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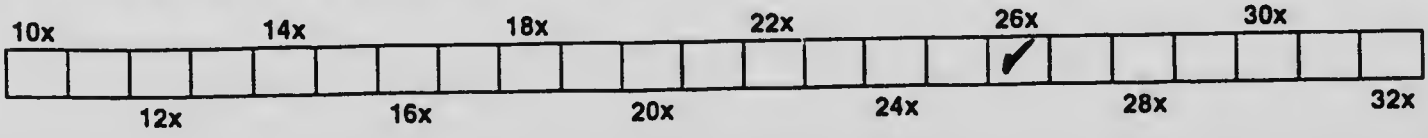

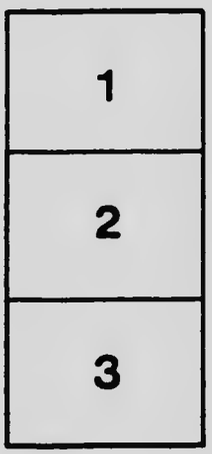

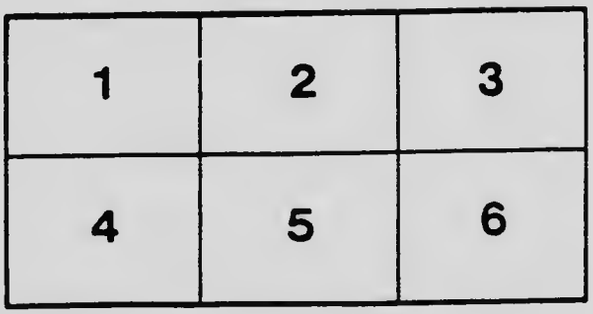

PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE

GUIDE TO BEE KEEPING

BULLETIN No. 10

Second Edition

E. CHARLTON TODD

PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF AGRICULTURE

GUIDE TO BEE-KEEPING

BULLETIN No. 30

(SECOND EDITION)

BY

F. DUNDAS TODD

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1918.

Honourable W. J. Bowser, K.C.,
Minister of Finance and Agriculture,
Victoria, B.C.

Sir,—I have the honour to transmit herewith Bulletin No. 30, entitled "Guide to Bee-keeping." This bulletin has been reissued in order to meet the large demand for practical information concerning this most important branch of farming. The instructions contained therein are concise and practical, and adapted to the conditions prevailing in British Columbia, and will, it is hoped, prove of benefit to those starting or at present engaged in this industry.

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

WM. E. SCOTT,
Deputy Minister of Agriculture.

Department of Agriculture,
April 20th, 1915.

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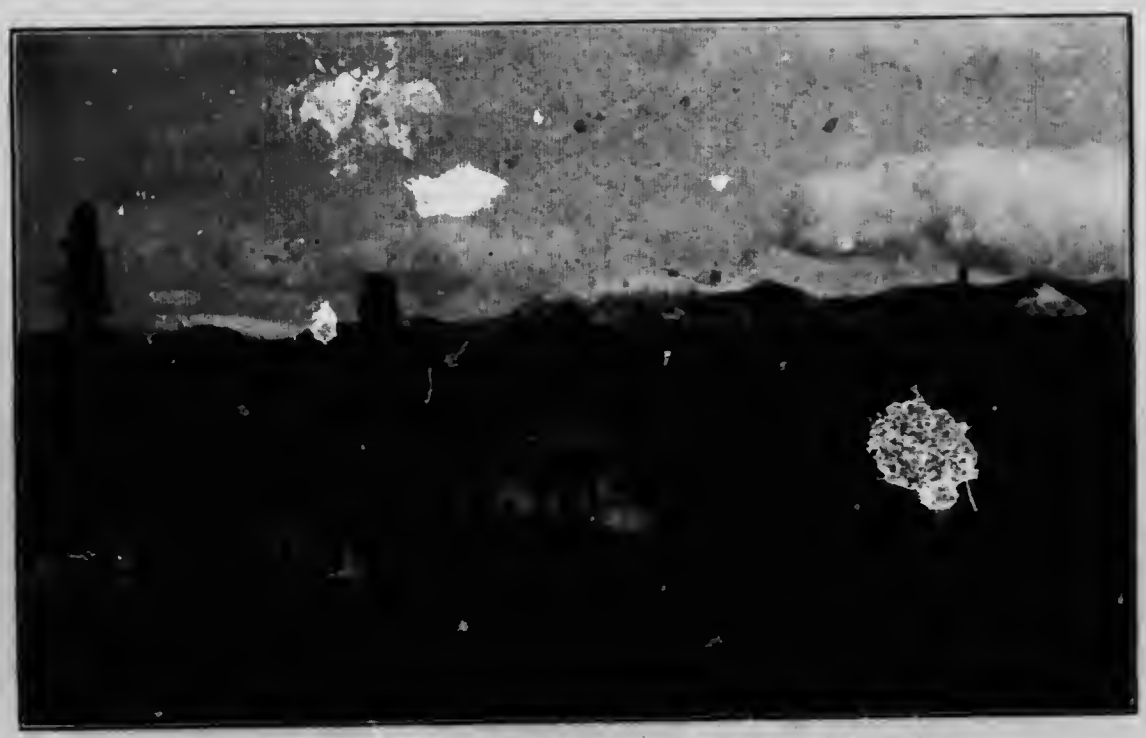

Fig. 1. Mount Cheam and Fraser River as seen from the apiary of Sam. Smith, Dewdney.
[Photograph by F. Dundas Todd.

GUIDE TO BEE-KEEPING.

CHAPTER I.

Bee-keepers' Calendar for British Columbia.

Jan. 1. Place order with dealer for beeware; payment to be made when goods are delivered in April or May. In summer a hive consists of at least three stories—two brood chambers and the honey super.

March. On a warm day in the latter half of the month clean bottom boards.

May 1. *Wet Belt.*—On all strong colonies place a second story of brood-combs to give queen more room to lay.

„ 15. *Dry Belt.*—On all strong colonies place a second story of brood-combs to give queen more room to lay. When bees hang out at night, enlarge entrance of hive.

June 21. Place honey supers on all strong colonies. In most years the honey-flow starts early in July. Generally the clover honey-flow is over by the middle of the month. The season is very short, so to secure a good crop the colony must be strong.

Aug. 15. Extract in clover districts.

Sept. 15. Extract in fireweed and alfalfa districts.

„ 15. Pack bees for winter. Make sure each colony has at least six combs of honey in brood-chamber.

Progress of Brood-raising.

Spring development of the hive as noted in 1914 during demonstration-work. The results are not the best possible by any means, and beginners may find them useful as a standard.

April	3.	Average combs with brood,	4; best, 5.
„	15.	„ „	4; „ 6.
„	20.	„ „	5; „ 6.
„	30.	„ „	5¾.
May	3.	„ „	6¼.
„	5.	„ „	7¼.
„	8.	„ „	11.
„	17.	„ „	9½.
„	20.	„ „	10; best, 13.

CHAPTER II.

Apiarian Possibilities of British Columbia.

Before the first edition of this bulletin was issued in 1911 an effort was made to secure from bee-keepers in every part of the Province definite information as to the possibilities of honey production. While a few rather good reports were received, take it all in all, most of them were rather discouraging. The facts as given were plainly set forth, and then the Department of Agriculture sent out three Inspectors to study the situation and to guide the novices.

There is no need to tell the trials and troubles of these men during the first two years of their labours; how they found keepers of bees in plenty, but few bee-keepers; and how every suggestion for improvement was met with indifference. The climatic and floral conditions of every district, down almost to the last square mile, had to be learned and understood, but unfortunately the bee-men of each locality were generally rather unobservant. Patiently the Inspectors kept on with their work;

being cheered occasionally by finding some one really interested in bee-keeping. Here is a choice example that still brings great comfort to the Inspector in the Wet Belt. In the first edition one bee-keeper who had conducted an apiary of about fifty colonies for fourteen years is reported as saying: "We keep bees now only to make certain the pollination of the fruit. I do not advise any one to try to make a living in this region from bees, as they rarely do more than get sufficient stores to winter on, and often not that much. Our nights are too cool for the secretion of nectar." The Inspector visited his apiary in May, 1911, and suggested a slight change in his management, which was adopted. The crop that season averaged 66 lb. a hive. The poorest crop was in 1913, the worst season for honey in twenty years, when 40 lb. a colony was got. The crop of 1914 averaged over 110 lb. The region was all right, but his system was wrong at just one point. It would have worked splendidly in Ontario, but it was not suited for British Columbia. When the Inspector first gets in touch with a man who has kept bees east of the mountains, he almost invariably meets a bee-keeper who ignores all suggestions, and who undoubtedly knows that the Inspector is not a good bee-man. However, if the Inspector can get the other to run even only one hive his way, he feels he has made some progress.

So far as apiculture is concerned, British Columbia differs from almost the whole world in one important respect—namely, our spring building-up season is four months long; east of the Rocky mountains it is not half as much. Our bees are carrying in pollen early in March; clover blooms at the end of May, but, and this is all-important, apparently nectar is not secreted until June is past. The whole system of bee-management has to be based on the fact of a long spring. Independently the Inspectors worked out a bee-keeping system; on comparing notes they found themselves in agreement. The essence of it is tersely set forth in the first chapter, where it has been placed for ready reference.

By the end of 1914 the Bee Inspectors had been in touch with close on 1,000 bee-keepers, and at the end of the season the Department of Agriculture asked from each a report on the honey-crop for 1913 and 1914. The former year was considered, as has already been said, to be the worst honey-year for twenty years; the latter is considered as being a little better than the average, so from the figures we can form a pretty fair estimate of the honey possibilities of British Columbia as a whole and by districts. The table given below is a copy of the crop report for 1914 as prepared for the Statistical Bureau of the Department.

REPORT OF HONEY-CROP BY DISTRICTS FOR 1914. COMPILED JANUARY 31ST, 1915.

District.	Bee-keepers on List.	Bee-keepers reporting.	Hives reported.	Crop reported.	Average per Hive.
				lb.	lb.
Islands	151	41	185	7,900	42
Lower Mainland	596	216	1,260	63,366	50
Thompson River Watershed	30	14	115	9,314	89
Okanagan Valley	86	37	285	14,233	50
Kootenays	97	56	269	15,164	56
Totals	960	364	2,114	109,977	52

Estimated total crop of British Columbia, 1914, 150 tons.

The average crop per hive reported by more than one-third of the bee-keepers is the rather presentable amount of 52 lb. The beginners with no crop, and they are numerous; the men of little experience, and they form the majority; the experts, who are few, all are included when the average crop is struck. But let it be distinctly understood that this average is not the possible by any means, for, as a matter of fact, less than 100 men owning 778 colonies secured three-fourths of the total crop.

The average crop per hive reported in 1913 was 35 lb., no bad showing for a poor season.

Returning to the crop of 1914, it may be worth while to note a few of the higher records, as they will tell better than words the possibilities of the different districts.

	Colonies.	Average per Hive.
Municipality.		Lb.
Burnaby	40	87
Chilliwack	23	115
Coquitlam	14	50
Delta	36	150
Dewdney	28	20
Kent	5	60
Langley	5	125
Maple Ridge	12	54
Matsqui	8	100
North Vancouver	38	52
South Vancouver	45	22
Sumas	5	140
Surrey	7	100
Vancouver	11	94
District.		
Comox	6	130
Ladysmith	5	140
Castlegar	3	140
Cranbrook	30	83
Creston	25	60
Nelson	7	93
New Denver	3	166
Rossland	9	111
Arrow Lake	3	86
Armstrong	4	50
Kaleden	4	191
Okanagan Centre	16	73
Vernon	59	86
Enderby	25	160
East Robson	3	83
Grand Forks	50	52
Erie	2	190
Queens Bay	10	46
Lytton	14	70
Revelstoke	2	50
Salmon Arm	7	64

Such figures as these and our 52-lb. average for the whole Province suggest rather emphatically that our bee-men on the whole have a first-class opportunity to develop a clean and profitable industry.

The Inspectors are heartily tired of being told by old-timers that this is a poor Province for bees and honey, and hope that the figures just given will put an end to all such remarks for ever. They also want to go on record as saying that for quality alone British Columbia honey will some day bear a high reputation, for they know of none better.

INTENSITY OF THE INDUSTRY.

On Vancouver Island and along the Lower Fraser bee-keeping has been carried on for about forty years, but the individual apiaries have been and still are small. In this region the largest apiary contains about fifty colonies; there are few with more than thirty. In the past it would seem that hundreds have started bee-keeping, but made no effort to acquire the necessary knowledge, so the bees died out or were

disposed of. To-day in the same region are to be found scores of men in a small way who are taking the industry seriously, each owning but a few hives, but determined to acquire no more until they prove themselves efficient bee-keepers. They realize that the bee is not toiling to gather a honey-crop for them, but in order to raise more bees; therefore bee nature must be understood if one wants to divert the energy of the insect to the production of surplus honey. It is the bee-keeper who gets a honey-crop, not the bee.

In the Dry Belt bee-keeping is practically in its infancy, but is seemingly capable of great expansion, especially in districts where hundreds of acres are under alfalfa and clover. The acreage of these plants will from now on still further increase, as the fruit-men have lately begun to use alfalfa as a cover-crop, which will furnish a wider field for the gathering of nectar.

To those not familiar with bee-keeping terms, it is perhaps advisable to explain that the phrase "honey-flow" means that season of the year when the bees gather more nectar than is necessary for the daily need of the hive, and they are thus able to store up surplus honey for winter consumption. As from 25 to 30 lb. are usually sufficient to carry a colony over the winter, all above that amount may be taken by the bee-keeper. Since his returns are immediately concerned with the honey-flow, it is important for him to know its source, its real source, for not infrequently he assumes that it comes from a well-known honey-plant, when, as a matter of fact, it may be actually obtained from one he never suspected. For instance, white clover is a famous honey-plant that in most regions can be depended upon for a good average yield in a series of years, and so even experienced bee-keepers are tempted to assume that the presence of clover in quantity should indicate a good honey region. This does not necessarily follow, for both summer and fall droughts or cool summer evenings may retard the secretion of nectar; yet there may be a good honey-flow in such a region from a very different source. The southern end of Vancouver Island would appear to be a good example. Clover is plentiful in many portions, but is sparingly visited by the bees. Some years the snowberry-bush is generally covered with blossoms at the time clover is in bloom, and a good supply of very delicious honey is secured. Therefore, any one contemplating an extensive investment in bee-culture should not venture on a very large scale until he knows for a certainty the actual source of the honey-flow and how extensively it is to be found within a radius of a mile and a half of the apiary.

SOURCES OF NECTAR DURING HONEY-FLOW.

In the Wet Belt white clover is so far the principal source of honey, but on our mountain-sides, along the stump lands of the Fraser River, and in the great valleys of the interior there are immense tracts of fireweed that suggest to the thinking mind possibilities of honey production so great that one feels the day is not far distant when the honey-crop of British Columbia will not be stated in terms of a hundred, but by thousands of tons. Our honey production to-day practically equals our present rather low consumption; in a very few years we must be looking to the Prairie country east of the Rockies for a market.

In the Dry Belt region we have clover, alfalfa, and along the watercourses a little sweet clover. The last-named plant, long despised by the farmer as an annoying weed, is now becoming just as popular as a soil-renovator. A little of it has been scattered in the Wet Belt in the past two years, with rather doubtful results. To get a stand, one must before sowing mix the seed with suitable bacterial culture or with the soil from an alfalfa-field. The writer knows of only one alfalfa-field in the Wet Belt, and that is on the Olsen Ranch, between Chilliwack and Munro. There is also a patch of about an acre on the Grimmer Ranch, Pender Island.

FORM IN WHICH THE CROP IS PRODUCED.

Since the nights in British Columbia are cool, the bees are generally driven out of section supers during the hours of darkness, unless, by means of packing or dead

air-spaces round the supers, radiation of heat is prevented. This cessation of labour naturally means a rather small honey-crop, so those who are raising honey for the market find it most profitable to work for honey in the extracted form.

