CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

Technical and Bibliographic Notes / Notes techniques et bibliographiques

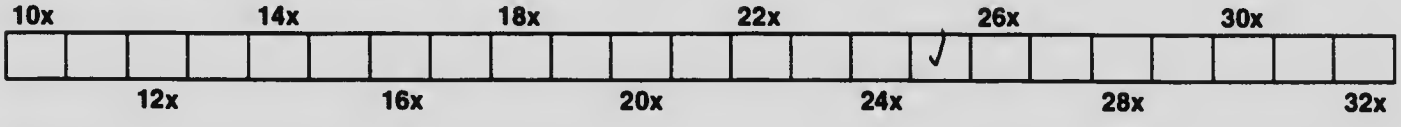
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

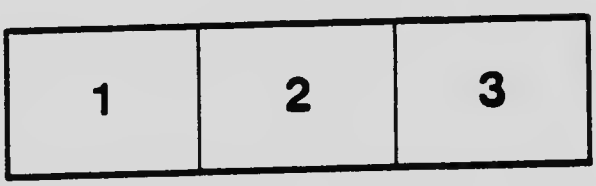
- [x] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [ ] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [ ] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- [ ] Additional comments / Commentaires supplémentaires:

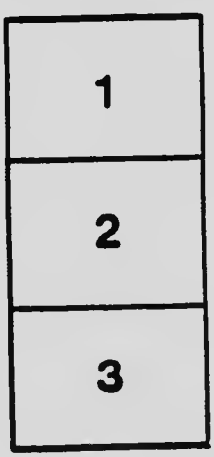
L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

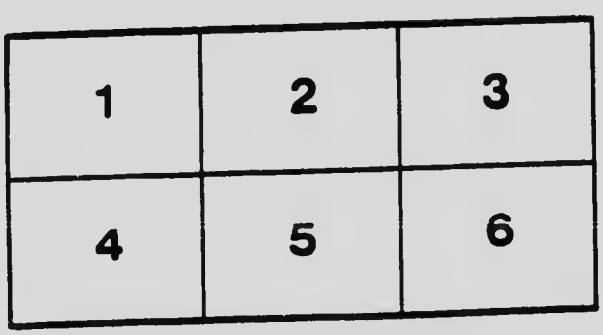
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [ ] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary material / Comprend du matériel supplémentaire
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- [ ] Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below / Ce document est filmé au taux de réduction indiqué ci-dessous.









DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEES

AND HOW TO KEEP THEM

BY
F. W. L. SLADEN
Dominion Apiarist

BULLETIN No 26
[SECOND SERIES]

Published by direction of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont.

OTTAWA
GOVERNMENT PRINTING BUREAU
1916

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

BEES

AND HOW TO KEEP THEM

BY
F. W. L. SLADEN
Dominion Apiarist

BULLETIN No. 26
[SECOND SERIES]

Published by direction of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont.

OTTAWA
GOVERNMENT PRINTING BUREAU
1916

90179—1

OTTAWA, December 22, 1915.

The Honourable
The Minister of Agriculture.

SIR,—I have the honour to transmit herewith Bulletin No. 26 of the Second Series, entitled "Bees and How to Keep Them," which has been prepared by Mr. F. W. L. Sladen, Apiarist of the Experimental Farms.

This bulletin replaces our Bulletin No. 69, "The Honey-bee," which is now out of print. The demand for a publication of this nature is steadily increasing, and has now reached such proportions that, in my opinion, the issuing of this new bulletin is advisable.

The information contained therein is given in a concise form, and I think should prove useful to those of our farmers who find that the keeping of bees adds very materially to their income.

I have the honour to be, sir,
Your obedient servant,

J. H. GRISDALE,
Director, Dominion Experimental Farms.

90179—1½

TABLE OF CONTENTS.

INTRODUCTION.

The purpose of this bulletin is threefold: to point out the advantages of bee-keeping; to give, very briefly, reliable advice to the beginner; and to show to those who are keeping bees in an old-fashioned or neglectful way how their profits may be doubled or trebled by the adoption of modern methods. Unfortunately, bees are more often neglected than other kinds of live stock. Hidden in their hives they seldom show any outward sign that they need attention, and it is not widely enough recognized that efficient management of the apiary is well repaid.

THE ADVANTAGES OF BEE-KEEPING.

The saying "the resources of Canada are inexhaustible" is true of no food product more than of honey. An abundance of honey-yielding flowers, with a high average of favourable weather for the production and ingathering of the honey, makes Canada a good country for the bee-keeper. Moreover, the bulk of Canadian honey is of unsurpassed quality, and honey has become, as it deserves to be, a staple article of food in many places, selling readily at satisfactory prices when properly distributed.

Honey has a claim to be regularly used in every home both on account of its sweetness, which is delicately flavoured with the aroma of the different kinds of flowers from which it is gathered, and also because of its high food value, it being a concentrated and easily assimilated heat and energy producing food.

In Ontario, Quebec, and in favourable regions in the other provinces, there are an increasing number of people who make bee-keeping their principal business—in Ontario the incomes of some of these specialists exceeds $2,500 per year—while scattered throughout the Dominion are thousands who find it an auxiliary pursuit that yields no mean profit and combines healthy outdoor occupation in pleasant weather with the fascinating study of an insect whose marvellous habits are a subject of absorbing interest to the nature lover. It is estimated that there are about 10,000 bee-keepers in Ontario alone.

All kinds of people keep bees—young and old, rich and poor, educated and uneducated, dwellers in the cities and dwellers in the country. Among the principal vocations represented are farmers, fruit growers, clergymen, school teachers, merchants and clerks. More than one student has paid his way through college by keeping bees in the summer vacation. With help for the heaviest work, women frequently make successful bee-keepers. Many a farmer has found that, for the small amount of capital invested, bees will yield a larger return than anything else on the farm. In cases where the farmer or fruit grower is unable to spare time to pay proper attention to the apiary, some member of his family will frequently take charge of it with the most satisfactory results. However, the successful management of a small apiary does not require the expenditure of a large amount of time, but consists in knowing what to do and in doing it at the right time. To acquire this knowledge, the life history and habits of the bees must be studied.

The amount of extracted honey that may be obtained from a well-managed colony of bees is hard to state, because it varies with the locality, but most localities will be covered if it is put at from 30 to 120 pounds in an average year. The yields also vary from year to year, principally on account of the weather. In a good year a colony will pay for itself in the average locality, but seasons in which the honey crop is a failure occur even in the best districts. Consequently, the professional bee-keeper should have sufficient capital to tide himself over a bad season, or he should have some additional source of income.

In Ontario, extracted honey is, at the time of writing (August, 1915), worth from 8 to 11½ cents per pound, wholesale, and 10 to 15 cents, retail, the higher prices being for the white honey, which constitutes the bulk of the crop. In the West the prices are somewhat higher than in Ontario, and in Quebec a fraction lower. Prices have varied but little from year to year. Up to one hundred, and sometimes two hundred or more colonies, can be kept profitably in a good location. Professional apiarists frequently keep one or more out-apiaries, these being situated not less than two miles from the home apiary, and from one another. In estimating profits, 50 cents to $1 per colony should be deducted for working expenses other than labour. Part of this may be offset by the value of the wax produced and sold.

The peculiar advantages of bee-keeping are not sufficiently recognized. Without investing in land or expensive equipment a man or woman who has the aptitude can learn to make money in the production and sale of an article of food which one is never compelled to sell at temporarily depressed prices, because it will keep in good marketable condition, even from year to year if necessary.

A crop of honey and a little wax do not represent all that is to be gained by keeping bees. To the fruit grower, bees may be more valuable for ensuring the crop of fruit than for honey production. It has been experimentally proved that the production of most kinds of apples, pears, plums and cherries, and also raspberries and gooseberries, depends upon the transmission by insects of the fertilizing pollen from blossom to blossom of different trees or varieties. The industrious and methodical honey-bee is by far the most efficient insect for this work, and in regions or seasons where wild bees are scarce, or where frequently unfavourable weather during the blossoming period demands that pollination be accomplished quickly, a few hives of bees in or near the orchard become a necessity. Bees are also useful pollinizers of several farm and garden crops. In the alsike seed-growing districts of Ontario the farmers are glad to have the specialist bee-keeper locate his large apiary near their fields, because an abundance of bees increases the seed crop, and bees are a recognized item in the equipment of those who grow cucumbers for market in hot-houses.

HOW TO BEGIN.

Before starting to keep bees the beginner should, if possible, visit a bee-keeper in his vicinity, one who keeps bees in an up-to-date way in modern frame-hives, so as to see how a hive is opened and how the combs are handled, and also to learn by question and answer many things about bees and their management, which are not nearly so easily acquired by the perusal of books.

It is a mistake to start on a large scale. One or two colonies are enough to begin with. When experience has been gained the number may be increased. Nothing is more discouraging to the beginner after he has gone extensively into bee-keeping than to lose most of the bees through bad wintering or some other cause, all from the want of a little experience. It is a good plan to make the bees pay their way after the first outlay, which need not exceed $20, and can often be made much less.

The best time of the year to begin bee-keeping is in the spring. Colonies complete in their hives may be obtained in May, or swarms may be obtained in June or early July. The former should each give a fair amount of surplus honey or a swarm or two the same season, but a swarm is not likely to produce much honey the first year, unless it is an early one.

The colony or swarm should be fairly populous, and should have a young fertile queen. The apiary from which it comes should be free from disease. It is best, if possible, to procure the bees in the neighbourhood, one reason being that bees sent long distances may die in large numbers during transportation unless packed skilfully; another reason is that the risk of introducing disease into the district is avoided. Besides, the neighbour from whom the bees are purchased can often be induced to

assist in the moving and will prove a helpful friend in case of difficulty or doubt. If the colony is procured in April or May the bees will travel with less risk than in the height of summer, because there will then be fewer bees and less honey in the hive and the weather will probably be cooler. Colonies should be moved in autumn or early spring if the distance is less than two miles in order to avoid the return of many of the bees to the old location.

If colonies are obtained it is very desirable that they should be in Langstroth hives. Sometimes bees can be bought very cheaply in box hives, or a colony may be found in a hollow tree. Such colonies will have to be transferred to Langstroth hives, an operation for which the beginner is advised to secure the services of an expert. (See Transferring, page 40.)

A method of buying bees that is coming into favour is by weight, without combs, in boxes specially constructed for the purpose. Packed with care the bees will survive a journey lasting several days, and will not be likely to carry brood disease after so long a separation from their combs if the food supplied for the journey is free from infection, and they are compelled to build new combs.

Before deciding to obtain bees from places outside the province one should communicate with the local bee inspector, as there are sometimes regulations requiring the quarantining of bees.

Those who desire advice as to where to procure bees may communicate with the secretary of the local Beekeepers' Association (see page 54), or consult the advertising columns of the bee journals. The Dominion Apiarist, Central Experimental Farm, Ottawa, may be able to supply the names of beekeepers located not far from the applicant, who have bees for sale.

HONEY HOUSE.

A wooden hut or honey house, for the storage of supplies and combs, for making up the hives and fittings, and for extracting and putting up the honey is a great convenience in a small apiary, and indispensable in a large one. The honey house may be constructed of boards one inch thick laid on a suitable frame work, with the roof covered with waterproof sheeting. It is not usually advisable to line the roof with insulating material, because a high temperature in summer is advantageous for extracting and ripening the honey. The floor should be firm and capable of supporting a heavy weight of honey. A convenient size of house for an apiary of forty or fifty colonies is 16 feet long by 12 feet wide. It is important that the honey house should have no crevices through which bees can enter. This may be accomplished by constructing it of tongued and grooved boards. The window openings should be covered with wire cloth. Small holes may be made with the point of a lead pencil in the screen at the top of each window to permit any bees that may have been brought in upon combs to escape, these holes being plugged when not in use. The glazed sashes should be removable or sliding. The door should fit closely; it is a convenience to have it capable of swinging both ways and shutting automatically. A door on rollers may be fixed outside the swinging door.

BEGINNER'S OUTFIT.

The following is a list of items that would be needed for making a start with one or two colonies, with the approximate cost:—

One or two colonies of bees in 10-frame Langstroth hive, each costing $8 to $12	say	$10 00
Bee smoker		1 00
Bee veil		0 35
Book on bee-keeping		2 00
¼-lb. No. 30 tinned wire		0 15
Spur wire embedder		0 25
For each colony add one spare 10-frame hive with self-spacing frames and 1½ lb. medium brood foundation to take a possible swarm (two spare hives will be needed in a good district if rapid increase is desired)		3 00
and either of the following sets of supplies for surplus honey:—		
For comb-honey production—		
3 comb-honey supers, 150 sections in the flat and 1 lb. thin super foundation		3 00
For extracted-honey production—		
2 10-frame hive bodies fitted with Langstroth frames in flat	$2 00	
1 queen excluder (wood-bound)	0 30	
		3 90
For extracted-honey production the following additional articles will be needed:—		
Honey extractor, 2-frame, non-reversible	$10 00	
Uncapping knife	0 60	
		10 60

LOCATION OF THE APIARY.

It has been remarked that the quantity of honey that bees will gather varies considerably in different places. There are, however, few places in Canada where they will not yield enough to make them profitable.

While the beginner or amateur is usually limited in the choice of a location for the apiary to the neighbourhood of his home, the man who has learned to be successful in managing bees and desires to go more extensively into the honey producing business may find it profitable to select a location, either for an out-apiary or to remove to, in which one or more of the most important of the honey plants mentioned in the list given on pages 29 to 32, such as alsike clover or fireweed, abound within a radius of one or two miles.

In the Prairie Provinces more honey from wild flowers may be expected on the scrub and timber lands than on the open prairie.

The spot chosen for the apiary should be sheltered from high winds and especially from cold winds in the spring, which in most places blow principally from the north-west and north. If the bees are to be wintered out-of-doors, protection from wind needs special attention (see Wintering). In a windy region it is an advantage, especially for the spring, to locate the apiary where there are windbreaks, to lead the bees into the surrounding country. It is desirable, but not essential, to have the hives partly shaded in the summer. This is very often accomplished by using an old orchard for the apiary. Usually the best place for a small apiary, especially in the

case of the beginner, is the home garden from which horses and cattle are excluded by a fence, and where the hives are within sight or hearing of the dwelling house, so that any swarms that may come out are seen or heard at once. The bees should not be placed near a public highway, nor where young children are likely to run about in front of the hives. A valley is a better place for an apiary than a hilltop. A situation subject to inundation by floods should be avoided.

The ground around the hives, and especially in front of the entrances, should be kept clean, the grass and weeds being cut short periodically.

RACES OF BEES.

