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DIVISION OF ENTOMOLOGY.

BEEKEEPING FOR BEGINNERS



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‡In cooperation with School of Agriculture, A. & M. College of Texas.

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BEEKEEPING FOR BEGINNERS

BY

H. B. PARKS, B. S., APICULTURIST OF THE TEXAS EXPERIMENT STATION.

INTRODUCTION.

This paper is to take the place of Bulletin No. 142, issued in 1902 and again in 1911. Because of the constant demand for No. 142 the last edition was exhausted several years ago. This demand is rapidly becoming greater owing to the work of the increased number of apiary inspectors and the campaign for improvement in beekeeping under the Extension Service. This paper, like the former, is not intended for specialists or professional beekeepers, but is for those who possess very little or no knowledge of this subject and wish to care for a few colonies. The plan is to give definite information as how to begin, what to get, and what to do. No discussion of variation in bee behavior, or of method is given. To give a choice of methods is but to confuse the beginner and to compare methods is to so bewilder him that he becomes discouraged and quits. The information given is simple and if followed by the new beekeeper will guide him through his first year of bee work. Then if this system does not answer his needs, his year's experience will enable him to understand and to carry out the more elaborate methods of advanced beekeepers.

Only a few become successful commercial beekeepers. The temperament, insight, and skill for this occupation is possessed by few. Anyone who thinks of commercial beekeeping should go very slowly until he has actual experience in handling bees. However, the majority of the farmers and people living in small towns, with little expense and time, can keep a few stands of bees with profit.

The number of stands which can be taken care of by one man and at one place becomes a question of interest. The first year, the beginner should have two stands. The reason for two becomes apparent as one reads this brief description of bee culture. The man on the farm with his many other duties, should not have more than five colonies. If he has more, the time required will be so great that the bees will be neglected in favor of the crops. If he has less than five, he has not enough to pay him to buy foundation and hive fixtures in the original packages, and therefore he must pay a much higher price for the few fixtures, and further he does not own colonies enough to warrant his buying a honey extractor and a solar wax extractor. The man in the small town with some time to spare can keep from ten to twenty-five stands to an advantage. Not more than this number should

be kept at one place, as the commercial beekeepers are coming to believe that from twenty-five to fifty stands to the bee yard will do far better than a greater number. Under ordinary conditions twenty-five colonies to the yard, with the yards at least three miles apart, will give the best results. To choose a location for a bee yard requires much experience, but the choice is based on the following factors: an abundance of bee flora, blooming from spring until winter, a good supply of fresh water, accessibility to the owner, and protection from weather and animals.

LIFE HISTORY OF THE BEE.

Before one can rightly care for bees it is very necessary that he have the main facts of their life history at hand, for on these depend the principal operations of beekeeping. The honey bee is the most highly specialized of all insects and is one of the few man has been able to domesticate. It is highly probable that bees had their origin in two widely separated localities, namely: India and Abyssinia. From these centers man carried them to the ends of the earth. In the domesticated state today, the black and yellow bees indicate the dual origin, and the dependence on man's protection indicates the early domestication of the insect.

THE QUEEN.

The normal colony of bees consists of one queen, several hundred drones at certain seasons, and from 8,000 to 75,000 workers. The queen is the mother of the colony and is in no way a ruler; in fact, she is but an egg-laying individual that follows the same social instinct which governs the rest of the hive. As the egg-laying individual upon whose existence depends the life of the hive, she is of more importance than if she ruled. The queen is the only perfectly developed female in the hive; the workers are stunted females; the drones are perfect males. Within the hive are found three classes of cells. The class most commonly found is that which averages about five cells to the inch; it is in these cells that the worker bees are raised. Another class is that which averages about four cells to the inch; the cells of this class are known as drone cells. In early summer on the combs there will be found long pendant cells much resembling peanuts. In these few especially constructed cells the queens are raised.

CAUSE OF SWARMING.

In the economy of the bees, in order that the species be perpetuated and that new colonies be established, swarming occurs. In the early summer the worker bees construct a few large cells, in which the grub or larva is fed on the royal jelly for about six days. This royal jelly is a white substance secreted by the nurse bees. This food is also supplied to the worker larvae but in far less quantities. The full grown larva is sealed over to go through the change into the adult, which period is known as the sealed brood or pupa stage, and extends over seven days. As it requires three days for the egg to hatch, the time from the egg to the adult queen is sixteen days.

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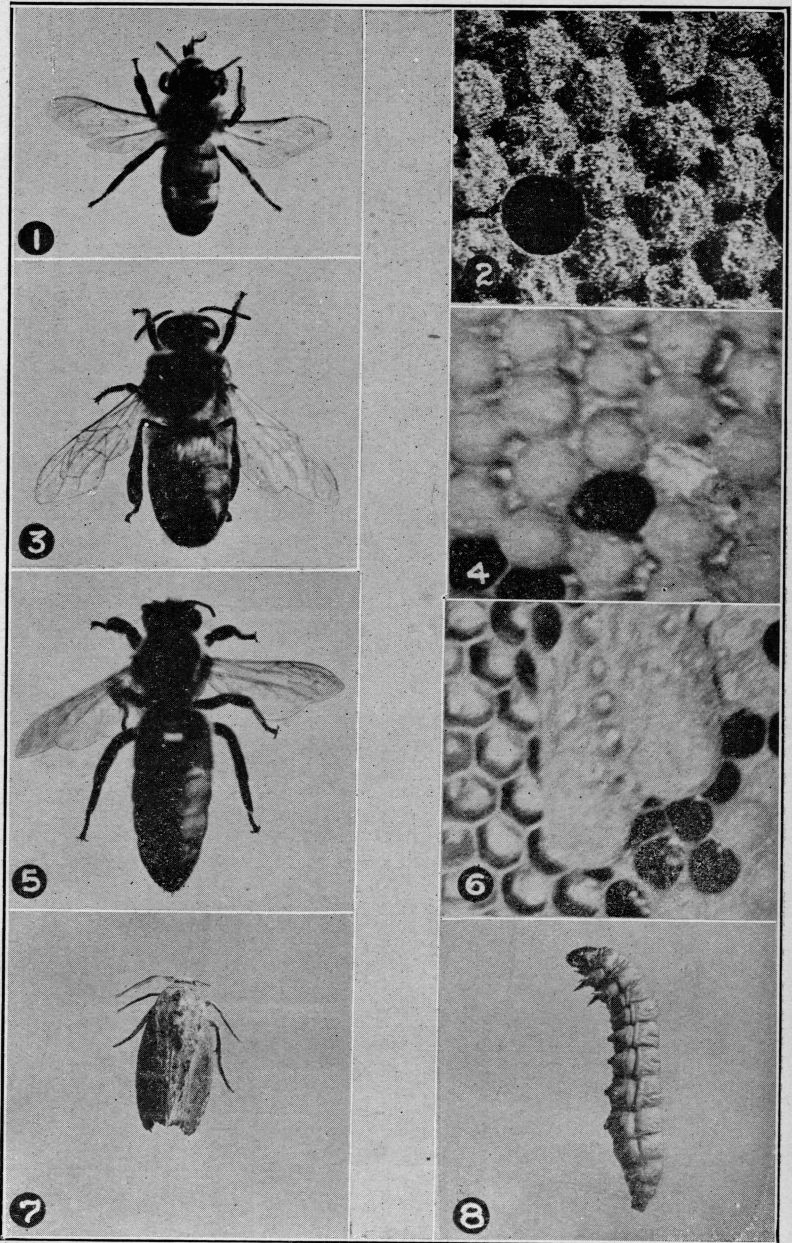


PLATE 1—THE BEE AND WAX MOTH.

