One of the questions of great importance at this time is, can any city or town council compel a bee keeper to remove his apiary from within the corporate limits? It is impossible to completely answer this question because of the fact that we had had very little law on this subject and there have been very few cases in which this question has risen, and in those cases where the question has come up the courts have seldom given a direct opinion on the subject. One engaged in the business of keeping bees may not rightfully keep his bees in a place upon his premises so as to annoy his neighbors. This rule was substantially laid down by the New York Supreme Court in the early case of *Olmstead vs. Rich*, 6 N. Y. Supt., 826, and many other courts have very closely followed this case in the more recent decisions. The city councils of several cities have at different times threatened to pass and have passed ordinances which made the owning, keeping or raising of bees within the city's limits a nuisance per se. Ordinances of this character have been held to be entirely too broad but the cases on record are very limited. About the only case directly in point is the case of *Clark vs. City of Arkadelphia, Arkansas*, reported in the 52 Ark., 23, wherein that court held that:

"Although bees may become a nuisance in a city, an ordinance which makes the owning, keeping, or raising them within the city limits a nuisance whether it is in fact so or not, is too broad and is not valid."

The precedent established by the Arkansas court in this case is valuable in that it is stimulating good law for the protection of the bee keeper and his property.

THIRD ANNUAL REPORT

OF THE

STATE BEE INSPECTOR

TO THE

GOVERNOR OF THE STATE OF IOWA

FOR THE YEAR 1914

TOGETHER WITH PAPERS READ AT THE THIRD ANNUAL CONVENTION OF THE IOWA STATE BEE KEEPERS ASSOCIATION AT AMES NOVEMBER 17, 18, 19, 1914

FRANK C. PELLETT
STATE BEE INSPECTOR

PRINTED BY AUTHORITY OF THE EXECUTIVE COUNCIL

DES MOINES
ROBERT HENDERSON, STATE PRINTER
1914

LETTER OF TRANSMITTAL

Atlantic, Iowa, November 10, 1914.

To the Honorable George W. Clarke, Governor of Iowa:

I hereby submit my third annual report as State Inspector of Bees as required by chapter 169, acts of the Thirty-third General Assembly, showing work accomplished for the year 1914, together with information of value to bee keepers in the care of their apiaries and the prevention and treatment of disease.

Respectfully offered,

FRANK C. PELLETT.

ACKNOWLEDGMENT

We are indebted as follows for the loan of cuts for use in connection with this report:

To the Iowa Homestead for the cuts of C. P. Dadant, Dr. E. F. Phillips and Wesley Foster.

To the American Bee Journal for the cuts of S. W. Snyder, Hamlin B. Miller, E. G. Brown, the Gallagher apiary and home, the Pangburn home and apiary, the Aldrich home and honey house, the Hechler apiary, the Hall apiary, honey house and home; for two cuts of the summer meeting at Delmar, the summer meeting at McGregor, one group at Clarinda and two at Colo.

To Gleanings in Bee Culture for groups at Clarinda, the Des Moines summer meeting, the 1913 convention, the government laboratory at Washington, prominent men at Delmar, the apiary of J. L. Strong at Clarinda and two pages of glimpses of Iowa bee keepers.

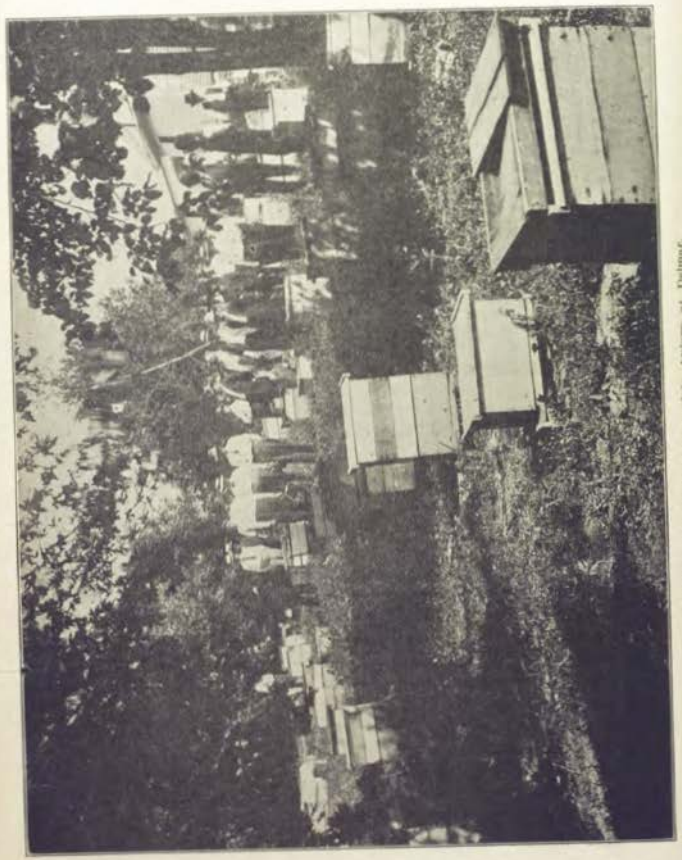
To the Illinois Bee Keepers' Association for the cut of Dr. Burton N. Gates.

To Bee Keepers' Review for cut of J. W. Stine and wife.

To all the above named we wish to express our sincere appreciation.

STATE BEE INSPECTOR'S REPORT

The year 1914 has not been a favorable one for honey production in Iowa. The drouth of 1913, followed by a similar one this year was responsible for a failure of the white clover, which is the principal source of nectar secretion. The dearth of honey during the best part of the summer has made conditions favorable for the spread of bee diseases, and the bee keepers have not only had to face a short honey crop but in many localities have had to combat foul brood as well. Both American foul brood and European foul brood have been reported from many localities the past season. European foul brood has been especially prevalent and has made its appearance in all parts of the state. It is now present in several counties where it has never been known previously. Indications are that within a short period it will have spread into every county of Iowa and that the bee keeper of the future must be prepared to deal intelligently with disease or quit the business. In localities where disease is present, the inspector frequently finds a lot of empty hives but no bees, on the premises of the careless apiarist. Hundreds of farmers are thus involuntarily quitting the bee keeping end of their business. Bee diseases are not an unmixed evil for they compel better attention. Many a careless bee keeper has found it necessary to study his business more carefully or lose his property, with the result that better attention has increased the return from his apiary. Some of the most successful honey producers of the writer's acquaintance say that they never made any money from their bees until they were compelled to fight foul brood. On the average farm the bees are the last thing to receive any attention. Too many men are content to leave the bees to shift for themselves as best they may and if there is a surplus of honey in the fall they regard it as so much velvet. Foul brood is rapidly removing such apiaries from disgracing their owners. Unfortunately, however, while they are being thus removed the disease is too often carried to the apiary of



Demonstration work in Coverdale Apiary at Delmar.

the most careful bee keepers who are compelled to fight the disease, perhaps for years, at great loss. Seldom a man passes through an epidemic of foul brood and remains in the business but he becomes a thorough-going bee keeper. In spite of the unfavorable conditions of the season there is much interest manifested in the business of honey production and many beginners are taking it up.

NEW PUBLICATIONS.

So many inquiries reached this office early in the season, as to where books and papers on bee keeping can be secured that we were compelled to issue a bulletin containing this information in order to reduce the necessary correspondence and at the same time give the desired information in sufficiently comprehensive form. This bulletin seems to fill a decided need and the small edition printed is nearly exhausted. (Bulletin No. 2, "Bee Keeper's Library.")

At the request of Prof. Kennedy, then head of the extension department of the Iowa Agricultural College, the writer prepared manuscript for a bulletin on wintering bees which was issued by the extension department of the college and is being distributed from Ames.

The demand for information concerning brood diseases has been so great that the supply of the second annual report was reduced to a few hundred copies by the middle of the summer. In order to retain a supply of this report for future use a brief bulletin on "Brood Diseases of Bees" was issued from this office in July. This bulletin is placed in the hands of each bee keeper visited by the inspector and it is also mailed on request from the office. (Bulletin No. 3, "Brood Diseases of Bees.")

NEED OF EDUCATION.

It is becoming more and more apparent that the problem of bee diseases is largely one of educating the mass of bee keepers to an understanding of the nature and treatment of the two forms of foul brood. Professional bee keepers readily recognize that something is wrong as soon as disease appears among their colonies. Such need only to have a sample examined to inform them which kind of disease is present and they are then able to give the matter prompt and efficient attention. It has frequently

Group of beekeepers at Delmar.

happened that disease has promptly been stamped out on its first appearance in an apiary whose owner was alert. With the rank and file of people who only have a few colonies there is no suspicion of anything wrong until the bees are dead and their honey carried away by visiting bees and the disease thus spread far and wide. When the inspector is called into a neighborhood to examine bees in such cases, he is almost sure to be informed that the particular bees which he may wish to examine are all right. Yet in most cases their owners have never examined the brood nest and would be unable to recognize diseased brood if they saw it. The fortunate visit of an inspector has located many cases of disease in apiaries of this kind where but for his coming the disease would have surely been spread to surrounding apiaries. In one case the inspector called at a farm house where he was advised that there were bees. The housewife informed him that they had no bees but some empty hives. An examination of the hives disclosed the fact that bees had died of American foul brood, yet the combs and honey were still in the hive. It was in early spring and fortunately it had not been found by the bees from neighboring apiaries. The owner was in the field and when visited by the inspector and informed of the condition promised to burn the whole outfit when he went in at noon. The inspector would have much preferred to do the job himself but the owner insisted that it would be promptly attended to. A man was sent back the following day to see that instructions had been carefully followed, only to find that the hive had been carefully disinfected by burning out the inside, but the honey was left lying on the ground, where it was much more likely to be found by bees than had it been left in the hives. As far as the hive was concerned it had been effectively cleaned of the disease but the owner had failed to grasp the fact that the disease is carried from hive to hive in the honey. Very fortunately a large apiary near at hand was saved from infection by the opportune visit of the inspector.

MOVING PICTURES.

It early became apparent that with the funds available but little progress could be made by personal visitation as seems to be contemplated by the law. With the consent of the executive council a moving picture film of nearly one thousand feet in

First summer meeting at McGregor, Iowa, June, 1914.

length was secured. This film shows the modern methods of apiary management and is a revelation to many who have had bees on their premises for many years. Unfortunately the film is too short to give all the information that is to be desired. One can get an idea from the moving picture at a glance which would not be fully made clear by pages of reading. The film has been sent out to institutes, schools, churches and anywhere else where public meetings discussing agricultural questions were being held. Those using the film have been required to pay the express, thus relieving the department at the expense of keeping it in use.

The agricultural college very generously gave the department the privilege of showing this film at the close of their picture program in the college building at the state fair twice each day. Mr. Colburn who operated the machine for showing the college

Group at Clarinda.

pictures also showed our film, thus relieving the department of expense of operation.

The officials of the agricultural college have shown themselves uniformly courteous and have assisted this department in every possible way in carrying on the work of the year.

SUMMER MEETINGS.

At the 1913 convention of the Bee Keepers' Association arrangements were made to co-operate with the inspector in various ways. Among other things planned was a series of summer meetings

at convenient places over the state. Eight in all of these meetings were held. Six were well attended and the day very profitably spent in discussing not only bee diseases but other subjects of timely interest relating to bee keeping. Several conditions conspired to interfere with the success of the other two meetings.

The Iowa Bee Keepers' Association is lending every possible aid to the inspector in his work. At some points branch associations have been organized locally for the express purpose of assisting in the work of checking brood diseases among the bees. The Polk County Bee Keeper's club is one of the most active.

At Sioux City the bee keepers are also very energetic and when the writer was called to that city, more than twenty-five

After dinner group of beekeepers at Hall apiary.

came together with but a few hours notice to discuss ways and means of assisting in inspection of the apiaries in and around the city. In such a location the inspector would be helpless without the aid of some one well acquainted with the locality to assist in finding the bee keepers. At Sioux City the bee keepers offered their services freely in acting as guides and assistants and also furnished transportation by placing their teams and automobiles at the service of the inspector without charge. Mr. Aldrich, the deputy for the northwestern district, did most of the work there and his expense account was lightened by probably fifty dollars

by the generosity of the local bee men. The same condition has prevailed to a greater or less extent all over the state and it would have been otherwise impossible to have reached so many apiaries without a much greater expenditure of funds.

UNFAVORABLE CONDITIONS.

The conditions that have favored the spread of disease have made it extremely difficult for the inspectors to work. The fact that no honey was being brought to the hive during much of the summer made it very easy to start robbing and it very frequently happened that an inspector would only get nicely started to work when such conditions would compel him to stop. At such a time an inspector had much better be at home for he can easily spread disease instead of checking it.

The protracted illness and death of the father of Prof. Bartholomew, who was working in the northeastern district, interfered with his work greatly and prevented him from finishing some much needed inspection. Taken altogether it has been a trying year for the inspectors. The unexpected appearance of disease in so many new localities has made an unprecedented demand for assistance and the unfavorable nectar secretion has made it impossible to reach nearly all of them or to do really satisfactory work in many of the localities visited.

NEED OF COUNTY INSPECTORS.

A season like the present one when conditions that favor the spread of disease make it impossible for the inspectors to make rapid progress in dealing with it make it very clear that in order to get effective inspection a considerable number of men must be available for work at the time when conditions permit good work to be done. I am doubtful whether with a large appropriation it would be possible to get a sufficient number of competent men for the short period that they can be thus employed. Then, too, it is often necessary to travel long distances and considerable expense is necessary. It seems to me that provisions should be made for cases where disease is badly scattered in any county, to authorize the county boards of supervisors to appoint a competent resident bee keeper as county inspector on petition of about ten resident bee keepers and the recommendation of the State Inspector. In this way a man would be able to work

with little expense beside his time and the total amount necessary to do the work in any one county in any one year would be so small as hardly to be considered. Being on the ground the county inspector could do his work at the most favorable time and his local acquaintance would greatly facilitate his work. There are at present about ten counties where such a county inspector should be at work during the coming summer. The small expense necessary will be returned a hundred fold in the increased honey production of the state. During the past summer the department has tried the experiment of appointing one deputy with no work outside his home county. Mr. L. W. Elmore, a bee keeper of Fairfield, has had charge of the work in Jefferson county. Because of the fact that he was not compelled to

Demonstration work in the Hall apiary at Colo.

leave his work half finished to rush off to some other quarter to meet insistent demands he has perhaps made more real progress than we have been able to do in other sections. With efficient county inspectors in counties where disease is badly spread, and the state department to look after localities where there is not so much to be done, and to have a general supervision of the work, there is hope that foul brood can be reduced to a point where it will no longer be a serious menace to the bee keeping interests of Iowa. This plan will not only be the most effective, but by far the cheapest plan that at present seems possible.

CHANGES IN THE LAW.

Without a very much larger appropriation than is now available, it would be impossible to follow the law as it now stands. This being the case the department has been compelled to follow it only as far as funds will permit. Section 2, of chapter 169, requires the inspector to examine such apiaries as are reported to be diseased and all apiaries in that locality. This should be changed to leave the matter a little more to the best judgment of the inspector. In some such localities are bee keepers who have extensive apiaries that would require several days of an inspector's time to examine thoroughly. These same bee keepers may understand the treatment of disease fully and may be able and anxious to find it on its first appearance. For an inspector to spend a week in such an apiary would be a useless expense. Then the same section requires the inspector to make a second visit to these same apiaries. Experience shows that this is not always necessary. In fact only occasionally is it necessary for the inspector to go to the expense of a second visit. This should also be left to the discretion of the inspector.

IMPORTANCE OF THE INDUSTRY.

Quite frequently one can hear the total production of the poultry and bees compared, to the disparagement of the bee keeping industry. Such persons seem to forget that 75 per cent of the total figures represented by the product of the poultry yard have already been counted as corn, wheat or other grain which had been fed to the poultry to produce the product, while with the honey produced we have a net resource. The bees gather the nectar from which the honey is produced direct from the flowers and if it were not so used it would be lost. The few millions that honey adds yearly to Iowa's production is a net addition to her wealth. The expenditure for hives and fixtures can be compared to the investment in poultry houses and fences which are not deducted in considering the returns. This is rather an investment than an expense and is good for many years.

The presence of large numbers of bees also greatly increases the production of fruits and seeds of many kinds by better cross pollination of the blossoms so that but a small part of the revenue derived from the bees is represented in the direct product

of honey and wax. The real value of the bees to Iowa cannot be told for there is no way to measure this indirect product. The business is only partially developed in this state and is capable of sustaining many thousands of people in comfort and adding millions of dollars to the resources of the commonwealth.

ADVANTAGES OF IOWA BEE KEEPERS.

Most of Iowa's honey is of high quality and brings the highest prices in the world's markets. When the markets are glutted, the white clover honey is among the first to be moved and seldom is there a season when first quality white clover honey does not move readily. This being the case there is little danger of over production. As long as our honey will bring several cents more per pound than honey from many southern and western localities, in the same market, the Iowa honey producer need have little fear of being unable to sell his crop.

ASSISTANCE NEEDED.

The large correspondence of this department with bee keepers concerning every phase of bee keeping is evidence of the need of some special headquarters for disseminating information relating to bee culture. The industry is one well worthy of encouragement and every possible means should be offered to inquiring bee keepers to secure dependable information. While it would be possible to enlarge the work of this department to cover such needs as is being done in some states, I am of the opinion that the better plan would be to provide a special appropriation for research work in bee culture in connection with the state experiment station at Ames. There is no apparent reason why the man with less than ten colonies of bees should be exempted from taxation. This is depriving the state of revenue from hundreds of thousands of dollars worth of taxable property without accomplishing the purpose for which it was intended. I would suggest that this section of the tax law be repealed and that all bees be taxed the same as other property and that a part of the funds thus raised be appropriated for special work in the development of apiculture at the state experiment station. There is no reason why Iowa should not set the pace for the world in bee keeping as well as in some other lines of agricultural development. The state has not been slow to

recognize the value of educational work in other agricultural lines and the bee keepers feel that they should receive the same consideration. By following the plan above outlined no additional burdens will be laid on the general taxpayers.

COMMON CAUSES OF FAILURE.

When one goes into the apiaries in all parts of the state as an inspector is compelled to do, he is impressed with the fact that the standard of Iowa's professional bee men is a high one. The crops they raise and the general showing they make is surprising

Group of bee men at Strong apiary, Clarinda.

when one considers how little attention has been given to the development of bee culture in this state. On the other hand the standard of the mass of bee keepers is deplorably low. The average production per colony is not more than 20 per cent of what is possible and what reasonably should be expected with proper attention.

One of the common difficulties is excessive swarming at the time of the main honey flow. Too often only one super is placed

on a hive at a time and this without bait section or foundation in the sections. The bees are slow to enter the super at all under such conditions and when they do, as soon as the super is well filled and the bees crowded for room they will swarm. Dividing the colony in the middle of the honey flow is making increase at the expense of the crop. The professional bee keeper makes his increase at the close of the honey flow and thus gets both a honey crop and increase. Another very common reason why little surplus is stored is because the bee keeper is raising too many drones. The drone is the male bee. It gathers no honey and adds nothing to the productive powers of the hive. The only purpose of the drone is the perpetuation of the species. As each hive has only one queen and one mating is sufficient for life it will readily be seen that but a small number of drones in an apiary will serve all the purposes for which nature designed them. I think it safe to say that I have found more drones in a single hive in the ordinary farm apiary than I found in nearly one hundred hives in the yard of F. W. Hall at Colo, Story county. The drones are reared in larger cells than are the workers. If the bees are allowed to build according to their own notions there will frequently be from one-fourth to one-third of the total comb surface in the hive made up of drone comb. During the productive season the queen lays thousands of eggs daily and in such hives thousands of drones will soon appear. Some one has estimated that it requires the labor of five worker bees to support one drone. I do not know whether this estimate is anywhere near correct but if it is, it will readily be seen that the presence of 20 per cent drones in the total population of the hive will absorb all the surplus honey that would otherwise be stored.

The use of full sheets of foundation in the brood chamber results in the building of nearly all worker combs and thus few drones are present at any time. Large numbers of drones are not only loafers where workers should be present but they consume the product of the labor of their industrious sisters. These sheets of foundation are made of pure bees wax rolled out thin and run between rollers that leave the impression the exact size and shape of the bottom of worker cells. The bees are quick to make use of this boost in building their combs and straight combs with cells nearly all of worker size are the result. Instead of large blocks of drone cells as in natural built combs only a few small places in the corners will thus be used.

Improper preparation for winter is another common source of loss. Thousands of colonies are allowed to remain on their summer stands without suitable protection, with old and failing queens and frequently with honey dew or other low grade stores. The percentage of annual losses is so large as to make one wonder why some people will keep bees at all.

With a systematic plan of education such as has been carried on with corn and some other agricultural crops, these losses can be greatly reduced and the production of honey increased to the point of adding millions of dollars annually to the resources of the state.

Prominent men at Delmar—Frank Coverdale, C. E. Bartholomew, C. P. Dadant and S. W. Snyder.

THE IOWA BEE KEEPER'S ASSOCIATION.

It is doubtful whether there is another agricultural organization accomplishing so much under such unfavorable conditions as the Iowa Bee Keepers' Association. The association has no funds aside from its membership fee of fifty cents annually, yet it is undertaking the improvement of the bee keeping industry along all lines. Its secretary and other officers perform a vast amount of labor without compensation. While the association has never asked for any state appropriation such as has been given the horticultural and other societies it would seem that

some provision should be made for the publication of the annual reports, for in no other way, perhaps, can as much be accomplished looking toward the general betterment of an industry than the judicious dissemination of printed matter. Among the objects of the association as announced in its printed matter may be mentioned: To assist in checking the spread of bee diseases, to spread information concerning improved methods of production, to assist its members in marketing their crops, to secure recognition of the industry at state and county fairs, to instruct its members in their legal rights and to assist when necessary in securing them; to inform the public as to the value of honey as food, of the importance of the business of honey production and the value of bees to other crops, and to elevate the business of bee keeping to a place of eminence among agricultural activities.

The membership fee is only fifty cents per year payable to the secretary. The association is affiliated with the national organization of the same name and one dollar additional secures membership in the national association and the official organ, "The Bee Keepers' Review." Officers for 1915 are:

President—C. E. Bartholomew, Ames.
Vice President—B. T. Bleasdale, Des Moines.
Secretary-Treasurer—S. W. Snyder, Center Point.
Directors—A. P. Chamberlain, Des Moines; W. S. Pangburn, Center Junction; J. W. Stine, Stockport.
Attorney—Russell E. Ostrus, Des Moines.

SUMMARY OF THE SEASON'S WORK.

The state has been divided into four districts. Prof. C. E. Bartholmew of Ames had charge of the northeastern district. As before mentioned he was greatly hindered in his work by illness and death of relatives. The southeastern district has been in charge of J. W. Stine, now of Stockport. While the drouth and consequent unfavorable conditions have interfered with the work all over the state, conditions have been particularly unfavorable in the southeastern district. There is great need of work the coming season in both of the eastern districts. In the northwestern district B. A. Aldrich has made good progress, for the disease conditions are not so widely scattered as further east.

The state inspector has had charge of the field work in the southwestern district, in addition to general supervision of the entire state. There are less bees in this district and consequently less appeals for assistance, although some much needed work has not, as yet, been reached. The following summary gives the total results of the combined efforts of the four inspectors and also of the work accomplished by L. W. Elmore, who has been at work in Jefferson county.

Total number of apiaries visited	294
Total number of apiaries where disease was found	127
Total number of colonies in apiaries visited	6,623
Number of colonies diseased	995
Number of colonies with American foul brood	552
Number of colonies with European foul brood	342
Number of colonies with sac brood	91
Number of colonies destroyed	21
Number of cases treated	86

Total expenditure of funds, including salary of the state inspector and four deputies, traveling expenses, office expenses, moving picture film and incidentals, $1,539.46, from January 1, to November 1, 1914.

It need hardly be added that most of the nearly one thousand diseased colonies found have been cared for by their owners and have either been treated or destroyed. It has not been the policy of the department to insist on destruction, only as a last resort. Destruction has frequently been recommended, but whether destruction or treatment should be given has been usually left to the owner to decide.

Respectfully submitted,

FRANK C. PELLETT,
State Inspector of Bees.

THIRD ANNUAL REPORT OF IOWA BEE KEEPER'S ASSOCIATION

The third annual convention of the Iowa Bee Keepers' Association was held at Ames, November 17, 18 and 19, 1914.

The program was carried out as follows:

TUESDAY, NOVEMBER 17.

10:00 a. m. Welcome and response.
Address of President, Frank C. Pellett, Atlantic.
Report of Secretary, S. W. Snyder, Center Point.
Report of Treasurer, C. H. True, Edgewood

Appointment of Committees.

1:30 p. m.—Short Course Demonstrations in Charge of C. E. Bartholomew, Professor of Apiculture, Iowa College of Agriculture.

7:30 p. m.—History of Bee Keeping, C. P. Dadant, Editor American Bee Journal.

Honey Flora of Iowa and Nectar Secretion, Dr. L. H. Pammel, Ames

WEDNESDAY, NOVEMBER 18.

9:00 a. m.—
Fifty Years of Bee Keeping in Iowa, E. Kretchmer, Council Bluffs.
Temperature and Moisture of the Hive in Winter, Dr. E. F. Phillips, Washington, D. C.
Wintering Bees in Iowa, W. S. Pangburn, Center Junction.
Experience With European Foul Brood, J. I. Wiltsie, Arlington.
Discussion Led by L. W. Elmore, Fairfield.
Experience With American Foul Brood, D. E. Lhommedieu, Colo, Iowa.
Discussion Led by J. W. Stine, Salem.

1:30 p. m.—Demonstrations.
Wiring Frames, etc., F. W. Hall, Colo, Iowa.
New Method of Using Split Sections, Dr. L. D. Leonard, Minneapolis.
Putting in Foundation, W. S. Pangburn, Center Junction; J. W. Tinsley, Ames.

7:30 p. m.—
Individual and Co-operative Methods of Marketing Honey, Wesley Foster, Boulder, Colorado.
Discussion Led by P. J. Doll, Minneapolis, Minnesota.
Relation of Bees to Horticulture, Dr. B. N. Gates, Amherst, Mass.

THURSDAY, NOVEMBER 19.

9:00 a. m.—
Wild Bees of Iowa in Their Relation to Plant Pollination, L. A. Kenoyer, Toledo.
What the Agricultural College Can Do for the Bee Keeper, Prof. Francis Jager, University of Minnesota.
Reports of Committees.
Election of Officers.

OFFICERS FOR 1914.

