Beekeeping in Missouri

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Beekeeping in Missouri

LEONARD HASEMAN

Since the earliest times the honeybee has commanded the respect and admiration of man. While man has tamed and domesticated wild beasts and live stock, he has not been able to change a single habit of the honeybee. It stands today, as in the days of the Pharaohs, a living example of industry, thrift, frugality, and devotion to duty, which man might well imitate.

Missouri’s present extensive and thriving beekeeping industry had its modest beginning when the red men still held dominion over the hills and valleys of the Missouri, the Gasconade, the Osage, and the Grand Rivers. Before Daniel Boone came to Missouri the “white man’s fly” had moved in and taken possession of available bee-trees. Later, when the whites came and settled in villages, many and interesting were the reports of long fall excursions into the unsettled regions for the cutting of bee-trees. Later, farmers learned to save the bees, keeping them in sections of the tree trunks or “gums” in which they were found. Still later, homemade box hives came into use, and today we have modern movable-comb hives.

Missouri today there is widespread interest in beekeeping, for approximately forty thousand persons in this State keep bees. Fruit growers are coming to realize the importance of bees in the orchard. Four editions of an earlier Experiment Station bulletin on “Farm Beekeeping” have been exhausted. To meet this ever-increasing demand for practical information on the handling of bees this publication has been prepared.

Interesting Facts About Bees

The Bee Colony and Its Organization

The honeybee is a social insect; that is, it lives in colonies. Some species of ants and the termites have similar social organizations. This type of colony life is found well developed only among the insects. It represents a very highly specialized type of life, with castes, division of labor, socialized activities, nursing of the young, birth control, control of sex, and the most perfect example of self sacrifice for the common good found anywhere in the animal kingdom. In case of the honeybee, a well furnished nest or permanent home is a part of the colony’s equipment.
The Bee and Its Near Relatives.—Among the insects, the honeybee belongs to the order Hymenoptera, which shows the greatest degree of advancement or specialization. Bees, wasps, and ants form the class of so-called stinging insects. The bumble bee is a rather close relative of the honeybee, though it does not have the same remarkable colony organization. With the possible exception of certain highly specialized ants, the honeybee stands at the peak of advancement among the several hundred thousand known species of insects. In fact, nowhere else in the entire animal kingdom, man alone excepted, do we find the orderly planning and the intelligent carrying out of work displayed by the worker honeybees. Instinct approaching human intelligence is displayed in their various activities.

The Kinds of Individuals in a Normal Bee Colony.—During the height of the season a strong colony of bees may include from 60,000 to 80,000 workers, a few hundred drones or male bees, and one queen. The workers are sexually undeveloped females. This is brought about by the type of food they receive while in the grub stage. They do all the mechanical work of the colony, including the secretion of wax and molding of the comb, nursing the young, guarding and ventilating the hive, gathering food and building materials, and producing and conserving the heat in the winter cluster. The workers and queens are reared from exactly the same type of eggs. These are fertilized eggs, or those which before they are deposited receive a sperm. The drones are reared from eggs with are not so fertilized though, strange to say, they hatch the same as the fertilized eggs.

![Fig. 1.—On the left are the earlier stages in the development of the honeybee. a. Egg. b. Young larva. c. Old larva. d. Pupa. On the right are the three adult or mature forms slightly enlarged. a. Worker. b. Queen. c. Drone. (After Phillips).](image)

It requires about three days for bee eggs to hatch. On hatching, the future workers, queens, and drones all appear as tiny white...
grubs in the bottom of the cells as you look down upon them. The grub destined to produce a queen is fed royal jelly, a very rich food, for 5½ days and then is ready to change to the next stage of development, the pupa or resting stage. This stage is inclosed in a delicate cocoon within the capped-over, thimble-like queen cells. It remains in this stage for 7½ days when the young virgin queen comes forth. The queen requires 16 days to pass from the egg to the adult stage. The worker follows a similar course of development in the small worker cells. It remains a larva for 6 days and a pupa for 12 days, thus requiring 21 days from egg to adult. The drone develops more slowly but has the same type of growth. It remains 6½ days as the grub or larva and 14½ days in the pupa stage, thus requiring 21 days from egg to adult.

The queen is much longer than the workers with the long, tightly stuffed abdomen dragging along on the comb when at the height of egg production. She is not as broad as the drone, but longer. The drones are the thick, heavy-appearing, loud-buzzing bees so abundant at swarming time. They are easily distinguished from the more slender, neat, active, business-like workers. Both the queen and the workers have stings while the drones do not. The sting is the same organ as the long, spear-like ovipositor which projects from the tip of the abdomen of a cricket. In the cricket it is used to place the eggs, but in the bee it is changed into the sting as an organ of defense. The bees use it only as a weapon of defense.

The Brood Nest.—In the modern hive, the same as in the bee-tree, portions of usually the lower combs, forming a more or less spherical mass, are used for rearing the young bees. This is
known as the brood nest. Early in the season there may be only a small patch of brood on one or two combs, but as the season advances it usually fills most of the combs in the brood chamber. In fact, an unusually prolific queen at the height of egg production may require most of fifteen to twenty brood combs.

As the season advances the first brood reared will emerge as adult bees and the queen returns and lays eggs again in these empty cells. In fact, every 21 days the queen resupplies with eggs all the cells used in the brood nest. During the height of brood rearing, on examining a comb taken from the brood nest, it will be found to include near the top bar a narrow strip of cells filled with honey, usually some cells with pollen or bee-bread, and then most of the rest of the comb will be occupied by curving, more or less parallel, strips of cells containing eggs, young brood, sealed brood and emerging adult bees.

Reproductive Processes.—The most interesting thing about the honeybee is its remarkable reproductive processes. It has already been pointed out that normally there is one fertilized egg-laying queen in each colony and that she produces the eggs and is the mother of the colony. The queen is reared in a queen cell from a fertilized egg and, due to the chemical composition of the food she receives as a grub, she becomes a normal, sexually mature, virgin queen when she emerges from her cell. In due time she leaves the hive on her mating flight and is fertilized by a drone. In the process of mating she receives from the drone a supply of sperms and these are stored in a sperm sac inside her body. Here they remain alive and ready to be used in fertilizing eggs throughout the rest of her useful life as a fertile queen. She mates but once and that usually occurs within a few days after she emerges from the queen cell as a virgin.

The queen is thus provided with a lifetime supply of sperms stored in the sperm sac, which connects by means of a tube with the oviduct through which the eggs all pass when they are laid. The eggs are produced in the ovaries of the queen bee, the same as in other animals. They are all apparently alike when first produced in the ovaries but as they pass down the oviduct those which are to produce female offspring, that is, either queens or workers, receive each a sperm, while those which are destined to produce males or drones receive no sperm as they are being laid. Each egg has a microscopic opening at one end, the micropyle, through which a sperm may enter. This is an almost unbelievable method provided by nature in the honeybee for the production of males.
and females. The eggs placed in drone and worker cells appear identical to the unaided eye, but those in the worker cells contain a sperm while those in the drone cells do not. Just how the queen can cause the fertilization of some of her eggs and prevent it in others is one of the many unknown mysteries about the honeybee.

The queen is able, therefore, to actually regulate the sex of her offspring, a thing impossible in the higher animals. The power of the queen to influence the nature of her offspring ceases when she lays the eggs. Then the workers or nurses take charge and work their marvels by varying the chemical composition of the food fed to the worker and queen grubs. By feeding, man can vary egg, milk, and fat production in poultry and livestock, but he has not yet learned what the nurse honeybees have known since the beginning of time. The nurse bees through feeding can check the normal development of the reproductive organs of the future workers and in turn cause them to have a more perfectly developed brain and a different sized body with highly specialized salivary and wax glands and leg structures. In fact, any worker could and would have been a normal queen had it received queen making food when it was a grub.

The Life and Labor of the Worker Bee

Although some observations would lead us to conclude that the worker bee leads a life of ease, the fact remains that during periods of heavy nectar flow the worker is exceedingly active. She literally works herself to death. It is a well known fact that each worker bee is endowed with a limited amount of energy and when that has been used up she dies. During a heavy nectar flow the workers live for only about six weeks. By requeening a black colony with an Italian queen at such a time the beekeeper finds that in from six to eight weeks his old black workers have all died and the new working force consists of Italian workers.

Immature Stages of Development.—In three days after a worker egg has been placed in a worker cell by the queen it hatches. For the next two days it is given an abundance of rich food by the nurse bees. In those first two days it increases in weight twelve hundred times and is then a small curled, tightly stuffed grub in the bottom of the cell. If destined to become a worker, the chemical composition of its food is then changed by the addition of some undigested pollen and honey. This change of diet is responsible for the remarkable differences between a normal worker and a sexually mature queen. During the next three days the hungry
grub is visited frequently by the nurses. During this period its rate of growth is less rapid but in the first five days of larval life it increases a total of almost 2000 times.

When full-fed, the cell is capped over by the nurse bees and the grub spins within this a thin cocoon in which it changes to the pupal or resting stage. This change from the grub to the pupa involves profound internal and external body changes. It is necessary that the food stored as fat by the rapidly growing grub be worked into muscles, legs, wings, eyes, and other external and internal structures possessed by the adult bee. During its life as a pupa, lasting 12 days, all these changes take place. The worker is then ready to cut away her cocoon and the wax cap and emerge. On first emerging from her cell she reminds one of a moist freshly hatched chick. In a few days she is ready to take up work in the hive as an apprentice.

The Young Worker in the Hive.—During her apprenticeship as a worker in the hive she may help feed the queen, drones, and the brood, or she may help clean, guard, and ventilate the hive, or secrete wax and mold it into comb. She is a busy creature but requires some schooling and experience before she is exposed to outside dangers or entrusted with the important work outside the hive. Her schooling, however, is of short duration, for in about a week she is allowed to go out on short play flights to exercise her wings and to become acquainted with the surroundings for soon she will have to take her place with the field workers, replacing some older, exhausted worker. These play flights may be mistaken at first by the beginning beekeeper for robbing or swarming.