1. Worker. 2. Worker brood. 3. Drone. 4. Drone brood.
 5. Queen. 6. Queen cells. 7. Wax moth. 8. Wax moth larva.

MANNER OF SWARMING.

Shortly after these queen cells are sealed, the old queen leaves accompanied by all the old bees which happen to be in the hive at the time. The old queen and the old bees go out in the swarm to hunt a new home. The hive now contains the field bees, which were absent at the time the swarm left, the young or nurse bees, and the brood. The first queen that emerges or "hatches" destroys all unemerged queens. She is now known as a virgin queen. In a few days she leaves the hive on her mating flight, where she is met on the wing by a drone and fertilization takes place. This act of pairing occurs but once in the lifetime of the queen and the drone dies in the act of copulation. The queen now returns to her hive and in two days begins laying eggs. The far greater number of these eggs are fertilized and develop into workers; a few develop into queens; a small number are not fertilized and develop into drones. Normally, swarming occurs but once in a year, but if the hive is small and hot a large number of swarms may occur.

AGE OF QUEENS.

A good queen will lay from 2,000 to 3,000 eggs per day during the active season. Queens have been known to live to an age of six or seven years, but after two years of egg laying they become so worn that it pays to replace them with young queens.

THE DRONE.

The drone is developed from an unfertilized egg which was deposited by the queen in a drone cell. This egg hatches in three days; the larva is fed six days and exists in the sealed brood stage fifteen days. The drone or male thus requires twenty-four days from egg to adult. As their whole service is but to insure the fertilization of the new queen, they occur in large numbers only during the swarming time. In the production of such quantities of males, nature is making certain that the queen will get mated and that the stock will be held to the natural requirements, as only the best developed male is likely to be successful in overtaking the queen in her flight.

DRONE CONTROL.

As the drones have to be fed by the nurse bees and their large size occupies space needed by the worker-bees, their presence in large numbers is a great disadvantage to the beekeeper. Any device that lessens their numbers will increase his honey production. One of the most efficient devices used to reduce the number of drones raised is wax foundation. This foundation which is fastened in the frame is a sheet of bees' wax stamped with worker cells. The bees in building upon this make only worker cells, and as drones are rarely produced in worker cells, the use of foundation very largely controls the drone production. The beekeeper need not worry about having sufficient drones, for in spite of all he can do, during swarming time, drones will be produced in every odd corner of the hive; even mashed places

on foundation will be made into drone comb. The newly introduced aluminum comb is also a good drone preventive. The fact that the drone is developed from an unfertilized egg and is thus the son of the mother only, is of advantage in improving the stock of the apiary, for, even if the queen has mis-mated, the drones are of pure stock. At the end of the swarming season or when a honey flow ends, the worker bees generally kill the drones.

THE WORKER BEE.

The worker is the real bee; a knowledge of its industry, sting, and so-called intelligence is common property. The fertilized eggs which are to produce the workers are deposited within the smallest cells in the comb. The egg hatches in three days; the larval stage is five days; the pupal stage is thirteen days: thus, the worker passes from egg to adult in twenty-one days. The worker larva is fed first with the royal jelly and then with a mixture of honey and pollen called bee bread. On emergence, the workers have a grey color that disappears in a few days. The young workers act as nurses, as general housekeepers, and when they grow older as guards and water carriers. After this period of training, the worker goes out to bring in nectar and pollen, helps within the hive to secrete wax, to build comb, and to occupy its place in the economy of the colony. The length of a bee's life depends largely upon its wings. In the summer from three to five weeks' work in the dry hot air so breaks the wings that the worker, no longer able to sustain the load, falls in the field and does not return to the hive. The life period varies from three weeks upward; those bees that winter over must in some places be seven or eight months old. As the worker is an imperfectly developed female, so when a hive becomes queenless, certain workers will lay eggs which develop into drones. These egg-laying workers are called "fertile workers."

KINDS OF BEES.

The beginner is concerned with but three kinds of bees: the Native Black or German bee and the Three Banded and Golden Italian bees. By far the greater number of bees found in gums and trees are black. These are susceptible to disease and ravages of the wax moth. They are not gentle and are inclined to fly when one is taking care of them. Because of the brief life cycle of the bee and the fact that there is but one egg-laying individual, one may change the color and temperament of a colony of bees within a very short time. It will pay every beginner to re-queen with a pure bred Italian queen. These queens can be purchased from many parties in the State at very reasonable prices. The choice between Three Banded and Golden Italian is purely a matter of personal opinion.

THE START IN BEEKEEPING.

Few persons plan to go into the work of beekeeping; most beekeepers and those who have bees came into possession of them accidentally and as a consequence the bees were in various conditions of housing. These

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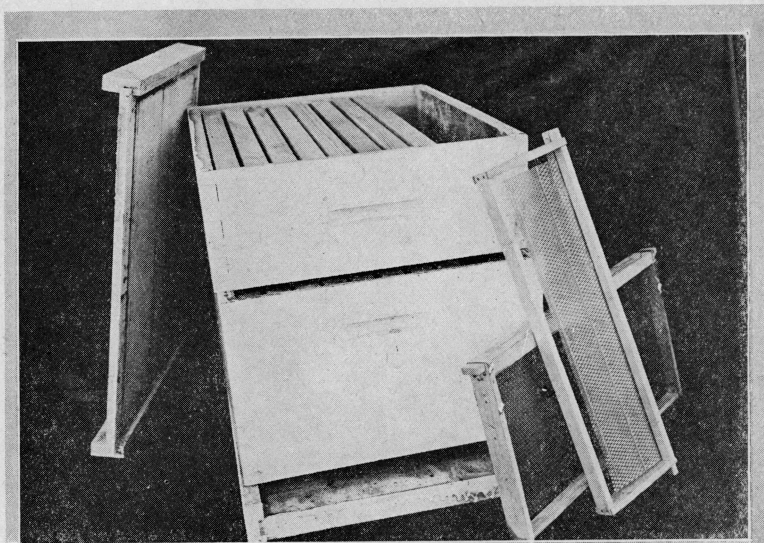


PLATE 2.

Above, the standard hive showing its parts; below, the tools used in bee culture: smoker, gloves, brush, veil, and hive tool.

varied conditions often discourage the beginner. If one can choose as to where he gets his start of bees, let him buy a colony of the best bees that can be purchased from a reliable beekeeper. He should specify that the queen is under two years of age, that the combs are drawn from full sheets of foundation, that the frames are wired, and that the bees are free from disease. Such a stand of bees will cost from eight to ten times as much as a box gum, but the difference between the two is about the same as between a thoroughbred cow and a scrub.

