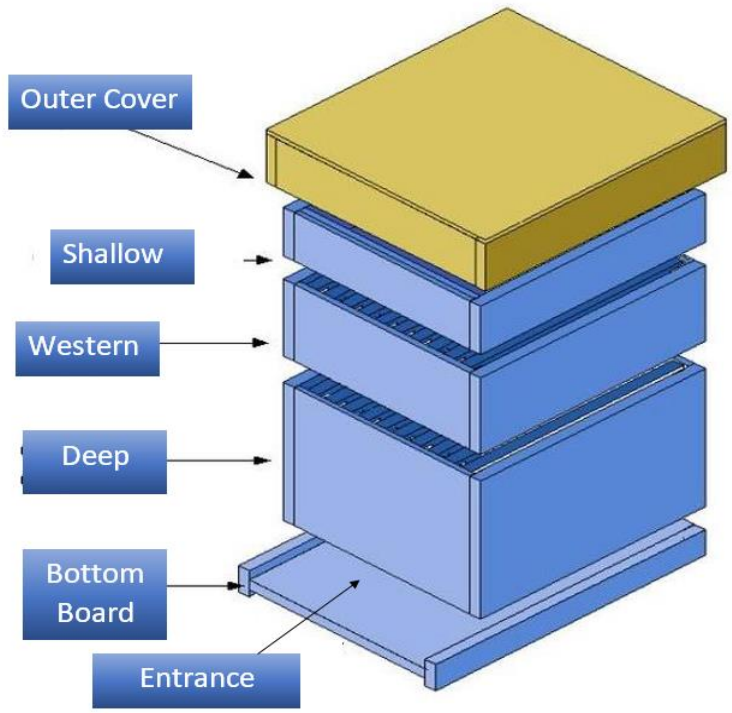


Figure 11 - Hive parts

Almost any typical modern hive includes the following parts in (some form).

- **Outer Cover**- Keeps the hive dry and protects from wind. Types of covers include, telescoping, migratory, and cottage

- **Inner Cover** - Under the outer cover. Can help control moisture depending on its construction material. Inner covers are sometimes removed in summer to increase ventilation. In addition, screened inner covers exist to increase ventilation as well.

- **Boxes –** Container for frames there are several sizes to be aware of.
    i. *Shallow*: 19-13/16" x 16-¼" x 5-3/4 (on average) Used to collect excess honey for the bees or for extraction.
    ii. *Western*: 19-13/16" x16-¼" x 6-5/8 (on average). Westerns or mediums used as both brood chambers and for honey collection. Easier to shift than deeps.
    iii. *Deep*: 19-13/16" x16- ¼" x 9-9/16 (on average) Most often used as brood chambers. Heaviest
- **Frames and foundation**- Langstroth hive frames hold foundation. Frames are specific to fit woodenware shallows, westerns, or deeps. Langstroth boxes use 8 or 10 frames. The frame and plastic or wax foundation provide a 'base" for the bees to build their comb. Foundation may be either pressed bees wax or plastic rectangles that support comb built by bees. Artificial foundation helps stabilize the foundations during honey extraction. Warre and top bar hives do not use any artificial foundation.

- **Bottom Board** The hive body is placed on a bottom board for support and protection. Bottom boards may be solid or screened. Screened bottom boards aid ventilation and is a part of Integrated Pest Management (IPM). The space between the bottom board and first brood box becomes the entrance.

- **Hive Stand**- May be wood, metal, or block. Raises hives off the ground to protect the bees from moisture and from predators.

- **Landing Board**- Provides a handy place for bees to land during honey flow, when the front entrance is congested.

Protecting the outside of the wooden hive components helps give the hives a longer useful life span. You might want to paint or treat the OUTSIDE of the hive (never the inside). Normal outdoor paints work well with a base coat and two or three coats of paint. Visit your local hardware store to find marked down paint, or "oops paint". Another common method is to "dip" the lid, bottom board, and hive bodies in boiled linseed oil mixed with 5 – 10% bees wax or paraffin oil.

Figure 12 Queen Excluder (KU-W)

MORE EQUIPMENT

Some of the other equipment you may find is as follows:

- **Entrance Reducer -** Usually wood. Used to change the diameter of the hives entrance based on season and need.

- **Slatted Box** A place for foragers to rest during the night. The slatted rack is positioned on top of the bottom board and under the first brood box providing an efficient platform for rest (otherwise the foragers must climb to the top of the hive to rest). Its use may help alleviate perceived overcrowding by the bees. In winter, it lifts the hive further off the ground allowing the winter cluster to begin lower in the brood box. If a slatted box is not available use a super with frames and foundation with UNDRAWN comb)

- **Queen Excluder** - Used during a honey flow to keep the queen from expanding her laying into the super, which you want filled with honey. Come in both metal and plastic versions.

- **Winter/Mouse** Guard Usually metal. Keeps Mice out of the cozy winter hive.

- **Robbing Screen** - Robbing screens protect the colonies hoard of honey during times of dearth when other bee may feel the need to “rob” their hives. They can also effectively stave off wasps in late summer.

Langstroth, Topbar, and Warre Hives

The following tables provide a comparison between Langstroth, Top-bar, and Warre hives. While these are not the only hives in use in the United States, they are the most frequently used.

Langstroth	
History	Moveable frames perfected by Rev. L. L. Langstroth in 1852. First to incorporate critical "bee Space" 3/8 inches for the bees
Usage Notes	Moderately heavy. Heavy to moderate boxes – only one box at a time need be lifted. Individual movable frames for inspection. To lessen weight may switch to all westerns or convert or start with 8 frame boxes instead of 10.
Time Investment	Every 14 days to check on the queen; Spring - more often for feeding Fall - more often for feeding; must be prepared for flows (boxes ready);
Locating Equipment	In an emergency, swarm, etc. can interchange easily with fellow beekeepers (beware of getting diseased or other undesirable equipment)
Mentoring	Easy to find a mentor through most beekeeping clubs. Lots of chatter on blog sites.
Harvest	Extractor

Figure 13 - Langstroth Hives

Figure 14 - Top Bar Hive

Top Bar	
History	Long history of "Top-Bar" type hives (log hives). Evolution of hive development in Canada and Tanzania. Top-Bar we know today developed in the 1960s. Takes bee space into consideration
Usage Notes	Lightest No boxes to lift, individual frame manipulation
Time Investment	Twice weekly inspections; high maintenance with switching top-bars and lots of inspections for keeping straight comb.
Locating Equipment	Build. No standard top-bar sizes of configuration. Difficult to borrow equipment from other top-bar beekeepers.
Mentoring	Moderately easy to find other Top-Bar keepers. Sites dedicated to Top-Bar hives. Lots of books and information
Harvest	Crush and strain.

Warre	
History	Developed by a French monk Emile Warre. He believed that everyone could keep bees if he developed the correct hive. Warre hive also known as the Ruche Populaire (People's hive)
Usage Notes	Heaviest Full box manipulation. Naidering (or adding boxes) requires lifting the entire colony. Frame inspections are impractical.
Time Investment	No inspections except to determine if adding boxes is required. NOTE: May be illegal in some states that have apiary inspection Programs
Locating Equipment	Build.
Mentoring	Warre beekeepers are few and far between. Difficult to find mentoring.
Harvest	Crush and strain.

Figure 15 - Warre Hive

TOOLS OF THE TRADE

Smoker – Is a tool, not a weapon, From the time humans started raiding beehives they have used smoke. Whether it calms or confuses; it works. Honeybees rely heavily on scent; the smoke covers any alarm pheromone the bees may send. A belief that smoke singles forest fire to the bees persists; that the bees, preparing to flee, gorge themselves with honey, thus becoming more docile.

Figure 16 The smoker is a tool, not a weapon (By Stubbeguy, Own work)

Cool smoke is critical; as is keeping your smoker lite. Individuals all seem to have their own preference for fuel: burlap, pine needles, newspaper, pellets, or cotton, etc. For cool smoke, green grass or leaves can be added to the smoker. Foremost, a smoker is a tool, just like your hive tool. It is not a weapon to wield about; one or two puffs go a long way. Practice keep your smoker lite.

Figure 17 SMOKER By Taken byfir0002

Hive tool Hive tools are specialized metal implements that can pry and lift hives apart. Hive tools become very personal tools to a beekeeper. Most often they adopt the tool that was used to teach them. Key points regarding hive tools. Always buy two; in the beginning, you will inevitably lose one. Paint the end of the tool with florescent paint; helps you find it when you drop it or put it down. Finally, don't put your hive tool down it should always be in your hand.

Figure 18 HIVE TOOL CC BY-SA

Brush A soft brush is useful to gently brush bees aside. Especially useful during honey harvest to help get the bees off the frames. Some beekeepers use feathers. Check feather to make sure they are free of pests.

Small spray A spray bottle with sugar water and/or your own honey: Some beekeepers keep a small spray bottle handy; filled with sugar syrup. Gently spraying the bees when you first open the hive provides them with feed. The bees become busy cleaning each other and are easier to work. Other beekeepers always set aside honey from the previous year's harvest. When they open the hive, they lay a bead of honey down one or two frames. The bees, again, become preoccupied with the honey and almost ignore the bee keeper. Remember not to use they honey during a time of robbing.

Figure 20 BEE BRUSH

Figure 19 WHAT TO WEAR

What to Wear

To Glove or not to Glove: the great debate Gloves or no gloves for beekeeping. Wearing or not wearing gloves is a personal choice. If you are more comfortable wearing gloves, then do so. You are most likely to keep beekeeping if you are comfortable around the bees.

If, on the other hand, you chose to not wear gloves, do not berate or belittle those who do. It's a personal choice.

Face protection: Veil A veil, attached to a suit or attached to a hat is, I believe, vital. While beekeepers debate the merits of gloves, most will wear a veil to protect delicate tissues around the eyes, ears, nose and mouth.

Body protection A bee suite is the ultimate, yet not foolproof, protection to wear against bee stings. You may choose a jacket or a full suit that covers you from ankles to the top of your head. Always make sure you zip everything and close all Velcro. If you do not have a suit, wear heavy denim pants and a heavier long sleeve shirt. Duct tape the ankles and wrists.

QUICK REVIEW CHAPTER 3

KEY POINTS –

1. Hive selection is tied to your overall goals in beekeeping
2. Using syrup in a spray bottle or honey (your own) during a hive inspection may help calm or distract the bees
3. The Langstroth hive is the most commonly used hive configuration in North America
4. To wear or not wear gloves is a favorite beekeeper's debate
5. A smoker is a tool, not a weapon to use on the bees.

CHECK OUT

Backyard Beekeeper - Revised and Updated, 3rd Edition: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden - by Kim Flottum (Author)

Pictures: KU-W, USDA, and WikiCommons Open Source

Slovenian "Bee House"

CHAPTER IV THE APIARY

You have your hives, suit, and gloves. You bought a dome smoker and you practiced keeping it lite with pine needles, newspaper and burlap. You bought 2 eight-frame Langstroth hives (unassembled); now built and painted. The bees come in 2 weeks.

Someone at beekeeping class asks the innocent question:

"So, where are you going to put your hives?"

You quickly answer,

"Putting them in the front yard, facing the street so everyone can enjoy their activity."

"Nope, can't do that; it's illegal in Tacoma."

You freeze, and think, "Now what?"

No need to panic. Just follow some simple rules of thumb that apply to beekeepers and to bees

FIRST YEAR BEEKEEPERS:

Remember to register your new hives

EXPERIENCED BEEKEEPERS:

Remember to register your hives

BEEKEEPER NEEDS

ORDINANCE First and foremost, new and old beekeepers must know, understand, and follow the beekeeping statutes and regulation governing your area. No use in having the 'perfect" site for your bees if it's illegal.

JURISDICTION City, county, unincorporated county, or rural areas may vary regarding their enforcements of regulations. Your apiary may be under the jurisdiction of the city or county government, or be under the auspices of the county department of health. Check it out early in your beekeeping journey. No surprises is best.

Figure 21 Example of an Urban Ordinance

Chapter 5.24
APIARIES

Sections:

5.24.010 Beekeeping – Maintenance of colonies – Nuisances designated.
5.24.020 Enforcement and entry – Right of entry for inspection.
5.24.030 Violation – Penalty.

5.24.010 Beekeeping – Maintenance of colonies – Nuisances designated.

A. It shall be the duty of any person having honey bees, Apis Mellifera, on his or her property to maintain each colony so as not to create a public nuisance.

B. Honey bee colonies shall, in addition, be maintained in the following condition:

1. All honey bee hives shall be registered with the Washington State Department of Agriculture as required by RCW 15.60.030.

2. Colonies shall be maintained in movable-frame hives.

3. Adequate techniques, such as requeening, in handling bees, and adequate space in the hive shall be maintained to prevent unprovoked stinging 75 feet or more from the hive.

4. Lots having less than 10,000 square feet shall not have more than four hives.

5. Hives shall not be located within 75 feet of any property line, public street, sidewalk, or alley except when situated behind a solid fence or hedge six feet in height parallel to any property line within 25 feet of the hive and extending at least 20 feet beyond the hive in both directions, or if such fence completely encloses the hives.

C. All other nests (colonies) of stinging insects, such as yellow jackets, hornets, and wasps, including Vespidae, in trees, buildings, underground, or in any other space, and diseased colonies of honey bees, constitute public nuisances.

(Ord. 22662 § 1; passed Apr. 6, 1982)

5.24.020 Enforcement and entry – Right of entry for inspection.

A. The Tacoma-Pierce County Health Department and the Police Department shall enforce this chapter.

B. Proper officers of the Tacoma-Pierce County Health Department and any Tacoma Police Officers are authorized and empowered, during reasonable business hours, to enter premises to inspect hives or colonies for the purpose of ascertaining the variety of insects occupying the hives, conditions of health, and management of crowding. Entry may be pursuant to warrant or pursuant to the consent of the owner or occupier of the premises, or without consent or warrant if there is probable cause to believe that a violation of this chapter is occurring on the premises and evidence thereof will be lost or destroyed before a warrant can be issued.

(Ord. 22662 § 1; passed Apr. 6, 1982)

5.24.030 Violation – Penalty.

Any person, firm, corporation, or other legal entity found to have violated any provision of this chapter shall be guilty of a misdemeanor and shall be punished by a fine not exceeding $1,000.00 or by imprisonment not exceeding 90 days, or by both such fine and imprisonment. Upon a first conviction, there shall be imposed a fine of not less than $100.00 and, upon a second conviction, there shall be imposed a fine of not less than $500.00 and, upon a third or subsequent conviction, there shall be imposed a fine of not less than $1,000.00 or imprisonment for not more than 90 days, or by both such fine and imprisonment. Upon a conviction, and pursuant to a prosecution motion, the court shall also order immediate action by the person, firm, corporation, or other legal entity to correct the condition constituting the violation and to maintain the corrected condition in compliance with this chapter. The mandated minimum fines shall include statutory costs and assessments.

(Ord. 25557 § 2; passed Aug. 23, 1994)

Beekeeping statutes may regulate: Number of hives, number of hives per plot size, setbacks, perimeter restriction, and apiary barriers (fences). Some jurisdictions enforce laws through inspections, while others may follow 'nuisance ordinances". Nuisance ordinances are only enforced if a complaint is made by someone who feels that they are adversely effected by your apiary.

NEIGHBORS Obviously, if you live on acreage you have few neighbors in contrast to beekeeping close urban or suburban setting. No matter where you live, it's a good idea to start neighbor bee education as early as possible. You want to dispel any misconceptions or fears neighbors may have about bees; answer question; show them your progress with your hives; let them help you paint your hives; etc. Discuss your neighbor's ponds or fountains and even hummingbird feeders that could potentially become honeybee hotspots. Warn them all about cleansing flights.

Promise your neighbors honey (at least in the second year); they will reward you. My neighbors keep an eye out for swarms, even protecting them from passers-by. Ask them to suit up and helped with the bees. When your neighbors become concerned about your bee and about honey bee survival in general, we all win. They become new ambassadors for honeybees.

