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BEEKEEPING IN KENTUCKY

A house apiary.

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Beekeeping in Kentucky

By W. A. Price

ANYONE CAN ENGAGE in beekeeping successfully who first makes himself acquainted with the habits, instincts and behavior of bees. An understanding of these essentials is necessary for the proper manipulation of the colonies. Much information can be had from literature on the subject of beekeeping but the most fruitful source of knowledge is the intimate study of the bee itself.

HOW TO GET BEES

It is often possible to get bees from a beekeeper near home. Care should be taken that no bee disease is present. If there is any uncertainty about the freedom from foul brood, an examination by the State bee inspector should be requested.* Colonies so purchased may come in movable-frame hives, skeps, gums, box hives or barrels. If they are in anything except a movable-frame hive, they should be transferred according to methods described later in this circular. Colonies may be secured, also, at swarming time by placing empty hives in the yard of a beeman who will fill the hives with first swarms, those which come in late May and early June. If the bees so purchased are not the kind wanted, it is an easy matter to requeen with the desired stock. The Italian race is uniformly popular and generally recommended.

Bees may also be obtained from dealers in combless packages. Such packages are sent now either by express or by parcel post. A two-pound or a three-pound package of bees received ten days before fruit bloom should produce nearly as much surplus honey as a normal overwintered colony.

When package bees are purchased, they should be removed from the post office or express office as soon as possible and transferred to the hive. If it is impossible to hive them on the day they are received, they should be kept in a cool, dark room if weather is hot or in a room not warmer than 70° if it is cold, and then liberated in the hive the following day. This hive should have five or six frames with full sheets of foundation. On top of these there should

* Apply to the State Entomologist, Experiment Station, Lexington, Ky.

be placed a ten-pound pail (friction top) feeder filled with syrup. An empty hive body makes up the second story. The package, opened to release the queen and bees, should be placed in the lower hive body in the space ordinarily occupied by four or five frames, and the front entrance of the hive should be contracted to prevent robbing. Within a few hours, the bees will have left the shipping case and gone to the frames. The case can be removed after seven days and the space filled with frames. If, for any reason, the queen has not been released from the cage, let her run out among the bees.

Before opening the package, the bees should be fed by spraying or brushing sugar syrup (2 parts sugar and 1 part water) on the wire screen of each cage. Continue to feed until the bees are gorged. This will quiet the bees and make them easy to handle.

At the time of opening the shipping case, the queen cage should be prepared for the liberation of the queen. Remove the metal and paper covering the candy hole in the end of the cage. Punch a small hole with a lath nail thru the candy and place the queen cage, candy end up, between the top bars of the middle frames.

The names of reliable dealers in bees can be had from any bee paper. It is suggested that the beginner start with not more than four or five colonies. He can increase as his ability warrants and the proceeds of the enterprise permit.

LOCATION OF THE APIARY

There are two requirements for a good location for bees. First, there should be shade, and second, protection from cold winds. Shade is essential to keep up the morale of the colony and to prevent swarming. The cold winds in the spring and winter are detrimental to the colony by causing chilled brood in the spring and general loss of colony strength in the winter. For these reasons, the colonies should have protection, especially from the north and west winds. This can be given by placing the hives in naturally protected places, such as hillsides and valleys. Where possible, they should have an exposure east or south. Groves, buildings and board fences make good windbreaks. Hives should be placed on bricks, tiles, cement blocks or anything else that raises them two to three inches off the ground.

An apiary should be located near as many nectar-secreting plants as possible. This point is more essential to the commercial beekeeper than to the beginner or amateur. However, it is always an important factor in the success of the enterprise and should be kept in mind. Bees will fly a distance of two or three miles or even farther for nectar and pollen. The pasture of a given colony is, therefore, a circle four or five miles in diameter, the colony being in the center.

HONEY REGIONS OF THE STATE

Bluegrass. White clover, the most valuable honey plant in Kentucky, growing in practically every section of the State, is especially important as a nectar-producer in the Bluegrass section and northern Kentucky where many of the native honey plants have largely disappeared. In this general area, black locust, maples, sweet clover, alsike, asters, smartweed and goldenrods play a large part in honey production. Less important sources of nectar are birch, honeysuckle, blackberry and miscellaneous ornamentals.

Mountains. In the eastern and mountainous section of the State, the native wild plants constitute the important sources of nectar. Of these, the basswood and sourwood are the most important with yellow sweet clover, black locust, redbud, maples, tulip poplar, smartweed, persimmon, spanish needle, mints, partridge pea, sumach, goldenrod, sand vine, serviceberry, blackberries and asters contributing to the honey yield in that area.

Central and Western. White clover, alsike, asters and yellow sweetclover are important sources of nectar in these parts of the State. Others are smartweed, mints, spanish needle, goldenrods, buckbush, wild indigo, bonesets, alsike, buckwheat, yellow-wood, sand vine and wild cucumber.

Without respect to location, the following additional plants are listed as sources of honey and pollen in the State: dandelion, bush fruit blossoms, fruit-tree blossoms, ironweed, beggarticks, willow, melon, cucumber, teasel, cowpeas, soybeans, figworts, thoroughworts, hawthorns, elms, apple, wild black cherry, elder, alfalfa, vetches, thistles and sunflowers.

BEGINNER'S EQUIPMENT

The beginner will make no mistake in adopting standard hives and equipment at the outset. Reasons for this advice are many.

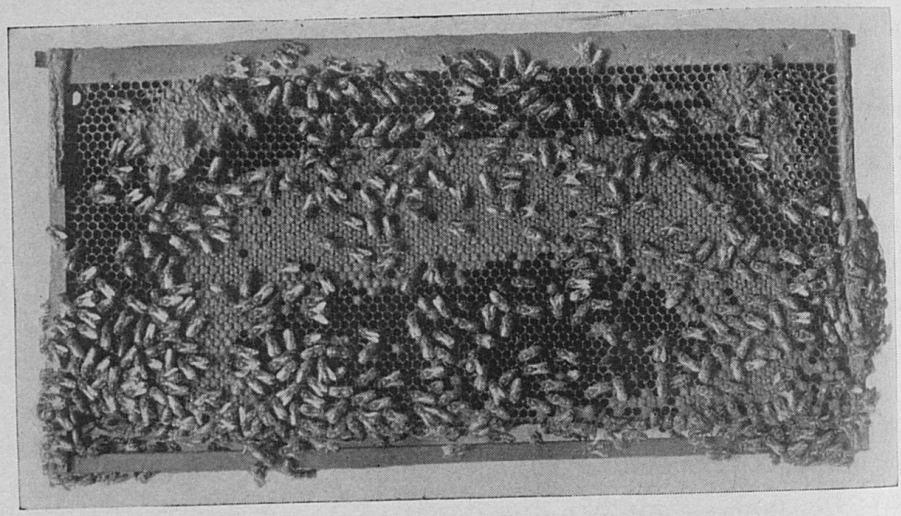

Fig. 1. A frame of normal brood. Photo by Vaughn

First, the beginner may become a specialist. He would then be supplied with standard equipment and no change would be necessary. Second, the standard outfit would be worth more on the market if the beekeeper wished to sell. Third, most of the written and verbal

