

# Plant Domestication in Indus Valley Civilisation

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## Abstract

The paper tries to document about 54 plant species including cereal, millets, pulses, vegetables, medicines and some other economically important species of Indus Valley civilization. The plant species discovered during the archaeo-botanical excavations not only indicate the food habit of the people inhabiting the region but also help in biological reconstruction of the past environment, ecological systems and the climatic changes that took place during the period.

**Key words:** Archaeo-botanical excavations, Harappan civilization, Mohenjo-daro.

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## 1 Introduction

Indus Valley was a Bronze Age civilization extending from north-east Afghanistan to Pakistan and north-west India. It is also known as Harappan civilization (McIntosh 2008; Shinde et al. 2019) which thrived from 3200 to 1900 BCE (Possehl 1992; Lal 1997; Madella and Fuller 2006; Agarwal 2007; Kenoyer 2008; Weber et al. 2010; Pokharia et al. 2014). First excavated in 1921, over 1500 cities and small settlements of this civilization have been discovered till date that flourished in the basins of Indus, one of the major rivers of Asia and Ghaggar-Hakra (ancient Saraswati) which once coursed through north-west India and eastern Pakistan (Bisht 1989, 1997; Sonawane 2002; Pokharia et al. 2011, 2014). Along with ancient Egypt and Mesopotamia, it was one of the three early civilizations of old world spreading over a vast area of about 480000 square km in diverse geographical regions (Agarwal 2009; Pokharia and Srivastava 2013). The major centers of Harappan civilization are Harappa, Mohenjo-daro, Dholavira, Ganweriwala and Rakhigarhi.

The early Harappan community had turned into large urban centers by 2600 BCE with well-developed town planning, water supply and drainage system, impressive dock yards, granaries, warehouses, brick platforms and protective walls. Indus civilization at its peak (2600–1900 BCE) had a population of about four to six million people (Desai 2019) and Mohenjo-daro was the greatest city in the world with around 40,000 inhabitants (McIntosh 2008; Nipper 2018). The people had developed new techniques, had great accuracy in measurement, weight and measures, trade and transport, ceramics, handicraft, metallurgy, pottery, seals, figurines, ornaments etc. They were wearing colourful robes, jewellery fitted with gold and precious stones. There was entertainment, toys, art and culture and paintings. The archaeologists have discovered concrete evidence of cultivation and food production, rain water harvesting and water storage systems (Bisht 1991; Wright 2010; Vaity and Tawde 2017; Baba et al. 2018; Nipper 2018). But they were specifically interested to know the type of food, and miscellaneous uses of plants, which enabled them to survive and develop such a vast and developed civilization. The type of plant remains excavated like carbonized and silicified seeds, fruits, wood

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charcoals, phytoliths, traces of husk or glumes, fiber imprints on pottery and burnt mud clods etc. were taken into account which provides evidence to reconstruct the history of plant domestication and agriculture in Harappan sites (Vishnu-Mittre 1972; Saraswat 1986, 1992; Meadow 1989, 1996; Pokharia 2008; Pokharia et al. 2011). The plant remains has been analyzed and the results indicate that the Harappans were sophisticated in their use of plants for vegetables, culinary and medicinal purposes from third millennium BCE to second half of second millennium BCE. For the convenience of study, the archaeologists have divided the Indus valley area under three sections viz. (i) Indus valley in present day Pakistan; (ii) in the eastern region of Indian sub-continent, and (iii) the southern region (Pokharia and Srivastava, 2013).

## 2 Indus Valley region in Pakistan

The major sites studied in this region for the study of plant use and food economy were Mohenjo-daro, Harappa, Chanu-daro and Pirak settlements (Stapf 1931; Luthra 1941; Mackay 1943; Costantini 1996; Possehl 2002; Bates 2019). Principal food grains discovered from these sites belong to species of wheat (*Triticum aestivum* L., *T. compactum* Host. and *T. sphaerococcum* Perc.) and six rowed barley (*Hordeum vulgare* L.). There are also evidence of consumption of rice (*Oryza sativa* L.) from Pirak, sesame (*Sesamum indicum* L.) from Harappa, linseed (*Linum usitatissimum* L.) from Pirak and Indian mustard (*Brassica juncea* (L.) Czern. & Coss) from Chanu-daro. The evidence of use of grape (*Vitis vinifera* L.), melon (*Cucumis* sp.) and date palm (*Phoenix dactylifera* L.) has been discovered from Harappa. There was also knowledge about pomegranate (*Punica granatum* L.) and coconut (*Cocos nucifera* L.) as evident from the shapes of discovered earthenware vases (Saraswat 1992). A pendant was also excavated with the shape of a lemon (*Citrus limon* (L.) Burm. f.) leaf. There was discovery of cotton (*Gossypium arboreum* L.) fibre indicating the type of clothes used by the inhabitants. Moreover, coffins made with scented wood of deodar (*Cedrus deodara* (Roxb.) G. Don and rosewood (*Dalbergia latifolia* Roxb.) indicate their knowledge about various uses of wood. There was also use of wooden mortar made from jujube wood (*Ziziphus* sp.) for pounding of grains (Chawdhury and Ghosh 1951; Chawdhury 1970; McIntosh 2008; Krishnamurthy and Bahadur 2017).

## 3 Plants used in eastern region

The culture moved from lower Indus to east and spread to the extinct Ghaggar-Hakra river in regions of Rajasthan, Punjab, Haryana and western Uttar Pradesh (Dikshit 1980). The important sites in this region were Kalibangan in Rajasthan; Rohira, Mahorana and Sanghol in Punjab; Banawali, Kunal, Balu and Farmana in Haryana and Hulas and Alamgirpur in western Uttar Pradesh.

