

Origin and Promotion of Artificial Field Rearing Technology of Tussah

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Abstract

The artificial field rearing technology of Tussah silkworm is the first creation of China's sericulture, and thus opened the industrialization process of modern silk industry in the world. Because the literature on the origin and dissemination of the artificial field rearing of tussah is more in ancient Chinese books, the international overall research on the technology of the artificial field rearing of tussah academic papers is very rare. By referring to many ancient documents and translating them, this paper points out that the origin of artificial field rearing technology of tussah silkworm is in the late Ming and early Qing dynasty (from the beginning of the 15th century to the middle of the 15th century), and the only place of its origin is the mountainous area in the southwest of Shandong province, from which it spread to Henan, Sichuan, Anhui, Guizhou, Japan, Russia and European countries.

Keywords: wild silkworm, Tussah, The fifteenth century, artificial field rearing technology of Tussah, Pongee, Origin, spread

The artificial field rearing technology of tussah was first developed in China. ¹Silkworms are mainly fed indoors, while tussah silkworms should be fed in the wild. *Antheraea pernyi* (Guerin-Meneville, 1855) is an insect belonging to the genus *Antheraea* *pernyi* in the family of the order Lepidoptera. The tussah silkworm has been used for large-scale silk reeling since the 15th century AD. The tussah silkworm used for weaving silk cocoon is domesticated from wild silkworm seeds. ²China four or five thousand years ago began artificial rearing of silkworms, and the history of artificial field rearing tussah silkworms only four or five hundred years ago. Oak silkworm artificial field rearing technology is divided into maintenance, breeding, silkworm rearing, silkworm, insect-resistant drive beast, to pass in the oak trees planting and maintenance, to select the silkworm egg placed on oak for parenting, need according to the circumstance of silkworm feeding, in the process of the silkworm uniform change new blade, and pay attention to prevention in the process of grazing, insects, etc., Finally, the cocoons are harvested in spring, summer and fall, after which the moth needs to be selected as a backup for the next year, It's a cyclical thing. The famous Shandong silk cocoon is made from silk spun by the tussah silkworm. The emergence and spread of the artificial field rearing technology of tussah silkworm directly affected the development of silk cocoon, which laid the foundation for its transition from unstable small-scale production to relatively stable large-scale production.

¹ Department of Biology, Sun Yat-sen University. Research on tussah silkworm. *Journal of Sun Yat-sen University*, 1966(1)

² Ding Dechao. (2020). *Trivial Silk, Great Business: Tussah Slik Industry in Modern China*. Beijing: China Social Sciences Press.



Figure 1. Tussah



Figure 2. Tussah cocoon

1. Tussah Artificial Field Rearing Technology Origin Time

Throughout the history of Chinese agricultural books before the Song and Yuan dynasties, such as "*Nongsang Jiyao*", "*Wang Zhen Nongshu*", there is no record of tussah or wild silkworm, it can be seen that the tussah rearing did not appear at that time, the emergence of "wild silkworm cocoon" is a natural phenomenon in the pure wild environment. In the qing Dynasty, Zhang Song (1697 -- 1758) recorded this in the book "*Shan can Pu*", which was translated as: Although tussah silkworm appeared for a long time, they lived in the wild in the early period without artificial field rearing and were left to fend for themselves. The ancients also did not make use of it, only as an auspicious prophecy. In the Qing Dynasty, people mastered the technology of artificial field rearing tussah silkworm, and improved the weaving process, and finally woven pongee. However, the account in "*Shang Shu Yugong*"³ about 400 BC about the farmers living in the mountains weaving silk with silk spun by wild silkworms in the mountains only refers to the cocoons of wild silkworms in natural conditions, which is an accidental act, and cannot be regarded as the source of reeling silk and weaving silk of tussah silkworm. ⁴Yang Shen, an agronomist in the reign of Emperor Qianlong of the Qing Dynasty, recorded in "*Binfeng Guangyi*"⁵: "As early as in the late Ming Dynasty (early 15th century), someone taught farmers in Shandong to artificially raise tussah silkworms, and now results have been seen."⁶ Zhou Zhanmei, a scholar of the Republic of China, also pointed out clearly in the article "Tussah silkworm" that "tussah silkworm originated from the mountains and forests in Shandong and other places in China, and it was a common phenomenon before the Han Dynasty, but did not cause too much attention; Until the Qing Dynasty, began to be artificially raised by farmers, then farmers began to use tussah silk woven silk." ⁷Thus it can be seen that tussah silkworm field rearing technology should be produced in the middle and late Ming dynasty to the early Qing Dynasty.

