STATE OF IOWA

1915

REPORT OF THE

STATE BEE INSPECTOR

FOR THE

YEAR ENDED OCTOBER 31, 1915

Fourth Annual Report, together with Report of Convention of the Iowa Bee Keeper's Association in Des Moines, December, 1915

FRANK C. PELLETT
State Bee Inspector
ATLANTIC, IOWA

DES MOINES:
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1916

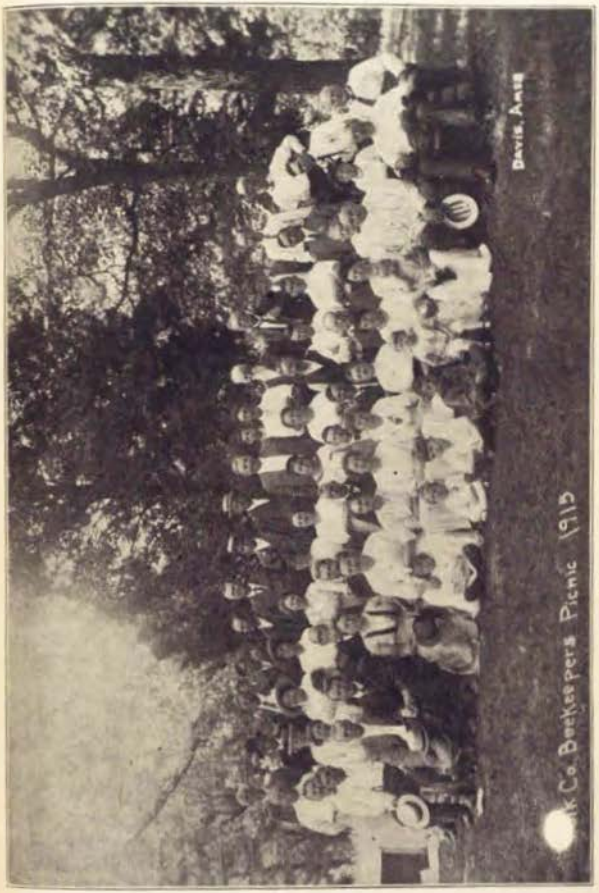
LETTER OF TRANSMITTAL.

To His Excellency, George W. Clarke, Governor:

I have the honor to submit herewith my fourth annual report as State Bee Inspector, as required by law, showing the work for the year 1915, with report of the meeting of the state association.

FRANK C. PELLETT.

Atlantic, Iowa, Dec. 1, 1915.



A group of Beekeepers at the Des Moines summer meeting, July, 1915.

STATE BEE INSPECTOR'S REPORT.

The business of honey production in Iowa is rapidly assuming its proper place among the agricultural activities of the state. While there is no marked increase in the number of beekeepers, those who have bees are taking them more seriously. Some who have been carrying on bee culture in connection with general farming have come to realize that the bees can profitably occupy one's whole time, and as a result the other lines have gradually been abandoned. Beekeeping is thus rapidly changing from a side line to a specialty.

Until recently this department was the only official source of information in the state, and accordingly enquiries relating to all phases of beekeeping have been addressed to the state bee inspector. This has resulted in a large correspondence in regard to matters other than the inspection of apiaries and the treatment of disease, with which we are especially charged by law. In former reports, attention has been called to the need of more extended educational work than this department has been authorized to undertake.

BEE CULTURE AT AMES.

Since bee culture has lately been added to the regular work of the State College of Agriculture at Ames, this department will be relieved of much of the work not directly in line with the purpose for which it was created. The establishment of such a course will result in great benefit to the beekeeping interests of the state. The experimental work and the publication of bulletins which the college has the facilities for undertaking, will reach beekeepers in every section of the commonwealth. As soon as it becomes generally known that the college is prepared to furnish the desired information, questions not pertaining to disease will be addressed to the college instead of to this department, to a much greater extent.

NEED OF EDUCATION.

It will readily be apparent to anyone who is familiar with beekeeping, that the problem of control of bee diseases is largely one of educating the masses of beekeepers in the proper management of their apiaries. Unless the beekeeper be well informed, he is seldom able to treat disease successfully, no matter how carefully the inspector instructs him in the details of the treatment. Either the treatment is not given at the proper time, is not properly handled,

or the bees from healthy colonies are permitted access to the honey from the diseased colony, with the result that the disease is further spread. With the present funds it is impossible for the inspectors to examine every hive and give the necessary treatment. There has been some criticism of the department because the inspectors are not thorough enough in their work. While, at times, it would seem there has been some ground for the criticism, it has been because of the impossibility of examining every colony in a locality where work has been attempted, without a greatly increased appropriation. It has been the policy of the office to make the best use of the funds available and to work out a plan, if possible, whereby the work can be handled without asking for more money, until such a time as experimental work and general educational work in bee culture have been provided for. Accordingly, when a beekeeper who is reasonably well informed has been visited, we often examine a few colonies, to ascertain whether disease is present. If disease is found, the owner is informed the nature of the particular disorder from which his bees are suffering, and instructions given for proper treatment. The owner is then trusted to examine the remainder of the apiary and to care for infected colonies. In this way only, is it possible to meet the many demands for assistance.

The large majority of beekeepers have only a few colonies and are not well informed concerning the best methods of honey production. Such men, often, although willing and ready to do anything possible to eliminate the disease, do not feel competent to undertake the treatment of diseased colonies. So many desire assistance that much time is consumed in this manner. Unless the work is carefully done, it often becomes necessary to go all over the ground again.

THE SEASON'S WORK.

The year 1915 has been a very favorable one for bee inspection. Although there have been many rainy days when the inspectors could not work because of unfavorable weather, the season has favored the examination of colonies and the treatment of disease nearly every day when the weather was such that field work was possible. The season of work has thus been much longer than any year previously, and, we feel that on the whole, better results have been obtained. More apiaries have been reached than ever before in one season, and we hope that something has been accomplished toward eliminating foul brood from a considerable area.

By working in an ever widening circle around an infected center until disease was no longer found, we have tried to cover the territory as thoroughly as possible. We find that some localities where careful work was done two years ago have since been entirely free from foul brood and this fact gives some encouragement to hope that in time the state may be comparatively free from the disease.

Iowa has from four to six times the area of some other states with an appropriation similar to ours. The longer distances that must be traveled make it impossible for us to make an equal showing in number of colonies examined, as much time and expense are consumed in traveling from place to place in different parts of the state. Other states, according to census reports, do not have more than from one-third to one-fourth of the number of colonies of bees. This makes it easier for them to show a larger area free from disease, since they do not have so many cases to contend with.

Speakers at the Tri-State Meeting: E. R. Root, L. H. Pammel, Frank C. Pellett, E. F. Phillips, C. P. Dadant, N. E. France.

However, by putting more men in the field during the short season when work can be done to the best advantage, it has been possible to greatly reduce the expense of travel.

During the past summer, Mr. J. I. Wiltsie of Arlington, a beekeeper of long experience, has been at work in the northeastern district. Mr. L. W. Elmore of Fairfield, who worked in Jefferson county last season, has had charge of a considerable part of the southeastern district. Mr. D. A. Davis of Ames, who has had considerable experience in the large apiaries of Texas and Utah, has looked after the work in the northwestern district and assisted some in other parts of the state. Beside these, Mr. Walter Reppert has worked in Des Moines county, Chas. E. Dustman, in Polk county, and J. F. Stille, has assisted in Mills county.

LOCAL INSPECTORS.

After a locality has once been gone over thoroughly, it is often of great advantage to have some local beekeeper appointed as a deputy to keep careful watch for the reappearance of disease. His acquaintance makes it possible for him to do this with a minimum of expense and his interest in keeping the locality free from disease furnishes an incentive to careful and thorough work.

If a local man is appointed at first, there is a saving in expense, but he is at a great disadvantage in one respect. In any office with police powers some persons always have to be dealt with somewhat vigorously to get any action. If a local man insists on destruction or treatment of colonies against the wishes of the owner, he has made an enemy with whom he may have to deal for years, and such disagreeable tasks are always best done by a stranger. After the preliminary work has been done, however, and such cases dealt with, the local man can usually get results without much ill feeling. During the past summer there have been a number of cases where the department has found it necessary to be very firm in insisting on the proper treatment or destruction of diseased colonies, and such experiences have been very unpleasant for the inspectors.

SUMMER MEETINGS.

The Iowa Beekeepers' Association held three summer meetings in 1915. The first was held at McGregor and was a joint meeting with the Wisconsin beekeepers. Because of a rainy day the attendance was not large, although those present enjoyed a profitable meeting. The second field meeting was held at Des Moines and was well attended. The third was a joint meeting with beekeepers from Illinois and Missouri, and was held at Hamilton, Illinois, just across from Keokuk. Beekeepers from nearly all parts of Iowa were in attendance at this field meet.

These summer meetings are the source of much interest on the part of those who attend, and enable the wide awake beekeeper to make the acquaintance of the leaders in the business of honey production from all parts of the state. Being held in different parts of the state, many are able to attend the summer meetings who cannot go to the annual convention in December.

INSPECTORS' CONFERENCE.

The day following the field meeting at Hamilton, Illinois, a conference of official bee inspectors was called at Keokuk. Several inspectors were present, as was Dr. E. F. Phillips, who is in charge of bee culture in the U. S. Department of Agriculture. A note-

Some of the Beekeepers in attendance at the Ames meeting, November, 1914.

worthy result of this conference was the appointment of a committee to secure joint action in dealing with disease along the state boundary lines. There is always some difficulty in eliminating disease from any locality along the state line, because of its presence in the adjoining state. N. E. France, of Wisconsin, proposed that some plan be developed to work through the U. S. Department of Agriculture in such cases. Mr. France was appointed to represent the

inspectors, and Dr. Phillips to represent the government in formulating a plan of action. It is thought that by using a system of duplicate reports whereby the record of all cases shall be filed in the U. S. Department of Agriculture, and border cases promptly reported to inspectors in adjoining states, that something will be accomplished in this direction.

PARALYSIS.

Until this year foul brood and sacbrood have been the only diseases with which the beekeepers have had to contend to any extent. This season, paralysis or something very similar has been quite prevalent. Unlike the other diseases which affect the larvae only, this disease affects the adult bees, and, in severe cases, greatly reduces the colonies. It has been reported as much more severe in the northern and western states than in Iowa. It is not thought that it will reappear seriously except in cold and rainy seasons.

NEW PUBLICATIONS.

The last annual report was practically exhausted within sixty days after it became available for distribution. A reserve supply was retained for future use for furnishing libraries with full sets of our publications, but numerous requests had to be refused. The supply of Bulletin No. 2, "The Beekeeper's Library" was entirely exhausted, and a new edition was issued by authority of the Executive Council, as Bulletin No. 4. The new edition was revised and brought up to date by including numerous publications that have appeared since the last issue was printed.

This bulletin together with Bulletin No. 3, "Brood Diseases of Bees," are now available on request from this office. The extension department of the State College of Agriculture, is sending out two bulletins on bees. Extension Bulletin No. 11, "Beekeeping in Iowa" and Extension Bulletin No. 22, "Wintering Bees in Iowa."

MOVING PICTURES.

The film showing the various operations in honey production has been sent out to various parts of the state. Wherever desired in institutes, short courses, or other assemblies where agricultural matters were under discussion, the film has been sent on payment of the express charges. Arrangements have been made whereby the department of engineering extension of the State college will keep the film in use during the present winter.

SUMMARY OF RESULTS.

Although some much needed work could not be reached, most of the calls were promptly answered. The following summary gives the total results of the visits of the six inspectors:

Total number of apiaries visited	597
Number of apiaries where disease was found	291
Total number of colonies in apiaries visited	6,669
Number of colonies diseased	1,256
Number of colonies with American foul brood	729
Number of colonies with European foul brood	378
Number of colonies with sacbrood	149
Number destroyed by inspectors	48
Number treated by inspectors	238

Total expense, including per diem and expenses of inspectors, office expenses, etc., from November 1, 1914, to November 1, 1915, $1,701.00.

IOWA BEEKEEPERS' ASSOCIATION

REPORT OF ANNUAL MEETING.

The annual convention of the Iowa Beekeepers' Association was held in Des Moines, Dec. 13, 14, 15, 1915, and an extended program was given. President C. E. Bartholomew presided.

At this convention action was taken approving the action of the committee in filing articles of incorporation and perfecting the corporation of the association. The name under which the body was incorporated is the Iowa Beekeepers' Association of Des Moines, Iowa.

The report of Secretary S. W. Snyder of Center Point, was as follows:

The report of this office consists of but few items for the past season. The first thing of any importance attempted was to send a letter to the members of the Legislature in regard to the establishment of a course in bee-keeping in the college at Ames. This effort cost us a few dollars in postage and stationery and finally failed in the purpose for which we were striving.

The receipts of this office are as follows:

Balance in hands of Treasurer Nov. 17, 1914	$ 27.63
Receipts for membership dues	43.00
	$70.63

Disbursements:

Nov. 19, 1914, paid stenographer, Mrs. J. H. Lechner	$ 3.50
Nov. 19, 1914, flowers for Prof. Summers	1.00
Dec. 19 1914, printing, Hamlin B. Miller	24.36
Jan. 5, 1915, paid J. M. Jamison for binding 250 copes of report	37.50
April 15, 1915, printing stationery, H. B. Miller	25.20
Aug. 18 1915 printing circular letters Center Point Independent	2.00
Nov. 29, 1915, printing programs, H. B. Miller	5.75
Postage since last meeting	9.31
	$108.61
Total receipts	70.63
To balance above bills, as due this office	$ 37.98

As a further report I might read a few items from the minutes of the last meeting, giving a few items which have not been recorded otherwise. On motion, Mr. R. E. Ostrus was elected to honorary membership for one year; also, all visiting delegates were elected to honorary membership. There was a committee appointed of awards consisting of B. F. Bleasdale, H. B. Miller and J. W. Stine. A committee consisting of the incoming officers was to have in charge the revision of the Constitution and By-Laws. A committee was appointed to confer with the State Board of Agriculture for the revision of the premium list. The committee consisted of F. C. Scranton, R. H. Longworth and B. T. Bleasdale.

The following committees were appointed:

Denver, Colora

We approve a two-day convention providing a program commensurate with the importance and needs of this association can be arranged.

We cannot too forcibly remind the friends of the bee, of the importance of calling to the attention of their legislative candidates the needs of proper legislation in the interest of apiculture.

Delegates in attendance at the National Beekeepers Convention at Denver, Colorado, February 16-18, 1915.

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The following committees were appointed:

Resolutions—A. D. Beckhart, Hamlin B. Miller, W. S. Pangburn.
Auditing—W. P. Southworth, B. T. Bleasdale, T. W. Blackman.
State Fair—President of Association, F. C. Scranton, R. H. Longworth.
Nominations—Frank C. Pellett, C. E. Dustman, H. E. Roth.

On motion of J. W. Stine the following resolution was adopted:

"The Iowa Beekeepers' Association in convention assembled at Des Moines would respectfully call attention of the United States congress to the need of more extended work in bee culture through the United States Department of Agriculture. Since our industry is not now receiving the attention which its importance deserves and which is already extended to other branches of agriculture we instruct our secretary to convey to the Iowa members of the House of Representatives and the United States Senate, our desire for assistance of this kind, and we further appoint Mr. Frank C. Pellett, State Bee Inspector, as our official representative to call upon the members of congress in person and to call the matter to their attention."

On motion the following persons were elected to honorary membership in the association for the following year: Prof. Francis Jager, St. Paul, Minn.; Dr. E. F. Phillips, Washington, D. C.; P. J. Doll, Minneapolis, Minn.; R. A. Morgan, Vermillion, South Dakota; Russell E. Ostrus, Des Moines, Iowa.

Resolutions adopted on recommendation of the committee:

We heartily endorse and will encourage the course in beekeeping recently established at the Agricultural College at Ames, and recommend that a short summer course also be provided and advertised.

We are greatly indebted for the work done by our legislative committee and recommend that it be made a standing committee for systematic legislative work.

We are not forgetful of the valuable service rendered by our officers and directors and in special terms do we commend the patient and efficient work of our secretary, Mr. S. W. Snyder.

We have been much profited by the original research of Dr. E. F. Phillips of Washington and hope that he may often be with us.

That we greatly regret the detention of Mr. E. R. Root, editor of Gleanings in Bee Culture, and Mr. C. P. Dadant, editor of the American Bee Journal and we extend our cordial remembrance to these men and their families.

We greatly esteem the wise and efficient service of Mr. Frank C. Pellett, State Bee Inspector, and feel honored in his unfailing interest in extending and conserving the work of the Iowa beekeeper.

We notice with appreciation the valuable and ever increasing assistance of our bee journals, especially Gleanings in Bee Culture and The American Bee Journal, which with their excellent and profuse illustration makes them most desirable among bee journals, therefore, we commend them to all live beekeepers and recommend their regular visits to every association member's home.

We urge every member of this association to solicit his neighbor beekeeper and others interested in apiculture to become members of this association.

We sincerely thank the Chamber of Commerce for their courtesy in extending to us the use of such commodious and convenient rooms for this convention.

We approve a two-day convention providing a program commensurate with the importance and needs of this association can be arranged.

We cannot too forcibly remind the friends of the bee, of the importance of calling to the attention of their legislative candidates the needs of proper legislation in the interest of apiculture.

Officers for ensuing year were elected as follows:

President, C. E. Bartholomew, Ames.

Vice President, B. T. Bleasdale, Des Moines.

Secretary-Treasurer, Hamlin B. Miller, Marshalltown.

Directors: W. S. Pangburn, Center Junction; J. I. Danielson, Fairfield; J. H. Schlenker, Ankeny.

Legal Adviser, Russell E. Ostrus, Des Moines.

Most of the papers and addresses at the association meeting follow:

ADDRESSES AND PAPERS ON BEEKEEPING.

PRESIDENT'S ADDRESS TO BEEKEEPERS' ASSOCIATION, 1915.

BY C. E. BARTHOLOMEW, PRESIDENT.

