ISBN: 978-81-19149-19-3

6. History and Domestication of Millet Crops

Dr. Santosh Bhadkariyaa, Mr. Arif Khana

Shri Ramnath Singh Institute of Pharmaceutical Science & Technology,
Sithouli, Gwalior (M.P).

6.1 History of Millets in India:

6.1.1 Introduction of Millets:

The proso millet and foxtail millet, which were domesticated in China, travelled to India probably through trade routes. Archeological data of proso millet and other crops suggested that the Indian valley of Kashmir was integrated into a wider network of crop exchange in the mountainous regions of South and Central Asia during the 3000-2000 BC period.

6.1.2 Millets from China:

Foxtail millet spread from China to south and westward to reach India. In Sanskrit, it has been referred to as BhAvajJA, PriyaGgukA, Rajika, etc. confirming its ancient cultivation. It occurred in Harappa levels (2500-2200 BC) at Shikarpur (Kutch) and late Harappan levels (1900-1400 BC) at Punjab. Also, it was recovered from the earliest strata of Rojdi (Saurashtra), placed within 400 years of the oldest find of domestication. Carbonized seeds were reported from Jorwe culture levels (Ahmadnagar, 1500 BC) and Daimabad in Mahararashtra.

The mention of millets in Indian Sanskrit text Yajurveda's verses- of foxtail millet (priyangava), proso millet (aanava) and Barnyard millet (shyaamaka), indicated that millets culture and consumption was very common, dating to the Indian Bronze Age (1,500BC).

Archaeobotanical remains have also been found from upper and middle Gangetic Plains. It was also grown at Manjhi (Saran, Bihar) during the red ware levels (250 BC-250 AD). In South India, foxtail and proso millets were the staple diet for the people from the Sangam period (300 BC to 300 AD). Sushruta (Sushruta Samhita, 600-500 BC) classified cereals as dhanya varga, khudhanya varga and samidhanya varga. Khudhayna varga includes, among others millets viz., kodo millet (kodrusaha), barnyard millet (syamaka), and coix (gavedhuka).

Kalidasa (4-5th AD), in his legendary literary masterpiece 'Abhijnana Shakuntalam', has sage Kanva pouring foxtail millet while bidding farewell to Shakuntala in Dushyanta's court, which indicates the auspicious nature attributed to this millet. In the 10th-12th Century AD Varaha purana, it is mentioned that God Srinivasa is favourable to the one who offers foxtail millet. According to Dakar Bachan, composed sometime in early medieval Bengal (8th to 13th Century AD), cultivation of proso millet (china kaon) was advised if it rained during Phalgun month (February-March).

6.1.3 African Millets Transformed Late Harappan Agriculture in Western and Peninsular India:

The Saurashtra Center was dominated by little millet, native small Setaria spp. and brown top millet during the Mature Harappan period, 2500–2000 BC.

Arrival of high-yielding African millets led to increase in settlements in the Gujarat region and expansion of cultivation. It is believed that there was a distinct climate change in Gujarat region around 2000 BC and the region became more arid. At this time millet became more predominant in the Harappan subsistence system.

Pearl millet and sorghum from Africa also appear during this time, besides finger millet. Pearl millet was known in the later 3rd millennium BC in Saurashtra and moved to South India where it was known around 1800 BC. Pearl millet was a noticed in Neolithic South India (2000-1200 BC) and Narhan culture (1300-800 BC). However, the millet finds it's mentioning in Ayurvedic texts only since the 14th Cen. AD. It is known to be Nali in Sanskrit and the very first mentioning of the word Nali is found in Madanapala Nighantu (1374 AD) under Truna Dhanya category. The presence of finger millet in India dated to approximately 2300 BC at Hallur, Karnataka, during Harappan levels. This suggests direct or indirect connections with African populations prior to 2600 BC Finger millet has also been reported from late Harappan levels in Northern and Western India. Finger millet was the staple of Neolithic Karnataka.

African cultivars moved to southern India and southern Indian cultivars to Africa as early as the second millennium BC, testament to active networks of exchange and innovation. It is believed that arrival of African millets to India coincided with an increase in sedentism and agriculture in Peninsular India. The Hallur site in Haveri district of Karnataka yielded crop cultivation pattern during 2000-1000 BC, comprising of Neolithic-Chalcolithic and early Iron Age. Brown top millet, bristly foxtail (Setaria verticillata) and pearl millet (African origin) seeds pertained to Neolithic age (2000-1200 BC), while finger millet (African origin) and kodo millet were Early Iron age dated (1200 to 1000BC).