Two races of bees merit consideration,—the black bee and the Italian bee. In the black bee the horny skin under the hair is entirely black, whereas in the Italian the abdomen is striped with yellow. The black bee was introduced into North America from Western Europe nearly three hundred years ago and has now spread all over Canada. The Italian bee was introduced into the United States from Northern Italy in 1859. The Italian is more prolific than the black bee, gentler and less excitable under manipulation and therefore easier to handle. In regions where the summer is warm, and where most of the honey gathering takes place at a temperature above 70°, it is more industrious than the black bee; but the black bee is less adversely affected by unfavourable weather in spring when the temperature hovers for long between 50° and 60° F., and the colonies consume less food in August. Thus it happens that the Italians are preferred by most progressive bee-keepers in Ontario and western Quebec, in the Prairie Provinces and the inland parts of British Columbia, while blacks have their strongest supporters in the St. Lawrence Gulf region and in the northern part of Nova Scotia. Italians resist European foul brood much better than blacks, and in regions where this disease occurs it is necessary to keep Italians in order to make a success of bee-keeping.

It is quite easy to Italianize an apiary of black bees. This is done by replacing the black queens with fertilized Italian queens, which may be purchased from a professional queen breeder.

Hybrids between blacks and Italians have the prolific qualities of Italians and the hardiness of blacks, and they are often more industrious than either race, but they are rather more inclined to sting. This is especially the case with the darker-coloured hybrids.

Golden Italians, in which the first three segments of the abdomen are clear yellow, are not, if pure, quite so hardy as three-banded Italians in which these segments are edged with black.

Carniolan bees are sometimes recommended on account of their rapid breeding in the spring, their white-capped honey-comb, and when pure, their gentle temper, but they have the serious fault of an excessive tendency to swarm.

THE BEES, AND HOW THEY DEVELOP.

A colony of bees consists normally of one queen bee,—the mother of the colony,—from 10,000 to 50,000 or more workers, non-reproductive females specialized for a life of labour and, in the summer, a few hundred males or drones. These three kinds of individuals may be recognized by their size and shape. (See Fig. 1.)

The combs which fill the interior of the bees' dwelling are composed of wax secreted by the workers from glands situated in the under side of the abdomen, and are in the form of vertical slabs built downward from the top of the cavity or hive. Each comb consists of a dividing wall with hexagonal cells on either side.

The honey is stored in the cells in the upper part of the combs, and in the outer combs. In the cells in the middle and lower part of the interior combs are reared the developing bees. This region of the hive is called the brood nest. Pollen is stored in the cells surrounding the brood nest. The majority of the cells in the brood nest are about one-fifth of an inch across. They are used for rearing workers, each cell forming the cradle of a single bee.

There is also a small quantity of comb consisting of larger cells measuring one-fourth of an inch across; in these the drones are reared. The drones are stingless and do not visit the flowers to gather honey. Their function is to fertilize the queens, for which purpose but a few are needed. The bee-keeper can control the production of drones by fitting full sheets of worker foundation (see page 15) into the brood frames.

A worker bee does not commence to gather nectar until about two weeks old, and during a period of abundant nectar gathering it is worn out and dies at the age of about six weeks, but one that emerges late in the summer will live until spring. To replace the constant loss of bees and also to build up the colony after the heavy loss of life during the winter and early spring, the queen must necessarily be very prolific. She commences to lay on the first signs of spring, and it has been estimated that in June a good queen will lay from two to three thousand eggs per day. The larva or maggot hatches from the egg at the end of the third day. It is fed during the first three days on a milky food rich in proteid, and then for two days upon a mixture into which a considerable amount of honey enters. On the eighth day after the egg was laid the cell is capped over with wax. Within the capped cell the larva throws off its last skin and becomes a pupa. This develops into the perfect bee, which emerges twenty-one days after the egg was laid. Twenty-four days are needed for the drone to pass through the same stages.

The work of preparing the food for the larvæ and of feeding them is carried out chiefly by the young bees.

In the production of a queen to replace one that has died, the workers select about a dozen worker larvæ that have not yet been weaned from the richer food and supply them with an excess of this food, upon which the larva floats and feeds during the rest of its growing period. At the same time the cell containing the larva is enlarged and extended downwards to form what is known as the queen cell, which is capped over in due time. Queen cells are also made when the bees are preparing to swarm. These are not built over young larvæ, but they take the form of inverted cups constructed on the comb, chiefly along its bottom edge and the queen lays an egg destined to develop into a queen in each. The queen emerges from her cell as early as 15½ days from the time the egg was laid. As the queen will not tolerate another in the same hive, the first of the young queens to emerge will destroy the others in their cells, or if it is in the swarming season and the colony is strong she may lead off a swarm. Four or five days after emergence—later, if the weather is unfavourable—the queen leaves the hive for her nuptial flight. The drones follow her and one is successful at the cost of his life. The queen is impregnated for the remainder of her life, which may extend to five years, although her fertility becomes impaired, and she is consequently usually not worth keeping after the second or third year. If, as a result of long-continued unfavourable weather, or through injury to or malformation of her wings, or through scarcity of drones, a queen fails to get mated within about five weeks after emergence she will commence to lay eggs, but these eggs will produce drones only. Occasionally a fertilized queen that produces only or mostly drones is found. A drone-breeding queen is worthless and should be replaced. In a colony that has been long queenless, certain workers may lay eggs which also produce drones only. The presence of a drone-breeding queen or fertile workers may be detected before the drones actually emerge by the much raised and very convex capping of the brood. The capping of worker brood is almost flat.

Fig. 1.—Worker bee, queen bee and drone

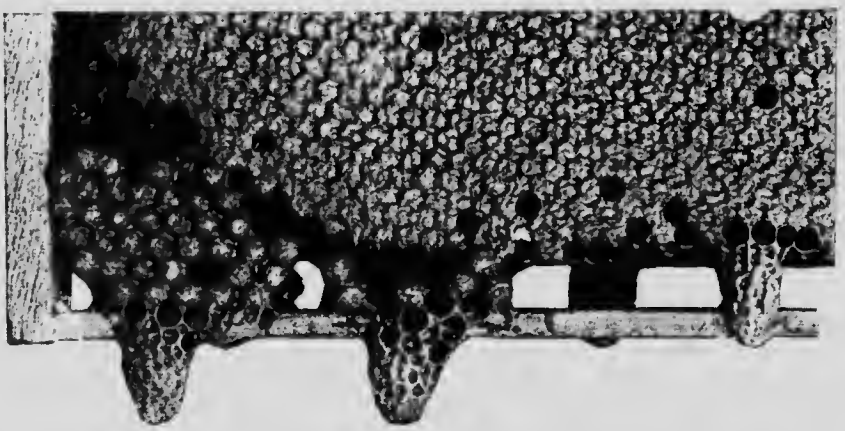


Fig. 2.—Corner of brood comb showing capped worker brood capped drone brood and four sealed queen cells.

HIVES WITH MOVABLE FRAMES.

During the nineteenth century the ignorant and barbaric methods of bee-keeping that had previously been in vogue gradually gave place to intelligent and humane methods, with the result that the production of the hive was greatly increased. Nothing contributed to this great change more than the adoption of movable frames for the combs. A frame hive was invented by Huber in France about 1789 and Langstroth in the United States introduced an improved type of hive with movable frames in 1861. The Langstroth hive with slight modifications is the standard hive in North America at the present time. Unfortunately, bees in box hives without frames are still to be found in the older settled parts of Canada, but the poor returns from, and heavy loss of bees in, such hives, due to the impossibility of making a proper examination of the combs and so discovering and supplying the bees' needs, are causing their gradual disappearance. At the present time no one who understands bees keeps them in frameless hives. The method of taking the honey that is usually employed

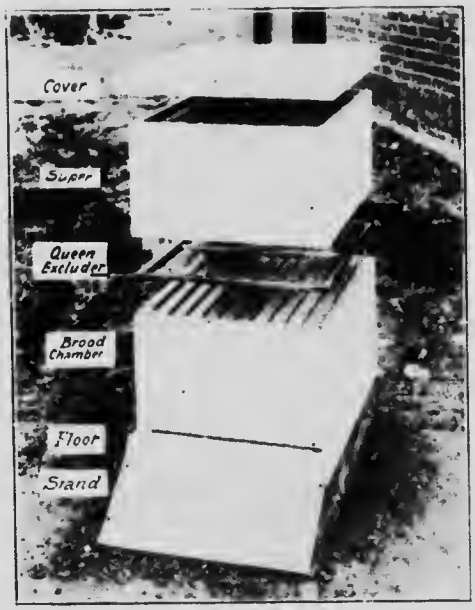


Fig. 3.—A 10-frame Langstroth hive, with the upper parts separated.

by those who keep such hives, namely destroying the bees by the fumes of burning sulphur or by drowning is unjustifiable destruction of valuable live stock and a relic of the barbarism of the middle ages.

The form of Langstroth hive recommended in this bulletin is shown in the accompanying engraving. It consists essentially of (1) a plain wooden box known as the hive-body or brood chamber, with (2) a loose bottom-board or floor, and (3) a cover which constitutes the roof. The frames containing the combs are suspended from rabbets in the top of the hive-body, so that they hang free in the hive and do not touch the sides or bottom, one-quarter to five-sixteenths of an inch space being left for the bees to pass around the sides of the frames and about five-eighths of an inch being left beneath the frames. In the majority of hives the last mentioned space is provided entirely in the floor section and there is a bee space of one-quarter of an inch above the frames.

The Langstroth frame is of a certain size,—17⅝ inches long and 9⅛ inches deep. This is the size most generally adopted, but frames of other sizes are used in some

apiaries. The interchangeability of frames is one of the great benefits of movable frame hives, and the adoption of the Langstroth size has the great advantage that fresh supplies of these frames, together with the hives made to take them, can always be obtained from the principal dealers in bee-keepers' supplies.

Three sizes of the Langstroth hive, taking 8, 10 and 12 frames, are in general use. The beginner is advised to adopt the 10-frame size. The 8-frame size does not provide enough space in the one chamber for a prolific queen to lay her eggs, and the 12-frame size is apt to be cumbersome. It is well to have the hive large enough to take besides the ten frames a thin division board, also to place over the frames an oilcloth quilt, of which the oiled side should be next the bees.

Various styles of roof are made. A board ¾-inch thick and cleated at the ends to prevent warping sometimes used, but a hollow roof packed with fine shavings, or containing several sheets of heavy paper, to prevent the escape of heat in spring and autumn and on cold nights, and to protect the bees from the hot sunshine in the summer, and covered with a thin sheet of non-rusting metal to keep it dry, is better. The rim or sides of such a roof should telescope over the brood chamber to the depth of about an inch. A good roof for very humid regions is a ventilated one consisting of two parts,—a six or seven-inch bottomless box telescoping over the brood chamber to the depth of about an inch and the roof proper. The box is deep enough to take two or three empty bran sacks or a chaff cushion laid over the bees with air space

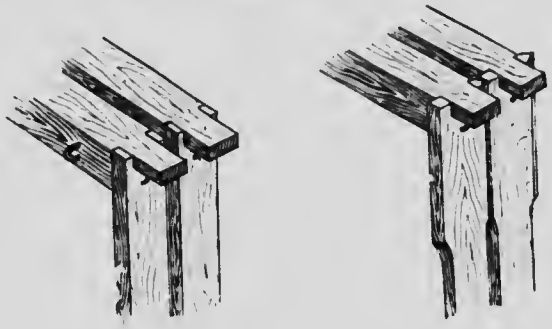


Fig. 4.

Upper corners of two staple-spaced frames. Upper corners of two Hoffman frames, showing spacing.

above, or it will hold a shallow super or feeder. The roof proper contains holes bored in the gables for ventilation, and is covered with waterproof sheeting.

The hive should be well painted, preferably of a white colour, as a white hive does not get overheated by the sunshine.

The hive should be kept off the ground, preferably by a stand made up like a box of four rough boards, one of which forms an inclined plane extending from the entrance of the hive to the ground to act as an alighting board. The back end of the hive may be raised an inch to prevent rain running in at the entrance.

The frames should be spaced in the hive at a distance of one and three-eighth inches from centre to centre.

It is a great convenience to have the frames self-spacing. This may be done by driving a fine staple to each side of the top bar, as shown in Fig. 4.

A good self-spacing frame is the Hoffman frame, in which the upper one-third of each end bar is widened to one and three-eighths inch. This frame will not rock when the hives are moved. In regions where the widened parts of the end bars of the Hoffman frames are liable to be firmly glued together by propolis, a resinous substance gathered by bees from the buds and stems of certain trees and used by them to fill crevices in the hive, fine wire nails should be driven into them to prevent the projections from splitting off during manipulation when the frames are separated, or staple-spaced frames may be used.

In order to get the bees to build straight combs in the frames, there must be fitted into each frame, fastened to the top bar, a sheet of beeswax, embossed with the pattern of the bases of the cells. This wax sheet is called comb foundation.

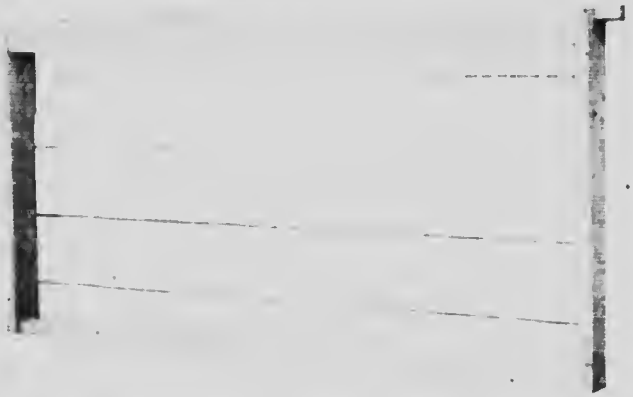


Fig. 5.—Hoffman frame wired ready to receive foundation.

Fig. 6.—Hoffman frame with full sheet of foundation wired in.

Upon the foundation the bees build out their comb, of which it eventually becomes the midrib. Narrow strips of foundation, known as starters, are sometimes used, but it is better to fit full sheets and to support the comb by stretching wire horizontally across the frame three or four times through holes made in the end bars and embedding the foundation in it. No. 30 tinned iron wire should be used. The wire is embedded in the foundation by means of an embedding tool made for the purpose, which should be heated if the wax is not warm and soft. The ordinary foundation sold by dealers is of the worker-cell pattern, and an additional advantage in using full sheets of it in the brood chamber is that the production of a large brood of useless drones is prevented. The frames supplied by most dealers have two grooves on the underside of the top bar, one to receive the foundation and the other a wooden wedge to hold it tight.

It is a good plan to fix a wire clip under the hive cover to take a card for notes.

Upon the approach of the honey flow a chamber, known as the super, to receive the surplus honey, is placed over the brood chamber. As the honey flow proceeds additional supers are usually needed.

Accuracy of dimensions in beehives and fittings is of prime importance, and it usually pays better to procure them from a reliable manufacturer or his agent than to make them oneself. At least a pattern hive should be so obtained. For easy handling all the parts of the hive should be as few, as simply constructed and as light as possible, consistent with strength, warmth and efficiency.

