



Approaching the Origins of Rice in China and Its Spread towards Indus Valley Civilization (Pakistan, India): An Archaeobotanical Perspective

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Authors' contributions

This work was carried out in collaboration between all authors. Author MAS designed the study, performed the statistical and analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ZJ and YMM managed the analyses of the study and also managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRCS/2018/45749

Editor(s):

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Complete Peer review History: <http://www.sciencedomain.org/review-history/27731>

Original Research Article

Received 27 September 2018

Accepted 03 December 2018

Published 12 December 2018

ABSTRACT

The rice (*Oryza sativa*) was the central crop of the Ancient Civilizations. Most of the economy of ancient societies was based on rice. In the present Era, archaeobotany and ecology rebuild the ancient rice domestication in a systematic way. Historical and archaeobotanical records establish the fact that early rice farming was started at the Southern part of the China (Yangtze River basin), and later on rice was spread towards Indus Valley Civilization (Pakistan, India). It is also the fact that rice has been a crucial crop of both Ganges valley and China. The journey of earliest rice from China to Indus Valley Civilization (Pakistan, India) is the focusing of this manuscript. With this, the ancient rice agriculture of China, as well as Pakistan and India, is also the central part of the writing. Different phases of archaeobotany and its progress in Pakistan and India has also been presented in the writing. The origin of ancient rice and its dispersal is appealing debate which has been discussed in this paper hypothetically and systematically.

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Keywords: Archaeobotany; Ancient Chinese rice; Ancient rice of Indus Valley; rice dispersal.

1. INTRODUCTION

Rice is considered to be a pivotal crop in East Asia, South Asia, and Southeast Asia in the sense of the economy of ancient times [1]. It is also actuality that a large quantity of the population of this planet has been provided dietary staple by the rice from the China, India, Southeast Asia, and Sri Lank from the earliest times [2]. As far as the history of Asian societies is observed, the evolutionary history of the rice cannot be separate from it [3]. Asian rice is often attributed to the Yangtze River basin which is the center of early rice agriculture [4]. The rice is observed as the part of agricultural production from the crucial regions like the Ganges to Southeast Asia to China. With the accordance of archaeological records, the centers of the early rice are Ganges valley, India as well as in the middle or lower Yangtze River of Southern China [5]. So, the rice agriculture is vital for Asia (East and South). Chinese rice dispersal towards Indus Valley is motivating occurrence through which the ancient rice history can be established of the regions. If we peep into past, the vitality of rice surrounds in the reputed regions like the Ganges Valley (India), Mekong and then China's central plains [6]. With this understanding, the similarities of early rice clues have been noted by different scholars who proved that from the Southern part of China to Indus Valley regions, the rice has been got entangled with and belong to the routes from China to Indus Valley. There is clear-cut evidence of rice dispersal from China to India in the form of *indica* at eastern India or Gangetic basin. This process of crops transformation can be called a process of loans of Chinese crops towards India. The relationship between China and Indus Valley regarding the dispersal of crops also been proved by some Chinese legends as well. A Chinese legend depicts that during the 12th century B.C, the trade of India with ancient China occurred [7]. China has been its important foreign trade partner to India among other ancient regions. This trade may have crucial in the spreading of ancient crops, especially ancient rice. From China to North India, *japonica* rice was introduced allocating hybridization too. The appealing thing is that the shape evolution and grain size of Indian rice do not come into sight early in domestication as assumed for the rice of China [8]. About 3900 BP, the Chinese horizon in its first appearance, can be judged in South Asia (Pakistan and India) about the domestication

of *indica* rice, in further as evidence. The Ganges Valley is considered the center of rice farming which is an important site in India. In Pakistan, Harappa is imperative site and called as the mother site of Indus Valley Civilization. In Harappa, the rice was as important as wheat and barley. There are many sites which have been assigned as having the reports about rice. The cultivated rice from Swat Valley and Pirak (Pakistan) shows vitality and significance of rice in these regions respectively [9,10]. This manuscript evaluates the existing information about the Chinese early phases of rice and its dispersal towards Indus Valley Civilization (Pakistan, India), in the perspective of archaeobotany. Overall, this paper is valuable because it spots the dispersal of rice from China to Indus Valley (Pakistan, India), that is an important debate as well.

2. MATERIALS AND METHODS

2.1 Archaeological Excavation

Archaeobotany is the sub-field of archaeology. For achieving the results about ancient crops, archaeobotany is a resourceful study that connects the people to ancient agriculture. Archaeological excavation is the first step to hold the archaeobotanical activities for the utmost and accurate results. Before the conduction of excavation, the survey and analysis about sites are inevitable. During archaeological excavations, the artifacts have been found by the archaeologists. These all artifact are seen on site and inside the trenches. Such as pottery, terracotta figurines, bangles, beads, stones, chard blades, coins, and others. But to determine the ancient agriculture, archaeobotanical sampling is conducting on site.