THE HIVE.

To keep bees in the best possible manner, the beginner must have certain articles which belong strictly to the bee business. The first is the standard hive (the word hive as used in this paper means the standard movable frame hive and the word gum refers to any housing for bees in which the combs are immovable). This standard hive is in many places called the patent gum. At the present time no patent exists on this hive as it is the result of the experiments of hundreds of beekeepers. Its size and spacing give better results than any other form tried; so if the beginner thinks of making his own hives he should buy one standard hive and follow this pattern very closely. The hive has three parts: a bottom board, a hive body or brood chamber, and a top board. The bottom board is so made that on one side there is a three-eighth inch entrance for winter use, and on the other side a seven-eighth inch entrance for summer use. The hive body or brood chamber contains the brood frames. These should be fully wired and have full sheets of medium foundation. The cover or top board should be kept clean of propolis and weighted down at the sides, preferably with a brick, in order to prevent warping. Neither the top nor the bottom should be nailed to the brood chamber, except when the hive is to be moved some distance; and then only hive staples should be used.

THE SUPER.

When the brood chamber becomes filled with the brood in the spring there is no longer a place to store supplies; so a super is put on the hive. The super is not so deep as the hive body and for that reason is more easily handled, and is recommended for the beginner. If one is going to extract, the super frames should be wired and have full sheets of foundation. If chunk honey is wanted, use full sheets of foundation only. When one super is almost filled with brood and honey, another should be added. Always put the empty super between the brood chamber and the filled super.

OTHER TOOLS.

In addition to the hive, the keeper must have certain articles: The *smoker* is the big stick of the beeman; a few whiffs of smoke blown into the entrance of the hive causes the bees to start filling up on honey. Well-filled bees are not inclined to sting, but too much smoke is often as bad as too little. The *hive tool* is used in opening the hive, in removing frames, and in cleaning off propolis. Screw drivers,

putty knives, or other similar articles are much used as hive tools. The *bee brush* is used to remove the bees from the comb that is being taken from the hive and is an absolute necessity in transferring. A good strong feather is better than most brushes. Whenever the brush or feather has become covered with honey, it should be washed and dried in the sun. Bees sting, and stings hurt most people, but if one handles bees properly, there is little danger of being stung. Always be on the safe side and wear a veil, which can be easily made of bobbinette or of mosquito bar. Get a piece of material thirty-six inches long, sew the ends together, make a half-inch hem around the top and bottom of the net, and put one-fourth inch elastic tape into the two seams. Pull the veil on over a straw hat so that the top tape fits the hatband. Pull the lower part of the veil down and tie the lower tape so that it fits snugly around the shoulders. A string should be tied to the edge of the veil just in front of the left shoulder; then pass the string under the left arm around the back, up under the right arm, and tie to the edge of the veil. Thus will the edge be held tightly against the body. Use black or blue material for the veil, but use a light colored hat. It will pay every beginner to wear a pair of *bee gloves* until he has learned to handle bees. The sleeves of the gloves should reach above the elbow and have elastic tape to hold them in place. If the gloves are made at home, use a lightweight duck. Gloves are hot and bunglesome but will save the beginner much trouble.

USE OF HIVE.

The hive is designed as a factory and warehouse for bee products. Few beekeepers make their own hives as the factory article is more nearly exact in size and the cost is but little more than that paid for the hand-made product. The beginner should buy his fixtures knocked down, that is, not nailed together, as the cost and freight is much less. With each package of parts will be found printed directions showing how to put the bottoms, tops, and frames together. One should follow closely the advice of the manufacturer. Two good coats of white paint should be applied to all the surfaces of every bottom and top; it is necessary to apply two coats of paint to the outside only of the bodies and supers. Do not paint the frames.

BEE PRODUCTS.

Within the hive the bees make, store, and re-work a number of products. These substances in rank of production are as follows: honey, bee bread, wax, propolis, royal jelly, silk, and formic acid.

HONEY.

In the word honey is expressed the complete cause of all the worry and care of beekeeping. This material consists of a water solution of two sugars, very small amounts of essential oils, and probably some little formic acid. The main source of honey is nectar, a sweet liquid secreted by certain plants from glands called nectaries, located mainly within the flowers, but in some cases on other parts of the plant. At

times other sweet liquids such as the sweet sap of plants, for instance, the maple tree and sugar cane, the sweet secretion from plant galls, and even the aphid secretion called "honey dew" become a component of honey. This material when collected by the bee is a trifle heavier than pure water. The bee sucks the nectar into a storage tank called the "honey stomach," in which it is carried into the hive; here the bee sprays the load of nectar into an unfilled cell. Throughout the entire nectar-gathering period the bees keep up a forced circulation of air within the hive by "fanning" their wings. This circulation, helped perhaps by some absorption of water by the honey stomach, reduces the water content until the liquid weighs twelve pounds to the standard gallon. At this point the honey is capped over by the bees. Such honey seldom ferments, but if it is taken off before "capping over or sealing," fermentation is very likely to occur. Bees cannot transport to the hive dry crystals of sugar or even very thick sugar syrup. The reason that in dry hot seasons honey plants bloom and bees fail to get nectar from them is that the dryness of the air absorbs the water in the nectar as soon as it is secreted and the bee finds nothing but sugar crystals, which it cannot carry.

BEE BREAD.

On almost every brood comb will be seen cells filled with solid colored material which is called bee bread, as it is used for bee food and is indispensable to the grub or larva. It is composed of pollen mixed with just enough honey to make the mass hold together. This pollen, which is a powder found in almost all blossoms, is collected by the bee and carried on the hind legs. On entering the hive the bee deposits these pellets in a cell containing only bee bread, where a nurse bee spreads them out until a layer is formed over the entire surface of the cell. This making a layer of each load of pollen together with the fact that there are rarely two kinds of plants possessing pollen of the same color, has led to the belief that the bees fill a cell with but one variety of pollen. During a heavy flow half-filled cells of bee bread may be filled with honey, but never the reverse. In some localities there is a lack of pollen plants blooming at the time necessary to supply food for the fall brood. This lack of food reduces the strength of the colony so that it cannot recover in time to take care of the next spring flow. Any plant, blooming in July and August, and producing an abundance of pollen, is a welcome source of food to the bee in these places.

WAX.

The combs are made of wax, which is a secretion of the worker bees and generally of the young workers. In order to produce this wax they gorge themselves with honey and hang in curtain-like clusters. While hanging in these clusters the wax is secreted from glands on the underside of the bee's body. The wax is collected by the nurse bees and worked into the cell walls. It requires quite a high temperature for the bees to secrete wax. One often sees small pieces of comb in early spring or late fall made from old wax. This reworked wax is composed principally of old cell cappings and has a dirty grainy

appearance. Various authorities estimate that it takes from ten to thirty pounds of honey eaten and digested by the bees to produce a pound of wax. The latest estimate made gives twenty pounds as the amount.

OTHER SUBSTANCES.