Beekeeping in Iowa is not up to the standard that this state deserves. I have the statement of men who have estimated the possibilities and found our present production far below what it could be and I have the statement of men who think that the state is producing more now than is good for the industry and the establishment of more apiaries would mean the over production of honey. In all the estimates of the first group I find that the estimates are too small to cover the possibilities, and the ideas of the latter group are based upon a mistaken idea of the economics of marketing. There can be no such thing as over-production of any commodity but there is often an under consumption, and one of the prominent causes of under consumption is under production. From the best information available the average limit of flight from the home apiary that bees make in gathering their load is about two miles and usually it is much less. This means a range of a trifle over twelve square miles. The successful beekeeper in this state secures nearly an average from a 100 colony yard of 6,000 lbs. of honey. On this basis Iowa should produce an average surplus of 25 million lbs. of honey annually if her possibilities were developed. Today Iowa is producing but little more than one per cent of the honey she could produce, and we have a long way to go to reach the maximum so that the beekeeper who fears over production as he calls it need not worry and fight to maintain under production or prevent over production, and to do so is to fight for the generations still unborn. Some states are making better percentages than Iowa and to compare one of these with our own I choose Texas, because I know more about it and also because with one-half the colonies Texas produces an average of twice the amount of surplus that Iowa does. The average surplus per colony is about four times what it is in Iowa. The longer season can not be given as the reason for this as the most of our successful Iowa beekeepers do better than the same class of beekeepers do in Texas in the average season.

What is the matter with Iowa as a beekeeping state then?

We can give the answer but we very much dislike to admit it. Texas has more successful up-to-date beekeepers than Iowa and fewer persons who just keep bees. It means that in Iowa the majority of bees are kept by people who give them little or no attention and most of them would not know how to properly care for them even were they so inclined. Such beekeepers are not a benefit to the industry but they are a serious menace to it. Their bees when disease once enters become a source of infection and a center for the spread of bee diseases. The vicious habits their bees develop are also a detriment to the industry by spreading an undue fear of bees. And again these are the most prominent individuals at belittling the value of the industry. But the principal injury they cause to the industry is in the spreading of disease to the apiaries of those who are trying to care for their bees and make them something of value to themselves, the community and the state.

How can this condition of things be changed?

The only answer to this is that by spreading the knowledge to these would-be beekeepers of the proper methods to follow in caring for their bees and impressing upon them the fact that if they do care for the bees properly the returns will be well worth while and if they don't give the bees the proper care they should dispose of them to people who will. If by the spreading of such ideas new men are encouraged to become real beekeepers it will be so much the better for the industry.

We will have to concede that the Texas beekeepers are as a class better informed as to the best methods for the manipulation of their colonies to get the best results (the largest amount of surplus), than we are in Iowa.

But why are they better off in this respect than we are?

I will cite two of the primary reasons. First. They have had an active association for many years that has endeavored to spread the doctrine of good beekeeping. Second. There has been maintained at the State Experiment Station an experimental apiary where new ideas have been tested and the information has been spread throughout the state by means of bulletins and association meetings of the best things in beekeeping. Good beekeeping has been encouraged and careless beekeepers discouraged.

Let us hope that Iowa with twice the number of bees may soon be producing as much surplus honey as they do in Texas. We ought to as we have a better bee locality.

I have a bit of good news for the association this meeting.

An experimental apiary has been established at our State Agricultural Experiment Station. The amount of the funds that were appropriated for equipment were small but the start has been made. The work has not been started on quite as an extensive a scale as might be desired but it will grow. This small beginning is the entering wedge and the extent to which it shall develop will depend entirely upon the extent of the active co-operation of this association. If the interest of this association is an active personal interest the industry will gain all the recognition that it deserves.

Another point of recognition that apiculture has gained in Iowa is the establishment of a course in apiculture at the State College. This course will be offered for the first time at the beginning of the next college year.

This course may be supplemented by research courses and work in the related basic sciences of botany, entomology, bacteriology, etc., to such an extent that a graduate will be well fitted to become an investigator in apiculture, or if the young man desires to enter the productive branch of beekeeping, the work will be such as to permit him to fit himself for the successful management of the commercial apiary.

Plans are under consideration at the present time for offering a summer course in beekeeping of six weeks. Whether this may be offered the coming summer I can not say at the present time. If such a course is offered it will be made a valuable short course for the beekeeper as well as the beginner.

I desire to suggest at this time that for the summer meeting of the association we hold a symposium on bee diseases. If the association can meet in Ames this coming summer I think that we can arrange to give you the advantages of our equipment for giving demonstrations in the recognition and treatment of bee diseases. I will desire the co-operation of the state inspection department in this, however, should it be your pleasure.

I wish to recommend that the annual meeting in the future be changed to two days instead of three as in the past. This is too long for many and when the program carries important subjects or business many do not feel that they can be present either the first or the last day and thus miss something that they can not well afford to miss.

Another thing that I wish to emphasize at this time is that this association is not growing with the rapidity that such an association should grow. The increase in our membership list can be quickly doubled if the members will work toward that end. Every individual in this state who keeps only one colony of bees should be a member of the association as well as the man who keeps a hundred or more and it is to the interest of the large beekeepers to see that the little fellows come into the association. It is to your advantage as well as the other fellow for it will assist in encouraging him to keep his few colonies in the way they should be kept. You will also find that most of them are only waiting for the invitation, and will be glad of the chance to become members. Membership will make them more progressive beekeepers and as such they will aid you in protecting your markets. It is the little fellow with just a few colonies and who at the most only produces a few pounds of honey that plays havoc with the markets by trading his honey for anything that may be offered him. It is not the real honey producer.

The question of marketing and the purchase of supplies in a co-operative way often comes up before associations of this kind. Let me say that such a function is not a prerogative of this kind of an association and that when such an association attempts anything of the kind it is on the road to destruction. It is the duty of the association to assist in all ways possible without entering into the actual commercial side in the marketing. The active work of the association should not extend beyond the discussion of means and the dissemination of the information to the general public of the value of honey as a food.

As long as the association sticks to the function of dissemination of the knowledge of good beekeeping and the improvement of the industry so as to place it on a par with other branches of agriculture it will thrive and be a benefit to the beekeepers of the state. It will work for the benefit of all but when it attempts to exercise a function that requires dictation to individual members it is sure to fail.

Co-operative buying and selling associations have been a success in many lines but they do not attempt to enroll all who are interested in the particular line of industry. Unless the individual can see a personal advantage he is free to remain independent. Too many members of an association of this kind are able to market their products at as good a price as an association can obtain and sometimes they have a trade worked up locally that gives them a return that is even better.

This association has no right to dictate to any member what his individual act may be. This association has no right to attempt to formulate rules of conduct for members in their individual capacities. Our right to exist lies only in the promotion of the industry and the dissemination of knowledge in regard to beekeeping, and only in so far as we do this and do not assume the right to dictate to any individual member what his acts shall be, we shall be successful. When we attempt to control the acts of any member no matter in whatsoever manner they may effect the rights of another member then we are going beyond our privileges and assuming the rights of the state. However, when these acts may effect the industry, and the association stands for the industry, as a whole then we are within our rights as an association if we attempt to have the state control such acts whatever they may be by law.

It is not necessary for me to mention to the members the failure of the proposed legislation before the last session. But I wish to remind the association that in another year there will be another session and that if we expect to gain anything thereby now is the time to begin to prepare for it. The members who were active in the work for the bills proposed at the last session should have the thanks of this association.

The best way to gain our ends before the legislature is to strengthen our organization. By next year we should have at least 500 members in this state. The association is now incorporated in accordance with the action of the association at its last meeting, and if you members will extend the invitation to all beekeepers in your locality I am sure that the desired number will be obtained.

FOOD VALUE OF HONEY.

BY FRANK C. PELLETT, ATLANTIC, IOWA.

In the days of our grandfathers honey had a place on every table. Honey and maple syrup were the only sweets supplied to the family. Refined sugar, as now used, was unknown. A few bees were kept to supply honey, the same as a cow was kept to furnish the family milk and butter. As the conditions of the country changed and ways of living became more complicated, new food products appeared upon our tables,

and substitutes took the place of things formerly regarded as necessities.

The dairy interests of the country made a tremendous fight to prevent oleomargarine from replacing butter and the sentiment created by this organized effort was sufficient to create a demand for butter from the American public, rather than for its cheaper and inferior substitute.

Unfortunately, the beekeepers have not been organized and while butter has continued to grow in demand and to sell at constantly higher prices, the demand for honey which was once well nigh universal has been largely supplied by corn syrup and other inferior products, while honey sells at a lower price than it brought half a century ago.

The beekeeper who offers his product for sale constantly meets the statement that honey is a luxury which the man of small income cannot afford to buy. Even the beekeeper himself has accepted this view, and undertaken to build a market on this basis.

Is honey a luxury? While it may not be a necessity, no more is it a luxury than is butter, or beefsteak. Some writers have pointed out that because one could not live on honey alone, it was a luxury and should be sold as such. One could as well live on honey alone as on butter alone, yet no one regards butter as a luxury.

A fair basis of values of food products is the actual food units which they contain. In order to secure reliable information as to the food values of the products which we wish to compare with honey, we have taken the table compiled by W. B. Barney of the Iowa food and dairy department. With this table at hand we went to a retail store in Keokuk, where probably the usual retail prices prevail and purchased different products of equal food value.

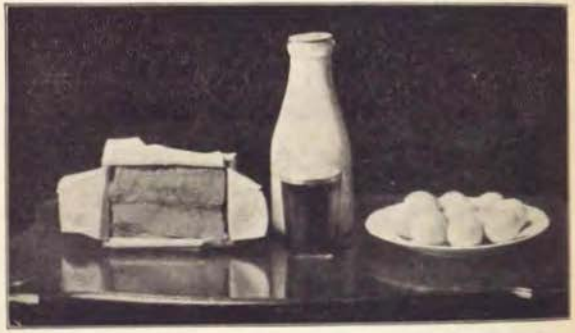

FIG. 1—Four articles of equal food value. Seven ounces honey, one quart milk, fifteen ounces codfish and ten eggs.

Figure 1 shows three articles of food value equal to seven ounces of honey. For the quart of milk we paid ten cents, for the codfish twenty cents, and for the eggs twenty-five cents. Milk and eggs are generally

FIG. 2—Seven ounces of honey is equal in food value to twelve ounces beefsteak, 5.6 ounces cream cheese, or 8½ ounces walnuts.

recognized as necessities, yet as far as food value is concerned the eggs cost more than twice as much as the honey and the milk is slightly higher in price.

In figure 2 is shown a twelve ounce steak which cost at retail fifteen cents, yet which according to Mr. Barney's table is only equal to seven ounces of honey in food value. When beefsteak is regarded as a necessity even by those who are working for the lowest wages, why should the beekeeper permit the impression to grow that his product is a luxury at half the price? Nine cents worth of cream cheese is equal to seven ounces of honey, yet even this costs more than the product of the hive. Thirteen cents worth of walnuts are necessary to equal the small jar of honey. Since extracted honey usually sells at less than sixteen cents per pound at retail, seven cents will not be far from the cost.

Figure 3 shows that eight oranges, which cost thirty cents, supply an amount of food equal to seven ounces of honey, and five bananas, at twenty-five cents per dozen, cost ten cents.

The following table shows the amount of the various items required to supply food value equal to seven ounces of honey, according to the above mentioned authority. The retail prices that prevail at this time are also given.

Honey, 7 ounces, 7 cents.
Cream cheese, 5.6 ounces, 9 cents.
Eggs, 10, 25 cents.
Round beefsteak, 12 ounces, 15 cents.
Boneless codfish, 15 ounces, 20 cents.
Oranges, 8, 30 cents.
Bananas, 5, 10 cents.
Walnuts, 8½ ounces, 13 cents.

The above items are in general use and few if any of them are regarded as luxuries. By reference to the above table it will be seen that as far as actual food value is concerned, honey is one of the cheapest of the ready-prepared foods. Only such raw products as potatoes, cornmeal, beans, etc., which must be prepared for the table after purchase, are cheaper in food value, at current prices than is honey.

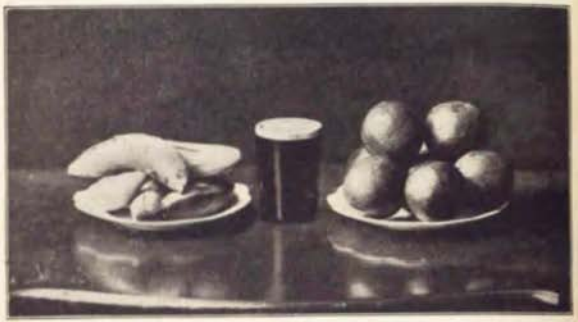

FIG. 3—Seven ounces honey, five bananas, eight oranges, are of equal food value. Honey is one of the cheapest foods for actual nutritive value.

Since honey is a concentrated food product and contains little waste, it can very fairly be compared with other concentrated products like butter. If butter is worth the prices at which it sells, honey could be sold at much higher prices without injustice to the consumer. According to a recent number of the South African Farmer's Weekly, honey sells in many South African towns at from 36 to 54 cents per pound, notwithstanding the fact that good crops are readily produced there. Butter often sells at such prices in this country, but never honey.

Since honey contains but little waste, it can be eaten in moderate quantities with much less tax on the eliminating organs than most other foods. Dr. Imfeld of Geneva, Switzerland, has been quoted as saying:

"If people would eat more honey, we doctors would starve."

It is up to the beekeepers to inform the public as to the true value of honey as food.—American Bee Journal.

ADVANTAGES OF BEEKEEPERS' ASSOCIATIONS TO THE INDUSTRY.

piary, Hamilton

fected as they protect that of the stockman. We want quarantine against diseased bees as they have against smallpox, or Asiatic cholera. This can only be done by union.

A group of Beekeepers at the Tri-State Field Meet at the Dadant apiary, Hamilton, Illinois, September 7, 1915.

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ADVANTAGES OF BEEKEEPERS' ASSOCIATIONS TO THE INDUSTRY.

BY C. P. DADANT, EDITOR AMERICAN BEE JOURNAL, HAMILTON, ILL.

In this world of ours, selfishness is the leading fault and the leading virtue. It is the leading fault because through it the meanest actions are perpetrated. Nations start war out of selfishness, for the gain they may make at the expense of other nations. It is the leading virtue because of the struggle for life and the survival of the fittest. It is through selfishness that much of the progress comes.

I believe, however, that selfishness can only be useful when properly directed and intelligently used. I remember, when I was a child, hearing my father ask a very able butcher for the best method of pickling pork. The answer, made in a gruff voice, was: "I once said things that benefitted a man several hundred dollars, but I am not ready to do it again." This man clearly thought that he should keep his knowledge to himself. My father was so displeased at the tone and the meaning of the reply that he never had any dealings with the butcher afterwards. Misplaced selfishness caused the man to lose a good customer.

You will sometimes hear beekeepers say: Don't encourage any one to go into bee culture, there are too many of us already. I believe that this is misunderstood selfishness, for when enough honey is produced to make the article a staple there will be greater consumption, creating greater demand.

When we associate together, in our industry we have our own interest in view. It is selfishness, but it is of the right kind. We give of our own, as we gain from others. We gain more than we give, because each of us secures information from many others. The union of interests and exchange of views creates a progress which is beneficial to each.

I do not know what is the sentiment of others in attending a beekeepers' meeting, but I will tell you frankly that, each time, I feel that I am much less progressive than I thought myself, that there are others who are much more practical than myself, that the world is big and that, after all, I am only an infinitesimal part of it and should not be so proud of what little I know. I find that some methods which I use have been tried and discarded by some others who have found something better and shrug their shoulders at the idea of any one still holding methods long ago set aside by them.

But it is not only to hear of other people's methods and improvements and give them ours in exchange that we attend beekeepers' meetings. We have struck unpleasant features in our industry. Disease has appeared among our bees and our attempts at cure have been only partly successful. We want to hear what others have suffered, whether the disease is spreading, in what direction, how they overcame it, and we want them to join us in preventing it from spreading or from returning if eradicated. We unite to obtain recognition from legislatures and have our industry protected as they protect that of the stockman. We want quarantine against diseased bees as they have against smallpox, or Asiatic cholera. This can only be done by union.

We find that in the spread of diseases our intelligent competitors, the other industrial producers, are not to be feared, that the main danger comes from the ignorant bee-owner, the man who has never kept bees without the protection of "luck," who owns immovable frames in what he calls "patent gums." This man must be educated, but as he is usually too old, our teachings must be addressed to the young generation, to the boys who have gone to college and found out that practical farming needs the help of chemistry, botany and entomology in order to succeed. But to get beekeeping taught in colleges as a part of the curriculum, we need to unite, to put forward a strong front, to show the importance of our industry. This is difficult, since after so many years of effort we are only now beginning to succeed.

But among the most important needs of association, should we not place in the front line, the necessity of united effort in securing uniformity of prices at a living and money-making rate? The man who tells you that he does not need a beekeepers' association because he "knows all about bees" is the very man who takes his honey to market without any idea of what it should bring. As a result, he accepts whatever the grocer offers him, and the active beekeeper has to wait until this random supply is exhausted before he can expect to sell his own. I dare say every large producer of honey who reads or hears this has suffered from this annoyance. The trouble would be much greater if the careless one knew enough to put up his honey in good shape. But usually his selfishness has not gone far enough to induce him to learn from others how to pack his goods and they show on their face the lack of information of their owner. Whenever he learns how to put up his honey in attractive shape, he is won over to the idea of union, because he has found out that he is as much in need of others as they are of him.

This is not all. We need to join together in shipping our honey to market, to buy our implements, to secure freight rates for our product. If we club together either to buy or to sell our success is greater, for we save both ways and get better attention either in selling or in buying.

When we attend conventions or fairs, we make or see exhibits of well-packed product. We get ideas or impart them, usually both. It is selfishness well placed, since we gain by helping others to gain.

Our associations have another great benefit which is not always given due credit. It is in the influence upon the general public of a recognized body of men. One apiarist might repeat for a score of years to his neighbors that bees are beneficial in the fertilization of flowers, that the fruit, the clover would be barren were it not for the action of insects and especially bees. His neighbors would pay but little attention to his assertions for "a prophet is not without honor, save in his own country, in his own house." But let a beekeepers' association meet with him, let them proclaim a few of the facts which he has been preaching vainly and every one is ready to accept them. We have found this out in our own experience and our sales of honey never succeeded fully until a beekeepers' meeting gave a sort of sanction to the value of our goods.

Outside of the intelligent selfishness which is promoted by our meetings with others in the same pursuit, there is a pleasure in these associations

which cannot be described in words. Perhaps not every man enjoys, in the same measure, the intercourse with others. We judge others by ourselves, so I conclude that most of you find great pleasure in meeting men whose names you have seen in print, in hearing their voices, in getting from them, in direct connection, the statement of their successes or failures.

