ARCHAEOBOTANICAL INSIGHTS OF THE PRE-HISTORIC AGRICULTURE IN PAKISTAN: ARCHAEOLOGICAL ACUMENS

Yuzhang Yang, Muhammad Hameed & Muhammad Azam Sameer

ABSTRACT

The land of the Pakistan has witnessed as the cradle of an ancient society of the ancient world, called Indus Valley Civilization or Harappan Civilization. This prodigious civilization is contemporary to the other ancient societies like Egyptian, Persian, Mesopotamian, and Chinese. The Harappa, Mohenjo-Daro, Ganweriwal, Kot Diji, and Mehargarh are its renowned archaeological sites, which illustrate the ancient agriculture and social lives of the Indus people. This civilization is also significantly known with its urbanization, town planning, bronze technology, seals, and trade networks. In Pakistan, earliest farming was started in the Neolithic at Mehargarh site (7000 B.C. to 2500 B.C.). In later stages, it progressed towards the Harappan culture. This paper will focus on collected archaeobotanical data from some important prehistoric sites that recommend the evidence of origins and dispersals of important ancient crops and agropastoralism of ancient Pakistan. In addition, the ancient cereals from these sites during the Neolithic will also be examined with the context of agricultural strategies, socio-economic structure, farming system, domestication of animals, and ecology of ancient Pakistan. Moreover, the history of archaeological research and archaeobotanical evolution in Pakistan are pivotal theme of this research.

Keywords: Archaeological acumens, Ganweriwala, Harappa, Mohenjodaro, Agriculture, Mehargarh.

INTRODUCTION

Pakistan came into being on August 14, 1947, but its history extended back to thousands of years. In a broader spectrum, the land of Pakistan has Paleolithic, Mesolithic, Neolithic and Bronze Age settlements. The earliest remains of Pakistan dating back to Lower Paleolithic (ca. 700,000 to 400,000 B.C (Rendell and Dennell, 1985). It is a fact that Pakistan has witnessed as the cradle of one of the ancient civilizations of the ancient world, called Indus Valley Civilization (Figure 1). This is a Bronze Age civilization (3300 B.C.) that prolonged over the northwestern regions of

South Asia with the expansion of Pakistan and India (Wheeler, 1968; Murray, 1989; Possehl, 1990; Lal, 1997; Kenoyer ,1998; Possehl, 2002; Agrawal, 2007; Wright, 2009). This civilization is also termed as Harappan Civilization due to its chief type site, called Harappa which is a small village located in Pakistan. The Indus Valley Civilization is also significantly known with its urbanization, town planning, bronze technology, seals, and trade networks (Shaffer, 1992). To portray the ancient society of Indus Valley Civilization, its artifacts are the best sources, which elucidate it as the indigenous society. The attributes of its ancient artifacts elaborate it as purely aboriginal society, because these artifacts have never been recorded in any other ancient civilization. The culmination of this verdict is that the ancient civilization of Pakistan was an indigenous one. There are countless archaeological sites housed in this civilization. It is roughly estimated 2600 archaeological sites, which are recorded in both Pakistan and India (Possehl, 1999). Among all these archaeological sites, Harappa, (Figure 2) Mohenjo-Daro, (Figure 3) Ganweriwala (Figure 4) are located in Pakistan, and Rakhigarhi and Dhulavira in India, are imperative urbanized or metropolitan sites (Petrie, 2013). After probing these sites, the remarkable Mature Phase or Urban culture of this civilization can be scrutinized well. Except for these metropolitan sites, some other crucial archaeological sites in Pakistan also portray the Stone Age to Iron Age such as Lower Paleolithic sites, Soan Valley sites, Neolithic sites, Bronze Age sites, Mature Harappan sites, Late Harappan sites, and Iron Age sites. To highlight the Stone Age from Lower to Middle, Acheulean period sites and Potohar Plateau from Pakistan are the best sources (Ikawa, 1978). In Pakistan, the farming establishment was begun with the association of northwestern regions (Meadow, 1996). It is also a vital point that in the earliest stages, rice (Oryza sativa) was missing but wheat (Triticum aestivum), six-row barley (Hordeum vulgare), and dates (Phoenix dactylifera) were present. All these crops were cultivated in the Neolithic Age, where ancient farming was started. A well-known and worthy Neolithic site, called Mehargarh (7000 B.C to 2500 B.C.) in Baluchistan Province, is the best starting place to know the earliest agriculture (Jarriage, 1984; Possehl, 1988; Sharif and Thapar, 1999]. The available archaeobotanical record describes the ancient staple crops in Pakistan with the reference of Mehargarh site. Wheat and barley in the Neolithic Age and rice and millets (Setaria italica, Panicum miliaceum) in the Bronze Age and