The royal jelly is a creamy white substance secreted by the nurse bees and is used in feeding larvae and probably the drones and queens. Silk is secreted by glands in the mouth of the full grown larva. On completing its growth the larva spins a cocoon or envelope of silk around itself in which to pass the pupal stage. This silk is brown and gives that color to all combs which have had brood raised in them. Formic acid is the substance which is injected by the sting and which causes the pain and swelling. Small amounts of this acid have been reported in analyses of honeys and it is supposed that it is placed there to aid in preserving the honey.

WAX ECONOMY.

As it requires many pounds of honey to produce a pound of wax it is of the utmost importance to the beekeeper to see that the bees build but the minimum of comb. This is accomplished by the use of the wax foundation already mentioned and also by the use of an extractor.

THE FOUNDATION.

The foundation is a sheet of bees' wax stamped with worker cells on both sides and comes in several thicknesses for use in brood and extracting frames. Medium brood should be used for brood frames and light super for the extracting frames. Full sheets of foundation should be used in all frames so that all combs will be drawn straight and as the bee "draws" out the foundation to some extent, the new comb is produced at the least wax expenditure. To get the best results the foundation must be properly fixed in the frame; to do this the frames are first wired as shown in Fig. 1, Pl. 3. The wire is tightened by winding it around the small nail as shown in Fig. 2, Pl. 3, and is fastened by driving in the nail. Then the sheet of foundation is placed against the wire and its edge in the groove in the top bar as shown in Fig. 3, Pl. 3. The frame is then placed on the waxing rack shown in Fig. 4, Pl. 3. The bottom bar is hung over the nails so that the top bar comes just under the board. The top nails shown are to hold brood frames. When waxing brood frames remove the nails that are for the super frames. When the frame is in the position shown in Fig. 5, Pl. 3, pour on enough bees' wax, which is slightly above the melting point, to securely fasten the sheet in place. The frame is now placed on a board that fits inside the frame with the wires on the top side. A spur imbedder is then used to fasten the sheet to the wires, as shown in Fig. 6, Pl. 3. If the board is wiped off occasionally with a damp cloth the wax will not stick. It also helps to dip the imbedder in water.

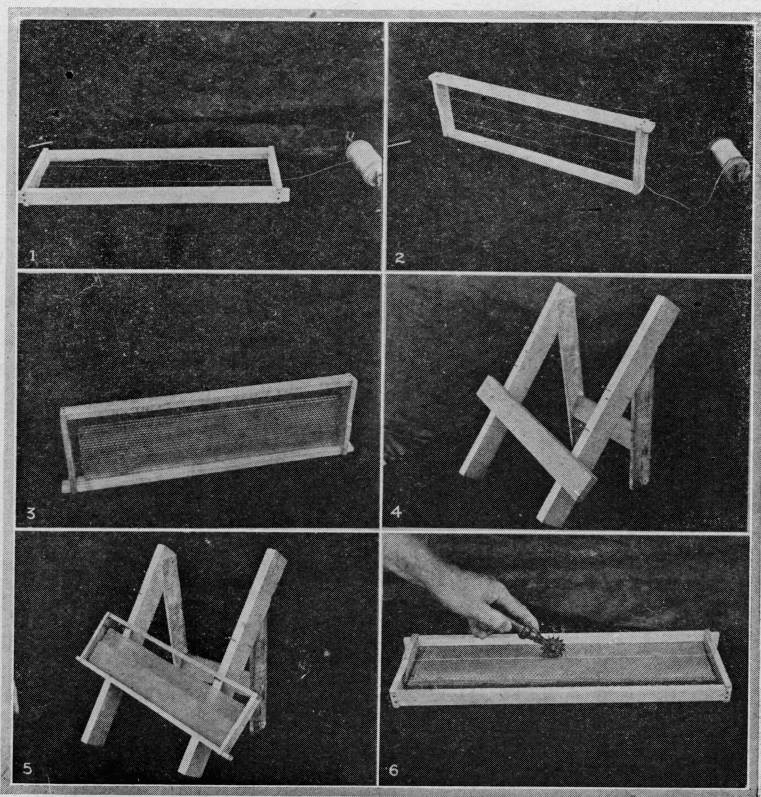


PLATE 3—WAXING IN FOUNDATION.

1. Stringing wire.
2. Tightening wire.
3. The sheet of foundation in place.
4. Waxing rack.
5. Frame on waxing rack.
6. Embedding.

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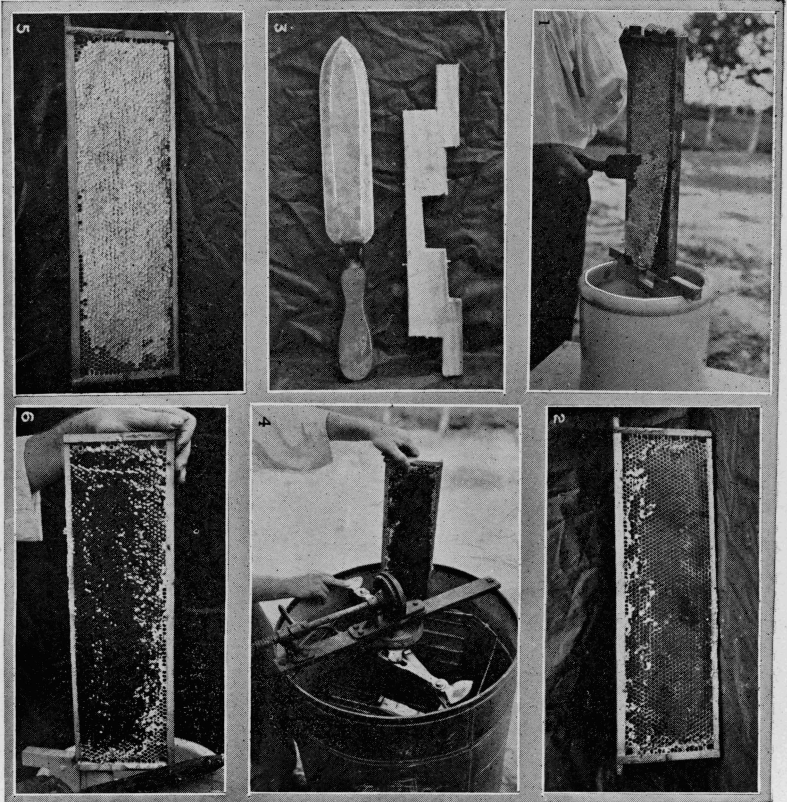


PLATE 4—EXTRACTING.

1. Uncapping.

2. The extracted frame.

3. Uncapping knife and bar.

4. Extracting.

5. The full super comb.

6. The uncapped frame.

THE EXTRACTOR.