It is worth noting that in the early days of field rearing, there was no distinction between the varieties of wild silkworms. In the Ming Dynasty, Xu Guangqi wrote in the Annotated Book of "*Nongzheng Quanshujiaozhu*", "The techniques of artificial field rearing tussah silkworms are known to include mulberry and cudrania, and the farmers of The Donglai ⁸region can use many species of silkworms..."⁹ At that time, the people with oak trees, pepper trees, toon trees, chu trees to raise tussah silkworms. To the Qing Dynasty, "*Shandong Tongzhi* record: "mountain silkworm has tsubaki silkworm, chu silkworm, willow silkworm, tussah silkworm these different varieties, because tussah silkworm is the largest number, so it is also the most famous."¹⁰ From this, because the oak tree is more suitable for planting and maintenance, tussah silk quality, high yield, so to give priority to the tussah tree, and the range of mountain silkworm species is also fixed as tussah silkworm.

³ "*Shang Shu Yugong*" is the first regional geography work in China. It was written by a person in the State of Wei during the Warring States period

⁴ (Qing) Zhang SONG. Sequence of silkworm of The Mountain.

⁵ Note: "*Ballad of the bin Area in the general area*" is a farming book written by Yang Shen of the Qing Dynasty. The book is divided into three volumes, leading about ten thousand words, to record sericulture, mulberry planting, silk weaving.

⁶ (Qing) By Yang Shen. translated by Zheng Guangjiang, Zheng Zongyuan. (1962). *General Ballad of the bin Area*. Beijing: Agriculture Press.

⁷ Zhou Zhanmei. (1936). Tussah silkworm. *Agricultural Journal*, 3(35).

⁸ Named because of ancient place names, now refers to shandong Jiaodong Peninsula Yantai, Weihai area.

⁹ (Ming) written by Xu Guangqi, annotated by Shi Shenghan, collated by agronomy Institute, Northwest Agricultural University. (1979). *Annotated agricultural and Political books*. Shanghai Ancient Books Publishing.

¹⁰ Kang Xi (Qing Dynasty). (1673). *Shandong annals Products*.

Until the Qing Dynasty, the artificial field rearing technology of tussah silkworm had been fully mature, and the yield of tussah silkworm cocoon increased greatly, which provided the guarantee of raw materials for mass production of silk. The discovery, understanding and artificial field rearing of tussah are closely related to people's production practice.¹¹

2. Tussah Artificial Field Rearing Technology Origin Region

In the research on the origin of artificial field rearing technology of Tussah silkworm, the conclusion of "the only source" is more positive in academic circles at present. That is to say the only source of artificial field rearing technology tussah silkworm is in the Shandong area, more accurately said artificial field rearing tussah silkworm originated from Shandong central and southern mountains at the earliest.¹² After consulting a lot of literature, it can determine the "only source" of the reasons are summed up to have two: first, ancient books, poems on the Shandong mountain range of tussah silkworm and its transmission of the most recorded and earliest; Second, in the local Chronicles of many places in Shandong, mountain cocoons and ponies are listed as special products.

"Haiyang county annals", once recorded in Ming Wanli years, zhaoyuan County under the of a village named Tussah LAN. "Tussah LAN" in the ancient text has the meaning of raising wild silkworms in the forest. The village is named for the reason it is located near the tussah silkworm cultivation forest. Shancan Shuo in "Wild silkworms theory", written by Sun Yanquan in the eighth year of Shunzhi in the Qing Dynasty, recorded in detail the scene of wild silkworm farms in the mountains near Zhucheng. It is believed to be the earliest writing detailing how to artificially release tussah silkworms. Near the village of Anqiushimen, there are many tussah forests, known locally as wild silkworm rearing forests, and such forests and wild silkworms are abundant in the valleys of southwestern Shandong. In April the young of the wild silkworms are hatched, and the farmers immediately place the young silkworms on the leaves of the oak tree. The fresh leaves of the oak tree are like mulberry leaves, and the young silkworms will replace another leaf after eating the leaves. Whether hatching young silkworms, releasing silkworms, moving silkworms, preserving oak trees are completed by manpower. Farmers also have to protect silkworm seeds from extreme weather, such as drought and floods, and drive away birds and rats with long poles. They have to endure harsh natural conditions and overwork every day, which is very hard. The maturity time of tussah silkworm is similar to that of mulberry silkworm, which can be harvested three times a year, respectively in spring, summer and autumn. The mature cocoons of tussah are about three inches long¹³, beige in color, and hang from the branches like fruit.¹⁴ Thus it can be seen that the southwest mountain area of Shandong at that time had a set of relatively mature technology and formed a certain scale.