PERMISSION If the sight you seek is not your own yard or pasture, ensure that you have permission, better written permission to place the hives on the property.

HIVE MARKINGS While legally required if you place your hives on other than your own property, marking your hives with your name and contact information has become necessary for many smaller beekeepers due to theft. You might also want to place your state registration number on your hives.

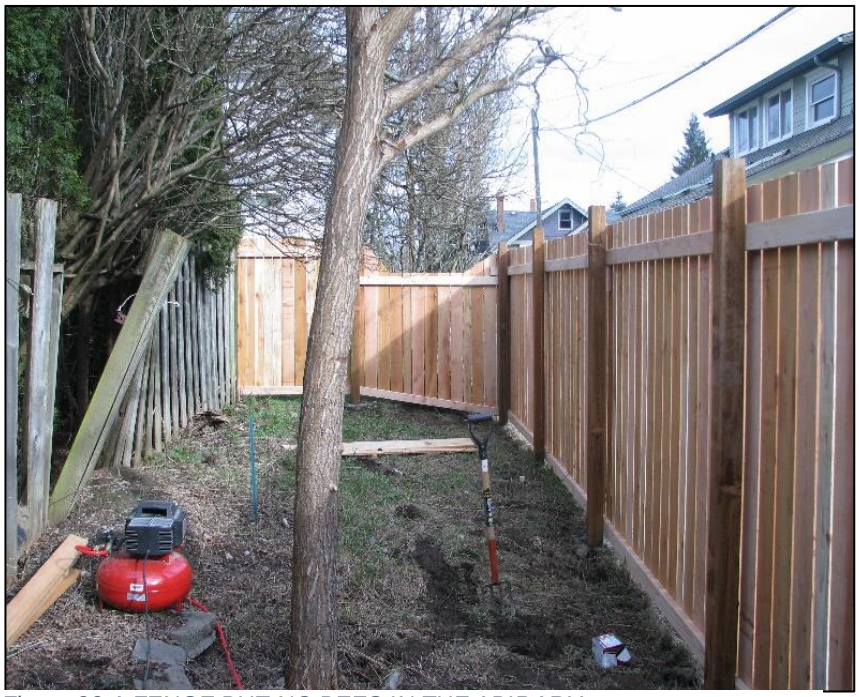


Figure 22 A FENCE BUT NO BEES IN THE APIRARY

SITE ACCESSIBILITY The greatest deterrent to beekeeping is having an apiary or some hives located in an inaccessible area. All factors being equal, if you cannot get you and your tools to a site easily and in turn, easily move harvested frames, you will be less inclined, motivated, etc. to visit and inspect your hives as often as needed. Your hives will fail to thrive (most likely), you will feel unsuccessful, and maybe even give up on beekeeping.

Beekeeping, especially in the first year, requires a great deal of dedication. Make yourself successful by making it fun and easy. If your hives are on acreage, ensure that a road leads to the hives. Make sure that you are neither having to carry your gear up a steep hill, or down a steep slope (more on this subject, under What Do Bees Need?).

PROTECTION Hives need protections from 2-, 4-, 6- and 8 legged predators. Skunks, bears, wasps, hornets, and people are all actual or potential predators of the hives dependent on where you live. In an urban or suburban environment, the best protection from 2-legged predators is fencing. You never want your apiary labeled an “attractive nuisance” which tempts people to encounter your hives. While your neighbors are aware, few others are “in-the-know.”

Both urban and rural settings may deal with skunks (raise the hives), less so bears (electric fencing). However, wasps and hornets are, importunely, too pervasive and deadly for a weak colony. Begin you hunt for wasps and hornets early- In many areas as early as February and March. Place your traps laden with wasp/hornet pheromones in the Spring months, catch a queen and destroy potentially, thousands of hive marauders. Share wasp and hornet traps with your neighbors, a win-win situation for you and your bar-b-queuing neighbors.

HONEYBEE NEEDS

As with any other question of real estate, the answer is, "Location, location, location." The listed factors help make and keep your bees healthier, and thus, hopefully, more productive pollinators and honey masters.

SUNSHINE Sun shine equates to warmth. The earlier the hive warms, i.e. the colony warms, the earlier the bees will get to work. Optimum placement of hive entrances is to the South or Southeast.

SHADE IN HOT CLIMATES

Heat is critical to getting bees motivated and moving in the morning. Too much heat, however, in the afternoon can prove detrimental. Especially true in the eastern part of Washington, where Summer temperatures soar in the triple digest.

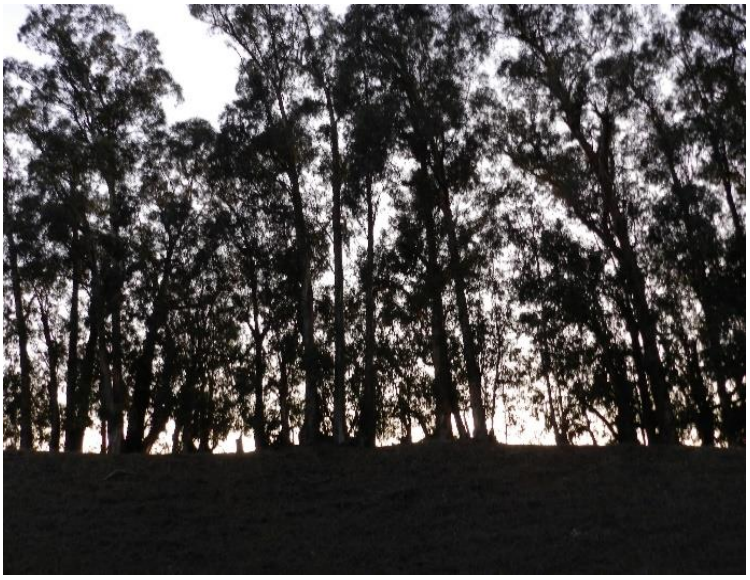


Figure 23 Eucalyptus: shade and windbreak

Beware that the fine shade trees that rescue your hives from the Summer sun, may become deadly water drippers helping keep moisture in the hive in Autumn and Winter.

WATER Water is essential to all living things. Providing a nearby water source for your bees will help keep them in your yard or at least in the vicinity (and out of your neighbor's yard). You may have noticed that, given a choice, bees will most often head for what we consider "dirty" water. Dirty water which is actually full of minerals and salts that the bees prefer. When you place your water source, remember the minerals and salts: place a couple of rusty nails and copper into your water source and perhaps add a handfuls of salt. Bees do not mind moving water, such as in a fountain, if they have pebbles or rocks to land on and drink form.

Often, no matter what you do, the bees prefer to visit the neighbor's hot tub (it's the chemical salts) or neglected metal birdbath (minerals leeching from the birdbath). If this happens, use lemongrass oil on the fountain for a couple of days, the bees will find it and use it. Lemongrass oil mimics the scent of a queen.

Once your bees consistently visit your source, remember to keep the water flowing. Bees will just as easily abandon a depleted source as adopt a rich one.

Additional water sources may be a Boardman feeder placed at the front entrance of hives (beware the water does heat up) or even a chicken feeder with pebbles.

Figure 24 FIRST YEAR APIARY

PROTECTION FROM PREVAILING WEATHER Know which direction the prevailing winds hit your potential site. Provide a windbreak for frosty winter winds and guard against Autumn and Winter rains blowing directly into the hive. While you may not need to insulate your hives for winter, you will need to ensure that they stay as dry and warm as possible. Place your hives to take advantage of natural terrain and trees.

PROTECTION FROM DAMP and COLD-AIR SINKS As a camper, you know not to place your tent at the bottom of a hillside. Water drains downhill; therefore, the bottom side of a hill hosts more wet and damp than the top of hill. Similarly, you should not place your hives at the bottom of a hillside.

Avoid wild areas with many birch trees. These trees and other similar trees love to have their roots wet, they thrive in the damp. Your bees will not thrive in the damp.

DAMPNESS IS THE NUMBER ONE ENEMY OF BEES. DAMP LEADS TO DISEASE; DISEASE LEADS TO WEAKENED HIVES.

Avoid cold-air sinks. Cold-air sinks occur cold-air crossed an obstacle, like a hill. The warm air keeps moving, but the cold air sinks to any low spot. The same effect occurs if you have a fence without openings; the air passes over the fence and the cold-air is deposited on the other side. A fence

with opening allows all the air to pass by without creating a cold-air sink. Avoid placing hives in low areas in your selected environment.

Figure 25 Borage, a bee favorite Credit KU-W

FORAGE Planting you yard with favorite bee forage is wonderful. Note, that it may be more important to understand the forage that surrounds your apiary for a mile or two. Is there forage to support all the bees in an area? Is there a variety of forage that is plentiful at least three seasons of the year? Promote and support your neighbors, city or county planting forage for bees (and other pollinators).

HIVE ARRANGEMENT

In addition to finding the perfect site, with all the listed critical factors, all your work could go to waste if you do not pay attention to how you arrange your hives on your painfully, well-prepared apiary site.

Do not place hives too close together. Placing hives too close cuts into efficient management. Nothing worse than bending over and knocking down the next hive over.

Figure 26 Bees on SEDUM Credit Ku-W

Do not place your hives in a straight-line unless you are conducting experiments on bee “drift”. Bees tend to drift to the right; after a time, you will notice that your far-right hive are amazing full and strong, while your far-left hive, inexplicably, dwindle. (If this happens exchange the far-right hive with the far left until you regain a balance.)

Figure 27 HIVES ALL IN A ROW

Paint your hives distinct colors. Pay special attention to the hive entrance or landing boards which do not change position when you rotate your brood boxes. Bees come to depend on such marks. Do be creative and have fun with your painting, make the hives your own.

Inevitably, the time arrives and you realize that you need to move a hive. You want to move then with the least amount of stress to the bees or to the beekeeper. The standard rule calls for either a 3-foot move or a 3-mile move. Some beekeepers think the rule is more superstition than reality. But if it is your hive to move, you make the choice.

Move to a new location or to a new site in your

apiary more than 3 feet away

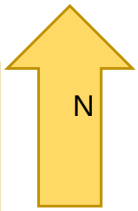
- Night move- bees are calmer and all the foragers are home
- Close all openings; secure the boxes; ensure some ventilation
- Transport at least 3 miles from the original site - stop here if this site will be their new home.
- Wait 4 - 6 weeks
- Close all openings – secure the boxes; ensure some ventilation
- Night move to the new spot you chose in your apiary

Move the bees less than

three feet in your apiary

- At night, slowly move the hive a couple of inches in the direction you want to place it.
- Some advocate moving the hive as much as 3 feet in a single day.
- Bees might be a bit confused but with incremental moves you should be able to bring the bees along to the new site.

Sketch your own apiary design. Remember all the beekeeper's and bee's needs.



QUICK REVIEW CHAPTER 4

KEY POINTS.

1. Where you keep your bee will determine their health and their productivity
2. If your apiary is not easily accessible – you will visit less
3. Water is a major need for bees
4. It is important to know the beekeeping ordinances for your area
5. Understand the importance of when and how to move hives.

CHECK OUT

Langstroth on the Hive and the Honey-Bee: A Bee Keeper's Manual by Rev. L. L. Langstroth

Photo Credits: KU-W, unless otherwise noted. Additional photo credits from open source WikiCommons, Author credited.

CHAPTER V BEE DISEASE

HOW TO IDENTIFY A SICK COLONY

Figure 28 DWD

Brood Struggling and dying brood may be the strongest indicator of overall colony health.

Behavior Honeybee behavior is also a strong indicator of colony and honeybee health. Bees are at their best when they: are foraging for nectar and bringing in pollen; when they consistently and thoroughly clean comb cells and hive; when the queen's laying pattern is strong; when, obviously, no dead bees litter the front of the hive; when no bees wander aimlessly round the ground in front of the hive; and when the bees are formed intact, e.g. no missing limbs, fully formed wings, etc.

Population shift When colony strength suddenly dwindles and you cannot blame a swarm, it is time to make a thorough inspection of the hive. (But never in winter or when the temperatures are consistently below 50°F.)

Figure 29 Deformed Wing Disease (DWD)

In many cases when a colony population suddenly dwindles, it is too late to effectively intervene. Careful inspection of the brood and regular mite monitoring can help prevent the sudden

Today's natural, political, geographical, and agricultural environment proves a bee-health challenge for even the most experienced beekeeper, let alone the new

dwindling of populations. Don't manage your colony in denial, take action sooner, rather than later.

Visible signs Other visible signs of sick or diseased bees include: dysentery, signs of bee cleansing (bee poop), Not the expected signs of winter cleansing flights from bees kept too long in their hives, rather heavy and thick streaks across the hive.
Smell The warm honey-smell of a Summer apiary is not easily forgotten. Unfortunately, neither is the sour, rotten, musty smell of an infected hive. Most dreaded is the sour smell associated with American Foul Brood (AFB). If you diligently visit your hives, any foreign smell is worth investigating.
Bee Labs *What* if you're not sure your bees are sick? What if treatment depends on a correct diagnosis?
Sending samples of bees (in alcohol) to a bee lab (WSU Bee Lab http://entomology.wsu.edu/apis/diagnostic-lab/) will provide a correct diagnosis. However, you may need information faster to enable treatment.

Ask Questions, Research, and Field tests
Washington state does not employee a state bee inspector. States that do, have an individual who provides a resource for beekeepers and who can identify a disease outbreak quickly due to their unique perspective. Washington lacking a bee inspector and you needing information fast, what are your options?

Figure 30 HEALTHY BEE BROOD By

1. Ask a more experienced beekeeper to inspect you your hives. Maybe ask two more experienced beekeepers to "look".
2. Research on-line, compare pictures and descriptions
3. Field test: Commercially available – single-use test for AFB and EFB.
4. For serious matters, contact the WSU Bee Program 509-335-5422
5. Research on-line, compare pictures and descriptions

Washington State University Honey Bee Diagnostic Lab

Colony Health Data Form- This Form must accompany sample(s)

Beekeeper Contact Information

Name:

Address:

Phone:

Email:

Beekeeping Association:

Background Information on Beekeeping Operation

Number of colonies overwintered last year:
Estimated colony losses in last 12 months:
Were these replaced or rebuilt?
Strain of bees:
Origin of stock/queen producer:
Chemicals/treatments used in past 12 months and frequency:

Field ID of Varroa mite?
Tracheal mite?
Nosema?
Have you seen symptoms that appear to be CCD?

Sample Information

Date samples were taken:

Number of samples submitted for analysis:

Location samples were taken: (town/state/county)

Reason for sampling: (routine? problem?)

Sample ID#:(same as in sample cup):

Recommended Number of samples to be submitted:
1-10 colonies: 1 sample
11-25 colonies: 2 samples
26-50 colonies: 3 samples
More than 50 colonies: contact the Lab
Beediagnosis.fd@wsu.edu entomology@wsu.edu/apis/diagnostic-lab (forms/instructions)

Figure 31 WSU Bee Lab submittal form

Colony Collapse Disorder – A Cluster of Symptoms

The Perfect Storm

Colony Collapse Disorder (CCD) is not a specific disease, pest, or environmental factor. Rather it is a cluster of symptoms coinciding, unfortunately, to bring about the loss of millions of bees and millions of dollars. The excerpt below is from the USDA Agricultural Research Service.

"One problem plaguing honey bees since 2006 has been Colony Collapse Disorder (CCD), which is a syndrome specifically defined as a dead colony with no adult bees and with no dead bee bodies but with a live queen, and usually honey and immature bees, still present. CCD is not a general term that covers all managed honey bee colonies that are lost due to any reason. No scientific cause for CCD has been proven. Most research has pointed to a complex of factors being involved in the cause of CCD, and possibly not all of the same factors or the same factors in the same order are involved in all CCD incidents.

But CCD is far from the only major threat to the health of honey bees and the economic stability of commercial beekeeping in the United States. In fact, the number of managed colonies that beekeepers have reported losing specifically from CCD has been waning since 2010. But the beekeeping industry continues to report losing a high percentage of their colonies each year to other causes.