As regards price, the comparative merits of the two forms may be seen at a glance. A section usually has about 12 to 14 oz. net of honey, and sells wholesale

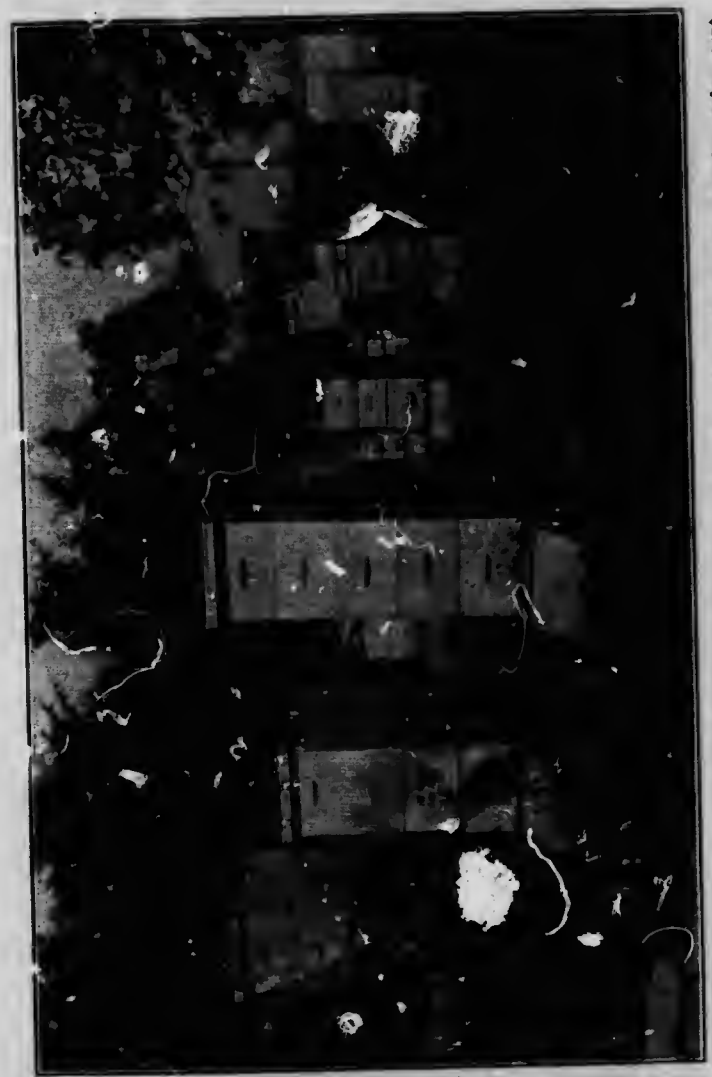

Fig. 2. Apiary of Sprott & Schou, Burnaby Lake, at the end of the honey-flow. In 1914 forty colonies, spring count, averaged 97 lb. of honey. Only four swarms.

at 20 cents. After deducting 2 cents for the cost of section and starter, we find the honey is worth to the producer 20 to 24 cents a pound. The weight of extracted honey in a half-pint jar is 12 oz., for which 20 cents is got wholesale. The jar costs 6 cents, so the bee-keeper gets 14 cents for the honey, or at the rate of 18 cents a pound. In warm climates it is generally held that when two colonies of equal

strength are working side by side, the one for extracted, the other for section honey, the section honey-crop will weigh at least one-third less than the extracted one. The increased price of section honey therefore simply equalizes the money value of the crop for two equally strong hives. But our cool nights will probably lower the proportions still lower, so that on the average section honey will be produced at a loss.

MARKET PRICES OF HONEY.

In the past from 40 to 60 tons of honey a year have been imported into British Columbia, chiefly from the Pacific Coast of the United States; in addition, a considerable quantity has reached the Province from Ontario. Extracted honey in bulk from any outside point costs at least 12½ cents laid down in Vancouver, and this is the basic point from which we must estimate all prices. The grocery-stores prefer most of the honey in a package that will retail for 25 cents, and so most of the sales are in a half-pint jar, United States measures, which has a fluid capacity of 8 oz. The honey in such a jar weighs 12 oz. nearly. The wholesale price to the grocer is 20 cents, freight prepaid. The jar costs 6 cents, leaving 14 cents to pay the bee-keeper for the honey, freight, and the labour of packing. In estimating the value of larger packages, the simplest way is to figure the honey at 17 cents a pound, and add the cost of the jar. Thus a quart jar, which holds 3 lb. of honey, should wholesale at 51 cents, plus 13 cents, for the jar, say 65 cents. This is about the price usually paid for small lots at the city market, Vancouver. The grocer will probably retail the quart of honey at 85 cents. From the above data any bee-keeper can readily calculate what to charge local customers who bring with them the container for the honey.

Friction-top tins are much cheaper than jars, and recently the larger producers are packing the honey in them.

SEASONAL DEVELOPMENTS.

In the southern part of Vancouver Island the bees have occasional flights in January and February, but it is not until about the 20th of the latter month that they fly freely, and by that time the willow is in bloom, so that pollen is often carried in during the last week. Nanaimo reports free flight early in March, but Comox is later by a few weeks. Willow is plentiful in all regions.

From the Delta up to Mission free flight is usual in the first week of March. At Revelstoke it is after the middle of the month. All along the Fraser River willow is plentiful.

In the Okanagan and other Dry-Belt regions the date of free flight varies from the 1st to the 15th of March. At Vernon the first pollen is carried in about March 12th. However, from several districts of the arid region there comes a complaint of the lack of pollen in the spring, so that it will be probably advisable to provide a substitute in the form of pea-flour, according to the methods described in a later chapter on feeding. In contrast, Rossland reports a plentiful supply of pollen.

In most regions dandelions and fruit-blooms follow the willow; in fact, one rancher wants to know how to get rid of the first named, a rather unusual request from a bee-keeper. The writer would like to oblige with a remedy, but though he wrestled with the problem for several years and consulted many experts, the only conclusion he arrived at was this: the more thoroughly he mowed the lawn, the quicker it developed into a dandelion paradise. Therefore, like a child, he learned to love the glorious display of yellow; as a bee-keeper, he welcomed the blossoms.

Clover and snowberry bloom about June 1st, but it is not until about the end of the month that the bees begin to get surplus honey. As fruit-blooms are over about the last week in May, there is frequently quite a dearth of nectar for several weeks, but pollen is more than plentiful. It is at this time that many a honey-flow is lost unless sugar syrup is fed to keep up brood-raising in the hives, so that the colonies may be strong when the flow of nectar does start. Similar conditions would seem to

obtain along some parts of the Fraser River, but, on the other hand, there are many square miles of territory where the maples are so plentiful that strong colonies should secure a surplus. In the irrigated fruit regions there is apparently no break in the flow of nectar, so that brood-raising is continuous after it once starts.

On Vancouver Island the honey-flow is over by the middle of July. Like conditions prevail in the purely clover regions of the Lower Mainland, but wherever fireweed abounds the flow lasts into August.

In the Okanagan and similar regions it would appear that surplus honey is got from the fruit-blooms. The flow from clover ends with July.

HONEY-DEW.

Honey-dew, which is usually considered to be an excretion from aphides and certain scale-insects, is in some years very plentiful on Vancouver Island, and is freely gathered by the bees in the absence of nectar. It is considered very poor winter stores unless the bees are fortunate enough to have an occasional flight in December and January. It is very dark in colour, and when mixed with the honey in the supers impairs both its colour and flavour. It occurs also some years along the lower part of the Fraser River, but in the Dry Belt it is practically unknown. It would appear to be most plentiful in the fir-tree regions and where cottonwood abounds.

HIVE PREFERRED.

The ten-frame hive is the standard recommended by the Inspectors. The Langstroth hive is practically the only one in use.

CHAPTER III.

Starting Bee-keeping.

To learn the art of bee-keeping, one must keep bees. It is not enough to buy a colony and trust to luck for the outcome; the owner must learn to *keep* bees; that is to say, have them at the end of some definite period, say twelve months or five years, or longer. The beginner in bee-keeping must realize that bees are just a variety of stock, like cattle, hogs, or chickens, and, like them, must be taken care of; therefore he must learn about bee needs and bee habits, so that in times of necessity he can give the little aid that is required to tide them over the period of trouble. Too many beginners assume that bees need no care, that they will work for nothing and board themselves, yielding profit in the form of honey, and multiplying their kind several times in the course of a single season, so that by the investment of a few dollars in one hive there will in a very few years result a good-sized apiary that has easily paid its way out of surplus honey.

The actual facts do not correspond with so rosy a picture. Without doubt, bees will pay better returns for the capital, time, and labour invested than any form of farm enterprise; but the big returns are got, one year with another, as the result of knowledge and skill judiciously applied. It is undoubtedly true that in most years bees reproduce themselves prolificly by means of swarms; but this is Nature's way of compensating for a high death-rate in normal conditions, so that there will generally be in an average of years just about the same number of colonies in a certain locality. Any permanent increase must be brought about by the skill of the bee-keeper.

Again, the production of surplus honey is not the reason for the existence of the colony; this result is due to the manipulations of the apiarist. In a state of nature, what would be surplus honey is transformed into more bees, until the hive is overflowing, when it divides, often several times, into duplicates of itself. Bees, we thus see, make honey, and then out of the honey make more bees. So the colony that

sends off swarms is not always a honey-producer that season; hence the bee-keeper who is working for surplus honey is generally endeavouring to find a sure method for the prevention of swarming.

The purpose of this book is to set the beginner in bee-keeping in British Columbia on the right track, but he is advised to see, if possible, an experienced apiarist open and examine a hive, if for no other reason than to gain confidence in himself, so that he may do slowly and methodically what he is tempted to rush rather hastily. A slow man usually makes the best bee-keeper.

Fig. 3. Apiary of Miss Gillander, Ladner. In her second year of bee-keeping this young lady managed sixteen colonies, securing 1,000 lb. of extracted honey.

HOW TO START BEE-KEEPING.

In most regions the best time to begin bee-keeping is in the end of April or the beginning of May. Not only is it near the commencement of the honey-flow, which in this Province is mostly from white clover in July, but the risk of loss through the death of the colony is at the minimum. Of course, the novice is ignorant of what constitutes a good colony; but if he buys a hive in which the bees are clustering in

six spaces between frames on May 1st, he will get one in first-class condition. He should buy only one hive, for he will learn as much in the first year from one colony as from twenty, while if he lets them run themselves his financial loss will be at a minimum. The man who cannot take care of one colony and its increase in one season is lucky to learn his inability at small cost. After the first season, only such money as the bees have actually earned should be invested in increase. A little experience will soon show that every colony on the stand at the beginning of winter will represent an actual cash outlay from $8 to $10.

The novice should not be tempted to buy a colony housed in a soap-box or similar makeshift; in fact, such a combination means endless annoyance to any one not an expert; but he should see that he gets a modern hive in good physical condition, free from cracks and loose joints.

THE HIVE TO CHOOSE.

There have been fashions in hives, but the bee-keepers in British Columbia are almost unanimous in preferring what is known as the Langstroth hive, with ten frames. There are other hives in use; a few men on the Mainland use the British standard, while on Vancouver Island there still linger examples of the Gallup hive, which is about 14 inches square and deep. There are also in use a few hives about half an inch longer than the regular Langstroth. Modern bee-keeping demands that all frames be interchangeable, hence the beginner will be wise to start with a standard size and so avoid future annoyance. A factory-made ten-frame Langstroth hive is usually of ⅞-inch lumber, and is 20 inches long, 16 inches wide, and 9⅝ inches deep, outside measurements. If home-made, it will probably be of ¾-inch lumber; hence the length and width will be ¼ inch less than the sizes given above. It is, however, the inside dimensions that count. These are: Length, 18⅝ inches; width, 14⅝ inches; depth, 9⅝ inches.

When possible, it is wisdom to have the bargain include the delivery of the hive and placing it in position, as this foresight will in all likelihood evade many stings, and ensure the colony being placed in a suitable location—that is, one sheltered from cold winds.

COST OF FIRST SEASON.

The cost of a venture in bee-keeping should not be much over $20, made up thus:—

Colony	$10 00	
Smoker	1 00	
Bee-veil	75	
Bee-gloves	40	
		$12 15
New hive for swarms, complete	$ 3 50	
Supers, say	5 00	
		8 50
Total		$20 65

The above prices are not the lowest possible, but a fair average. If uncontrolled swarming be permitted, more new hives may have to be bought, running up the total cost to not more than $30.

LOCATION.

The location of the bees in the yard is important. The hive should be sheltered from cold winds in the spring months; hence, in most regions it should be shielded on the north by a fence, clump of shrubs, house, or barn. On the other hand, in the summer months there must be free circulation of air all round; therefore the hive must be at least 6 feet from the fence or building. The position of the entrance is not really important, but it generally faces the south, so that the sun's rays in spring

will send warm air into it, while as the end of the hive warms up the heat will circulate between the frames. When the doorway faces east or west the noonday sun heats up a side, warming up a comb next to it, but not affecting in any way the middle frames, on which the bees are apt to be clustered.

The hive must not rest on the ground, as the moisture will rot the bottom board. So far as utility is concerned, a couple of pieces of rough 2 x 4 lumber are as good as anything. If the ground is uneven, it must be made perfectly level, for perfect combs cannot be secured if the frames are off the plumb. During the rainy season the back end of the hives should be raised an inch or two, so that water may run freely off the alighting-board.

CHAPTER IV.

Tools and Dress.

The tools essential for the practice of bee-keeping in a small way are neither numerous nor expensive, consisting practically of a smoker and a hive-tool. The latter may be disposed of in a few sentences, so will be dealt with at once. Its principal use is to force apart the frames, which are generally glued together by an adhesive known as propolis. As any piece of flat and light metal is fit for this simple work, we find the majority of bee-keepers are content to use a screwdriver or a wood-chisel an inch wide in their ordinary work. But once in a while one must

Fig. 4. Root hive-tool.

scrape away the accumulations of wax and propolis from the frames, or the deposit of dead bees and other waste matter from the bottom boards, so that a tool with a scraping-edge is a great convenience. Many hive-tools have been invented, but after trying about a dozen the writer pins his faith to the Root tool, which is illustrated in Fig 4. The bent end is used for scraping, the straight one for separating frames and hive-bodies.

THE SMOKER.

Bees have an instinctive dread of smoke, probably due to the fact that their natural home is in the hollow trunk of some forest tree, where the greatest danger that can threaten is fire. Safety lies in flight, and so when fire threatens the bees

gorge themselves with honey and endeavour to reach some region outside of the danger zone. This we know; that if we drive smoke into a hive the inmates proceed to lap up the honey in the cells and ignore the bee-keeper when he proceeds to break up their home by removing the frames.

The smoker of to-day consists essentially of two parts, the bellows and the stove. Figs. 5 and 5A illustrate types on the market. In the first the grate is below the fuel, in the second it is above. The latter works nicely for a while, but soon the grate becomes clogged and the smoker is out of business. The writer therefore recommends the one with the grate below the fuel, which is shown in Fig. 5.

The stove is fed with any substance that will burn slowly and give off pungent smoke. Cotton or linen rags—never woollen—are very good, so are pieces of old sacking, especially if weather-worn. The writer has found an old tent, so rotten that it tore easily, a very suitable form of fuel. Greasy cotton-waste is excellent, and can usually be had for the asking at any factory or printing plant. Many bee-keepers use the prunings from fruit-trees once they are thoroughly dry, but they give off a great deal of a tarry substance the writer does not recommend their use.

Fig. 5. Fig. 5A.

The smoker is started by placing a small piece of burning rag on the grate at the bottom, then this is fanned into flame by working the bellows gently. At intervals more is added, until the stove is too hot to touch, and then the full loading is done. A good smoker should keep alive for several hours without attention, when not in actual use, and be ready for business after a few puffs with the bellows. When in steady demand it should always be stood on end, so that a slow draft is passing through the stove all the time; if not wanted for some time, it should be laid on its side so as to secure very slow combustion.

DRESS.

The sweet stores of the honey-bee are exceedingly tempting to many forms of animal life; therefore Nature provides her with a very efficient weapon of defence, not offence, in the shape of a sting, so whoever desires to rob the hive of its toothsome treasures must be protected against the little javelins. Ordinary clothing is a sufficient covering, so far as it goes, but in addition the head must be shielded, while with most people the hands are all the better of being protected. Many experts rarely use gloves, having attained a stage at which a sting gives little annoyance; but, as a matter of fact, the writer finds that much of the poor bee-keeping he has come across is largely due to the dread of stings. When a man has to lay off work for a couple of days because of a sting in his wrist, and at the same time does not know how to get perfect protection, he can scarcely be blamed for leaving his bees

alone as much as possible, even if neglect means the loss of half the crop. The beginner will therefore be wise if he provides himself at the very outset with a really sting-proof costume. Such a one is shown in Fig. 6, and is the invention of one of the biggest bee-keepers on this continent.

Essentially the dress consists of a blouse, to which is attached an upper part of white netting, this being faced with a square of black mosquito wire gauze. The simplest way to make this suit is to buy a cotton nightshirt two or three sizes larger than is ordinarily worn, cut off a part above the shoulders and another below the waist. From the latter portion make extensions of the sleeves so that they will reach down a little below the knuckles, then cut a hole in the side for the thumb and run a shirr of elastic round the extreme end. The lower part of the blouse is taken up with a string hemmed in the edge, so that the blouse can be tied round the wearer's waist.