I speak of failures. Do we not get as much benefit from the account of a failure as from the best success? The man who has tried a method and failed warns us against similar troubles.

When we are too sanguine, too sure of unvaried success, the recital of the losses sustained by another may cause us to hold our breath and think and perhaps avoid the dangerous pitfall.

The only drawback to associations of beekeepers in our immense country is the great distance which we have to travel to meet a respectable number of other men interested in the same pursuit. It is true that we can do a great deal by correspondence. But to derive the most positive benefits from beekeepers' associations we must attend meetings at least once in a while.

The existence of these associations is just beginning. I do not have to look very far back to remember when a State Association did not bring together more than a half dozen men. So we must take heart if we have disappointments. When our younger men succeed in getting information on this subject out of the colleges, beekeeping will become more and more important and the pleasure and profit of beekeepers' meetings will be increased a hundred-fold.

If we turn to foreign countries for information concerning the possibilities of association, we find the beekeepers of Eastern Switzerland organized in a powerful union of over 9,000 members, insuring their members against losses by foulbrood, or by disasters such as floods, avalanches, so common in that country, and the cost annually is only one cent per colony.

In Italy also, we find a federation of beekeepers, organized only a few years ago, with seventy-two members, and handling now each year hundreds of tons of honey for its members, who now number many hundreds.

Although so far, in this country, there has been very little done by federations of beekeepers, we can point to the Colorado Honey Producers' Association which sells the crops of its members at much better prices than they could realize singly. The beekeepers of Minnesota are also showing how much advertising can be done for disposal of honey by a good display at the Fair. They have secured a special building at the Minnesota Fair, and by clubbing together have supplied enough honey to keep an extractor busy on the ground every day, at the same time demonstrating practical beekeeping.

There is no limit to the possibilities of the future in any industry whatever and ours is not an exception. America's peaceable pursuits are putting our country fast in the lead, while other leading nations are at war; but to secure the best results, we need to associate together more than ever.

POLLINATION OF ECONOMIC PLANTS.

BY L. A. KENOYER, IOWA EXPERIMENT STATION, AMES.

One of the most intensely interesting chapters in the story of nature is that opened by Christian Conrad Sprengel more than one hundred years ago when he learned the advantages of insect visits to a flower and investigated the devices by which flowers encourage such visits.

As Dr. Pammel's paper tells of the structure of flowers and their relation to insects, I am to limit my remarks to economic plants, and attempt to show something of the real value of bees to farmer and gardener. Extensive work has been done along this line by the agricultural experiment stations, but much more remains to be done.

As most of you know there are two general classes of flowers as regards pollination: the wind flowers and the insect flowers. As a rule it is the insect flowers that are showy, sweet-scented and provided with nectar, these being the three important means of attracting insects. Their pollen is sticky and rather small in amount. In many cases the stamens, which bear the pollen, are removed some distance from the stigmas, which receive it; in other cases the two organs in the blossom mature the one before the other, and indeed it often happens that the two organs grow in separate blossoms. The object evidently is to prevent self pollination. Cross pollination gives the new plant two parents with two distinct sets of characters from which to inherit, and thereby makes variety possible in the plant world.

WIND FLOWERS.

Wind flowers are usually lacking in color, odor and nectar, but they make up for this lack by producing a great amount of pollen and by bearing large stigmas to receive it, for wind carries pollen, not with the precision insects use, but everywhere, and enough must be provided so that this random distribution will result in the production of a satisfactory number of seeds.

Corn, wheat, oats, sorghum and practically all the members of the grass family are wind pollinated. Likewise are the hazel, hickory, oak, cottonwood and numerous other nut and shade trees. But the majority of our cultivated plants must depend upon insects for seed production. We shall notice the part these play in the pollination of our more important plants.

Most of the orchard and garden fruits belong to the Rose Family. They have flowers constructed on a similar plan, with attractive petals, numerous stamens and nectaries near the base of the flower. A bee, on thrusting its proboscis into the flower for nectar is sure to rub off some of the pollen, which is then carried to the next flower. Honey bees especially are prodigious in the frequency of their visits to these flowers.

A Kansas observer remarks that they are about twice as numerous on the apple as all other insects together. He saw two of them visit respectively 61 and 53 blossoms without returning to the hive. I have followed a single bee as it visited more than 150 strawberry blossoms.

THE PLUM.

It has been found that practically all varieties of plums, which by the way are probably most visited by bees of all tree fruits, are self sterile, that is they produce no fruit, with their own pollen.

A cover of mosquito netting placed over a cluster before blossoming prevents the development of the fruit, as has been shown by Waugh in Vermont. I repeated the experiment in Iowa last spring, with the same results. Wind, then, does not suffice for the pollination of the plum.

Among wild bees the Andrena, a solitary bee which is about half the size of a honey bee and which burrows in the ground, is said to be of some importance in pollinating the plum. Wild bees gather pollen principally, and since they do not have to visit many blossoms to get a load and do not ordinarily fly from tree to tree, their value as pollinators is relatively slight. Dr. Bartholomew tells me of a plum tree on his place at Ames which was for four years hardly visited by honey bees and which bore not over a dozen plums a year although many wild bees and flies worked its blossoms. Next year a neighbor across the street brought bees into the community, and the tree responded with three bushels of fruit.

Dr. Cockerell noticed in New Mexico that wild bees come rather late in the blooming season of the plum, the earlier blossoms being, however, largely visited by flies, which are poor pollinators. He considers that honey bees do most of the work of pollination.

The Vermont Experiment Station, after extended study, decides "Observations show conclusively that the common honey bee is the only insect which can be depended upon to effect the pollination of the plum in a satisfactory manner.

THE PEAR.

Waite of the U. S. Department of Agriculture has worked on the pear, finding that out of 36 varieties studied, 22 are self-sterile and 14 self-fertile. All self-pollinated pears, however, are smaller than the cross-pollinated and not so well filled out toward the blossom end. He finds bees to be the leading pollinators.

It is in connection with the pear that there is a blot on the bee's reputation, for pear blight is carried from flower to flower by the bee and in suitable weather they may infect the entire orchard with disease. California people claim that they can dispense with the bee as a pollinator, for they feel that it does more harm than good. But over most of our country pear growers feel that they need the bee. The use of proper precautions will do much toward suppressing the blight, which, by the way, can be carried by any insect that visits pear flowers, even if there are no bees. Professor J. H. Merrill of Kansas has during the last three years made observations and experiments which show the apple aphis or plant louse to be an important factor in carrying fire-blight among apples and pears. Further work is to be carried on, and it may be that the bee will be vindicated.

THE APPLE.

Pollination of the apple has been extensively studied at the Oregon Experiment Station. Of the varieties investigated, 59 were found to be self-sterile, 13 partially self-fertile, and 15 self-fertile, but even the self-

fertile varieties produce much better fruit when pollen from another variety is applied.

One by three inch glass slides were smeared with vaseline and left at distances varying from 4 to 30 feet from the tree. These slides caught each from 6 to 16 wind-blown pollen grains. A much larger number would have to strike the same area to insure the wind pollination of the fruit.

Petals and stamens were removed from all the blossoms on a tree. Only eight bees visited it in the whole period that its pistils remained receptive. More than twice this number was seen in a half hour on a nearby normal tree. This experiment shows the importance of color in the attraction of bees.

The author concludes: "As the assurance of a crop depends upon insects as distributers of pollen, it is necessary that apiaries be established in the different fruit sections.

Waite noticed that in western New York there were ordinarily not enough insects to secure complete pollination when the main body of apple orchards come into bloom. He recommends that hives of bees be kept in the vicinity.

It is said that the peach and the quince are to a large extent self-fertile, and do not so much demand the visits of insects as do the pear and apple.

BERRIES.

The red raspberry is a favorite of the bee, giving rise to extensive honey stores in some sections, and no doubt it is much aided by the visits of the bee. There can be little doubt that the black raspberry, blackberry and strawberry also owe much to bees. Many of the best varieties of strawberries have pistillate flowers and require the pollen of perfect blooming sorts. In my community in southern Kansas a few years ago bees were scarce, and the pistillate strawberries, although planted but three rows in a strip, did not mature their berries perfectly on the middle row. At the same time it was the practice of growers in sections where bees abounded to plant the pistillate varieties in solid blocks of an acre or more, from which an abundance of berries was secured.

THE GRAPE AND OTHER FRUITS.

The grape has an inconspicuous blossom, the petals of which drop off without opening. It is not probable that bees play a very important part in its pollination, Dr. Beach of Ames tells me. Most grape blossoms are self-fertile, the fertilization occurring before the falling away of the united petals. Among the self-sterile sorts the prevalent opinion is that pollen is carried largely by wind, although insects do visit them and may be of some aid.

Currants and gooseberries are plants that require the visits of insects. The gooseberry blossom matures first the stamens, then the pistil, so self-pollination can hardly occur. The honey bee is an important visitor to these blossoms.

Cranberry growers have learned to recognize the value of the bee, and it is the custom among many of them to keep hives near their berry bogs, assigning about one hive to the acre. Franklin in Massachusetts screened

insects off a plot, and it produced but 2¾ quarts of berries. A similar unscreened area produced about a bushel.

The tropical as well as the temperate agriculturists are aided by the bee, for California makes use of it in orange groves and Porto Rico in coffee plantations.

GARDEN VEGETABLES.

Passing to vegetables, we find cucumbers so much dependent on bees that those who grow them under glass have recognized the importance of keeping bees, and doing away with the rather laborious task of hand pollination. Hundreds of hives are kept in greenhouses for this purpose. Many also use bees to pollinate greenhouse tomatoes.

Dr. Pammel finds the honey bee chief among insect visitors of the muskmelon and watermelon. It is also abundant on the pumpkin and squash, but is generally exceeded in numbers by a wild bee which resembles it so closely as easily to be confused. The striped and spotted beetle, which so much enjoy eating the foliage of the cucurbits, are found abundantly on the blossoms. They are there mainly to eat the delicate tissues. It is probable that they aid to some extent in pollination. Although as compared with bees they are poorly adapted to carrying pollen, the spiny pollen grains of the pumpkin may often be found adhering to them.

One investigator has found that bees are valuable agents in the setting of a good crop of sweet peas.

ALFALFA.

A very important group of economic plants is that of field legumes—important not only because of their high feeding value but besides because of their propensity to enrich the soil by adding to it nitrogen from the air. Many of these legumes are self-sterile and require that insects carry pollen from other plants. Red clover seems to be a plant of this character. Some of those that are self-fertile have flowers so constructed that they are seldom or never pollinated without the aid of insects. The peculiarity of legume flowers may be illustrated by the alfalfa blossom. There are three types of petals, the broad outer standard, the two wings and the two which, united by their lower margin, form the keel. The ten stamens and the pistil are tucked away in the fold of the keel. As long as they are here, no pollination can be accomplished. But the pressure of an insect against the keel causes the organs to be loosened from this confinement and to suddenly move toward the standard. This springing of the keel, and the accompanying liberation of the essential organs of the flower must precede the fertilization of the pistil, in those forms that have been investigated.

Alfalfa is not freely visited by insects in Iowa, for it seems to contain little or no nectar to reward their visits. Out in the Rockies it is one of the leading honey plants. Whatever other factors may be involved, the fact that alfalfa produces so little seed in Iowa seems partly attributable to this dearth of insect visitors.

RED CLOVER.

Red clover takes the lead of the forage legumes in our own section. It can easily be demonstrated that this plant must have insect visitors. Last

summer at Ames we screened off a plot 3 by 6 feet to exclude insect visitors. In 100 heads gathered from this plot there were found only 8 seeds.

It is a well known fact that in Australia red clover did not produce seed until the bumble bee was introduced.

The question now arises as to the relative importance of the different insect visitors. Waldron of North Dakota says that bumble bees are responsible for the pollination of 95% of the red clover seed produced.

Ordinarily the honey bee cannot, on account of the length of the corolla tube, reach the nectar in red clover. But sometimes they work on it, the possible inducement being the pollen, which they can easily gather as they were observed to do on two or three days last summer, the abundance of nectar, which at times comes well up the sides of the tube, or the scarcity of other picking, inducing them to search for nectar even though they cannot obtain much.

When bees are confined with clover in a cage, the escape from which is possible but difficult, they work on the blossoms much more than they would otherwise do. In Ames in 1911 clover in a cage 12 feet square and 6 feet high, and containing a hive of bees set 37.2 seeds per head, while in a similar cage in which bumble bees were daily placed it set 30.4 seeds per head. In 1915, clover in a similar cage with a beehive set 18.8 seeds, while that in the open plot set 35.1. The difference may be explained by the fact that 1911 was a very dry summer, while 1915 went to the other extreme. In the former year there was a scarcity of nectar from other sources during the blossoming time of the clover. Last summer not only was there an abundance of nectar plants, but the working time of bees was much reduced by cool, cloudy weather. Possibly, also, there was less nectar in red clover this year, for the indications are that it yields more in warm than in cool weather. Furthermore we must bear in mind that the confinement of bees in a cage with clover is not a natural condition. The recent statement of a European author that honey bees may occasionally aid bumble bees in clover pollination, is about as strong as we can safely put the matter, under the light of present knowledge, for our section. To be sure the presence of honey bees in the vicinity of a clover field can do no harm, and conditions are very likely to be such that they will do good.

An effort has been made recently to breed bees with tongues long enough to reach clover nectar. The Italian bee is said to be a step in this direction. Perhaps another solution of the matter would be clover with a shorter tube. If bee breeders and clover breeders could meet half way, what a bonanza it would be for both, since the nectar of our clover fields would yield enormous amounts of honey and since the difficulty that farmers experience in growing clover seeds would be largely overcome.

White and alsike clover, though they are not nearly so great nectar yielders as the red and are peculiarly erratic in the manner of their yielding, are easily accessible to our bees and are much visited by them. There seems to be no question as to the value of the bee in the pollination of these widely-grown lawn and pasture plants.

SWEET CLOVER.

Sweet clover is a plant that has come into remarkable prominence in recent years, and its pollination is now engaging the attention of investi-

gators. Last summer at Ames I enclosed plants in nets of cheese cloth to exclude insects from the blossoms. But few seeds were formed, not more than 1-10 as many as on plants normally exposed. I have not yet determined the cause for the setting of these few, but from the results it is evident that insect visits are desirable. I learned also from experimentation that the flowers which are open in sunny weather, when bees are at work, invariably produce more seeds than those which are open in cloudy and rainy weather when bees are not working. It was also evident that the flower clusters high on the plant and best exposed to the activities of bees produce more seeds than those that are lower down and less likely to be visited; furthermore a patch kept free from weeds produced more seeds to the cluster than one in which the plants are surrounded by weeds.

OTHER FIELD CROPS.

Buckwheat is much visited by insects. It would be interesting to know just how important they are in pollination.

The blossoms of the sugar beet are not much visited by bees. Shaw, of the U. S. Department of Agriculture, noticed while experimenting on pollination, that blossoms enclosed in a paper bag produce a few seeds. Further investigation led to the discovery that the thrips, an almost microscopically small insect which abounds on the flowers, is of considerable importance in cross pollination. Many pollen grains may be found clinging to their bodies. They are not an unalloyed benefit, however, for they burrow into the tissues of the flowers in such a way as to cause considerable injury.

THE FIG.

I can no better close than with a brief statement of the most remarkable of all stories of insect pollination, that of the fig. The fig is an example of a flower cluster turned inside out, for the flowers line the inner surface of the fig, which opens by a small aperture at its tip. One type of fig, known as the caprifig, bears mostly staminate flowers, and develops one inferior fruit while the commercial or Smyrna fig has mainly pistillate flowers and develops a luscious fruit. The ancients, without knowing the reason for its benefit to the fruit, practiced what is known as caprification, that is, they would cut off branches of the wild fig tree about blossoming time, and hang them over the limbs of the Smyrna fig. Quite recently it has been established that a tiny wasp, known as Blastophaga, reaches maturity in the wild fig, crawls out, enters the aperture of the Smyrna fig with much difficulty, often, even, at the sacrifice of her wings, and deposits her eggs on the styles of the pistillate flowers. Singularly enough she dies without offspring, for these flowers have styles too long and the egg does not reach the ovary. But she has brought pollen from the wild fig, and the development of a larger and sweeter fruit results from the placing of this pollen on the pistil. It is indeed a curious relation between plant and insect, but one which the fig grower must take into account for success in his business.

As knowledge advances and as competition becomes more keen, the grower of economic plants becomes more and more inclined to control the conditions that insure a successful crop, leaving nothing to chance.

Wild insects fluctuate in numbers from year to year, and inasmuch as the honey bee has proven so capable of doing the important work of pollination in so many of these plants, it is not strange that those who grow plants are in ever increasing numbers availing themselves of the two-fold value of this busy little creature.

POLLINATION OF PLANTS.

BY L. H. PAMMEL, PROFESSOR OF BOTANY, STATE COLLEGE.

Since promising to appear on your program an unavoidable conflict has made it impossible for me to attend your convention. I regret it, I assure you, because I had looked forward to meeting you with a great deal of pleasure. Professor Kenoyer has kindly consented to take my place on the program and I am sure you will have a treat in listening to his presentation of the subject.

The subject I have chosen is close to my heart. I became interested in bees when I was a boy on a Wisconsin farm and shortly afterwards it was my pleasure to have been a student in the University of Wisconsin where I became acquainted with Dr. Wm. Trelease, the professor of botany, who had published some papers on the pollination of plants. It was during the spring of my sophomore year when I and a number of students interested in botany took a course of lectures and laboratory work on the pollination of plants. It opened up to me a new world. I had heard of Darwin and the great work he had done on the pollination and cross fertilization of plants. I had more than once heard the name of Darwin used with derision. To the average layman he was known only for the work he had published on the origin of species and the descent of man. The ecology of the flower was a new field to me. Here was a great naturalist who found "poetry" in flowers, who saw and had described wonderful contrivances in plants to secure the pollination of plants. I became acquainted with the works of Herman Muller, Fritz Muller, Hildebrand, Asa Gray, Sprengel and Sir John Lubbock and many other botanists who were students of flower pollination as it was then called, later going by the name of pollination and now as flower ecology.

The subject was fascinating to me beyond measure. Not only, did I become acquainted with some of our wild plants but the insects important in pollination. For several years I studied and made observations on plants at various times. My interest in the subject has never ceased.

The subject of pollination is wonderfully fascinating. Take the matter of the conspicuousness of flowers to attract insects. I like the old theory but there are now controverial points. Dr. Cowles has put it well.