2.2 Process of Sampling and Flotation

From the trenches different and selected soil sampling is conducted to start the analysis and laboratory work during excavation. This sampling is done for the process of flotation in the next step. The sizes of the sample can be different with the accordance of site condition and disposition. With the usage of a bucket method, the samples are floated. During flotation work, the material is used to make it sift to come across carbonised plant remains with some other remains as well such as shells and bones.

2.3 Laboratory Work

The charred plant remains are sorted and quantified with the help of sieves as well as stereoscopic. The plant remains are searched from the dried samples after flotation. The samples are sieved by 2.00 mm, 1 mm and 0.5 mm respectively. During the quantification seeds, parts of spikelet, thorns, and awns are also observed at different sites. To get the accurate dating of the remains ¹⁴C dating method is also used in archaeometry labs. So, the chronology of the seeds measured and then the dating of the site with the help of plant remains is determined.

2.4 Compilation of Rice Database

The entire rice database has been collected first related to East Asia as well as South Asia. Through which the model of rice diffusion from China to South Asia has also be determined. Very minute hierarchy observed regarding ancient rice of both above-mentioned regions of Asia. The analysis and experiments were affirmed over the rice morphology and its species such as *japonica* and *indica*. The archaeobotanical assemblage also observed, even about the ancient harvesting tools of China and the regions of Indus Valley too. The demographics, as well as ancient language hypotheses, are also the best resources to figure out the vigorous results.

3. RESULTS

3.1 The Spread of Chinese Rice towards Indus Valley Civilization (Pakistan, India)

The discussion about the origin of rice and its dispersal, have been studied for long period [11]. It is obvious that the origins of Indian rice have been challenging, but contrary to this fact, the domestication occurrence in north India is surely feasible (Fuller, 2006). But in China (southern side) Yangtze basin, rice was domesticated [12-16]. There are rising of evidence that farming culture produced important influences from South China [17]. There are also some clues that the rice farming culture also spread from Yangtze River towards the South Asia with the language speaking of Austroasiatic and Austronesian respectively [18]. The diffusion of South Chinese rice towards northeast India was occurred due to migration with the languages of Austro-Asiatic [19]. The *indica* rice came from China (Yunnan)

to India through the speakers of Austroasiatic [20]. There are many reasons through which the rice dispersal occurred from China to India, from those reasons, one may be the trade as like India is recognised as one of the four important trading nations in Pre-Christian Era [7]. Another aspect to identify the charred grains of ancient crops is vital too. Charring rice grains experiments techniques practiced in South Asia and its comparison with East Asia is also interesting. In South Asia, charring experiments in the context of archaeobotanical rice to identify its types have also been complexed such as from Navdatoli [21] and Swat, Pakistan [10]. Parallel to this, attempts to separate archaeological rice into *indica* and *japonica* have been distinguished in China [22]. Optimistically, identification of rice now enhancing and developing from the sites of China [23]. More results would come out about the origin and process of the rice farming in Indus Valley if same measures and modern techniques would be used as in China. The wild precursors of the Asian rice *O. nivara* and *O. rufipogon* are distributed through southern China to northern and eastern India [24,25]. The clues of *Indica* rice suggest the rice cultivation by 2500 B.C at Ghalegay site [10] that illustrates the dispersal from the Gangetic Valley to the Southeast region. On the contrary, Late Harappan rice from Pirak, has been noted as shorter in form, illustrated as *japonica* rice [26]. In the past, the long distant trade activities of China with Northern Pakistan (Kashmir) show the cultural sphere as well. The evidence of similarities in harvesting tools of China and South Asia has also been illustrated. The presence of the knives of stone harvesting in Kashmir as found in China shows the technological diffusion and continuation in data. This dispersal occurred after 2000 B.C. In later Neolithic phases like Burzahom II and Gufkral 1C, such kinds of forms also took place [27,28]. In the Late Harappan era, at Pirak site, Pakistan, the appearance of these harvesters has been noted as well [29]. The following model can describe the rice dispersal from China to South Asia.