Fig. 6.

Fig. 7.

The black wire netting in front of the face is about 8 inches square, preference being given to a mesh of eight wires to the inch as permitting clearer vision. To prevent the wire from cutting the white netting, it is edged with strips of oilcloth 1 inch wide. These are doubled over the edges, then sewn very slowly on a sewing-machine.

Netting such as is used for window-curtains is the best material for the upper part of the suit, as it permits of the free circulation of air round the neck and head. It should be quite loose at the back, but not in front, for the closer the wire netting is to the face the better one sees. The upper edge of the wire should reach the brim of the hat, for if it does not the sun's rays will strike the white netting and irritate the eyes. The black netting is sewn into place with the sewing-machine run slowly, before the white netting in front of it is cut away. The upper edge of the cloth netting has, of course, a piece of elastic hemmed in so that it can be fastened to the broad-brimmed straw hat.

The extension pieces that protect the hands are made sting-proof by being coated with a thin layer of paraffin-wax, such as is used for covering home-made preserves, which is easily applied by means of a hot flatiron.

Fig. 6 shows the suit in use; Fig. 7, how the face-protection can be lowered, so that the wearer can take a drink or mop his brow.

GLOVES.

With this suit a pair of gloves can be slipped on when wanted. In some regions there are on the market thin gloves of sheepskin that have a glossy surface which is a safe protection from stings. When these are not available, one must buy what

Fig. 8. Bee-glove.

is on the market, preference being given to a pair with glossy surface, but, of course, any glove may be made sting-proof by coating with paraffin-wax or the least possible quantity of linseed-oil.

BEE-VEIL.

Most bee-keepers use the ordinary veil, extending from the hat to the shoulders. This style can be bought in any store that carries bee supplies. It is very tender,

Fig. 9. Bee-veil.

easily torn, and not to be recommended where one has to work [illegible] low-branched trees. The lower edge in front should be drawn down tight and fastened to vest or a suspender with a safety-pin. When this veil is worn the gloves [illegible] must be long

sleeved, so as to protect the wrists. These are shown in Fig. 8. They are generally too thin to ward off stings, but a very thin coating of linseed-oil will make them sting-proof, though rather stiff.

The lower openings of the trousers must be closed either by bicycle-clips, pieces of string, or by tucking them into the socks. Boots are, of course, preferable to shoes.

LADIES' COSTUME.

A famous lady bee-keeper thus describes her costume: "A shirt-waist with some light-weight worsted skirt makes a very good work-dress. Under this I wear a divided skirt made of the same material as the dress. A pair of leggings starched stiff reach from the boots to above the divided skirt, the latter being pulled well down on the leggings.

"To the top of the bee-gloves is sewn a pair of sleeves, usually cut from a man's worn-out shirt, having them long enough to reach well up over the shoulders, where they must fit rather closely so that bees cannot crawl inside. These are fastened together with a piece of white-rubber tape, 1 inch wide and 4 or 5 inches long, sewing each end of the tape to a sleeve. Fasten in the same way in front, only instead of sewing one end of the tape to the sleeve, work a button-hole and sew a button on the sleeve. In this way your sleeves and gloves can be slipped on or off quickly, and are perfectly safe so far as stings are concerned. A big apron with a couple of good-sized pockets finishes up the suit.

"Then, if you have a good bee-hat with a veil sewed securely to the edge of the brim, and a rubber cord run in the bottom edge, and pull the veil down tight in front, and fasten with a safety-pin, I think you may feel pretty secure from stings, and not suffer very greatly from the heat."

CHAPTER V.

Hives.

The beginner in bee-keeping ought at once to get acquainted with the parts of a hive, also the principles that are involved in its construction. On seeing one for the first time, he might be tempted to assume that the structure in which the bees are housed is a solid piece of carpentry, but examination will show it consists of at least a dozen movable pieces, and even this number is increased in the active months of the year—June, July, and August.

Let us suppose that the reader and the writer are going to examine a hive together, and that the latter is going to explain things a little as the inspection proceeds. We will therefore start with a modern hive on the stand, and since we are not side by side in reality, the writer will bring photography into play, and, as far as possible, illustrate each feature that is deemed worthy of notice.

First, we get the smoker agoing, then put on our bee-suits. All being ready, we stand alongside the hive, which will appear as in Fig. 10—that is, if it is a ten-frame Langstroth. Looking at it even casually, we observe that, like a dwelling-house, it has a roof, side-walls, and a foundation. These three are definite and distinct parts; furthermore, they are essential features of every modern hive. If you take hold of the roof you will find it to be removable, sometimes with a little difficulty, as the bees have a habit of fastening it down tight to the walls with propolis, so as to prevent the escape of heat from the interior. Just keep this little fact in mind, for as we proceed with our investigations we will learn the reasons for the bees' desire to keep warm the inside of their home. Fig. 11 shows the hive-cover removed. So far we have not seen the inside of the hive, because on lifting the cover we find a cloth quilt just underneath. This may be made of any kind of fabric that will retain heat, but ordinary table oilcloth is generally preferred, with the glossy side turned

down, because the bees will attack fibres of ordinary cloth and carry them onside. It is, however, a good plan to put a piece of ordinary cloth, such as a double layer of sacking, above the oilcloth quilt.

Our next step is to remove the quilt. The interior of the hive is now presented to our gaze; at least, we see the tops of the frames from between which, if it be in late spring or summer, thousands of bees are appearing and covering the upper part. Fig. 12 shows the frames.

We will now have a chance to learn something about the temper of the insects in this particular hive, for if they are good they will not offer to fly, but if they are bad they will run round and fly off, some at us, some at the hive entrance. Now is the time to use smoke to keep them in subjection; how much will depend upon circumstances, but never any more than is necessary. In the case of a colony known

Fig. 10. Eight-frame hive.

to be irritable, it is usually necessary to give a puff or two into the hive entrance before removing the cover, but with gentle bees a few puffs across the frames, never down through them, will be sufficient. In spring and autumn when the colonies are weak in numbers it is often unnecessary to use smoke.

Before touching anything we will examine the arrangements a little. The frames are ten in number, jammed tightly together and against one side of the hive. If we measure them we will find that they are spaced 1⅜ inches from centre to centre, and since there are ten of them, they will occupy exactly 13¾ inches, thus leaving a clear space of 1 inch on one side of the hive. Part of this is filled by a piece of plain board about ⅛ inch thick, with a top bar like a frame, and is known as a follower, though occasionally it is called a division-board. In use it is pushed

tight against the last frame. We are now ready to proceed with the examination of the internal arrangements of the hive, and while doing so we will adhere to a few simple rules.

First: We will never stand in front of the hive, for there is the bees' roadway, and they will resent our presence, even to the point of stinging.

Second: We will never put any frame or other part of a hive in front, for the same reason.

Third: We will not have more than one frame at rest outside of the hive at one time, but this rule will not forbid us having another one in our hands.

Fourth: We will take care that we leave all frames in the same order that we found them and turned the same way.

Fig. 11. Showing quilt.

Fifth: We will be very slow in all our movements, never dropping a frame into position, but placing it exactly where it belongs, because bees are very nervous creatures and the slightest jar will cause them to fly off the frames and show fight.

Sixth: We will avoid killing a single bee, not only for humane reasons, but because in a bee-hive an injury to one is an injury to all, therefore the death must be avenged.

Our first work is to remove the follower that occupies the space between the frames on the side of the hive. Very probably it will be glued to the frames with propolis, so we insert the hive-tool between frame and follower, pushing aside the bees gently if in the way: then with easy pressure we pry the board apart from the frame, first at one end and then at the other. The follower is now removed from the hive and set to one side, or at the end of the hive. We can now reach the first frame, which is apt to be clear of bees, excepting from May to September. As before,

we break the glue adhesion with the hive-tool; then lift the frame with both hands, one at each end bar. Should bees be clustered where the fingers will grasp the top bar, then gently puff a little smoke on them and they will quickly scurry away. Remember it is such little tricks as these that make hive manipulation easy and prevent the bees becoming ill-tempered. Lift the frame straight up, with your back to the sun, and proceed to examine it. Fig. 13 shows the operation.

The frame we find is made of four pieces of wood, known as top bar, bottom bar, and end bars. The first is 19⅛ inches long*, the second is 17⅝ inches, while the other two will be about 8½ inches, depending on the thickness of the top bar. The

Fig. 12. Showing frames.

full depth of the frame is 9⅛ inches. The projecting ends of the top bar rest upon rabbets cut into the end pieces of the hive. The frame proper, it should be specially noted, is ⅝ inch shorter than the inside length of the hive-body, so that between the ends of the frame and the hive there is a space of a little over ¼ inch. Modern bee-keeping is based on this vacancy, for until the Rev. L. L. Langstroth discovered that the bees will fill up a space less than ¼ inch wide with propolis, and build comb in one larger than ⅝ inch, a movable frame was impossible. A bee-space then is one that is not less than ¼ inch, nor more than ⅝ inch. It is important that this fact be remembered, for it has much to do with practical bee-keeping, and is the reason why it is better for the bee-keeper to buy factory-made goods than to attempt makeshifts of his own construction.

The inside of our frame is filled with wax comb, which is made up of an innumerable number of cells, at least 3,000 on each side. In these cells is stored the food-

* Some manufacturers are now making the top bar only 18¾ inches long, so that there may be a bee-space round the end of each bar. When such top-bars are used spacing staples must be driven into the side bars, otherwise the frame will drop out of place.

supply of the colony; in them are laid the eggs from which develop the young bees, the whole time from infancy to maturity being spent in such narrow confines. Then in the cold days of winter, when all activity in the hive practically ceases, when the individual members huddle close together to keep each other warm, each empty cell may be filled with an insect so that no space shall be unoccupied. The interior of a bee-hive is a wonderful utilization of a limited area, down to the minutest detail, and it is hard for most people to realize that in a capacity of about 2 cubic feet as many as 50,000 bees will carry on all the activities of their life, for here is at once a pantry, kitchen, incubator, nursery, living-room, and bedroom for them all.

Fig. 13. Examining a frame.

But let us investigate our comb a little more, and first we will probably notice that there are at least two different sizes of cells, one series in the upper part of the frame, running about five to the inch; another kind, generally in the lower half of the comb, that are a little larger, running about four to the inch. In the smaller cells the worker-bees are raised; in the larger the drones, who are the males, spend their days of infancy. Both kinds of cells are used when necessary as storehouses for food. In a well-managed hive the worker-cells vastly predominate; in fact, all good bee-keepers strive to keep the drone-cells to the lowest possible number. Drones are essential to the welfare of the apiary, but an unlimited quantity of them means a waste of valuable space and food, for they are consumers only. Fig. 14 shows the two kinds of cells side by side.

We will now proceed to examine the next frame, [illegible] we will dispose of this one by setting it on the ground, leaning it against t[illegible] of the hive. As before,

we will break the gluing between the frames. Since it is May it is probable the colony is strong enough to cover six frames, so that this one may have thousands of bees on both sides, while the weight suggests that the cells contain something. They do, for the centre of the comb is filled with young bees in all stages—eggs, larvæ, and sealed brood; these surrounded by a band about an inch or two wide of pollen, while outside of that, especially at the top and ends, is honey. Quite a neat arrangement, you see, so as to have everything handy; nursery in the centre with the food all round about. But stop a minute; all the other frames are arranged exactly the same way; so think a little and you will realize that the brood-nest is a ball, with, of course, the most brood in the centre frame, the least at the sides. Now you will understand why you should not disturb the order of the frames when you examine a hive, as changing the arrangement will upset the brood-nest. This is why you are advised never to set more than the first frame outside of the hive, just to prevent yourself getting mixed up as to their order. The bee-keeper's business is to help the bees, never to hinder them.

Drone-cells. Fig. 14. Worker-cells.

SHAKING BEES OFF THE COMBS.

Maybe the comb is so thickly covered with bees that careful inspection is impossible, in which case hold the frame above the hive, raise it slowly about a foot, then lower it quickly, finishing up with a sudden jerk, when practically every insect will drop on the frames.

Fig. 15 shows the position of the frame at the end of the operation. It is not considered wise to shake the queen off the combs at the season when she is laying heavily. Another way, which the writer prefers, is to hold the frame perpendicularly by the end of the top bar with the left hand, then with the right hand clenched hit the left a smart blow from above (Fig. 16). The comb being free from bees, turn your back to the sun so that its rays shine into the cells. Along the upper part of the frame and at the ends the cells will probably be all sealed, the cappings, as the coverings of the cells are called, being flat, often sunk and wrinkled. Such sealing indicates the presence of honey. On the edge of this region there will likely be a narrow belt of unsealed cells showing the honey, indicating that the bees are using up their stores to feed the young. When we reach the bottom board in our investigations we shall find lying there a brownish-looking deposit, like coarse dust, but which is really the fragments of comb-capping torn from the cells.

POLLEN STORES.

Next to the open cells with honey comes a narrow band of cells, filled with a brilliant-coloured solid substance. This is pollen, the bee-bread of our forefathers, which is the male principle of plants, and forms part of the food of the young of the bee while in the larva or maggot stage.

THE BROOD-CELLS.

In the centre of the frame we find the brood in all stages—egg, larva, and cocoon. The last is sealed over, just as is the honey, with this difference, however, that the cappings are slightly raised in the case of worker-brood, decidedly so with drone-cells. The larvæ or maggots are easily seen, coiled up in the bottom of the cell, especially after they are three days old, but the eggs are harder to distinguish on account of their small size; in fact, they look like very short bits of white thread attached to the far end—that is, the bottom of the cell. It is just as well for the beginner to learn to detect the presence of eggs in the comb, for an evenly arranged patch is pretty good proof that the queen was busy at least three days ago.

Fig. 15. Shaking bees off frame.

Fig. 16. Knocking bees off frames.

HOW TO REVERSE A COMB.

A frame has two sides, so you had [illegible] look at the other one too. Your most natural impulse will be to cant the fra[illegible], but don't do that, for as you tilt it up to the level the weight o[illegible] comb [illegible] break it away. Try it thus: Lower one hand, say the right, [illegible], the top b[illegible] pendicular (Fig. 17); turn the frame half-way round, using the top bar as [illegible] (Fig. 18); then raise the hand that was lowered (Fig. 19). Your frame is now upside down with the second side towards you. Here is another method that can be carried out without a pause: Let the lugs of the frame rest on the middle fingers of each hand, these being bent towards the chest. Turn the comb end for end by swinging the left hand to the right of the right hand, then swing the comb up to the position shown in Fig. 19. To get to the original position, reverse the movements.

REPLACING FRAMES.

When through with this frame, replace it in the hive, pushing it tight against the vacant side. There is no excuse for placing it on the ground. If you have changed it so that you have forgotten which is the front end, just look at the brood, for the bees prefer to have their young towards the entrance of the hive, but the honey at the rear. When you have examined as many frames as you want, push them over to their original position by putting the hive-tool between the side of the

Fig. 19.

Fig. 18.

Fig. 17.

hive and the end bar of the frame and using it as a lever. Now insert the frame first taken out, pushing it into place, then the follower. Many bee-keepers insert a wedge between the latter and the wall of the hive, but this is not necessary, excepting when the hive is to be moved in a vehicle of some kind.

THE BOTTOM BOARD.

The foundation of the bee-home remains to be examined, and to do this we must lift off the hive-body. Where shall we place it in the meantime? Certainly not on the ground or any other flat surface, as there we might mash bees. A good support is a shallow empty box without a cover, so we place one handy and set our hive across it. Should the bottom board be glued tight to the body, insert the hive-tool between the two at a rear corner, then with a slight twist force them apart.

We now find that the bottom board—so the foundation of this bee-house is called—is of the same width as the hive, but a few inches longer, the projection being in front so as to form a landing-place for the bees. Cleats are nailed to the sides and end, forming a resting-place for the body, at the same time securing a clear run for the bees underneath the frames, thus facilitating free communication in all parts. Just how high these cleats shall be depends on the judgment of the bee-keeper. At one time ⅝ inch was usual—a bee-space, in fact—but in recent years the pure-air agitation has influenced bee-men, and so we find most of them preferring cleats at least an inch high, while some have gone as far as 2 inches. Here is the point: Bees breathe, so they must get fresh air, and this enters only through the doorway, the foul air being expelled through the same channel. A fixed shallow entrance leaves no room for extension, whereas a deep one can be readily contracted at any time. But the big space under the frames is a great temptation to comb-building, especially during the honey-flow season. Bee-keepers differ on many details; this is one of them; but in the meantime the tend is towards giving plenty of room for the admission of pure air. On the surfa bottom board there will likely be lots of waste matter, such as comb-capping dead bees, and all of it should be scraped away.