From the northern Song poet Wang Yucheng's "Heiqou", to the poet Wang Shizheng's "four Poems of Mountain silkworm poems" in the early Qing Dynasty, and then to the poet Zhang Gangsun's "poetry Mengyin", many ancient poets who praised the fine qualities of silk also described the long history of silk weaving in Shandong. The Ming Dynasty's "Long Things" said that "Shandong produces the most durable pongee". In the Ming and Qing dynasties, the local Chronicles of Shandong mentioned mountain cocoons and pongee many times and listed them as famous local products. The local chronicles recorded in it are arranged as follows:

It shows the list of products related to pongee mentioned in Shandong local records of Qing Dynasty¹⁵

Age	Literature sources	Recordation
(Ming Dynasty) Jia Jing	"Shan Dong Tong Zhi"	Cocoon silk comes from Qingcheng and Laiwu. It is woven from the silk of wild silkworms. Dengzhou prefecture jurisdiction of Qixia and Green Lai have tussah silk.
(Ming Dynasty) Jia Jing	"county annals of Linqu"	People living in the plain cultivated land and raised silkworms, while people living in the

¹¹ Chinese Ancient Agricultural Technology, Beijing: Agriculture Press. (1980:441). (in Chinese with English abstract) Hua Degong. *The understanding and transformation of Chinese ancient people to Tussah silkworm*.

¹² Hua Degong. (1987). The artificial field rearing of Tussah silkworm takes the southwest mountain area of Shandong as the early. *Science of Sericulture*, (3).

¹³ Three inches is about 10 centimeters, which is the traditional Chinese unit of length, 1 inch = 1.333 centimeters

¹⁴ Hua Degong. (1997). Sun Tingquan and Shan Silkworm. *China Sericulture*, 4(44).

¹⁵ The list of products related to pongee in the Local records of Shandong in Ming and Qing Dynasties source: Longqing. Yanzhou Fu Zhi, Volume three: Products; (Ming) Wan Li. Anqiu County Annals, Vol. 1: Local Annals Examination; (Qing) Shunzhi. Zhaoyuan County Annals, Vol. 4: Customs; (Qing) Qianlong "The Unification of the Qing Dynasty" volume 137 "Dengzhou Zhi. Native products"; (Qing) Qianlong "Qing Unified Records" volume one forty-one "Yi Zhou Fu. Native products";

			mountains and forests used tussah cocoons as reeling silk to weave pongee.
(Ming Dynasty) Long Qing	“Yan zhou Fu Zhi”		Living in the mountains of the farmers with tussah silk woven into pongee, Yizhou, Shouzhong two places have.
(Ming Dynasty) Wan li	“county annals of Anqiu”		Tussah silkworms tussah cocoon in the woods. Farmers reeling them into silk, light brown in color and tougher than ordinary silk, is called tussah silk. Woven silk is called Shandong pongee.
(Qing Dynasty) Shun Zhi	“county annals of Zhaoyuan”		Tussah silk is very thin.
(Qing Dynasty) Qianlong	“Laizhou Fu Zhi”		This special product belongs to the silk pongee
(Qing Dynasty) Qianlong	County Annals of Haiyang		Silk is tussah silk.
(Qing Dynasty) Qianlong	"The Annals of Dengzhou. Native Products"		Dengzhou prefecture under the jurisdiction of Qixia County, Wendeng, Zhaoyuan and other counties have tussah
(Qing Dynasty) Qianlong	"The Annals of Yizhou Native Products"		Lanshan, Tancheng, Mengyin, Yishui four counties have silk.
(Qing Dynasty) Qianlong	Yizhou Fuzhi		Silk cocoon is woven from tussah silk reeling, tussah cocoon is divided into spring cocoon, autumn cocoon, autumn cocoon is better.
(Qing Dynasty) Qianlong	County Annals of Zhucheng		Everywhere people wore clothes made of ponyo, which became a specialty of the place.
(Qing Dynasty) Guangxu	Haiyang Xianxuzhi		The special product is silkworm cocoon, divided into mulberry cocoon and tussah cocoon.
(Qing Dynasty) Guangxu	County Annals of Wendeng		Reeling silk woven silk known as pongee, natural color, texture, tough, stiff.