Major factors threatening honey bee health can be divided into four general areas: parasites and pests, pathogens, poor nutrition, and sublethal exposure to pesticides. In reality though, these factors tend to overlap and interact with one another, which complicates issues. In addition, there are other issues that have impacts on honey bee health such as the narrow genetic base of honey bees in the United States.

The Agricultural Research Service (ARS), USDA's in-house scientific research agency, is striving to enhance overall honey bee health and improve bee management practices by studying honey bee diseases and parasites and how best to control them, as well as basic honey bee biology and genetics. ARS scientists also are working on projects as diverse as studying the biological interaction of simultaneous exposure to sublethal amounts of pesticides and infection by Nosema fungi to long-term storage of honey bee semen to preserve genetic resources. In addition, ARS researchers are cooperating with other Federal agencies and State departments of agriculture, universities, and private companies in a variety of projects to improve honey bee health."

https://www.ars.usda.gov/oc/br/ccd/index/

United States Dept. of Agriculture (USDA) Bulletin 690

Table 1. Comparative symptoms of various brood diseases of honey bees

Symptom	American foulbrood	European foulbrood	Sacbrood	Chalkbrood
Appearance of brood comb	Sealed brood. Discolored, sunken, or punctured cappings.	Unsealed brood. Some sealed brood in advanced cases with discolored, sunken, or punctured cappings.	Sealed brood. Scattered cells with punctured cappings.	Sealed and unsealed brood.
Age of dead brood	***Usually older sealed larvae or young pupae.****	***Usually young unsealed larvae***; occasionally older sealed larvae. Typically in coiled stage.	Usually older sealed larvae; occasionally young unsealed larvae. Upright in cells.	Usually older larvae. Upright in cells.
Color of dead brood	Dull white, becoming light brown, coffee brown to dark brown, or almost black.	Dull white, becoming yellowish white to brown, dark brown, or almost black.	Grayish or straw-colored, becoming brown, grayish black, or black. Head end darker.	***Chalk white.*** Sometimes mottledwith black spots.
Consistency of dead brood	***Soft, becoming sticky to ropy.***	Watery; rarely sticky or ropy. ***Granular.***	***Watery and granular; tough skin forms a sac.***	Watery to pastelike.
Odor of dead brood	Slight to pronounced odor.	Slightly sour to penetratingly sour.	None to slightly sour.	Slight, non-objectionable.
Scale characteristics	Uniformly lies flat on lower side of cell. Adheres tightly to cell wall. ***Fine, threadlike tongue of dead pupae maybe present.*** Head lies flat. Brittle. Black.	Usually twisted in cell. Does not adhere tightly to cell wall. Rubbery. Black.	Head prominently curled toward center of cell. Does not adhere tightly to cell wall. Rough texture. Brittle. Black.	***Does not adhere to cell wall.*** Brittle. Chalky white, mottled, or even black.

* Bold italics indicate the most useful field characteristics.

THE GREAT CONTROVERSY

The time for eloquently and profoundly debating the pros and cons of varroa Treat vs. Non-treatment has swept past us. Beekeepers are backed into a corner and the only viable debate left is Chemical treatment vs. Non-chemical treatment for the control of varroa.

In truth, few if any beekeepers, want to watch their colonies dwindle, and die a prolonged and miserable death. Still, some beekeepers begrudge any treatment citing "survival of the fittest" in the hope of developing more robust bee stock. If you chose not to treat (chemical or chemical-free), you put all hives within a 1- to 3-mile radius at risk.

PLEASE DO NOT PUT MY BEES AT RISK.

Survivor Stock. The idea of breeding for "survivor stock" or more specifically, not treating, in the belief that a lack of treatment will lead to varroa resistance, has long been an uncomfortable and agonizing topic in the beekeeping community. Many friendships have suffered.

No Treatment. If you belong to the small cohort of beekeepers who are also bee breeders, you find yourself in a field of people who have been pursuing the "survivor stock" goal since the arrival of varroa mites. If, in turn, you are not a bee breeder, and you chose no treatment, you are simply letting the animals in your care suffer and die a slow death while spreading mites and applying unnecessary disease and pest pressure on your neighbors' hives. The statement may seem harsh, but so is the varroa mite war we are waging.

Assuming you are a dedicated bee breeder be mindful about where the idea that it is possible to breed/select for bees that can tolerate surviving with varroa mites.

> For example, perhaps hearing about isolated population of bees in the Arnott forest. If so, keep in mind that these forest populations survive under very different circumstances than your bees [4]. The size of such a colony is smaller, they swarm ore often, moreover, the density of colonies in the landscape is much lower. In such an environment, there is as much pressure on the adaptation of the mites to be less virulent (too quickly killing their hosts) as there is pressure for the bee to be more resistant.

A beekeeper who over the years is:

1) extremely isolated with acreage to spread hives out miles apart;
2) keeps their colonies small;
3) allows them to swarm at-will; and
4) while producing little to no excess honey, might be able to select for "survivor stock".

However, even with modern tools to track heritability of resistance, such methods require thousands of individuals or in our case thousands of colonies. Without modern genetic selection tools, we are relying on "observational field data" which is inherently filled with bias, and less than robust interpretation, or 'noisy'. Now add to the suboptimal field observations, existing environmental 'noise' such as drought, excessive rain, cloud cover, climate change, so that even a trained epidemiologist would find it difficult to identify a heritable genetic factor for one hives survival over another's.[5]

If you are considering your own breeding and selection program, consider a goal to select for bees that are: gentle, make some honey and survive under a varroa control strategy that you can reasonably maintain.

State bee inspectors used to visit beekeepers, if they found diseased colonies, they could order all bees and equipment destroyed (AFB) or treatment to begin (dysentery).

Lacking a state bee inspector forces us in Washington to rely on the professional and moral character of beekeeper. Hoping they have some sense of community and responsibility tied to beekeeping including not having sick bees foraging in areas used by other beekeepers.
There are critical economic consequences as well. A package of bees may cost upwards of $135. Most beekeepers cannot afford to continually replace their bees. If my bees become ill because you failed to quarantine your sick colonies, who is responsible?

Figure 32 Frame infected with American Foul BROOD AFB

ADULT BEE DISEASES v

Disease	Identify	Cause Agent	Prognosis	Treatment
NOSEMA CERANAE[6,7,8]	Fecal staining outside of hive, bee poop; more common in Summer Difficult without lab tests	Fungi Microsporidium Nosema ceranae Can co-infect with Nosema a.	1. Affect life-span of worker 2. Quality of queen 3. Increased Winter losses	Treat Fall & Spring Fumagillin-B; may need to "drench" Decontaminate frames by freezing
NOSEMA APIS[9,10,11,12]	Heavy fecal staining more common in Fall and Winter. Difficult without lab tests	Fungi-Microsporidium Nosema Apis Can co-infect with Nosema c.	1. Affect life-span of worker 2. Quality of queen 3. Increased Winter losses	Treat in Spring with Fumagillin-B; can self-resolve
DEFORMED WING VIRUS**	Wings do not fully develop; or a single wing may develop	Deformed Wing Virus Spread by the varroa mite; heavy infestations.	Very poor; infected bees ejected from hive by the colony.	No treatment
DYSENTERY	Fecal staining	1. Nosema 2. Not being able to conduct cleansing flights	Dependent on cause See Nosema	Good ventilation, eliminate excess moisture; strong colony going into Winter

In the adult bee table of bee disease Deformed Wing Virus (DWV) becomes a place holder for many bee viruses. Most of which have no cure.

Adult Viral Bee Diseases	
1. Acute bee paralysis virus 2. Kashmir bee virus 3. Israeli acute paralysis virus 4. Black queen cell virus 5. Aphid lethal paralysis virus 6. Big Sioux River virus 7. Deformed wing virus 8. Kakugo virus 9. Varroa destructor virus-1 10. Egypt bee virus 11. Sacbrood virus	12. Thai sacbrood virus 13. Slow bee paralysis virus 14. Chronic bee paralysis virus 15. satellite virus 16. Cloudy wing virus 17. Bee virus X 18. Bee virus Y 19. Lake Sinai virus-1 20. Lake Sinai virus-2 21. Arkansas bee virus 22. Berkeley bee virus 23. Apis mellifera filamentous virus

WORTH A CLOSER LOOK

European Foulbrood[13]

European foulbrood (EFB) can also devastate weak colonies, yet is known to spontaneously resolve with a honey flow[14]. Colonies under stress can develop EFB quickly. The classic treatment is to requeen and/or break the brood cycle.

EFB kills larva before worker bees cap the cells. Frames can look spotty with a range of dead and decaying larva laid open. Smell foul, but different than AFB.

Recommend 3 dusting treatments of Terramycin 3 to 5 days apart. Note that Terramycin is no longer available over the counter; obtain form a veterinarian.

American Foulbrood

American Foulbrood is a destructive disease; the most harmful that beekeepers faced before the appearance of the varroa mite. Once discovered, a beekeeper's only choice is to destroy all the woodware, frames, and boxes.

AFB spores last over 40 years in the environment; placing neighboring beekeeper's hives at risk. Burning everything is the age-old response to AFB. Additional post-infection treatments include: irradiation for truckloads of infected hive woodenware or freezing equipment in an attempt to eradicates the spores).

Prophylactic treatments of Terramycin have become problematic with no more over-the-counter access to over-the -counter treatments.

The smell of AFB is the first indication of infection a beekeeper may notice. They open a hive and the smell over comes them. In addition to smell, the appearance of sunken brood cells, some with pin-size holes appear. The overall brood pattern is spotty (adults removing sick larva from cells). Next the toothpick test: a toothpick is inserted into one of the cells, swirled and pulled out slowly. If, present AFB attaches to the toothpick and causes a "ropey" attachment to the toothpick as you withdraw it from the infected cells.

Field Test for AFB: Holst milk test

"The Holst milk test (Holst 1946) is a simple test based on

the high-level of proteolytic enzymes produced by sporulating P. larvae. The test is conducted by suspending a suspect scale or a smear of a diseased larva in a tube containing 3 to 4 ml of 1-percent powdered skim milk in water. The tube is then incubated at 37o C. If AFB is present, the suspension should clear in 10 to 20 minutes. It should be noted that this test is not always reliable."

- Diagnosis of Honeybee Diseases, USDA, Agricultural Research Service, Agricultural Handbook #690

In addition to the HOLST test (SEE BOX ABOVE), commercial field testers are available. One-time use test: +$13.00 each. Finally, the only definitive answer comes from a lab diagnoses.

If AFB is suspected, isolate the hive and the colony from your other hives.

Pesticide/Herbicides Kills

Pesticides, deadly to both larva and adult bees proliferate in urban, suburban, and rural localities. The use of honeybee-toxic pesticides/herbicides, especially when nectar bearing trees and plants are in bloom is forbidden in most agricultural areas. Bees may encounter pesticides when foraging or the poisons may drift from a neighbor's yards to engulf hives.

Figure 33 AFB BURNING EQUIPMENT By Jrmgkia - Own work, CC BY-SA 3.0

Pesticide/herbicide kills are sudden, as well as devastating to colony and beekeeper alike. Beekeepers often discover a kill, when mounds of dead bees are clustered around the outside of a hive. More insidious is that pesticide residue can remain in honeybee wax combs forever where it continues to severely impact larva leading up to and including immunosuppression.

Who to blame? It's not always obvious, identifying perpetrators for pesticide Kills is sometimes only circumstantial. Therefore, state, city, and county and commercial sprayers must stay vigilante to the presence of hives and bees. In some areas, commercial sprayers are responsible and liable for pesticide drift. Communication is the best defense/practice against pesticide exposure. Talk to your neighbors or nearby farms, most people are aware of the importance of bees are willing to work together to reduce exposure risk. Talk to your neighbors about the risk of pesticides. A defensive practice is to net your hive, or run a sprinkler keeping the bees in the hive during times of heavy spraying.

QUICK REVIEW CHAPTER 5

KEY POINTS

1. Prevention is always better than treatment
2. Prophylactic treatment means you treat whether disease symptoms are visible or not
3. American Foulbrood is a devastating disease forcing drastic steps to eradicate disease spores
4. Pesticide kills are most often identified by layers of dead bees in front of the hive
5. CCD is not a disease, but a cluster of symptoms

CHECK OUT

A Field Guide to Honey Bees and Their Maladies from Penn State, College of Agricultural Research and Extension

Recently revised and updated this guide identifies and describes treatments for most problems commonly encountered by beekeepers. Features over 100 color photographs

Figure 1 HEALTHY BEE By Zeynel Cebeci - Own work, CC BY-SA 4.0,

CHAPTER VI HONEYBEE PESTS

WHAT ARE ACCEPTABLE PEST LEVELS**?**

Bee pest abound; many only annoying, a few deadly. While you tolerate ants or maybe even earwigs (while unsightly, don't harm a strong colony) other 2-, 4-, 6-, or 8-legged pest are considered zero-tolerance. A beekeeper makes choices: what level of pest is too much, for the bees and for the beekeeper.

ANYTHING OR ANYONE THAT CAUSE ILLNESS, DECIMATES, OR DISRUPTS HONEYBEE BEHAVIOR IS A PEST

2-LEGGED

Humans and Birds: As far as beekeeping goes, often, humans are the most obnoxious pests. Heinous because they are not foraging for food or searching for a warm place to leave their young, rather humans are pests for the sake of money or for the sake of vandalism.

Immediately after the first person claimed the first honey tree, beekeepers started battling thieves[15]. Honey and, to a lesser degree, wax, were precious and prized throughout history. Held in high esteem, honey paid both taxes and rents from Mecca to Egypt to medieval England. While honey is not accepted by the IRS, individuals will still steal honey, and hives[16], and queens[17].

Sophisticated "bee rustler" take entire pallets of hives and erase all markings from the former owner. In 2016, 20 artificially inseminated WSU queens were stolen (along with 4-5 frames/hive) from an almond orchard during pollination season.

The small-time beekeeper may not worry about theft; however, but do need to worry about vandalism. Tipping hives, especially those located in fields, out of direct sight offer vandals opportunities to practice their loathsome craft. In addition to vandals, some 2-legged pests antagonising bees by throwing rocks or large sticks, create hostile colonies, difficult to work. The best defence against vandals is to make your hives 'blend' with the environment. Tall fences work well to deter interlopers; locked gates are a great deterrent. Informing neighbors to keep an eye out is also helpful.

Figure 1 Western Taninger PHOTO CREDIT Peter Pearsall/U.S. Fish and Wildlife Service

Birds: While most birds in the Northwest co-exist happily with the honeybee, the Western Taninger, is an exception. The Western Taninger migrates across Western Washington in early Spring. He enjoys catching honeybees in mid-air. A pair stops in my apiary each Spring and feeds for 2 or 3 days, then move on. The taninger's feeding does not decimate a colony, unless the colony is already weakened following a hard winter. If the colony is weak the birds could bring the colony's numbers down to a critical level.

4-LEGGED

Lions and Tigers and Bears: Northwest lions and tigers tend not to bother the *A. mellifera*. However, Northwest bears are a major threat, as are skunks, mice, and cows.

BEAR: Once a bear knows where hives are and has tasted honey, it is almost impossible to stop the marauding beast. Bears will knock hives over hives, destroy comb, frames and woodenware (they are mostly after the brood, the honey is an "extra"). First, the strongest defense is to not place your hives in known bear territory. However, with spreading suburbs and housing many of us now live in what was natural habitat for the bear. Second, is to use an electric fence. Close in you can tap current from your home, otherwise you may want to invest in a battery-powered or solar-powered electrified fences.

Figure 34 Ursus

SKUNKS: Skunks come in the night; knock on the side of the hive; and eat each guard bee as it emerges. You can surmise a skunk has prowled your colonies if you find: scratch marks on the side of the hives; skunk feces around the apiary (the feces with have bee parts in it); and nervous colonies.