4. DISCUSSION

4.1 The Origin and History of Chinese Rice

There are two important rivers in China such as Yangtze River (6500 km long) and Yellow River (5500 km long) which have the enduring association with important staple cereals such as rice with the Yangtze River and millets with the

Yellow River [30]. Usually, rice has been associated with the Yangtze River, because this river is proved to be the abode of ancient rice with the accordance of archaeological records. Normally, the early cultivation of rice in China belongs to the Middle Yangtze, southwest Henan, the Huai River, Shandong, the lower Yangtze, and Houli culture [3]. It has been noted that Pleistocene cave, as well as Early Holocene residents in China (Southern side), considered as the most primitive rice farming regions as well [3]. Some of the scholars claim and associated the early ceramics 18000-15000 years ago with the early farmers, but early ceramics cannot be linked with early farmers [31]. Further study may bring the ideal conditions of the true judgment. Since 1970s, after some discoveries, it has been noted that the early rice farming is associated with Yangtze basin with the basic discovery of the Hemudu (Fig. 1), a waterlogged Neolithic site (7000-6300 BP) where, after excavations, the quantities of rice were recovered and it was unanimously observed that this site may be the origin of early rice farming. The focus on the sites named Bashidang and Pengtoushan of the Middle Yangtze region having the cultural phase from ca.6500-5500 B.C. These sites denominate the vitality of Yangtze River rice too. From the Bashidang site, huge quantity of rice has been recovered, mostly the wild ones. Afterward, many other imperative sites were excavated which resultantly proved that the Yangtze region is the origin of early rice [32]. In the middle Yangtze region, about 6000 years ago (Daxi culture) and (Majiabang culture) in the lower Yangtze display the picture of the early key nutrition of the societies belong to Neolithic Era. Another later Neolithic site, named Chengtoushan that represents the Daxi Culture from 4400-3300 B.C, has been noted with paddy field together with rice. The most interesting factor is that the Hemudu and Kuahuqiao sites, which has also been associated with early textile with early rice cultivation in China which opens the new doors for the coming scholars to ponder over it through their further researches. The rice was further spread out towards some other southern parts in later periods such as Guangdong, Fujian, and Guangxi in about 5000-4500 BP. Ultimately, after some enhanced researches, it has been pragmatic that the domestication of rice was completed after the culture of Hemudu [33]. On the other side, the Huai River and Han River (northern tributaries of Yangtze) are indicated as the additional hub of the early farming of rice. There are some other shreds of evidence about rice field systems as

from the lower Yangtze region, from the eastern side of Taihu Lake (Choudun and Caoxieshan sites) represent the early rice field system showing the small dugout avoiding with puddle fields in a systematic way [33]. This system establishes some hints about early rice agriculture.

As far as ancient wild rice (Fig. 2) of Zhejiang province is observed, this wild rice dated back to probably 8750–6200 years. Basically, this rice found at *Zhujajian* site that is an island, situated in the east to Zhejiang Province. This wild rice which was intact in form having the length from inner side of 2.0 mm as well as from outer side 2.2 mm glumes, was discovered by some scholars who were busy to collect material from the site in 2002. This rice was recovered from the eastern part of China and with this three other wild rice species belong to southern side such as; *Oryza rufipogon* (*O. perennis*), *O. officinalis* and *O. meyeriana* [34] also clued with the connection of wild rice from south to east in China. This wild rice discovery may help the researchers to plunge into the history of Chinese rice from south to east. In archaeological understanding wild rice, which is the ancestor of Asian domesticated rice that is considered as the best source to identify *Oryza* species, with the attention of examining grain morphology focusing with starch granules as well as double peaked phytoliths. If we talk about the wild rice from the northern side of the China, the wild rice from Dongxiang site is considered as the recent most coverage from northern side as it has been reported less in the past researches. This rice is pertinent to the period of 500-300 cal. BP (Little Ice Age). This size and morphology of this wild rice may be creating confusion in the identification of *indica*. Usually some of the *indica* rice from different sites is considered as *japonica* in term of morphology. The wild rice from Dongxiang site has been observed as the antecedent of Asian rice [35] found in northern part of the China.

Cut the story in short, accumulation of archaeological data proved that the early start point of the early rice is the Yangtze River, middle and lower reaches (Fig. 3), which is a vital one to trace the center of the early crop growing. The lower reaches of Yangtze River sites are Hemodu, Kuahuqiao, 6000-5000 B.C (Zhejiang Province), Majiabang, 5000-3800 B.C, Jiangsu Province, Shangshan, 9400-6600 B.C, Zhejiang Province. Middle reaches sites are, Yuchanyan (Yuchanyan site, Hunan Province),

Pengtoushan, 7500-6100 B.C, Hunan Province, Chengbeixi (Hubei Province, 7000-5000 B.C), Diaotonghuan, and Xianrendong (Jiangxi Province). The three stages (Fig. 4) of ancient rice farming in China are crucial to understanding

the ancient rice agriculture of this region. Overall, the preliminary phase is before 8000 B.C (Mesolithic Age), a mounting phase is between 8000-5000 B.C, and mature phase is from 5000 B.C respectively.



