

An important military city of the Early Western Zhou Dynasty: Archaeobotanical evidence from the Chenzhuang site, Gaoqing, Shandong Province

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In ancient Chinese history, the Western Zhou Dynasty has long been renowned for having expanded its control and territory into many other states. However, historical documents and archaeological records of this period are limited; thus the early history of the Western Zhou Dynasty's operation in eastern China and its establishment of the Qi and Lu states have been unclear. The discovery of the Chenzhuang city site in Gaoqing County, Shandong Province, with chariot-horse pits, an altar and bronze vessels with inscriptions, adds a new line of evidence for studying the history of this period. However, with no direct evidence, the nature of the city site is controversial. Plant remains, especially a large number of sweet clover seeds, recovered from this site by systematic archaeobotanical methods provide an important source of information for research into the site's function. Considering that modern sweet clover is superior fodder for horses and the sweet clover seeds from the Chenzhuang site coexist with chariot-horse pits and horse remains, it is suggested these sweet clover seeds might represent the fodder of battle steeds. This suggestion supports the opinion of those who believe the Chenzhuang city site was once an important military city of the Western Zhou Dynasty in eastern China.

Early Western Zhou Dynasty, military city, Chenzhuang site, archaeobotanic evidence, carbonized sweet clover seeds

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The Western Zhou Dynasty, which extended its control and territory into surrounding states, including the establishment of the Qi and Lu states in eastern China, was highly renowned in classical Chinese records [1]. However, not only are detailed classical records for this period limited [2] no archaeological evidence related to the history of this period has been found, especially archaeological evidence of the capital city of the early Qi State, one of those established by the Western Zhou Dynasty. Archaeologists in Shandong Province have long worked to discover any historic remains of the early Qi State and finally made a breakthrough in 2008–2009 during excavations at the Chenzhuang city site

[3]. This site dates from the early to the middle period of the Western Zhou Dynasty and is near Linzi, the capital city of the Qi State during the Eastern Zhou period. City walls, tombs, altar, chariot-horse-pits, and inscriptions on bronze vessels have been unearthed in this site. But the nature of the city site is controversial because no direct evidence of its nature has been found and archaeologists and historians have suggested that this city site should be either the remains of Yingqiu, the early Qi State capital [4], the cemetery of the Qi State [5], or a military fort of the early Western Zhou Dynasty [6].

Confirming the function of the Chenzhuang site would greatly improve the understanding of the history of the early Qi state and the Western Zhou Dynasty. Despite the discov-

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ery of artifacts and remains such as the tombs of nobles, the remains of daily life in the settlement can also provide important information about the function of the site. Plant remains from the Chenzhuang site could provide important clues to understanding the function of this site and its change over time.

1 Archaeological discoveries of the Chenzhuang site

The Chenzhuang site lies in Gaoqing County, Shandong Province (Figure 1). The archaeological findings related to the function and nature of the site include city walls, a chariot (Figure 2) and horse pits, altar, tombs of nobles, and bronze vessels with inscriptions; in particular, the two characters “Qi Gong(齐公)” are inscribed on one vessel [3].

Based on the stratum of the Chenzhuang site, the archaeological remains can be divided into four stages: the late stage of the Early Western Zhou (EWZ), the early and late stages of the Middle Western Zhou (MWZ), and the early

stage of the Late Western Zhou (LWZ). It has been suggested the city wall was constructed during the Early Western Zhou and was damaged during the late stage of the MWZ because some part of the wall was disturbed by the end of the late stage of the MWZ and the Spring-Autumn Period [9].

2 Methods and results of the archaeobotanical research

During excavations in 2009, 75 soil samples were collected from ash-pits. Samples were immersed in water to float the seeds using standard archaeobotanical techniques [10], and many carbonized seeds were recovered. These seeds were identified and photographed at the Quaternary Environment and Archaeobotanic Lab in Shandong University and at the Institute of Botany, the Chinese Academy of Science, with Nikon SMZ 1500 and Hitachi-480 microscopes. Modern seed collections and some publications were used as identification references [10,11].