THE HIVE-STAND.

Lift the bottom board and see what it rests on. Its life is dependent on the absence of two enemies, water and ants; therefore the bearing surfaces of the supports should be as small as possible. Contact with bare earth is very, very bad. Four bricks, one at each corner, are good, so are a couple of pieces of unplaned 2 x 4 lumber a little longer than the width of the hive, one placed under each end of the bottom board. As has already been said, the bottom board must be perfectly level across the frames, but a little higher at the back. No vegetation of any kind should be permitted to grow above its level; better still, destroy it entirely, as all growth interferes with the flight of the bees.

Our first excursion through a bee-hive has been quite a long one and has disturbed the arrangements of the inmates not only to a considerable extent, but possibly to the injury of the young, for in May it is a rather extensive incubator where as many as 10,000 eggs are being hatched, while 50,000 young bees are being brooded. An open hive means the loss of heat; therefore we resolve that in future we will do the necessary examinations as speedily as possible, and never lift the cover unless the shade temperature is about 65 degrees, or warmer.

CHAPTER VI.

The Bee People.

From the dawn of history the greatest intellects have found a fascination in the study of the inmates of the hive, for here is a form of society which closely resembles that of human beings. Only in recent times has its actual organization been understood with all the marvellous activities that are carried on night and day. The subject is an entrancing one, but this is not the occasion to enlarge upon it; our business at present is to become familiar with such facts as will lead to success in our aim, which is the production of surplus honey.

The inmates of the hive are of three kinds—queen, worker, and drone. The queen is not the ruler of the colony, as was for centuries supposed, but is the mother of a big family. Her sole function is to lay eggs, her capacity being literally thousands every twenty-four hours. From October to February she lays very few, but with the advent of the first pollen from the willow in spring she resumes her activity, laying eggs as fast as the worker-bees can take care of them. About May 1st the colony becomes strong enough to permit her to develop her full gait, and this she will keep until the honey-flow in July deprives her of the use of the cells. In the fall, as the cells are emptied, she resumes her laying for a few weeks to provide bees for the winter, then enters upon her period of rest.

THE WORKERS.

The worker-bees are undeveloped females. They are hatched from a fertilized egg just like a queen, but at the end of the third day of the larval stage they are put upon a less nutritious diet which retards the development of the sex-organs, hence

Fig. 20.

Queen. Drone. Worker.

they are unfit to become mothers. Their business is to carry in nectar, pollen, and water, incubate the eggs, feed the larvæ, do the scavenger-work of the community, ventilate the apartment; in fact, do anything useful that happens to be necessary at the time. In the period of flight they live about six weeks, their short career being due to their intense industry, but those hatched in September and October generally last until April, when their successors appear on the scene. Broadly speaking, the main effort of the community is to have as many producers as possible during the honey-flow, and as few consumers as will keep the community going during the period of dearth.

THE DRONES.

The drones are the male members of the colony. They are called into existence in late spring in preparation for the mating season, and are mercilessly exterminated

at the end of the honey-flow. From their structure they are unfit to gather nectar or pollen from blossoms, so the bee-keeper considers them as merely consumers, and rather costly ones at that; therefore he limits their number as closely as possible to the actual needs of his apiary. By the use of wax foundation in the brood-frames he prevents the building of drone-cells; should the bees outwit him, he cuts the drone-comb out of the frames.

The mating of a queen with a drone occurs usually only once, when she is but a few days old, the event taking place in the air. When she makes her marriage flight, she flies swiftly away from the hive pursued by thousands of drones, the swiftest of them being the winner of the race; but he pays for his success with his life, for she deprives him of the sex-organs, rupturing his abdomen so completely that he expires almost immediately. As the result of the intercourse, she is able to fertilize the hundreds of thousands of eggs she may lay in the course of her life, which may endure from a few weeks to several years.

Worker-bees are produced from eggs that have been fertilized, but drones are raised from eggs that have not been impregnated. These, therefore, have no father: consequently, any queen that has failed to mate, and this is not very unusual, will be the mother of drones only. Such an one is known as a drone-laying queen.

DEVELOPMENT TABLE.

The following table shows the duration in days of the various stages of development of queen, worker, and drone:—

	Egg.	Larva.	Pupa.	Total Time.
Queen	3	5½	7	15½
Worker	3	5	13	21
Drone	3	6	15	24

From the start the novice will know the workers, as in suitable weather they are continually moving in and out of the hive. Drones appear about May 1st. They are bigger than the workers, fly generally in the heat of the day, making a loud hum, from which their name is derived. The queen never leaves the hive excepting to mate or with a swarm; therefore, to be seen she must be looked for on the frames. She is easily found in the spring months when the colony is weak in numbers, but rather difficult to find in the height of the summer. Once seen she will be readily recognized, as her abdomen is very much longer than that of the bees that surround her. Also she moves very slowly, especially when she is laying freely, as she is then heavy with eggs. There is but one queen to a hive.

For the first two weeks of her life the worker does inside work only, her recreation being a short flight along with thousands of her kind round the hive entrance in the heat of the day. These play-spells are sometimes mistaken for swarms coming off, so numerous become the young workers in midsummer. At the end of two weeks the worker becomes a fielder—that is, a provider. It is worth while to note, for it is of practical value in hive-management, that five weeks elapse from the laying of the egg to the day when the young worker carries in her first load of nectar.

CHAPTER VII.

The Cycle of the Bee-year in British Columbia.

Since bees pass the cold days of winter in a semi-dormant condition, flying freely only on fine sunny days when the thermometer is at least 48 degrees in the shade, one is tempted to consider that the bee-year will start with the carrying-in of the first pollen, which occurs in the coast regions of the Province towards the end of February—in Victoria as early as the 22nd, and in the Dry Belt a few weeks later; March 12th in the Okanagan. As the probable date draws nigh, even the oldest bee-keepers kindle with enthusiasm and watch for the first bee that is carrying the brilliant-hued pellets on her hind legs. Not only does he rejoice over the prospect of once more being active with a pleasant part of his life, but when he sees bee after bee alighting with her load he knows almost to a certainty that brood-raising has been started and all is well with the queen. If, however, he observes a hive where no pollen is being carried in, while others are busy, he is suspicious that the queen has died in the course of the winter. He makes note of all such colonies and at the first favourable opportunity, that is a day when the sun shines brightly, the air is quiet, and the temperature is comfortably warm, rapidly learns whether the colony is queen right or not. Opening the hive, he chooses a frame in the middle of the cluster, looks into the cells to discover the presence or absence of eggs or larvæ. When these are found he investigates no further, but if they are wanting he will inspect the balance of the frames. Failing to find signs of brood, he will then look for the queen, an easy task at this time of the year. If she be located, all is satisfactory; if not, the case is very suspicious, but it does not do to assume she is actually missing. But if on examination a week later the same conditions exist, then the colony should be combined with one that has a queen. (*See* chapter 16.)

ESSENTIALS IN SPRING.

The most essential features of a hive when pollen begins to be carried in are the sure presence of a queen, lots of bees, and plenty of stores—that is, honey or its substitute, sugar syrup. The lack of a queen means certain death to the colony in a few weeks. A hive weak in bees will develop strength very slowly, or dwindle out of existence, while one without stores may die of starvation or do little more than hold its own during the spring months

The food-supply is largely under the control of the bee-keeper, and at one time spring feeding with sugar syrup was strongly advocated, but in recent years it is considered that the best time to feed, when feeding happens to be necessary, for spring consumption is in the autumn of the previous year. So the modern bee-keeper, in September or October, begins to put his bees in shape for the honey-flow in July by making certain that there are at least 25 lb. of honey, or the equivalent in sugar syrup, in every colony.

A SIMPLE DIARY.

The bee-year from the apiarist's point of view begins, therefore, in September. But since we have made a little progress with the spring conditions we may as well continue. Every beginner in bee-keeping should keep a diary for the first year, at least as a guide for the future. It need not be in any way elaborate, just a sheet of note-paper lying convenient on which to make brief jottings like these:—

February 22—Willow blooms; pollen carried in.
March 13—A few dandelions; plentiful April 7.
March 15—First examination of hives; temperature, 65 degrees.
April 12—Early pears.
April 18—Early plums; pollen plentiful.
May 3—Nectar and pollen above immediate needs.

May 10—Dearth of nectar; feeding.
June 1—First clover-blossom.
June 10—Honey-flow starts.

These items are simply suggestive, as the apiarist should make it his business and pleasure to know every plant visited by bees in his locality, also their date of blooming. In most regions there are breaks in the flow of nectar, and these should be anticipated, as during a dearth brood-raising will be stopped, with serious loss at the time of the honey-flow unless feeding be done. The end of fruit-bloom often marks the beginning of one of these periods.

MARCH.

In the latter half of this month lift the hive off the bottom board and clean off the dead bees and other waste matter. The simplest way is to take a spare board, remove the complete hive, place the new board on the stand, then swing back the hive to its place. The operation takes but a minute, so there ought to be no disturbance to the inmates. The old board is now cleaned off and used for the next hive. While lifting the colony one learns roughly its condition as to stores. If light, it must, of course, be fed with as little disturbance as possible, because during this month and next the bees may cluster in a compact ball round the queen—ball her—when the frames are disturbed, and a balled queen is apt to disappear at an early date. Smoke is rarely necessary at this time, provided the bee-keeper is gentle and avoids jarring the frames when returning them to the hive.

APRIL.

In the Coast regions, during the latter half of March and the first week of this month, there is apt to be a cool spell, with cloudy or wet weather which prevents bee-flight. Brood-raising frequently comes to a stop, so that when the warm weather returns there may not be a single egg in the frames. However, as soon as pollen again comes in freely, the queen resumes her duties, laying so freely that by the 20th there is generally brood in as many as five frames. The young bees begin to hatch out about the end of the month, when they are very much needed, as the old ones that carried the colony through the winter are dying off very rapidly. In fact, for a few days at the end of April the low-water mark of population is apt to be reached; then the tide turns, the working force is rapidly added to, and almost as if by magic the frames become covered with bees. During this month the great source of nectar and pollen in most regions of the Province is the dandelion, but in some parts of the Dry Belt there is complaint of great scarcity of pollen at this time. In such localities a substitute, in the form of some kind of flour, should be provided, as described in the chapter on feeding. Fruit-blooms are a great help in the latter part of the month.

The end of April is a most important period in the development of the hive in most regions, because the bees that will work on the honey-flow will be hatched from eggs that are being laid now. They will become field-workers about June 4th, at which date white clover, snowberry, and rhamnus (cascara plant) are in blossom, the nectar of the latter two in a favourable season secreting freely about ten days later.

Brood-raising at the end of April must therefore be encouraged. Should nectar fail, feeding may be necessary; on the other hand, it may have come in so freely that the combs become honey-clogged, thus preventing the queen from laying. When this occurs it is a good plan to take from such a hive a frame of honey and exchange it for an empty one from another colony. The full comb should be placed next the side of the hive, but the empty frame right in the centre of the brood-nest, so that the queen can proceed to fill it at once. Drone-brood will probably be started this month.

Scrape accumulations of wax and propolis from the top and end bars of the frames.

MAY.

Colonies that are in good condition boost along this month at a great pace. Any hive that on May 1st shows bees occupying all spaces between frames is in fine condition, and should be given a second brood chamber above the first.

Early in the month one must attend to weak colonies if possible. If the lack of numbers is due to a failing queen, the bees may endeavour to supersede her during fruit-bloom, or she may disappear from the hive. Queens raised in a weak colony at this time are of very little value, and are almost sure to be supplanted again in June or July, provided they live that long. There is also great risk that they will fail to mate on account of the cool weather. The writer has had queens hatched out in the end of April and do all right, but the instance is rather unusual. Most bee-keepers have little use for a queen that is not raised during the normal swarming season, or in the time of the honey-flow.

In districts where soft and vine maples abound it should be possible to get 40 or 50 lb. of surplus honey if colonies are strong.

Fig. 21. A picturesque apiary. F. E. White, North Vancouver.

As fruit-blossoms cease there is often a dearth of nectar the last week of the month; in fact, up until the honey-flow starts, and unless feeding be resorted to, the colonies will dwindle rather than increase. Where broom grows there is no lack of pollen. The Dry Belt seems to be fortunate enough to have no break once nectar begins to come in.

JUNE.

This is the great swarming month. Very strong colonies may send out a swarm in the early part of the month, but most will start near the commencement of the honey-flow. The new colony has to build a set of combs, raise thousands of bees, and provide stores for the winter; hence the best time to start housekeeping in a new locality is when nectar is coming in freely.

In most parts of this continent June is the month of the honey-flow, but in British Columbia clover rarely yields until about the end of the month. The first few days the bees will deposit the nectar in the brood-chamber, filling every vacant cell just as fast as they become empty through the hatching of brood. Then comes the capping of the honey. This is the time to put on supers, and is indicated by

the whitening of the wax on the top of the frames. If comb-honey supers are put on before this, the bees often remove the foundation to use in the brood-chamber. Where an upper division of empty extracting combs was given earlier, and the intention is to run for extracted honey, nothing need be done excepting to make sure that the bees have enough room.

JULY.

All over the Province the clover honey-flow comes to an end about the middle of this month.

Ordinarily there is very little swarming after the beginning of the month, and it is well that this is so, as late swarms will simply starve to death unless fed regularly for several weeks.

All sealed comb-honey should be removed from the hive at the close of the flow, to prevent its delicate whiteness becoming soiled by the travel of the bees. Extracted honey should be left on longer, to ensure its being thoroughly ripened. When there is a second flow the crops should be kept apart by extracting the first before the other is due.

AUGUST.

Excepting in the fireweed regions, there is but little forage for bees in August, this being especially true of the Coast regions; in fact, were it not for fall dandelions and thistles, there would be practically nothing coming in. Towards the end of the month the second flow starts in the Dry Belt.

SEPTEMBER.

In the Coast districts there is no nectar. Early in the month the hives should be gone through to see how the bees are off for stores. Some bee-keepers feed for the winter before the month closes; others prefer to give half the necessary amount now, the balance a month hence. Any weak or queenless colony should be combined with another.

OCTOBER.

Before the end of the month make certain that every colony has at least six frames of honey or sugar syrup to carry it through the winter. Feeding over, the colonies should be prepared for the cold months, as described in the chapter on wintering.

CHAPTER VIII.

Swarming.

Living creatures reproduce their kind to ensure the perpetuation of the race. Generally speaking, the interest is centred in the direct descent from individual to individual, as each one in turn becomes the fountain source of a new generation. But with bees it is different, for here we have a social organism in which the factor of parentage is subordinate. There is continuity from queen to queen, but this is less important than the reproduction of colonies; that is, the fact of perpetuation is more centred in the community than in any individual. Furthermore, a queen may die and be succeeded by her daughter, without any increase in the population of the bee world at large; whereas, when new colonies are formed, there is an increase both in communities and in the total number of bees.

The bees' method of reproduction, then, is by the formation of new colonies. When the proper season has arrived, generally in June, the hives become very strong with a superabundance of inhabitants, and some fine day thousands of them rush pell-mell out of doors, circling in the air in an ever-darkening cloud for several minutes; then, as if of one mind, they settle in a cluster on a convenient object,

which is generally the branch of a near-by tree. Here they cling for quite a while, frequently hours, as if awaiting important news from somewhere; then, if unmolested, they will suddenly decamp to parts unknown, locating in a hole in the trunk of some decaying tree, and there start up the routine of the colony afresh. But in a well-conducted apiary the flight to distant regions is summarily prevented by the bee-keeper, who secures the cluster and houses it in a regular hive. Ordinarily, they accept the domicile, just as pleased as if it were of their own selection. The whole procedure is technically known as swarming.

In a hive in summer-time there are to be found bees of all ages and occupations. The very youngest are nursing the larvæ, making wax, building combs, curing the honey and capping it over; the older ones are field-workers, their business being to carry in nectar, pollen, water, and propolis. An interesting point at once arises, what is the age of the bees that form the swarm? The old queen undoubtedly leaves the hive; that is beyond all dispute; and it is believed that the greater part of the swarm consists of fielders, but there is also a fair proportion of younger ones whose duty is concerned with the inside labour. This should be so, for the best welfare of the new community.

