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A MANUAL

OF

BEE HUSBANDRY

BY

ELMER G. CARR

Deputy of the State Entomologist in Bee Inspection.

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HON. JOSEPH FRELINGHUYSEN,

President of the New Jersey State Board of Agriculture:

SIR:

I transmit herewith the manuscript for "A Manual of Bee Husbandry."

Statistics of apiculture in this State clearly show that the honey bee branch of New Jersey livestock is under present methods producing less than one-third the income it is capable of yielding under better management. Furthermore, study of honey producing and fruit plant fertilization conditions shows unmistakably that the present bee population is far below that which the State could profitably support.

For the purpose of enlightening the man, who already has bees but is not getting a proper income from them, and for the further purpose of aiding the would-be bee-keeper to make the proper start, Mr. E. G. Carr has drawn together the important facts bearing on bee husbandry and has woven them together with the facts derived from his personal experience as a successful bee-keeper, into a simple account of how bees may be kept at a profit.

Believing that this manual will go far toward extending the practice of good bee husbandry among New Jerseymen, I recommend the publication of this manuscript as a regular bulletin of the Board of Agriculture.

Respectfully,

THOMAS J. HEADLEE,

State Entomologist.

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A Manual of Bee Husbandry

BY ELMER G. CARR.

INTRODUCTION

Comparatively few Jerseymen realize the opportunity for commercial honey production offered by the climate and plant life of their State. While it may be true that bees cannot profitably be kept in large yards containing hundreds of colonies, it is true that they are now kept in small and scattered yards at a large profit. The fact that there are at present few commercial honey producers in New Jersey must not be taken as an indication that the business is unprofitable, for, with rare exceptions, the bee men of this State have made no attempt to keep bees on a large scale.

The census of 1910 shows that the 10,484 colonies of bees on Jersey farms make only 14 pounds of honey apiece. The reason for this profitless husbandry is to be found in faulty methods of handling. With proper attention these colonies would produce nearly 50 pounds each, and the wealth of the State would be $36,500 greater than it now is.

No other farm animal is capable of giving so large a return for money and time expended. Not only does the honey bee utilize the nectar which would otherwise go to waste, but in securing it incidentally fertilizes the blossoms of many cultivated plants and renders them fruitful.

Believing that the prime need of New Jersey bee-keeping is a more thorough and widespread knowledge of the general principles of good bee management, the author has drawn together the experience of bee masters and attempts to present in the following pages a simple statement of what he believes to be the general principles of successful bee husbandry.

Life Economy of the Honey Bee

SOCIAL ORGANIZATION

The social organization of the hive is a marvel of economy and efficiency. The shape of the honeycomb is such as to accommodate comfortably the maximum amount of brood in the minimum space. Each bee of the hive appears to have its own work to perform and there is no evidence of shirking or neglect. The queen gives her entire time to the production of eggs. She does not even feed herself but is waited upon by workers which supply her every need. While she is called the queen there is no evidence that she acts in any way as the ruler. The only function of the drone seems to be that of fertilizing the queen—an operation which, however, is vital to the perpetuation of the colony. The workers, as the name implies, perform the labor of the hive. While this labor is of many sorts, the oganization is so perfect that each part of the hive work is promptly and properly performed. Some of the workers act as guards and freely give their lives in defense of the colony when it is threatened with danger. A part of the workers, usually those under 14 days of age, perform the indoor labor, while another part, usually those that are older than 14 days, do the outside work. While few of the inmates of the hive live to see the result of their labor, there is apparently no lack of enthusiasm or thoroughness with which each does its part.

LIFE CYCLE.

QUEEN.

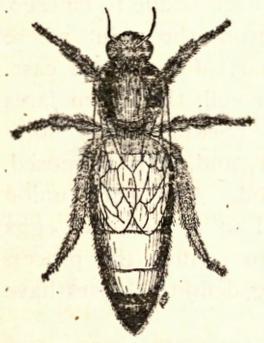


Fig. 1. Queen

The queen, which is the only fully developed female in the colony, produces all the eggs and at certain times of the year may deposit as high as 2,000 or more a day. She is reared from the fertilized egg in a specially formed cell which is always built pointing downward on the side or edge of the regular comb, and which resembles an acorn cup when first started and a peanut when completed. All the workers come also from fertilized eggs but are not reared in specially formed cells and are not furnished with the rich food, except during the first three days of their larval existence.

All eggs deposited by the queen look alike and are slightly more than one-sixteenth of an inch long. Their short diameter is about that of an ordinary pin. They are fastened by the end to a cell and when first deposited stand upright. As the hatching time comes near, they bend over and lie on the base of the cell. The color of the egg is pearly white. The larva, "grub," which hatches from the egg and is the second stage in the development of the bee, is a bluish-white worm-like creature. It is fed by nurse bees, and during the first few days of its existence floats in the food.

The food which is furnished by the nurses to the prospective queen is composed of honey and pollen and much resembles condensed milk. Throughout its entire existence, the queen larva is fed this highly concentrated product which is called royal jelly. At the end of a five-day period the larva has grown from a tiny worm to one which entirely fills the cell. The cell at this stage is about one-third of an inch in inside diameter. The workers now build a waxen cap over the opening. Soon the queen larva commences a third or pupal stage of its existence. In preparation therefor it prepares its cocoon, sheds its old skin and becomes a helpless creature. For eight days the queen remains

in this condition, and during this time the organs of the worm are torn down and the organs of the winged queen honey bee are built up in their place. When the end of this period is reached, the pupal skin is burst open and the queen bee makes her way forth. About two days before the queen is due to emerge, the workers remove the waxen covering from the point where the queen will come forth, and expose a part of the pupal case.

About one week after emerging from her cell, the queen fares forth from the hive in search of a mate. Sexual union takes place during this or later flights in the air, and, it is supposed, at a considerable distance from the ground. One such union suffices to furnish the queen with material to fertilize her eggs throughout her active life time. Efforts to confine the process of mating to a cage for purposes or insuring definite crosses have been made without success.

Queen honey bees are not tolerant of each other. There is but one fully developed queen in the hive at a time.

The queen is much of a home-body and leaves the hive only for her mating flights or for the purpose of establishing a new colony.

The normal lifetime of the queen covers a period of three or four years, but under best bee-keeping it is found unprofitable to keep a queen for more than two years. After this period of time has passed, the queen produces eggs with comparative slowness. Some very good honey producers requeen every year.

DRONES.

Fig. 2. Drone

The drone is a fully developed male honey-bee. It is reared from unfertilized eggs which are placed in comb that is normal in every way except that the cells have slightly greater diameter. In three days from the deposition of the egg, the drone larva hatches. It is fed on very rich food for three days; then it is compelled to subsist on coarser food for the rest of its larval existence—seven days. At the end of ten days from the time the egg is deposited, the nurses close the cell with a wall of wax and the drone larva, after constructing its cocoon, transforms as did the queen from a worm to a winged insect. Fourteen days from the time the cell is capped, the adult drone gnaws its way to the outside.

Drone brood is distinguishable from the normal worker brood by the fact that the cappings of the cell are much raised and resemble revolver bullets placed upright close together on a board.

The number of drones in a hive varies with the season, the amount of drone comb present, and the nectar supply. In the seasons when young queens would normally make their appearance there are 200 and upward drones in a single colony. After the mating season is over, they are driven from the hives and perish.

The only way in which the drones promote the success of the bee colony is in furnishing to the queen fertilizing material for her eggs. Hence they are produced in large numbers when there is demand for their function and they are destroyed when the season of reproduction is passed. Sometimes a queen fails to obtain fertilization and is unable to produce anything but drones. The life of the drone ranges from a few days to a few months, and there are no drones during the winter.

WORKERS.

Fig. 3. Worker

The worker is far more numerous than any other caste in bee organization. Workers range from 20,000 in the spring to 100,000 or more in midsummer. They are reared from fertilized eggs just as are the queens.

In three days after deposition, the egg hatches and the larva is fed for three days on rich food. For three days longer it is fed on coarser food and is then sealed up by its nurses. The larva spins its cocoon and transforms to a pupa. For twelve days it lies in this condition and is changed from a "worm" to a winged bee. At the end of this period it makes its way through the enclosing wall to the general hive chamber. The worker differs from the queen in that its reproductive system has never reached full development. Under exceptional conditions, workers may sometimes produce eggs, but these eggs, being, of course, unfertilized, give rise to drones only.

Workers of less than fourteen days normally stay in the hive and feed the larvæ, secrete and work wax, build comb, ventilate the hive, care for the queen, glue up the cracks, and do what might be called the general inside work. Workers over fourteen days old go into the field and gather and bring to the hive water, nectar, pollen and propolis or "bee glue." The bee-keeper who desires to gather a maximum amount of honey must have, during the height of the honey flow, a large number of workers per colony.

The life of the worker in the harvest season is about six weeks, but one which is hatched late in the season may live until the following spring. The worker bee is old or young as she has worked much or little.

RELATION TO FOOD..

Bees, like other animals, must have food, and when considering the question of keeping bees, one must investigate the nectar producing flora of the place where he wishes to keep them. One must know whether the supply of nectar and pollen is sufficiently continuous to enable the bees to live. Of course, the bee does not consciously produce honey for man's use, but gathers the nectar and transforms it into honey in order that it and its offspring may have food enough to last it while food cannot be obtained. Man takes advantage of the providence of the bee, removes its stores from time to time and thus induces it to gather larger quantities of nectar.

Wherever wild bees flourish it is safe to consider the practice of bee-keeping, because the nectar flow must be large or the wild bee would be unable to gather a sufficient supply to last it over winter and through times when food cannot be obtained.

The bee husbandman must watch the supply of food which each colony has, for it is an easy matter to remove the stores of honey to a point where the bees have not enough to tide them over winter. When it chances that the stores have thus been cut down, the bees must be fed or they will perish.

The lack of nectar can be partly supplied by the use of sugar syrup, and where necessary a substitute for pollen can be obtained and fed. The sugar syrup feeding is sufficient during the

season when brood is not being produced, but when young bees are in the process of growth, a substitute for pollen must also be fed as well as for nectar. Pollen, however, will rarely be found lacking during the breeding season in New Jersey.

BEE PASTURAGE.

While some persons will succeed with bees no matter in what part of Jersey they may be located, it is true that, other things being equal, where the greatest abundance of natural pasturage is found the bee-keeper will be most successful. Setting out of plants for honey production alone has not thus far proven practical except in instances where a honey plant like sweet clover can be scattered on waste ground. It sometimes pays to plant crops which normally give a heavy honey flow, not for the prime purpose of obtaining the honey flow, but for the purpose of obtaining the crop itself.

Perhaps no one thing in New Jersey agriculture has increased the bee-keepers' chance for obtaining paying crops more than the increase in dairying which has brought about the planting of much alsike clover.

While bees can be and are kept in almost every part of our State, it is true that certain parts are much more favorable than others, and it is wise for anyone who is considering going into bee-keeping to make sure that the locality chosen will support profitably a large number of bees. For recreation, study, or the supplying of a little honey for home use, bees may be kept in any part of New Jersey.

HONEY AND POLLEN PLANTS.

The various plants in New Jersey which produce either nectar or pollen suitable for honey-bee use are so numerous that it is impossible to give a complete list and the statement which here follows covers only the most important. An effort has been made to list separately those from which the bees gather pollen and nectar for brood rearing, and nectar in surplus quantities. With some plants this will vary slightly with the locality and bee-keepers. Some bee-keepers build up their colonies in time to gather surplus from early blossoms like those of the apple, while

others get their colonies ready to use such early blossoms as the apple as a source of nectar for brood rearing only.

Every bee-keeper should study his locality and know not only which plants produce honey or which produce pollen, but also the usual time and duration of the bloom and whether they are annual yielders or not. The bee-keeper should also know whether the flow of nectar is greatly affected by atmospheric conditions. The person who has all this knowledge of the sources of honey is the one, all other things being equal, who will get the largest crops.

The bee-keeper who has built his colonies up to the maximum strength when the surplus honey flow makes its appearance is the one who will get the maximum amount of honey.

The tables with the exception of the blooming period which, of course, varies with the latitude and the season will be found reasonably correct. Every bee-keeper will profit by a close study of these tables and should add to them observations of his own.

PLANTS FROM WHICH BEES GATHER POLLEN.

Common Name.	*Botanical Name*	*Approximate Blooming Time*
Skunk Cabbage	Spathyema foetida, L.	February-March.
Shad bush	Amelanchier intermedia Spach.	April.
Maples	Acer, L.	March-Mid April.
Hazel	Carylus americana, Walt.	March.
Elms	Ulmus, L.	Late March-Early April.
Willows	Salix, L.	Late Apr.l.
Dogwood	Carnus florida, L.	May.
Dandelion	T. taraxacum, L.	May.
Ash	Frax nus	May 1-15.
Horse chestnut	Aesculus hippocastanum, L.	May-June.
Birch	Betula	May 15-30.
Hickory	Hicoria	May.
Oaks	Quercus	May.
Locust	Robina pseudacacia, L.	Late May-Early June.
Crimson Clover	Trifolium incarnatum, L.	May.
Tulip Poplar Whitewood	Liriodendron tulipifera, L.	Late May-Early June.
Wild cherry	Prunus serotina, Ehrh.	Mid May-Early June.
Mountain laurel	Kalmia latifol a, L.	June.
Sheep laurel	Kalmia augustifolia, L.	
Black alder	Ilex verticillata, L.	Mid June-Late June.
Sweet chestnut	Castenea dentata, Marsh.	Late June-Mid July.
Ox Eye daisy	Chrysanthemum leucanthemum L.	Mid June.
Indian corn	Zea Mays	July-August.
Cucumber	Cucumis salivus, L.	August.
Melons	Citrullus, K.	August.
Sunflower	Helianthus	Mid Aug.-Mid Sept.

A profitable yard on a town lot.

A fine Union County apiary.

Common Name.	*Botanical Name*	*Approximate Blooming Time*
Wild turnip	Brassica campestris, L.	August.
Ragweed	Ambrosia, L.	August.
Touch-me-not	Impatiens biflora, Walt.	August-September.
White aster, Heath aster, St. Michaelmas daisy	Aster ericoides, L.	August-Mid October.
Bushy goldenrod	Solidago lanceolata, Britton	Late Aug.-Early Oct.

PLANTS FROM WHICH NECTAR IS GATHERED IN LESS THAN SURPLUS QUANTITIES.