Figure 2 skunk *BY KEVIN COLLINS -*

Two practical skunk deterrents:

1) raise your hives up to 3-feet off the ground. At that height, a skunk must be rise on their hind legs and expose their belly, which is susceptible to stings;

2) install a skunk board. A skunk board is a piece of plywood the width of the hive entrance with nails or screws imbedded (think bed-of-nails). The board is place in front of the hive (best to tack it down), skunks and other small animals will not want to walk across the nails.

MICE: To a mouse, a winter spent in a dry and warm hive, (once the bees have clustered), is absolute bliss. Mice will wreck a hive by chewing on wax, wood, and comb. They also defecate in the hive bringing disease carrying pathogens into contact with bees.

Figure 3 many mice

To prevent your hives from becoming mouse hotels, purchase mouse guards for the hive entrance or install hardware cloth in the entrance. Be warned, if you install the mouse guards too late you might just trap the mouse in the hive. More than one beekeeper has found the remains of a mummified or propolize bee in the back of the hive (the bees wanting to keep everything tidy).

Keep your apiary free of excess brush and beekeeping equipment, don't provide a reason for mice to visit.

COW: A cow seems a benign creature. But cows needing a back scratch find tall hives irresistible and spell trouble. Cows will sidle up against a hive and scratch their back and sides… suddenly the hive is laid out on the ground like dominos. Be cautious of seemingly placid cows. If you do find your hives in contention with cows, consider purchasing metal straps to bind the hive.

6-LEGGED

Ants/Wasps/Hornets/Small Hive Beetle/Wax Moth

Figure 4 ants infest an Apiary By CHIXOY - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=5627410

ANTS: Ants are not just troublesome to find in you hives, but a true menace. Ants invade a hive in search of sugar syrup, honey, and in some cases brood. A weak hive may spend its time fighting ants instead of building a healthy colony. In contrast, a small proportion of beekeepers claim a harmonious ant and bee co-existence. Ants are another case of how much are you willing to tolerate, given the behavior of the ants and the bees.

To deal with ants, you first deal with the landscape. Keep the grass or plants around the hives cut short. Ants will seize any advantage or blade of grass to cross/jump/bridge a barrier and thus, get into the hives. Think about planning mint around your hives, ants hate mint. Hive stands are a key ant deterrent.

Place the legs of the hive stand in tuna fish cans of oil or diatomaceous earth. Finally, some beekeepers claim that sprinkling cinnamon or foot powder around the hives will keep the ants in check. Monitor for ant activity whenever you visit the apiary; catch a potential infestation early.[18]

Wasps and Hornets: In a bee's world, there is no place for wasps or hornets. None, none at all. Wasps and hornets annually destroy colonies. A hive boiling with bees at the end of August, is suddenly too weak to go through Winter in the beginning of September. The marauders are patient, making stealthy attacks on the hive, probing for weaknesses; once found, they destroy the hive in a matter of days. Or worst, leave a disheartened handful, which withers away.

Figure 35 Yellow Jacket https://www.google.com/imgres?imgurl=http

The best defence is an offense when it comes to wasps. In early spring, the queens[19] wake from dormancy and scout for a suitable nesting space. Catch these queens early (with rotten meat, canned cat food or with pheromone lures) and you destroy a potential 3,000 wasps. Place robbing screens on hive entrances to discourage wasp forays into the hive.
Wasp/hornet traps come in every size and shape; early glass traps based on Victorian design and all plastic types with engineered entrances. Homemade traps abound from:

Drown-Them-in-Soap-Water- traps to Take-The-Poison-Back-to-the-Hive combos to Kill-the-Colony-Where-it-lives-method. (See YouTube links at the end of this chapter).

Figure 36 Mud Dauber WikiCommons

To discourager wasp/hornets from your yard: clean dead bees in front of hives, keep garbage and any outside food in covered containers -make sure the garbage can lid is set tight. Ask neighbors to be vigilant and place traps as well.

Do not mistake the solitary mud dauber as either aggressive or dangerous to your bees. This wasp, with a thin, thread-waist (in contrast to an hour glass figure) Is almost shy. This solitary, wasp eats spiders.

Small Hive Beetles (SHB): *Aethina tumida* or the small hive beetle. Before our climate started to warm, we did not give much thought to the small hive beetle in the Pacific Northwest. It was a problem found only in the south. Unfortunately, the first SHB was spotted in Washington state in 2008. A serious outbreak hit out neighbors to the north, British Colombia, in 2017[20].

The SHB has yet to decimated hives in Washington, as it has in southern states; it may just be a matter of time.[21]. Therefore, as long as we have winter in Washington the SHB pupae should die in the soil.

Figure 37 SHB Larva in the hive Gorging on honey.

Adult SHB spend their lives in the sandy soil surrounding a hive, their only trips to inside the hive is to lay eggs. Small hive beetles (SHB) burrow into hives, lay their eggs and the damage begins. The SHB larval stage gorges on honey, pollen and honey, and comb and honey. They have the potential to ruin comb and frames. Control SHB with ground drenching the soil around the hive to destroy the adults.

WAX MOTH: Wax moths cause extensive damage in the hive. The larva chewing through woodenware and comb. The larva spins their cocoon and make the hive inhabitable for bees. Never store wax combs in dark dank spaces, that is a sure way to attract wax moth to lay in your equipment. Wax moth prevention is simple. Place all wax comb in the freezer for 2 days and store your frames in a black garbage bag (to kill any lingering wax moth eggs lurking on frames

It may also make sense to protect your stored equipment by storing wax moth crystals in and around the storage area.

8-LEGGED

Varroa Destructor - external

Varroa destructor[22] (*V. destructor*) is native to Asia. A. cerana, the Southern and Southeast Asian honeybee regularly grooms itself, causing the varroa to drop off. A cerana has evolved additional traits that make it possible for A. cerana to survive with varroa.

Unfortunately, the European honeybee *A mellifera*, has no defenses when introduced to the mite, leaving it extremely vulnerable.

Varroa is found on both adults and brood; they reproduce in brood cells living off their host. Varroa prefer drone brood because it of its longer incubation period (24 vs. 21 days for workers).

Figure 38 Varroa at the bottom of a cell

Adult female mites like to crawl into brood cells containing almost-ready-to-seal larva (5- or 8-day old larvae); lay eggs in the sealed brood comb to incubate and watch as their young feed on the hemolymph (blood) or the fat bodies (as new evidence suggests) of the larva and pupae. Mite behavior weakens bees and makes them more susceptible to viruses and disease

Relatively speaking, varroa and A. mellifera have co-existed for only a brief period, our western honeybee and the varroa have yet to develop a host/parasite balance (moving from parasitic to mutualism). Mutualism is a beneficial relationship between two species.

Varroa causes millions of dollars in honeybee loses each year since its introduction to the U.S. (and most of the world). The varroa acts as a viral vector (carrier of disease) for most honeybee viruses[23]. In only 12 months, a heavily infested colony may be brought to its knees. The mite also serves as a factor, along with pesticides, and loss of habitat/forage in the “perfect storm” scenario relating to colony collapse disorder.

Varroa population peak in the fall about the time the queen decreases her previously extravagant egg laying behaviors.

Mite load refers to the number of mites in a hive relative to the number of bees. Generally, mite load is expressed as mites/100 bees or percent of mites. The higher the load; the high the potential for complete disaster. To establish mite load, or mite-math several approaches have evolved; some more accurate and reliable than others. And since no one could possibly count each mite in a hive there are several 'estimates' techniques available.

The most accurate method, may be the alcohol shake or the powdered sugar roll sample. . Each analysis-type requires ½ cup of bees or, roughly, 300 bees for complete testing

The sugar roll or shake method needs 300 bees collected from brood frames, placed in a mason jar with a solid lid, gentle shake and rolled the specimens. Next replace the solid lid with a screened lid and begin to shake the bees toward the screened lid and out onto a white cloth. The alcohol technique necessitates a contraption made from two mason jars with a screened lib between. The ½ cup or 300 bees are again gathered from the brood frames (make sure you don't pick up the queen).

The solution of alcohol and bees is rolled back and forth, ending with siphoning the alcohol and debris (including mites) into one jar, with the dead bees in the other. Count the mites in the first jar. Table 9 estimates at what level treatment should take place. The other option is to treat prophylactically, no matter what the count.

Recently, the University of Minnesota Bee Squad developed a field test kit which are convenient, easy to use, and you never have to worry about forgetting a part of the testing kit.

A sticky board, on the other hand, is most effective as a monitoring device, post-treatment opposed to a diagnostic tool to establish mite load. Place a grid pattered sticky board sprayed with pam under a screened bottom board insert. Replace insert over screened bottom board. Wait the prerequisite number of days, and then, count the varroa (sesame seed sized brown/orange bits) and divided by the number of days you leave the sticky board in in position.

Figure 39 University of MN Bee Squad Field Test Kit used with permission of M. Spivak

Varroa mite treatments – Chemical Control Treatments suite every need. But whatever you select, remember that varroa can build up a resistance to the medication, keep switching medications in Spring and Fall.

Some beekeeper use essential[24] and natural oils to threaten varroa; beekeepers report varying success rates, with few scientific studies to use as proof of veracity.

Commercially available treatments abound, some less intrusive, some more toxic. Varroa mite treatments vary. Your choice: estimate how well the girls will tolerate the medication.

Table 1 Essential Oils used to Battle Varroa		
Lemon grass oil	Eucalyptus oil	Garlic oil
Thyme oil (thymol)	Mint oil (menthol)	Piper (pepper)
Rosemary oil	Camphor oil	Lemon oil
Oregano oil	Linalool (vitamin. E)	Wintergreen oil
Sage oil	Cinnamon oil	Neem oil
Catanga oil	Nutmeg oil	Tobacco oil

Important is that almost all treatments should be completed at least 2 weeks before the honey flow. Frames with honey, left in the hive during treatment, will contain the mite medication, therefore making it unfit for human consumption., Whichever treatment you choose read and follow the directions closely and complete a full cycle of the prescribed medication ("leave on for 5

days" or" 7 days with 14 days between treatments"). Pay special attention to the temperature. Some medication become ineffective in wintry weather.

NOTE: Some of the compounds used for mite treatment can be harmful to the beekeeper if used improperly. Finally, keep a close eye on the behavior of each colony after medicating. After a week inspect and confirm that the hive is still 'queen-right". You make expect some break in the queen's laying after medication.

Table 2 Varroa Treatments

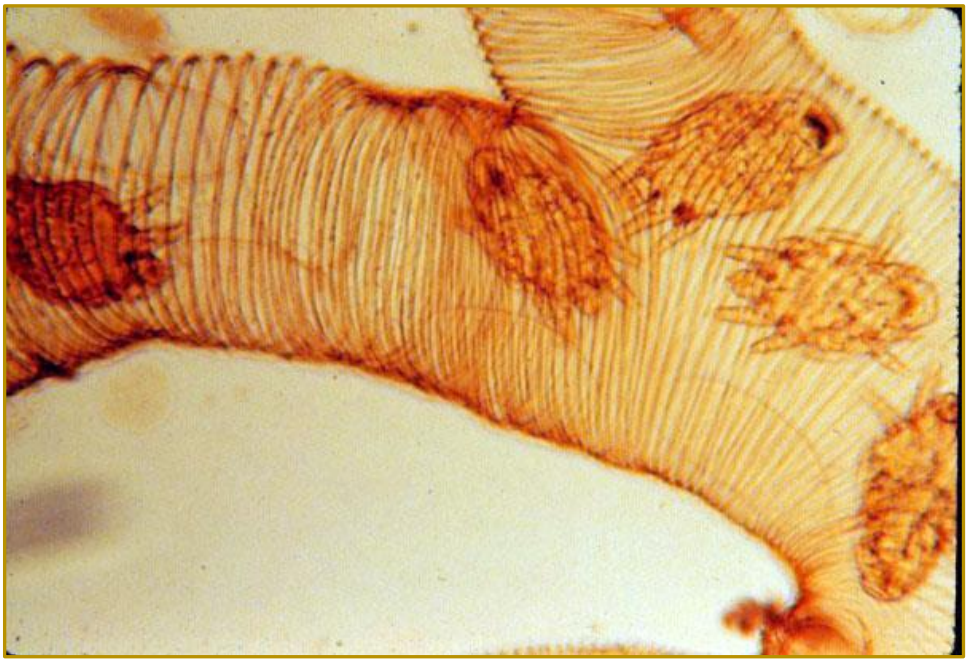
- See more on Varroa treatments in Chapter IX Fall.

Active Ingredient	Commercial Name	NOTES
Potassium salt of hop beta acids	Hop Guard II	Best if used when there is little or no capped brood. Great for use when installing packages or after catching a swarm. Can be used in winter months
Thymol	Apiguard	
Formic Acid	MiteAway II	Can kill mites in sealed brood. Highly sensitive to temperature/hive ventilation
Oxalic acid	Oxalic Acid	Vapor, trickle, or spray depending on time of year. Best if used when there is little or no capped brood. Great for use when Installing packages or after catching a swarm. Can be used in winter months
fluvalvinate	Apistan	Due to overuse, considered ineffective against varroa. Leaves long persisting residue in wax
Coumaphos 10%	CheckMite+	Due to overuse, considered ineffective against varroa. Leaves long persisting residue in wax
formic acid	MiteAway Quick Strips	
thymol, eucalyptol, menthol, camphor	Api Life VAR	
amitra	ApiVar	The most commonly used compound in Commercial operations does not leave Residue in bee's wax (not lipophilic)

Acarapis woodi Tracheal mites - Internal

"The honey bee tracheal mite, Acarapis woodi, or acariosis as the disease is known in Europe, afflicts only adult honey bees. The parasite was first described in 1921 in bees in Great Britain. This discovery and concern over the potential impact that this mite would have on beekeeping in the United States led to the enactment of the Honeybee Act of 1922, which restricted the importation of honey bees from countries where this mite was known to exist"[25]

FIGURE 7 TRACHEAL MITES ISLE OF WIGHT DISEASE BY USDA - USDA.



Tracheal mites are an internal post and only found in adult bees. The mite clogs a bee's breathing tubes and shortens the live of the honeybee.

Determining the presence of Tracheal mites is difficult since no single symptom determines the presence of the mite. Bees may have disjointed wings and wander near the entrance of the hive. Bees may have distended bellies. However, these are also symptoms found in other diseases. Presents of tracheal mites cannot be confirmed without dissecting a bee and visualizing its trachea.

Treatment for tracheal mites includes Menthol Crystals, formic acid and grease patties. Menthol is placed in the hive: top of the hive bars when the temperature is less than 80° allows the Menthol vapor to waft through the hive. When the temperature is greater than 80°, place the menthol on the bottom of the hive. Grease patties include grease, sugar and may have wintergreen oil or other essential oil.

KEYPOINTS CHAPTER 6

1. Humans are a long-standing pest as far as honeybees are concern.
2. Raising hives to force a skunk to expose its underside to capture bees, makes it more vulnerable to bee stings
3. Varroa destructor is one of the most vicious and harmful threats facing honeybees
4. Because you cannot see Acarapis woodi, you must become familiar with infected bee behavior and treat
5. Many forms of commercial and home-grown treatments for Varroa mites exists

CHECK OUT

http://extension.wsu.edu/snohomish/garden/gardening-resources/bees-and-beekeeping/beekeeping-links/

Apprentice Master Beekeeper Additional Reading

(Updated 05/23/16) Links used in the 2008-'16 Apprentice Master Beekeeper Certification Classes

https://www.youtube.com/watch?v=ng-ylBN43PA

https://www.youtube.com/watch?v=Vh7RN0dib58

https://www.youtube.com/watch?v=kcvmzi9yo4M

Chapter VII SPRING

The Mason Bees are out and about, the forsythia just starting bloom. The yard seems less muddy than last week and the bees are starting to take things seriously.

APIARY START UP

Your apiary, bees do not magically come to life on the first day of Spring. It happens slowly and methodically starting in late winter; the colony prepares for Spring and Summer. Taking their time little by little, their warm-day, fair-weather flights become longer. The queen starts to lay, and the workers bring in pollen.

