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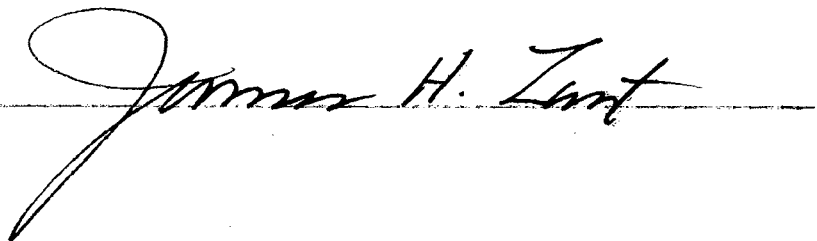
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Scope of Report: Bees are very ancient creatures. They were fully developed in their present form at least as early and probably earlier than modern mammals had evolved from their primitive beginnings, long before man had become man. Few, if any, other insects have had such a long and useful association with man. Man's natural appetite or craving for sweets has perpetuated this association, and led to his semi-domestication of the honey bee. Naturally, this close association has produced a vast folk-lore and an even more thrilling history of the art or science of beekeeping. This report is designed to cover in a brief manner the history of the keeping of honey bees for pleasure or profit.

Findings and Conclusions: Early records indicate that man has used the products of the hive since about 15,000 B. C. and possibly much earlier. Honey and beeswax have been important items of commerce since about 3500 B. C. Man has been both intrigued and envious of the honey bee colony and much study, observation and experimentation with these fascinating little creatures has developed.

The practice of beekeeping has increased over the centuries and many thousands of individuals now keep honey bees for pleasure or profit. There are approximately five and one-half million colonies of honey bees in the United States at present and the value of honey and beeswax produced yearly is nearly forty-four million dollars. The value of the honey bee as a pollinating agent is virtually impossible to estimate but it undoubtedly runs into the millions and possibly billions of dollars annually.

ADVISOR'S APPROVAL

James H. Lutz

HISTORY OF BEEKEEPING

By

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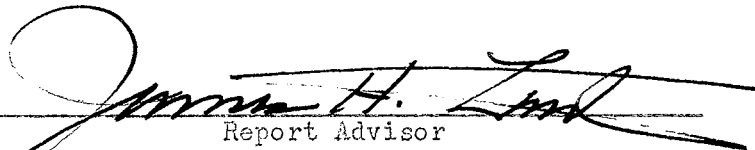
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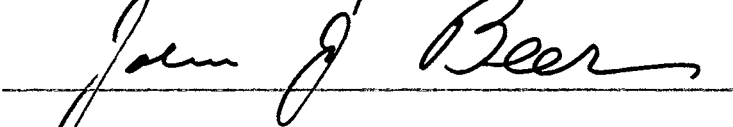

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HISTORY OF BEEKEEPING

Report Approved:


Report Advisor




Dean of the Graduate School

PREFACE

This report is a brief history of beekeeping. Early records indicate that man has been closely associated with the honey bee from the dawn of civilization on earth. There is a wealth of material available on the history of this, possibly the oldest of mans' useful animals. It is only too readily recognized by the author that this history, therefore, is brief and sketchy but an attempt has been made to cover the highlights in the development and the practice of beekeeping.

Two series of articles were of great assistance in the preparation of this report and special acknowledgment and appreciation is here given to the authors of these articles as well as the editors of the two magazines. The first is a series of eight articles by George F. Georghiou, Entomologist of the Department of Agriculture on the Island of Cyprus. These articles are titled "The History of Beekeeping" and were published in consecutive issues of Gleanings in Beeculture, volume 83 (January to August 1955). The second is a series of two articles by G. S. Demuth, published posthumously in "The American Bee Journal", volume 75 (January and March 1935). These latter two articles were titled "The Evolution of Beekeeping Practice."

The author wishes to express his appreciation to Dr. John Beer of the Oklahoma State University History Department for his suggestions and guidance in limiting the subject to the History of Beekeeping rather than to the more involved topic of History of Entomology. Appreciation is also expressed to Professor G. A. Bieberdorf of the Oklahoma State University

Entomology Department for his interest and the loan of valuable references. Deep appreciation is expressed to Dr. James H. Zant of the Oklahoma State University Mathematics Department and Director of the National Science Foundation Teacher Institutes and to the National Science Foundation for making it possible for the author to be a participant in the Academic Year Institute for 1958-59 and the Summer Biology Institute for High School Teachers during the summer of 1959.

Acknowledgment is also given to the three above mentioned members of the Oklahoma State University faculty for their reading of the manuscript and their helpful suggestions. Appreciation is also expressed to Marcia Kabriel, National Science Foundation secretary, for her assistance in preparing the figures.

The author has accepted a position to teach in the Biology Department of one of the smaller colleges in the state and will be teaching a course in "The History of Biology" and it is felt that this type of report will be of great value to him in understanding the far reaching facets of the subject. It is felt that this will provide a better understanding of the efforts necessary to write a report in the History of Biology and the author will be better qualified to evaluate such reports from his students.

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PART I. INTRODUCTION

The keeping of honey bees for pleasure and profit has been an important vocation or avocation for many centuries, and there are at present thousands who follow this ancient pursuit. Few other insects have had such a long and intimate useful association with man. This association has been so close and has been perpetuated for so long that the non-entomologist naturally thinks of the honey bee when the word "bee" is used. Of course, the basic reason for this association is man's natural appetite or craving for sweets, and the fact that until recently honey was about the only accessible substance containing sugar in a concentrated form.

An occupation as old as beekeeping, possibly the oldest branch of husbandry in agriculture, naturally has a thrilling history. Over the centuries there has accumulated a vast folk-lore and many superstitions and traditions concerning the honey bee. There has also been written such a wealth of material concerning the care and management of the honey bee for pleasure and profit that it is impossible to assemble all of these into a single paper or book.

Poets, philosophers, artists and artisans have found the honey bee to be an interesting subject. Honey production has received governmental support for centuries. All this interest in honey bees and beekeeping results not only because their product, honey, is the most concentrated form of natural sweet, but, also, because the honey bees themselves have such an intriguing and enchanting social organization.

In many ways this social organization is similar to that of man and is considered by some to be superior to man's in some respects.

Although honey bees have been studied for many centuries it has only been during the past half century that real advances have been made in the biology and manipulation of the honey bee. This increased knowledge and the improved facilities and techniques for further biological studies have attracted a great many biologists. The teaching of beekeeping was practically unknown prior to the First World War but today the science of beekeeping, or, more properly, Apiculture, is taught in a large number of colleges and universities both in the United States and in other parts of the world. Many colleges have founded extension classes to teach the "new beekeeping" to the practicing beekeeper as well as the hobbyists.

The United States Department of Agriculture reports¹ that at present there are 5,438,000 colonies of honey bees in the United States with the value of honey and beeswax reaching \$43,996,000 in 1959. It is virtually impossible to estimate the value of the honey bee in terms of the pollination of various farm crops but it is known that the presence of the right number of honey bees near certain crops will increase production by as much as 500%. This has led to the modern practice of renting colonies of honey bees to aid in pollination of such crops as alfalfa, clover, and various fruits. The orchardists have been among the first to recognize the value of this service and have used it rather extensively in some localities. It is also variously estimated that ten times the present honey crop might be produced without exhausting the nectar

¹Honey: 1959 Annual Summary, Agriculture Marketing Service, Crop Reporting Board, USDA, (Washington, January 1960)

resources or overstocking the country with honey.

It is recommended by the author that those who have further interest in this vast subject after reading this brief paper refer to the materials available in practically every public and institutional library on both the theory and practice as well as the history of beekeeping.