Mature Age have been observed in Pre-historic sites after some archaeological excavations. In this manuscript, ancient staple crops of Pakistan with the context of important archaeological sites would be discussed in succeeding passages.



Fig.1 Map of the Indus Valley showing archaeological sites (https://commons.wikimedia.org/wiki/File:IVC-major-sites-2.jpg)



Fig. 2 Panoramic view of Harappa site, Punjab Province



Fig. 3 Mohenj-Daro site, Sind Province (https://en.wikipedia.org/wiki/Mohenjo-daro)



Fig. 4 Upper mound of Ganweriwal site, Cholistan Desert, Bahawalpur.

THE DEVELOPMENT OF THE ARCHAEOLOGICAL RESEARCH IN PAKISTAN

A person from East India Company, named Charles Masson discovered Harappa (Pakistan) in 1829, which is a metropolitan city of Indus Valley Civilization. He also described the archaeological remains of the Harappa in his writings, as well as the size and extension of this civilization, was mentioned too (Marshall, 1931). After Charles Masson, another person called Alexander Burnes, who was also from East India Company, traveled Harappa site and made some notes about this site. According to him, the baked bricks belong to the Harappa site were plundered by some aboriginals. With the context of some other accounts, countless precious bricks were also used in railways lines about 100 miles between Multan and Lahore cities. Later on, in 1853, Alexander Cunningham who was the first director-general of Survey visited Harappa and mentioned the brick wall, which shows the extensive use of bricks in Harappa city. With this, he also mentioned the Harappan stamp seal in his writings too. After the archaeological expeditions of Alexander Cunningham, proper archaeological work was started. Another person, called Lord Curzon who appointed John Marshall to carry out the archaeological project in the region of Indus Valley Civilization, specifically Harappa site. After the direction of John Marshall, for the first time, Daya Ram Sahani excavated the two renowned mounds of Harappa site. After Harappa, Marshall also appointed three officers, named D.R. Bhandarkar in 1911, R.D. Banerji in 1919, 1922-23, and then M.S. Vats in 1924, who made their surveys on Mohenjo-Daro site which is another important metropolitan city of Indus Valley Civilization. During these surveys, many artifacts were documented and among those artifacts, King-Priest bust (Figure 5) is a crucial one. According to Wright, excavation at Mohenjo-Daro was conducted by K.N. Dikshit in

1924, Hargreaves in 1925 and then Earnest J.H. Mackey in 1927-31. Mortimer Wheeler also conducted an excavation at Mohenjo-Daro in 1944. He also supervised the establishment of archaeological institutions in Pakistan. After 1947, UNESCO, Achen University of Germany, and Italian Mission to Mohenjo-Daro worked on Harappa and Mohenjo-Daro sites. From 1970 to 2010, American teams excavated Harappa including George F. Dales and Dr. Mark Kenover. A French archaeologist Jean-Francis Jarrige carried exaction at the site of Mehargarh (Baluchistan) and exposed the hidden ancient crops of Pakistan. In the 1970s, Dr. Muhammad Rafique Mughal, a local archaeologist did a survey on the bed of Hakra River, southern Punjab, Pakistan (Mughal, 1098) through which the desert archaeology was focused on and highlighted through his valuable writings. The work of Dr. Muhammad Rafique Mughal is worthy in terms of excavations at Harappa, Tulamba site, Kot Diji, and others and his collaborative work with international scholars in Pakistan. This collaborative work was based on archaeological excavations which are; Sutkagen-dor, 1960, Harappa, 1967, Jalilpur, 1971 and 1976, Jhang, 1974, Malir Megaliths, 1975, Participation in the excavations at Charsada headed by Sir Mortimer Wheeler from the United Kingdom and with Rita P. Wright from the U.S.A, for a combined Field Survey around the city of Harappa. Being a local archaeologist, his contributions in the field of archaeology in Pakistan is still superior. Except him, in 2007, the writer of this manuscript, Muhammad Azam Sameer also participated in the archaeological excavation at Harappa headed by Dr. Mark Kenoyer, a supervisor of an American team.