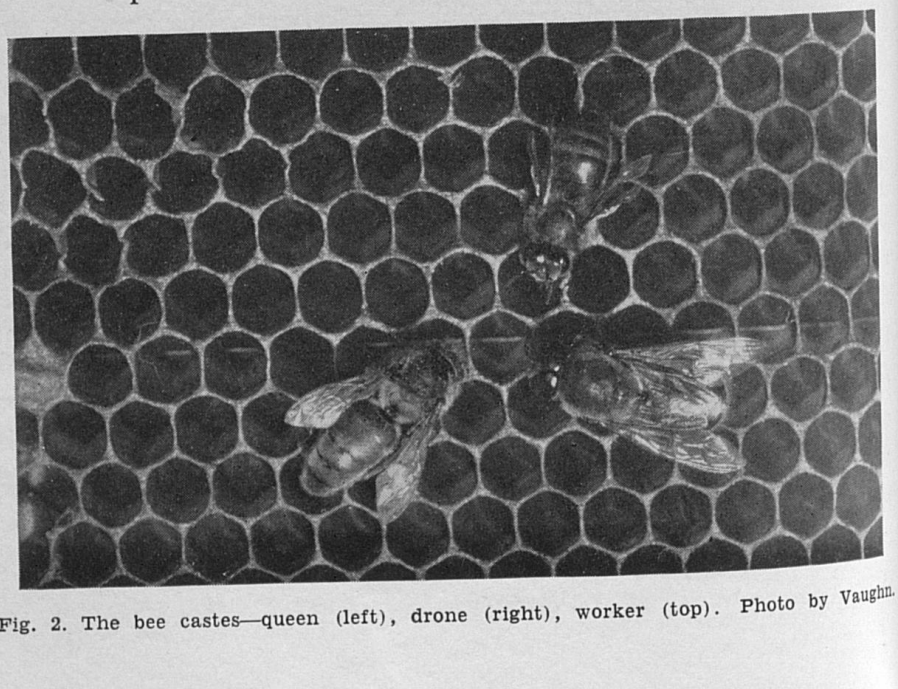

Fig. 2. The bee castes—queen (left), drone (right), worker (top). Photo by Vaughn.

discussions of swarm control, transferring, wintering and kindred subjects are based upon the assumption that frames are of standard dimensions. Fourth, bees bought in the neighborhood would probably be in standard hives and need no changing to become a regular part of the outfit.

The movable-frame hive taking eight or ten Langstroth or Hoffman frames hanging side by side on tin rabbets is considered standard. The popular trend is toward the larger hive. These frames are 9 1/8 inches high by 17 5/8 inches long. They are self-spacing and, therefore, considered better for the beginner. Imperfect combs, unevenness, improper thickness, burr and brace combs and general irregularities in the combs very often result from improper spacing.

To secure well-filled frames with even combs and with worker cells, full sheets of foundation should be used. If the frames are for brood rearing or for extracting, wired foundation is necessary. In comb or chunk honey production, foundation without wire is used.

The beginner should have a smoker, hive tool, gloves and bee veil. If increase is desired, he should have one extra hive for each colony of bees. The extra hive should be furnished with at least three supers. This will be sufficient equipment to start the business. As the enterprise grows, more and varied items of stock may be added.

A NORMAL COLONY OF BEES

A normal colony of bees during the active season contains three castes – workers, drones and a queen (Fig 2). The workers and queen are females and the drones males. All these develop from eggs laid in the cells (Fig. 3). Fertilized eggs hatch and produce females and unfertilized eggs produce drones. All pass thru four stages of development. The length of time required for each stage is quite uniform at all seasons because the bees maintain a fairly even temperature within the brood nest. Eggs hatch in about three days. On hatching, the future workers, queens and drones all appear as tiny white grubs imbedded in a thick, cream-like material, royal jelly, in the bottoms of the cells. Those individuals destined to be queens are provided with special cells (Fig. 4) and fed royal jelly for the larval period of 5 1/2 days. They then enter the

resting, or pupal, stage within a delicate cocoon where they remain for 7 1/2 days. The young virgins emerge from the cells 16 days from the time of egg laying. The workers follow a similar course of development in the small worker cells. They spend 6 days in the larval stage, 12 days in the pupal stage and emerge as adults in 21 days. The drones develop more slowly but have the same type of growth. They remain 6 1/2 days in the grub or larval stage, 14 1/2 days in the pupal or resting stage and emerge as adults in 24 days.

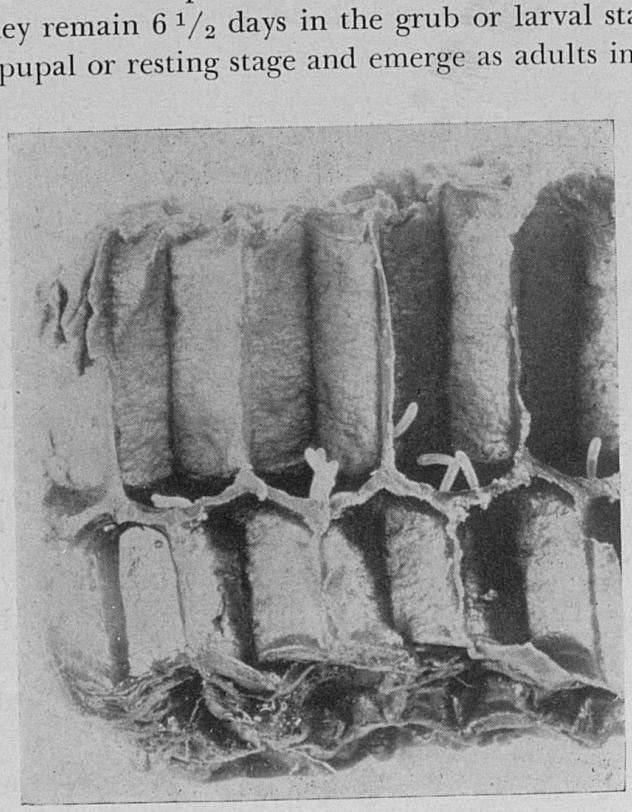

Fig. 3. Eggs in cells. Queen normally deposits a single egg in a cell. These multiple deposits are the work of a laying worker bee. Photo by Garman.

The adult workers perform practically all the labor in connection with the life of the colony, such as secreting wax, building comb, feeding the brood, maintaining brood nest and cluster temperatures, gathering nectar, pollen, propolis and water, evaporating nectar and protecting the colony and its stores. The workers may live four to six weeks during the active season and several months during the dormant season. In other words, they have a given amount of energy to spend and when that is consumed the insects die. For this reason, their energies should be conserved, during the

dormant season especially. This can be done by giving proper winter protection and stores.

The number of workers per colony varies with the season. A normal colony should have 10,000 to 15,000 bees in the spring. The first of June should find the number increased to 90,000 or 100,000. This is the peak of population. The number gradually diminishes with the approach of fall when there should be 50,000 by October 1.

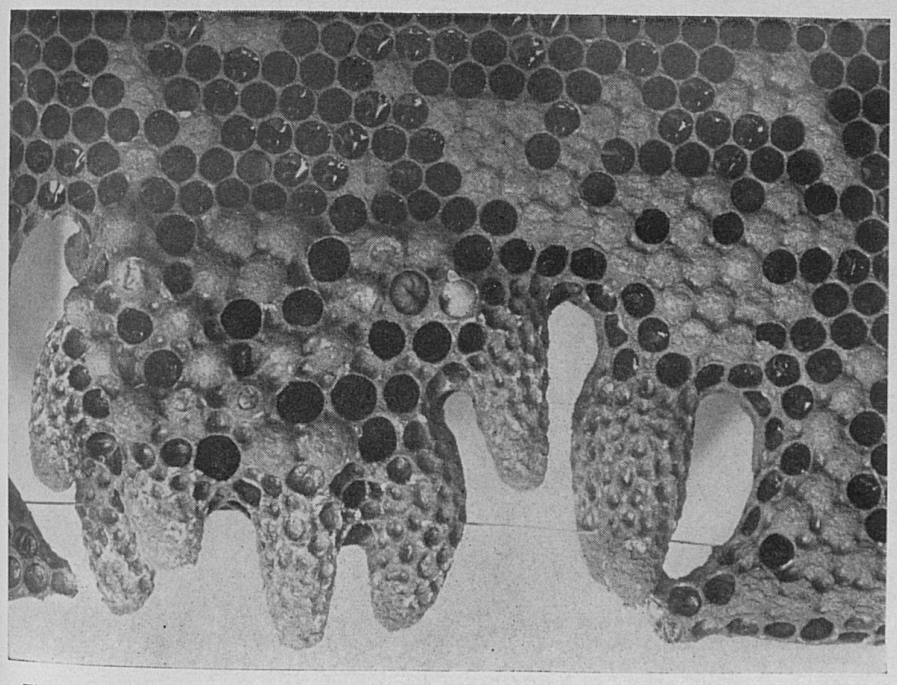

Fig. 4. At lower edge of comb, pendant queen cells. Large, circular openings, drone cells. Smaller hexagonal openings, worker cells. Photo by Vaughn.