PART II. ANCIENT RECORDS AND WRITINGS

The history of apiculture as a practiced science has its beginnings somewhere in the dim past of unwritten history. There is abundant evidence that the honey bee was known to pre-historic man. Georghiou¹ states,

Fifteen thousand B. C. is the oldest record that we have on beekeeping. It is a painting of the Magdalenian period (Paleolithic Era) found on a rock of the "Cuevas de La Arana" in Valencia, Spain. The painting shows two men climbing up long ropes, probably woven of sedge-grass, to a small natural hole in a cliff, evidently intended to represent the dwelling of a swarm of bees. One of the men is shown taking the honeycomb out of the hole and placing it in a basket. Bees are shown flying around. (Fig. 1)

Thus the art of beekeeping had its beginning among pre-historic men.

It is stated that a hieroglyph of the honey bee is depicted on an Egyptian sarcophagus dating back to 3633 B. C., and on Egyptian monuments in 3500 B. C. Whether the honey bee had become domesticated at this time is not known but there is good reason to believe its domestication was in the dim past. Honey is known to have been an important article of commerce by 3500 B. C. Man undoubtedly discovered early in his evolution that the honey was sweet and a good food and sought it out much as some wild animals still do today.

There are frequent references to the honey used for sweetening and to wax in the Bible but none of these references indicate that the honey

¹George P. Georghiou, "The History of Beekeeping", Gleanings in Bee Culture, 83(1955), 9.

bee was actually cared for as a domesticated animal. The honey and wax were probably products of wild swarms. (Fig. 2)

Of course, the first attempts at keeping honey bees in ancient times were crude. The hives and equipment that are considered standard today were unknown to the ancients and in fact have reached any degree of the perfection that exists today in the last century. Receptacles in which the wild swarms were kept after capture were generally mere cavities made of earth. Under such conditions it is not possible to examine the combs without destroying the combs (and hive) and only a part of the honey was normally removed by cutting away part of the combs. Nevertheless honey was used frequently in the home for sweetening, and physicians were aware of its health giving properties and used it in their medicines.

Migratory beekeeping, a well-known practice today, probably originated in Egypt about 3000 B. C.² Since the season in the upper region of Egypt is earlier than in lower Egypt, beekeepers took their honey bees up the Nile River at the end of October. The hives were placed on rafts and the bees were allowed to fly out to gather nectar. (The honey bees actually gather the raw products that eventually become honey.) As the bee pasture waned the rafts were moved farther down stream until they came to a place where there were more flowers. The rafts were floated down the Nile to Cairo where the honey was sold. It is stated by Georghiou³ that there are written records to validate the above statements but he fails to give his source. He further states,

²Georghiou, p. 9.

³Ibid.



Figure 1. Portion of a rock painting representing a gatherer of wild honey. From the New Stone Age period, discovered at the Cuevas de la Arana (Spider Cave) near Bicorp in Valencia, Spain. Actual size. (From Grout, p. 126.) (Originally from H. Obermaier's "Fossil Man in Spain")



Figure 2. A colony of honey bees in nature. Not being able to find a hollow tree or other suitable abode, the colony elects to build its combs in the branches of a tree. Lacking a true guide for starting the combs, they are wavy and irregular in shape. (Photo by Alvard Bishop) (From Grout, p. 154.)

From the First Dynasty of Pharaohs (3200-2780 B. C.) until the Roman period, the titles of the kings of Egypt were always associated with the sign of the bee. The cartouche containing the name of the king is preceded by a bee. Tombs of the First Dynasty bear the sign of the bee. It is evident that the Egyptians held the bee in honor.

According to Wheeler⁴ man was probably for thousands of years, like the bears, a systematic robber of the bees till, possibly during the neolithic age, he became an apiarist by enticing the bees to live near his dwelling in sections of hollow logs, empty baskets or earthen vessels. It is known that primitive tribes keep bees today, and also, that within the geographic range of the honey bee we know of no people who have not kept them. He further states that they appeared as figures on Egyptian monuments as far back as 3500 B. C. and that we even know the price of strained honey under some of the Pharaohs' rule. He states, as do several other authors, that it was very cheap - only about five cents a pound.

It is stated that during the time of Sargon I, in Assyria, (c. 2750-2695 B. C.) and for an unknown period following this time, the bodies of the dead were smeared with wax and buried in honey. Authors disagree as to exactly when this practice started and when it ended but it appears to have been practiced before and until about 2000 B. C.

It is a mystery as to whether beekeeping began in Egypt, Europe, or China. A similar mystery exists as to whether beekeeping originated in the one place and then was introduced to the other localities, or whether it evolved on its own in each of these places. It has been mentioned that the earliest records go back to Spain in the form of a painting. The earliest written records go back to Egypt and appeared in about 3500 B. C. Beekeeping in China must be as old as it is in Egypt or

⁴William M. Wheeler, Social Life Among the Insects (New York, 1923), p. 91.

Europe but its origin in China is obscure. According to most authors, beekeeping began in China about the same time as it did in Europe. In Chinese textbooks of apiculture, beekeeping is stated to have been begun by one Pan-li about 470 B. C. but there is reason to believe that it was practiced on a crude scale many centuries previous to that time. Chinese literature abounds in records and descriptions of beekeeping and of honey as a part of the diet. The earliest authentic record of the use of honey as food can be traced to the early part of the Chow Dynasty about 500 B. C.; and of beekeeping to the East Han Dynasty about 25 to 150 A. D. Of course, the using of honey as part of the diet does not imply the practice of apiculture as such, but it is probable that by 500 B. C. the Chinese already knew how to keep the honey bee for its honey and wax.

It is stated by various authors that there exists a wall painting of the 18th Dynasty in Thebes, Egypt which shows a man carrying honeycombs and grapes, and bees are hovering over the combs. Some authors claim that these bees have the same striping and coloring as the bees that are found in Egypt today.

King Solomon⁵ (986-933 B. C.) speaks of honey and the honeycombs in various passages. i.e. "My son, eat thou honey, because it is good; and the honeycomb which is sweet to thy taste."

The Greeks were well versed in the art of beekeeping as early as 750 B. C., with bars in their hives to guide the bees in constructing the combs and laws regulating the number of hives that were permitted in a given area. Solon (640-599 B. C.), the Athenian Lawgiver, provided in one of his laws that no new apiaries could be established within a distance of 300 yards from a previously established apiary.

⁵Proverbs 24:13.

The Greek philosopher, Democritus (460-370 B. C.), as well as other Greek writers before Aristotle, make mention of the generation of bees from oxen. Democritus gives instructions on how to obtain bees in such a way. This belief has persisted for several hundred years, and appeared for the last time in 1842 A. D., when it was stated that a certain Carey had successfully performed the miracle in Cornwall, England.

Democritus' instructions are here presented in some detail:

"Kill an ox and confine it in a oneroom building, closing with clay every opening. Then open the building on the 32nd day and you will find it full of bees, crowded in clusters on each other, and the horns and the bones and the hair and nothing else of the bullock left.

"They say indeed that the 'kings' are produced from the brain, but the other bees from flesh. Kings are also produced from spinal marrow. But those that are produced from the brain are superior to the others in size and beauty and in strength.

"But the first change and transformation of the flesh into living creatures, and as it were a conception of birth, you will thus know: For when the building is opened, you will see things small and white in appearance and like one another and not perfect, not yet such as may be called living animals, in greater number about the bullock, all indeed motionless. But gradually you may then see the form of the wings with their divisions, and the bees assuming their proper color and seated around their king, and flying, but to a small distance and with tremulous wings on account of their members."⁶

The above description of the legendary method for the generation of bees was also given in the literature of the time as the method of generating silkworms and was accepted until well into the nineteenth century. Actually the theory of the spontaneous generation of insects was disproved in 1668 by Francesco Redi in his great experiments on the theory of the generation of insects.⁷ But despite his clarity in disproving it, the spontaneous theory survived. Its adherents were obliged to shift their ground to the realm of microbiology where Pasteur and Tyndall took up the battle and the final clinching experiments were performed by Schroeder and Dusch in 1854.⁸ These experiments quelled forever the theory of spontaneous generation.