Field Activity.—After the worker enters upon the duties of a field laborer she becomes largely a bearer of burdens, though her rich experiences both within and outside the hive enable her to help guide the future destiny of the colony. In the field it is her duty to locate, collect, and carry back to the hive nectar, pollen, water, and propolis. At times she may be forced to go long distances, even several miles, for nectar, though most of the nectar is collected within a mile of the hive. Her sense of smell, sight, and possibly other guiding senses, enable her to go to new places for nectar and to return with her load on a “bee-line” to her hive. Authorities are not in agreement as regards the senses used by the worker in going to new fields for nectar and in safely returning home. In some respects the bee resembles the homing pigeon.
The Old Workers.—As has been said, the workers literally work themselves to death during a heavy nectar flow. At such a time, few live for more than six weeks and may die much sooner. During the less active periods workers may live for several months. When the worker has completed her work and has used up her strength she does not ask for favors from the other busy workers. In the bee colonies there are no old, worn-out, useless workers. Each worker, if her failing strength permits, will usually leave the hive before she dies, or finding her strength gone she drops in the field. This seems a hard and cold practice, but it has no doubt always been so in the bee colony. The busy workers have no time to devote to the care of the old or sick. Stores and time are too valuable to use on any member which is no longer of any use to the colony. When the swarming season is over, a normal colony will dispose of its drones for the same reason.

The Anatomy and Physiology of the Worker Bee

Even the most casual reader or observer cannot help but marvel at the wonderful physical and physiological adaptations of the worker honeybee. In this day of specialization the worker bee is a good example of a specialist capable of doing a number of specialized lines of work. Next to assisting in the perpetuation of the species the worker's chief function is the pollination of flowers. In this work she has no equal. Her body is clothed with branching hairs for picking up and holding the microscopic pollen grains until they are again brushed off on the female part of the same or a different flower. Her legs are also equipped with special structures used in connection with her work of pollen gathering. The front legs have the antenna cleaners, the middle legs a strong spur, the exact function of which is still in dispute, while the hind legs have the complicated set of pollen combs and the so-called pollen basket. While pollination of flowers is carried on automatically by the worker while gathering pollen and nectar as food for the colony, it is the one great service which the bee renders in the wonderful scheme of nature. It is a law of nature that every normal creature must not only earn a living and help reproduce its species but it must also render some service to some other animal or plant. The bee's service is the pollination of flowers causing the setting of fruits and seeds. The storing of surplus honey for man is a service which man himself has stimulated in the bee, and this also assures more bees for pollinizing flowers.
External Anatomy.—It does not seem necessary to go into any great detail regarding the anatomy of the worker bee in this publication, though beekeepers are always interested in such a discussion. In the first case, the bee has a hard external skeleton inside which the soft vital organs are protected. The body is divided into the head region with its eyes, feelers and mouth organs; the thoracic region with the two pairs of wings and three pairs of legs; and the abdominal region consisting of hoop-like segments with the sting at the tip of it. The head is the sensory region, the thorax the seat of locomotion, and the abdomen the carrier of vital internal organs and the organ of defense, the sting.

On the head are located two large compound eyes and three small bead-like eyes placed in triangular position. These eyes are very complicated organs but all have a fixed focus incapable of any adjustment. The antennae, or feelers, carry organs of touch and undoubtedly the sense of smell. The mouth organs consist of the hard mandibles which are hinged at the side of the mouth and the so-called tongue consisting of a pair of maxillae and the lower lip. The mandibles are used for molding wax and for picking up small objects and for holding on to robbers and drones when they are being disposed of. They have smooth, curved cutter edges which are essential in the molding of wax, but are not used for breaking the skin of ripe fruit as some people think. The tongue is so arranged that it can be thrust into the tiny flower cups and through it the liquid nectar is drawn into the mouth and then passed on to the honey stomach.

The wings are provided with very powerful muscles which fill most of the space inclosed within the thorax. These muscles make the wings move very fast and enable them to carry heavy loads. When in flight the front and hind wings fasten together with small hooks but when they alight they unhook the wings and fold them over the back. Each leg consists of nine movable segments as follows: coxa, trochanter, femur, tibia, and five tarsal segments. The last tarsal segment has a pair of strong hooks and between these a soft disc or pad used for walking on smooth surfaces.

On the abdomen the sting is the only external organ and it is kept withdrawn in the tip of the body, except when it is being used. It consists of a pair of microscopic needles propelled by muscles at their base and guided and strengthened by accessory structures at their base. These two needles bear barbs which prevent their withdrawal once they are forced into the flesh of man
or beast. Connected with the base of the needles and emptying its store of poison between them is the poison sac with the poison gland. The sting is a very effective organ of defense. The bee, unlike wasps and some other stinging insects, never uses its sting for killing other creatures as prey but only as an organ of defense. When the worker bee stings an animal, it loses the sting and the connecting organs and dies as a result of it.

Senses Possessed by the Bee.—Most animals, except the lower types, have normally all the five cardinal senses of sight, hearing, touch, taste and smell. The bee undoubtedly has all of these and possibly others which man does not have. They show evidence of a well developed temperature sense and a homing sense or instinct. They are closely connected with the nervous system and are built on much the same microscopic scheme as our own sense organs. The location and function of some of the sense pits is not yet fully understood since the bee cannot talk to us and tell us just what sensations it experiences.

Internal Organs and Their Function.—On the inside of the body of the worker bee are to be found all the organs and systems found in our own bodies and they perform much the same function. She has the circulatory, respiratory, digestive, nervous, muscular, and reproductive systems the same as any other animal.

Her circulatory system consists merely of a heart with valves and a slender tube, the aorta, leading forward from the heart to the region of the brain. Her external skeleton makes it possible for her entire body cavity to form a continuous compartment which is filled with blood. In this way all the internal organs are continuously bathed in blood and the heart merely serves to keep the blood in motion. The blood stream carries food to the organs needing it and uric acid wastes from worn tissues to the kidney tubes which remove them from the blood stream.

Since the blood does not carry oxygen and carbon dioxide, a very elaborate respiratory system is present to carry oxygen to organs needing it and the carbon dioxide wastes from such tissues. A system of air tubes extends throughout the bee's body connecting with the outside world by means of spiracles, or breathing pores, located along either side of the body. These air tubes branch and rebranch and finally connect all internal tissues directly with the supply of air outside the body.

The digestive tract consists of the mouth, three sets of salivary glands, the pharynx, the oesophagus with its honey stomach similar to the chicken's crop, the stomach, the small intestines with
attached kidney tubes, the large intestine or rectum, and the anus. The salivary glands are very highly developed with three distinct kinds. They are supposed to be used by the nurse bees in producing and in varying the chemical composition of the diet for the brood and queen. After the nectar is drawn from the flower by means of the mouth organs, it is passed on to the honey stomach where it is carried by the bee when it returns to the hive. It then regurgitates and stores it in the honey comb. Digestion takes place in the stomach and the nourishment which is used by the bee later passes through the walls of the stomach and intestines directly into the blood stream. The kidney tubes (Malpighian tubes) take from the blood the uric acid or nitrogenous wastes and pass them into the small intestines and they are later discharged with other wastes. The rectum is a greatly expanded organ which serves as a reservoir for holding the fecal matter until the bee has a chance to leave the hive on a cleansing flight.

The nervous system consists of a well defined brain in the head and a ventral nerve cord with its seven pairs of ganglia. From the central nervous system nerves extend to all parts of the bee’s body. The muscular system of an insect is very complicated. In case of the worker bee the wing muscles are the most powerful. They enable the bee to carry a load approaching the weight of her own body. They cause the wings to move so rapidly that the eye cannot follow them. In fact, the high pitch of the tune played by a mad bee is due to the rapid vibration of the wings similar to the vibration of a tuning fork.

In the normal worker bee the reproductive organs are not fully developed or functional but, being a female individual, she possesses the female organs. In case of “laying workers” her organs do become functional and she may lay eggs which, being unfertilized, naturally produce only drones.

The queen, on the other hand, possesses a pair of fully developed ovaries, the oviduct, sperm sac, and vagina, similar to higher animals. The males have a pair of testes, the vas deferens through which the sperms pass to the sperm reservoir and the ejaculatory duct and penis. In mating with the queen, a thing which has never yet been observed in case of the honeybee, the male transfers the sperms to the sperm sac of the queen and then dies as a result of the operation.

The wax used by bees in producing comb is a product of the wax glands of the workers. These are located on the lower side of the abdominal segments and their secretion, at first a liquid,
passes through the body wall and on striking the air forms into flakes in the eight wax chambers beneath the body. These flakes are then used for molding into comb. From their location and general nature they may be likened to the milk producing glands of the cow. The workers which secrete the wax hang in festoons and transform the food with which they are fed into the wax secretion. The amount of honey required to produce a pound of wax has been variously estimated at from five to twenty pounds, so it is important to save the bees the labor of wax secretion whenever possible.

The Yearly Cycle of Activity of the Colony

Most insects pass the winter in a quiescent condition commonly spoken of as hibernation. The honeybee is an exception. It does not hibernate, though when conditions in the hive are proper during the winter it exerts the least possible amount of energy but is always more or less active.

Spring Brood Rearing.—After the severe winter is past the colony makes preparations for the coming spring and summer. A normal colony properly wintered will not rear any brood until signs of spring awaken in the colony the instinct of brood rearing. At first, only a few eggs each day may be laid by the queen. They are usually placed in the center of the cluster or the center of activity of the colony. As brood rearing is increased several of the central combs will be used and eggs and grubs in all stages of growth may be found. Brood rearing continues until most of the space in the brood chamber may be occupied. The height of brood rearing in Missouri may be expected in a properly handled colony just before the opening of the white clover nectar flow. At that time a strong colony may have from ten to fifteen brood combs well filled with brood with perhaps forty to sixty thousand active spring reared workers.

Swarming.—Swarming is a natural activity of bees. It is their method of increasing the number of units or colonies. For the preservation of the honeybee species it is just as important that colonies of bees shall divide or swarm as it is that each colony shall continue to rear workers to replace those which die from day to day.

Usually just about the time that white clover begins to produce nectar abundantly colonies of bees may be expected to swarm, unless the necessary precautions have been taken to prevent swarming. The colony becomes strong, with most of the brood
combs full of brood, with usually a great many drones and then they prepare to swarm. Some queen cells are made and some future queens are reared in these cells. The bees begin to "lay out" on warm days and every indication of swarming is noted.