> The sensitiveness of pollinating insects to color and to odor. It is believed commonly that odors and bright colors in flowers are of great importance as indicators, or "signals," to insects of the presence of nectar or pollen, and some observers even go so far as to suppose that these features have arisen through natural selection, the insects preferring the more fragrant and showy flowers, while others go unpollinated, so that the plants bearing them have no progeny. There is no evidence whatever for the selection theory of the prevalence of showiness and odor, and even the theory that insects are attracted by color and fragrance rests too little on experiment and too much on the untenable assumption that the theory must be true, because nobody knows any other role for these floral features. It is tenable hypothesis that such features are without value to the flowers possessing them, and the "signal" theory deserves support only as it is proven experimentally.
>
> It is not certain that insect attraction is the only possible role of colored corollas; it has been suggested that they may play an important part in the chemistry of fruit maturation. Pigmented plastids may be important in food making, and pigmented cell sap may indicate the formation of useless by-products. It is to be noted that some wind-pollinated flowers are very showy, as in the larch and the red maple. Corollas also are of some importance as protective organs for the pollen and stigmas, especially in flowers whose corollas close at night and in stormy weather.

The possession of a keen sense of odor by pollinating insects is undoubted, inconspicuous fragrant flowers being visited much more than are showy odorless flowers. The readiness with which flies are drawn to sources of nauseous odors is well known, and they frequent ill-smelling flowers in a similar fashion. Hawk moths have been found to be able to detect at a distance of several meters the presence of fragrant but invisible nocturnal flowers, and bees have been seen to fly directly toward honey artificially hidden. Indeed, there are reasons for believing that many insects are able to detect odors that are inappreciable to human nostrils.

The possession of a keen sense of color is much less certain. Even the ardent supporters of the "signal" theory hardly postulate it except for the more specialized insects, such as butterflies and bees. The best experiments indicate that insects are very short-sighted, none being able to see distinctly for more than sixty centimeters, and bees very much less than that. Objects in strong contrast (such as large light and dark bodies in juxtaposition, or bodies in motion) appear to be seen much farther than are other objects, certain Lepidoptera seeming to be able to see thus vaguely for a meter and a half, and bees for a half meter. The only insects in which color perception has been definitely demonstrated are the honeybees. These highly organized insects often have been seen to visit gaudy but nectarless artificial flowers, and sometimes they attempt to get at showy natural flowers that are under glass. Frequently they visit colored, unopened buds and wilted flowers, the latter being at times approached, even after they have fallen to the ground. Apiarists rather generally believe that honeybees are able to perceive color differences, and hence they sometimes paint their hives in different colors, so as to aid the bees in recognizing their abode. To the extent that color is perceived by insects, it is a much more reliable "signal" than odor, since the latter often is affected by the wind or masked by other odors. Probably the characteristic forms of flowers serve as indices to nectar, especially in the case of flowers that are conspicuous by their shape or by their size; some observers think that form is even more important than color as an insect "signal."

> Some investigators believe that honeybees not only perceive colors, but that they have marked color preferences. Experiments with honey on colored papers seem to show that bees tend to visit a particular color, even if others are more conveniently situated, and elaborate theories have been worked out on the assumption that bees dislike yellow and

prefer blue, whence it seems to some observers an easy postulate that the day of yellow flowers is waning and that of blue flowers is in the ascendant. Such conclusions certainly are unwarranted. The constancy of the honeybee to a given color, such as blue, does not mean a preference for blue as such, but the association of nectar or pollen with that color. If a bee commences its activities on a red flower, or on honey placed on a red paper, it is constant to red. In visiting flowers, bees are constant not only to color, but also to form, flying from flower to flower of the same species. This constancy to a given plant species for a certain period is of great advantage to the plant, since it means a minimum waste of pollen. It is equally of advantage to the bees, since the nectar or pollen is all of the same quality, and since time and energy are saved in that exactly the same process is repeated in each flower that is visited. The collapse of the color preference theory is well shown in those cases in which different individuals of a given plant species have flowers of different colors. In such species bees soon learn the essential likeness of the differently colored flowers, going from one color to another indifferently. In other words, bees learn to ignore differences in color that are unaccompanied by differences in nectar or pollen. Even if bees prove to be the only insects with a color sense, other insects certainly are able to appreciate differences in tone, as they appear in a photographic print where whites and various colors come into sharp contrast with the darkness of the foliage. Similarly, the prevalent whiteness of nocturnal flowers makes them more conspicuous than would any pigment color.

A survey of the whole subject may be obtained from the English translation of Knuth Handbook of Flower Pollination, three volumes published by the Clarendon Press, Oxford in 1906. This admirable treatise has a splendid summary of the more important work done along the lines of pollination up to the year 1906. Some work has, of course, been done since by entomologists and botanists. In this country John H. Lovell and Graenicher have made a number of important contributions. The flower ecologists have missed the contributions formerly made by Charles Robertson of Carlinville, Illinois. Mr. Robertson greatly enriched the American literature of the subject.

The following agents are important in the pollination of plants, I Water (Hydrophilous) Fresh Watel Eel grass. II Wind (Anemophilous) corn, wheat, rye, pine, oak. III Animal (Zoidiophilous), birds (Ornithophilous) Trumpet creeper, snails (Malacophilous) duckweed, aroids; Insects (*Entomophilous*) pear, quince, clover, plum, strawberry, etc. Large bee flowers (*Melittophilous*) sage; small bee flowers (*Micromelittophilous*) parsnip, goldenrod, dogwood; small fly flowers (*Micromyiophilous*) birthwort with a temporary prison; carion fly flower (*Sapromyiophilous*) carion flower; beetle flowers (*Cantharophilous*) many compositae, magnolia; butter fly flowers (*Psychophilous*), pink sphinx flowers (*Sphingophilous*), flowers pollinated by hawk moths and moths (*Noctuids*).

Loew classified flowers and the insects adapted to them into: 1. Allotropous. 2. Hemitropous. 3. Eutropous. The *allotropous* flowers are adapted to various kinds of insects with short proboscis. The *hemitropous* flowers are visited by insects with a medium proboscis. The *eutropous* flowers are exclusively adapted to insects possessing a long proboscis. These flowers are therefore exclusive and are visited by the bumblebees, honey bees and the butterflies and moths (Lepidoptera).

Plants are either (1) self pollinated (Autogamous) e. g., the closed flowers of violet or (2) cross pollinated with the same species (Allogamous). Cross pollinated, e. g., with the same species, red clover (3) *hybridization* occurs between different species, offspring from the wild crab and cultivated apple. In most cases the flowers are open at the time of maturity (*Clasmogamy*) (2). The flowers are closed at the time of maturity of the stamens and pistils (*Cleistogamy*) late autumn flowers of the violet.

Close pollination is prevented by the difference in time of the maturing of the stamens and pistils. When the stamens mature first the term proterandrous is used—goldenrod, dandelion, geranium, etc. When the pistil matures first it is called proterogynous as in *Luzula*. In some plants as in European primrose and the little bluet two sets of flowers are produced in the same species, one with a short style and long stamens and another with a long style and short stamens. These flowers are known as dimorphic.

In the trimorphic flowers, three sets of plants are produced one with a short style; stamens of medium length and long stamens, a second plant with short stamens and long stamens and the style of medium length, and a third plant with a long style, short stamens and stamens of medium length—Loosestrife is an illustration. Seed will not be produced unless the pollen comes from stamens corresponding to the length of the style.

It would take a great deal of time to describe the special adaptations in flowers. A few special cases will serve our purpose, one of the most remarkable plants is Yucca which is a native to western Iowa along the Missouri river. This plant is pollinated by the Yucca moth (*Pronuba yuccasella*). The female moth has a specially constructed maxillary palp which can be rolled up so the yucca moth can gather the pollen and carry it to the flower. The female deposits its eggs in the pistil and then pushes the pollen into the funnel shaped stigma. After a few days the eggs hatch and feed on the developing seed. Each larva consuming about 20. Then the larva bores its way out of the pistil and pupates in the ground the next season when the yucca is in bloom the moths are fully developed. The remarkable thing about the yucca is that seeds will not be produced without the yucca moth and the perpetuation of the moth is dependent on the yucca.

We have another class of flowers known as pitfall flowers represented by the Birthwort (*Aristolochia*). The flowers are proterogynous, that is the pistils mature before the stamens. The flowers as Muller says appear to bloom but actually do not, neither the anthers and pistils are mature. The insects enter the flower, the hairs point down obliquely, the insect finds it easy to enter. The fly may be in the flower for six days. In the meantime the stigmas mature and the fly leaves some of the pollen on the stigma from another flower, the anthers mature later; when these have shed their pollen the hairs relax and the insect goes out and to another flower. A somewhat similar trap occurs in some of the aroids. In the milkweed (*Asclepias syriaca*) insects, especially bees are trapped by the pollen or pollen masses. These masses are often so

abundant on honey bees that they cannot extricate themselves. The strong and pleasant odors as well as the large amount of nectar in the nectaries attracts many insects to the flowers. The common Stapelia of the same family sometimes cultivated in greenhouses attracts flies because of the Carion-like odor. The hair and color of the flowers resemble the flesh of some wild animals where the plants grow, and for this reason blow flies deposit their living young in the flowers.

The moccasin flow also traps insects. The so-called slipper or labellum is provided with a revolute margin. The odor which is pleasant attracts insects that find it an easy matter to go into the flower by the opening. It feeds on the juicy hairs but it cannot get out because the margin is revolute. The only way for it to get out is by means of the small openings on each side at the base of the flower. In doing so it comes in contact with stigma where it leaves some of the pollen from another flower and carries away some of the sticky pollen to another flower.

Quite a number of flowers are sensitive like the thistle, barberry, bachelor's button, laurel, etc. In the case of the barberry which is much frequented by honey bees when mature. The honey bee touches the anther, the stamen moves toward the insect in the flower. The Iowa thistle and other species are also sensitive. When the insects try to get the nectar in the flower the stamens move and force the pollen out. Try the experiment sometime when you have some of the thistle heads at hand by touching them with a pencil and you will find that a gentle wave will pass over the heads. You can see the sensitiveness in the stamen of the moss rose, simply touching them will cause the stamens to move forward.

A BEE INSPECTOR'S PROBLEMS.

BY J. E. CRANE, STATE APIARIST OF VERMONT.

(Read at the Inspectors' Conference, Keokuk, Sept. 8, 1915.)

I know not whether to congratulate you and your office as inspectors of bees or to commiserate you. The work of an inspector is not altogether a pleasant one. The sting of bees and the sting of tongues are not always conducive to one's enjoyment of life. Long days of toil and loss of mid-day meals teaches patient endurance. But there are many most enjoyable things in the life of an inspector. We make many most delightful acquaintances, some of them we number among our choicest friends.

The joy of helping our fellow beekeepers is ever with us. It is a source of satisfaction to know that through our efforts a fearful plague is being checked, and slowly eliminated; that discouraged beekeepers are once more prospering, building up their depleted yards and securing good harvests. We have unusual opportunities to learn how others keep bees, and not infrequently learn of ingenious devices or short cuts, that are of some pecuniary value to ourselves. On the other hand we have unusual

opportunities to instruct beekeepers who have had less experience than ourselves, and desire to learn.

I hold that it is quite as much our duty to instruct beekeepers in beekeeping as to help them to get rid of disease. It is not of much permanent value to simply eradicate disease when it makes its appearance unless you teach the beekeeper how to detect it and cure it himself. Probably not more than one beekeeper in five or six takes a journal devoted to beekeeping, and the ignorance of many is beyond comprehension. Think of one who has kept bees for a score of years and yet can not tell drone from worker brood, or a healthy larva from one diseased or dead. The kinds of hives in the older sections of country are too numerous to mention. The laws in some states have tried to correct this by compelling all beekeepers to use a comb frame hive; but of what use is a frame hive without guides of some sort to produce straight combs. And so we find hives with frames with combs running at every conceivable angle to them with bottoms securely nailed on and the whole glued together with several years accumulation of propolis. I sometimes carry a hammer and chisel as necessary tools to open the so-called movable comb hives. A crow bar would often be more useful. Would not a law compelling these ignorant beekeepers to use a little common sense or even ordinary horse sense be a good thing?

How does foul brood spread? We have been taught for the past fifty years that it was caused by healthy colonies robbing those that were diseased. This will undoubtedly account for some of it, but not all. This is a subject that has given me much thought and no little anxiety. With American foul brood this may be the main source of infection. It would seem to be quite different with European foul brood. It makes its appearance so unexpectedly, spreads through a yard so rapidly, that there seems at first something about it most mysterious, almost uncanny. Like influenza in the human family it seems to move in the air without let or hindrance. But if we study it carefully I believe we shall see that it is governed by well defined laws. American foul brood moves slowly. It may be in a hive for several years and yet the colony remain fairly prosperous. On the other hand European foul brood spreads in a hive with great rapidity. The first diseased larva may appear today and in six weeks one-half of the unsealed larva will be dead and the colony greatly reduced in numbers, in fact so greatly reduced as to be unable to prevent bees from other hives entering and carrying away honey and disease with them. It may be that the disease has entered the hives of an innocent, ignorant beekeeper, over on some back road, that before he is aware of the fact this hive has scattered the disease through a whole neighborhood. But the carrying of honey from diseased colonies to healthy ones is not the only way or even the principle way European foul brood spreads. Last year European foul brood appeared for the first time in one of my out yards. I left it mostly to others to look after as I was away from home much of the time. This spring the yard was broken up, many of the colonies that appeared healthy were sold, and the weakest carried to other yards. Of those brought to our home yard a few, as the season advanced, showed a few cells of European foul brood, giving me a

good opportunity to study the disease. Two facts appeared as it seemed to me with great distinctness. One was the rapidity of the development of the disease in a hive and the apparent ease with which it transmitted the disease to its neighbors. I have come to think this is not caused so much by spores floating in the air as by the drifting of nursing bees from diseased to healthy colonies, and it may be older bees. I have found colonies on one side or both sides of European foul brood to become diseased very soon with the same malady, while it did not appear in other parts of the yard. The indiscriminate change of combs by amateur beekeepers may often spread disease.

It seems evident that "locality" has something to do with these diseases, as I find it less virulent in some places than others, and appears much more difficult to bring under control on low damp ground than on high dry locations. In fact these diseases appear quite different in localities not far removed from each other. This is especially true of European foul brood, and I often find myself puzzled to recognize it. We are having a good deal of sacbrood here in Western Vermont that often proves quite injurious and sometimes fatal to a colony afflicted with it. Another larval disease has appeared from which I have lost several colonies. It appears something like European foul brood and quite difficult often to distinguish from it. It appears to be somewhat contagious, but not nearly so bad as European foul brood. It is yet to be studied and named.

There seems to be little that is new in the treatment of American foul brood. The method of treating European foul brood by the introduction of a vigorous Italian queen into a strong colony before the disease has progressed very far seems to work well, if the colony is allowed time to clean up before she begins laying. I have cured two or three in my own yard this season by this treatment. In one case however I introduced a virgin queen and the colony swarmed and the last state of that colony was worse than the first. I have hesitated somewhat as to the advisability of giving this method to beekeepers, as the average beekeeper does not seem to distinguish very carefully between a strong or weak colony, one badly diseased or one but slightly affected, or even between European and American foul brood.

Since writing the above I have spent several days inspecting bees in another county and am rejoiced to find foul brood disappearing among intelligent beekeepers and they are reaping a good harvest. The corners of their mouths turn upward instead of downward as in the past. One young man who had two colonies with European foul brood in the spring had introduced Italian queens after leaving them queenless for a time and I found them as healthy as one would care to see. But I found the usual number of ignorant and shiftless beekeepers for whom my disgust knows no bounds. I hope you do not have so many in the west.

We have one difficulty to contend with here that I presume you are free from in many parts of the west. Large forests with many bee trees and more or less disease in them, so disease is liable to break out in a locality where before it was unknown.

"SOMETHING."

BY DR. A. F. BONNEY, BUCK GROVE, IOWA.

It becomes easier each year to find something to talk about at these meetings, for apiculture is not standardized as a science, and new fields for exploration are being opened on every side. We are rather ignorant of the animals we have to manage; for instance, it has been but a few months since the electrical thermometer in the hands of Dr. Phillips exposed to us the very interior of the bee cluster in winter, and upset many very pretty theories. We knew, in an empirical way *how* to winter our bees, but not *why*, never dreaming that the colder our bees became the hotter they got, as paradoxical as that statement is. As a result of this new information I fear I shall have to begin packing my chaff hives in winter cases, or put them in a cellar. I surely shall if I must have four inches of packing against the walls, but I do not propose to discuss that now.

Our president wrote me, asking for a subject from me that he might get out the announcements. I was too sick at the time to smile, so asked him to put me down for something, and I am going to try to give it to you, and begin, as I have, by telling you a lot of things you know all about. We do not know, with all our work, what causes the swarming "fever" in bees, more than that it is a part of nature's plan to perpetuate the bee family; we do not know if the bees smell with their antena or their toes or hear with their stings, but they sure do hear something from me when they do sting. Evidently we have plenty to learn, but our progress seems lamentably slow.

I have planned to tell you in this little talk about the use I have found in the bee yard and honey house for some of the sciences, but found that to touch on one alone would use up all my available time, so I have picked out a few cases at random.

A person does not have to be long with the bees before he finds that by boiling together cane sugar, water and tartaric acid he gets an elegant bee feed for winter. I found the study of this simple thing very interesting, and think it will prove so to others, and will explain that this treatment inverts the cane sugar, to use a chemical term. That is, it causes the plane of polarization to turn to the left instead of the right as cane sugar does. The water is broken up, and its elements of hydrogen and oxygen go to the sugar and convert it into dextrose and levulose, a compound very similar to honey, which is a natural invert sugar. Properly made this artificial invert sugar will, in the hive, remain liquid indefinitely, but if not well boiled will soon turn to sugar and if depended on for winter feed the bees will perish. It will be apparent that the thin syrup used to stimulate the bees will not need this treatment, as it is not intended to be kept for long.

In connection with the theory that bees inject formic acid into honey to ripen and preserve it, it may be interesting to know that there are four forms of tartaric acid; one that is dextrorotary, another levo-rotary

while two are neutral. These are all carbon-hydrogen-oxygen compounds, as is formic acid, and as tartaric acid occurs in grapes, in the argols, in the sorrels and other plants, we may possibly find that it is tartaric acid which appears in honey, to aid in the inversion of the sucrose. So far as I have investigated, all honeys are acid. Those which granulate soonest are most acid, those which remain a long time fluid are less so. This is a reasonable chemical proposition, for the acid is used up in the process of inversion. I have found it extremely difficult to make these experiments, owing to the extremely small amounts of acid we have to deal with.