Fig. 1. A Neolithic site, Hemudu site, 7000-6300 BP (After Liu et al., 2017)



Fig. 2. *O. rufipogon* grain, Zhujiajian Island, Eastern China (Adapted from, Shen et al., 2004)

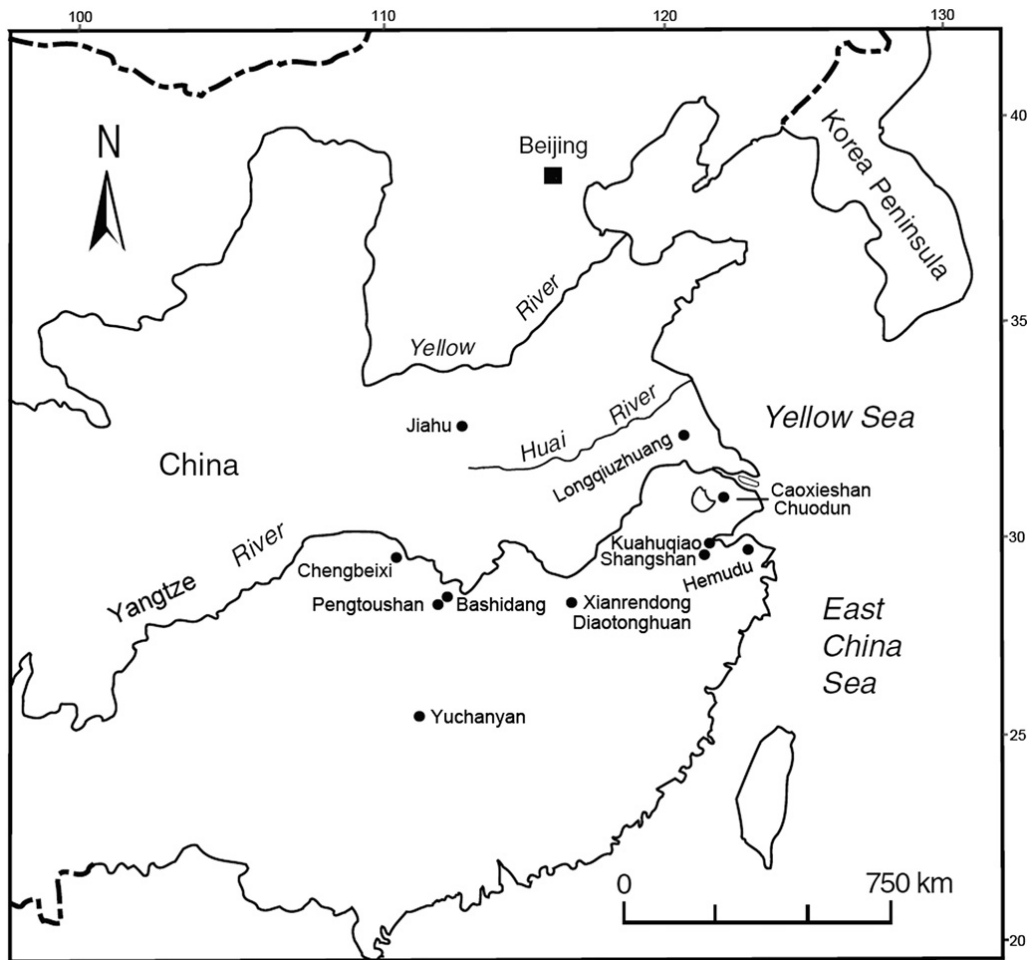


Fig. 3. The map of mentioned sites (adapted from Liu et al., 2007)

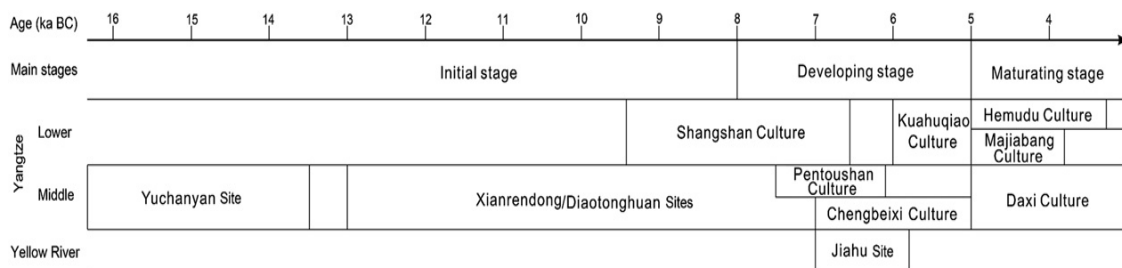


Fig. 4. Diagram showing China's prehistoric rice farming in three phases (After Wang et al. [87])