Queens may live several years. There are records showing them to be active at eight years of age. Most of them, however, have passed their period of usefulness at two years of age. A great many good beekeepers requeen each year. This, however, is a matter of individual merit, shown by the strength of the colony and the way the bees perform their work. The queen normally mates but once during her lifetime. This takes place in the air at a considerable altitude and usually between the fifth and eighth day after emerging as an adult. The quantity of male cells (sperm) received at the time of mating is her lifetime supply. When the supply runs low or is exhausted, the queen lays only drone eggs and, consequent-

ly, is of no value and should be replaced. Except at the time of swarming or supercedure, there is only one queen to a colony.

Drones are found in the normal colony only during the honey-gathering season. With a dearth of nectar in the fall, they are all driven from the hive and killed by the workers. The number of drones per colony varies from a few to several hundred. The aim should be to have few. The drones fertilize the virgin queens. This is the only contribution made to the colony by this caste.

Fig. 5. Applying smoke to a hive in front entrance (left) and under top (right).

MANIPULATION OF THE HIVE

Handling bees is neither difficult nor dangerous if certain precautions are taken. First, have confidence — do not be frightened; avoid quick, jerky movements; provide ample protection — a veil for the head and neck, gloves for the hands and a bee-suit or other clothing for the ankles and body and, finally, a smoker for quieting the bees. The smoker commonly used is one of the bellows type. The proper fuel makes a mild and lasting smoke. Gunny sack or used oil waste, as found about the machine shop, is very satisfactory. Upon opening the hive, two or three puffs of smoke should be blown into the front entrance then the lid of the hive raised and a few puffs blown over the top of the frames (Fig. 5). This drives the

bees down on the combs and, at the same time, quiets them and soothes their anger. With the hive tool, the frames are loosened and one is withdrawn. It is examined by holding it in a perpendicular plane with the top bar up. This permits inspection on one side only. To observe the other side, turn the frame so the long axis is up and down. Then turn it on this axis, one-half turn, and then make the long axis again a horizontal with the bottom bar up This permits observation on both sides of the frame and at the same time, the frame is never in a horizontal plane so that there is no loss of the comb by breaking. The first frame examined is placed against the outside of the hive. Each remaining frame is inspected in order and replaced in the hive body. When finished, the first frame is returned to its original place in the hive, and the cover is adjusted. The job of "going thru" is completed.

A record should be kept of the findings in each examination. For this purpose, a shingle, painted and hung on the side of the hive is handy. At the end of the season, it can be repainted and will then be ready for use the following season. If this method is not used, a notebook or file cards should be employed. This record would not only be a complete history of the colony for the season but it would also serve as a guide to, and reminder of, future treatment for that colony. This record is especially helpful during the building-up process in the spring. It should contain such items as the strength of the colony, number of frames of brood, condition of brood, condition of queen, amount of stores, suggested treatment and treatment already given.

SEASONAL MANAGEMENT

Fundamentals of beekeeping practice may be divided into two parts, as follows:

Part 1

Fall (Aug. and Sept.): (a) Stores; (b) Room; (c) Protection.
Winter (Oct.-Feb.): (a) Stores; (b) Protection; (c) Room.
Spring (Mar.-May): (a) Stores; (b) Room; (c) Protection.

Part 2

May 15 (Average date): Swarming and Morale.

Stores is by far the most important item. There should be ample stores in the colony at all times. To keep thirty pounds

or more of stores in each hive is a good rule to follow. A normal colony properly protected will consume about twelve pounds of stores during the winter. That is ideal wintering. However, if conditions are not good, a single colony may consume as much as 65 or 70 pounds of stores over the same period.

The items, room and protection, vary in degree of importance with the season. In the fall, room is more important than protection. At this time, winter stores fill up a good portion of the hive and brood rearing is also in progress. Early fall weather conditions usually are such as not to require protection from cold.

In winter, protection is more important than room. Brood rearing has ceased at this time and sufficient room to contain the stores and cluster is all that is necessary. On the other hand, protection is of great importance. The kind and amount of protection given the colonies will, to a large extent, determine the condition in which the colonies come thru the winter. If they must spend their energy during the winter in an effort to keep warm, they will have just that much less energy to start brood rearing in the spring. Indeed, they may dissipate all their strength keeping warm and die out entirely during the winter.

In spring, brood rearing starts and additional room is necessary if the colony is to build up to desired strength; that is 100,000, by May 15. Unless the swarm has been wintered in two hive bodies, a second hive body should be added about April 1, and winter protection removed.

In Part 2 of the fundamentals of beekeeping practice, we have listed swarming and morale. These should receive our attention during May. Swarming will be discussed in detail further on.

There is no definition for this thing called morale. One may have all the requisites for a honey crop, such as abundant nectar, good weather, and plenty of bees and yet fail to get a crop. Why? Because of poor morale. The bees loafed. They hung on the outside of the hive. They made only two or three trips to the field per day. They were not industrious. They gathered only 25 to 30 pounds of honey, whereas another colony alongside may have gathered 100 pounds. What was the difference? Morale. What improves morale? A young queen, young bees, shade, ample ventilation and an unfinished piece of work, such as a bait super, often improve the morale greatly.

Four factors combine to make a honey crop. These are nectar-secreting plants, weather conditions favorable to gathering and storing, surplus of bees (five times the normal population) and high morale of the bees in the hive. All these factors must be present and in conjunction, if a honey crop is to be had. Take any one of them out and a zero crop results. One has little or no control over the first two items mentioned. However, one does have control over the latter two factors. The good beekeeper starts on August 1st to prepare for the honey flow that is expected ten months later. On this date he requeens his colonies with young, vigorous queens (See Page 24, Requeening). These start laying eggs immediately and produce usually two broods of bees before the close of the season. This insures a stock of young bees to go thru the winter and to start the colony vigorously rearing brood in the spring. A young, healthy queen put into a colony improves the behavior of the bees and strengthens the morale of the colony.

When the fall season comes to a close, that is, when the nectar flow ceases and brood rearing has stopped (in a normal season, about October 15), each colony should receive about ten pounds of sugar syrup. This should be in addition to the 40 or 50 pounds of stores already in the hive. The syrup should be made from granulated sugar, using two parts sugar to one part water. It should be given in a friction-top pail feeder (Page 22). To the uninitiated, this may seem a foolish thing to do, but to one who understands, it is foolish not to do it. The bee is an insect that does not hibernate over winter. True, its activities are greatly reduced during the cold season, yet the organs continue to function. If a hive of bees is opened during the winter, what is found? Not comatose individuals waiting for the warm sunshine of spring to waken them, but instead a cluster of bees quietly, slowly weaving in and out of a ball-like formation. What are they doing? They are generating heat in the cluster to keep themselves from freezing to death. They are active, hence they must consume food. Honeys are not equally free of indigestible materials, such as resin and gums. Honey gathered from asters and other fall flora generally found in Kentucky, is high in percent of indigestible material. However, that gathered from sweet clover, white clover, alsike and certain other early flora is almost completely digestible. In the ordinary way of handling bees, the early gathered honey, which is the best for wintering, is

removed from the colony as surplus; and that gathered in the fall, with much indigestible matter, is left in the hive for winter stores. These stores are all right if conditions are such that the bees can get out for occasional flights.