When everything is ready on some warm day, usually between nine and two o'clock, the old queen and about one-half of the worker bees swarm out and in time cluster on some object. If the beekeeper is on hand, he will hive the swarm. If placed in a hive the swarm soon settles down to work and, since it includes a majority of the older experienced field bees, it may fill the hive rapidly and store more honey than the parent stand. In the meantime, a young virgin queen emerges from one of the older queen cells in the parent stand. Where the colony is not given to heavy swarming this first virgin queen may be permitted to cut open all the other queen cells, after which the workers remove the occupants. This then leaves only one young virgin queen in the parent stand. When conditions are favorable the young queen leaves the hive on a mating flight, is fertilized by a drone, and then she returns to become the new queen and, in time, the new mother of the colony. In this way two colonies carry on where before only one was present. The wise beekeeper plans to keep down swarming where a maximum of surplus honey is desired.

Storing Honey.—To the beekeeper the busy, contented bustle and hum of the bee colony during a nectar flow is music indeed. If each colony is in "pink of condition" when the nectar flow opens the beekeeper will get a maximum of honey. Success in beekeeping depends on having each colony ready when the nectar flow opens.

The field workers go out and collect the nectar from the blossoms. This they carry back to the hive in their honey stomach, as described earlier. This thin sugar solution is then worked into honey by the removal of the surplus water and by the chemical change of parts of the cane sugar to grape sugar. This is termed "ripening" of honey and includes long hours of fanning and manipulation of the nectar. When properly ripened the honey cells are capped and it is then ready to be removed as surplus honey.

In Missouri we may expect first a white clover nectar flow beginning usually early in June, and second, a fall flow of darker honey from heart's-ease, Spanish needle, asters, and the other fall flowers. This usually begins in late August and it may continue until killing frosts. A region is doubly blessed where it has this
second or fall nectar flow. In the first place, it helps to insure a proper supply of winter stores usually of satisfactory quality, and second, it stimulates late brood rearing, which sends the colony into the winter with plenty of fall reared workers.

**Killing the Drones.**—Since the drones are needed only for fertilizing the young queen when she takes her mating flight, they are in the way and of no use to the colony after swarming is over. Occasionally a colony may swarm in the fall, when drones are needed and usually on hand. However, as a rule, when the white clover nectar flow closes, the colony gets rid of its supply of drones. They are no longer fed and cared for, are dragged from the colony, and usually in a very few days they are dead. If any colony has an old, failing queen, which is to be superseded later, they will usually tolerate drones after the strong colonies have gotten rid of them.

**Preparation for Winter.**—As the fall comes on and the nights begin to get cool, brood rearing is reduced. As the combs in the brood chamber become vacant, the bees fill the combs with winter stores. Some colonies are more expert at filling the brood combs with winter stores. In case of early frosts, it is well to leave surplus honey in the supers, which the bees may carry down for storing in the brood chamber.

When everything works properly before winter really sets in the colony will have in its brood chamber from 50 to 75 pounds of winter stores, the combs will be firmly anchored by the use of spur combs, all cracks will be thoroughly sealed with propolis, and the contented guards at the entrance will soon say to the world, “well, we are ready—let winter come.” The wise beekeeper will help make this prediction come true by providing a proper windbreak, if a natural one is not present, and by the provision of packing or insulation to help temper the winter cold.

**Winter Activity of the Bees.**—After the stores are properly placed, the winter seals made, and brood rearing has drawn to a close, the colony is ready to enter upon its winter activities. These consist largely of guarding the stores and providing sufficient heat to prevent the freezing of the queen and the colony. Honey is consumed by the heat producers and it is transformed into heat energy. When the temperature drops to the point where the colony clusters or forms a winter cluster, the bees in the center eat honey and generate heat which is used to keep the whole colony above the freezing point. As the bees on the surface of the cluster are chilled they work into the mass and others from within are pushed to the sur-
face. As the outside temperature drops, the size of the cluster is reduced, resulting in a smaller loss of heat by radiation. This continues through the winter. When the weather becomes warm the cluster may break up, at least during the day, and the old spent workers, which die and drop down to the bottom of the hive, are carried out to prevent their interfering with ventilation. The workers also take cleansing flights to discharge accumulated wastes. These few weeks of winter are trying and the beekeeper, who has the comfort of his bees at heart, will make sure that he has done his part to put each colony into winter quarters in the most favorable condition possible. Plenty of good stores in the right place, plenty of young vigorous workers, a young vigorous queen in a good modern hive in a favorable place as regards winter exposure and preferably some added protection, will usually insure safe wintering. Bees suffer from cold the same as man or his livestock and they deserve winter protection.

Fig. 3.—Hoffman-Langstroth hive. The dovetailed hive may contain either eight or ten movable frames.
The Business of Beekeeping

Making a Start in Beekeeping

For the prospective beekeeper the all important thing is to get started right. As with any other line, there is a right and a wrong way to begin. If this discussion on beekeeping does nothing more than help a few prospective beginners to become proficient honey producers, the writer will feel well repaid for his efforts. Nothing in beekeeping is so discouraging as to find an occasional person who failed to heed the warning "grow, not go, into beekeeping" with the result that he has many dollars worth of equipment piled up for kindling. The average beginner will find that two or three colonies are enough for the first season and some of our most successful beekeepers began with a single swarm.

Essential Equipment.—Even the amateur who plans to keep a few colonies of bees largely for recreation and pleasure should make it a rule that the bees must pay their way. Certainly the beginner who plans to keep bees for profit cannot afford to invest in any unnecessary equipment. The one all important piece of equipment is a good modern, movable-frame hive. In Missouri most beekeepers have found the standard, 10-frame Langstroth, or so-called dove-tailed hive, most satisfactory. Some prefer a larger type hive, however. Make your decision as to the hive you are going to use and then use only that size hive, so that all hive parts may be interchangeable. The beginner is advised by all means to start with extracting rather than section supers. The production of section honey in Missouri is the work of an experienced beekeeper and the beginner should leave it alone until he has had some experience. The average beginner, however, insists on starting out to produce those beautiful pound sections and he is usually disappointed.

Start with extracting supers and for the first few years cut the combs from the super frames and market it as cut-comb honey. When the production justifies, an extractor may be secured. If the standard shallow extracting supers are secured, later they can be used for the production of section honey by simply securing the sections and the section trays which fit them. Equipment may be secured in units of five in the flat and nailed and painted at home, if one is handy with tools and is careful to put the equipment together properly.
Besides the hives, a good bellows smoker should be secured, for the one thing which will give the beginner most courage is a well-filled smoker in prime condition. However, he must remember that smoke is a whip and he should use it sparingly. A bee veil may be bought, though a good homemade bee hat is better. Use any discarded, stiff brimmed hat, sewing to the brim a five-inch strip of black, screen wire and to the bottom of this a strip of thin cloth for tucking under the clothing to keep the bees out. Such a bee hat has never been beaten and one or two extra ones will come in handy when visitors call.

Besides these few pieces of equipment, a hive tool and scraper are useful, though a wide wood chisel or the thin end of a leaf of a buggy or car spring will serve the purpose very well. The use of comb foundation, properly supported by wiring, for securing straight combs is essential. Syrup pails or glass fruit jars may be used as containers for storing or marketing the surplus. Such equipment as swarm catchers, drone traps, queen excluders, hive bases, and hive tool-kit with seat attached are non-essentials which one can very well get along without.

Selecting the Apiary Site.—On every farm and in each town or city backyard may be found a satisfactory place to keep a few or several colonies of bees. If possible, give each colony an east or south exposure and some natural shade though shade boards may be used where natural shade is not available. Place the hives on well drained or sloping ground. Favorable air and soil drainage are essential. Place the hives six feet or more apart, when possible, to prevent drifting. A natural windbreak is fine, where it is available. In town a high board fence may not only provide a windbreak but it also helps to keep the flight of bees up above traffic. On a fruit farm the ideal place for the bees during the blooming period at least is out among the fruit trees.

Face the hives toward the east or south and set them at least six feet apart and a rod is better. A brick under each corner makes a very satisfactory support for the hives. It keeps them off the ground and at the same time does not raise them so high as to seriously inconvenience the loaded bees which miss the alighting board. Be sure that the hives are level sidewise and tilted to the front slightly, so that the rain and moisture in the hive will drain off the front of the bottom board. Under Missouri conditions, it is more satisfactory to winter bees on their summer stands with such windbreaks and packing as the beekeeper finds necessary. In arranging the hives, therefore, select a permanent location for them.
How to Secure a Start in Bees.—Most beekeepers of the present day made their start by catching a stray swarm. Few deliberately planned to keep bees. The opportunity was thrust upon them and the inspiration to keep bees came with the hiving of the first swarm. However, for the benefit of those who plan to keep bees and for the beginner who wants to get more bees, suggestions as to best methods of getting bees will be helpful.

The beginner will usually find that his best means of getting a start of bees is to buy one or more swarms from a neighbor who understands the handling of bees. They will cost him less and he will get helpful advice free. Simply supply the beekeeper with new hives in which to place the swarms. A good swarm will cost about two dollars, and if they need to be requeened, a good Italian queen can be bought for a dollar. If the summer and fall are favorable for honey production, a strong early swarm may store sufficient surplus the first year to pay for the hive, the swarm, and the new queen. Certainly if swarms can be secured locally it is better than to buy package bees from the South in making a start. If swarms are not available, package bees may be purchased. Packages containing two or three pounds of bees and a select untested Italian queen have given very satisfactory results in the Experiment Station apiary. They cost from three to five dollars and require feeding until the nectar flow opens. They should be secured at about the time apple trees bloom, or from the middle to the last of April in Central Missouri. Instructions come with them telling just how to open the package and how to put the bees and queen in the new hive.

The average farm boy will have in mind a much cheaper plan of getting a few swarms of bees. In timbered regions a hive with drawn combs, securely fastened in the fork of a tree during the swarming season, will quite likely become occupied by a colony of bees. It can later be taken home. Another easy way is to watch for runaway swarms, or swarms clustered on limbs of trees during June. Still another plan is to locate bee trees early in the spring or by examining likely trees during the heavy honey flow. Usually permission to cut the tree and transfer the bees can be secured. To cut a bee-tree, wait until about the time fruit trees bloom when there are fewer bees and less honey and brood to transfer. Robbing bee-trees in the fall, leaving the bees to die, should be condemned.
Handling Bees

This brief discussion on the handling of bees is intended primarily for the inexperienced beekeeper. Only general rules or suggestions can be given. Each experienced beekeeper will have his own methods and short cuts and these he may modify from year to year as occasion may demand.