President, Frank C. Pellett, Atlantic.
Vice President, J. W. Stine, Salem.
Secretary, S. W. Snyder, Center Point.
Treasurer, C. H. True, Edgewood.

DIRECTORS.

E. C. Wheeler, Marshalltown.
Dr. A. F. Bonney, Buck Grove.
Hamlin B. Miller, Marshalltown.

NEW BOARD OF OFFICERS TO SERVE DURING THE YEAR 1915.

President, Prof. C. E. Bartholomew, Ames.
Vice President, B. T. Bleasdale, Des Moines.
Secretary-Treasurer, S. W. Snyder, Center Point.

DIRECTORS.

W. S. Pangburn, Center Junction.
A. P. Chamberlain, Des Moines.
J. W. Stine, Stockport.
Attorney, Russell E. Ostrus, Des Moines.

COMMITTEES.

Nominations—
F. C. Scranton, Des Moines.
L. W. Elmore, Fairfield.
R. H. Longworth, Polk City.

Resolutions—
A. D. Beckhart, Atlantic.
E. C. Wheeler, Marshalltown.
W. S. Pangburn, Center Junction.

Fairs—
F. C. Scranton, Des Moines.
B. T. Bleasdale, Des Moines.
R. H. Longworth, Polk City.

President's Address—
C. E. Bartholomew, Ames.
A. D. Beckhart, Atlantic.
B. H. Tripp, Brooklyn.

Auditing—
E. E. Townsend, Ft. Dodge.
W. W. Lester, Glidden.
Wm. Zahs, Jr., Riverside.
Legislative—
B. T. Bleasdale, Des Moines.
A. P. Chamberlain, Des Moines.
Russell E. Ostrus, Des Moines.

The opening address of the President, Frank C. Pellett, was substantially the same as his official report as inspector of bees to the Governor. He laid special stress on the importance of general educational advance to raise the standard among the masses of bee keepers. He recommended that the law exempting six colonies of bees from taxation be repealed and that the legislature be asked for a special appropriation for research work in bee keeping in connection with the agricultural college. The difficulties of inspection under existing conditions were outlined and the appointment of county inspectors mentioned as desirable. The advisability of adopting a new constitution was suggested and that the association be incorporated.

The committee on President's address reported as follows:

We, the committee on President's address, recommend and approve:

First—The suggestion of the appointment of a nominating committee for nominating the officers of this association.

Second—We further approve the suggestions of the adoption of a new constitution and the incorporation of the association.

Third—The suggestion of the appointment of county bee inspectors we recommend.

Fourth—We approve the recommendation to remove the exemption of the tax on bees.

Fifth—We approve the recommendation to the legislature of financial support for the development of bee keeping in the state.

C. E. Bartholomew,
B. H. Tripp,
A. D. Beckhart,
Committee.

The matter was discussed and passed without objection. It was determined to ask the legislature to make an annual appropriation of four thousand dollars for the work in bee keeping at the experiment station at Ames.

Report of the Treasurer of the Iowa State Bee Keepers' Association for the Year Ending December, 1914.

Dec. 14, 1913—Amount on hand to balance at time of last report	$ 9.50
Nov. 12, 1914—Received from Secretary S. W. Snyder	27.65
Total receipts	37.15
Disbursements, none.	
Leaving balance in treasury	37.15

The above funds are forwarded to the secretary to be reported in my absence.

Respectfully submitted,
C. H. True, *Treasurer.*

Edgewood, Iowa, Nov. 12, 1914.

REPORT OF SECRETARY OF IOWA BEE KEEPERS ASSOCIATION FOR 1914.

S. W. SNYDER, CENTER POINT.

S. W. Snyder, Secretary.

The report of this office will be short as the past year has been an uneventful season for the bee keepers of this state. The only thing left over at our last convention to be accomplished through this office was to have printed about 300 placards containing the words "Eat Honey With Your Xmas Dinner," to be distributed among the bee keepers of the state who requested them. We had them printed and ready for distribution by December 20th, but by that time the orders had increased to the amount of 497, overreaching our estimated requirements nearly 200. It being too late to order more printed they were apportioned out as best we could to all those having requested some of them.

The list of members has increased handsomely during the past season, having 137 paid up members. There has been sent out during the season

464 letters, one postal card and about 70 packages of placards, reports, programs, etc.

The following is a statement of the receipts of this office:

RECEIPTS OF SECRETARY'S OFFICE.

137 membership fees	$ 68.50
62 subscriptions to "Review"	62.00
For sale of list of members	1.50
Total	$132.00
Paid out for subscriptions	$ 62.00
Postage due this office at close of business, 1913	7.23
Paid H. B. Miller for printing 1913 programs, etc	15.43
Paid H. B. Miller for printing placards	7.85
Guthrie-Lorenz Co. for flowers	1.00
Expended for postage since last meeting	10.84
Total	$104.35
In hands of treasurer	27.65
Total	$132.00

We, the committee on secretary and treasurer's report, find the accounts to be correct.

(Signed)
W. W. LESTER,
E. E. TOWNSEND,
WILLIAM ZAHS.

RESOLUTIONS ADOPTED.

Resolved, We, as members of the Iowa Bee Keepers' Association, appreciate the kindly reception accorded to us by the Iowa State College during our present interesting session at that institution.

That we heartily commend scientific investigation and research in the furtherance of bee keeping work; therefore we wish to express our appreciation of the assistance of Prof. C. E. Bartholomew and Dr. L. H. Pammel of the Iowa State College.

That we feel especially indebted for the valuable services of our honored visitors: Prof. Jager of the University of Minnesota, Dr. E. F. Phillips of the U. S. Agricultural Department, Editor Dadant of the American Bee Journal, Dr. L. D. Leonard and P. J. Doll of Minneapolis, and Dr. Burton N. Gates of Amherst, Mass.

That we cordially recommend such state legislation as will secure greater protection and care of the public highways. We feel that the present legal width of the highway should be maintained, and that plants, shrubs and trees of suitable varieties should be grown on the wayside for the use of bees, birds and for ornamentation.

That the compliments of the association are due to A. I. Root Co., and C. P. Dadant & Son, for their liberal donation of bee keepers' supplies to serve as a permanent exhibit at the agricultural college.

That we herein agree to co-operate actively with our new board of officers, it being our earnest desire that the Bee Keepers' Association of Iowa may stand for the best things in bee keeping achievement.

That we greatly regret the illness of our friend, Prof. H. E. Summers, who has manifested such a lively interest in all our work. We extend to him our sincere sympathy, and hope for his early recovery.

A. D. BECKHART,
E. C. WHEELER,
W. S. PANGBURN,
Committee.

The following additional resolution was offered after the election of the new board of officers and adopted unanimously:

Resolved, We are not unmindful of the good services hitherto rendered by our retiring officers. The Association will greatly miss the official leadership of the retiring President, Mr. Frank C. Pellett. He has been most efficiently identified with our organization from its beginning. He has greatly inspired us with his enthusiasm and spirit, and we bespeak for him a successful career.

NEW CONSTITUTION.

The new board of officers were voted authority to revise the constitution and to complete the incorporation of the association.

HONORARY MEMBERS.

Russell E. Ostrus, Des Moines.
Dr. E. F. Phillips, Washington, D. C.
Dr. Burton N. Gates, Amherst, Mass.
Prof. Francis Jager, St. Paul, Minn.
Dr. L. D. Leonard, Minneapolis, Minn.
P. J. Doll, Minneapolis, Minn.
C. P. Dadant, Hamilton, Ill.
W. C. Campbell, Grant City, Mo.

MEMBERSHIP LIST.

Anderson, Carl A., Madrid, Iowa.
Anderson, P. Z., Grand Mound, Iowa.
Aldrich, B. A., Smithland, Iowa.
Allen, J. W., Zearing, Iowa.
Ashley, Dr. Edith, Wyola, Montana.
Adix, Rev. H. L., Waterloo, Iowa, R. R. No. 4.
Adams, A. M., Clayton, Iowa.
Ackley, M. R., Topeka, Kansas, 709 Morris Ave.
Bleasdale, B. T., Des Moines, Iowa.
Beckhart, A. D., Atlantic, Iowa.
Bonney, A. F., Buck Grove, Iowa.
Blackman, T. W., Nevada, Iowa.
Brown, E. G., Sergeant Bluff, Iowa.
Bartholomew, C. E., Ames, Iowa.

Brown, D. K., Norwalk, Iowa.
Bittenbender, J. W., Knoxville, Iowa.
Brown, B. A., South Des Moines, Iowa.
Barber, C. J., Smithland, Iowa, R. R. No. 2.
Barton, Ed, Salem, Iowa.
Belt, Geo. W., 207 S. 2nd Ave., Marshalltown, Iowa.
Bennett, Mrs. Clyde, Hamilton and Milliner Sts., Ottumwa, Iowa.
Burghduff, J. H. Union, Iowa.
Botsford, E. F., Urbandale, Iowa.
Brown, H. C., Salix, Iowa.
Buchmayer, J. F., Iowa City, Iowa.
Blunk, J. P., Moorland, Iowa.
Bruce, M., Berwick, Iowa.
Berryman, Bell E., Central City, Nebraska.
Bennett, S. H., Cantril, Iowa.
Claney, A. D., Tama, Iowa.
Campbell, W. C., Grant City, Missouri.
Chamberlin, A. P., Des Moines, Iowa.
Chamberlin, A. W., Wheatland, Wyoming.
Caldwell, Dr. J. W., Steamboat Rock, Iowa.
Cartwright, W., Steamboat Rock, Iowa.
Cole, Edwin M., Audubon, Iowa.
Coverdale, Frank, Delmar, Iowa.
Clark, G. A. C., LeMars, Iowa.
Cate, J. M., Centerville, Iowa.
Cussen, J. E., 420 West 2nd St., Sioux City, Iowa.
Cox, Aaron, Oxford, Iowa, R. R. No. 2.
Christiansen, Chris, Laurel, Nebraska.
Davis, D. A., Ames, Iowa.
Donahue, J. C., Holbrook, Iowa.
Davis, J. C., Russell, Iowa, R. R. No. 3.
Dadant, C. P., Hamilton, Illinois.
Dustman, Chas. E., 416 4th St., Des Moines, Iowa.
Durr, George C., Kellogg, Iowa.
Dirr, Chas. H., 1311 W. 19th St., Sioux City, Iowa.
Drolik, Josef, 1524 Riverside Ave., Sioux City, Iowa.
Dadant, M. G., Hamilton, Illinois.
Danielson, J. I., Fairfield, Iowa, R. R. No. 7.
Elmore, L. W., Fairfield, Iowa.
Espy, J. B., Sioux City, Iowa.
Edison, L. S., 3417 1st St., Des Moines, Iowa.
Elskamp, George H., Maurice, Iowa.
Egenes, John, Story City, Iowa.
Edgar, G. L., New London, Iowa, R. R. No. 4.
Fairburn, John, Whittemore, Iowa.
Fhleisen, G. W., Madrid, Iowa.
Guinnan, S. M., Sergeant Bluff, Iowa.
Gray, A. W., Eldora, Iowa.

Grantham, R. R. C., 1832 Mondamin Ave., Des Moines, Iowa.
Good, J. M., Colfax, Iowa.
Gillett, Roy U., Fostoria, Iowa.
Griffin, C. P., Stuart, Iowa.
Gardiner, N. Fred, Geary, Oklahoma.
Gear, H. H., 2012 Riverside Ave., Sioux City, Iowa.
Goddard, T. M., Vermillion, South Dakota.
Hyllested, Rasmus, Peterson, Iowa.
Hansen, Chas. H., Marshalltown, Iowa.
Hull, J. E., Maxwell, Iowa.
Hall, F. W., Colo, Iowa.
Highland, J. R., Linden, Iowa.
Harris, N. J., Des Moines, Iowa, Box 507.
Hinkson, F. O., Stuart, Iowa.
Hodson, Albert, Salem, Iowa.
Harrington, M. W., Williamsburg, Iowa.
Honeyman, M. C., Emerson, Iowa.
Hatcher, T. H., Leeds, Iowa.
Hogendorn, W. H., Colfax, Iowa.
Huber, S. T., 1616 W. 20th St., Sioux City, Iowa.
Hartman, H. C., Braddyville, Iowa.
Hautz, F. G., Tingley, Iowa.
Howard, R. D., Bussey, Iowa.
Hollingsworth, W. L., Mt. Pleasant, Iowa, R. R. No. 5.
Hatch, R. C., Central City, Iowa.
Iseminger, Chas. A., 1114 Summit Ave., Sioux City, Iowa
Irvine, Walter, Clay Works, Iowa.
Jacobson, J. N., Story City, Iowa.
Johnson, M. D., Webster, Iowa.
Joslin, F. R., 2510 S. 41st St., Omaha, Nebraska.
Judd, William, Danville, Iowa.
Johnson, O. H., Essex, Iowa.
Kenoyer, L. A., Toledo, Iowa.
Kuersten, A. G., Burlington, Iowa, Box 382.
Kramer, J. O., Hosper, Iowa.
Klaffenbach, Henry C., Muscatine, Iowa.
Lhommedieu, D. E., Colo, Iowa.
Lester, W. W., Glidden, Iowa.
Longworth, R. H., Polk City, Iowa.
Lynn, E. C., Marshalltown, Iowa.
Lotz, Charles, Monroe, Iowa.
Little, D. G., Hartley, Iowa.
Lange, H. M., Grafton, Iowa, R. R. No. 1.
Lewis, S. R., Fairfield, Iowa
Miller, H. B., Marshalltown, Iowa.
McHose, J. B., Boone, Iowa.
Meloy, J. H., 615 So. 15th St., Ft. Dodge, Iowa.
McNeilly, James, Onslow, Iowa.

McKinnon, C. P., 1414 26th St., Des Moines, Iowa.
Milligan, W. H., Cedar Rapids, Iowa.
McCarty, Dan, 1206 3rd St., Sioux City, Iowa.
Myers, J. S., 420 Broad St., Grinnell, Iowa.
Mutschler, Mrs. Belle, Afton, Iowa.
Morgan, R. E., Webster, Iowa.
Mosher, S. P., New Grand Bldg., Sioux City, Iowa.
Monroe, C. F., 2200 W. 5th St., Sioux City, Iowa.
McWilliam, W. R., Sioux City, Iowa, General Delivery.
Mitchell, Miss Myrtle, Keokuk, Iowa.
Nance, G. W., Anthon, Iowa.
Nehring, William, Colo, Iowa.
Nelleletan, E. M., 2302 W. 3rd St., Sioux City, Iowa.
Ostrus, Oscar, Wiota, Iowa.
Pangburn, W. S., Center Junction, Iowa.
Pellett, Frank C., Atlantic, Iowa.
Pidgeon, Harry, Salem, Iowa.
Pearson, W. H., Mitchellville, Iowa.
Pinney, C. L., LeMars, Iowa.
Pease, F. W., Lansing, Iowa.
Pabst, Con, Dell Rapids, South Dakota.
Rinehart, A. C., Ogden, Iowa.
Rouse, H. L., New Hampton, Iowa.
Rickman, A., 3339 Nebraska St., Sioux City, Iowa.
Repert, Walter, 1009 Liebrick St., Burlington, Iowa.
Rider, E. H., Cantril, Iowa.
Southworth, W. P., 311 Pearl St., Sioux City, Iowa.
Schedtler, Rev. F., Sumner, Iowa.
Scranton, F. C., Des Moines, Iowa.
Stine, Rev. J. W., Stockport, Iowa.
Sweitzer, R. M., Union, Iowa.
Stephens, Geo. W., Dennison, Iowa.
Schweer, J. H., Valley Junction, Iowa.
Stocks, J. C., 328 Park St., Grinnell, Iowa.
Strong, J. L., Clarinda, Iowa.
Schlenker, J. W., Ankeny, Iowa.
Summers, H. E., Ames, Iowa.
Secor, Eugene, Forest City, Iowa.
Snyder Bros., Center Point, Iowa.
Schmidt, B. F., North Buena Vista, Iowa.
Strupat, Fred, Omaha, Nebraska.
Shettle, E. R., Lawton, Iowa.
Simm, Julius, Williamsburg, Iowa.
Shafer, W. S., 2311 North St., So. Omaha, Nebraska.
Swanson, Albert, Swea City, Iowa, R. R. No. 1.
Swanson, Henry A., Swea City, Iowa.
Saas, John, Cantril, Iowa.
Townsend, E. E., Ft. Dodge, Iowa.

Tripp, B. H., Brooklyn, Iowa.
Tinsley, J. W., Ames, Iowa.
Tisdale, J. P., Zearing, Iowa.
Thomson, Geo. M., Grand Junction, Iowa.
True, C. H., Edgewood, Iowa.
Thompson, W. F., Colo, Iowa.
Tharp, David, Clarinda, Iowa.
Tiede, Rev. F. Maynard, Iowa.
Tackaberry, A. B., Cantril, Iowa.
Walden, J. M., Wallingford, Iowa.
Wetter, Geo., Glidden, Iowa.
Wheeler, E. C., Marshalltown, Iowa.
Walker, H. L., Cedar Rapids, Iowa.
Winslow, I. N., Madrid, Iowa.
Wiltsie, J. I., Arlington, Iowa.
Wright, Arthur, Des Moines, Iowa.
Winch, Warren H., Hopkington, Iowa.
Webster, Fred M., Runnells, Iowa.
Williams, Wendell P., Danville, Iowa.
Weinmann, H. C., Indianola, Iowa.
Wager, John G., Elkader, Iowa.
Whitehead, J., Panora, Iowa, Box 46.
Wright, Gillinan H., Fallon, Nevada.
Wilson, James, Sergeant Bluff, Iowa.
Weeks, William, Salem, Iowa.
Wagner, John G., Elkader, Iowa, R. R. No. 3.
Wernick, Irving, Lake City, Iowa.
Zahs, William, Jr., Riverside, Iowa, R. R. No. 3.
Zenor, Walter, Woolstock, Iowa.

SHORT HISTORY OF BEEKEEPING.

C. P. DADANT.

C. P. Dadant

This is a long subject, for bees and honey were mentioned in the remotest times. So I can give but a short glimpse of it.

Those familiar with the Old Testament are acquainted with the name of "Debora," a prophetess of Israel. But only a few know that this name is that of the honey bee in Hebrew. They know also that Samson found a swarm of bees established in the dried-up carcass of a lion which he had slain a few weeks before. That suggested to him the riddle which he gave for his Philistine guests to solve and which they were at a loss to explain until they bribed his wife to secure the solution.

In the Proverbs, it is said "Eat thou honey, my son, for it is good." The promised land was a country "flowing with milk and honey." Our bee keepers, to advertise their honey, can have no difficulty in securing good testimonials, when they can even quote the Bible in their favor.

In mythology, we find Jupiter, king of gods, born in the Island of Crete, fed upon honey from golden bees by a nymph called Melissa. The Greek word "meli" dignifies. Hence came the names of various plants producing sweets or honey: Melica, melilotus, melissa.

The fabulous story of Aristaeus, king of Arcadia, which shows him as obtaining swarms of bees from the bodies of slain bulls and heifers, is the first where the teaching of bee culture is suggested. Aristaeus was a lover and teacher of agriculture. But his method of securing swarms from the bodies of slain animals is criticized in our day, by Jules De Soignies, a Belgian writer, who merrily suggests that it was probably from this most extraordinary source that foul brood originated. Decaying flesh is hardly the proper conveyer of swarms of bees.

When we seek outside of fabulous folk-lore, for the first writers on bees and their culture, we find the Greek Aristotle, the teacher of Alexander the Great, 384 years before the Christian Era. Later Latin writers, Varro, Virgil, Pliny, who died in Pompei by the eruption of Vesuvius, Columella, who wrote a treatise on agriculture entitled "De Re Rustica" (About Rustic Things). But none of these writers knew much about the natural history of bees. Their teachings were much mixed with the mystic and fabulous beliefs of the time. Most of them believed that bees gathered their eggs from the blossoms which they visited. They called honey "the dew of heaven." They asserted that from it was made the "ambrosia," the food of the gods. Similarly "nectar," the drink of the gods, was thought to be brewed from honey. That is why, to this day, the liquid sweet taken by the bee from the blossom is still called by us "nectar."

The best honey was said to be produced on Mount Hymettus, in Greece, from aromatic plants, like thyme, and orange blossoms. The directions for bee keeping were confined to the methods of hiving swarms and taking the honey. But Virgil had already noticed that there were bees of a yellower color than others, in some districts, and wrote about it.

During the dark ages, many unimportant writers mentioned the honey bee and gave directions for its culture. Bees were of much more importance than at present, since sugar did not exist and honey was the only sweet produced, with the exception of the juice of some fruits and plants, which served mainly for fermented drinks. Beeswax was also greatly appreciated. It was used for candles for divine service. Then the ancients used tablets covered with a light coat of it for writing, with a stylus. The stylus was an instrument shaped like a pencil, sharp at one end and blunt and flattened at the other. The sharp end served to write upon the wax, the flat end to erase what had been written, so that the tablet might be used indefinitely. Hence the Latin expression employed to advise pupils to often correct their work: "saepe stylum vertas" (often invert the stylus.)

It was not until 1609 that an English writer, Butler, affirmed the existence of a queen, or mother bee. Until then she was called "king." The purpose of the drones was unknown, although some asserted that they were intended to keep the brood warm and hatch it, just like sitting hens.

There are people yet who believe this to be their main function, and who also believe in the existence of a king bee.

The production of wax was also thought to be from the pollen which the bees bring home on their legs.

Swammerdam, in 1737, first described the queen as a female, for he had dissected this bee. He found the ovaries. But the mating was ascertained by Huber, the first positive scientist to give us a correct natural history, at the end of the eighteenth century.

Huber used a leaf-hive, the first style of movable-frame hive in existence, now called "closed-end frame hive." His frames were hinged and opened like a book. He was one of the most persistent observers, though he had to rely on the eyes of others for his experiments, for he was blind.

During that wonderful century, the eighteenth, a number of writers recorded important discoveries; Wildman, Schirach, Della Rocca, Duchet, Reaumur and hosts of others studied the honey bee. The production of wax was ascertained, the function of the drones proven and observing hives built that permitted investigation. In 1845, in the Bienenzeitung, the first bee journal, the famous Dr. Dzierzon published his discovery of parthenogenesis, or the ability of a queen bee to lay eggs that would hatch into live drones without having ever mated. This was first written as a hypothesis. It soon became an established theory and is now considered as a proved fact. Numerous scientists, especially in Germany, studied this problem, and the present methods of rearing queens from worker eggs were fully inaugurated.

Dzierzon was keeping his bees in what he called a movable comb hive. It was simply composed of a box in which top bars were set upon which the bees built their combs. But as there were no side bars to these, the bees fastened the edges of the combs to the walls of the hive and at each visit it was necessary to separate these combs from both ends in order to be able to lift them with the top bar to which they adhered. It was with such an unhandy contrivance that he made some of the most interesting experiments which have been handed down to us.

A little later Berlepsch invented a movable frame hive, which is still much used in Europe. It had most of the principles of the movable frame hive in present use, with the exception of the removable ceiling of the brood chamber or supers, and was made like a cupboard. In other words, the frames of this hive have to be removed from the rear, one at a time, and when you wish to examine the front comb or that which is nearest the entrance, you must remove all the others first, one at a time, drawing them out of the hive horizontally. It will be understood, therefore, that the frames of the Berlepsch hive run parallel with the entrance, instead of at right angle with it.

A little later, Debeauvoys invented a top-opening movable frame hive, but the frames were made to fit closely in the hive at both ends. This hive worked finely as long as there were no bees in it, but as soon as the bees occupied it they fastened the frames with propolis, so that it was impossible to move them without breaking them.

At length, Mr. L. L. Langstroth experimented upon this same subject and in 1852 obtained a patent on the movable frame hive in use the world over at the present day, a hive in which the frames hang upon rabbets at the ends of the box, by two projecting shoulders, these frames separated from the walls, ceiling and bottom by a bee space. This invention caused a revolution in bee culture. Mr. Langstroth himself was a very careful observer and made many remarks which have been confirmed to this day. He was the first man to dare assert that the bee moth never destroyed a single colony of bees, that the colonies which had died supposedly by the invasion of the moth worms were invariably queenless, or contained a worthless queen, so that the colony was doomed. He boldly stated that it was as senseless to imagine that the moths could destroy a colony of bees in normal condition as to believe "that carrion birds or worms, which are devouring a dead horse, were the primary cause of its untimely end."

Although the principle of the Langstroth hive has been criticized by some students, who have called it "a rattle box" owing to the freedom of hanging of its frames, this hive, in one shape or another, is at present used all over the civilized world, in many places to the exclusion of any other hive.

After 1852, bee culture took long strides. In 1861, the American Bee Journal was established by Samuel Wagner. It was the third bee journal in point of age, the first being the Bienenzeitung, already mentioned by me, the second L'Apiculteur of Paris. The old Bienenzeitung has been discontinued, other German bee papers having taken its place.

In 1865, Major Hruschko, of Dolo, Italy, invented the honey extractor, by the use of which honey is removed from the combs without damaging them, so that they may be returned to the hive to be filled again and again. He hit upon this discovery by accident. Having given his little son a piece of unsealed comb honey to carry on a dish, the boy tied this in his handkerchief as in a sling and swung the dish around his head. The honey was found to have emptied itself into the dish. That gave a clue to the making of the instrument which consists of wire-cloth baskets revolving speedily within a metal receptacle. Little beginnings often make great endings.

They certainly had no idea of the great proportions which the use of the honey extractor would take. Millions of pounds of honey are now taken all over the world by this method, which produces a better and cleaner article, while permitting the expensive comb to be returned to the hive, to be filled again. It did away with the "strained honey" obtained by crushing the combs and pressing the honey out. Perhaps this assertion is a little too strong, for in many parts of Europe and in a few districts in this country, there are still bee owners who are uninformed and persist in breaking up the combs and straining the honey. In whole districts, for instance in Southern France, visited by me last year, and in Italy, England, etc., especially in the heather regions, establishments are in existence which buy brimstoned colonies every fall and render up the combs by the straining process. The honey thus produced is dark,

strong, and cloudy. I was told that it is used principally to give flavor to glucose compounds sold in some countries under the name of honey.

Although much remains to be done in enlightening the country people of Europe on practical and scientific production, the fact is that the bulk of the honey produced through such countries as ours and in the more enlightened parts of Europe is now harvested in the best shape and in the most economical manner. The straw or willow skep and the "gum" or the box hive have been replaced by the movable-frame hive. With the exception of Switzerland, which is very far advanced in progress, the older countries are following somewhat in the rear of the newer States, Canada, Australia, New Zealand, the United States, etc.