The bee does not normally void its feces in the hive. It usually evacuates in flight. If the outside temperature is not sufficiently high (60° F. or above), the feces accumulated must be stored in the alimentary tract, occupying an enlarged portion near the rectum, known as the cloaca. When this structure becomes filled and weather conditions will not permit a flight, the bee becomes nervous, runs about on the combs, eats more food, accumulates more feces, and, in general, travels in a vicious circle. Feces are voided on the combs, walls of the hive, and promiscuously about the hive. This results in trouble generally, and often in a disease known as dysentery. Now if good stores (sugar syrup) are consumed during the period of non-flight, the capacity of the cloaca is ample and no discomfort from this source will be experienced. The reason for giving the syrup at the time mentioned (October 15) is that the syrup will be stored in the cells from which the last brood emerged. This is the place where the winter cluster is formed and, consequently, the stores placed here will be those used first, and that is as it should be. The good stores will last the colony thru the more severe portion of the winter and, when the cloaca becomes filled because of consumption of the poorer stores, occasional warm days will arrive, thus affording the bees a flight.

WINTERING

There are two well-known methods of wintering bees. These are cellar wintering and outside wintering. Either method presupposes the presence of three items:

1. Plenty of good stores.
2. Protection from wind and low temperature.
3. Room for expansion at brood-rearing time.

It is essential that the overwintering bees be, for the most part, young. Old bees either die during the winter or so dissipate their small reserve of energy as to render them valueless in building up the colony in spring. All colonies going into winter should be strong. If there are weak colonies, they should be united with strong ones by the method described on page 24. A colony is considered weak or deficient if it does not have four frames or more of

brood August 1st. Since August 1st is the time for requeening, this operation and uniting can be done together.

Cellar wintering is practiced in the colder areas to the north. It is not recommended for Kentucky. Our rather mild weather enables the bees, in many instances, particularly where a windbreak is provided, to go thru the winter with no additional protection

Fig. 6. Wintering in Kentucky. Reduce to two hive bodies, contract the front entrance, supply ample stores and provide a wind break. Photo by Ritcher.

(Fig. 6). However, the progressive beekeeper who does not have a good windbreak, will provide a shield of some kind for his colonies. A cheap and satisfactory method is to use roofing paper. The hive, on the summer stand, is provided with a two-inch collar which is dropped over the brood chamber, after the telescope lid has been removed, and allowed to rest on the projecting bottom board. A strip of tar paper is then cut long enough to go around the hive and overlap six or eight inches. When the hive is thus enclosed, the paper extends some inches above the top. The lower edge of the paper is then secured to the collar by means of lath tacked on the outside. A strand of heavy cord can now be wound around the middle of the hive body to prevent the paper parting where it overlaps. The space between the hive bodies and the paper should now

be filled with sawdust, shavings, dry leaves, straw or crumpled paper. The same material to a depth of two to four inches should be put on top of the inner cover. The upper edge of the tarred paper may be folded over the packing, and a second strip of paper cut large enough to fold over the top of the whole. This is held in place either by nails or cord. The telescope lid is now placed on top with a few stones or brick to prevent it being blown off during the winter. The front entrance is now contracted about one-half and the colony is ready for winter.

If wintering in two hive bodies is practiced, the winter cover may remain on until warm weather arrives which in most regions will be some time in April.

HINTS FOR SPRING MANAGEMENT

Beekeepers are learning that good fall and winter care relieves them of much spring work and anxiety. When winter conditions are ideal, the queens vigorous, stores good and ample; when there is room enough to permit the good queen to do her best to populate the colony during the early spring and summer; and when there is sufficient protection from the winds and there is no disease–then the beeman need not worry. When, for any reason, however, his bees have not enjoyed ideal conditions during the fall and winter, and any doubt exists as to the amount of stores, disease or condition of the queen, it would be well to look into the colony early in March, or sooner if necessary, to ascertain the condition. At this early period, do not look for the queen unless you wish to clip her wings; and do not keep the hive open longer than necessary, as robbing may start.

With favorable weather conditions, a normal overwinter colony starts brood rearing as soon as the first pollen and nectar are available. From this time until late May, the population of the hive builds up rapidly. When the hive appears crowded in the brood chamber, additional room should be provided by adding one or two hive bodies containing empty combs.

SWARMING

Swarming is the natural method of increase in the number of colonies among honey bees. In the early beekeeping period, success was measured by the number of swarms cast. Today, the successful

beeman is striving to avoid swarming, as it greatly disrupts the work of the colony and this, in turn, diminishes the yield of surplus honey.

With a good, prolific queen and all other conditions right, the colony builds up rapidly in spring. Some time in early May, the hive becomes filled with bees and brood. This crowded unbalanced condition usually results in swarming. At this time, the old queen and a part of the workers leave the hive and quite often cluster

Fig. 7. A device for providing shade.

nearby; sometimes, however, they leave the vicinity without clustering. While in the air the bees may be induced to settle by sprinkling or throwing water or dirt into the swirling mass. Soon after clustering, they should be hived. Place a clean, movable-frame hive with full sheets of foundation, or combs, in a convenient location. In front of the hive, spread newspapers. Remove the covering from the hive and shake or jar the bees on top of the frames and in front of the hive – about three-fourths of them should be in front. Soon they will start running into the entrance. The cover can then be put on and, as soon as the bees have collected on the inside, move the hive to its permanent location. This is done to lose the scouts,

who upon returning and finding the colony may induce it to abscond.

If the swarm has come from a colony in one's own apiary, the swarm colony should be returned to the old stand, and the "parent" colony (the one remaining after swarming) should be moved to one side and at right angles to the former. This throws the field bees into the swarm colony and enables it to produce some surplus honey.

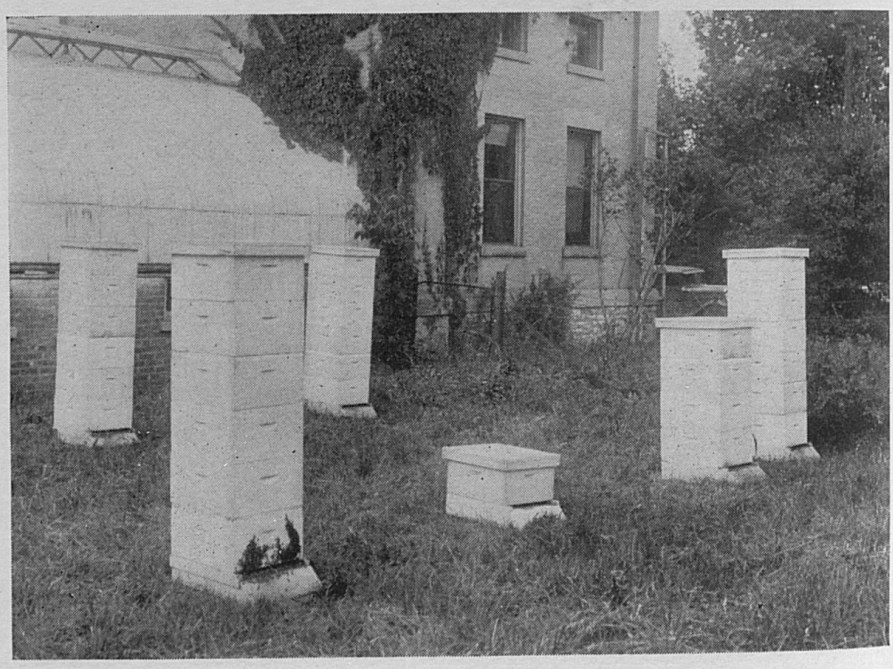

Fig. 8 More ventilation needed by strong colony in foreground with bees on outside of hive. Supers should be staggered. Photo by Vaughn.

Natural swarming should be avoided, especially when honey production is the aim. Therefore, it is better to follow the modern trend of progressive beemen and either artifically swarm the bees or control swarming by the commonly accepted methods, such as: (1) cutting out the queen cells every eight days during the pre-swarming period; (2) providing ample room; (3) giving shade (Fig. 7) and ventilation (Fig. 8); (4) furnishing young queens; (5) relieving congestion in the brood nest by separating the brood from the working force.