The other great wax saving device is the extractor. After the bees have built comb on the wired foundation, filled the cells with honey, and have capped it over, the frame is removed from the hive. While it is best to wait until the capping is complete as shown in Fig. 5, Pl. 4, frames two-thirds capped on both sides may be extracted with but little danger from souring. In taking the frames from the hive, brush all bees from the comb and place the frames in a covered box or can. The frames are carried in this covered container to keep them free from bees and to lessen the chances of starting robbing, the menace of the extracting season. The combs are taken into a screened enclosure where the extractor, and the other tools used, are kept. The extractor is a sheet iron tank containing wire baskets which can be rapidly revolved by means of a crank and gear. The first step in extracting is to remove the caps,—an operation that is performed by an uncapping knife, such as is shown in Fig. 3, Pl. 4. This operation must take place over a container to catch and hold the cappings and dripped honey. For a beginner a five-gallon stoneware jar is probably the best. To aid in holding the frame a wooden bar such as is shown in Fig. 3, Pl. 4, is placed across the top of the jar. This bar is made from an inch board, and is knotted at the ends to tightly fit the jar. The opening in the top of the bar is four inches long and three-fourths of an inch deep and has the nail points shown near the ends, on which to stand the frame. The knife, also shown in Fig. 3, is used in the manner shown in Fig. 1, Pl. 4. Always begin at the bottom, using the top and bottom bars as guides cutting with a slant stroke upward, holding the frame so that the cappings swing free as seen in Fig. 1. In order to have the knife work to the best advantage it should have a keen edge and be kept hot; this is done by having a bucket of boiling water at hand in which the knife is dipped as often as it becomes cool. The uncapped comb, Fig. 6, Pl. 4, is placed in the extractor in Fig. 4, Pl. 4. Revolve the frames 30 times at the rate of 60 turns per minute; reverse either baskets or frames and turn them 60 times at the same rate; again reverse and turn 30 times. By turning the frames three times one saves breaking many combs. Always start and stop the extractor slowly. The empty comb shown in Fig. 2, Pl. 4, is almost dry and should be returned to the hive at once. As the honey in the extractor reaches the baskets, it should be drawn off through a tap at the bottom and strained through a cheese cloth sack into suitable containers. The cappings should be put into a colander or sieve and be allowed to drain. The honey so obtained should then be strained through cheese cloth to take out the fine particles of wax. It has been estimated that the use of foundation and an extractor increased the production of honey from fifty to one hundred per cent. It will pay anyone having three or more hives to own an extractor. Where one has no extractor no wires should be put into the super frames, but the foundation should be well waxed in. When capped over the whole comb is cut from the frame and the frame scraped and filled with a new sheet of foundation.

CARE OF WAX.

As bees' wax is a valuable substance, every particle should be kept. All scrapings of frames and bits of comb removed in cleaning up the hives should be saved. To get these bits of wax and cappings in shape to sell, the beginner can utilize any double boiler or substitute. About equal amounts of water and wax should be placed in the inside vessel; bring the water in the outside vessel to a boil, and after all the wax is melted allow the boiler to cool slowly. In this way a fairly pure cake of wax is procured as the honey in the cappings remains in the water and the dirt sinks to the bottom. When the wax is cold, remove it from the boiler by cutting around the edge and then wash off any adhering honey. No wax should be sold on the market, but should be sold direct to the manufacturers of foundation or their jobbers. When owning less than 50 stands, one should possess a solar wax extractor; when more than 50 stands are owned, a hot water wax press is desirable.

TRANSFERRING.

The explanation already given will enable the reader to understand the brief outline of the year's work in beekeeping that follows. In order that all may begin on the same footing it is necessary to describe the transferring of bees from a gum to a hive, as bees in gums cannot be cared for. Bees can be transferred any time when there is a honey flow. The best time is during the first honey flow in the spring. A hive with all but three frames filled with sheets of foundation should be provided for each stand to be transferred. To make the transfer, smoke the gum well; then after allowing time for the bees to fill up, place the hive and gum in the position shown in Fig. 2, Pl. 5, placing some loose boards over the opening as shown. Remove the top from the gum and smoke heavily at that end. After a few minutes' smoking remove one of the boards that was set up at the side in order to be able to brush the cluster of bees, which will be seen, onto the lighting board of the hive. If they do not go in they should be brushed in, a bee brush or feather generally being used for this purpose. After two or three smokings and brushings most of the bees will be in the hive. Either pull the nails along the edge of the gum or split it open endways, insert the blade of a knife as shown in Fig. 4, Pl. 5, and cut the comb loose, side and top; then spread the gum out flat as is seen in Fig. 4, Pl. 5. Pick out the best and largest pieces of brood comb, which, after the adhering bees are brushed off before the opening of the hive, is placed on a flat surface, the brood frame laid on it, and the included portion cut out as shown in Fig. 5, Pl. 5. If one piece of comb does not furnish enough good brood comb, a number of pieces may be used, just so they reach from the top to the bottom bars. These pieces are tied in with cotton twine as shown in Fig. 6, Pl. 5. Place this frame into the hive. The presence of the brood has a wonderful effect on the bees as they become quiet almost at once. Tie in the other two frames. It will take all the good brood comb to complete the frames. If there is but little honey in what has been tied in, it is well to tie in a fourth frame of honey. As soon as all frames are in place, brush the bees that remain on the pieces of comb onto the ground and remove every particle

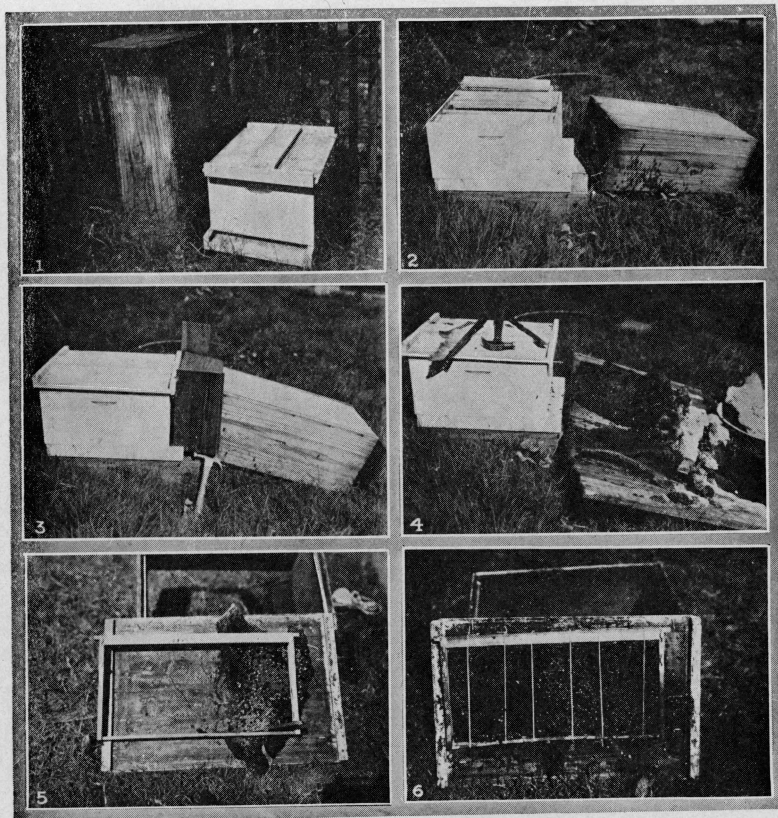


PLATE 5—TRANSFERRING.