Each bee fills her honey-sac to its utmost capacity before starting out, so that the new colony is provisioned for several days ahead, should inclement weather prevent the gathering of nectar. On arrival at the new abode, part of the swarm starts at once to clean it out; another gathers into festoons and proceeds to secrete wax; while still others collect the wax and build combs. Just as fast as cells are built the queen lays eggs in them, or the workers store honey, so that in a few days the usual routine of a bee community is established.

In the hive from which the swarm emerged there has been left quite a strong force of bees, thousands of young brood in all stages, from egg to those about to hatch, and several queen-cells, from each of which there may come out a queen. If the conditions seem propitious, the workers may decide to send off several swarms, each accompanied by a virgin queen. Since the hive has been decidedly weakened by the loss of the first swarm, the second will be much smaller, the third weaker still, and so on with the others, until the last may consist of a mere handful of bees. Such weak colonies are almost certain to die of starvation during the winter, as they are rarely strong enough to build up a numerous force and lay in sufficient stores before the cold weather sets in, excepting in very highly favoured localities.

RETRIEVING A SWARM.

(For plate illustrating this subject *see* Bulletin No. 42.)

The handling of a swarm is not a serious proposition, provided it does not settle in a rather inaccessible place. Until it does cluster nothing can be done with it; therefore it is utterly useless, so far as the bees are concerned, to beat tin pans, ring bells, or otherwise make a hideous noise. Such strenuosity may provide occupation for the bee-keeper at a time when he feels he ought to be doing something to show he is in control of the situation, but he will display more wisdom if he sedately waits until they settle, in the meantime providing himself with a bushel or clothes basket—best of all, a big dishpan—and a large apron or similar covering. When the cluster is at the end of a low branch the basket is held close under it, then the branch is given a sudden downward jerk that tumbles the bees into the basket, which is then quickly covered with the apron. For a higher branch a step-ladder is almost a necessity, sometimes one must climb the tree to reach the bees. In windy weather they may gather on a thick branch, or even on the trunk, in which case they must be brushed off with the hands. When the branch happens to be a small one the speediest way is often to cut it off. In any case, it is always as well to have a small saw handy when gathering in a swarm, to cut away twigs and sprays that interfere.

Once the swarm has been secured it is carried to the new hive, in front of which a sheet has been spread or boards laid to form a runaway. A small lot of the bees is dumped out close to the entrance, the rest farther away, or they may be left in the basket, which is stood on edge leaning against the hive-front. In a few minutes some daring spirit will venture into the entrance and soon all will follow. In warm weather it is always wise to have the cover a little raised at the back, to provide plenty of ventilation; otherwise the lack of air may tempt the bees to make a second flight. In the case of a very large swarm it is well to have an empty hive-body under the one with frames to provide lots of clustering-room.

PREVENTION OF SWARMING.

The writer wants to emphasize the non-swarming idea, for here is the crux of successful honey production. We all know that if we eat something from stock, we as a direct consequence prevent the coming of the next generation. Thus, when we eat eggs or the hen, no chickens can follow; if we eat the cow, there can be no calf; and usually, when we want milk, we kill the offspring. The swarm is the next generation of a bee colony, hence if we want honey we must prevent its coming.

The prevention of swarming is to the bee-keeper in most parts of the world a regular will-o'-the-wisp. He wants surplus honey, but he knows by experience that he will get far more from a colony that does not swarm than he will get from one that does, even with the aid of all its offshoots. Therefore he tries hard to get rousing strong hives by the beginning of the honey-flow, and to hold the forces intact all through the season.

Thousands are wrestling seriously with the swarming problem every summer, striving to understand the immediate cause. It is not enough to say it is the bees' method of reproducing the species, for all strong colonies in an apiary do not throw off swarms in the season; often the majority do not. Again, it is not a problem of sex instinct, for the queen has no desires but to lay; in fact, the decision whether to divide or not to divide the colony is determined by the workers, who are free of the sex impulse.

Uneasiness, discomfort, practically sums up the conditions that develop the swarming impulse. It is caused:—

(1.) By the want of room in the combs, and this is the most important cause of all. There must be readily accessible cells for the queen in early May if the bees are to be contented, hence the importance of giving the colony a second chamber as soon as the bees are crowding the first. To put an extracting super over a brood-chamber, but with a queen-excluder between, is no preventive, for this is giving more room for honey when there is none, while it gives no additional room for egg-laying, which is what is wanted. Once the swarming fever has developed, the only cure is swarming, so that giving additional space at this stage is too late.

(2.) By the heat of the summer sun. This is not enough in itself, but it encourages the impulse.

(3.) By the presence of an army of drones in the hive, who crowd it and make it uncomfortable. Therefore keep down the amount of drone-comb.

(4.) By poor ventilation. It is simply impossible during hot weather for a small entrance to give sufficient circulation of air to satisfy the needs of, say, 50,000 bees and about as many in the baby stage. Therefore let the entrance after May 1st be at least an inch high and as wide as that part of the combs on which the bees are clustered. In most cases this will be the full width of the hive. In the hot-weather period the brood-chamber may be pulled back or pushed forward a couple of inches to clear the end of the bottom board and thus give a free current of air under the frames.

(5.) Colonies run for extracted are very much less liable to swarm than those run for comb honey. Since extracted honey is more profitable in this Province and is produced with less labour, the beginner is advised to devote his energy to securing his crop in this form.

TO PREVENT SECOND SWARMS.

The principle involved in the prevention of second swarms is to weaken the parent hive, strengthen the swarm, and secure as much surplus honey as possible. Remove the old hive from the stand and set it in a new location, the sooner the better, as we want to catch all the bees that are coming in from the fields with nectar. Set the new hive in its place, using full foundation in the frames. Then secure the swarm and hive it in the new hive on the old stand. The bees will at once proceed to draw out the foundation into comb. If there be a super on the old colony, two days later transfer it to the new one, bees and all; but if the combs be for extracted honey, place a queen-excluder between the bodies.

The old hive has been so thoroughly weakened that it will have very little ambition to again swarm. The new colony is in possession of practically all the field bees, so will rush in the nectar. There is no room for it in the brood-chamber, since there is no comb ready, so it is stored in the super. Just as fast as the new combs are built below, the queen is ready to take possession and fill the cells with eggs. In the meantime, in the old hive, the bees will probably permit one queen to hatch out and destroy the rest. As young bees are hatching all the time, the colony will get quite strong and possibly lay up enough stores to carry it over the winter.

At one time it was thought that cutting out all queen-cells was a sure preventive of swarming, but it merely delays it. If near the end of the flow, the delay may carry it past the crisis, when the desire will vanish; but if not, then the result is rather problematical.

In British Columbia the best preventive of swarming is to give a second brood-chamber the first week of May in the Wet Belt, about the middle of the month in the Dry Belt.

CHAPTER IX.

Frames, Sections, and Foundation.

A honeycomb is about 1 inch in thickness in ordinary conditions, with a space of about ⅓ inch between each pair. In a state of nature the bees do not build them in the symmetrical form we like to get in the modern hive; the perfect comb is very largely the work of the bee-keeper. He provides a frame not the least bit like anything the bees would naturaly use; he compels them to build straight, and to start at a certain part of the top bar; furthermore, he limits their activity principally to the construction of worker-cells, permitting the luxury of a few drone-cells where the bees would make hundreds.

Uniform thickness of comb is secured by a self-spacing device on the upper part of the end bars of the frames, which are there 1⅜ inches wide. Now, the bees naturally glue together the end bars where they are in contact; therefore the smaller the touching surfaces the better. If you look at an end bar you will see that the narrow side of one is flat, while that of the other is brought to an edge. In the hive a sharp edge is intended to touch a flat edge. Since frames may be turned round, we must, in putting the parts of them together, point the sharp edges in opposite directions; furthermore, we must have a uniform way. The writer, for instance, when he holds up a frame for inspection, as in Fig. 13, has the sharp edge against the fingers of his right hand, but against the thumb of the left.

If a swarm be hived on perfectly empty frames, there is no reason, from the standpoint of the bees, why they should build a comb from the top bar of each and that truly in the centre. The bee-keeper forces them by fastening artificial foundation along the centre of the bar, and once they have begun they will naturally carry the comb straight down to near the bottom bar, sometimes all the way. Through motives of economy, many bee-keepers use merely a strip of foundation, say an inch

wide, but the present-day tendency is to use full sheets in each frame: First, to be sure of getting evenly built combs; second, to prevent the building of drone-cells. There are many conflicting theories as to how the bees decide when they shall build drone-comb, but this much seems to be true: A swarm provides worker-cells at first so that the queen may start laying, and will build no other kind for twenty-one days if she can use each cell as fast as it is made; but at the end of that time the cells first occupied are again empty, hence she may be unable to keep the new ones full, and then the comb-builders may turn their attention to drone-comb. When there is too much of this—a patch as big as the palm of one's hand is enough for any hive—it should be cut out, in the hope that it will be replaced by worker-cells. The best way, however, is to start right by using full sheets of foundation in each frame. The cost is about 10 cents a sheet, which is soon saved, since there will be no army of drones eating up much more than that value in honey, besides helping to arouse the swarming fever in the minds of the workers.

Fig. 22. Embedding wire in foundation.

The sheet of foundation is inserted into a narrow groove cut in the under-side of the top bar, then held in position by a wedge alongside of it. This wedge must be driven in very tight.

In a fine specimen of a finished frame the comb is attached to the bottom bar and the two end bars; but, unfortunately, such fine examples are not as common as they might be. Now, a comb filled with honey and brood weighs several pounds, so that there is quite a strain on the upper part; furthermore, if it be tilted from the perpendicular it is apt to break and drop out of the frame. To hold it securely in position the frame is usually wired. For this purpose the end bars are pierced with three or four holes, through which the thin wire is strung. Of course, the wiring is done before the foundation is put in. An unwired frame should never be run through the extractor.

The operation of wiring is a very simple one. Where three wires are to be used, begin by driving in half-way a couple of tacks, one beside a hole next the top bar, the other alongside the hole nearest the bottom bar at the other end of the frame. These

tacks mark the position of the two ends of the wire when it is in place. We want the wires to be so tightly strung that when the job is finished, if we pluck them as if playing a harp, they will "sing." The easiest way to secure the proper tightness is to nail a couple of cleats on the bench, whose distance apart shall be a little less than the length of the bottom bar, then spring the end bars between these two. Wiring drawn tight with a frame in this position will be more so when the frame is released. As the wire is rather inclined to kink, it is better to pass it first through the centre holes, then through the top ones, finishing off this part of the work by winding the end round the tack next the top bar. Now pass the other end of the wire through the bottom holes, draw every strand tight, then twist the end round the second tack. Remove the frame from the cleats and finish the job by driving home the tacks.

Once the foundation is in place the wires should be embedded in it by means of a wire embedder, which is a small wheel on whose rim are spurs set alternately. These straddle the wire, which is forced into the foundation as the wheel is passed along. To secure a firm support for the foundation, lay it on a piece of ¾-inch board, a little smaller than the inside dimensions of the frame.

SECTIONS.

Most beginners in bee-keeping chose comb-honey as the preferable form of the crop, probably because they hesitate to invest in an extractor until they learn what prospects there are in the venture. The production of a fine article of section-honey in paying quantities is the acme of expert bee-keeping, and that too in favourable regions, but this Province is not one of them, on account of the cool nights. The making of a section is accompanied by much comb-building, which calls for a high temperature in the super at night, a difficult matter when the outside atmosphere is cool. The production for other reasons is difficult in some parts of the Province, so that, all in all, the results from this form of honey production cannot be considered as a guide as to the possibilities of the locality or the suitability of one for the industry.

The section in general use is 4¼ inches square, the width is 1⅞ inches, with bee-way at top and bottom to give the bees free access to the comb. Of course, there are many other styles, but the one described is the one most likely to be carried in stock by local houses. A special body called a super, because it is placed above the brood-chamber, is used to hold these sections. It is 4¾ inches deep, otherwise it is the same size as an ordinary hive. A beginner is apt to be puzzled with the descriptive names given to a super, but he must remember they are got from the hive. Thus, an eight-frame super is intended to go on top of an eight-frame hive. In this surplus chamber the sections are carried in holders, a kind of frame, in fact, with separators between, whose purpose it is to secure uniform thickness and evenness of comb. A couple of springs between the last separator and the side of the super hold everything tight.

Though devices exist for folding sections—in fact, are a necessity where many thousands are used—in a small way the folding is usually done by hand. Since the joints are very thin and brittle, it is necessary to wet them a little while before they are bent.

As with frames, foundation must be used, starters at least, say, an inch wide, and very thin. Brood foundation is much thicker, but the proper kind for either purpose is carried by all dealers in bee supplies. When several thousand sections are needed, a machine will be found a great convenience, such an one as a Root's Daisy Foundation Fastener, which costs about a dollar. But where only a few are wanted the starters can be readily fastened in with melted wax. One way is to attach the starter to the top part of the section—that is, one of the sides in which is the bee-way—before the wood is folded. First, with an ordinary jack-knife cut the wax foundation into strips 3⅞ inches long and 1 inch wide; then melt some wax in a shallow dish set on boiling water; lay the sections in a pile, face up, on the bench in front of the melted wax. Now take a starter, dip a long edge in the wax for a second, then set

in position on the section. Some who can work swiftly find this plan all right, but the writer is not quick enough, for by the time he gets the starter in position the wax is set. A surer plan is to run a line of melted wax along the edge of the starter while it is in contact with the wood. Hold the starter with the fingers of the left hand, run the wax with a teaspoon held in the right hand. The most certain way is to make a special jig for the job. First, out of ⅞-inch wood cut pieces 3¾ inches square; about a dozen will be enough. Then nail these an inch apart on a board. Now you can hang the folded sections on these, upside down, place the starters in position, then run the wax along the edge. A slight backward tilt to the board is an advantage. The wax will set very quickly, but it takes a little while for it to harden, so handle each section carefully while setting it aside.

EXTRACTING COMBS.

Extracted honey is produced in ordinary combs, just the kind used in the brood-chamber. While new they are rather tender; therefore many will not use a comb for extracting purposes until it has been bred in at least one season. The colour of the comb in no way affects the colour of the honey. To get first-class combs they must be built during the honey-flow. The frame filled with foundation is placed between two old combs, either in the brood-chamber or super. We have already seen that spare sets of empty comb are of great value in May, when they come in very handy to give the queen more room.

HONEY FOR HOME CONSUMPTION.

The shallow extracting-frame is excellent where chunk honey for home consumption is wanted.

CHAPTER X.

Securing the Harvest.

Everything needed for the honey-flow in June should be got ready in May, at the latest. When a swarm is clustering on the limb of a tree is not the time to rush to town for the needed hive, yet such has happened many times in the history of bee-keeping. It is just as bad to put off the making-ready of supers until the honey-flow is on. One cannot turn the mill with the water that has gone, neither can the bees gather the nectar that was in the blossoms yesterday, but which they could not store away on account of the lack of room in the hive. Besides, they have learned to loaf and to think of swarming, both bad habits from the bee-keeper's point of view.

So be prepared for whatever may come, whether a flood or a failure. If you are running for section-honey, have for each hive at least two supers ready, filled with sections, and, in addition, have at least fifty more sections in the house. One famous bee-keeper in an ordinary region says he has five section supers for each hive ready every season, even if he finds them necessary only once in half a dozen years. Once he found that number not nearly enough.

When the flow starts the problem is to get the bees to work in the section supers, for they do not take to it kindly on account of the restricted passages to which they are accustomed; often they will rather swarm than take possession. When a hive has been so strong that the bees occupied two brood-chambers, they have learned to carry the nectar above; so if we remove the upper one—of course, making sure that the queen is left behind—then put on the comb super, it is probable the honey will be stored in the sections. The upper division may be placed above a weak colony to strengthen it, or the frames of brood distributed where wanted. The flying bees will return to the old hive.

Bait sections are often used to decoy the bees above. The unfinished sections from last season are kept over the winter, and at least one is placed in the centre

of each super; more is even better. But if the honey-flow is not started when the bait sections are given to the colony, the honey will be removed and used below to feed the brood.

The sections in the centre are the first to be filled. It does no harm to remove them as soon as they are finished, filling up with empty ones. If you leave them alone until all are done, watch their progress just the same, and as soon as you see that the super is more than half-full, put a second on top of the first. Further actions will depend on conditions. Should the first super be completed before the end of the flow is in sight, then empty it, fill in new sections, and set above the second. If the end is near, go slow, for you want finished sections, not a lot in various stages of development.

The removal of a super full of sections in the midst of the honey-flow is a simple affair; just take it off the hive and set it on end on top of the cover. In an hour or two the bees will have vacated it, returning to the hive, nor will other bees bother, as they are too busy carrying in nectar. But when the honey-flow is over it is a very different affair, for then the worker-bees are looking for a chance to rob each other's hives. The super must be at once cleared of bees by jarring it, also by the use of smoke, but the less of this the better, so as to avoid tainting the honey.