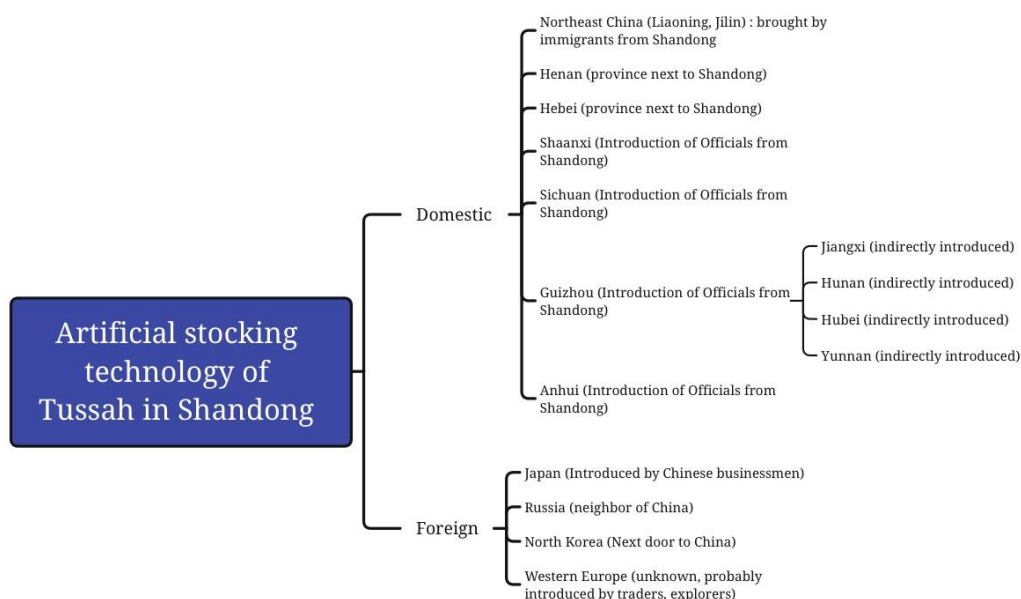
In the local annals of Shandong around the emergence of tussah cocoon, silk places are Jinan, Dengzhou, Laizhou, Qingzhou, Zhucheng, Yishui, Mengyin, Haiyang, Linqi, Zhaoyuan, Yanzhou, Anqiu, Qixia and other places, distribution almost covers the whole Shandong province.

It is worth noting that the southwest region of Shandong is the first area to record the artificial field rearing technology of tussah. Before that, there was no record and evidence of artificial field rearing of tussah in other places including Shandong Peninsula, so it can be seen that the technology of artificial field rearing of Tussah originated in the southwest of Shandong, and the technology of artificial field rearing of tussah in other areas was also directly or indirectly spread from here. ¹⁶Shandong is the birthplace of artificial field rearing range tussah in China.

3. Development and Promotion of an Artificial Field REaring Technology of Tussah

In Qing Dynasty, the artificial field rearing technology of tussah entered the peak of development, and the artificial field rearing technology of Tussah in Shandong gradually spread from the southwest mountain area of Shandong to the whole Shandong Peninsula, and even the whole China and overseas. It is summarized as the following figure:

¹⁶ Hua Degong. (1987). The artificial stocking of Tussah silkworm takes the southwest mountain area of Shandong as the early. *Science of Sericulture*, (3).