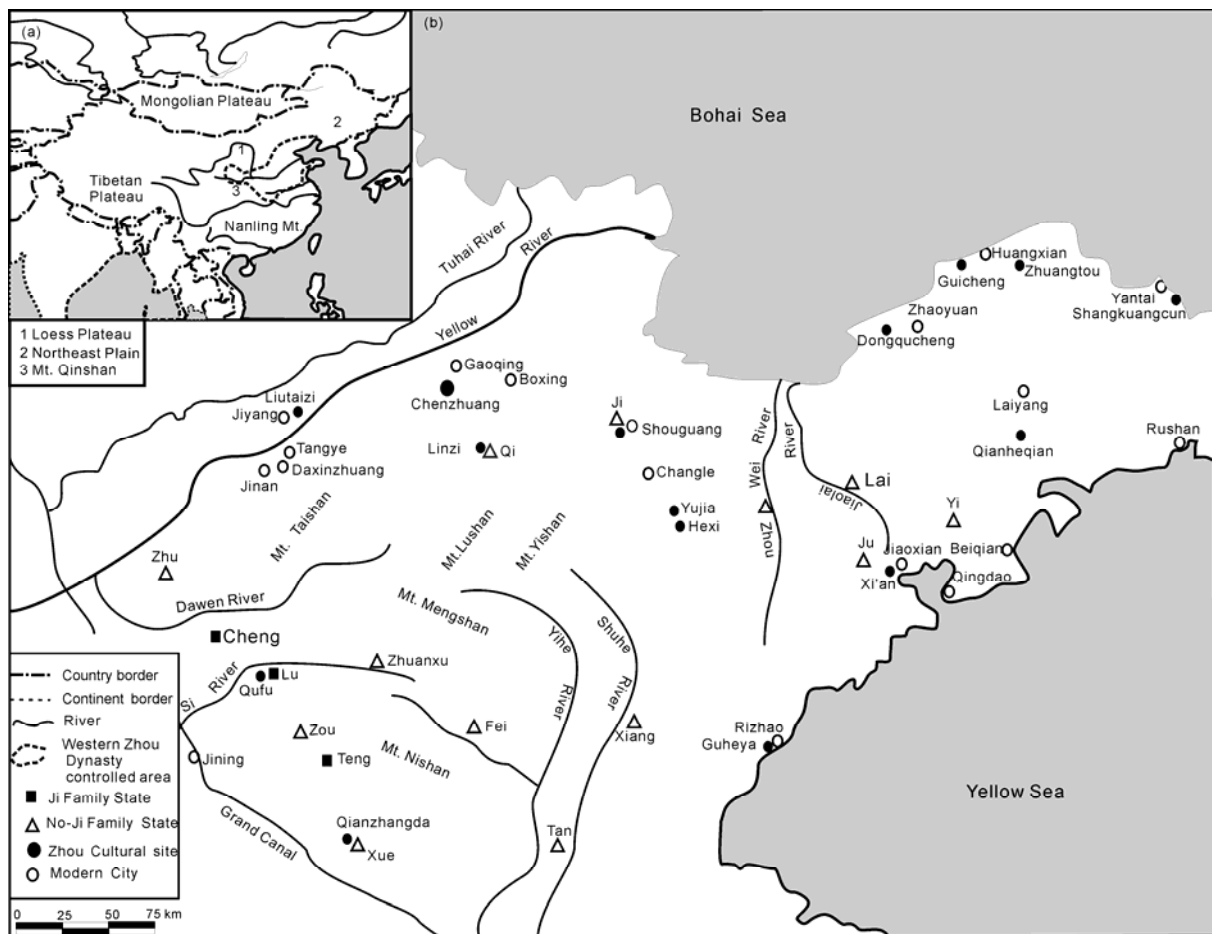


Figure 1 (a) Sketch map of the Western Zhou Dynasty sphere of control; (b) location of the Chenzhuang site and sketch map of the early period of the Qi State (modified from Figure 16 in [7] and [8]).



Figure 2 Remains of chariot pit 1 (CMK1) at the Chenzhuang site.