Food grains unearthed from most of these sites are hulled and naked barley (*Hordeum vulgare* L.), field pea (*Pisum arvense* L.) and chick pea (*Cicer arietinum* L.) (Vishnu-Mittre and Savitri 1982). There was discovery of hulled barley (*H. vulgare* L.), dwarf wheat (*Triticum sphaerococcum* Perc.), emmer wheat (*T. dicoccum* Schrank ex Schübl), jowar millet (*Sorghum bicolor* (L.) Moench), lentil (*Lens culinaris* Medikus) and horse gram (*Macrotyloma uniflorum* (Lam.) Verdc.) from Rohira. There have been clear evidence of cultivation of horse gram, sesame and indicating the practice of mixed cropping pattern. Timber taxa discovered are *Calligonum* sp., *Ficus* (*Ficus glomerata* Roxb.), sissoo (*Dalbergia sissoo* Roxb.), *Boswellia serrata* Triana & Planch., *Tamarix dioica* Roxb. ex Roth, *Morus indica* L., *Salvadora persica* L., *Terminalia* sp., *Albizia lebbek* (L.) Benth., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr. and *Tectona grandis* L.f. Wood charcoals of *Acacia* sp., *Dalbergia* sp. and *Tectona* sp. have also been identified during the investigation. One important and interesting finding during the survey is regarding the use of herbal shampoo from Banawali, which was a mixture of soap nut (*Sapindus emarginatus* Vahl) and shikakai (*Acacia sinuata* (Lour.) Merr. The evidence of use of garlic (*Allium sativum* L.) has been found in Balu.

## 4 The Southern region

The southern region of Indus valley civilization covers Kutch and Saurashtra portions of Gujrat and some areas of Maharashtra. The important settlements include Khirsara, Rojdi, Rangpur, Lothal, Surkotada and Kuntasi. The crop plants discovered from Rojdi were barley, finger millet (*Eleusine coracana* L. Gaertn.), pearl millet (*Pennisetum glaucum* L.) (R. Br.), sorghum (*Sorghum bicolor* L.) Moench, lentil (*Lens culinaris* Medikus), grass pea (*Lathyrus sativus* L.), green gram (*Vigna radiata* L.)

(R. Wilczek), field pea (*Pisum arvense* L.), linseed (*Linum usitatissimum* L.), rape seed (*Brassica campestris* Hook. f. & Thomas), *Echinochloa* sp., foxtail millet (*Setaria italica* L.) P. Beauv and little millet (*Panicum sumatrense* Roth. Ex Roem. & Schult.). Fruit remains of jujube and cucumber (*Cucumis* sp.) have also been discovered. A large number of weeds and wild taxa have also been unearthed like *Amaranthus* sp., *Andropogon* sp., *Chenopodium* sp., *Dactyloctenium* sp. and *Eragrostis* sp.

At Lothal, remains of *Oryza*, wood charcoals of *Acacia* sp., *Adina cordifolia* (Roxb.) Brandis and *Albizia* sp. were detected. The timbers of neem (*Azadirachta indica* A. Juss.), teak (*Tectona grandis* L.f.), red sandalwood (*Pterocarpus santalinus* L.f.) and *Tamarix* sp have also been discovered. There was concrete evidence of cultivation of barley, bread wheat, field pea, jujube, rice, green gram, linseed and cotton from southern region of Harappan civilization.

It is argued that Indus populations were the earliest people to use complex multi-cropping strategies across both seasons, growing foods during summer (rice, millets and beans) and winter (wheat, barley and pulses), which required different watering regimes (Bates et al. 1986). Tripathy et al. (2004) and Clift et al. (2012) stated that the Ghaggar-Hakra system was rain-fed, and water-supply depended on the monsoons. The Indus Valley climate grew significantly cooler and drier from about 1800 BCE, due to a general weakening of the monsoon at that time (Giosan et al. 2012). The Indian monsoon decreased and aridity increased, with the Ghaggar-Hakra retracting its reach towards the foothills of the Himalaya, leading to aridification (Giosan et al. 2012). Recently, from the archaeological site at Khirsara and Kanmer, Pokharia et al. (2017) elucidated a persuasive evidence for a major change in cropping pattern from barley to millet based crops around 4,200 years ago, suggesting that it was probably the first ever agricultural (human) response to prevailing monsoonal dryness. Botanical evidences suggest that ~4,200 years ago, arid events might have forced a shift in agriculture to millet type crops at Khirsara, Kanmer and other human-occupied sites of the region. The shift towards millet-based food habits might be due to decreased monsoonal activity, significant change in rainfall pattern and prevailing arid climate, suggesting a warmer or drier climate leading to the dominance of drought-resistant millet species.

## 5 Conclusion

Plant remains recovered from archaeological sites offer precious insights on past landscapes, human adaptation to definite climate and the relationship between humans and their environment. The food choice, their production and distribution are most complex indicators of social life and thus a study of foods consumed by ancient people in a region provides many clues about their life style. Moreover, the discovery and identification of plant remains from geological specimens and their use are helpful in the biological reconstruction of past environment, ancient ecological systems and climate respectively.

The archaeological findings suggest that the Harappan people procured and domesticated the reported plant species for their multipurpose utility. These sites were abandoned by around 1800 BCE which might be due to climate change and change in course of water sources. The population might have migrated to other places carrying with them all those beneficial germplasm of plant species and the knowledge concerning their cultivation and utility. In turn, they were instrumental in disseminating the botanical knowledge in other regions of the continent.

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