3.1 Promotion in Shandong Province

In modern Times, Muping in Yantai, Shandong province was also known as Ninghai in ancient times. Wang Yuanyan, the author of *Records of Wild Silkworms*, was a native of Muping. In his book, he said: During the Reign of Emperor Kangxi of the Qing Dynasty (1706), wang Ruyan, a political scholar, recruited people from Qingzhou and taught them to cultivate tussah silkworms, reeling silk and weaving silk, but people thought it was irrelevant. A few years later, tussah silkworm industry began to develop, and people gained great benefits through sericulture and silk reeling.¹⁷ Another important producing area of tussah silk, Qixia County, Yantai, is recorded in the county annals of the fifth year of Guangxu of Qing Dynasty (1879): Since the thirtieth year of Kangxi (1691), zhucheng people have taught Qixia people to plant tussah trees, raise silkworms and reeling silk. Now Qixia produces the most tussah silk, while Zhucheng and Yishui produce less than one tenth of it.¹⁸ In Qing Dynasty, Zhucheng was a county belonging to Qingzhou Prefecture, so among the three producing areas of silk, except for Changyi Linhai because the land was saline soil, so tussah trees could not survive, Qixia, Muping two counties of tussah silkworm field rearing technology were introduced from Zhucheng. During the reign of Emperor Qianlong in the Qing Dynasty, the local officials in Taian introduced the artificial field rearing technology of tussah silkworm. According to the records of Taian Prefecture, the wild silkworms raised were called tussah silkworm and those who could weave delicate silk were called cocoon silk. Before, there were only those in Laizhou, but now Taian also has them. Recently, the seeds of the oak tree were specially collected and distributed to civilians, trying to persuade them to plant. Seven years later, the foothills were almost entirely planted with oak trees. Large oak trees are called "acorn trees", while small trees are suitable for sericulture, known locally as "brokos". Oak trees planted within three years, can not cut down, get a lot of profits.¹⁹ Since then, a lot of oak trees have been planted throughout Shandong province, and the technology of artificial field rearing tussah silkworm has become more and more prosperous throughout Shandong. There are two kinds of raw silk produced in Shandong Province. One is Dongshan silk, which comes from Haiyang, Laiyang, Qixia, Muping and Rushan in the mountains of Jiaodong Peninsula. The other is Nanshan silk, which comes from Wulian, Zhucheng, Juxian, Yishui and other areas in the central and southern mountains of Shandong Province. After 1858, when Yantai opened its port, the silk industry entered its golden age, and the export volume of tussah cocoons in Jiaodong Peninsula exceeded that in the south-central mountains of Shandong Province.

3.2 Promotion Outside the Province

In addition to the spread in Shandong province, artificial field rearing technology also spread from Shandong to Henan, Sichuan, Anhui, Guizhou and other places. According to the *Book of Wild Silkworms*, the cultivation of

¹⁷ (Qing) Wang Yuanyan. (1962). *Zheng Guangjiang Record of wild silkworm*. Beijing: Agriculture Press.

¹⁸ Qixia County Annals of Guangxu (Qing Dynasty).

¹⁹ (Qing Dynasty) Qianlong. Taian Fu Zhi.

tussah silkworms in Denzhou and Laizhou, and the weaving of silk with tussah silkworms reeling silk opened up another way of making money besides farming. The artificial field rearing technology of Tussah silkworms gradually spread to many places in China from Lushan in Henan province, Ningchang in Shaanxi province and Zunyi in Guizhou Province.²⁰ Shaanxi is an early promoted Chinese oak silkworm artificial field rearing technology province, in the thirty-seventh year of Kangxi (1698), Shandong Zhucheng Liu Qi went to Shaanxi Ning Qiangzhou serve as governor, saw shaanxi forest there are many oak trees, oak trees, he purchased tens of thousands of Chinese oak silkworm species from Shandong, Recruiting farmers and weavers who were good at releasing silkworms and weaving silk from Shandong to teach the local people the techniques of field rearing tussah silkworms and weaving silk pongee. From then on, Shaanxi silk was born and became a local famous product. In order to commemorate Liu Ming's achievements, people call the local cocoon silk "Liu Gong silk".²¹ According to the record of "Ballad of the bin Area in the General area", Yang Shuangshan of Xingping County, Shaanxi Province in the third year of Yongzheng (1725) brought the species of *Antheraea pernyi* bought from Shandong to the foot of the Zhongnan mountain for breeding outside cages.²² During the reign of Emperor Qianlong, Chen Hongmou advocated field rearing tussah silkworm in Shaanxi province and wrote an article called "Guangxingshan Silkworm". In March of the ninth year of the Reign of Emperor Qianlong (1731), the governor of Shaanxi, Chen Hongmou, went to Shandong on the orders of the emperor to compile and amend the Law on Sericulture in Shandong. Later, shaanxi mei county, Zhou Zhi, Qian Yang, Shang Nan, Shang County, Lantian, Longzhou, Xing 'an, Tongguan, Luoyang have tried to raise tussah silkworms.²³