Average seed density from the soil samples was 69 seeds per liter of soil sample. However, seed density varied widely among the samples and only 10 of the 75 samples had above average seed density (Table 1). These 10 samples contained mostly crop seeds, panic grass (*Panicum*) and sweet clover (*Melilotus* Miller), with the highest density being 1103 seeds/L. Five samples containing more than 300 sweet clover seeds were taken from the eastern part of the excavated area. The other 65 soil samples had lower seed densities, with the lowest being 4 seeds/L of soil.

In addition to foxtail millet (*Setaria italica* (L.) Beauv.), broomcorn millet (*Panicum miliaceum* L.), and digitaria (*Digitaria sanguinalis* (L.) Scop.) seeds, the panic grass seeds also contained two unknown types which we named Paniceae1 and Paniceae2. Paniceae1 is shaped similar to broomcorn millet seed but a little smaller. The caryopsis is a long oval with a bulge on the back. The embryo is less than half the length of the caryopsis and has a small bulge on top of the abdomen (Figure 3(a)). Paniceae2 seeds are similar to foxtail millet seeds but smaller. The oval caryopsis has an embryo half the length of the caryopsis or a little longer and is flat on the surface of the abdomen (Figure 3(b)).

The seed identification here may be not completely un-

questionable because of the imperfect preservation of plant remains, or immaturity of the seeds. A shape analysis of modern seeds revealed typical immature seeds of foxtail and broomcorn millet are smaller than mature ones [12], and some immature foxtail and broomcorn millet seeds were identified as panic grass despite their shape and size. The seeds identified as panic grass at the Chenzhuang site might include some foxtail and broomcorn millet.

Most sweet clover seeds from the Chenzhuang site are oval or ovoid (Figure 4(a),(b)), averaging 1.28–1.75 mm long, 0.85–1.13 mm wide, and 0.65–0.9 mm thick. The radicle is from 2/3 to 3/5 of the length of the cotyledon and the 0.13–0.2 mm diameter round navel is near the top of the radicle. These seeds are very similar to those of the modern *Melilotus*, *Medicago*, and *Trifolium*; these three genera belong to tribe Trifolieae, subfamily Papilionoideae, family Leguminosae [13] and have embryos of the bent-type, having a bend between the base of cotyledon and the lower hypocotyl (Figure 5(a)). The *Flora of Shandong* lists only three non-native/introduced species of *Trifolium* [14]. If *Trifolium* is non-native, then the Leguminosae seeds from the Chenzhuang site cannot be *Trifolium* spp. Of the five species of *Medicago* in Shandong Province, two are from Europe and West Asia and the other three are indigenous. All five are superior fodders [15]. Although the seeds of *Medicago* and *Melilotus* are very similar, the obvious difference is that the top of the radicle and the cotyledon diverge in *Medicago* seeds but converge in *Melilotus* seeds. The seeds from the tribe Papilionoideae found at the Chenzhuang site are very similar to those of *Melilotus* (Figure 5(b)), but are a little smaller.

While it is not very hard to differentiate modern *Medicago* and *Melilotus* seeds, it is very difficult to absolutely and precisely identify the Leguminosae seeds from the Chenzhuang site because of their poor preservation. Even though some *Medicago* seeds from the Chenzhuang site may be incorrectly identified as *Melilotus*, this will not have much effect on our conclusions because *Medicago* and

Table 1 Data of samples with seed density higher than average

Unit	Sample volume (L)	Number of seeds	Foxtail millet	Broomcorn millet	Wheat	Soybean	Paniceae1	Paniceae2	Crabgrass	Sweet clover	Wild soybean	Goosefoot family
H64	10	8238	6528	170	1		455	187	314	398	2	91
H240②	7	579	382	27			65	43	25	21	2	8
H257③	8	575	218	10			5	16	163	153		8
H257④	7	783	206	22	1	2	35	68	98	334	2	9
H266	8	8825	7494	430	1		445	117	10	112		190
H304	8	1741	247	333	1	1	807	245	71	12	4	6
H356	7.5	8164	6193	13			564	522	171	675	2	11
H388	8.5	3914	76	2			86	49	5	1727		1506
H451③	11	1103	236	142			265	267	146	25	5	4
H502	2	608	40	2			2	38	18	503		2
Total	77	34530	21620	1151	4	3	2729	1552	1021	3960	17	1835

