

Ancient Chinese Apiculture

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Constantine obtained his MSc from UCSD with his work on honey bee communication. He then started his teaching career while working as a Visiting-Lecturer at the Hong Kong Polytechnic University, and developed a great interest in the history of Chinese apiculture. He is currently teaching Biology at the Tsung Tsin Christian Academy in Hong Kong.



Introduction

Apiculture has a long history in China. The Eastern civilization has been dependent on agriculture for several thousands years. Along the Yellow River and the Yangtze River, farmers grew crops and reared animals. One of the animals they found nutritionally and medicinally valuable was the honey bee. Through the practice of collecting bee products such as honey and brood from the wild colonies, farmers started to understand more about bee behaviour and became able to manage some honey bee species like *Apis cerana*.

In general, bees and wasps are called *Feng* in Chinese, and honey bees are called *Mi-feng*. The earliest written record of bees is the Chinese character *Feng* in ancient inscriptions on animal bones dating back 3000 years (Zhou Yau 1990). Later in the Zhou Dynasty (around 300 BCE), the Chinese character *Mi*, meaning honey, was recorded in the Book of Manner, *Li Ji*, as a dietary recommendation (1993).

Bee hive was first described in *Shan Hai Jin* (A Chinese Bestiary) around the same time period. It was a creature that looked like a human with two heads called *Jiao-chong* and lived in the Grain-Citadel Mountain. It was the leader of the stinging insects. According to the description, it was possibly two big colonies of *Apis dorsata* hanging on a tree branch similar to those in Photo. 1.

Other references to bees can be found in several ancient documents, but none of them specifically focused on apiculture.



Photo. 1. A tree with multiple colonies of *Apis dorsata*

Several hundred years later, the technology of beekeeping advanced and developed into a commercial apicultural industry. In terms of beekeeping skills, people knew special techniques that used honey to attract wild swarms into a wooden hive.

In terms of the bee industry, beeswax was harvested and made into candles (*Mi-zhu*) and given in offerings to the first Han Emperor (206-195 BCE). Soon after there is the first record of a professional beekeeper. His name was Jiang-qi (158 CE -167 CE) who had more than 300 servants working in his bee and pig farm (Zhou Yau 1980). By the end of Tang Dynasty (9th century CE), honey harvesting had become a very common business practice in China. The honey harvest had even become nationally recorded event In the Ming Dynasty (1368 CE -1644 CE), It took place in the sixth month of the Chinese calendar (approximately July).

Beekeepers were already applying beekeeping techniques that were very similar to the modern skills (Liu Jin). For example, they knew how to regularly clean up pests like spiders, wasps and ants and to care for the weak post-swarmed colonies. With this knowledge and technology each beekeeper in the Ming Era, on average, was able to manage 25 colonies in one season.

It was in the Qing Dynasty that the first book of apiculture *Feng Ya Xiao Ji* (Record of a Bee Palace) was written by Hao Yi-xing (1755 CE -1823 CE). The book had 12 chapters about honey beekeeping, namely:

Loyal Relationships	Government (of the colony)
Reproductive Swarming	Making Honey
Foraging among Flowers	Honey Extraction
Yin Yan Attributes (of the photophobic behaviour)	
Knowledge of the Sky (about fortune telling)	
Knowledge of the Habitat	Stinging
Offspring	Exodus of the Drones

There were three other chapters on bees and wasps.

Poetic literature about honey and bees were not rare in Ancient China. One of the earliest recorded is in the Song of Poetry (before 200 BCE), under the Hymns of Zhou. It is a cautionary poem composed by the King of Zhou who reminded himself to avoid threats from dangerous objects, the stinging bees (which probably represented the warlords of his country). One of the most famous poems about the honey bee was created by Guo Pu in Jin Dynasty (265 CE - 420 CE). It briefly recorded the daily activities of bees gathering nectar in the wilderness, the processing of

nectar into honey, the queen ruling the colony and a swarming scenario in which the bees covered the sun. Besides the bees, poets were also aware of other aspects of the bee hive. Yang Wan-lin from the Song Dynasty (960 CE – 1279 CE) even recorded the taste of worker bodies and lava in a dietary dish.

The history of Chinese apiculture is long and deep. Although China does not have the early cave rock art records of bee-keeping it has a detailed collection of written records showing how mankind has managed colonies to obtain bee products. There were about a thousand individual Chinese writers able to describe a worker, queen and queen cell in the long history of beekeeping in China (Crane, 1999). These writings have to be discovered to have a better understanding of the development of honey beekeeping. Our goal is to make this valuable information more broadly available to non-Chinese readers.