If you have been feeding your colonies, do not slack off in the feeding. Once there is protein in the hive, queen starts laying; protein and carbohydrates are essential to the young. Now is the time to build up the over wintered colonies, and if you are lucky, split them before the nectar flows in Summer.

- Figure 40 Spring comes slowly

OVERWINTERED BEES

The last eggs the queen lays in fall are the bees that tend the queen all winter. The queen shuts down her egg production in the Fall, it gets colder, and the bees cluster for the winter. Note, that bees do not hibernate. They cluster (like a ball of bees), with the queen in the middle. All the bees emitting CO_2; with the mass becoming hypoxic (the center of the cluster can measure at only 15% oxygen which in turn, lowers the bees' metabolism).[26]

The bees on the outside of the cluster barely move, but their sisters from inside the warm cluster constantly rotate to the outside of the cluster, giving everyone bee a chance at the warmth. The queen in the middle of the cluster maintains a toasty

85° if any brood is present or 93° with no brood. The cluster must stay in contact with the stores of honey, or they could starve.[27]

Be patient, about conducting a full inspection. Do not make a full inspection until the weather holds out between 55° - 60°. Before the weather warms up, you can knock on the outside of the hive and listen for buzzing. If you're using a telescoping top, you can also lift the lid and check for bees through the inner cover. You can also monitor for cleansing flights on the outside of the hive on warmer sunny days. Time to monitor diligently; are the bees out and about?

Make your first full inspection for assessment of the post-winter on a sunny and clear, day with maybe just a bit a wind. The first inspection includes a cleaning, perhaps a great deal of cleaning. Look for the calling cards of hive health:

1. Is there brood?
2. How are the honey stores?
3. How are the pollen stores?
4. How full are the frames?
5. Check and clean the bottom board and front entrance.
6. Remove mouse guards

During the first few inspections if you find all the bees in the top box and little to no bees or brood in the bottom deep box useful to "reverse" the colony. By moving the top box to the bottom board and the bottom box to the top it provides "space" for the bees to grow. Colonies tend to expand up through the equipment.

ALL SUGAR IS NOT CREATED EQUAL

Making syrup for the bees. Only use <u>refined white sugar</u>. Other types of sugar (brown, raw, organic, etc.) all contain solids that are hard for the bees to digest and may cause dysentery.

I place a large pot, measure the water, get the water to a rolling boil, take the pot off the heat and mix in the sugar a bit at a time. Stir till the sugar is all dissolved

.

NOTE: Do not attempt too early in the season. Furthermore, do not attempt if there is brood in the bottom box; you risk splitting the brood and the bees may not be able to keep the two halves of brood warm.

Figure 41 in-hive frame feeder

Inspect, and clean your hives; it's an appropriate time to inspect and clean your apiary. After inspection, you will most likely start feeding.

FEEDING: While feeding fondant in Winter is great, now that the days are getting warmer, (consistently 55°) make sure to feed syrup 1:1 (1-part sugar to 1-part water). You might feel inclined to throw on pollen patties, however, *beware*, that once you place pollen the queen will start ramping up egg production, you don't want too many new bees if the weather is still rough.

If warm weather creeps in too early, the bees with break cluster. If their stores are already eaten, they are forced to forage (look for food) and, ultimately, find nothing.

If you've been feeding since mid or late winter the cluster will find your fondant or sugar on the top of the hive. If you have not been feeding, it may be time to start. Few things are more disheartening than getting your bees through a rough winter, only to lose them in the early spring.

FEEDERS: Start a lively discussion at your bee club, ask someone about which type syrup feeders is best.

In-hive frame feeders: In-hive frame feeders are, technically, feeders placed next to the frames a brood box. Some feeders have covers and even include "ladders" plastic trellis for bees to climb up and down while feeding. They come in 3, 2, and 1-pound capacity. They also come in deep and medium sizes.

Top feeders: Top feeders are placed on the top, hence the name, of the brood boxes. They have two or sometimes a single 'trough' covered with wire that the bees use to climb to the food source.

Gallon baggies: Simple, but a bit more labor intensive. Pour syrup into the baggy (not too full) place the baggie directly on the top of the frames, but not over the brood, use a pin to poke holes in the bag, and you're ready to go. Note: watch for leaks which can bring in marauders.

Gravity feeders: Gravity feeders are either a large can or jar with a single hole in the lid. (this is the feeder that you usually receive with a package of bees. You turn it over and the bees draw the syrup out of the bottom. The vacuum in the top keeps all the syrup from draining out.
Front entrance feeders: First front entrance feeders are discouraged because they may attract predators and/or encourage robbing behavior. Boardman feeders, require the addition of a Manson jar attachment. Some companies have started to produce larger plastic version of the front entrance feeders. Free standing feeders may be placed near the hives or on top.

Figure 42 in-hive top feeder

Check your feeders every couple of days. The bees go through a great deal of syrup in a relatively brief period.

NEW BEES

New Spring bees come in nucs, packages, swarms, and even from splits from a friend. Few things are as exciting, especially for the first-year beekeeper as getting new bees. For Washington beekeepers, the spring bees come up after pollenating the almond orchards in California. The workers and the queen are introduced to each other right before shipping. Because of that, the queen may need a slower introduction, allowing the workers will accept her as their own. No matter how you get your bees, after installing and before the package or swarm colonies have capped brood and for the nucs is the time to treat for varroa mites

Packages: Packages come in 2,3,4, or even 5-pound options. Inside the box of wood and screen is a cluster of worker bees, a queen in her cage and a gravity feeder.

The quality of queens in packages varies. It's best to know your supplier, or trust your middleperson who makes the distribution. Picking up bees can be fun. And an opportunity for some, last-minute shopping. Look for a healthy tight cluster on the queen. If there are lots of bees flying at your pick-up sight, a large group of bees clinging to the outside of a package is a good sign that the queen has some extra-strong pheromones.

When you get your package(s), the first thing to do is give the bees a good drink. Bring along a spray bottle filled with water, syrup, or syrup with a kick (like Pro Health or Honey B Healthy). The water will help cool the colony. Bees are better off too cold than too hot in these situations. You might also want to bring along a lightweight sheet to place over the packages for the drive home; stray bees while driving is not fun.

Nucs: Nucs are mini "starter colonies". The term nuc stand for nucleus or I like to think of it as, "Heart of the Hive". You receive 3, 4, or 5 frames of varying amounts of bees, brood, and a queen. The entrance closed to prevent "wandering". Due to lack of air circulation, try and immediately provide the bees with water to cool them down.

Receiving a nuc comes with an increased risk of inheriting someone else's mite or disease problem. Practice an ounce of prevention: dispose of any combs that appears old or dark, almost black.

Swarm: A young Spring swarm is the best. (Others may argue that point.) Spring swarms are cast off a colony that did so well over the winter that they've decided to divide at the earliest possible moment. After you catch a swarm - feed, feed, feed. Swarms build comb quickly, and they need a large amount of feed, to do so efficiently.

Consider requeening the swarm. You will likely have no idea regarding the genetics or characteristics of the queen. She might be an old queen near the end of her reign. She may have passed on less than desirable behavioral issues.

Figure 43 Have all your equipment ready to go. Note the top feeders

Split: Receiving a spit from a friend is a true mark of friendship. Remember, however, that the splint comes with a BYOQ, that is Bring Your Own Queen. Obtaining a queen within two to three days of receiving a split is good time span. Don't wait too long, or you may end up with a laying worker.

Treating new bees for varroa mites: After hiving your bees, whether from a swarm, a split or package, is an excellent time to treat for varroa mites. Remember, you have a 7-day window after the queen begins laying to apply your preferred treatment.

HIVING

Hiving, getting your bees from "container a" into "box b", is one of the most highly anticipated aspects of beekeeping for beginners, and probably the most anti-climactic. The hiving process is so quick that you are done before you have time to think about it. Most likely because you, the new beekeepers, has watched every YouTube video on hiving possible. As well as gone to demonstrations. You have most likely committed each hiving steps to memory, still it is a satisfying feeling to hive your first colony.

Have your hives set-up and ready to go by the time you go to pick up your bees. Also, make sure that you have all the equipment that you need BEOFRE you open your nuc or package.

Nuc: Nucs are the easiest to hive.

Figure 44 nucs and HIVING CREDIT KUW

1) Carefully move frames from one box to another.
2) Check that you have the queen.
3) Lay the nuc at the front of the hive, and the stragglers with fly to the hive.

Package: Packages provide the beekeeper with a choice– shake or not shake.

Shake-method:

1) Prepare the hive by removing the outer and inner covers of the brood box. Remove up about 5 frames.
2) Give the package a small thump to remove the cluster around the queen cage. Remove the queen cage from the package and carefully exchange the cork in one end of the cage for a mini marshmallow. Install the queen with the marshmallow side upward; ensure that the screen on the cage is unobscured. Using a paper clip or other wire, attach the queen cage on an inner frame making sure the screen isn't covered so workers can feed her. NOTE: If the package is less than 24-hours old you might want to start off by leaving the cork in place an extra day, giving the workers more time to accept the queen.
3) With the package opening facing upwards, give the package a meaningful thump on the ground so that most of the bees are now at the bottom of the package.

Figure 45 Shaken package waiting for stragglers

4) Remove 4 or 5 frames from the end of the brood box, Turn the package over and give two or three meaningful shakes. Most of the bees will come out of the package in a clump and make a satisfying 'whoomph' sound.
5) Replace the inner and outer cover
6) Lay the package in front of the hive to catch the stragglers.

7) Check the queen cage in two or three days to make sure she has released.

Non-shaken method.
Follow steps 1-3 above. Deviate on step 4 by placing the package in the open space in the brood box. No need to shake. Continue with steps 5 – 7. You can remove the package and replace with frames the next day.

Feed after hiving: All new colonies need to be feed as soon as they are hived. NOTE: Inner top feeders and inner gravity feeders require a shallow or medium box placed around the feeder. Baggies require a 2-inch shim. When to stop feeding? Stop feeding when the nectar flows. Most colonies will forsake the syrup for the nectar. (Before you yell, remember I said "most" colonies. A select few will happily take syrup all summer.)

MAINTAINING A BALANCE

If your beekeeping goal is a healthy hive that produces a surplus of honey and goes into the fall with few mite issues and tackles the Winter with stores and strong bees, then this is the time to make it happen. Beekeeping demands that you manage two seasons ahead. Always think about what impact your actions will have on the colony down the line.

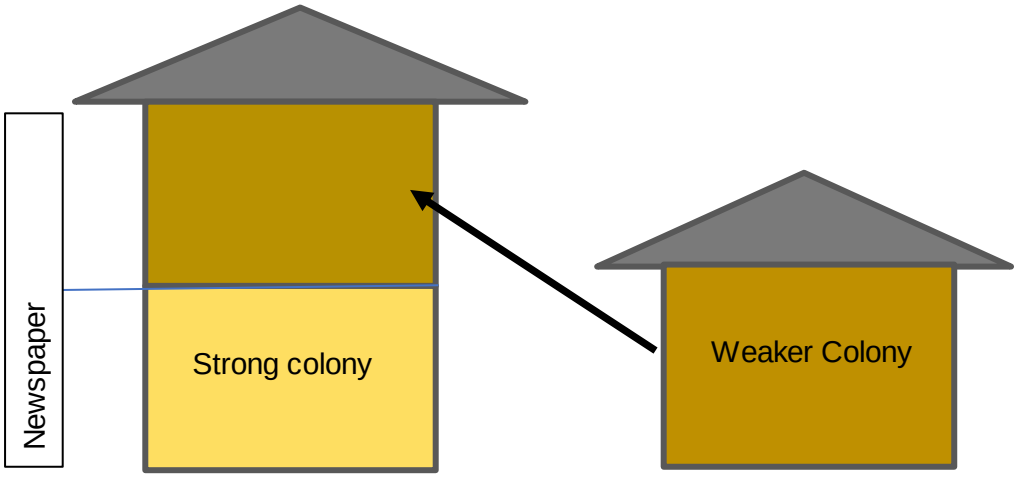
By the first nectar flow look for seven to eight frames full of bees and 4 to six frames of brood. They should already have 12-15 pounds of honey stores (about 2 deep frames full, or three medium frames). The laying pattern should be even, not spotty. If the colonies appear weak, with 5 or 6 frames of bees, consider combining with a stronger colony.
Hive storage is at a premium in the Spring; the colony requires pollen, nectar, and brood space. With additional areas for the queen to keep laying. Finally, the worker bees need a place to rest when they come home after foraging. Provide slatted racks or a rec room (shallow box with frames and foundation, with undrawn comb) for the tired workers to rest without congesting hive activities. Never let the bees think they are running out of room.

Frames: Frame manipulation has one cardinal rule, never separate brood from pollen and honey stores. Simple enough. More on frame manipulation in the Chapter 8 when we discuss SWARMS.

Keep the balance in your hives. If needed you can combining weak and strong colonies.

- Remove the queen from the weak colony.
- Open the strong colony and place a piece of newspaper across the top of the frames. Make sure it covers all the frames. Trim the sides if you can, otherwise it may wick rain. Put one or two slits in the newspaper and spray it with just a spritz or two of syrup.
- Place the weak hive on top of the newspaper.
- Close it up as usual.

The newspaper allows the weaker hive's bees to accustom themselves to the new pheromones. By the time the bees from the weak hive make it through the newspaper (the bees will clean it out) they will accept the new queen.

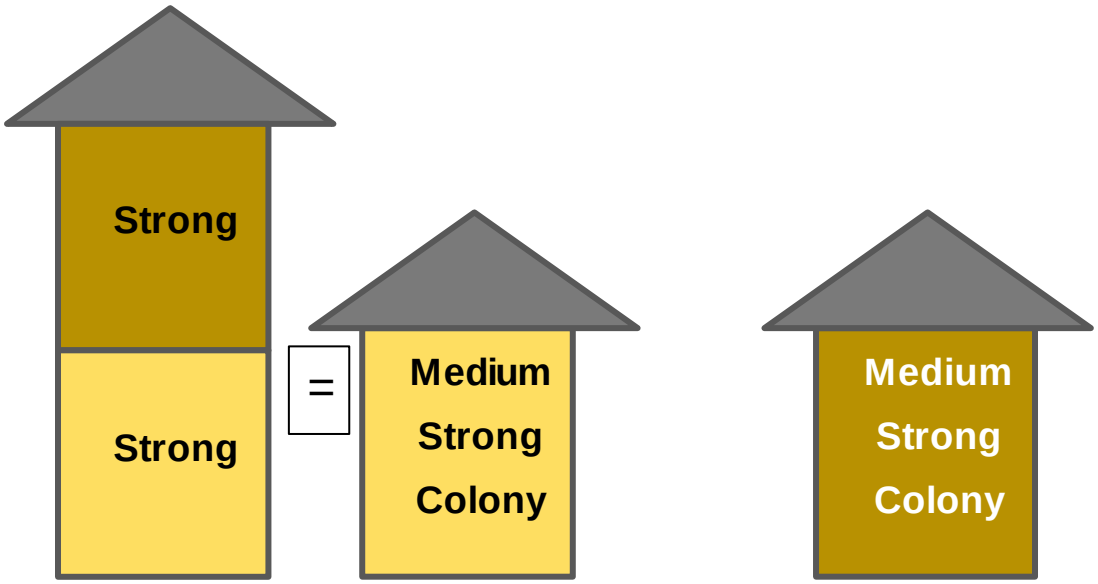


What if you have the opposite problem -- too strong a hive, one that may swarm due to lack of space. What to do? Make a split.

