232-613-10m

TEXAS AGRICULTURAL EXPERIMENT STATIONS

BULLETIN NO. 158 JUNE, 1913

# Investigations Pertaining to Texas Beekeeping

## EXPERIMENTS IN ARTIFICIAL DIVISION AND SWARM-CONTROL

By Wilmon Newell, State Entomologist and Entomologist
to the Experiment Stations

## THE LIFE HISTORY AND CONTROL OF THE BEE-MOTH OR WAX-WORM

By F. B. Paddock, Assistant Entomologist

## A STATISTICAL STUDY OF TEXAS BEEKEEPING

By William Harper Dean, Formerly Assistant Entomologist

POSTOFFICE:

COLLEGE STATION, BRAZOS COUNTY, TEXAS

VON BOECKMANN-JONES CO., PRINTERS
AUSTIN, TEXAS
1913

## TEXAS AGRICULTURAL EXPERIMENT STATIONS.

### GOVERNING BOARD.

Board of Directors, A. and M. College.

E. B. Cushing, President .......... Houston
John I. Guion, Vice President .......... Ballinger
L. J. Hart .......... San Antonio
J. Allen Kyle .......... Houston
Walton Peteet .......... Fort Worth
R. L. Bennett .......... Paris
Ed R. Kone .......... Austin

President of the College.

R. T. Milner .......... College Station

Station Staff.

B. Youngblood, M. S. .......... Director
M. Francis, D. V. S. .......... Veterinarian
G. S. Fraps, Ph. D. .......... Chemist
H. Ness, M. S. .......... Horticulturist
J. C. Burns, B. S. .......... Animal Husbandman
Wilmon Newell, M. S. .......... Entomologist
A. B. Conner, B. S. .......... Agronomist
F. H. Blodgett, Ph. D. .......... Plant Pathologist and Physiologist
Rex E. Willard, M. S. .......... Farm Management Expert
W. L. Boyett .......... State Feed Inspector
J. B. Rather, M. S. .......... Assistant Chemist
F. B. Paddock, B. S. E. .......... Assistant Entomologist
H. H. Jobson, B. S. .......... Assistant Agronomist
William Levin, A. B. .......... Assistant Chemist
H. B. Spaulding, B. S. .......... Assistant Chemist
H. Schmidt, D. V. M. .......... Assistant Veterinarian
Chas. A. Felker .......... Chief Clerk
A. S. Ware .......... Secretary
J. M. Schaedel .......... Stenographer
C. A. Case .......... Stenographer
R. L. Spiller .......... Mailing Clerk

### STATE AGRICULTURAL EXPERIMENT STATIONS.

Governing Board.

His Excellency, Governor O. B. Colquitt .......... Austin
Lieutenant Governor Will H. Mayes .......... Brownwood
Commissioner of Agriculture Ed R. Kone .......... Austin

Director of Experiment Stations.

B. Youngblood, M. S. .......... College Station

Superintendents of Sub-Stations.

E. E. Binford, Beeville Sub-Station .......... Beeville, Bee County
W. S. Hotckiss, Troup Sub-Station .......... Troup, Smith County
E. M. Johnson, Co-operative Rice Station .......... Beaumont, Jefferson County
R. W. Edwards, Supt. Co-operative Forage Crops Station .......... Chillicothe, Hardeman County
I. S. York, Spur Sub-Station .......... Spur, Dickens County
A. K. Short, Temple-Belton Sub-Station .......... Temple, Bell County
T. W. Buell, Denton Sub-Station .......... Denton, Denton County
V. L. Cory, Lubbock Sub-Station .......... Lubbock, Lubbock County
H. C. Stewart, Pecos Sub-Station .......... Pecos, Reeves County
N. E. Winters, Angleton Sub-Station .......... Angleton, Brazoria County
G. T. McNess, Nacogdoches Sub-Station .......... Nacodoches, Nacogdoches County
*C. S. Scharff, Feeding and Breeding Station .. College Station, Brazos County

Note.—The main station is located on the grounds of the Agricultural and Mechanical College, in Brazos county. The postoffice address is College Station, Texas. Reports and bulletins are sent upon application to the Director. A postal card will bring these publications.

*Acting.

## CONTENTS.

# ERRATA.

Explanation of Plate III, *below* should read "larva" instead of "larvæ."
Page 21, line 23, should read "Plate V, *below*" instead of "Plate V, *b*."
Page 21, line 25, should read "Plate VI, *right*" instead of "Plate VI, *a*."
Page 21, line 36, should read "Plate III, *below*" instead of "Plate III, *c*."
Page 21, line 36, should read "Plate VI, *left*" instead of "Plate VI."

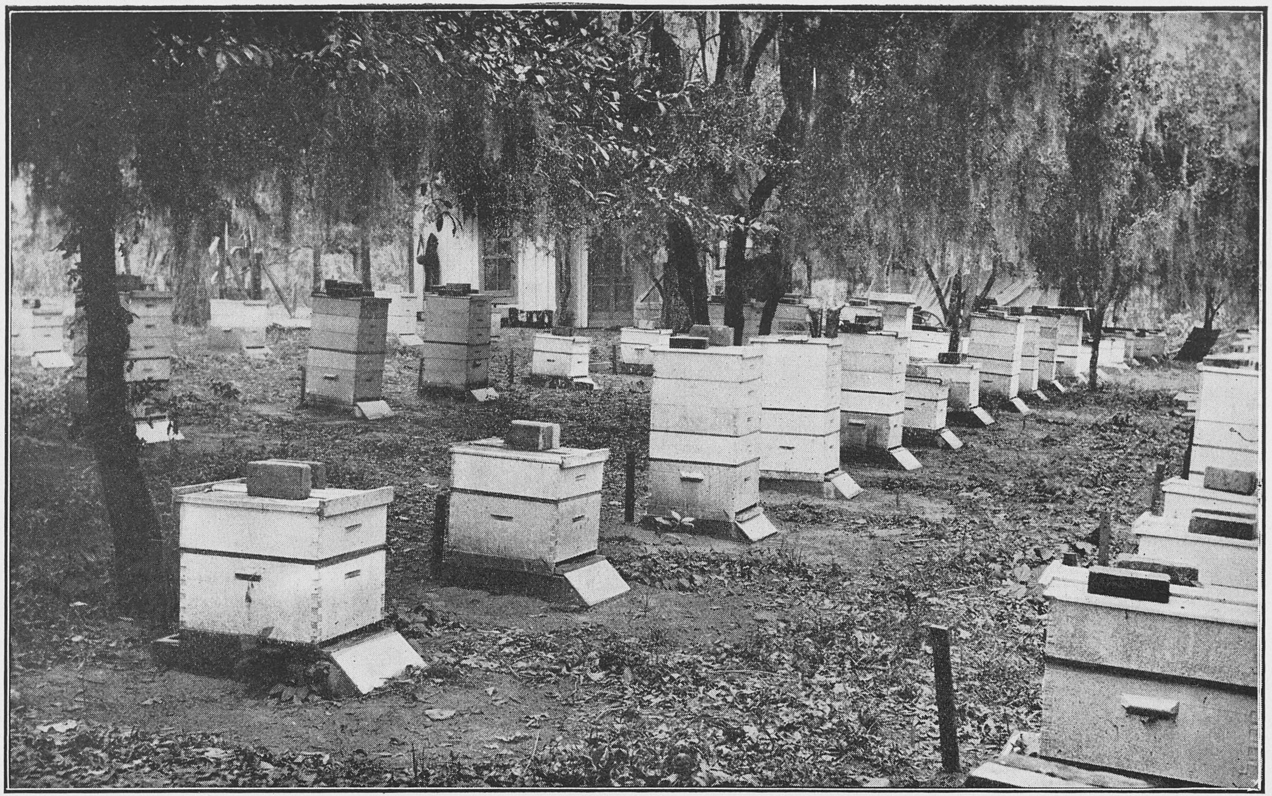

Plate I.—Experimental Apiary of the State Entomologist. Located in Brazos County, Texas. (Original.)

# INVESTIGATION PERTAINING TO TEXAS BEEKEEPING.

## EXPERIMENTS IN ARTIFICIAL DIVISION AND SWARM-CONTROL.

By Wilmon Newell.

So far as his other duties permit, the State Entomologist conducts experiments with honey-bees with a view to perfecting or improving practical methods of handling them under Texas conditions.

The experiments described herein were made during the season of 1912 in the writer's apiary of sixty colonies, located on the Brazos river in Brazos county. Unfortunately, the number of colonies included in each experiment was smaller than desirable, but owing to the fact that the writer has to conduct other research work for the Experiment Station, has charge of the foul brood eradication for the State of Texas and in addition is obliged to handle a large correspondence throughout the entire year, it has been impossible for him to maintain and care for a larger apiary. For the same reason, the experiments here mentioned are relatively simple ones. The fact that very little in the way of experimental work with bees has ever been done in Texas is our only justification and excuse for publishing these results. The reader may rest assured, however, that the experiments, as far as they go, have been made with painstaking care, the records are precise and accurate, and the yields of honey given are exact to the pound.

### NATURE OF THE EXPERIMENTS.

The apiary contained for the most part three-banded Italians, several Carniolan colonies and a few hybrid colonies.

The first line of experimentation was to test different manipulations in their effect in discouraging or retarding swarming. In connection with this the honey production of the colonies treated by the different methods was also determined and compared.

The second line of observation was that of determining the comparative production of honey by both Italian and Carniolan colonies, kept in the same yard and under the same conditions.

All the colonies were domiciled in the standard ten-frame dovetailed hives, with Hoffman style brood-frames, the combs being in nearly all cases built from full sheets of foundation. The supers used were all of the shallow extracting type, frequently referred to as the "Ideal" by many Texas beekeepers.

The production of colonies, as given below, has reference in every case to extracted honey, and particular pains were taken to determine the yield of each colony with accuracy. When the full supers were taken from the hives, the hive number was marked on the super with chalk. When carried into the extracting room the super was weighed and its number and gross weight set down in the record. The honey was then extracted and each empty comb returned to the super from which it was taken. The super with its empty combs was then weighed, the weight recorded, and the difference between its weight when full and when empty set down as the net weight of extracted honey taken from it.

THE SEASON.

A general knowledge of the season, the time and duration of honey-flows, the available honey-plants, etc., is quite necessary to a proper understanding of the experiments and their results.

Upon the whole, the season was what the beekeeper would consider "fair." The experimental apiary is located upon a sandy ridge less than one-half mile from the Brazos river. On this ridge horsemint* grows in abundance, as well as in waste places in the river bottom across the river from the apiary. A considerable area of cotton, in the Brazos bottoms proper and in a wide creek bottom near at hand, is within easy reach of the bees. However, the principal source of honey was the horsemint, fully 80 per cent of the surplus being secured from this plant. The amount of honey produced by the cotton was relatively small and would not, of itself, have constituted a surplus of any importance. The following data, taken from the writer's notes, will convey to the experienced beekeeper a fair idea of the season and of the bees' activities at different times:

"February 28.—Weather still cold, temperature 32° ; nothing in bloom.

March 3.—Warmer; plum and peach beginning to bloom.

March 15.—Cold spell; freezing.

March 16.—First adult drones hatching in the hives.

March 20.—Dewberries in bloom; first oak blooms.

March 30.—Bluebonnet, wild vetch, wild pea and post oaks now in bloom. Supply of nectar about equal to amount being consumed by the bees.

March 31.—Swarming fever coming on. Wild grape beginning to bloom.

April 3.—Some honey being deposited in supers. Placed supers on strongest colonies.

April 5-9.—Rain.

April 9.—Youpon beginning to bloom. Swarming impulse strong.

April 11.—Youpon blooming well. More rain.

April 22.—Youpon flow over with; red haw and black haw in full bloom. Swarming fever still strong. The colonies have put in an average of about 15 pounds surplus up to this time.

May 1.—Haw done blooming; no honey-flow. Bees inclined to rob.

May 1-12.—No honey-flow. Robbing bad.

May 16.—Prickly pear coming into bloom. First horsemint bloom of the season discovered.

May 23.—Considerable horsemint in bloom, but weather dry. Honey-flow very light.

May 28.—Heavy rain.

May 31.—Horsemint in full bloom. Honey-flow increasing rapidly.

---

**Monarda punctata*.

June 3.—More rain. Flow very heavy.

June 15.—Horsemint still in full bloom but honey-flow slackening on account of no rain.

June 17.—Good rain, with cool norther.

June 19.—Honey-flow improved slightly.

June 20.—First honey extracted from supers.

June 24.—Horsemint flow failing.

July 4.—Horsemint flow entirely over; seeds ripe.

July 12.—All horsemint dead. Cotton honey beginning to come in slowly.

July 20.—Very hot and dry. No honey-flow at all.

August 8.—Still no rain. Amount of honey from cotton hardly sufficient to be perceptible in supers.

September 16.—First light shower since June 17th.

September 17.—Bees getting a little dark honey, source unknown.

September 19.—Weather has been very hot to the present time. First fall in temperature today—60° night temperature.

October 15.—A little honey has been coming in from broomweed and cotton since September 17th, but of little importance. Weather cooler. Reduced entrances of weakest colonies.

October 16-17.—First autumn rain of importance.

October 18.—First norther, temperature 58°.

October 20-November 25.—Light flow from cotton and broomweed continued. A small amount of honey placed in the supers, but averaging less than 10 pounds per colony.

November 27.—First frost."

## SWARM-CONTROL EXPERIMENTS.

The term "swarm-control" should not, in this instance, be construed too literally, for the experiments under this head had as their object the prevention, anticipation or delay of swarming in order that natural swarms would not be lost in the out-apiary where the colonies were located. The methods used for this purpose may be grouped as follows:

1. Artificial division of colonies.
2. Increasing size of brood chamber:
   - (a) Before queen-cells were started.
   - (b) After queen-cells were started.
3. Increasing super-space, but without increasing size of brood-chamber.
4. Shaking colonies onto foundation.

### 1. *Artificial Division.*

The question is often asked: "Which is the most profitable, to prevent a colony from swarming and thus conserve its strength, or to divide it into two colonies early in the season and have both of them gather honey?" The question is an interesting one as well as an important one and, from conversations which the writer has had with various beekeepers, the consensus of opinion seems to be that the one colony, if increase is prevented, will give the most profitable returns. It must be conceded that various factors have a bearing on this question, and this is particularly true of the time and duration of the honey-flow as well as upon how much time elapses between the time of division and the beginning of the main honey-flow.

In the attempt to answer this question for the conditions prevailing in Brazos county, the writer undertook the experiments described below. Five strong colonies were divided early in the season, making ten colonies in all. The production of these ten colonies was determined and compared with the average production of other strong colonies in the same yard which did not swarm and which were not divided. All of the colonies involved in this experiment were typical three-banded Italians.

*Colony No.* 106.—On March 31st this colony was very strong and building queen-cells. On April 2nd it was divided, the queen and five frames of brood and bees being placed on a new stand and thereafter known as "Colony No. 206." On the old stand, No. 106, were left the other five frames of bees and brood and a ripe queen-cell. Both colonies were given a sufficient number of frames with full sheets of foundation to fill out the ten-frame hives.

The total surplus production of No. 106 for the season was 32 pounds and of No. 206 was 49 pounds.

*Colony No.* 107.—This colony was divided in the same manner as No. 106, the division being made on March 31st, when the colony was very strong and had plenty of sealed queen-cells. In this case the queen and five frames of bees and brood were removed to a new stand known as "No. 207."

The surplus produced by No. 107 during the entire season amounted to 36 pounds extracted honey, while No. 207 produced 81 pounds.

*Colony No.* 317.—This colony was also very strong and had sealed queen-cells on March 31st, so was divided on that date in the same manner as Nos. 106 and 107. The queen and five frames of brood and bees, removed to the new stand, were subsequently designated as "Colony No. 417."

The surplus production of No. 317 for the season was 33 pounds, and of No. 417 was 115 pounds.

*Colony No.* 319.—On April 2nd this colony was very strong and had about a half dozen sealed queen-cells. On this date it was divided in the manner above described, the queen and five frames of brood and bees being moved to a new stand and designated as "No. 419."

No. 319 produced 75 pounds surplus honey, and No. 419 produced 54 pounds by the end of the season.

*Colony No.* 517.—On March 31st this colony was very strong and had plenty of queen-cells. Division was made as in the case of the preceding colonies, and the new colony, composed of the queen and five frames of bees and brood, was called "No. 613."

The season's surplus production by No. 517 was 32 pounds and by No. 613 was 63 pounds.

In all of these divisions it should be noted that the portion of the colony deprived of the laying queen was left upon the original stand, so that it had the advantage of all "field bees" belonging to the original colony. In other words, the part moved to a new stand had the advantage of a laying queen and the part remaining on the old stand, having only a ripe queen-cell, had advantage of all fielders, as the latter all returned to the location of the old colony.

The results of these five divisions are more readily compared by consulting the following table:

| Original Colony No. | Divided Into Colonies. | | | | Total Production of the Two Colonies Made by Division, Pounds |
|---|---|---|---|---|---|
| | With Ripe Queen-cell and Field Bees. | | With Laying Queen. | | |
| | Colony No. | Surplus Produced, Pounds. | Colony No. | Surplus Produced, Pounds. | |
| 106 | 106 | 32 | 206 | 49 | 81 |
| 107 | 107 | 36 | 207 | 81 | 117 |
| 317 | 317 | 33 | 417 | 115 | 148 |
| 319 | 319 | 75 | 419 | 54 | 129 |
| 517 | 517 | 32 | 613 | 63 | 95 |
| Totals.... | ........... | 208 | ........... | 362 | 570 |
| Averages.. | ........... | 42 | ............ | 72 | 114 |

The most apparent fact shown by the above table is that the colonies which had a laying queen from the start produced an average of 30 pounds more per colony than the others, even though they were handicapped at the beginning by being deprived of all fielders. It seems a safe conclusion that, had the ones which were provided with a ripe queen-cell at the time of division (Nos. 106, 107, 317, 319 and 517) been provided with a laying queen instead, their production would have been at least as great as the others, especially as they had the advantage of retaining all fielders at the time the division was made. The conclusion is justified that the purchase of queens for these colonies, even at a price of $1 each, would have been profitable, inasmuch as this would have increased the average production of these colonies by 30 pounds of extracted honey, worth, at a net price of 7 cents, $2.10.* The average profit from purchasing queens for these five colonies would have been $1.10 per colony.