In comb honey production, artificial swarming is the usual resort, assuming the colony has built up strongly during the spring,

and queen cells are being started. At this time, on a bright day about noon, set the hive a few feet to one side and place on the old stand another hive with full sheets of foundation. This we will call the storing colony; the one set to one side will be the parent colony. From the parent colony, take a frame of brood with the queen and bees adhering and place it in the center of the storing colony. Then place the frame of foundation in the parent colony in the space made vacant by removing the frame of brood. The field force will now join the storing colony. If supers were on the colony originally, they should be put on the storing colony. Then both hives should be covered. The parent colony is put at right angles to the storing colony and close up to it. In two days, start turning this hive around until it faces the same direction as the storing hive. At the end of seven days from the time the colony was swarmed, lift the parent hive to the opposite side of the storing hive. This should be done in the middle of the day when the bees are flying freely. At the end of another seven days, the parent colony is turned to its original position. This throws the field bees into the storing colony, thus giving a good working force. After eight or nine days, the parent colony can be moved away. At this time, it should have a young queen. If she proves to be all right, she may be used to requeen another colony in the yard. The remaining bees can be shaken in front of the storing colony and the brood used to strengthen other colonies in the apiary.

In case increase is desired, the parent colony is set off on a new stand at the end of 7 to 14 days. A sufficient number of bees will then remain in the hive with the new queen to form a nucleus which should build up to full colony strength by fall.

In extracted honey production, swarm control is obtained rather easily in the following manner. When the hive (with two bodies) becomes filled with bees and queen cells begin to appear, set the hive body with the queen cells to one side. This is the parent colony. Place on the old stand a hive with frames of full sheet foundation or drawn combs, if possible. Remove a frame from the center of the new hive and lift a frame of brood (be sure it has some young larvae) with the queen and adhering bees from the parent colony and place it in the new hive. Put the empty frame into the parent colony. On top of the new hive place a queen excluder. If the bees were working in supers, place them on top of the queen

excluder. If they were not working in supers, then place two empty supers on top of the queen excluder. Then put the hive body containing the remainder of the brood (the parent hive body) on top of the tier. Destroy all queen cells. If no increase is desired, destroy the queen cells again in eight days. In 21 days the brood will have hatched and joined the force below. This hive body then becomes a super.

If increase is wanted, set the upper story on a new stand eight days after the separation of the queen and brood. The bees will rear their own queen and the colony will soon become a normal one in every respect. It might be added that queen cells developed under these conditions (i. e., in hive bodies filled with young bees that throw all their energies into the building of queen cells) usually contain superior queens and, for this reason, most beemen use these cells with protectors for requeening other colonies.

HONEY PRODUCTION

There are several methods of handling the colony in comb honey production. One only will be discussed here. It is the one now most common in practice. Assuming we have two hive bodies filled with bees at the time of the principal honey flow or a short time previous, there will be in the hive, besides the bees, some stores, brood and probably a few empty or partially filled frames. Place the queen in the lower hive body with empty frames of drawn comb (except one which should contain brood). Shake all the bees into this hive body. Give the remaining frames of brood to other colonies in the yard. Now put on a section super, if possible one that has been started. The crowded condition in the hive will cause the bees either to go into the super to work or they will swarm. Quite often they will swarm. If they decide to work in the super, allow them to do so until the sections are started, then raise this super and put a new one below it next the brood chamber. Allow them to work this one until it is well started and if the honey flow seems yet to be promising, add a third super, putting it as with the second one, next to the brood nest. Should the beeman think that no more can be filled that season, he allows them then to complete the super next to the brood chamber. When it is finished, it is removed and the others are lowered, filled and removed. Should any of them fail of completion, save them for the next year as they make excellent bait.

Under the subject of swarming, we have already mentioned a good and generally used method of extracted honey production. In brief, it is as follows. Build up the colony to 75,000 or 100,000 population by the time of the principal honey flow. Separate the brood from the queen and working force by placing the queen in the lower hive body containing empty frames and the brood on top with two empty supers between them. When the honey flow is over, remove the surplus, take it to the honey house and extract it, by first cutting off the caps then running it in a centrifugal machine to empty cells. Then store the frames under moth-proof conditions (Page 34) until they are again needed in the yard. Put the liquid honey, after heating to 140-160° F. and straining it thru two thicknesses of cheesecloth and one thickness of bolting cloth, into cans, jars or other receptacles for marketing.

Chunk honey is sometimes produced by the amateur. It requires less skill to produce and, at the same time, affords an opportunity for the novice to learn something of the business of beekeeping.

REMOVING SUPERS

It is desirable to have supers free of bees when they are removed from the hive. This may be accomplished by use of the bee escape. The board containing this one-way trap is placed beneath the super to be removed. Bees go down thru the escape and are unable to return. This leaves the super vacated. If the escape board is put in position about 3 o'clock in the afternoon, ordinarily the super can be removed free of bees by noon the following day.

The carbolized cloth is now coming into general use, particularly for out-apiaries. With this material, a super can be freed of bees in a few minutes. A durable cloth with fine mesh is tacked inside the telescope hive cover or to a wooden rim large enough to slip easily over the top of the hive body. If a hive cover is used, the tin should be painted black. If the rim is used, it should be covered with tar paper. The cloth is then sprinkled with a mixture of half pure carbolic acid and half water, using an ordinary clothes sprinkler fitted to a bottle for the purpose.* The carbolized cloth tray is placed over the supers to be freed of bees and ordinarly within five minutes time the bees will have left them.

* To liquify pure carbolic acid crystals, place the bottle in a container of warm water. Carbolic acid burns the skin and for this reason, it should be used with utmost caution.

FEEDING

If, in early spring, any colonies are found scant of stores, it will be advisable to feed them at once. For this purpose, sugar syrup has been used but it is not generally recommended at this season, as it may start robbing or it may stimulate the bees unduly

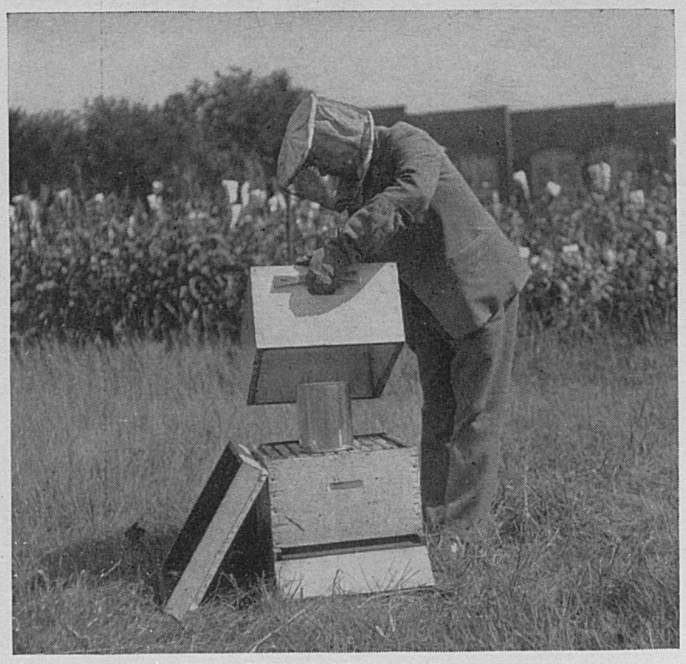

Fig. 9. Feeding with a friction-top pail.

for this early period. The use of rock candy, cube sugar or fondant made from granulated sugar is better. If sugar syrup is fed, it should be made of two parts of sugar to one of water. This is quite often given in the friction-top pail, the lid punctured with five or six holes the size of an ordinary lath nail. Place the filled pail with the lid on, top down, on top of the frames. Put an empty hive body around the feeder (Fig. 9). This, of course, is to prevent robbing.