4.2 Searching for Rice Domestication in Pakistan and India (Indus Valley Civilization)

The Harappan or Indus Civilization (Fig. 5) has been consisted of ancient compound culture which has been absolutely extended its great division of present day Pakistan and India, Sub-

continent [36-39]. In detail, it is stretched over the moorland territories of Baluchistan, Afghanistan, and some areas of Gujrat and Kutch (India), which show the greater Indus Valley Civilization [40]. Overall, the culture of the Indus Valley Civilization is recognized as the developed culture in the old world [36]. Roughly estimated, about 2600 archaeological sites are existed

recognized as Indus Valley or Harappan Civilization sites, well identified in Pakistan and India [41]. In Indus agriculture, the role of rice has been debated due to its development in this region [2]. From 3200 to 1300 BCE, Indus valley's agriculture has been noted as developing period. As far as rice is concerned, different stories have been presented during the excavations at Ganges Valley and some other regions like Vindhya that shows hunting activities, as well as the origin of agriculture in this region, has been noted with the case of Gangetic Valley, Chapanimanda (c. 15,000 B.C. - 7,000 B.C), Ganga Valley (10,000 B.C), and Mahagara. According to Prof. G. R. Sharma, Cultivation of rice started in these sites. There are also some direct shreds of evidence of rice cultivation like at Koldihwa site, direct cultivated rice evidence found dated back to c. 4500 B.C from the fired pottery with carbonised and charred rice proof [42]. And in Iron Age, the continuation of rice is found in many Iron Age sites in India like Hastinpur site that has the evidence of rice cultivation showing continuous process [43]. In South Asia's Indus Valley, the pieces of evidence about clear archaeobotanical material for morphological domestication has been unidentified and unreported [44]. There is also the region with a diverse environment of South Asia, specifically Indus Valley that has advantages of rainfall system of both winter and summer seasons [36]. Most prominently, winter crops have been subjugated Indus Valley regions during mature urban phase from c. 2600-1900 B.C [45]. In this region, winter and summer seasons have been noted for multi-cropping, but the rice has experimented as a summer crop. With over all observation about the ancient rice agriculture in Indus Valley, according to [46], millets, rice, and pulses have been cultivated in the zone of Indus in pre-urban culture.

4.3 Different Phases of Archaeobotany and Its Progress in India

In the early parts of Indian history, the archaeobotany was not treated as today. Usually, archaeologists sent some important samples which were mostly few to the botanists for recognition and identification only. During excavation, material was few and was collected with mismanaged measures, but charred grains in pots, as well as some pieces of wood in preserved form, were prominent in all collected material [47]. In the early stages of archaeobotany, all the got material was sent to agricultural officers who just sent species in a list

without handy description [48]. But with the passage of time, archaeobotany became recurrent as many of the archaeologists from South Asia (Pakistan, India). In the early 1970s, the interest and increasing of thoughts about archaeobotany improved about accentuation in ecology and archaeobotany [49]. But many archaeological sites of Indus Valley Civilization were examined regarding archaeobotany to carve out the ancient agricultural history of Indus since the 1990s [50]. As far as the agricultural strategy of South Asian people is observed, two strategies have been noted by different scholars. These two strategies have been found in Harappan Civilization [51]. Discussion these two strategies one by one, in first one, in prehistory in northwest South Asia, the crops were sown in the autumn and harvesting done in the season of spring, afterward, got fed with the rains of winter. The harvested crops were wheat, barley, peas, chickpea, lentils, mustard, and jujube. In the second strategy, the crops were sown in the season of summer and harvesting was done in the fall season, getting benefits from the monsoon rains of summer. The cultivated crops were rice, millet, cotton etc., in many parts of Indus Valley Civilization. The major city of Indus Valley, Harappa, is thought to be the center of the winter season strategy. The most prominent thing about the summer season strategy, it is related to Indus Pastoralism and was more progressed than winter season strategy in later Eras. According to [52] the pastoralist activities are linked with summer strategy. Usually, rice was cultivated in summer strategy in South Asia, in both Pakistan and India. On the other hand, In China, during the 1970s, the discoveries and understanding about the origin of rice were improved due to the discovery of Hemudu (7000-6300 BP) site at Yangtze River in the South of China [32,53]. In the broad spectrum, this phase of 1970s in India is considered as professionalization in archaeobotany. But until the 1990s, the crop processing was not gravely integrated. Conclusively, the South Asian archaeobotany did not incorporate and enhanced as East Asia. Due to this phenomenon, still many of the archaeological sites have been explored without fundamental applications of archaeobotany to carve out the ideal analysis of the ancient crops of South Asia including rice. Misleading in interpretation about South Asian Bio-archaeological data is high due to less scholarly expertise. Such as impressions of wheat from Kalibangan site has been noted as rice [54].