Maples	Acer	Mid March-Early April.
Peach	Amygdalus persica, L.	Early April.
Pear	Pyrus communis, L.	Mid April.
Apple	Pyrus malus, L.	Late April-Early May.
Willows	Salix	Late April.
Dandelion	T. taraxacum, L.	Early May.
Wild strawberry	Fragaria virginiana, Mill.	May.
Lupine	Lupinus perennis, L.	May.
Raspberry	Rubus occidentalis, L.	May.
Grape	Vitis	Late May-Early June.
Huckleberry, Blueberry	Vaccinium, L.	Late May-Late June.
Persimmon	Diospyros virginiana, L.	Mid June-Late June.
Vervain	Verbena hastata, L.	Late June-Early Sept.
Virginia creeper	Ampelopsis quinquefolia, Michx.	Late June-Late July.
Milkweed, Silkweed	Asclepias syriaca, L.	July.
False indigo	Baptisia tinctoria, L.	July.
Button bush	Cephalanthus occidentalis, L.	July.
Burdock	Arctium minus, Schk.	July-October.
Tree of Heaven, Pride of China tree	Ailanthus glandulosis, Desf.	July.
Catnip	Nepeta cataria, L.	July.
Motherwort	Leonurus cardiaca, L.	August.
Smartweed, Heartsease	Polygonum pennsylvanicum, L.	Late Aug.-M'd Sept.
Horsemint	Monarda punctata, L.	August-September.
Boneset	Eupatorium perfoliatum, L.	Mid August-September.

SURPLUS HONEY PLANTS.

Crimson clover	Trifolium incarnatum, L.	Mid May.
Locust	Robina pseudacacia, L.	May 20-June 1.
Tulip poplar	Liriodendron tulipifera, L.	May 20-June 10.
Poison ivy	Rhus radicans, L.	Mid May-Mid June.
Holly	Ilex opaca, Ait.	Late May-Late June.
Mountain laurel	Kalmia latifolia, L.	Late May-Late June.
Sheep laurel	Kalmia augustifolia, L.	Late May-Late June.
Swedish clover, Alsike clover	Trifolium hybridum, L.	June 1-July 10.
White clover	Trifolium repens, L.	Early June-Mid July.
Dogbane, Indian hemp	Apocynum cannabium, L.	Early June-Late August.
Basswood, Linden	Tilia americana	Late June-Early July.

Common Name.	*Botanical Name*	*Approximate Blooming Time*
California privet	Ligustrum ovifolium	Mid July-Late July.
Sumac	Rhus copallinum, L.	Mid June-Mid July.
White sweet clover	Melilotus alba, Desr.	June-November.
Cranberry	Oxycoccus macrocarpus, Ait.	June 15-August 15.
August flower, Soap bush, Sweet pepper bush	Clethra alnifolia, L.	Late July-Late August.
Rose mallow, Swamp mallow	Hibiscus moscheutos, L.	Late July-Early Sept.
Burdock	Arctium minus, Schk.	July-November.
Spanish needle	Bidens bidentoides, L.	Mid August into Oct.
Heartsease, Smartweed, Blackheart	Polygonum pennsylvanicum, L.	August-September.
Heath aster, White aster, St. Michaelmas daisy	Aster ericoides, L.	Late August-Mid October.
Bushy goldenrod	Solidago lanceolata, Britton	Late August-Mid October.
Buckwheat	Fagopyrum esculentum	Early August-Late Aug.

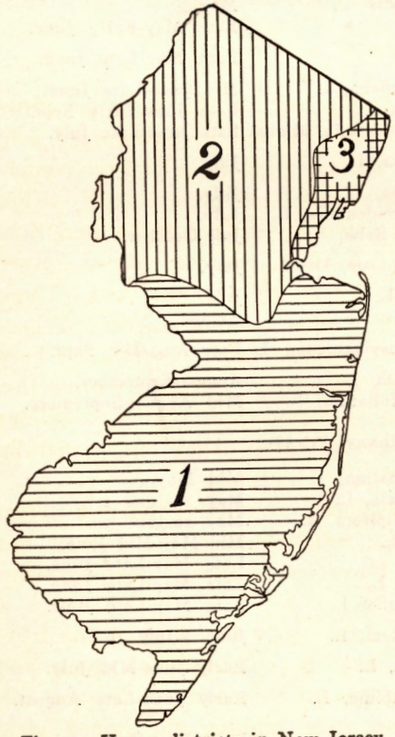


Fig. 4. Honey districts in New Jersey
1. Surplus honey from clover
2. Surplus from both clover and fall flowers
3. Surplus from fall flowers only

SURPLUS HONEY REGIONS.

We may divide the State of New Jersey into three sections on the basis of surplus honey production.

The first section includes all of the southern and middle counties and the southern part of Middlesex, Somerset and Hunterdon. As a rule, the surplus honey in this district comes from clover. There are, of course, occasional places, such as low-lying land along large streams where a second flow is harvested in late summer and early autumn.

The second district includes all north of the first with the exception of Hudson County and a part of Bergen, Passaic, Essex, and Union. In this district there are generally two distinct heavy honey flows; the first from clover and the last from buckwheat and fall flowers such as goldenrod, aster, etc.

The third division which roughly includes the Passaic and Hackensack valleys, and the Raritan valley below New Brunswick, rarely produces any surplus honey except in the fall, and that comes from goldenrod, aster and mallows.

The presence or absence of a single kind of plant will often decide whether the fall flow will be worth consideration. This principle applies more particularly to the second district. Should the amount of buckwheat sown be very small in some parts of this region the fall surplus would be missing. In certain parts of this second district white sweet clover is found in great abundance and furnishes surplus throughout the late summer and early fall.

RELATION TO NATURAL CHECKS.

CLIMATE.

Mild or broken winters normally permit the bees to come through with very small losses. Severe and long-continued cold weather may cause the death of a heavy percentage of over-wintering bees because after they have consumed all the food within their reach they are unable to move to fresh supplies and thus starve with honey in the hive. As an insurance against severe winters some bee-keepers use extra packing over the bees. There is great diversity in wintering practice among successful bee-keepers. Some take the greatest possible care to keep their bees warm, while others winter them out-of-doors with no protection other than the hive itself. There is considerable reason to believe that winter losses are much greater than they are generally thought to be.

There is evidence that atmospheric conditions have a direct bearing on nectar secretion but, unfortunately, the subject has not as yet been carefully enough studied to render positive statements advisable.

Backward springs sometimes delay early breeding in the hive. Late and untimely frosts may shut off the supply of nectar and pollen for brood rearing. Changes of this sort render the colonies weaker and prevent them from making the honey yield that would normally be possible.

Drought sometimes seriously interferes with the blooming of honey plants and prevents the bees from obtaining the normal supply of nectar.

DISEASES.

Bees are subject to several serious diseases, some of which have been most carefully studied and have had remedies found for them.

American Foul Brood.

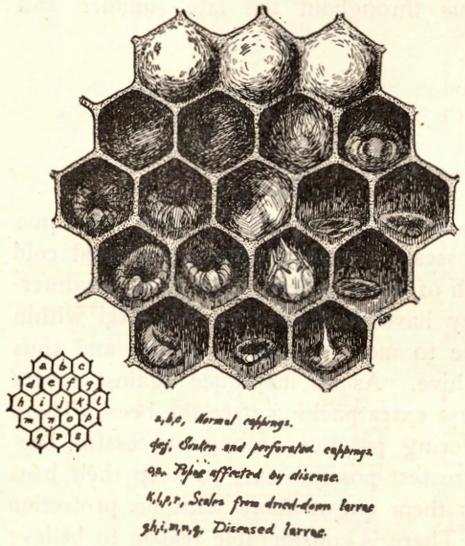


Fig. 5. American foul brood

This disease is caused by a bacterium known as Bacillus larvæ. This disease destroys the larvæ, usually after they have been sealed. In some instances, death comes before sealing. The first symptoms of this trouble are discoloration and loss of usual plumpness. The loss of form generally makes its appearance about the middle of the larva.

As the symptoms are usually manifested after the larva has been sealed, these early indications of trouble are not of so much advantage to the practical bee-keeper as the later marks of the disease.

The majority of the larvæ die fully extended in the cell, and as the process of decay advances they sink down and come to lie on their backs on the lower cell wall. The capping of the cells which contain dead larvæ, instead of being slightly raised and having a papery appearance as in the healthy state, look greasy and sunken. It is, however, when the bees remove cappings entirely that the most striking characteristics of this disease appear.

The dead larvæ when completely dried are reduced to mere

scales which, however, are plainly seen when the comb is held so a strong light strikes the lower cell wall. This scale adheres so tightly to the cell wall that it is impossible for the bees to remove it without tearing down the comb. It is brown in color and, of course, is not to be found in healthy comb.

If, when the decaying larva is about half dried down, a small stick such as a toothpick is inserted in its body and then withdrawn, the mass will adhere to the stick and be drawn out in a thin thread sometimes two inches in length.

The advanced stages of the disease are marked by the presence of a very foul odor as of decaying animal matter. The odor has been likened to that coming from a poor grade of glue when it is heated.

This disease is infectious.

European Foul Brood.

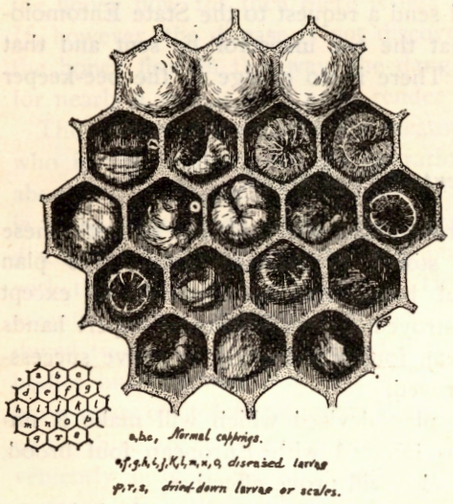


Fig. 6. European foul brood

European Foul Brood is also a bacterial disease, its cause having been determined as Bacillus pluton. This disease destroys larvæ at an earlier stage than does the American foul brood, a great many of them dying while still curled up in the cell. The first symptom is the appearance of a yellow or grayish spot near the head of the larva, and soon the loss of plumpness becomes marked. Sometimes in the early stage the tracheae (breathing tubes) become prominent. As the disease advances the larvæ appear to melt down gradually and many lose all definite form and look like irregular masses sticking to the side of the cell.

The larvæ may be found in all conceivable shapes and on all sides of the cell, while in American foul brood the dead larvæ lie on the lower cell wall. The odor accompanying European foul brood is exceedingly disagreeable and in some cases so prominent as to be detected ten feet from the infected colony. In almost every instance where the disease has made much progress the characteristic odor can be detected by one acquainted with it as soon as the hive cover is lifted. Scales are occasionally formed of the dried down larvæ, but as they are not tightly attached to the cell wall they are eventually removed by the bees. Such scales are grayish in color.

This disease is infectious and the infection is carried in the honey. The work of this bacterium does not apparently affect any other organism than that of the larva. Adult bees experience no ill effect from feeding upon infected honey and all the evidence indicates that it is perfectly fit for human food.

The bee-keeper who finds dead brood in his hives which he does not understand should send a request to the State Entomologist at New Brunswick that the bee inspector be sent and that an examination be made. There is no charge to the bee-keeper for this service.

Treatment of Foul Brood.

It has been definitely proven that the infection of both these diseases is in the honey stored in infected comb. No plan of treating American foul brood has been successful except as the combs have been destroyed, and only in most expert hands is any treatment of European foul brood likely to prove successful, if the comb is not destroyed.

There may yet be some plan devised which will make it unnecessary to destroy combs infected with European foul brood, but for the present nothing else will prove effective.

The plan of effective treatment for these diseases includes the removal of all infected material from the hive, and compelling the bees to start anew. For this operation one should have a completely clean hive filled with wired frames which are furnished with narrow (one inch) strips of foundation.

The operator should have, further, a queen and drone trap,

entrance guard, queen-excluding honey board or strip of perforated queen-excluding metal large enough to cover the entrance of the new hive, a smoker and hive tool, and a tightly closed hive body to receive the beeless combs.

There are two periods in the day favorable for the application of this treatment. Each has its advantages and its disadvantages. The first period is the middle of the day when the bees are gathering nectar freely, because at that time the larger part of the fielders are out and there are not so many bees to handle. The second period is in the evening after the bees have ceased flying, for the reason that the bees do not get confused and enter other hives than their own, and, furthermore, by morning they will have recovered from the excitement and be in better condition to go on with their regular business. Our personal experience indicates the middle of the day as best for the treatment of an entire apiary, and the evening for the treatment of a few colonies.

It is probably best to apply the treatment at the beginning of the honey flow for then there is less chance for starting robbing. If, however, the disease is not discovered in time to make use of the honey flow in this way, the danger of keeping diseased bees for nearly a year is such as to render prompt treatment advisable.

The following directions for treatment will serve to give one who is not familiar with the operation some idea of how to go about it. With the lighted smoker, approach the colony which is to be treated and give it a few puffs of smoke. Remove the diseased colony from its stand and put in its place the clean hive with the starter as a foundation. These one inch starters are an essential part of the treatment, because the bees will then be induced to use up all the infected honey which they carry in their bodies into the new hive in the making of new comb, and will have none of it left to infect the brood when it appears. The empty hive to receive the beeless combs should be placed conveniently near. Old bagging or newspapers should be spread in front of the new hive to serve as a place to shake the bees. Open the diseased colony and one by one take the combs from it and shake or brush the bees from them in front of the new hive, being careful to see that the first bees shaken fall right in the entrance. Should much nectar shake from the combs it is best to brush off the bees with something which can afterward

be burned. Continue brushing until all combs are free of bees and are placed in the empty hive. Keep these beeless combs so closely covered that no bee can get at them and sip the infected honey. The utmost care should be used to the end that infected honey may not be dropped where bees can get at it, as one drop is sufficient, if carried to a healthy colony, to infect that colony. Shake from the old hive any bees which remain on it, gather up and burn the newspaper or bagging which was spread before the new hive. When sure the queen is in the new hive, affix the queen and drone trap, entrance guard or strip of perforated zinc or place under the hive between it and the bottom board the queen excluding honey board. The purpose of this measure is, of course, to confine the queen in case the bees are dissatisfied and to prevent them from flying off to parts unknown. There is a quarter of a pound of wax in each Langstroth-size comb, and if a wax rendering apparatus is at hand the wax should be removed. If no good method of wax rendering can be had, the diseased comb should be burned and the ashes covered up. There is always a chance that through some oversight the bees may get at the diseased combs and carry out the infected honey thus undoing all the labor.