There are other acids useful to the beekeeper. All of them should know how to mend leaks in tin and galvanized iron vessels, but I venture to say there are some here who do not. As a child the soldering fluid used by tinners was a great mystery to me, but I soon found out that it was made by dissolving zinc in muriatic acid. A drop of it put on the surface to be soldered serves as a flux to flow the solder. At the same time I found that if the soldering iron was filed bright then rubbed on a piece of sal ammoniac with a piece of solder the tin would stick to the iron, which causes the heat to escape rapidly. Before the soldering iron was invented the old-time tinker used to make a little dam of bread chewed up and built around the hole to be filled with solder. It is from this that we get the old saying: "It is not worth a tinker's dam," for the little piece of burnt bread was, of course, quite valueless.

If you will put into a glass vessel four ounces of glue, one ounce of number eight acetic acid and water enough to cover the glue, let stand all night, then dissolve by setting the dish in hot water you will have a liquid glue which will hold like a first mortgage on a town lot. It is handy to have on hand to mend frames, hives and other things, and to fasten labels onto anything.

Carbolic acid used to be employed to scare away robber bees and as a germicide, but as the price has jumped from 25 cents a pound to almost $3, wholesale, it will probably be used hereafter as a perfume.

I think that I have lately made a valuable discovery in apiculture, that in naphtalene I have found a certain and continuous protection against the bee moth, and possibly its larva; naphtalene is a benzine hydrocarbon with a formula of $C_{10} H_8$. It forms white crystalline leaflets, having a peculiar odor. It is insoluble in water, and this feature makes it of double value to the beekeeper as it will not waste. It is known as "tar camphor" as it resembles gum camphor when melted into a cake, and it has practically superceded camphor as a moth repellant in the family closet. It volatilizes more or less rapidly according to temperature, and fuzes at about 175 degrees F. At any temperature above 50 it soon fills the air with vapors of itself which is death to most fungi and most insects. This last summer I used nothing else to protect my combs from the moth, and with the best of results, for several piles of supers filled with brood combs were left outside the honey house from early in May until the middle of June and were entirely free from worms. Later I laid a comb out for several days, then took it into the house and shut it up in a box with a couple small pieces of the naphtalene. A month later

I saw no signs of moth larva. I was so busy the last season dodging rain drops that I had no time to experiment with the moths themselves, but another season I shall pay them my respects.

I noticed a curious thing about the naphtalene. Some of the hives I had out contained combs with honey in them, and when they were opened the bees went in, paying no attention to the odor. I do not know what this means, but hope to find out. It may be that the drug will kill the moths and not the bees, which will be very nice if true.

Just now the price of naphtalene is rather high, being about 28c against 7c a year ago, wholesale, but at that price it is still cheap, for a quarter of an ounce, in little balls, will last a long time and will keep the air in a Langstroth hive saturated with the vapor. The fumes are not poisonous to the human, in fact it has been used as an intestinal antiseptic in doses of 2 to 8 grains. The vapors of naphtalene are not explosive, at any rate under certain circumstances of moderate temperature. All in all, I think it worth while to give it a thorough trial the coming season.

Even a knowledge of so simple a thing as linseed oil may be of value to the beekeeper. How many of them know that raw oil used in paint dries from the bottom up, while the boiled dries from the top down. This makes the raw valuable for outside work and the boiled for inside and glossy finish.

It is asserted that a little knowledge is a dangerous thing, but of course it is only so when one tries to do more than they know. I have known a newly fledged druggist to pound a mixture of sugar and chlorate of potash in an iron mortar, and at once double his fund of information about those chemicals. Let me demonstrate. Here is sugar, this is the chlorate, and this is sulphuric acid. I mix the salts together, touch it with a drop of the acid, thus. If one wants to scare animals from the bee yard, in the night, without killing them, the sugar-chlorate can be put in a tin can, and with it a small phial containing the acid. A string goes to outside from the cork of the phial which when pulled lets the acid come in contact with the mixture when an animal would get a scare which should last him all summer.

Saltpeter is another valuable chemical in the bee yard. It is an essential element of black powder, as you will soon see, for I am going to make you some. This is sulphur, this saltpeter and this charcoal. I put them together, thus, shake them up well, pour out a little and touch a match to it. Pretty good powder, what?

If you will dissolve 3 ounces of saltpeter in a pint of water, soak blotting paper in it and then dry the paper you will have a fine touch paper, or it can be burned to relieve an attack of asthma, and this was for many years about the only relief we had. I often roll a sheet of this paper up *with*, not *in* some cotton cloth and thus get an immediate large volume of smoke. A piece of solid wood soaked in this solution and dried will burn well, while if one end of a chunk of rotten wood just too hard to break up well is dipped in the saltpeter solution and dried it will catch fire much more readily.

I have often wished for a way to light a smoker quickly, and am going to make one with a little sliding door on the side just above the grate, into which I can shove a piece of the touch paper and light it. I know I have reduced my chances of salvation by having a smoker go out just as I needed it worst.

Even poisons come in handy in the bee yard. Mice just love to winter in a nice warm hive, to the destruction of many square inches of comb if nothing worse. It is not always possible to fix the entrances for winter before the mice get in, I mean for a semi-invalid with asthma and a hookworm, so I soak corn in a strong solution of strychnia sulphate and scatter it about the yard and in the hives. Last winter as an experiment I used no wire guards at the entrance of my hives, used plenty of poison, and this spring found but one hive had been bothered, and in that the mouse was found dead. No fear your chickens will be killed, for a dose of the strychnia which would lay a man out at once will not injure Biddy. I do not know why, any more than I do the reason that a rabbit will feast on berries of the deadly nightshade when a few of them will kill a man.

Various essential oils are used by beekeepers, generally in uniting swarms. I have tried about all of them, and think the oil of peppermint the best, as the most odor destroying. I have found it better than smoke or creosote. I think I may say I never had a case where the bees showed even an inclination to fight where this was used, say five or ten drops to the pint of water, first dissolving the oil in alcohol.

We often need a good paste in the bee house, and one can be made by mixing flour and water together and boiling them in a double cooker such as the wife uses for puddings. To every pint of paste add a heaping tablespoonful of pulverized alum and boil for three hours. When cooled somewhat add a teaspoonful of oil of wintergreen and stir well. The paste should be just thick enough when hot to drop off a spoon readily, for it thickens when cold.

I have found paraffine of great use in the bee yard. This is known as hard petrolatum, and is a by-product in the manufacture of kerosene. It is a transparent, waxy body, softer than wax, and melts at a temperature between 109 and 150 degrees F. I use it to waterproof wood, for which it is invaluable. Inner covers coated with it will not warp, bottom boards are made everlasting and covers a thing of joy, but one of the best things about it is that it can be used to keep tin vessels from rusting. A thin coating of it will prevent or stop decay, and make the dish fit for the finest honey. In this connection I have often wondered why second-hand cans cannot be made as good as new with the paraffine. Three or four years ago I picked up a large milk pail which had been thrown away. There was a small hole in the bottom which I mended, then coated the bucket, all over with paraffine, and it is still in use.

Even common rosin is valuable in the honey house. Mixed with oil, using heat, and smeared on paper which has been sized with thin glue you have fly paper as good as any you can buy. Made a little thicker it makes a fine artificial propolis which is invaluable when it becomes necessary to break the sealing of the hive cover late in the season, so late I mean, that the bees will not reseal. I often use this and like it.

It is not necessary to haunt your neighbor's garage and bother your railroad friends to get fuel for your smoker, waste which, nowdays is apt to be more than half wool. Get some cotton rags from the wife, put them into a dish and pour some cheap machine oil over them. In a short time they are ready to use. If you have a spite against some particular colony of bees you can add a little jimson weed or tobacco to the stuff, which will make the bees think there is drug law in the whole state of Iowa.

HONEY VINEGAR.

BY C. E. BARTHOLOMEW, AMES.

Nearly all beekeepers find themselves at times in the possession of more or less low grade or waste honey which is practically unmarketable. The practice of many beekeepers is to feed back such honey to the bees but such practice is often times very detrimental to the bees. The best means of utilizing such honey is to turn it into vinegar. Honey vinegar is, when properly made, seldom excelled by vinegar from any other source. The strong honeys that bring only a very low price on the market are adapted to making the best grades of honey vinegar as the strong flavors, that reduce the price as honey, when diluted in the vinegar only add to its desirability.

The majority of recipes for making honey vinegar are haphazard methods and in following them usually nine out of ten trials will be failures. The usual one of filling a barrel with honey and rain water and allowing it to stand for a year or so is too slow and too uncertain for most persons to undertake. The last thing in the world to use in making honey vinegar is rain water as most persons understand the term. The best water to use is good pure well water. Water that is without any peculiar odors or flavors. Tap water from city water works is usually the best water that can be obtained.

There are two processes of vinegar fabrication in common use. These are known as the Orleans process and the quick process. The quick process is not adapted to the manufacture of honey vinegar as the heat generated in this process would destroy any flavors that might come from the honey and the resultant vinegar would not differ from a vinegar made from acetic acid and water. In the Orleans process the fermented liquor is placed in casks or tuns in a cool room of constant temperature and allowed to stand for several months until the fabrication of the vinegar is complete. In this process there is but little heat generated as the process is very slow. This is the process originated in France for the making of wine vinegar. It is well adapted to the manufacture of honey vinegar and on the large scale of production it is the only method to use. There is another method that is really a modification of the Orleans method that for the small producer is more desirable but is not used much by the large manufacturer because of the large area required in comparison with the other methods. This method is based upon discoveries made by Dr. Josef Bersch and first proposed in 1876. The prin-

ciple upon which this method is based is, that the acetic acid ferment works upon the surface of the liquor and by using shallow tubs a larger percentage of the liquor is exposed to the action of the ferment than is the case when barrels or tuns are used. The Bersch method reduces to days, the months required by the Orleans process.

The first step in the fabrication of vinegar from honey is to ferment the honey and water solution and form an alcohol solution. This first process of fermentation should be completed and all the sugar in the honey solution transformed into alcohol no matter what method is used later in the fabrication of the vinegar. Yeast is required for this fermentation and as all the substances are not present in the honey and water solution for the rapid growth of the yeast these substance must be added. For instance yeast requires just as other plants require, for their development, potash, nitrogen and phosphorus and to supply them we must add these to the honey in such form that the yeast may utilize them. The best substances to add to secure these elements in a usable form is ammonium chlorid and potassium phosphate. The proportions in which to use them is as follows:

10 gal. of 10% honey solution.
2 oz. ammoniun chlorid.
1 oz. potassium phosphate.

Add to this for ferment one-fourth cake of compressed yeast softened in warm water.

FIG. 1—A cheap hydrometer.

To determine the percentage of the honey and water solution a hydrometer is necessary. One of these may be obtained through the local druggist for from fifty cents to one dollar depending upon the quality. The

hydrometer should be graduated, to the Baume scale, to read from zero to ten degrees by one-tenth degree marks. The hydrometer is simply a glass tube sealed and weighted at one end so it will float upright in the solution. See Fig. 1. The smaller calibered portion of the tube is graduated so as to read the density of the solution. To test the solution a portion is drawn off into a long glass jar or long large mouthed bottle and the hydrometer floated in it. Where the surface of the liquid cuts the tube, the degrees and tenths of a degree is read and compared with the following table to determine the percentage of honey in the solution.

Degrees Baume Scale 59 degrees Fahrenheit.	Percentage Honey Solution.
.6	1.
1.1	2.
1.7	3.
2.3	4.
2.8	5.
3.4	6.
4.0	7.
4.5	8.
5.1	9.
*5.7	10.
6.2	11.
6.8	12.
7.4	13.
7.9	14.
8.5	15.
9.0	16.

You will observe that a reading of 5.7 degrees shows a 10% solution which is the proper strength to use. If the reading is higher than 5.7 then more water must be added and if less, then more honey must be added.

PROCESS MAKING.

A clean barrel makes a good container for the fermenting solution, but it must rest on its side with the bung up and open. There should also be two holes bored near the upper side in each end. These two openings together with the open bung will give sufficient ventilation. The yeast ferment must have fresh air for its development. The openings should be covered with gauze to keep out pests. Forty gallons of solution as above described placed in such a barrel should have all the honey converted into alcohol in about two or three weeks if the temperature of the room has been nearly constant and around 65 degrees Fahrenheit.

After having the honey converted into alcohol the next step is to change this alcohol in the solution into vinegar. For this will be needed a special apparatus, but the materials for this can be obtained cheaply and the work can be easily done at home. Obtain a good vinegar barrel and saw off each end so as to make two tubs one foot deep. Fit tight wooden covers for these tubs. In each cover make three openings in line. One in the center three inches in diameter and the other two one inch in

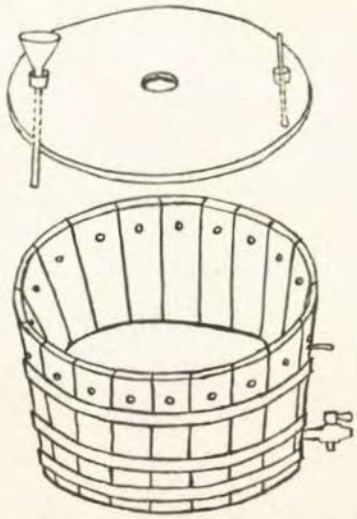

FIG. 2—Tub for use in making honey vinegar.

diameter and five inches from the edge. In the smaller of these holes should be fitted corks through one of which passes a thermometer and the other a glass funnel. If a glass funnel with a tube long enough to reach the bottom of the tub can not be obtained a piece of bamboo may be used, but no metal that may come in contact with the vinegar should be used. The iron hoops of the tubs should be painted with asphaltum varnish. The thermometer should reach about half way to the bottom of the tub. In each stave in the tub a 5/8 inch hole should be bored. These holes should slope downwards toward the inside of the tub, they should be on the same line and the best way to obtain this is to place the tub in the position that it is to occupy in action and fill with water to within two inches of the top and then mark the position of the holes on the water line. Just one ¼ inch hole should be made ½ inch below one of the 5/8 inch holes, this latter is to govern the depth of the liquid in the tubs. A wooden spigot should be fitted to each tub far enough from the bottom that when the tub is drained about one inch of liquid will be left. This is to be used for starter when the tub is filled with fresh solution. A strip of gauze should be stretched around the tubs over the holes to prevent the entrance of pests and also a piece should be tacked over the large opening in the cover. For a diagram of the tub see Figure 2.

A convenient arrangement of this apparatus is shown in Figure 3. The apparatus should not be disturbed while working except to add more solution and draw off the vinegar. It will not need cleaning more than once a year unless it becomes infected with some of the undesirable ferments or pests and then it must be thoroughly cleaned and scalded. The apparatus should be placed where the temperature is nearly constant and around 65 degrees Fahrenheit.

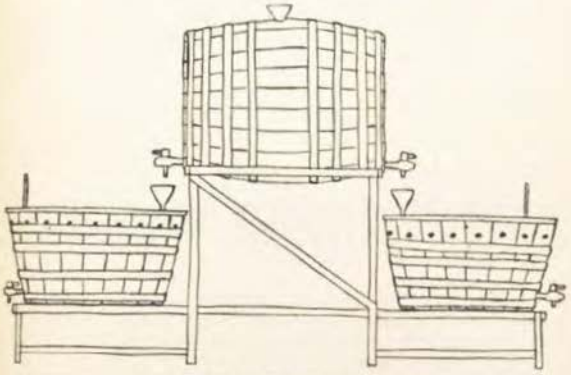

FIG. 3—Outfit for making honey vinegar.

The solution of fermented honey should be allowed to run into the tubs through the glass funnel in which has been placed a small piece of absorbent cotton, through which it must filter. The first time the tubs are filled they must be innoculated with the vinegar ferment and this can best be done by drawing off a quart of the liquid and adding through the large hole in the cover a quart of good cider vinegar. This vinegar should be drawn from a barrel as the bottled vinegar on the market now seldom contains any living vinegar ferment. About ten days or two weeks after the tubs have been filled all the alcohol in the solution should be turned into acid. The rapidity of the action can be determined by observing the thermometers. The temperature will rise while the change is taking place and when complete, the temperature of the liquid will fall to the room temperature. If the action of the ferment should be too rapid and the temperature rise above 80 degrees the large opening in the cover should be partly closed by a cover as otherwise there will be a loss in acid by evaporation. To test the acidity of the vinegar the hydrometer is used as in testing the honey solution and the percentage of acid may be determined by comparing the reading with the following table. No vinegar should be sold that does not test at least five per cent acidity.

Baume degrees.	Acidity of vinegar per cent.
Temperature 59 degrees Fahrenheit.	
.1	1.
.2	1.5
.3	2.0
.4	2.3
.5	2.6
.6	3.0
.7	3.5
.8	4.0
.9	4.5
*1.0	5.0*
1.1	5.5
1.2	6.0
1.3	6.5
1.4	7.0
1.5	7.5

VINEGAR PESTS.

Vinegar Eels. These are small animals, microscopic in size, that belong to a group of worms known as nematode worms. These worms are able to live in dilute acid and dilute alcohol of the strength used to make vinegar. The worms are so small that it would require over 500 placed end to end to measure one inch in length. They multiply very rapidly but the principle injury they cause to vinegar is by the disagreeable odor, the putrefaction of their dead bodies produce. The only remedy when the tubs become infested is to empty and scald them thoroughly.

Vinegar Flies. These insects are sometimes known as fruit flies as they live and feed on decaying fruits and fermenting fruit juices. These flies are about one tenth of an inch in length and a yellowish brown in color. The eyes are prominent and red. They are common and disagreeable pests around vinegar but can be kept out of the apparatus by covering the openings for ventilation with gauze.

Molds and Bacteria. There are several molds and bacterial forms that oftentimes effect the fabrication of vinegar. These organisms destroy and reduce the acid contents and often times develop disagreeable odors and flavors. When the apparatus becomes infected with any of these forms the only remedy is to empty the apparatus and scald it thoroughly.

SWEET CLOVER—ITS VALUE TO THE BEEKEEPER.

BY M. G. DARANT, HAMILTON, ILLINOIS.