4.4 Origin, Stretch, and Evidence of Rice in South Asia (Pakistan, India)

In Pakistan, It is observed that the farming foundation at Pakistan was started with the connection of northwest with near east plant origination [55]. The winter and summer agricultural system was enriched and diversified by the beginning of summer crops such as rice in the ending of 3rd millennium B.C till the Second millennium B.C [56]. At Pakistan, the earliest agricultural clues are found at Mehargarh(Baluchistan) without the presence of rice at that time. The Period I A, at Mehargarh site, Radio-carbon dates (7000 B.C. or 6500 B.C) propose the earliest agriculture [57,58]. In the Chalcolithic Period, in the region of Saraikhwa, the rice is observed at Loebanr, Ca. 2300-1500 B.C, and Period III. Here, rice was cultivated in

the summer season. Fujiwara acknowledged rice phytoliths in the fragments of two baked brick and three pottery (ca.2000 /1900- 1500 B.C) from Harappa site. It is also a fact that the rice cultivation in the region of Harappa was practiced by the mid to late third [59]). Very important part of Harappan Civilization is the Hakraaware period which has been noted as vital as Mohenjo-Daro and Harappa sites in Pakistan. There are many sites which have imperative cultural artifacts. These sites are existed on the old bed of Hakra River. The Mature Harappan site, named Ganweriwala (Pakistan) has been recorded the metropolitan city in ancient times. Unfortunately, no archaeobotanical records found from this site. According to Dr. Rafique Mughal, there is not any archaeobotanical material associated with this site, situated in a Cholistan desert, Bahawalpur, Pakistan [60,61]. It shows some mature