Section-honey should be sold as speedily as possible, before it has time to granulate. When stored in a hot, dry place it will probably remain liquid until Christmas, sometimes much longer, but, all in all, the early market is the safest.

Sections intended for sale should be scraped clean of all propolis and wax. A jack-knife with a straight blade is a good tool for the purpose. The agricultural world cannot learn too soon what is well known in the industrial sphere, that more money is spent to gratify the eye than on all other sense-organs combined; therefore it pays to have clean and neat every article that is to be placed on the market.

EXTRACTED HONEY.

When the queen has the run of a comple hive-bodies there is nothing to be done at the commencement of the honey-flow, unless the bee-keeper wants to confine her to the lower chamber. In this case he gets her below, then places a queen-excluder between the two parts of the hive. The bee-keeping world is very much divided on this question; some men use the excluder, just as many do not. It is the nature of the bee to store the honey above the brood; therefore, when they have been occupying two divisions, it is natural for them to start storing in the upper one, occupying the brood-cells as quickly as they are vacated. At the end of a good flow the upper division will be entirely free of young. When the super is half-full, a second one should be inserted between it and the brood-chamber. It is well to leave the honey on the hive for several weeks after the flow is over, so that it may thoroughly ripen, for green honey is very apt to turn sour.

The honey is removed from the comb in a machine called an extractor. After the cappings have been cut from the cells the frames are set in the baskets of the machine, which are then made to revolve at a high rate of speed, quick enough to throw the honey out of the combs against the sides of the can. An extractor suitable for Langstroth frames and big enough for a small apiary costs $9 or $10.

TAKING THE COMBS FROM THE HIVE.

(For cuts illustrating this subject *see* Bulletin No. 42.)

The actual work of extracting is best done on a warm day, as the honey is most liquid then, and in a room from which bees are excluded by a screen-door. Removing the frames from the hive is to most beginners a rather serious problem, on account of the multitude of bees on them. Go about the task in this fashion: Smoke the bees down among the frames. Take out the first frame and shake the bees off it at the entrance of the hive, then place it in an empty hive, which should be standing on a wheelbarrow close by. Draw the second frame towards the side, so as to make

a gap between it and the next frame. Into this pass a whisp of long green grass, or a switch brush, and so wipe most of the bees from the comb. Lift the frame and shake off the remaining bees into the vacant space then set it beside the first frame in the hive on the barrow. Treat the balance of the frames in the same way. The empty body is now removed—of course, supposing that the honey-flow is past; if not, it must be refilled with empty frames. Now wheel the load of combs to the extracting-room and do not worry about the few bees you may carry in, for they will soon try to get out by door or window, and not bother you at all.

Uncapping is done by a long, very sharp knife; a butcher knife is good, but one can buy a style specially designed for the purpose. Old combs are rather tough, so it is often necessary to heat the blade of the knife, which is best done by placing it in hot water when not in actual use. In uncapping, the idea is to cut a slice from each side of the comb, starting at one end of the frame and working to the other, using a kind of saw motion, as in cutting bread. The frame is stood endways on a support, the upper end of the top bar being grasped by the left hand. Some workers cut upwards, tilting the frame away from their body, so that the slice will hang clear of the comb as it is cut. Others prefer cutting downwards and appear to have no

Fig. 23. Queen-excluder, or honey-board.

trouble with the cappings; these are caught in a vessel below. The uncapped combs go into the baskets of the extractor, one to each; the handle is turned swiftly for a few minutes, thus emptying the outside cells; the frames are reversed, then the other side is freed of honey. The faster the baskets travel the more efficient will be the work of the machine. Just a word of warning to a beginner. Do not worry if you cannot get lots of honey after you have run through the first pair of combs, for remember it is spread very thinly over a large surface, but in a little while it will gather in the bottom of the can. The set of empty combs should be returned to their former position on the hive for a night, to be cleaned up by the bees, then stored away until wanted next season.

The uncapping device should be so made that it will give the cappings a chance to drain. In a small way one can use a large pail in which is set a cheap barrel, in the bottom of which a number of 1-inch holes have been bored. Next take a piece of 1- x 4-inch wood a little longer than the barrel is wide, and through the middle of it drive a strong nail that will project 1 inch at least. Sharpen this point with a file. Fasten this board across the month of the barrel, nail point up. During

uncapping rest the end bar on the point of the nail. The cappings will drop into the barrel and drain into the pail below. What to do with the wax will be told later.

The impurities present in extracted honey consist of fragments of wax, pollen, parts of bees, such as wing or leg, also occasionally a few larvæ. The first mentioned are all lighter than honey, so will in time rise to the surface; so in the case of a small run the honey may be allowed to stand in the machine for a day before it is drawn off. A piece of clean, strong muslin tied over the faucet makes a good strainer.

Bulk-extracted honey is generally stored in cans. The chief point to remember is, seal the can tight to keep the aroma in and moisture out. Honey absorbs moisture from the atmosphere, becomes thin as a consequence, then ferments and turns sour. In air-tight vessels well-ripened extracted honey will keep for many years.

Most honeys granulate—that is, candy—in a little while. To liquefy, set the can in a dish of water on the stove, but with pieces of wood between the can and the bottom of the vessel. Melting is slow, but if there be no hurry it is a good plan to leave the can of honey above the water-tank that is found in most stoves. Of course, the can-cover should be loosened.

Honey that has been melted does not granulate so quickly as at first. The higher the temperature to which it is raised the longer will it remain liquid, but if made too hot the colour will change to amber. The average buyer of honey in small quantities does not like to be bothered with the melting of it; therefore it is a good plan, before putting the honey into jars, to bring it to a temperature of 150 to 160 degrees, never more than the latter.

CHAPTER XI.

Feeding.

We have seen that in the spring months the bees build up a huge army of producers to secure the benefit of the heavy flow of honey in June. All during the breeding season every drop of nectar is converted into more bees about as fast as it is brought in; then in June and July every cell in the comb is plugged full of honey, on which they will have to subsist until dandelions bloom in spring. But the bee-keeper finds a ready market for the toothsome honey, and therefore robs the hives of the stores, not infrequently leaving too little for the bees to winter on, with the natural result that, unless other provision is made, the colony will starve to death. Again, for some reason the bees may have consumed stores in the winter much more rapidly than was anticipated, so that they must get help in the spring. We have also seen that at the end of fruit-blossom there is often a dearth for a few weeks which would put an end to brood-raising unless the bee-keeper lent his aid. In each instance the necessary assistance is given in the form of sugar syrup, made from the best granulated sugar; any other kind is risky.

The feeding in the fall for winter and spring consumption is the most important. About the beginning of September an estimate should be made of the amount of stores in each hive, this being done by examining each frame and sizing up how many sections of honey it is equal to. Roughly speaking, an ordinary frame will hold eight sections of honey, each weighing about 14 oz., let us say 1 lb. To be in safe condition, each hive should contain about 25 lb. of stores. For every pound short of that amount, feed 1 lb. of sugar dissolved in water.

Fall feeding is usually done quickly—that is, large quantities of syrup, often as much as 25 lb., are given at one time. Some men give the full amount needed about the middle of September; others give half then, the other half about the end of October.

The syrup fed in the fall is made rather thick. The thinnest ever used is got by taking equal quantities, by measure, of sugar and hot water, boiling, if possible.

It is important to dissolve the sugar thoroughly, so stir well. Some bee-keepers, for fall feeding, use as much as two parts of sugar to one of water, but this strength should not be exceeded.

In the spring months a very much thinner syrup is better, one composed of two parts of hot water and one of sugar. This is given slowly, say from half a pint to a pint a day, according to the needs of the colony.

After four years' experience in the Wet Belt the writer wants to say plainly that sugar syrup is a poor substitute for honey, at least there. Feeding sugar must be looked upon as a makeshift in a time of stress, not as a regular habit.

FEEDERS.

There are four methods of feeding—namely, open-air, above the brood-chamber, in the hive, and below the brood-chamber. Open-air feeding has several limitations. One is apt to feed other bees if there be any within a couple of miles; then there is a temperature limit, for the writer finds bees will not take up syrup from below unless the thermometer is above 50 degrees, so that the same conditions will probably apply to the open air. Feeding below the hive has much to recommend it with suitable dishes, but on the Coast regions it is unfortunately impracticable in the spring

Fig. 24. Division-board feeder.

months, as there are often weeks of cool weather. For fall feeding this system is all right. For giving syrup in spring, preference should be given to a feeder that fits into the brood-chamber, where the syrup will retain the heat and be readily got at by the bees. In the fall it is usually most convenient to feed from above.

There are many devices by which syrup can be given from above the brood-chamber. Perhaps the simplest is the ordinary friction-top can, such as is used as a container for syrup, jam, etc. Prepare it by punching the lid fairly full of small holes with the point of a nail. Fill the can with the syrup, put in the top, set the can upside down on the top of the frames. As many cans as the frames will hold can be used at once. The bees will carry the syrup as fast as it leaks out. Of course, an empty hive must be on top of the hive to hold in the heat and to prevent bees from other hives getting at the supply. A Mason jar will do just as well. An excellent top feeder on the market is known as the Miller. With it 25 lb. of syrup can be fed at one time.

For spring feeding the writer recommends the Doolittle division-board feeder, which is placed in the hive alongside the brood-nest like an ordinary frame. The illustration will show its construction. The sides are made of ¼-inch wood, 5 x 17⅝ inches, rough on the inside to give foothold to the bees. The bottom and end bars are of ⅜-inch wood, 1¼ inches wide. The end bars are 5 inches in length; the

bottom bar is 16⅞ inches. Each joint is coated with thick paint before nailing. For the lugs cut two pieces of ¾-inch wood, 1¼ x 3½ inches. From one end of each piece cut a check ⅜ x 1 inch. This feeder will drown bees unless a slat is put inside of it to float on the top of the syrup. To fill the feeder, turn back the quilt sufficiently far, pour in the syrup, then replace the quilt.

FEEDING A POLLEN SUBSTITUTE.

In some parts of the Dry Belt there is a lack of pollen in the early spring months, so that in the ordinary course brood-raising is seriously hindered. The bee-keeper in such a region can provide a substitute in the form of finely ground, dry, unbolted rye-meal, or even ordinary flour, which is set out in shallow troughs or boxes. The layer must be quite thin, otherwise the bees will drown in it. To attract the bees, smear a little honey on the edge of the tray. The boxes must be placed in a warm spot, sheltered from the wind. Continue feeding until the bees cease to use it, which will be when the blossoms provide the real article.

Various methods have been devised for feeding artificial pollen inside the hive, but in practice they are found to be injurious to the welfare of the colony.

CHAPTER XII.

Preparing for Winter.

In British Columbia the custom has been so far to winter bees unprotected on the summer stands. Only a very few bee-keepers have given protection of any kind, this usually consisting of a shed to shield the hives from the rain. Since many remarkable cases of successful wintering occur where according to all recognised principles every bee should have died long before spring, most bee-keepers assume it is entirely unnecessary to give the hives any kind of shelter from the winds and rains of winter and spring. The real test of any system of management, however, is always the same—what is the average production of honey per colony in the ensuing honey-flow, not what did one or two exceptional colonies net. The writer is not familiar with the management of apiaries in the Dry Belt, but he knows that in the district of the Lower Fraser the bee-keepers who average around 150 lb. per colony invariably protect their hives during the winter and spring months. Furthermore, he knows that in the same yard where protected and unprotected colonies are side by side the yield from the former is usually double that from the latter. On the average a winter-protected colony is equal in honey production to two managed on the let-alone plan.

To no phase of bee-keeping has the writer devoted more time and labour in the past six years than to this problem of winter protection. He has made and tried out every device recommended in the bee books and magazines, compared the results, and studied their behaviour in different degrees of atmospheric temperature. At a very early stage of the experiments he discovered that spring protection—that is, during the months of March and April—was even more important than during the months of winter, for it was found that after brood-raising commenced a weak protected colony would in time outstrip in strength more populous colonies whose hives were exposed to the direct influence of the elements. The next conclusion was that a solid packing, say of straw or sacking, held in position between the walls of the hive and the outside case, such as is generally employed on this continent east of the Rocky Mountains, was not suited for our more temperate climate, unless probably in those regions where steady frost prevails for several weeks at a time. On Vancouver Island and the Lower Mainland we often in spring have many days in succession when the thermometer registers from 48 degrees, the minimum temperature for bee-flight, to 52 degrees, and one learns that at such times the bees in packed

hives do not send out a single bee. Take a concrete case: At the writer's home in Victoria, in the spring of 1914, the first pollen was carried in on February 11th, and on the 22nd he found brood-raising well under way in a strong colony that had been left all winter without protection. On that date the hive was set inside a case and the vacant space of 2 inches all round was packed with grain-bags and an equal thickness placed above the frames. The weather remained delightful, but the packed colony did not send out a single bee for three weeks, though the thermometer in the shade frequently rose to 53 degrees. From all other hives the bees were flying freely.

At the same time he was carrying out other wintering experiments, the most interesting of which was one whose essential feature was a dead-air space all round the hive. This particular combination had been in active service for several years, during which time the writer had learned some of its merits. Its highest recommendation to his mind is this: that it prevents its bees flying until the atmospheric temperature outside is at least 50 degrees, and there is therefore very little chance of its inmates being tempted outside when there is risk of them being chilled, so that they cannot fly home. Right here let the writer say he has found several apiaries in his territory where the hives are really standing in a sort of cold frame, being surrounded on all sides by high fences, trees, or houses, and as a consequence, when the sun shines brightly on a cool still day, the apiary warms up, the bees fly out, but the moment they get above the level of the surrounding shelter they are chilled by the cold air-currents and at once drop to the ground, to rise no more. Every bee lost in early spring means a shortage of a hundred in the time of the honey-flow. Need it be said that in such apiaries the most noticeable feature is the slow building-up of the colonies in the spring months; in fact, it is not until near the end of June that the hives show brood right across the frames. As a contrast to this, in one protected apiary he has seen brood in eight frames in practically every hive in the first week of April.

The next fact learned about winter protection was that the bees in them consumed just half the stores necessary for those unprotected. In an average winter the writer's bees consume 10 lb. of honey between the middle of September and the middle of March when housed in unprotected hives; those protected use less than 10 lb.

There is no need to enlarge further on the advantages of suitable hive-protection during the months of winter and spring, say from October 1st to April 30th. Any one of the reasons when duly considered will show that it pays annually the whole cost of the original outlay, but the one fact that we get strong colonies early is enough in itself to justify even greater outlay. The writer has no hesitation in saying that more than half the colonies he examines can fairly be described as "off-schedule" bees; that, broadly speaking, their strength at any date during the season of flight is what it should have been about two months previously. They were weak at the end of winter, struggled along in desperate straits all spring, had not nearly enough bees to carry in the crop when the honey flow was on in July, but the queen then struck a big laying streak such as was due in May, with the natural consequence that the hive became full of young bees in August, when the flow was over; so there resulted the unhappy condition of many thousands of consumers with a small amount of stores for the winter. Brood-raising stops early, the August bees die off, so the colony faces the cold season weak in bees and stores. If it survives until March it repeats the dreary round of the previous year, and the series may be prolonged indefinitely until a severe winter puts an end to its existence. When the bee-keepers of British Columbia keep their bees right—that is, have them strong all the year round—the honey production of the average apiary will easily be quadrupled, and that without the addition of a single colony to those now in existence. The standard of efficiency should be: "Brood in eight frames by May 1st"; it is possible to get this condition even earlier than that.

Bit by bit the writer's ideal of a winter-protection case developed along definite lines. First, he wanted a dead-air space around the hive for seven months in the year; second, he did not want to make any departure from the present method of handling frames; third, the hive had to be unquestionably rain-proof; and, lastly, when not in use for protection, the case should not be a nuisance in the bee-yard or cellar. The third and fourth conditions were the hardest to satisfy, but he felt in taking as a basis the convertible hive designed by Mr. J. Hand, an able Ohio bee-keeper, he was following safe lines. Mr. Hand says he has found it excellent both for winter protection and for honey production in summer. The writer knows by trial that the first part of his claim is true, and has confidence that the second is probable. Even if it should fall down in the latter respect in British Columbia we are not far out, for it will more than pay for its cost annually as a winter case, and will be no more expensive than an ordinary one.