Opening the Hive.—The following general rules should be followed. First, fire the smoker and be sure that the fuel is well lighted. A tight roll of clean “gunnysack”, rags, waste, dry chips or decayed wood may be used. Put on the bee hat or veil and make sure that it is well tucked in to prevent the bees getting in from beneath. While standing at one side of the hive, puff a little smoke in at the entrance. With the hive tool lift the cover slightly at one corner and puff a little smoke beneath the cover. In a few moments the characteristic subdued hum will be noted, when the cover can be removed and the adhering bees shaken in front of the hive with one quick, firm shake of the cover. Place the cover bottom side up on the ground alongside or, if you wish, in front of the hive. In case the super combs are to be examined, carefully pry over a comb to break the seal of propolis and then lift it straight up from the super. If it is too full of bees to see what is wanted, they may be shaken into the super or in front of the hive. After it has been examined, stand it alongside the hive and remove other combs as desired. If an examination of the brood chamber is to be made, return the combs to the super and with the hive tool carefully pry loose the super or supers and set them “crisscross” on the cover, so that few or no bees are crushed. Then, in the same way, remove a brood comb and stand it alongside the hive if more are to be examined. After one has a little experience he can very quickly examine a hive and see what he is interested in.

Handling the Frames.—It should be kept in mind that the combs are easily injured and must always be handled carefully. Sure steady movements without unnecessary jarring of the hives and combs should be used. In handling a comb of brood or honey, particularly a new, comb, do not hold it horizontal but always in a vertical position. With a little practice, after watching an experienced beekeeper handle combs, the beginner will soon be able to properly handle them, even up-ending them and rotating them so as to see all parts.

Uniting Weak Colonies or Nuclei.—There are occasions when it is desirable to unite a nucleus or a weak colony with a strong colony. Each colony recognizes its own workers and will not allow
stragglers from a neighboring colony to enter its hive, unless perhaps when they drift in loaded with nectar. If two colonies are to be united, therefore, they must have time to assume the same odor and get acquainted with each other. This is usually done by separating them with a strip of fine window screen wire or a few layers of newspapers after the queen in one of the colonies has been killed. The queen in one colony may be taken away or killed and the hive body containing the queenless colony placed upon the brood chamber of the other as a super with the screen or paper between. If it is very warm the upper colony should be given additional ventilation and shade. In about two days the paper will be cut away and the bees will slowly mingle, or in case a screen is used it may be removed and the two colonies will unite without much, if any fighting.

Feeding Bees.—While the beekeeper earnestly hopes that the bees will not only store all they need but also a profitable surplus for him, there are times even in the best kept apiaries when some feeding is absolutely necessary. This is most likely to occur when an unfavorable spring catches colonies with their overwintering stores exhausted before a new supply of spring nectar becomes available. Feeding may be necessary at other seasons, however.

Where feeding is necessary, the best food to use is combs of sealed honey taken from strong healthy colonies and held in reserve for feeding purposes. Next to honey, sugar syrup made of clean granulated sugar is best for feeding bees. In cool weather, use about two pounds of sugar to one pint of boiling water. In warm weather, use one pound of sugar to a pint of water. To prevent granulation of the sugar syrup, where fall feeding is necessary, use one teaspoonful of tartaric acid to twenty pounds of sugar used in making syrup. Always be careful that the syrup is not scorched, preferably using a double boiler.

Various types of feeders are available and the different beekeepers have their own methods of feeding bees. Do not expose the feed in the yard for the bees to come and help themselves to it. By so doing, the strong colonies which may need the feed least will get most of it and robbing is likely to be started. All things considered, a shallow pan or a friction top pail full of syrup placed in an empty super above the colony to be fed is the most satisfactory method. If a pan is used, drop plenty of clean chips, shavings, or grass into the pan of syrup to prevent the bees crowding into it and drowning. Two or three very small nail holes in the lid of a friction top pail will permit the syrup to slowly leak out
for the bees to lap up, when the pail is placed upside down in the super. Such feeders can easily be refilled as more feed is needed by simply lifting the hive cover and refilling and replacing the feeder. Such feeders can be used even in cool weather by using packaging around them in the empty super.

Stimulative feeding is practiced by some early in the spring, but it is risky and the average beekeeper will find that better results are secured by giving what feed is needed just as fast as the colony can take care of it and then remove the feeder and empty super and carefully close the hive again. Entrance feeders and bottom board feeders are used, but in that case the feed is placed below the colony where it is always colder and less readily taken by the bees. They also require special bottom boards or extra equipment whereas the shallow pan or pail is usually available.

Transferring Bees.—One may wish to transfer a colony of bees to a modern hive from various objects, such as a tree, the wall of a building, a barrel, box, or regular hive where the combs are crossed. There are two ways in which this may be done. First, the bees may be trapped, or drummed, and smoked out of the old container and placed in the new hive with the view perhaps of letting them later return and rob out the surplus honey for storing in the new hive. Second, the old container may be opened up and the bees, as well as their combs of honey and brood, transferred bodily to the new hive. This requires that the better combs be carefully cut out and fastened into the frames set in the new hive, which is sure to be a messy job the first few times the beginner tries it. Still, it has the advantage of saving all the honey and brood and is done and over with in a short time. However, most beekeepers prefer the first method.

In case one’s time is worth much, the transferring of a colony of bees is never a very profitably undertaking. The transferred colony is worth about the price of a good swarm which will sell for about two dollars and it will take two men an hour or more to make a careful transfer from a box hive, and much longer if a tree must first be cut. However, in case there is a large supply of surplus honey, which is seldom the case, that helps pay for the labor. For transferring it is better to select that time of year when there are the fewest adult bees and the least amount of brood and honey in the hive. That is usually about the time apple trees bloom in the spring. At that season very little is lost, if only the adult bees and queen are saved or transferred.
To transfer a colony from an old box hive or similar container which is readily accessible, smoke the colony lightly and remove a part of the cover or else turn the old box hive upside down. Place a modern brood chamber, containing one or two combs with brood and honey and the rest of the frames with full sheets of foundation, on top of the old box hive as a super. If it does not fit even, as it seldom does, nail thin boards over the cracks. Then smoke the bees heavily from below at the same time, drumming on the old hive with a hammer or club to drive the bees and queen up into the new brood chamber. After most of the bees and perhaps the queen are above, slip a queen excluder between the old hive and the brood chamber so as to keep the queen above, if she has gone up. The workers and queen will find the combs of brood and honey in the new brood chamber and will occupy them and the queen will soon begin laying. Workers will of course return to the old box hive to care for the brood there. If the old hive was turned upside down, a new entrance will be needed and it may be provided between the old hive and queen excluder. In three or four days look for the queen in the new hive, or her eggs in the drawn combs. If neither are found, she was probably not driven up into the new hive with the first drumming and smoking and it must be repeated, first removing the queen excluder. If she is in the super in three weeks the brood below will all have emerged when the old hive may be removed and replaced by the regular bottom board of the new hive. Then the old box can be broken open and any surplus honey saved and the old combs rendered into wax. This takes some time but is perhaps the easiest plan, all considered.

Where bees are in a valuable tree, which cannot be cut, or in the walls or attic of a building, but are causing no annoyance, it will not pay to try to get them out. If they cause trouble they had better be gassed and the entrance closed to prevent another swarm from occupying the space later.

**Moving Bees.**—When for any reason it becomes necessary to move a colony of bees it must be remembered that the field workers will by instinct return to the old location, if precautions are not taken to cause them to note their new location when they leave the hive the first time after being moved. It is important, therefore, to guard against such losses when bees are moved. In case a colony is to be moved only a few feet, the hive may be moved a little every day until the new location is reached.

When the colony is to be moved a few rods, a mile, or several miles, close the entrance late in the evening after all the field work-
ers are home. In warm weather window screen wire folded over to form a V-shaped strip pushed into the entrance and held in place with small nails will confine the bees and still give them ventilation. If they are to be moved far the cover may be replaced with a piece of screen wire held in place with strips of wood. If it is not too warm and the bees are not moved far, one may simply stuff the entrance with a strip of cloth for the short time while they are being moved. However, the hive must not be left closed long or the bees may smother.

For best results, move bees in the cool of the evening. Baled hay wire or strong cord securely tied about the hive will prevent danger of the super or the brood chamber slipping, permitting bees to escape. For short moves simply have a second person help carry the hive of bees. For a longer move, or in case of several colonies, a car or truck driven slowly will not shake up the bees seriously. Place the hives on straw facing the side of the truck and with straw or hay securely packed between the hives and the sides of the truck. On rough roads drive slowly. Do not move bees in cold weather, as the combs are brittle and may be damaged.

After the hives of bees have been placed in their new location, fold back one end of the V-shaped strip of screen wire so as to provide only a small opening through which the bees may escape in the morning and over this throw a little straw or a brushy limb. Then at daybreak when the bees prepare to go to the field they will find the opening and the straw and, in place of rushing out, each bee will note the change and when on wing will fly about in circles learning the new location before going to the field.

Prevention of Robbing.—Nothing is more annoying in the apiary than a bad case of robbing. Bees by nature turn instinctively to robbing when nectar is not available. When a strong colony suddenly finds its field work closed out by a drought the workers do not seem to know how to expend their energy, so begin “snooping” around at the entrances of other hives and, on finding one not fully guarded, they start robbing it. If one attempts to take honey or to handle bees when there is no nectar flow, he is sure to start them robbing. The bees’ mania for hoarding causes them to try and get honey wherever they find it and, as a consequence, the colony which is not able to guard its stores is sure to be relieved of them.

To prevent robbing, avoid handling bees during a drought. If you must go into a colony at such times, do so just before dark and then carefully close up the hive as soon as possible. In hand-
ling bees or taking honey at any time avoid smearing honey around. Do not get in the habit of dropping bits of honey comb at the entrance of the hive or laying it out in the apiary for the bees to clean up. You will regret it later when you set up robbing. Learn to be just as neat and skilled in the handling of bees, as surgeons or cabinet makers are with their work. Bees despise a “messy” keeper.

In case robbing occurs, restrict the entrance of the hive being robbed by inserting a strip of screen wire into it and place a little brush in front of the hive. By reducing the size of entrance to be guarded the weaker colony may be able to protect its stores. In a serious case of robbing the entrance may be closed completely with a strip of screen wire, or the hive may be removed to a more protected place. In case the hive is taken away, put an empty one in its place. Also restrict the entrances of neighboring hives, as the robbers may turn to them. A little thought and effort at preventing robbing during a dearth of nectar flow is much better.