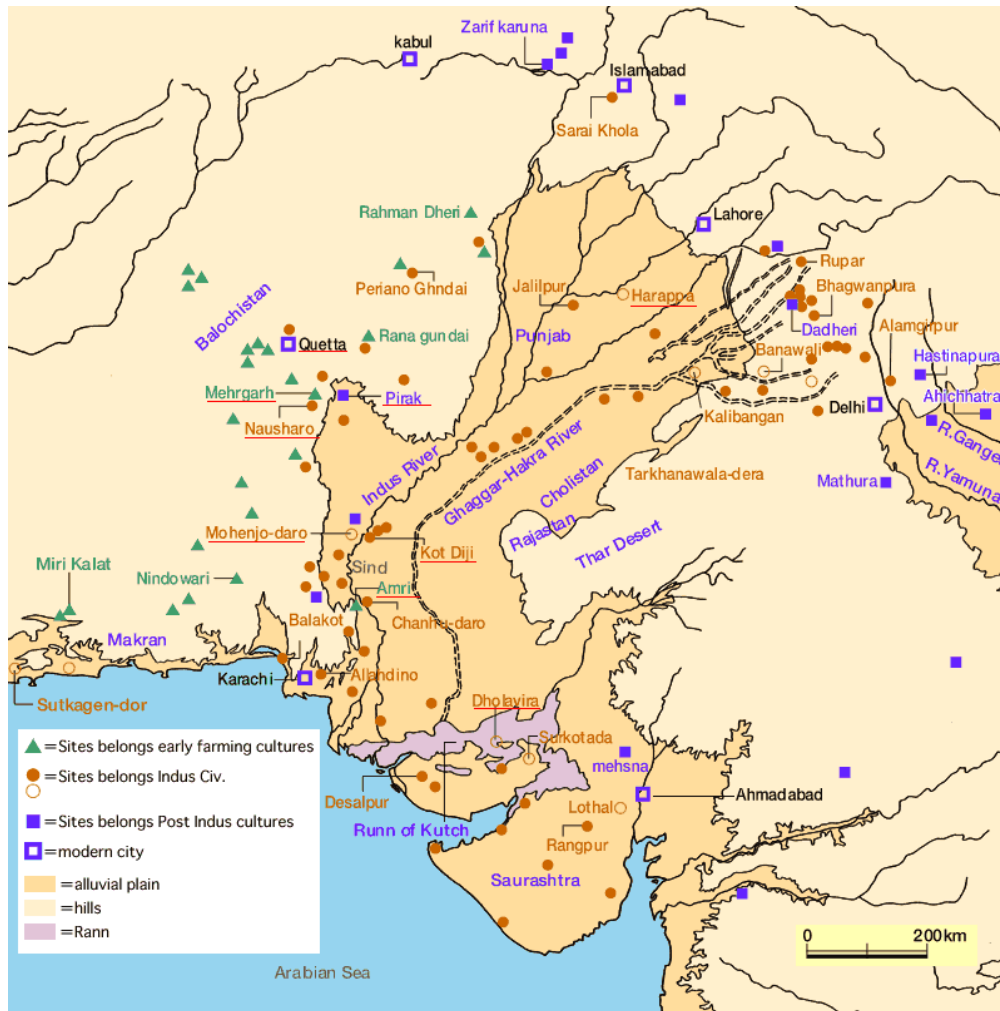


Fig. 5. Map of Greater Indus Valley Civilization (adapted from Tokai University, 2000)

period sites also do not have the record of rice but mostly wheat and barley. Talking about Pakistan's crop economy which material evidence is based on the reports which were written in earlier times [62-64]. There are also some examples of rice dispersal from Ganga Valley to other sites like Pirak (Pakistan), where the proof of rice shows the diffusion of rice from one place to another [65]. Some of the sites like Harappa, Kunal, and Banwali depict the presence of rice that leads the scholars to ponder over the rice domestication here [50]. At Harappa, the rice morphotypes were identified by Madella [66] that belong to the Mature Harappan period. In India, rice is a significant crop in South Asia [67]. In the grounds of agricultural origins, there have been noted many crops including rice at Ganga basin [5]. Some of the sites had clues of rice impressions on pottery like Haryana [56] and upper Ganga Valley [68] as well as charred grains [69,70]. The Ganges is considered to be the center of rice [3] as the samples suggested that belong to ancient ages. It has been noted that evidence proposed that *indica* rice belongs to this region as well. At Bihar, Uttar Pradesh, Maharashtra, rice has been reported among other cereal crops too [71-73]. The strength and support to research about rice were enhanced when the clues about Indus people found after the observation of rice impressions in pottery in Rajasthan and Gujrat, India [74]. At Masudpur I and II (close to Rakhigiri site), archaeobotany reveals the occurrence of rice (*O. nivara*) or maybe proto-*indica*. This hints the economy of village settlements of ancient times. The Kanmer (Gujrat) site has the evidence of rice that belong to the phases of Mature and Late, which is the hint of rice farming over this region. From the western part of India, the rice cultivation was practiced in Harappan times such as the site Ojjiyana in adjacent, Rajasthan, has been the best example that gives the date of rice cultivation by 2500–1500 B.C [75]. The rice grains recovered from the sites such as Masudpur I and VII, present the utilisation of the rice dated back to Early Harappan phase [76]. At Ganga Valley, some localities are well noted with the evidence of wild rice which was eaten in the advanced Mesolithic period (ca. 8080 ± 115 B.C) such as at Chopani Mando. The cultivation of rice at Mahagara is noted as a unique discovery of cultivated rice at Ganges Valley [77,78]. It is proved that Mahagara has both the Wild rice and Cultivated rice with the conduction of Electron microscopic studies by Vishnu-Mittre [79]. Another site at Ganga Valley called Gufkral depicts the

diffusion of Rice cultivation westwards in the period of ca. 2000 B.C [80,81]. Cultivated rice was also identified from Lothal, ca. 2300 B.C. and Rangpur, ca. 2000 B.C. On the southeastern fringes of India, the Neolithic-Chalcolithic Settlements (from lowland coastal sites) of Odisha are recognised with the appearance of the dominant crop of rice [82] which shows earliest rice domestication in this region. After having the approach of spikelet, the judgment about rice appearance, have been evidenced in Odisha too. The rice rotation at Atranjikhhera, 2000-1500 B.C. [83] and at Lal Qila contemporary to Atranjikhhera [68], show the exclusive rice records. Another important site like Inamgaon has been noted with the presence of rice. The recognition of single rice in the early times [84] built a statement that rice was a vital crop in the Chalcolithic period [85].

As it is guided above, the abode of rice is, Southern China (Yangtze basin) and it get entangled with South Asia from the northern side of India, where the Ganges Valley is situated. The center of rice in India is the Ganges and Yangtze is of China respectively. Later on, the stages of the rice dispersal was occurred first from China and then from the Ganges to other parts of India and some Pakistan. As it is observed, some of the cultivation tools are found in Kashmir resembled with the tools used in China. Due to the trade activities, northern Pakistan/Kashmir expanse had connections with the north/east in the Chinese. It has the connection of agriculture from China to Kashmir too. Harappa site also has the hints of early rice of the region. As the rice spread from China to South Asia, the rice towards Southeast Asia also occurred from China respectively.