The old hive, which contains the diseased combs, together with the top and bottom board, must be well scorched to render them safe for further use. The frames cannot be satisfactorily disinfected by fire and should be destroyed unless facilities are at hand for boiling them. Actually boiling them for fifteen minutes will render them fit for use. Merely dipping in hot water will not be effective.

The treatment can be successfully given when very little honey is being gathered if the operator will use sufficient care and feed enough to enable the bees to build and fill the combs. When the treatment must be given in a period of small honey flow, it should be administered in the evening and extra care should be taken to prevent the treated colony from being overpowered and killed outright by its stronger neighbors. Its entrance should be made as small as the state of the weather will permit. If very hot, a larger entrance must be allowed than under normal conditions. When the treatment must be administered with small nectar flow another method is possible. The shaking may be

done in a dark cellar. Move the infected hive into the cellar after the bees have ceased flying for the day. Leave them in the cellar after treatment for about two days.

In all efforts to control these diseases the bee-keeper must remember that he is dealing with a highly infectious disease and the utmost care must be used to prevent its spread either by dropping infected honey or by robbing.

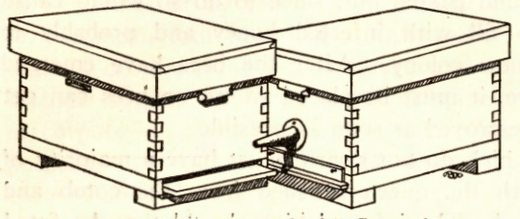


Fig. 7. Hives arranged with Case tube escape for treatment of foul brood

Recently a new plan of treating both American and European foul brood has been devised by Mr. W. W. Case of Frenchtown. This method has some points of great advantage, the chief of which are less disturbance of the colony and the saving of all the healthy brood. The plan is substantially as follows: Infected colonies may in early spring, if the disease is not too far advanced, produce normal swarms. In case they are able to do this, the parent colony should be set to one side and the swarm hived on foundation starters in the place where the parent hive originally stood. All queen cells should be removed from the parent hive and it should be made bee-tight. Bore an inch hole in the end of the hive and over this hole fasten an inch tubular bee escape which is about six inches long and which tapers to a point just large enough to allow a single bee (including drones) to pass out at a time. Place the hive in position as shown in Fig. 7 with the small end of the tube opposite the middle of the hive and about two inches in front of and above the entrance. It is *imperative* that the colony which has been hived on foundation on the old stand *be not disturbed* in less than four and better five full days, for when bees start to work after hiving, the wax workers will take all the infected honey brought from the old colony and, if left entirely alone, will digest it and utilize all of it in forming wax. If disturbed before the four or five days have elapsed, the fielders will place some of the infected honey in the first cells the wax workers have completed. It will then be fed to the first larvæ that hatch, thus infecting the new brood. If

it becomes absolutely necessary to disturb the colony before the fifth day, all comb built must be removed and destroyed and fresh foundation given. In about three weeks the good brood in the hive with the tube escape will have hatched, passed out, and united with the new colony. As all that leave the hive with the tube escape leave it with empty honey sacks they will not carry the infection. The infected hive must not be opened until the last bee has hatched and passed out, since to do so would cause any enclosed bees to fill with infected honey and probably to carry it out to the new colony. After the bees have emerged from the diseased hive, it must be placed where no bees can get to it and the combs destroyed as soon as possible.

Diseased colonies which do not swarm must have a majority of the bees together with the queen brushed from the comb and placed on the old stand. The infected hive should then be fitted with the tube and should be managed as in the preceding instance.

This tube escape can also be used when treating bees in box hives, making sure that there is absolutely no place in the box hive for the bees to go in or out except through the tube. This device is also useful for transferring bees from box or undesirable frame hives because with it there is no dripping honey and no robbing. Should the treated hive stand in the sun it must be shaded to prevent melting of combs.

Bee Disease Control Law.

In response to a strong sentiment among the bee-keepers of New Jersey, the Legislature of 1911 passed a bill having for its purpose the control of bee diseases.

CHAPTER 60.

LAWS OF 1911.

An Act to supplement an act entitled "An act to prevent the introduction into and the spread of injurious insects in New Jersey, to provide a method for compelling their destruction, to create the office of State Entomologist, to authorize inspection of nurseries and to provide for certificates of inspection," approved April fourteenth, one thousand nine hundred and three, to provide for the inspection of apiaries and for the suppression of contagious or infectious diseases among bees.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. It shall be unlawful for any person, firm or corporation to have or keep in his or their possession or in any apiary, any colony of bees infested by the diseases known as American foul brood or European foul brood or by any other disease which is contagious or infectious in its nature and injurious to honey bees in their egg, larval, pupal or adult stages, and any person, firm or corporation so having in his or their keeping or in his or their possession any colony of bees so infested, after notice of the existence of such disease given as hereinafter provided, shall become and be subject to a penalty of twenty-five dollars, to be collected as hereinafter provided.

2. It shall be the duty of any person, firm or corporation in the State of New Jersey who is engaged in the rearing of queen-bees for sale, to have his or their apiary inspected at least twice during each summer, and it shall be unlawful to ship from such queen-rearing apiaries any package or parcel containing queen-bees without having attached to it a certificate from the State Entomologist, giving the date of the last inspection, and containing the statement that the apiary in which such queen-bees were reared was, at the time of such inspection, free from American or European foul brood, or other discoverable contagious or infectious disease. Any person violating the provisions of this section shall be liable to a penalty of fifty dollars, recoverable as hereinafter provided.

3. It shall be the duty of the State Entomologist, designated as provided in the act to which this is a supplement, by himself or by a deputy appointed as provided in said act, to investigate, or cause to be investigated, all apiaries or other places where bees are kept or raised in New Jersey, and to study and investigate, or cause to be studied or investigated, outbreaks of bee disease and other conditions unfavorable to the development of bees within the State. It shall also be the duty of said entomologist to investigate all complaints of the existence of disease of any kind in apiaries or other places where bees are kept, and to in-

spect or cause to be inspected at least twice in each season, when requested by the owner, all apiaries where queen-bees are reared for sale. It shall further be the duty of said State Entomologist, whenever he finds any apiary where queen-bees are raised free from foul brood or other discoverable infectious or contagious disease, to furnish the owner of such apiary with a certificate stating that fact, and such certificate shall state the date beyond which it will not be effective.

4. Whenever in the course of inspections or the investigations made or carried on as provided in this act by the State Entomologist or under his direction, said State Entomologist shall become aware of the existence of American or European foul brood or other infectious or contagious disease in any apiary or colony of bees, it shall be his duty to notify forthwith the owner or owners or manager of such infested or diseased apiary or colony, of the character of the infection and of the means to be taken to treat the same for the eradication of such disease. Said notice and order for treatment shall be in writing, and the directions for treatment may be written or printed, and may consist of a bulletin or other publication of the New Jersey State College Experiment Station. Said notice and order for treatment shall also specify the time within which the prescribed treatment must be made, which shall not be less than eight days after service of the notice or order upon the owner, owners or manager of the apiary or colony. And in case of doubt, where the presence of disease is suspected but cannot be definitely determined because of the character of the hives used, said State Entomologist may, in his discretion, order any owner of bees in box hives without movable frames, to transfer such bees to movable-frame hives to facilitate inspection and supervision. It shall thereupon be the duty of the owner, owners or manager upon whom such a notice and order is served, to comply with it in all respects within the time limited in said notice and order, and in case of a failure so to comply, such owner, owners or manger shall be liable to a penalty of twenty-five dollars, recoverable as hereinafter specified.

5. It shall be unlawful for any owner or other person having diseased bees or their larvæ, or infested hives or combs, or other appliances or utensils for keeping bees, to expose, sell, barter or give away or allow the same to be moved, until after treatment as

prescribed by the State Entomologist, and it shall be unlawful to expose, sell, barter or give away such infested bees, larvæ, hives or combs or other appliances after treatment, until such materials are declared safe and permission is given by the State Entomologist or his deputy. Any person offending against the requirements and provisions of this section shall be liable to a penalty of fifty dollars.

6. In case the State Entomologist or his deputy shall find any apiary or colony of bees, in his opinion, so badly infested by American or European foul brood or other infectious or contagious disease that he shall deem it necessary to order the destruction of some or all of the hives, combs, bees, larvæ or other material as part of the treatment, and the owner, owners or manager of such infested apiary or colony shall dispute the diagnosis made by the State Entomologist or his deputy, or the necessity for the destruction of the hives, combs, bees, larvæ or other material, it shall be the privilege of such owner, owners or manager to appeal within three days after the service of the notice and order upon him or them, to the committee of appeal provided for in section twelve of the act to which this is a supplement, and the proceedings of such appeal shall be in all respects as provided in said section. Said committee of appeal shall have the same power to reverse, modify or confirm the order of the State Entomologist made under this act, that is conferred upon them in the act to which this is a supplement.

7. Any person who offends against the provisions of this act and becomes liable to the penalties prescribed in any of its sections shall be prosecuted as prescribed in section fifteen of the act to which this is a supplement, as amended by chapter forty-seven of the laws one thousand nine hundred and four approved March twenty-second, one thousand nine hundred and four, and if the order of the State Entomologist commanded the destruction of any bees, larvæ, hives or combs, or other utensils or material used in keeping bees, the judgment of the court imposing the fine shall include also an order to the officer enforcing its judgment to seize and destroy the specified colonies of bees, larvæ, hives or combs or other utensils or material used in keeping bees, in accordance with said order, which the said officer shall thereupon be fully authorized to do.

8. For the purpose of making the investigations and inspections specified in this act and to enforce the provisions of the same, the State Entomologist or his deputy shall have free entry upon or into any apiaries or premises where bees are kept, or infested hives or combs are stored, and any interference with or obstruction made to the entomologist or his deputy while engaged in the performance of the duties herein imposed shall subject the offender to punishment as a disorderly person under the general laws of the State, upon a charge made against him by the officer interfered with.

9. The sum of two thousand dollars annually is hereby appropriated to the State Board of Agriculture for the purposes of this supplementary act; *provided,* that no payment shall be made pursuant to this supplementary act until the amount thereof shall have been included in the annual appropriation bill.

10. This act shall take effect immediately.

Approved March 28, 1911.

Sacbrood.

Sacbrood is another disease to which bee larvæ are subject. It is perhaps better known under the name of "pickle brood." The cause of this trouble is not yet proven. So few larvæ are destroyed by it that its resemblance to European foul brood and the danger of mistaking it therefor form the only excuse for discussing it at all. Larvæ killed by this disease lie on their backs on the lower cell wall with the head outward pointed and turned upward. The color is a dirty brown and sometimes somewhat mottled. If the dead larvæ are gently prodded with a small stick the transparent skin will seem loóse and ready to slip off. If the bodies are punctured the contents will be found watery. In both forms of foul brood the larva rots down in a solid mass. Furthermore, the odor of larvæ dead from sacbrood is very slight and not to be detected except as the larvæ are held close to the face. Such odor as there is is sour, resembling that from fermentation.

This disease usually disappears of itself and no treatment is necessary.

Bee Paralysis.

Paralysis, unlike the three diseases just discussed, is a trouble of the adult bee. Colonies affected will usually have a number of crippled bees crawling about in front of the hive. These bees have greatly swollen abdomens. They also show a slight trembling motion. Some will climb blades of grass and attempting to fly, fall again to the ground. If the abdomen of one of these affected bees is pressed between thumb and finger the bowel will discharge an ill-smelling fluid. Some have considered this disease a form of constipation and have fed a physic claiming excellent results. The real cause of this trouble is unknown. The death rate appears to be slightly in excess of the birth rate and there is, therefore, a gradual weakening of the colony.

One commonly recommended remedy is to sprinkle powdered sulphur on top of the frames and at the entrance. Another is to kill the queen and introduce a new one. Still another is to break up the colony entirely and distribute the frames of brood in other colonies. Fortunately this trouble is not common in New Jersey.

Bee Dysentery.

This, like paralysis, is a disease of adult bees and seems to be caused by too long a confinement in the hive, when the stores of honey are not suitable. The best symptom of this trouble is to be found in the spotting of the infected hive with bee excrement.

This is not a very serious trouble for bees in New Jersey, for they are wintered out-of-doors and are able to take more or less frequent cleansing flights.

Spring Dwindling.

This is still another trouble of adult bees. It is thought to be due to low vitality caused by poor wintering. The principal symptom of this trouble is indicated by the colony gradually becoming weaker in the spring instead of stronger as it should. The best remedy for this trouble is to be found in extra packing to hold the warmth of the hive and in stimulative feeding with warm syrup. If available, frames of hatching brood should be given to the colony.

ENEMIES.

Bee Moth.

Fig. 8. Larvæ of bee moth

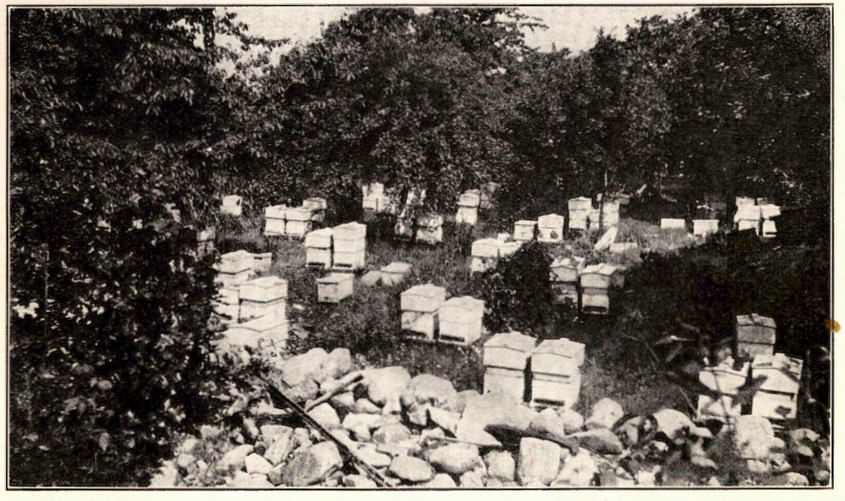
The larva of this msect causes much loss to the bee-keeper by destroying unprotected combs and by eating the cappings from comb honey. Colonies of bees which are kept strong will protect their combs against the ravages of this creature. The Italian bee appears to be especially able in preventing the work of the bee moth.