A necessary complement of the invention of the extractor was comb foundation. To handle frames readily, to be able to sell honey in nice little sections, it was indispensable that the combs be built straight in them. Comb foundation not only secured that end, but saved the bees a great deal of labor and a great deal of honey expenditure, since beeswax worth commercially between 25 and 35 cents can be thus returned to the hive in such acceptable shape as to save the bees from 8 to 12 pounds or more of honey for each pound of wax. The diminishing of the amount of drone comb in undesirable colonies is also a great advantage of the use of foundation with worker cell base. This wonderful improvement was thought out in the middle of the nineteenth century, by Mehring, a German. But it remained for an American, A. I. Root, to make it in a practical way. With the help of an able machinist, Mr. Washburn, he produced cylinders in 1876 that made foundation as thin as 8 square feet to the pound. This was later improved upon by Vandervort, in the 80's, and thin sheets are now made as light as 13 square feet, which have long ago removed the objection of a fishbone in the honey. Strange to say, on the European Continent, beekeepers have only slightly improved upon the Mehring invention and make foundation by presses which our American beekeepers would reject, owing to its imperfection and its great weight.

Minor inventions, such as the bee smoker, the honey knife, were improved upon from time to time since the middle of the nineteenth century.

Advance in the diffusion of apiarian knowledge is noticeable every day in a more marked manner. The Germans have dozens of noted writers and scientists. In Switzerland, Bertrand, in England, Cowan, have written books on bees which have been translated in seven or eight different languages. Another Englishman, Cheshire, in his "Bees and Beekeeping," gave a summary of modern advances, in 1886. In this country, Langstroth, Quinby, Cook, Root, C. C. Miller have written the leading text books on the subject. But why name any, when so many have to be left out?

Queen rearing and the importation of bees from one country to another to try the best races have become common. The selection of the best honey producers as breeders has increased the yield of honey materially. A new method of rearing queens by making artificial cell cups, invented by Doolittle some 26 years ago, has permitted an unlimited production of queens from selected stock.

Bee journals are in many countries. Our own United States have four, France has a dozen, Italy two. Our Department of Agriculture is giving bees a special place in the Bureau of Entomology and the spread of diseases is being checked with their help.

The growth of bee keepers' associations is perhaps one of the most marked features of progressive bee keeping. A few years ago, a meeting calling together as many apiarists as are now found in almost any state convention would have been an impossibility. But I make bold to say that we are only at the beginning of success in our industry. The United States have not yet produced in a single year enough honey to supply a pound to each inhabitant, and there is plenty of room for more bees.

Dr. E. F. Phillips.

TEMPERATURE AND HUMIDITY IN THE WINTERING OF BEES.

E. F. PHILLIPS, WASHINGTON, D. C.

It is not necessary to argue before a company of beekeepers, especially in the North, that the successful wintering of bees is not only one of the most important problems before the bee keeper, but also at times one of

the most difficult of solution. You all know that the winter losses are considerable, but it is nevertheless a fact that bee keepers often fail to realize in full the magnitude of the winter loss, even in an average or even in a mild winter. The season of 1911-12 was the most recent case that we have experienced of a winter accompanied by severe losses. The summer of 1911 was a poor season for most localities in the North and most colonies were weaker than usual all summer. They went into winter weak, short of stores and with too many old bees. The winter was exceptionally severe and many colonies were not in condition to expend the energy necessary to maintain life, and as a result the loss by the death of colonies was over 50 per cent in many apiaries. If the bees had been in condition to obtain the bountiful crop of 1912 that year would have been a banner year in beekeeping, but there were not enough bees.

Similarly in 1909 there was a dearth of nectar but an abundance of honey-dew in many localities, causing enormous losses in the following winter. The winter of 1903-4 was another of heavy losses, while that of 1884-85 was one of the worst experienced by American beekeepers.

It is, of course, evident that good beekeepers lose less colonies than those who are uninformed, but even the good beekeeper loses sometimes. An estimate of 10 per cent for the average annual loss is probably conservative, and it speaks well for beekeeping as an occupation that American beekeepers can sustain such a loss year after year without destroying the industry. Looking, then, at the other side of the picture, it is clear that if this loss can be prevented beekeeping ought to advance rapidly to its rightful place in American agriculture.

From the experience and observations of beekeepers we now know considerable about wintering, and our information is increasing constantly. There are two facts concerning this information to which attention should be directed. First, many of the very best observations have appeared in the bee journals, but are now practically forgotten because beekeepers are often not careful enough to keep complete files of their journals and to consult them frequently. A bee journal is not altogether a newspaper, but should be considered as a permanent record of the good things observed. The other consideration is that the results have been obtained at enormous cost, since they are records in the main only of gross results. A beekeeper tries a certain method of wintering and necessarily gauges his success by what is left the following spring. With the facilities of the apiary detailed observations as to the daily activities and requirements of the bees are impossible, and consequently our knowledge of wintering is based largely on commercial experience, but is lacking in facts concerning the detailed needs of the bees.

In the present discussion of this subject it is proposed to depart somewhat from the usual methods in discussing the wintering problem and to record some of the things that bees do in winter, as well as to explain some of the physical phenomena observed. In doing so I shall draw on the results published by Mr. Demuth and myself concerning our work of the past two years. While I am having the pleasure of attending this meeting, Mr. Demuth is back at the laboratory making more observations, although rightfully we should read this paper as a duet.

THE SOURCE OF HEAT IN THE COLONY.

It is a well-known fact that bees generate heat during cold weather, so that the temperature of the cluster never drops very low. The lowest temperature that we have found is 57° F. In order to see what the bees do during this period of heat production, we devised a special outfit so that we could see the inside of the cluster. A colony in winter forms a compact, approximately spherical cluster and on the outside of the cluster there is nothing that one can see that suggests the heavy heat production that must take place. However, a narrow hive was provided, with double glass sides and top, with an air space between the sheets of glass to act as an insulation. The stores were then so arranged that the only place available for the cluster was next to the glass on one side. In the outside space were placed a number of the electrical thermometers which we used and which are briefly described in Bulletin No. 93 of the Department of Agriculture, to which those interested are referred. In the space provided there was not room for a spherical cluster, so the bees formed a hemisphere, the equator of which was against the glass. This showed as a circle of bees on the glass, exposing to view the center of the cluster.

It was then clearly demonstrated that the cluster is not uniformly compact. The cluster consists, between the combs and sometimes above and below them, of an outer shell of bees packed close together, with their heads toward the center. The thickness of this ring varies with the weather being thicker when the outer temperature is warm and when less heat production is needed, and becoming thinner with the increase in heat production. This is because when more heat is produced more bees are needed for this work, leaving less for the outer rim.

In order to expose this colony (Colony C) to rapid changes in temperature, the hive was placed on the roof of the building, and while one person watched the bees another read the temperatures in the room below where the instruments were located. A telephone was installed, so that the two persons could be in constant communication, head pieces being used, so that the hands of both observers were free. The observations made on the roof were then given over the telephone and all records were made below. This colony was of course in the light, but the normal cluster was nevertheless observed. The colony was disturbed as little as possible during the observations to eliminate abnormal conditions.

The nearly spherical cluster of bees consists, between the combs and sometimes above or below them, of an outer shell of bees close together, with their heads toward the center. This ring may be several layers thick. The position with the heads inward is typical, except when condensed moisture drops on the cluster, as it often does in cool weather, when the bees at the top turn so that their heads are upward. The bees in this outer shell are quiet, except for an occasional shifting of position. Inside this rather definite shell the bees between the combs are not so close together, nor are they headed in any one way. Considerable movement, such as walking, moving the abdomen from side to side, and rapid fanning of the wings, takes place inside the sphere, and when a bee becomes

unusually active the adjoining bees move away, leaving an open space in which it can move freely. Two bees may often be seen tugging at each other. In addition to the bees between the combs, placed as above described, others are in empty cells of the comb on which the cluster is always formed, always with their heads in. A verification of these statements is contained in the following observations, and the experiment may easily repeated by anyone: For the purpose of obtaining a colony without combs for another experiment, a hive was opened December 15, 1913, while the outside temperature was low enough to cause the formation of a compact cluster. When the combs were separated the circle of bees in the shell was clearly observed. When a comb from the center of the cluster was shaken the active bees in the center of the circle dropped off readily, and those in the outer shell which were somewhat sluggish were removed with more difficulty. After this was done those occupying empty cells in the center of the sphere backed out of the cells and were shaken off. Finally those occupying cells in the border of the sphere backed out, showing a well-marked circle on the combs. Evidently the bees in the shell, whether in the cells or between the combs, are less active than those in the interior of the cluster. Naturally such a manipulation as this is not to be recommended, except for purposes of demonstration.

It is clear from observations previously recorded that the highest temperatures are those of points in the center of this shell, and this is to be expected, as the heat is generated here. The outer shell constitutes an ideal insulator for the conservation of the heat, since the bees arranged so close together form small dead air spaces in their interlacing hairs, especially those of the thorax, and afford still more insulation with their bodies. The abdomens of the bees in the outer row are practically separate one from another, and must often be exposed to severe cold. That this method of conserving heat is effective is shown by observations on undisturbed colonies out of doors. For example, on January 14, 1914, there was at 9 a. m. a difference of 68° F. between thermometers 14 (center of the sphere) and 16 (outside the cluster) of Colony D, which were less than 4½ inches apart on the same level in the same space between combs, and a difference of 75° F. between this couple and the bottom board 4¼ inches below it. What this difference might sometimes be in colder climates may be imagined. Examples of this kind might be multiplied indefinitely from the records of these experiments.

The source of the heat of the cluster must, of course, be the oxidation of the food consumed by the bees. The bee is classed as a cold-blooded animal, in that the temperature of the individual bee is practically that of the surrounding medium. There is obviously, from the records just given, no internal regulation of the temperature of the body, such as is found in birds and mammals, for the temperature of a broodless cluster varies greatly. From the observations made on the various colonies, especially Colony C, it is clear that heat for the warming of the cluster is produced by muscular activity. While, of course, some heat is doubtless liberated by other life processes, this is practically negligible when bees are quiet, as in Colony A, when above 57° F. That higher temperatures may

be produced greatly increased muscular activity is required, and in Colony C in cold weather bees in the center of the shell of insulating bees were seen fanning vigorously and executing other movements, such as shaking and rapid respiration. We thus have the paradoxical condition that bees fan to heat the cluster in winter as well as to cool the hive in summer. Observations of this kind were repeated beyond number, and this theory of the method of heat production is entirely supported by the repeated observation of a humming noise from the cluster during cold weather.

A few details of the observations on Colony C may be of interest. For example, one bee was observed fanning vigorously for 7½ minutes (9.53 to 10.00½ a. m., January 23), while the other bees kept a space cleared for it. The temperature of the nearest thermometer rose ½° F. during this time. At 9.52 this thermometer was almost a degree cooler than at the time of greatest heat during the fanning. The rapidity of fanning of the wings varied, and toward the end of the time it became so slow that the outline of the wings was distinguishable. After the excessive activity this bee stood in the same place for a time. Rapid respiration may play a more important part in heat production than at first appears. One bee was observed to breathe 21 times in 14 seconds and then cease the rapid respiration. On other occasions 50 or more bees would begin shaking their bodies from side to side.

THE EFFECT OF CHANGES IN EXTERNAL TEMPERATURE ON THE HEAT PRODUCTION.

Another colony (Colony A) was used during the winter of 1912-13 to determine the responses of a normal colony to changes in outer temperature. It also was located on the roof, where the bees were free to fly when ever the weather permitted, and where it was exposed to rapid changes in temperature. It was in a 10-frame Langstroth hive, the entrance being reduced to ⅜ inches deep and eight inches wide, and the colony was not packed or given additional protection. In this hive we placed nineteen electrical thermometers, three on the bottom board in a row down the center, one in each upper corner and twelve among the combs, distributed in such a way that the cluster could never get away from all of them. Readings were made hourly from 9 a. m. to 4 p. m. through the entire period of observation (September 26 to March 28), except Sundays and holidays, and at intervals additional special series of readings were made every 15 minutes (sometimes every 30 minutes) during the night (5 p. m. to 8:45 a. m.) for periods of several days each. In all 41,413 records were made of temperatures in Colony A.

The reaction of the cluster in heat production, as induced by changes in external temperature, is well shown by the records made from noon November 13 to 2 p. m. November 15 (1912), when readings were made hourly from 9 a. m. to 4 p. m. and every 15 minutes at night. From noon on November 13 the outside temperature dropped slowly until 6 a. m., November 15, and the weather was cloudy, so that the bees did not fly. At noon on the 13th the outside temperature was about 69.2° F. and all

the points within the hive were then cooler than the outside air, due to the fact that it took some time for the inside of the hive to warm up. At 4 p. m. the outside temperature had dropped to 65.3° F., when it was lower than any of the points within the cluster, which had in the meantime become warmer. From this time until 6 p. m. the next day (14th) the temperature wthin the cluster gradually dropped as the outer air cooled, until the lowest one (No. 9) was 57° F. (Outside temperature, 48.2° F.). The generation of heat began at 6:15 p. m. at this point, which was to one side of the cluster, and is to be attributed to the movement of the bees in forming a definite cluster. At 6:30 p. m. a rise in temperature was noticed on thermometer 19, at the other side of the cluster. Until 10:15 p. m. the changes in temperature are probably to be interpreted as incidental to the formation of a compact cluster, and from this time until the next day at the close of the series of readings thermometers within the cluster showed a considerably higher temperature than the outer air, or than the thermometers outside the cluster. The maximum in this series was reached at 3:15 a. m. November 15, when thermometer 12 in the center of the cluster registered over 89.4° F.

After the coldest outside temperature was reached and the outer air began to get warmer (6.15 a. m., November 15), there was a tendency for the cluster temperatures to drop. This is somewhat noticeable in the case now being discussed, and is more clearly seen in records obtained in other series. In general, after a period of cold, when the outside temperature begins to rise, the cluster temperatures drop slowly to meet the outside temperature. The generation of heat is reduced, or even discontinued, only to be increased when the outside temperature again drops, or when it gets high enough to induce greater activity, as in flight. It is found also by taking more frequent readings when the cluster temperature is above about 69° F. that it is less constant than when it is below this temperature, indicating that temperatures above this point the bees move about to some extent, while between 57° and 69° they are quiet, unless flight is desirable owing to a long confinement.

This series of readings is supported by numerous records taken on this and other colonies throughout the winter, and, since all the observations tend to confirm what was first seen on the record presented here, we feel justified in presenting a definite statement of the reactions of the cluster to outside temperatures. It may be added that a careful study of the records of previous investigators fails to show a similar statement on this subject. When a colony is without brood, if the bees do not fly and are not disturbed and if the temperature does not go too high, the bees generate practically no heat until the coolest point among the bees reaches a temperature of about 57° F. At temperatures above 57° F. a compact cluster is not formed, but the bees are widely distributed over the combs. At the lower critical temperature, which is for the present stated as 57° F., the bees begin to form a compact cluster, and if the temperature of the air surrounding them continues to drop they begin to generate heat within the cluster, often reaching temperatures considerably higher than those at which they were formerly quiet and satisfied. It is evident, therefore, that the temperature within the cluster is far from being uniform in winter, as has been, in a sense, assumed among practical beekeepers. At the temperature at which other insects become less active (begin hibernation), the honey bee becomes more active and generates heat, in some cases until the temperature within the cluster is as high as that of the brood nest in summer. To sum up, when the temperature of a colony of undisturbed broodless bees is above 57° F. and below 69° F. the bees are quiet and their temperature drifts with the outer temperature; at lower temperatures they form a compact cluster, and the temperature within it is raised by heat generated by the bees.

We desire to state that while the lower critical point, 57° F., appears rather well established, the observations up to the present do not justify too definite a statement concerning the upper limit of quiescence. It must be emphasized that these conditions do not apply when the colony has brood. The rearing of brood in winter causes a marked increase in heat production and constitutes a condition which may become one of the most disastrous that can befall a confined colony.

When the heat production of the colony is explained, we are able to understand to some extent the divergence in the records obtained by other observers. It has, of course, long been known that bees generate heat, and it has been pointed out that during cold weather the temperature of the cluster is often higher than during warmer weather. While the temperatures previously recorded are in most cases abnormal, due to disturbance, the chief difficulty in understanding the phenomena which takes place is due to insufficient observations. For example, if between noon November 13 and 2 p. m. November 15 only a half dozen temperature records had been made for the cluster (and perhaps without finding the warmest part of it) and the outside air, it would have been impossible to determine the limits of heat production. Most observers have been satisfied with a few observations, and seemingly everyone who has inserted a thermometer in a hive has felt called upon to publish the results, thereby only confusing the problem.

THE EFFECT OF CONFINEMENT AND THE ACCUMULATION OF FECES.

Before beginning a discussion of the effect of confinement and the accumulation of feces, it may be recalled that during the active summer season the length of life of worker bees is in a sense determined by the work done by them rather than by days or weeks. The greater the necessity for excessive activity the shorter the term of life. We believe that they have evidence to prove that this applies to the winter also, and this belief is entirely supported by the experience of beekeepers everywhere. That bees may come out of winter quarters strong in numbers and vitality, it follows that the work to be done by the bees in the winter should be reduced to a minimum; and the winter problem, as thus interpreted, is therefore to find the conditions under which broodless bees do the least work. The work which broodless bees do in winter consists, so far as has been determined, solely in the production of heat or in activity incident to flying

on warm days (if free to fly), and therefore the problem, so far as it is under the control of the beekeeper, is primarily to obviate the necessity for the production of heat. If brood is reared the work of the bees is necessarily enormously increased, and their vitality is correspondingly decreased. So far as evidence is available in our work, the colony is not fully recompensed for this expenditure of energy by an increase in the strength of the colony by bees thus reared.

The colonies to be discussed under this heading (Nos. 1 and 3) were wintered in a constant-temperature room at the University of Pennsylvania, Philadelphia, Pennsylvania, in special 6-frame hives (to economize space and concentrate the colony so that fewer thermometers would be required) with full entrances and were not propolized or sealed at the top. During the regular series of readings the room was kept at a temperature which rarely dropped below 40° F. or went above 45° F., and the average temperature from October 14 to March 6 was 42.67° F. This temperature was chosen as being nearly the one usually considered best by beekeepers. The foods given these colonies were stored in the combs, just as placed by the bees. There was some pollen available in colony No. 1. On this colony, 24,077 temperature readings were taken.

According to what has been said in the previous section, we should expect bees at such a temperature to maintain a compact cluster and to generate some heat at all times. This was actually the case, the temperature of the interior of the clusters dropping below 64° F. only a few times in either colony.

Colony No. 1, on honey stores, was in the constant-temperature room from October 12, 1912, to March 24, 1913, or 163 days. It was then removed for a flight and put back the same evening, where it remained until March 28. From March 7 at 9 a. m. until March 28 at 4 p. m. readings were made on this colony every 15 minutes night and day, with the exception of the period between 9 a. m. and 7 p. m. on the 24th, when it was out of doors. During this period of three weeks the temperature of the room was changed slowly, being raised as high as 64° F. and cooled to 13° F.

When this colony was first placed in the room for the regular series of readings, after a preliminary confinement, October 12 (the readings were begun Monday, October 14), it maintained a cluster temperature which usually lay between 64° and 68° F., the daily average temperature departing from these rather narrow limits only four times up to November 22. The average temperature is 66.5° F. During the first five weeks the temperature of the room was less regular than later (due to faulty working of the regulating apparatus), and this doubtless accounts for some irregularities in the cluster temperature. At first the three thermometers in the cluster (1, 2, and 5) gave temperature readings quite close together, while thermometer 6, which was near the cluster, gave readings intermediate between the three thermometers of the cluster and the four others in the hive, farther from the cluster. After November 22 the records of the thermometers in the cluster were more widely separated and the temperature of the center of the cluster (shown on thermometer 5) tended to rise gradually. It varied constantly, but by December 7 and from then until the end of the month, it averaged between 69° and 75° F. On November 29 and December 12 the cluster temperature rose to over 88° F. From the 1st of January until March 6, which ended the regular series of readings, the cluster temperature became more and more irregular, and on January 20 the cluster moved (probably to accommodate itself to the stores) until theremometer 2 was nearer the center and showed a higher temperature than thermometer 5. The size of the cluster was gradually decreased by the death of the bees, and all the thermometers except 2 and 6 show a gradual decrease in temperature until finally, from about February 25 to March 6, they are all low and of nearly equal temperature. The two thermometers giving high readings continued to show in general a higher and higher average temperature and to become more irregular (except from February 15 to March 1), the periods of increased heat becoming more frequent. There was absolutely no regularity in these intervals. After February 1 the temperature of the cluster varied between 75° and 91° F., the average from February 1 being 85.4° F.

On March 6 all colonies in the constant-temperature room except two were removed. The colony described above (No. 1) and one other (No. 12), not to be described at present, were left. On March 7 at 9 a. m. the temperature of the room stood at 42° F., and the temperature of the interior of the cluster was about 84° F. The brine which cooled the room was then shut off and the temperature of the room rose very slowly and regularly, until on March 11 at 8:45 a. m. it was 64° F. For the first day the temperature of the cluster was slightly variable, and at 10:45 p. m. thermometer 6, which had been cooler than thermometer 2, showed a rise in temperature (probably due to a shifting of the cluster), and from then on to the 24th they were nearly of the same temperature at all times. On March 8, at 3 a. m., thermometer 2 rose to 87° F. (room temperature, 48.5° F.), having previously shown a cooling. The cluster temperature then dropped slightly, showing relatively little variation until at 4:15 p. m., March 9, it stood at 77.3° F. (room temperature, 55.7° F.). As the room temperature continued to rise, the cluster temperature increased still more rapidly, until at 8:15 a. m., March 11, it reached 93° F. (room temperature, 64.2° F.). A little brine was now turned on, sufficient to lower the temperature gradually to 58° F. at 9 a. m., March 12, and it again rose to 63.3° at 5:45 p. m., March 15. During this period the cluster temperature followed the room temperature, but remained constantly over 20° warmer. The room was again cooled slowly, and the cluster temperature dropped until on March 16, at 3 p. m., the room was 49° F. and the cluster 77.5° F. As the room continued to cool, the cluster temperature increased, the bees responding to the colder temperature, until at 4:15 a. m., March 17, the room was 48° F. and the cluster 88° F. The room then gradually warmed, and again the temperature of the cluster dropped and then again rose with the room temperature, remaining always over 20° warmer. At 6:45 p. m., March 19, the brine was turned on full and the room cooled rapidly, reaching the mini-

mum of 13° F. at 9 p. m., March 20. At no time, however, did any of the thermometers in the hive record a temperature below 33° F. Here it remained constant within 0.1° F. for about six hours, during which time the cluster temperature varied between 86.5° and 89.5° F. (a difference between the room and the cluster temperatures of 73° to 76° F.) The brine was turned on full and the room cooled rapidly, reaching the minimum, when it reached a temperature of 44.5° F. During this warming the cluster cooled until at the close it was varying between 72° and 79° F.

As stated above, the colony was now (9 a. m., March 24) removed for a flight and put back the same day at 7 p. m. In the meantime the room was cooled to 33° F. When the bees were put back into the room the temperature of the entire inside of the hive showed great variation and naturally an increase due to the warming up while out of doors and to the activities of a good flight. The points outside the cluster dropped rapidly, but it was midnight, March 25 (31 hours), before the curves of temperature again appeared normal. The room was slowly warmed to 63.2° F. at 6:30 p. m., March 26, and then slightly cooled to 54° F. at 6 a. m., March 27, and again warmed to 58.5° at the close of the series, 4 p. m., March 28. After the flight the temperature of the cluster never dropped below 89.5° F., and the highest temperature reached was over 95° F. (soon after the flight). Thermometer 6 remained high, but thermometer 2, which had previously been high, now approached the other thermometers, probably due to a rapid loss of bees and to a decrease in the number of bees during the flight. It must be recalled that these bees had been confined for an abnormally long time and were subjected to treatment which is at least unusual. After this colony was taken from the room for the last time it was found that thermometer 6 was over a patch of larvae, and, estimating as accurately as possible, the eggs from which these hatched must have been laid at the time when the room was coldest (March 20-21) and when the cluster temperature was at its highest point. There had been no brood previously according to the temperature records as compared with those of this colony earlier and with those of other colonies, nor was there much evidence of increased heat production due to the presence of brood until after the flight. Probably no extra heat was produced for the eggs, and possibly the hatching of the eggs was somewhat delayed by the low outer temperature. The effects on the cluster temperature which might be expected from a flight, in relieving the accumulation of feces, were not observed, because brood rearing had been begun.

Colony No. 3 was placed in the constant temperature room October 12, 1912, after a good flight, and readings were begun on Monday, the 14th. In all, 2,165 temperature records were made on Colony 3. The stores provided this colony consisted of honeydew honey, which was gathered in the department apiary and which, since it granulated almost at once, had been removed by melting up the combs which contained it. After this operation it remained liquid. During the summer of 1912 some of this honeydew honey was fed to a colony in the open, during a dearth of nectar, and was stored in new combs above the brood chamber, in which no cells

of pollen were to be found. After the second storing the honeydew honey was clear, well ripened, and did not granulate. This colony was also in a six-frame hive, as previously described, and contained five thermometers (Nos. 14-18) among the combs. It is of course well known to beekeepers that honeydew honey is not a good food for winter.

When this colony was first put into the constant temperature room it behaved much as did Colony No. 1, except that the temperature varied between 69° and 78.7° F. for the first week, being slightly higher and more variable than that of Colony No. 1. The second week it remained much the same, the temperature, however, varying between 69° and 80° F. From this time on the temperature of the center of the cluster rose rapidly, never dropping below 79° F. From October 29 almost to the close of the readings. After November 4 the temperature remained above 86° F., and after November 11 it dropped below 89° F., only twice until the end. Thermometer 17 at first read about 4° below thermometer 14, but after November 11 they were close together until November 25, when thermometer 17 began to cool rapidly, due to loss of bees, and after November 30 thermometer 14 cooled rapidly until, on December 9, it showed that no more bees remained alive. From December 2 to 7, inclusive, there was little heat generated, due to the scarcity of bees. It is of interest to observe the records of thermometer 16, near the cluster, but usually outside of it. It at first showed a temperature but little higher than the two thermometers away from the cluster, but on October 31 it began to rise until, on November 12, it reached 80.5° F., when it was doubtless covered by the bees. Even the two thermometers (15 and 18) clear to the back of the hive rose until, on November 13, they recorded 61.5° F. These thermometers showed about the same temperature for about ten days, and then these two and thermometer 16 showed a cooling, since the bees were dying so fast that there were no longer enough to warm up these thermometers away from the center of activity. It was to be expected that this colony would die, and the experiment was performed to learn the phenomena incident to the loss.