The fundamental idea of its construction can be told in a few words. The four-side-walls of the case are so proportioned that when they are nailed together we really have a hive whose capacity is double that of the hive it is meant to protect. Rabbets are cut on the long sides, so that the frames in ordinary use can be hung crossways in it. Many years ago an ordinary hive of this size and shape, known as the "Long Idea" hive, was rather popular; in fact, many are in use to-day by men [illegible] are content with a medium crop for home use, gained by the smallest amount of effort. In the Prairie regions of this continent, where the building-up season before the honey-flow is about half the length of ours, a hive of this size is just about right for an average colony by the time the hony-flow begins, as there would be available sufficient empty combs for a fair start to be made with honey storage, and additional room would be gained as the young bees hatched out. In winter it is generally placed in the cellar. Such a hive would be equally serviceable in the honey-flow, so far as size is concerned, in British Columbia, but to keep warm its bulky interior while exposed to the elements during the winter and spring months would cause the bees to consume honey stores very heavily. In the course of the writer's work he has seen a few "Long Idea" hives, but has met only one that was not weak in spring, so he believes it is not suited for our climatic conditions. When full of bees it should do all right from the first of May to the end of September.

In constructing our winter case, then, we must make it 18⅝ inches wide, inside measurement. Its length theoretically should be just double the width of the hive in use. There are three seasonal stages in handling this hive: First, as a winter case it protects the ordinary hive; second, about May 1st, when the inside hive is crammed with bees, the frames are transferred from the inside hive and set cross-ways in the outside case, which now becomes the real hive, and the remaining space is filled with empty combs. Instead of tiering up we are working backwards. Third, when the honey-flow starts, if more room for surplus honey is needed, we can place on top either another body like the one we have, or a couple of ordinary hives side by side. There is but one objection to this procedure, and it is this: We are giving, where we are running for extracted honey, a rather big amount of room all at once. Hives tiered up four stories high are not uncommon in British Columbia at the end of the honey-flow, but until the matter has been tried out the writer hesitates to say more than this: that with the tremendous rousing colonies our skilled bee-men have no trouble in getting, he is inclined to think that all will go well. Besides, it is always possible by means of quilts to cut off access to the rear super until its storage-room is needed. With shallow extracting-frames, or with sections for comb-honey, there should be no trouble. One thing he does know—the average rancher would be quite content with the surplus honey in the main hive alone, for it should amount to at least 50 lb.

After the crop has been gathered in, the colony is transferred to the ordinary hive, and our summer hive once more becomes a winter case. One thing the writer

likes particularly about this arrangement is that its use will compel many men who never touch a frame to handle their bees at least twice a year, and so see their actual condition.

A little thought will suggest that for this system of bee-management an eight-frame hive is better suited than is a ten-frame one. When the former is the standard of the apiary the hive will be 27¼ inches long; when the latter is used the length will be 32¼ inches. The winter case designed for an eight-frame hive is equally available for the protection of a ten-frame hive, but when two supers are used they must be eight-frame width. It is suggested that at the start any one interested should be content to make one or two according to the specifications given later, but to view them mainly as winter protecting cases, giving one or both a trial through the honey-flow.

Since there should be at least a couple of inches of packing above the frames, the walls of any winter case are generally made 3 inches deeper than the sides of the enclosed hive. Mr. Hand in his design consistently followed out this idea; hence it followed that in the summer, when the case was used as the hive proper, there was left a vacant space of 3 inches under the frames. In hot regions the space is rather an advantage than otherwise, but after trying out deep spacing under the

Fig. 25. Case for winter and spring protection. The case complete is in the centre. To the left is shown the under-side of the bottom board, while its upper surface is presented above the complete case. To the right is the under-side of the cover. The bridge leans against the case.

frames for many years, the writer decided that about 1 inch the full width of the hive is usually enough in British Columbia on account of our cool nights. To fit this condition, and to make the case available for the protection of section supers when comb-honey is wanted, the case has been designed in two parts—one the hive proper; the other a 3 inch extension to be placed below in the winter months, when the body is functioning as a protection case.

Any one desiring to try out a case should order the following bill of lumber. Cedar is recommended for the sides, cover, and bottom, but for the extension body, sides of cover, binding-cleats, bridge, and spacing-cleats fir will be more suitable.

BILL OF LUMBER FOR ONE CASE.

Cedar, all smooth—

Body, 2 pieces, ¾ x 9¾ x 26½; half-width rabbet ¾ inch deep along upper edge.

Body, 2 pieces, ¾ x 9¾ x 19⅞; half-width rabbet ¾ inch wide across both ends; distance between edges of rabbet, 18⅜ inches.

Bottom, 3 pieces, ¾ x 6⅝ x 34.

Cover, 3 „ ¾ x 7¼ x 20.

Fir, all smooth—

Bottom binding-cleats, 3 pieces, ¾ x 2 x 19½.

„ thin cleats, 1 piece, ⅜ x 4 x 19⅞.

„ „ „ 2 „ ⅜ x 4 x 23¼.

„ thick „ 1 „ ½ x ¾ x 19⅞.

„ „ „ 2 „ ½ x ¾ x 26⅜.

Cover, sides, 2 pieces, ¾ x 2 x 21¾.

„ „ 2 „ ¾ x 2 x 27½.

Bridge, 1 piece, ¾ x 3 x 18¼.

Extension hive, 2 pieces, ¾ x 3 x 19⅛.

„ „ 2 „ ¾ x 3 x 27¼; half-width rabbet ¾ inch across both ends.

To assemble, begin with the bottom board, which is 19⅞ x 34. Lay the pieces face down and nail on the binding-cleats. As nails have a poor catch in cedar, turn board over and nail also from upper side. Next, across one end fasten the short ⅜-inch piece of fir, then the other two of the same thickness along the sides, butting them tight against the cross-piece. These three pieces form the support of the ordinary hive in winter, and determine the height of the winter entrance, which is sufficiently low to keep out mice.

The ½-inch strips are next fastened into position on top of the thin pieces. These thicker strips form the support of the case and in addition determine the height of the summer entrance at ⅞ inch.

The body of the case may be next assembled, each corner being nailed both ways; at least twenty-four nails being needed for each body. Place the case on the bottom board and you will gain some conception of what you are making. By setting an empty hive inside the case you will gain a still better idea.

The cover comes next. It is of the telescope variety, with rather deep sides, but these provide scope for lots of packing over the frames, which is something the bees need in British Columbia on account of the cool nights. When made correctly the sides will have a little free play all round, but if a strip of packing be permitted to hang over the sides the cover will jam tight, and be safe in even high winds. The sides meet with ordinary butt-joints, but after nailing they should be strengthened with a strip of zinc or galvanized iron, such as is used to fasten shingles in the bundle. A piece 6 or 8 inches long bent round each corner and fastened with short nails will hold everything tight in all weathers. The extension should be next assembled.

Three coats of paint, according to instructions given elsewhere, should be applied to every part that may be exposed to the weather. Then the roof and sides of the cover should be covered with a stout roofing-paper, this being held in position with narrow strips of thin or half lumber. For appearance' sake it ought to be also painted white. A cheap grade of canvas will do just as well, provided it be given three coats of paint. At a push one may use oilcloth, laid oil-side down, and painted.

To prepare bees for the winter, set the hive containing the bees, but without cover, in the centre of the bottom board; then put the extension down over it, and slip the entrance bridge into position between the hive and front of the case, adjusting matters so that all three come in contact. Next, place the big case on top of

the extension, and then pack old sacking, rags, or dry hay between the hive and case to the depth of about 4 inches; that is to say, the packing must come above the joining line of the outside cases. We have sealed air-tight the lower entrance to our air-spaces.

To seal the upper part we must first have a frame to roughly close the gaps. Out of thin lumber make a couple of pieces 4 x 18½, and another pair 25½ inches long, and just a trifle narrower than the spaces on each side of the hive. When nailed together and placed above the hive, the end pieces will rest on the ends of the hive; the side pieces should roughly fill the gaps between the sides. Then prepare four strips of wood ⅜ x 1 x 10 inches.

Remove the oilcloth quilt, place the frame you have just made in position, lay the sticks across the frames at equal distances apart, place a couple of layers of sacking snugly all over, then finish with more sacking or dry hay to within 1 inch of the top. Now put on the cover, and then make certain that the rear of the bottom board is at least 1 inch higher than the front, so that no water can run back under the frames.

A colony so packed should winter perfectly and breed up quickly in the spring; in fact, it should be so strong by the time the soft and vine maples are in bloom that in the regions where they are plentiful a good surplus crop of this most delicious honey should be almost a certainty. As designed, the writer can see only two possible weak spots in the case, and these are the meeting-points of the two casings and where the casing rests on the bottom board. If poorly constructed there is a possibility of water finding entrance at these places, but strips of thin wood, a couple of inches wide and chamfered on the upper outside edge, nailed along the lower edge of each case, and projecting, say, ½ inch over the wood below, will provide perfect protection.

With such a method of packing it will be utterly impossible for bees to be tempted to fly in bright sunshiny weather with snow on the ground, as in 1913, to the utter demoralization of almost every hive on the Lower Mainland.

In Victoria the writer finds that when he orders a few cases at a time all the material necessary costs about $3 a case, but an increased honey production of about 20 lb. would pay for that, and he is convinced from what he has observed that proper wintering means an increased honey production of over 50 lb.

Two notable cases, the only ones in his territory where every colony is winter-protected, are worth mentioning. One has thirty-six colonies; average hive production in 1914 being 150 lb. The other is owned by a beginner in his second year, and consists of five colonies; average hive production in 1914, 140 lb.

CHAPTER XIII.

Queens.

The average beginner naturally makes no effort to control his bees in their natural impulse to increase by swarming, but one season's experience of retrieving swarms, and of investing money in new hives, with not infrequently very little returns in the shape of honey, will soon arouse a desire within him to become master of the situation, so that increase shall be when he wants it and to the extent that will suit him. To attain this desirable end he must learn a few simple facts about the life-history of the queen, from the egg to the time when she begins to lay.

We have already learned that the egg from which a queen is to be raised differs in no way from that from which the ordinary worker develops. Furthermore, it hatches out the same, and for three days the young larva is fed like a worker-larva, but on the fourth day the latter is put on a less nutritious diet that prevents the development of the sex-organs. The food of the royal larva remains unchanged; its quantity is lavish; with the result that the full development of the insect is secured

not only organically, but in actual size. Since she is to be larger than either worker or drone, the ordinary cells of the hive are not big enough, hence the bees must build a special cell for each young queen, which is known as a queen-cell. Fig. 26 will show how they look. In ordinary course, a populous hive will make preparations for swarming by starting a number of royal cells, usually placing them on the edges of the comb that are not attached to the bars of the frame. When complete they somewhat resemble a small peanut, and are about an inch in length. When first started they rather suggest an acorn-cup; in fact, after their usefulness is past they are usually trimmed down to about the same size. While all other cells are horizontal, queen-cells always hang perpendicularly, with the mouth downward. The number in a hive varies greatly; sometimes there are only a couple, generally about six, occasionally as many as a dozen.

In due course an egg will appear in each cell, but not all at the same time, as two queens cannot be free in the same hive together. One will certainly kill the other.

When the first cell has been capped over the first swarm will come forth, accompanied by the old queen. A week later the second swarm is due, this being headed by the first of the young queens. Others may follow at intervals of a day or two. As each virgin hatches out she tries to get at her rivals in the cells, and if successful stings them to death. Whether she reaches the others or not depends upon the bees, who hinder her progress or give free access as suits them. In any case she issues

Fig. 26. Queen-cells.

a challenge, in the form of a shrill peep-peep-peep, which is responded to by the most advanced of the others, but since they are confined in a close chamber the sound is more like qua-qua-qua. When a second swarm is due one can hear both sounds by placing one's ear in contact with the side of the hive. The second swarm having departed, another queen is released. Should both sounds be again heard, a third swarm is likely. But if the bees feel there has been enough of swarming, the other queens will be killed. Many bee-keepers, after the first swarm has issued, open the hive and destroy all cells except the largest one, and so prevent any more.

Should a hive in the breeding season become queenless, either through the death of the queen or through her removal by the bee-keeper, the bees at once proceed to develop a successor from the young larvæ and eggs on hand, building the cells on the faces of the combs. Should they send out a swarm it will be headed by a virgin, and, of course, the second one will come forth a day or two later.

The facts in the last paragraph give us the key to making increase under the control of the bee-keeper. A simple method, but rather wasteful, is to divide a very strong hive into two parts, leaving one-half on the old stand and setting the other on a new one. The half without a queen will at once start queen-cells. The drawbacks to this plan consists in the probable loss of young brood through neglect in the part that was moved, and in the slowing-down of egg-laying by the queen.

Here is a much more efficient way: Remove the hive from the stand and in its place put one containing only empty combs or foundation. Take out the centre comb, then turn to the old hive and look for the queen. When she has been found, set the frame she is on in the centre of the empty hive. Put a queen-excluder above, then on top place the old hive, into which now put the empty comb from the lower one; replace the cover. Leave the combination alone for five days, then look carefully over the combs in the upper body to see whether or not queen-cells have been started. If such are found, carry the upper story to a new stand. We have gained much in the five days. The queen has been stopped but little; much of the brood above has hatched, lessening the cares of the workers there, and there is an army of young bees in the upper division that will stay where they are put. When no cells are started, leave the hives together for five days more. After moving the upper story to a new stand it must be provided with a frame containing larvæ and eggs, for, of course, all its own larvæ are too old. This frame may be taken from any hive, preferably from one that is noted for good workers. Shake all the bees off the frame, to make certain you do not carry the queen with you.

As many queens get lost in the mating flight, it is always advisable to examine a hive about twelve days after the queen hatches out. If eggs are found, things are probably all right; but if no eggs are present, then give a frame of brood with eggs from another hive, so that, if necessary, another queen may be raised.

CHAPTER XIV.

Diseases.

Bee-diseases are divided into two kinds, those that attack the mature bees and those that affect the brood.

The adults are liable to diarrhœa, paralysis, and ague trouble in the early part of the season that is generally called "spring dwindling." Diarrhœa frequently occurs when the bees have been compelled for several weeks to stay in the hives, especially on poor stores, such as fruit-juices and honey-dew—an excretion from aphides and scale-insects—which is sometimes plentiful in the autumn in the Coast regions. Honey-dew is usually very dark, often granulates quickly, and has an unpleasant taste. When in health, bees empty their bowls only when on the wing, but when flight is hindered for some weeks the evacuation may occur in the hive. This is the reason why bottom boards should be cleaned early in spring, so as to get rid of the germs.

Bee-paralysis is not a common disease in cool climates, but there are a few reports of its occurrence in the Province. The sick bees look black and greasy, and have a very swollen abdomen. They generally stagger around as if paralysed. The disease is supposed to be constitutional, so the usual remedy is to destroy the old queen and introduce another from a healthy stock.

Spring dwindling is a term that may cover a multitude of troubles. There is undoubtedly a germ disease affecting the intestines that sometimes developes in the spring months, but not much is definitely known about it. Dwindling may, however, be due to lack of bees—that is, not a sufficient number to keep the hive warm enough for brood-raising, or from want of stores—either honey or pollen.

BROOD-DISEASES.

The diseases that attack the larvæ are American foul-brood, European foul-brood, and sac brood. Both of the forms of foul-brood are very deadly, and once they get a foothold in a district they will, if unchecked, wipe out every colony. The bees themselves are unable to cope with them; hence it is utterly futile for a bee-keeper to conceal the fact that there is something wrong with his bees, in the hope that the trouble may disappear. If left alone, a slight case of infection, once it gets headway, will spread, not only over every colony in that apiary, but in the district.

When the first edition of this bulletin was written no known cases of foul-brood were in the Province, but the developments then in progress, and accelerated later, brought, as was to be expected, several outbreaks. The first case was found in the bees of a settler who came from Ontario; the second originated in a hive specially imported from England; the third was brought by a settler from Oregon. The last case is specially noteworthy because the germs appear to have lain dormant in the hive three years before they attacked the larvæ.

In the summer of 1914 a serious outbreak of American foul-brood was found to have occurred in Vancouver City. It apparently originated in an apiary into which a number of queens imported from outside the Province had been introduced in 1912. Last summer the disease was found in seventeen apiaries in Vancouver, which gives us some idea how speedily it spreads once it has got a foothold. One apiary of twelve colonies had dwindled to only one, and this was found to be diseased. One bee-keeper who bought half a dozen of the empty hives with combs found he had conveyed the infection to as many of his colonies. A couple of empty hives with combs from the affected district that were taken to Chilliwack started a new centre of infection, and from these in turn the disease was carried to near Coquitlam by an unlucky purchaser. To sum up, American foul-brood was found in twenty apiaries, affecting forty-six colonies, all of them from one source of infection in three years. In every instance the diseased bees, hives, and frames were destroyed by fire.