Preparing Bees For the Winter

In Missouri the beekeeper’s greatest single loss is due to faulty wintering of his bees. This is not generally known but it is true, and it is due largely to the beekeeper’s own neglect in properly preparing each colony in advance of cold weather.

A Young Queen and Plenty of Young Workers Essential.—To properly prepare a colony of bees for the winter it is important to begin with a young vigorous queen. If requeening is done in the spring, the queen is usually still strong and active for going through the winter, but many beekeepers prefer to requeen in August so that the new queen will be in the “pink of condition” for building up the colony for the winter. The one disadvantage of requeening in August is the fact that spring-reared queens are likely to be stronger and better than summer reared queens. It is essential that the queen be active late in the fall so that the colony will have a goodly number of young vigorous workers to start into the winter. Old worn-out workers die off with the first severe winter weather, while the young vigorous workers live through to start off the spring work when the queen begins to lay eggs to build up the colony. Each worker bee seems to have just about so much energy and if most of that is spent during the summer and fall in gathering nectar there is little of it left for use in helping to keep the colony warm during the winter. Make sure, therefore, that each colony has plenty of young workers reared late in the season.
Winter Stores.—The next thing to consider is stores. Each colony must have plenty of winter stores and they must be of good quality. Many colonies of bees die because of insufficient good stores properly located for the use of the bees during the winter. For winter stores, nothing equals a good grade of clear honey free of honeydew or other indigestible materials. Sugar syrup made from clean granulated sugar fed to the bees in the fall may be used where a shortage or stores exists, or it may be safely used to replace a poor grade of honey. Amber honey from heartsease, Spanish needle, asters, goldenrod, and other fall plants, is entirely satisfactory for winter stores if it does not contain honeydew, or too much fruit or cane juice or other undesirable materials. The lighter honeys stored in the summer from white or sweet clover are considered better for winter stores by many beekeepers, but a good grade of fall amber honey is entirely satisfactory.

For safety an average strong colony should have from 50 to 75 pounds of honey for winter stores. They may use only 20 to 25 pounds of this during the winter, but when brood rearing begins in the spring, stores are used rapidly. If the spring is backward and bees get little or no new nectar before the white clover flow starts, the extra stores are important. It is much more desirable to leave on plenty of stores, than to be obliged to practice spring feeding. The bees will use only what they need so the beekeeper should not begrudge them plenty. Besides plenty of good stores, it is important that these stores be properly located in the hive. The combs in the brood chamber should be practically full of stores when cold weather comes. Many beekeepers winter in a single brood chamber though some insist on also leaving on a full super. After killing frosts prevent further gathering of nectar there may still be considerable brood in the brood chamber and sufficient stores should be left in the supers which the bees may take below to fill the space as the brood emerges. In case of a prolonged cold spell with perhaps sub-zero temperatures, the stores must be located so that the winter cluster may encircle a sufficient supply to last until it warms up again. In case the spring starts off early and the bees begin to rear brood abundantly and then it turns cold for a few weeks, surplus stores may all be used up and the bees must then be fed promptly or they may starve.

It is seldom that a strong colony of bees with a young queen, plenty of young workers, and an abundant supply of good stores housed in a tight hive ever dies from winter exposure, but its strength may be seriously reduced by winter losses. A colony
containing fifty to sixty thousand bees in the fall is often so reduced that it may have only ten to fifteen thousand workers left in the spring. Every effort should be made, therefore, to give bees proper winter protection to help reduce these winter losses. The best authorities are agreed that winter losses are more serious than any other loss experienced by beekeepers.

![Hives wrapped with roofing felt for winter protection.](image)

**Windbreak and Winter Packing.**—To prevent winter losses from exposure, windbreaks and packing should be used. In selecting the apiary site it is often possible to provide a natural windbreak in the form of a hill slope, hedge, board fence, or the like. The strong winter winds are more serious than the steady cold, since they tend to draw from the hive the heat produced by the bees in their cluster. A windbreak should be provided by all means, therefore, and some additional protection in the form of winter packing will help. In a small apiary of only a few colonies, each hive may be packed in a goods box, or prepared packing cases may be used. With a large apiary of a few hundred colonies, packing is often considered impractical and some beekeepers claim that it does not pay, if a windbreak is provided. In such an apiary if packing is used it must be of a simple type which can be cheaply and quickly put on. Leaves held in place with a strip of chicken wire around the hive and fastened with stakes driven into the ground in front of the hive is a simple and effective type of packing. Weighted boards, strips of tin or roofing felt, placed on top to keep the leaves dry will help. A sack of dry
leaves placed in a shallow super above the bees will help keep the colony warm and take care of excess moisture in the hive. Roofing felt wrapped around and over and under the hive is also a practical protection for mild winters.

**Cellar Wintering.**—In the far north beekeepers find that a properly constructed bee cellar is useful in wintering bees. Under Missouri conditions, all experience and careful investigations show that wintering bees in cellars is less satisfactory than wintering them on their summer stands with a windbreak, and preferably some packing. Where a cellar is used the temperature must be kept reasonably constant so that the bees remain practically inactive but so that they do not cluster. The moisture must also be carefully watched. It is not a simple matter to regulate these conditions and then after it is time to bring the bees from the cellar we may get some severe weather, which proves serious to colonies which are not accustomed to such weather conditions. The labor and expense with the chance of serious mishaps does not justify the use of a cellar for wintering bees in Missouri.

**Nature of Winter Losses.**—The serious nature of our winter losses has already been referred to. The loss of colonies outright as well as so-called spring dwindling, may be due to improper wintering. However, the greatest loss is usually due to the fact

![Small apiary packed in hay for the winter](image-url)
that colonies come through the winter so weak that they cannot be brought up to full strength in time for the honey flow. The careful carrying out of these suggestions on preparing bees for the winter will go far to reduce these losses. Too many of our beekeepers are interested primarily in taking from the bees all they can possibly get without considering the best interests of the bees. Under such conditions winter losses are bound to occur.

Spring Management of Bees

Just as soon as settled spring weather permits, each stand of bees should be given a thorough house-cleaning. Dead bees, debris, excess propolis, and spur combs should be removed. The bees' home needs this spring house-cleaning the same as our own. About the time fruit trees come into bloom this important work should be done. Take a clean empty brood chamber, bottom board and cover. Set the stand of bees to be given a cleaning to one side and place the empty hive in its place. Open the hive and remove one frame at a time going over it with a hive tool or a pocket knife, scraping away all propolis, wax and dirt. Remove any patches of drone cells and press in to line any combs which may not be straight. Set the cleaned frames over in the clean hive, being sure to keep them in the same order in which they were found in the old hive, as it is then too early to spread the brood very much. When the bees and frames are all set over in the new hive, scrape clean the empty hive, bottom board and cover and use them for receiving the bees and combs from the second stand. It is surprising how bees will respond to this spring house-cleaning. While giving the hive the cleaning, check on brood, the queen, amount of stores, and anything else requiring attention.

Any colony which may be queenless or below par should be marked and at the first opportunity requeened, fed, built up, or united as may seem desirable. If the colony has a normal queen but is simply weak because of poor wintering, it may be strengthened by giving it a few combs of sealed brood ready to emerge. Care should be taken to avoid giving a very weak colony too many combs of brood early in the spring as the bees may not be able to properly protect the brood on cool days and nights. One or two combs added at intervals of a week or ten days will soon build up a healthy colony which may be weak. In case the colony is queenless or has too few bees left to justify building up, it should be united with a strong colony as described earlier under handling bees. Do not allow a failing colony to continue to dwindle where
it is possible to build it up or unite it with another colony.

If, for any reason, the bees are slow in building up in the spring a little stimulative feeding and the spreading of the brood may be practiced if the beekeeper is careful and does not go too fast. If stores and a normal queen are present in the hive the natural instinct of the bees will guide them in the matter of spring increase. Stimulative feeding and spreading of brood is dangerous if practiced too early or too vigorously.

It is the beekeeper's duty to help encourage his bees to build up to full strength ready for the white clover nectar flow when it arrives around the fore part of June. It is always the strong colonies, which are properly handled so as to prevent them from swarming, that store the greatest amount of surplus honey. However, swarming requires more attention with strong colonies, especially when comb honey is produced.

**Swarm Control**

Swarming is a natural and essential habit of bees in order to insure the perpetuation of the species. For the perpetuation of the honeybee species it is just as important for bees to swarm and thus increase the number of colonies as it is that each colony shall remain strong. Swarming, being a natural instinct of the bee, can be regulated by man but not entirely prevented in the normal management of bees.

**Factors Influencing Swarming.**—Since swarming is a provision of nature to save the species, we should expect evidence of it to show up just as soon as conditions surrounding the colony begin to oppress or cause it discomfort and that is precisely what occurs. Overcrowding, poor ventilation, lack of shade, lack of storage space, too many drones, a failing queen, all tend to cause discomfort or uneasiness, resulting in the development of what is commonly called the swarming fever.

**Prevention of Swarming.**—If the beekeeper is wise he will plan his spring management so as to remove those conditions which stimulate swarming. This can usually be done without checking the normal building up of a strong colony. Experience and judgment help, but a beginner soon learns to give the bees those small helps which means so much in building up the strength and in conserving that strength until needed. It is always better to prevent the development of the swarming fever than to overcome it after it has been formed. It should be borne in mind that when a strong colony is allowed to swarm or prepare for swarming that
colony has wasted considerable energy, stores, and time and if it swarms it divides its strength just when united effort is needed for storing honey. Swarming should, therefore, be prevented if maximum honey production is desired rather than increase of colonies. Begin early, therefore, to provide the comforts and to remove unfavorable conditions so that swarming will be reduced to a minimum where you are after large honey yields.