Classification

There are four species of honey bee native to China (Crane, 1999). Today, besides honey-hunting of the little honeybee, *Apis florea*, and the giant honeybee *Apis dorsata*, honey is also harvested from beekeeping of *Apis mellifera* which have been introduced and *Apis cerana* which are native to the region. The Ancient Chinese claimed that there were thousands of species of bees. Actually, they meant there were many species of bees and wasps, and the two were generalized as "Feng". The word of "Feng" was found crafted as ancient scripts on tortoise ventral shells and animal bones (Photo. 2).

One of the forms of this character had fire below the insect (Photo.3.), which possibly meant the bee (hive) was being smoked and handled. The earliest record of smoking a bee hive can be dated back to Song (960 - 1279) and the technique has been employed by the Chinese tribe of Dai for driving off hornets and the collection of lava from the nest since ancient times (Wild China, BBC 2008).

The ancient Chinese character Feng, is composed of two parts: the upper part determines the pronunciation and it means a sharp edge (of the stinger), and the lower part indicates the category of insects where the bees belong.



Photo. 2. An ancient oracle script of "Autumn". Note the lower left character of feng has a character of "fire" underneath. It represents burning the locusts in the autumn, but the insect also looks like a bee when comparing with the characters crafted in Photo. 3.

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Photo. 3. A series of characters suggested to be "Feng" (top; note the stinger), a drawing record of an oracle script (left; note the drawing of Feng in the middle) and a picture of the oracle bone.

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Honey bees species like *A. cerana*, *A. dorsata* and *A. florea* that produce a large quantity of collectable honey are called Mi-feng. Wasps and hornets were generalized into a few types such as Huang-feng (yellow bees), Da Huang-feng (big yellow bees), Hu-feng (bees that build a mud bottle), Mu-feng (bees that live inside wood logs), Cao-feng (bees that live in grasses), Ma-feng (horse bees), and so on. Since the bees and wasps were not clearly defined, it is difficult to identify the species described in the old documents. Even so, we were still able to confirm a few of these species using the inductive clues from different literature. For example, one of the document mentioned that the hive of the biggest Feng (no name offered) was as big as a wheel lid and its deadly venom could kill a cow. By matching the description with the list of native species in China we can deduce that the bee is in fact a hornet, and its nest, along with the nests of wasps, was commonly known as the "bee nest" which have been used in common traditional Chinese medicine (Materia Medica).

Behaviour of honey bees

Eusocial organisms like honey bees behave in a collective manner and sometimes the colony was treated as a super-organism instead of a group of individuals. Chinese culture is based upon a holistic worldview, but they did not have any idea of a colony or a superorganism in the ancient times. The hive and the colony were not clearly distinguished in Chinese literature. Usually, the Chinese character of a bee hive, Feng-fang is sometimes misinterpreted as a colony. Although Chinese naturalists had not come up with the idea of super-organism, they at least recognized some of the group behaviour of honey bee and understood that honey bees were social animals.

A colony of honey bees living in a hive was thought to be a royal family living in a palace. There was a king (queen bee) managing the servants to carry out different tasks. This palace was called Feng-ya meaning Bee Palace (or Government). General intra-specific interactions like aggression and swarming were also referred to in early literature.

Beekeepers found that bees performed a group attack once a person was stung more than three times. This phenomenon is now well explained in science as an induced reaction to the alarm pheromone. Once the bees receive a degree of this chemical signal, they will attack potential offenders around them and the Chinese realized that three stings on a target would trigger massive attacks. However, the group attacks did not receive as much attention as reproductive swarming.

Documentation of honey beekeeping always had a chapter on the subject because it was directly affected the strength of the existing colony. It also leads to the business expansion of an apiary.

The discovery of what today we call labour division was first observed by Hao Yi-xing around 1819 CE, showing that bees in the same colony performed different tasks. He pointed out that foragers were different individuals from those made that honey in the hive and vice versa.

Workers

Worker bees were generalized as Mi-feng (honey bees). There are many documents describing the foraging behaviour of workers because these are the bees most generally encountered. Besides the general behaviour of collecting pollen and nectar Su Che (1039 - 1112) recorded water collection in a poem. On top of that Hao Yi-xing further found bees collecting salt from the ocean which lead him to claim that bees used it to make honey.