Fig.5 The bust of Priest King (2200-1900 B.C.), found at the archaeological site of Mohenjo- Daro, Sindh Province, Pakistan.

THE PRE-HISTORIC SITES AND ITS AGRICULTURE IN PAKISTAN

The Mehargarh, a Neolithic site (7000 B.C.) in Pakistan, is located near the Kacchi Plain of Bolan Pass (Baluchistan Province), has the record of early farming in Pakistan. Mehargarh site provides the evidence of ancient crops such as six-row barley, wheat, emmer (Triticum dicoccum), and dates cultivated by semi-nomadic people. However, in later stages, they also cultivated jujubes (Ziziphus mauritiana) and grapes (Vitis). The results of the pollen analysis depict that, from about 8000 yrs BP to 6000 yrs BP, some vegetation like Salix, Tamarix, and Ulmus were existed (Costantini, 2006). On the contrary side, there was no existence of rice at the site of Mehargarh in the Neolithic Age. The cattle, sheep, and goats were also herded here (Chen et al., 2010). The analytical study about the Neolithic Age provides facts about the aboriginal signs of zebu cattle too. Domestication was of mixed origin but wheat and barley have no local wild progenitor, on the contrary side, zebu cattle has the clarity to be called as indigenous domestication in the region (Jarriage et al., 1995). Additionally, Mehargarh is splitting up into two categories: Mehargarh I (aceramic) and Mehargarh II-VI (ceramic). According to Jean-Francois, at Mehargarh the farming economy was introduced in a full-fledged form in the Neolithic Age, which is also an agricultural development of the region. According to the model of Patterson and his team, South Asian agricultural center was considered as hunting-gathering population and initial farmer populations near Mehrgarh (Patterson et al., 2010). The Mehrgarh site in Pakistan attributed as an early phase in the transition to an agricultural-pastoral economy and predominantly with a deep-rooted everyday life pattern. There is also a record of human figurines, pottery, burials, and metallurgy with ancient crops at the site of Mehrangarh. After discussing the ancient agriculture of Mehargarh site, ancient cereals and some important Pre-historic sites and in Pakistan are briefed here.

RICE

The rice was the significant crop of all the ancient societies and this crop placed a central position in the enhancement of the economy. Archaeobotanical record depicts that the origin of earliest cultivation of rice belongs to China, specifically to the middle and lower Yangtze River, Houli Culture, Southwest Henan, the Huai River, and Shandong (Fuller, 2011) In Sub-continent, the origin of rice is associated with Ganges Valley in India. In the earliest agriculture of rice in Pakistan has also been debated due to its vitality and importance. Prominently, between 3200-1300 B.C, the agriculture of Indus Valley was recorded as the developing period through which the Bronze Age, Mature Phase and Later Phase were highlighted. Here, rainfall system of winter and summer seasons has been observed and the crop of rice was cultivated in the summer season mostly. Ultimately, rice farming was started in the summer season at the end of 3rd millennium B.C. until the Second Millennium B.C. (Willcox, 1992). In the Chalcolithic Period, a famous site called Saraikhola has the record of rice which is dated back to 2300-1500 B.C. and shows the development and trend of rice cultivation after