Fig. 8. Bee moth. (*Galleria Mellonella Linn*)

Should a colony become so weak as to be unable to protect all of its combs, some should be removed and stored in a moth proof box until the colony increases in strength.

All stored combs must be frequently examined to guard against loss. No pieces of comb or wax should be left where the moth can breed in it. Should combs become infested with larvæ of the bee moth, they can be freed by fumigating with carbon bisulphide or sulphur. Unfortunately, neither of these fumigants can be depended upon to kill the eggs and two treatments are therefore necessary to insure complete freedom. The second should follow the first after ten days or two weeks. Bisulphide of carbon is the more convenient and the more effective of the two fumigants but the temperature under which it is used must be 70° F. or greater. It is not effective under low temperatures. The combs to be treated should be placed in a practically gas-tight box and a shallow plate should be set on them. The carbon bisulphide should be used at the rate of one teaspoonful to a cubic foot of space. When the amount of carbon bisulphide necessary to fumigate the box in question has been determined, it should be measured out and poured into this shallow plate. The box should then be tightly closed and left that way for 36 hours. A second and similar fumigation after ten days or two weeks has elapsed will destroy all the larvæ then hatched from the eggs that were present during the first fumigation.

One of eight yards of a successful Monmouth County honey producer.



A glimpse of a 150 colony yard of a successful New Jersey queen breeder.

Contrary to the common impression, the bee moth does not destroy bees, and it does not make its appearance in the hive except as the colony has been weakened by something else.

Birds and Mammals.

The kingbird is sometimes accused of catching bees on the wing, particularly young queens engaged in their mating flight. This charge is not, however, proven and it is extremely doubtful whether, in a honey-producing yard, their influence is seriously harmful. In the queen rearing yard, however, serious damage is quite possible. It would be well for the individual bee-keeper to observe closely before reaching any positive conclusions.

Toads are accused of sitting near the hive entrance and catching the workers. This accusation has not been proven.

Skunks will sometimes greatly weaken a colony. The skunk occasionally develops the practice of taking its stand in front of the hive at night, pawing the bottom board and the front of the hive and catching and consuming the bees as they come out to investigate the disturbance. Evidence of their visits can be found in claw marks on the front and bottom board.

If mice can succeed in gaining an entrance to the hive in winter they will gnaw down the combs and build nests. This occurs only during the inactive period and may be prevented by closing the hive entrance to a space three-eighths of an inch high by five inches or more wide.

Bee Management

APPARATUS NECESSARY.

For the beginner in bee-keeping there are some tools and fixtures that are absolutely necessary. Others can be left out, but if procured will prove a decided advantage and a paying investment.

HIVES.

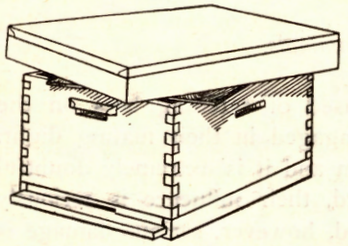


Fig. 9. Ten frame dove-tailed hive

The hive is a home for the bees and a tool in the hand of the bee-keeper. As a home for the bees it must be of such size and shape that they can do most effective work in it, and it must afford them proper protection from the changes in weather. As a tool in the hand of the bee-keeper it must be of such a nature that it can be easily and rapidly manipulated. Some style of movable frame hive has been shown by experience to serve both purposes the most satisfactorily. The dove-tailed type of movable frame hive appears to be giving the best satisfaction in the State of New Jersey. This is made in 10 and 8 frame sizes. Perhaps the "Hoffman" frame, owing to its self-spacing provision, now enjoys the greatest favor among bee-keepers. It is especially well adapted to the amateur, for with it he cannot easily make a mistake in spacing his brood frames.

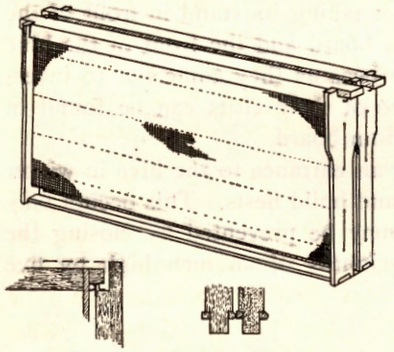


Fig. 10. Hoffman frames

The hive is divided into two parts. In the lower portion the queen and the bees attend to brood production and that portion has come to be known as the *brood body*. The upper portion which is put on to receive the surplus honey, is known as the *super*. Another style of brood body, the "Danzenbaker," is used to a limited extent in the production of comb honey. This is fitted with 10 frames nearly two inches shallower than the "Hoffman," and with the ends the same width from top to bottom. In the hands of a practiced bee-keeper this hive has been made to give good results in comb honey but it is likely that it will require closer attention than most bee-keepers can give it.

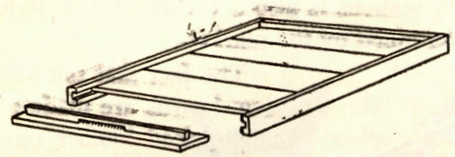


Fig. 11. Bottom board

The bottom board is perhaps the least important part of the bee-hive. It is essential, however, that it be made in such a fashion as to be removable and to give a space of at least 3-8 of an inch below the frames. Bottom boards constructed of 7-8 inch lumber are better than those made of thinner material because being near the ground the thick board protects the colony better from dampness and is less likely to warp.

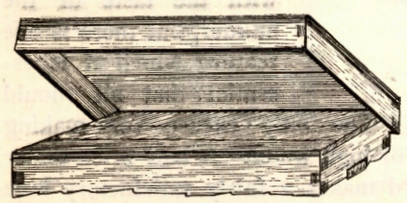


Fig. 12. Telescope cover

The cover or roof of the hive must be wind and water tight. The "Excelsior," which is an all wood cover, gives fair satisfaction if kept well painted. The three-inch telescope cover shown in Fig. 12 will prove much more satisfactory and will be improved by substituting a covering of canvas, painted, for the usual covering of metal.

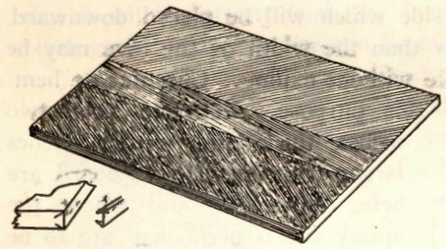


Fig. 13. Super cover

With the telescope cover it is necessary to use an inner cover of some sort because without such a provision the bees would fasten the cover permanently to the hive. The escape board can be used as an inner cover by removing the escape and covering the hole with a piece of thin board. The super differs with the type of honey the bee-keeper is trying to produce. The extracted honey super is usually just the same as the *brood body*. Persons producing extracted honey on an extensive scale almost without exception use the deep frame super. Comb honey supers are normally fitted with sections which when well filled will weigh one pound gross. The "Danzenbaker" super shown in Fig. 14 using sections 4 x 5 x 1⅜ inches has proven very satisfactory. Another

super using 4¼ x 4¼ x 1½ sections is also a favorite. The style of section used must be determined by the market.

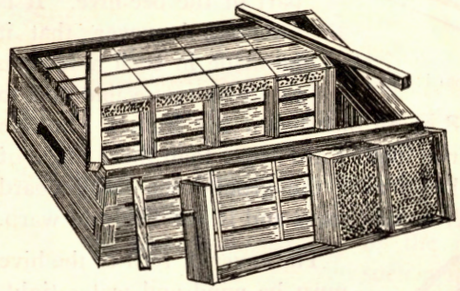


Fig. 14. Danzenbaker super

The fact that the bottom boards are made of high-priced lumber renders it wise to provide a stand for the purpose of keeping the hive off the ground. Satisfactory hive stands vary with the taste of the builder, but there is one feature which it is essential that all should have. They should be low. The only excuse for making a high hive stand is the danger of high water. A half brick under each corner of the bottom board makes a fairly satisfactory hive stand. A more elaborate stand can be made of four pieces of 1 x 4 inch boards, two of them the length of the bottom board, and the other two as long as the hive is wide. Make a rectangular frame the same size as the hive bottom by nailing the short pieces crosswise, the long ones on the side which will be placed downward. Two pieces of lumber longer than the width of the hive may be used crosswise under the hive without nailing. Chestnut or hemlock lumber lasts well for this purpose. Concrete slabs two inches thick and a few inches larger than the bottom board are being advocated, and where the apiary site is permanent are to be recommended. An excellent combined hive stand and runway can be made like the illustration. Individual stands are best, and more than two hives should never be placed on a single stand, because the best place to stand when manipulating the hive is at the side.

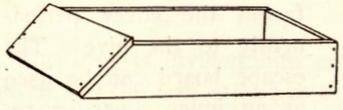


Fig. 15. Hive stand

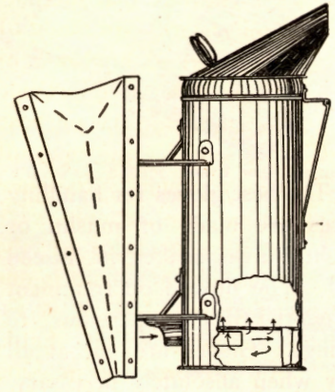


Fig. 16. Root's smoker

The smoker is used for so stupefying the bees that they can be handled with the minimum amount of stinging. They are made of metal cans to hold the burning material, and bellows to blow the smoke. There are two general types—one called the hot-blast in which the air is forced through the fire, and another called the cold blast in which the air is forced over the fire. The hot blast is the type always used by practical honey producers. Hot blast smokers are made in two styles—one with a valve and the other without. When buying a valveless smoker, the purchaser should test the bellows to see if they open instantly after being compressed. If they do not, the smoker will be unsatisfactory. The bee veil should be made of such material and in such a way that it will stand out from the face and will be cool. Ordinary black cotton mosquito bar can be made to serve the purpose very well. It should be made into a tube open at the top and bottom and furnished with an elastic cord long enough to slip over the crown of a hat at one end. The other end should be provided with a string or elastic to hold it down in front. Another type can be made by sewing a strip of wire mosquito bar to the under side of the rim of a straw hat, and sewing a skirt to the lower edge of the wire. The "Alexander" veil (Fig. 18) is a very practical one and is made of a strip of wire mosquito bar nine inches wide and thirty-four inches long

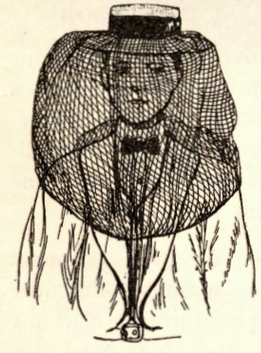


Fig. 17. Bee veil

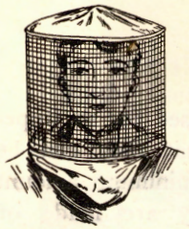


Fig. 18.
"Alexander" bee veil

sewed together in such a fashion as to form a cylinder. A muslin crown is sewn in the upper edge and the muslin skirt sewn to the bottom. This veil is worn without a hat.

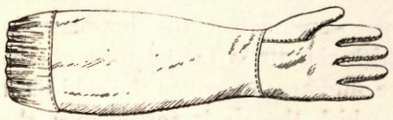


Fig. 19. Bee glove

The best gloves for handling bees are made of muslin or light canvas soaked in linseed oil. The linseed oil treatment renders them impervious to stings. Gloves are not at all convenient and should be utilized only when absolutely necessary. Practiced bee-keepers normally work without gloves, and with arms bare to the elbow.

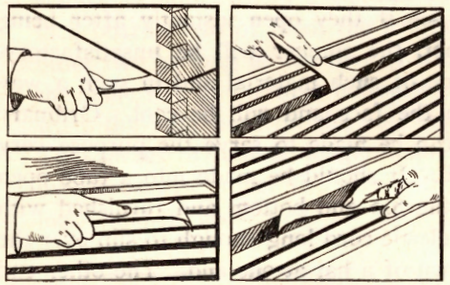


Fig. 20. Root hive tool

The hive tool is needed to pry open the hive. separate the frames, and scrape and smooth various parts. The tool which best combines these three features is the one most likely to prove satisfactory. One can get along after a fashion with a screw-driver or some such ill-adapted tool, but one made for the business will prove an investment worth while.

Fig. 21. Bee escape

The bee escape is a metal device so arranged that the bees can pass through it in one direction only. It is used in a board beneath the super of

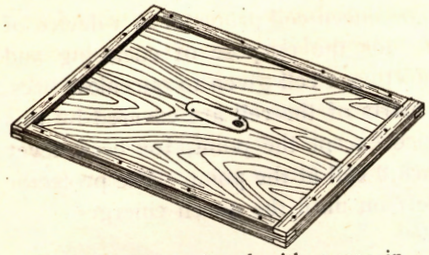


Fig. 22. Escape board with escape in position

surplus honey for the purpose of clearing the super of bees preparatory to its removal. The escape in place on a board is shown here.

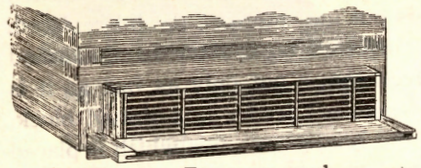


Fig. 23. Entrance guard

The entrance guard is made of perforated metal or of wire and is so arranged on the hive entrance that workers only can pass through it. It is used to keep the queen and drones from flying away from the colony.

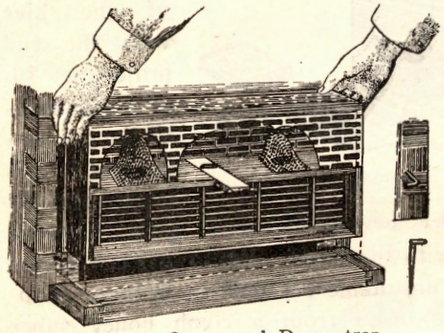


Fig. 24. Queen and Drone trap

In addition to the entrance guard an upper compartment into which the queens and drones can pass, may be employed. In passing through this compartment they are led into wire cones and are confined until disposed of by the bee-keeper. This method is used to trap undesirable drones or to catch the queen of a hive that is expected to swarm when she attempts to go out.