Henan and Hebei, as neighboring provinces of Shandong, the artificial field rearing technology of tussah silkworm spread to the two provinces about during the reign of Emperor Kangxi and Emperor Yongzheng of the Qing Dynasty. Kangxi eight years, henan recorded on a "LuShan county annals" : "LuShan area because there are a lot of trees, have recently field rearing tussah" to nine years of qianlong (1744) in September, henan governor to realize color mentioned in the letter said: "recently in shandong province, people make the tussah cocoon bring to henan to carry and herding of tussah, they get together and have mastered the technology of artificial field rearing tussah." Hebei was introduced into the artificial field rearing technology of tussah silkworm, although there is no accurate document record, but the time should be similar to Henan, in the Qing Kangxi, Yongzheng years.

And modern another high-quality raw material of silk - northeast silk, from the Liaodong Peninsula mountains. According to the Record of Emperor Gaozong of the Qing Dynasty, it recorded the events in the twenty-seventh year of Emperor Qianlong (1762): The governor of Liaoning told the emperor that Jin, Fu, Xiong, Gai and other places under the jurisdiction of Liaoning Province were close to the mountains and the sea. Many tussah trees were planted in the mountains, which could be used for sericulture, reeling and weaving silk. Now the wandering people of Shandong, to build shelters to live in the tussah silkworm for business. Spring and summer artificial field rearing tussah silkworm, silkworm cocoon after the daily reeling silk woven silk.²⁴ In the thirty-eighth year of Qianlong's reign (1773), it is recorded in Tazigou Lyuji that in the later period of Yongzheng's reign, "People in Shandong tried to export silkworm seeds from their own province for breeding, and later people followed their example. Today, there are a large number of secular people."²⁵ Tazigou is now Lingyuan County in Liaoning Province, located at the border of Hebei, Liaoning and Inner Mongolia provinces. According to the book, farmers in Shandong occupied mountain farms in Inner Mongolia during the silkworm breeding process, and then the local government stipulated that the farmers in Shandong should pay the mountain owners one-tenth of the profits of their annual silkworm harvest as rent. Since then, the artificial field rearing technology of tussah has also been spread in Inner Mongolia. Because the shandong peninsula and the liaodong peninsula across the sea, the climate is suitable for the growth of oak, and northeast China is an early start field rearing tussah region, the fastest growing, and the qing dynasty shandong nearbu businesses in liaoning and jilin provinces set up a lot of factories to make silk, there are about 125 large-scale silk house, liaoning xifeng county have Kuang car more than 3000 a. Even to modern times, the northeast region jumped into the country's largest tussah cocoon production base.

²⁰ (Qing) Wang Yuanyan. (1962). *Zheng Guangjiang Record of wild silkworm*. Beijing: Agriculture Press.

²¹ (Qing Dynasty) Guangxu. *Zhucheng County Annals*.

²² (Qing) by Yang Shenshen. Translated by Zheng Guangjiang, Zheng Zongyuan. (1962). *General Ballad of the bin Area*. Beijing: Agriculture Press.

²³ Qianlong (Qing Dynasty). Chen Hongmou. Silkworm of Canton Line mountain is called Zhou Zhi county zhi.

²⁴ The Annals of Gojong.

²⁵ (Qing) Hada Qingge. Tazi ditch strategy notes.