The outcome of this experiment should also be viewed in another way; whether the production of the two divided colonies would have equaled the production of the original five had they not been divided and had their swarming been prevented. In the apiary there were sixteen colonies which did not swarm during the season, or which were prevented from swarming by the manipulations which they received. These sixteen colonies produced on average surplus of 127 pounds per colony. From the above table it is seen that the average production of each two colonies made by division was 114 pounds, or 13 pounds less than that of the colonies which did not swarm. Stated in another way, it may be safely assumed that the five original colonies, had they not been divided, would have produced an average of 127 pounds of honey each, as against the average of 114 pounds actually made by the two colonies which resulted from each division. This would appear at first sight to indicate a slightly larger production (13 pounds per colony) in the case of colonies not

*For the purpose of estimating the value of these productions we have arbitrarily assumed a wholesale price of 8 cents per pound for extracted honey, to the beekeeper, and have deducted therefrom 1 cent per pound for cost of cans, leaving the *net* value of the honey 7 cents per pound. The profit or loss from the experiment, at *any* price for honey, may be readily computed from the data given.

divided, as compared to those which were divided. However, the fact that the division resulted in a net increase of one colony of bees must also be taken into consideration in determining the profit or loss from the experiment. In the case of the colonies which were not divided, we had one colony at the end of the experiment, the same as at the beginning, and an average honey production of 127 pounds, worth, at 7 cents per pound, $8.89. In the case of the colonies which were divided, on the other hand, we obtained not only the surplus honey, but also one additional colony of bees. The honey produced by the two colonies, made by division of one, averaged 114 pounds, worth, at 7 cents, $7.98. The additional colony, without the frames or hives to contain it, may safely be estimated as worth, with its queen, $3 more, making the season's net income from dividing one colony amount to the total of $7.98 and $3, or $10.98 in all. This comparison may be more readily made in the following manner:

| | |
|---|---|
| Average income from one colony divided into two at beginning of the season: | |
| 114 pounds surplus honey, at 7 cents | $ 7 98 |
| 1 additional colony of bees, net | 3 00 |
| Total income | $10 98 |
| Average income from one colony not divided: | |
| 127 pounds surplus honey, at 7 cents | 8 89 |
| Difference in favor of division, per colony | $ 2 09 |

In considering this difference in favor of dividing the colonies, as compared to keeping them intact and preventing increase, one should not lose sight of the fact that these colonies were divided between March 31st and April 4th, fully six weeks before the main honey-flow from horsemint, which commenced between May 15th and 20th. Had the divisions been made later, there would have been less time for the divided colonies to build up in strength and their production would have been correspondingly smaller.

Had the divided colonies 106, 107, 317, 319 and 517, which received ripe queen-cells at the time of division, been furnished with laying queens instead, their production would, as already shown, doubtless have been as great as that of the colonies (206, 207, 417, 419 and 613) which did have a laying queen, or 30 pounds more per colony than was actually obtained. In this case the outcome would have been substantially as follows:

| | |
|---|---|
| Average income from one colony divided into two at the beginning of the season; each divided portion being furnished with laying queen: | |
| 144 pounds surplus, at 7 cents net | $10 08 |
| 1 additional colony of bees | 3 00 |
| | $13 08 |
| Less cost of one queen | 1 00 |
| Net income, average | $12 08 |

Average income from colony not divided:

| | |
|---|---|
| 127 pounds surplus, at 7 cents | $ 8 89 |
| Difference in favor of division | $ 3 19 |

### 2. *Increasing Size of Brood-Chamber.*

While swarming is but the natural response to an instinct calling for an increase in communities, just as brood-rearing is the response to the instinct for increasing the number of individuals within the colony, it has, nevertheless, long been recognized by beekeepers that a crowded condition of the hive is one of the conditions which induces the swarming fever and precipitates swarming. Many of the methods in vogue for delaying swarming, or preventing it entirely, are based upon giving the colony an abundance of room in which to store honey and to rear brood. Some of our experiments were conducted to determine the effect, in discouraging swarming, of giving additional room within the hive, either by increasing the size of the brood chamber or of the super-room. In some instances this additional room was given before the first queen-cells were started; in other cases, afterwards.

In the case of Colonies 102, 103, 104, 320 and 321, the space in which the queen could lay was increased, prior to the appearance of the first queen-cells, by adding a super of empty combs above the brood-nest, with no queen-excluding honey-board between. As is readily seen, this increased the size of the brood-chamber by about 50 per cent. The details of these experiments follow:

*Colony No.* 102.—On March 31st, with the colony strong, the super of empty combs was added. By April 11th eggs had been laid in the super-combs and some honey stored in them, but no cells had been built. On April 21st the colony cast a swarm.

*Colony No.* 103.—On March 31st the colony was strong and the super of empty combs was given. By April 11th the super was well filled with brood and honey and on April 22nd another super was given. The colony did not build any queen-cells during the season, and its total production of honey was 154 pounds.

*Colony No.* 104.—On March 31st, the colony being very strong, a super of empty combs was given. A second super was given on April 11th, after the first one had been well filled with brood and honey. The colony did not build queen-cells or swarm during the season. The honey yield, however, was but 69 pounds.

*Colony No.* 320.—Received the super of empty combs on March 31st. On April 22nd the colony was building queen-cells and these were destroyed, another empty super being given at the same time. The building of queen-cells was abandoned by the bees until about May 12th, when they built cells again, and swarmed about May 16th or 17th.

*Colony No.* 321.—This colony received its super of empty combs on March 31st and a second super on April 22nd. No queen-cells were built until early in May, and the colony cast a swarm about May 5th or 6th.

Thus, of the five colonies, the queens of which were furnished with 50 per cent more room for egg-laying prior to the appearance of the swarming fever, two did not swarm and three cast swarms.

A similar treatment was given colonies 322, 324, 325, 515 and 516; that is, the brood-chamber was increased 50 per cent in size, prior to the advent of the swarming fever, but in addition a super was also added above the enlarged brood-chamber.

*Colony No.* 322.—On April 2nd the colony was strong and no queen-cells had been started. Two shallow extracting supers, both containing drawn-out empty combs, were placed above the brood-chamber. A wood and wire queen-excluding honey-board was placed between the two supers. The lower super served to increase the size of the brood-chamber by one-half, as the queen could lay in it at pleasure. The upper super was intended for storage of honey. At this time the light honey-flow was about equal to the daily consumption for brood-rearing. On April 12th it was found that the queen had not laid in the lower super and, instead, the bees had nearly filled it with honey, leaving the upper super still empty. The supers were accordingly reversed, bringing the empty super next to the brood-nest and the partially filled one above it, with the honey-board still between the two supers. On April 23rd it was found that the super next to the brood-nest contained honey, but no brood, while the upper super was again empty. The supers were accordingly reversed again. Up to this time no queen-cells had been built. The colony cast a swarm during the first week in May.

*Colony No.* 324.—Very strong on April 3rd; no queen-cells. Two supers were given as in the case of Nos. 322 and 324. By April 12th many queen-cells had been built and the colony was ready to swarm. It was then used for another experiment.

*Colony No.* 515.—Treated, on April 3rd, in the same manner as described for Nos. 322, 324 and 325. No queen-cells were built prior to April 23rd, but cells were built and the colony swarmed about April 28th.

*Colony No.* 516.—Very strong on April 3rd; no queen-cells. Treated in the same manner as Nos. 322, 324, 325 and 515. On April 12th the lower super contained honey, while the upper one was empty. The supers were reversed, so as to bring the empty one next to the brood-chamber. On April 22nd the colony had plenty of queen-cells and was ready to swarm.

Thus, out of the five colonies that received 50 per cent additional room in the brood-chamber and an equivalent amount in super-room, four developed the swarming fever and one did not.

A similar addition of two supers of empty combs was made to Colonies 323, 508, 512, 514 and 518, but in the case of these the supers were added *after* queen-cells had been started and the latter were torn down at the time. In the case of all five colonies queen-cells were built again immediately and the treatment had no apparent effect on the swarming impulse.

In the case of the ten colonies (102, 103, 104, 320, 321, 322, 324, 325, 515 and 516) which received the increase of 50 per cent in the capacity of the brood-chamber prior to the development of the swarming impulse, three did not swarm at all and in the case of the other seven swarming was apparently delayed for from two to three weeks. Strong colonies not treated in this manner swarmed, in most cases, during the first week in April, whereas most of the treated ones did not swarm until between April 20th and May 5th. For the seven colonies the treatment did no more than delay the time of swarming. This was a decided disadvantage under the conditions existing, for in the case of the colonies which swarmed early, both new swarm and old colony had ample time to build up in strength before the main honey-flow commenced between the 15th and 20th of May. The late swarms were, of course, weak at the beginning of the honey-flow and, without exception, their surplus production was very low, as they did not store any honey to speak of until the honey-flow was more than half over. This loss was not compensated for by the rather heavy production of the three that did not swarm.

As stated in a preceding paragraph, these experiments should be construed in the light of a clear understanding of the conditions existing in this locality. Where the swarming season comes on from six to seven weeks in advance of the main honey-flow, as in this instance, the delay of swarming, by giving additional room or by destroying queen-cells, seems inadvisable. An artificial division of the colonies, or their treatment by the "shaking" method, appears to bring much better returns.

### 3. *Increasing Super-Room.*

Many experiments were tried in which a large amount of super-room was furnished the colonies, both prior to the development of the swarming fever and afterwards. It is unnecessary to take space for describing these experiments, as in no case did the addition of abundant super-room have any perceptible effect upon the swarming tendency.

### 4. *Shaking Onto Foundation.*

A common method of swarm control in vogue among Texas beekeepers is that known as "shaking." When the colony shows symptoms of swarming and is building queen-cells, another hive is prepared, containing frames filled with foundation, preferably full sheets. The colony is placed to one side and the hive, containing the foundation, placed on the old stand. The combs are then taken from the old hive and the bees and queen shaken from them onto the ground in front of the new hive. In this way the colony is transferred, with rather rough handling and much excitement, to a brood-chamber containing nothing but foundation. The super, if one has been on the old hive, is transferred to the new one.

The hive containing the brood and one or more queen-cells, with sufficient workers to care for the unsealed brood, is placed on a new stand and the entrance contracted somewhat to prevent robbing, and left there. In course of time a young queen issues, mates, commences laying, and, with the hatching workers, constitutes a new colony.*

In the case of several of our colonies this shaking treatment was given as a preventive of swarming.

Five colonies, all of which were very strong at the time, and were building queen-cells, were shaken onto foundation on April 21st and 22nd. The swarming impulse was checked entirely and these five colonies produced, respectively, 175, 117, 103, 174 and 118 pounds of surplus during the season, an average of 137 pounds each. Twelve colonies in the yard,

*Rough shaking of combs bearing sealed queen-cells will, in nearly all cases, kill the queens within. For this reason the bees should be gently *brushed* from the comb which contains the queen-cell that is to be preserved for hatching.

which did not swarm and which were not manipulated in any way to prevent swarming, produced an average of 120 pounds per colony, hence it does not appear that the shaking treatment materially reduced the honey production of these colonies. One might be inclined, from a consideration of these figures, to suppose that the shaking treatment had actually increased the production, but such a conclusion would not be correct. The fact that the five "shaken" colonies made a higher average yield than the twelve which did not swarm is doubtless accounted for by the fact that these five colonies were exceptionally strong. Had it been possible to prevent them from swarming and still retain all their brood, their production would have been even higher than it was following the shaking treatment.

### HONEY PRODUCTION OF CARNIOLAN AND ITALIANS COMPARED.

We had in this yard four Carniolan colonies which were up to full strength at the beginning of the honey-flow. They produced, respectively, 79, 98, 115 and 121 pounds of surplus during the season, or an average of 103 pounds per colony. Twenty Italian colonies, also in good condition and strong at the opening of the honey season, made an average of 121 pounds per colony. It also happened that the average production of the Carniolan colonies, 103 pounds per colony, was exactly the average production of *all* colonies, Carniolans, Italians and hybrids, in the apiary. In fairness to the Carniolans, it should be said, however, that four colonies is too small a number to give an accurate index of producing capacity. It is never possible to get even two colonies at exactly the same strength or in the same condition, hence reliable conclusions from experiments in which honey production is involved can be arrived at only by a large number of experiments and by taking the average production of a large number of colonies. We offer the above figures for what they are worth and they show that the Carniolans at least equaled the average of the yard.

It is expected that more complete data on relative production by the Carniolans and Italians will be available at the end of the coming season, as the result of experiments which are now under way and which include a larger number of colonies.

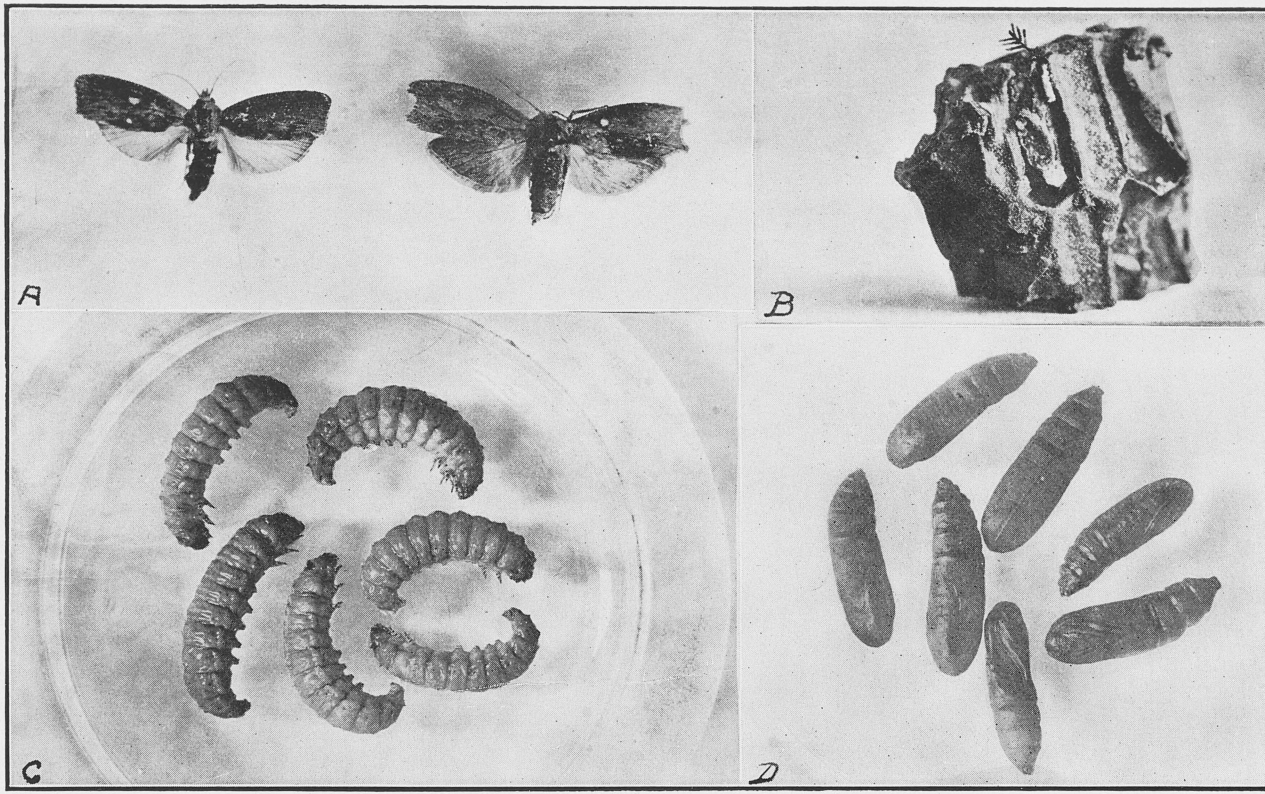


Plate II.—Life history of the bee-moth: *a*, moth; *b*, eggs on comb; *c*, larvæ; *d*, pupæ. (Original.)

# THE LIFE HISTORY AND CONTROL OF THE BEE-MOTH OR WAX-WORM.

By F. B. Paddock.

A serious hindrance to the beekeeping industry in the State of Texas, as well as in many other States, is the bee-moth (*Galleria mellonella*). Under the name of "web-worm" this pest is known to every beekeeper, but it is not as generally known that these web-worms develop, after maturity, into moths or "millers." The larvæ feed upon stored comb and honey, as well as on combs in the hive, and this makes it a difficult pest to fight successfully.

When and how this pest was introduced into Texas is not known, nor has the location of the first infestation been determined. It is evident that the dissemination has been complete, for there are few counties in the State where bees are kept that are free from the pest today. The climate of the State, with its long, hot summers and short, mild winters, greatly favors the increase of the insect and it is much harder to fight here than in many other States. In Colorado the high altitude is apparently a check on its development and in the Northeastern States the long, cold winters act as a natural check to a considerable extent.

With some beekeepers this insect is no longer considered a serious pest, for they realize that if the colony is provided with a vigorous queen and is kept strong the bee-moth cannot enter the hive to deposit the eggs which hatch into the worms. The insect has become very largely an enemy of bees in box hives and a destroyer of stored comb and honey, found often around the honey house and in piles of unused supers of comb. In large apiaries the wax and comb that is often carelessly left lying around affords sufficient food in which the insect breeds, ready to infest any weak colony in the vicinity. With many beekeepers the bee-moth is a source of continuous trouble, for if the bees are not closely watched and become queenless, the colony is sure to become infested in a very short time. If the bee-moth becomes established in a locality it is very hard to exterminate. At present the beekeepers are not able to more than check the pest, but it is hoped that a more thorough knowledge of the habits and life history will result in better control of this enemy and a reduction of the loss now suffered from its ravages.

## ECONOMIC IMPORTANCE.

What this pest is costing the beekeepers of the State is hard to determine. The price of bees, honey and wax varies in the different sections of the State. Often the loss of colonies is attributed to other causes and frequently the presence of the bee-moth is not detected. In the reports which have been received from beekeepers, no mention has been made of the loss of stored comb, but this must certainly be considerable.

The loss in some cases is very heavy. In reporting for the year 1911, 136 beekeepers reported losses varying from 5 per cent of their colonies to as high as 95 per cent. Many more beekeepers reported the presence of the bee-moth as "general," indicating that they suffered no small loss. In one very well-kept apiary that has come under the observation of the writer there is an annual loss of 3 per cent due to the bee-moth. It is safe to say that in many of the larger apiaries throughout the State this loss is not uncommon, while in the smaller apiaries and in box-hive apiaries the loss is much greater, as was indicated by the reports referred to above.

The census of 1910 shows 238,107 colonies of bees in the State, and it is generally conceded that these figures are much below the actual number. Assuming that 3 per cent is the average annual loss of colonies due to the wax-worm, including the large losses in the poorly kept apiaries, it is seen that the annual loss amounts to at least 7000 colonies. At an average valuation of $3 per colony, this amounts to $21,000 a year, a very considerable tax on the beekeeping industry of the State.