A sufficient supply of hives, supers, frames, foundation, etc., to cover all possible needs during the season should be ordered during the winter or early spring. The hives should be made up and painted and the frames put together and wired before the busy season. It is advisable to have the foundation shipped during mild weather, and to defer fitting it into the frames until just before these are to be given to the bees.

HANDLING BEES.

It is sometimes said that bees tolerate some people and dislike others. It would be more correct to say that they resent interference, but can be easily controlled by

Fig. 7.—Bee-smoker

Fig. 8.—Hive tool and bee brush.

anybody who knows how to handle them. Fear, induced by the smell of smoke and the opening up of the hive, makes the bees perfectly tractable provided they are in an active state and have not been previously irritated. The best time to open the hive is on a fine warm day when the bees are flying freely. If possible they should not be disturbed in cold weather nor when rain threatens, and never at night. Care should be taken to avoid stings, not only because they are painful, but because the odour of the poison irritates the bees and makes them difficult to manage.

To apply the smoke a bee-smoker is required. This consists of a tin firebox attached to a pair of bellows. The best fuel for the smoker is dried cedar bark, dried

rotten wood, planer shavings or pieces of old sacking. To start the smoker the firebox is opened and a small quantity of the fuel is lit and placed in the box. When, by the work of the bellows, this is well alight the remainder of the fuel is thrown in and the lid shut down. A few puffs given occasionally will keep the smoker alight. When not in use the smoker should be stood on end; if laid upon its side it usually goes out.

To protect the face from possible stings, a bee-veil should be worn. The veil should be made of light and durable material, such as Brussels net. The upper end of the veil is gathered with an elastic band so as to fit closely around the crown of a broad brimmed hat. The lower end of the veil may be tucked inside the coat collar or slipped under the suspenders, or held down with a string tied around the waist. Gloves may be worn by the beginner to create confidence, but they hamper work and are seldom used by experts.

Fig. 3.—Opening the hive—lifting the quilt.

For separating frames and hive parts a chisel-like tool should be used. This can be easily made by a blacksmith from an old buggy spring. A screw-driver will serve the same purpose. A brush or turkey feather is useful for brushing the bees from their combs.

Before opening the hive have the smoker well alight and drive a light puff or two into the entrance. Stand behind or to one side of the hive so as not to interfere with the flight of the bees. Lift off the roof gently, and if there is a quilt remove it or turn it back, and immediately direct a few light puffs of smoke downwards between the frames. With the aid of the hive tool loosen and lift out, or push to one side, the division board if one is present, and push to the same side the adjacent frames so as to make room to lift out one of the central combs without crushing the bees. Another puff or two of smoke will probably be needed after this frame is lifted out; this is

Fig. 10.—Opening the hive—removing division board.

effectively administered by driving it into the gap formed by the removal of the frame. The work should be done quietly and slowly, quick, jerky movements being avoided. It is desirable to examine the central comb because this will probably contain brood, and the presence of worker brood in all stages is evidence of the presence of a fertile queen and of the wellbeing of the colony. If it is necessary to examine the other combs, the one first removed may be stood up on end and leaned against the outside of the hive, care being taken not to crush the bees upon it when setting it down. The danger of the queen getting injured or getting lost by dropping off the comb should always be borne in mind and guarded against. Do not keep the hive open longer than

Fig. 11.—Examining the brood.

is necessary; it taxes the patience of the bees and in cool weather may chill the brood. Whenever the bees show signs of restlessness a few more puffs of smoke should be given, but they should never be smoked heavily unless they have been allowed to become angry. Other things that may need to be noted are the number of combs well covered by the bees, the amount of brood present and whether it is healthy, the amount

Fig. 12.—Turning a comb to examine the other side.

of stores and, during the honey flow, the progress of the work in the supers. It may be necessary to give a queen, to feed or to add or remove combs or supers.

Bees need regular attention like every other kind of live stock, and this should be given in a systematic way. It is a very good plan to set apart a certain day of the week for apiary work. During the most active part of the season an examination of the colonies every seven or eight days to see if they need more room, etc., will not be too often, and it is of the greatest value in the control of swarming.

Not a few people are deterred from keeping bees by the fear of bee stings. This fear is generally unfounded. When bees are properly handled there is no risk of getting many stings. With the vast majority of people the effect of a bee-sting is one or two minutes of pain, followed by a little local swelling for a few hours or a day. Its severity usually diminishes with succeeding stings, the system gradually becoming

immune by growing accustomed to the poison. In rare individuals, however, the effects of a bee-sting are more severe and prolonged, and it may sometimes cause a rash to appear over the body and difficulty in breathing. Persons who experience these symptoms should not go near an apiary.

Fig. 13.—Shaking the bees from a comb in front of the hive.

To minimize the unpleasant effects of a bee-sting, the sting, which is always left in the wound, should be extracted immediately, that is to say, before it has pumped in much poison. Rubbing the wound only aggravates the irritation and should be avoided. So-called sting antidotes for external application, such as solutions of ammonia and washing soda, are of practically no value, because the puncture made by the sting is so small that it closes immediately.

SPRING MANAGEMENT.

Spring is an important and critical period of the bee year because it is during this season that the bees have to build up their strength, often under trying weather conditions and in a short time, in readiness for the honey flow, and also because colonies that are in bad condition may die if not attended to.

The principal object of spring management, therefore, is to get a large number of bees reared in each colony, and also later on, to prevent the tendency to swarm. For a maximum production of honey there should be, during the honey flow, an abundance of bees between the ages of two weeks and six weeks.

If the bees have been well prepared for winter no anxiety need be felt about their condition in early spring and they are best left undisturbed for a while, but if any colonies are likely to run short of stores or if so many bees have died in a colony that it is in danger of getting robbed out, or of perishing, a short superficial examination

Fig. 14.—Case for light protection in spring after removal from cellar. An unprotected hive is shown on the left.

should be made on a mild day when the bees are flying. The weight of stores may often be estimated by lifting the hive. Combs containing stores may be taken from colonies that have more than they need and given to those that are deficient. If it is found there are not enough bees to cover two combs the colony should be united to a stronger one. It is often possible to save the queen of a weak colony by placing the colony on top of the strong one with a queen excluder between the two, care being taken to see that the weak colony has sufficient brood (taken, if need be, earlier in the day from the strong colony) to keep the bees from deserting, and the colonies may be separated a month later.

When the weather improves a warm day on which the bees are flying freely should be selected for making a thorough examination of the brood nest. Evidence of the presence of a fertile queen may now be found in the appearance of worker brood. Any colony that is found to be queenless or to contain a drone-breeding queen (see page 12) should be united to one containing a fertile queen. Colonies may be equalized by shaking bees from the combs of strong colonies in front of the entrance of those to be helped: of course the queen must not be included and precautions may have to be taken to avoid fighting. (See under Uniting, page 41.)

Since a high temperature is needed for brood rearing, care should be taken to conserve the heat generated by the bees in the hive by providing good insulation. Colonies wintered out-of-doors should be kept in their wintering cases until settled warm weather. In most places this is not until mid-June. The amount of protection to be given to colonies that have been wintered in the cellar will depend on the spring climate and the extent of shelter from wind. In many places it pays to give special protection in the form of an outer case deep enough to cover the sides of the brood chamber and projecting several inches above it, giving room for several sacks or a chaff cushion to be placed over the bees. In exposed places and those subject to great changes in temperature it will be advisable to have the case large enough to take packing material between the hive and the case. The size of the entrances should be kept small in early spring—only an inch or two wide in the case of weak colonies.

Bees need water in spring. If there is none within easy reach it should be supplied in a warm sheltered place in or near the apiary.

The building up of colonies may be seriously delayed by spring dwindling, that is, the dying of the bees that have wintered faster than young bees can be reared. The common cause of dwindling is bad wintering, the bees having died in large numbers or become enfeebled through age or dysentery, and it is more likely to occur in coastal regions where the spring is long drawn out than in the interior where the transition from winter to summer is more rapid.

The colonies should be examined weekly, weather permitting, or fortnightly if the weather has been cool, to see that the brood nest is expanding properly, the aim being to get the bees gradually to consume the stores and replace them with brood. If stores accumulate it may be necessary to remove a portion of them and give empty comb.

The best stimulus to breeding is the natural gathering of honey and pollen in favourable weather; these are usually supplied in abundance, first by the willows and later by dandelions, and, where it is plentiful, fruit bloom, as well as from a number of minor sources. In many places there is a short period of dearth between fruit bloom and the opening of the honey flow from alsike and white clover. If the weather during this period is warm and fine a little thin syrup given every evening will maintain breeding, but whether it will pay to do this depends on the duration of the honey-flow and other considerations.

Periods of inclement weather preventing the collecting of nectar may occur at any time in the spring. Short periods of this kind may be guarded against by making certain that the bees have a reserve store of a few pounds, but longer periods demand feeding to avert starvation, especially if such periods occur late in the spring or in the summer when the rate of food consumption is high. As spring advances the putting on of supers and preventing preparation for swarming will need attention. Systematic management of the apiary from this time forward is of great importance.

PRODUCTION OF HONEY.

The sources of nectar within a mile or two of the apiary should be studied so that the period and abundance of the honey flows may be estimated and the bees may be managed to make the most of them.

The question whether it will pay better to produce extracted-honey or comb-honey needs careful consideration. In the production of extracted-honey the bees are saved the great labour of building combs, these being emptied by means of a machine known as the honey extractor. They are then returned to the bees to be filled again and again. A colony will yield nearly twice as much extracted-honey as comb-honey, but this is balanced by the fact that the price of comb-honey is in many places almost double that of extracted-honey. Extracted-honey is a marketable article at all seasons everywhere, is easily transported and keeps well. On the other hand, the demand for comb-honey at a satisfactory price is limited, and it is somewhat fragile and difficult

to keep. Comb-honey is not so easy to produce as extracted-honey, a rapid honey flow being desirable and skilful management being needed to control swarming and to get the sections finished. These considerations will lead, in many cases, to a decision in favour of extracted-honey for the bulk of the crop, but it must not be forgotten that comb-honey is a luxury that appeals to many people in a way that nothing put up in a tin can or a glass jar can do, so that it will not be wise to neglect it. The beginner will sometimes prefer to produce comb-honey in order to avoid the expense of a honey extractor the first year.

EXTRACTED-HONEY.

The extracting super may be of the same size as the brood chamber, taking frames of the same size, or a shallow super taking frames only 5¾ inches deep may be used. A shallow super is more readily occupied by the bees in the spring and is not so heavy to remove when filled, but there are important advantages in having the frames in the brood chamber and the super interchangeable, and the employment of full depth supers saves much time in apiaries in regions where the honey flow is heavy. The extracting frames should be fitted with full sheets of foundation, which should be wired in, as already explained.

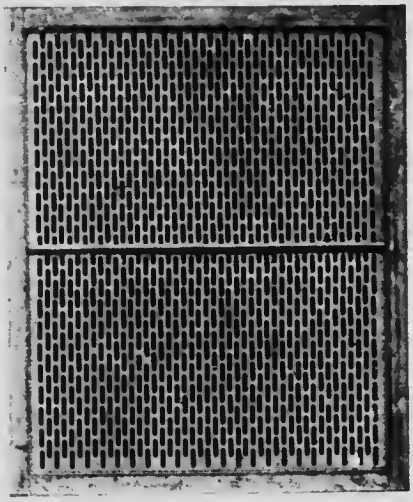


Fig. 15.—Queen excluder of perforated zinc.

To prevent the queen from entering the super and laying eggs therein, a queen excluder is placed between the brood chamber and the super. The queen excluder contains numerous holes about $^{165}/_{1000}$ of an inch wide which permit the passage of the workers, but are too small to allow a well-developed queen to go through. The queen excluder is usually made of perforated zinc, but wire excluders have lately been introduced and they allowed freer passage for the bees. In the hive there should be a clear bee space of a quarter of an inch on both sides of the queen excluder. To get these bee spaces it is usually necessary to bind the sheet of zinc on one side around the margin with narrow strips of wood a quarter of an inch thick.

Whether to use the queen excluder or not is a frequent subject of discussion among bee-keepers. If swarming proves troublesome it will be wise not to use it previous to, and during the development of the main honey flow, unless a system of swarm control employing the queen excluder is followed. During the last three or

four weeks of the honey flow it may be used with profit to rid the supers of bees, and to check the raising of brood which is always carried on at the expense of honey production.

The super should be placed on the hive as soon as the bees occupy the space between the outer combs and the hive side, provided honey is being gathered. When the super is filling rapidly with honey it should be raised and a second one placed beneath it. This will keep the bees occupied and help to discourage swarming. In removing the super from the hive, which should not be done until the honey is all or nearly all capped over with wax, the bees are shaken or brushed off the comb, or a super clearer such as is employed for the removal of comb-honey may be used.

The honey may be extracted as soon as the super has been removed from the hive, because it is easier to extract it when the combs are warm than when the honey has grown cold. Before the honey can be extracted it is necessary to uncap the comb on both sides; this is done by means of a sharp uncapping knife which has been heated in hot water.

The uncapping should be done over some kind of receptacle into which the cappings will fall. After the comb is uncapped it is placed in one of the cages of the extractor and the other cage is similarly filled. By turning the handle of the extractor the honey in the outer side of the combs is thrown out by centrifugal force. When the honey from one side has been thus removed the combs are reversed and

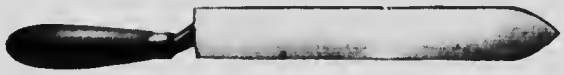


Fig. 16 Uncapping knife.

the other side is emptied in a similar way. In the best extractors the combs are reversed automatically. Large extractors taking eight frames and driven by gasoline engines may be profitably used in large apiaries. It is convenient to use a honey pump when employing a power outfit.

To expedite the work of uncapping a pair of knives should be employed, the one not in use being kept in hot water, or a hollow knife heated by steam supplied through a rubber tube from a small boiler may be used.

It is sometimes advisable to keep the honey from different successive sources separate as far as possible, especially to prevent the main crop of light coloured and mild flavoured honey from becoming degraded by the admixture of darker coloured or stronger flavoured honey. In some parts of the country just before the main honey flow from clover comes on, small quantities of a disagreeably flavoured dark honey may be stored. This should be removed promptly. After the clover honey flow there will often be a crop from golden rod, aster and other fall flowers, varying in colour and flavour.

The honey should be freed from particles of wax, etc., by straining through cheese cloth, or by allowing it to stand for a few days in a deep gravitation tank, in which the wax rises to the surface. The honey is drawn through a honey gate or treacle tap fixed in the bottom of the tank.

Should any of the honey have been extracted from uncapped cells, it will need to be ripened, that is, to have the excess of water evaporated out in a warm room before it is run into the containers.

At the end of the season the extracting combs may be returned to the bees to be cleaned prior to their being put away for the winter. A large supply of empty combs is a valuable asset.