ROBBING

Robbing is an undesirable activity in the apiary (Fig. 10). It often happens when there is a dearth of nectar, when honey is spilled about the yard or when hives have been left open too long. The robbing bees fly in large numbers about the entrance of the

hive being robbed, alighting hastily and then flying away at first. Later, they return, make a sudden rush and enter the hive, dodging the guards and acting as tho suspicious and wary. When robbing is well under way, they come and go freely as the guards have be-

Fig. 10. Colony in the foreground shows robber bees.

come demoralized. During the process of robbing, bees will be seen tugging at each other, gnawing at the wings and fighting in every way possible to ward off the intruders.

There are times when the beginner may be fooled by young bees that are out in front of the hive for their play flight. These young bees usually appear about midday (noon to two o'clock). They might be mistaken for robbers. Guards do not struggle with young of their own hive.

As with diseases, preventive measures are much better than remedial. However, if robbing has set in it can be stopped usually by prompt and vigorous action on the part of the beekeeper. The process of opening of hives should cease as soon as the robbers are noticed. All exposed honey should be removed. If the robbing is serious, the entrance of the hive being robbed should be partially contracted and the front of the hive rubbed with a mixture of

carbolic acid and kerosene. Grass or hay well wet with water and thrown against the entrance will often tone them down. This obstruction should be left on until after sunset and the grass kept wet for an hour or more. Do not remove the hive being robbed as this will drive the robbers to other hives. If robbing has been going on some time so that the colony attacked is demoralized and the stores nearly depleted, it may be just as well not to interfere.

UNITING

Very often we find colonies in the apiary too weak to persist long. These should be united with strong colonies. Never unite two weak colonies. There is always a reason for a weak colony. Very often this can be traced to the queen. Uniting two weak ones would not remove the cause.

To unite two colonies, first destroy the queen in the weak one. Remove the lid and cover from the strong one, place two or three thicknesses of newspaper on top, then remove the bottom board from the weak colony and place the latter on top of the former with the paper between them (Fig. 11). The bees on each side of the paper gnaw at it until holes are made. This requires two or three days. Working at the same job for this period, they become accustomed to each other, are then accepted and work as a unit. The paper should be removed three or four days after the operation.

Often queenless colonies develop laying workers. These are undesirable since they produce only drone brood. To free a colony of this trouble, carry the hive about 50 paces from the old stand and dump all bees on the ground. Be sure no bees are clinging to the frames or the hive parts. Return the empty hive body and frames to the old stand. The worker bees will return to the old hive presumably leaving the laying workers in the yard. The returning bees can then be requeened or united with a strong colony.

REQUEENING

When it becomes necessary or desirable to supply a colony with a new queen, she may be obtained from any one of several sources. A very common practice, especially during the early spring, is to order from queen breeders. By choosing reliable breeders, the desirable high grade of stock can be maintained. Queens are shipped in regular mailing cases, one end plugged with candy.

Usually 12 to 15 attendants are enclosed to care for the royalty while in transit. The colony receiving the new queen, if not already queenless, should be made so a day or two before the arrival of the successor to the throne. Sometimes, the shipping case is also the introducing cage. In this instance, remove the pasteboard from the end of the candy-plugged hole and place the cage between the top bars of two frames near the center of the brood nest. The bees both inside and outside the cage will gnaw away the candy thus liberating the queen. This drilling process usually requires about two days. By then the bees have become accustomed to the new

Fig. 11. Uniting a weak, wax-moth-eaten colony (finger pointing to cocoons) and a strong one, by the newspaper method.

queen and she is accepted. Some breeders have special introducing cages. These for the most part are very good, and a high percentage of acceptance is obtained with them. Directions for their use accompany the cage.

A second method of obtaining a new queen is to take a ripe cell from a strong producing colony in the same apiary, and place it with a cell protector in the queenless colony. The colony receiving the

ripe cell should be queenless two or three days before the cell is introduced.

A third method sometimes employed might well be called "self-serve." A queenless colony is given a frame of young brood (some eggs in the cells) from another colony in the apiary, having desirable traits and characteristics. The bees are shaken from the frame to be introduced and it is inserted in the center of the brood nest. The bees will develop a queen from the young larvae on the introduced frame. This method presupposes the colony has been queenless for some time (nine days or more); otherwise, the bees would have developed a queen from their own brood. Queens are developed in 16 days, from fertilized eggs. A queen can be made from a worker larva provided the bees decide upon this policy before the larva is three days old, after which time it is too late to develop a queen. Worker larvae receive royal jelly only three days, whereas queen larvae receive this rich nitrogenous food during their entire larval period. This material apparently influences the development of the reproductive organs and causes the principal difference between the queen and worker. The latter has only rudimentary reproductive organs. Thus, unless there are eggs or very young larvae in the hive when the old queen dies, the workers cannot produce another. The second and third methods of requeening, described above, cause an interruption in brood rearing covering a considerable length of time (especially true of method number three). Therefore, these methods should be employed, if possible, at a time when a temporary cessation of brood rearing will do the colony the least damage, probably immediately after the principal honey flow.

COMB BUILDING

When honey bees are producing wax, they gorge themselves with honey and hang in curtains in the hive for a period of about 24 hours. At the end of this time, there appears on each of the eight wax glands, located on the fourth, fifth, sixth and seventh abdominal segments of each bee, a small flake of wax, resembling a tiny fish scale. These flakes are transferred by the legs to the mandibles where they are kneaded and worked into comb. It has been estimated that it requires 8 to 10 pounds of honey to produce one pound of wax. It is seen that much time is consumed by the

bees in producing wax that otherwise might be used by these same bees in gathering nectar. So, wax production is a rather costly operation for the beekeeper. Therefore, he should save every scrap of comb and convert it into foundation, which is the name applied to sheets of embossed beeswax, made to fit properly into frames. Scraps of comb are melted, refined and run thru a machine resembling a clothes wringer. This process makes an embossed midrib, locating and starting the hexagonal cells which later are drawn out by the bees into full combs.

TRANSFERRING

In spite of our advancement in knowledge of beekeeping, we still have many colonies in Kentucky kept in box hives, soap boxes, kegs, boilers, barrels, log gums, or other containers which do not permit free removal of the combs. Box hives are an obstacle to the elimination of foulbrood — the worst menace to modern beekeeping; therefore, as a first step toward profitable beekeeping, transference of bees from the box hive is of paramount importance. The best time to transfer bees is when honey is coming in from the fields and the combs are not too heavy with stores. In Kentucky, these conditions are met during the apple-blossom period.

Several methods of transference are used. Three are in common use in Kentucky, any one of which when properly done will prove satisfactory.

Method One. Cutting Combs from Old Hives. Provide a pail of water and a towel to keep the hands and tools free from honey, a hive tool, smoker, carving knife, soft twine, two wooden mallets or clubs to drum with, a table or broad board covered with several thickness of burlap to protect the caps of cells containing brood, a drumming box a trifle larger than the old hive bottom and a modern hive full of empty frames.

About noon on a bright day, blow a few puffs of smoke into the entrance of the box hive, then remove the old hive from the original stand and place a box or temporary hive on the old stand to catch the field bees. Now blow more smoke into the entrance of the old hive and turn it bottom side up, removing the bottom board if it has one. Set the drumming box over the box hive, seeing that the edges (especially the back one) are in contact. Tilt the old hive forward a little and place a stick under the rear end. Pry what is

now the bottom (formerly the top) of the old hive loose sufficiently to permit of smoking. After smoking, drum a few minutes on the old hive with the mallets, beginning at the bottom and working up gradually toward the top, alternating the pounding on the sides and front and rear. Follow each period of pounding with a puff of smoke at the bottom of the old hive. When most of the bees have been driven into the drumming box, lift it off and set it to one side. Now split off a side of the old hive and cut out the combs. Lay these carefully on the burlap. Piece them in the frames, putting the empty end of the comb next the top bar and the capped stores near the bottom bar. If brood is found, it should be placed as it is normally found in the frame. When the frame is filled with comb patched together, wind string around the frame to hold the comb in place. The bees will soon fasten in the combs and gnaw away the strings. They will transfer the honey from the bottom of the frame to the top. Now set the brood frames in the center of the new hive and those containing stores on each side and place the hive on the old stand. The bees in the temporary hive and those in the drumming box are now dumped in and in front of the new hive as in hiving a new swarm. Contract the entrance of the new hive to about two inches.