⁶Georghiou, p. 9-10.

⁷Mordecai L. Gabriel and Seymour Fogel, ed., Great Experiments in Biology, (Englewood Cliffs, N. J., 1955), p. 187.

⁸Ibid., p. 105.

The Greek Historian, Xenophon, in about 400 B. C., in the 4th book of Anabasis, gives the earliest record of honey causing sickness to man. It is felt that this honey was probably produced from nectar from a species of rhododendron. He also describes the activities of the queen and compares her work to the work of a housewife:

While she stays in the hive, she does not allow the bees to get lazy, but sends out those who have to work outside, observes what they bring in, takes it and stores it until it can be used. When the time comes she divides it fairly well to each one. Further she supervises the building of the combs in the hive and she sees to it that they are constructed well and pretty and that the brood is reared in an orderly way.⁹

From this we can see that Xenophon considers the queen to be the controlling force or the brain of the hive.

The Greek Aristophanes is said to have recommended the use of wax for many purposes also about 400 B. C. Among the uses he suggested were metal protection, modeling, writing tablets, and for sealing love letters.

Aristotle (384-322 B. C.), the great Greek scholar, and his pupil, Theophrastus (372-287 B. C.) were the first to deal with bees in a really scientific way. In fact one might say that all that was best in the natural history of that time was contained in the writings of these two great naturalists. The beginnings of botany and zoology as fields of scientific study are lost in the past, but all (or at least most) of the previous accumulations of knowledge regarding natural history, clarified and reduced to system, are preserved in the writings of these two great men. The works of Aristotle, and those of his co-workers under his direction, represent probably the most prodigious intellectual achievements ever connected with a single man.

Included in his writings are: "The History of Animals", "On the

⁹Georghiou, p. 10.

Movements of Animals," "On the Generation of Animals," "On Respiration," and "On the Phenomenon Chiefly Connected with Natural History." Aristotle was not a mere compiler of facts, he was a skilled observer. He did accept many of the observations and reports of his co-workers without first putting them to a test. This, as well as other things, did cause inaccuracies in his writings. His writings contain an immense quantity of accurate observations on honey bees, as well as other insects. He was limited in his observations of the honey bees because the hives of his day lacked movable frames. His hives contained only top bars as guides for the bees, in the making of their comb. In this type of hive the bees will use the top bars as guides but they will fasten the sides of the comb to the sides of the hive making it almost impossible to remove the comb and replace it for further observation. This greatly limited his study of certain phases of the life of the honey bees. One only needs to read his own description of the life history of the honey bee to realize the handicap that Aristotle and his co-workers worked under.

He begins the life history of the bee by remarking that after the cells have been constructed, the larvae are placed in them. This is the earliest stage of which he speaks, from his own observation. He describes with great accuracy the growth of the larvae into an adult bee.¹⁰

In the "Generacione Animalium," he indicates that he believes that the rulers generate rulers, and that the workers generate drones and the drones do not reproduce at all. This places him among the first to drop the idea that honey bees were generated from oxen. He also thought that there was more than one ruler to each hive, and that the hive would not survive if there were either too many or too few rulers. However, he was correct in stating that the rulers are connected with the production of

¹⁰Georghiou, p. 10.

the brood.* Aristotle also tells us that some beekeepers use what we might call a "primitive drone trap" made of a net which keeps the drones out, because of their larger size, but allows the smaller workers to go through. This was done to "starve out" the drones because they do no work and they eat up the stored food. The only useful function of the drones is to fertilize the virgin queen and the drone traps would exclude them from the hive after this vital function was performed. He knew that the honey or nectar is carried in the honey stomach, and that beebread or pollen is carried on the legs of the workers. He did not understand where the wax came from but was of the opinion that it was brought into the hive on the legs of the workers also. He knew of some of the hazards of beekeeping and he mentions among others: wasps, toads, frogs, and swallows, as well as the well known honey bee disease called "foulbrood" which is a bacterial infection that attacks the brood.

It is said that he was among the first to observe that worker honey bees did not visit flowers of several different species of plants on one flight, but remained constant to one species. It is known today that individual bees even remain constant to individual plants.

It should be mentioned that Theophrastus wrote mostly on plants, but he refers to beekeeping in several places in his works. He seems to have had the idea that nectar is connected in some way with flowers, but he still mentions the old belief that nectar is spontaneously generated from air and reeds.

*Brood is a term commonly used to designate the young of the honey bees that have not emerged from the cells. It may be young bees just before they emerge from the cells, the larvae in various stages of growth, or even the eggs.

Other events about beekeeping in antiquity mentioned by Georghiou¹¹ are described in the following quote from his article:

116-27 B. C. - Varro (Roman scholar and author). He mentions a certain Seius, who leased his hives at a yearly rent of 500 pounds of honey, and another successful beekeeper named Velanius whom he knew in Spain. He inherited half an acre of land, on which he made a garden and used the rest planted with thyme, cytins, and apiastrum, as an apiary. He was successful and cleared on the average 10,000 sesterces a year (\$320)

Varro gives a long list of the materials of which hives are made, including those made of osiers and round in shape (perhaps skeps), those made of wood and bark, those made of hollow trees, of earthen-ware, and last of all those made of reeds. The last named are to be 3' x 1' x 1', narrower in the middle than at the ends, and capable of contraction and enlargement, by pushing in and drawing out the ends.

He mentions that spring diarrhea is said to be due to feeding on almond and cornel flowers, and for a cure, urine is given them to drink. Wax is still thought to be collected from flowers. It is believed that Virgil (70-19 B. C.) copied largely from Varro.

From Varro's writing it is evident that beekeeping was an established commercial practice in several countries bordering the Mediterranean Sea.

100 B. C. - In Roman Law, bees which were not enclosed in a hive, were legally considered masterless. "Bees are wild by nature. Therefore, bees that swarm upon your tree, until you have hived them are no more considered your property than the birds which build their nests on your tree; so if anyone else hives them, he becomes their owner."

70-19 B. C. - Virgil (Roman poet). His poems are characterized by a deep love and admiration toward bees. He refers to bees on about 16 occasions, in Eclogues, Georgics, and Aeneid. He is both a beekeeper and a poet. He gives a lot of realistic information and instructions about bees, but he lacks the scientific method of Aristotle. He considers thyme to be the best honey.

Virgil recommends clipping of the wings of the ruler to check the issue of swarms. He speaks about shade and wind protection. He also states that the noise of cymbals is to be used to make the swarms settle. This belief has persisted in many countries until today. He states that bees gather their young from leaves and sweet plants, a statement which Pliny later copied. (Pliny, 62-113 A. D.)

The keeping of honey bees could not fail to excite the wonder and admiration of primitive peoples. They looked upon the honey bee as a privileged creature, because it lived in societies like those of man but much more harmonious. Its flying ability, its painful sting, its close relationship with the beautiful flowers of nature, its avoidance of all

¹¹Georghiou, p. 11.

unwholesome things, the attachment of the workers to the queen - regarded by the ancients as a king -, its singular swarming habits and its astonishing industry in collecting and storing provisions and skill in making wax, made the honey bee a divine being and a prime favorite of the gods. No wonder that the honey bee in the course of time came to symbolize all the virtues except hospitality. To the ancient peoples, bent as they were on maintaining their tribal or national integrity, the fact that honey bees will not tolerate the society of those from another hive was probably interpreted as a virtue.