## ORIGIN AND DISTRIBUTION.

There is some dispute and no little uncertainty about the origin of the bee-moth. Dr. A. J. Cook has this to say in regard to its origin: "These moths were known to writers of antiquity, as even Aristotle tells of their injury. They are wholly of Oriental origin, and are often referred to by European writers as a terrible pest."*

The bee-moth was introduced into America about 1805, though bees had been introduced some time prior to this. The time of the introduction of the bee-moth into Texas is not known. The insect is now found in Italy, Germany, France, England, Ireland, India, Australia and in most of the beekeeping sections of the United States. This insect is distributed practically all over Texas. Following is a list of counties from which the bee-moth has been reported to us by beekeepers:

Anderson, Atascosa, Bandera, Bastrop, Bee, Bell, Bexar, Blanco, Bosque, Bowie, Brazoria, Brazos, Brooks, Brown, Burleson ,Burnet, Caldwell, Callahan, Cass, Cherokee, Coleman, Collin, Colorado, Comanche, Concho, Cooke, Coryell, Crockett, Dallas, Delta, Ellis, Erath, Falls, Fannin, Fayette, Franklin, Freestone, Gonzales, Gregg, Grimes, Guadalupe, Hamilton, Harrison, Hays, Henderson, Hill, Houston, Hunt, Jasper, Jefferson, Karnes, Kaufman, Kendall, Kerr, Kimble, Lamar, Lampasas, Lavaca, Lee, Leon, Liberty, Limestone, Llano, Madison, McCulloch, McLennan, Mason, McMullen, Medina, Milam, Mills, Morris, Navarro, Nolan, Nueces, Panola, Parker, Polk, Rains, Red River, Robertson, Rockwell, Runnels, Rusk, Sabine, San Jacinto, Schleicher, Shackelford, Smith, Stephens, Taylor, Travis, Trinity, Tyler, Uvalde, Val Verde, Waller, Ward, Washington, Wood, Wilson and Williamson.

The above list includes nearly all of the important beekeeping counties of the State. That the bee-moth is present in many more counties than are shown by our records is beyond doubt.

The larva ("web-worm"), upon reaching maturity, constructs a cocoon by means of silken threads which it is able to spin. After the cocoon is completed the larva changes to the pupal stage. This is the stage in which the form of the larva is reconstructed to make the moth which will emerge later from the cocoon. The moths mate and the females

*"Manual of the Apiary," A. J. Cook, p. 485.

deposit the eggs which hatch into the larva. This is called the "life cycle."

### THE ADULT MOTH.

The adult bee-moth (Plate II, *a*) is about five-eighths of an inch (15 millimeters) in length, with a wing expanse of about one and one-quarter inches (30 to 32 mm.). The moth with its wings folded appears ashy-gray in color, but the back third of each front wing is bronze colored, and this wing is thickly covered with fine scales which rub off easily when the moth is touched. On the outer and rear margins of the fore wing is a scanty row of short hairs. The hind wings are uniform in color, usually gray, with traces of a few black lines extending from the outer margin inward toward the base; on the outer and rear margins is a thick fringe of hairs on which is a dark line running parallel with the border of the wing. The body is brown, the shade varying, with a covering of scales. These scales rub off easily and are not always present on the older moths. The male is slightly smaller than the female. A difference between the sexes is noticed in the fore wing, which, in the case of the male, is deeply scalloped on its outer margin. This scallop carries a heavy fringe of hairs, almost black in color. Another difference is in the mouth parts, the palpi of the male being rudimentary.

#### *Habits.*

The moths emerge entirely at night, and in the cages observed no moths emerged after 9 p. m. They at once seek some protected place in which to expand their wings and dry, and by the next morning they are able to fly. During the day the moths seek a sheltered place away from light and enemies, where they apparently settle down and draw their wings around them, remaining very still and quiet. Usually they are well protected by their color, which resembles weather-beaten wood. If disturbed during the day, the moths will make a dart or short flight, acting as though blinded by the light. When an object is met, the moth quickly settles down and seems very anxious to avoid flight. That they are hard to disturb in the daytime is shown by the fact that in several of the cages used in the experiments small ants attacked the moths and killed them without any apparent struggle on the part of the moths. Only by close examination could it be detected that the moths were dead and not resting in the usual manner. It is only during the latter part of the oviposition period that the females are active during the daytime.

The male moths emerge a few days earlier than the females and are much longer lived. In several cages, closely observed, the males lived an average of twenty-six days, which was fourteen days longer than the average life of the females. The male moths are very active throughout their existence. Just how long the males are functional has not yet been determined. In some matings under artificial conditions one male fertilized two females at an interval of ten days. During the first part of the emergence period the males are in excess of the females, since the males emerge first as a general thing. Later on, the number of males and females reaching maturity at the same time is about equal. During the latter part of the emergence period the females predominate. However, for the brood as a whole, taking sometimes as long as a month for all of the individuals to reach maturity, the males and females are about equal in number.

The first and the last emerging individuals of the brood are smaller in size than the average, regardless of the sex. The quality of the food has a great deal to do with the size of the adults. The last larvæ of the brood are always under-sized, but are most always able to pupate and reach maturity. Several matings have been made with odd-sized individuals, such as large males and small females, and *vice versa*. The results of these matings indicate that those larvæ which were forced into pupation prematurely may transform to functional adults.

*Mating and Oviposition.*

During the mating period the males are more active than the females and at this time can be noticed "drumming" with their wings, the vibrations of which are, at times, sufficient to produce a low hum.

The moths probably mate very soon after emergence, though no direct observations have been made upon this point. However, females only one and one-half hours old were killed and their ovaries examined. It was found that, at this time, fully two-thirds of the eggs were of full size and well down in the oviducts, though not packed closely, as was found to be the case in the older moths. The eggs had the appearance of being ready for deposition.

Mating takes place at night, as would naturally be expected from the nocturnal habits of the species. In one cage a pair of moths was observed *in coitu* early in the morning, but this was no doubt an abnormal condition, as the female died in a short time. Another case was observed where the moths were *in coitu* from 7 p. m. till 10:30 p. m. The next morning no eggs had been deposited, but the following night the female began ovipositing. This was an exceptional case, as the female had been confined for a week after emergence before having the opportunity to mate.

It would seem that the female commences to oviposit in a comparatively short time after emergence. However, in the cages, an average of six days elapsed between the time of emergence and the first egg laying. This period varies with the different broods of the year. Oviposition usually takes place at night and the moths generally start laying the eggs soon after dark. In the cages they have been observed busily engaged in ovipositing as early as 7 p. m. While depositing eggs the female seems mindful only of the task she is performing and is not easily disturbed, though she is active, seemingly nervous, darting in and around the comb. While thus engaged the antennæ vibrate continuously and perhaps are used to locate suitable crevices in which to place the eggs. The ovipositor is long, equal in length to the last two abdominal segments, and is very slender. It is constantly moving over the comb to detect a roughened spot wherein to deposit the egg. It thus has the appearance of being dragged after the female in her travels over the comb.

Having found a suitable place for the egg, the ovipositor is spread at the tip, the female braces herself as though pushing backward to force the ovipositor into the comb, and then, after a quick jerk of the abdomen, an egg is forced down the ovipositor to its destination. In many instances females have been observed depositing their eggs at the rate of one every

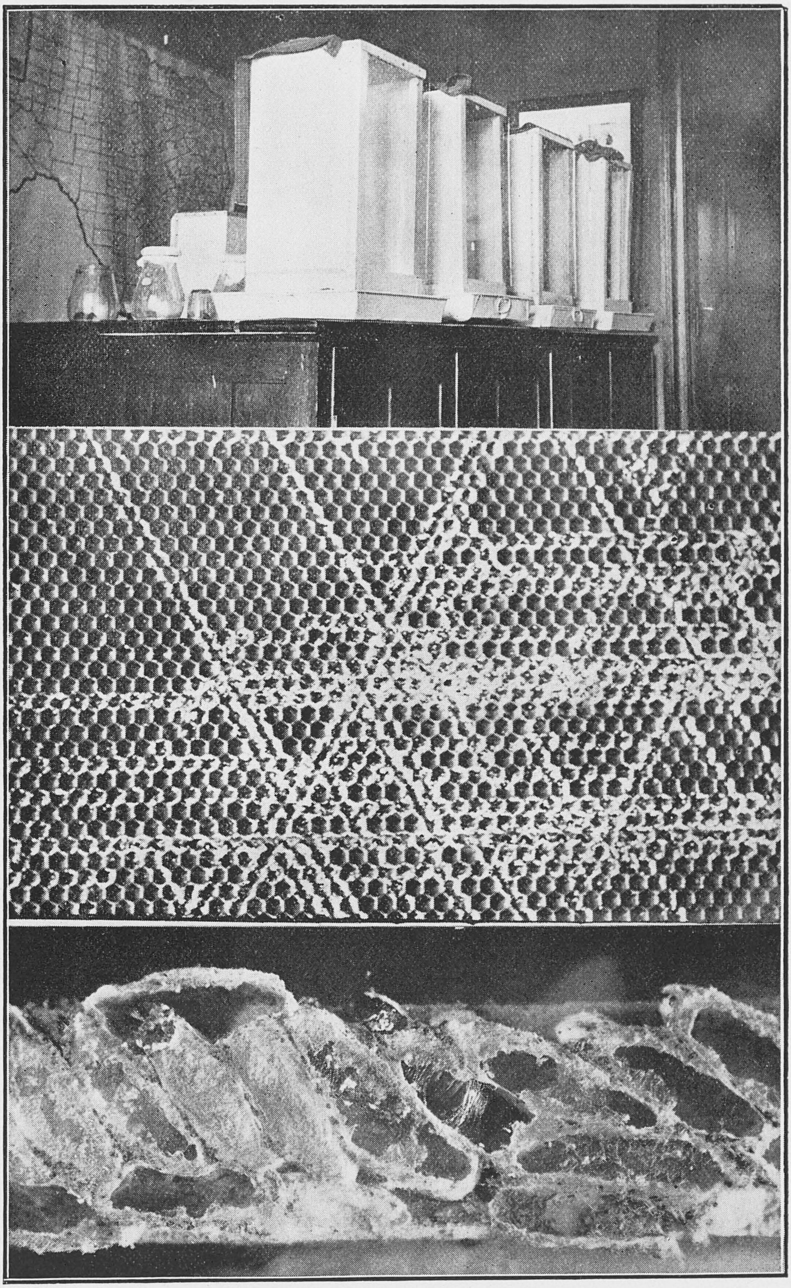

Plate III.—Above, cages used in studying the development of the bee-moth; at center, work of wax-worm, or larvæ, on comb foundation; below, mass of cocoons, one of which shows larvæ repairing damaged cocoon. (Original).

minute for a period of thirty minutes, and then, after a short rest, have continued again at the same rate. The eggs are always securely fastened to whatever object they are laid upon. The eggs are always laid in cavities. In the cage experiments this was on the side of the comb, often where the walls of a cell had been turned in. An example of this is shown at Plate II, *b*. Only one egg is deposited at a time, although in working over the comb a female often places the eggs close together. On the smaller pieces of comb, furnished to moths confined in cages, as many as seven eggs were found in a single cavity. The number of eggs actually deposited by one female has not been determined, but females which had not deposited eggs were killed and the eggs in their ovaries were counted. The largest number of eggs found in ovaries of a single female was 1128 and the average number was 1014.

In the cages, under artificial conditions, if comb was not supplied for the female, she would deposit her eggs in any rough place detected by her ovipositor. In many instances the females would refuse to oviposit on cappings which were furnished in some of the cages, but would go around the base of the lamp globe in which they were confined and fill every crevice with eggs. Sometimes these eggs would be fastend on the outside of the glass, and in such cases the globe would be fastened to its resting place.

The average time consumed in depositing the full quota of eggs varies with the brood. In the first brood it is nine days, but in the second only seven days. During the last part of the egg-laying period the female appears to be in a great hurry, and during the last two days she oviposits during the day as well as during the night, at times stopping to rest. If disturbed during the resting periods, she vigorously resumes her egg-laying. The females usually die while ovipositing and the last three or four eggs are barely extruded from the ovipositor. If a female is being killed or injured, she will attempt to oviposit even after she is unable to walk.

The females will deposit their eggs even when they have not had the opportunity to mate. In all cases where the sexes were not properly paired, the females would finally oviposit, the period of oviposition being, however, much shorter than the natural one. Although many females which did not mate were confined in cages and although they deposited eggs, none of these unfertilized eggs ever hatched. It seems a fairly safe conclusion that parthenogensis does not occur with this species.

### THE EGG.

The egg (Plate II, *b*) is elliptical, measuring about one-fiftieth of an inch (.48 mm.) in length and .43 mm. in width. The shell is pearly white in color and slightly roughened by wavy lines running across it diagonally at regular intervals. If the egg is not deposited on dark comb it is very difficult to see and even then experience is necessary to detect all of the eggs present.

The embryonic development of the egg has not been studied, but a few observations have been made upon the incubation period. Throughout this period the egg gradually changes from a white to a yellow color. About four days before hatching, the developing larva becomes visible as a dark ring inside of the shell. The perfectly formed larva can be distinctly seen for at least twelve hours before the shell bursts. During this time the larva is engaged in cutting an opening in the shell and its final emergence from the egg is made through a ragged hole in the top. After the larva is out of the shell it appears white and clear.

The egg stage of the first brood averages twelve days and of the second only ten days.

### THE LARVA.

The larvæ ("worms") when first hatched are white in color and very small, only one-eighth of an inch (3 mm.) in length. After emerging from the shell they are quiet for a short time while they are apparently drying and stretching in preparation for their work of destruction. Soon they become very active, but only upon close examination can they be seen hurrying over the comb in their attempt to gain an entrance before being detected by the bees. During this short period of one or two hours they are at the mercy of their enemies. Within a short time after hatching the first meal is taken and this consists of scales of wax which they loosen from the comb in their attempts to gain an entrance. The entrance is made at the top of the cell-wall between the cells.

The entrance is extended by the larvæ into tunnels directed toward the bottom of the cells. Their presence is now noticeable, for in their work the bits of chewed wax not used for food are pushed back of them and out of the tunnel, making the surface of the comb appear rough and poorly kept. This tunnel affords protection and food for the larvæ and also leads to their desired feeding place, the center of the comb. Usually four days are consumed in reaching this point.

When the center of the comb is reached, the larvæ leave their tunnels and wander over the bottom of the cells or, in the case of comb containing honey, tunnel along the midrib from cell to cell. If disturbed, they seek their tunnels for protection. At first only small holes are eaten through the bottoms of the cells, thus affording a passageway from cell to cell through the center of the comb, so that, if disturbed, they can pass into another cell or through several cells in their attempt to escape. In two or three days these openings are enlarged and outlined by threads of silk spun by the larvæ in their travels from cell to cell. These threads soon become numerous enough to form a silken gallery, which gives almost complete protection from the bees or other enemies. From this central gallery the feeding is extended out along the bottoms of the cells or the middle of the comb. The silk is spun wherever the larvæ go, so that very soon the bottoms of the cells are replaced by a layer of silk thread covered with excrement of the larvæ and particles of chewed wax. This condition is shown in Plate IV.

After the midrib has been eaten, the larvæ start on the walls of the cells, the ones farthest away from the light being the first that are destroyed. As this feeding continues out along the cell-walls, the threads of silk are extended to cover the new feeding ground, and not only serve to protect the larvæ, but also act as a scaffold to support the damaged cells. Soon the center of the comb appears as a mass of tangled refuse and discarded wax. This condition is also shown at Plate IV. The feeding continues until the walls are entirely eaten, but the top of the cells is

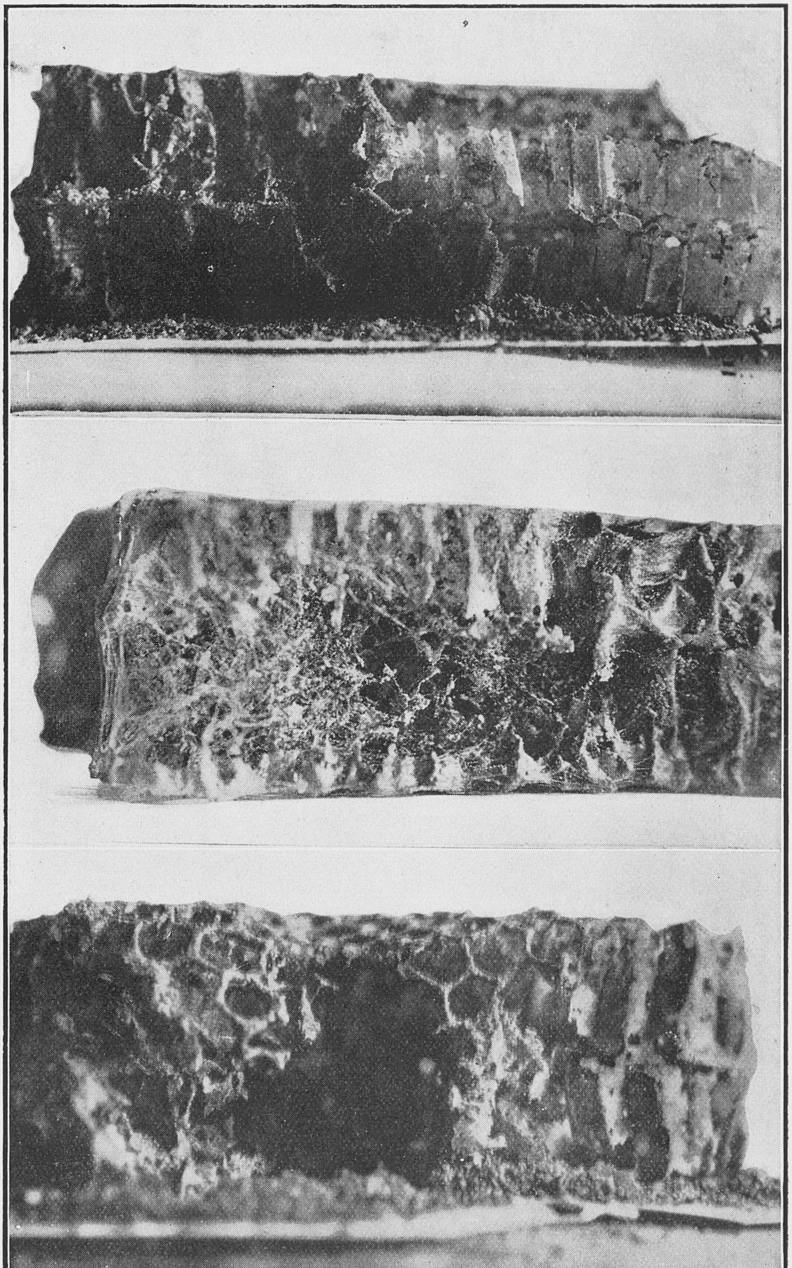

Plate IV.—Characteristic work of the wax-worm on empty comb. (Original).

BLANK PAGE IN ORIGINAL

never eaten, perhaps because this would expose them to outside influences and enemies. An example of this is shown at Plate IV, lower photo. The area of feeding is gradually extended from the point of infestation to finally include the entire comb. If the comb does not furnish sufficient food for the larvae that are present, they will begin to feed in the refuse under the comb in which there is considerable wax in small pieces. In this they construct such a large amount of web that they are absolutely protected from enemies.

The length of the larval period for the first brood is forty-five days, or about six and one-half weeks. In the second brood this period is shortened to thirty-five days, or five weeks.

The full-grown larva, shown at Plate II, *c*, is about three-fourths of an inch (18 mm.) in length. The body is large and the head is small and pointed. The general color of the body is a dirty gray, with the first segment brown on top and a broad line across it. The head is brown in color, with a light V-shaped line on top, this "V" opening towards the front of the head.