1. The gum and hive. 2. First position for transferring. 3. Second position. 4. The gum opened. 5. Cutting the comb. 6. The comb tied in.

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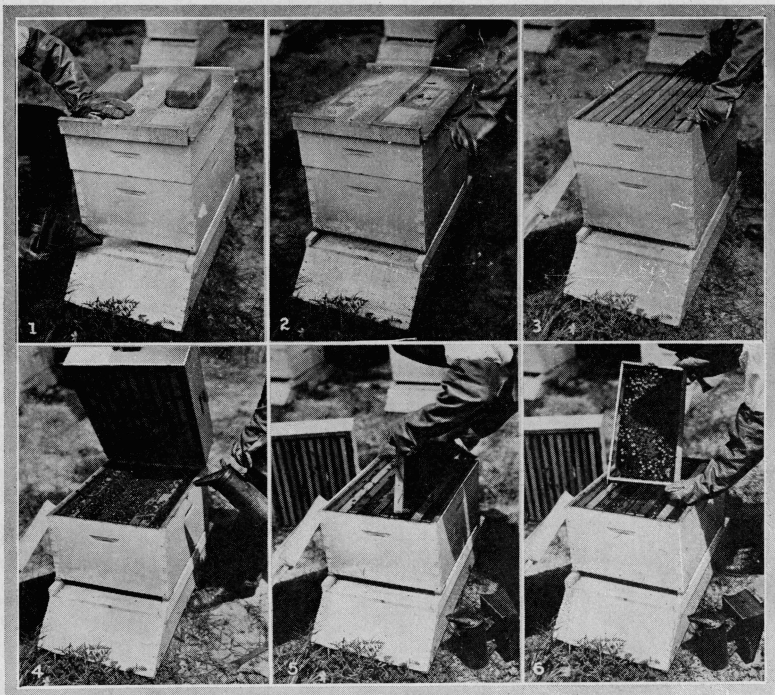


PLATE 6—INSPECTING THE HIVE.

1. Smoking the hive.
2. Removing the top.
3. Inspecting super.
4. Removing the super.
5. Removing brood frame.
6. Inspecting brood.

of honey, comb, and the old gum from the vicinity of the hive, as the spilled honey may start robbing. Just as soon as the bees fasten in the comb, they will remove the strings, but one must examine the hive in four or five days to see if the queen is present. If she is seen or eggs are present, all is well; if no queen or eggs are found, a new queen or eggs must be provided. Re-queening will be discussed under that head in the discussion of the year's work. There are many other methods of transferring which are easier but slower than this and involve a considerable knowledge of beekeeping. If the new beekeeper uses this method, he is done with the transfer at once and is ready to go to work advantageously.

THE YEAR'S WORK.

SPRING.

As soon as the bees are seen bringing in loads of pollen from mistletoe, elm, or other early blooming plants, it is time to clean up the hive for spring activities. At this time of the year, open the hives only on warm, bright days and near the middle of the day, as the young brood and even the old bees are very susceptible to cold. The manner in which a hive is entered has a marked effect on the bees. If the hive is opened without jar or quick action, the bees will rarely sting, but if the hive is roughly handled, look out. To go through the hives proceed as follows: give each hive a few puffs of smoke as shown in Fig. 1, Pl. 6; then place the hive tool under the edge of the top and slowly raise without a jar, at the same time blowing smoke through the widening crack, as shown in Fig. 2, Pl. 6. If a super is present, blow smoke across the top bars, Fig. 3, Pl. 6, until the bees go down; now scrape all wax and propolis from lid and top bars. The super frames should be removed one at a time and all excess propolis and wax removed. After the super has been finished, insert the hive tool between the super and hive body and after blowing in a little smoke remove the super as shown in Fig. 4, Pl. 6. Clean the top of the brood frames, remove the frames separately and clean them (see Figs. 5 and 6, Pl. 6). Now put the hive back together, and after blowing smoke into the entrance, remove the hive from the bottom board, on which will be found a mass of cappings and other debris of the winter. This board should be brushed and scraped clean, care being taken that neither worm nor cocoon be left in crack or corner, for in this mass of dirt the wax worm generally gets its start. When one cleans the hive, one notices that the frames do not quite fill the body and that, after the hive has been cleaned, these frames can be pushed to one side. To clean the top bars and push them to one side and then space them back is called by the beemen "working a hive." The object of this "working" is to keep the hive clean, and the frames movable, and at the same time to control the wax moth. The eggs of this insect are mainly deposited in the spur comb between bars and under the ends of the top bars. This cleaning and moving of frames removes the eggs and exposes the moth larva and when so exposed the bees make short work of the intruder. This working must be done at least every eight days during the active season.

Uniting.

If one, on going through the hive, finds that the old bees are numerous, that the queen is laying quantities of eggs, that young grubs are present, and that at least ten pounds of honey still remain, then, he should pay only the minimum attention to this hive. However, the following conditions may be found: the colony may be dead, in which case, clean the hive very thoroughly and put in new foundation in preparation for the first new swarm. If any good wax is found, it should be extracted; but if the combs were destroyed by the wax worm, burn all the scrapings and dirt from the hive. If a hive is found with only a small number of bees in it and neither queen nor brood, it should be united with a colony having a queen. To unite take the top from the hive having a queen, spread two thicknesses of common newspaper over the top, and put on it the weak colony. In two or three days the hive should be opened, the paper removed, and what bees remain in the top smoked down. If honey remains in the frames, these frames can be exchanged for empty ones in the lower chamber or the entire brood chamber can be removed for use elsewhere.

Requeening.

If a colony is found strong, that is, with plenty of old bees and with stores, that is, honey and bee bread, and no queen, eggs, or young brood, it should be requeened. Send to one of the various queen raisers of Texas and buy a tested Golden or Three Banded Italian queen. The queen will come to you by mail in a small wood and wire cage. To introduce her smoke the hive well, open the brood chamber, and move the brood frames apart so that there is a wide opening between the middle bars. Now take the queen cage and remove the paper tag that is nailed over one end. Under this paper will be seen a lump of sugar closing the entrance to the cage; take the cage by the other end and place it, entrance down, into the gap between the brood frames, near one end of the frame. Press one edge of the queen cage against the comb until it sticks there; now return all the brood frames to place, so that the cage is just below the top bar and held by both edges. Examine the hive in three days and most likely the queen will be found laying. If she is still in the cage, loosen the lump of sugar with a knife blade and let the bees at it again. Later in the season the easiest way for the beginner to requeen is to give the queenless colony a frame of brood containing eggs and young larvae and allow the bees to raise a queen. To do this, take from the best hive you have a frame containing eggs, brush the old bees from it, and put it in the queenless hive. Next, take the frame from the queenless hive, and, after having brushed it well, place it in the first hive.

Feeding.