Down through the centuries the honey bee became the object of many myths, legends and superstitions. It is supposed to have played an important role in the lives of all of the more important divinities of the time. Among the Latins it even had a divinity of its own, the goddess Mellonia. The housefly had to be satisfied with the patronage of the prince of the devils, Beelzebub, and the ant was given so obscure a patron saint as St. Saturninus, but the honey bee enjoyed the special favor of the Virgin or was even considered by some to be the "ancilla domini," the maid-servant of the Lord.

Honey was formerly given to babies during baptism and the tapers of many of the modern Christian Churches, by tradition, are still supposed to contain at least 51% pure bees' wax

Until the time of Christ honey bees were looked upon with awe and superstition, as is evidenced in the meager records available. As we move from the time of Virgil (B. C.) to the next important writings there is evidence of a change in attitude towards the honey bee.

PART III. FROM VIRGIL TO DZIERZON

As previously stated, as we move from the time of Virgil to the later authors and writers we can notice that history records a very important change in beekeeping. One no longer finds the affection for honey bees so characteristic of men like Virgil. In about 60 A. D. Columella, a Roman practical writer on agriculture, wrote on honey bees and stressed their commercial value. From this time on we notice more and more writings that tell the beekeeper the step-by-step methods of caring for his apiary and how to make more profit from his honey bees. There were, of course, still some who wrote on the mystical and esthetic side. Pliny, the Younger, (62-113 A. D.) was such a writer. He wrote a great deal on beekeeping, but his works had no systematic arrangement and he merely repeats what other authors have written both factual and legendary. For example, he goes into great detail in giving the directions for slaying the ox and caring for the carcass for the generation of honey bees. He also explains in detail how the bees gather their larvae from flowers.

In the series of books called "Geoponica" which were written by order of the Emperor Constantine VII of Byzantium and are in the form of an encyclopedia and are supposed to contain all of the available information known at the time (950 A. D.), one can find considerable information on the honey bee and beekeeping.

One of the first references available on honey bees in the New World is to the reign of the Inca, Tupac Yupanqui, who lived from 1448 to 1482.

Georghiou¹ states that Tupac Yupanqui conquered some Sylvan natives who were so poor that the only tribute that they could pay was one of macaws, monkeys, honey, and beeswax.

In 1568 Nickel Jacobs recommended a treatment for the honey bee disease that we now know as American foulbrood (*die foule brut*) similar to the one used until recently. His method was to cut out all of the honey and combs, keep the bees locked in for three days and starve them, then place a new hive in the same place as the old hive originally stood, place the sick bees in the new hive, give them new honey and they should improve. The only better method known today is to completely destroy the entire hive by burning. This is what is required in some states today.

Sometime in the latter part of the 16th century bar hives and movable combs came into being. In the bar hives flat pieces of wood (bars) were laid across the top of the hive to give the bees a guide and a support for their combs. In the movable comb hives the frame for the comb surrounded the comb and made them movable. (Fig. 4c). Reference is made to both of these in a book on honey bees published in 1590 by the Italian Giovanni Rucellai.

As previously stated, many of the early writers and workers believed that the honey bees which we now speak of as queens were kings. It seems that they did not definitely know the sex of any of the three casts of bees that lived in the hives. (Fig. 3) The idea that the 'King Bee' is a female was not wholly unfamiliar to ancient authors, however, for Aristotle² wrote:

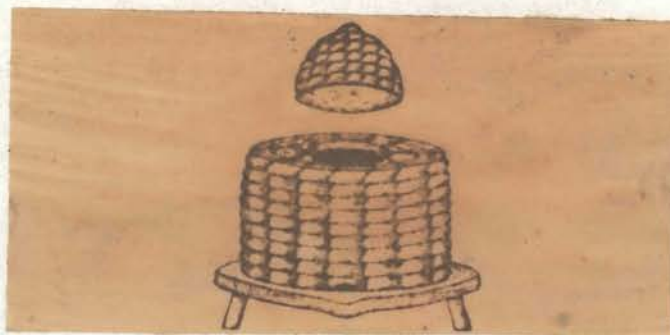
By some they are called mother bees, as if they were the parents of the rest; and they argue that unless the ruler is present, drones only are produced and no bees (workers). Others affirm that they have sexual intercourse and that the drones are males and the bees (workers) females.

¹Georghiou, p. 87.

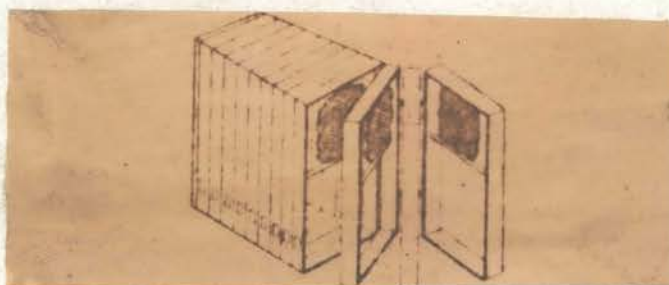
²Aristotle, History of Animals, tr. Cresswell, 1907, p. 128.



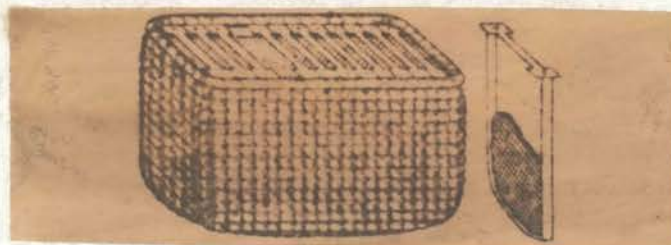
Figure 3. a, Drone; b, Queen; c, Worker; Casts of the honey bee colony. Enlarged slightly. (Photos by O. W. Park) (From Grout, p. 25.)



4a. The straw skep and small super.



4b. Huber's Leaf Hive.



4c. An early bar frame hive, upside down. The hive is made of straw and the combs fit close to the sides.

Figure 4. Three early types of beehives.
(From Clark, p. 45.)

Butler³ states that it was not until the Reverend Charles Butler of Magdalen College, Oxford, published his justly famous book The Feminine Monarchie in 1609 that the sex of the various casts was established, and the statement made that the rulers were females. It should be noted that Butler made a big mistake in assuming that the workers mate with the drones and lay the eggs from which both workers and drones are produced, while the queens beget only queens.

The drone, which is a gross hive bee without sting, hath been always reputed a greedy lazer. For howsoever he brave it with his round velvet cap, his side gown, his full paunch, and his loud voice; yet is he but an idle companion, living by the sweat of others brows. For he worketh not at all, either at home or abroad, and yet spendeth as much as two labourers; you shall never find his maw without a drop of the purest nectar. In the heat of the day he flieth abroad, aloft and about, and that with no small noise, as though he would do some great act; but it is only for his pleasure, and to get him a stomach, and then returns he presently to his cheer.⁴

I am afraid that Reverend Charles Butler clearly disapproved of drones and was scarcely fair to them, and I wonder whether he was not perhaps largely responsible for the slanderous epithet "idle as a drone."

The anonymous author of Traité Jurieux des Mouches à Miel (Paris, 1734) mentions the "King Bee" as the mother of all the others. This concept of the queens role in the hive had actually been established earlier, sometime prior to 1680, by Swammerdam⁵ who ascertained the sex of the casts of honey bees by dissection, and to whom most likely belongs the credit for having been the first to demonstrate conclusively the sex of the queen honey bee. His discoveries left no room for doubt either as to the sex of the ruler honey bee or as to the origin of the other bees of the colony. Naturally, the mother honey bee came to be known as the queen, although she in no way governs.

³Colin G. Butler, The World of the Honeybee (New York, 1955), p. 35.

⁴Ibid, p. 35-36.