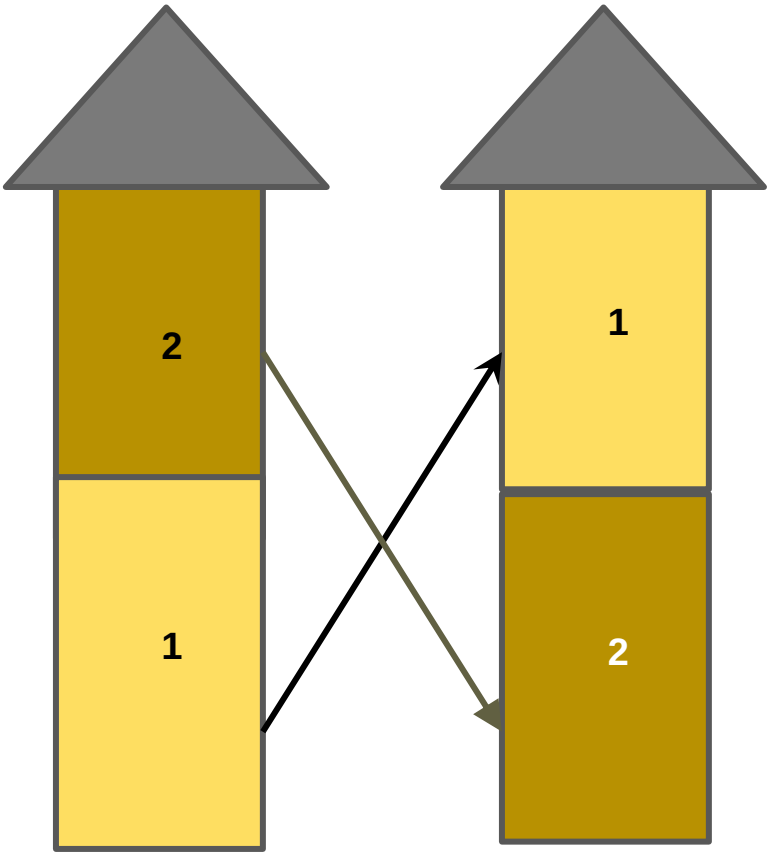
Split a strong colony by removing frames of brood and nurse bees and placing them in:

1) a nuc; allow the nuc to raise a new queen OR
2) place the frames in a deep and provide a new queen

Afterwards you may consider switch locations: That is, placing the split with the new queen in the location of the original strong hive, and moving the original strong hive to a new location.



With the split in the old location the hive will benefit from field bees returning with pollen and nectar. If the split becomes to "full" you can switch the two hives back.



Mid Spring and the bees are doing magnificent. You've already placed a second deep on the first. Now the second deep is full. What to do?

Switch the boxes, emptiest box on top. The queen climbs upward and lays in the "new" space.

The Queen starts to believe she lives in a high rise.

A congested brood nest may have the colony thinking "swarm". Manage your hives appropriately. There are many techniques for providing space in the brood nest to reduce congestion. These include the Demaree method, checkerboarding (these techniques involve frame manipulation). Frame manipulation has one cardinal rule, never remove brood from pollen and honey stores. Simple enough.

Never let the bees think they are running out of room. Let's say you have a super colony and you have already provided them with a second brood box. Now the second deep is full. What to do? Switch the boxes, emptiest box on top. Make sure that the queen and her brood is in the bottom brood box. The Queen tends to climb upward and lays in the "new" space.

KEY POINTS CHAPTER 7

REVIEW

3) Overwintered bees may have lived for over 3 months.
4) Supplemental feeding should be 1:1 sugar to water in the Spring.
5) If you are medicating for mites, Nosema, etc., make sure the medication is done before any nectar flows start.
6) New spring bees are usually purchased by the package or as a 'NUC" nucleus -- a small 5 frame box.
7) Always manage at least 2 seasons ahead.

CHECKOUT:

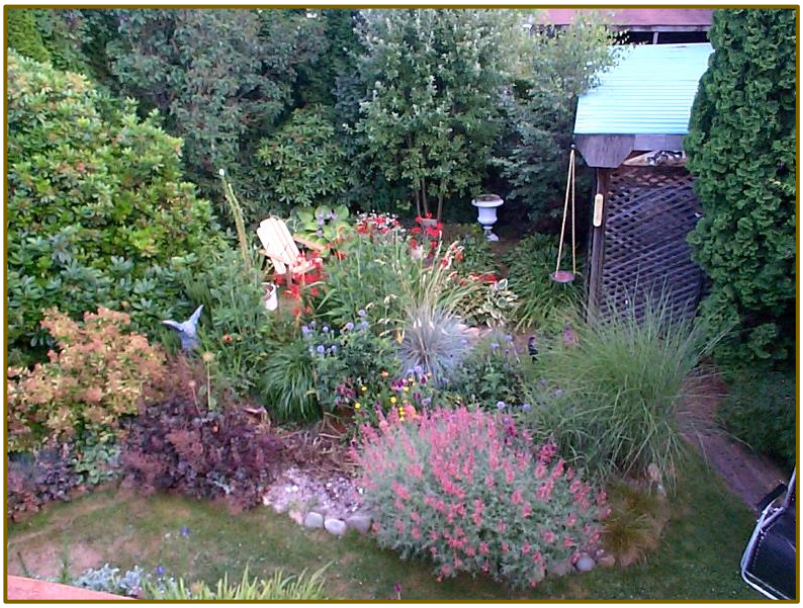
- The Backyard Beekeeper, Flottum, K. Revised, 3rd Edition (2014) Quarry Press, Beverly, Massachusetts

Both books are by Ormond and Harry Aebi- They are still in print and available from several publishers including Prism and Rodale. These books contain practical advice and speak to why so many of us are beekeepers.

- The Art and Adventure of Bee Keeping (1979) Unity Press, Santa Cruz
- Mastering the Art of Beekeeping Vol. 2 (1979) Unity Press, Santa Cruz

CHAPTER VIII SUMMER

SUMMER



Summer is the best time of year to sit in the apiary and watch the bees. The bees are at their most industrious; making stores for Winter; the bees will often work till 8 o'clock at night. Summer also heralds a period of colony leave-taking; swarming or absconding. Hyper-vigilance of weather, availability of forage, bee behavior, and queen viability can predict whether your bees are likely to make it through the next two seasons, Fall and Winter.

> *"Bees do have a smell, you know, and if they don't they should, for their feet are dusted with spices from a million flowers."*
> — **Ray Bradbury, Dandelion Wine**

INTEGRATED PEST MANAGEMENT

Fundamental to healthy beekeeping practice are techniques referred to as Integrated Pest Management (IPM). IPM practices help keep bees, strong and robust. IPM includes environmental, physical, mechanical, biological, chemical, and genetic methods. The theories applied by IPM to beekeeping are some of the same theories applied throughout agriculture. IPM procedures should become second nature to the beekeeper.

ENVIRONMENTAL CONTROLS

A first step in beekeeping is apiary site selection. A IPM environmental control consideration is selecting a site with sun and drainage. Controlling killer-damp protects a colony from a host of disease which weaken them and make them pray for other pests. Selecting a site with no standing puddles or depression ensures the site has adequate Winter drainage. Another control is not placing hives near the foot of a hill, where cold sinks can adversely affect the bees. More controls include protections from Winter's prevailing winds and protection from rain gushing through the entrance. Making a solid site decision keeps bees healthy.

INTEGRATED PEST MANAGEMENT

Successful Varroa control solutions are proactive. They control Varroa before the mites reach levels that threaten colony productivity and survival, rather than respond after the damage has occurred. *Integrated Pest Management (IPM)* is a set of proactive, non-chemical and chemical methods that offers beekeepers the best whole systems approach to controlling Varroa.

- **TOOLS FOR VARROA MANAGEMENT, Honey Bee Health Coalition**

PHYSICAL/MECHANICAL CONTROLS

Physical IMP methods include:

A. Fences – keep out bear, and other creatures (including humans)
B. Elevated Stands – keep skunks, etc. away
C. Screened bottom boards – increased ventilation, Mites that drop can't climb back up through the mesh
D. Screened inner covers - Ventilation
E. Mouse entrance reducer - No mice in winter
F. robbing screens -- keep marauding bees, and pirate hornets and wasps out of the hive.
G. Drone comb.
    - (1) attract the varroa (since drones have a longer incubation period) Drone comb removed and frozen to kill all varroa and placed back in the hive.
H. Interruption of brood cycle
I. Sanitation - Cleaning tools, etc. moving from hive to hive
J. Keeping apiary clean – not allowing mice or hornets to fins a foothold

BIOLOGICAL CONTROLS

None have proven effective

CHEMICAL CONTROLS

Chemical controls include the use of synthetic miticides, acids and essential oils. Key to IPM is treatment rotation from season to season to avoid varroa building resistance to any one treatment. It seems plain that we cannot totally eradicate varroa, therefore we must control the population growth.

GENETIC CONTROLS

Genetic IPM controls include obtaining genetically diverse stock such as VSH stock, Minnesota, WSU, etc., that have known varroa resistance traits (cleaning, biting). Such stock can pass on their behaviors to their daughters, again making the hive healthier.

Overall, checking on varroa levels is crucial, check at least 4 times each year. Record your findings, treatments, weather, temperature. Know your bees, but more importantly learn to know varroa to better battle them.

COLONY BEHAVIOR

Summer requires the highest amount of vigilance of bee behavior. Their behavior signals a nectar flow, a possible swarm or a failing queen. Sudden aggressive behavior may signal pests. Depressed behavior a dead queen. Bees bearding ready to swarm or just need more ventilation? These are all behaviors to watch for, because when they occur you need to act.

QUEENS

The queen is the pheromone barometer of the hive. Although workers are recognized as the true decision makers, the queen's pheromones, or lack of quality pheromones ultimately drives the workers to action.

Summer is when the queen you breed and raised, or acquired needs to show off her breeding. The queen must have mated well, to have sufficient supplies of quality sperm. The queen must come from robust and hearty stock, laying eggs in strong patterns across the frames. A younger queen may have stronger pheromones, but if you have a queen with queen daughters you've breed which one do you use; the know quality or bet on the new bee?

Figure 46 queen By CSIRO, CC BY 3.0,

Queens dictate the story of the honey harvest. Vigorous queens lay all Spring expanding the colony for expected nectar flows. If you are lucky, you'll have a VSH queen. Her genetics helping keep the varroa count down and the honey gathering strong.

This is the horrible time when a queen is failing and you're in denial, wanting to giver her a couple of more days. When she ultimately fails, did your action delay getting a new queen and increase the chances of developing laying workers, who may never again accept another queen.

This is the time of year you relay on your experience and that of others having the same goals as yourself. Good luck.

SWARMS

'A SWARM IN MAY IS WORTH A LOAD OF HAY; A SWARM IN JUNE IS WORTH A SILVER SPOON; BUT A SWARM IN JULY IS NOT WORTH A FLY'

-English beekeeper proverb

Figure 47 Swarm Figure SWARM By fir0002 at the English language Wikipedia, CC BY-SA 3.0

Beekeepers love to find swarms.

Beekeepers hate their colonies to swarm. What's a beekeeper to do?

Swarming is a natural behavior for *A. mellifera.* Swarming is how a colony reproduces, passing on the queen's genes and behaviors to another generation. Bees also swarm when they don't like the conditions present in the hive: over crowding, major mite infestation, lack of forage, etc.

As a beginning beekeeper, you are constantly being told to inspect "at least" every 14-days. Now is when that advice, and the habit you have adopted pay off. Signs that a swarm may be imminent:

a) Queen cells. Queen cell are usually built at the bottom portion of the frames. They hatch in 16 days

b) Bees are bearding on the front of the hive (and it is not due to the hot weather).

c) There is a sudden growth in the drone population,

d) no new comb is evident

Inspecting your hives, you find 3 or 4 or more occupied queen cells. What to do? First, follow your goals. If honey production is the goal, you want to stop the swarm which will negatively effect honey production. Remove the filled queen cell(s) to a nuc and have the bees raise her. You can remove all the queen cells (making sure you still have a queen) and, maybe, keeping one cell in reserve so that you will have a queen if the hive swarms. You might also place bait boxes to catch your own swarms. Add a deep for more room. Or you could let them swarm. Often, they swarm no matter what you do.

Figure 48 swarm on dead tree GFDL 1.2,

If swarm behavior seems due to over crowding, lack of ventilation, etc. take additional steps which include: checkerboarding, alternating honey filled and empty frames above the brood (never in the brood boxes), making a split (either obtaining or raising a new queen), increasing access to honey supers by adding a top entrance, adding an additional brood box or add space for the forgers to hang out, e.g. a rec room. Often, they swarm no matter what you do.

Another type of bee leave-taking is call absconding – that is the entire colony, leaves. Will discuss this more in Chapter 9 Fall.

FIGURE 1

He is not worthy of the honeycomb
That shuns the hives because the bees have stings.

William Shakespeare, *The Tragedy of Locrine* (1595) III, II. 39

Supersede. Do not confuse supersedure and swarming. Supersedure occurs when a queen fails or dies. Workers immediately look for the youngest egg and attempt to build a queen cell, usually mid-frame. Supersedure mid-frame; swarm at bottom and/or very top of a frame. Not 100%; but 98% reliable rule. If you remove a supersedure cell, the colony will most likely: either abscond, dwindle, or develop a laying worker. None of these options are desirable. If you do remove a supersedure cell by mistake, get a new queen as soon as possible to avoid developing a laying worker. Laying workers only produce drones, causing the colony to fail. While it is great to catch a swarm, no beekeepers want to have their hives swarm.

HONEY HARVEST

<u>Before you begin – ensure that the bees have 60 – 80 pounds of honey for their Winter stores.</u>

Since the discovery of bees and, more importantly their honey, bees have reluctantly shared their bounty with humankind. Early man climbed cliff faces and monstrous trees, for just a taste of honey. They braved stings with just a smoking branch to shield them to keep the bees at bay.

Today harvest is somewhat easier; however, it still requires skill, lots of patience, and a keen desire. Whether you extract using crush and strain, have a flowhive, or use an extractor (motorized or hand crank) the end is the same, get the honey into the bottle. Follow the process in the series of photos[28]

Honey flows faster if you're working in a warm space. Leave extraction for either the first or the last warm days of the season.

First, remove the frames of honey from the hive. A couple of methods are available. Which one you chose depends on the number of hives and the time you have for the harvest:

a) Use a bee escape, which allows the bees to leave the hive but not to come back in. Place it in the top of the inner cover for about 24-hours before you harvest and your suppers should be clear of bees. Place the frames in a container or cover the super and frames as you continue to harvest.

b) Use a fume board. A fume board looks like a simple cover for the hive, however the inside is covered in felt. Drip a drop or two (NO MORE) on the inner felt and place it on the hives. Bees vacate in minutes. Collect the honey laden frames in a covered Rubbermaid bin and get ready to harvest.

c) Use a bee vacuum, or use a low power blower designed to be used with bees.

d) Carefully lift each frame, gently brush away the bees. Finally, place the honey filled frames in a large bin with a cover. You are set.

e) Bring the beeless frames into your honey house, or secured kitchen. Fundamentally, the honey harvest space should be warm, clean, have running water, be screened against bees, hornets, wasps, mice, etc. Make sure that you cover any area you do not wish to wash. Honey, as you know is sticky and will somehow end up on everything (see blue tarpped kitchen to the right).

Once in your harvest space, that has been set-up prior to your getting the frames, prepared to uncap the frames.

Uncapping means removing the wax covering from the cells filled with honey so that they honey can flow out of the cell to the sides of the extractor. Uncapping should be done over an uncapping bin or container which will catch the wax caps and any honey (you will recover an amazing amount of honey from the process). You can uncap using:

a) Hot knife, electrical knife what warms and easily slices through the wax. Use a slight sawing motion as you move the knife

b) A plain knife, that you can dip into hot water to do the same as above.

c) Use a scrapper to simply scrap and uncap.

d) Try and keep the frames warm as you go, warm honey flows more easily

The frame to the right is an example of an uncapped frame. When enough frames are uncapped, and fit into your extractor) you are ready to spin. Spin, because extractors are just large centrifuges.

Extractors come in small and large sizes, depending on your operations and needs. They also come either manual or motorized.