Making Increase by Dividing Colonies.—If one wants to increase the number of colonies in his bee yard he can divide colonies at the proper time more effectively than to permit colonies to swarm in the natural way. In making increase in this way it is generally considered best to divide those colonies which are only moderately strong, saving the strong colonies for heavy honey production. If increase is to be made slowly with the addition of only a few colonies each year, simply select a few colonies for dividing and set over into a new hive half of the combs and about half of the bees from the hive used for the division. Take half of the combs, beginning at one side of the hive. Then add to each of the two hives enough drawn combs or frames with full sheets of comb foundation to fill it. Move the new hive to a different place and loosely close its entrance for a time with green grass or brushy limbs. Make the division about the time apple trees are in bloom, and, if honey is scarce in the hives, it may be necessary to feed thin sugar syrup, as described under “Feeding Bees.” One of the hives will have the old queen, the other will be queenless but will soon rear a young queen, or it can be given a comb containing a capped queen cell, or a queen secured from a reliable queen breeder. With a little extra attention and perhaps some building up and stimulative feeding, both nuclei or divisions may be brought up to full strength by the time white clover begins to bloom.

If more rapid increase by division is desired, two or three frame nuclei may be formed and each of these given a queen. It takes longer to build up such small nuclei, but with conditions favorable each nucleus may develop into a strong colony with plenty of winter stores by fall. However, for the average beekeeper the single division of a colony is preferable. It more nearly resembles natural swarming but may be done earlier, permitting each division to work up to full strength for the important honey flow.

The Cure for Swarming.—If bees are properly handled early in the season most swarming can be prevented, but in case prevention fails one may turn to a cure. This may include simply the cutting out of queen cells, the removal of some of the central
combs of brood to be replaced with frames containing comb foundation, or by killing the old queen when the swarm emerges and returning the swarm to the hive. Practice prevention first as it is more practical, and in case of an occasional hybrid or black colony, which thinks more of swarming than of gathering nectar, requeen with a young, vigorous Italian queen.

**Hiving a Swarm.**—The old experienced beekeeper, as well as the beginner, is pretty sure to get very much excited when a colony of bees begins to swarm out. He may not turn to the old practice of ringing bells or pounding on tin pans, but he is sure to rush about getting things ready for hiving the swarm once it settles. He is fortunate if it decides to settle low on a limb or a shrub. Too often it settles high in a tree if one is near. It usually requires but a few minutes for the old queen and the swarm of workers, which go with her, to pour out of the hive. In a few minutes more the air is one working mass of bees. Soon they decide to settle and, as a rule, a few workers first settle, then the queen joins them and quickly the air is cleared of bees and the swarm is in a cluster.
While the swarm is enjoying itself on wing the beekeeper should get his hive ready and, if he knows which hive gave off the swarm, it is a good plan to take from it one or two brood combs with brood and honey but no queen cells replacing them with drawn combs, and place these in the hive which is to receive the swarm. After the swarm settles, if possible, cut off the limb containing the swarm and shake it into the hive or upon a sheet or canvas placed under the hive and allow the bees and queen to enter. If the swarm settles high, a ladder, rope and saw may be needed to get them down safely. If the hive is clean, cool, and without any disagreeable odor, and especially if one or more combs of brood are used in it, the swarm will seldom abandon it. Give them shade however, if it is hot.

In case one finds a swarm hanging to a limb somewhere remote from the apiary, a simple way to get it home is to use a clean gunnysack. Slip the sack up over the swarm and end of the limb. Then tie the mouth of the sack securely around the limb, cut off the limb, and take it home, keeping it shaded if it is a hot day.

**The Problem of Bee Pasturage**

In Missouri a safe and dependable bee pasturage is one of the most important requirements of successful honey production. It is a thing which should be given careful consideration by the prospective commercial beekeeper. This state lies mostly in the so-called white clover belt and is well situated for successful beekeeping on a small scale. There are comparatively few commercial apiaries due largely to the uncertainty of dependable bee pasture from year to year.

**Best Honey Producing Regions.**—Dependable pasture largely determines the honey producing regions in any state. In Missouri the best regions lie alongside the larger rivers and particularly those which tend to overflow wide valleys or swamp areas. In such regions usually there is access to much upland with white clover and sweet clover during the summer, followed with summer and fall lowland pasture. The valleys of the Mississippi and Missouri rivers and the larger north tributaries of the Missouri river provide some of the best bee pasture. However, there are to be found some quite dependable nectar producing regions along the southern tributaries of the Missouri river and even in some of the small Ozark valleys.

**Effect of Cultivation on Bee Pasture.**—In the past when farming was less intense and when greater acreages were left for graz-
ing the problem of bee pasture was less acute. Every time that a pasture with its stand of bluegrass and white clover is plowed up the bees are deprived of that much clover pasture. Unfortunately bees can gather but little nectar from most cultivated farm crops. It is the wild pasture, so to speak, which is most valuable to them. Sweet clover and alsike clover are, to be sure, important nectar-producing crops which farmers grow but when these crops are cut for hay much of the supply of nectar is lost. The more a region is given over to the growing of the usual cultivated crops the less valuable it becomes as a honey producing region.

Overstocking a Region.—Every honey producing region has a limit to the number of colonies of bees it will sustain economically. Regions which are only average good for beekeeping may become overstocked with bees. This is particularly true during unfavorable seasons. While the State, as a whole, in favorable years could easily maintain ten times as many colonies of bees as are now present, in poor years there is not sufficient nectar in most sections for the present supply of bees. Under prevailing conditions, therefore, the large commercial beekeepers find it necessary to scatter their colonies of bees in outapiaries, so as to prevent overstocking their region in bad years. This uncertainty of annual profitable nectar flows is what makes the development of commercial beekeeping unsafe in Missouri.

Succession of Nectar Crops.—Missouri is fortunate in having a very favorable succession of nectar crops. Some years the clover crop may be poor and yet the fall crops may be very good. The spring opens with such pollen and nectar producers as willows, maple, elm, fruits, and basswood, followed by white clover, alsike clover, sweet clover, buckbush, heartsease, Spanish needle, asters, and other late fall flowers. A favorable succession of nectar crops capable of producing some surplus helps to prevent unfavorable climatic conditions from proving so disastrous.

Factors Affecting Nectar Flows.—It is a perfectly well known fact that white clover and the other nectar producing flowers do not always produce an abundance of nectar. Some seasons the pastures may be white with clover and yet the bees store little or no white clover honey. The nectar producing crops vary from year to year, both as to the abundance of blossoms and the amount of nectar in those blossoms. It is also true that plants which produce nectar abundantly in one part of the country may produce but little in another region. Alfalfa and buckwheat are both im-
portant nectar crops in their favored regions but of little value as such in Missouri. It is not entirely clear just what causes a variation in a plant's ability to produce nectar in different years and regions. It is true that proper moisture in the air and soil combined with favorable combinations of temperature and no doubt other soil and air conditions influence the flow of nectar. Too much rain spoils a honey season as well as a drought. Weather favoring a vigorous growth of the crop and an abundance of blossoms followed by well timed showers with warm days and cool nights usually insure favorable flows of nectar. While it is true that nectar flows do vary, neither faulty nectar flows nor overstocking of the region will account for the inefficient beekeeper's failure to get a crop of honey when his neighbor secures a bumper crop. They are often used merely as an alibi.

Growing Nectar Producing Crops.—Except where it is possible to utilize flood lands and other waste areas, the beekeeper cannot afford to grow nectar crops simply for bee pasture. There must be some return through the use of the crop also as pasture for livestock, as forage, for seed, or for other purposes. Sweet
clover used as a pasture crop will bloom and yield much nectar. Where grown for seed it is very valuable as a nectar crop. Alsike clover on wet soil for hay or pasture is usually a heavy nectar produced. Crimson clover where it does well and, no doubt, other legumes will be found of value as nectar crops where they can be grown profitably for seed, hay or pasture. Careful investigations of the question of profitable nectar-producing crops and their culture in Missouri should be undertaken. Until the beekeeper can protect himself against serious losses due to drought and other unfavorable climatic conditions in his region, commercial honey production will continue to be uncertain.

**Bee Products and Their Utilization**

**Producing Extracted Honey**

Until the beginner has sufficient colonies to justify the purchase of an extractor he usually markets his surplus as cut-comb honey, but he may use equipment and the essential manipulations used by the producer of extracted honey. It requires less skill to handle bees in extracted honey production than for successful comb honey production. The problem of swarm control in particular is greatly simplified where extracted honey is produced and, as a rule, it is easier to shape the colonies for successful wintering.

In this case the supers will carry either deep or shallow extracting combs which, when filled and capped by the bees, may be uncapped, the honey extracted, and the empty combs returned to the supers for refilling. It thus saves the production of new combs each time. The busy beekeeper can put on extra supers at the beginning of the nectar flow so that the bees are assured of storage room later without so much attention on the part of the beekeeper. The experienced producer of extracted honey, however, finds that it pays to carefully handle the addition of supers so as to keep the unfilled ones next to the brood nest where the bees can reach them with the least amount of traveling in the hive. Where outapiaries are not visited very often several supers of drawn combs are given to each colony when the season opens and they are taken off and extracted when filled, or at the close of the nectar flow.

Much more extracted honey per colony may be secured than comb honey, but it sells at a lower price and, as a rule, first class section honey is in greater demand on most markets. However,
extracted honey can be held for a later market, where it is unsafe to hold section honey too long. No one can say which type of honey is best to produce, as local conditions and demands for honey vary. It is safe, however, to advise the beginner to learn beekeeping by starting out with the simpler work of extracted honey production.

Producing Comb Honey

Comb honey production is particularly attractive to the beekeeper of some experience who is fortunate enough to have a dependable and heavy white clover flow and whose local market demands comb or section honey. In comb honey production each colony is built up to full strength and when the nectar flow opens

section supers are put on and the bees are literally squeezed or coaxed up into the super for storing surplus. Often a shallow super carrying extracting combs is used to start the bees to storing in the supers and once storing starts the super is lifted and one or more section supers are added beneath it. The one problem to overcome is getting the bees in the super rather than to have them prepare for swarming. The advantages gained by comb honey
production are better price per pound and greater ease of marketing and cheaper equipment. The disadvantages are reduced production, increased difficulty of swarm control, more difficulty in manipulating supers, greater care required in taking off and handling the comb honey.

The Chemical Composition of Honey and Its Use as Food

Honey is produced from natural nectar collected from flowers with, at times, some addition of fruit juices and other plant saps and even honeydew. In the ripening process the excess moisture is removed from the solution and a portion of the cane sugar is changed to grape sugar. The nectar of flowers may contain up to 60 per cent of water and in the ripening process the water content is reduced to 20 per cent or less. Honey is, therefore, a highly concentrated sugar solution and, if protected from moisture, it does not require any acid or other chemical to preserve it. In time, however, honey will normally granulate, releasing moisture of crystallization which, under unfavorable conditions, may permit yeast spores to germinate causing the honey to sour.