⁵Swammerdam, Jan. 1737. Biblia Naturae Leyde(Leyden)

It is reported that Swammerdam worked so hard and so steady on his treatise on bees that he never again regained his former health. It is known that he worked from sunup to sundown in the bright sun without a hat for fear of impairing his vision and that he spent much of the nighttime in recording his observations by making drawings and suitable explanations. He was truly one of the greatest of the early naturalists, and apiarists.

During the time from 1590 to the time of Linnaeus' 10th Edition of Systema Naturae there were several rather important advances in the art of beekeeping. In 1590 J. and Z. Janssen of Holland invented the microscope, which enabled workers to examine structures that had before been invisible to the unaided eye. This was the same year that bar hives and movable combs are referred to by Giovanni Rucellai. (Mentioned previously). In 1652, a man by the name of Mewe, in Great Britain, is said to have constructed hives of wood, with movable top bars. In 1655, Maraldi, in Italy, invented a single comb hive having glass sides for observation. John Houghton, in England, (1683), invented a movable frame hive but his bee spaces were too wide and the bees would soon make the frames immovable by trying to fill the bee space with propolis. Reaumur (1683-1757), in France, was the first to report experiments of confining a queen and a drone together in a glass dish, for mating. This seems rather odd to the modern beekeeper, but it must be remembered that it was thought by most of the beekeepers of the time that the queen mated in the hive and this appeared to be a rather logical experiment.

In 1684, Martin John is reported to have picked scales of wax from the abdomen of a bee that was working at comb building. He was thus the first to observe and record the fact that wax for the comb was a product

of the body of the honey bee. First mention of the parasitic Dipteran (two winged fly) *Braula coeca* on bees was in 1740. The larvae of these wingless flies burrow into the combs just under the cappings while the adults can be seen on the back of the queen and sometimes the workers, feeding on nectar that exudes from the bees' mouths.⁶

The next important date in the history of beekeeping, although it has no direct effect on the actual practice of beekeeping, is the publishing in 1758 of the 10th Edition of Systema Naturae by Carolus Linnaeus. It was in this book that for the first time the binomial system of nomenclature was used consistently. It was also in this book that the honey bee was named Apis mellifera, which means honey carrier. Some workers of more recent times have called the honey bee Apis mellifica, which means honey maker, but due to the rule of priority in zoological nomenclature we must properly call the honey bee Apis mellifera.

In 1771, Anton Janscha,⁷ the son of poor country folk, who had knowledge of both theoretical and practical beekeeping in advance of his times and became the Imperial and Royal Beekeeper to the Empress Maria Theresa, gave a full and extraordinarily accurate description of the process of swarming,* and of the mating of the virgin queen outside her hive and how she thus became the mother of the colony. He published two books in which he mentioned his discoveries about the life history of the honey bee, but as mentioned elsewhere, it was not until well into the nineteenth century that the theory of spontaneous generation was disproved forever.

⁶Georghiou, p. 87-88.

⁷Butler, p. 36.

*Swarming is nature's provision for the reproduction of colonies, as distinguished from reproduction of the individuals that make up the colony. It involves the multiplication of colonies through division together with provisions for the production of additional queens. It is the natural result of overcrowding, lack of food, etc.

Francis Huber, in Switzerland, in 1788, noted that the virgin queens fly out and when they return to the hive they have evidence of having mated. (The male reproductive organs are seen attached to the abdomen of the queen, the drone having given his life in the process.) One year later he actually demonstrated that they mate outside of the hive in the air.⁸ About the same time he invented his famous "leaf hive." (Fig. 4b). He provided a frame which supported the combs on all sides. Instead of hanging the frames inside the hive, he fastened them together at the back with hinges enabling him to spread them apart in front like the leaves of a book.⁹ Huber made several other contributions. In 1788, he first reported that he observed two queens that mated twice. In 1791, he tried unsuccessfully to "fecundate" a virgin queen artificially by introducing within her vagina, at the end of a hair pencil, a little of the liquid of the male. In 1793, he showed that the true source of beeswax was nectar and not pollen. Huber contributed a great deal to our knowledge of honey bee behavior mainly as a result of being better able to observe them in his leaf hive. His contributions are all the more outstanding when one realizes that he was blind,¹⁰ and his observations were made through the eyes of an assistant.

At about this time, 1788 to be exact, a German beekeeper by the name of Ernst Spitzner (or Spilzner) observed and reported on what is now called the "dance" of the bees. He was the first person to give this act its correct interpretation, but like many other bits of information, these

⁸Georghiou, p. 88.

⁹H. C. Dadant, "Beekeeping Equipment," The Hive and the Honey Bee, ed. Roy A. Grout (Hamilton, Ill., 1954), p. 169.

¹⁰Ibid., p. 170.

observations published so many years ago had been forgotten or overlooked and had to be rediscovered from time to time. In 1886, A. I. Root suggested the true meaning of the "dance" but most beekeepers continued to believe that this behavior was restricted to young honey bees bringing in their first loads.¹¹ It is now known that the "dance" of the incoming foragers is a method of communicating to their hivemates certain information concerning the type and location of the substance they are seeking, as well as the amount (or abundance) and the distance it is from the hive. They perform the "dance" when they return to the hive regardless of whether they carry nectar, pollen, propolis, or water.

Of course such a striking activity must have been noticed by untold numbers of beekeepers, and doubtless its meaning has been surmised by a number of unknown observers. But, to Karl von Frisch, the noted German experimenter on honey bees, must go the credit for having demonstrated by numerous careful experiments that the "dance" of the incoming foragers is actually a means of communicating to their hivemates certain information concerning available booty. Von Frisch¹² describes two types of "dances" that the returning foragers perform.

To study the behavior of bees which have just discovered a rich source of food one may set out near the observation hive a glass dish filled with sugar-water. When a foraging worker comes to this feeding place she is marked with a colored spot while she is sucking up the sugar, so that we can recognize her later in the hive. After she has returned to the hive our marked bee is first seen to deliver most of the sugar-water to other bees. Then she begins to perform what I have called a round dance. On the same spot she turns around, once to the right, once to the left, repeating these circles again and again with great vigor. Often the dance is continued for half a minute or longer at the same spot. Frequently the dancer then moves to another spot on the honeycomb and repeats the round dance and afterwards ordinarily returns to the feeding place to gather more sugar.

¹¹O. W. Park, "Activities of Honey Bees," The Hive and the Honey Bee, ed. Roy A. Grout (Hamilton, Ill.) 1954, p. 107.

¹²Karl von Frisch, Bees: Their Vision, Chemical Senses, and Language (Ithaca, N. Y., 1950), p. 53-96.

During the dance the bees near the dancer become greatly excited; they troop behind her as she circles, keeping their antennae close to her body. Suddenly one of them turns away and leaves the hive. Others do likewise, and soon some of these bees appear at the feeding place. After they have returned home they also dance, and the more bees there are dancing in the hive the more appear at the feeding place. It is clear that the dance inside the hive reports the existence of food. But it is not clear how the bees that have been aroused by the dance manage to find the feeding place. . . .

These dances are observed only if there is a rich source of food, so that evidently they also carry the basic meaning "There is plenty of food and sweetness." . . . The sweeter the sugar the more vigorous are the dances.

This reaction can be observed under natural conditions when the bees are visiting flowers; and it is important for the bees, since several kinds of flowers often come into bloom at the same time. When this happens the various species may be discovered by foragers from the same hive, but those bees which have discovered the richest source of food dance most vigorously and send out the largest number of new foragers to this kind of plant.¹³

Observations had suggested to several workers that honey bees could also convey information concerning the distance from the hive to the source of food supply. To study this interesting question Von Frisch (1944) established two feeding stations, one 10 meters away from his observation hive and the other one 300 meters from the hive. The results of the experiment are given here in some detail.