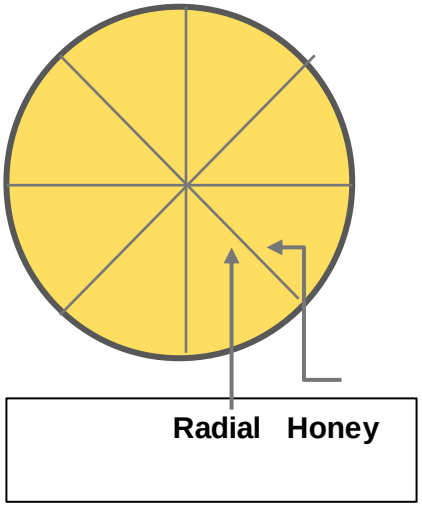
Place the frames in your extractor. Make sure the load is balanced or the extractor will 'buck'. Extractors are either radial or tangential. Radial extractors accept the frame and expose both sides of the uncapped honey to the centrifugal forces. On the other hand, tangential extractors take longer to finish extracting. Tangential extractors only expose one side of the frame at a time. The extractor must be stopped and the frames turned to extract all the honey.

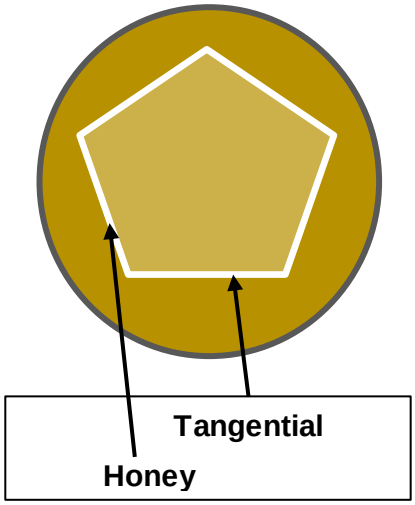
Caveats:

a) Make sure that the honey gate is CLOSED on the catch bucket.

b) A catch bucket is a food-grade plastic bucket placed under the extractor's honey gate to catch the honey. (5-gallon buckets work well.)

c) Make sure you've placed your filters, cloth or metal (to catch bee bits and large pieces of wax in in the catch bucket.





On the next page is a picture of an open honey gate with a catch bucket underneath. Note the large wax pieces caught by the filter cloth. To the right is a metal filter.

After you have harvested all the honey from the frames. The frames may be placed back on the hives for the bees to clean.

Place a piece of clear plastic wrap on top of the honey in the catcher bucket; the plastic wrap adheres to the honey foam and makes it easier to remove. Place a tight sealing lid in the catcher bucket to keep out any additional moisture.

Don't forget to drain the cloth filter material from the catcher bucket and from the uncapper bin. Both should be placed above a bucket or pan to drain. You can get a fair amount of honey from draining.

Bottle your honey on a warm day; the honey flows well on a warm day, but becomes stubborn and viscose on chilly days. Use clean jars with new lids. Make sure you label the jars per Washington state codes. As you prepare your labels, remember that honey weights more than water. Honey weight to volume. Many states (including Washington state) require honey labels to include the fluid oz.

Convert pounds (weight) to fluid ounces (volume). A pound of honey by weight equals, approximately, 11.3 fluid ounces.

Honey labels should also include: Honey source (wildflower, blueberry, fireweed). In addition, labels must include according to the Revised Code of Washington (RCW)

RCW 69.28.050

Containers to be labeled.

It shall be unlawful to deliver for shipment, ship, transport, sell, expose or offer for sale any containers or subcontainers of honey within this state unless they shall be conspicuously marked with the name and address of the producer or distributor, the net weight of the honey, the grade of the honey, and, if imported from any foreign country, the name of the country or territory from which the said honey was imported, or if a blend of honey, any part of which is foreign honey, the container must be labeled with the name of the country or territory where such honey was produced and the proportion of each foreign honey used in the blend. [1939 c 199 § 32; RRS § 6163-32.

You should have your treatment plan in mind by this time

AUGUST DEARTH

Dearth. A dearth means that bees have no nectar, basically, no forage. A dearth often occurs at the end of summer into early fall. Always remember that you are working towards success 2 or 3 seasons ahead. You're not just working the bees in order to address the symptoms of the dearth; you are working the bees to prepare them for season ahead.. You are feeding them so they have adequate food stores for winter. It is difficult for them to make honey or add significant weight in the Fall.

Feed. A dearth means it's time to feed your bees. You must, however, be shrewd and careful. Feed the bees as much as they need, but only use internal feeders. Do not leave the hive open for periods of time. Open feed, get out. Try not to spill any sugar syrup on the hive or around it or the apiary. While your bees are starving, so are all the neighborhood bees. All those bees need is a bit of incentive to start robbing your hives.

Figure 49 DEARTH BY Dominicus

Yellow jacks and hornets are abundant during the same time of year. They will happily take down a colony in a matter of days. Have wasp traps up, have robbing screens in place. It is a tough time for the bees as they prep for the coming Fall and Winter.

KEY POINTS CHAPTER 8

REVIEW

1. Swarming is a natural behavior for bees.
2. The old queen leaves with the primary swarm
3. Honeybee colonies use a “majority vote” to make decisions.
4. Beware of the effects of a late Summer dearth.
5. Pick a warm day for harvesting the honey from your frames.
6. As honey supers are pulled, it is an appropriate time to assess varroa levels and consider treatment

CHECKOUT:

- Seely, Thomas D. (2010), The Democracy of Bees, Princeton, Princeton Press
- Flottum, Kim, (2012) The Backyard Beekeeper's Honey Handbook: A Guide to Creating, Harvesting, and Baking with Natural Honeys, Crestline Publishers
- The Art and Adventure of Bee Keeping (1979) Unity Press, Santa Cruz (Record setting honey harvest).
- Laidlaw, Harry H., (1979) Contemporary Queen Rearing, Dadant & Sons
- Connor, Larry, Queen Rearing Essentials (2016), Wicwas Press
- TOOLS FOR VARROA MANAGEMENT: A GUIDE TO EFFECTIVE VARROA SAMPLING & CONTROL (2015), HEALTHY BEES · HEALTHY PEOPLE · HEALTHY PLANET™ THE KEYSTONE POLICY CENTER ON BEHALF OF THE HONEY BEE HEALTH COALITION. THIS WORK IS LICENSED UNDER THE CREATIVE COMMONS ATTRIBUTION-NON-COMMERCIAL-NO DERIVATIVES 4.0 INTERNATIONAL LICENSE.
- HONEYBEE HEALTH COALITION HTTP://HONEYBEEHEALTHCOALITION.ORG/

Chapter IX FALL

You've pull they honey off the supers, entered it at the fair and did well. Now comes that strange weather period – not warm enough to be summer, hardly cold enough for Winter. Flowers aren't blooming, no nectar; not cold enough to consider clustering (for the bees).

Figure 50 Fall trees By Tommie Hansen, CC BY 3.0,

Fall is not the time to rest. Winter is coming. You've worked through the Spring and Summer to keep your bees, safe and healthy, now is the time to tuck them in for the cold (and wet).

HIVES IN FALL

Fall is time to enter honey competition, time to feed, medicate, clean, buffer, and shelter your bees.

Fair. Fall is the time to enter your local county and state fairs. It provides the opportunity to compare your honey to others, but mostly it compares your skills to bottle and market. Originally, state fair completions rules help local farmers market their honey; making sure that the honey was bottled hygienically and looking well helped it sell. Most fairs have additional completion for honey products (wax, comb, etc.), baking using honey, educational exhibits, others (sewing, body lotions, etc.), meads, and apiary gadgets.

Figure 51 Leaves by Dave Lauretti from

Check out rules and dates for county and state fairs early. Some competitions require multiple entries and specific types of bottles. Read the deadline information carefully. Every beekeeper should enter the honey portion of the fair at least once in their lifetime. Even better if you can make it to and watch the judging.

Judges Score Card	
Division 483: Honey	
Class 7090	Amber Honey
Entry No, 3455	

Sample Honey Show
Judges Score Card

POINTS	SCORE	ITEM
15		Moisture Content _____ (*above 18.6% automatic disqualification*)
10		Freedom from Crystals
15		Cleanliness
10		Freedom from foam and air bubbles
10		Fill (*uniformity among containers*) Appropriate level
10		Containers (*cleanliness, neatness, uniformity*)
10		Flavor (*down-grade for overheating, fermentation, and other objectionable flavors*)
10		Brightness
10		Uniformity of honey
100		
Award		

Feed. Time for vigilance; with the supers off, the weather mild, and bees are still active; they inevitably break into their winter stores. Unless you feed them, they could starve by Christmas. Fall feeding is a 2:1 sugar syrup. Place Winter feed patties as soon as the supers are off. Do not feed protein patties or substitute pollen this will send inappropriate messages to the queen (Protein/pollen = time to lay). The bees need to be fat and happy, and out of the Winter stores.

Medicate. With the supers off, it's also time to medicate for varroa. You may be thinking, I already medicated in the Spring…. why now? Varroa mite populations ebb and flow; the bee population ebbs and flows, but on slightly different schedules. To effectively and efficiently treat the varroas, you should understand the cycles of these dynamic populations.

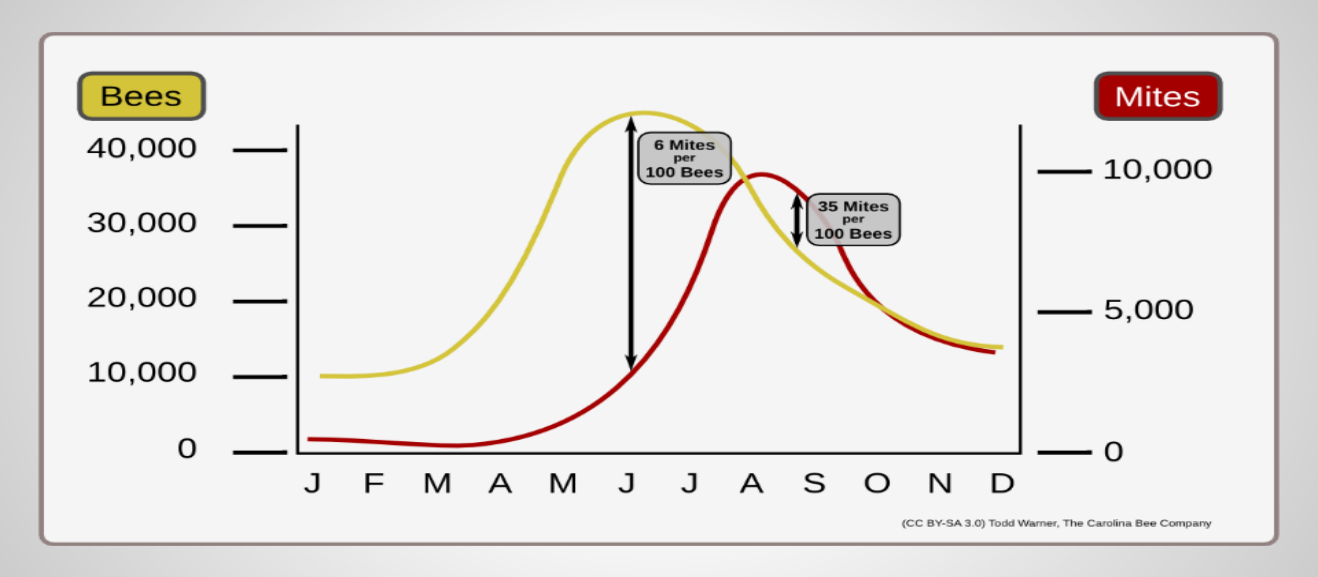


Figure 52 Cycle Drones and Bees *Used with permission of the Carolina Bee Company 2017*

In Winter both bee and varroa population are small. Bees are clustered and the varroa, without any brood to breed on are on the bees (phonetic) or almost non-existent. Spring arrives and the bee population surges, peaking in June. Simultaneously, but more slowly the mites, breed in the brood. Miter populations peak in late Summer/ early Fall. Figure 40 shows the mite population surging, just as the bee population is shrinking. The bee population contracts as the queen slows her laying and the drones are 'asked' to leave the hive. Vulnerable in their reduced numbers, they are tired, there could be a dearth, there could be harassing hornets and wasps. These stressors leave bees susceptible to the viruses carried by mites.

Beekeepers who treat should do so at least twice each year. Once in the Spring (March/April), just prior to the first big nectar flow (June). And once in the Fall (August, September) right after the supers are harvested when mites are at their height. While many varroa treatments fail to penetrate brood cell to kill the varroa, fall treatment will catch the queen as her laying slows. The following tables, developed by the Honeybee Health Coalition, describes the most effective treatment given the season, and the varroa life cycle. In addition to selection the most effective treatment for the time of year, ensure that selection is different from your Spring treatment.

TREATMENTS[29]

Treatments are based on the growth phase of the colony.

DORMANT PHASE	
Bees are clustered; no brood in northern locations with reduced brood rearing in southern locations; all or most Varroa mites are phonetic (i.e., on adult worker bodies, as there is little to no developing brood) and both populations are in decline because there is little or no reproduction occurring within the colony.	
Highly Effective Options: Oxalic acid (fumigation method) Winter or broodless period	Notes: Oxalic acid is best used when there is no brood. Varroa mortality over extended broodless period is high.
Moderately Effective Options: HopGuard® II In beekeeping regions with brood during this phase, Apiguard, or Api Life Var®, or formic acid (MAQS®) provided temperatures are within optimal ranges.	Notes: Little or no independent test results are available for HopGuard® II during the Dormant phase. The formulation has changed each of the last two years. The effectiveness of Apiguard®, Api Life Var® and formic acid (MAQS®) during the Dormant phase is unknown.
Least Effective Options: Anything that risks colony success through this phase Screen bottom board	Notes: Screen bottom board removes a small percentage of mites that fall from adult bodies. These mites are usually post-reproductive and no longer play a role in the reproductive rate or have any effect on the growth rate of the varroa.

POPULATION INCREASE	
Seasonal colony buildup; colony brood population growing rapidly and adult worker population increasing; Varroa mite population usually low but increasing; pre-honey flow supering of colonies.	
Highly Effective Options: Apivar® Apiguard® or Api Life Var® MAQS® (formic acid) Drone brood removal	Notes: Terminate Apivar® after 42 to 56 days of treatment, at least two weeks prior to adding supers. Terminate Apiguard® treatment before adding supers. Terminate Api Life Var® after two or three treatments (7-10 days each). Remove Api Life Var® tablets from the hive at least one month before harvesting honey or, if not using the colony for honey production, treat for full treatment period. It is legal to use MAQS® when storing honey. Strong, populous colonies tolerate drone brood removal two to three times.
Moderately Effective Options: HopGuard® II Colony division; Requeening using hygienic stock; Basic sanitation	Notes: The effectiveness of HopGuard® II has not been widely tested. Dividing the colony during the Population Increase phase will most likely negatively affect surplus honey production. Hygienic queens are not always available. Basic sanitation may help reduce other stressors.
Ineffective Options: Screen bottom board; Powdered sugar, Mineral oil Failure to perform managements	Notes: A screen bottom board does nothing to control a mite population. They are, however, very effective in promoting ventilation in the hive. There is <u>no</u> scientific evidence that powdered sugar or mineral oil has any effect on mite populations

POPULATION PEAK	
Period of nectar flow and rental of colonies for pollination services; bee population (both adult & brood) at peak; mite populations increasing, nearing peak; often honey supers on colonies.	
Highly Effective Options: MAQS® Apivar® or Apiguard® or Api Life Var® (Use is permitted only if no supers are present or colonies are not producing honey.)	Notes: MAQS®, Apiguard® and Api Life Var® are not suitable for use in all temperatures. See the detailed descriptions of products below for temperature ranges for use of these products. Apivar® (amitraz) is highly effective. Be cautious about using it too often to avoid risk of developing resistance.
Moderately Effective Options: Requeening with hygienic stock Division of colonies HopGuard® II Oxalic acid drip	Notes: Requeening or dividing may negatively affect honey production (if colonies are strong enough to produce surplus). Hygienic or locally selected stock is not widely available. The effectiveness of HopGuard® II has not been widely tested. Oxalic acid is best used when there is little or no capped brood in the colony during the Dormant Phase or because of queen replacement that interrupts brood rearing.
Least Effective Options: Screen bottom board Drone brood removal	Notes: A screen bottom board removes a small percentage of mites that fall from adult bodies. Use it in combination with other techniques. Drone brood removal is restricted in this phase by the absence of sufficient drone brood and the difficulty of accessing the brood nest beneath honey supers.