In early spring the hives should be watched closely to see if they are getting supplies enough to live on. If they have no stores they should be fed and there are two easy ways for the beginners. The first is to place a pan on the top brood bars inside an empty super. In the pan

put about two inches of syrup made by mixing sugar and water in equal amounts by weight. A strip of cloth is placed across the pan, touching the bars outside and the bottom of the pan inside. This enables the bees to reach the syrup and carry it away without danger of getting drowned. The other way is to put the sugar syrup into a two or three-pound friction top can. In the center of the can lid punch three holes with a cigar box nail. Fill the can with syrup and put on the lid. Now bore a half-inch hole through the lid of the hive and place the can over this hole so that the syrup drips through into the hive. Renew the syrup as often as it is necessary.

Swarming.

With the advance of spring the colony builds up until the brood chamber is full of brood and then unless some control measures are used, the bees swarm. The old queen with her working force leaves the old hive, which becomes the property of the unemerged queen. The majority of swarms cluster shortly after leaving the hive. As soon as they cluster, bring a hive with either full sheets of foundation or comb in the frames and place near the swarm, cut the limb on which they are clustered, and dump all the bees on the ground before the hive using just a little smoke to keep them moving. The bees will go into the new hive and again cluster; then the hive can be placed where it is wanted. If the bees cluster on a post or part of a building, brush them into a box and then dump before the hive. Bees sting but seldom while swarming. As most beekeepers desire honey and not colonies, some form of swarm control should be practiced. As the first precaution against swarming, reverse the bottom boards giving the bees $\frac{1}{8}$ -inch opening as soon as the hive begins to build up, and put on a super with drawn comb or full sheets of foundation as soon as the majority of cells in the brood chamber are occupied by eggs, larvae, or bee food. If you find brood in the super, put on another; the longer you keep a queen laying the less likely you are to have a swarm. The more bees you have in your hive the more honey they can gather, and during a heavy honey flow and in late summer the bees will crowd the queen back into the brood chamber so that all the supers can be extracted. As these supers must be added, it will pay you to put on the super early whether it prevents swarming or not, for if you want honey the bees must have room. Watch your supers and add a new one as soon as the majority of cells in the last put on have honey deposited in them.

Swarm Control.

The second method is perhaps the most reliable one known. As soon in the spring as the brood chamber is filled, add another brood chamber and put half of the brood frames in the second story. Have the frames in both stories in the central part of the hive. Fill the vacant outside places with frames of empty combs or foundation. As the time approaches for swarming spread the brood by alternating the full frames with those put in the week or so before. A hive so treated rarely swarms if supers are supplied to it as soon as the two brood chambers are well occupied. A stand that has been transferred in

early spring rarely swarms that year. If you wish honey, watch your hives and see that there are always empty cells. Bees will swarm if there is no room for brood rearing, and they cannot store honey unless there is a place for it. Give bees plenty of room.

SUMMER.

Extracting.

In early summer comes the beekeepers' harvest. As soon as frames are found sealed over, they should be removed, extracted, and returned. The process of extracting has already been described. The beginner should not wait until the whole super is capped over. Go through your hives at least once a week and take out all frames that are three-fourths or more sealed. If you wait for the complete capping of the super, the bees may be raising brood in it the next time you go through the hive. The extracted honey, if intended for home use can be kept in glass or tin, and covered with a cloth to keep out dust. If the honey is intended for the trade, it is well to pack it in 2½, 5, and 10-pound friction top cans. Honey packed in flint glass jars holding up to 6 pounds, sells well, but one must get the price of the container in addition to the price of honey and also enough to make good the loss by breakage. Extracting should be carried on as fast as the bees make the honey until the crop is all harvested.

Shade and Ventilation.

Where an apiary is located permanently, the hives should be placed on bricks or other indestructible objects. The hive bottom should be at least four inches above the earth. The hive should be level crossways and slant slightly toward the entrance. Locate the hive so that the summer sun will not hit it, especially from 1 to 3 p. m. If the apiary is moved or no shade is at hand, shade boards will often save the life of a colony of bees. One of the most common accidents that befall bees is the melting down of combs, which causes many bees to drown in the honey and wax, and to perish from lack of air, caused by the stopping of the entrance with melted comb. If one decides to make permanent shade boards, one should take a piece of one-by-ten-inch board, three and a half feet long and to this nail shingles so that three inches of the thick end of the shingle is on the edge of the board, the rest extending at right angles to the length of the board. When a row of shingles has been nailed along both sides of the board one has a very light and efficient shade. Lay this on top of the hive, extending a trifle farther to the south and west than elsewhere. When winter time approaches these shades should be packed away for the next year's use. The common opening of seven-eighths of an inch is not enough in the summer. If more ventilation is not given, bees continue to swarm and will lay out most of the day in midsummer. Hives raised by putting three-eighths-inch blocks between the bottom board and brood chamber give very good results. By the middle of September these blocks should be removed and by December the three-eighths-inch entrance to the hive should be turned up.

Fumigation for Bee Moth.

Summer is the period of the year when the bee moth works rapidly. All cappings should be rendered at once. Extracted or unused combs should be put on a strong hive to protect them from the worms. If combs are not replaced, they should be racked up in brood chambers or supers with an empty one on the top. In this one put an uncorked bottle containing a few ounces of carbon bisulphide or "high life" or a like amount of crystals of para-dichloro-benzene in an open container. Either of these poisons will control the wax moth if an air-tight cover is put over the top super and no large cracks exist in the stack. Where the combs are to be kept long periods, renew the poison every month. The wax worm has been considered the greatest menace to the beekeeper and so it is to the beeman who never cares for his bees, but if one works his bees, and keeps his combs in the manner described above he will be free from this trouble.

FALL.

Brood.

The fall season begins when cooling nights and shortening days tell the bees that winter is approaching. Brood is produced in large quantities as the fall flowers bloom in profusion and the winter store is made up of their strong flavored honeys. About September 1st the beginner should take off his last honey. All that is stored after that time will be needed as winter stores by the colony. Great care should be exercised to see that the queen and brood are in good shape. If any colonies are queenless, requeen at once with an adult queen, or unite.

Dividing and Requeening.

It will be remembered that in one of the systems of swarm control a two-story hive was made. If things went well, this hive has been strong and a good producer and now has the two hive bodies well filled with brood. This is the best time and the following is the easiest way to make two colonies from it and to start on the next season's swarm control. Procure a good young queen, take a hive bottom and extra brood chamber and a top to the side of the two-story hive. Open the strong hive, take from each of the chambers half of the frames showing the most sealed brood. Put all the unsealed brood in the lower chamber of the old hive. In changing the location of these frames do not attempt to brush or shake the bees from them, but allow all bees adhering to the frames to go into the new brood chamber. Be sure that the old queen is placed in the new hive. Introduce the new queen into the old stand. The newly-made hive containing the old queen should be removed to some other part of the yard. The field bees returning to the old hive will find the introduced queen and with their narrowed quarters will be able to raise sufficient brood and provide abundant stores for the winter. It has been the experience of those who have tried this system that a hive having a fall-introduced queen rarely swarms the next year. The newly-made hive with its

stock of sealed brood shortly hatches out and the old queen, after this short rest, becomes active again, so that this hive also goes into the winter strong and with abundant stores. The next spring this hive must have the brood divided as was explained under Swarm Control. Where this system is carried out fully, strong colonies, large honey production, and no swarming is the rule. If one does not wish to increase his number of colonies, one should requeen in the fall and see that the two-story hive has a gross weight of about 90 pounds.