When we now look into the observation hive we see a truly curious sight: all the bees marked at the 10-meter food source are performing round dances just like those described above. But all the bees that have come from the more distant feeding place are dancing in quite a different manner. They perform what I have called a "wagging dance". They run a short distance in a straight line while wagging the abdomen very rapidly from side to side; then they make a complete 360-degree turn to the left, run straight ahead once more, turn to the right, and repeat this pattern over and over again. This wagging dance was one I had observed many years before; but I had always taken it for the characteristic dance of bees bringing pollen to the hive, whereas now I saw that it was performed most vigorously by bees which were bringing in sugar solutions from the experimental feeding place at 300 meters.¹⁴

¹³Von Frisch, p. 55-65.

¹⁴Ibid., p. 69-70.

On the basis of this and other experiments, von Frisch reported that the kind of dance performed by an incoming forager is determined not by the character of her load, but by the distance of the food source from the hive. When the distance is less than about 75 yards (50 to 100 meters) she does the round dance. But when the distance is greater than about 75 yards, the forager performs the wagging or wag-tail dance. The number of repetitions depends upon the distance to the source of the supply. If only a little over 75 yards away, there may be as many as 40 wag-tail runs in a minute, but their number decreases with increased distance, until at 2 miles only about eight tail-wagging runs are made per minute.

Furthermore, the direction of the food supply from the hive was found to be indicated by the direction of the straight portion of the forager's run. By a vertical upward run, the dancer indicates that the feeding place is in the same direction as the sun, or by running downward she shows it to be in the opposite direction. To indicate a location to the right or to the left of the sun, she runs upward and to the right or left of the vertical at an angle equal to that by which the source lies to the right or left of the sun, as the case may be. It is remarkable that the heading toward the sun is the direction of flight selected to correspond with an upward movement during the straight component of the wagging dance. (Fig. 5).

During the last decade of the 18th century John Hunter explained how the eggs of the queen are fertilized from the contents of the spermatheca, the saclike structure in the female in which sperms from the male are received and stored, and also again discovered the wax glands by which the scales are produced for making the comb.

In 1794 the first report on the existence of poisonous honey in the United States, by Barton, an American Botanist was given.¹⁵ Poisonous honey generally does not cause death, only acute illness.

The greater wax moth, Galleria mellonella L., was first recorded in the United States in 1805. The larvae of the moth destroys the combs in stored supers* and in weak hives if not controlled by the beekeeper.

One of the first movable-frame hives was invented by Prokopovitch in the Ukraine in 1807. It is said that he personally had over 3000 of them in his own apiary. His frames bear considerable resemblance to our beeway sections of today and his hive joints were dovetailed.

Alsike clover which had proven to be an excellent bee pasture in Northern Europe was introduced into England in 1834 and into America in 1839.

About 1843 Gottlieb Kretchmer, in Germany, conceived the idea of using an artificial base for comb foundation. He dipped tracing linen into molten wax and afterwards passed it between engraved rollers. The idea was all right but for one thing, the bees would start their cells on the base, but upon reaching the fibers of the linen, they would destroy what they had built trying to remove the fibers.

Two years later, in 1845, the Reverend John Dzierzon of Poland propounded his ideas on the parentage of the various casts in the colony. While he was not the original discoverer of parthenogenesis, he threw a great deal of light on the subject, and in reality laid the foundation for much of our scientific and practical knowledge of honey bees.

¹⁵Georghiou, p. 89.

*Supers are the removable upper stories of the beehives which contain comb or comb foundation for the storage of honey. They are removed after the honey-flow, the honey is extracted, and they are stored.

Dzierzon's theory was published in "Eichstadter Bienenzeitung", a journal, in 1845. It is said that he was thrown out of a scientific society for his claims. The real essence of Dzierzon's theory as he originally published it, is that in the honey bees, the males (drones) arise from unfertilized eggs while females (workers and queens) arise from fertilized eggs. Georghiou¹⁶ states the following points as the basic idea of the theory.

- (1) The queen is the only perfect female in the hive.
- (2) She lays male and female eggs from which are produced drones, and workers or queens respectively.
- (3) The queen possesses the ability to lay male or female eggs, after she has been fertilized by a drone in the air. (1849)

Beekeepers all over the world began to hear of the superiority of the bees of Italy (the Italian race of honey bees) and of course desired them for their own use. The first recorded exportation of Italian bees from their homeland was in 1843 to Switzerland. They were introduced into Brazil in 1845 and in 1853 Dzierzon introduced them into Silesia, Germany. He attempted to ship a nucleus of Italian honey bees to Samuel Wagner and Edward in Pennsylvania in 1855 but they arrived dead. The next attempt to introduce the Italian honey bees to the United States was in 1858 and 1859 by Samuel Wagner, L. L. Langstroth, and Richard Colvin and it was successful.¹⁷ It is not known exactly how they were shipped but undoubtable they received good care and were fed regularly.

The introduction of Italian honey bees along with other events at about the same time mark the real beginning of beekeeping in the United States.

¹⁶Georghiou, p. 89.

¹⁷Ibid., p. 153-154.

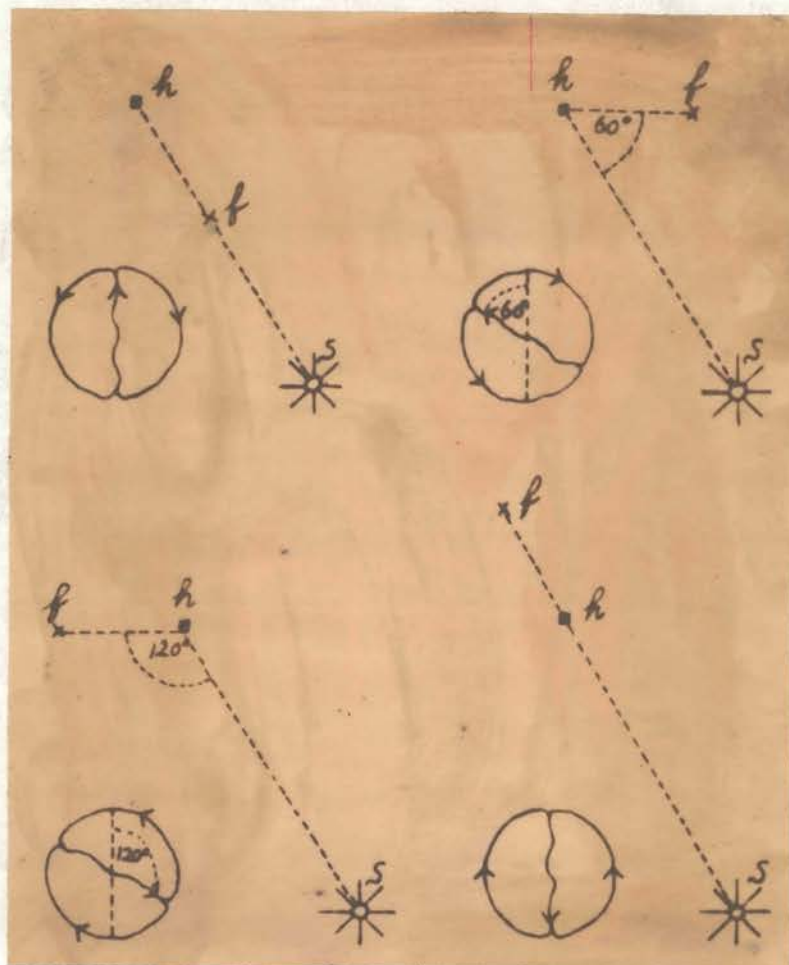


Figure 5. The wagging dance. h = beehive, f = feeding place, S = sun's position. At left of each diagram is shown how the bees dance on the perpendicular comb to indicate the direction of the feeding place with respect to the sun's position. Note that the bearing of the sun is transferred to the upward direction, perceived by means of gravity. (From Von Frisch, p. 77.)