Having completed its growth, the larva seeks a place in which to pupate, though sometimes the end of the feeding gallery may be enlarged and closed to serve as a cocoon. The cocoon may also be spun in the refuse under the comb and this mass of webs affords an excellent protection to the pupa. The most common place is in some crack or corner about the hive, as shown in Plate V, *b*, or between the frames and the hive or in the "bee space" at the end of the top-bars, as is shown in Plate VI, *a*. The larva prefers to get into a place which it can chew in order that a cavity may be constructed and the cocoon thus be better protected.

Having prepared for the location of the cocoon, the larva begins to spin the silk thread about itself, starting just above the head and working backward more than the length of the body. A thin layer of silk is spun in the general shape of the cocoon and this framework is covered with fine silk from the inside. The larva is able to reverse itself within the cocoon, which it does many times during its construction. The outer layer, upon hardening, becomes very tough and even like parchment, while the inner layer remains soft and fluffy. Cocoons, both whole and broken open, are shown at Plate III, *c*, and in Plate VI. The average time consumed in the construction of the cocoon was two and one-fourth days in the case of the larvæ observed in our cages.

## THE PUPA.

As the cocoon nears completion, the larva becomes very sluggish and the body shortens. The last act of the larva is to make an incision in the cocoon near the head end which provides for the easy emergence of the moth at maturity. The average time elapsing from the completion of the cocoon to the formation of the pupa was three and three-fourths days in the cages of the experiments.

The change to the pupa takes place during the night. The newly formed pupa is white. At the end of the first twenty-four hours it turns to a straw color, very light at first, deepening slowly. By the end of the fourth day the pupa is light brown and this color gradually deepens, so that by the end of the pupal period the insect is a dark brown. (Plate II, *d.*) The male pupæ average 14 millimeters (about two-thirds of an inch) in length and the female pupæ are fully 16 millimeters in length. A row of spines arises just back of the head and extends to the fifth abdominal segment; the body line is somewhat curved downward. The time from the formation of the pupa to the emergence of the moth was seven and three-fourths days in the cage experiments.

The total time from the starting of the cocoon to the emergence of the moth averages two weeks.

### LIFE HISTORY.

From the work which we have done in trying to identify the different broods, or generations, of this insect, it appears that there are three broods in the extreme southern part of the United States. The third brood is not nearly as large as the first two, due to the fact that some of the second brood of larvæ do not pupate until late fall. There is a decided overlapping of the generations, which makes it difficult to determine the exact number of broods a year. At most any time, from early spring until December, examination of a colony of bees is likely to reveal this insect in all stages. It is often assumed that the life history is short and that there are several generations each year.

In well-protected hives the development may continue throughout the year without interruption. Usually the winter is passed with about one-third of the insects in the pupal stage and the remainder in the larval stage. Warm spells during the winter cause some of the moths to emerge from their cocoons; in the laboratory many moths emerged when the temperature was maintained constantly at 60 degrees F. It is not unusual to see moths on the windows of the honey house, trying to escape, during the warm spells in December and January. Their presence may be accounted for on the supposition that they have just emerged from their cocoons or they may have been in hibernation as adults and become active with the rise in temperature. Such moths do not reproduce in localities where freezing temperatures are frequent. Even the most vigorous moths cannot withstand a freezing temperature for more than three days. Moths in well-protected places can survive an outside temperature as low as 26 degrees F. for as long as five days. The moths are never active during the day when the temperature is below 50 degrees F., so at such times reproduction does not take place.

For College Station, Texas, the following life history and duration of broods has been carefully determined.

The maximum number of moths which mature from the over-wintering larvæ and pupæ appear about the first of April. These moths are active for some time before any eggs are deposited and it is the middle of April before the eggs are laid for the first brood of larvæ. Usually twelve days are required for the eggs of this brood to hatch, so by the first of May most of the first brood of larvæ are out. The larval period of this brood is quite long, most of them feeding at least forty-five days before completing their growth. A majority of the larvæ of the generation are ready to pupate by the middle of June, but there is a considerable variation in the rate of growth, for some of these larvæ feed for six weeks longer before attaining their full size. The pupation of the first brood takes

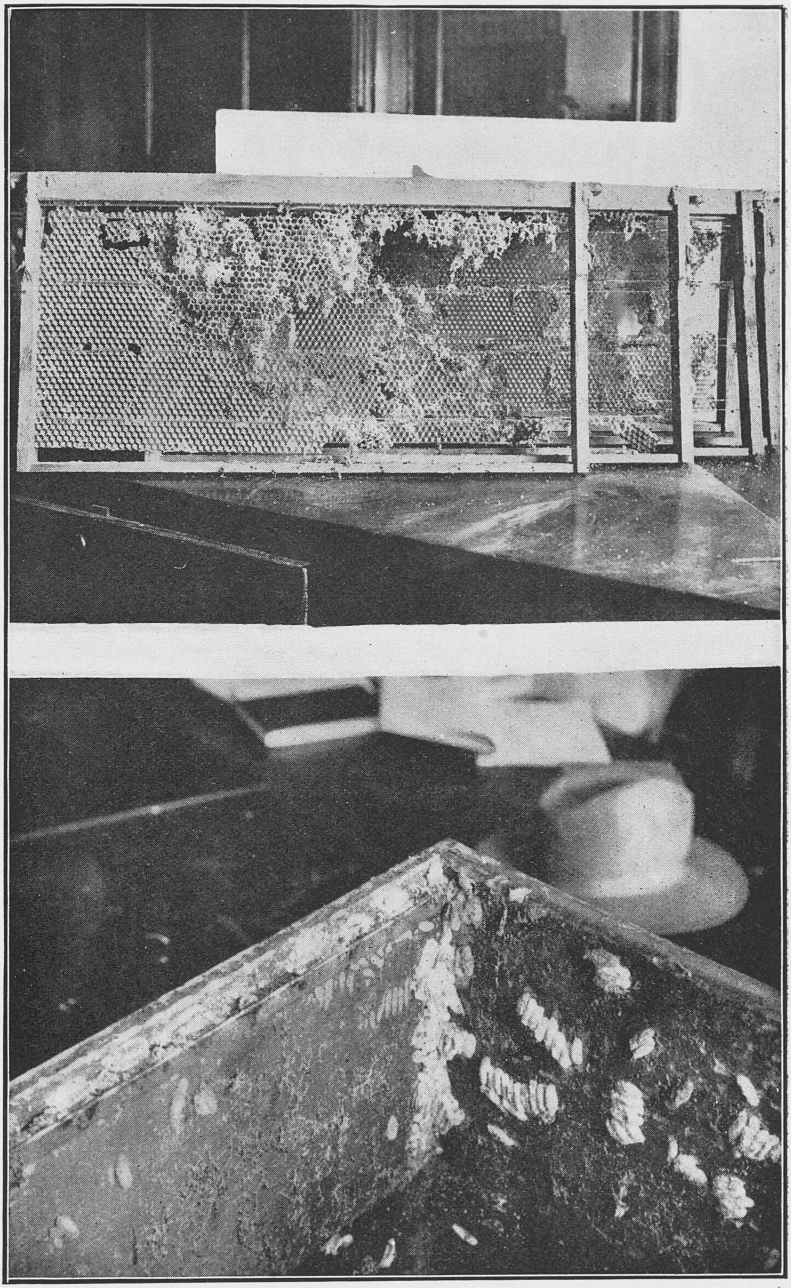

Plate V.—Above, comb and foundation destroyed by wax-worm; below, characteristic appearance of cocoons inside of bee hive. (Original.)

BLANK PAGE IN ORIGINAL

place during the last two weeks in June and by July 1st some of the moths of the second generation are to be seen.

The moths of this generation emerge at about the same time and give the impression of constituting a very large brood. Most of the eggs are laid very soon after emergence of the moths and by the middle of July all of the eggs of the second generation are deposited. The higher temperature at this time of the year shortens the egg period, only ten days being required for these eggs to hatch. There is a considerable variation in the maturing of this brood of larvæ. Normally the larval period is shorter than for the first brood and by the first of September many of the larvæ are full grown. Some of the larvæ may continue to feed for four weeks longer and then pupate.

Some of the larvæ which mature early in September may pass through a short larval stage and soon emerge as moths. This accounts for the appearance of a number of moths about the first of October. This brood is usually small and scattered and many of the larvæ which result from the eggs of these moths seldom reach full size. Some of the larvæ of the second generation do not pupate during the fall, but live over the winter in the larval stage and pupate the following spring.

The following summary shows the stages which normally occur each month of the year at College Station, Texas:

April: Moths reach maturity from the over-wintering larvæ and pupæ.
Eggs are deposited.

May: Eggs hatch.
Larvæ are about three-fourths grown.

June: Larvæ reaching maturity.
Some pupæ.

July: Pupæ.
Adults of the second generation.
Eggs deposited by the second generation of moths.

August: Larvæ of the first generation.
Pupæ of the first generation.
Moths of the second generation.
Eggs of the second generation.
Larvæ of the second generation.

September: Pupæ of the first generation.
Moths of the second generation.
Eggs of the second generation.
Larvæ of the second generation.
Moths of the third generation.
Eggs of the third generation.

October: Larvæ of the second generation.
Pupæ of the second generation.
Moths of the third generation.
Eggs of the third generation.

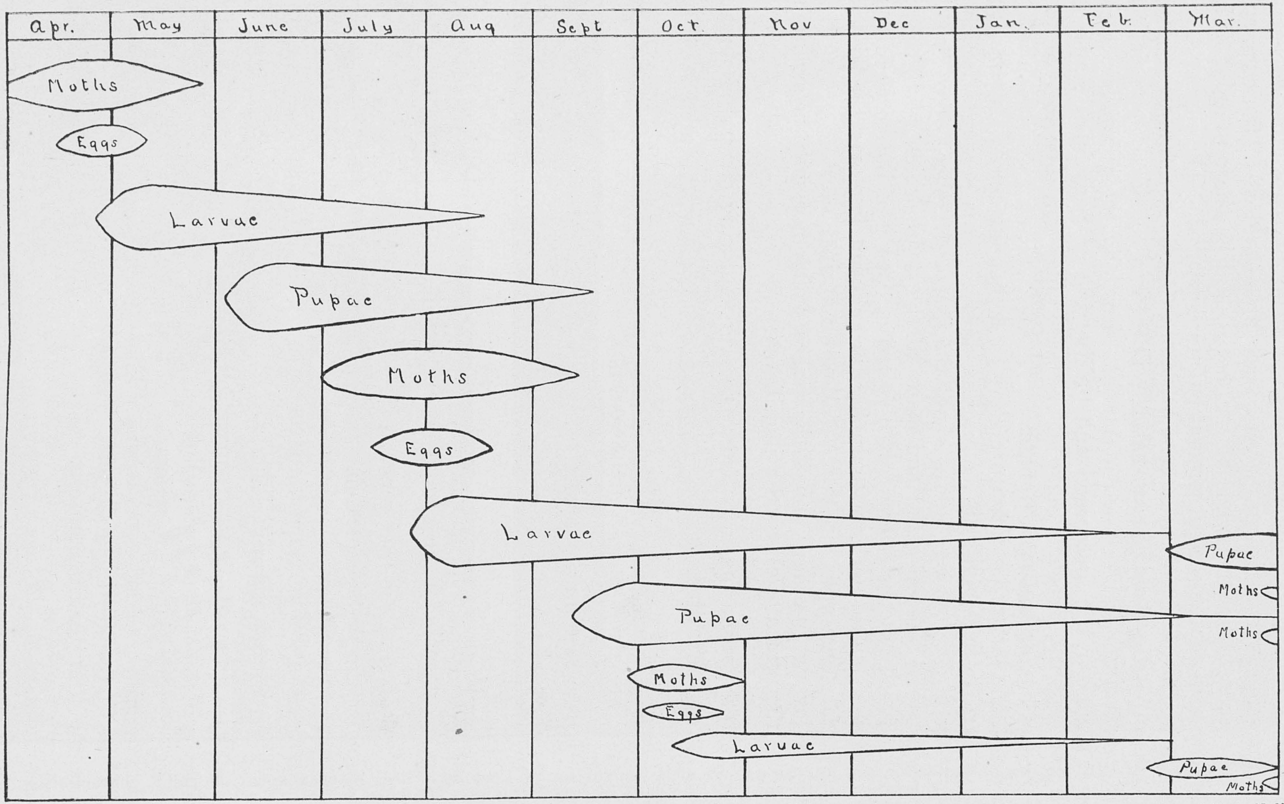


Fig. 1—Life history of the bee-moth at College Station, Texas. (Adapted from Titus, "Control of the Alfalfa Weevil," Utah Experiment Station, Circular No. 10.)

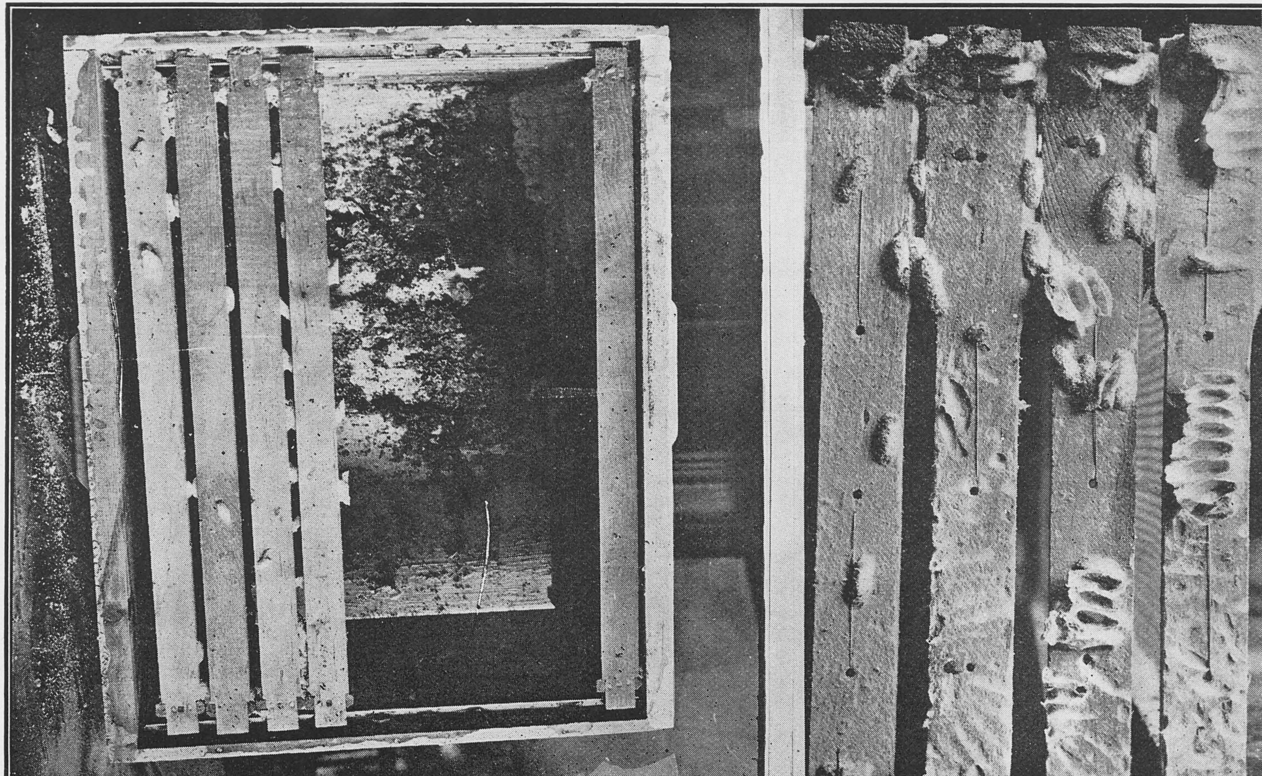

Plate VI.—At left, cocoons of wax-worm and interior of hive after destruction of a colony of bees by wax-worm; at right, characteristic location of cocoons on the ends of brood frames. (Original.)

November: Larvæ of the second generation.
Pupæ of the second generation.
Larvæ of the third generation.

December: Same stages as during November.

January: Same stages as during November.

February: Same stages as during November.

March: Pupæ.

NATURAL ENEMIES.

Of the natural enemies of the bee-moth, the most important is the honey-bee itself. It is a well-established fact that if the colony be kept strong, healthy and with a vigorous queen, it will defend itself against the bee-moth. This is particularly true in the case of "Italian" bees. "In the *Ohio Cultivator* for 1849, page 185, Micajah T. Johnson says: 'One thing is certain: if the bees, from any cause, should lose their queen, and not have the means in their power of raising another, the miller and the worms soon take possession. I believe no hive is destroyed by worms while an efficient queen remains in it.' This seems to be the earliest published notice of this important fact by an American observer."*

This fact is of vital importance in the fight against the bee-moth, for if the pest can be kept from its favorite food, control measures are made much easier. The fact that the bees under natural conditions are able to defend themselves should leave the problem of control to such means as will destroy the pest in places other than the hives. Recently it has been found advantageous to introduce Italian blood into the colony, as the workers of this race seem to be more efficient fighters of the bee-moth. In most cases this is sufficient for the control of the pest in the colonies, but it must be remembered that the colony cannot be kept under close observation and maintained at full strength unless domiciled in a frame hive.

A small red ant, *Solenopsis sp.*,† has been found to be an enemy of the bee-moth, as many of our cage experiments were destroyed by this ant killing the moths and larvæ. The attack is made on the moths during the day or when they are at rest. Usually the ants crawl under the wings of the moth and begin the attack upon the abdomen. There is no apparent struggle on the part of the moth, for close examination is necessary to determine that the moth is dead and not resting. The abdomen seems to be all that is desired, and this is carried away in small pieces to the nest of the ants. This same species of ant also destroyed moths which had recently been prepared for exhibits. At such times only the abdomen was taken by the ants. In their attacks on the larvæ the ants entered the cages and crawled over the comb and wax in search of their prey and if any larvæ were exposed they were attacked. The larger larvæ are more frequently attacked, as they are less active and usually feed in more exposed places than do the smaller ones. Unless the larvæ were well protected by webs in the refuse, they were destroyed by the ants. Appar-

---

*Langstroth on the Hive and Honey Bee, by Chas. Dadant, p. 469.

†Determined by Mr. Wilmon Newell.

ently there are days and even parts of days when the ants are most active in their destruction. Never were the ants present in sufficient numbers to attempt tracing them to their nests. No observations have been made upon this ant in or about the apiary, and, while it proved very destructive under artificial conditions, the moths and larvæ might be better able to protect themselves under natural conditions.

Three hymenopterous parasites have been recorded from the bee-moth. One is a chalcid, *Eupelmus cereanus,* found by Roudani in Italy; another is *Bracon brevicornis,* which was found by Marshall in France, and a third species, *Apenteles lateralis,* was recently found by A. Conté in France.* This last species was found near Lyons, where it spread very rapidly. It is apparently of considerable importance since it has also been reported to attack the larvæ of several other moths in England and Germany. The adult parasite is about one-sixth of an inch (4mm.) in length, very lively, and avoids light; the body is black and the wings are transparent, with black specks. The larvæ of the bee-moth are attacked while quite young and never attain a large size. A single parasite develops in each larva. The bees are said to pay no attention to the presence of the parasite, so that it can easily enter the hive in search of the bee-moth larvæ. It was artificially introduced into hives by Conté with very satisfactory results.