Most kinds of honey granulate quickly after extracting. The honey should, therefore, be run into the containers as soon as it has been strained and is ripe. Stored in a dry place, honey will keep good for months and even years, but it will absorb moisture from moist air, and is then liable to ferment and decompose.

Fig. 17.—Uncapping a comb of honey. Spare uncapping knife in hot water and honey extractor in background.

Fig. 18.—Honey extractor.

In view of the fact that nearly all Canadian honey is good enough for table use, for which purpose it realizes the highest price, the kind of container that is most likely to be in demand by consumers must be studied and selected. A convenient and economical package for distribution either through stores or direct to the consumer is the lever lid tin provided with a stout wire handle, known as a tin pail; the usual

Fig. 19.—Steam heated uncapping knife with boiler.

sizes hold 10 pounds, 5 pounds and 2½ pounds of honey. For family use, or for supplying honey to grocers to be bottled, tin cans holding 30 pounds and 60 pounds may be employed. Those who buy small quantities of honey in a retail way almost always prefer it in glass, despite the higher relative cost of the package. Probably the most popular glass jar for retail stores is the metal screw-top jar, holding about one pound, and retailing when filled with honey at from 20 cents to 30 cents each. Quart sealers holding about 3 pounds of honey are preferred in some places, and glass jars holding only about half a pound appeal to a small class of city dwellers. Honey in glass jars sells largely on account of its appearance. It will, therefore, pay to make it as attractive looking as possible. Care should be taken to see that the jars do not easily leak. For this purpose, the screw-top jars may be provided with a wad of cork or other material and a circular piece of paraffined paper under it. A label, specially printed for the producer, attached to each tin or jar, helps wonderfully to sell the honey and to build up a demand for it. In many places it is easy to develop a local market for honey.

Honey in glass jars often sells better in the liquid condition than when granulated. To liquify honey so that it will remain liquid for some time, it should be placed in a water bath over a stove and heated to a temperature of about 150° F. The temperature of the honey must not be allowed to go higher than 160° F., because above that point the flavour is liable to be injured and the colour darkened. For this reason honey should never be heated directly over a stove or flame. Hermetically sealing the jars of liquified honey helps to prevent regranulation.

COMB-HONEY.

Comb-honey is now almost entirely produced in "sections"—small boxes made of basswood, each containing from twelve to sixteen ounces of honey when filled. The common size of the section is 4¼ inches square. A new size that is becoming popular in some places is 4 inches wide by 5 inches high. A comb-honey super usually contains from 28 to 32 sections. To ensure the building of the combs to a uniform thickness, a thin sheet of wood or metal, known as a separator, should be placed between the faces of the sections. If the sections are self-spacing the separators used are plain, but if the sections are plain the separators are in the form of a fence to supply the necessary spacing.

Before the comb-honey super is placed upon the hive a sheet of comb foundation must be fitted into each section. Special thin foundation, known as thin or extra thin super foundation, is made for use in sections. Sections are usually made with a saw-cut in the top bar to receive this foundation. There are various devices for fitting the foundation into sections not having the saw-cut.

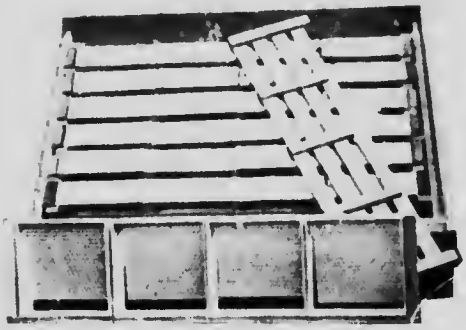


Fig. 20.—Comb honey super.

The queen is less inclined to enter the comb-honey super than the extracting super, especially if the form of super in which each row of sections is placed in a section holder is used, consequently, it is usually unnecessary to use a queen excluder for comb-honey production.

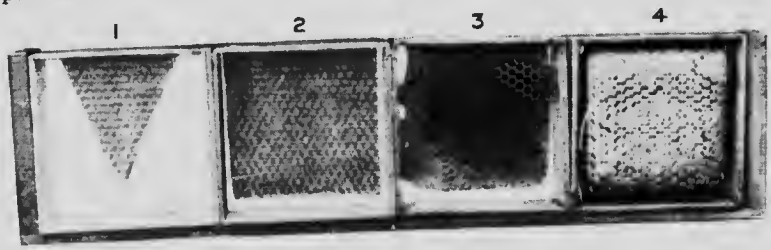


Fig. 21.—A row of sections in holder.

1. Section fitted with starter of thin super foundation.
2. Section fitted with full sheet of thin super foundation.
3. Partly filled section.
4. Completed section.

Early in the honey flow if nectar is coming in quickly a new super may be given to a strong colony as soon as work in the first super is well begun. As soon as all the sections in the super are capped over it should be removed from the hive. Before removal, the super should be emptied of bees by means of a super-clearer placed beneath it. The super-clearer consists of a board with a hole in the centre into which is fitted a device known as a bee-escape through which the bees can pass only one way. In warm weather the super clearer will empty a super of bees within twenty-four hours.

To secure the best returns from comb-honey production, not only is it necessary to have a rapid flow of honey but the field force should be large and the bees crowded in the super in order that the filling of the sections may proceed as rapidly as possible. Unfortunately these conditions favour the development of the swarming impulse. If the bees swarm the swarm should be hived on the old stand as explained on page 35, or the swarm may be made artificially, and it should be supplied with starters instead of full sheets of foundation in the brood chamber in order that it may concentrate on

the work in the super. One empty comb, however, should be given to receive the pollen. By treating swarms in this way almost as large a crop of honey may often be obtained as when swarming does not take place.

The volume and duration of the honey flow must be well estimated in order that sufficient, but not too many, sections may be given, so that the bees may finish as large a proportion of them as possible, an unfinished section being of value only for extracting and for use in the following year as a bait comb to entice the bees into the super which, with its many little compartments, is less readily taken possession of by the bees than an extracting super.

Fig. 22.—Alsike Clover (*Trifolium hybridum*). Flowers white or pink-white. Notice the upright branched stem.

Since comb-honey is a fancy article it usually pays to produce it in perfection. A good section of honey should have all the cells filled and capped over, excepting perhaps a few in the row next the wood, and the wood should be scraped clean and free from propolis.

Comb-honey should be kept in a dry warm place from the time it is removed from the hive until it is sold, and it calls for a package protecting it from dust and insects. For selling it in quantity a glass fronted shipping case containing 12 or 24 sections is perhaps the most satisfactory package. Single sections may be enclosed in cardboard cartons.

LIST OF PRINCIPAL HONEY-PRODUCING PLANTS WITH THEIR APPROXIMATE SEASONS OF YIELD.

For Brood Rearing.

Willows.—Mid April to mid May; on the Pacific coast, March.

Maples, various species. The Pacific coast species are especially valuable, but the Manitoba maple and some of the eastern species are unimportant. April and May.

Dandelion.—Will often produce surplus honey in a favourable season. May and early June. On the Pacific coast, April.

Fig. 23.—White Dutch Clover (*Trifolium repens*). Flowers white. Notice the creeping stem.

Apple, Plum, Cherry and Peach orchards. In places where apples are grown extensively surplus honey is obtained from apple bloom in favourable seasons. May and early June. On the Pacific coast, April.

Pin Cherry and Choke Cherry.—May.

Bearberry (*Arctostaphylos uva-ursi*), known locally by the Indian name "Kinikinic." Kootenays, B.C., and other places. The abundant nectar in this plant is not entirely within reach of the bees. May.

Blueberries.—Eastern Canada, May.

Raspberry, principally in forest clearings. June.

Alsike Clover (*Trifolium hybridum*) and **White Dutch Clover** (*Trifolium repens*).—Wild and cultivated throughout the farming regions of Canada except on the drier parts of the prairies. These are the most important honey plants of Canada, but under excessively dry or cool conditions they fail to yield sooner than many other plants. In some years the amount of clover is much reduced by the plants being killed by repeated severe freezing and thawing when unprotected by snow in winter and spring. In the districts of Ontario where alsike clover is grown for seed, bee-keeping is an important industry. Colour of honey light,

Fig. 24—White Sweet Clover. (*Melilotus alba*).

flavour excellent. These clovers do not usually commence to yield nectar i Ontario until they have been in bloom for one or two weeks, and on the Pacif coast for three or four weeks. Duration of honey flow, two to .ve weeks. Mi June to end of July.

Alfalfa.—Southern Alberta and British Columbia dry belt. Of no value for surplu honey production in the east. End of June to August.

Sainfoin.—May become a valuable source of honey in the Upper Columbia Riv Valley, B.C., and in other places where it can be cultivated successfully. End June to August.

Wild flowers of different kinds found on the prairies. Collectively these are importan Among them may be mentioned **Wild Bergamot** (*Monarda fistulosa*) and vario mints. June to September.

epens).—
ot on the
f Canada,
ner than
ed by the
tected by
clover is
ney light,

nectar in
the Pacific
eeks. Mid

for surplus

nbia River
ly. End of

important.
and various

Fig. 25.—Fireweed, as it grows on burnt-over land.

Basswood (*Tilia americana*).—Ontario and Quebec. Less plentiful than formerly. Yield very uncertain, in some years heavy. Colour of honey light, flavour pronounced. July.

Snowberry (*Symphoricarpos*).—British Columbia. July.

Wild Radish (*Raphanus raphanistrum*).—Maritime Provinces. Abundant in the Annapolis Valley, N.S., where it yields a considerable amount of honey. July.

Sweet Clover (*Melilotus*) white and yellow.—Very attractive to bees and of growing importance because the plant is spreading. The honey is inferior to clover honey. July and August.

Fig. 2[illegible] [illegible]EWEED. Flowers purple.

Great Willow-herb or Fireweed (*Epilobium angustifolium*).—A tall plant three to seven feet high with long racemes of showy red-purple flowers; a valuable source of honey in forest clearings and places recently devastated by fire. Colour of honey almost water white, flavour mild. In British Columbia the colour is darker, but this may be due to the admixture of other honeys. Duration of honey flow, seven to eight weeks, not stopped by drought. July and August.

Buckwheat (*Fagopyrum esculentum*).—Important in the Upper St. Lawrence valley, southern Quebec and old Ontario. Colour of honey is dark and flavour strong. August.

Golden Rod (*Solidago*); **Aster.**—Of the many species of golden rod and aster some are good honey producers under suitable conditions, especially in the east; others, including some of the common early flowering species, are of little value. The honey varies in colour and quality. That gathered in the Gatineau Valley, north of Ottawa, in September is white. *Solidago puberula* and *Solidago squarrosa* have yielded about 40 pounds of light-coloured honey per colony on a sandy plain forty miles north of Ottawa. August and September.

Fig. 27.—*Solidago puberula.*

It should be noted that a large crop of honey depends not only upon the abundance of flowers but upon favourable weather,—in the case of most plants, rain, followed by warm sunny weather during the honey flow, and also upon the climate, soil and other conditions best suited for each variety of plant. In some places and seasons the less important honey plants, of which there are many, yield surplus honey which frequently influences the colour and flavour of the honey gathered from the main sources. Among these may be mentioned:—

Milkweed (*Asclepias*);
Dogbane (*Apocynum*) especially in the B.C. dry belt.
Boneset (*Eupatorium perfoliatum*), (Ont.);
Viper's Buglos (*Echium vulgare*), (Ont.);
Wild mustard (*Brassica arvensis*);
Canada thistle;
Buckthorn;
Sumach (Ont.);
Button-bush (S. Ont.);
Blackberry;
Smartweed;
Catnip;
Motherwort;
Hound's tongue (*Cynoglossum*) (Ont.);
Sheep laurel (*Kalmia*);
Blue Vervain.

Some of these produce considerable quantities of honey locally. It does not pay to grow crops specially for bees, but alsike, white clover, alfalfa, sainfoin and buckwheat are valuable farm crops and excellent for bees in the areas that have been indicated for each. In regions favourable for alsike and white clover, where these are absent or scarce, the seed may profitably be scattered about. Caution should be exercised in sowing sweet clover because this plant may spread and become a troublesome weed in seome places; moreover, its honey is not of the highest quality, and the bees will often work busily on it when it is not secreting much nectar and so wear themselves out without adequate return. Wher it is cut so that it continues to flower until late in the season, it may thus, like certain other fall flowers, help to shorten the lives of the bees that are to pass the winter. Red clover occasionally produces surplus honey when the flower tubes have been sufficiently shortened by drought for the bees to reach the nectar.

Bees are much attracted by the flowers of certain ornamental shrubs such as the Siberian Pea Tree (*Caragana*) and garden flowers such as mignonette, but these are seldom abundant enough to be of any practical value. Caragana hedges, however, should be planted around homesteads where bees are kept in the prairie provinces, as they provide not only food in spring, but also shelter from the wind.

SWARMING.

Swarming is the bees' natural method of increase and is likely to occur in the majority of the colonies in spring and early summer when the hives are populous and honey is being collected, and also sporadically at any time in the summer during a honey flow.

A few days before swarming the bees commence to rear queens, and the swarm containing the old queen usually issues about the time when the earliest queen cells are capped.

The swarm generally settles upon the branch of a tree near the apiary. In securing the swarm, advantage should be taken of the bees' fondness for running into a cavity.

A new hive containing frames fitted with foundation should be prepared to receive the swarm. This hive may be brought close to the clustering swarm. Some of the bees should be shaken into the hive; the remainder should then be shaken into a box and immediately dumped on to a sheet spread before the entrance of the hive. If it is not convenient to bring the new hive to the swarm the bees should be shaken first into the box which should then be turned upside down on the ground nearby and propped up with a stick or stone to collect the stragglers. A comb containing brood may be placed in the new hive to prevent the swarm from absconding.

A swarm will need feeding on the third day after hiving if bad weather has prevented the bees from collecting honey. About eight days after the issue of the first swarm, the first of the young queens will emerge and then a second swarm may go off with some of these queens. A third swarm may come out and go off a few days later. Second and third swarms are usually too weak to be of much value, and should be returned the day after they emerge or they should be united.

It should be noted that the earliest sign of definite preparation for swarming is the presence of eggs in queen cells, the first of which are usually laid about eight days before the swarm is due to leave. Queens are also reared when the colony is preparing to supersede its failing queen, but in this case there is much less than the normal amount of brood. A colony that is superseding its queen is not unlikely to swarm if it is strong, though it usually delays to do so until the first of the young queens emerge.

Since queens are sometimes lost on their mating flight it is advisable to make an examination of colonies that have thrown swarms about twelve days after the young

queen has emerged. If eggs are present the queen is probably fertilized. If there are no eggs, a frame of brood in all stages should be given; from this the bees will raise a queen if their queen is lost.

SWARM CONTROL.