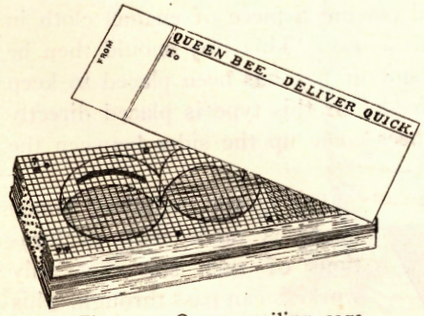


Fig. 25. Queen mailing cage

The queen cage is used in sending the queen by mail and is large enough to include the queen and her escort with a sufficient supply of provisions.

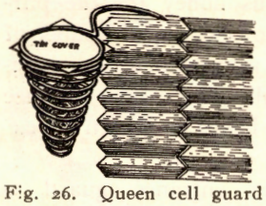


Fig. 26. Queen cell guard

The queen cell protector is a device of wire for the purpose of enclosing and protecting a cell given to queenless bees. All parts of the cell are covered by this device except the point, for bees never attack a cell at the point. The protector is left on until the queen emerges.

Fig. 27. "Pepper box" feeder

Various types of feeders have been devised. The "pepper box" is merely a tin can with perforated lid. The feed is put into the can, the lid replaced, and the can is inverted on the top of the brood frames. The feed comes out only as fast as it is used. The "Alexander" feeder is a slotted block, which is placed under the back of the hive with the end projecting. Into the grooves of the projecting end feed is poured and exposed portions of the grooves are covered with the block. Both types of feeders have small capacity and are unsuitable for feeding in large quantity. A large feeder can be made from a comb honey super equipped with fences by putting all the fences at the sides, the section holders in the middle, and placing a piece of enamel cloth in the central space so as to form a tray. This tray should then be filled with feed in which excelsior or hay has been placed to keep the bees from drowning. A feeder of this type is placed directly over the brood body and the bees come up the sides between the fences.

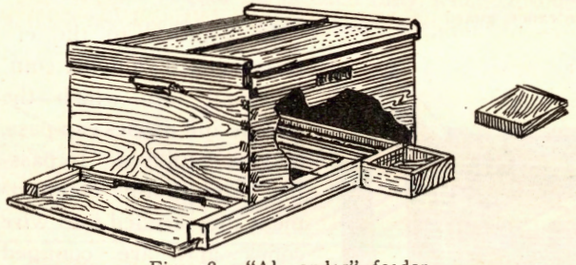


Fig. 28. "Alexander" feeder

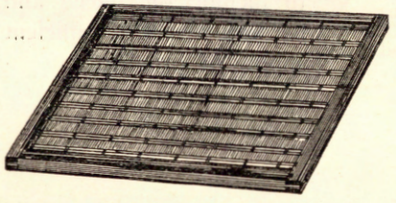


Fig. 29. Wood-wire queen excluder

The queen excluding honey board is made with perforations of such size that only workers can pass through. This device is used mainly in extracted honey production for the purpose of confining brood rearing to the brood body.

A small room or building for honey extraction is a necessity where much extracted honey is produced. This room must be bee-tight and the windows must be screened. It is well to leave the door unscreened and leave it closed in order that the bees may not be attracted to it. For if they should be attracted to it, keeping all of them out would be an impossibility.

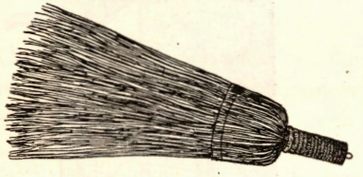


Fig. 30. "Coggshall" bee brush

If for any reason the bee husbandman has not made use of the bee escape before the time for honey extraction comes, the combs may be removed one by one and the bees brushed off. The "Coggshall" brush is a very good one for this purpose.

The "Bingham" uncapping knife, which has a long, stout blade, bevelled on one side, is very useful for the purpose of removing

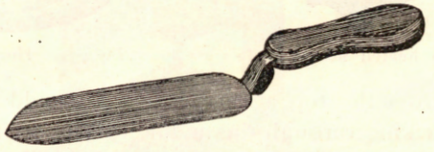


Fig. 31. "Bingham" honey knife

the cap from the combs in honey extraction. The "Dadant" uncapping can is used by some bee-keepers. A cheap and service-

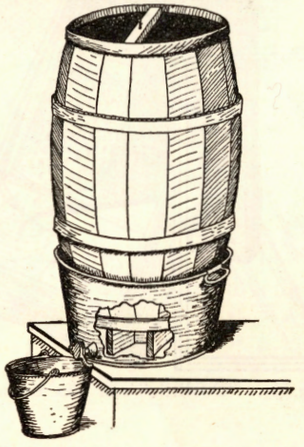


Fig. 32. Barrel for uncapping

able "can" for this purpose can be made of a cracker barrel by boring a few holes in the bottom and supporting it over a galvan-

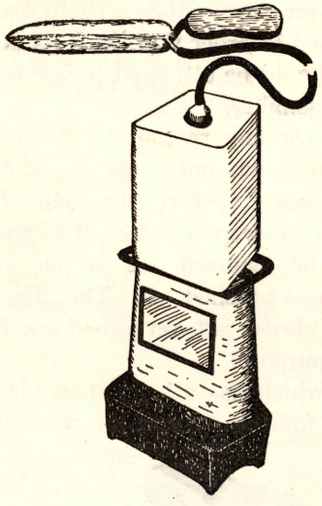


Fig. 33. Steam heated honey knife

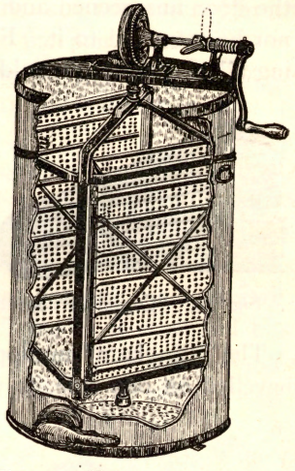


Fig. 34. Honey extractor

ized tub. Across the top a narrow board should be nailed with a nail point sticking through the middle to support the comb while it is being uncapped. The steam heated uncapping knife is hollow

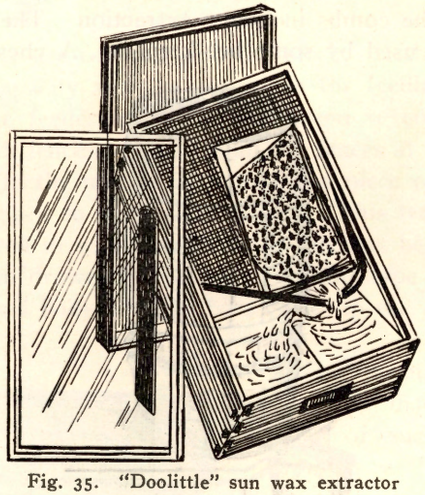


Fig. 35. "Doolittle" sun wax extractor

and so arranged that it is heated by a jet of steam which is passing through it. This knife is very efficient.

The honey extractor is so made that the uncapped combs are whirled about and the honey thrown out. Extractors are made in two, four and six frame sizes, the larger one being driven by power of some sort. For less than one hundred colonies the two-frame machine will be found satisfactory.

The "Solar" wax extractor is a tight box with a double glass lid and is fitted with a black iron tray and a tin pan to catch the melted wax. This device is placed in the sun in such a fashion that material in the black iron tray is exposed to the direct rays of the sun. This will not do satisfactory work with old combs.

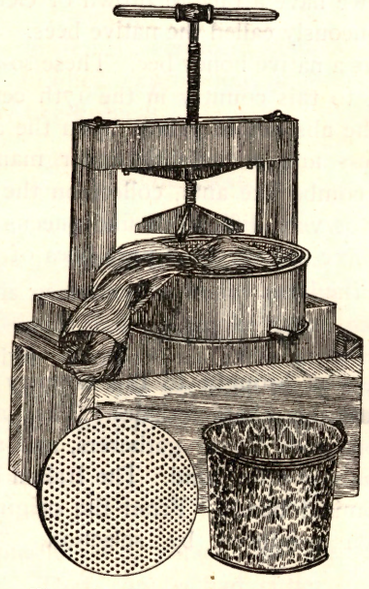


Fig. 36. Root-Hatch wax press

The "Root Hatch" wax press is made to press the wax from the old material after it has been brought to the boiling point in another vessel. When used according to directions which come with this press, it does very satisfactory work. Another wax rendering device similar to the "Root Hatch" press is fitted with gasoline burners. The material to be rendered is placed in a sack

in the can, the can filled with water, and the burners lighted. When the whole mass boils thoroughly pressure is applied, the fire turned out, and the whole mass left to cool. The cake of wax forms on the top and can then be removed. This could be arranged with a spout near the top in such fashion that by pouring in boiling water the wax would run off. This modification would increase the capacity of the press.

RACES OF BEES.

BLACKS.

In this country we have a race of brown or German bees, which are sometimes erroneously called the native bees. America does not have such a thing as a native honey bee. These so-called native bees were first brought to this country in the 17th century. They are characterized by the absence of yellow upon the abdomen, and by extreme nervousness and excitability under manipulation. They scamper over the combs like ants, collect on the edges, and drop off in bunches. It is very difficult to find queens of this race. At the present time there are very few pure bees of this type in New Jersey.

ITALIANS.

The Italian bee was brought to this country in 1859, and at present lead in desirable characteristics. They are prolific, quiet under manipulation, good honey gatherers, and more resistant to brood diseases than any other kind. The Italian bee bears at least three yellow abdominal bands. From the original stock various strains have been produced by selection, "Golden," "Five Banded," etc.

CARNIOLANS.

This type of honey bee is a later importation and by some is said to have superior qualities. Their most serious drawbacks are their great tendency to swarm in ordinary manipulations and their close resemblance to the brown or German bee. The Carniolans are black in color and the hair of the abdomen is gray instead of brown as is characteristic of the German bee.

CYPRIANS.

These were brought from the island of Cyprus and while great honey gathering qualities are claimed for them, they are exceedingly difficult to handle. When once aroused they are savage and have for this reason probably not become popular. The Cyprian is a yellow bee and can be distinguished from the Italian by a distinct yellow spot on the scutellum or ridge on the rear of the thorax.

CAUCASIANS.

The Caucasian bee was imported by the United States Department of Agriculture and an effort has been made to popularize them. They are extremely gentle in disposition, but in other respects have not fulfilled expectations and are no longer considered seriously by bee-keepers.

GENERAL.

There is a considerable difference in the disposition of different races of bees and it should not be thought that the endurance of much stinging is necessary to honey production. Some bees are almost entirely unaffected by smoke (such as the Cyprians and their crosses) while others are not easily aroused and respond very easily to a little smoke. Do not keep cross bees; they require entirely too much time and patience in handling.

SECURING BEES.

Bees can be purchased of persons making a regular business of dealing in bees. They can be had either in full colonies or as nuclei. The nucleus consists of two or three frames with brood and bees. Starting with a good nucleus and favored by a good honey flow, a full colony may be expected by fall. Because of the high cost of transportation, it is best to purchase bees as near home as possible. In some instances the purchaser can obtain full colonies near home and develop from them the race he desires to handle, by killing the old queen and introducing a tested queen of the desired race. It is sometimes possible to take a hive to a

bee-keeping neighbor and to induce him to hive one of his swarms in it. When one has sufficient skill it is frequently practicable to buy bees in old box hives at a low figure and transfer them to modern hives. It is always best to start with a small number of colonies—not more than five—and increase the number as skill and experience is gained.

LOCATING THE BEE YARD.

Bees adapt themselves to almost any location. There are two apiaries in New Jersey which are successfully kept upon roofs. There is an apiary in south Jersey kept in a brick building. This last bee-keeping venture is, however, not successful. Whether this failure is due to the building or to the manipulation has not been learned.

While it is possible to keep bees in small towns or villages, the bee-keeper will sooner or later experience trouble for his bees will annoy his neighbors. For the reason that we are unable to control the flight of bees, the bee yard should be located away from highways and fields where horses are used in cultivation. Preference should be given to a location gently sloping to the southward and to a place sheltered from prevailing winter winds. The entrance to the hive should face southward so that cold winds will not blow directly into the opening.

Bees should not be kept in large numbers in thickly settled communities, for there is little likelihood of sufficient pasturage and there is much opportunity for neighborhood quarrels.

ARRANGING HIVES.

There can be no question that a bee yard with hives arranged in regular rows is more pleasing to the eye and it is doubtful whether the orderly person will tolerate anything else. There is, however, a real difficulty in bee management that is sometimes had with this orderly arrangement. If the hives are set close together in the row and the rows close together, the young queens returning from their mating flight are likely to mistake their own

hive and enter a corresponding one in another row. This mistake, of course, costs them their lives. The death of the virgin queen leaves the hive from which she came hopelessly queenless and the death of the colony is sure to follow unless the bee-keeper discovers the trouble in time to remedy it. While hives placed irregularly and facing in many directions will be less subject to this trouble, the average bee-keeper, because of the better appearance, would rather risk losing a few queens than have the yard in a disorderly condition. When ground space is limited, hives may be placed in pairs and thus to some extent overcome this disadvantage. Another very good arrangement is to place hives in groups of five, three facing south and at their back two others, one facing east and the other west. This arrangement will accommodate a large number of hives in a small space and leave the groups far enough apart to prevent the loss of many young queens.

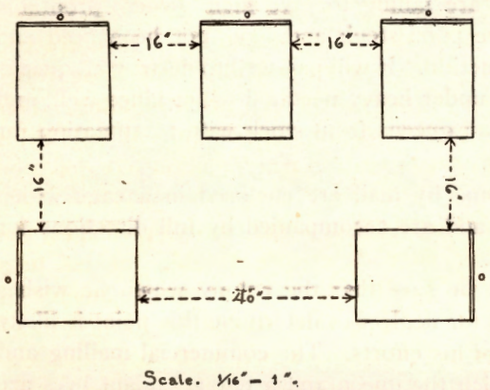


Fig. 37. Hives arranged in group of five

Care must be taken that no grass or weeds are allowed to obstruct the hive entrance, for this condition will occasion much waste of the bees' time and may so shut off ventilation as very seriously to interfere with the hive work.