Before summing up the results of these two colonies, Nos. 1 and 3, it may be stated that, so far as the evidence here presented is concerned, the results as far as here discussed are confirmed by records from ten other colonies kept in the constant temperature room, but fed other foods and otherwise different. There is in all of the records no evidence which we can interpret as at all contrary to the views here stated.

It is evident from the behavior of Colony No. 1 that at least one factor entered which gradually caused the bees in the cluster to generate more and more heat until at the beginning of the special series, March 7, the cluster temperature was about 20° warmer than it was at the same room temperature at the beginning of the confinement. It is also seen that during the special series, March 7-24, the cluster temperature always remained at least 20° above the room temperature, whereas from the discussion of bees unconfined (Colony A) we might expect them to cease heat generation when above the lower critical temperature (57° F.) In the case of colony 3, fed on honeydew honey stores, the factor which caused more heat to be produced evidently increased much more rapidly. As

stated previously, honeydew honey is a poor food for winter and is so recognized. It contains the same sugars as honey, but contains in addition a considerable amount of dextrin, the particular lot fed to colony 3 containing 4.55 per cent while good honeys contain only a fraction of 1 per cent. From the evidence at hand it appears that dextrin can not be digested by bees and, whether or not this is the explanation, honeydew honey causes a rapid accumulation of feces which usually results in the condition known as dysentery, in bad cases of which the feces are voided in the hive. In the case of Colony 3 the whole hive inside and out, as well as the frames and combs, were spotted badly, the inside of the hive being practically covered. Even with fine honey stores such a spotting is usually noticed after a prolonged confinement, especially in severe weather (or during brood rearing). It therefore appears that the accumulation of feces acts as an irritant, causing the bees to become more active and consequently to maintain a higher temperature. We are therefore justified in believing that the cause of poor wintering on honeydew honey is due to excessive activity, resulting in the bees wearing themselves out and ultimately in the death of the colony. In the case of colonies on good stores the feces accumulate more slowly and the excess activity is not so marked and is induced more gradually. The accumulation of feces due to confinement causes increased activity and this in turn is the cause of excessive heat production, resulting in a reduction in the vitality of the bees.

It therefore follows that excessive activity causes the consumption of more food, resulting in turn in more feces, so that colonies on poor stores are traveling in a vicious circle, which, if the feces can not be discharged, results in the death of the colony.

While the activity of the cluster is greater at some times than at others, there are not, as has been held, regular intervals of activity at which the colony rouses itself to take food. At no time is a colony kept at a room temperature of 45° F. or less in a condition which can be characterized as inactive. Presumably the reported "intervals of activity" have occurred when the colony made a noise due to disturbance by the beekeeper.

The bees in Colony 3 were compelled to work constantly to maintain so high a cluster temperature. In fact, they did more work than colonies wintered in the open air. Keeping these bees in a cellar protected them from low outside temperatures, but the lack of opportunity for a normal ejection of feces caused a condition more serious than extreme cold weather. We seem to have here an explanation of the fact, often observed by beekeepers, that some colonies wintered in the cellar are in worse condition in the spring than colonies that are exposed to severe cold. Poor food is evidently a more serious handicap than low temperature.

HUMIDITY IN WINTER.

This subject is one concerning which less definite information is available, although it is one which has been much discussed by beekeepers. One of the chief difficulties seems to be a lack of information concerning the interrelationship of temperature and relative humidity and it may be well to make some of these points clear.

THE SOURCE OF MOISTURE IN THE HIVE.

All northern beekeepers know that under some conditions, especially in the cellar, the atmosphere in the hive in winter may become so laden with moisture that it cannot all remain in the form of water vapor but condenses on the hive and combs. Water may even run from the hive during the winter confinement. Obviously this moisture does not come from outside the hive for this often occurs when the cellar appears dry.

Within the hive the only source of moisture is the food consumed by the bees. Honey not only contains about 20 per cent water but when the sugars are consumed and assimilated the final products are carbon dioxide and water. Honeys vary in composition but on an average when one pound of honey is consumed there is produced about two-thirds of a pound of water, and since honey is one and one-half times as heavy as water, one gallon of honey when consumed produces approximately one gallon of water.

If we take for example a bee cellar containing 216 colonies and estimate the average consumption of honey during the winter at ten pounds per colony the total honey consumed is 2,160 pounds or 180 gallons. This produces 1,440 pounds of water or 180 gallons, enough to fill six 30 gallon barrels. If these colonies are in the cellar for four months there will be given off one and one-half gallons of water a day and unless there is considerable movement of air within the cellar the atmosphere cannot take it all up as water vapor and condensation will occur.

THE RELATION OF HUMIDITY TO TEMPERATURE.

Before discussing the changes which take place in the humidity of the hive it may be best to take up some facts concerning the moisture content of the atmosphere as influenced by temperature. It is of course well known that if warm moisture laden atmosphere is cooled its capacity for water vapor is decreased and moisture is condensed. This is shown in the condensation of moisture on the outside of a glass of ice water. Similarly we have condensation on the surface of the leaves which we call "dew" if the moisture remains liquid and "frost" if it is frozen as it condenses. These phenomena are duplicated in the bee hive and bee cellar.

The problem of the beekeeper is to eliminate this moisture, which leaves the body of the bee in the form of water vapor, without condensation. This has been done in cellar wintering (1) by raising the temperature of the outer air, (2) by drying the air (as by the use of unslaked lime in the cellar) or (3) by causing the air to move so that as the atmosphere becomes laden with moisture it is replaced with other air capable of taking up more moisture.

To determine by weight the actual amount of water in the atmosphere is difficult in ordinary practice and the usual method is to determine the relative humidity, that is the amount of moisture in the atmosphere compared with the maximum which might be held at that temperature. The common method is by the use of the wet and dry bulb thermometers, to

determine how much the wet bulb is cooled by evaporation. Then from this data the relative humidity is obtained from prepared tables.

To make clear the relation of the relative humidity to temperature it may be well to choose a few examples. For the first case, there may be assumed a cluster temperature of 60° F. (barometer, 30 in.) in an atmosphere which is fully saturated. In this event the slightest cooling will cause condensation and the wet bulb in such an atmosphere (if it could be circulated rapidly) would show no cooling. No evaporation can occur as the atmosphere cannot take up any more moisture. If, however, the wet bulb can be cooled at this temperature the relative humidity is less as the readings of the wet bulb thermometer are lowered. The temperature to which an atmosphere must be cooled to produce condensation is known as the "dew-point." This is also lowered as the humidity decreases. These points are illustrated in the accompanying table:

Assumed cluster temperatures		Dew	Relative
Dry bulb	Wet bulb	point	humidity
60° F.	60° F.	60° F.	100 per cent.
60° F.	58° F.	57° F.	89 per cent.
60° F.	56° F.	53° F.	78 per cent.
60° F.	54° F.	49° F.	68 per cent.
60° F.	52° F.	45° F.	58 per cent.
60° F.	50° F.	40° F.	48 per cent.
60° F.	48° F.	35° F.	39 per cent.

With such an assumed temperature of the cluster (60° F.) only the highest relative humidities would show condensation in an atmosphere in which such a cluster temperature would be found, for such a cluster temperature could occur only when the external temperature is above 57° F.

If different temperatures are assumed for the cluster (all of which have been observed under different conditions by various investigators) the relative humidity of the warmer atmosphere which will show no condensation when cooled to cellar temperature is given in the following table, (barometer, 30 in.):

Assumed cluster temperatures		Dew	Relative
Dry bulb	Wet bulb	point	humidity
60° F.	52° F.	45° F.	58 per cent.
65° F.	54° F.	45° F.	48 per cent.
75° F.	58.5° F.	46° F.	35 per cent.
96° F.	66° F.	45° F.	18 per cent.

In this second table the numbers are chosen so that the dew-point is practically 45° F. in all cases, assumed as an average cellar temperature. It appears that a given amount of water given off by bees at 96° F. creates a much lower relative humidity (18 per cent) than the same quantity of water at 60° F. (58 per cent) because the warmer atmosphere is capable

of holding more water vapor and relative humidity is simply an expression of the percentage present compared with all that the atmosphere can hold. However to maintain a temperature of 96° F. necessitates the consumption of much more honey and this in turn gives off much more water vapor. Consequently with a cellar temperature of 45° F. we should expect much more condensation in a colony with a cluster temperature of 96° F. than in one with a cluster temperature of only 65° F., except that the increased heat would tend to produce stronger currents of air in the hive which might relieve the situation somewhat. Since 96° F. is about brood rearing temperature it is partly indicated why brood rearing during the winter confinement may be highly injurious, as it is usually held to be. It may be stated that a cellar temperature of 45° F. and a cluster temperature of 60° F. might not occur; the other temperatures used in the table might well occur under different conditions.

In making determinations of relative humidity it is necessary to take into account the barometric pressure but in any given locality the changes of the barometer are so small as to be negligible and therefore need not be discussed here. In any event in using wet and dry bulb thermometers the conversion table used must be for the right barometric pressure.

A further word of warning concerning the use of wet and dry bulb thermometers may not be amiss. To obtain accurate results the air must be moving past the bulbs at the minimum rate of 15 feet per second and if this is not occurring naturally the thermometers must be whirled at a corresponding rate. Unless this is done the readings are entirely worthless. Great care must be taken not to read the wet bulb thermometer until it registers as low as it will fall. It is therefore obvious that wet and dry bulb thermometers hung in the bee cellar and not whirled give no reliable data as to the relative humidity of the cellar. Many beekeepers thus use them incorrectly.

HOW MOISTURE ESCAPES FROM THE HIVE IN WINTER.

During the summer when nectar is being ripened into honey, great quantities of water leave the hive in the form of water vapor. During this period the hive is being well ventilated by fanning bees so that the atmosphere is changed rapidly and, being warm, is capable of taking up more moisture than is the atmosphere of the bee cellar. In winter when the bees are in a cluster this ventilation by fanning does not occur. The amount of water that must leave the hive is much less than in summer, but on the other hand it either must pass out in air set in motion by changes in temperature, or will condense on the frames, combs and hive and possibly run out of gravity.

If the atmosphere of the bee cellar is heavily charged with water vapor, as is frequently the case, that within the hive must be saturated. The additional water produced by the bees will therefore condense and run out the entrance. It frequently happens that the air inside is saturated while that outside is capable of taking up this moisture again by evaporation, so that there may be no water visible except within the hive, most often on the cover, and possibly also on the bottom board.

If the wooden cover of the hive is loose or if the hive is covered with some absorbent or porous material, the heat escaping from the cluster may cause the formation of slight upward air currents which will carry the moisture out the top in the form of vapor. Out of doors there may be condensation of moisture in the porous packing more rapidly than it can be carried off by evaporation, in which case the packing becomes wet and usually thereby less effective as a non-conductor of heat. With sealed covers the moisture must pass out the entrance and this may also occur in the form of vapor if the outer air is of sufficiently low relative humidity to take up all the water as it comes outside.

One of the much discussed questions among beekeepers is whether it is better to have the wooden cover of the hive sealed tightly by the bees with propolis or whether the replacing of the cover with an absorbent cushion to take up the moisture does not keep the colony in better condition. The usual method of providing upward ventilation is to place several thicknesses of absorbent cloth or other absorbent material over the frames, over which is placed suitable packing material. Out of doors care must be taken to have the cover water proof so that the packing and absorbent material will not become wet from rain or snow. Another method used to a considerable extent in New York State is to have a small hole in the front of the hive through which the moisture laden air may escape.

If the temperature of the inside of the hive, not in the cluster, is low and the humidity of the air which escapes from the cluster is high, this moisture will not escape from the entrance without condensation. In such a combination of circumstances it is obviously advantageous to provide an avenue of escape. This the upward ventilation and absorbent cover does. The late W. Z. Hutchinson, who had unexcelled opportunities for studying bees in winter in North Michigan, says: "Those beekepers who have been the most successful in wintering their bees out of doors in the higher latitudes have, so far as I know, given upward ventilation through some kind of packing material." Coggshall refers to the severe winter of 1880 when in his region (Groton, N. Y.) the temperature remained below 0.0° F. for three weeks in January. Three-fourths of the bees in New York died and he lost half of his. Those saved had been packed with burlap or carpet over the frames over which was four to six inches of dry sawdust. Bees in box hives died unless the boxes had a hole for flight half way up or were cracked so that moisture could escape.

On the other hand it is frequently observed that colonies in box hives sealed inside by the bees often winter better than colonies in hives with movable frames carefully packed. The majority of box hives are much higher than they are wide. This enables the bees, by going toward the top to keep the temperature of the combs about them high enough so that moisture does not condense and furthermore there are frequently cracks to allow the escape of moisture.

In situations where the temperature of the combs and hive does not often reach the point of condensation, or if a low temperature is prevented by packing, a tightly sealed cover can do no harm and many beekeepers report success in wintering bees in such conditions. The attributing of differences in manipulation and methods to "locality" has been greatly overdone by beekeepers, particularly since they usually do not describe the characteristics of the locality or analyze their conditions to determine why certain things prove best. This peculiarity in the beekeeping literature is probably largely to blame for the discussions on the virtues of upward ventilation. It should be borne in mind, however, that while sealed covers may be harmful in colder regions, upward ventilation is not objectionable in warmer regions. A careful study of the methods employed by the beekeepers who winter their bees most successfully would probably show that the quotation given above from Hutchinson is correct.

EFFECT ON THE HUMIDITY OF CHANGING THE OUTSIDE TEMPERATURE.

Any change in the temperature of the bee cellar may affect the humidity of the air in the hive in two ways. As the optimum cellar temperature is approached, the heat produced by a normal colony will diminish and this decreases the food consumed and consequently the water produced. The widely varying reports of the food consumed by bees in cellars find their explanation chiefly in the difference in the temperature of the cluster. As the cellar is cooled below the optimum not only is there more water produced, but the cooler atmosphere is incapable of holding so much and there is therefore an augmented cause for condensation.

In this connection it may be of interest to record a few observations made by one of the authors on bee cellars not long since. The first cellar was away from any house, was ventilated by the sub-earth system and was without any artificial heat. The temperature of the air at the floor was 40° F. and in the center of the cellar 41° F. There was little circulation of air and moisture had condensed freely in the chamber above the cellar proper, under the roof. In this cellar were 98 colonies in 24 stacks. Of these, condensed moisture was seen on the bottom boards of 21 in the bottom tier, 11 in the next tier, 3 in the third and 6 in the top tier. There was no condensed moisture on the floor. The only adequate explanation for the greater number of wet colonies in the lower tiers is the slightly lower temperature at the floor. If now there had been more ventilation provided without greatly lowering the cellar temperature, this moisture might at least have reached the chamber above the cellar before condensing, and doubtless if the temperature could have been raised a couple of degrees all of the condensed moisture would have disappeared from the bottom boards. There might still have been condensation on the covers, where it first appears, but this, too, would doubtless have evaporated at 45° F. with good ventilation.

In a second cellar where the temperature was 45.5° F at the floor and 50° F. six and one-half feet from the floor, there was no condensed moisture in any of the 93 colonies. Here the ventilation was much more abundant and the cellar was artificially heated. In a third cellar, temperature 40° F. five feet from the floor, there was moisture on several covers but none on the bottom boards. The ventilation was excellent. In a fourth cellar, temperature 52.5° F., no condensation was observed

even on the covers. It therefore appears from these few observations that in the two cellars at 40° F. the moisture was more in evidence in the poorly ventilated cellar and that when the temperature was raised to 45.5° or 52.5° F. no condensation occurred. In this connection it should be remembered that the cellar temperature is often higher than that of the outer air, thus giving the atmosphere a greater capacity for water vapor. For example, if air comes from the outside at 0.0° F. into a cellar where it is warmed to 45° F. its capacity for moisture is increased thereby almost eight times (barometer, 30 in.) so that even if the atmosphere at 0° F. is saturated, it is capable of taking up much more moisture when it reaches the cellar temperature. Moist air passing from the cellar will often cause frost to form about the ventilating holes.

The only conclusions that can safely be made from the data on these four cellars is that concerning the capacity of the atmosphere for water at different temperatures. Other factors entered into the wintering of bees in these four cellars so that probably no reliable conclusions could be formed from data as to the food consumed by the various colonies, even if these were available.

In discussing the condensation of moisture in the hive and the various methods by which it may be avoided, one must not lose sight of the fact that little is definitely known as to the effects of such condensation or of a high relative humidity on the wintering of bees. From the experience of numerous beekeepers there is justification for concluding that bees winter better in the dryer cellars, but it is not so clear whether this statement would hold true for all cellar temperatures. In most systems of cellar ventilation the object accomplished is not so much to provide oxygen for the bees as to eliminate the exhaled moisture without too great condensation. The amount of oxygen needed to oxidize a couple of pounds of honey per month is not great. Even in a cellar in which a ton of honey is consumed during the winter, as in the theoretical case cited, sufficient oxygen would probably get in without any special provision for ventilation. This is not true for the elimination of the water, however.

In discussing the exclusion of moisture from the hive it is necessary to bear in mind one other hiding place for moisture, usually overlooked. In hives where condensation is common the hive and cover often become saturated and sufficient moisture may be held in this way that it comes through and blisters the paint on the outside surface of the hive. It is clear that on account of this absorption of water by the hive many records of weights on the removal of bees from the cellar fail to give accurately the loss in weight by the consumption of honey and the death of bees. Much honey finds its equivalent in the water in the soaked hive. Before drawing any conclusion as to the honey consumed we must be sure that condensation or evaporation do not affect the weights of parts assumed to be constant. A reverse example of this phenomenon is to be found in some records made of the weight of a hive and combs (without bees) made recently. The hive lost weight constantly by evaporation when placed in a dry room.

EFFECTS OF HUMIDITY.

It may as well be stated that we have no data showing the effects of an increase or decrease in the relative humidity on the activities of the bees in winter. We therefore do not know what relative humidity is best, for we do not know whether the moisture is the cause or the effect of poor wintering. From practical experience it may be concluded that excessive condensation is indicative of poor wintering and most beekeepers aim to have their cellars as dry as practical. Whether this is desirable for the warmer cellars remains to be determined.

Government apiary and laboratory at Washington.

Elwood falls into a common error, in which he is probably accompanied by many beekeepers, when he states that a damp cellar at 45° to 50° F. is no warmer than a dry cellar at 38° to 40° F. This conception arises from our personal experience that high relative humidity gives us a feeling of chill. There is no evidence that bees with very different exteriors are so affected.

At any rate it is evident that condensation of moisture on the combs of honey is not beneficial since this favors the growth of molds. The damp dark interior of the hive is certainly favorable for the growth of these organisms. It is not yet shown how these are injurious but they can scarcely be assumed to be desirable as food. A still more serious consideration is the fact that honey tends to take up moisture either from a

highly saturated atmosphere or from water condensed on the surface of the comb. This dilution of the honey often leads to some fermentation, injuring the honey as a food.

A discussion of the humidity conditions in the hive would be incomplete without mention of the work of Parhon. This author attempts to determine the physiological phenomena of the bees during the four seasons of the year. The bees under investigation were obviously abnormal and it is a matter of serious doubt whether her results are of value. She found that the water content of bees in winter was 74.82 per cent and in summer 71.44 per cent, which difference is assumed to be advantageous to the bees in withstanding cold by conserving the heat necessary to evaporate this slight amount of water. No data are given concerning the humidity of the atmosphere in the hive which might throw light on the differences observed. It is claimed that the respiratory changes in the bee are greater than in any other animal investigated, and this is attributed to the colonial life, but why this makes any difference is not made clear.

WINTERING BEES IN IOWA.

W. S. PANGBURN, CENTER JUNCTION.

Friends, in one sense my subject is well chosen as I never wintered a colony of bees outside of Iowa in my life. In another sense I am not the man for the subject. The one to do the subject justice should be able to handle both outside and cellar wintering. Having never wintered a colony of bees outside of a cellar I am not capable of giving you anything from that point of view.

Mark Twain said "he always liked to talk about things he knew nothing about because he wasn't hampered with facts."

It is evident in my mind Mark never talked before a beekeepers' convention or wrote for a bee journal. If he had he would have become acquainted with a lot of mighty fine fellows, and would have been hampered with something worse than facts.

I don't know who put me on for this subject, but I suppose our modest President, Mr. Pellett.

The fellow who writes "beekeepers I have known"—you who have had your biographies written up by him know—well, he reminds me of a little dialogue that took place between Johnnie and his mother. Jimmie Jones had just moved to town and Johnnie had gotten pretty thick with him. Everything was Jimmy Jones. Johnnie's mother, who was very particular what sort of company Johnnie kept, as all mothers should be, asked Johnnie one day what kind of a boy this Jimmie Jones was. Johnnie straightened up and says: "Well, I'll tell you, mother. He's no angel; that isn't his profession. But he's all right."

I am simply giving you 11 years of experience and observation in wintering bees in the cellar. I leave you to judge as to whether it has been successful or not.

I don't know that my cellar has any marked peculiarities different from lots of cellars. It is located under one part of our dwelling and is 16x22x6½ inside measurements. Located on a hill with good drainage, plastered walls and cement floor. It has always been dry. Two 3-light sash, one in the southwest and one in the southeast corner of cellar, with an outside door in the center of the east side for carrying the bees in and out. There is nothing uncommon about the cellar. In fact, when the cellar was dug 20 years ago I had no idea of ever owning a bee.

When we had our kitchen and living room over this cellar with two stoves going most of the time in the winter, the temperature rarely varied over 2 degrees in any reasonable weather. The thermometer registered 45 to 47° most of the time. Two years ago we remodeled our home and

Home of W. S. Pangburn.

moved kitchen and dining room to another part of the house, leaving but one stove over the cellar, and it not going very regularly.

Since that time the temperature ranges from 40 to 45°, about 43 on an average, I should judge. Still I can't see but what the bees winter just as well as they did before. But there was more moisture in the hives which had to be gotten rid of which I did by removing the piece of section over the hole in the inner cover and placing a sheet of muslin under the covers. It had its objections, however, as the bees ate holes (in some cases) in the muslin, especially the thin grade. I expect to use flax board this winter as I think it better. But like Dr. Miller, "I don't know;" will know later. The muslin cloth does very well if you use a heavy grade.

I use a ⅜-in. entrance winter and summer. I tier hives up in the cellar five high with outside covers off. Back of hive a little higher than front and the tiers about 4-in. apart. I leave an alley way of about 2 ft. between rows so I can examine them at any time and note their conditions. Rows are put in facing each other which darkens the entrances of both rows, so if I wish to ventilate I can without the little light that might show disturbing the bees. If the weather is mild, I ventilate often. In fact, one of the windows is left open whenever the weather will permit. I usually hang a gunny sack over it to exclude the most of the light. I often open outside door and window in the evening and let in copious supplies of fresh, pure air in mild weather.

I am satisfied right here is the cause of lots of failures in cellar wintering. People should have pure air to be healthy. Are bees unlike people in this respect? Doesn't hygiene teach that pure air is easier and quicker warmed than impure? Then why not ventilate? I never could understand why the temperature should be so exact in a cellar, when bees wintered outside are subjected to more changes in temperature than any cellar wintered bees could possibly be. From 60 above to 20 below zero is not uncommon in Iowa, and that inside of 24 hours sometimes.

If fresh, pure air will winter bees out of doors with the different changes of temperature, I don't see why it isn't a mighty good thing in a bee cellar, even if the temperature goes down to 40° or some less.

I would rather have a cellar with a temperatur of 40° and pure air than one with the orthodox 47° and impure air.

I don't take so much stock in that 47° business as I used to, or perhaps I should say I don't pay so much attention to it. It worried me a good deal when I first commenced keeping bees.

I am satisfied that statement "If you can't keep your cellar at 47° or close to it, better winter out of doors," has caused many an amateur to chink up his cellar, compel his bees to try to live on that foul poison air, just to mantain that 47°, then to wonder in the spring what killed his bees—of course it was cellar wintering.

Now don't understand me to be knocking against the orthodox 47°. Because I like to have it, if I can, and have pure air. However, my bees seem to be in a more normal condition at 40 or 45. But if I have to lower that temperature to have pure air, down she goes.

I use my nose in a bee cellar fully as much as the thermometer. In fact, I haven't had a thermometer in my cellar to my knowledge for three years.

I have wintered 100 per cent several times in this cellar and don't remember of carrying out over eight dead colonies in any one winter, and that year we got honey dew in the winter stores. The only year I ever knew my bees to gather honey dew. However, they gathered some from the maples in early summer this year and I had two reports of bees working on the spruce. I imagine spruce honey dew would be fine dope. It might do to compete with some of this imported honey that is selling at three cents per pound.

We have wintered as high as 116 swarms in this cellar besides all our vegetables and canned fruits. Perhaps an average of 75 swarms for the

past 10 years. I have never kept an exact account of the per cent of loss, but don't think it would average more than from 3 to 5 per cent in normal colonies.

I never could understand why a good dry cellar with plenty of pure air and the bees with plenty of good stores wouldn't winter bees successfully, but seemingly some don't.

Before I close my subject I wish to mention one thing that is of vital importance to cellar wintered bees, and that is don't put the bees out too early in the spring. Here is where lots of the so-called cellar losses come in.

Pangburn Apiary.

You hear a good deal about spring dwindling. Personally, I don't think I have had bother enough with that to mention it. I think there is a remedy for most of this trouble and it is left for the beekeeper to apply.

I never put my bees out of the cellar until the soft maples are in bloom *a la* Miller. This year it was the 13th of April, soft maple froze on the trees and gone when bees went out. Bees never went out in finer condition. But they had all the fresh air I could get into the cellar in the spring.

No use to set bees out of the cellar in March when weather is changeable and nothing to do. It is mighty hard on cellar wintered bees. They will get out on days not fit, chill, and never get back to the hive.

I want plenty, yes, plenty of honey and pollen in the hives early in the spring so the bees never feel skimped. I want them to feel as Brother Doolittle says, "millions of honey at our house," and brood rearing can go on unhindered, and replenish the hive with young bees just as soon as possible to take the place of the old ones that die off. If brood rearing is hindered early in the spring the results are a lot of weak colonies. The old bees will die and they die mighty fast in the spring too. It takes bees to make honey and also honey to make bees. If your colony hasn't got the honey give it to them if you ever hope to get any surplus. Do not kill the goose that lays the golden egg.

Beekeeping is made up of little details and the beekeeper who pays attention to the little details at the proper time is the man who gets a crop of honey *if* there is any to get.

FIFTY YEARS OF BEEKEEPING IN IOWA.