Figure 6. A section of honeycomb. All three types of brood cells are shown. The large "peanut shaped" ones are the sealed queen cells. The larger sealed cells in the lower right hand corner are sealed drone cells. The smaller sealed cells on the left are worker cells. Both drones and workers are shown on the hive. (From Clark, p. 112.)

PART IV. BEEKEEPING IN AMERICA

The controversy as to when the first honey bees were brought to America, or, indeed, whether they were native or were introduced, is a whole facet of the history of beekeeping in America, but is very involved and much of the information necessary to establish the facts seems impossible to obtain.

The Indians spoke of the honey bee as the "white man's fly" and translators have found no word in the native language of the Indians to express either wax or honey. This would seem to indicate that there are no native honey bees in America.

To quote Fellett:¹

When the colonists came to America they brought the honey-bee with them and the Indians called the honeybee the "white man's fly". These early bees were kept in boxes or straw skeps (Fig. 4a) just as they had been in Europe. Even after a hundred years, the most useful hive was a large box for a brood chamber, with a hole in the top and a cap or surplus chamber placed above for the storage of the surplus honey.

Possibly the greatest discovery in the beekeeping world was the discovery in 1851 of the bee space by Lorenzo L. Langstroth. (Fig. 7) This revolutionized the beekeeping practices and studies everywhere, but especially in the United States. For this great discovery and his invention in the next year of a hive with hanging frames, along with his pioneering work in queen rearing, he is justly considered to be the

¹Frank C. Fellett, "The Development of Beekeeping," The Hive and the Honey Bee, ed. Roy A. Grout (Hamilton, Ill., 1946), p. 1-2.



Figure 7. Lorenzo Lorraine Langstroth,
the father of American Beekeeping.

"Father of American Beekeeping". The bee space seems like such an obvious thing that it is a great mystery why it was not discovered long before. Langstroth, by observing that the honey bees left a space of approximately five-sixteenths of an inch as a passageway between their combs, probably hit upon the most important fact in the habits of these most remarkable little creatures. He made his hive so that each of the hanging frames in the hive was surrounded by the bee space. The honey bees did not need to fill up the spaces with propolis* and it made the frames easy to remove and thereby permitted greatly improved observations and manipulations of the honey bees. The public failed to understand that the fundamental part of Langstroth's patent was the bee space. Many other beekeepers built hives of a slightly different size, but with the same bee space. A book could be written on the various kinds of hives which attained some local repute but only a few of them had any claim to any originality. Pellett² devotes a chapter of his book to what he calls "The Hive Controversy" and it is enjoyable reading if one cares to pursue the subject further.

Demuth³ has stated that there are certain well-defined eras through which beekeeping has passed in its development and that the changes in beekeeping practices are reflected in the development of the beehive. He has divided the development of beekeeping practices into the following eras:

*Propolis is a resinous material gathered by the honey bees from the exudations of the buds of certain trees and other vegetative sources. It is used by the bees to fill cracks, reduce openings, cover objectional objects within the hive, etc.

²Frank C. Pellett, *History of American Beekeeping*, (Ames, Iowa, 1938), p. 21-30.

³G. S. Demuth, "The Evolution of Beekeeping Practice," American Bee Journal, 75(1935), 30-32, 49, 115-117.

The Box-Hive Era - Previous to 1853
The Box-Honey Era - 1853-1867
The First Extracted Honey Era - 1867-1876
The Comb-Honey Era - 1876-1906
The Second Extracted Honey Era - 1906 to present

The titles of these eras are very descriptive and almost tell the story of the development of beekeeping in America by themselves.

Prior to 1853, bees were kept in boxes or other crude devices and therefore this era was properly designated the Box-Hive Era. About this time beekeepers began to notice that the honey bees placed their stores above the brood chamber and various attempts were made at giving the bees added space to store the fruits of their toils so man could reap the harvest of honey with more ease and without so much destruction to the combs. This was usually accomplished by inverting a box over a hole in the top of the box hive.

The Box-Honey Era was characterized by several great discoveries. As previously mentioned, Langstroth discovered the bee space in 1851 and invented a movable frame hive in 1852 or 1853. He also made another great contribution to beekeeping by the publishing of his famous book, "The Hive and the Honey Bee" in 1853. In this book he gave a detailed description of bee management by his system. This book, although it has been repeatedly revised, is in common use today.

Johannes Mehring, in Germany, invented comb foundation produced on a flat press, in 1857. Franz von Hruschka, in 1865, invented the honey extractor in Austria. The honey extractor is a machine used to remove the honey from the combs by centrifical force. The bee smoker, which is used to partially control the bees when working with them, came into use during this era also. Moses Quinby is credited with the discovery of the bellows smoker in about 1870.

During this time men had little interest outside their home surroundings and beekeeping offered an enticing occupation. With the establishment of the "American Bee Journal" in 1861, the first American periodical about honey bees in English, beekeepers found a common means of contact. Interest developed rapidly and new publications arose frequently. The first issue of "Gleanings in Bee Culture" appeared in 1873 as did the first issue of the "British Bee Journal". More than 100 magazines on bees and beekeeping were started in the next fifty years. Some soon disappeared while others continue publication today.

The First Extracted Honey Era was ushered in by the invention of the honey extractor and the wide dissemination of information through the many periodicals of the time. L. L. Langstroth built the first honey extractor in America and is reported to have sold several during the 1867 season. A. I. Root is reported to have produced the first all-metal extractor in America in 1868.

With large amounts of liquid honey available, it became the practice of some unscrupulous operators to adulterate it with the addition of syrup or glucose. Of course reputable beekeepers objected to this practice, but it was not until in the next Era that anything was actually done about it. In 1878, Charles Dadant⁴ went to St. Louis to sell his honey, and was shown jars of glucose that were being sold as honey at a price below what he expected to get for his honey in bulk. Needless to say, he was perturbed. He bought a jar of this glucose and took it home to do some investigating. He learned that it was substituted in like manner for maple syrup, molasses and other sweets. He also learned that

⁴Frank C. Pellett, History of American Beekeeping, (Ames, Iowa, 1938) p. 206-213.

the presence of glucose could be detected by putting a few drops in a cup of tea. The sulphate of iron then present in the glucose turned the tea black. Further investigation disclosed that the sweets then on the market were very generally adulterated in this manner. Dadant immediately started a movement against the adulteration of honey and for the establishment of a Federal law against such practices. The beekeeping industry backed him and gave their enthusiastic support and assistance. Several years later as a consequence of this and similar other agitations, the Pure Food Laws were passed by Congress in 1906. These laws were opposed by powerful interests, but they brought protection to the food supply of the nation and paved the way for an increased supply of extracted honey free from adulteration, and honey rapidly became accepted by the public as a pure food.

It was during the First Extracted Honey Era (1867-1876) that the component parts of the hive were more or less standardized. However, the complete standardization of the beehive and beekeeping practices was not entirely complete, for on the horizon appeared another great invention, upsetting the established system of management, changing the destiny of hive construction, and ushering in the Comb-Honey Era. It was the invention of satisfactory comb foundation.

It will be remembered that comb foundation was invented by Mehring in Germany about 1857, but it was far from perfected at that time. Many improvements were made, but it was not until the latter part of the nineteenth century that comb foundation was manufactured to any great extent. Comb foundation has been continually improved even down to the present time. It should be noted that man has not been able to find a suitable substitute for natural beeswax and must use it almost exclusively in the production of comb foundation.

Demuth⁵ describes the real beginning of comb foundation manufacturing thusly.

In 1875 A. I. Root, with characteristic enthusiasm and energy, began his experiments in making foundation. At first he built up plates to emboss the wax sheets, making the plates by assembling "type" which he moulded, each type having the upper face modeled after the base of the cell. These types were soldered together in such a manner that they formed a solid plate, two of which were used to impress the wax sheets. He also, during the same winter, worked on a roll machine, the first of which was finished at Medina, Ohio, on February 26, 1876. During the year 100 pounds of comb-foundation were sent out from Medina to beekeepers throughout the country for experimental purposes.