The time when success in bee-keeping was measured by the number of swarms hived has passed, and nowadays the progressive bee-keeper endeavours to prevent swarming. One of the troubles encountered in permitting bees to swarm is the frequent difficulty of capturing the swarm which may collect in an inaccessible situation, or even fly across the country. Then there is the time spent in watching for the bees to swarm and in hiving swarms. But by far the most serious disadvantage of swarming is the fact that the swarm and the parent colony produce less honey than the same bees had they remained in one colony. Indeed, instances are not rare in which unrestricted swarming has entirely prevented the production of surplus honey in an apiary. It is not too much to say that the control of swarming is probably the most important and difficult problem that most bee-keepers in Canada have to face. Careful study of the bees' behaviour is needed to successfully cope with it. Fortunately for the bee-keeper, several days' warning of the probability of the issuing of a swarm is given by the appearance of eggs in queen cells.

Colonies vary much in their prospensity to swarm, even under the same conditions and in the same apiary. By replacing the queens of colonies that swarm with queens that are the progeny of queens whose colonies have not swarmed the bee-keeper may hope to reduce the percentage of colonies that swarm. Another point that should be noted is that colonies containing queens under a year old are less inclined to swarm than those in which the queen is older.

However, at the present date the most successful methods of swarm control are by manipulation. Easy manipulations tending to the prevention of swarming are: (1) giving abundant ventilation and room at the mouth of the hive in warm weather, and (2) preventing over-crowding and giving ample room to store the honey by adding a super, preferably one containing empty extracting combs, directly above the brood chamber, as soon as the brood chamber is almost full of bees, and honey is coming in. As soon as this super is filled rapidly with honey, another super containing preferably empty extracting combs should be placed between it and the brood chamber.

A good way to provide ventilation at the mouth of the hive is to insert a wooden wedge 20 inches long and ⅜-inch x ⅜-inch at the thick end, on either side between the side of the bottom board and the hive body.

In most places these steps are not sufficient to prevent swarming and it is necessary to add to them the more effective one of enlarging the brood nest so that it will become less crowded with young bees and the queen will have more room to lay.

A frequently successful practice is to put no queen excluder between the brood chamber and the first super of empty extracting combs in order to permit the brood nest to expand into the super. When the honey flow has well started the queen should be again confined to the brood chamber by means of the queen excluder. Seven or eight days later any queen cells that may have been built in the super should be cut out.

However, in many places it is often impossible to be sure of preventing swarming by this manipulation, and it is necessary, from the time that the brood chamber becomes full of bees until all likelihood of swarming has ceased, to open the hive every seven days (the eighth day will do if the weather is unfavourable on the seventh) and examine the brood combs to see if queen cells containing eggs or larvæ are present. If any are found the combs should be carefully gone over and all of them should be cut out. At the same time, whether queen cells containing eggs or larvæ are found or not, one or two combs containing honey, or if this is not present in quantity, capped brood, are

Fig. 28.—SWARM ENTERING HIVE.

To face page 34.

Fig. 29.—SEARCHING FOR QUEEN CELLS. Notice card for notes under hive cover and small apiary house in background.

1916

lifted out of the brood chamber which should preferably contain not less than ten frames, and are removed or are placed above the queen excluder, and empty combs (if these are unobtainable, frames with full sheets of foundation will do) are put in their place but not next to one another. This practice will usually prevent or stop preparations for swarming.

Making this weekly examination may look like a lot of work, but when experience has been gained it can be simplified and carried out expeditiously.

Some colonies however,—especially those in which the bees are crowded for the production of comb-honey,—may persist in building queen cells. Colonies that behave in this way not only entail a great deal of labour on the part of the bee-keeper in searching for and destroying the cells (which is useless should only one cell be missed), but they become lazy. The best way to deal with such colonies is to permit them to swarm or to make artificial swarms from them, but, at the same time, to compel nearly all the field bees, by a manipulation that is about to be described, to join the swarm so that the swarm may continue the work of honey storing and the parent colony may be so depleted of bees that it will not swarm again.

In order to prevent the possibility of the swarm flying away it is a very good plan to clip the queen's wings; this should be done at the second examination of the colonies in early spring before the bees become numerous enough to make it difficult to find the queen. Clipping the wings also affords a ready means of marking the queen. Where clipping is practised and swarming allowed the grass around and to some distance in front of the hives should be kept short during the swarming season, and some one should be present in the apiary to attend to the swarm when it emerges, and find and pick up the queen. While the swarm is still in the air the queen is placed in a cage, and the hive is turned around and placed immediately behind its former stand. Without delay a new hive containing frames fitted with foundation is placed on the old stand and the queeen in her cage is placed at the entrance of this hive so that the swarm upon returning, finds her and enters the new hive. The queen may then be set free among the bees. The super is removed from the old hive and given to the swarm over a queen excluder. Five days later the old hive is removed to a distant part of the apiary. Each time the parent colony is moved it loses its field bees which go to swell the population of the swarm and it becomes too weak to throw an after-swarm.

In regions where the nights are warm the swarm may be made artificially from a colony that has larvæ in queen cells by shaking the bees off their combs into the new hive. Sufficient bees should be left with the brood to feed it and prevent its getting chilled.

Occasionally colonies are found that will swarm with only eggs or young larvæ in queen cells or even before any queen cells have been built, but these cases are rare.

Swarming is more frequent when the honey flow is light or irregular than when it is abundant and steady.

DIVIDING COLONIES FOR INCREASE.

To build up an apiary dividing may be practised, but this is done at the expense of honey production. As a rule no colony should be divided until the bees nearly, or quite, fill the brood chamber. The part that is removed to a new stand should consist largely of young bees, because these are not so likely to return to the parent hive as field bees and all, or nearly all, of its brood should be capped, because eggs and young larvæ are likely to be destroyed in large numbers. The part that does not contain the queen should be supplied with a fertile queen or a ripe queen cell, that is, one in which the queen is about to emerge. With a normal colony it is hardly possible to fulfil all these conditions in one operation.

One of the best methods of dividing a colony into two is the following. The queen is found and placed with one comb of brood containing no queen cells in a new hive which is then filled up with frames of empty comb or foundation. This hive is then put on the old stand, a queen excluder is placed over it and on top of this is put the old hive containing the remainder of the brood. Nine or ten days later the old hive, which now contains young bees and capped brood but no eggs or young larvæ, is removed and placed on a new stand and a fertile queen or ripe queen cell is introduced to it, any queen cells that may have been built in the combs above the queen excluder having been cut out on the fifth day after the first operation, and again at the second operation on the ninth or tenth day. If no queen or queen cell can be introduced the new colony may be allowed to re-queen itself from the queen cells that have been built.

An easy method of dividing for increase, well suited for the beginner, is to separate a colony into two or three parts six or seven days after it has thrown off the prime swarm, each part consisting of two or three combs containing the now nearly all capped brood and honey with one or two queen cells and the adhering bees, very few of which will desert on account of the attraction of the advanced queen cells and brood. Each little colony or nucleus, as it is called, as soon as its queen is fertilized and laying can, if necessary, be built up by the addition of brood from other colonies. The combs of brood that have been placed above the queen excluder in certain manipulations that have been described for swarm control and honey production may also be used, with the adhering bees, to form or strengthen nuclei economically. Brood can be obtained with a minimum of loss from strong colonies during the last two weeks of the honey-flow.

It is not advisable to make division after the middle of July because the new colonies will hardly have time to build up to full strength before winter, nor after the honey flow has ceased because of the risk of robbing.

POLLEN.

The yellow, white or red pellets that the bees carry home from the fields on their hind legs are not wax, but pollen. This material is packed into the cells around the brood nest and is used largely in preparing brood food. A shortage of pollen that occurs in some places in early spring is rare in this country, the willows especially supplying an abundance of this material.

THE PRODUCTION OF WAX.

Beeswax being worth more than twice as much per pound as honey, all the wax that is produced in the apiary should be saved. In an apiary worked for extracted honey the wax will come principally from cappings. In every apiary old combs that have been rejected for some fault, pieces of adventitious comb, pieces of drawn comb that have been cut out of worker combs, trimmings of foundation, etc., accumulate. A special box should be kept in the honey house to receive these scraps of wax. The best way to deal with cappings and pieces of clean new comb is to place them in a solar wax extractor, consisting of a glass covered box containing a sheet metal tray, which will melt the wax by the heat of the sun during the warmer months of the year, but combs that contain much pollen or have been used for rearing brood so often that they have become dark-coloured cannot be rendered profitably in the solar extractor and must be melted over a fire in boiling water or by steam. A certain amount of wax may be extracted from such combs by rendering them in a wax extractor made on the principle of a potato steamer, but to get nearly all the wax out of them it is necessary

to subject the molten mass to pressure. An exc ·t wax press, known as the "Sibbald," costing about $9, will soon pay for itself in an apiary of thirty or more colonies. If the combs are rendered and pressed out of doors, the work should be done during the honey flow so that robbing will not take place. Bee supply dealers will usually take beeswax in exchange for comb foundation, charging only a few cents per pound for making the foundation.

Fig. 30.—Rendering old combs in wax press.

WINTERING BEES.

Bees do not become torpid in winter like other insects, but they generate heat and consume their stores in so doing. In cold weather the bees form a compact spherical cluster, the interior of which may be as warm as 80° or 90° F. Successful wintering depends principally upon the number of bees in the cluster, the youth of the bees, sufficient and wholesome stores, and protection from cold. When good protection is provided the bees do not need to produce so much heat consequently less stores are consumed and there is less drain upon the vitality of the bees.

Preparation of bees for winter, therefore, begins by seeing that each colony has a good fertile queen and enough bees to crowd the spaces between seven to ten combs,

the more the better, and that these consist principally of young bees that have done but little field work. Weak colonies must be united. To get plenty of bees reared in August and September in regions where but little honey is gathered during these months, the queen should be one that has been reared during the summer. Since such a queen will also usually build up her colony more rapidly and to greater strength in the spring, and will be less inclined to swarm than an old queen, the advantages of re-queening colonies that have old queens are great and it will often pay to buy queens for this purpose if they have not been reared.

Each colony should have thirty to forty-five pounds of wholesome sealed stores if it is to be wintered out-of-doors, the amount depending on the intensity of the cold, and thirty to thirty-five pounds if it is to be wintered in the cellar. The weight of an ordinary 10-frame Langstroth hive made of white pine with walls ¾ of an inch thick, with ¾ inch thick bottom board, combs, bees and pollen, but without cover, is, if dry, usually between 30 pounds and 35 pounds, so that in weighing hives for the winter the weight of stores may be liberally estimated by deducting 35 pounds from

Fig. 31.—Wintering case for four hives, with side removed.

the weight. Any deficiency in weight is made good by feeding as rapidly as possible during the third or fourth week in September (the first week in October in southern Ontario), with sugar syrup made and supplied as explained under "Feeding," allowance being made for loss due to evaporation and consumption.

To avoid dysentery (see page 52) it is good practice to give each colony at least ten pounds of syrup. This is stored next to the cluster which occupies the empty parts of the comb from which the last brood emerged, and it is therefore consumed first, so that the accumulation of the fæces is delayed. At the Central Experimental Farm, Ottawa, where a considerable amount of honey is gathered from wild flowers in August, it has been found that colonies whose stores have been thus supplemented with about ten pounds of syrup winter better than those whose stores consist of honey only, and this has been found to be the case in many places in Ontario and elsewhere.

If honey-dew honey or other stores that quickly produce dysentery are suspected to be present in quantity, the outer combs should be removed and replaced with combs of clover honey saved from the summer, the honey should be extracted from the inner combs and the colony should be fed with sugar syrup.

In many places in British Columbia, southern Ontario and the Annapolis Valley, N.S., the bees may be wintered successfully out-of-doors, provided adequate protection is given, but in regions where the winter is very cold they must be wintered in the cellar. In places where there is a choice between the two methods, out-door wintering is sometimes preferred by absentee bee-keepers for out-apiaries because the bees need no attention from the time they are prepared and packed for winter at the end of September until spring has opened. Nevertheless, where the bees are unable to get a good cleansing flight for several weeks their vitality is better conserved in cellars where the optimum conditions of temperature, ventilation and humidity (which as yet are but imperfectly known) are approached than under the severe and fluctuating conditions found outside.

OUTDOOR WINTERING.

On the Pacific coast where the winter is mild and damp a weather-proof wooden case that slips down over the outside of the hive and projects about 3 inches above it, with a 2-inch covering consisting of sacks or a chaff cushion on top of the frames and a ventilated waterproof roof, makes a sufficient and satisfactory extra covering. It is advantageous to have a dead-air space between the case and the hive, and this may be filled with cork granules or other packing that will not attract or hold moisture. The entrance to the hive should be reduced to 6 or 8 inches long by ⅜ of an inch deep.

In colder and drier regions the hive without its roof is placed in an outer case large enough to take two to four inches of good packing such as planer shavings or closely packed dried leaves around the sides (in severe climates the bottom also) of the hive and six to twelve inches on top. The material on top may be placed in bags or a cushion for easy removal. It is an advantage to make such a case large enough to take four hives in two pairs, back to back, because the colonies keep one another warm. The cases made to take four hives have proved very satisfactory in many apiaries in southern Ontario, and with three inches of planer shavings at the sides and underneath and ten inches on top, they have met with fair success at the Central Experimental Farm, Ottawa, in the winters of 1912-13 and 1913-14.

The roof of the wintering case should be covered with waterproof roofing. Above the packing material an air space should be left which should be ventilated by holes in the gables. To prevent the mouths of the hives getting choked with dead bees there should be a space of at least an inch between the floor and the bottom bars of the frames. A suitable size for the outside entrance where the winters are severe is one and one-quarter inches high by eight inches wide, the width being reduced to three-eighths of an inch during the winter by means of a piece of wood revolving on a screw and resting on a projecting nail or block of wood. To prevent the small entrance getting partly closed with ice there should be no projecting ledge under it. To be buried under a moderate depth of loose snow does bees no harm in mid-winter, but snow may advantageously be cleared away from the hives in March.

Bees wintered out-of-doors must be sheltered from wind. Protection from wind is especially important in the colder regions. In such regions if the apiary is not surrounded by evergreens or other satisfactory shelter a close board fence about eight feet high should be erected around the apiary. It is necessary to emphasize the importance of wind protection in the winter, because it is often given insufficient attention.

Bees wintered out-of-doors start breeding earlier than those wintered in the cellar, and they benefit by the better protection provided by the wintering case in the spring.

CELLAR WINTERING.

The bee cellar should be well ventilated but not draughty, and the temperature should be kept steady at about two to five degrees below that at which the bees would begin to show signs of restlessness. The best temperature in the early part of the winter will usually be around 48° F., but as the fæces accumulate a somewhat lower one (42° F. to 45° F.) with more fresh air will be needed. The air in the bee cellar must not be too dry, but it must not be damp enough for moisture to condense on the floors of the hives, and the cellar should be well drained. The bees must be kept in darkness and should be left undisturbed.

The cellar of the residence is usually satisfactory for wintering bees, or it can be made so, the furnace helping to supply the required temperature and ventilation.