A number of bee-keepers are found using a sheet of enamel cloth or canvas on top of the frames or sections. No one seems to be able to give a good reason for this arrangement. It is very objectionable because in trying to seal air tight the upper part of the hive the bees use great quantities of propolis, causing the cloth to adhere and making it frequently necessary to remove it in pieces. Furthermore, as the bees are unable to get at the cover to glue it fast, some kind of a weight is needed to keep it from being blown off. Without the canvas or enamel cloth, the bees use the propolis around the edge of the top of the hive, place

comparatively little on frames and sections, and so seal the cover that no weight is needed. When making use of a telescope cover, a flat board or super cover should be used instead of a cloth.

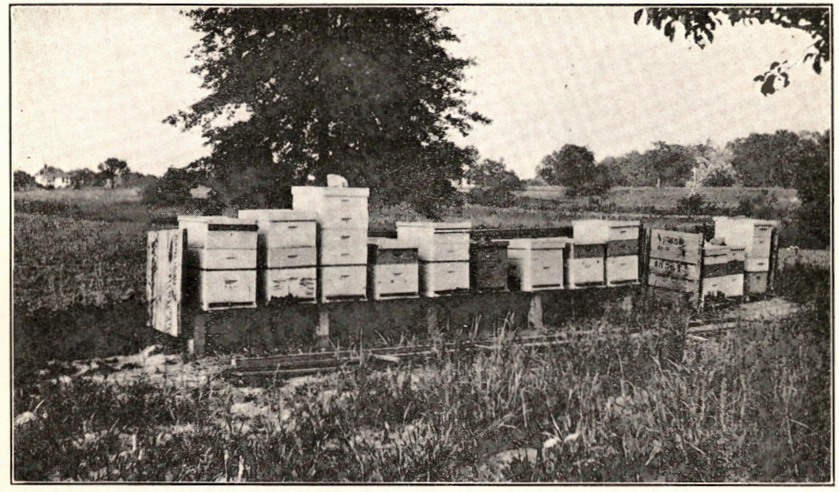
Hives should be levelled from side to side and may tip forward slightly to make water run from the entrance.

INTRODUCING QUEENS.

It is through the process of introducing queens that the quality of the bee stock can be changed for the better. Many colonies of bees in New Jersey are failing to give their owners profitable results because they are poor stock and have not been bred and selected for honey production. It will pay well to destroy all queens whose colonies do not, under heavy nectar flow, produce well, and purchase for introduction queens from stock with a reputation for good work.

All queens which come by mail are enclosed in a cage which is an introducing cage and are accompanied by full directions for the operation.

The bee-keeper must be sure that the colony which he wishes to requeen is queenless, for neglect to determine this point is likely to result in the failure of his efforts. The commercial mailing and introducing cage in which the queen and a few attendant bees are included, is introduced into the hive which the bee-keeper wishes to requeen. The cage is laid lengthwise on top of the frames, wire cloth side down, in such a fashion that it lies over the space between frames or it is sometimes pushed into a comb near the top bar and the neighboring combs squeezed up against it to hold it in place. It may also be laid on the bottom bar of the frame with wire cloth side up. In any case, care must be taken that the candy in the end of the cage is uncovered and that the cage is so placed that the hive bees may have access to it. The queen is shut off from access to the hive and the colony from access to the queen by means of a dough-like composition of pulverized sugar and honey known as *queen candy*. The queen and her attendants feed upon one side of this queen candy, and various members of the colony on the other side. By the time the queen candy has been so far consumed as to permit the egress of the queen and the ingress of the workers, the queenless colony is ready to ac-



Hives too close, impossible to work from sides of hives.

A well arranged yard. Scattered hives on a hillside facing south and protected on the north and west by large trees.

cept its imported mother. A colony thus in process of requeening should not be opened until four days have elapsed, for the opening may so excite the colony that the workers will attack and kill the queen. The real objection to this method lies in the fact that it deprives the colony of a laying queen for about five days and in the further fact that there is a possibility of introducing foul brood through the queen candy having been made of infected honey. Most, if not all, queen breeders now understand this possible danger and boil the honey used in making queen candy. This operation, of course, destroys any possible disease germs in the candy and renders the introduction of foul brood out of the question. A method of direct introduction, which it is hoped will give good results, is published by A. C. Miller, of Rhode Island, and runs as follows: The entrance of the queenless colony should be reduced to about a square inch. Three puffs of thick white smoke should then be blown in and the entrance closed entirely. In about 20 seconds the entrance should be opened, the queen allowed to run in, and the entrance again closed for ten minutes. A small opening (1 in. x 1 in.) should then be made and the full opening be given the next day. There are at least two things to recommend this plan, provided it can be made to work successfully by all —the colony may be rendered queenless and requeened at once, thus avoiding interruption in egg laying, and the avoidance of the necessity of putting the queen cage in the hive obviates the possibility of carrying of brood infection. The author has had the opportunity to test this plan in only a single case, and while this instance was one where adverse conditions rendered failure probable, the operation was a complete success.

A new queen is sometimes introduced while still in her cell. In such cases it is usually necessary to protect her from destruction. A cell which is torn down by the bees is never attacked at the point but at the side or the base. If a queen cell is found in the hive with a hole in the side one may be very sure that the queen did not emerge alive. If a regular circular opening at the point is discovered, it is highly probable that the queen is alive. In requeening by introducing queen cells, they should be furnished with cell protectors. If the cell can be protected until the queen is ready to emerge, the bees are sure to accept her without question.

SWARMING.

CAUSES.

The swarming of bees apparently serves the function of increasing the number of colonies. Of much greater importance to the practical bee-keeper than a knowledge of the reason why is a knowledge of the conditions that lead to swarming.

Bees swarm when there is a lack of egg laying room during heavy breeding. This lack of room is not a matter of mere space but a matter of empty comb. Lack of room may be the result of stored honey or pollen.

Lack of proper ventilation may induce bees to swarm.

The presence of an old queen is more conducive to swarming than of one reared the previous season. An excess of drones will have a tendency to induce swarming.

CONTROL.

Control of swarming consists in the practice of allowing the colony to cast one swarm and in so handling the swarm and the parent colony as to get the best results from each.

Perhaps the most important factor in this phase of swarm control is the clipping of the queen's wing. This should be done about apple blooming time for the reason that there are then comparatively few bees in the hive and some nectar coming in, rendering balling (see page 58) of the queen much less likely to occur.

When a swarm, headed by a clipped queen, issues from the hive it will not go very far, for the queen, being unable to fly, will be compelled to walk about on the ground in front of the hive. The swarm may cluster on some support, but it is not likely to hang long, for it will soon miss the queen. The bees return to the hive searching for her and all come back into the old colony. If the weather be favorable they are likely to try swarming again the next day and may repeat the performance several times. Soon, however, they will find that the queen is unable to accompany them, will kill her, and will go off with the first virgin which hatches.

Should the bee-keeper be on hand when the swarm issues, he should pick up and cage the queen for safety, keeping her out of the sun, move the old hive to a new stand and put a new hive on the old stand. In the entrance to this new hive he should place the caged queen, and, as soon as the bees begin coming back and freely enter the new hive, the queen should be released. Hiving of the new swarm is thus accomplished.

Should the apiarist not be present when the swarm issues and should he not reach the yard until all the bees have returned, the queen should be found and caged and a new hive should be placed on the old stand with the old one temporarily beside it. About two-thirds of the bees should then be shaken from the old combs in front of the new hive and the queen allowed to run in with them. The old hive should then be put on a new stand. This placing of the new hive on the old stand will give it all the flying bees, so weakening the old colony that ordinarily there will be no further swarms from it during the season.

Some very good bee-keepers modify this practice by placing the old colony beside the new hive with its entrance turned away at an angle of 90 degrees. In a day or two turn it to an angle of 45 degrees, in another day or two place the two hives side by side as close as possible, and at the end of a week from the issuing of the swarm, place the old colony on a new stand. This modification gives to the swarm all the bees from the parent colony which have become fielders since the swarm issued, and makes it a booming colony.

PREVENTION.

In swarm prevention, we have a problem which is not as simple as swarm control. Methods which will give good results one year may prove entirely adequate another season. The apiarist need, therefore, not be surprised if his bees insist on swarming in spite of any or all methods which he may use.

Usually the provision of abundant empty comb for the use of the queen before the surplus flow begins, will prevent swarming.

Furnishing the colony with a queen less than one year old has a tendency to prevent swarming.

Good ventilation also tends to prevent swarming. In some in-

stances it is well to raise the hive an inch from the bottom board in front or both in front and behind for the purpose of giving a freer circulation of air. If the hives stand in open sunlight and are partly surrounded by trees, they should be shaded to prevent the temperature from becoming too high.

The destruction every eight days of all queen cells found in the brood body will have a tendency to prevent swarming. It must be remembered that this will prove effective only when the cell contains eggs or very small larvæ, for when queen cells are nearly or quite finished nothing short of swarming, either natural or artificial, will satisfy the bees.

Normal swarming may sometimes be prevented by a method known as "shook" swarming. This is a system by which swarms are made artificially at the convenience of the bee-keeper. This may be accomplished at the beginning of the harvest and will usually prevent bees flying away after the harvest has commenced. To make a "shook" swarm, the queen and about two-thirds of the bees should be brushed or shaken from the combs of a strong colony into a hive with full sheets of foundation. The new colony should be put on the stand of the old hive and the old hive placed on a new stand. This method is not recommended unless the old colony is given a ripe queen cell or has a sealed cell at the time of shaking, for the old colony is not in a condition to do good queen rearing. A comb containing a sealed queen cell should not be shaken, for such action is almost certain to injure the immature queen.

When the number of colonies is small, the queen and drone trap can be used on the front of the hive which is expected to cast a swarm. The queen will be caught in this and the swarm can be handled as when a clipped queen is caught and caged.

ROBBING.

Under certain favoring conditions a strong colony will seize upon and consume the store of a small one. Robbing usually occurs when there is little or no nectar to be had and when certain colonies become too weak to defend their stores. It may be induced by opening the weak colonies when there is a dearth of nectar. At such times neighboring bees may take advantage of

the manipulated colony, while it is yet under the influence of the smoke. Robbing in the bee yard is characterized by unusual excitement. The buzz is of a higher pitch and bees are seen running out of the robbed hive and part way up the front before taking wing. Bees leaving the hive are found full of honey. Bees are found fighting their way into the hive and many grappling with each other near the entrance.

Robbing is sometimes started by carelessly leaving honey where the bees can get at it.

When robbing is in progress the bees appear to become crazy and sting everything near. Prevention is much to be preferred to any cure.

When robbing has not been in progress long and little damage has been done, contraction of the entrance of the robbed hive so that only one bee can enter at a time may put a stop to the process. A bunch of wet weeds thrown in front of the hive will sometimes prove effective. Sometimes the robbed colony can with satisfactory results be taken into a dark cellar for a few days. In that case the entrance should be made very small when it is returned to its stand. When the robbed colony is removed, the neighboring hives must be given close attention or the robbers will devote their attention to them. If the robbed colony is not found till the robbers have cleaned up practically everything, it is best to let them finish up their work and leave the robbed hive so that the bees can satisfy themselves that there is nothing more to be had from it.

Do not smoke a colony which is being robbed.

FINDING QUEENS.

The most common method of finding the queen is to look over the entire hive, comb after comb, until she is located. This may take more time than the apiarist may be able to spare and other ways have been suggested. It is probably best to take a more or less hasty glance over the combs at first, and to resort to other means only after this has failed.

One way to find the queen is to remove the colony from its stand and in its place put an empty hive with an entrance guard, and shake every bee from the comb in front of the empty hive, put-

ting beeless combs in the new hive as shaken. The queen will usually be found on the outside of the guard. When very little nectar is being gathered this plan is likely to start robbing and should not be employed. With little or no honey flow, two extra

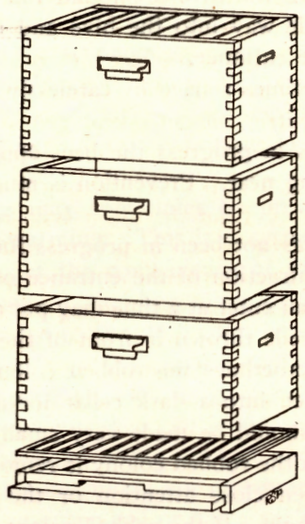


Fig. 38. Arrangement of hive for finding queen

hive bodies should be placed on a bottom board near the colony in which the queen is to be found. A queen excluding honey board should be placed between the extra body and the bottom board. Remove the two outside frames from the hive to be operated on and smoke or brush the bees from these frames and place where the robbers cannot get at them. Remove the hive from its bottom and place on the top of the extra hive bodies. Spread the frames and smoke very freely to drive most of the bees below the bottom bars. Raise the hive and set it down sharply, dislodging the cluster of bees from below the frames. Replace the hive on its stand. Return the two frames and place over it the extra body with the cluster of bees, making sure that the honey board is between the brood nest and the extra bodies. Now gently smoke the cluster of bees in the upper body and usually the queen will be found there. A wood zinc honey board makes it easier to see the queen than an all zinc one.

TRANSFERRING.

The bees in the State of New Jersey are housed in boxes and kegs to such an extent that the operation of transferring is one with which the bee-keepers should be familiar. From every standpoint of good bee husbandry, the box hive is an abomination.

Bees may be transferred by the Heddon method which runs as follows: When the fruit bloom opens, gently smoke the box and turn it upside down. Place on it a similar empty box. Beat the sides of the old box with two sticks until most of the bees, including the queen, have moved from the lower box into the upper. It is essential that the queen be drummed out with the bees. Empty the bees in the upper box in front of a hive prepared to receive a swarm. In preparation for this operation, this hive should be equipped with full sheets of foundation, unless brood disease is present, when it should be furnished with starters of foundation merely. Place the old box hive right side up at about ten feet from the new one, and every other day move it nearer the new hive until it is close beside it. At the end of twenty-one days from the first drumming, drum the old hive entirely free of bees and place them in front of the new hive, remove the old box, cut out the combs and render the wax. It is likely that the Case tube escape would prove an excellent device for getting rid of the bees that remain in the old box hive. It should be attached and the hive should be placed as has been described on page 25 of this manual.