Method Two. Drumming out Twice on Full Sheets of Foundation. Remove the box hive from the old stand and put in its place, a movable-frame hive with full sheets of foundation. Turn the box hive bottom side up and place over it a drumming box as under Method No. 1. Also, pound and smoke the bees as before. When a cluster of bees has moved into the drumming box, lift it and look for the queen. The success of this method depends upon getting the queen into the new hive. If she is found, run her into the entrance of the new hive and dump the cluster in front of the hive entrance as mentioned under Method No. 1. If the queen is not found, then place the drumming box in position and again drive a small cluster into this box. Examine the cluster for the queen and repeat until she is found. Leave about one-fourth of the population of the colony in the old box hive to finish rearing the brood remaining in it. After the bees are in the new hive, contract the entrance to two inches and turn the old box hive facing the new hive at right angles. After three or four days, turn the old hive a little each evening until

it is parallel to and facing the same direction as the new one. Twenty-one days from the time of transfer, the brood in the old hive will have emerged. The bees can then be drummed out and shaken into the new hive as before. Both lots of bees should be well smoked before they are united. After the bees are out of the box hive, salvage the stores, render the wax and burn the box.

Method Three. Placing New Hive Over Box Hive. Remove the top from the box hive and set the new movable-frame hive, with drawn combs or full sheets of foundation, over it. If possible, put a frame of brood from another hive in the center. Make the new hive fit snugly over the old box by nailing on strips of board. Drum the

Fig. 12 Dislodging a colony from a hollow tree. Photo by Vaughn.

bees into this second story and then place a queen excluder between the old and new hives. After a few days examine the upper combs for the presence of eggs. If none are there, the process must be repeated until the queen is in the upper hive. In about 21 days the brood in the lower hive will have emerged and much of the honey will have been transferred to the upper one. The lower hive and the excluder can then be removed and the upper one placed on a bottom board. After shaking the bees from the old hive, its combs can be rendered and the hive body destroyed.

Method No. 1 is mussy and laborious. Method No. 2 is less laborius but it requires two operations. Method No. 3 involves less labor than either of the other two and it interrupts the work of the colony less, thus permitting a surplus of honey to be gathered.

REMOVING COLONIES FROM TREES OR HOUSES

Bees sometimes take up their abode in a tree or dwelling where they are undesirable guests. From such places, they can be dislodged without cutting the tree or injuring the house. Begin by closing all openings to the bee nest except one. Over this place a bee escape, either a Porter escape or a long wire cone thru which the bees can emerge but not find the way back. A hive or box should be placed with the entrance as near as possible to the escape (Fig. 12). If the hive or box can be supplied with a frame, or piece of comb, or foundation, it will serve as a potent lure. The bees coming out and unable to return to the old haunts on account of the trap, will enter the hive. Within a few days, most of them will be in the hive which can then be moved or destroyed as desired. The hole to the old nest should be permanently plugged or screened to prevent reoccupation. If the colony is to be saved, it should be provided with a queen.

STINGS AND REMEDIES

The stinging apparatus of the honey bee is composed of three parts, the glands which secrete the poison, the poison reservoir and the barbed, hollow shaft made of three lancets and a sheath. In stinging, the bee inserts the shaft into the flesh where it remains because of its barbed structure. With the shaft is left the poison reservoir and the gland. The poison is injected into the wound by the action of the muscles attached to the lancets. It is, therefore, advantageous to remove the sting from the flesh as soon as possible. Do not attempt to pull it out by grasping between the thumb and finger. This would squeeze the contents of the poison reservoir into the wound. The sting should be scraped out with the finger nail, knife blade or other similar implement.

Some bees are more prone to sting than others. The black bee is noted for its bad disposition while the Caucasian, Carniolan and Italian races are, as a rule, not difficult to handle under proper con-

ditions. One can expect much stinging from all bees regardless of the race under adverse conditions. To avoid stinging, keep colonies headed with young queens and handle bees during the middle of warm, bright days when nectar or pollen is available in the field. Use smoke and observe the rule to avoid quick, jerky movements in operations about the hive. Wear a veil and gloves if necessary. Avoid mashing bees and, what is equivalent in effect, the first sting. When a bee stings or is crushed the odor from the poison permeates the air and incites stinging. To correct this, use smoke immediately on the wound or in the threatened area.

Various remedies for stings have been advocated but all are of little value. The puncture made by the sting is so small that no liquid can enter it after the sting is removed and the opening has closed. After stinging, the wound should not be rubbed as this serves to spread the poison thru the tissues. If possible, forget it.

In case of severe stinging, local application of an ice bag or cloth wet with ice water may be beneficial. Household ammonia is sometimes used. The heart action should be stimulated if necessary.

DISEASES AND ENEMIES

Bee diseases, known generally as foulbrood, are the greatest menace to the beekeeping business today. There are two commonly recognized brood diseases. These are known as American foulbrood and European foulbrood.

American Foulbrood is caused by an organism known as *Bacillus larvae*. This is a spore-forming bacterium which works on the larva, sapping its vitality and finally killing and causing it to dry down to a scale. It attacks the larva in the later stages of development and, for this reason, many of the cells containing brood afflicted with this disease, are capped. The caps are sunken, discolored and perforated. If the caps are removed and the scale has dried, the larva will appear to occupy the bottom and one side of the cell, adhering tightly to the wall of the cell. In the earlier stage of development, the dead larva is ropy so that when a match or toothpick is inserted and withdrawn, there is a characteristic stringiness. Also, there is an odor resembling that of a glue pot.

Since this disease is caused by a spore-forming organism that can live for some time in honey, old combs and hive equipment, one cannot be too careful in handling infected material. One should

be cautious in buying bees and used equipment. Prevention is much better than cure. Bees should be bought only from disease-free yards, and equipment coming from a diseased yard should never be used without first having been sterilized.

A few years ago, "shaking" was practiced by some beekeepers in an attempt to save the adult bees from colonies afflicted with American foulbrood. The operation, however, exposed contaminated material to bees from other hives and generally resulted in the spread of the disease. For this reason, the practice is no longer popular. Instead, it is recommended that the bees be killed and then burned along with the frames and combs. At night, when all the bees are in the hive, kill them by placing a tablespoonful of powdered cyanide on the bottom board a few inches back of the entrance. Cyanide is a deadly poison and it should be handled with great care, so that the fumes are not inhaled, nor the material otherwise taken into the system of the operator. If cyanide is not at hand, the bees can be killed by spraying them with kerosene. After the bees have been killed, the hive should be carried to one corner of the apiary where a pit has been dug previously and in which a good fire is burning. Place the frames, combs and dead bees on the fire and destroy them. When the fire has burned the combustible material, the hole is filled with dirt, thus covering the honey, wax, propolis and other materials that have not been completely consumed by the flames. The pit should be so deep that the ordinary methods of handing the soil will not uncover the buried contaminated material. The beekeeper is cautioned never to try to burn this material in a furnace. The honey melts, runs down on the ashes and is carried out where it is exposed to the bees once more.

After the frames are disposed of, the hive body, bottom board, inner and outer cover should receive attention. They can be cleaned by charring them well with a plumber's torch or by boiling them ten minutes in lye water, made by dissolving one can of lye in 10 gallons of water. Another way to clean the hive is to scrape away all wax and propolis and to scrub it with a stiff brush and hot soap suds or lye water. When dry, the equipment may be painted if necessary and put back into service.