A portion of the cellar should be boarded off for the bees. The principal faults in cellars are insufficient insulation to keep the temperature within the stated limits, insufficient ventilation, and insufficient or excessive humidity. The combination of a too low temperature with excessive humidity is particularly injurious.

A bee cellar to contain many colonies should be furnished with a chimney to draw off the foul air, the draught being regulated by dampers. Good insulation may be secured by having the cellar wholly underground or in the side of a hill, and the fresh air may be brought in through a six-inch or eight-inch earthenware drain pipe laid under the ground.

The bees should be brought into the cellar as soon as possible after the last good flight that they are likely to get. This is usually some time in November. It is advantageous to contract the entrances and give light protection for two or three weeks previously. During transportation to the cellar the entrances to the hives should be temporarily closed with, for instance, soft paper or burlap. Inside the cellar the size of the entrances should be large enough to allow sufficient ventilation and to facilitate the ejection of dead bees. The hives may be raised behind slightly to allow the dead bees to roll out. It is a good practice to replace the cover of the hive with three or four empty sacks. The dead bees should be swept out of the cellar two or three times during the winter if they accumulate and become offensive.

The date that the bees should be taken out of the cellar depends upon their condition and the weather. It is usually about the time when the first willows are in bloom, but it may be advisable to bring them out earlier if they are restless and dying fast. They should be brought out when the weather is mild, but too cool for them to fly at once, preferably late in the afternoon of the day before a good flying day is expected. To select the day the forecasts of the Dominion weather service published in the daily newspapers may be consulted.

To avoid their getting spotted, washed clothes should not be hung out to dry near the hives until the bees have had a cleansing flight.

It is not advisable to winter bees in trenches dug in the ground nor in the upper rooms of houses. Should a colony, through accident, have been put away for the winter light in stores thin cakes of candy, made as explained under "Feeding," should be placed over the frames to avoid starvation, but to have to feed bees in winter is a sign of bad management.

TRANSFERRING.

To transfer a colony of bees from a box hive into a hive with movable combs, the box hive should be moved from its stand and a hive containing frames fitted with foundation should be set in its place. The box hive should now be turned upside down and the bees should be driven out, by rapping the sides of the hive, into a box inverted over the hive. When the bees are clustering in the box the portions of comb containing brood should be cut out of the hive and pieced together and fitted

into frames, string being used to hold them in the frames. These combs are placed in the new hive and the bees are shaken into it. If no honey is coming in the bees should be fed. The best time to transfer is in May or June before much honey has been gathered. If the work is done when the honey flow is over robbing must be guarded against.

Instead of cutting out the combs the bees may be placed in the new hive containing frames fitted with foundation and the box hive may be placed over it with a queen excluder between, keeping the queen below. In three weeks the box hive may be removed, all the brood in it having emerged.

To transfer colonies located in hollow trees and other places where the bees cannot be drummed out the combs must be cut out with the bees still adhering to them.

Where the combs cannot be got out as, for instance, in the case of colonies located between the walls of a house, a bee-escape may be placed over the hole through which the bees pass in and out. The hive, in which has been placed a frame of brood and some combs, is then set up close to the hole. The field bees, being unable to return home, gather on the brood and these are joined by bees passing out through the escape. In a few weeks' time almost all the bees except the queen will have left their old home. A good bee escape for this purpose may be made from a piece of wire cloth by shaping it into a cone six inches long with a hole at the apex just large enough for one bee to pass. A queen or queen cell should be given to the colony as soon as possible.

UNITING.

In uniting colonies there are several principles to be borne in mind. The bees know the exact location of their hive, consequently, colonies to be united during the active season should stand within eight or ten feet of one another, otherwise bees will get lost. If it is desired to unite two colonies standing further apart, they may be gradually moved towards one another at the rate of two feet each day on which the bees fly freely until they stand side by side. In cool weather in autumn when the bees remain for days together in the hives, colonies in different parts of the apiary may be united with only trifling loss. Each colony has its own odour which the bees recognize, so that it is necessary to guard against fighting, especially at times when honey is scarce. At such times robbing, too, has to be avoided, and it is, therefore, advisable to defer the uniting until late in the day. To avoid fighting, both colonies are well smoked, and the combs are arranged in the new hive with a view to mixing the bees as much as possible. The brood combs should be placed in the centre of the hive and the heavier combs of honey at the sides, the combs that are light in weight or otherwise undesirable being left out. From these the bees may be shaken on to a large board leaned against the entrance. The bees usually take good care of the queen, but as a precaution she may be caged in the hive for 48 hours. If both colonies have queens it is advisable to keep the poorer one caged in the hive until it has been ascertained whether the other has been accepted or not. In uniting in the autumn it is advisable to do any necessary feeding for winter before releasing the queen.

A simple way to unite colonies situated in different parts of the apiary in moderately cool weather in the autumn is to place the hive containing the weaker or queenless colony on top of the other with a sheet of newspaper between. When, after some time, the imprisoned bees succeed in gnawing their way through the paper there is no fighting and few return to the old location. Five days after uniting the double colony should be examined and all brood placed in the lower story, the upper story being removed.

Swarms that have recently emerged may be united by simply shaking them together.

RE-QUEENING.

The queen being the mother of the colony, she is by far the most important insect in the hive. Should she die, leaving no young worker larvæ from which another queen can be raised, the colony will dwindle away unless another queen be given to it. A queen may prove unsatisfactory and require replacing for several reasons. She may be a worthless drone breeder, or she may be unprolific. The prolificness of a queen is very likely to be reduced after her second year so that she fails to maintain the large population of the colony that is needed for getting a maximum honey yield. Another common reason for re-queening is to change the race of the colony from black bees to Italians. If the Italian queen has been mated by a pure Italian drone all the bees in the colony will be pure Italians as long as the queen remains alive.

PURCHASING ITALIAN QUEENS.

In purchasing queens care should be taken to get them from a reliable breeder whose apiary is free from disease. Fertile Italian queens reared during the current year are obtainable from the end of June (earlier if ordered from the southern States) to the beginning of October.

In purchasing from a professional breeder of Italians it is usually advisable to order "untested" queens, that is, queens that have been kept only until they have commenced laying, in preference to "tested" queens, that is, queens whose worker offspring have been found to be uniformly banded with yellow to the extent demanded by the trade, because the untested queens are less liable to sustain injury in transit, and those sent out by a good breeder are usually purely mated; besides, uniformity in the colour of workers does not prove that they are pure. Untested Italian queens usually cost $1 each or a little less and, if taken in quantity, they can be got for from $8 to $10 per dozen.

The queens are sent by mail accompanied by about a dozen workers and a supply of candy in small wooden boxes covered with wire cloth. (See Fig. 33c.)

QUEEN INTRODUCTION.

Before a queen is introduced into a colony the old queen must be removed. If possible, this should be done one or two days, not longer, before the introduction of the new queen. Beginners sometimes experience much difficulty in finding the old queen, especially if she is a black one. When the hive is opened she will be in the brood nest and should be diligently searched for on each comb containing brood before the bees have begun to rush about the hive or gather in knots, which usually occurs after the hive has been open a few minutes. If by this time the queen has not been secured the hive should be closed and another search made a few hours later. As a last resort the queen may be isolated by sifting the bees through a queen excluder placed over the entrance of an empty hive into which the combs are placed after the bees have been shaken off them onto a runway placed in front of the hive.

Precautions have to be taken in introducing the new queen to prevent the workers attacking and killing her. One of the most reliable and widely practised methods of queen introduction is to confine the queen in the hive in a wire cloth cage until she has acquired the odour of the colony. A queen introducing cage may easily be made from a piece of wire cloth screening 2½ inches by 2½ inches by cutting a half-inch square out of each corner and folding over the sides so formed. This cage with the queen inside is pressed into a tough portion of comb near the centre of the hive. Only one or two of the cells enclosed by the cage should contain honey. The queen should

be liberated about forty-eight hours later, provided the bees are not clustering closely around her, in which case she is left caged another day or two. The colony should not be disturbed or examined to see if the queen is safe until five days after the queen's release.

Another very good queen introducing cage is the "candy" introducing cage, which contains a hole plugged with candy. The bees will usually eat through the candy in about twenty-four hours, and will thus release the queen automatically without any

Fig. 32.—Searching for the queen.

disturbance of the bees by the bee-keeper. To delay the release of the queen the candy may be kept covered during the first twenty-four hours with a piece of wood or tin. The candy is made by mixing powdered sugar and honey into a stiff dough. The travelling cage in which the queen is mailed is usually adapted for use as a candy introducing cage, and it is often used in commercial apiaries to save trouble, but it is safer to take the queen out of the travelling cage and introduce her alone, or with a recently emerged worker from the hive in a new cage. As a precaution against introducing disease the mailing cage and workers may be destroyed.

Queens are less liable to be attacked and killed by the workers after introduction during a honey flow than during a honey dearth. The period immediately after the honey flow when robbers are prowling about should, if possible, be avoided for introducing queens. In autumn the colony should be well supplied with food before the queen is liberated.

If the colony has been queenless for more than three days, all queen cells should be cut out at the time of caging the queen in the hive. If eleven or more days have elapsed since the colony lost its fertile queen and young brood was in the hive, a young virgin queen (possibly two or more about the eleventh or twelfth day) will be present and must be found and killed before the queen is introduced.

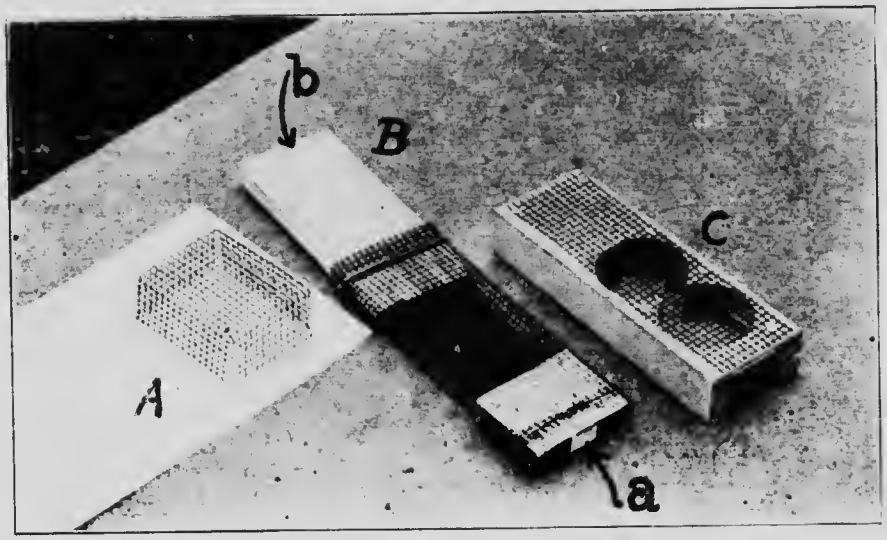


Fig. 33. —A. Queen introducing cage for pressing into the comb.
B. Miller's candy-introducing cage.
(a.) Plug of candy between two strips of wood held together by two squares of tin.
(b.) Piece of wood to be removed when inserting queen.
C. Mailing cage.

REARING QUEENS.

Too little attention has been paid in Canada to queen rearing. A large apiary kept for honey production possesses all the best conditions for the successful rearing of queens and frequently also for obtaining a high percentage of matings with drones of selected parentage for the improvement of stock.

Space forbids giving more than an outline of the process.

Beginners may save queen cells from their best colonies that swarm, breaking up the colony into several little colonies or nuclei shortly before the young queens are due to hatch, each nucleus consisting of two combs containing brood, honey and a queen cell, with the adhering bees. Spare queen cells may be given to other nuclei specially formed to receive them.

However, it is better to rear queens from the best colonies that do not swarm. This may be done by transferring on the turned-up point of a sharpened quill about twenty young worker larvæ of the desired parentage into artificial (or natural) queen cells and giving them to a colony which four hours previously was deprived of its queen and all brood, except one comb containing chiefly capped brood. The colony

should contain plenty of young bees for feeding the larvæ. The larvæ should not be more than about one day old. The artificial queen cells may be made by dipping the rounded and moistened tip of a wooden stick three-eighths of an inch thick into melted wax to a depth of one-half inch three or four times, the cups so formed being afterwards fixed on to the edge of a narrow board which is suspended in the hive. Handy queen cell cups that can be used repeatedly may be made by hollowing out one end of a short cylinder of wood to the size of a queen cell base and lining it with wax. The bases of the cups are fastened to the edge of the board by means of projecting nail points. The operation of transferring the larvæ is carried on during the honey flow, and care is taken to see that the larvæ are continuously supplied from the time of transference with an abundance of brood food. For this purpose the cups may be primed with food from an uncapped queen cell, but as this food is apt to dry up and the bees sometimes remove it before they commence to give the larvæ a fresh supply it is better to replace the larvæ to which the bees have supplied food with a new batch of larvæ the next morning. On the tenth morning after the transference of the

Fig. [illegible]een cells in wooden cups attached to board.

larvæ the queens will be due to emerge in a few hours and the queen cells should be distributed to nuclei in cell protectors made of wire cloth, or of wire wound in a spiral with a hole at the tip of the cell through which the queen will emerge. These protectors prevent the bees from tearing open the sides of the cell. In due time the queen in each nucleus will get mated provided no accidents occur, and she may be introduced to any colony requiring a queen at any convenient time thereafter.

FEEDING.

The various occasions on which feeding is necessary or advisable have been mentioned under "Spring Management," "Swarming" and "Wintering," and only a few remarks on how to make and give the food are here necessary.

Syrup made from the best grade of white granulated sugar is a cheap and safe substitute for honey in spring and summer, and a desirable supplementary food for winter.

For spring and summer feeding, two parts by measure of sugar stirred into three or four parts of water until dissolved makes a satisfactory syrup.

For autumn feeding, use two parts of sugar to one of water in the interior of Canada, and two and a half of sugar to one of water on the coasts. To get the sugar to dissolve completely in the case of autumn syrup the water must be hot. If the syrup is made over the fire the sugar must be added to the water in small quantities

at a time and kept constantly stirred until dissolved to prevent it from settling on the bottom of the vessel and burning, because burnt sugar is very unwholesome for bees and would cause their death during winter. To prevent the syrup from granulating, a teaspoonful of tartaric acid may be added to every twenty pounds of sugar.

Candy for feeding in an emergency during winter is made by dissolving over a slow fire 6 pounds of sugar in 1½ pints of hot water and boiling it to 238° F. over a hot fire with ¼ teaspoonful of cream of tartar for a few minutes without stirring. Boil longer if too soft. When the candy becomes almost cool enough for the finger to bear it, it should be stirred until it begins to whiten. It should then be poured quickly into moulds to form cakes about one inch thick.

Syrup made as described above should be given inside the hive and covered up so that bees from the other hives cannot get access to it. To prevent undue excitement and robbing, it is best to feed in the evening.