Mehargarh Phases. Afterward, at Harappa site, the existence of rice was analyzed with the help of phytoliths of the two baked brick and three potsherds in Later Phase (ca.2000 /1900- 1500 B.C) (Fujiwara et al., 1992). Here, rice morphotypes were also identified by Madella through which new horizons of rice agriculture came into being. In 1989, Dr. Muhammad Rafique Mughal and three researchers from Japan started exploring the rice, and the results of plant opal analysis indicated the existence of rice over here. Prominently, Cemetery H and Mounds A and B were selected for this expedition. Overall, rice farming was probably not well suited to the environment of Harappa, just as today, it is not the major crop grown in the expanse of Harappa. Talking about the desert archaeology in Pakistan, there are almost 420 archaeological sites existed in the desert of Cholistan (Southern Punjab Province) where Hakraware, Harappan, Mature Harappan, and Late Harappan sites among these sites, a Mature Harappan and metropolitan site, named Ganweriwala is also housed but unfortunately, there is no any archaeobotanical research on these sites. Therefore, there is not enough information about ancient agriculture of Cholistan Desert. Another important Neolithic site like Ghalegay, in Swat (ca. 2970-2920 B.C.), where the farmers cultivated rice in the summer season and other crops such as barley, wheat, lentil, and field-pea in winter. Other sites like Pirak and Kashmir also denote the ancient rice agriculture in the northern site of Pakistan, which shows the trend of rice farming from north to south. The Pirak site is located on a small hill, rising out of the North Kachi plain, about 20 km. east of Mehrgarh site, Baluchistan Province. This site had three occupational levels and rice was cultivated during all the phases of occupation, but from first level, an enormous deposit of rice has been reported (Constantini, 1981). Furthermore, the proof of rice at Pirak site, outside the region of Ganges Valley (India), depicts the rice dispersal in early times due to the suitable conditions for rice agriculture of this region. It is also accepted fact that rice came into northwestern Pakistan from China rather than India in the early second millennium B.C. has been remained to be importantly assumed (Jarrige, 1997).

WHEAT AND BARLEY

With the available archaeological record, the wheat was first evidenced in Turkey, Syria, Lebanon, Ethiopia, and Egypt (Lev-Yadun et al., 2000) and einkorn type wheat in Turkey is dated back to 9000 B.C. On the other side, barley is ancient than wheat as wild barley (*Hordeum sp*) was first occurred on 23000 B.C. (Tanno and Willcox, 2006). Amazingly, the ancient wheat got the attention of the researchers more than modern wheat, because of its better nutrition (Kohajdova and Karovicova, 2008). However, in Pakistan, the first evidence of wheat and barley has belonged to Mehargarh site where these two crops were first recorded in the Neolithic Age that was the start of agriculture of the region as well. These two crops were also cultivated in Indus Valley Civilization in the winter season (Fuller, 2006) that shows its sequence and agricultural strategy from the Neolithic to Bronze Age. Overall, this agricultural strategy prevails in all phases like Early Phase (3000-2500 B.C.), Mature Phase (2500-2000 B.C.) and Late Harappan Phase