The enthusiasm with which this new product was received and tried out gave a new impetus to comb-honey production. Instead of several combs in a box, as in the Box-Honey Era, comb honey was at this time produced in single comb boxes and sheets of comb foundation were used to guide the work of the bees. . . . During the year 1876 neat sections, made of four pieces, but otherwise similar to the comb-honey sections of today, were evolved from their crude prototype, the single comb boxes or frames which had been used by some beekeepers previous to the introduction of comb-foundation.

Comb-honey production now became so attractive that within a few years beekeepers talked and wrote chiefly in terms of comb honey. . . .

There were those who asserted that comb-honey could be produced by man without the aid of the honey bees but A. I. Root made a standing offer of a \$1000 reward to anyone who could do it and he never had to pay out the \$1000.

It was during this era that several improvements were made in the hives and frames being used. Practically all of these improvements were made to improve comb-honey production. The self-spacing devices, the thick top bars, as well as many other more or less minor improvements, were made especially for the comb-honey hive. It might be said that the standardization of hives and frames used in the United States was practically accomplished during this era. The modern hive is illustrated in the Figure 8, page 38.

⁵Demuth, p. 32.

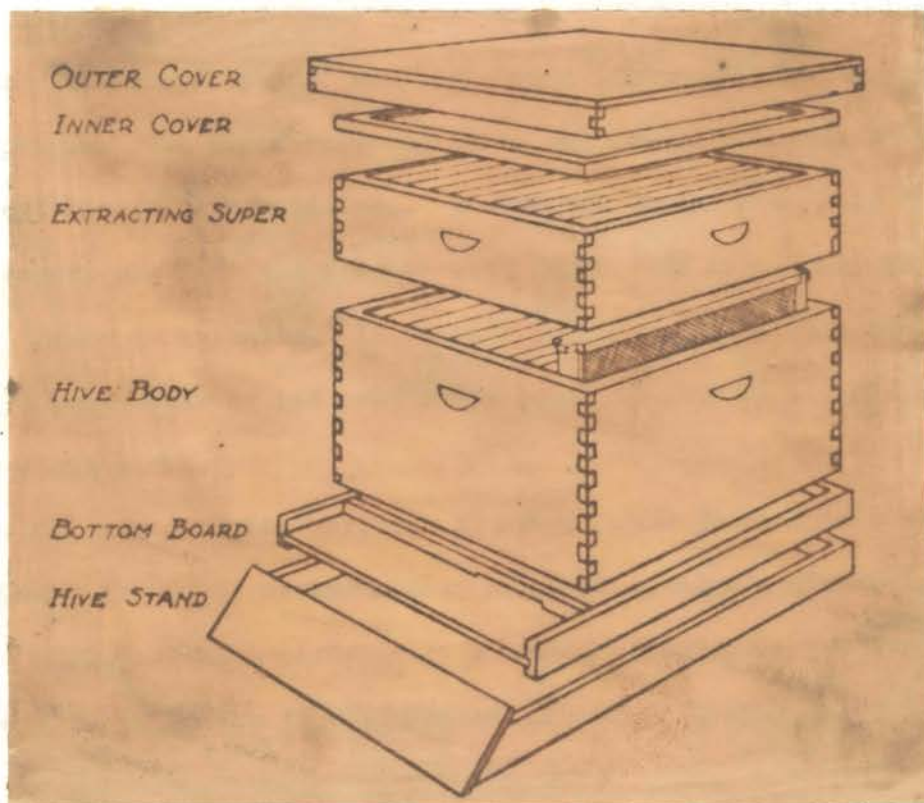


Figure 8. Diagram of the various parts that comprise the beehive, in the order in which they are assembled. (From Grout, p. 192.)

The passage of the Pure Food Laws in 1906, ushered in the Second Extracted Honey Era in the United States. These laws, as previously stated, made it possible to sell liquid honey without its purity being questioned. We are at present only in the dawn of the Second Extracted Honey Era.

The advent of the First World War brought with it a serious shortage of sugar, and the price of honey increased. As a result, the industry expanded by "leaps and bounds" and beekeeping became a fulltime occupation for many people. The honey producing area was greatly increased by the use of sweet clover as bee pasture. It was not uncommon at this time to have beekeepers who operated from several hundred up to as many as five or six thousands of colonies. It is said that many individual beekeepers produced as much honey as had previously been produced by a whole county or even a whole state.

With the ending of the war, the price of honey dropped to a new low and the demand for honey became almost nil. It appears that the industry failed to recognize the importance of a proper advertising program and the price of honey in the 1930's dropped to as low as four cents a pound.⁶

It was then that the last law of nature, self-preservation, became the driving force of the beekeeping industry. Honey co-operatives were formed as a means of marketing honey. Also, the American Honey Institute was formed to educate the public to the fact that honey was a delicious, healthful food and to inform them of the many ways of using it.

The advent of the Second World War again caused great changes in the

⁶Grout, p. 4.

beekeeping industry. This time it was beeswax that was sought. It was in great demand as a weatherproof coating for airplanes, shells, and other war-time equipment. It was (and is) also used in adhesive tape, carbon paper, lipstick, face creams, other such cosmetics, church candles, phonograph records, wax polishes, ointments, and over 100 other products. Dentists still use beeswax to make impressions of teeth, and the cobbler waxes his thread with it. All of these demands for beeswax placed greater emphasis on wax production but there was again a great shortage of sugar all over the world. The products of the hive were so eagerly sought that a ceiling had to be placed on the selling price of both beeswax and honey for the protection of the industry as well as the consumer.⁷

The extreme demand for food caused a big change in bee pasture. Many farmers destroyed their honey plants to plant cash food crops. This, of course, caused a reduction in the number of honey bee colonies. Also, the introduction of the various insecticides and weed sprays took a large toll of honey bees. This reduction had its repercussions in the difficulty caused in the pollination of fruits, vegetables, and field crops that require the presence of honey bees for pollination.

Since the Second World War, a great emphasis has been placed on the number of food crops that require, or are greatly improved, by the presence of the honey bee for pollination,⁸ and a great many small apiaries have been established in areas not previously enriched by their presence.

Most of the research work on honey bees in recent years has been concerned with improved honey plants, improved insecticides containing bee repellants, improvement of the strains of honey bees by selective and

⁷Grout, p. 4.

⁸The dependence of agriculture on the beekeeping industry, (Wash., 1942), USDA Circular E-584.

artificial queen breeding, and upon the understanding of the social organization and the communication activities of the honey bees. There has also been some work in recent years in trying to develop a stingless honey bee from the native ones of South America, but no real progress has been made along that line.

Honey bees are found in every state in the United States. There is in excess of 4,492,000 pounds of beeswax and 228,162,000 pounds of honey produced by nearly six million colonies of honey bees in the United States each year.⁹ It is impossible to estimate the increased value of the various crops that are pollinated by the honey bee but it has been demonstrated on several occasions that proper management of the bee-acre ratio on crops such as alfalfa, clover, and fruit, may increase the crop production by as much as 500% or more. In recent years quite a substantial business has been developed in the renting of honey bee colonies for pollination service.

The practice of beekeeping has increased in importance over the centuries. Many thousands of individuals now keep honey bees for both pleasure and profit. The importance of the honey bee in the pollination of agriculture crops has established beekeeping as one of the fundamental branches of the field of agriculture. What lies in the future for the beekeeping industry can only be speculated upon but the future looks bright, indeed.

⁹Honey: 1959 Annual Summary, Agriculture Marketing Service, Crop Reporting Board, USDA, (Washington, January 1960).

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