European Foulbrood is a disease caused by the organism known as *Bacillus pluton,* a non-spore-forming bacterium. It develops, as

does *Bacillus larvae,* on the larvae of bees. It attacks the larvae at an earlier stage in development than does the latter. For this reason, combs showing this disease have relatively few cells capped over, the reason being that the larvae are killed before they have

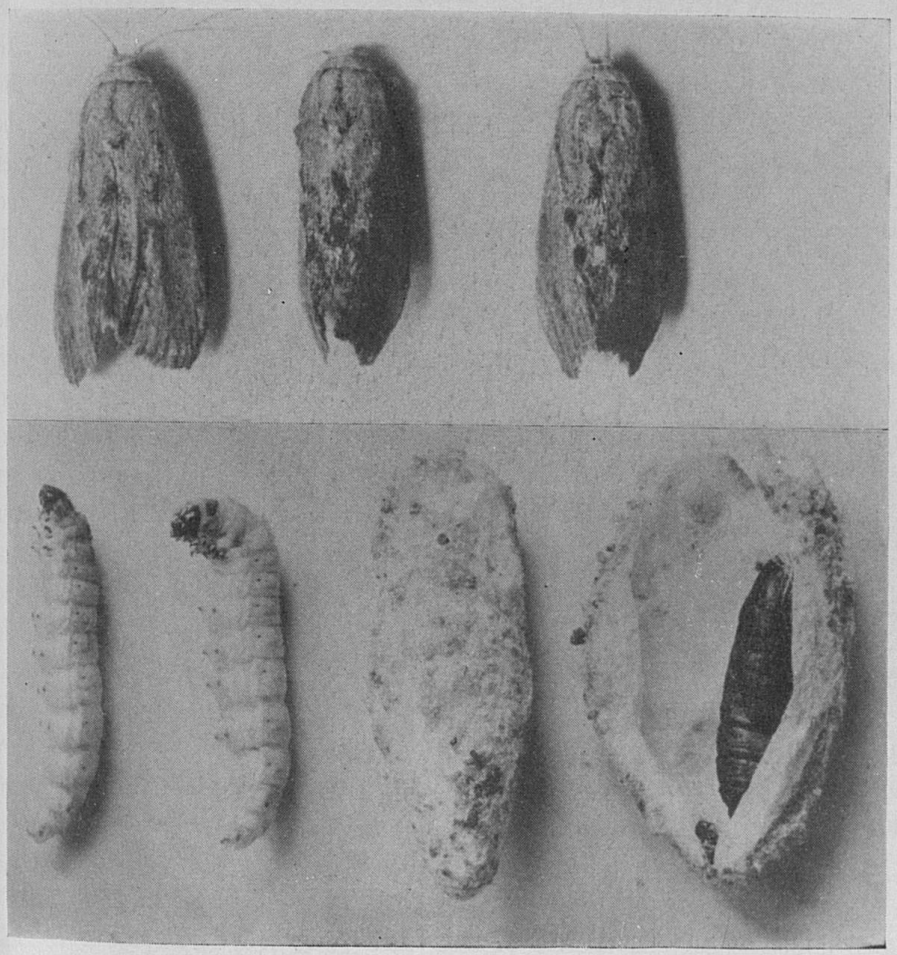

Fig. 13. Adults of the wax moth above. Below, larvae (left), pupae (right). Photo by Garman.

reached the stage when capping takes place. Most larvae afflicted with this disease die before completing the fourth day of growth or before they have left the curled position on the bottom of the cell. Examination will disclose that the larva has lost its shining, creamy appearance and is somewhat putty colored. As the victim dries down, the tracheal system stands out in bold relief. Later, it forms a scale that is loose in the cell and it can be removed easily by the bees. The dead larva is not ropy and the odor is described as sour.

This disease appears only in weak colonies and most often among black and hybrid bees. The Italian bees are resistant to European foulbrood. So, the treatment lies in Italianizing and building up the strength of the colony. The good beekeeper will not be bothered seriously with this disease.

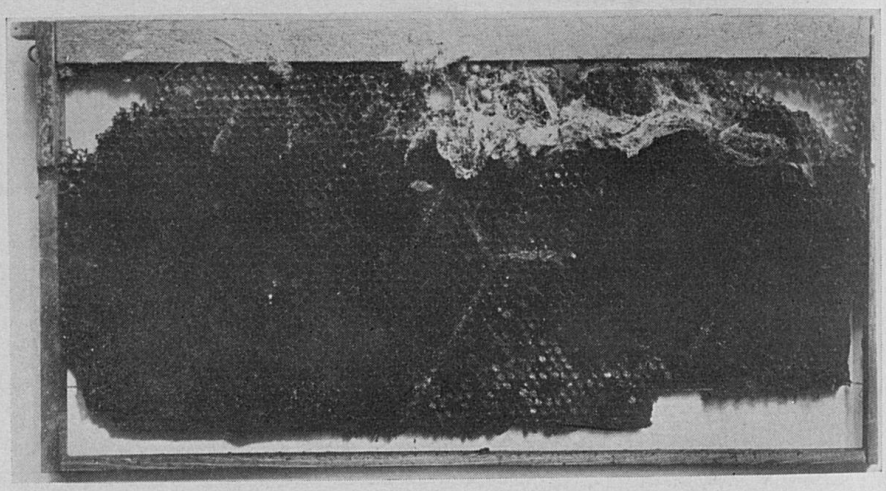

Fig. 14. Work of the wax larvae. Web started near top bar. Photo by Vaughn.

The Wax Moth is another source of annoyance to beekeepers. This insect passes thru four stages in developing; the egg, the larva or worm, the pupa, or resting stage, and the adult (Fig. 13). Eggs are laid in neglected combs, especially the old combs. The larvae hatch and go immediately to the midrib of the comb. Here they start tunneling and making webs or galleries, and in a short time the entire comb is enveloped in the webs (Fig. 14). This renders the comb worthless. After the worms have become full grown, they spin cocoons on the inside of the hive (Fig. 15). These are oblong, about three-fourths of an inch in length and grayish in color. From these, emerge the moths that lay eggs for another generation.

The moth cannot gain a foothold in strong colonies. It is found usually in stored combs, in queenless colonies, in colonies having more combs than the bees can cover and in colonies that are weak from any cause. Good beekeeping practice insures strong colonies and this, in turn, eliminates the moth from the hives. Combs that are stored can be protected by tiering them carefully in hive bodies and placing paradichlorobenzene in a shallow receptacle or on a paper laid on the top bars in the uppermost hive of this tier. If

the hives are joined so as to make them nearly air-tight, with the top and bottom of the tier closed, the combs will be protected from the moth as long as the insecticide lasts. Two or three ounces will give protection to one hundred frames for several months.

In case of doubt concerning the diagnosis of any bee disease, send a sample of the diseased brood to the Department of Entomology, Agricultural Experiment Station, Lexington. A piece of comb

Fig. 15. Cocoons to the wax moth. Photo by Garman.

about four inches square containing the dead brood and little or no honey is a satisfactory sample. It should be mailed in a cardboard or wooden box. After the specimen has been examined, a report will be made and with it will be sent recommendations for the treatment of the disorder.

Other less important diseases and pests of bees sometimes give trouble. Among these may be mentioned sac brood (which is a virus attacking larvae), dysentery, paralysis, Nosema, acarine, and septicemia, affecting adult bees. Also there are several recognized pests such as skunks, mice, birds, ants, and toads. Any of these may be encountered by the beekeeper. Of these, ants are perhaps the most troublesome. Ants may be kept from a bee colony by use of a barrier. Place under the hive body, to serve as supports, four half bricks in shallow pans containing crank case or other waste oil. Ants will not cross the oil and if the pans are placed well under the hive few bees will be lost in the oil.

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