The most interesting thing is that the soil of India and China is different to each other but agricultural conditions are amiable for the settlements. Towards the Central and Western India, hill or mountain clay, black cotton soil particles, and the alluvial soils of river plains show its different denomination. And the topographical varieties have been noted and preserved by the accounts and reports of foreign writers, travelers, and scholars. Exemplary, the account of a Chinese traveler named Hiuen Tsiang (7th Century A.D), who visited India and wrote that "the product is dissimilar in its nature" when he talked about "climate and soil being different" [86].

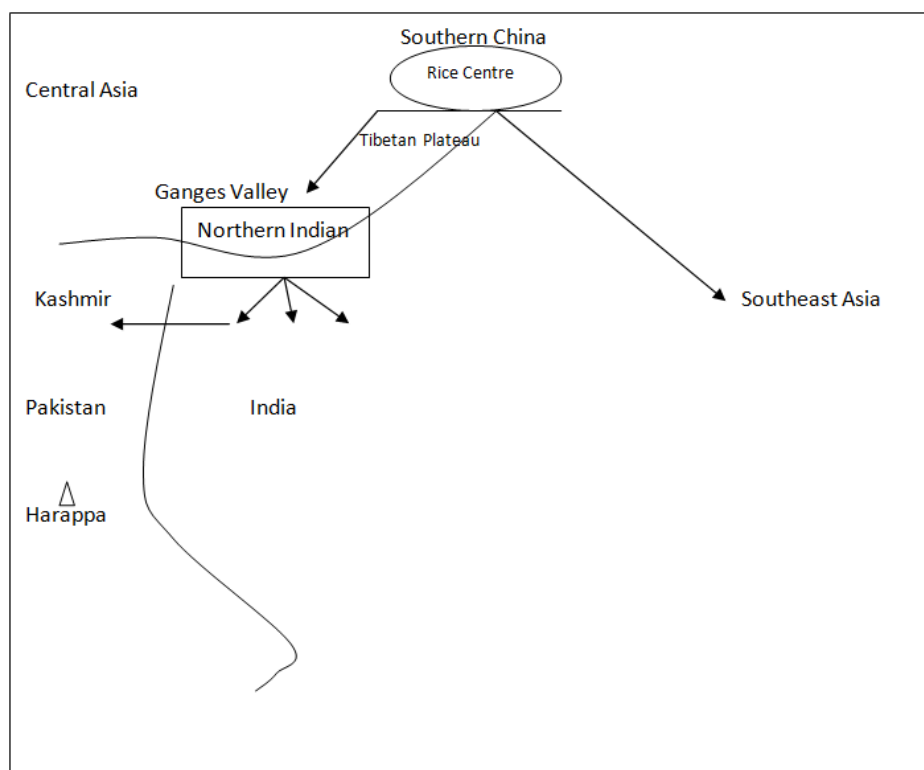


Fig. 6. The centre of rice in South China and its dispersal towards Indus Valley

5. CONCLUSION

By amalgamating the archaeobotanical data for the earliest farming in the Southern part of China and its dispersal towards neighboring regions such as Indus Valley regions, the results provide the conditions, reasons, routes, and some other sources through which rice was spread from East to South Asia. With this, the established truth is that the Yangtze River basin is the abode of early rice as well as Ganges Valley, which is considered to be the center of the origin of Indus Valley rice. Some of the Chinese legends prove that there had been trading activities between China and India in ancient times resultantly; the rice was dispersed during these activities. There are also so other reasons, through which the rice migration from east to south Asia can be judged such as geographical boundaries and evidence of historical linguistic models. The naked truth is that, in China, the domestication procedure was finished from 6500 to 6000 years ago, afterwards in India, most probably about 2nd millennium, in the result of the hybridisation of Chinese rice in Indus Valley region. In this respect, the trade as economics or ecology can also play an important role to carve out the ancient hierarchy of Chinese

Civilization with Indus or Harappan Civilization respectively. The most important aspect of Chinese rice dispersal is that the wild progenitors of Asian rice are *Oryza rufipogon* and *Oryza nivara* that can be observed as native to Southeast and South Asia, stretching northwards into the Chinese Southern part.

ACKNOWLEDGEMENT

Being First author, I am highly grateful to CGS and CSC. Through the platform of CGS, I was able to write the manuscript with the profound ideas.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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