### ARTIFICIAL CONTROL.

Unfortunately, the only natural enemy of the bee-moth that is present to any great extent in Texas is the honey-bee itself. In the absence of any other natural enemies of importance, the measures of artificial control must be made all the more effective if the beekeeper is to free his apiary of the pest. If the moths are driven from the hives by strong colonies of Italianized bees, they will surely seek scraps of comb and wax about the ground and stored comb and honey in the honey house. It seems quite likely that in such cases the eggs are deposited as near to the comb as possible, as along the cracks between the supers, and the larvæ, after hatching, find their way to the comb through crevices much smaller than the moth could enter.

One of the best methods of artificial control, and one upon which many beekeepers depend, is fumigation of combs and honey. Gas is able to penetrate material that it is not possible to treat in any other manner. The fumigation process is not difficult, for, when once started, no further attention is necessary until the treatment is complete. It is not necessary to watch the entire process. Stored material, such as comb honey and empty combs, should be examined from time to time, and at the first evidence of the wax-worm they should be fumigated. Stored material of this kind should be examined at least once every week during the summer and once every month during the winter season, so as to detect the infestation at the start.

### FUMIGATION.

In the present investigation two materials have been used in the fumigating experiments. These were selected because most every beekeeper

*"A Hymenopterous Parasite of the Bee-Moth," A Conté (*Compt. Rend. Acad. Sci. Paris,* 154, pp. 41, 42.)

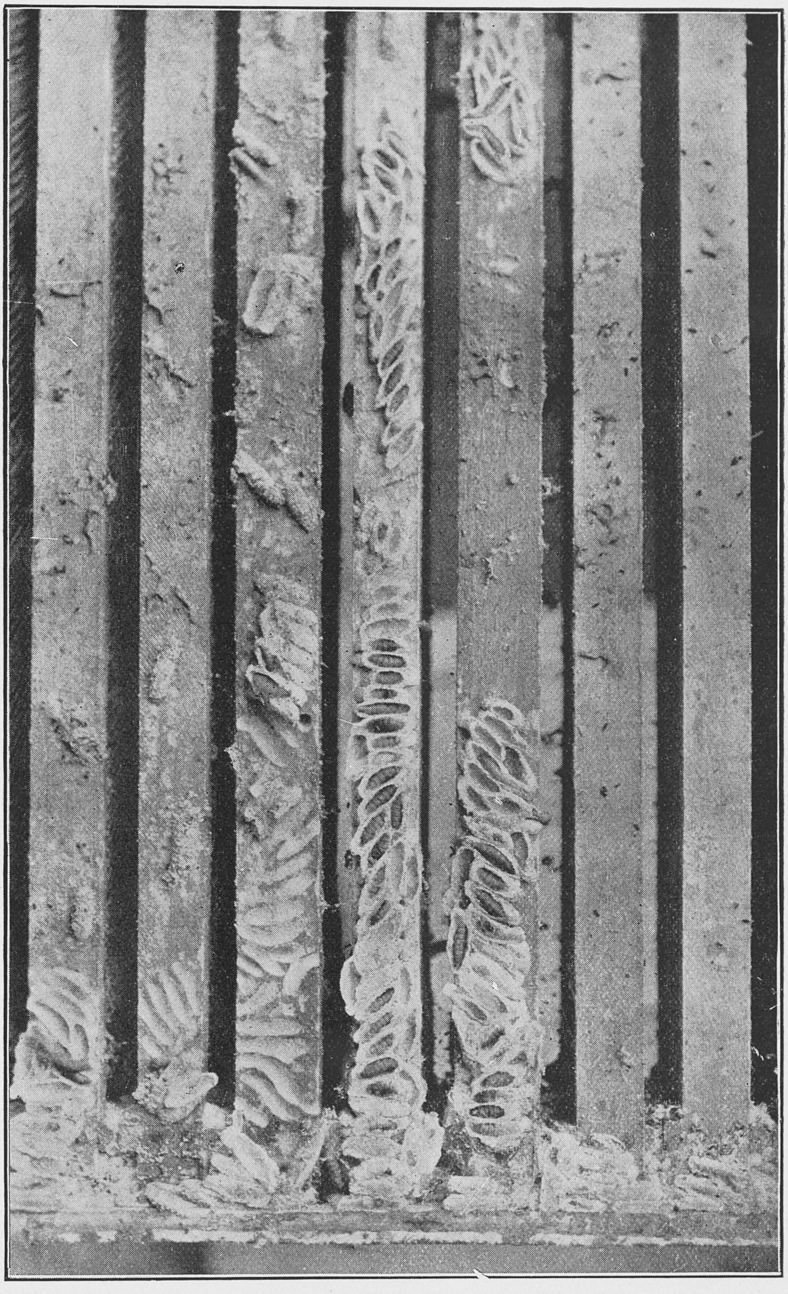

Plate VII.—Appearance of infested hive with cover removed, showing cocoons broken open and the larvæ inside of them. (Original.)

BLANK PAGE IN ORIGINAL

is acquainted with them and they can be obtained in practically every locality at a reasonable price. They are sulfur and carbon bisulfide, or "high-life."

*Sulfur.*

Dry powdered sulfur, or "flowers of sulfur," is a light yellowish powder, with which every one is familiar. When sulfur is burned it unites with the oxygen of the air and forms a poisonous gas known as "sulfur dioxide." This gas is quite effective in killing some kinds of insects, including the wax-worm. A common method of burning the sulfur is to place it on a pan of red-hot coals and immediately tier up the infested supers over the burning sulfur. The bottom super should not contain any infested material and the pile should be covered as quickly as possible. A number of experiments were made with sulfur for fumigating combs containing the wax-worms. The results of these experiments are given in the following table:

*Table I.—Results of Fumigating Infested Combs with Sulfur Dioxide.*

| Stage of Bee-moth. | Amount of Sulphur Used per Cubic Foot. | Time the Combs Were Confined in Fumes. | Effect. |
|---|---|---|---|
| Larvae | One-fourth ounce | One hour | Killed. |
| Larvae | One-half ounce | One hour | Killed.* |
| Larvae | Two-thirds ounce | One hour | Killed.* |

The larvæ which were used for these experiments were ten to twenty days old and in every case they were well protected by the webs and refuse.

From the experiments with sulfur dioxide it is evident that only extremely large doses will affect the eggs of the bee-moth—so large, in fact, that such fumigation would not be practical.

The larvæ which were used in the experiments were of different ages and some were better protected than others. When the larvæ are not very well protected they are quite susceptible to the gas, but the larger larvæ, which are often enclosed in a mass of webs, are not killed except when extremely large doses of sulfur are used.

These results seem to indicate that the sulfur fumes are not ordinarily penetrating enough to affect the eggs, and only when the larvæ are young and not well protected will the gas affect them. While the method is simple, there are minor details upon which the success of the operation depends. The sulfur must be burned at a high temperature in order to generate the most effective gas. While the method is generally effective under proper conditions, it cannot be recommended in preference to fumigation with carbon bisulfide.

*Carbon Bisulfide ("High Life").*

The commercial bisulfide is an oily liquid, very volatile and exceedingly foul-smelling. It is cold to the touch and because of its rapid evaporation it produces a freezing sensation when dropped on the skin. When exposed to air at ordinary temperatures the bisulfide changes to a gas quite

*Eggs which were present on these combs were not killed by the sulfur dioxide as larvæ were found hatching a few days after the fumigation.

rapidly, and this gas, or vapor, is a little more than two and one-half times as heavy as air. This is a point to be remembered in its use, since it goes first to the bottom of whatever it is confined in. When mixed with air it becomes highly inflammable and sometimes explosive. Such a mixture of air and bisulfide gas may be exploded by even a spark, such as might be made by hitting a nail with a hammer. The liquid, on evaporation, leaves a residue of impurities. Its rate of evaporation is in proportion to the temperature and the area of the exposed surface. Its efficiency is greatest with rapid evaporation, and this is secured in relatively warm weather, but artificial heat *must never* be used to hasten its change into gas. Carbon bisulfide is obtainable from practically every druggist.

When carbon bisulfide is to be used for fumigation of infested material, the greatest precaution should be used to keep all fire, such as lights, cigarettes, etc., away from the liquid and where it is being used. For this reason it is well to take the material that is to be fumigated to some place out of doors and at least a hundred feet away from any building. The infested material should be placed in supers or hive-bodies if possible. These are piled as high as is convenient and all cracks between the supers made as nearly gas-proof as possible. Especially should the bottom be tight. A good plan is to place an inverted hive cover on the ground, lay a piece of canvas over it, and then tier up the supers on this. After the pile has been completed, an empty super should be put on top. In this should be placed a large shallow pan into which the bisulfide is to be poured. When all is in readiness, pour the bisulfide into the pan and immediately put a hive cover on the top of the tier to confine the gas. This operation is best performed in the evening and the pile of supers should be left intact until the following morning. When the supers are taken down the confined gas will escape from them immediately, even before they can be carried, separately, into a building.

The results of fumigating infested material with carbon bisulfide is shown in the following table:

BLANK PAGE IN ORIGINAL

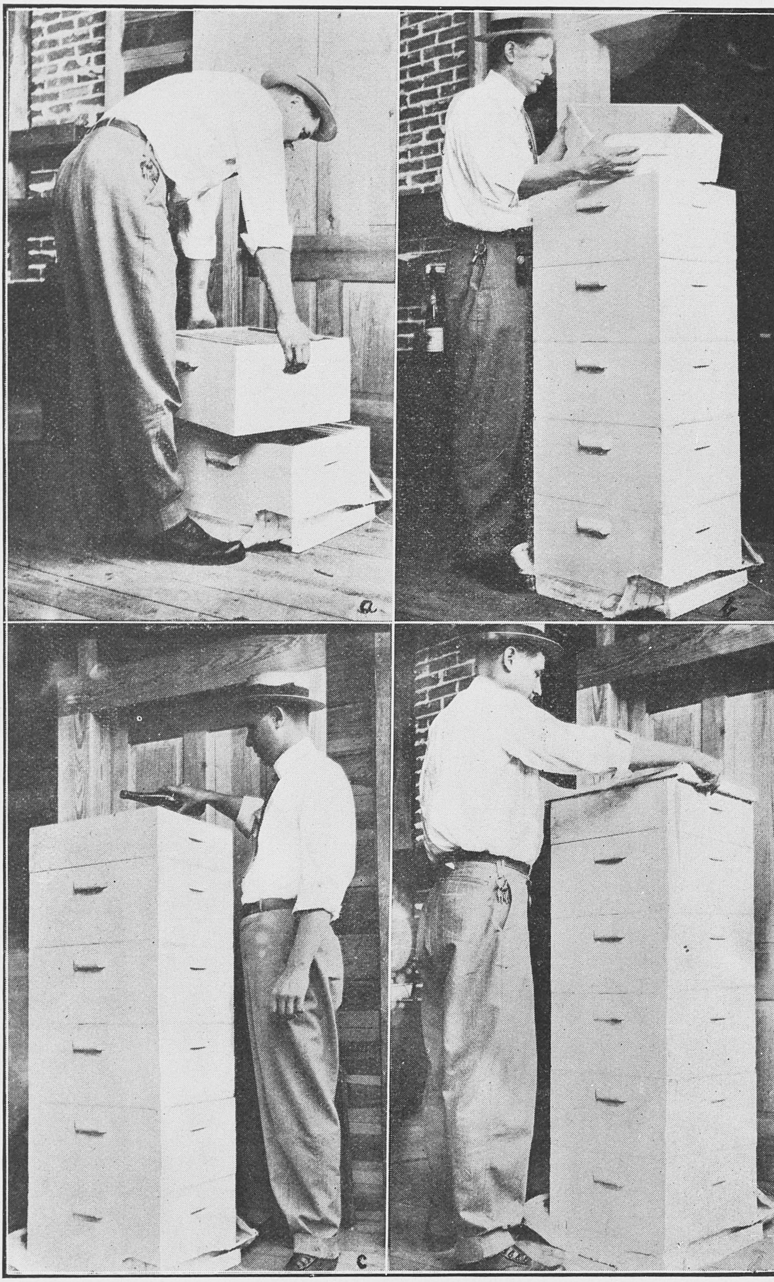

Plate VIII.—The process of fumigating hive-bodies of infested combs with carbon bisulfide: *a*, tiering up the bodies; *b*, placing an empty super on the top of the tier; *c*, pouring out the bisulfide; *d*, putting on the cover to confine the gas. (Original.)

*Table II.—Results of Fumigating Infested Combs with Carbon Bisulfide.*

| Stage of Bee-moth. | Amount of Liquid Carbon Bisulfide Used per Cubic Foot. | Time of Confinement. | Effect. | Remarks. |
|---|---|---|---|---|
| Moth | One-half ounce | 15 minutes | Killed | |
| Moth | Two-thirds ounce | 20 minutes | Killed | The moth was unable to walk within 10 minutes after being confined. |
| Moth | Three-eighths ounce | 20 minutes | Killed | The moth was unable to walk within 10 minutes. Not all the bisulfide evaporated. |
| Moth | One-fourth ounce | 20 minutes | Killed | The moth was dead before all the bisulfide evaporated. |
| Pupae | One-sixth ounce | 24 hours | Killed | Several larvae in cocoons were also killed. |
| Pupae | One-fourth ounce | 24 hours | Killed | Several larvae in cocoons were also killed. |
| Pupae | Three-eighths ounce | 24 hours | Killed | Several larvae in cocoons were also killed. |
| Pupae | One-half ounce | 24 hours | Killed | Several larvae in cocoons were also killed. |
| Larvae (in cocoons) | One-eighth ounce | 24 hours | Killed | Some died in 1 hour, in the cocoon. |
| Larvae (in cocoons) | One-fourth ounce | 24 hours | Killed | Some died in 1½ hours in the cocoon. |
| Larvae (in cocoons) | Five-eighths ounce | 24 hours | Killed | |
| Larvae (exposed)* | One-sixth ounce | 24 hours | Killed | Larvae were 10 days old and well protected. |
| Larvae (exposed)* | One-eighth ounce | 24 hours | Killed | These were 5 days old and well protected in webs. |
| Larvae (exposed)* | One-eighth ounce | 24 hours | Killed | These were 25 days old and protected. |
| Larvae (exposed)* | One-fourth ounce | 24 hours | Killed | These were 20 days old and fairly well protected. |
| Larvae (exposed)* | One-fourth ounce | 24 hours | Killed | These were 20 days old and exposed. |
| Larvae (exposed)* | One-fourth ounce | 24 hours | Killed | These were 12 days old and exposed. |
| Larvae (exposed)* | One-half ounce | 24 hours | Killed | These were 15 days old and fairly well protected. |
| Larvae (exposed)* | Three-fourths ounce | 24 hours | Killed | Eggs were present which hatched afterwards. |
| Larvae (exposed)* | Three-fourths ounce | 24 hours | Killed | Eggs were present; hatched afterwards. |
| Larvae (exposed)* | One ounce | 24 hours | Killed | Eggs were present; hatched afterwards. |
| Larvae (exposed)* | One ounce | 24 hours | Killed | Eggs were present; hatched afterwards. |
| Larvae (exposed)* | One ounce | 24 hours | Killed | |

In all the experiments conducted, the eggs of the bee-moth were uninjured by the fumes of carbon bisulfide. It is possible that in cases of extremely large doses the eggs may be injured.

A number of experiments were conducted to determine the effect of the fumes of carbon bisulfide upon the larvæ. Comb containing larvæ of various ages and different degrees of protection were fumigated. Many experiments were made with the larvæ in cocoons, and these showed that carbon bisulfide is very effective. The larvæ which are hardest to kill are those about three-fourths grown and well protected in a mass of webs and refuse. Ordinarily the larvæ succumb to the average dose of carbon bisulfide in a comparatively short time. The outcome of the experiments demonstrated the effectiveness of carbon bisulfide for the destruction of the larvæ.

Several experiments were conducted to determine the effect of carbon

*These larvæ were feeding in empty combs.

bisulfide upon the pupæ. It was found that they are quite susceptible, but a long exposure to the fumes is necessary, as the pupæ do not consume air very fast.

From the experiments conducted with the moths it was found that they are very susceptible to the fumes of carbon bisulfide. With the average dose the moths were overcome in ten to fifteen minutes and were killed in fifteen to twenty minutes after being confined.

All fumigation should be allowed to continue for at least twelve hours, for those larvæ which are best protected by webs and refuse will not be killed unless plenty of time is given for the gas to penetrate the material. The liquid will evaporate in a few hours, but the resulting gas will be effective for several hours.

The following table has been prepared to show at a glance how much liquid carbon bisulfide is required for the effective fumigation of supers and hive-bodies containing infested material.

*Table III.—Amount of Carbon Bisulfide to Use in Fumigating Supers for the Wax-Worm.*

Shallow Extracting ("Ideal") Supers, 10-Frame Size, Depth, 5 3-8 Inches.

| Number of Supers in the Tier. | Cubic Feet Contained in Tier. | Amount of Liquid Bisulfide Required. |
|---|---|---|
| 2 | 1.74 | One-third ounce. |
| 3 | 2.61 | One-half ounce. |
| 4 | 3.48 | Three-fourths ounce. |
| 5 | 4.35 | One ounce. |
| 6 | 5.22 | One and one-fourth ounces. |
| 7 | 6.09 | One and one-half ounces. |
| 8 | 6.96 | One and three-fourths ounces. |
| 9 | 7.83 | Two ounces. |
| 10 | 8.70 | Two and one-fourth ounces. |
| 11 | 9.57 | Two and one-half ounces. |
| 12 | 10.44 | Two and three-fourths ounces. |

*Table IV.—Amount of Carbon Bisulfide to Use in Fumigating Hive Bodies for the Wax-Worm.*

Hive Bodies (10-Frame), Depth 9½ Inches.

| Number of Bodies in the Tier. | Cubic Feet Contained in Tier. | Amount of Liquid Bisulphide Required. |
|---|---|---|
| 2 | 2.90 | Two-thirds ounce. |
| 3 | 4.35 | One ounce. |
| 4 | 5.80 | One and one-third ounces. |
| 5 | 7.25 | One and two-thirds ounces. |
| 6 | 8.70 | Two ounces. |
| 7 | 10.15 | Two and one-third ounces. |
| 8 | 11.60 | Two and two-thirds ounces. |

For 8-frame supers and hive-bodies use 80 per cent as much bisulfide as is given above for the corresponding number of supers or bodies.

Example: We will suppose that the beekeeper has six 10-frame shallow extracting supers containing combs which he wishes to fumigate. All are tiered up as previously directed and an empty super is placed on top. This makes seven supers in all. Reference to the above table shows that this tier of seven supers contains 6.09 cubic feet of space and that for the destruction of all of the wax-worms in it, one and one-half ounces of the liquid bisulfide are required.

# A STATISTICAL STUDY OF TEXAS BEEKEEPING.

By William Harper Dean.

Recognizing the importance of the role played by beekeeping in the development of Texas' natural resources, and the growth of this industry during recent years, the State Entomological Department has undertaken to gather such statistics as would give a clear insight to the present status of apiculture in the State.