Stores.

Throughout the autumn season the bees should be watched closely and should a large honey flow occur a super should again be put on the hive so that the bees will not fill the brood nest with honey. A brood nest filled with honey means a very weak colony the next spring. On the other hand if the fall is dry and hot with no honey flow, it will be to the advantage of the beekeeper to feed thirty-five or forty pounds of sugar syrup or honey to the colony.

WINTER.

Protection.

When the weather becomes so cool that the bees are no longer in regular flight, remove from the hive all supers that do not contain honey, see that all of the frames in the brood chamber are in good shape and well supplied with stores. The hive is now reduced to the bottom board, brood chamber, and top. If this hive is now lifted and found to weigh approximately fifty pounds, the bees have sufficient stores for the winter. If the hive weighs less, it must be watched and fed, if to do so is found necessary. The hive should be placed facing the south and in such a locality that the west and north wind cannot hit it and should be placed so that the entrance is high enough above the ground that blowing dirt and leaves will not enter. Precaution should also be taken that the hive is safe from damage by farm stock, especially from hogs. If either forest or field fires are common in the vicinity, see that the hives are placed in a location from which the grass has been removed.

Care of Equipment.

As the hives are being prepared for winter all of the extra parts should be put away very carefully in a dry place. The parts of hives are small and cost but little money, but when they are neglected, the loss is considerable. During the winter season all the equipment should be cleaned, new foundation should be put in where needed, and any new fixtures should be purchased and made ready for the spring work. Any honey that may have crystallized may be liquefied by being heated in a double boiler. As much of the honey is not sold until mid-winter, this operation becomes part of the winter work.

ENEMIES AND DISEASES.

BEE MOTH.

This insect, so well known to the beekeeper as the grey worm, which "webs up" combs that are not on the hive and very frequently reduces a hive to a mass of web and dirt, is a mouse-colored moth in the adult state. This flying insect will enter the hive unchallenged by the bees and deposit her eggs. It is only after the eggs hatch that the bees will attack this enemy. It was impossible to give an idea of bee work and of the seasonal activities without fully describing the work of the bee moth. This insect will cease to be a menace if the control measures already given are closely followed, especially if one has Italian bees.

ANTS.

Ants of various kinds, especially the Argentine ant, have the habit of entering beehives and carrying off honey, bee bread, and even young bees. Where their nests can be easily located they can be destroyed by the use of carbon bisulphide. In case the hive must be protected in some other way, it is best to place the hives on benches so located that nothing save the legs of the bench touches the ground; these legs should be placed in cans containing a small amount of crude oil. Another very successful method is to make a band around each leg of the bee stand with a mixture of axle grease and coal oil. This sticky material will remain soft enough for two or three months to stop any ant that attempts to cross it.

FLIES AND SPIDERS.

Large robber or *Asilid* flies very often kill worker bees and are sometimes accused of capturing queens. This loss is not noticeable because of the fewness and of the local distribution of these robber flies. Spiders occasionally spin webs close to the hives and thus capture numerous bees. Certain small spiders hide in clusters of flowers and when the worker bees light they are caught and become food of the spider.

BIRDS.

Beekeepers sometimes accuse birds of killing many of their bees. The king bird or bee martin has this reputation. If one of these birds takes up its abode near the apiary and persists in catching bees, use a shotgun. In all of the investigations which the Biological Survey has carried on it has been unable to find but very few remains of honey bees in the stomachs of birds. Chickens very often form a habit of catching bees. This is especially true where chickens are fenced in the same yard with bees, and a grain feed only is supplied.

In order to protect the apiary from farm stock a hog and cattle fence should enclose the bee yard.

ACCIDENTS.

The bee, like a human, is subject to accident, disease, and death. Natural causes bring about the death of the worker bee in a few weeks during summer. During the winter when there is little activity, a

worker bee may live a number of months. Queens have been known to live as long as six years. Among the more common accidents which cause death in the colony is that of drowning, resulting from the melting down of the comb, caused by the lack of protection from the sun; the suffocation of the bees results from the choking up of the entrance to the hive by fallen comb, or the accumulation of dust or mud from the outside. These accidents are largely the result of ignorance or inattention on the part of the beekeepers.

DISEASE.

Poor housing, unsanitary conditions, and exposure to disease bring about physiological conditions, the result of which causes the death of bees. These results are known under the various names of American Foulbrood, European Foulbrood, Bee Paralysis, Pickle Brood, Sacbrood, and the like. The liabilities to these troubles are greatly reduced when the bees are kept in modern movable frame hives and receive proper care.

CAUTION.

The beginner in beekeeping will soon recognize when his bees are working normally and when they are not. Should numbers of dead larvae be found in the combs the beginner should not diagnose the case himself, but consult an expert on bees. The State Entomologist, located at College Station, should be consulted when a bee disease makes its appearance in the apiary. Because of the resemblance of certain of these troubles, the beginner is very apt to be mistaken and very often will follow the wrong method in trying to control the troubles. When you are sick you call a doctor. If your bees get sick consult the State Entomologist.

INFORMATION.

No one should attempt to keep bees without subscribing for at least one of the leading bee periodicals and having at hand one or more text-books on apiculture. The paper will supply the addresses of queen breeders, of dealers in bee supplies, and articles that will help the novice over many a hard place. A good text-book is indispensable if the beekeeper is prudent enough to take advantage of the other man's work and profit by others' experiments instead of trying them all over again. The following magazines are of the most interest in this State:

American Bee Journal, Hamilton, Ill.

Gleanings in Bee Culture, Medina, Ohio.

Texas Beekeepers' Item, New Braunfels, Texas.

In the following list of books occur many that it will pay the beginner to own, and he should not consider himself a beekeeper until he has read the more popular ones. Addresses of publishers will be found in the bee papers.

LIST OF BOOKS.

Comstock, Anna B.—“How to Keep Bees.”

Cook, A. J.—“Manual of the Apiary.”

Dadant, C. P.—“First Lessons in Beekeeping.”

Doolittle.—“Scientific Queen Rearing.”

Hutchinson, W. Z.—“Advanced Bee Culture.”

Langstroth.—“The Honey Bee.”

Miller, C. C.—“Fifty Years Among the Bees.”

Miller, C. C.—“A Thousand Answers to Beekeeping Questions.”

Pellett, F. C.—“Practical Queen Rearing.”

Pellett, F. C.—“Productive Beekeeping.”

Phillips, E. F.—“Beekeeping.”

Root, A. I. and E. R.—“A B C and X Y Z of Bee Culture.”

All beekeepers and those interested should belong to the County Beekeepers' Association and if none should exist it will be to the advantage of the new beekeeper to write to the State Entomologist relative to organizing.

When special problems and troubles arise, when difficulties come, or when definite information is wanted upon any subject relative to beekeeping, the Division of Entomology, Texas Agricultural Experiment Station, College Station, Texas, may be consulted. Letters of inquiry are always welcome.