According to the Annals of Emperor Gao-Zong in the Qing Dynasty, Jiang Shunlong, the minister of military aircraft and the inspector of Sichuan province, reported to the emperor that there were two kinds of silkworms in Shandong Province. Those that ate the leaves of toon trees were called toon silkworms, and those that ate the leaves of tussah trees were called tussah silkworms. These silkworms do not need to eat mulberry leaves, and can disperse branches to grow into cocoons. Sichuan Dayi County governor Wang Jun, once in Shandong province to obtain tens of thousands of silkworm cocoons, to the people, to the people to feed, two years of breeding has been fruitful. I saw a kind of oak tree in Sichuan, which can feed the tussah silkworm. I asked the governor of Shandong province to write down the methods of feeding toon and tussah as examples and tell them in detail to each province. If each province has a toon tree, an oak tree now, can consult this method to carry on feeding to profit. You can also send a letter to Kalgishan²⁶, asking him to carefully consider the provinces with toon trees and tussah trees, and tell the governor and governor of this province the method of feeding toon and tussah silkworms, so that he can feed them in accordance with this method and make profits in the tussah industry.²⁷ These are the earliest documents that recorded the technology of feng-du, which was introduced into Sichuan. Several local officials of Sichuan province, whose origin is Shandong, and Wang's contemporaries made a big effort to popularize feng-du, so they began to put out silkworms and make silk.

Also promoted by local officials is Anhui province. In the thirty-first year of the Reign of Emperor Qianlong (1766), Han Litang, a native of Wei County, Shandong Province, was appointed magistrate of Lai 'an County, Anhui Province, and introduced the artificial field rearing technology of Tussah in Shandong province to Lai 'an.²⁸ In the 35th year of the Reign of Emperor Qianlong (1770), Zheng Ji, then governor of Shouzhou, bought seedlings from Shandong and sent them to Shouzhou for field rearing.²⁹ To the middle of the Qianlong year, Anhui laian, Shouzhou, Guichi and other places field rearing tussah have become a scale.

Zunyi is the earliest and most developed place for the cultivation of tussah silkworm in Guizhou. In the third year of the Reign of Emperor Qianlong (1738), Chen Yubi, then governor of Zunyi, like officials in Shaanxi and Sichuan, saw that there were many tussah and oak trees in Zunyi, but the local people only used them for fuel. He felt very sorry and wanted to use them to raise tussah silkworms. He sent people to Shandong many times to buy silkworm seeds, and invited a teacher of silkworm propagation to Zunyi to teach the local people the techniques of silkworm propagation and silk weaving. In the seventh year of The Reign of Emperor Qianlong (1742), Chen Derong, a political envoy of Guizhou province, submitted a letter to the emperor, which recorded that this year, wild silkworms raised on the tussah trees in Qianshan had begun to produce cocoons and had achieved success.³⁰ The following year, Zunyi harvested eight million tussah cocoons. Chen Yubi set up a cocoon weaving workshop in Baitianba, east of Zunyi, where weaving workers recruited from Shandong province taught people how to make silk.³¹ Since then, Guizhou liping, Anping, Duyun and other counties have begun to raise tussah. Early jiaqing, the superintendent of guizhou, s.j. Fang to zunyi in its "qian" People's Daily lives have this record: both men and women, old and young hand holding a lun silk pendant to twist the tussah silk, even the rulers also twist tussah silk in my spare time to kill time.³² These phenomena reflect putting silkworm, silk weaving is as common sideline the zunyi. In Qijiang, which lies at the junction of Sichuan and Guizhou, according to the county annals of qijiang, there was a flourishing silk market in daoguang period of the Qing Dynasty. Every year in February and March, merchants from Shandong and Shaanxi gathered in the market, and the sales reached as high as one million liang.³³

Jiangxi, Yunnan, Hunan and Hubei are all neighboring provinces of Guizhou, and the transportation of silkworm seeds from Shandong to Guizhou is often via, so the artificial field rearing technology of tussah in these provinces is introduced from Guizhou. For example, after it was introduced into Hunan, the free rearing of tussah silkworms first arose in Daozhou and Chenzhou. In the ninth year of Qianlong (1744), The governor of

²⁶ Kalgishan (? -- 1757), Ilgen Jae Luo shi, courtesy name Dan Yuan, manchurian Zhenghuang banner. He was an important minister of yongzheng and Qianlong dynasties in the Qing Dynasty. He was the governor of Shandong in the eighth to eleventh year of Qianlong (1743-1746).