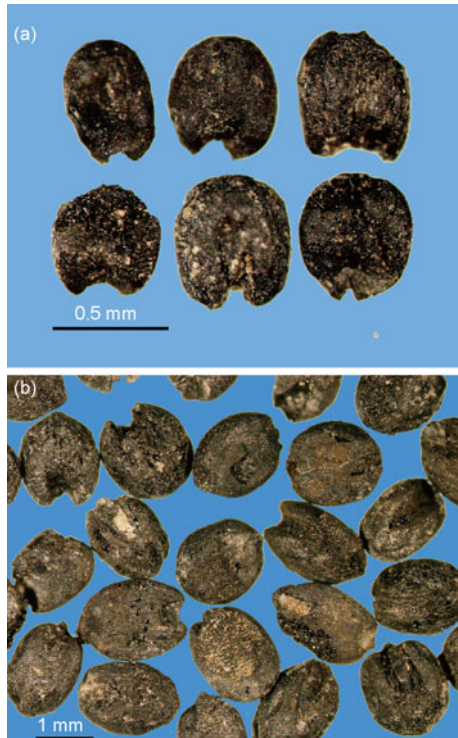


Figure 3 Carbonized Paniceae seeds from the Chenzhuang site. (a) Paniceae1; (b) Paniceae2.

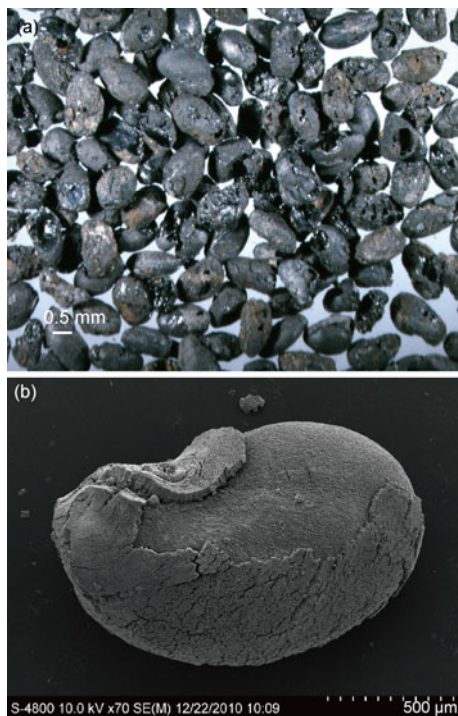


Figure 4 Carbonized sweet clover seeds. (a) Group of seeds; (b) single seed SEM.

Melilotus at Shandong would both have been superior fodders.

All the carbonized seeds from the 75 samples from the Chenzhuang site can be divided into two groups, crop seeds

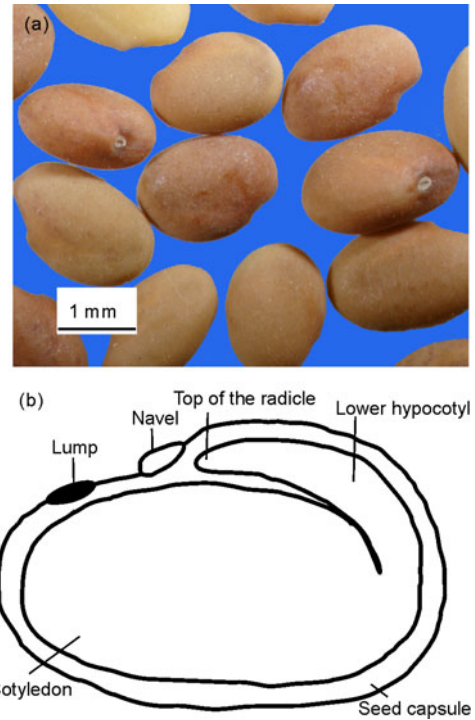


Figure 5 Cross section sketch of a Leguminosae seed with bent radicle (a) and modern sweet clover seeds (b).

and non-crop seeds. The percentage and frequency of crop seeds are 58.5% and 38.7%, respectively; of non-crop seeds are 41.5% and 100%, respectively.