We have seen sweet clover advance in the last few years from the position of a noxious weed to that of one of the best forage plants of the country, some claims being made that it is even superior to alfalfa. The farm papers have contained many articles extolling its value, giving proper soils, their preparation, methods of tillage, etc., in order to get the best results. Much has been said also of what may be expected from the plant.

What, however, is the honey value of sweet clover? Beekeepers have known for a long time that it is of benefit to the bees, that it yields enough honey for its influence to be noted, especially in certain seasons. But now that it is likely to have universal planting, that your bees or ours may regularly forage on many acres of sweet clover in bloom, let us enquire what we may expect. Will it be only a helper or will it yield a surplus? Will I be able to depend on it so that I may double the number of my colonies in each apiary and may I be safe in starting apiaries any place throughout the country where much of this clover is planted?

In order to determine this beforehand, if possible, I submitted the proposition to some prominent beekeepers who have had considerable experience with it, many of whom are at present harvesting crops from it, and some of whom rely on it solely for surplus. Replies came from the following states: Colorado, South Dakota, Iowa, Illinois, Kentucky and Alabama. Four general questions were asked as follows:

1. Does the soil on which sweet clover is grown, influence the honey yield?
2. Is the yield affected by drouth or moisture, and how?
3. Is sweet clover a sure honey yielder or are there failures?
4. If you had 100 colonies within reach of 100 acres of blooming sweet clover what would you expect the yield to be in extracted honey?

The last question of course is hypothetical, but will give an idea of what is thought of its value.

INFLUENCE OF SOIL ON HONEY.

Without an exception all correspondents agree that soil has little effect on honey yield, except that sweet clover of course, grows best on soil with plenty of lime and we should reasonably expect honey-producing qualities to be best where growth was most favorable.

EFFECT OF DROUTH AND MOISTURE ON YIELD.

All agree that atmospheric conditions play a most important part in honey yield. Very probably the irrigated regions have the advantage in this respect, as the moisture can be in a large degree regulated to suit. "Dry, hot weather is best," says Wesley Foster "with plenty of moisture through irrigation." This is confirmed by L. W. Benson, of Alabama, who thinks irrigated lands are ideal, but for Alabama mentions as best, "dry, hot weather, with plenty of moisture at the roots of the plants." A. B. Brown, also of Alabama, whose sole dependence is sweet clover, wants a "hot and sultry atmosphere with plenty of moisture in the ground." Others mention weather neither too dry nor too wet as better than either extreme.

IS SWEET CLOVER A SURE HONEY PRODUCER.

From the above points we deduce that sweet clover honey production varies much with variation in atmospheric conditions. I have yet to hear, however, of an absolute failure in Alabama. By this I mean a season where the bees starve with acres of blooming sweet clover within reach. In Illinois, however, the situation is different. We have, ourselves, observed seasons when the yield was nil. A. O. Heinzel, also of

Illinois, reports that the plant generally yields, but he has seen absolutely flat failure. At one time bees were starving with 160 acres of blooming sweet clover within easy reach. This was at Kenney, Illinois, and occurred in a very dry year when nearly all vegetation was "burned up." Indications are, therefore, that extreme drouth or extreme moisture make an extremely light yield.

100 COLONIES AND 100 ACRES.

Nearly all correspondents, before answering this question, stated emphatically that theirs could only be a guess as other factors entered into the crop.

Here are some of the answers:

1. In irrigated districts 200 pounds per colony in Alabama—Alabama.
2. 100 pounds to the colony, more if bees were stimulated—Alabama.
3. 70 to 125 pounds to the colony—Colorado.
4. 150 to 200 pounds to the colony—Kentucky.
5. 100 pounds to the colony—South Dakota.
6. 50 pounds to the colony would not be remarkable—Illinois.
7. I have produced better than 100 pounds average of comb—Illinois.

Frank Coverdale of Iowa, the sweet clover man, has his 300 colonies of bees in one apiary. He harvested a carload of comb honey in 1915, most of which was from sweet clover. He has 170 acres of sweet clover on his own place.

Taken all in all these approximate and actual yields are encouraging. Even if we reduce the yield to that of the lowest guesser, fifty pounds would be no mean crop when added to what we already have, even if we had to do without it some years.

GENERAL CHARACTERISTICS OF VALUE.

In the central west, the white clover crop ends the spring flow and there is a lull till the fall crop. This lull may be filled with sweet clover. As Miss Emma M. Wilson of Marengo, Illinois, writes, "There has never been a time when we had to feed bees to keep them going through the season since sweet clover became important, although we may have had to feed in the spring or for the winter. The advantage shows more in poor than in good seasons. It fills in the gap when other things fail."

Another thing mentioned by one or two correspondents is that if sweet clover is cut for hay before it blooms in spring, the second crop blooms later (not co-incident with white clover) and continues to bloom until frost. Atmospheric conditions seem to be a little better also in the late summer, and the honey yield is noticeable.

CONCLUSION.

Proper growth of the plant and proper atmospheric conditions are the prime requisitions for obtaining the best honey crops with sweet clover. Warm, sultry weather with plenty of moisture in the ground for the plants tends towards the heaviest yield.

Sweet clover will not prove as good a honey yielder for the central west as alfalfa is at present for the Rocky Mountain states, principally because we cannot control moisture. But when sweet clover is grown

generally throughout any section of the country, that section may be assured of a distinct addition to the honey flora with some good crops of this honey alone, while absolute failures, with bees starving, though not absolutely provided against, will be much more rare than formerly.

THE PLACE OF BOTANY IN A BEEKEEPER'S EDUCATION.

BY L. H. PAMMEL.

(Read at the Inspectors' Conference in Keokuk, Iowa, Sept. 8, 1915.)

The state bee inspector invited me to address you on the topic as announced in your program. I can assure you that I gladly accepted his kind invitation to address you, not that I can bring you much of a message, but I am always glad to help Mr. Pellett, who has done so much for the Iowa Beekeepers and those who are interested in study of the great out-of-doors.

Botany, I need not tell you, should occupy an important place in a beekeeper's education. It is next to the subject of entomology an important one for you.

To me it is a fascinating subject and we could make much more of it than we do. It goes without saying that a beekeeper should begin his botanical training at an early age. It is not merely sufficient to know a few plants that are useful to obtain honey. So I would begin the botanical work by studying the morphology of plants; namely the structure of the root, leaf, stem and flower. In other words before the beekeeper can become proficient in the identification of plants he must know something about the structure. Let a study of the form of plants be taken up thoroughly. Should you not have had the pleasure of a college or high school education get some book like Leavett's Outlines, a revised edition of the old Gray's Lessons. So far as the general morphology of flowering plants is concerned nothing better has ever been published than the admirable and simple books of Dr. Gray. There are, of course, other books, splendid in their way, it does not seem to me that they meet all of the points. Such books as the Bergen and Davis's Foundations of Botany, Atkinson's Text Book of Botany, Coulter's High School Botany were not written primarily for the taxonomist. They are splendid as general botanical works, but they do not meet the requirements to become familiar with the terms in systematic botany. The student should have at least one semester of morphology.

I would follow morphology with a course in systematic botany "The mother of all botanies." I place systematic botany or taxonomy second because it should naturally follow structure. I think it a wise policy to have the student of plants become familiar with our common plants as soon as possible. The plant life about us is always of interest. To know the early blossoming plants, the first harbinger of spring, the hepatica, willow, wind flower, blood root, and many others is always a delight. It makes a person young to greet the old friends by name, *Hepatica acutiloba* or *Anemone nemorosa*, etc. There is a practical side for the bee-

keeper. We want to encourage the growing of plants that are useful to us in our business. We want to know what plants of the *Ranunculaceae* furnish honey of the *Compositae* or the *Leguminosae*. The beekeeper above all should be familiar with all of the honey plants in his vicinity. I think he should be an up-to-date botanist on the flora of his region.

I feel sure that most of the beekeepers know more about plants of their vicinity than the average layman in the community. The beekeeper should know, for instance, the method of distinguishing most of the families of flowering plants in the state. Here, I may ask a few questions. How many of you know that Buckbrush *(Symphoricarpos orbiculatus)* and Snowberry *(S. occidentalis)* are related to the Tatarian honey suckle *(Lonicera tatarica)* one of the splendid early blooming honey plants? How many know that the Hoary vervain *(Verbena stricta)* is related to the cultivated verbena *(Verbena Aubletic)*? Now the latter is not a good honey plant, though the former is. How many know that the Oleaster or Russian olive *(Eleagnus angustifolia)* a splendid honey plant is related to the Buffalo Berry *(Shepherdia canadensis)*? How many know that our willows *(Salix)* are related to the cottonwood and poplars? You know, of course, that the Silver maple *(Acer saccharinum)* is related to the hard maple *(A. nigrum)* both species good honey plants. You recognize also a likeness to the Boxelder of no use as a honey plant, although it furnishes some pollen.

Do you recognize that the Prairie rose *(Rose pratinicola)*, agrimony *(Agrimonia Eupatoria)* and Black cap raspberry *(Rubus occidentalis)* are related and belong to the Rose family. Rosaceae like the wild crab *(Pyrus Iowensis)* and cultivated apple *(Pyrus Malus)* and American plum *(Prunus Americana)* and cherry *(Prunus Cerasus)*?

The beekeeper should make a comparative study of these plants from the standpoint of relationship. There are certain points in the external resemblances of plants the beekeeper can become familiar with very readily. Take for instance the square stem of the mint family with the two lipped corolla. The majority of such plants belong to the family *Labiatae*. When the flowers are borne in heads like the sunflowers and dandelion they belong to the composite or sunflower family. When the flowers are borne in umbels like the carrot and parsnip they belong to Parsnip family or *Umbelliferae*. When the flowers have four green sepals and four petals arranged in a cross they belong to the Mustard family or *Cruciferae*, and so I might go on. There are certain external and striking characters which will enable any one to readily place a plant.

We come now to consider another phase of the subject, one which certainly concerns the beekeeper. I refer to Physiological Botany. There are two phases of the subject—one deals with the function of the plant; how the plant elaborates its food, how the plant stores its food, how the plant conducts its food, how the plant secrets nectar, and why. Then there is the subject of Ecology. This I consider of utmost importance. Ecology has to do with the environment of plants. How the growth is influenced by climate and soil. The relation of plants to pollination. Every beekeeper should make a study of the relationship of insects to the pollination of plants. I think this is not only of fundamental importance to the horticulturist and agriculturist but the beekeeper.

Beekeepers should always keep in mind that bees of all kinds are of great value to the horticulturist. Without bees the horticulturist would get small returns in the way of fruit. Omit the bees and the apple crop would be cut very short and for this reason I believe every fruit grower should keep bees as a side line.

Now, every farmer knows his clover seed crop will be cut short unless he has some bees. Bees are essential then for the farmer and horticulturist. There are many other most interesting questions concerning the pollination of plants.

The marvelous adaptations between insects and flowers and the structures of flowers adapted to some insects has engaged the attention of such men as Darwin, Hermann Mueller, Delpino, Trelease and Roberts. A beekeeper might well spend much time in studying these plant relations.

I would also add courses dealing with fungi and bacteria. The latter work is now made a part of a separate course. The beekeeper should have not only a general knowledge of bacteriology but more especially the diseases caused them, especially the bee diseases, which are playing such havoc with the beekeepers in all sections of the country. The proper relationship of bacteria to other plants should be understood and for this reason I believe a study of the lower forms of plants is important. There are some diseases produced by fungi and these should, of course, be studied.

May I add the best education is none too good for the beekeeper and in conclusion allow me to thank you for the privilege of addressing you on this subject and the splendid facilities you have had here in viewing the great establishment of the Dadants. It should be an inspiration to you.

OUTDOOR WINTERING.

BY E. F. PHILLIPS, IN CHARGE OF BEE CULTURE INVESTIGATIONS, U. S. BUREAU OF ENTOMOLOGY.

There was recently issued by the United States Department of Agriculture a bulletin (Farmers' Bulletin No. 695) entitled "Outdoor Wintering of Bees" by Mr. George S. Demuth and myself. In presenting this important subject to this meeting, I can do no better than to give the material included in this bulletin, especially since not all present have obtained this publication. It would have been pleasant to prepare a special paper for your association but since the essentials of the subject have recently been outlined, it would be useless to attempt a rearrangement simply for the sake of assuming originality. I shall omit certain paragraphs of minor importance.

This bulletin contains a somewhat unusual classification of the causes of winter loss and I may say in advance that I shall be glad to explain any points which have not been made sufficiently clear.

CAUSES OF WINTER LOSS.

The causes of the death of individual bees or of a colony of bees in winter, barring unusual accidents, are only two in number: (1) Inadequate stores and (2) excessive heat production. The numerous factors usually given in the literature on the subject as entirely distinct fall into these two classes, except for some that are usually given which the authors do not believe to be operative.

At hive temperatures between about 57° and 69° F. a normal broodless colony of bees does not form a cluster, but the bees remain inactive on the combs. When the temperature of the air immediately surrounding the bees (not the temperature of the air outside the hive) falls to 57° F. or lower, they form a cluster and those in the center begin to generate heat by muscular activity, while those in the outer portion serve as insulators by crowding close together, usually with their heads toward the center of the cluster. The innermost portion rapidly acquires a temperature considerably higher than that of the air about the bees before clustering was necessary, often going to 90° F. in normal colonies and higher in abnormal ones. The number of bees engaged in heat production increases as the outer temperature falls and the insulating zone is consequently decreased in thickness but becomes more compact. The entire cluster becomes smaller as the outer temperature falls.

If bees can be kept in an environment such that the temperature of the air immediately surrounding them is 57° F. or slightly above, they are saved much unnecessary and unprofitable labor. To the theoretical objection that bees need exercise, it is necessary only to state that we have so wintered bees in a cellar as well as outdoors with wonderfully successful results. If bees are kept in a cellar under the best conditions the results are excellent, but it is not proposd to discuss this more complicated phase of the subject here. If wintered outside in a packing case with abundant insulation, any heat generated escapes slowly and the temperature of the air in the hive rarely falls below 55° F. If inadequately protected, the temperature of the hive can not be kept so high and the bees must generate much more heat. In single-walled hives it is common for the temperature of the air around the cluster to fall to freezing or lower, in which event the bees generate an excessive amount of heat and perhaps die when they are no longer capable of the necessary muscular activity. The necessity of packing is thus made clear, and in any locality in which the outer temperature often falls to 40° F. or below it is desirable to protect bees to conserve their vitality. If the temperature should fall to 40° F. only a few times during the winter, this would not be serious enough to make insulation necessary. It is obvious, however, that winter protection is beneficial throughout practically the entire United States.

Necessity of having young bees.—Bees may be compared with minute dry batteries, in so far as their vital energy is concerned. They emerge as adult bees with a certain amount of vital energy, and when

this is exhausted they die, not having power to recover lost vitality as human beings have. To withstand the hardships of winter under usual conditions, a colony must have many young bees, capable of prolonged muscular work. Obviously the better the wintering conditions, the less necessary it becomes to provide young bees, but even with the most perfect wintering it is desirable that there be plenty of young bees in the fall, so that they will be available for extensive brood-rearing in the spring. This calls for prolonged brood-rearing in late summer. Old bees, which have been worn out earlier and are ready to die, soon succumb from the work of heat-generation.

Danger of weak colonies.—In a strong colony many bees in the center of the cluster may be engaged in heat-generation, and there will still remain many bees to serve as insulators. A weak colony, on the other hand, has less reserves for insulation, and, since heat is rapidly lost, the bees on the inside must generate excessive heat in order that the outermost bees may always be at a temperature of over 50° F. Since the surface of a spherical cluster is proportionate to the square of the diameter, while the volume is proportionate to the cube of the diameter, it follows that a large colony cluster has a relatively smaller surface for radiation of heat than does a small one. Below about 50° F. individual bees become numb, and so long as the cluster remains active we have never found normal bees at a temperature lower than the critical temperature, 57° F. In a small colony the inner temperature is often many degrees warmer than that of a neighboring strong colony, which doubtless explains the prolonged brood-rearing of weak colonies in the fall. Most colonies which die of excessive heat-generation are rushed to their doom by the temperature being high enough to start brood-rearing, which is perhaps one of the most unfortunate circumstances which a colony can experience in winter. By all means a colony should be so protected that brood-rearing will not be begun until frequent flights are possible.

Since weak colonies so frequently succumb in winter, it is obvious that a too rapid increase in the number of colonies in summer is unwise. Beekeepers have learned that swarming is to be avoided because of the resulting reduction in the honey crop, and the loss in winter is additional argument against allowing the bees to exercise this instinct freely. It is a common saying among beekeepers that a rapid increase is usually followed by a rapid decrease. It is impossible to get too strong a colony for winter, the error always being in the opposite direction.

Effects of accumulation of feces.—Heat-generation causes increased consumption of stores; this in turn causes an accumulation of feces within the bees, which is more rapid if the stores contain a high percentage of indigestible materials, and the presence of feces causes increased activity, often resulting in death from excessive heat-generation. Beekeepers call this condition dysentery if the accumulation is so excessive that the bees are unable to retain the feces. Dysentery causes the death of bees in winter, so far as has been seen, solely by undue ac-

tivity and excessive heat-production. This detrimental effect is reduced by good stores, but obviously the proper method is to prevent an unnecessary accumulation of feces by preventing a heavy consumption of stores, chiefly by providing a sufficiently high surrounding temperature. Honey-dew honey is especially injurious because of the rapidity with which feces accumulate.

In mild climates, in which there are frequent days when bees can fly and rid themselves of feces, the injurious effects of poor stores are less noticeable, because the feces do not accumulate sufficiently to cause abnormal activity. The accumulation of feces is to be considered as an irritant, causing responses similar to disturbance by jarring or exposure to light.

Influence of the queen.—In discussions of wintering it is usually stated that to winter well a colony must have a good queen. Obviously a good queen will better prepare a colony for winter by providing a strong colony of young bees than will a poor one, while a colony that is queenless in late summer and fall has little chance of living until spring. A good queen will also increase brood-rearing rapidly in the spring, if the colony has good stores and has been properly protected during the winter. Aside from the important influence on the population of the colony, the queen probably plays no part in wintering.

Spring-dwindling.—If the individual bees of a colony are reduced in vitality by excessive heat-production, they may live until spring, but are unable to do the heavy work then needed to bring the colony back to full strength. The adult bees die more rapidly than they are replaced by emerging bees, and the population decreases. This condition, which can be produced experimentally, has long been known among beekeepers as "spring-dwindling." If this condition is observed, the bees may perhaps be slightly relieved of further unnecessary work by packing to conserve heat and by giving abundant stores, but the proper treatment is to prevent the condition by proper care in the preceding fall and winter. The term "spring-dwindling" should not be applied to death of bees from other causes.