Bees may be transferred with a smaller loss of time as follows: Prepare the new hive as above and drum out as many bees as will go readily. Place these in front of the new hive, split open the old box hive in such a manner that when spread open it will not break the combs more than necessary. Cut out the combs one by one, and into empty brood frames fit such pieces of worker brood as may be found, fastening them in by tacking splints on each side of the frame. This brood should, of course, be placed in the new hive as soon as ready. The splints should be removed as soon as the bees have attached the combs to the frame. As each piece of comb is cut from the old hive, the bees must be brushed from it in front of the new hive. When all has been removed, jar the remaining bees from the box, gather up all bits of comb and render. Do

not transfer drone comb. Fill out the new hive with frames furnished with full sheets of foundation, because bees under these conditions will be likely to build drone comb in any vacant space.

Another plan of transferring, which involves neither drumming nor cutting out of the combs, may be employed if there is a supply of empty combs on hand or combs which can be taken from a frame hive. This plan is as follows: Turn the box hive bottom up and on it place a board the size of the frame hive bottom in which a hole nearly as large as the bottom of the box hive has been cut in such a way that the bees from the box hive must pass out of the entrance of the frame hive. The bees and the queen will go up into the frame hive and commence brood rearing there. When well at work a queen excluder is placed between the two hives. It is necessary that the queen be in the upper hive when the excluder is placed in position. In three weeks the lower hive will be free of brood and should be removed.

The operation of transferring may be carried out at any time by one who is proficient at handling bees. It is, however, likely to prove most satisfactory at the time when the apple comes into bloom, because the bees will gather enough nectar from this honey flow to repair and build combs and to be in a condition to gather the clover harvest.

STINGS.

Although good-tempered bees may be handled without serious stinging, the bee-keeper will always experience some trouble of this sort.

The bee sting is composed of two barbed, horny shafts held together by a third piece of horny material, which with the other two parts form the sides of a canal. Attached to this and lying entirely within the body is a small sack which is filled with a poisonous fluid. When the sting is thrust into the flesh, by muscular contraction this sack is compressed and the poison is pushed through the canal into the wound. Normally the bee, having thrust its sting into the flesh, is unable to withdraw it and tears itself loose from the sting shaft and the poison bag. Ordinarily, only a part of the contents of the poison sack is emptied as soon as the sting enters the flesh and the rest is forced out gradually as the

sting goes deeper and deeper. The sooner, therefore, that the sting is removed, the less painful the wound will be. If any attempt is made to remove it by grasping it with the fingers the poison sack is squeezed entirely empty into the wound. For this reason the sting should always be scraped or brushed out. In the practical work of the bee yard, the operator soon learns to give a glancing blow to any part stung, killing the stinging bee and removing the sting at the same time. Occasionally one of the barbs will break off and remain in the flesh, necessitating its removal by a needle or some such instrument.

When attacked by a great many bees if within reach of a building, one should enter it, for, realizing that they are in strange quarters, they immediately turn their whole attention to finding a means of escape. Lying flat on the ground face downward will sometimes cause them to leave.

Generally speaking, the practical apiarist does nothing for a bee sting except to remove it. The pain resulting from stinging is sometimes alleviated by touching a little honey to the points of injury. Human spittle similarly applied seems to be helpful. The fact that a bee loaded with honey will not sting unless pinched, indicates clearly the best conditions under which to manipulate the colony. When the honey flow is so abundant that practically every bee is filled, manipulation can be made without much danger of stinging. Manipulation when the honey flow is light can be carried out with minimum stinging by the judicious use of the smoker, for as soon as the smoke pours in upon the bees, they fill themselves with honey.

Bees are very likely to resent quick, nervous movements. By moving deliberately about the hive and avoiding jarring it, the bee-keeper gets along very satisfactorily with them at nearly all times.

CLIPPING QUEENS.

In the control of swarming the clipping of the queen's wings is an important factor. One-half or more of one or both wings is removed, making the queen unable to fly. While it seems that such an operation would be a difficult and dangerous task, it is really very simple, the most difficult part of it being the finding of the queen.

Clipping is usually recommended to be performed about the time of fruit bloom because with the smaller number of bees about that time of year, the finding of the queen is comparatively easy. It is a good rule, however, to clip every laying queen whenever found, unless one does not desire to have all the queens clipped.

When the queen is found pick her up by the wings with the right hand and hold her so that she will grasp by the feet the tip of the first finger of the left hand. Then close the thumb and the second finger upon her thorax, holding her gently but firmly. With small scissors cut off the desired amount of wing and gently replace her on the comb.

While a considerable amount of pressure can be brought to bear on the thorax of a queen, care must be taken that the abdomen is not squeezed. One need have no fear of being stung by the queen for although she has a sting she uses it only on a rival queen.

SMOKER FUEL.

Almost anything that will burn may be used in the smoker. Cotton waste, containing only a small amount of grease, will give good results. Rotten wood makes a very satisfactory smoke. Other fuels are corncobs, chips, planer shavings, old burlap, cotton rags, etc. Whatever fuel is used it is well to place on the top of it some green leaves or grass for the purpose of preventing live sparks from being blown from the smoker. Tobacco may be used for fuel when the bees are particularly difficult to control.

BALLING.

This term designates the treatment accorded by the bees to the queen when they desire to kill her. The bees tightly cluster around the queen, forming a compact ball about one and one-half inches in diameter. This action is sometimes due to excitement caused by opening the hive when there is little or no nectar being gathered. Sometimes a queen when returning from the mating flight will enter the wrong hive and be thus balled. Sometimes the queenless colony refuses to accept the introduced queen and balls her as soon as she emerges from the introducing cage. The queen may be rescued by dropping the ball into water, which causes it to break up and liberate her. Sometimes gentle smoking will have the same effect. After the queen has been rescued, she must be placed in an introducing cage and another effort made to have her accepted.

LAYING WORKERS.

When a colony becomes hopelessly queenless certain workers begin to produce eggs from which drones only can come. The colony having laying workers will not readily accept a laying queen and only rarely will it accept ripe queen cells.

This condition may be remedied by removing the hive some distance from its stand and shaking every bee into tall grass or brush, returning the combs and hive to their original place and introducing a laying queen in the usual way. The laying workers being heavy with eggs are not able to return to the hive. Should the colony be found very much weakened when laying workers are discovered, it will be found best to break it up and give the bees to a normal colony.

The presence of laying workers is indicated by drone brood in worker cells scattered generally through the brood comb. Drone laying queens are also responsible for drone brood in worker cells, but this brood is quite regular. Furthermore, the eggs of drone laying queens are placed in the bottom of the cells, while those of laying workers are usually attached to the side wall.

REQUEENING.

Occasionally it becomes necessary to change the queen of a colony. This operation is known as requeening and can be done by killing the old queen and introducing another which has been raised in the home apiary or elsewhere, or by destroying the queen and introducing a ripe queen cell protected by a cell protector.

When there are no other bees in the neighborhood, one can entirely change all of one's bees to Italians or any other race in two seasons and rear the queens at home by buying one queen early enough during the first year to be used as a breeder. The first year cells should be reared from the purchased queen and introduced into all the colonies except the one having the breeding queen.

The young queens will mate with the German or hybrid stock, as it may be, in the yard, and the offspring will be hybrid except the drones which will not be affected in the first mating. If the breeding queen is purely mated the drones of her daughters will also be pure. The second season all young queens should be replaced with cells from the breeder, and as these will mate either with drones from the breeding queen or with her daughters whose drones are pure, offspring of this second year will be pure, both drones and workers, provided always, of course, that there are not German or hybrid drones in the neighborhood. When mismating occurs, the mismated queens must be replaced.

After the bee yard is stocked with pure blood, if one does not desire to leave the requeening to the bees, the easiest way is that practiced by Mr. S. D. Chapman of Michigan. About ten days before the close of the honey flow, Mr. Chapman hunts up and kills all the old queens. This is as far as he goes, because his yard is stocked with such queens that he can use any or all as breeders. If one wishes to breed from only a part of his colonies, he should kill the queens as Mr. Chapman does, in ten days thereafter destroy the cells in such hives as are not satisfactory for breeding and replace them with ripe queen cells from satisfactory colonies.

MANIPULATION.

DETERMINING FROM WHICH HIVE THE SWARM ISSUED.

When a swarm issues during the absence of the apiarist it is often desirable to know from which hive it came. To learn this put a teaspoonful of flour in a cup and then put in half a cupful of bees from the cluster, and, after covering the cup, shake up the bees to get them well dusted with the flour; then throw them into the air. The hive before which is found the largest number of floured bees fanning is the hive which cast the swarm.

BEFORE THE HONEY FLOW.

There is no such thing as a particular date on which a certain operation should take place, for seasonal conditions which govern these things are variable from year to year. Ordinarily, the first of May is about as early as bees can be handled without danger of

harm. In early seasons, however, they may be manipulated as early as the first of April and in exceptional cases even earlier. As early in the spring as possible the bee-keeper should determine the amount of stores in the hive, for early brood rearing requires such a quantity of honey that bees starve more readily in the spring than during the winter. Queens usually begin laying in February. The first manipulation is usually for the purpose of learning if the hive is properly supplied with honey and whether a laying queen is present.

When opening a hive always stand back of or beside it. Never stand in front for one thereby obstructs the line of the bees' flight and is likely to cause them to sting. With the bee veil properly adjusted, stand at the side of the hive and give them two or three puffs of smoke at the entrance to alarm the guards. With the hive tool, loosen the cover and raise it only enough to allow smoke to be blown under, not enough to allow the bees to escape. After a few seconds have elapsed, entirely remove the cover, applying smoke if necessary to keep the bees from running out of the top of the hive. The amount of smoke to be used depends entirely upon each individual colony and can be learned only by experience. It is easy to use too much smoke and thereby so demoralize the bees that the manipulation will be almost as difficult as if no smoke had been used. With the hive tool, pry the second frame toward the side of the hive and the fourth frame in the opposite direction. This will usually make sufficient room to remove the third frame. Should any of the combs be crooked, it will be necessary to move a straight one first, then work toward the crooked one if necessary. Should the hive be equipped with a division board, this can sometimes be removed first and thus make room for the removal of the frames. Division boards are not held in high favor, and some of our best bee-keepers have discarded them entirely. When opening a hive from which it is necessary to remove one or more stories, place the cover on the ground, top down, and set the removed story on this in a diagonal fashion. Placing it in this manner is necessary to avoid killing the bees which may be on the under side. When replacing supers or the cover, gently smoke above the frames to drive the bees out of danger.

Care must be taken in removing a single comb from near the center of the brood nest, especially when the combs lie close to-

gether, for it rolls the bees over and ruffles their temper besides being likely to kill the queen.

If examination shows the bees not to have plenty of stores they should be fed. Bees without proper feed will not increase in numbers as they should. It is the colony which produces the most brood up to the time when harvest begins that will gather the largest crop. An examination each week or ten days from the time when the hive can first be opened will usually suffice to indicate the needs of the colony previous to harvest time. The beginner in bee-keeping will hardly be satisfied to allow his bees to stand so long without overhauling, but he must remember that when a colony is smoked and handled there is a loss attendant upon the interruption of its operations.

If the first spring examination shows eggs and brood in all stages, it is evident that the queen is present. If no eggs or brood are found when the colony is still of fair size, a queen should be gotten and introduced. If the colony is small it will prove best to unite it with another weak colony which is possessed of a laying queen. To unite two small colonies, smoke both well when they have ceased flying for the day and place the queenless colony on top of the other with a single sheet of newspaper between. The bees will gnaw away the paper and unite, after which one set of combs can be removed if desired.

Many bee-keepers now use two sets of combs for brood rearing previous to harvest for the purpose of promoting the development of the maximum amount of brood. When the harvest arrives it is customary to take away one story of the brood comb. If the apiarist desires to produce comb honey, this second story of brood is, of course, replaced by the ordinary comb honey super. If the production of extracted honey is desired, the pollen bearing combs and the queen should be placed in the first story and a queen excluding honey board should be placed on top of the first brood body. The second brood body should then be set over the queen excluding honey board. With this arrangement, any combs in the upper brood body containing brood will be filled with honey when the brood emerges.

When the honey harvest arrives, the bee-keeper should see that his colonies are furnished with young queens, and have plenty of ventilation and room, for these conditions will tend to keep the

bees together and busy. An indication of the arrival of the harvest is to be found in the presence of new white wax along the top bars of the brood nest.

Some bee-keepers put on the supers when the first clover blossom is seen. While this is before the harvest really commences, it has the advantage of allowing the bees to become familiar with the super before the flow begins.

If the apiarist desires more colonies, he may allow his largest colonies to cast one swarm apiece, but after the honey flow begins, he should, by every means in his power, prevent swarming.

PRODUCING EXTRACTED HONEY.

Extracted honey is normally gathered in combs of size similar to that of brood combs. When the honey flow starts, put the pollen bearing combs and the queen in the first story, filling the places of removed comb with brood bearing comb taken from the lower story. Introduce a queen excluder between the two stories. Should both stories of comb be filled with brood and honey, another story with drawn combs or full sheets of foundation should be used on top. As the flow advances more room should be given as needed. The bee-keeper should be so familiar with the time and duration of the honey flow that he can give the bees an abundance of room for the honey storage and can withhold extra space when they are nearing the end of the harvest. In some cases when nearing the end of the honey flow, full combs of a strong colony can be exchanged for the empty ones of a weak colony.

As soon after ripening as possible, the honey should be extracted, because there is always danger of some other honey of inferior quality coming in and lowering the grade. Ten days or two weeks is usually ample time for ripening. It is not necessary that all the cells be sealed, for it may be fully ripened and still unsealed.

Honey may be removed from the hive either by smoking the bees, removing each comb separately, brushing the bees off each as it is removed and placing them in an extra hive body; or it may be removed by the use of the bee escape. When utilizing the bee escape, the bee-keeper must be careful to see that the combs are not damaged by the sun's heat. When the escape board is put on, ventilation is largely shut off and the combs may melt if the hive

stand in the hot sun. In such cases the hive should be shaded. Escape boards should be put on in the afternoon and by the following morning the supers will be practically free from bees.

The cappings are removed from the combs with the uncapping knife, using a sawing motion similar to that used in slicing bread. Perhaps the majority of extracted honey producers uncap the combs by supporting the frame on a nail point so inclining the comb as to allow the cappings to fall away from it and by drawing the knife from below upward. Others cut downward and claim that this method is the best. It is suggested that the downward stroke be given a thorough trial. The aim should be to remove all the cappings from one side of the comb without removing the knife. Make no effort to remove merely the caps, but cut the entire comb down to the thickness of the top bar. This will render uncapping easier and make the combs more uniform.