In studying the figures and summaries which follow on succeeding pages, the reader should bear in mind the fact that while these figures are authentic and accurate as far as they go, they do not represent the status of the industry in its entirety.

They are incomplete. There is hardly a system of mail canvass for statistics that is not faulty and that fails to get complete returns. The personal equation is a factor to be reckoned with; there are many beekeepers who do not consider their operations of sufficient scope to warrant their making out a report; many forget to send them; many are lost in the mails.

However, the fact remains that with detailed reports from upwards of 3000 active beekeepers situated in every part of the State, figures are sufficient for deducting some valuable conclusions and establishing important facts.

In the beginning, this department built up a list of 5788 presumably active beekeepers. To each of these was sent a letter asking for a detailed report of the status of his business for the year 1911. Report blanks and return stamped envelopes were included with these requests for information. In an effort to curtail the number of delinquent correspondents in this canvass, follow-up letters were mailed to all those who had failed to respond to the initial request for reports. These letters brought in a great many reports. Finally post cards were mailed to all who still had not responded, and after the returns from this final effort were all in, the remaining names not heard from were eliminated from the "active list." The result, as stated above, was that the original 5788 names were reduced to 2733, the figures from whose reports for the year 1911 constitute the basis for this digest.

## TABLE I.—NUMBER AND VALUE OF COLONIES REPORTED, BY COUNTIES.

The following tabulation of hives and their value by counties is based upon actual reports received, the valuation of $5 apiece for colonies in movable frame hives and $1 apiece for colonies in box hives, or "gums," being placed by this Department. Such valuations, especially in the case of colonies in movable frame hives, are low—conservative, to say the least, in view of the fact that in recent years full colonies in movable frame hives have brought in Texas from $7.50 to even as high as $10 apiece.

| County. | No. Box Hives. | Value. | No. Frame Hives. | Value. | Total Hives. | Total Value. |
|---|---|---|---|---|---|---|
| Anderson | 48 | $ 48.00 | 61 | $ 305.00 | 109 | $ 353.00 |
| Atascosa | 76 | 76.00 | 3,430 | 17,150.00 | 3,506 | 17,226.00 |
| Austin | 19 | 19.00 | 492 | 2,460.00 | 511 | 2,479.00 |
| Bandera | 4 | 4.00 | 68 | 340.00 | 72 | 344.00 |
| Bastrop | 73 | 73.00 | 190 | 950.00 | 263 | 1,023.00 |
| Baylor | ........ | ........ | 4 | 20.00 | ........ | 20.00 |
| Bee | 125 | 125.00 | 4,962 | 24,810.00 | 5,087 | 24,935.00 |
| Bell | 117 | 117.00 | 1,169 | 5,545.00 | 1,268 | 5,662.00 |
| Bexar | 42 | 42.00 | 3,872 | 19,360.00 | 3,914 | 19,402.00 |
| Blanco | 22 | 22.00 | 131 | 655.00 | 153 | 677.00 |
| Bosque | 94 | 94.00 | 588 | 2,940.00 | 682 | 3,034.00 |
| Brewster | 41 | 41.00 | 21 | 105.00 | 62 | 146.00 |
| Bowie | 3 | 3.00 | 54 | 273.00 | 57 | 276.00 |
| Brazoria | 26 | 26.00 | 1,300 | 6,500.00 | 1,326 | 6,526.00 |
| Brazos | 39 | 39.00 | 729 | 3,645.00 | 768 | 3,684.00 |
| Brooks | ........ | ........ | 308 | 1,540.00 | 308 | 1,540.00 |
| Brown | 12 | 12.00 | 260 | 1,300.00 | 272 | 1,312.00 |
| Burleson | 18 | 18.00 | 453 | 2,265.00 | 471 | 2,283.00 |
| Burnet | 125 | 125.00 | 160 | 800.00 | 285 | 925.00 |
| Caldwell | 110 | 110.00 | 423 | 2,115.00 | 533 | 2,225.00 |
| Callahan | 105 | 105.00 | 205 | 1,025.00 | 310 | 1,135.00 |
| Cameron | 9 | 9.00 | 665 | 3,325.00 | 674 | 3,334.00 |
| Camp | ........ | ........ | 285 | 1,425.00 | 285 | 1,425.00 |
| Cass | 23 | 23.00 | 26 | 130.00 | 49 | 153.00 |
| Cherokee | 44 | 44.00 | 61 | 305.00 | 105 | 349.00 |
| Coke | 9 | 9.00 | 9 | 45.00 | 18 | 54.00 |
| Coleman | 90 | 90.00 | 237 | 1,185.00 | 363 | 1,275.00 |
| Collin | 9 | 9.00 | 141 | 705.00 | 150 | 714.00 |
| Colorado | 18 | 18.00 | 75 | 375.00 | 93 | 393.00 |
| Comal | 53 | 53.00 | 646 | 3,230.00 | 699 | 3,283.00 |
| Comanche | 52 | 52.00 | 148 | 740.00 | 300 | 792.00 |
| Concho | 51 | 51.00 | 466 | 2,330.00 | 517 | 2,381.00 |
| Cooke | 2 | 2.00 | 118 | 590 00 | 120 | 592.00 |
| Coryell | 86 | 86.00 | 688 | 2,440.00 | 774 | 3,526.00 |
| Crockett | 7 | 7.00 | 56 | 280.00 | 63 | 287.00 |
| Dallas | 38 | 38.00 | 376 | 1,880.00 | 414 | 1,918.00 |
| Delta | 13 | 13.00 | 379 | 1,895.00 | 392 | 1,908.00 |
| Denton | ........ | ........ | 22 | 110.00 | 22 | 110.00 |
| DeWitt | 1 | 1.00 | 42 | 210.00 | 43 | 211.00 |
| Dimmit | ........ | ........ | 693 | 3,465.00 | 693 | 3,465.00 |
| Eastland | 7 | 7.00 | 40 | 200.00 | 47 | 207.00 |
| Edwards | ........ | ........ | 151 | 755.00 | 151 | 755.00 |
| Ellis | 49 | 49.00 | 874 | 4,370.00 | 923 | 4,419.00 |
| El Paso | 5 | 5.00 | 880 | 4,400.00 | 885 | 4,405.00 |
| Erath | 70 | 70.00 | 42 | 210.00 | 112 | 280.00 |
| Falls | 26 | 26.00 | 533 | 2,665.00 | 559 | 2,691.00 |
| Fannin | 2 | 2.00 | 330 | 1,650.00 | 332 | 1,652.00 |
| Fayette | 84 | 84.00 | 405 | 2,025.00 | 489 | 2,109.00 |
| Fisher | 5 | 5.00 | 13 | 65.00 | 18 | 70.00 |
| Fort Bend | ........ | ........ | 52 | 260.00 | 52 | 260.00 |
| Franklin | 3 | 3.00 | 39 | 195.00 | 42 | 198.00 |
| Freestone | 93 | 93.00 | 346 | 1,730.00 | 439 | 1,823.00 |
| Frio | 67 | 67.00 | 2,947 | 14,735.00 | 3,014 | 14,802.00 |
| Galveston | ........ | ........ | 16 | 80.00 | 16 | 80.00 |
| Gillespie | 12 | 12.00 | 29 | 145.00 | 41 | 174.00 |
| Goliad | 92 | 92.00 | 1,958 | 9,790.00 | 2,050 | 9,882.00 |
| Gonzales | 68 | 68.00 | 404 | 2,020.00 | 472 | 2,088.00 |
| Gray | 2 | 2.00 | ........ | ........ | 2 | 2.00 |
| Grayson | ........ | ........ | 139 | 695.00 | 139 | 695.00 |
| Gregg | 19 | 19.00 | ........ | ........ | 19 | 19.00 |
| Grimes | 205 | 205.00 | 451 | 2,255.00 | 656 | 2,460.00 |
| Guadalupe | 69 | 69.00 | 330 | 1,650.00 | 399 | 1,719.00 |
| Hamilton | 31 | 31.00 | 163 | 810.00 | 194 | 841.00 |
| Harris | 2 | 2.00 | 15 | 75.00 | 17 | 77.00 |
| Harrison | ........ | ........ | 60 | 300.00 | 60 | 300.00 |
| Hays | 47 | 47.00 | 406 | 2,030.00 | 453 | 2,077.00 |
| Henderson | 72 | 72.00 | 86 | 430.00 | 158 | 502.00 |
| Hidalgo | 1 | 1.00 | 2,769 | 13,845.00 | 2,770 | 13,846.00 |
| Hill | 120 | 120.00 | 840 | 4,200.00 | 960 | 4,320.00 |
| Houston | 122 | 122.00 | 36 | 180.00 | 187 | 302.00 |
| Hunt | 4 | 4.00 | 510 | 2,550.00 | 514 | 2,554.00 |
| Hutchinson | ........ | ........ | 1 | 5.00 | 1 | 5.00 |
| Johnson | ........ | ........ | 3 | 15.00 | 3 | 15.00 |
| Jasper | 5 | 5.00 | ........ | ........ | 5 | 5.00 |
| Jefferson | 1 | 1.00 | 53 | 159.00 | 54 | 160.00 |
| Jim Wells | ........ | ........ | 353 | 1,765.00 | 353 | 1,765.00 |
| Karnes | 16 | 16.00 | 932 | 4,660.00 | 948 | 4,676.00 |
| Kaufman | 47 | 47.00 | 278 | 1,390.00 | 325 | 1,437.00 |
| Kendall | 70 | 70.00 | 113 | 565.00 | 183 | 635.00 |
| Kerr | 54 | 54.00 | 44 | 220.00 | 98 | 274.00 |
| Kimble | 43 | 43.00 | 269 | 1,345.00 | 312 | 1,388.00 |
| Kinney | 3 | 3.00 | 897 | 4,485.00 | 900 | 4,487.00 |

| County. | No. Box Hives. | Value. | No. Frame Hives. | Value. | Total Hives. | Total Value. |
|---|---|---|---|---|---|---|
| Lamar | 10 | $ 10.00 | 683 | $ 3,415.00 | 693 | $ 3,425.00 |
| Lampasas | 20 | 20.00 | 623 | 3,115.00 | 643 | 3,135.00 |
| La Salle | 1 | 1.00 | 79 | 395.00 | 80 | 396.00 |
| Lavaca | 34 | 34.00 | 244 | 1,220.00 | 278 | 1,254.00 |
| Lee | 22 | 22.00 | 95 | 475.00 | 117 | 497.00 |
| Liberty | ........ | ........ | 895 | 4,475.00 | 895 | 4,475.00 |
| Limestone | 97 | 97.00 | 299 | 1,495.00 | 396 | 1,592.00 |
| Live Oak | 57 | 57.00 | 1,842 | 9,210.00 | 1,899 | 9,267.00 |
| Llano | 55 | 55.00 | 1,629 | 8,145.00 | 1,684 | 8,200.00 |
| Lubbock | ........ | ........ | 12 | 60.00 | 12 | 60.00 |
| Madison | 24 | 24.00 | 7 | 35.00 | 31 | 59.00 |
| Mason | 67 | 67.00 | 141 | 705.00 | 208 | 772.00 |
| Matagorda | ........ | ........ | 2 | 10.00 | 2 | 10.00 |
| McCulloch | ........ | ........ | 186 | 930.00 | 186 | 930.00 |
| McLennan | 50 | 50.00 | 742 | 3,710.00 | 792 | 3,760.00 |
| McMullen | 17 | 17.00 | 373 | 1,865.00 | 390 | 1,882.00 |
| Medina | 61 | 61.00 | 2,634 | 13,170.00 | 2,695 | 13,231.00 |
| Menard | 9 | 9.00 | 967 | 4,835.00 | 976 | 4,844.00 |
| Milam | 66 | 66.00 | 634 | 3,170.00 | 700 | 3,870.00 |
| Mills | 10 | 10.00 | 146 | 730.00 | 156 | 740.00 |
| Mitchell | ........ | ........ | 53 | 265.00 | 53 | 265.00 |
| Montgomery | 25 | 25.00 | 7 | 35.00 | 32 | 60.00 |
| Morris | 1 | 1.00 | 25 | 125.00 | 26 | 126.00 |
| Nacogdoches | 12 | 12.00 | 1 | 5.00 | 13 | 17.00 |
| Navarro | 62 | 62.00 | 759 | 3,795.00 | 821 | 3,857.00 |
| Nolan | 12 | 12.00 | 153 | 765.00 | 165 | 777.00 |
| Nueces | 11 | 11.00 | 552 | 2,760.00 | 563 | 2,771.00 |
| Orange | 9 | 9.00 | 46 | 230.00 | 55 | 239.00 |
| Palo Pinto | 6 | 6.00 | 83 | 415.00 | 89 | 421.00 |
| Panola | 16 | 16.00 | 69 | 345.00 | 85 | 361.00 |
| Parker | 19 | 19.00 | 113 | 565.00 | 132 | 584.00 |
| Pecos | 2 | 2.00 | ........ | ........ | 2 | 2.00 |
| Polk | 105 | 105.00 | 399 | 1,995.00 | 504 | 2,100.00 |
| Rains | 3 | 3.00 | 33 | 165.00 | 36 | 168.00 |
| Red River | 1 | 1.00 | 187 | 935.00 | 188 | 936.00 |
| Reeves | ........ | ........ | 32 | 160.00 | 32 | 160.00 |
| Refugio | 6 | 6.00 | 59 | 295.00 | 65 | 301.00 |
| Robertson | 42 | 42.00 | 444 | 2,220.00 | 486 | 2,262.00 |
| Rockwall | 12 | 12.00 | 116 | 580.00 | 128 | 592.00 |
| Runnels | 11 | 11.00 | 62 | 310.00 | 73 | 321.00 |
| Rusk | 16 | 16.00 | 122 | 610.00 | 138 | 626.00 |
| Sabine | 26 | 26.00 | 159 | 795.00 | 185 | 821.00 |
| San Jacinto | 25 | 25.00 | 677 | 3,385.00 | 702 | 3,410.00 |
| San Augustine | ........ | ........ | 6 | 36.00 | 6 | 36.00 |
| San Patricio | 2 | 2.00 | 2,125 | 10,625.00 | 2,127 | 10,627.00 |
| San Saba | 28 | 28.00 | 345 | 1,725.00 | 373 | 1,753.00 |
| Schleicher | 13 | 13.00 | 82 | 410.00 | 95 | 423.00 |
| Shackelford | 13 | 13.00 | 43 | 215.00 | 56 | 228.00 |
| Shelby | 12 | 12.00 | 7 | 35.00 | 19 | 47.00 |
| Smith | 36 | 36.00 | 59 | 295.00 | 95 | 331.00 |
| Stephens | 32 | 32.00 | 117 | 585.00 | 149 | 617.00 |
| Tarrant | 5 | 5.00 | 79 | 395.00 | 84 | 400.00 |
| Taylor | 48 | 48.00 | 363 | 1,815.00 | 411 | 1,863.00 |
| Throckmorton | ........ | ........ | 76 | 380.00 | 76 | 380.00 |
| Titus | ........ | ........ | 4 | 20.00 | 4 | 20.00 |
| Tom Green | 9 | 9.00 | 89 | 445.00 | 98 | 454.00 |
| Travis | 24 | 24.00 | 585 | 2,925.00 | 609 | 2,949.00 |
| Trinity | 8 | 8.00 | 85 | 425.00 | 93 | 433.00 |
| Tyler | 40 | 40.00 | 46 | 230.00 | 86 | 270.00 |
| Upshur | 4 | 4.00 | ........ | ........ | 4 | 4.00 |
| Uvalde | 5 | 5.00 | 10,160 | 50,800.00 | 10,165 | 50,805.00 |
| Val Verde | 18 | 18.00 | 379 | 1,895.00 | 397 | 1,913.00 |
| Van Zandt | 80 | 80.00 | ........ | ........ | 80 | 80.00 |
| Victoria | ........ | ........ | 187 | 935.00 | 187 | 935.00 |
| Walker | 19 | 19.00 | 69 | 345.00 | 88 | 364.00 |
| Waller | 2 | 2.00 | 45 | 225.00 | 47 | 227.00 |
| Ward | 10 | 10.00 | 247 | 1,235.00 | 257 | 1,245.00 |
| Washington | 57 | 57.00 | 123 | 615.00 | 180 | 672.00 |
| Wharton | 9 | 9.00 | 312 | 1,560.00 | 321 | 1,569.00 |
| Williamson | 118 | 118.00 | 1,762 | 8,810.00 | 1,880 | 9,828.00 |
| Wilson | 40 | 40.00 | 4,306 | 21,530.00 | 4,346 | 21,570.00 |
| Wise | 15 | 15.00 | 15 | 75.00 | 30 | 90.00 |
| Wood | 12 | 12.00 | 89 | 445.00 | 101 | 457.00 |
| Yoakum | ........ | ........ | 2 | 10.00 | 2 | 10.00 |
| Young | 5 | 5.00 | 4 | 20.00 | 9 | 25.00 |
| Zavala | ........ | ........ | 3,750 | 18,750.00 | 3,750 | 18,750.00 |
| Totals | 5,275 | $5,275.00 | 85,495 | $428,849.00 | 90,770 | $434,124.00 |

TABLE II.—HONEY PRODUCTION BY COUNTIES, SEASON OF 1911.