EDWARD KRETCHMER, COUNCIL BLUFFS.

I hastily will give a few reminiscences on the subject assigned me, namely—"Fifty Years of Beekeeping in Iowa." In order to make the matter a little more complete, I have to go back to the year of 1860 when Mr. Parson of Flushing, Long Island, brought the first Italian bees to the United States. It was in the fall of that year when I obtained the first queen of Italian bees that crossed the Mississippi, and as such the first Italian bees in the state of Iowa.

From this queen, several queens were raised the next year until the writer entered the service of the United States, and during his absence, his father sold the original colony to W. H. Furman of Cedar Rapids, Iowa, who then owned the patent for the Langstroth hive for the state of Iowa. On my return from the service I again purchased a colony of Italian bees from Mr. Furman, and again entered actively into beekeeping in the state of Iowa.

During the Iowa State Fair the writer showed to a vendor of so-called bee charmer that bees could be handled with a little smoke, creating quite a sensation on the fair ground, which was exaggerated by newspaper reporters, resulting, however, in numerous inquiries as to his manner of handling bees, and was soon followed by a demand and description of his hive.

In order to more fully outline my method of handling, I wrote a small pamphlet entitled "Winke fur Bienen Zuchter," followed by an English edition "Intimation to Beekeepers," followed by "The Beekeepers' Guide," a small volume of 244 pages, and two years later another book entitled "The American Beekeepers' Guide," of a slightly larger edition.

About that time much was said about the Langstroth frame being too shallow for our Iowa climate, and to settle this question a number of the enthusiastic beekeepers met in Des Moines, at which meeting there were

present Suel Foster of Muscatine, Dr. Elisha Gallup of Orchard, Iowa, and Ellen S. Tupper of Washington, Iowa, myself, and a number of others whose names I can not now recall.

At the meeting the subject of a frame suitable for our northern climate was discussed at some length, and the sense of the meeting seemed to be for a frame whose outside dimension should be twelve inches square, and be known as the American frame. A number present who favored that size made the remark in substance as follows:

"I have several hundred combs and Langstroth frames. What shall I do with those combs to change to the American frame, and not sustain material loss?"

It should be remembered that at that time comb foundation was not to be had. Consequently, every scrap of comb was carefully used; hence, the desire on the part of some not to change from the combs then in use. But in order to yield to the demand for the hives, the writer manufactured what was then known as the Champion Hive, and later the Alternating Hive, a horizontal divisible brood chamber hive, also the Langstroth Hives.

The aforementioned Furman of Cedar Rapids, Iowa, was then selling the Langstroth hive already nailed and painted, from wagons traveling over the state, which necessarily made those hives expensive, and a demand sprung up for a cheaper hive. To gratify this demand, we manufactured for a while a so-called "Plain Hive," which is today practically the same hive with the dovetailed or lock corners. About this time the writer in reading a German bee journal saw the description of the centrifugal force honey extractor, as invented by Major Hursky. I long pondered on a process of extracting the honey from the comb and saving the comb. As is already mentioned, combs were considered a very valuable adjunct to practical beekeeping, and even the present day I have to smile at the numerous attempts to extract honey by air pressure, suction, etc. But as soon as I learned of the use of centrifugal force to extract honey from the combs, I instantly saw the requirement necessary to accomplish the result.

I then at once used the tail tub constructed with wooden reel surrounded with common wire cloth, and in the absence of a gear, I wound around the center post a stout string and used the center reel to revolve the center wheel, like a boy would use a string on a top. Although decidedly crude as compared with the present extractors, it did extract the honey from the comb, and as far as we know, this probably was the first honey extractor manufactured in the state of Iowa, if not in the United States.

At that time, in the early '70's, we still had to depend mainly on the wild flowers of the prairies and the wild fruit bloom for our supply of honey. Goldenrod at that time furnished an abundance of fall honey, and the writer with one assistant did actually extract 3,000 lbs. of goldenrod honey in a single day of a consistency so thick that a common table knife would stand upright in a bowl of this goldenrod honey.

Honey crop at that time was very spasmodic, and I kept a record, not only of the product of every colony, but also the various yields during one year and successive years, and one record shows that for four suc-

cessive years the average for those four years did not exceed ten pounds of surplus honey, and the fifth year following, owing to very late summer and fall rains, we had an abundant yield of goldenrod and heartsease honey, and the yield exceeded 400 lbs. extracted honey, so that even after a failure of four years, we get an average yield of about 90 lbs. for the five years.

I presume that Iowa may take the credit of being the first to ship queens by mail any great distance. From my record it appears that in 1866 we shipped queens to Stockton, California, a greater distance of which was by the so-called pony mail. For this purpose the writer obtained a patent for the mailing cage, consisting of a drum shaped cage of wire cloth, in which was suspended a small frame which contained comb, which would hang perpendicular regardless of what shape the cage might be placed. At that time it was believed that bees could only be shipped on combs, which must always be perpendicular.

During the World's Fair in Chicago, 1893, the writer had charge of the Iowa honey exhibit, where over 12,000 pounds of honey at various times was displayed, and seven different persons received awards, including a medal and diploma awarded to the writer for extracted and comb honey.

Among the comb honey exhibits were the words "Iowa Honey" built by the bees in letters six inches high, which attracted an unusual amount of attention, as also did the curved nozzle smoker and the horizontal divisible brood chamber hive.

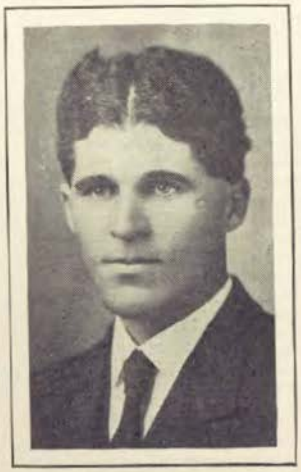
In 1875, I think, we organized the first Iowa Beekeepers' Association, with the writer elected as president, but at that time the professional beekeepers, or beekeepers who kept a large number of colonies were very few—hence, the attendance was very limited. Farmers who had only a few colonies could not be induced to attend, and after holding two meetings, it was decided that the organization was premature, and the subject matter was dropped. But now I am glad to know a rousing Beekeepers' Association has been formed, and trust will be continued—and now I can only repeat my regret of inability to be present, but trust that I may have the pleasure of meeting the members at future meetings.

INDIVIDUAL AND CO-OPERATIVE METHODS OF MARKETING HONEY.

WESLEY FOSTER, BOULDER, COLORADO.

We must get as direct and short a line to the consumer as possible. If we cannot get such a line we find that the profits in honey production are microscopic except in the best of years. We can view our situation perhaps with more calmness than the fruit growers or potato growers who often have such a poor market that the fruit is left unpicked or the potatoes undug. Our crop will keep and it always pays to get the surplus off the hives though the market may be slow.

It is probably true that the marketing question troubles the majority of beekeepers very little. In 1913 the clover crop was very large and market conditions were decidedly off, but this year the market has been better in some respects and poorer in others. Comb honey has been in good demand and fair prices have been easily secured for well put up stock. Extracted honey has been slower sale and it is with extracted honey that we should more urgently work the markets. About all marketable comb honey needs is to be shown, to be sold, while extracted honey has to be pushed and its deliciousness demonstrated.



Wesley Foster.

ONE INDIVIDUAL PLAN THAT WORKED.

In 1913 I had 800 cases of comb honey and about 5,000 pounds of extracted honey. My brother had about 500 cases and perhaps 2,000 pounds of extracted honey. We went in as partners in selling some of our comb and extracted honey that at the time was slow sale. We employed a gentleman who had had some experience in selling goods and also had worked for us with the bees for several weeks to go on the road with samples and sell honey. He had a fair knowledge of our methods of producing honey and so could talk bees pretty well. We paid him $12 a week and expenses and he carried a side line which probably brought his weekly earnings up to about twenty dollars a week, for the time he was out for

us, which was about three weeks. It was a short campaign for the reason that the territory which can be profitably worked from our location is limited in extent and the time that profitable business can be secured is also limited to a few weeks in early fall.

The cost of the three weeks' campaign was about ninety dollars and the amount of orders secured that were filled and collected for were over $900. The price secured for comb and extracted honey by this method of sale was more than ten per cent above the price we got by selling wholesale. There was more work attached to crating and shipping the honey, sending out bills, etc.

All orders were taken subject to two weeks' shipment. This gave us time to ascertain the reliability of the parties making the purchases. As the orders came in we took them to our bank and the bank wrote to its correspondent in the town where the orders came from as to the responsibility of each party. This cost us nothing except postage of about a dollar. All orders reported to us as good by the banks were shipped on thirty days' time or two per cent off for cash in ten days. Those reported doubtful or slow were written that if they wanted the honey we would ship C. O. D. Every one such was turned down or we did not hear from them again. In this way we cancelled a number of orders. One order was shipped C. O. D. without writing the party and we had it turned down, so had it shipped on a few miles farther to another customer.

I think where a bank will perform this service for you it is far more reliable than the commercial agencies. One bank is very careful about reporting a doubtful party as O. K. to their correspondent bank.

Something over fifty orders were received and filled and all were collected for inside of ninety days except one which was put in the hands of an attorney, one letter from him bringing a check in full payment within a week. The attorney's fee was $2.00 for collecting this bill of about $25.00.

All bills that were not paid promptly in thirty days were drawn on through our bank. This procedure brought the money in every case except the one mentioned, which required the services of an attorney. Several customers wrote that crops had been poor and collections slow and asked a little more time, which was given, but all were settled for in less than four months from the time we began shipping honey.

If the beekeeper is adapted to the work of selling honey he should, if favorably located, be able to place a good proportion of his crop direct to the grocers. We sold honey to restaurants, hotels and farmers where an order of $6.00 or more could be secured. Our salesman was alert and would not turn down business no matter where from.

Especial care was taken in packing the comb honey and liquid honey for shipment as the grocers told us that their great difficulty in buying honey of the commission men was the broken and leaky shape in which the honey was received. All comb honey was crated in carrier crates holding four to eight cases with plenty of straw on all sides.

Glass jars of honey were packed in like manner and I do not recall a single case of breakage being reported.

The disadvantages of this method are that it may not pay every season, if the grocers get stocked up before you get to them and it takes considerable time in preparing the honey for shipment as grocers want extracted honey in glass and several sizes of tin packages which makes the filling of orders rather tedious and fussy work unless you are well equipped for it. The letter writing and making out bills, bookkeeping, etc., is considerable. It could not be done by the beekeeper unless he has his beework out of his way and can devote most of his time to the selling and shipping.

THE CO-OPERATIVE PLAN THAT WORKS.

I have sold my honey in large part through our Colorado Honey Producers' Association for a number of years and with satisfactory results. No fussing with little orders or much bookkeeping, for the association, comprised of between two and three hundred stockholders, has a manager, bookkeeper, stenographer, etc., to look after that.

All I have to do is to pack and mark my honey according to the rules of the organization and either ship it in car lots with other members from Boulder or ship it to Denver where the main office is located and have it handled from there. If the car is loaded in Boulder, the manager or his representative is present to inspect the honey and superintend the loading.

An advance is made to the beekeeper, if he needs it, on the day the honey is shipped and remittance in full, less commission, comes in ten days to three weeks.

This marketing through the association cuts out the fuss and worry over small details. The beekeepers have grown so used to selling in large lots that many do not want customers coming to their homes for honey at all—they do not solicit such business. It is an aggravation to have to stop one's work and show a customer around for ten or fifteen minutes and then only sell him one or more pounds of honey, especially if one is busy.

The prices secured for comb honey through the association are often higher than the local grocers will pay in small one to five-case lots. The association has a market that is little affected by the farmer-beekeepers' honey of uncertain quality and grading. Numerous have been the times that we association members would be loading out a car of comb honey at $3.00 a case for No. 1 when the grocers would pay but $2.50 to $2.75 for honey in small lots, and then the grocers want you to trade all or part of it out in goods.

Personally, I like the co-operative method best, but the direct-to-the-grocer selling is good in an emergency or where one is located favorably and has the qualifications for successfully handling the business end of such a deal.

Following Mr. Foster's paper on marketing honey, the discussion was opened by Mr. P. J. Doll of Minneapolis, Minnesota, who spoke as follows:

I have attended bee-keepers' meetings for fourteen years, and at nearly every one I have heard a paper or discussion on marketing of honey. Everybody agrees that the price of honey is much too low and that the commission house man is not working to the interest of the bee-keepers. The bee-keeper who can market his honey in his home town is not subject to the abuses of the commission house business, but many bee-keepers are compelled to find a market in the larger cities.

It was for the benefit of this class of bee-keepers that the Minnesota Bee-keepers' Association took action to organize a honey exchange in Minneapolis, whose object and purpose is to buy and sell honey; to help the bee-keepers in Minnesota, Iowa and Wisconsin market their product at a fair and uniform price, and to advertise to the public the fact that clover and basswood honey produced in Minnesota, Iowa and Wisconsin is the finest honey on earth. After it is once generally known that our honey is finer, we can easily obtain a higher price, because honey produced in this section is of finer flavor, but it does not always follow that *all* honey produced is of the highest quality.

Some of the plants growing in these states yield honey which is very distasteful. Some bee-keepers even extract basswood and clover honey before it is ripe, sell this in a fermented state to dealers and consumers in large cities as pure clover or basswood honey. The innocent public who get this kind of honey decide that they do not like honey and, as a rule, cannot be induced to taste it again. We, therefore, must try to educate the public to know that there is a difference in honey, no matter where it is produced, the same as there is good or poor butter or any other staple product.

This Honey Exchange does not only handle fine honey which is carefully graded and sold under their brand as table honey, but aims to serve the bee-keepers who have off-flavored or unripe honey which must be sold. This is disposed of where it will do no harm to the honey trade. In Minneapolis and St. Paul there are many places where honey is wanted regardless of flavor. In fact, you can sell anything if you know how to find a party who wants the article you have to sell.

One of our best stores is glad to get all of our fancy comb honey, and pay 20 cents per pound for it. They will not buy from ordinary, small bee-keepers, because they do not want to bother with inspecting the goods and depend on getting what they order. A lot of stores want No. 1 honey. There is no inducement at all to offer fancy because their trade does not demand it. Other stores are satisfied with No. 2, and even some are glad to buy No. 3.

Very much the same can be said about extract honey. Besides wanting different flavors, stores require different size packages. Many handle only quart bottles, others pint bottles, some five and ten pound pails, and many will handle only tumblers.

The bee-keepers in and around Minneapolis, realizing the difficulty of marketing their product to the best advantage, decided to find a remedy, so on May 20, 1914, a meeting was held at which the Tri-State Honey Exchange was established. Among the members are many prominent bee-keepers, some having one hundred colonies or more, who have successfully marketed their honey at very good prices in Minneapolis for years, but they realized that it takes considerable time to handle their product and decided they would rather hire somebody to do it for them, so they all joined together and, in this way, were able to hire a good salesman and keep him in a permanent position where he can do business with all the bee-keepers who wish to market their honey in this way.

The Tri-State Honey Exchange is a co-operative stock company, to which over thirty members have subscribed for one share, each costing $10.00. No member is allowed to have more than one vote. We want to get as many bee-keepers as possible to join as stock-holders, but we are doing business with anybody who is producing honey in Minnesota, Iowa or Wisconsin, on exactly the same terms and everybody will receive the same treatment. This is not a money-making institution and we must buy our honey at a very low price to eliminate all chances of loss.

Our manager, of course, will try to realize as much for his goods as possible, but at the end of the year we return eighty per cent of all the profit to the people who have furnished the honey. The stock-holders who have helped establish this business will receive only ten per cent of the profit and the balance is to be retained as a surplus and will be used to buy equipment.

This association, if managed right, will eventually become a big institution and have a good influence in maintaining fair and uniform prices for honey. We, at the present time, find many localities where honey is sold at $1.00 per gallon, or 8½ cents per pound, at retail. I know several men who claim that all their extract honey sells at 25 cents per pound. Why should there be so much difference, sometimes in one county, for honey of the same quality?

Let us all help make this Exchange a success so we may all reap the benefit and work together for the good of the community.

We want to help and encourage every large commercial center organize a honey exchange. These exchanges can then organize and work together, so when there is a failure of a crop in one section they can procure from a section where there is a surplus. It will be to the best interest of the bee-keepers to have an established trade always supplied.

EXPERIENCE WITH EUROPEAN FOUL BROOD.

J. I. WILTSIE, ARLINGTON, IOWA.

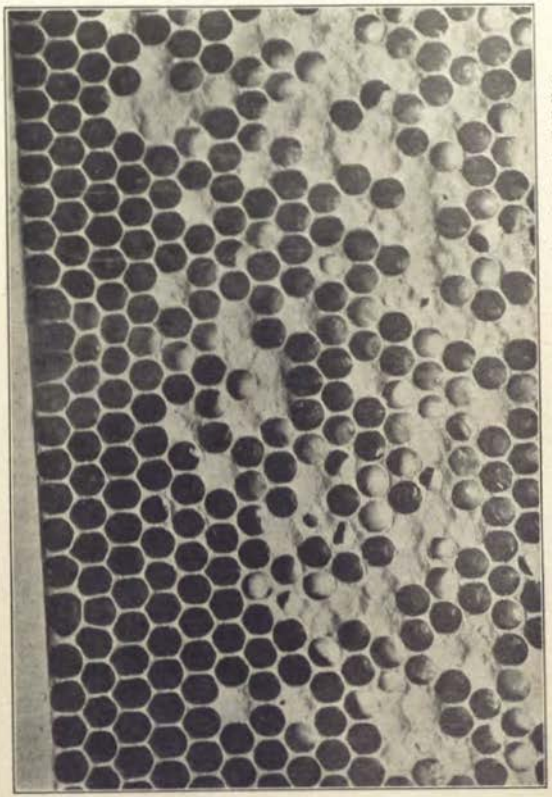
My first experience with the disease was the summer of 1913. One of my neighbor beekeepers who lives about one-half mile west of me, came to my yard and wanted to look over some of my weak colonies, which we did, and found nothing wrong. He informed me that there was something wrong with the brood in some of his colonies. We then visited

another beekeeper who lives about one mile east of me and found his bees apparently all right. We then returned and examined the diseased brood, which we decided was European Foul Brood, judging from what we had read of the disease. It showed up in a few of my weak colonies that fall. These colonies I destroyed.

The winter of 1913-14 I lost about forty colonies in the cellar, a 50 per cent loss where my loss for the winter of 1912-13 in same cellar was less than 3 per cent. The disease did not show up in the spring of 1914 until the bees had been out of the cellar about two weeks, when it spread rapidly to all of my colonies. During the meantime I had taken thirty-nine colonies on shares from my neighbor to the east of me, he having moved to Delaware county the fall before, taking twelve colonies with him. I examined the thirty-nine colonies within a day or two from the time they were taken from the cellar, they were apparently O. K. at that time, but

Thirteen clonies left of 105, result of European foul brood in eight months.

the disease soon developed in all of them. I visited this beekeeper in Delaware county in August this year and found him with eight or ten colonies all diseased; we also visited another beekeeper in his vicinity, who had over one hundred colonies of which we examined ten or twelve and found no disease. On May 19 I went to the picnic at McGregor and succeeded in having Mr. Pellett return with me that evening. The next day we went through my colonies, caged the queens and muted them until I had but 13 colonies of my original lot remaining. I also had fifteen colonies that were apparently free from the disease, these I had bought about the first of May. Mr. Pellett inspected a number of yards in this vicinity finding one yard with all colonies diseased and one yard of twelve colonies with three diseased. On May 22 my neighbor and myself ordered eighty queens from a party in Arkansas, who kept putting us off and finally said he could not furnish them at all. On June 17 we ordered the queens from the American Bee Journal, and received them the 20th, introducing them in the same day. Our colonies having been queenless for 30 days and having given them close attention, some had reared new queens and had brood



Appearance of larvae affected by European foul brood. Copyright by Frank C. Pellett.

well along with the most of it diseased. All of them that had reared new queens we now shook into foundation, giving them a new queen. The ones which had not reared new queens we left on same combs. We shook our fifteen swarms we had bought on to full sheets of foundation. Finding that five or six had the disease very light, we gave all new queens. We stacked all of our combs which contained brood, diseased or not, on five of our weakest colonies which had been shaken on to foundation. We removed these combs when the brood was all out. The disease did not reappear in these colonies and they are among the best I have now. The disease did appear in some that I shook on to foundation and some that I left on their combs, destroying five of my colonies, and nine of those I had taken on shares. I now have twenty-three colonies of my own and eight of those that I took on shares left, they all seem to be in a good healthy condition. I am expecting the disease to reappear this next spring, but think I will be able to keep it under control.

EXPERIENCE WITH EUROPEAN FOUL BROOD.

L. W. ELMORE, FAIRFIELD.

The European Foul Brood proposition is a serious one, more especially to those who are unfamiliar with brood diseases. Two or three years ago I knew only a few farmer bee men who knew anything about foul brood or treatment of same. I am glad to say that in my acquaintance I have found only a few that did not want to know or make an effort to master the disease as required now by our state law. In reference to my own personal experience with European Foul Brood, allow me to say when it made an unwelcome visit to my apiary a few years ago I was prepared to meet the occasion. Knowing what I had and how to handle it I proceeded to do so at once. It being in early spring I soon had everything as good as new again; as far as my apiary was concerned, at least. But, alas—I realized my troubles had only begun—with over 100 colonies within a radius of three miles, owned by about a dozen farmers. As before stated these were people entirely unfamiliar with this disease. Just at this time it looked rather discouraging, to say the least.

As we had no foul brood law or inspector; it was up to myself alone to apprize them of the danger if I could. Well, I talked to this and that one, first inquiring about their bees getting the necessary evidence before approaching the subject. Most all had lost some bees, some had lost all they had from one cause or another. Some said the moth had eaten them up. It was very clear to me they had foul brood. I was now aware foul brood was all around me. No one making any effort to clear up the trouble. I must take my chances for better or worse and wait for results. I knew in course of time many would go out of business as bee keepers. Time drifted along for a year or two, and as expected one by one they were losing out.

All along I had many diseased colonies in my own apiary which were promptly treated. About this time, one or two having several colonies

began to sit up and take notice, it dawned upon them that Elmore's Foul Brood theory was not all a myth. Our foul brood law already enacted, the inspector talked of, and 50 per cent of the bees dead, I will admit circumstances looked better to me every way. The state inspector being now appointed, at his earliest convenience he sent the deputy to Jefferson county. I being better acquainted, and having a little spare time just then, had the pleasure of going with him over part of the county on his first trip in June, 1913. We found many diseased colonies, as he left proper instruction for treatment, literature, etc., the change for the better was seen at once, only a few contrary ones refused to obey orders until forced to do so.

As I served as deputy inspector for Jefferson county this year, I had a good opportunity to see the results of our previous inspection which was generally very satisfactory. I appreciate very much the kindly feeling toward me as shown by my fellow beekeepers and friends; as it is a good natured bunch of fellows that *can* or *will* without a word of protest quit plowing or planting corn and go to the house one quarter or one-half mile with a bee inspector, it shows they are interested. Just two farmers did not have enough interest to go. Upon examination of their apiaries I found all they had were diseased.

In fact the situation is improving nicely, and the literature sent out by the department is a good educator and I can not recommend this method too highly. Let us all unite and keep the work moving on.

EXPERIENCE WITH AMERICAN FOUL BROOD.

D. E. LHOMMEDIEU, COLO, IOWA.

Mr. President, fellow beekeepers: If the program committee had assigned me the subject of "Shook Swarming," "Handling Cappings," "Starting Out Yards," or something congenial, it would have been a much pleasanter theme for me to talk upon.

About twenty years ago while attending the Seventeenth Annual State Convention at Madison, Wis., an old countryman (I think a Swede) described how he could tell if his hives had the disease. He smelled the hive entrance and if they had the disease it made him sick.

When the American Foul Brood first passed through central Iowa, all of my yards were affected about the same time, more or less badly (except one), before I knew what was the matter. Before I had gotten control of the situation I was not only sick and tired but hundreds of dollars out of pocket. While the knowledge cost high, yet I think it may be worth it.

Now all I have to do is to lift one frame from the center of the brood nest, in dandelion time, if one cell is diseased, then make a full examination and treat according to existing conditions and quarantine such hive by driving a stake in front of the hive and keeping tab until a cure is made. Some may say, "You can't quarantine bees. "Well, you will find you will need to be doctor, nurse and health officer and see that they

don't go visiting into your other houses. By looking through each hive about every three weeks through the rest of the season, I have no disease to go into winter quarters, the next fruit blossom time going through each hive as in the previous season. I may find a swarm now and then that has contracted the disease from some outside source, say a few dozen cells on each frame of brood. These I remove with all other combs, leaving the bees in their old hive until all the honey they carry with them is consumed, then set a clean hive on the old stand and fill from the strongest hives in the yard. Leave brood, honey and empty combs, just about as they were before treated, then shake the bees in front of the clean hive, scald diseased hive with a teakettle of boiling water. Cut out the diseased brood and burn or bury it. If much honey is left, extract it. If you wish to feed the honey, boil thoroughly for fifteen minutes and see that every particle of the scum is cooked (before boiling dilute the honey with water), feed scum and all.

To clean the brood frames immerse in a No. 9 wash boiler in boiling water until the wax rises, being careful to dry the frames well before using again.

This plan is for spring and fall not during the regular honey flow as then you can proceed as per the (except I do not double shake) McEvoy treatment. In a day or so after giving the brood you may go through the apiary and find every swarm looking and working as if nothing had happened.

I look upon the American Foul Brood among bees to be as contagious as the smallpox among the human family, or the hoof and mouth disease among cattle. To place one diseased cell in the center of a strong colony I figure that swarm will be a dead swarm of bees in one year if left to themselves and the whole yard in a year or two more.

We need as careful laws to govern this disease as for the other contagious diseases.

The Alexander plan may work on European Foul Brood but not on a bad case of our American kind.

If through ignorance or neglect the infection becomes epidemic, move the few swarms that show no disease to another part of the yard, build, double, and even up the diseased swarms until the summer or fall flow starts, then shake on foundation starters all of the strongest colonies, catch out the queens in the weak ones and tier the brood above them four or five stories high; carry the rest of the combs to the bee house. Any of them you may experiment with, if they are clean. Melt the rest for wax. After three weeks shake these swarms, running in a good queen by the smoke plan at the same time.

In conclusion, will say to the would-be-beekeeper, get in touch with our energetic state inspector and make a date this summer some time to spend one day in a diseased yard, and learn to tell the disease when the first little, white grub begins to turn a cream color or yellow. Even if you have to pay ten dollars car fare and lose a day in the rush of the season, it will save you hundreds of dollars when the American Foul Brood reaches your locality.