If the combs are newly built or without wire (all combs should be wired whether used for extracting or not) much care must be taken or they will break down in the extractor. In such cases, it will be found best to extract about half the honey from one side of the combs, reverse, and extract all from the other side, and then finish the first side.

The extracted combs may be returned to the hives for the bees to clean up and if any flow is anticipated may be allowed to remain. Otherwise the dry combs should be stacked away in the supers and every precaution taken to protect them from the attacks of the wax moth.

The extractors should be allowed to fill with honey until the comb pockets strike, then a pailful should be drawn off. Drawing off only a part of the honey at a time leaves the greater amount of the bits of comb in the extractor and avoids clogging the strainer.

The honey may be strained through cheese-cloth and run directly into five gallon cans or into a large tank with a gate near the bottom. After the air has arisen the honey may be drawn off.

In the production of extracted honey, some bee-keepers spread the combs and place seven in an eight frame super and eight in a ten frame super. This gives "fat" combs, which are more easily uncapped.

Alsike clover, New Jersey's best honey plant.

An attractive Monmouth County yard.

PRODUCING COMB HONEY.

Perhaps no phase of bee management has brought out a greater diversity of methods and devices than the production of comb honey, and the end is not yet. Comb honey is sold almost entirely on its appearance, and every effort is, therefore, made to have it as attractive to the eye as possible. The manipulation of the colonies before the honey flow is the same as when producing extracted honey, and the main thought is to have the maximum number of bees in the colony when the honey flow begins.

If the colony has more than one story of brood at the opening of the flow, put all capped brood in the first story. If the colony be of average strength, put one comb honey super in place on top of the second brood story. If the colony be exceptionally strong, put on two supers. These supers should have full sheets of foundation in the sections.

During the early part of the honey flow, extra supers should be put under the ones partly filled, but during the latter part of the period they should be added at the top. When capping commences in one super it is time to add another if the flow promises to continue and uniform work has been done in it.

The surplus brood may be placed over a weak colony, and when the combs are filled with honey, it should be extracted or saved for feeding or the surplus brood may be used to form new colonies.

When first completed, the appearance of the section is best, but it is not practicable to remove it at that time, because of the extra labor and the loss due to the interruption of the bees' work. It is a common practice to remove it by the superful. As the outside sections are the last to be finished, the super may be removed when they are not quite finished, the unfinished sections being put in another super and returned. If left long enough after finishing or after the flow has ceased, bees will discolor the cappings more or less by smearing propolis on them. More propolis will also be put on sections.

The bee escape should always be used in the removal of comb honey. Comb honey, which has been removed from the hive, if not at once put in shipping cases, must be guarded with great care lest the wax moth ruin it. It should be kept in a dry, warm room

and should never be stored in a cellar, refrigerator or other damp place, for it will absorb moisture and the honey will ferment.

Unfinished sections may be extracted and put on the next season with the first super introduced. They are known as "baits" and will induce the bees to commence work sooner in the super and will tend to prevent swarming. Of course, the honey in such sections may be cut out and sold as chunk honey in the home market. No more smoke than is absolutely necessary should be used in removing comb honey, as it will often cause some of the bees to uncap some of the cells and spoil the appearance.

A very good plan to get all the sections well filled is to use a shallow extracting frame at each side of the comb honey super.

When the time for surplus honey flow has passed, all surplus arrangements should be removed leaving only that which is intended shall form the winter brood nest.

With the arrival of the first killing frost, the bees should be examined to determine whether they have from 25 to 30 pounds of honey for winter and spring use. Should there be less than this amount, they should be fed as soon as possible until the deficiency is made up. The entrance should be contracted to ⅜ inch by 5 inches. If any sort of winter protection is to be used, the sooner it is put in place the better in order that the bees may seal up the cracks.

WAX PRODUCTION.

While beeswax is a by-product of the apiary, it can, if properly handled, be made greatly to increase the net return. There is a constant demand for good beeswax and the market price rules about the same at all seasons. When combs become unfit for further use either by being damaged or infected with disease they should be protected from the wax moth and rendered at the first opportunity. The cappings which are removed from the combs in the process of honey extraction should be allowed to drain and then rendered.

Wax may be rendered by utilizing the direct heat of the sun, or by boiling and pressing.

When the solar extractor is used the old combs and wax are placed in it and the sun's heat does the rest. This process is, of course, only practicable in warm weather, and will not do thorough work with old combs.

In the second process the material is melted in plenty of water and when brought to a boil is put in a wax press, the wax is pressed out under water and poured off the top into another vessel in which it is allowed to cool.

If no press is to be obtained a fairly satisfactory result may be obtained by stuffing the combs into a sack and boiling them in a vessel of water. The sack should be prodded frequently to work the wax out. When completely melted the sack should be weighted down and the water allowed to cool. The beeswax cake, which will have formed on the surface of the water, can then be removed. Of course, this process will not do as thorough work as the press. If the wax cools slowly nearly all sediment will be found on the bottom of the cake and can be scraped off when the wax is prepared for market. The scraping should go into the next melting.

The sun extractor should not be used for diseased combs for the heat generated is not sufficient to destroy the disease germs.

FEEDING.

Many bee-keepers place entirely too much reliance in the old saying that "bees work for nothing and board themselves" with a result that following a poor season for honey collection many swarms perish. As a matter of fact bee-feeding may become necessary at any time, and, if properly managed, it can be made to pay excellent returns.

Bees are fed for two purposes: First, to provide the necessary amount of stories in the hive for winter and spring use, and, second, for the purpose of stimulating greater brood rearing activity. They are never fed any mixture to be stored in the combs and marketed, for there is no profit in the operation.

When for any reason, the bees are not able to accumulate 25 to 30 pounds of stores in the brood body by the time storing ceases, they must be fed until they have about this quantity. Nothing is better, or perhaps even as good as granulated sugar and water—2 parts of sugar to 1 part of water. This mixture should be fed in a feeder of sufficient size that a single feeding will enable the

bees to complete their necessary stores. Of course, if filled combs are available they are far superior to any substitute.

Stimulative feeding will not be needed if the hive is properly supplied in the fall. When it does become necessary a much thinner feed is better. One part of sugar should be used to one part of water, or even one half part of sugar to one part of water. Daily feeding seems to give the best results, and when once it has been undertaken it should be kept up until the bees are able to gather a sufficient supply from natural sources. Should the bee-keeper cease feeding after having started the process, a part of the brood would be almost certain to perish.

When no feeder is to be obtained, empty combs can be placed in a wash boiler or similar deep vessel and the syrup slowly poured on them from such a height as to force it into the cells. When one side of a comb is filled the other side should be treated in a similar manner until it is filled. After allowing them to drip they should be placed in the hive requiring feed.

QUEEN REARING.

There is a great need among New Jersey bee-keepers of better stock and of a strain of bees, which will prove more resistant to disease. The subject of queen rearing is, therefore, of interest.

Buying Italian queens from a reputable breeder or dealer for the purpose of requeening all the poor or hybrid stock is the quickest way to make the change, and in many cases will prove the best way since few bee-keepers have the time or skill to raise good queens. If requeening is undertaken in July or August, the change will cause but little interruption in the work of the hive, and the vigorous young queens should continue laying late in the season, producing plenty of young bees for taking up the work early the following summer. A further point in favor of requeening at this period is to be found in the fact that the queens are cheaper at this time.

Queen rearing is a branch of beekeeping which requires more care and a closer acquaintance with the natural workings of the bee hive than any other phase of the industry. In view of these facts it is probable that the average bee-keeper will get the best

results in the improvement of his stock by the purchase of good queens rather than by trying to raise them.

Perhaps the simplest way to requeen a poor colony is to remove a ripe queen cell from a colony which has prepared one or more in preparation for swarming, cover it with a cell protector and place it in the colony which should be requeened. The old queen must, of course, first be removed. Unfortunately, this plan of taking queen cells from colonies preparing to swarm does not always meet the requirements of the apiarist, for he may not have the queen cell producing colony at hand. He can, however, deprive the colony of bees which he desires to requeen of its present queen, and they will at once set about rearing another. The bee-keeper may take advantage of this habit and compel his most desirable stock of bees to produce queen cells with which his poorer colonies can be requeened.

The grafting process is generally used by commercial queen rearers for the purpose of obtaining satisfactory queen cells. In their hands this process is entirely satisfactory. Newly hatched larvæ are transferred from the comb in which they have been hatched to artificial queen cells in a cell building colony. This manipulation requires so much care that it will not be given in detail. Fortunately, there are other plans which are sufficiently simple for the average bee-keeper to employ, and the following space will be devoted to a brief statement of their nature.

The first plan of securing queen cells is that given by Dr. C. C. Miller, of Marengo, Illinois, and published in the American Bee Journal: "Into an empty brood frame at a distance of 2 or 3 inches from each end fasten a starter of foundation about two inches wide at the top and coming down to a point within two inches of the bottom bar. Put it in the hive containing the best queen. Take from the hive either for a few days or permanently all but two frames of brood and put the frame between these two. In a week or later this frame will be half filled with new comb. It will contain young brood with an outer margin of eggs. With a sharp knife trim away all the outer edge of comb which contains eggs, except, perhaps, a very few eggs next the youngest brood.

"Now put this prepared frame into the middle of a very strong colony from which the queen has been removed. In about ten days the sealed cells are ready to be cut out and used wherever desired."

The name of the originator of the other plan cannot be given for there exists uncertainty as to the person who first suggested it. The only extra fixture required is a rim the size of the hive 2½ inches deep with ends of ⅜ inch and sides of ⅞ inch material. A clean comb which is not too old should be placed in the center of the colony having the breeding queen and left four or five days when it will be found full of eggs. The bees should then be brushed off this comb, then two rows of cells should be destroyed and one row left. Thus continue until the entire comb has been gone over. The destroyed cells should be removed to the midrib with a flat chisel or other suitable instrument. The same operation should be carried on in a transverse direction, so that when the entire preparation is completed every third cell will be left untouched. The prepared comb is now ready to be given to the cell building colony, which must be queenless with no brood or sealed brood only. Under these conditions the larvæ will be abundantly fed. Satisfactory results can be expected only where the feeding colony has an abundance of young bees. On the cell building colony put the 2½ inch deep rim. On top of the frames lay an empty brood frame on its side and on this with the top bar over the bottom bar of the lower frame place the prepared comb with the prepared side down. Cover the prepared comb with a quilt and put on the hive cover. The completed queen cells should be ready to be removed on the tenth day. The bee-keeper can make sure that the colony which he desires to utilize for queen rearing has sealed brood only by removing the queen six days before giving the prepared comb. This process should be carried on during the honey flow for then conditions are best for rearing queens. The ripe cells should be introduced near the close of the honey flow.

MARKETING.

No part of bee husbandry seems as much in need of or as capable of development as does the marketing of the products of the apiary. The home market is usually neglected and the bee-keepers do not seem to realize it. There is a splendid opportunity for the development of a honey market in surrounding towns.

Comb Honey.—This form of honey is sold almost entirely on its appearance and everything possible must be done to make it look

well. All sections should be thoroughly cleaned by scraping the propolis off and all should be graded into uniform grades. The basis of grading should be shape and color. Pack about ten cases (about 200 lbs.) in a crate-like carrier, using hay or straw on bottom as a cushion to absorb shocks, and provide handles on the crate for the convenience of freight handlers. Comb honey will usually arrive in better condition when shipped by freight than by express. Do not ship a section of honey that you cannot guarantee fully in every respect.

Extracted Honey.—This type of honey may be shipped in five gallon cans in which it was placed as it came from the extractor, or it may be bottled and sold in that way. Where the quantity of extracted honey is large, the employment of a good salesman will be worth while.

Wax.—There is a constant demand for wax by comb foundation manufacturers and nearly all supply dealers will be found willing to take wax in exchange for supplies or for cash.

WINTERING.

In some states the problem of bringing the bees through the winter alive is one which taxes the skill and ingenuity of the bee-keeper to the utmost; but in New Jersey if the bees are provided with a fairly good hive, plenty of young bees and an abundance of stores the winter loss is very small. It will usually be safe to dispense with all packing.

The successful wintering means the bringing through of the bee colony with the maximum number of vigorous, healthy workers. To this end, the bees must be protected from moisture, extreme low temperatures, starvation and must be given the best chances possible to take necessary cleansing flights.

To insure their protection from moisture, the top of the hive should be water-tight. If there should exist any doubt in the mind of the bee-keeper as to whether the tops of his hives are water tight, he should cover each of them with a piece of tarred paper, letting it project down the sides and fastening it with strips of wood tacked on. This type of covering will make the roof of the hive water tight and will absorb the rays of the sun, drying and warming the hive's interior.

Unless the bee colonies are exposed to the winter winds, there will be no occasion to use packing. Locate the stands where they

will be protected from wind and have an opportunity to feel the effects of all the sunshine, and further housing provisions to protect them from low temperatures will be unnecessary.

Each colony must have from 25 to 30 pounds of stores, or low vitality and perhaps death are likely to result. Lack of stores should be supplied by feeding as described under the head of "feeding." The best investment a bee-keeper can make is to provide plenty of stores in the hive during the early spring, because such provision insures much brood rearing and the formation of a strong colony, which can utilize the early honey flow.

Leaving the bees in the location occupied during the summer, or in a fairly open place will provide the best opportunity possible for cleansing flights.

Appendix

Let every bee-keeper visit good bee-keepers as much as possible and exchange ideas.

Secure all books, bulletins and bee journals possible and become so well informed on every phase of bee management as to secure the maximum production always.

BEE BOOKS.

"Fifty Years Among the Bees"—Dr. C. C. Miller.
"A B C & X Y Z of Bee Culture"—A. I. & E. R. Root.
"Langstroth on the Honey Bee"—Revised by Dadant.

BULLETINS.

No. 442—"Treatment of Bee Diseases"—Dr. E. F. Phillips, Bureau of Entomology, U. S. Dept. of Agric., Washington, D. C.
No. 447—"Bees"—Dr. E. F. Phillips.
No. 503—"Comb Honey"—Geo. S. Demuth, Bureau of Entomology, U. S. Dept. of Agriculture, Washington, D. C.

BEE JOURNALS.

"American Bee Journal"—Hamilton, Ill. (monthly).
"Gleanings in Bee Culture"—Medina, Ohio. (semi-monthly).
"Bee-keepers' Review"—Northstar, Mich. (monthly.)

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