There are many kinds of bee feeders. For stimulative feeding in spring and summer a good one is the division board feeder, which hangs in the hive like a frame. For rapid feeding in autumn there is nothing better than the Miller feeder, which consists of a wooden box so constructed (see diagram) that the bees can not get drowned. This feeder is placed on top of the frames and an empty super or extension will be needed to cover it.

Fig. 35.—Division board feeder to hang in hive in place of frame.

A bee-keeper never need be at a loss for feeders. A simple feeder may be made by punching a number of small holes in the cap of a two-pound glass fruit jar. If the jar is then filled with syrup and the cap screwed on tightly it may be inverted over a hole in the quilt on the top of the frames. For rapid feeding a ten-pound lever lid tin pail with about a dozen small holes punched in the lid, also turned upside down over the frames, will usually prove quite satisfactory. If the syrup begins to run through

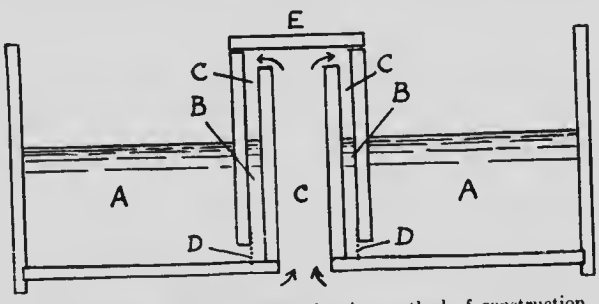


Fig. 36.—Section of Miller feeder, showing method of construction. A, B, reservoir for syrup; C, passage for bees to syrup; D, wire cloth; E, movable cover.

the feeder faster than the bees can take it, a piece or two of cheese cloth may be placed under it. A favourite method of feeding is to half fill a shallow tin pan with syrup and fill it up with grass or weeds which enables the bees to obtain the syrup without any danger of their getting drowned.

ROBBING.

In warm weather when there is little or no honey to be got from the flowers the bees will easily yield to any temptation to obtain it by any other means that come in their way. After more or less fighting they will overpower any very weak colonies, especially those that, having long lost their queen, consist entirely of old bees, and will carry the honey to their own hives. Robbing may also be started by the carelessness of the bee-keeper during manipulation, especially when removing the honey.

During a honey dearth the bee-keeper should in all his work carefully avoid doing anything that will excite robbing, for robber-bees are a constant annoyance and danger in the apiary.

No colony should be allowed to grow weak and no honey or syrup should be exposed in the apiary. If robbing has begun the attacked colonies should have a bunch of wet grass or weeds thrown over the entrance. Hives should be opened as little as possible, and then only during the hour before sunset or early in the morning or under a net tent. Robbing is most likely to be troublesome in the late summer during the decline of, and immediately after, the honey flow. It is advisable at this time to contract the entrances of all hives. One can tell if a colony is being robbed by seeing the robbers enter hurriedly with the abdomen contracted and leave with the abdomen distended, flying straight home. Old robbers have a shiny appearance, the hair having became rubbed off.

BEE DISEASES.

Five bee diseases are known to occur in Canada,—three affecting the brood, namely, American foul brood, European foul brood and sacbrood, and two affecting the adult bee,—paralysis and dysentery.

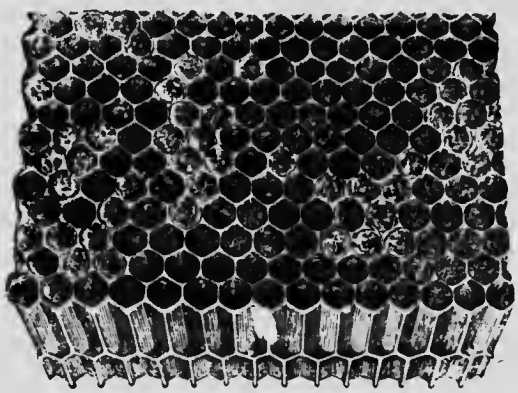


Fig. 37.—American foul brood comb, showing irregular cappings and scales. The position of the comb indicates the best way to view the scales.
(Phillips, Farmers' Bull. No. 442. U.S. Dept. Agric.)

American foul brood and European foul brood are serious diseases which have caused enormous loss to bee-keepers in the United States. They have also appeared in various parts of Canada and, unfortunately have gained foothold in some regions. They are highly infectious, but by proper treatment they can both be controlled and their spread checked. It is, therefore, important that every bee-keeper should acquaint himself with the symptoms of foul brood and the proper methods of treatment and should keep a careful watch for its appearance in his apiary.

AMERICAN FOUL BROOD.

This disease affects principally the larvæ just after they have been capped over. In a colony suffering from American foul brood the cappings of some of the cells are seen to be discoloured and they may be sunken, irregularly perforated or removed altogether. If these affected cells be examined it will be found that the larvæ in many of them have sunk down in the cell and have become a coffee-coloured and viscid mass. If a match or toothpick be inserted into the cell the rotting mass adheres to it and can be drawn out into a string an inch or two long. There will often be other cells in which the decayed larvæ has dried down to a scale which adheres tightly to the lower wall of the cell. In a badly affected colony a glue-pot odour is usually noticeable. The colony grows weak through the diminishing number of emerging bees and usually dies sooner or later.

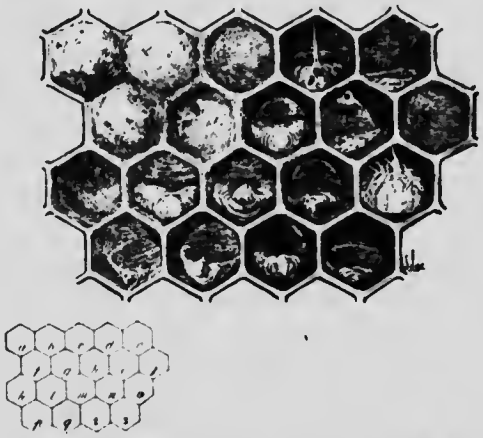


Fig. 38.—American foul brood: *a*, *b*, *f*, normal sealed cells; *c*, *j*, sunken cappings, showing perforation; *g*, sunken capping not perforated; *h*, *l*, *m*, *n*, *q*, *r*, larvæ affected by disease; *e*, *i*, *p*, *s*, scales formed from dried-down larvæ; *d*, *o*, pupæ affected by disease. Twice natural size.—(*Phillips, Farmers' Bull. 442, U.S. Dept. of Agric.*)

American foul brood is rather widely distributed in Canada. It exists in most of the counties in the southwestern half of old Ontario. It has been found in the Annapolis valley, N.S., and outbreaks have been reported in Manitoba and at Vancouver. The cause of American foul brood is *Bacillus larvæ* (White).

EUROPEAN FOUL BROOD.

In European foul brood most of the larvæ are attacked and die just before the cell is capped over, but a few capped larvæ are often affected also, and quite young larvæ are sometimes attacked. The larva loses its plump shape and lies in the bottom of the cell, a shapeless collapsed mass, giving the appearance of being melted, and its colour changes from pearly white to yellow or grey. The decaying larvæ are usually not ropy as in American foul brood, but a slight ropiness is often present.

Queen and drone larvæ are quickly attacked by this disease, whereas American foul brood seldom attacks these. The scale to which the larvæ eventually dries down does not adhere to the cell. Many of these scales are carried out by the bees. A slight sour odour is usually present in cases of this disease, and a disagreeable odour of putrefaction is also sometimes noticed. The symptoms of the disease are more vari-

able than those of American foul brood. This disease is most destructive in late spring and early summer before the honey flow; in late summer it sometimes disappears, to return the following spring. It spreads through the apiary and district more rapidly than American foul brood.

Black bees are more susceptible to European foul brood than Italians, but both races are equally susceptible to American foul brood. Neglected apiaries of black bees quickly die out when attacked by European foul brood, and many a careless bee-keeper has been put out of business by it.

European foul brood is spreading in Ontario and Quebec, the principal centres at present being the Niagara district and from Durham county in Ontario eastwards into southwestern Quebec.

The organism causing European foul brood is *Bacillus pluton* (White).

METHODS OF SPREADING OF FOUL BROOD.

Both American foul brood and European foul brood spread from colony to colony and from apiary to apiary in much the same way. An affected colony becomes very weak or dies. The hive is robbed and the honey containing the germs of the disease is carried by the robbers to their hives. The bee-keeper may unwittingly aid the spread of the disease by feeding the bees with infected honey or by putting swarms into hives or upon combs that have come from diseased colonies. Discarded receptacles that have contained honey from a diseased colony, if not thoroughly cleaned, may also be a source of infection.

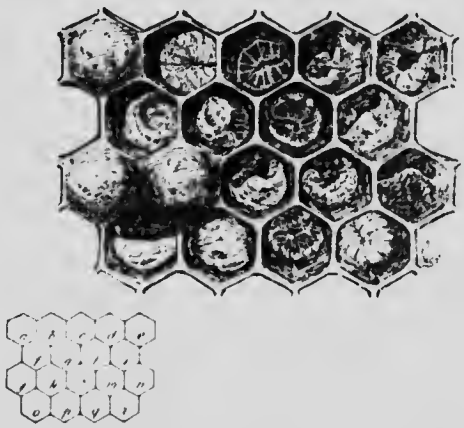


Fig. 39.—European foul brood: *a*, *j*, *k*, normal sealed cells; *b*, *c*, *d*, *e*, *g*, *i*, *l*, *m*, *p*, *q*, larvæ affected by disease; *r*, normal larvæ at age attacked by disease; *f*, *h*, *n*, *o*, dried-down larvæ or scales. Twice natural size.

(Phillips, Farmers' Bull. No. 442, U.S. Dept. Agric.)

PREVENTIVE MEASURES.

The following precautionary measures are recommended for adoption by all bee-keepers: Never purchase colonies of bees unless it is certain that they are free from disease. Never feed bees with honey of unknown origin. If the bees need feeding give sugar syrup, not honey. Do not purchase old combs, used hives or second-hand bee supplies unless it is certain that they came from healthy apiaries. Keep all colonies strong. The disease should be explained to neighbouring bee-keepers, and they should be invited to co-operate in its prevention and treatment. Such practices as leaving colonies to die on their stands and exposing combs of honey taken from

colonies that have died for the bees to feed upon are very bad bee-keeping, and may result in all the apiaries in the neighbourhood becoming diseased. Those who keep bees in box hives should be urged to transfer them to hives with movable combs.

TREATMENT OF AMERICAN FOUL BROOD.

The treatment of American foul brood consists in the removal and destruction of all infected matter and compelling the colony to make a fresh start by building new combs and gathering fresh stores.

The bees should be treated, if possible, during the honey flow so that the other bees in the apiary will not be inclined to rob, and also that the treated bees may make a good start. If no honey flow is taking place, the newly treated bees will need feeding with syrup. To further reduce the risk of robbing the work should be done towards evening unless the number of colonies to be treated is great.

Before the operation is begun all appliances that will be required should be in readiness. The hive containing the diseased colony is lifted back two feet or so and a clean hive containing frames fitted with strips of foundation about half an inch wide is set in its place. A spare cover or similar board is placed in front of the clean

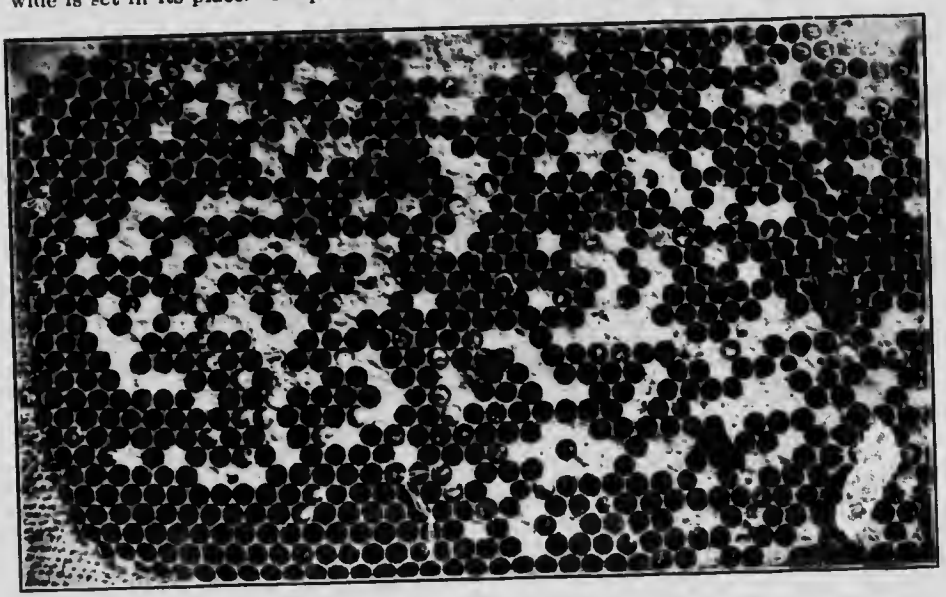


Fig. 40.—European foul brood.

hive to act as a runway. Five frames are lifted out of the clean hive to make a vacant space into which the bees are to be shaken, and the part containing the rest of the frames is covered with a board or sack to prevent the bees crawling out at top. The old hive is now opened and the combs are lifted out one at a time and the bees are shaken off them into the new hive, each comb being put into a spare hive body that has been placed nearby. As soon as the combs have been collected in this they should be covered over. The five frames of foundation are now returned to the clean hive and the cover is put on. If honey drops out of the combs the bees should not be shaken into the hive, but instead, on to sheets of newspaper spread over the runway close to the hive so that the bees will run in. The soiled newspapers are afterwards destroyed.

When most of the bees are in the hive a queen excluder should be placed under the hive between the bottom board and the brood chamber, or a strip of queen exclud-

ing zinc should be fastened over the entrance to prevent the bees from deserting their hive next morning.

As soon as the operation is over the hive body containing the combs is brought indoors so that no bees can get access to them. Care must be taken that no honey or scraps of combs are left lying about for robbers from healthy colonies to carry home the disease. As soon as convenient the combs should be melted down in water which should be kept boiling for at least half an hour to destroy the virus. The wax may then be pressed out in a wax press. The honey in the supers may be extracted and is perfectly safe for human consumption.

Three days later the bees will have consumed the infected honey they carried with them, and they should then be given frames fitted with full sheets of foundation in place of the frames fitted with starters. Colonies that have become much weakened by the disease should be united during treatment.

Hives that have formerly contained diseased colonies or infected combs should be cleaned of honey and wax, and should be disinfected by being scorched inside with a gasoline lamp such as is used by painters. If this appliance is not available hive bodies may be tiered upon a bottom and gasoline poured over the inside of the pile and on some excelsior placed within it. The gasoline is then ignited and after a few seconds the flames may be extinguished by placing a close fitting cover on top.

TREATMENT OF EUROPEAN FOUL BROOD.