Li Shi-zhen (1518-1593), the author of the first comprehensive encyclopaedia of Traditional Chinese Medicine, *Compendium of Materia Medica*, not only pointed out that bees used their antenna as an olfactory organ to smell the flowers, he also believed that bees used faeces, (Song Ying-xing [Ming Dynasty] interpreted this as urine) to make honey (*Material Medica*). Even in the English translation of Li Shi-zhen's book bees were also mistaken reported collecting urine to make honey. This was a possible misunderstanding of bee and wasp behaviour. It was also possible that Li was referring to the case of honey bees collecting sewage at the same time because they were also known for collecting minerals from the ponds and even human sweat. Thus, both cases are empirically supported, and similar to those of Hao Yi-xing with "Feng" collecting substances from an open sewer.

Queens and Swarms

A bee colony naturally has only one king, Feng-wang. In a traditionally male dominated culture like China, the honey bee queen and workers were assumed to be males. Simply the queen bee was called the King because the people associated the highly structured honey bee colony with the Palace of the Chinese emperor a non-scientific association common in traditional Chinese culture until very recent times. The queen was finally clarified as a female in the Qing Dynasty (1760) as female by Zhang Zong-fa.

Detailed behavioural and physiological observation on the queens and swarms was also made as early as the 10th century. Documents showed that the queen of a strong colony left the hive between the 7th and 8th month of the Chinese

calendar (around August and September) taking a large number of workers with her. Some workers served as scouts finding a new hive before moving out, and four (probably meaning "some") workers physically supported the queen in the air, but we suspect this event could be a record of a mating swarm because it was placed right after the section on mating in the literature. The swarm of bees was known to be calm and would not sting if it was carrying the queen, which somehow made the servants (the worker bees) behave well. This information indicated that the Chinese farmers understood that the queen had the ability to control and calm the workers. Today we can explain this through our understanding of queen pheromones. In addition, the colour of the queen was also known to change from yellow to a darker colour once mated.

Drones

For a long time the idea of the actual queen being a male and the drone being a female prevailed. Drones were called "Feng-fu", the "bee woman" and were mistaken for larger hive workers which collected nectar from foragers to process into honey. The misunderstanding of the drone behaviour was a likely a derivative of the traditional Chinese gender role of women (the drones) staying at home (the hive) and doing the housework (processing the honey). In addition, the Chinese correctly claimed that drones did not have venom, and Hao Yi-xing (around 1819) also found drones being ejected from the hive during the food scare winters.

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Table 1. Chinese characters of general bee keeping and their meanings.

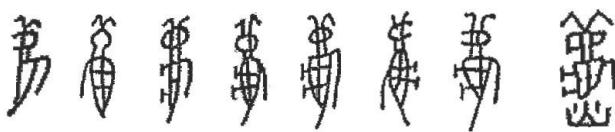
Chinese Characters	Pronunciations	Direct Translations	Meanings (Singular)
蜂	Feng	Bee	Bee or wasp species / sometimes referring to any insect with a stinger
蜜	Mi	Honey	Honey
蜜蜂	Mi-feng	Honey bee	Honey bee
蜜燭	Mi-zhu	Honey Candle	Beeswax candle
蜂王	Feng-wang	Bee King	Queen
蜂婦	Feng-fu	Bee Woman	Drone
蜂子	Feng-zi	Bee Child	Brood
蜂蛹	Feng-yong	Bee Pupa	Pupae
蜂房 / 蜂衙	Feng-fang / Feng-ya	Bee House / Bee Palace	Hive
鋒屍	Feng-shi	Bee Corpse	The (full) freshly dried body of bees or warps
蜂針	Feng-zhen	Bee Needle	Stinger of bees or wasps
蜂毒	Feng-du	Bee Venom	The venom that was ejected from the stinger

Table 2. Years of the Chinese Dynasties (中國歷史年代簡表 文物出版社2001 第二版)

Dynasties	Period*
Prehistory time	Before 1600 BCE (Before Shang)
Shang	1600 BCE – 1100 BCE
Zhou	1100 BCE – 771 BCE
Spring and Autumn Period	770 BCE – 476 BCE
Warlord Period	475 BCE – 221 BCE
Han	206 BCE – 220 CE
Tang	618 CE – 907 CE
Song	960 CE – 1279 CE
Yuen	1279 CE – 1368 CE
Ming	1368 CE – 1644 CE
Qing	1644 CE – 1911 CE
Modern time	1911 CE and after

* BCE Before the Common Era
CE Common Era

Table 3. A series of oracle script characters suggested to be Feng due to the presence of a stinger at the base of each symbol.



The symbol on the extreme right is the ancient oracle script for Autumn. It shows an insect character located above the character for fire. It represents the burning of locusts in Autumn but the insect also look like a bee when compared with the other Feng characters.