DISCUSSION ON EXPERIENCES WITH AMERICAN FOUL BROOD.

J. W. STINE, STOCKPORT, IOWA.

I scarcely knew what was expected of me, whether I was to speak on my experience with American Foul Brood or whether the discussion was to be a question box. If the latter should be the desire of the convention we have present, men of authority to help answer your questions.

In our experiences in handling bees we find "knowledge is power." Especially is this true in any of the bee diseases. It is with the diseases of bees like an old colored aunty told a noted preacher who was denying the existence of the Holy Spirit. She said to him, "Dere isn't any as you

J. W. Stine, Director, and Mrs. Stine.

knows of." So with bee diseases, some will say my bees are perfectly healthy, never have had any disease. All I ever had to die either froze to death or the moth killed them out. These excuses for bees dying are quite familiar to the inspector. Had the owner of the bees known what was the matter with them in time he would not only have saved the diseased ones but have saved other healthy ones which would turn in and rob the diseased bees of their honey.

One of the best ways of preventing the spread of disease is that at all times as far as possible keep all colonies from the tendency to rob. I believe the feeding of bees outside and away from the hives should be avoided. I was in one locality last spring where a man had lost all his bees

with American Foul Brood, except two colonies, and had placed his empty hives containing the diseased honey outside or above his bee shed, as he said, "so the bees would clean out the honey easier." You can imagine something of the conditions in that locality. Every colony of bees for miles around was diseased. I believe the beekeepers can help themselves if they will by showing the danger of exposing honey containers so bees may reach them. For we never know where a drop or so of diseased honey is going to be exposed.

I believe another good way of preventing disease might be in introducing queens, by taking away the attendant bees from the cages befcre introducing the queen. I believe the introduction of the queen might also be safer in doing this, for the queen would be the only stranger among strangers and there would not be as much antagonism to the queen as though she had ten or twenty attendants.

There is no sure way of telling whether a colony has disease by outside observation except when the disease is in an advanced stage when you can plainly smell it at the entrance of the hive.

Truly the old saying is a good one to observe with bee diseases, "An ounce of prevention is worth a pound of cure."

While waiting for the adjustment of the lantern for an illustrated lecture, Mr. Dadant was called upon to tell something of his recent visit to Quebec. He spoke as follows:

TRIP THROUGH QUEBEC.

BY C. P. DADANT.

We received an invitation from the Quebec Beekeepers Association, which is composed mostly of French Canadians. We left home on the 2d of November and returned on the 15th. This gave us but a short trip, so we had time to visit only four or five of the leading apiarists. We learned a number of interesting things, but did not secure much practical information. Here are some of the interesting things.

When we arrived in the City of Quebec, we called one of the leading beekeepers on the telephone. He came with his auto and took us to visit several other beekeepers. I found that in many places they use a much larger hive than is in common use in the United States, some of their hives containing twelve and thirteen Langstroth frames.

In lower Quebec, the season is short, the crop beginning as late as the 20th of June and closing by the first of August. The Italian bees do not prove very satisfactory because of this short season and the coolness of the mornings and evenings. These bees are accustomed to rise early and retire late, in a sunny climate, and to breed too late in the season. As soon as the sun begins to warm up they breed plentifully and many bees get lost by being out too early in the day or too late at night. By the first of August, when the crop is over, the common bees prepare for winter, while the Italians continue their breeding, using up their honey, so that they have to be fed for winter, while the other bees have enough. But

this was not the case all through the Province. In Western Quebec, the season is longer, there are two crops of honey, owing to the warmer climate, and the Italian bees thrive as they do in the United States. The same may be said of the Province of Ontario, where the climate is similar to that of Southern Michigan. They have also ascertained that the Italian bees overcome European Foul Brood much more readily than the common black bees. I heard numerous statements of having done away with this disease by the introduction of Italian queens.

As a matter of course, they winter their bees almost invariably in the cellar. The few cellars which I saw were very shallow and I remarked that they would be subject to great changes of temperature and would be too cold in winter. But when they told me that the snow usually covers the ground to the depth of five or six feet, I could understand that the changes of the outside temperature would have but little effect on the temperature of the cellars. One of the apiarists told me that he had kept his bees 186 days in the cellar one winter and that they came out in good shape in the spring. He stated that the temperature of his cellar kept regularly at 49 degrees, but when I visited it, the thermometer registered only 45 degrees which is a satisfactory degree for the wintering of bees. They pile the hives in the cellar four or five tiers high, much as we do. Some had their bees already in the cellar, but most of them were just preparing to take them in. They take them out at the blooming of the soft maple in spring.

In Western Quebec, they harvest large crops of honey. One record given at the meeting, from a man of St Hyacinthe, which was vouched for by several neighbors of his, also present, was 6221 pounds from 15 colonies, or about 415 pounds per colony of extracted honey. He had 13 frames Langstroth hives, with supers of the same dimension. In that locality, the bees get their first crop from white and sweet clover and their second crop from buckwheat. According to the reports in the hands of the secretary, Mr. Comire, the average of the crop for the entire Province was about 70 pounds per colony.

As I am a firmly convinced supporter of large hives, I was glad to see that, even in that country with short summers, the best crops were harvested from the large hives.

The beekeepers of the western part of Quebec are practically a unit in praising the Italian bees. The beekeepers are encouraged to buy Italian queens, for the Province has appropriated the sum of $500 to pay half of the cost for the apiarists who wish to try them. The only difficulty is that this amount is insufficient to supply as many queens as have been desired. The Province has already passed a law forbidding the use of poisonous sprays on fruit bloom. They have also passed a law compelling the beekeeper who keeps his apiary within 50 feet of neighbors' homes to build an eight foot tight board fence between the hives and the neighbor's yard. They say that this is an advantage because when they have complied with the law, if anything happens, they cannot be held responsible.

The homes are usually very close together and the villages are strung along a roadside. The lands were granted in long narrow strips, only 180 feet wide, which extend back several miles. This was for the better protection, in the old days, against the Indians, who were not destroyed

as in Anglo-Saxon countries, but were slowly civilized. There are still Indian villages in close proximity, and I was shown a settlement of Abenakis who have become so mixed with the whites as to be almost indistinguishable.

The French Canadians of Quebec have retained their identity, their language and their religion, in spite of the efforts to assimilate them with the more numerous Anglo-Saxons. They have fine, neat homes, they are thrifty and prolific. It is said that the French population of Quebec doubles every 20 years and the Province would soon be overstocked if their young people did not emigrate towards the Great West.

HONEY PLANTS OF IOWA.

BY L. H. PAMMEL, AMES.

Through the kindness of your secretary, Mr. S. W. Snyder, I have been invited to prepare a paper on the honey plants of Iowa. I am glad to appear before you, because the Iowa State College wants your co-operation in the study of the honey plants of Iowa. In a little leaflet issued this summer by the Botanical Section, "Information Regarding the Honey Plants of Iowa," the following statement was made:

"Mr. Frank C. Pellett, the State Inspector of Apiaries, estimates the honey production in Iowa at ten to twelve million pounds annually. He estimates, moreover, that the bees could gather $5,000,000 worth more of honey that now goes to waste.

Aside from honey production, bees and other insects are of great importance in the pollination of flowers. Without these insects, in many cases, seed and fruit will not form. They are, therefore, of inestimable value to the fruit and agricultural interests of the state. It has seemed wise to undertake an exhaustive study of the problem from many different angles. Professor C. F. Curtiss, Director of the Iowa Agricultural Experiment Station, has authorized the undertaking of a study of this problem. It will take time to do this work properly, since a great many questions are involved. In this work the Botanical Section will have cooperation on fruit blossoms and leguminous forage plants (alfalfa, etc.,) by Dr. J. N. Martin. Prof. L. A. Kenoyer and a number of assisants will, during this and succeeding seasons, work on the problems of honey plants, insects, nectar secretion, etc., and the beekeepers are invited to co-operate with us by filling out the blanks on this sheet and indicating as fully as possible their experience with honey plants.

It is especially desirable to obtain specimens of honey plants. We would appreciate your sending these specimens to us with notes on their abundance and their value for honey purposes.

Yours truly,

(Signed) L. H. PAMMEL,
Botanist, Iowa Experiment Station.

May I invite your attention to this leaflet and ask each of you to take this home and look over the questions, answer them and return to me. It will enable us to carry on the investigation more intelligently.

The list of plants enumerated in this pamphlet gives the more important honey plants. It is not, however, complete. Some of the plants mentioned in this list are not generally distributed in the state. One

Fig. 1.

Common Wind Flower (*Anemone memorosa*). One of the early spring blooming plants visited by bees. (Charlotte M. King.)

plant may be a good honey plant in one part of the state and not in another. A plant may yield an abundance of nectar at one time and not at all at other times. During a visit in southeastern Iowa the past summer, I found bees abundant on the yellow, or golden Spanish needle (Bidens aurea) in the vicinity of Centerville. This was after a rain. A day later, the same plant was found in abundance near Keosauqua, the

Fig. 2.

Common Barberry (*Berberis vulgari*). An excellent honey plant. (Charlotte M. King.)

rains here had occurred in abundance a few days previous. The day was bright and clear and in spite of the fact that an abundance of the plant occurred in the vicinity of an apiary, no bees, or very few, were found on this species. Every beekeeper has made similar observations. Prof. Kenoyer tells me that although buckwheat was in blossom abundantly in southeastern Kansas until frost, very few honey bees were working on this plant. Some plants have their maximum secretion for honey in the

Fig. 3.

Black cherry (*Prunus serotina*). Visited by bees. Gather some honey from the flowers. (U. S. Dept. Agri.)

morning. Mr. Munger and Prof. Kenoyer found honey bees working on buckwheat only in the morning until 10:00 a. m. During the latter part of September, I found that the same was still true. Bees were abundant up to 10:00 a. m. or a little later. None were observed at 11:00 a. m. or 12:00 m., or in the afternoon.

The amount of nectar secreted varies in the different plants.* Thus Mr. Dadant mentions the copius secretion of nectar in the South African *Protea mellifera*.† It is said to be so abundant that the natives gather the nectar by dipping it from the flowers with spoons. The writer and

*Langstroth on The Hive and Honey Bee, revised by Dadant, 397.
†Proc. Ia. Acad. Sci. 2:148.

Miss Beech, in a paper on the pollination of cucurbits, made this statement with reference to the nectar in the flower of the common squash (*Cucurbita maxima*): "In some pistillate flowers covered with bags, it (nectar) was found outside the nectary. In one or two cases a half teaspoonful of sweet nectar might easily have been obtained."

Fig. 4.

Cultivated Strawberry. Visited by bees and pollinated by them. (Charlotte M. King.)

The amount of moisture in the soil, and the humidity of the atmosphere gives us in a measure the amount of nectar secreted by the plant. We hope to determine some of these points in our investigation. Prof. L. A. Kenoyer during the past summer has been investigating this problem, and we hope to get at some of the interesting facts before another season is over. In this connection my attention has been called by Mr.

Fig. 5.

Wild Plum (*Prunus americana*). Chiefly pollinated by honey bees. Bees gather much honey from these flowers. (Charlotte King.)

Pellett to an interesting article on the secretion of nectar in flowers by F. W. Sladen.‡ For instance, he calls attention to an interesting feature in nectar secretion, by *Arabis alpina* which blooms in England in April and May. During the first half of its flowering period it is visited abundantly by honey bees but not later. In the case of goldenrods at Ottawa, he found during the first two weeks of flowering, hardly a bee was seen on them, it was dry, but during the third week of blooming there had been no change in the weather, that is there had been no rain, the goldenrod was in full bloom and the earliest flowers had withered, bees were working abundantly. It seems to me that there is here an interesting problem for us to work out.

Fig. 6.

Creeping Charlie (*Nepeta hederacea*). Related to catnip. Catnip is a most excellent honey plant. Creeping Charlie is not visited as frequently. (Johns Medical Botany of North America.)

I may here allude to another interesting matter concerning the gathering of honey by bees and the visits of honey bees to different flowers. First, there is the matter of promiscious visiting of different species of plants. Some years ago, while I was studying the pollination of clover, I found growing together in one small area, the common red clover, white clover, Partridge pea, Horsemint. I carefully observed bumble bees and honey bees. I found that a bee would visit only a single species of plant, the honey bee did not as a rule go from the white clover to the Partridge pea. The bumblebee did not go from the red clover to the Horsemint. This confirms the results that have usually been published

‡Beekeepers Review 2: 419, Nov., 1914.

on this point. A second point I wish to refer to is this. When there is a scarcity of honey, bees visit flowers that ordinarily are not visited by them. When the flow of nectar in the white clover is abundant, bees

Fig. 7.

Horse Mint (*Monarda fistulosa*). Pollinated by bumble bees. The corolla tubes too large for honey bees to get nectar. Mr. Brown at the Bee Keepers' convention at Ames, stated bees gather honey from this plant.

will not go to red clover, but when nectar and pollen are scarce, honey bees are frequently found on red clover. Do honey bees get nectar from the red clover? I notice the statement made in Langstroth's Hive and

Fig. 8.

Willow Herb or Fireweed (*Epilobium angustifolium*). A splendid honey plant. Common northward in the Rocky Mountains and on the Pacific coast.

Honey Bee, that "unfortunately its corollas are usually too deep for the tongue of our bees. Yet sometimes in summer, they can reach the nectar, either because its corollas are shortened on account of dryness or because they are more copiously filled." Some years ago, I made this statement in my Ecology, that honey bees frequently pollinated red clover because they frequently collect pollen. The tongue is not long enough to reach the nectar. In some cases the nectar is taken through perforations.

A few years ago I had a large number of measurements made of the length of the staminal tube. Miss Mildred Walls found by measurement,

Fig. 9.

Phacelia (*Phacelia sericea*). This plant is visited by bees. In the Rocky Mountains.

that out of 493 flowers, the mean length was .3513 in. and that the length of the tube varied between .3082 in. to .4018 in. The flower because of the pleasant odor and large amount of nectar are attractive to insects. The nectar is concealed in the base of the staminal tube, which is formed by the fusion of the nine lower filaments and attached to the claws of the petals. The upper free stamen lies on one side so that the opening of the staminal tube permits the insect to get the nectar. In order to reach the nectar, the honey bee must have a tongue from .3543 to .3937 inches in length to get the nectar.

I have for several years closely observed honey bees and red clover, and from these observations I am still inclined to the opinion, earlier expressed, that honey bees do not get nectar from the flowers of the

red clover, notwithstanding the statements made by several correspondents in recent numbers of the American Bee Journal, and the opinion of many beekeepers in Iowa. Third, I want to especially exonerate the honey bee from the perforation of flowers and the injury of fruits. Some years ago I published a monograph on the Pollination of Phlomis tuberosa

Fig. 10.

Mint (*Mentha piperita*). Bees frequently visit this mint.

and the Perforation of Flowers. The conclusion reached was that our flowers are not perforated by honey bees.§ This is slightly at variance with a few recorded observations by Hermann Mueller, who found that the honey bee perforated the flowers of *Erica Tetralix* and *Nepeta hederacea*.

Fig. 11.

Blue Weed (*Echium vulgare*). Many of the borages are good honey plants. (Selby Ohio Agrl. Exp. Sta.)

§Trans. St. Louis Acad. Sci. 5:241.

The fourth point I desire to make is this. Let us plant more honey plants. A few friends of mine have lately been discussing the desirability of reducing the width of the Iowa roads. Another friend, Senator Larrabee, has been advocating the planting of the highways with useful forage plants to make the highways useful. I believe this is a very sensible proposition. It would bring in several million dollars annually to the farmers of Iowa. The beekeepers of Iowa should encourage Senator Larrabee and advocate the sowing of such plants as the alsike clover, which is a most excellent honey plant and a most useful forage

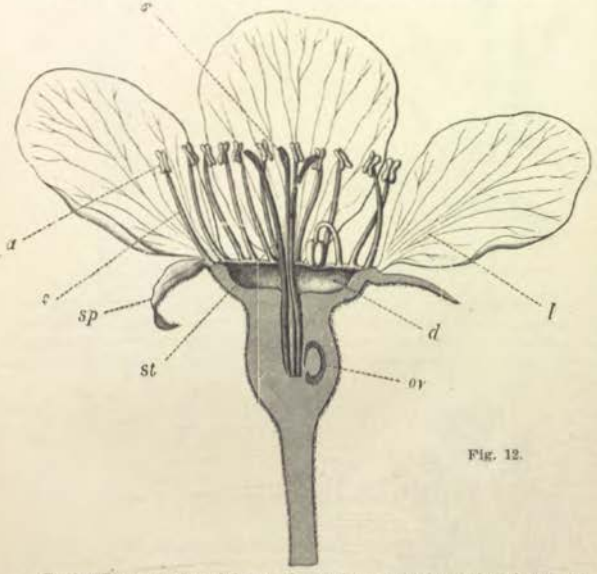


Fig. 12.

Bartlett Pear, an enlarged flower. *Sp*, sepals; *p*, petals; *a*, anther of stamens; *f*, filament; *s*, stigma; *d*, disc where nectar is secreted; *ov*, ovary. (Waite, U. S. Dept. of Agri.)

plant. There are many places on our highways that cannot be reclaimed for meadow purposes. I refer to the slopes of hills and banks. These should not be left bare, but can be planted with trees and shrubs useful for the beekeepers and at the same time furnish an excellent honey crop. In many places in Iowa, such places can be planted with the wild crab, a splendid honey plant. The Russian Oleaster, which blooms later than the wild crab, and in many places the basswood would be a most suitable plant. Then there is the Vitex. A host of other ornamental honey shrubs and small trees should be planted with reference to their blooming season, so as to give continuous bee forage. Such planting would be a delight to those who use our highways, besides furnishing a large amount of honey.

Fig. 13.

Dogbane (*Apocynum*). Bees were abundant on the dogbane the past summer. (U. S. Dept. Agri.)

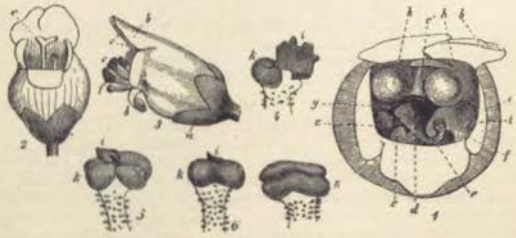


Fig. 14.

Simpson Honey Plant (*Scrophularia nodosa*). Flowers in different stages, 2, the female stage; 3, male stage; *a*, calyx; *b*, corolla; *c*, stamens; *f*, stigma. (After Mueller.)

HONEY PLANTS.

Should I give you a list of all the honey plants in Iowa, I would go beyond the limits of a paper desirable at a meeting of this kind.

I want to call your attention to a few of our most important plants. Of the early blooming plants, the willows are the most important. There are several species widely distributed in the state. The almond leaved

Fig. 15.

Sneezeweed (*Helenium autumnale*). Bees gather honey from this plant. It is however bitter. (U. S. Dept. of Agriculture.)

willow, (*Salix amygdaloides*), the Black willow (*alix nigra*), the pussy willow(*Salix cordata*). These species furnish an abundance of nectar and pollen. The pussy willow is the earlier of the blooming willows. The soft maple (*Acer saccharinum*), now cultivated everywhere in the state, is one of the best of the early blooming plants for nectar. The hard maple (*Acer nigrum*) also furnishes an abundance of nectar, but it blooms much later. The dandelion (*Taraxacum officinale*) is one of the early and late nectar producing plants. I saw honey bees visiting it on the 30th of October 1914. In May, or the latter part of April, the apple, plum, and cherry furnish an abundance of honey. Then come the raspberry and blackberry and with them the white clover followed by the alsike clover, and soon the white sweet clover, which in Iowa is

the best of all the honey plants. Though it be ever so dry it furnishes a good supply of honey during the entire blooming season, till nipped by the frost. The yellow sweet clover is also a good honey plant, though not as good as the white flowered species. The basswood is one of the best of our honey plants, though its season is short. The tree might very profitably be planted as a shade tree more than it is. There is no

Fig. 16.

Canadian Goldenrod (*Solidago canadensis*). Pollinated by bees and in some places furnishes honey. (Iowa Agri. Exp. Station.)

better shade tree. Simpson honey plant, though a homely weed is an excellent honey plant. The Motherwort (*Leonurus Cardiaca*) and catnip are most excellent honey plants, though both are rather troublesome weeds. The Persicoaria, Pennsylvania smartweed or Heartsease, is a most excellent honey plant. Buckwheat in its season is a splendid honey plant, although the honey is dark in color. One of our very common pasture weeds the Vervain (*Verbena stricta*) is one of the best of the dry season honey plants. The honey is of good quality. Of the composites, I have mentioned the dandelion. We should also mention common Boneset (*Eupatorium ageratoides*), Spanish Needle (*Bidens aurea*), perhaps the best of all of our composites is common in Southern Iowa. Those of northern Iowa (*B. cernuua*) in sloughs, and the purple boneset of similar places are excellent. I do not think that our goldenrod and asters furnish as much honey as some people believe but this year in places they furnished some. Snowberry (*Symphoricarpos occidentalis*) and Buckbrush (*Symphoricarpos orbiculatus*) furnish much honey of

good quality. The former is common in western Iowa and the latter in western and southern Iowa. Bitter honey is obtained from the sneezeweed (*Helenium autumnale*). The Snow on the mountain furnishes an acrid, poisonous honey.

Fig. 17.

Yarrow (*Achillea millefolium*). Flower and its structure, *f*, *f'*, *f''*, and *f'''*, different stages and views of the flower; *e*, in *f* style pushing the pollen out; *g*, the five anthers surrounding the style; *h*, filament of the stamens; *d*, coralla; *p*, pollen on brush hairs papillae; *j*, nectary; *k*, ovary, this becomes the seed; *o*, stigmatic papillae, the pollen grains germinate here. (After Mueller.)

DISCUSSION AFTER DR. PAMMEL'S PAPER.

Mrs. Miller: Is the Black-Eyed Susan a good honey plant?

Dr. Pammel: It is not so good as the Crownbeard or Golden Glow.

Mr. Beckhart: How is the Rattle Weed—sensitive plant—Partridge Pea.

Dr. Pammel: It is a good honey plant.

Mr. Brown: Is Motherwort a good plant?

Dr. Pammel: It secretes plenty of nectar but not of good quality.

Mr. Snyder: How about the Russian Olive?

Dr. Pammel: The Russian Olive is very good, and its extremely rapid growth should recommend it to beekeepers.

Mr. Pellett: Buckwheat is overestimated as a honey plant, under Iowa conditions.

Mr. Brown: In my district I have observed that the honey produced from buckwheat is much the same as that produced from Heartsease.

THE VALUE OF BEES IN HORTICULTURE.

BY DR. BURTON N. GATES.

Associate Professor of Beekeeping, Massachusetts Agricultural College, Amherst.

The Bee's Service in Garden and Orchard.

This field of the biology of bees and plants or the relations of honey bees to horticulture is a vast one, somewhat treacherous and intricate. While it has been worked for years and while there is a vast accumulation of information concerning the method by which the various plants are pollinated, yet today there is considerable dispute as to the actual need of honey bees or even other insects in setting some of our more important fruits and vegetables. As Dr. Pammel said in his lecture last

Dr. B. N. Gates.

evening, there is a recent attempt today to remove the poetry from our belief in cross-pollination, to show that apples for instance, are capable of self-pollination, thereby dispensing with the need of bee service. With a full realization of this uncertainty concerning our present knowledge of the value and need of bees, in every horticultural pursuit, I am inclined to believe that for years to come the old assumption that bees, to a greater or less extent, are of service in procuring our crops of fruits and vegetables, will be retained. From this standpoint, therefore, and with it fully in mind that every future discovery may contradict our present ideas, I take up my subject.

It is generally believed that bees pollinate the greatest number of flowers of any insect. Generally speaking, too, every horticulturist is indebted to their inestimable service and while this has been but partially realized for years and decades, it is relatively recent that the horticulturist has made any active effort to retain bee service, thereby insuring a crop. Today he is more awake to the situation and ready to realize that the honey bee is an agent of service which will better enable him to meet that important, keen competition.

The bee's service to the horticulturist may be briefly stated as the result of her effort to secure either nectar or pollen (which is the male element of the flower). In her search for nectar or pollen, this is transplanted from the anther to the stigma (which is female), effecting pollination, resulting, if the elements are correct in fertilization. Many flowers, it has been shown, repeatedly require for satisfactory fertilization, cross-pollination, producing a better, larger, more fully developed and rounded, oftentimes more highly colored fragrant, luscious fruit. Dr. Pammel well explained, last evening, some of the many intricate mechanisms by which pollination is accomplished and which have been described by many botanists, among whom are Darwin and Müller.

THE CLASSES OF BEES WHICH SERVE IN THE ORCHARD AND GARDEN.

In considering the relationship of bees to horticulture it should be remembered that there are two general classes of bees, roughly grouped as the solitary and the colonial, or social bees. The solitary bees live isolated and singly and are not always numerous. The other group, the social bees, comprise a number of genera or species and may be roughly exemplified by the common bumble bee and our honey bee. Any and all of these bees, including the honey bee, may be wild. In its larger sense, wild bees should include all the various kinds, both social and solitary. They may often be observed on the blossoms of pear, apple and the flowers of many other fruits. Considering the vast number of these wild insects it so happens in well cultivated localities, that the honey bee outnumbers the other wild forms. These honey bees may, as just intimated, not come from apiaries under the control of some beekeeper but may come from the woods. If it were possible to calculate the value derived from the pollination by honey bees alone, these returns would without doubt, far exceed the total income to be derived through the produce of honey, bees and wax. Thus, as has already been said, the honey bee is of inestimable value to the orchardist or horticulturist, besides being a source of revenue to the beekeeper. Thus the honey bee serves in a double capacity; she is a source of double income.

It may be well to mention at this time some of the more common fruits and vegetables which are essentially in need of the activities of the honey bee. The list might be made much longer than that which I will give, yet it is generally estimated that honey bees are important in the setting of the apple, pear, plum, quince, peach, raspberry, blackberry, strawberry (to some extent and according to locality), the mulberry, pea, bean, currant, grape, squash, melon, cucumber and the cranberry. The tomato apparently is not dependent upon the service

of bees, yet in greenhouses for tomato culture, bees have been seen to work the flowers, apparently for pollen. It should also be borne in mind that season, locality and climatic conditions are tremendous factors in the activities of bees on these and other plants. For illustration, the strawberry may be cited. The writer has seen in some localities, large areas of strawberries devoid of bees, while elsewhere the honey bee was active. This is repeatedly observed with other plants and in different localities and seasons.