POPULATION DECREASE	
Post-honey harvest; bee population decreasing; colonies rearing overwintering bees. Varroa mite populations growing, peaking, and then declining until eventually only phoretic mites on adult bees after colonies become broodless	
Highly Effective Options: Apivar® MAQS® Apiguard® or Api Life Var® HopGuard® II	Notes: Apivar® should not be used until surplus honey is removed. MAQS®, Apiguard® and Api Life Var® are not suitable for use in all temperatures. See the detailed descriptions of products below for temperature ranges for use of these products. HopGuard® II manufacturer's test data supports its effectiveness
Moderately Effective Options: Requeening with hygienic bees Oxalic acid drip	Notes: Hygienic stock is not widely available. Requeening and dividing colonies may be difficult. Oxalic acid is most effective if there is little to no capped brood present.
Least Effective Options: Apistan® or CheckMite+® Drone brood removal Screen bottom board Sanitation	Notes: Mite resistance to Apistan® and CheckMite+® is well established. Colonies are unlikely to raise drones during this phase. Basic sanitation may help relieve stress.

PREPPING FOR WINTER; PLANNING FOR SPRING

Fall maintenance and care, help prepare the bees for a hard winter, and along with Winter care, prepared them to hit the ground running in the Spring.

1. Address any moisture problems now, do not wait for Winter. For example, moisture boards, quilts with cedar or other absorbent materials.

2. Remove any partially filled supers and remove the queen excluder.

3. Combine weak hives

4. You may want to replace old queens with new, ensuring a vigorous queen for the Spring.

5. Provide both top and bottom entrances

6. Consider addition protection from winds and rains (tents, covers???)

7. Clean the apiary, do not leave a foot-hold for vermin

8. Place your mouse guards.

9. If you are using solid bottom boards, tip them slightly to the front to all moisture to run out.

QUICK REVIEW CHAPTER 9

KEY POINTS

1. State and county fair honey show guidelines/rules were developed for farmers, to learn to market their honey to the public
2. Fall feeding is sugary syrup 2:1, sugar to water
3. Rotate your varroa treatment from the one season to another
4. Get the mouse entrance guards attached.
5. Do not try to winter a weak hive; either combine it with a strong one, or let it go.

CHECK OUT

The Honey Bee Health Coalition, Tools for Varroa Management: A guide to effective varroa sampling and control (2015)

Honey Show Prep (2017) http://www.easternapiculture.org/resources/honey-show-prep.html

Morse, R. and M., Honey Shows: Guidelines for exhibitors, superintendents and judges. (2015)

Roger A. Morse was a professor of apiculture at Cornell and a beekeeper for over 50 years. He researched and consulted in more than 60 countries. Author of other books and scientific articles, Morse died in 2000.

CHAPTER X WINTER CLUSTERS

Provided adequate ventilation; damp kills more readily than cold.

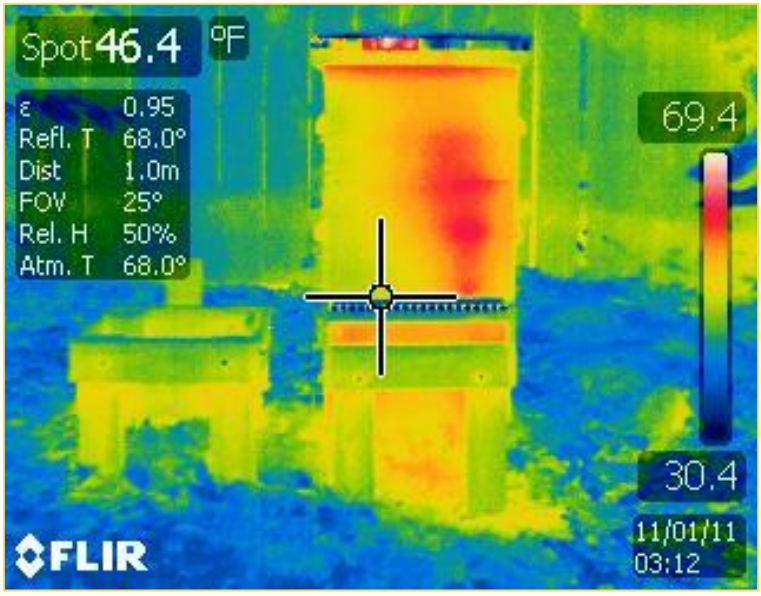


Figure 53 CLUSTER *Credit Chris Beeson, Show me the Honey Blog http://www.littlehouseonthebighill.com/beekeeping/thankyou.php*

In Winter bees form themselves into a cluster, with the queen and any brood in the middle. Heat is produced by the bees flexing their wing muscles; keeping the cluster core at approximately 77° (54° to 98°)[30]. When the outside temperatures are moderate, the cluster is loosely formed; if temperatures plummet, the cluster tightens closer together. Bees continually move from the outside of the cluster to the inside.

As Winter progresses, the cluster moves upward in the hive, maintaining contact with stored honey. Figure 49 provides an infrared picture of a clustered colony, distinguished by their red glow, indicating heat.

The first step in Winter feeding is taking care in late Summer and Fall to feed the colony to ensure they have adequate stores. Winter feeding should be a last resort.

Note, however, that the recent trend in mild Western Washington Winters will keep the colony awake, moving and eating through their Winters stores earlier than expected. If in January, on a clear, calm, and warmish day, you peek inside your hive and the bees are looking at you from the topbars of a deep, better place some food for them immediately. If they are at the top of the hive, they believe that everything below is gone.

Winter feeding may consist of candy boards or fondant placed on the top bars of the topmost hive. (Note that bees cannot take liquid feed when the temperatures are less than 55°.) The candy boards and fondant may have already been placed earlier in Winter, but may require a re-fill. Once you start feeding, do not stop, you are the bees' only source of food.
If the weather remains cold, you may check on your bees by rapping on the side of the hive and listening for a buzz; a stethoscope may be a handy tool to hear they bees.

Bees fail to live through Winter if:

1) They enter the season weak or too small to make an adequate cluster.
    a. Weakened by varroa, hornet attacks, less-than robust queen, etc.
2) Starve
3) Moister promotes disease.

Figure 54 Apiary in Winter credit KU-W

Address these issues in the Fall, Winter may be, and often is, too late to take any meaningful action. Make sure that any honey left in the hive is fully ripened or then bees may exhibit signs of Nosema on their cleanings flights, or worse, defecate in the hive.

If it should snow, remember to go out to the apiary and clear snow from the front entrances. Snow and other debris could block the front entrance and the bees could suffocate.

Winter means cleaning and sharpening your hive tools (yes, they should be sharpened) and conducting maintenance on any equipment.

Winter is also the perfect time for planning next year' goals and for reading. Every book, new or old, will provide a least one piece of beekeeping lore or skill that will enhance your beekeeping skills.

QUICK REVIEW CHAPTER 10

KEY POINTS

1. Damp is more dangerous to bees than cold
2. During temperate Winters, check-on and feed the bees. The mild temperatures will keep them active, and eating their Winter stores fast.
3. The temperature inside a bee clusters ranges from 54° - 98°
4. Clear front entrances periodically.
5. Do not try to winter a weak hive; either combine it with a strong one, or let it go.

CHECK OUT

Overwintering honeybee colonies in northern climates, http://edis.ifas.ufl.edu/in1006

Researchers feed, breed, protect bees to survive winter, http://cahnrs.wsu.edu/blog/2016/11/researchers-feed-breed-protect-bees-to-survive-winter/

Chapter XI Saving the Bees

WHAT TO DO?

As an individual, you can:

1. Plant for bees
2. Not use pesticides
3. Educate you family and neighbors about the importance of bees.
4. Take a beekeeping class

As a beekeeping club, you can:

1. Educate the public about bees, honey, pesticides, forage
2. Get involved with queen breeding programs
3. Plant for bees
4. Support community efforts that support forage and habitat for bees and other pollinators
5. Help new beekeepers get started and involved.
6. Speak to schools and 4H groups

BEEKEEPING RESOURCES

STATE AND LOCAL

STATE BEEKEEPING ASSOCIATIONS –

Washington, Oregon, Idaho, Montana

COUNTY LEVEL BEEKEEPING ASSOCIATIONS –

Pierce, King, Thurston, Lewis, Benton, Chelan, Yakima, Spokane

COLLEGE/UNIVERSITY EXTENSION PROGRAMS

Washington State University - http://extension.wsu.edu/

Oregon State University - http://extension.oregonstate.edu/

University of Idaho - https://www.uidaho.edu/extension

UNIVERSITIES WITH LARGE HONEYBEE RESEARCH PROGRAMS

Washington State University
Cornell
Oregon State University
University of California, Davis
University of Minnesota

NATIONAL ORGANIZATIONS

USDA Agricultural Research Service (ARS) Bee Research Labs (BRL)
https://www.ars.usda.gov/research/programs/

Pollinator Partnership Honey Bee Health Improvement Project supports the United States, Canada, and Mexico's attempts to assuage the depletion of honeybees in the Western Hemisphere.

The **Center for Honeybee Research** in Asheville, North Carolina conducts research looking at the effects of pests on modern agriculture and promotes educational opportunities on the importance of bees in the environment.

Friends of Honeybees promotes local consumer action to support bee-friendly agricultural practices. Through their Buzz for Bees campaign, Friends of Honeybees advocate for financially supporting, locally sourced, and positively farmed products that will aid beekeepers practicing sustainable techniques. The necklaces cost US$12.50 and the proceeds support nonprofits.

Save the Bees campaign started a petition to protect bees and ban the use of bee-killing pesticides. The campaign's goal is one million actions for bees–supporters can sign the petition, order seeds and beehive instructions, or sign up to volunteer.

Save the Honeybee Foundation works to promote sustainable farming practices and educational opportunities for beekeepers and citizens in Oregon and the Pacific Northwest.

The Honeybee Conservancy *thehoneybeeconservancy.org/*

American Beekeeping Federation

1. Promoting the use of honey through a very active honey queen program, which includes selecting a honey queen annually and sending her on promotional tours throughout the country.
2. Publishing an informative newsletter every 2 month.
3. Sponsoring a national honey show each year.
4. Holding an annual convention to transact business and to present an educational and informative program featuring topics of interest and importance to beekeepers.
5. Representing all parts of the bee industry in Congress. Recent efforts have been made to obtain import controls, price support, and a continuation of the indemnification program.

American Honey Producers Association

1. A well-funded bee research program.
2. A smooth-working program of indemnity for losses caused by pesticides.
3. A well-funded honey research program.
4. Honey price support and loans.
5. A commemorative stamp.
6. Protection from imports.

American Bee Breeders Association

This national association of queen and package bee producers was founded in 1948.

Western Apicultural Society

It is designed to serve hobbyist and sideline beekeepers and is patterned after the Eastern Apiculture Society.

Bee Industries Association

The BIA is a national organization of bee supply and equipment manufacturers.

Honey Industry Council of America (HICA)

Of the nine council members, four are elected by the American Beekeeping Federation, two each by the National Packers and Dealers Association and the Bee Industries Association, and one by the American Bee Breeders Association.

National Honey Packers and Dealers Association

The association holds a short annual meeting during the American Beekeeping Federation Convention.

INTERNATIONAL ASSOCIATIONS

Apimondia

International federation of beekeepers' associations consists of more than 50 national associations from most of the major countries of the world. Included are such diverse nations as the United States, Russia, Israel, Egypt, and Zambia.

International Bee Research Association (IBRA)

This research association collects and abstracts all available scientific literature on apiculture throughout the world. IBRA publishes *Bee World*, a quarterly journal for beekeepers; *Apicultural Abstracts*, a compilation of scientific literature abstracts; and the *Journal of Apicultural Research*, an outlet for original bee research papers. The association also publishes books and pamphlets about bee culture.

CHECK OUT

- Researchers travel world to breed a better honeybee, http://www.capitalpress.com/Research/20160922/researchers-travel-world-to-breed-a-better-honeybee

- SUSTAINABLE SOLUTIONS TO PROBLEMS AFFECTING BEE HEALTH https://portal.nifa.usda.gov/web/crisprojectpages/0211900-sustainable-solutions-to-problems-affecting-bee-health.html

- Could a mushroom save the honeybee: http://www.npr.org/sections/thesalt/2015/10/09/446928755/could-a-mushroom-save-the-honeybee

Washington State University takes the problem of CCD very seriously. After all, honeybees are essential to most of the fruit and vegetable crops grown in the state. WSU's Honey Bee Colony Health Diagnostic Laboratory is researching Nosema, the interaction between parasites and pathogens, and the effects of sub-lethal pesticide residues being found in hive combs.

What can gardeners do while researchers try to find the solution to the CCD problem? The Home Garden Seed Association recommends:

1. Planting flowers in clustered clumps at least four feet in diameter. They're more attractive to honeybees and other pollinators.
2.
3. Plant a variety of flowers that bloom at various times, so you'll have flowers that provide nectar and pollen for the bees from spring to fall.
4. Avoid the use of pesticides, even those that aren't highly toxic to bees. Try to manage pest problems without chemicals.

LATE WINTER INTO SPRING

Mahonia	**Primrose (Primula vulgaris)**	**Dicentra**
Winter Aconite	**Bluebell (Choose native varieties)**	**Pulmonaria (Lungwort)**
Crocus	**Cowslip (Choose native varieties)**	**Gorse (Ulex)**
Daffodil	**Snakeshead (Fritillaria meleagris)**	**Rosemary (Rosemarinus)**
Genista	**Winter Honeysuckle**	**Flowering Curran (Ribes)**
Bugle (Ajuga)	**Barberry (Berberis) (Lamium)**	**Winter Heathers (Erica carnea)**
Ground Ivy	**Lenten rose (*Helleborus orientalis*)**	**Snowdrops**

SPRING INTO SUMMER

Forget-me-not (Myosotis)	**Campanula**	**Thyme**
Foxglove	**Crocus**	**Penstemon**
Bistort	**Comfrey**	**Salvia**
Crane's-bill Geranium	**Honey Suckle**	**Hebe**
Poppy (Papaver)	**Sweetpea**	**Allium**
Chives	**Lupin (Lupinus)**	**Agapanthus**
Bugle (Ajuga)	**Rosa rugosa**	**Passion Flower**
Lesser Celandine	**Sea Holly**	**Muscari**
Borage officinalis	**Columbine**	

Figure 55 Sedum

SUMMER INTO FALL

Scorpion Weed (Phacelia)	Nasturtium	Snapdragon	Verbena
Purple Loosestrife	Salvia	Nepeta (Catmint)	Sweet Sultan
Sedum	Verbascum	Bugle (Ajuga)	Watermint
Golden Rod (Solidago)	Veronica	Bergenia	Bergamot
Cornflower	Sunflower	Hellebores	Zinnia
Veronica	Lavender	Hollyhock	
Scabious (Pincushion Flower)			

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ENDNOTES

[1] With temperate winters producing earlier spring weather, colonies may swarm as early as March. 9 Jun 2016: The PLOS Biology Staff (2016) Correction: Honey Bee Inhibitory Signaling Is Tuned to Threat Severity and Can Act as a Colony Alarm Signal. doi: info: doi/10.1371/journal.pbio.1002496http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1000506 Sept

[2] Historically, landowners and beekeepers adhered to strict laws regarding rightful ownership of swarms. Ownership could depend on: 1) where the swarm landed; 2) whether another beekeeper could identify the swarm as theirs; or 3) who found it first.

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[19] Only the queen makes it through the Winter; in the spring, she starts a new colony.

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