(2000-1200 B.C.). In detail, double cropping in rabi (winter) & Kharif (summer) was extensively proficient and as the winter crops; wheat, barley, field pea, lentil, chickpea, grass-pea, and summer crops; rice, millets, black gram, sesame, and cotton were a part of the strategy of the Indus agriculture [Tengberg, 1999; Saraswat and Pokharia, 2002, 2003; Weber et al., 2011]. In Pakistan, in present time, there is much worth of these two seasons like past because still the cultivation of crops are done with the accordance of these two season. In Present Era, wheat and barley got the attention of its origin and dispersal in Pakistan (Spengler et al., 2014a; Liu et al., 2014). In this regard, archaeological record suggests that in fifth/fourth millennium B.C, free-threshing wheat was recovered from Pakistani sites such as Miri Qalat, Sheri Khan Tarakai, and Shahi Tump (Desse et al., 2008; Thomas and Cartwright, 2010) and then these crops moved further east and south into the other Indus Valley regions during the third millennium B.C. The shape and size of the crops of this region are noteworthy as a compact form is recorded from Mehrgarh site in Pakistan by at least the mid-fifth millennium B.C (Zohary and Hopf, 2000). At Harappa, wheat and barley have been observed well which depict the extensive use of these two crops. The site of Harappa portrays the fortified city of a Bronze Age, which is the type-site or mother site of Indus Valley Civilization. This ruined city had approximately 23500 inhabitants with an area of 150 hectares and Mature Phase was its prime apex as an urban city (Fagan, 2003). At Harappa, wheat and barley crops had the taxonomic features as there is a steady enlargement in the number of wheat and barley species farmed at Harappa, but the most of the wheat grains are consistent, shot, bread or club wheat (T. aestivum/compactum). On the other hand, the grains of barley are either 6-row naked 'shot' barley (Hordeum sphaerococcum) or 6-row hulled barley, prominently; the barley was the dominant crop in earliest stages at Harappa. However, suddenly, wheat became dominant in Harappan Phase and barley was declined. Later on, barely again rose up and wheat declined in Later Harappan Phase. Ultimately, both wheat and barley have been acknowledged in the deposits of both the Mature and Late Harappan Phase (Madella, 2003). All of these demonstrate the ascendancy of wheat and barley agriculture with at Harappa. Another archaeological site named Kot Diji (Sindh Province) is also known to its ancient agricultural record that provides the dominance of wheat and barley in the urban phase of this region (Bates and Petrie, 2016). This ancient agricultural knowledge came to hand after the preliminary excavation by the Italian Archaeological Mission to Pakistan in 1994. In concluding remarks, by 7000 B.C. emmer and einkorn wheat, barley, and some other crops like pea, lentil and flax had reached Pakistan, through a middle Asian corridor between China and South Asia [Fuller, 2006; Stevens et al., 2016]. The identifications of the wheat varieties were attested and wheat crop was identified at the sites of famous Mohenjo-Daro and Chanu-Daro in Sind Province. Eventually, the usage of wheat crop describes the flow and sequence of wheat agriculture that withholds the economic assessment of Pakistan throughout the ages. Hence, wheat has been an important crop in the past and even in modern time; it is included in three main cash crops with two other crops like rice and maize in the world (Cooper, 2015).

MILLETS

The history of millets is associated with China in the Neolithic Age, specifically from newly excavated storage pits at the Cishan site, China that is traced back to between 10,300 BP and 8,700 BP (Lu et al., 2009). The millets are not as significant today as it once were, but still, developing countries use millets as a staple food, where about 97 percent of the world's millet production is used (McDonough et al., 2000). Generally speaking, foxtail millet, broomcorn millet, bulrush millets (Permise turn spp.), finger millet (*Eleusine corocaaa*), and barnyard millets (*Echinocloa spp.*) have been categorized in the species of millet. In a broader spectrum, in the land of China, almost 14 species of "Setari" have been noted through which seven are suggested in the northerner part that shows the vital place for the millets is North China along the Yellow River and its tributaries. In the case of Indus Valley Civilization, Various kinds of millets have been reported from the Pre-Harappan culture to the Late Harappan culture at many sites of Pakistan, while the Late Harappan Phase between 2100-1700 B.C, millets were dominant crop. The millets made its impact on the survival of the economy of the region also (Reddy, 1994; Weber and Fuller, 2008; Pokharia et al., 211). In ancient Harappan culture, in the land of Pakistan, Harappa (Early Phase), Miri Qalat (Mature Phase), and Pirak (Late Phase) are the famous sites for the cultivation of millets. The dispersal of Chinese broomcorn millet towards Pakistan (at Pirak) is observed in 2000 B.C., which was spread in the Late Harappan Phase. At the same time, this millet was also dispersed towards Central Asia (Shortugai site). It is worthwhile that Chinese Millets also arrived in Pakistan after the establishment of native Indian millets because the indigenous people were well aware of the cultivation of millets before adopting the Chinese millets (Fuller, DQ and Boivin, 2009). This was happened due to a number of sites arise in northern India and Pakistan with elements that constitute a defined 'Chinese Horizon' in the second millennium B.C. With millets, other crops like rice and apricots appeared here after the trade network and social exchange too. For example, in 1800 B.C, cultural and archaeobotanical assemblages from the sites in Swat, northern Pakistan, begin to illustrate the similarities. In 19996, at Harappa, the soil samples were taken from hearth and floor contexts and results depicted the presence of millets (foxtail and broomcorn) with some other crops like wheat and barley (Madella, 1999). In 1997, at Kot Diji site (Sind Province), again a total of 15 samples were analyzed by Madella and again millets (foxtail and broomcorn) were recovered with above-mentioned crops. It shows the sequence and practices of millets in central and southern parts of Pakistan. Unfortunately, at many important sites of Pakistan, only hand-picked seeds have been recovered like Mohenjo-Daro [56], but after the archaeobotanical practices at Mohenjo-Daro, it is conspicuous that millets or some other crops may recover from the site. As in present time, In Pakistan, pearl millet (Pennisetum glaucum), locally known as "bajra" is an