IN CRANBERRY CULTURE.

The value of the honey bee in cranberry cultivation has but recently been recognized. The cranberry industry of Massachusetts for instance, is worth between one million and a million and a half dollars annually. It has been observed that in certain years, certain parts of cranberry bogs fail. Dr. Franklin, at the experimental bog in Massachusetts, has carried out experiments, the details of which show that bees are of service and explain that the failure of bogs or parts of bogs may be attributed to the inability or lack of bees to work the blossoms while the vines are in bloom. It has been shown, too, that the inability of bees to visit these bogs was due to climatic conditions, the prevalence of winds or coldness in that part of the bog. With the large number of blossoms which are produced on cranberry vines, it was also established that bees maintained purposely for their service in pollination were an insurance to cranberry growers who are now maintaining apiaries in proportion to the size of their bogs. It cannot definitely be stated how many colonies are necessary to a certain area; this will depend upon conditions. It may be suggested, however, that one colony to the acre of bog is none too many bees.

IN CUCUMBER GROWING.

The cucumber has been mentioned. In Massachusetts in recent years, cucumber growing under glass has developed. Originally the growers "fertilized the plants" by hand, a most laborious process. Bees were later introduced and found to be indispensable, especially in the larger commercial houses. One grower, for instance, has forty acres under glass. Taking the industry in Massachusetts as a whole, it requires between two and three thousand colonies of bees annually to serve in the cucumber greenhouses. These colonies are largely reduced by the extremely unfavorable conditions of greenhouse life, so that cucumber-growing-under-glass demands that the beekeepers raise bees purposely for greenhouses. The larger commercial cucumber growers, too, have united in certain localities and maintain a circuit beekeeper whose duty it is to care for the bees of the greenhouses.

IN VARIOUS FRUIT ORCHARDS.

It might be well to take up some of the other special horticultural pursuits and show how bees are utilized in these, yet a general statement may serve. Fruit orchards, that is, the orchards of larger fruits, are much the same the country over. Within recent years, incorporated or large fruit growing companies have sprung up. With these has come

more keen competition. As a natural consequence in order to avoid the failure or partial failure of a crop apiaries have been maintained for the orchards and within the last two or three years apple growers, particularly in the West, have definitely decided to maintain bees, disregarding the honey production factor. In connection with the apple industry of the West I shall show you in the slides an almond orchard in California where bees are maintained purposely to set the almonds; so with the pears and lesser fruits. Peaches, however, are apparently not fully dependent upon bee service.

With this general survey of the situation I wish now to turn to a more particular examination of the requirement of bees for horticultural service.

FAILURE VS. SUCCESS.

In nature, especially wild nature, it is well known that the prevalence of life, either of plant or animal, is subject to fluctuation due to favorable or unfavorable environmental conditions. For instance, in a locality this year there may be a pest of mosquitoes or house flies; next year in the same locality the flies may be scarce and the mosquito more abundant or *vice versa*. So it is with the game birds, the fish, weeds and whatnot. They are plentiful or scarce from time to time and according to season or environmental conditions. It may be, therefore, expressed as a fundamental biological law, that the prevalence of all life, including bees, is subject to fluctuation. Bees have their periods of UPS AND DOWNS, numerousness and scarity. When conditions are favorable they rise to the crest of prosperity and prevalence; when unfavorable conditions set in, as for instance a disease appears in the locality, they become greatly reduced and scarcer. Hard winters may depreciate bees, so that within the short space of a year their prevalence may have fluctuated from the crest of prevalency to a depressed frequency; thus when most needed by the horticulturist as pollen bearers they may be at a low ebb and scarce. This biological law may be illustrated by a graphic or hypothetical curve of fluctuation or frequency. I have repeatedly given this at conventions and show it to you at this time.

The question naturally arises, how is this fluctuation to be overcome? How is the grower to protect himself against a possible lack or security of pollen bearers? There seems to me but one answer: KEEP BEES. By this means alone it would seem possible to control or provide for ample pollination. Growers commonly plow, cultivate, fertilize, they plant their trees, disbud, scrape, spray, according to the most approved practices of our best agricultural and horticultural experts; but, in many instances, these are of little or no avail if bees are absent. By maintaining colonies in proportion to the size of the orchard or farm, dependency upon wild bees or bees from a neighboring apiary is largely or wholly eliminated. I have often said IT IS FAR SAFER TO FLOOD AN APPLE ORCHARD FOR INSTANCE, WITH BEES DURING THE BLOOMING PERIOD THAN TO CHANCE THEIR SCARCITY. Furthermore, the cost of maintaining an apiary is infinitesimal and negligible as compared to the vast benefits or returns. Moreover, it should

not be forgotten that weather conditions during fruit bloom often prohibit the free flight of bees a mile or two across country. Numberless observations are on record of orchards having been successfully fertilized where bees had less than a mile to fly, while more distant orchards, the same year, bore smaller or no crops. Thus, to put it mildly, an apiary in or adjacent to an orchard will save great failure.

A $3,800.00 CROP DUE TO BEES.

I have in mind a specific instance reported by one of our agricultural experiment stations. In one of the western states there are two comparable apple orchards of about equal acreage, of similar location and age, each in a "pocket" in the foothills of an admirable fruit land, both well drained and protected from frost. One orchard bore heavily for successive years; in the other there was no crop, although the trees blossomed heavily each spring. In despair of financial ruin, the owner called the assistance of a State Experiment Station. A pomologist and entomologist was sent, who examined critically all the conditions in each of the orchards. He was about to return without solving the problem of failure, when the question arose, were there ever bees maintained to set this orchard which has fruited? It was asserted, however, that neither orchard had ever had bees. However, the problem was not given up and the ground was again gone over. As the experiment station man was about to leave without finding any apparent reason for failure, he chanced to see a stream of bees coming in one of the orchards from underneath a pile of swale. Further investigation revealed a fallen log, sunken in the damp land, sheltering a large colony of bees. It is needless to say in which orchard the log was. Immediately bees were secured for the failing orchard; the owner then netted $3,800 on his crop.

It has not been my purpose to give you many details. To do this I might have to write a book and by the time it was written, I might doubtless find that new investigations had revealed new results. This is a period of discovery and change, but I hope my attempted biological fundamentals will hold. For example, first, cross-pollination would seem to be the usual policy in nature, resulting as I have said, among other things, in greater strength, vigor and beauty. Second, that all life is subject to a frequency of fluctuation. Therefore, it is not desirable in fruit or vegetable growing, to depend upon the services of bees over which you have no control, but rather to maintain controlled apiaries especially for either horticultural or market gardening, pollinating services. Third, these two biological principles are further substantiated and applied by the practical grower, who is more and more dependent upon bees in his field to meet important competition. There is, therefore, a good reason for keeping more bees if you wish more fruit.

With these general remarks, it is my purpose to turn to the lantern slides and show you some of the results of the utilization of bees in this horticultural work. Therewith, I would show you other slides, of the apicultural work in Massachusetts, something of the natural history of the honey bee and as a general interest feature, a few of the prominent apiaries of the country.

BEES AS A NUISANCE.

J. D. Gustin, Kansas City, Mo.

Increasing population, greater dissemination of knowledge, and the development and specialization of industries, pursuits, and occupations combine to add constantly to the complexity of the relations of individuals, and to call, from time to time, for the readjustment of the affairs of men to meet changed and changing conditions. In no other branch of the law is the ingenuity of the courts more heavily taxed in this manner than in the subject of nuisances, where, from the very nature of the subject, first principles, rather than specific legislative enactment, must always exert a controlling influence. The lawmaking power may, as occasion seems to require, declare that particular objects, actions, omissions, etc., shall be nuisances, either with or without regard to attending conditions or circumstances, but the application of such statutes is necessarily so limited that the general law of the subject is not affected.

It therefore follows that courts still deal with nuisances largely from the principles of the common law and it is a matter of serious doubt whether, in any instance, specific legislative action can be proven to have any substantial value as an addition to the law of the subject. A nuisance at common law is that class of wrongs that arise from unreasonable, unwarrantable, or unlawful use by a person of his own property, real or personal, or from his own improper, indecent or unlawful personal conduct working an obstruction of or injury to a right of another, or of the public, and producing such material annoyance, inconvenience, discomfort, or hurt that the law will presume a consequent damage.

Text writers and legislative enactments state many variations of the foregoing comprehensive definition from Mr. Wood's treatise on nuisances, but there is no substantial disagreement as to what constitutes a nuisance. Another definition, stated broadly as a general proposition, is that every enjoyment by one of his own property which violates in an essential degree the rights of another is a nuisance; and this substantial violation of a right is the true test of a nuisance, for it is not every use of his property by one which works injury to the property of another that constitutes a nuisance. Injury and damage are essential elements of a nuisance, but they may both exist as a result of an act or thing which is not a nuisance, because no right is violated. On the other hand, the pecuniary injury may be insignificent and the act or thing causing them be such an invasion of the rights of another, or of the public, as to constitute a nuisance for which an action for damages or for abatement will lie.

Nuisances are classified by the law as public and private, and there is no authority for a third class called "mixed" nuisances. A nuisance is public where it affects the rights of individuals as a part of the public, or the common rights of all the community alike; a private nuisance is one affecting a single individual, or individuals of a particular class, group, or locality in a private right; the third class, referred to as

mixed nuisances, are public in their nature, but at the same time specially injurious or detrimental to one or more individuals in particular, who suffer a different or greater hurt than the community in general.

Nuisances are further divided into nuisances *per se*, or such as are declared so by the common law or by some statute, without regard to locality, surroundings, or circumstances, and nuisances *per accidens*, or those owing their hurtful consequences to some particular attendant circumstances, surrounding, location, or condition, without which they would not be unlawful. There are other less important and rather technical distinctions not necessary to be noticed here. The foregoing preliminary and very elementary observations of the general law of nuisances are necessary to a consideration of any subject with reference to its existence as a nuisance or otherwise.

It is also a frequent statement of the law, and may be accepted as authoritative, that no lawful occupation or business is a nuisance *per se*, except it be declared so by some special enactment prohibiting certain things as objectionable to particular localities. So also the reasonableness of the use of one's property may depend upon its situation, for what might be lawful in one locality would prove intolerable in another. The use of a building in the midst of a city densely populated for a storage house for hardware would not be objectionable in the slightest degree, while the use of the same building for the storage of gunpowder or other high explosives could not be permitted.

The common law, proceeding from fixed principles of universal application, and developing from the growth of civilization, has, in each succeeding period, found ready adjustment to new subjects resulting from the widening dominion of mankind over the creatures and forces of nature, furnishing a ready remedy for every wrongful encroachment of one upon the rights of another. In the times of the early law writers bees were most generally known as they existed in their original state. Hence they were called—*ferae naturae*—and classed as wild animals. A property right, or at least a qualified property right, in them could be acquired by capture which, in accord with the general rule concerning wild animals, existed so long as the captor could hold them in possession. A distinction seems always to have been made between the possession of animals ferocious and those of gentler dispositions, and it was an indictable as a nuisance to permit an animal of known mischievous disposition to go at large. Bees, however, seem never to have been regarded as ferocious or as likely to do injury to persons or property, and in the far greater number of instances in which they have been the subject of judicial consideration the questions at issue have concerned the property interests in them. It is doubtful now, however, if any court would denominate them as wild animals, in view of the present general state of development of the industry of honey production and the numerous instances of State legislation designed to promote and protect the breeding and rearing of bees for that purpose. In the one or two cases decided in American jurisdictions in which the question has been presented, it has been determined, in accordance with the rule

above referred to, that the keeping of bees, even in large numbers and in towns and villages, is not a nuisance *per se*.

But greater interest, perhaps, centers in the question of whether or not bees may be so kept as to constitute a private nuisance, and also whether municipal corporations, as cities and towns, may restrain or prohibit their presence within the corporate limits. In answering the first proposition, it must be borne in mind that persons who dwell in urban communities must of necessity submit to such restrictions upon their absolute liberties that the dwelling of other persons therein shall be tolerable. As it is the unreasonable or unwarrantable use of one's premises or property, otherwise lawful, that contributes an essential element of a nuisance, a first inquiry in any case would be directed to this point of reasonableness of the use or occupation, and in determining this all of the surrounding facts and circumstances would enter into the consideration. The presence of one colony at a given point might be perfectly consistent with the due observance of the rights of the owner of the next lot, while a colony stationed at another point within the same distance would be obnoxious to the law. Again, one colony at a given place might pass unnoticed, while a number of colonies at the same place would be a nuisance. The habits of the bees, the line of flight, their temper and disposition of the colonies, either separately or when collected together in numbers, might all furnish matter of more or less weight in reaching a conclusion. So also the character of the annoyance or injury done to the complainant must be a substantial element. In the only reported case involving this question it was charged, and the court found there was proof, "that during the spring and summer months the bees so kept"—140 colonies on an adjoining city lot and within 100 feet of plaintiff's dwelling—"by defendants greatly interfered with the quiet and proper enjoyment and possession of plaintiff's premises, driving him, his servants and guests from his garden and grounds, and stinging them, interfered with the enjoyment of his home, and with his family while engaged in the performance of their domestic duties, soiling articles of clothing when exposed on his premises, and made his dwelling and premises unfit for habitation." These facts were held to constitute a nuisance, against which the plaintiff was entitled to injunction and nominal damages. These facts just recited, however, probably present an extreme case, the immediate proximity of so many colonies being, no doubt, persuasive evidence that the annoyance suffered by the plaintiff was due to the defendant's use of his premises. Greater difficulty would be experienced in reaching such a conclusion if there were no colonies stationed in the immediate vicinity, a thing entirely possible under the common belief that the insects go considerable distances for their stores.

So it may be said of bees, as of other property, that no hard and fast rule can be laid down by which to determine in advance whether the presence of bees in any given numbers or at any given point will amount to a nuisance. But, not being a nuisance of themselves, as a matter of law, and absent also any general State enactment declaring them to be such, bees will not, under any circumstances be presumed to be a nuisance, but the matter will rest in the proof adduced, with the burden upon the party alleging the affirmative. But they may, upon proof of particular facts showing all the elements necessary to the existence of a nuisance, be condemned as such, either of a private or public character, as the nature of the injury might decide.

Predicated upon the theory advanced in the beginning that courts would now, if the matter were called in question, decide that bees are domestic animals, and it having already become a matter of legislative recognition that they are subject to communicable diseases, a question arises as to the liability of the keeper of diseased bees. At common law it was an indictable offense, which has been reenacted by statute in most of the states, to take a domestic animal sufferings from a communicable disease into a public place or to turn it into the highway so that the disease might be communicated to the animals of other persons. It could hardly be said to be less culpable to knowingly keep diseased bees, which, by their nature may not be restrained or confined, to spread disease to the apiaries of other owners. If to turn a horse with glanders or a sheep with footrot into the highway is a public nuisance, on the same reasoning to turn bees at large to carry communicable diseases peculiar to them to other bees ought to be an offense of the same grade.

The power of a municipal corporation, as a town or village, to restrain or prohibit within its limits the keeping of bees, or to denounce them as a nuisance, is commonly reported as a fruitful source of vexation to keepers of bees, but one case only is reported as involving a judicial determination of that particular point And here, too, a few preliminary observations will be necessary to proper understanding of this phase of the nuisance laws. Cities, towns, and villages, as municipal corporations or public bodies, receive their powers by express grant from the legislative authority of the State, and with the exception of some unenumerated powers without which the corporate body could not exercise its essential functions as such, their powers are limited to those expressly named in the grant. This grant of power is usually contained in the general laws of the State governing cities, towns, and villages, and is called the charter power, the law or statute itself being usually known as the charter. Keeping these facts in mind will aid the unprofessional man in understanding the terms to be encountered in an examination of local laws in regard to the power of a municipal corporation to legislate upon this subject.

Every state has its own peculiar policy toward these municipal corporations, and no two are exactly the same. They all, however, follow the same general plan, with variations influenced by local conditions. As the power of the state legislature is limited that its acts must be consistent with the constitution, so the power of a municipal corporation to make by-laws, as its ordinances or enactments are commonly known, must be in harmony with its charter, with this further distinction, that while the legislature of the state may exercise unlimited discretion in

all matters not prohibited by the constitution, a municipal corporation is restricted in legislative action to those matters in which it is expressly authorized by its charter.

It is the general rule that cities, towns, and villages have conferred upon their common councils power to declare, abate, and remove nuisances. In the case of nuisances *per se*, whether at common law or by statute, or by ordinance in those cases in which the council may declare such nuisances, the power to abate by summary action is either expressly given or exists by necessary implication. Summary abatement means arbitrary removal or destruction without judicial process. Nearly, if not quite, all city charters contain grants of power to license, regulate, and restrict all businesses, pursuits, and avocations, and also a section known commonly as a "general welfare clause," by which the corporate body is empowered generally to enact such ordinances, rules, and regulations as may be necessary to preserve the peace, safety, and health of its inhabitants and promote their general welfare. To undertake to set out the specific provisions of the charter of the municipal corporations of the various states would extend this article far beyond its intended scope.

It is a cardinal rule of the courts that all ordinances must be reasonable, and that while a city may define, classify, and enact what things or classes of things shall be nuisances, and under what conditions and circumstances such things shall be deemed nuisances, this power is subject to the limitation that it is for the courts to determine whether, in a given case, the thing so defined and denounced is a nuisance in fact, and that if the court shall resolve this point in the negative the ordinance is invalid. Under this rule, in an Arkansas case, it was held that the municipal corporation could not prohibit the keeping and rearing of bees within its limits as a nuisance regardless of whether they were so in fact or not. And this case seems to have been received as announcing the correct rule in recent text works, though the point has not been raised elsewhere in controversy.

Under the rule just stated, the power of summary abatement would not exist, even thought the presence of bees in a particular part of the city should be declared objectionable, but the point would rest, as has been heretofore observed, in the proof adduced, the burden brings upon the party declaring the affirmative of the issue.

BASSWOOD PLANTING.

Prof. G. B. MacDonald, Ames.

Beekeepers well know the value of basswood trees for the production of honey. It should be possible for farmers interested in bee culture to make the basswood trees serve a double purpose. Trees of this species might well be utilized for windbreak purposes as well as for the production of honey.

Under good conditions the basswood sometimes attain a height of 70 to 80 feet. The crown of the tree is quite compact and forms a very dense shade. It is a tree best suited to deep, rich, river-bottom soil and to cool situations. Very often the basswood will be found on the cooler slopes along with a variety of other trees. This species is quite hardy and although it will survive, in many instances, on up-land soil, yet as a general rule it is not advisable to plant this species in dry situations. The basswood can readily be reproduced by seed and by sprouts. The seeds ripen in September or early October. As soon as the seeds are collected they should be freed of the wings and planted at once. The freezing and thawing dring the winter aids in rotting and loosening the seed coat and, thereby, make possible an early germination. Although fall planting is generally recommended, it is possible to keep the seed over winter in a cool, dry place by storing in sand.

The young basswood trees should be grown in nursery rows and the young trees transplanted to their permanent location at the age of one year. The trees should be set out as soon as the frost is out of the ground in the spring and should be given protection from cattle and fire. Cattle, especially, do considerable damage to young trees by eating the small branches and foliage.

THE WILD BEES OF IOWA.

Leslie A. Kenoyer, Toledo.

The interest of the beekeeper centers about that order of insects which the scientists call Hymenoptera,—the order that is marked by the possession of four membranous wings. This is a most remarkable order,—the most remarkable, in fact, of the dozen or more into which insects are divided. It contains no less than 25,000 different species, and is preeminently noted for the complexity of its instincts and habits, for division of labor among the occupants of the home, and for actions that seem almost to be governed by intelligence. Here we find the saw-flies,—parents of some of our crop destroyers; the horn-tails, whose young are borers in wood; the gallflies, responsible for the remarkable formations that appear on oak leaves; the ichneumon flies which challenge our wonder and admiration for the derrick-like device which enables the mother to drill a tiny hole in wood and place her egg besides the victim of her offspring,—a wood-boring insect. Here also are those matchless little socialists, the ants, the sole aim of whose existence seems to be the welfare of the colony. Here we have the wasps, the myriads of wild bees, and finally those bees which are so well known to the apiarist,—the climax of the order from the social as well as from the economic standpoint.

In assigning my topic the president meant not those members of the old world hive bee family which have escaped from cultivation by swarming to the woods and making their domicile in some hollow tree to be unmolested save by bee-hunters and hungry bears, but the hundreds of

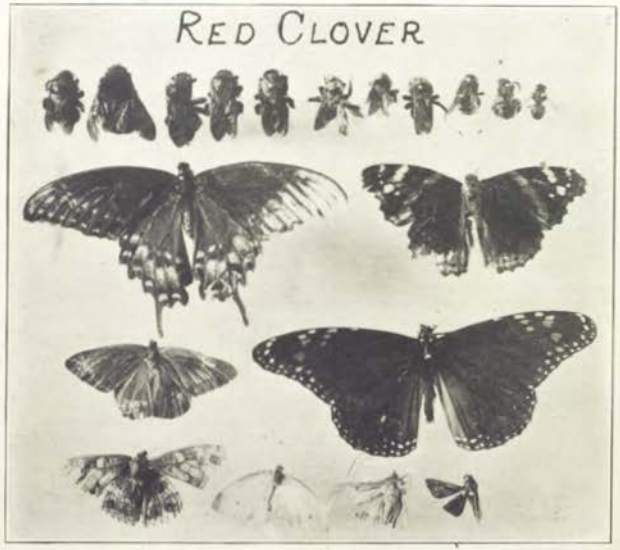


Fig. 1. Insects that visit red clover.

species of native bees unnoticed by the non-initiated but none the less present and at work wherever flowers bloom.

Scientists divide orders into families, of the thirty-four families of Hymenoptera represented in our country, only two include bees in the strict sense of the word. The members of seventeen of these families are commonly termed wasps. And since wasps are so much in evidence about flowers and doubtless play their part in pollination, we cannot omit them from our discussion. How do wasps differ from bees? We cannot safely judge by the shape, for some wasps are short and chubby and some bees long and slender. The primary difference is the food on which the young are reared. The infant wasp is fed upon insects, while the bee is reared upon a purely vegetarian diet of pollen and honey. The female bee, or the worker among the social bees, has the tibia of her hind leg flattened and bordered with a fringe of hairs, making it a pollen basket in which she may carry her pollen burdens to the hive. The wasp has a round tibia and no pollen basket.

Our early introductions to the wasp world are generally of such a nature as not to appeal to our sense of comfort, but if you do not think

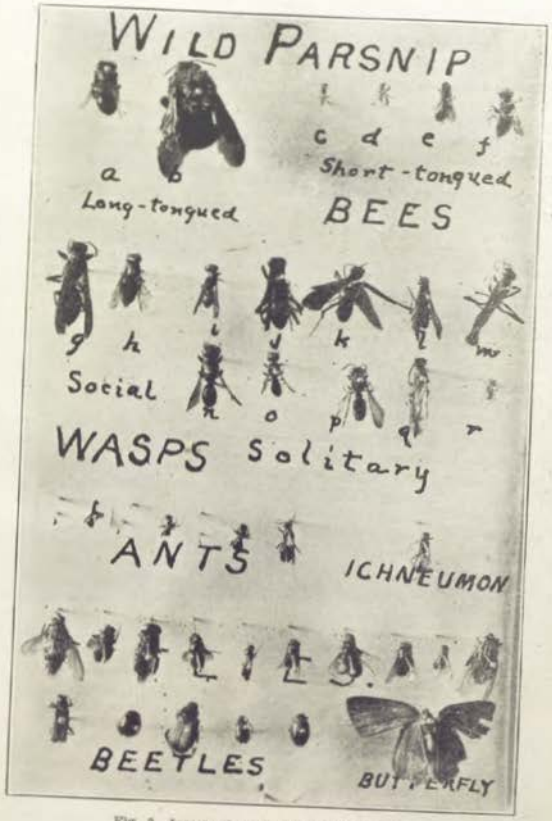


Fig. 2 Insects that visit the wild parsnip.

wasps are interesting just read Peckham's book on wasps, or better yet, get out on some warm summer day,—the warmer the day the more active the insects,—and study them for yourselves. The better you know them the more admiration and love you will have for them. Instead of remarking, "Go to the ant, thou sluggard," Solomon might as well have said, "Go to the wasp."

In a hornet's nest we find the same division of labor that occurs in a bee hive, but not quite so complete. The queen alone lives through winter. In the spring she gathers a bit of fiber from some old weathered post, makes a few cells, lays her eggs, catches and chews up caterpillars for her young, and rears them into workers who soon take upon themselves the duties of home enlargement and food-gathering. The queen is now able to devote her whole time to egg-laying, hence by fall the colony may number into thousands.

Contrasting with these, and far more numerous in species, are the solitary wasps. There are no workers among these,—merely males and females. The female digs her nest in the ground, bores it in wood, molds it of mud, or adapts some convenient cavity already prepared. In this nest the food insects, varying in number and kind with the species of the wasp, are stored after having been stung in the nerve centers by the mother wasp so that they may not become too active and unruly but yet are likely to remain alive and furnish fresh food for the waspling. With them is placed a single egg, then the mother leaves. Some species of wasp mothers never see their offspring, while others return at intervals to bring fresh food.

One wonderful thread-waisted creature, the sand-loving Ammophila, is said to take a small square pebble in her mandibles to tamp the filled-in shaft in which she has placed her larder and laid her egg, so that it may appear undisturbed like the surrounding soil. Man has been defined as the tool-using animal, but here we have the remarkable example of a wasp that uses tools.

But, you ask, what is the practical import of all this? Well, the grown-up wasp departs from its early dietary training and acquires a taste for the sweets from flowers. The flower is its dining table, not its field of labor. It is the Nimrod of the insect world, and devotes its busy hours to the chase, whereby it satisfies the needs of the home. Still it must tarry at the flower bed to meet its own personal needs.

Since it does visit flowers in its blustering sort of way, it is bound to carry pollen. For several reasons it is a less important agent of pollination than is the bee. Its season is shorter,— very few being seen on fruit blossoms in spring and on the last lingering dandelions and asters in fall; then because of the hunting habit that we have mentioned the wasp has less time during the day to spend on the flower than has the bee; it has no pollen-baskets and does not intentionally gather pollen; it is generally less hairy, and its hairs are simple, not branching and feather-like as are those of the bee,—the wasp's body under the microscope appears as a field covered with telegraph poles and not as a miniature forest as does that of the bee. But most of our showy flowers have sticky pollen-grains, which will readily adhere upon contact with the hairs of the wasp. A medium-sized wasp, Cerceris clypeata, which we collected from golden rod, was found to have on its body two thousand pollen grains of several different kinds.