Just how nectar is transformed into ripe honey is still under discussion but it is probably brought about by the action of enzymes rather than by an acid. Cane sugar may be changed to invert sugar, levulose and dextrose, by adding an acid and heating the solution sufficiently. The enzyme invertase, or sucrose, which is produced in quantity by the bees, will likewise change cane sugar to invert sugar and at temperatures ordinarily present in the hive. The converting of the cane sugar of nectar to invert sugar is largely accomplished before the bees cap it, though the process may continue even after the honey is capped.

The percentage of the different sugars vary in different honeys but in general it may be said that the chemical composition of honey is about as follows*:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>17.70</td>
</tr>
<tr>
<td>Invert sugar</td>
<td>74.98</td>
</tr>
<tr>
<td>Sucrose</td>
<td>1.90</td>
</tr>
<tr>
<td>Ash</td>
<td>0.18</td>
</tr>
<tr>
<td>Dextrin</td>
<td>1.51</td>
</tr>
<tr>
<td>Undetermined</td>
<td>3.73</td>
</tr>
</tbody>
</table>

In regard to the use of honey, it may be said that, being largely a combination of different sugars, it can be used for practically any purpose where ordinary sugar or syrups are used. In recipes,

however, the presence of moisture in honey must be taken into account and the liquid used in the recipe may be reduced accordingly. Honey is sweeter than granulated sugar. In recipes a cup of honey will sweeten a product as much as a cup of granulated sugar, even though nearly one-fifth of it is moisture. It is most extensively used at present as a substitute for syrups, preserves, jellies, and other sweets as a spread. It goes well on hot biscuits, waffles and pancakes. Since honey consists largely of invert sugar, it is much more readily available as heat or energy food than is cane sugar. Cane sugar must first be digested or converted to invert sugar in the digestive tract. However, it is not true that honey can safely be prescribed as a sweet for all patients who cannot eat cane sugar. Also, it now seems questionable whether honey contains any considerable quantity of vitamins. Still with its valuable mineral content, its invert sugars and attractive flavors, it is one of our most valuable sweets and it should be used more abundantly in the diet. Its more general use as a substitute for granulated sugar would help greatly in the matter of health. We in this country eat entirely too much sweets, but if we must use sugar the invert sugar of honey is much better from the point of view of health. The beekeeper need not hesitate to recommend his high quality honey as a desirable substitute for granulated sugar.

Honey is now available as liquid or extracted honey, as granulated honey, and as comb honey. Some insist on comb honey as they have an idea that the comb adds to its flavor and quality. The comb is merely indigestible beeswax which adds nothing to either the flavor or quality. However, some investigators have reported the presence of vitamin A in comb honey but not in extracted honey. Be that as it may, extracted honey has largely supplanted comb honey on the market.

**Marketing the Honey Crop**

The small producer will market his crop mostly in his own neighborhood, or in nearby towns and cities. If he produces and puts up a neat, attractive package and works for repeat orders he can usually sell his entire crop locally and at a profitable price. Make it a practice never to sell honey off in flavor or color. Use it at home in cooking or feed it back to the bees for brood rearing before the spring nectar flow opens. Remember that honey is a food and is to be eaten so it must be put up clean and in a neat, attractive package. Glass fruit jars make an attractive package for small orders and five and ten-pound pails are very satisfactory
as larger packages for extracted honey. Always try to keep a supply on hand for later or repeat orders and the honey consumers in the community will depend on you for honey year after year.

Roadside marketing for honey is becoming a very attractive method of selling honey. In this case, quality of honey and attractiveness of package are particularly essential. Either a small crop, or the crop from a large commercial apiary, may be turned and at a good price in roadside marketing. Remember that both extracted and comb honey will keep for several weeks, so that the entire crop need not be dumped upon the market. Beekeeping is a more or less hazardous occupation and the beekeeper is entitled to a reasonable return for his crop and if he is thoughtful in his marketing, he can help maintain a satisfactory price so as to receive a reasonable return for his labor.

The marketing of a large commercial crop running into tons or carload lots is not so simple as the beekeeper often is not in position to retail it so must sell in bulk and at wholesale prices which often seem ridiculously low. However, various organizations are attempting to increase the consumption of honey which will help improve marketing and the price of honey.

**Bees for Fruit Pollination**

The one major function of the honeybee is the pollination of flowers. In order that it may most effectively perform this function the honeybee is clothed with branching hairs and equipped with pollen gathering structures. Also, to insure that the bee will not neglect its duty it is so constituted that in the wild state it must have the pollen and nectar as food, so it is obliged to visit flowers. The beekeepers will find it greatly to their advantage to cooperate with the fruit growers in securing and using bees for orchard pollination.

**How Bees Pollinize Flowers.**—The blossom of seed producing plants normally contain both male and female parts. The pollen grains are produced by the male parts of the blossoms and they are usually microscopic in size and more or less sticky. In order that a flower be pollinized, or that the ovules be fertilized so that normal seeds may develop, the pollen grains must come in contact with that part of the blossom known as the pistil, the outer exposed part of the female part of the blossom. While crawling over or into blossoms in search of nectar and pollen, the hairy legs, body, head and mouth organs of the bee pick up thousands of the tiny pollen grains and when the same bee visits a second blossom
of the same kind some of these pollen grains are smeared on the exposed pistil. In time these pollen grains germinate, each sending a structure down through the pistil to the ovule which it fertilizes the same as the sperm fertilizes the egg. Besides the honey bee, various solitary bees, flies and butterflies visit fruit blossoms and help some in the pollination work when weather conditions are favorable. However, when the weather is cold and rainy during fruit blooming time, the honeybee is the only insect that helps much with fruit pollination. In such springs, honeybees are indispensable in the orchard. A poor set of fruit following unfavorable pollination weather may be due largely to a scarcity of bees, or their inability to get to the blossoms to scatter pollen.

**Distribution of Bees in the Orchard.**—Since the bees are needed most in seasons of unfavorable weather for pollination, it is important that they be so placed that they can get from the hive to the blossoms and back again with least exposure. For best results, the colonies should be scattered so that the bees can easily reach all parts of the orchard in spite of the weather. A strong colony of bees will take care of from one to five acres of orchard, depending upon the weather. The bees are needed in the orchard for only a few days. They may be moved in after the cluster bud spray
is applied and preferably removed before the calyx application is begun. Such being the case, they might just as well be scattered in units of two to four colonies throughout a large orchard. In a small orchard of twenty to forty acres it is not necessary to scatter them about as in a large orchard. If the grower plans to keep them in the orchard permanently they should be placed so as to interfere least with the men and teams while applying sprays, or doing other work in the orchard. If possible, place them in the northeast part of the orchard so the prevailing southwest winds will bear the odor of the fruit blossoms to them in the hive. It is better to enable the bees to fly into the wind when they go out to secure a load of nectar and to return with the wind. Bees work mostly in a radius of one mile from the hive but in bad weather during the period of fruit bloom the orchardist should arrange so that they do not need to fly more than twenty to forty rods in reaching all parts of the orchard.

Fig. 11.—Honeybee and white clover blossom.
How Fruit Growers May Secure Bees.—Many fruit growers have for years recognized the value of hives of bees in or near the orchard and they already have bees for pollination purposes. Those who have been getting poor sets of fruit should plan on securing bees to help out. If there is a practical beekeeper near, his help should be enlisted. A reasonable price per colony may be paid to him for placing his bees in the orchard during the blooming period. If he is unwilling to move his own bees into the orchard, he may be willing to help handle package bees which can be secured from the South. In return for his services he may be paid a wage, or some arrangement may be made whereby he will take over the packages of bees in payment for his services.

If the assistance of a skilled beekeeper cannot be secured, the grower or one of his helpers should learn to handle bees. If a permanent apiary is to be established the necessary equipment, as discussed earlier, should be secured and placed where desired in the orchard. Then if the necessary bees cannot be purchased locally, package bees should be secured. Where a large number of colonies are needed, three or preferably five-pound packages will prove most satisfactory. These should be ordered well in advance of the date of fruit bloom with the understanding that they will be delivered on short notice when needed. Printed instructions accompany packages of bees telling how to care for them when they arrive and how to transfer them to the hives. If the weather is unfavorable when they arrive, keep them in a well ventilated, dark place where it is not damp and, if it is cold, cover them with a canvas until it is favorable for transferring them to the hives. However, get them into the hives just as soon as possible after they arrive. In transferring them to the hives try to avoid getting too many of the bees in the air and throw some straw or other loose obstruction over the hive entrance. Feed them until the fruit begins to bloom and then force them to get their food from the blossoms. After pollination is completed they will require further feeding and should be handled as discussed earlier in this report.

In case the fruit grower does not wish to establish a permanent apiary he may simply order packages of bees each year, placing them in the orchard in the package in which they arrive and after pollination is completed give them to some one interested in starting an apiary, or otherwise dispose of them. In case they are secured in the regular screen wire cages, heavy tar paper should be wrapped around them to protect them when they are set out in
the orchard. If they arrive in a regular wooden package for orchard use, these packages may be set out in the orchard as regular hives. The assistance of a skilled beekeeper is to be preferred and in most fruit sections in this State such help is available.

Spray Poisoning of Bees.—Arsenical sprays used to destroy the codling moth are also poisonous to honeybees. For best results, therefore, the bees should not be left in the orchard when spray applications are being made. Some confine their bees to the hives by placing a strip of window screen in the entrance during the spraying periods. This is not entirely satisfactory or safe during hot weather. As a rule, it is the calyx application which poisons most bees. Where bees are exposed to spray danger the calyx application should not be made until practically all blossoms have dropped their petals and even then some bees may be poisoned. With later cover sprays during hot weather make sure that there is a supply of water in reach of the bees so that they will not sip the spray solution from the foliage and grass. Many experienced beekeepers absolutely refuse to supply their bees for orchard pollination because of the danger of poisoning. In a large orchard of early and late blooming varieties it is practically impossible to time all of the sprays so as to avoid some injury to bees if they are left in or near the orchard during the spraying season. Where lime-sulphur is used in the sprays as a fungicide its odor helps to repel the bees from the late blossoms. While severe poisoning of bees at times may occur, the experience of fruit growers, who keep their own bees, indicates that spray poisoning of bees is of less importance than is generally supposed. Where bees are moved into the orchard for pollination purposes and then removed, they should be taken at least two miles from the orchard and in moving them follow instructions given under “Moving Bees.”