A common cause of the death of colonies in winter is starvation, which is more certainly due to carelessness on the part of the beekeeper than is unnecessary heat-production. The greater the necessity for heat-production, the more necessary it becomes for every colony to have an abundance of stores of good quality. The amount required varies with the length of the winter, and also with the amount of heat which is generated. It is, of course, necessary also to provide or leave stores enough for brood-rearing in late winter or spring, before sufficient stores come to the hive from natural sources.

COMPARISON OF COLONY WITH A FURNACE.

Let us assume that we have a furnace for heating a building so constructed that ashes may be removed only when the temperature of the outer air is warm. If the house has thin walls and many openings, the furnace can not maintain a high temperature in extreme cold weather, the amount of fuel consumed is increased, the ashes accumulate rapidly and clog the furnace, and in a desperate effort to raise the house temperature we should probably burn out the furnace. On the other hand, if the house is well built and heavily insulated, a low fire will suffice, and as a result there will be a minimum amount of ashes. The better the fuel, the less the amount of ashes in either case.

It is permissible to compare a colony of bees as a unit of heat-production with this furnace. If the bees are in a single-walled hive in a cold climate, the colony must generate a great amount of heat, must consume much more honey, and feces will accumulate rapidly. As the bees are unable to discharge their feces until the temperature of the outer air is high enough for flight, the "furnace" is clogged. The bees are "burned out" by the excessive heat-production, and, even worse than in the case of the furnace, the irritation resulting from the presence of feces causes still more heat-production. On the other hand, if abundantly insulated, the heat generated is conserved, the consumption of stores and amount of feces are reduced, and the bees can readily retain the feces until a flight day, in any place in which bees can be kept. The better the stores the less the amount of feces in either case.

We should not expect much of a furnace in an open shed, and we have no more right to expect good results from a colony wintered in a thin-walled hive in a cold climate, or even in a better hive placed in a windy location.

CONSERVATION OF HEAT AND REDUCTION OF EXPENDITURE OF ENERGY.

In outside wintering the heat produced by the bees is conserved by the insulation of the cluster itself and also by the insulation of the hive and packing. In the cellar there is less insulation near the cluster, but the cellar itself replaces the packing, and is in reality simply an insulation. The insulation of the individual hive, of several hives packed together, or of bees in a cellar serves solely to reduce the loss of heat generated by the bees.

The amount of packing that should be used obviously varies with the climate and it is impossible to make definite general statements in a bulletin intended for all parts of the United States. There is one general statement which can be made with safety: The majority of beekeepers do not give sufficient insulation and no beekeeper ever gave a colony too much. The aim of the beekeeper should be to keep the air about the bees at about 57° F., at which temperature there is no condensation of moisture within the hive, even on the inside of the cover, where it first appears. It might be inferred that if double the amount of packing were used the temperature of the air about the bees would be too high. This is not the case, for bees cease heat-generation when the temperature reaches 57° F., (or even sooner when the surrounding temperature is rising), and the

temperature will not exceed 57° F. unless that of the outer air remains higher than that for a considerable period.

Bees well protected and with good stores do not fly from the hive because of the warmth within when the outer air is too cold for them to do so safely. If bees fly at low temperatures (45° to 50° F.), it is an indication that they need a flight because of an accumulation of feces from poor wintering, and does not at all indicate too high an inside temperature because of too much packing. In conclusion, the beekeeper can not apply too much insulating material to a hive.

It has been found that, even with abundant insulation, the temperature within the hive and outside the cluster is greatly reduced if the packing case is exposed to wind. During the winter 1914-15 a record was kept of wind velocity directly over a heavily packed case (with entrances ⅝ inch by 8 inches), and it was found that a wind with a velocity of 20 miles per hour directly on the case reduces the temperature within the hives practically to that observed in an unprotected hive. The beneficial effects of the insulation were therefore nullified, and the proper temperature within the hive was not regained for several days unless the outer temperature rose considerably. Beekeepers have long emphasized the importance of protection from wind, but the results observed were much more pronounced than was anticipated or than has ever been suspected by practical beekeepers. The ideal toward which the beekeeper should work is to keep his colonies during cold weather absolutely protected from wind, for here again the protection can not be too great. It is entirely erroneous to assume, as some have done, that such protection is not essential in well-packed hives.

There are several types of hives on the market in which the insulation is built in, to be retained throughout the year. There is no objection to the packing in the summer, except that such hives are not convenient for moving and in some other manipulations. Insulation in commercial double-walled hives is by means of air spaces or insulation, such as sawdust, chaff, broken cork, or shavings. These hives are better for outside wintering than single-walled hives in any part of the United States, but they do not provide adequate insulation at temperatures below about 40° F. Such hives must, of course, be protected from wind, or they are for the time being no better than single-walled hives.

Types of insulation.—Various materials are used for insulation. Beside those named above, paper, dry leaves, and many other substances are in use. Most of the common insulating materials depend on small confined dead-air spaces for their insulating value, and, in general, the more finely divided the air spaces the more efficient the material. Sawdust is usually condemned, because if moisture escapes from the hive into the packing it is retained and the insulating value is reduced. However, if a colony is sufficiently packed, moisture does not condense, except possibly at extremely low external temperatures, and this objection to sawdust is removed. From observations so far made, it appears that the beekeeper may use the materials most easily obtained. If dry leaves

are used, they should be packed tight, but sawdust should simply be poured in place without being packed tight.

The entrance.—The weak place in hive insulation is the entrance. An opening 8 inches wide and ⅝ inch high is abundant, it usually being constructed as a tunnel through the packing. In cold weather this might be still further reduced. The opening should be shielded from the wind, to prevent a rapid loss of heat, for if the wind blows against the entrance the heat stored up in the packing is lost both to the outside and the inside. The only reason for an entrance as large as the size mentioned above is the danger that dead bees will drop from the combs and block a smaller entrance. Since the number of dead bees is greatly reduced in well-insulated hives this is less important, and, furthermore, if the air within the hive is warmed to 57° F. the dead bees will be pushed outside, even in freezing weather.

Methods of packing.—The exact method of packing is not especially important, provided enough insulation is given on all sides. Colonies may be packed singly in any sort of box, or they may be packed in groups of four. Some beekeepers arrange colonies in long rows and apply insulation to the whole row. The placing of several hives in contact has the advantage that the colonies insulate one another. If arranged in groups of four, two facing east and two west, they may be left on the same stand throughout the year and are readily manipulated during summer. If in long rows close together, summer manipulations are impeded, unless the hives are moved after the insulation is removed. Placing colonies in long rows is therefore not advisable. Whatever type of outer case is used, it should be tight, to prevent rain and snow from wetting the insulating material.

A rather common practice is to pack the hive at the sides, top, and rear, but to leave the front unprotected and faced to the south, the object being to utilize the heat of the sun to warm up the interior of the hive and reduce the work of the bees. Any place through which external heat may readily reach the interior of the hive is also efficient as an avenue through which heat may be lost when the sun is not shining. Since the sun shines less than half the time in winter, making no allowance for cloudy days, the weakness of the argument for this practice is obvious. A similar practice is to paint the packing cases a dark color to absorb the sun's heat. Considerably more detailed work is needed to determine to what extent this source of heat is of value to the colony.

Time for packing.—At the time of the first killing frost the beekeeper should promptly remove supers, if any are on his hives. If the bees are not adequately supplied with good stores for winter these should now be given immediately, and, when the feeding is finished, the winter insulation should be applied at once. At this time bees are the quietest of any period of the year. The disturbance incident to putting on the insulation does not do them any harm. After this the beekeeper should have no occasion to open the hive until spring. An outer temperature about 60° F. is desirable at the time of packing, especially if no brood is present. Any day when bees are flying is suitable.

If packing is delayed until late it may do far more damage than to leave the bees unpacked. A colony of bees that is generating heat in response to low temperature is considerably disturbed by the manipulations during packing and the temperature of the inside of the cluster is promptly raised. Frequently, if bees are packed too late (when it is too cold outside), the cluster temperature is raised to brood-rearing temperature, the queen begins to lay eggs, and brood-rearing is usually then continued through the winter, unless it results in the death of the colony, as is often the case. Many beekeepers pack their colonies in December with most harmful results. There is probably no place in the United States where packing is needed in which it is safe to wait later than Thanksgiving Day. Since more beekeepers make mistakes here than in any other phase of outside wintering, this should be emphasized most strongly. We have succeeded on several occasions in starting brood-rearing in December by manipulation, both in colonies wintered outside and in removing bees to a cellar, and it is certain that such winter brood-rearing is highly injurious to the colony.

Time for unpacking.—If a colony has a good queen and plenty of stores and is well packed, the beekeeper rarely has any reason for opening the hive until spring is well advanced. If he is not sure of the condition of the colony, he may wish to examine it earlier, but this first examination should be brief and the packing may be partially removed and replaced afterwards. If there are any queenless colonies or any colonies short of stores, these defects should, of course, be promptly corrected, after which the colony should remain undisturbed until, as the season advances, frequent manipulations are necessary. It is often best to leave the insulation on until the colonies need more room, which will probably be as late as May 15th in the North. Colonies which have wintered poorly need their insulation longest, while colonies that have been well insulated, either in a cellar or outside, can, if necessary, stand considerable exposure without much damage, although the work of heat-generation thereby reduces the energy available for building up the colony rapidly.

The time for removing packing may be still further delayed by wintering a colony outside in two-hive bodies, the upper one being well supplied with honey. Since there is more space to keep warm, such a hive should be more thoroughly insulated. If this plan is followed, the beekeeper is sure that sufficient stores are available and he can probably locate any queenless colonies by a brief external examination. Since wintering in two-hive bodies has not been practiced extensively, it should be tried with caution, but reports of this method should be available from all parts of the country and beekeepers are urged to try it on an experimental scale. The plan has much to commend it.

Providing a windbreak.—It is well established that a windbreak of evergreens is superior to a solid windbreak such as a house or solid fence. The beekeeper can readily determine whether his bees are located in a place where the wind rarely or never blows more than five miles an hour in winter. If the apiary is not so located, it should be moved during the summer to a place in the woods, in a gully, or in some other sheltered place. Bees should never be moved in winter. If it is not practicable to move the

apiary, a high fence, perhaps 8 feet high, should be constructed on the exposed sides. The more compact the apiary, the easier it is to construct a windbreak, which is an argument for placing colonies in groups of four. Evergreens are slow growing, and a high fence may be used until the permanent windbreak is sufficient. If the apiary is practically surrounded by buildings, this may be adequate protection, but such a location is usually not the most convenient for the apiary. A southern exposure is usually recommended as best for winter, for it is claimed that the heat of the sun is beneficial. Since the sun shines only a small fraction of the time in winter in most localities, especially in the East, where there is much cloudy weather, this feature should not be unduly emphasized.

PROVIDING ADEQUATE WINTER STORES.

The amount of honey that a colony will need from the time it is packed until it is unpacked can not be closely estimated. The aim of the beekeeper in winter should be to save bees rather than honey, and he can make no more profitable investment than to give his bees more than they can possibly use. Some beekeepers claim that it is best to have the old bees die soon, so as to save stores. The actual consumption in such badly wintered apiaries is probably not at all decreased.

If the bees do not have sufficient stores, they may be given combs of honey, but these should always be given before cold weather, so that a proper clustering space may be formed by the moving of honey, since bees always cluster in empty cells of the comb adjacent to stores.

If honey in combs is not available, the bees may be fed extracted honey, but the usual practice is to feed a thick sugar syrup made of 2 or 2½ parts of sugar to 1 part of water by volume. To this syrup 1 ounce of tartaric acid should be added for each 40 to 60 pounds of sugar while the syrup is being heated to the boiling point to dissolve the sugar crystals. The syrup should be boiled 15 minutes. The acid helps to invert the cane sugar, thus retarding its granulation in the combs. If there is any question as to the quality of the stores, it is a good practice to feed about 10 pounds of syrup at the time of packing, in addition to the stores provided earlier, this being stored immediately above the cluster. It is thus used first and an accumulation of feces does not occur so long as the bees use only the sugar syrup. There is, however, no better food in winter than a good quality of honey. As was stated earlier, honey-dew honey causes a rapid accumulation of feces, resulting in dysentery. If this is present in the fall, it should be removed and better stores given. Some fall honeys are similarly injurious, but their injurious effects may be reduced by feeding syrup at the time of packing.

SUMMARY AND CONCLUSIONS.

Bees need protection from cold and wind in winter in practically all parts of the United States. The beekeeper should give abundant insulation, since it is impossible to give too much and since most beekeepers give too little. Great care should be exercised to protect colonies from wind. Every colony should be strong in the fall, so that heat may be generated and conserved economically. To reach the proper population a good queen is necessary.

Many colonies die of starvation in winter. This can easily be avoided. The beekeeper can make no better investment than to give his colonies proper care for winter.

If the excessive winter losses are prevented, commercial beekeeping will be greatly benefited. Such a condition is entirely possible when beekeepers come to understand the fundamental principle of wintering.

QUESTION BOX.

HOW CAN I PREVENT SWARMING.

ANSWERED BY F. W. HALL, COLO, IOWA.

Discourage it as long as possible. Fifteen or twenty days before the expected end of the clover flow, take away the old queen. Not less than ten days after, nor more than eleven days, remove all queen cells but one. There must be no queen cells in the hive when the queen is removed, nor must there be any young brood from which later cells can be built when the cells are removed. If the above plan is followed there will be no swarming that season if the job is thoroughly done.

HOW CAN I CURE FOUL BROOD?

ANSWERED BY EDWARD G. BROWN, SERGEANT BLUFF.

The first requirements are a thorough knowledge of the appearance and nature of the disease, coupled with extreme care and watchfulness, and a fair honey flow. If an apiarist does not know the disease, he will, if attacked by it, either soon learn it or be without an apiary. It has always been my advice to apairists, to go to some expense, if necessary, to see it in its live and active state; so as to be sure and know it, if they are unfortunate enough to have it in their district. And it is as necessary that you help your neighbor clean up his colonies and see that he keeps them clean, as it is to clean up your own apiary.

There is no form of treatment that is of any value, unless it is very carefully done, and the method of treatment carefully carried out. Where an apiary has become quite generally infected, it is advisable to give a complete treatment; which would consist of the rendering of all combs both surplus and brood, and following the McEvoy form of treatment. This consists of shaking onto inch starters; followed in three days by a second shake on full sheets of foundation.

The one dry comb plan, may be used in place of the McEvoy treatment by experienced apiarists; but I do not recommend it for beginners. This consists of a direct shake onto full sheets of foundation; using one dry, drawn comb in the center. This comb must positively be free from disease, and must be removed at the proper time. If the shake is made in the morning, the comb must be removed late in the afternoon or evening; if made in the afternoon, wait until about noon

of the following day; and at all times be quick and quiet about withdrawing this comb, and about removing the bees; so as not to shake out any of the honey in it, or give the bees a chance to fill themselves from its contents. Then be sure the comb is placed where no bees can get to it, until it can be burned or rendered; this depending upon the equipment of the apiarist for rendering diseased combs. A sun melter is not safe for this work. Under the one drawn comb system, it is necessary that there be a good honey flow at the time of treatment.

Where there is only a slight amount of infection, in a colony, and yet there are several colonies with a few cells of disease showing; or where the neighborhood can not be successfully cleaned, the picking system can be followed.

I recommend this system only to very careful and practical apiarists, who are very well informed as to the disease.

This plan is to give all seriously infected colonies a complete treatment; and where there are only a few cells showing in a few of the frames at a time, shake out the infected frames, replacing with full sheets of foundation, and brush off most of the bees; placing these frames in a hive which can be kept tightly closed for a few days on the start; and after some of the brood has hatched out, give it a small entrance.

The apiarist can keep adding frames of brood, until he has it built up three stories high; and then start a new hospital.

About three weeks after the first frames were placed in the hospital, it should be given a complete treatment; destroying all the combs from which the brood has hatched, and removing the ones with brood enough to amount to anything, to one of the newer hospitals.

Under this plan most of the brood will hatch, and the very young bees will consume most of the honey in these combs; and by treating before a young queen starts laying, and about the time the young bees get old enough to start storing surplus honey, there is very little loss of bees, and not much set back to the colony from which the picking is done; although the apiarist may find at the end of the season that he has completely replaced the combs in the brood nest.

But remember, these things are of the utmost importance; a very intimate acquaintance; a constant lookout; and extreme care.

HOW CAN I WINTER BEES IN MY HOUSE CELLAR?

ANSWERED BY C. H. TRUE, EDGEWOOD, IOWA.

By insisting upon the following provisions. A cellar that as far as possible will give a temperature varying only from about 40 to 50°, with subearth air duct supplying a fresh dry air inside and with an outlet for the escape of foul air thus affording an abundant and free circulation and ventilation inside the cellar. Perfect darkness and absolute quietude if practicable; a wide open hive entrance one inch in depth, the entire width of the hive for direct ventilation. Sealed inside cover (or quilt) with outside cover also on.

A fairly strong colony of late hatched bees from young queens. A liberal amount of wholesome honey for winter stores.

Removing the bees to the cellar before too severe freezing weather reduces their vitality. Better a little late rather than too early removal to summer stand.

HOW CAN I BEST MAKE ARTIFICIAL INCREASE?

ANSWERED BY O. E. LHOMMEDIEU, COLO, IOWA.

First you must have an extra good laying queen. A few days after the main honey flow starts when honey is coming in freely and the top of the combs show new white wax, lift the combs out of the hivebody and set the frame with the queen to one side. Fill the old hive with prepared frames, properly spaced. Care should be used that the hive is level sidewise. Shake and brush the bees in front of the hive, stringing them out for some distance so that they will not get in too quickly. Shake some honey on the bees to insure that they will remain, but don't overdo the matter. Gently pick up the queen and see that she runs into the hive, not under it. Do not allow the bees to cluster too thickly on the front of the hive, but keep them moving at the entrance by gently brushing them with a weed or brush. Keep the hive well shaded and in ten to twelve days you should have a set of ten frames filled with new combs, brood and honey, and very little drone comb. With an old or poor queen there will be too much drone comb unless full sheets of foundation are used. I have shaken the same bees at the end of twelve days and had them build another set of combs, but this is not usually advisable. If newly built combs are placed above a strong colony for a time they will be built down to the bottom bar. After a comb has been used for some time the bees dislike to add to it. These shook swarms will be stronger than the natural swarm as they get all the bees on the old stand.