important crop not only in the past but also in the present time in the areas of drought, in Punjab and Sind Province. Mohenjo-Daro is also situated in Sind Province so that the recovery of pearl millet is obvious if archaeobotanical research started at this site.

THE MEHARGARH SITE AND AGROPASTORALISM IN PAKISTAN

In Pakistan and India, seven Neolithic cultural zones have been discussed which are Northwestern, Northern, Northeast, Central-Eastern, Mid- Eastern, and Vidhyan-Gangetic [Saraswat, 1992; Thapar, 1974]. These cultural zones depicted the earliest agriculture of Sub-continent. Combining botanical knowledge with archaeological Materials, human-environment interactions pertain to food plants, and agricultural activities of the region. Approaches to archaeobotany, here earliest Agro-pastoralist conditions are presented. Indus Valley Civilization had large communities, which practiced the agriculture and used to store crops in their granaries that are observed at Harappa site and some other Harappan sites too. In a broader spectrum, the subsistence system was based on food production, domestication of plants and animals, and hunting and fishing activities. It is also argued there was an apex or sometimes decline in traditional crops in Harappan phases. The agricultural mechanism was also exceptional and worthwhile. Overall, two agricultural strategies were practiced that was attributed to Indus Valley Civilization. In details, one strategy engages crops sown in the autumn season, harvested in the spring season, and fed with winter rains in the areas of Baluchistan, Bannu Basin, Sind, Punjab, and Swat. The second strategy involves the plants sown in summer and harvested in the fall. As far as the Mehargarh is observed, the earliest phase of agriculture is determined. Here, both plants and animals were domesticated like sheep, goats, and cattle with wheat and barley by the semi-nomadic people. In later stages, pulse crops were also added with other crops. In Later Neolithic, cotton was cultivated too, before 5000 B.C. With staple food, some fruits like grapes (Vitis) and jujube (Ziziphus mauritiana), and dates were also cultivated which shows the varieties of food items of Mehargarh. Somehow, all these crops were also dispersed to eastern side and western side because the crops of other regions portray the trajectories of the crops, which were domesticated in Mehargarh. Mehrgarh is now seen as an ancestor to the Indus Valley Civilization, which exhibits the earliest settlement and the beginning of farming and herding. With the evidence of earliest agriculture, some other artifacts that were 32000 in numbers and were recovered from six mounds of Mehargarh show all aspects of the Neolithic culture of Pakistan. Some other features of Mehargarh portray the trade and economy of the region as a seashell, limestone, lapis lazuli, turquoise, women figurines, sandstone, and stone axe. Early Mehrgarh residents lived in the housed made with mud bricks, and they also used to store their grains in granaries and this tradition was also practiced in Harappan Phases. Overall, in South Asia, Mehrgarh is probably the most primitive known origin of agriculture [Meadow, 1996].

CONCLUSION

For the understanding of ancient agriculture of Pakistan, the archaeobotanical analysis on the Neolithic Mehargarh site is inevitable, because the ancient crops trajectories can be understood well. It is also obvious that earliest farming of the Mehargarh site relocated in Harappan Culture with the beginning of Bronze Age. The archaeobotanical dataset amassed here on cereals from the core and peripheral regions of Indus Valley Civilization, depicts the ancient cereals from the Neolithic to the Late Harappan Phase. The study of cereals is a key to understand the interplay between subsistence agricultural strategies and the settlement patterns of the pre-historic sites in Pakistan. The ancient staple cereals such as rice, millets, wheat, and barley have been noted in previous studies. To comprehend the earliest crops of Pakistan, the archaeobotanical methods: flotation work, starch grain analysis, and phytolith analysis can be accommodating for further understanding with the ancient crops in Pakistan.

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