To thoroughly stamp out the infection will need not only the unremitting care of the Inspector responsible for the district, but, in addition, every bee-keeper must help by notifying the Department of Agriculture the moment he suspects there is anything wrong. We have seen that the germs may be dormant for at least three years, and the Inspector knows of one instance where the infection was carried by a new hive-body in which a swarm had been housed for only three weeks. Our bee-keepers must for a long time to come view with suspicion any article of beeware that they know has been in contact with bees in an affected district, especially a hive in which bees have been kept.

Generally speaking, foul-brood is conveyed by honey from one hive to another, colonies weakened by the disease being robbed out by their stronger neighbours, but the germs are often found in every part of an affected hive and on the bodies of the inmates.

The importation of bees into the Province has practically ceased since the issuing of an order by the Hon. Minister of Finance and Agriculture under authority of clause 10 of the "Foul-brood Act," requiring the quarantining of all bees for nine months at the point of entry. The Department of Agriculture does not wish to hinder the importation of queens for the purpose of improving the stock, but it does recommend that all bee-keepers refuse to patronize any queen-breeder who cannot produce a copy of a certificate from a Foul-brood Inspector that his apiary is free from disease. The United States post-office authorities refuse to admit queens to the mails unless they are from certificated apiaries, and it is to be sincerely hoped that other countries will follow this example.

AMERICAN FOUL-BROOD.

American foul-brood has been so named because the germs that cause it were first isolated on this continent. The symptoms of the disease are thus described by an authority:—

"Some of the brood fails to hatch. Cappings here and there are sunken and perforated at the centre. On opening one of these cells there will be found a dead larva lying on one side of the cell somewhat shrunken, and of a brownish colour, varying all the way from a light pale brown to a dark brown. In the more advanced stages the brown is of the colour of a coffee-berry after being roasted. In the incipient stages the brown is of the colour of the coffee we drink, when greatly diluted with milk. But so far all these symptoms may be present as the result of chilled, overheated or sac-brood. But to determine whether it is the American foul-brood, run a toothpick into the dead larva and then draw it slowly out. If the mass adheres to the end of the pick like spittle, stretches out from ½ to 1 inch, and finally the fine thread breaks when the pick is drawn back, it is probably a case of foul-brood. With all other forms of diseased brood, with perhaps the exception of European foul-brood, where the roping is never more than slight, this ropiness does not appear; but with American foul-brood it is invariably present. The dried-down larva forms a scab which is tightly adherent to the lower wall of the cell.

EUROPEAN FOUL-BROOD.

The appearance of this form of foul-brood is thus described:—

"Adult bees in affected colonies are not very active, but do succeed in cleaning out some of the dried scales. This disease attacks larvæ earlier than does American foul-brood, and a comparatively small percentage of the diseased brood is ever capped; the diseased larvæ which are capped over have sunken and perforated cappings. The larvæ when first attacked occupy an unnatural position in the cell. Sooner or later the larva becomes a shapeless mass with the appearance of having been melted. Decaying larvæ which have died of this disease do not usually stretch out in a thread when a small stick is inserted and slowly removed; occasionally there is a very slight 'ropiness,' but this never very marked. The thoroughly dried larvæ form irregular scales, which are not strongly adherent to the lower side-wall of the cell. The disease attacks drone and queen larvæ very soon after the colony is infected. It is, as a rule, much more infectious than American foul-brood and spreads more rapidly. European foul-brood is most destructive during the spring and early summer, often almost disappearing in late summer and autumn."

SAC-BROOD.

This is the name given to a disease of the brood about which very little is at present known. The larva usually dies stretched out in the cell. Its shape changes much less than in the case of foul-brood. The skin usually remains intact, and the body contents before they dry up are more or less watery. The disease is mildly infectious, but usually does little damage and disappears without treatment.

BROOD DEAD FROM OTHER CAUSES.

We have seen that there may be a sudden stoppage of nectar at certain seasons; consequently, in a hive that is short of stores at such a time, thousands of the young must literally starve to death. In extremely hot weather, when ventilation is deficient, the inside temperature of the hive may become so hot as to cook the young larvæ; on the other hand, a sudden drop in temperature will cause the bees to contract their cluster, exposing many of the young so that they freeze to death. Then in the fruit-bloom season some ranchers spray before the blossoms fall with a poisonous solution, and, of course, the bees that visit such an orchard not only die of the poison, but frequently are able to empty their load into the cells before succumbing. The poisoned honey kills any brood to which it is fed.

We see, therefore, that the presence of dead brood in a hive demands instant consideration. The first question to be asked is, what is the likelihood of starvation? The condition of the stores should answer that. Next, has any one in the neighbourhood been spraying blossoms with a poisonous mixture? The bee-keeper should

know by the season, the number of dying bees round the hive, and the habits of his neighbours. In the same way he will probably know the facts about recent temperatures. When the disease is due to any of these causes the bees in due course clean out the cells, and there is no trouble with subsequent brood. Should, however, neither starvation, heat, cold, nor poison account for the condition, or should the diseased brood continue or increase, then help should be solicited from the Department of Agriculture. As a diseased hive weakens, bees from other hives rob it of its stores, thus conveying the germs to all the hives in the vicinity.

ANNOYANCES.

Complaint is made from certain regions that in some years wasps become so numerous in the autumn that by sheer numbers they can overcome the inmates of a hive and rob the stores. In all cases of robbing, whether by wasps or bees, narrow the entrance down to a space just wide enough to permit only one bee to pass at a time, so that defence will be very easy. A small bit of wood makes a good entrance block. The wasps that fly round in May are queens, so that every one killed then means a colony exterminated. A death at this time prevents thousands of lives in the fall.

CHAPTER XV.

Judging Honey at Exhibitions.

We have fully a thousand bee-keepers in British Columbia, but so far they have been rather indifferent about showing their product at the local exhibitions in the fall of the year, but it is to be hoped that from now on they will make a display annually to show the community that they have as much public spirit as those interested in other forms of agriculture.

Fig. 27. Honey and wax display made by F. E. White, North Vancouver.

The Bee Inspectors wish to draw the attention of the managers of agricultural exhibitions to a few points they believe could be changed with advantage. In the first place, they think exhibits are asked for in too many classes. Practically all

our bee-keepers are beginners, and are working with only a few hives, so that much variety cannot be expected from them. Secondly, the money inducement is rather small, being usually less than the cost of expressing both ways the winning exhibits. At the same exhibition it is not uncommon to find $1,000 offered in prizes in the poultry department, but only $5 in that of apiculture, the amount being offered in $1.50 prizes. Many bee-keepers rather resent the comparison.

The Inspectors, considering the present status of bee-keeping in the Province, recommend that at the average agricultural exhibition there be only two classes in apiarian products—namely, extracted and section-honey—and that not more than a dozen jars, any size, or a dozen sections be asked for. In a few districts a class for beeswax may also be included.

At the more important centres, New Westminster, Victoria, and Vancouver, in addition to the above they would include classes for products where honey is an essential, such as mead, honey vinegar, fruit preserved in honey syrup, and jams where honey is used instead of sugar. A class for observation hives is also recommended as an attractive and educational feature.

The Inspectors also recommend that no exhibitor shall be allowed to win a prize with honey that was not produced in his own apiary.

POINTS IN JUDGING HONEY.

The Inspectors recommend the following schedule of points for all exhibitions, so that a uniform standard may prevail in the Province:—

Extracted Honey.		Section Honey.	
	Points.		Points.
Colour	20	Absence of popholes	20
Brightness	20	Uniformity of cells	10
Density	20	Cleanness of wood	10
Aroma	10	Colour of capping	15
Flavour	20	Thinness of capping	10
General get-up	10	Colour of honey	15
		Flavour	20
Total	100	Total	100

NOTES ON POINTS.

Extracted Honey.

To judge, take a jar from each exhibit, and place them in a row in front of a good window-light. Give highest marks under each point to the best, and grade others in proportion.

Colour.—Light amber—that is, golden—is market standard in British Columbia.

Brightness.—This is absence of cloudiness and has nothing to do with colour.

Density.—To judge, take a jar in each hand and turn both upside down. Watch air-bells as they rise. The slower the upward movement, the denser is the honey. Give highest marks to the slowest.

Aroma.—This should be tested the moment the cap is removed by placing the jar under the nose.

Flavour.—Clover-honey is standard with most British people.

General get-up.—This particularly refers to bottle and cap.

Section Honey.

Absence of Popholes.—Count all the popholes between honey and wood in all sections, giving full marks to the exhibit with fewest.

Uniformity of Cells.—These should either be all worker or all drone, worker-cells being preferred.

Cleanness of Wood.—No propolis or scraps of wax should be found anywhere on the wood, either inside or out.

Colour of Capping.—White is preferred.

Thinness of Capping.—To judge this point, break cappings with point of penknife.

Colour of Honey.—Judge by removing a little from section and laying it on white paper.

Flavour.—Clover is standard.

Fig. 28. Bee demonstration at North Vancouver.

CHAPTER XVI.

Melting Wax.

In an eight-frame hive the combs contain about 2 lb. of pure wax, but after several years' use they may weigh as much as four times the original weight. The increase is due to dirt in various forms. The cappings that are removed during extracting are almost pure wax, there being usually about 1 lb. of wax to every 50 lb. of honey. Pure wax is always a marketable commodity in a fruit district and in every drug-store. In Victoria the latter pay 45 cents a pound for it. We therefore see that every scrap of comb is worth saving, so that it may be rendered at the end of the season. After making dozens of experiments, the writer believes that for the small apiarist the oven method is the best, and although it produces a little less than half of the available wax in old comb, it is as effective as any other process short of a regular wax-press. To pay the cost of the latter, one would have to work over about 100 lb. of old comb.

Take a bread-pan or similar dish and in one end at the bottom punch a hole a ¼ inch wide, any length. Fill it with comb and set it on the upper shelf of the oven, with a small stone under the unpunched end to tilt it up. On the lower shelf, so as to catch the drip, place another dish containing water. When the oven gets hot enough the wax will run from the old comb into the pan below. To make a nice cake of the wax, melt all the bits in a dish of water, then set aside to cool. A vessel with sloping sides like a lard-pail is good.

CHAPTER XVII.

How to build up a Weak Hive.

A hive that is strong in bees in early spring will attain great strength early in the season, while one that is weak will make very little headway, possibly may have a hard struggle to live. The laying capacity of the queen is limited by the number of larvæ the workers are able to care for; therefore, if we can add more bees to the colony, the quicker will it develop. The skilful apiarist in the spring often does quite a business in transferring bees from one hive to another, but to be successful he must understand the limitations. In the first place, it never pays to rob a medium strong colony to aid one that is weak. A hive that has every frame covered may be drawn upon, but never one that is weaker. Second, it is useless to give a frame of brood without nurse-bees to a weak colony, as the workers there are doing all they possibly can; but, on the other hand, it is risky to give old bees with a frame of brood, as these strangers may attack the queen, at least early in the season. Young bees are less liable to interfere.

To give young bees to a weak colony, go to a strong hive, select a frame containing brood, but be sure the queen is not on it—the only way to be certain is to see her—and shake the bees on to a large board in front of the hive. The old bees will fly home in a few minutes, then shake those that remain on the alighting-board of the hive to be strengthened. They will crawl inside and be made welcome.

Some give aid by exchanging sealed brood, preferably hatching, for eggs. To do this, take a frame of sealed brood from the strong hive and shake off the bees; then carry it to the weak one and exchange it for a frame of eggs, as before shaking off the bees. In each case place the new frame in the centre of the cluster.

When the weak hive is fairly strong, say with bees on five or six frames, one need not hesitate to give it a frame of brood with adhering bees, provided it is not put next the frame on which the queen happens to be at the time.

To combine a queenless colony with another hive, in the evening, when flying has stopped, go to the latter and remove the cover and quilts and spread a sheet of newspaper above the frames, punching a hole with a pencil in the centre of it, so as to give communication. Then lift the queenless hive and set it on top. The bees will gradually remove the paper and intermingle without fighting. In about a week remove the frames that are unoccupied, so as to make a compact brood-nest.

As a general rule, when nectar is coming in freely, the bees of a hive will welcome additions to their strength, but in times of dearth they will eject or kill the intruders.

CHAPTER XVIII.

Women Bee-keepers.

There are at the moment of writing at least a score of women bee-keepers in the Province, and by the title it is meant that they actually do all the necessary work round the apiary—build and paint hives, assemble frames, insert foundation, and manipulate the colonies. The only occasion when they call for help is when they have to face a specially heavy lift. On the average, the crop they secure is equal to that got by the men-folks; but in one respect they decidedly excel, they certainly do keep tidier bee-yards. Our men bee-keepers have not yet realized that a well-kept apiary may be made a thing of beauty, and that a few plants, such as roses, hollyhocks, foxgloves, and currant-bushes, among bee-hives have great value in decorative effect.

The biggest apiary managed by a woman is located in the Wet Belt and numbered sixteen colonies in 1914, when the crop was fully 1,000 lb. of extracted honey.

A close second is an apiary of fourteen colonies in the Dry Belt, which gave a crop of 919 lb. in the same season. Both of these apiaries are managed by young women; one is under twenty, the other a few years older—both born and raised on the ranch. They have chosen an open-air life, have given bee-keeping as much study as the would-be typewriter gives to stenography, and are now well on the way to owning a remunerative occupation, one that is not overexacting. Most of the other lady bee-keepers are in the beginners' class, but will probably be heard from later. In all, six women bee-keepers reported the crop of 1914; they owned fifty-eight colonies and produced 3,240 lb. of honey, an average of 58 lb. to the hive.

CHAPTER XIX.

Painting Bee-hives.

Most bee-keepers appear to think that hives are painted either for the sake of appearance or to preserve the woodwork, but, so far as the writer is concerned, his chief reason for painting hives is to safeguard the welfare of the bees. During wet weather the unpainted woodwork absorbs considerable water, which, during evaporation, carries away a great deal of heat from the hive. For most months of the year this interior warmth is the one thing above all others we should be trying to conserve. What we really must have is a home for the bees that is water-proof in every respect, even to the surface of the wood. That a hive be well painted is a practical necessity, not a luxury.

The principal material used in hive-painting is either white lead or oxide of zinc, ground in raw (unboiled) linseed-oil, by a mill, to the consistency of a thick paste. In this condition it is sold by the manufacturers in small cans or in kegs of various weights. To prepare it for actual use, one merely adds more linseed-oil to thin it sufficiently for one's purpose.

Three coats of paint should be applied to each hive. The writer's own practice is to consider the first coat as being largely an oil filler, so after stirring the contents of the can thoroughly, he pours some out into another can and adds at least an equal bulk of raw linseed-oil. The paint will be so thin that it will show only a slight tint of white after it has been applied. The oil will seek its way well into the wood, carrying with it the fine particles of zinc or lead, and on drying will block up most of the pores and so prevent the absorption of water during rain. In clear summer days this thin coat will dry in a day or two, but in damp weather drying may take over a week. In any case the second coat must not be applied until the first has become thoroughly hard.

The second coat should be thicker than the first, the added oil being only half the bulk of the paint as it comes from the can. As the pores of the wood have been filled by the first coat, the second application of the paint will work much easier than the first, and will dry more speedily. The third coat should be prepared like the second.

Many painters use a little turpentine in the first coat when working on resinous wood like our Douglas fir, as it has a beneficial influence on the resin, but turpentine penetrates ordinary wood with great rapidity, and leaves the zinc or white lead on the surface, where it soon develops a tendency to crumble off. The writer does not recommend the addition of turpentine when the painted article is to be exposed outdoors. Turpentine in paint dulls its surface, gives a flat finish; raw oil makes a glossy surface, which is preferable for outdoor work.

In working on a small job like a bee-hive, a good plan is to start on the end wood, which will soak up quite a considerable quantity of the paint; then to proceed to the smooth surfaces, giving the end wood further applications as the previous

ones are absorbed. Have but little paint on the brush, but work thoroughly in all directions, finishing up each surface by careful stripping the long way of the wood.

Between coatings the brush may be kept from drying out by standing in water. When needed for use it should be rubbed dry on a board. To clean the brush, press out the paint with a knife, then work in turpentine or soap and water. To prevent a hard skin forming on the top of paint in an open can, when not used for a few days, pour on a little raw linseed-oil.

One pound of paint will be needed to give three coats to a bee-hive, cover, and bottom board. When one has much painting to do, it is worth while to buy a can of white lead (Elephant brand is the writer's preference, as it works easily) and a gallon of raw linseed-oil, mixing them as needed.

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