Crop seeds from the Chenzhuang site include foxtail millet, broomcorn millet, wheat (*Triticum aestivum* L.), soybean (*Glycine max* (L.) Merr.), and rice (*Oryza sativa* L.) seed.

Non-crop seeds totaled 19129; 8036 panic grass (including 2008 crabgrass), 7430 sweet clover, 51 wild soybean, 2422 goosefoot family (Chenopodiaceae), 666 amaranth family (Amaranthaceae), 191 mallow family (Malvaceae), and 132 chaste tree (*Vitex* L.) seeds, with the number of seeds from the buckwheat (Polygonaceae), gourd (Cucurbitaceae) and other families numbering fewer than 100. In both percentage and frequency, panic grass ranked highest and sweet clover was higher than the goosefoot family (Figure 6).

In the 10 samples with a higher percentage than average number of seeds, foxtail millet seeds were most common, followed by panic grass and sweet clover seeds. Both panic grass and sweet clover were significantly higher in numbers than broomcorn millet, the fourth most frequent species.

The frequency of panic grass, sweet clover, and goosefoot family seed changed over time at different historical stages. Numbers of panic grass seeds started to increase in the late stage of the EWZ, while sweet clover and goosefoot family seeds obviously decreased in numbers of the early stage of the MWZ.

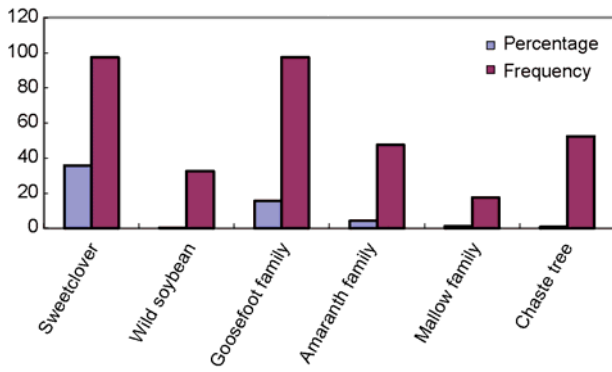


Figure 6 Percentage and frequency of main non-crop seeds.

3 Discussions about the function of the Chenzhuang site

The Chenzhuang site cannot be the remains of Yingqiu which was recorded as the capital of the early Qi State by classical documents, because it is dated to middle of the EWZ, but Yingqiu was established at the beginning of EWZ [16]. Furthermore, Chenzhuang must be more than just a cemetery for the Qi State because, in addition to some tombs, several types of artifacts representing daily life have been unearthed. The unearthing of plentiful sweet clover seeds, chariot pits, and other discoveries suggest the Chenzhuang site was once an important military city during the EWZ period.

3.1 Plentiful sweet clover seeds indicate the special function of the Chenzhuang site

Rich remains of sweet clover and panic grass seeds at the Chenzhuang site indicate this site served a different function from other Shandong area sites of the same period.

Comparison of the archaeobotanical data from the Chenzhuang site with that of the other Shang-Zhou period sites [17–19] shows the large quantities and high density of sweet clover seeds at the Chenzhuang site are unique (Figure 7) and could indicate the special function of the Chenzhuang site.

One premise of archaeobotanical research is that plant remains preserved at archaeological sites are mainly remains left from human activity [20]. We therefore concluded: (1) the sweet clover seeds and panic grass remains recovered from ash-pits at the Chenzhuang site should represent the imprint of human activities but not the remains of human food¹⁾, (2) and the high quantity and concentration of sweet clover seeds at the Chenzhuang site may indicate this plant had a special use.