The shaking treatment above described for American foul brood is also correct for European foul brood where the colonies are badly infected with the disease, but it should always be followed by the introduction of a young Italian queen. In light cases of European foul brood in strong colonies, introducing a young Italian queen is sufficient treatment. In an affected apiary of black bees every colony should be Italianized in this way whether it be diseased or not. The temporary cessation of brood rearing during the introduction of the queen and the youth of the queen both contribute to the success of the treatment. It is sometimes advisable to keep the colony without young brood for two or three weeks. This may be done by making the colony queenless and then, after a few days, giving it a ripe queen cell containing an Italian of resistant strain. The colonies should be kept strong at all times so as to avoid robbing. The resisting power of Italians to European foul brood varies both in individual colonies and in the strain. The brightest golden Italians are usually less resistant than darker goldens and three-banded Italians.

SACBROOD OR PICKLED BROOD.

In this disease the larva dies about the time of sealing. It usually lies stretched out in the cell with its head turned up. The body is swollen and the contents are watery. There is no ropiness. This disease seldom occasions serious loss, and as a rule no treatment is necessary. It is, however, infectious, and in extensive outbreaks the precautions and treatment prescribed for American foul should be adopted.

OTHER AFFECTIONS OF THE BROOD.

Brood may die from various causes other than disease. It may get chilled or starved. When the honey flow is suddenly stopped by the onset of unusually cold weather the bees will destroy a large quantity of drone brood and sometimes also worker brood. Such dead brood is soon removed by the bees.

Another condition that may be mistaken for disease is what is known as bald headed brood, in which the pupæ are uncapped or only partly capped. If the uncapped cells are in lines it may be suspected that wax moth larvæ are working in the combs, but if the uncapped cells are mixed or scattered and the pupæ are seen to be normal there is nothing seriously wrong.

DYSENTERY.

Healthy bees eject their faeces during flight. When in winter flight is impossible, the fæces may accumulate to such an extent that the bees are unable to retain them and will soil the hive and combs with yellowish brown spots. The faeces consist of the parts of the food that cannot be digested, and also the waste products. The food should, therefore, contain as little indigestible matter as possible. Sugar syrup fulfils this condition well, but it is not a complete food for bees. A good flight in favourable weather usually puts a stop to dysentery, but if the bees are unable to fly or if they make an untimely flight in cold winter weather they may die in great numbers. Honey-dew, the sugary excrement of the [illegible] or aphides, deposited principally on the leaves of trees on which these insects are feeding, and sometimes gathered and stored by the bees, contains a large amount of indigestible matter and quickly produces dysentery. Honey-dew honey has a disagreeable flavour and dark colour. Fortunately, in Canada it is seldom stored in sufficient quantity to be harmful. The honey gathered by bees located on certain marshes in Nova Scotia has also been found to produce dysentry. Bees wintered with [illegible] honey supplemented with syrup made from a good grade of white granulated sugar are little or not at all affected.

BEE PARALYSIS.

Bee paralysis is the name given to an obscure disease of the adult bee in which the bees are seen to crawl out of their hive with a trembling jerky motion and frequently with their abdomens distended. They often climb blades of grass and upon reaching the top, being unable to fly, they fall to the ground. The affected colonies sometimes dwindle considerably. The trouble usually occurs in spring. No certain remedy for bee paralysis is known, and it usually disappears at the advent of the honey flow.

The nature of this disease has not been ascertained and it is not unlikely that the symptoms noted are due to different causes in different cases. In Great Britain a disorder known as Isle of Wight disease with symptoms like those of bee paralysis has in late years caused enormous loss. The cause of Isle of Wight disease has been traced to *Nosema apis*, a unicellular parasite of the alimentary canal of the bee. The parasite may however be present without causing any disease. There are grounds for suspecting that some of the cases of bee paralysis in Canada may also be due to *Nosema apis*, which has been found in the United States. Care should be taken not to import the British variety of this parasite into Canada.

BEE DISEASE LEGISLATION.

Acts for the suppression of Foul Brood have been passed by the following provincial legislatures:—

Ontario, 1897, repealed 1906.
Quebec, 1908.
British Columbia, 1911.
Manitoba, 1914.
New Brunswick, 1915.

The Ontario Act of 1906 provides for the appointment of bee inspectors under the control and direction of the Minister of Agriculture. The inspector, when directed by the Minister, visits and examines apiaries to ascertain whether foul brood exists in a malignant type. It is the duty of the inspectors to order all affected colonies, together with the hives and contents and tainted appurtenances that can not be disinfected, to be immediately destroyed by fire under his personal superintendence, but if the inspector finds the disease to exist in a mild type or incipient stage and can be successfully treated he may omit to destroy.

The inspector has power to order bees in box hives to be transferred to a movable frame hive within a specified time, in default of which such hives and the bees may be destroyed.

Any person who knowingly sells, barters or gives away diseased colonies or infected appliances is liable upon conviction to a heavy fine or imprisonment. Any person whose bees have been destroyed or treated for foul brood who sells or offers for sale any bees, hives or appliances after such destruction or treatment before being authorized to do so by the inspector or who exposes in his bee yard or elsewhere any infected comb, honey or other infected thing, or conceals the fact that disease exists among his bees is also liable upon conviction to fine or imprisonment.

Provision is made for dealing with bee-keepers who refuse to allow the inspector to freely examine his bees or refuse to destroy infected bees or disobey the directions of the inspector.

"Every bee-keeper or other person who is aware of the existence of foul brood either in his own apiary or elsewhere, shall immediately notify the Minister of Agriculture of the existence of such disease, and in default of so doing he shall, on summary conviction before a justice of the peace, be liable to a fine of $5 and costs." (It is the usual practice to send the notification to the nearest inspector, as this often saves delay in inspection and treatment.)

The inspector is required to make a report to the Minister of Agriculture of apiaries inspected by him.

The Quebec Act passed in 1908 is framed on similar lines to the Ontario Act, but provision is made for the indemnification, under certain circumstances, of the bee-keeper in the case of compulsory destruction of hives, bees or accessories, and notification of the disease is not compulsory.

The British Columbia Act passed in 1911 is also drawn up in a similar way to the Ontario Act, but special precautions as to disinfection are enjoined and the Minister of Agriculture is empowered to order into quarantine for a period not exceeding nine months any or all bees imported into the province, and if these are found to be infected he may order them to be destroyed.

The Manitoba Act passed in 1914 does not differ in any important detail from the Ontario Act.

In 1914 Ontario had twenty-one regular government inspectors. Quebec had six chief inspectors and six assistant inspectors. British Columbia had three inspectors and Manitoba one inspector. The work of these men is not only that of police officers to enforce the law, but is very largely educational and is of great value to the bee-keeping industry.

ENEMIES OF THE BEE.

Wax moth.—The caterpillars of the Wax Moth (*Galleria mellonella*) are found in neglected apiaries where they destroy the combs and brood of weak colonies, and also the combs of colonies that have died out, lining the tunnels they make in the combs with a silky web. They will also get into the honey house and destroy the combs there. Colonies that are strong and well looked after resist the depredations of wax moth. The full grown caterpillar is about one inch in length and it spins an oval white cocoon in some crevice in the hive where it changes to the chrysalis. As the different stages of wax moth are killed by severe cold it is a good plan to store combs for the winter in the honey house and not in the cellar. All spare combs should be looked over and given to the bees, or fumigated, at least once a year. To fumigate combs they should be placed in hives tiered one above the other with an empty hive or super on top. In this super is placed a saucer containing bisulphide of carbon, the fumes of which, being heavier than air, settle down through the combs. Care should be taken not to bring a flame near, as the fumes are highly inflammable. Sulphur fumes may be used instead. Colonies affected with brood disease are very likely to become the prey of wax moth in the last stages of their existence.

Other enemies.—Amongst other enemies of the bee may be mentioned wasps, toads and certain birds. These do no serious harm to strong colonies. Mice and rats, however, will sometimes destroy colonies in winter if care is not taken to exclude them from the bee cellar or wintering case. Colonies wintered outside may be protected by reducing the width of the entrance to ⅜-inch so that mice are unable to get in.

BEES AND FRUIT.

The value of bees as pollinators in orchards has already been referred to in the discussion upon the advantages of bee-keeping.

Complaints are sometimes made of the poisoning of bees as the result of their visiting fruit bloom that has been sprayed with insecticides. Fruit trees should never be sprayed with poison while in full bloom. Not only may the poison kill the bees, but it also damages the reproductive organs of the flower, and in both ways it reduces the proportion of fruit that will set.

In the province of Ontario an Act passed in 1892 prohibits the spraying of fruit trees while in full bloom with any mixture containing Paris green or other poisons injurious to bees under penalty of fine or imprisonment. A similar law is now in force in the province of Quebec.

Bees may, at times, be seen feeding on ripe plums and other sweet fruit, and this has led some fruit growers to fear that they may damage fruit. Experiments conducted at the apiary of the Central Experimental Farm in 1901, and elsewhere, have shown conclusively that bees do not injure sound fruit. It is only when the skin has been broken by birds or wasps or in some other way that the bees suck the fruit juices.

BEE-KEEPERS' ASSOCIATIONS.

Bee-keepers, like the members of any calling, are greatly helped by getting into touch with one another for the exchange of ideas and the discussion of problems relating to their welfare.

Bee-keepers' Associations have sprung up in various parts of Canada, and, from the Ontario Beekeepers' Association, which is one of the most progressive and successful bee-keepers' organizations in the world, to the young societies that have only recently been established, all are doing good work for the advancement of the industry. Many of the bee-keepers' associations are fortunate in having for their secretaries men who are serving the government in the interests of bee-keeping and are in charge of, or engaged upon, the work of the control of foul brood.

In most of the associations the annual membership fee is one dollar, and the benefits usually include the supplying of a monthly bee journal.

The Ontario Bee-keepers' Association was organized in 1880. This association had in November, 1915, 1,130 members. Each member receives monthly a copy of "The Canadian Horticulturist and Bee-keeper." He also gets a timely report of the honey crop with the prices it is suggested should be asked. A three-day annual convention of the Ontario Bee-keepers' Association is held in Toronto in November where ideas are exchanged and matters pertaining to the success of the bee-keeping industry in Ontario are fully discussed. This convention is very well attended, and it is looked forward to as one of the principal events of the year by many members. The members of the Ontario Bee-keepers' Association have also the privilege of securing Italian queens at co-operative prices. There are various other benefits of membership. Mr. Morley Pettit, Provincial Apiarist, Apiculture Department, Ontario Agricultural College, Guelph, is the secretary-treasurer. There are twenty six county associations affiliated with the Ontario Bee-keepers' Association.

The Quebec Province Bee-keepers' Association has been established several years. The president of this association is Dr. E. Lalonde, and the secretary-treasurer (1915) is Mr. Ose. Comire, Abenakis Springs, Que. This association fosters progressive methods of bee-keeping among its members, aids in the disposal of their honey and co-operates with the provincial government in the control of foul-brood. It holds a two-day annual convention at Montreal in November, the proceedings of which are carried on in the French language. This convention is also largely attended.

The Quebec District Bee-keepers' Association, of which Mr. Jacques Verret of Charlesbourg, Que., is the president, has over 60 members, and is doing useful work in teaching modern methods of bee-keeping. Mr. Victor Chercnitte, of Beauport-Est, Que., is secretary.

The Manitoba Bee-keepers' Association was established in 1903 and re-organized in 1914, secretary-treasurer, Professor S. A. Bedford, Parliament Buildings, Winnipeg, Man. There has recently been a great awakening of interest in the bee-keeping industry in Manitoba.

The New Brunswick Bee-keepers' Association was founded in 1913, and in 1914 had 48 members, secretary Mr. H. B. Durost, instructor in bee-keeping for the Provincial Department of Agriculture, Woodstock, N.B.

The Kootenay Bee-keepers' Association, secretary-treasurer Mr. W. J. Sheppard, Nelson, B.C. was organized in 1914 and in 1915 had 78 members.

The Bee-keepers' Association of British Columbia, incorporated 1916, hon. secretary-treasurer, Mr. Williams Hugh, 316 Beckley Ave., Victoria, B.C.

PUBLICATIONS ON BEE-KEEPING.

No bee-keeper should be without a book that treats in much fuller detail than can be done here the different features of bee-keeping. The following are standard works:—

"The A. B. C. and X. Y. Z. of Bee Culture" by A. I. and E. R. Root, published by the A. I. Root Co., Medina, Ohio, U.S.A. at $2. An attractively written and profusely illustrated encyclopedia of all the phases of practical bee-keeping. A French edition is published.

"Bee-keeping" by E. F. Phillips, Ph.D., published by the Macmillan Co., Toronto, $2. A valuable text-book on bee-keeping, in which the subject is treated from the scientific point of view and the principles underlying success are discussed.

"How to keep bees," by Anna B. Comstock, published by Doubleday, Page & Co., New York, U.S.A., at $1. A charmingly written manual especially suited for those who think of taking up bee-keeping as a recreation.

Several bee journals are published which keep the bee-keeper in touch with current events and progress, and give helpful hints, and also information about the doings and personality of bee-keepers, and about the meetings of the various bee-keepers' associations. Canadian bee-keepers will find much interesting and helpful information in any of the following journals: "The Canadian Horticulturist and Bee-keeper," published monthly at Peterboro, Ont., "The American Bee Journal," published monthly at Hamilton, Ill., U.S.A., and "Gleanings in Bee Culture," published semi-monthly at Medina, Ohio, U.S.A.

BEE-KEEPING AT THE DOMINION EXPERIMENTAL FARMS.

Bees are now kept at fourteen of the Dominion Experimental Farms, namely:—the Central Experimental Farm, Ottawa, and the following branch farms:—Charlottetown, P.E.I., Nappan, N.S.; Kentville, N.S.; Fredericton, N.B.; St. Anne de la Pocatiere, Que.; Cap Rouge, Que.; Brandon, Man.; Indian Head, Sask.; Lacombe,

Sask.; Lethbridge, Alta.; Invermere, B.C.; Agassiz, B.C.; and Sidney, B.C. At all these stations, with the exception of Indian Head where bees have not been kept sufficiently long to produce definite results, bee-keeping has been found to be profitable. At Lethbridge alfalfa has proved the principal source of surplus honey. At Brandon, Lacombe and Invermere, the sources have been mixed. At the remaining stations, alsike or white clover are the principal, but by no means the sole, sources.

CONCLUSION.

In the foregoing pages an endeavour has been made to present briefly the main features of successful bee management in as concrete a form as possible. It may be well in conclusion to summarize the most important points in a few words.

The bee year may be said to commence in the autumn, and success the following season depends very largely on the proper preparation of the bees for winter, followed by careful and systematic spring and summer management. Colonies should be kept strong and every queen that is not prolific and does not produce industrious and hardy workers should be replaced. A sufficient supply of standard hive parts, frames and foundation to meet all possible needs should be procured and made up before the busy season. To the message "better keep bees" we would add with greater emphasis the one "keep bees better." The successful bee-keeper is the one who has learnt how the bees will act under various conditions and how these conditions and the actions of the bees can be controlled.