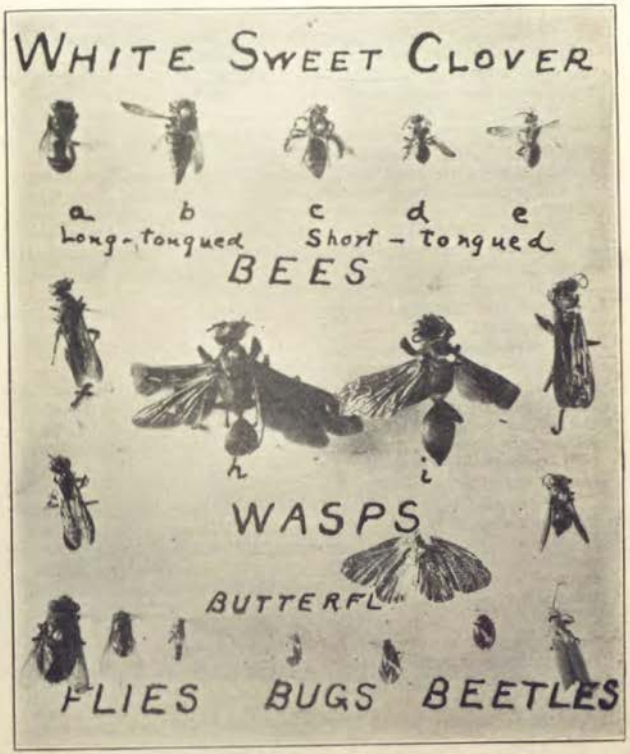


Fig. 3. Insects that visit sweet clover.

Some flowers are preeminently wasp flowers. Possibly their nectar is not apreciated by bees. Among such we might mention the dogbanes and the green milkweed. On a plot of this milkweed four feet square on July 22 there was seen but one honey bee during the entire day, while there was an average of fifteen wasps on hand all day long. The dogbanes and milkweeds have a treacherous way of trapping small

insects, and it may be that some of our wasp visitors are really trappers and are in quest of the insects that the flowers catch. But the majority are undoubtedly after nectar, for their insect food is of a type wholly unlikely to be found on milkweed blossoms. Now the pollen of the milkweed clings together in a peculiar way, and is jerked out by the foot of the visiting insect. Fig. (4) Wasps taken from milkweed usually have one or more of these pollen masses on their feet, hence it would appear that they play some part in the pollination of this plant.

Passing on to the true bees, skilled gatherers of pollen and honey, we find two families, the short-tongued and the long-tongued bees. This distinction is an important one, for, as we shall see, it determines what flowers the bees may visit. The short-tongued bees are all solitary, each female having the sole care of her own offspring, while the long-tongued ones are either solitary or social. Our natives social bees are all bumblebees. The honey bee probably comes from Asia. In the tropical parts of the earth are minute stingless bees that form much larger colonies than our honey-bee.

The more common of the short-tongued bees are the miner bees—those that dig in the ground for their combination storehouses and nests. Andrena, a smoothish black bee, with the rear part of the abdomen fuzzy, is a common example. Each Andrena female stocks her own larder with the requisite ration of pollen and honey, lays her egg, then closes the cell and leaves her offspring to begin life unattended. Several Andreaas may dig their shafts close together, however, the result being a neighborhood of homes.

Another miner, smallest of all the bees but very abundant, is Halictus. It is no larger than an ant. We were all brought up, I believe, to call it the sweat bee. Several of these unite and form a common vertical shaft, from different levels of which they make side passages extending to their individual cells. "While Andrena builds villages composed of individual homes, Halictus makes cities composed of apartment houses."

Similar to Andrena in its building habits is Augochlora, a familiar bee of a beautiful metallic green color. Last summer this bee was found in considerable numbers on the hollyhock, the copious pollen of this flower being to the bee's particular liking.

Certain bees of both short-tongued and long-tongued families are called cuckoos, for like the roguish bird of that name they slyly place their eggs in the cells of the industrious solitary bees. These cuckoos are often brightly colored and some of them might be mistaken for wasps.

Some of the long-tongued solitary bees bear a striking resemblance to our friend, the honey bee. In our study of pumpkin blossoms and their visitors, last summer we saw sipping the copious supply of nectar from the cup under the stamens, wherever by good fortune the stamen tube had a fissure large enough to admit of the insection of a proboscis, bees that were just the size of the hive bee but were little off color. A study of the wing-veins, which vary so greatly in different bees as to furnish our best standard for classification, told us that most of our pumpkin visitors were not honey bees. All of them, however, had a remarkable

Fig. 5.
Milkweed (*Arclepias syriaca*). Frequently visited by bees. They become, however, entangled in the pollen masses. The related Pleurisyroot is a good honey plant. (U. S. Dept. of Agri.)

number of the huge pollen grains of the pumpkin upon their bodies, and as they jostle against the spreading sticky stigmas of the pistillate blossom the latter is no doubt furnished with its most effecacious mode of pollination.

One familiar family of long-tongued bees is Megachile, a whitish fuzzy individual with the tip of the short abdomen partly turned up. Mrs. Megachile is a leaf cutter who lines her cells in the hollow of some stem with bits of rose leaf deftly cut out by her mandibles.

The bumblebee, less diligent than its better known cousin, and having a less elaborate division of labor, is nevertheless a most interesting creature. There are drones, queens, and workers as among the honey bees, but the colony, instead of containing many thousand individuals, has at best but a few hundred. As in the case of the hornets and yellow jackets, only the queen lives over winter. In the spring it is necessary for her to build up the colony by her unaided efforts until she can be relieved by her first worker offspring.

Very like the bumblebee in appearance is the guest bee who makes herself at home in the bumblebee colony. She does never a stroke toward the task of provisioning the colony, although she does build cells for her own eggs. There are no workers among these bees, for the entire task of gathering food, feeding the young, and housekeeping in general, is left to the host. Why the bumblebees tolerate so lazy a visitor is not understood, but it is altogether unlikely that they are familiar with the purpose of the intrusion or are aware that it will mean more hungry mouths for them to feed.

After a hasty study of the insects that were collected from a number of flowers at our state experiment station last summer, I have concluded that flowers should be divided into three general groups as regards their insect visitors: First, those with nectar at the base of elongated tube and accessible only to butterflies and to bees larger or longer-tongued than honey bees—the bumblebee flowers; second, those with shorter tubes and nectar accessible to honey bees, but not to the majority of short-tongued bees, ants and flies—the honey bee flowers, third, those that are not at all exclusive but expose their nectar to all comers—the fly and ant flowers. I wish to consider these three groups separately. The insects illustrated represent the species seen upon and collected from flowers of a typical plant of each group. These collections make no pretense toward being complete, though they do represent considerable time and study and, I think, show the facts pretty well.

I chose red clover as a type of Class I (Fig. 6), the long-tubed flowers, partly because of its abundance and partly because of its economic importance. It is a well known story how the red clover when introduced into Australia absolutely failed to mature seed until bumblebees were taken to that country. Now bumblebees are plentiful, and large crops of clover seed are produced. Notice that the honey bee, at the right end of the first row (Fig. 1), is the smallest of the visitors—the rest of them being large solitary bees, bumblebees, butterflies and moths—the elite of the insect world. The other hosts of nectar-loving insects have nothing to draw with and the well is deep. Indeed the honey bee, which

seems rather out of place here, is generally rare in its visits, although considerable numbers of them were seen during the dry weather of August, when the scarcity of other picking induced our little friends to undertake the heroic.

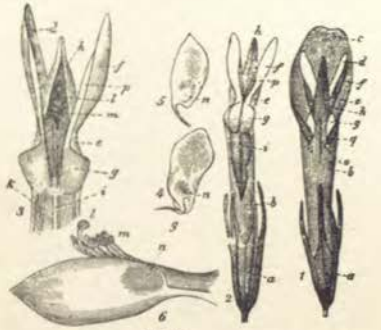


Fig. 6.

Flowers of Red Clover (*Trifolium pratense*). 1, 2, 3, flowers from below, showing *k*, keel; *w*, wings, *c*, standard; 4, 5, wings; *a*, calyx; *m*, stamen; *l*, style. Honey bees cannot get this nectar because it is out of reach of the tongue of the insect. (Mueller.)

Other plants of the same group are toadflax, thistle, lobelia, bindweed, pumpkin, and bergamot or horsemint. Pumpkin was visited by honey bees but comparatively seldom. Horsemint, also, numbered honey bees and even some smaller bees among its visitors. The whole corolla is covered with glands which exude an aromatic substance, and this may be a means of attraction. There is a wild bee which sometimes bites through the corolla tube, and steals the nectar, without giving the plant anything in return. The honey bee is ready, when it can find such an opening, to make use of the short cut to nectar that it affords.

As a type of the second or medium-tube group, I have chosen that plant which is rapidly coming to the front in the favor of beekeepers, the white sweet clover. Possibly its tube is a little shorter than the average of this class. White clover might have been a bit more typical, but for some reason white clover did not produce nectar this year. This reason is, as yet, one of the unsolved problems of botany.

Among the visitors of this flower easily first is the honey bee (a). Only on a few unseasonable days was this bee surpassed in numbers by another insect, and this is a large white-faced fly (first insect of fly row in figure) that is nearly always present on the flower. I must say that whatever may be the honey yield of sweet clover, my studies this summer have given me a very high opinion of its power to attract bees. (Fig. 3) When white clover is left alone, when buckwheat ceases to attract, when other recognized honey plants pass unnoticed, sweet clover is veritably humming with bee life and activity.

In the collection illustrated there is another long-tongued bee—a cuckoo bee (Coelioxys, b), which entrusts its young to the care of the leaf-cutter bee. There are also three short-tongued bees—the miner bee (Andrena, c), and two bright-colored cuckoo bees which impose upon miner bees (Spechodes d. and Nomada, e). The wasps gathered are all solitary. There are two huge caterpillar-gathering ground wasps (Sphex h and i), a spider-catching mud wasp (Pelopeus, j), and several smaller wasps. A few species of flies sip from this flower, also a few small butterflies, such large scale-winged creatures as the monarch and swallowtail seeming to steer clear of it. As the bugs and beetles are probably not after nectar, we pass them by.

Although we had clover plots under hourly observation for four days, only one bumblebee was noticed. This creature was evidently either a novice untaught in the traditions of the bumblebee world, or a pioneer in quest of something new.

Fig. 7.
Wild Parsnip (*Partinaca sativa*). Pollinated by flies and bees. Nectar shallow. (Charlotte M. King.)

To the honey bee group of plants also belong several other important plants of the clover type—the yellow sweet clover and the white and alsike clovers. Here also are the vervain, which fills so many of our pastures and keeps the bee world busy for most of the summer; the woodsage, catnip and motherwort among the mints; and in the sunflower family the cup-plant, heliopsis, crown-beard, Joe Pye weed, thorowort, and others.

The third class, that of the tubeless flowers, will here be represented by the wild parsnip (Fig. 7), a yellow-flowered weed which comes to us from Europe and is the original of the parsnip of our gardens. I chose the flower because of the wonderful variety of its insect visitors. The fleshy disk which secretes the nectar is fully exposed, and this, together with the conspicuous color and odor of its umbrella-like clusters, enables the flower to serve as the banquet-table for the multitudes.

Let us notice a few individuals of this vast assemblage (Fig. 2). First, there is the honey bee (a), eager to get a proboscis in the competition for sweets. Then comes a burly bumblebee (b), whose tribe is not very abundantly represented. There are several of the smallest of the short-tongued miner bees (Halictus c, d, e), a race that is denied admission to the two first types, and a cuckoo which lays in the mine of Halictus (Sphecodes, f).

Next are twelve species of wasps: The socially inclined being which inhabits the well known paper nests that hang from our ceilings (Polistes, g); the yellow jacket which builds a huge home of paper, generally in some underground cavity (Vespa, h); a little wasp which commonly adapts a hollow stem, a key-hole, or some other ready-made cavity, and stocks it with little caterpillars (Odynerus, i); two kinds of burrowing wasps that prey on spiders (Pompilus, j and k); a potter wasp that builds of mud or clay and fancies spider meat for her children (Pelopeus, m); a brightly colored little wasp which Mr. Peckham found storing white-winged moths in its tunnels in an old rotting log (Crabro, o); a burrowing wasp that begins life on a diet of beetle flesh (Cerceris, p); a little wasp probably protected by its resemblance to a fly, for it catches flies to place beside its egg and furnish ready meat for the waspling (Oxybelus, r). Such a wonderful variety of habits as we find among the wasps, and such a diversity of meats as are used by their young! Yet the parent wasps all find a common meeting place on the parsnip umbel, where they may satisfy their longing for sweets. The parsnip is a cafe at which the ants also are most welcome, though their limitations exclude them from more stylish places. Here we found an ichneumon fly whose young is a parasite feeding upon a living insect grub. Ten kinds of flies are fed here. There is a small butterfly, the larger members of the tribe being where the picking is better. Here are also five beetles, some of which, the lady beetles, are after an insect diet.

The third class of flowers, which we have been considering, falls into two natural subdivisions; those which make an appeal to some of the larger insects, honey bees at least, as well as to insects which are restricted to exposed nectar, and those having as their attendants only the smallest insects, such as the little mining bees, the ants and the small flies. I think that the former secrete more nectar, and that more is required to attract a bee than to attract a wasp, moth or fly. A hint that such is the case comes from the study of buckwheat, which is visited by the bees only during the early forenoon hours, but by these other forms all day, even after the bulk of the nectar has been removed. It is also noticeable that generally those flowers of the subclass which the bees visit are in more conspicuous clusters, while the others are more scattered. Doubtless the massing of color has not a little to do with their attraction for bees.

To the first subdivision belong along with our parsnip, the basswood, the elder, the buckwheat, the heartsease, the dandelion, the goldenrod, and most of the blossoms of our fruit trees and plants. In the second, those that scarcely make an appeal to honey bees, we find yellow hop clover, purslain, wild lettuce, buckhorn, mustards, yarrow and others.

As yet our work has given us no experimental knowledge of the role of wild bees in pollination. There can be no question, though, as to the importance of insects, especially bees, in the pollination of flowers, and there is no set of correlations in nature nicer than that between the varying types of flowers and the varying types of insects.

I shall give an illustration to show how amply able are the bees to take care of the details of pollination. On July 14, 1914, I kept under close observation for a day a clump of white sweet clover of about three by twenty feet and about three feet high. There were about 4,000 spikes of 20 flowers each, or 80,000 flowers in the patch. About 55 honey bees, on an average, put in nine hours work here. Each bee visits 40 flowers per minute. Hence there were, during the day, 55x9x40x60 or 1,188,000 visits of bees to these flowers—an average of fifteen to a flower. Of wild insects at least five more visited each flower, giving each twenty insect visits in all. This ought to be amply sufficient to pollinate every flower in the clump, and that such visits are necessary, was shown by covering a few of the buds with muslin to exclude insects, and noticing that these buds failed to mature seeds.

The fact that there are so many wild bees raises some interesting problems for the beekeeper and the horticulturist. Two shall be mentioned.

Do wild bees compete with honey bees and limit their honey supply? The fact of different flower levels adapted to bees of different tongue lengths make this competition less keen than it might otherwise be. Many of the wild bees seem to care much more for pollen than for nectar, and this may be a fortunate circumstance. Still it is probable that the numerous bees and other insects which work on the same level as the honey bee must take enough of the nectar to make some difference in the supply for our hives, and that they would cut some figure in the problem of overstocking.

Are the wild bees alone able to pollinate our farm and garden plants, making the honey bee an unnecessary acquisition from this standpoint? Nobody can see one of the former almost staggering along with its load of pollen without having a profound respect for its ability as an agent of pollination. The experiment station proposes to do further work on the pollination problem. So far, the best expression I have heard on the subject is that of Dr. Gates of Amherst—that while the wild bees might do the work, they cannot safely be depended upon because they are not under our control. Some fluctuation of weather or other conditions might occur as to diminish their numbers to such an extent that our fruit crop would be left sadly in arrears were we to leave the entire task to these creatures of the wild.

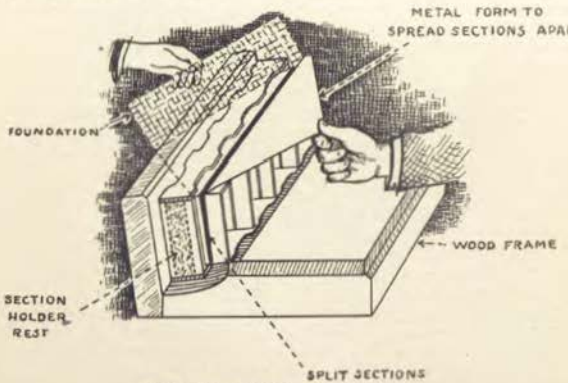
A NEW METHOD OF USING SPLIT SECTIONS.

DR. L. D. LEONARD, MINNEAPOLIS, MINN.

Last year at the Minnesota Beekeepers' Association meeting I presented to our beekeepers a new bottom board feeder. This feeder we named the Minnesota Bottom Feeder.

This year I shall present another appliance which we are going to call the Minnesota Foundation Fastener. Your committee has been kind enough to ask me to demonstrate the usefulness of this appliance at this meeting, an honor which I surely appreciate.

This appliance consists of a platform 10x20, a back 6 inches high set at an angle of 120 degrees. On the front side of this back is placed a form which fits the inside of a section holder and allows it to slip on



DR. L. D. LEONARD METHOD.

a little more than half its width. The angles and bevels must be made in such a manner that when the sections are in place in the holder their outer edge rests on the platform, thus making them more firm while spreading the kerf.

The speading is done by a tin or iron plate, the length of the section holder with an edge turned at right angle which slips into the kerf.

Unlike the British beekeeper, the American beekeeper has not as a general rule taken to the split section. I cannot account for this except that it takes too much mental effort to make the change. The habit of using the old style section is formed and beekeepers, as a general rule, are not progressive or at least have not been so until recently. I understand Mr. Hand of Ohio, the most practical and progressive beekeeper in the United States, has been using the split sections for some time and so will every other beekeeper if he will take the time to note the advantages.

Before speaking of these I wish to call your attention to the amount of handling necessary in putting foundation in the old style section.

First. In putting the sections together you must use a hammer after which you put them out of your hands into a pile; two lost motions: viz, taking up and laying down the hammer and putting the section out of hand.

Second. Cutting up foundation the right length to fit the sections. Lost motion entirely.

Third. Filling and lighting lamp and adjusting the foundation fastener. Picking up section and foundation, adjusting same on fastener and making the motion necessary to attach the foundation to the section. Again laying aside.

If attachment to the sides of the sections is desired it necessitates having a fire, melting wax and flowing it down each side. Now repeat all this if bottom starters are used. Almost all of No. 3 is lost motion and entirely unnecessary.

Fourth. Picking sections up again and putting into section holders and then into supers.

Now with the Minnesota Foundation Fastener the motions are:

First. Place section holder on form. Put sections together with your hands and place all four in section holder, one after the other. No lost motion.

Second. Place metal retractor in sawkerf in section and while spreading put in sheet of foundation. Push down until the upper edge will just be caught by the two sides of the kerf when the retractor is removed.

Third. Remove section holder and sections complete. Lay flat upon platform in front, press section holder down (a motion which shoves the sections into place) and the process is complete.

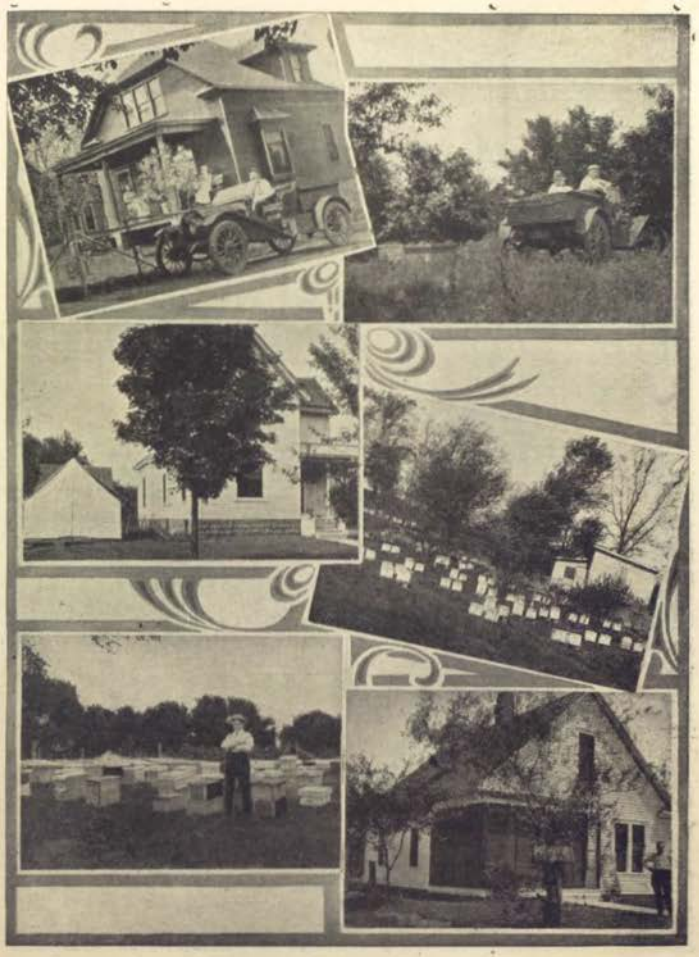
If you wish to put in bottom starters, cut your foundation in strips the right depth. Push the wide strip to the bottom of the kerf, the narrow at the top, press into section holder as before, turn upside down and there you are, with no possibility of displacement of foundation.

There is no patent on the Minnesota Foundation Fastener. You may make them for yourselves or by sending one dollar to the Minnesota Bee Supply Co., Minneapolis, you can get one ready made. Your dealer will furnish you with split sections and your foundation maker will furnish you with foundation cut to suit you. Always get foundation a little longer than the four sections to make sure that both ends will be caught.

GLIMPSES OF SOME IOWA BEE KEEPERS

Summer meeting at Des Moines.

Group of those in attendance at 1913 convention at Des Moines.



GLIMPSES OF SOME IOWA BEEKEEPERS. By Frank C. Pellett.

1. Home of E. E. Townsend, Ft. Dodge, Iowa. 2. (To the right, at the top), auto used by E. E. Townsend, Ft. Dodge, for outyard work. 3. Home of J. I. Wiltsie, Arlington, Iowa. 4. Bert A. Brown's apiary, Des Moines, Iowa (a beekeeper who sold $1,500 worth of honey from a town lot in 1913). 5. Irving Wernick, Lake City, Iowa (produced $1,000 from 40 colonies in 1913). 6. Home of J. H. Meloy, Ft. Dodge, Iowa.

GLIMPSES OF SOME IOWA BEEKEEPERS.

7. J. H. Meloy, Ft. Dodge, keeps 98 colonies in the rear of a town lot. 8. Home of J. L. Strong, Clarinda (50 years a beekeeper). 9. B. A. Aldrich's honey-house at Smithland. The finest equipped honey-house in Iowa. 10. Chris Bach and his apiary at Maquoketa. 11. C. J. Barber, Smithland, Iowa (85 years old, and as spry as a boy); still cares for his large apiary. 12. Home of Walter Reppert, Burlington, Iowa.

Gallagher apiary, Maquoketa, 165 colonies on lot 60x110.

Gallagher home, Maquoketa.

Hall honey-house.

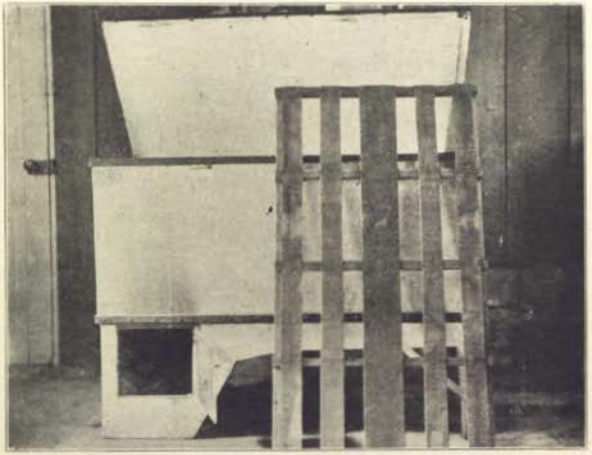
H. W. Heckler apiary at Hedrick, Iowa.

Home of F. W. Hall.

Snyder Brothers Apiary, Center Point, Linn Co.

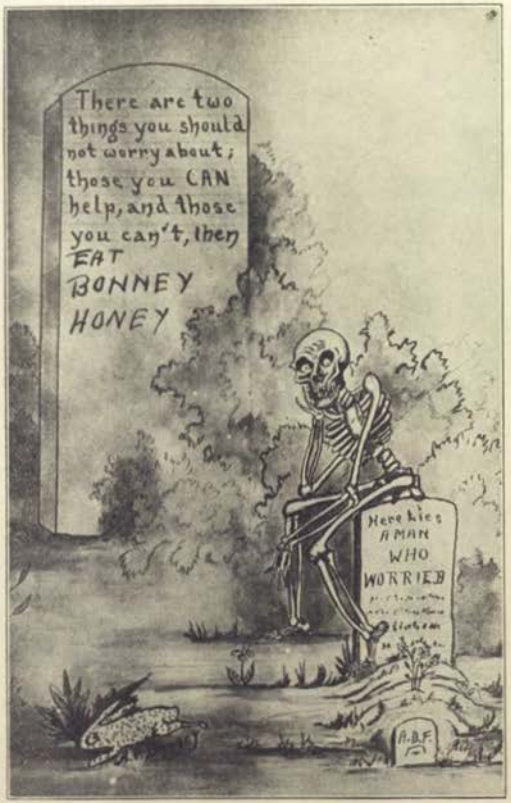
House built from 1913 crop of honey from less than 300 hives. Home of B. A. Aldrich, Smithland, Iowa.

Hall Apiary, Colo, Iowa.



Pangburn steam outfit for liquifying candied honey.

Dr. A. F. Bonney, retiring director, and Mrs. Bonney.



Post card used by Dr. Bonney in advertising honey.

Frank C. Pellett, retiring president.

Hamlin B. Miller, retiring director.

Apiary of J. L. Strong, of Clarinda. Its owner's sole dependence for 25 years.

Souvenir of Colo meeting.

Edw. G. Brown.

A. P. Chamberlain, member board of directors.

Meadow Sunflower (*Helianthus grosseserus*). Pollinated by the bumble bee fly—also visited by bees and moths (Iowa Agri. Exp. Station).