Beeswax

Beeswax is a fatty substance produced as a liquid by the wax glands. When it exudes through the wax plates on the lower surface of the body of the worker bees it solidifies as small, flat, rounded flakes of wax. These are then removed and after being worked by the mandibles are ready to be used in the building of comb. Wax is a product from the bee’s body, the same as milk and butter fat are produced by the cow. The bees gather nectar, pollen, water and propolis, but they secrete the beeswax.

Beeswax is absolutely indispensable to the bees. It is used in the manufacture of the comb without which the honeybee would
be helpless. It is also used to a lesser extent for building spurs to hold the combs rigid and along with the propolis it may be used to seal cracks and water-proof parts of faulty hives. It is really a marvel what the bees can do with this soft pliable wax. They can take less than two pounds of it and construct a framework of combs which will support about 75 pounds of honey and brood.

Outside the hive beeswax is an article of considerable importance to humanity. It is used in the manufacture of various polishes and tons of it are used each year in the production of comb foundation to be again returned to bees to assist them in the production of new straight combs. Beekeepers should save all waste comb and render it into beeswax as it will go far in helping to pay for necessary new equipment. By keeping a basket or pail handy all pieces of spur and bur comb, as well as broken combs and patches of drone comb cut out when the hives are given the spring cleaning, may be saved and later rendered. For rendering, a small solar wax extractor is satisfactory in a small apiary.
tities of wax are to be rendered, boilers and a wax press are necessary.

**Queen Rearing**

Most commercial beekeepers prefer to buy their queens since they find it is cheaper, as a rule, than to rear them. On the other hand, the home rearing of queens offers wonderful opportunities for the beekeeper to select from his apiary those colonies which for one or more reasons prove most desirable and then breed queens from these. If he keeps down drone rearing in the inferior colonies and allows certain desirable colonies to produce drones he can, to a large extent, regulate mating and always aim at a building up of a better race of bees in his apiary. Commercial queen men do more or less careful breeding, but their job too often is one of getting enough queens reared for their orders. The careful beekeeper can by selection produce his own queens and always direct his attention at improvement in the race. Unless he is interested in breeding up, however, it is doubtful if the busy beekeeper is justified in spending his time at rearing queens.

Under present conditions with its nation-wide breeding and popularity the Italian bee with its three types, leather, threebanded and golden, is perhaps the best all-round race for Missouri conditions. However, it is not perfect and with further breeding and selection it can no doubt be improved. Also work should be done looking to the possibility of crossing and selecting strains that may show improvements over the common strains of Italians. It is also highly desirable that careful breeding and testing be done with other old world races to determine their merits under Missouri conditions.

In rearing a few queens for home use, a simple method is to take the queen from one of the most desirable colonies, forming a nucleus with her and perhaps one comb with adhering bees. The colony finding its queen gone will begin to produce queen cells around selected grubs or eggs. In from five to eight days a number of queen cells will be capped. A frame with one or more of these may be introduced in a hive that is to be requeened, in exchange for one of its brood combs, always leaving all adult bees in their own hive. In case several queen cells are formed on a comb, some may be carefully removed by cutting out a patch of the comb surrounding the queen cell and one of these may be carefully grafted into a brood comb in a hive to be requeened. The old queen in a hive to be requeened must be killed before the queen cell is introduced. In due time the young virgin queen emerges and, if pre-
cautions have previously been taken to allow only the better colonies to rear drones, she will normally mate with a well bred drone and in time will become the new mother of the colony and will produce desirable offspring. After all the queen cells are removed from the parent hive the queen and attendants may be returned or the parent queen may be introduced into a hive for requeening and one queen cell left in the parent hive to supply a new queen. The apiary may be entirely requenened, eliminating all undesirable stock, with but little waste of time and labor of the various colonies. To be sure, more elaborate methods may be employed similar to those used by commercial queen breeders, but the beekeeper who wants to requeen a few colonies and is not interested in producing queens for the market will find the above method simple and satisfactory.

Introducing the Queen.—It is a relatively simply matter to introduce a queen and yet even experienced beekeepers often find it difficult to find a small active black queen in a colony to be requeened. When a colony is to be requeened the first thing to do is to find the old queen and pull her head off. To find the queen use but little smoke and with least disturbance remove and carefully examine two or three of the central combs first. She is usually on one of these. If she is not located, remove and quickly but carefully examine each of the remaining combs. In case she is not located on the combs, look for her among bees collected on the side or in the bottom of the hive. A small, nervous, black queen readily leaves the combs and when moving about among the workers she is not easily seen. If repeated examination fails to locate her, put a queen excluder between the bottom board and brood chamber and shake the bees in front of the hive. The bees will pass through the queen excluder while she ordinarily cannot and will be trapped there where an hour or so later she can be found and killed.

After the queen has been killed the new queen or a queen cell may be introduced in the colony. A queen cell or a recently emerged virgin queen will usually be accepted without protest, but a new fertile queen is likely to be killed. She should be introduced in a cage from which she cannot be released for two or three days. The regular mailing cages are used for this purpose and on each of these is attached brief directions as to care and introduction of the queen. Remove the cardboard strip and cork which close the escape hole in the end of the mailing cage containing the feed and either lay the cage screen side down over one of the spaces between the top bars in the hive, or suspend it between two of the combs.
in the brood chamber. In about 48 hours, as a rule, the bees will eat out the feed in the end of the cage and release the new queen and accept her. If a home reared queen is to be introduced, she may be placed in a small roll of screen wire with one end folded over to close it and the other plugged with a little beeswax or fresh comb and this placed in the hive the same as described above. It is not a good practice to use short cuts in the introduction of valuable queens.

**Enemies of Bees**

If the honeybee could only talk there is no doubt that it would name man as its greatest enemy. In spite of all his interest, good intentions and sentimental expressions, man has been and is a real foe to the bee. As with everything else which he tries to dominate his one thought is not what good turn can I do for the bee but how much can I get from it with the least outlay of time, labor and cash. Any comfort he provides for his bees is apt to be considered in terms of extra pounds of honey it will bring him. If he finds that he can make more by gassing his bees in the fall, selling all the honey, and buying package bees again in the spring, that is certain to become an accepted practice. Another complaint which the bee might properly lodge against man is his recognized ignorance of her real nature and ways and his neglect to either study her or to help make it possible for others to investigate her. Practical beekeepers are not the only ones guilty of such neglect. Mismanagement of bees through ignorance coupled with wilful neglect, due largely to laziness and indifference, are inexcusable and the cause of greater bee losses than all other enemies combined. Winter loss due to faulty management by the beekeeper is the greatest single loss.

**Wax Moths and Other Enemies**

To be sure, not all losses in beekeeping are due to man. Since the bee is an animal, it is naturally subject to attack by other animals and by parasitic plants. However, the honeybee and its close relatives, the ants, due no doubt to their colony life, great energy and activity, and parental care of the young, seem to be the nearest free of attack by both diseases and animal enemies of all insect life. Such enemies as birds, toads, skunks, mice, robber
flies, ambush bugs, and ants may be practically ignored in good apiary management. The wax moth, considered by some keepers of bees as a great enemy of beekeeping, works only in unprotected combs whether they be stored or in a hive where the colony is queenless, or so reduced in strength that the bees cannot protect all combs. The wax moth is not a problem in normal, strong colonies. Where it is troublesome, stored combs should be fumigated or otherwise protected from the moths which lay eggs to produce the caterpillars which feed on the combs. Seriously injured combs should be rendered as wax and the hives and supers thoroughly cleaned. Keep all colonies strong with a vigorous queen and the wax moths will not injury them.

Bee Diseases

With reference to the so-called diseases of bees it should be said that the literature discusses a considerable number, some of which are really cases of injury by animal parasites. The Isle of Wight disease is caused by a microscopic mite working in the respiratory system of the adult bee. It is not a disease at all, therefore, but the parasitic work of a tiny animal closely related to the common chigger. Likewise, the so-called Nosema disease of adult bees is supposed to be due to a microscopic protozoan found commonly in the digestive tract of bees and, under certain conditions, it is thought to cause losses. Arsenical poisoning of adult bees might also be classed in the same category.

In case of brood diseases, the so-called American and European foul broods are the two most feared and discussed. They are now pretty generally considered to be the effect of two different species of bacteria. The second is usually cleared up by heavy feeding of affected colonies, or by building up their strength by uniting colonies. It is most prevalent in regions where early favorable spring nectar flows are absent or during backward springs where such nectar flows occur. Good management will usually prevent serious losses. American foul brood, on the other hand, is not so easily eliminated from an apiary or a colony of bees. There is still a difference of opinion as to just what bacillus causes it and much is still to be learned about it and its control. Once it is introduced into a hive the bees seldom eliminate it, though in favorable nectar seasons it may cause but slight damage. As a rule, in unfavorable seasons it causes greatest damage. It is supposed to be introduced with honey robbed from an affected colony, or secured elsewhere. If any beekeeper finds dead brood in the
brood combs, which he is sure is not due to chilling or other exposure, he should send a sample of the comb including dead brood to the Bee Culture Laboratory, Bureau of Entomology, Washington, D. C., and ask for a diagnosis of the condition.

If a colony is affected it may be shaken off its combs and into a new hive with frames containing either part or full sheets of comb foundation and the old combs then rendered as wax, saving any honey for human consumption. Some treat affected combs with formaldehyde solutions but the average beekeeper will do well to leave such treatment of combs alone. The idea in shaking the bees onto foundation is to make sure that all honey carried over will be used in drawing out comb. Inoculation seems to be associated largely with the transfer of honey. In place of shaking, some experienced beekeepers find that it is easier to cage the queen in a hive body placed behind and just above the hive being treated and then slide the cover so as to leave a crack at the back edge and smoke the bees out of the affected hive and up and into the new hive. This eliminates the chance of robbing or the scattering of honey where the combs are shaken.

Other so-called diseases, such as dysentery, paralysis, sac brood, pickle brood, etc., are usually traceable to mismanagement, faulty stores, or other usually preventable causes. There are a number of federal publications dealing with bee diseases and their control which may be secured by writing to the Division of Publications, U. S. Department of Agriculture, Washington, D. C.