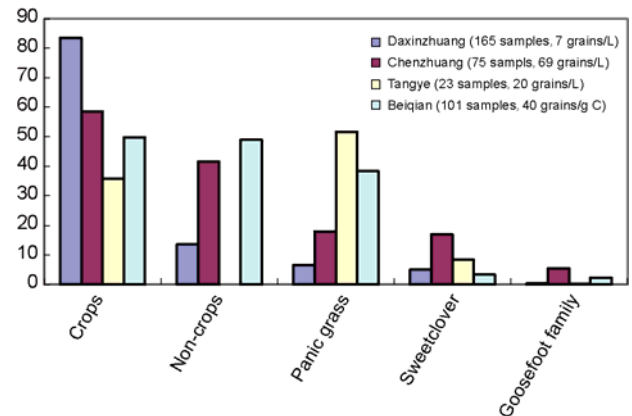


Figure 7 Comparison of archaeobotanical data from four sites of the Shang-Zhou period in Shandong.

3.2 Sweet clover and panic grass seeds might be remains of horse's fodder

The remains of two known fodder species, sweet clover and panic grass, in the chariot-pits at the Chenzhuang site indicate these plant remains may represent horse's fodder.

First, sweet clover plants are a superior fodder [21] and would have thrived in the sandy and saline-alkali soil around Chenzhuang [22]. The Chenzhuang site is located on a floodplain not far from the coast, which means sweet clover could have grown here during the Western Zhou period. Pre-Qin documents do not record what was used as horse's fodder during the Western Zhou Dynasty, but they do record fodder being used to feed horses [23]. *San Nong Ji*, of the Qing Dynasty clearly documented that the main horse fodder was legumes (pulses) and the main method of preparing fodder was to sieve and winnow the fodder or soak it in water [24]. Fodder prepared by these methods could have easily been deposited at any location where horses were being fed.

Second, large amounts of panic grass seed, which could also have been used as fodder, were preserved at the Chenzhuang site. The Paniceae1 seeds are similar to broomcorn millet and some of these seeds might actually be immature millet or another *Panicum* species. The Paniceae2 seeds are similar to foxtail millet and some might be immature millet or another *Setaria* species. Both *Panicum* and *Setaria* are superior fodder types and could have easily been grown in the ecosystems around the Chenzhuang settlement [25].

Third, the ash-pits at the Chenzhuang site from where many sweet clover seeds have been recovered are concentrated in the eastern part of the site. This indicates the area might have something to do with horse feeding. According to ancient documents, it is believed horse herders fed horses with fodder at special locations such as stables during the

1) We made this suggestion based on (1) the present archaeobotanic data from the Shang-Zhou period archaeological sites in the Shandong area reveal that, two kinds of millets, wheat, rice and soybean were crops and used as a human food resource and (2) the absence of the sweet clover seeds in the other three sites and its large amount and high density at the Chenzhuang site both indicate it is not used as human food.

Shang Dynasty [23]. Discoveries of chariot and horse remains at the Chenzhuang site demonstrate horses were fed in the settlement and so the sweet clover and Paniceae seeds might be the remains of horse's fodder.

3.3 The Chenzhuang site was an important military city during the early Western Zhou Dynasty

The chariots and horses at the Chenzhuang site were mainly used for military purposes. The archaeological discoveries including the city wall and the bronze vessel with the inscribed "Qi Gong" characters both hint at a military function for the settlement and the military function might be related to the political and military situation during the EWZ in its eastern territory. The decrease in numbers of sweet clover seeds after the MWZ period indicates the decline or disappearance of the military function of the Chenzhuang site.

Earlier research on chariots and horses from the Shang-Zhou period sites suggests these were mainly instruments of war [26] although the poor preservation of the chariot from the Chenzhuang site makes it difficult to confirm whether this one was a war chariot or not. The remains of horses as well as bronze weapons like the Ge (spear) as funerary objects also indicate the military function of the Chenzhuang site.