Set the beeless brood in an extracting super and place it on top of a weaker colony and after twelve days shake them fill out as the hive was first treated, giving all brood to the first shook swarm or to weaker colonies.

WHY SHOULD BEEKEEPERS ENCOURAGE STATE DEPARTMENTS TO ENCOURAGE MORE PEOPLE TO KEEP BEES AND OVERSTOCK THE TERRITORY AND REDUCE THE PRICE OF HONEY.

ANSWERED BY FRANK C. PELLETT, ATLANTIC, IOWA.

This question is based on a wrong supposition. We must not overlook the conditions that have prevailed in the past and that now prevail in other industries. I have spent several weeks in the editorial department of the American Bee Journal recently and can do no better than to repeat an editorial comment which appeared in the December number of that journal.

It is very apparent to everybody that honey has not grown in use with the increase of population. The use of honey was once almost universal. Now but a small portion of the people use it, and the proportion instead of increasing, is constantly growing smaller.

Butter has been kept before the public by the representatives of the dairy industry in agricultural colleges and elsewhere. Oleomargarine looks and tastes so much like butter that many people cannot tell the difference, yet but comparatively little of it is used. The reason is that its inferior qualities were brought to the attention of the public by these college representatives and other organizations who had the interest of the dairy industry at heart. As a result the public has formed a prejudice against it and refuses to accept a substitute for butter. If there had been an apiary department in every agricultural college when substitutes began to be offered for honey, instead of a small part of the population eating honey as now, 90 per cent would demand it and refuse to be satisfied with a cheap and inferior substitute.

Our educational institutions today largely determine what our ways of thinking and habits of life will be tomorrow. Unless the honey producing business has representatives at headquarters, our interests will not be kept before the public and the demand for our product will be met by those who are able to meet the changing conditions of our times. It was the official representatives that called the public attention to the inferiority of oleomargarine to butter and created a sentiment that refused to be satisfied with a substitute for the later product. Had the same fight been made against substitutes for honey, the general public would not need be told that the cheap corn syrups are inferior to the product of the hive.

When the demand declines for a product which is not only of the highest quality, but is at the same time one of the cheapest foods on the market, as analysis shows honey to be, it is time for the honey producers to rub their eyes and awaken to the real condition. The trouble is not a lack of demand, but because of lack of business methods on the part of the beekeeper, the demand IS MET WITH SOMETHING ELSE.

WHY CAN'T WE WINTER BEES AS WELL OUTDOORS AS IN THE CELLAR?

ANSWERED BY DR. A. F. BONNEY, BUCK GROVE, IOWA.

The natural out of door home of the bees is an ideal place for them to winter, and that all natural out of door homes are not perfect does not alter the fact. In such a home the bees are protected from sudden changes of temperature, and from wind, and the latter is, I think, the worst of the two, for a cluster of bees is just like an animal body, the wind will blow the heat away. Anyone who has faced a Texas norther knows that cattle protected from the wind will endure the cold—seldom below freezing—without suffering while others nearby IN the wind will perish. One single thickness of newspaper under one's coat when facing a cold wind for a long way is better than an inch of woolen clothing, as most doctors know, because it is impervious to wind.

The natural home of the bee is in the cavity of a forest tree. This cavity is generally conical in shape, the walls are three or more inches thick, the entrance an inch to three square inches in size and a considerable distance below the cluster. The cavity goes below the entrance and serves as a trap to catch and hold dead bees so that the entrance will not become clogged. The bees carry out all the dead wood they can, which is considerable, and then they waterproof the inside of the cavity with propolis. They next proceed to build combs in intricate patterns which totally break up all circulation of air.

Man followed nature in the first hives, like the skep and those made of clay, but later on laid the hive on its side, forced the bees to build straight combs by giving them frames in which they put sheets of foundation, then added injury to insult by putting the entrance at the end of the hive so that every breath of air might circulate freely over the combs and cluster.

In time someone got a bright idea and began cellaring their bees, and I should like to know, just from idle curiosity, how many thousands of colonies of bees perished while the idea was being perfected, how many more thousand died from "spring dwindling" when the bees were taken from the cellar—and still do, for that matter. Only lately a friend who has a matter of two hundred colonies wrote me that he had just lost 75 colonies after taking from the cellar. I could not help wondering if this was a sample of successful cellar wintering, but left the answer to come later.

Apparently the first attempt on the part of beekeepers to winter their bees without loss was the chaff hive, so called, while protected or insulated might have been a better term, but beekeepers are, it seems, given to fantastic phraseology, or used to be. Not for ignorance, but just some unfortunate happen so. These hives were, I read, cumbersome affairs with four inches of space between walls which were of full inch lumber, and chaff was used for packing. Modern protected hives are not large, and all seem to conform to the proper idea that the top of the hive must be kept warm. Personally I should prefer four inches of warm packing over a good thick inner cover, to a foot against each wall and little or no top protection, while moderate protection on the sides with heavy packing above seems to give me good results.

I say seems, for it is hard to decide, sometimes, as bees will die in the most unexpected way. Swarms may become queenless, or, in view of recent discoveries by Dr. Phillips, waste their lives producing heat so that the loss of a colony may be from causes independent of the hive or method of protection. I early decided that I wanted the chaff hive, because I had no cellar, no place to put one and was financially crippled besides, but I could make chaff hives and did, a matter of thirty of them, of Danzenbaker dimensions, but when I wanted to quit producing section honey I adopted the Langstroth hive, ten-frame size and often wish they were twelve. I sold the others at prices ranging from one to three dollars.

Those who have never used chaff hives have many objections to them, principal of which is that they are large and heavy. I think I have a right to complain on that score, for I am not as frisky and strong as I was thirty-five years ago, but I have not a word to say, for my hives are seldom or ever moved. When a swarm comes off—I have had but four in five years—I do not follow the old formula, "of move the old hive and put a new one in its place," but I move the frames instead, replace them with frames full of comb or foundation, then, making sure the queen is in the old hive shake the bees thereto, and I am done, and about as quickly as by the other method, and with less labor. I THINK I have found out that one frame of foundation in a hive full of comb does as well as all foundation, but I am not quite sure. However, I can always use drawn combs, and so do not hesitate to give them all foundation.

But this is drifting away from the question. My experience with the chaff hive has been quite satisfactory. Where I have had losses the cause or causes could be found elsewhere than in the hive. Using them there is no sudden change from a quiet, warm cellar to the blasts of a tardy spring, for I have seen in Iowa the wind blow so hard it would shave the hair off a dog's tail. I think Mr. Pellett will back this assertion, as I can prove almost anything by Frank. This is because he is the most accommodating fellow that ever lived, as many can testify. These hives are warm in winter and cool in summer, and because of it the bees begin rearing brood early and the hive does not heat up and keep the whole colony busy fanning in the summer. I have had three and four frames of brood to the hive in the chaff hive when there was little or none in the dove-tail hive.

Now to the proof of the pudding. I will preface by stating that I am more of an invalid than appears from an outside examination. The hive is all right, but there is a deal of foul brood inside. I can get no help whatever in my little home town, so the number of colonies I handle is no criterion of my methods. I manage all I can, and that is all big men like Mr. Hall can do. In the fall of 1914 I put away 19 colonies of bees, and all with old queens. They had an abundance of stores, all in chaff hives and on top the brood chambers six solid inches of packing. I used waste papers from the postoffice, excelsior and forest leaves. Of late I have been making thick inner covers, using two thickness of shingles, thin edges to butts, or thin box lumber, and tar paper between layers in both cases. I am now improving them by putting a3gle iron at each end, in addition to searing paraffine into one side and painting the other to prevent warping. Many a colony of bees has lost all its heat by an inner cover warping. Finally a flat, metal-covered roof covers all.

I came out in the spring of 1915 with 13 colonies. Two were queenless, and the other hive was full of stores, but minus bees. The hives I use have an inch packed space between walls and the outer wall is of ¾ inch lumber. The bees from these 13 hives were very friendly, and would meet me five rods from the yard and introduce themselves.

Introduce is the exact word, so I retaliated by standing afar off and throwing beer bottles at them. There was never known an April so warm in Iowa as that of 1915. The average morning temperature was about 45° for the month while that of the afternoon was much higher. 75° on the 14th, 80° on the 15th, and many days about as warm. The average daily temperature for May was but 46.6 while June was the limit, 66.6 average temperature, the thermometer being consulted three times daily, morning, noon and night. June ninth, for instance, there was ice formed in the low places, and it is a matter of record that there was frost every month in the year.

The bees began gathering from white clover the last few days in May, then it began to rain. May had been wet, with five inches precipitation on the 9th and the temperature down to 32°. Total for the month, 9.5 inches. June gave me 8 inches of wetness, and July gave us 9.4 inches, a total precipitation for the three months 26.9 inches.

I know that statistics are always monotonous, but in this case necessary for you to appreciate the fact that between the chaff hives, ugly bees and my method of producing extracted honey I secured some in 1915. A farmer friend gave me five colonies of bees the last week in May. These I had to put into new hives, and in most cases transfer the combs to new frames. Let us say I had 18 colonies, "spring count." I secured from them 180 pounds to the hive, or a total of 3,000 pounds, but I am ashamed to say that I got but about 10¼ cents a pound for it, net.

It is not knowing so many things about out of door wintering that hurts, but knowing so many things that are not true. We cannot winter bees successfully in an old, unpainted dovetail hive and on one pound of stores, that is patent. An inch of pine is no particular protection against cold, but would be somewhat better if painted, as it would seal the pores of the wood and confine the air, and for that reason a spongy wood, like the California redwood would be better than oak, but none will compare with the natural home of the bees in the woods, the hollow tree, of which the chaff hive is an imitation. I know nothing about wintering in the cellar except from reading, but the editor of Gleanings once wrote me that it takes much more skill to winter in the cellar than out of doors. I suspected that he meant brains, so I went out of doors where mine might grow.

And that, ladies and gentlemen, is all I know about wintering bees.

HOW CAN I PREVENT SO MANY DRONES?

ANSWERED BY C. E. DUSTMAN, DES MOINES, IOWA.

There are three ways by which the number of drones may be restricted. They may be trapped; they may be destroyed before emerging from the cells; or only worker comb may be permitted in the brood nest excepting of course a few drone cells which will be scattered through the hive despite the efforts of the apiarist.

Some have argued that drones do little or no harm, but in this they are much mistaken. To determine the cost of producing drones, we must consider the amount of space they occupy, the amount of stores they consume in development, and the amount of time they receive from attendant bees.

Sealed worker brood combs are one inch thick; drone brood combs are 1¼ inches thick. In the matter of thickness of comb the square foot of drone brood occupies 25 per cent more space. Worker brood occupies the combs but 21 days whereas drone brood occupies it 24 days or 14 2-7 per cent longer. 125 per cent of space occupied 14 2-7 per cent longer is equal to 142 6-7 per cent of space occupied for the same length of time. This does not take into account the damage done by crowding the adjoining worker comb.

As to the amount of stores required to produce a square foot of drone brood it may be considered that it requires the same amount bulk for bulk as does worker brood. And that being of 25 per cent larger bulk, they will require 25 per cent more stores. But this is not all for worker larva (at least before being sealed) feeds for but six days whereas drone brood feeds for 6½ or 8 1-3 per cent longer. If a square foot of drone larva consumes 25 per cent more stores for 8 1-3 per cent longer time it consumes 35 5-12 per cent more stores.

The time required from the attendant bees to produce this square foot of drone brood probably corresponds exactly with the amount of stores consumed which is 35 5-12 per cent more than is required to produce a square foot of worker brood.

To sum it up, it requires 42 6-7 per cent more space, 35 5-12 per cent more stores, and 35 5-12 more time of attendant bees to produce one square foot of drone brood than it costs to produce one square foot of worker brood.

We believe that all drones other than those produced or necessary for breeding purposes, are entirely worthless. Our square foot of drone brood has yielded us 2,304 worthless drones. This same amount of space and time and stores given to the production of worker brood would have produced 3,120 workers, even if the space occupied was only 35 5-12 per cent more.

It may be argued that the presence of drones gives the colony a better working spirit, but we cannot believe that this is true until competent observers give it their support.

It is sometimes argued that drones are helpful in producing heat, but this argument will never carry any weight unless it can be shown that when denied drone comb and provided with worker comb instead, they will refuse to produce an equal bulk of workers.

It is also sometimes argued that man cannot improve on nature and that bees should be allowed to follow their inclinations in the matter of drone production for they surely know what is good for them better than we do. This argument is most inexcusable. It is strange indeed that a man will constantly improve his stock and crops by selection and breeding, his fruit by budding, grafting and pruning, will dispose of his surplus rams and cockerels and then argue that it is best not

to restrict the number of drones because "nature herself provided them in large numbers and nature surely knows best."

If it is established that it is well to restrict the number of drones then it only remains to determine the best method of accomplishing this.

We said they may be trapped, or destroyed in the cells or eliminated by supplying only worker comb. Restricting drones by trapping is a makeshift, and is unwise. Trapping saves nothing of the cost of production. It saves only the cost of maintenance. Indeed it does not save even so much as that for traps hinder greatly, especially if the colony be populous and the day hot.

Restricting by destroying the brood is but little or no better. After brood is sealed it requires no stores and little attention but should it be destroyed the bees will promptly fill the cells with other thousands of hungry mouths and consume another requisition of valuable stores.

Drone brood is capped in 9½ days from the time the egg is laid. It emerges from the cells in 24 days. Now just for argument sake let us say the Apiarist who practices restricting by uncapping averages uncapping his drone brood every 12 days then he has put the bees to the expense of feeding twice as much stores for they would have to carry two generations of brood entirely through the food consuming period. And in addition would require the services of many more nurse bees than if the generations were allowed to occupy the cells the full 24 days.

We grant a very small portion of drone comb or cells here and there for bees seem so determined to have a little that it is possible it is best to humor them to this extent. But beyond this we claim that the only method of restriction worthy of practice, is the practice of removing from the brood nest all drone comb and replacing it with worker comb or foundation.

IOWA LAW RELATING TO BEES.

Sec. 2575-a53. *Inspector of Bees—Term—Deputies.* The governor is hereby authorized to appoint a competent man as inspector of bees, who shall hold his office for a term of two years, or until his successor is appointed and qualified; and said inspector shall have the power to appoint deputies. (33 G. A., ch. 169, § 1.)

Sec 2575-a54. *Powers and Duties of Inspector.* It shall be the duty of such inspector, when notified in writing, by at least three beekeepers of any locality, of the existence, or supposed existence, of the disease known as "foul brood" among the apiaries of such locality, to at once thoroughly examine such apiaries as are reported to be diseased and all other apiaries in the same locality, and thus ascertain whether such disease exists. If the bees in any apiary are in such place or condition as to prevent a thorough examination by the inspector, he may order the same to be put into proper place or condition for such examination. If such order is not complied with, and the inspector has reason to believe such bees to be diseased, he may cause them to be destroyed. If upon examination

the inspector is satisfied of such disease, he shall give the owner or person in charge of such apiary full instructions as to the manner of treating the same. Within reasonable time after such examination the inspector shall, without other notice, make further examination of such apiaries, and if the condition of any of them is such as renders it necessary, he may burn, or cause to be burned, all the infected colonies of bees in any apiary, together with all the combs and hives, in order to prevent the further spread of the disease. (33 G. A., ch. 169, § 2.)

Sec. 2575-a55. *Annual Report.* The inspector shall make a yearly report to the governor stating the number of apiaries visited, the number of those diseased and treated and the number of colonies of bees destroyed. Such report shall also show the expenses incurred by the inspector while in the discharge of his duties under the provisions of this act.

Sec. 2575-a56. *Sale or Removal of Diseased Colony of Bees—Penalty.* Any one who knowingly sells, barters or gives away, moves or allows to be moved a diseased colony of bees, be they queen or workers, or infected appliances or who exposes any infected honey to the bees without the consent of the inspector, shall be deemed guilty of a misdemeanor and be liable on conviction before any justice of the county, to a fine of not less than twenty-five dollars ($25.00) nor more than one hundred dollars ($100.00) or to imprisonnsent in the county jail not exceeding thirty days, or both fine and imprisonment.

Sec. 2575-a57. *Sales after Destruction or Treatment—Penalty.* Any person whose bees have been destroyed or treated for foul brood, who sells or offers for sale any bees, hives or appurtenances, after such destruction or treatment, without being authorized by the inspector to do so, or expose in his apiary or elsewhere any infected honey, or other infected thing, or conceal the fact that said disease exists, shall be deemed guilty of a misdemeanor and on conviction thereof shall be liable to a fine of not less than twenty-five dollars ($25.00) nor more than fifty dollars ($50.00) or imprisonment in the county jail not exceeding thirty days.

Sec. 2575-a58. *Failure to Comply—Resistance—Penalty.* Any owner or possessor of bees who disobeys the directions of the inspector, or offers resistance, or obstructs said inspector in the performance of his duties, shall be deemed guilty of a misdemeanor and upon conviction thereof before any justice of the peace of the county, shall be fined not exceeding fifty dollars ($50.00) or by imprisonment in the county jail not exceeding thirty days.

Sec. 2575-a59. *Compensation and Expenses.* Such inspector shall receive as compensation the sum of five dollars ($5.00) per day for each day actually and necessarily employed in the discharge of the duties as herein provided together with his expenses actually incurred while so employed, provided, that the amount to be paid on account of such expenses shall in no event exceed the sum of one thousand five hundred dollars ($1,500) for any one year, including salary and expenses of deputies. (35 G. A., ch. 211, § 1; 33 G. A., ch. 169, § 7.)

Sec. 2575-a60. *Inspection of Diseased Bees.* It shall be unlawful for any person, firm or corporation to bring into, or cause to be brought into

the state of Iowa, any apiary or honey bees infected with foul brood or other infectious disease, or bee destroying insects. (35 G. A., ch. 209, § 1.)

Sec. 2575-a61. *Certificate of Health.* No common carrier shall accept colonies of bees for delivery at Iowa points unless the said bees be accompanied by a certificate of health signed by some duly authorized state or government inspector. (35 G. A., ch. 209, § 2.)

Sec. 2575-a62. *Violation—Penalty.* Any person convicted of a violation of this act shall be fined not less than twenty-five dollars ($25.00) nor more than one hundred dollars ($100.00). (35 G. A., ch. 209, § 3.)

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FRANK C. PELLETT
State Bee Inspector

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