²⁷ Annals of Emperor Gojong, vol 204, Annals of Qing Dynasty, Vol 11, November 8th of Qianlong, Zhonghua Book Company, 1985, pp. 630-631.

²⁸ Lai 'an county volunteers.

²⁹ (Qing Dynasty) Guangxu Xiangshan County Annals of Guangdong province.

³⁰ The Annals of Gojong.

³¹ Science of Sericulture, 1982(2). (in Chinese).

³² (Qing) written by Li Zong and Fang. Guizhou [M].

³³ Compiled by Song Hao et al. (Qing). Qijiang County Annals - Volume ten: Products. Tongzhi two years according to daoguang six edition engraving.

Hunan, Jiang Bo, said in his book "Trying to find the silkworm in the mountains" that wild silkworms became cocoons and reeling into silk made the people happy. To this end, Jiang Bo promoted the experience of the two provinces in many places in Hunan, and said: record the experience into rules and regulations, and issued to each county, in accordance with the rules and regulations to get wild silkworm breeding. Although the technology of artificial field rearing of the tussah silkworm of above a few provinces is not introduced directly from Shandong, but say from another Angle, its source also is Shandong.

3.3 Overseas Promotion

In the late Qing Dynasty, with the break of the closed-door policy, many provinces and cities along the coast of China opened their ports, shandong ponies sold well all over the world at the same time, shandong antheraea pernyi artificial field rearing technology was also spread overseas. After the Meiji Restoration in 1876, the silk and textile industry in Japan was developing day by day. Japanese businessmen bought tussah from Yantai in Shandong province and planted them in Nagano area for grazing, and formed a certain scale.³⁴ The following year, Japan's Hokkaido development office official Kuroda Qingtakashi again from Shandong to introduce tussah in the Hokkaido area. Ponyon is known as mountain ponyon in Japan, among which the most famous xinzhou ponyon, knot city ponyon, ueda twisted silk and oshima twisted silk. It was at the same time that the famous French silk expert Natalis. Natalis Rondot came to China to investigate the silk industry. In 1878, he submitted the "Silk" report to the World Exposition, giving a detailed description of the tussah silkworm and artificial field rearing technology in Shandong.³⁵ About the spread of silkworm artificial field rearing to overseas, Wang Yuanyan volume in the "wild silkworms record" four "outside ji" recorded: western countries a began to also don't know the tussah artificial field rearing, when on the way to Mongolia the missionary get wild silkworms returned, try to keep in the trees, production is very good, so each country started to work It shows that tussah silkworm and field rearing technology also spread to European countries through various ways.³⁶ Currently known as Korea, Russia and other countries, because it is China's neighbor, so its tussah artificial field rearing technology is spread by China from the sea and land. In a word, the artificial field rearing technology of tussah originating in Shandong has made a contribution to the development of the tussah industry in the world.³⁷

4. Endnotes

After the 15th century, the "cocoon of wild silkworms" was gradually accepted and treated correctly from the auspicious prophecy and anecdotal, and there were more and more records of its weaving in ancient books. But really promoting the use of tussah silk weaving silk is the invention of tussah artificial field rearing technology and spread. The artificial field rearing technology of tussah silkworm was produced in the late Ming Dynasty to the early Qing Dynasty in the mountainous area in the southwest of Shandong and Shandong, and was gradually promoted to many places at home and abroad, which greatly increased the output of raw materials of pongee, and directly affected the development of pongee, making it transition from unstable small-scale production to the relatively stable large-scale production stage.

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³⁴ (Qing) Wang Yuanyan Zheng Guangjiang Record of wild silkworms. (1962, Vol. 4, External period.). Beijing: Agriculture Press.

³⁵ Natalis Rondot; Les Soies (Exposition universelle internationale de 1878). Paris. 2 vol,in-8.1mprimerie nationale, 1885.

³⁶ (Qing) Wang Yuanyan Zheng Guangjiang Record of wild silkworms. (1962, Vol. 4, External period.). Beijing: Agriculture Press.

³⁷ Chen Dong-sheng. (1994). Production development and propagation of Tussah silkworm in Shandong province in Qing Dynasty. *Ancient and Modern Agriculture*, (1), 11-17.