The horse-drawn chariots which prevailed during the Shang-Zhou period were always thought to be tools related to warfare [26]. Archaeological discoveries reveal that people of the Shang Dynasty traditionally buried chariots and horses in tombs or chariot-horse pits as burial accessories and the EWZ inherited this tradition. Chariot-horse pits have often been unearthed in some of the high level tombs such as those at the Zhangjiapo cemetery in Xi'an, Shaanxi Province [27]. These discoveries may indicate the general use of chariots and horses in both burials and chariot warfare. In Xi'an, Jiaozhou County, Shandong Province, a typical four-horse chariot, along with some bronze weapons, was discovered in a Western Zhou tomb [28]. This chariot was obviously used for warfare. Archaeological and related studies have shown that some chariot-horse pits around the mausoleums in Anyang, Henan Province were arranged in a pattern indicating military organization [29]. The buried chariots and horses in or around the tombs of the Shang-Zhou period might indicate the shape of war chariots or the system of command [30]. The war chariot was the main source of war power during the Western Zhou Dynasty [31]. Wu recorded the main function of chariots were for warfare [32] and the phrase "Rong Ma (戎马 army horse)" indicates the special military use of horses [33].

The remains of the city wall and the bronze vessels with the "Qi Gong" inscription reflect the military nature of the Chenzhuang site. The walled city at the Chenzhuang site would have had a military nature because Chenzhuang is located on the main route used by the Western Zhou Dyn-

asty to control the eastern area. Also, the small scale of the site with only one southern gate and a 20–25-m-wide moat around the city reflects Chenzhuang's military nature [34].

When the Chenzhuang site is compared with the other cities of the Shang-Zhou period, it is obvious that it is not only smaller than a capital city like Shangcheng [35] but also smaller than the cities of some local states like Fucheng [36], Yuanqu [37–39], Panlongcheng [40], Liulihe [41], and the city of the Lu State at Qufu [42]. Chenzhuang city, with only one gate, had fewer gates than the cities mentioned above. In addition to fewer gates, the high city wall and wide moat at the Chenzhuang site also clearly show its military function. This city's military nature might reflect the needs for the protection and operation of the dynasty's "far east" during the earlier stages of the Western Zhou Dynasty.

Study of the bronze vessel inscriptions shows the occupants of the tomb might be the descendants of Duke Jiang Tai (姜太公 Jiang Taigong) and the tomb's occupants were hereditary military leaders. The inscribed characters "Qi Shi" (齐师 army of the Qi State) might indicate an army was controlled by the King of the Western Zhou Dynasty and commanded by the occupants of the tomb [6]. The tomb occupant named Si Qi Shi (司齐师 commander of the army of the Qi State) once received a reward of Ma Si Pi (马四匹 four horses) from the king of the Western Zhou Dynasty which indicates the importance of horses in warfare and coincides with the military responsibilities of the occupants of this tomb [43].

Also, frequent warfare in eastern China during the EWZ gave rise to the urgent establishment of military cities. During the early period of Cheng Wang (King Cheng), the royal family of the Western Zhou Dynasty launched a series of wars to suppress the alliance of the Shang Dynasty and the aboriginal tribes in Shandong [44]. The Qi and Lu states, which held a key location, were often involved in military activities [7]. The alliance between the aboriginal forces and the Shang Dynasty left the Qi State facing constant battles [45].

We suggest the Chenzhuang settlement may have been an important military city during the earlier stage of Western Zhou Dynasty especially before the late MWZ period, but later its military function declined or even disappeared because the archaeological and archaeobotanical evidence shows the breakdown of the city wall and a sharp reduction in the numbers of sweet clover seeds.

4 Conclusions

Research on carbonized seeds from the Chenzhuang site provides important clues for deciphering its function. The high density of carbonized seeds and the large quantities of sweet clover seeds show humans at these sites made special

use of these plants while the chariot and horse pits and the “Qi Gong” characters suggest sweet clover was used as fodder for warhorses. This indicates the settlement was once an important military city during the early Western Zhou Dynasty. Later, the military function of the settlement declined or even disappeared as indicated by the archeological and archaeobotanical evidence, e.g. the city wall was disturbed and the numbers of sweet clover seeds at this site decreased.

Although we cannot confirm the military function of the settlement based solely on the remains of sweet clover and other horse’s fodder, based on the archaeological evidence presented our research in this paper strongly supports the hypothesis that the site had a military function.

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