In the following tabulation of the production of section, extracted and "chunk" (bulk comb) honey, it must still be borne in mind that these figures represent only such productions as were reported to this Department. They *do not* represent the total amounts of honeys actually harvested in the counties listed.

| County. | Pounds Section Honey. | Pounds Extracted Honey. | Pounds Bulk Comb Honey. | Total Production. |
|---|---|---|---|---|
| Anderson | 475 | 100 | 1,070 | 1,645 |
| Austin | 225 | 24,167 | 535 | 24,927 |
| Atascosa | 400 | 22,620 | 127,340 | 150,360 |
| Bandera | ........ | ........ | 600 | 600 |
| Bee | 96 | 34,998 | 93,666 | 128,760 |
| Bell | 406 | 24,574 | 28,221 | 53,201 |
| Bexar | 1,695 | 54,357 | 92,568 | 148,620 |
| Blanco | 25 | 1,200 | 1,205 | 2,430 |
| Bosque | 258 | 7,923 | 4,643 | 12,824 |
| Bowie | 6 | 30 | 620 | 656 |
| Brazoria | ........ | 14,650 | 680 | 15,330 |
| Brazos | 80 | 14,445 | 17,055 | 31,580 |
| Brewster | ........ | ........ | 2,000 | 2,000 |
| Brown | 144 | 908 | 877 | 1,929 |
| Brooks | ........ | 3,890 | 500 | 4,390 |
| Burleson | ........ | 1,000 | 30,040 | 31,040 |
| Burnet | 50 | 1,950 | 1,840 | 3,840 |
| Caldwell | 410 | 9,475 | 11,408 | 21,293 |
| Callahan | 525 | 1,998 | 1,200 | 3,723 |
| Cameron | 1,390 | 23,320 | 3,351 | 28,061 |
| Cass | ........ | ........ | 22 | 22 |
| Cherokee | 400 | 775 | 770 | 1,945 |
| Coke | ........ | ........ | 250 | 250 |
| Coleman | 60 | 1,897 | 2,940 | 4,897 |
| Collin | 315 | 690 | 1,537 | 2,542 |
| Colorado | ........ | 1,525 | 280 | 1,805 |
| Comal | 24 | 8,577 | 19,840 | 28,441 |
| Comanche | 180 | 240 | 1,974 | 2,394 |
| Concho | 1,335 | 785 | 2,585 | 4,705 |
| Cooke | ........ | ........ | 720 | 720 |
| Coryell | ........ | 685 | 4,100 | 4,785 |
| Crockett | 500 | ........ | 100 | 600 |
| Dallas | 772 | 100 | 260 | 1,132 |
| Delta | 245 | 17,116 | 1,520 | 18,881 |
| Denton | ........ | 576 | ........ | 576 |
| DeWitt | ........ | 1,088 | 182 | 1,270 |
| Dimmit | ........ | 1,700 | 7,975 | 9,675 |
| Eastland | ........ | 150 | 150 | 300 |
| Edwards | ........ | 3,710 | 920 | 4,630 |
| Ellis | 721 | 4,376 | 20,828 | 25,935 |
| El Paso | 5,822 | 10,995 | 70,040 | 86,857 |
| Erath | 50 | ........ | 470 | 520 |
| Falls | 3,060 | 5,930 | 7,520 | 16,510 |
| Fannin | 1,761 | 1,464 | 2,279 | 5,504 |
| Fayette | 510 | 5,366 | 1,690 | 7,566 |
| Fisher | ........ | ........ | 200 | 200 |
| Fort Bend | 60 | 500 | 300 | 860 |
| Franklin | ........ | 300 | 310 | 610 |
| Freestone | ........ | 4,450 | 2,280 | 6,730 |
| Frio | 500 | 20,870 | 62,434 | 83,804 |
| Galveston | ........ | 200 | 20 | 220 |
| Gillespie | ........ | 500 | 230 | 730 |
| Goliad | 500 | 4,860 | 74,702 | 80,062 |
| Gonzales | 372 | 3,410 | 8,396 | 12,178 |
| Grayson | ........ | ........ | 1,115 | 1,115 |
| Gregg | ........ | ........ | 250 | 250 |
| Grimes | 350 | 4,960 | 3,702 | 9,012 |
| Guadalupe | ........ | 500 | 25,303 | 25,803 |
| Hamilton | 463 | 1,360 | 550 | 2,373 |
| Harris | 375 | ........ | 25 | 400 |
| Harrison | ........ | ........ | 260 | 260 |
| Hays | 40 | 7,325 | 8,880 | 16,245 |
| Henderson | ........ | 150 | 1,475 | 1,625 |
| Hidalgo | 180 | 17,200 | 45,050 | 62,430 |
| Hill | 3,572 | 19,470 | 7,090 | 30,132 |
| Hood | 250 | ........ | 580 | 830 |
| Houston | 550 | ........ | 2,000 | 2,550 |
| Hunt | 809 | 6,400 | 6,431 | 13,641 |

| County. | Pounds Section Honey. | Pounds Extracted Honey. | Pounds Bulk Comb Honey. | Total Production. |
|---|---|---|---|---|
| Jackson | .......... | .......... | 30 | 30 |
| Jasper | .......... | .......... | 60 | 60 |
| Jefferson | 248 | 200 | 705 | 1,253 |
| Jim Wells | 24 | 9,386 | 4,560 | 13,970 |
| Johnson | 1,090 | .......... | 680 | 1,770 |
| Karnes | 43 | 9,585 | 11,351 | 20,979 |
| Kaufman | 1,576 | 210 | 5,099 | 6,885 |
| Kendall | 20 | 943 | 1,710 | 2,673 |
| Kent | 150 | .......... | .......... | 150 |
| Kerr | 50 | 310 | 1,600 | 1,960 |
| Kimble | 355 | 2,400 | 4,450 | 7,205 |
| Kinney | .......... | 7,740 | 4,200 | 11,940 |
| Lamar | 3,260 | 14,494 | 2,475 | 20,229 |
| Lampasas | 280 | 3,000 | 2,495 | 5,775 |
| La Salle | .......... | 908 | 180 | 1,088 |
| Lavaca | 175 | 4,712 | 1,115 | 6,002 |
| Lee | 160 | 2,616 | 396 | 3,172 |
| Leon | 3,694 | 1,500 | 6,680 | 11,874 |
| Liberty | 3,376 | 1,200 | 2,644 | 7,230 |
| Limestone | 280 | 6,295 | 3,361 | 9,936 |
| Live Oak | .......... | 14,620 | 43,015 | 57,635 |
| Llano | 1,424 | 9,250 | 4,585 | 15,259 |
| Lubbock | 1,600 | 700 | .......... | 2,300 |
| Madison | .......... | 250 | 575 | 825 |
| Mason | .......... | 300 | 2,200 | 2,500 |
| McCulloch | .......... | .......... | 2,622 | 2,622 |
| McLennan | 413 | 15,057 | 11,090 | 26,560 |
| McMullen | .......... | 1,692 | 2,630 | 4,322 |
| Medina | 989 | 22,705 | 56,495 | 80,189 |
| Menard | 500 | 3,550 | 15,475 | 19,525 |
| Milam | .......... | 11,675 | 7,374 | 19,049 |
| Mills | 400 | 950 | 1,665 | 3,015 |
| Mitchell | .......... | 600 | 700 | 1,300 |
| Montgomery | .......... | 85 | 225 | 310 |
| Morris | 50 | .......... | .......... | 50 |
| Nacogdoches | .......... | .......... | 60 | 60 |
| Navarro | 1,560 | 1,750 | 12,290 | 15,600 |
| Nolan | .......... | 2,488 | 455 | 2,943 |
| Nueces | .......... | 7,410 | 18,422 | 25,832 |
| Orange | 485 | 25 | 318 | 828 |
| Palo Pinto | .......... | 50 | 375 | 425 |
| Panola | 150 | 65 | 385 | 600 |
| Parker | 500 | 200 | 615 | 1,315 |
| Pecos | .......... | .......... | 115 | 115 |
| Polk | 3,375 | 1,012 | 2,272 | 6,659 |
| Rains | .......... | 200 | 375 | 575 |
| Red River | .......... | 200 | 2,155 | 2,355 |
| Reeves | .......... | .......... | 120 | 120 |
| Refugio | .......... | 360 | 600 | 960 |
| Robertson | .......... | 800 | 1,765 | 2,565 |
| Rockwall | 50 | 662 | 274 | 986 |
| Runnels | 30 | 20 | 570 | 650 |
| Rusk | 951 | 1,200 | 960 | 3,111 |
| Sabine | .......... | .......... | 580 | 580 |
| San Augustine | .......... | 38 | 300 | 338 |
| San Jacinto | .......... | 240 | 3,155 | 3,395 |
| San Patricio | .......... | 9,549 | 61,127 | 70,676 |
| San Saba | .......... | 785 | 4,810 | 5,595 |
| Schleicher | .......... | 1,500 | 1,860 | 3,360 |
| Shackelford | .......... | .......... | 190 | 190 |
| Shelby | .......... | .......... | 150 | 150 |
| Smith | .......... | 110 | 1,015 | 1,125 |
| Stephens | 8 | 70 | 685 | 763 |
| Tarrant | .......... | .......... | 1,425 | 1,425 |
| Taylor | 670 | 6,315 | 1,309 | 8,294 |
| Throckmorton | .......... | .......... | 900 | 900 |
| Tom Green | .......... | 620 | 1,025 | 1,645 |
| Travis | 366 | 21,888 | 497 | 22,751 |
| Trinity | 320 | 1,550 | 255 | 2,125 |
| Tyler | 200 | 160 | 710 | 1,070 |
| Upshur | .......... | .......... | 20 | 20 |
| Uvalde | .......... | 65,738 | 153,007 | 218,745 |
| Val Verde | 175 | 6,500 | 980 | 7,655 |
| Van Zandt | 1,000 | .......... | 500 | 1,500 |
| Victoria | .......... | 810 | 900 | 1,710 |
| Walker | 50 | .......... | 150 | 200 |
| Waller | .......... | 2,000 | 220 | 2,220 |
| Ward | 4,070 | 3,230 | 1,300 | 4,530 |
| Washington | 598 | 2,112 | 1.625 | 4,335 |
| Wharton | 265 | 450 | 4,425 | 5,140 |
| Williamson | 781 | 72,194 | 29,570 | 102,545 |

| County. | Pounds, Section Honey. | Pounds, Extracted Honey. | Pounds, Bulk Comb Honey. | Total Production. |
|---|---|---|---|---|
| Wilson | 100 | 21,709 | 92,248 | 114,057 |
| Young | ........ | ........ | 80 | 80 |
| Zavala | 24 | 28,395 | 88,310 | 116,705 |
| Totals | 75,790 | 823,311 | 1,510,244 | 2,399,345 |

**TABLE III.—AVERAGE PRICE RECEIVED FOR SECTION, EXTRACTED AND BULK COMB HONEY, SEASON OF 1911.**

The following figures are *averages* taken from all reported sales of honey in the various counties of the State during the season of 1911. It is a noteworthy fact that these figures vary greatly. Of course the sale of a car of extracted or bulk comb honey, for instance, would furnish figures lower than those from the sale of a few pounds of either honey. Yet, when in one case we find that the average price received for bulk comb honey in Bexar county was 9½ cents, and this figure obtained from averaging sales of small lots as well as large lots, then, on the other hand, we find that the average price received for the same class of honey in Taylor county, for example, was 14½ cents, the matter is entitled to consideration. This same variation occurs in the reported sales of wax, which is generally conceded a standard commodity and its price little affected by local conditions.

| County. | Average Price of Section Honey By Sales. (Cents per lb.) | Average Price of Extracted Honey By Sales. (Cents per lb.) | Average Price of Bulk Comb Honey By Sales (Cents per lb.) |
|---|---|---|---|
| Anderson | 13 | 10 | 12 |
| Atascosa | 12 | 8 1-5 | 10½ |
| Austin | 14⅔ | 7 1-5 | 8⅔ |
| Bandera | ... | ... | 11½ |
| Bastrop | 9 | 8 | 10 1-5 |
| Bee | 10 | 8⅛ | 10⅓ |
| Bell | 14 | 10 2-5 | 10 7-10 |
| Bexar | 12½ | 8⅓ | 10½ |
| Blanco | ... | 10 | 9½ |
| Bosque | 14 | 9 1-10 | 12¼ |
| Brazoria | ... | 7 1-5 | 14 |
| Brazos | ... | 8½ | 10 1-7 |
| Brewster | ... | ... | 13 |
| Brooks | ... | 8½ | 8½ |
| Brown | ... | 10⅓ | 10 1-5 |
| Burleson | ... | 8 | 10⅔ |
| Burnet | 13 | 9 | 10 5-7 |
| Caldwell | 10⅔ | 8⅔ | 8 6-7 |
| Callahan | 15 | 10 | 12 1-5 |
| Cameron | 14 | 10¼ | 11½ |
| Cherokee | 15 | 11½ | 10 |
| Coleman | 10 | 12 | 13 1-5 |
| Collin | 18 | 11⅔ | 14⅛ |
| Colorado | ... | 9 | 9½ |
| Comal | ... | 8⅔ | 10 5-7 |
| Comanche | 15 | 13 | 13⅙ |
| Concho | 14 1-5 | 10 | 12¼ |
| Cooke | ... | ... | 13 |
| Coryell | 12¼ | 9½ | 10⅙ |
| Crockett | 20 | ... | ... |
| Dallas | 14⅓ | 12½ | 16 |
| Delta | 15 | 11 | 13 2-7 |
| Denton | ... | 12 | ... |
| DeWitt | ... | 7⅓ | 11 |
| Dimmit | ... | 8⅔ | 11⅓ |
| Eastland | ... | ... | 15 |
| Edwards | ... | 8½ | 10 |
| Ellis | 20⅔ | 12 | 13 |

| County. | Average Price of Section Honey By Sales. (Cents per lb.) | Average Price of Extracted Honey By Sales. (Cents per lb.) | Average Price of Bulk Cumb Honey By Sales. (Cents per lb.) |
|---|---|---|---|
| El Paso | $10\frac{1}{2}$ | $7\frac{1}{2}$ | 11 |
| Erath | 15 | ... | 13 |
| Falls | $12\frac{1}{2}$ | $9\frac{3}{8}$ | 11 |
| Fannin | 16 3-5 | 12 | $14\frac{2}{3}$ |
| Fayette | 11 | 8 | 9 |
| Fort Bend | 15 | 10 | 10 |
| Franklin | ... | 10 | 14 |
| Freestone | ... | $9\frac{2}{3}$ | $10\frac{3}{8}$ |
| Frio | ... | 9 | $10\frac{2}{3}$ |
| Gillespie | ... | ... | 10 |
| Goliad | 13 | 8 5-6 | 10 8-11 |
| Gonzales | $12\frac{1}{2}$ | 8 4-7 | 9 1-5 |
| Grayson | ... | ... | 13 |
| Gregg | ... | ... | $11\frac{1}{2}$ |
| Grimes | 13 | $9\frac{1}{2}$ | $8\frac{3}{4}$ |
| Guadalupe | 12 | $8\frac{7}{8}$ | 9 3-5 |
| Hamilton | 15 | 13 | 13 |
| Harris | 15 | ... | ... |
| Harrison | 19 | ... | ... |
| Hays | 10 | 9 3-5 | 11 |
| Henderson | ... | ... | 11 1-5 |
| Hidalgo | ... | $8\frac{1}{3}$ | $10\frac{1}{2}$ |
| Hill | $15\frac{1}{2}$ | $10\frac{2}{3}$ | 12 3-5 |
| Houston | ... | 13 | 11 |
| Hunt | 15 | 10 | $14\frac{1}{2}$ |
| Jasper | ... | ... | 13 |
| Jefferson | 25 | 18 | 20 |
| Jim Wells | ... | 9 | $10\frac{1}{3}$ |
| Johnson | $14\frac{1}{2}$ | ... | 14 |
| Karnes | ... | $8\frac{1}{6}$ | $10\frac{2}{3}$ |
| Kaufman | $12\frac{2}{3}$ | 10 | $12\frac{2}{3}$ |
| Kendall | 8 | 9 3-5 | 9 5-7 |
| Kerr | 8 | $10\frac{2}{3}$ | 11 1-5 |
| Kimble | 9 | 9 1-10 | $9\frac{3}{4}$ |
| Kinney | ... | $8\frac{5}{8}$ | $9\frac{3}{4}$ |
| Lamar | $15\frac{7}{8}$ | $12\frac{1}{4}$ | $13\frac{2}{3}$ |
| Lampasas | 15 | 8 | 10 6-7 |
| La Salle | ... | 10 | 13 |
| Lavaca | $11\frac{1}{2}$ | 9 | $9\frac{1}{6}$ |
| Lee | 13 | $8\frac{2}{3}$ | $9\frac{1}{2}$ |
| Leon | 11 | $7\frac{1}{4}$ | 10 8-9 |
| Liberty | $14\frac{1}{2}$ | 23 | $13\frac{1}{3}$ |
| Limestone | ... | $10\frac{3}{4}$ | $11\frac{3}{4}$ |
| Live Oak | ... | 8 | 10 1-7 |
| Llano | 10 | 8 | $9\frac{1}{4}$ |
| Lubbock | 13 | 10 | ... |
| Madison | ... | 10 | 10 |
| Mason | 10 | 9 | 10 |
| McCulloch | ... | ... | $11\frac{1}{3}$ |
| McLennan | $11\frac{1}{2}$ | 11 2-9 | 12 1-9 |
| McMullen | ... | 8 | 10 |
| Medina | $8\frac{1}{4}$ | $8\frac{1}{2}$ | $10\frac{3}{8}$ |
| Menard | 12 | 10 4-5 | $10\frac{2}{3}$ |
| Milam | ... | ... | $10\frac{1}{2}$ |
| Mills | $12\frac{2}{3}$ | 10 | 11 1-5 |
| Mitchell | ... | 10 | 14 |
| Montgomery | ... | $9\frac{1}{2}$ | $9\frac{1}{2}$ |
| Morris | 13 | ... | ... |
| Nolan | ... | 10 6-7 | 12 4-5 |
| Nueces | 11 | 10 1-5 | 11 2-9 |
| Orange | 20 | ... | ... |
| Palo Pinto | 13 | ... | 15 |
| Panola | 13 | 10 | 12 |
| Parker | 15 | ... | $14\frac{1}{3}$ |
| Pecos | ... | ... | 15 |
| Polk | $13\frac{1}{8}$ | $10\frac{1}{3}$ | 10 5-6 |
| Rains | ... | ... | 10 |
| Red River | 10 | ... | 12 |
| Robertson | ... | $9\frac{1}{2}$ | $10\frac{1}{8}$ |
| Rockwall | 15 | 13 | 15 |
| Runnels | 13 | 13 | 12 |
| Rusk | $13\frac{2}{3}$ | 10 | 11 |
| Sabine | ... | ... | 10 |
| San Augustine | ... | 10 | 10 |
| San Jacinto | ... | ... | $9\frac{1}{3}$ |
| San Patricio | ... | 9 1-9 | 10 3-5 |
| San Saba | ... | $7\frac{1}{2}$ | $9\frac{7}{8}$ |
| Schleicher | ... | 8 | 10 |
| Shackelford | ... | ... | 13 |
| Shelby | ... | ... | 10 |

| County. | Average Price of Section Honey By Sales. (Cents per lb.) | Average Price of Extracted Honey By Sales. (Cents per lb.) | Average Price of Bulk Comb Honey By Sales. (Cents per lb.) |
|---|---|---|---|
| Smith | ... | 12½ | 9⅙ |
| Stephens | 15 | 14 1-5 | 14¼ |
| Tarrant | ... | ... | 13 |
| Taylor | 15 | 14 1-5 | 14¼ |
| Throckmorton | ... | ... | 12⅔ |
| Tom Green | ... | 10 | 11½ |
| Travis | 16⅓ | 10⅜ | 11½ |
| Trinity | 15 | 10 | 13⅓ |
| Tyler | 13 | 13 | 11⅔ |
| Uvalde | ... | 8⅓ | 10 1-5 |
| Val Verde | 11½ | 8½ | 10 2-5 |
| Van Zandt | 13 | ... | 10 |
| Victoria | ... | 19 | 12 |
| Walker | 12 | ... | 12 |
| Waller | ... | 8 | 9 |
| Ward | 13 | 10 | 10¾ |
| Washington | 14⅓ | 10⅝ | 10 |
| Wharton | 15 | 9 | 12 |
| Williamson | 10 4-7 | 8½ | 10½ |
| Wilson | 8½ | 10 1-7 | 10 1-5 |
| Wood | 13 | ... | 10 |
| Young | ... | ... | 20 |
| Zavala | ... | 8¼ | 10½ |

TABLE IV.—PRODUCTION OF WAX BY COUNTIES, AVERAGE SELLING PRICE PER POUND AND TOTAL VALUE, BY SALES REPORTED, OF WAX OUTPUT FOR SEASON OF 1911.

In discussing some of the points brought out by the data contained in Table III, attention was called to the fact that there appeared a great variation in the prices per pound received by beekeepers for their various grades of honey. Even a casual examination of the data in the following table will reveal the same variations for wax, and, as in the case of sales of honey, seem to warrant an inquiry into the causes making such wide differences possible with so staple a product as wax.

| County. | Pounds of Wax Produced. | Average Selling Price per Pound. (Cents.) | Total Value By Sales. |
|---|---|---|---|
| Anderson | 46 | 26⅔ | $ 12.27 |
| Atascosa | 1,817 | 17 | 308.89 |
| Austin | 387 | 24½ | 94.82 |
| Bandera | 35 | 20 | 7.00 |
| Bastrop | 207 | 22½ | 46.54 |
| Bee | 2,129 | 23½ | 74.52 |
| Bell | 650 | 23 | 149.50 |
| Bexar | 1,583 | 27 | 427.41 |
| Blanco | 18 | 23½ | 42.30 |
| Bosque | 243 | 23 | 55.89 |
| Bowie | 35 | 25 | 8.75 |
| Brazoria | 290 | 20½ | 59.45 |
| Brazos | 383 | 27½ | 105.33 |
| Brooks | 77 | 38½ | 29.65 |
| Brown | 63 | 31 | 19.53 |
| Burleson | 280 | 19¼ | 53.90 |
| Burnet | 63 | 17 | 10.71 |
| Caldwell | 269 | 22 | 59.18 |
| Callahan | 5 | ... | ..... |
| Cameron | 591 | 29⅓ | 173.36 |
| Cherokee | 4 | ... | ..... |
| Coleman | 73 | 24¾ | 19.09 |
| Collin | 53 | 25 | 13.25 |
| Comal | 306 | 25½ | 78.03 |
| Comanche | 24 | 24½ | 5.88 |
| Coryell | 553 | 21 | 116.13 |
| Dallas | 201 | 30 | 60.30 |
| Denton | 18 | 28 | 5.04 |

| County. | Pounds of Wax Produced. | Average Selling Price per Pound. (Cents.) | Total Value By Sales. |
|---|---|---|---|
| DeWitt | 43 | 20 | $ 8.60 |
| Dimmit | 192 | 27½ | 52.80 |
| Edwards | 225 | 25 | 56.25 |
| Ellis | 749 | 28 | 209.72 |
| Erath | 10 | 18 | 1.80 |
| Falls | 230 | 25 | 57.50 |
| Fannin | 25 | ... | ..... |
| Fayette | 203 | 24½ | 49.75 |
| Fort Bend | 50 | 25 | 12.50 |
| Freestone | 261 | 22½ | 58.74 |
| Frio | 1,276 | 25½ | 335.38 |
| Gillespie | 8 | 21 | 1.68 |
| Goliad | 815 | 26 | 213.90 |
| Gonzales | 174 | 24½ | 41.76 |
| Grayson | 15 | 28 | 4.20 |
| Grimes | 146 | 29½ | 43.07 |
| Guadalupe | 236 | ... | ..... |
| Hamilton | 50 | 24½ | 12.25 |
| Harrison | 10 | ... | ..... |
| Hays | 186 | 26⅔ | 49.58 |
| Henderson | 65 | 21⅔ | 13.09 |
| Hidalgo | 520 | 28 | 145.60 |
| Hill | 241 | 24½ | 14.09 |
| Houston | 56 | 26⅔ | 14.94 |
| Hunt | 114 | 30 | 34.20 |
| Jefferson | 10 | ... | ..... |
| Jim Wells | 213 | 24 | 51.12 |
| Johnson | 10 | ... | ..... |
| Karnes | 523 | 27½ | 143.83 |
| Kaufman | 73 | 24 | 17.52 |
| Kendall | 96 | 20 | 19.20 |
| Kerr | 58 | 19 | 11.02 |
| Kimble | 89 | ... | ..... |
| Lamar | 698 | 21¾ | 151.83 |
| Lampasas | 137 | 25 | 34.25 |
| La Salle | 21 | 28 | 5.88 |
| Fayette | 129 | 25 | 34.25 |
| Lee | 66 | 22½ | 14.85 |
| Leon | 411 | 24 | 98.64 |
| Liberty | 195 | 25½ | 49.73 |
| Limestone | 207 | 25⅓ | 52.44 |
| Live Oak | 689 | 25 | 173.25 |
| Llano | 290 | 24½ | 71.05 |
| Lubbock | 12 | ... | ..... |
| Madison | 50 | 22 | 11.00 |
| Mason | 166 | 21½ | 20.75 |
| McCulloch | 32 | 20 | 6.40 |
| McLennan | 332 | 26 | 86.32 |
| McMullen | 125 | 29⅓ | 36.67 |
| Medina | 1,161 | 26 | 291.86 |
| Menard | 850 | 27⅔ | 235.18 |
| Milam | 285 | 24 | 68.40 |
| Mills | 61 | 22 | 13.42 |
| Mitchell | 20 | 35 | 7.00 |
| Montgomery | 18 | 24½ | 4.41 |
| Nacogdoches | 5 | ... | ..... |
| Navarro | 225 | 24⅔ | 55.50 |
| Nolan | 30 | 22 | 6.60 |
| Nueces | 544 | 22 | 119.68 |
| Orange | 20 | 30 | 6.00 |
| Panola | 29 | 23 | 6.67 |
| Parker | 20 | 28 | 5.60 |
| Polk | 52 | 17 | 8.84 |
| Rains | 50 | ... | ..... |
| Red River | 42 | 25 | 10.50 |
| Refugio | 40 | 28 | 11.20 |
| Robertson | 141 | 21½ | 30.32 |
| Rockwall | 20 | 26 | 5.20 |
| Runnels | 40 | 20 | 8.00 |
| Rusk | 71 | 20 | 14.20 |
| Sabine | 56 | 19 | 10.64 |
| San Jacinto | 141 | 25 | 35.25 |
| San Patricio | 919 | 26⅓ | 242.02 |
| Schleicher | 160 | 24 | 38.40 |
| Shackelford | 10 | 25 | 2.50 |
| Smith | 22 | 22½ | 4.95 |
| Stephens | 10 | 23 | 2.30 |
| Tarrant | 10 | 28 | 2.80 |
| Taylor | 262 | 22⅔ | 59.40 |
| Tom Green | 7 | ... | ..... |
| Travis | 258 | 25½ | 65.19 |

| County. | Pounds of Wax Produced. | Average Selling Price per Pound. (Cents.) | Total Value By Sales. |
|---|---|---|---|
| Trinity | 61 | 28 | 17.09 |
| Tyler | 40 | 19 | 7.60 |
| Uvalde | 5,128 | 27½ | 1,410.20 |
| Val Verde | 27 | ... | ..... |
| Van Zandt | 30 | 20 | 6.00 |
| Victoria | 30 | 30 | 9.00 |
| Walker | 18 | 18 | 2.24 |
| Waller | 32 | 25 | 8.00 |
| Ward | 320 | 27⅓ | 87.47 |
| Washington | 110 | 23⅓ | 25.67 |
| Wharton | 116 | 26½ | 30.74 |
| Williamson | 1,051 | 22 | 231.22 |
| Wilson | 974 | 24½ | 238.63 |
| Wood | 40 | 20 | 8.00 |
| Zavala | 1,630 | 29 | 492.70 |
| Totals | 36,105 | | $8,449.62 |

TABLE V.—OPINIONS OF BEEKEEPERS AS TO THE MOST PROFITABLE SCALE ON WHICH APICULTURE MAY BE PURSUED.

The following votes by beekeepers were cast in answer to two questions in the report blanks sent out by this department:

"Is beekeeping in your section of the State profitable (a) as a side-line; (b) as a profession, to the exclusion of other occupations?"

| County. | (a) As a Sideline. | | (b) As a Profession. | |
|---|---|---|---|---|
| | Voting Yes. | Voting No. | Voting Yes. | Voting No. |
| Anderson | 7 | 2 | 1 | 5 |
| Atascosa | 58 | 3 | 40 | 10 |
| Austin | 14 | .. | 4 | 4 |
| Bandera | 3 | .. | .. | 1 |
| Bastrop | 14 | 2 | 4 | 9 |
| Baylor | 2 | .. | .. | 2 |
| Bee | 45 | 1 | 37 | 4 |
| Bell | 36 | 4 | 12 | 19 |
| Bexar | 64 | 7 | 37 | 18 |
| Blanco | 10 | .. | 3 | 6 |
| Bosque | 43 | .. | 12 | 19 |
| Bowie | 3 | 1 | 1 | 2 |
| Brazoria | 9 | .. | 3 | 4 |
| Brazos | 20 | 1 | 4 | 9 |
| Brewster | 2 | .. | .. | 2 |
| Brooks | 7 | 2 | 4 | 5 |
| Brown | 12 | 1 | 1 | 10 |
| Burleson | 6 | 1 | 3 | 3 |
| Burnet | 11 | 2 | 4 | 6 |
| Caldwell | 24 | 1 | 8 | 8 |
| Callahan | 15 | 2 | .. | 13 |
| Cameron | 15 | 2 | .. | 13 |
| Cass | 4 | 1 | .. | 3 |
| Cherokee | 3 | 2 | 1 | 7 |
| Coke | 1 | .. | 1 | .. |
| Coleman | 20 | 3 | 3 | 16 |
| Collin | 14 | 1 | 3 | 9 |
| Colorado | 6 | 1 | .. | 4 |
| Comal | 20 | 2 | 6 | 7 |
| Comanche | 9 | 4 | .. | 10 |
| Concho | 12 | 3 | 4 | 8 |
| Cooke | 4 | 2 | 1 | 3 |
| Coryell | 19 | 4 | 7 | 14 |
| Crockett | 2 | .. | .. | 2 |
| Dallas | 12 | 2 | 3 | 13 |
| Delta | 20 | 1 | 6 | 11 |
| Denton | 2 | 1 | .. | 3 |
| DeWitt | 4 | .. | .. | 3 |
| Dimmit | 5 | .. | 3 | 3 |
| Eastland | 4 | 1 | .. | 5 |
| Edwards | 1 | 2 | 2 | .. |

| | (a) As a Sideline. | | (b) As a Profession. | |
|---|---|---|---|---|
| | Voting Yes. | Voting No. | Voting Yes. | Voting No. |
| Ellis | 32 | .. | 12 | 10 |
| El Paso | 2 | 1 | 1 | 1 |
| Erath | 3 | 2 | 2 | 2 |
| Falls | 28 | 3 | 10 | 17 |
| Fannin | 18 | 3 | 3 | 16 |
| Fayette | 17 | 6 | 2 | 17 |
| Fisher | 1 | .. | .. | 2 |
| Fort Bend | 3 | .. | 1 | 1 |
| Franklin | 4 | 1 | 1 | 4 |
| Freestone | 20 | .. | 3 | 13 |
| Frio | 32 | 6 | 30 | 6 |
| Galveston | 1 | 1 | .. | .. |
| Gillespie | 3 | .. | .. | 1 |
| Goliad | 14 | 3 | 10 | 5 |
| Gonzales | 30 | 2 | 8 | 18 |
| Gray | .. | 1 | .. | 1 |
| Grayson | 4 | 8 | 1 | 11 |
| Gregg | 2 | .. | .. | 2 |
| Grimes | 9 | 2 | 4 | 5 |
| Guadalupe | 13 | 3 | 10 | 5 |
| Hamilton | 9 | .. | .. | 7 |
| Harris | 1 | 1 | .. | 2 |
| Harrison | 2 | 1 | .. | 3 |
| Hays | 12 | 3 | 4 | 7 |
| Henderson | 12 | .. | 2 | 9 |
| Hidalgo | 8 | 1 | 7 | 3 |
| Hill | 31 | 5 | 8 | 22 |
| Houston | 7 | 2 | 3 | 4 |
| Hunt | 19 | 1 | 3 | 14 |
| Hutchinson | 1 | .. | .. | .. |
| Jasper | 1 | .. | .. | 1 |
| Jefferson | 3 | 2 | 1 | 3 |
| Jim Wells | 9 | 1 | 5 | 2 |
| Johnson | 5 | .. | .. | 4 |
| Jones | 1 | .. | .. | .. |
| Karnes | 17 | .. | 12 | 2 |
| Kaufman | 18 | 4 | 3 | 16 |
| Kendall | 14 | .. | 2 | 11 |
| Kent | 1 | .. | .. | 1 |
| Kerr | 4 | 1 | .. | 3 |
| Kimble | 7 | 2 | 3 | 6 |
| Kinney | 11 | 1 | 2 | 7 |
| Lamar | 21 | 2 | 4 | 13 |
| Lampasas | 12 | 1 | 3 | 7 |
| La Salle | 4 | .. | 3 | 1 |
| Lavaca | 18 | 1 | 3 | 11 |
| Lee | 6 | 1 | 4 | 2 |
| Leon | 18 | .. | 7 | 8 |
| Liberty | 6 | 1 | 3 | 3 |
| Limestone | 18 | 4 | 4 | 11 |
| Live Oak | 18 | 2 | 12 | 1 |
| Llano | 37 | 5 | 8 | 31 |
| Lubbock | 1 | .. | .. | 1 |
| Madison | 2 | .. | 1 | 1 |
| Mason | 7 | .. | 4 | 3 |
| Matagorda | .. | 1 | .. | .. |
| McCulloch | 5 | .. | 1 | 1 |
| McLennan | 14 | 2 | 8 | 9 |
| McMullen | 4 | 1 | 4 | 1 |
| Medina | 31 | 3 | 22 | 15 |
| Menard | 9 | 1 | 8 | .. |
| Milam | 23 | 1 | 8 | 8 |
| Mills | 7 | .. | 1 | 5 |
| Mitchell | 2 | 1 | .. | 3 |
| Montgomery | 3 | .. | .. | 3 |
| Morris | 1 | .. | .. | .. |
| Nacogdoches | 3 | .. | 2 | 1 |
| Navarro | 27 | 2 | 10 | 12 |
| Nolan | 12 | 1 | 2 | 11 |
| Nueces | 17 | .. | 10 | 3 |
| Orange | 3 | .. | 10 | .. |
| Palo Pinto | 4 | .. | 1 | .. |
| Panola | 5 | 1 | 2 | 4 |
| Parker | 5 | 1 | .. | 5 |
| Pecos | 1 | .. | .. | .. |
| Polk | 17 | 3 | 4 | 10 |
| Rains | 3 | .. | .. | 2 |
| Red River | 10 | 2 | 2 | 8 |
| Reeves | 2 | .. | 1 | .. |
| Refugio | 3 | .. | 2 | 1 |

| County. | (a) As a Sideline. | | (b) As a Profession. | |
|---|---|---|---|---|
| | Voting Yes. | Voting No. | Voting Yes. | Voting No. |
| Robertson | 13 | 4 | 3 | 12 |
| Rockwall | 2 | 1 | 2 | .. |
| Runnels | 3 | 1 | 2 | 2 |
| Rusk | 11 | 3 | 3 | 10 |
| Sabine | 5 | 2 | 3 | 4 |
| San Jacinto | 4 | .. | 2 | 2 |
| San Patricio | 29 | 3 | 13 | 14 |
| San Saba | 10 | 1 | 2 | 7 |
| Schleicher | 3 | .. | 2 | 1 |
| Shackelford | 3 | .. | 1 | .. |
| Shelby | 2 | .. | .. | 2 |
| Smith | 7 | 2 | 5 | 6 |
| Stephens | 9 | 1 | .. | 9 |
| Tarrant | 1 | 2 | .. | 3 |
| Taylor | 17 | 1 | 3 | 15 |
| Throckmorton | 2 | 1 | 1 | .. |
| Travis | 5 | .. | 3 | 3 |
| Trinity | 5 | .. | 3 | 3 |
| Tyler | 4 | 7 | 1 | 7 |
| Upshur | .. | 1 | .. | 1 |
| Uvalde | 81 | 4 | 52 | 29 |
| Val Verde | 8 | 1 | 1 | 6 |
| Van Zandt | 1 | 1 | 1 | .. |
| Victoria | 3 | 2 | 1 | .. |
| Walker | 4 | .. | .. | 2 |
| Waller | 1 | 1 | .. | 1 |
| Ward | 5 | 3 | .. | 2 |
| Washington | 12 | .. | 4 | 7 |
| Wharton | 7 | 2 | .. | 8 |
| Williamson | 34 | 8 | 10 | 27 |
| Wilson | 52 | 2 | 34 | 12 |
| Wise | 1 | .. | .. | 1 |
| Wood | 4 | 2 | .. | 2 |
| Young | 1 | 1 | .. | 2 |
| Zavala | 28 | 5 | 18 | 7 |
| Totals | 1,750 | 225 | 705 | 947 |

## QUEEN BREEDING IN TEXAS.

This Department has secured a list of upwards of fifty active queen breeders in the State whose output of queens for the season of 1911 was approximately 9000. A *nominal* value placed on these at $7000 is nominal in the strictest sense of the word. For, in cases when no value was reported to us by the breeder, we have placed this at 75 cents apiece. To any beekeeper, such a valuation immediately suggests the common run of queens; such a figure would *not* justly represent the value of queens of the higher grades.

It appears that the rank and file of Texas queen breeders produce the Italian. Yet there are breeders of the Carniolan, Banat and Cyprian. The three-banded Italian seems to have the preference, then the Golden.

## GENERAL SUMMARY.

From our reports, as well as from actual observations in the field, we know that the past three or four years in Texas have been unfavorable to highly successful honey production in a number of localities.

The proportion of box hives, or "gums," to movable frame hives in Texas is gratifyingly small.

The average production of honey, all grades, per colony in Texas for the season 1911 as secured from reports of 2733 beekeepers was 26 pounds. Were the productions from box hives eliminated from this estimate, the average would be much higher, in spite of adverse seasonal influences.

Bulk comb honey ("chunk honey") is the chief production of the Texas apiary. Follows extracted honey and sections, the latter form being comparatively scarce.

In the data expressing the views of Texas beekeepers as to whether apiculture is profitable as a side line rather than as a profession, it is interesting to note that the most extensive beekeepers maintain that the industry is *unprofitable* unless conducted on a large scale, and that those who claim the industry is profitable *only* as a side line are almost invariably beekeepers who follow the calling on the corresponding scale.

In nearly every case it appears that the small beekeeper finds a good market locally for his honey. The large beekeeper does not and is forced to ship. Of course, such conditions are directly governed by the law of supply and demand, the small town near a small apiary or apiaries consuming their output, while an excessive honey crop would find no market there. Those who ship their honey find Fort Worth, Dallas, Floresville and San Antonio to be excellent Texas markets, and it appears that most of the shipments within the State reach these. Those shipping out of the State find a good and ready market in Oklahoma. But it is again worth stopping to note that the greater bulk of Texas honeys never get out of the State. Unquestionably Texas could consume yet a larger quantity than is annually produced by her own apiaries.