In the excavations of Oriyo Timbo in the Shavnager district of Gujarat state, 77% of seeds were found to be millets comprising proso millet, little millet, foxtail millet and finger millet. The site has been dated to the first half of second millennium B.C. and the excavators believe that it was a seasonal encampment occupied every year during the months of March to July. The evidence is suggestive of a primarypre-Harappan agricultural tradition based on native monsoon-adapted crops. As with South India, however, there is no archaeobotanical evidence for the earlier stages of this tradition or for the transition from collecting to farming these species. Evidences indicate cultivation of sorghum during pre-Harappan period (2300-2000 BC) in Punjab.

Late- Harappan phase (1800-1700 BC) of Indus valley civilization was marked by diversification of agriculture, perhaps as a response to climate change to cooler and drier seasons. At Pirak in Baluchistan, double cropping system was in place with pearl millet and sorghum being grown in summer. Excavations at Hulas (Saharanpur) yielded evidence for sorghum and finger millet grains.

Outside of the Indus Valley area of influence there were two regions with distinct agricultures dating back to around 2800-1500 BC. These are the Deccan Plateau and an area within the modern states of Odisha and Bihar.

Within the Deccan, the ashmound tradition developed around 2800 BC. The people of the ashmound tradition grew millets and pulses, some of which were domesticated in this part of India, for example, brown top millet, Setaria verticillata, green gram and horse gram. They also herded cattle, sheep and goat and were largely engaged in pastoralism. This era may be seen as establishing the basic South Indian repertoire of rainfed millets and pulses, sown in synchrony with the southwest monsoon.

In the east of India Neolithic people grew rice and pulses, as well as keeping cattle, sheep and goat. By 1500 BC a distinct agriculture focused on summer crops, including Vigna and little millet was developed.

Among the chalcolithic culture of the Deccan, the Jorwe farmers (1400-1000 BC) in Malwa practiced kharif and rabi crop rotation, where sorghum and finger millet were grown along with wheat, barley and rice.

Greek historian Megasthenes (350-290 BC) Mentioned that millets are grown after summer solastice, foxtail millet and sorghum are grown, among others.

During Satavahanas (1st to 3rd century AD) and Vataka dynasty (250-270 AD), sorghumwas abundantly used over rice in the Deccan region, which changed gradually The term ‘yavanaala’ mentioned in Indian text Charaka Samhita (100-200 AD) is attributed to sorghum. Greek author Pliny wrote about introduction of sorghum from India to Italy during 60-70 AD. In Vishnu purana (450 AD), gramausadhi group of plants includes cereals, including priyangu (foxtail millet), hyudar’sa (sorghum), korusa (kodo), yajgnausadhis includes priyangu (foxtail millet), syamaka (barnyard), gavedhu (coix), etc.

6.1.4 Millets in The Vijayanagara Empire:

The Kannada language composition ‘Ragi thandheera’ written by Purandara Dasa, a 15th century Indian poet, is much celebrated in Karnataka to highlight the popularity of finger millet (ragi) during those times. The Telugu poet Srinatha, who lived in the first half of the 15th century described of the people food habit of Palnadu area in Andhra, a part of the then Vijayanagara Empire, as entire subsistence on sorghum and pearl millet for porridge, fermented products, cooking, etc. and that except millets they have nothing to eat. Fernao Nuniz, a Portugese traveller, who visited Vijayanagar Kingdom in 16th century AD, mentioned that sorghum was the major food grain consumed in South India.

Kannada poet Kanakadasa (16th Century) has immortalised finger millet in his ‘Ramadhanya Charithre’; it is an allegory on the conflict between the socially strong and weak castes and classes, presented as an argument between two food grains, rice and finger millet (ragi), a most creative literary piece with a powerful social message. Sarvajna, a 17th century Kannada poet who belonged to this period, speaks in glowing terms of sorghum which was and is the staple food of the common people in North Karnataka districts.

6.2 Indian Millets:

6.2.1 Kodo Millet:

Chalcolithic 1800-1200BC era findings reported kodo millet from Northern and eastern India. The first report of kodo millet from South India is during megalithic age (1000-300 BC) from various places in Maharashtra and Andhra Pradesh. The record from Ganga valley pertained to cultivation during Narhan culture (1300-800 BC). In the Arthashastra of Mauryan age (200-300 AD), kodo millet has been referred to as kodrava, grown along with other crops. Ibn Batuta from Morocco who visitedIndian during the times of Muhammad-bin-Tughlak (1325-1351 AD) recorded that kodo millet was the commonest grain.

Kautilya's Arthashastra says….

Kodrava (kodo millet), … and priyangu (foxtail millet) will increase three times the original quantity when cooked; … Grains will increase twice the original quantity when moistened; and two and half times when soaked to sprouting condition.

6.2.2 Little Millet:

The Saurashtra Center was dominated by little millet, native small Setaria spp. and brown top millet during the Mature Harappan period, 2500–2000 BC. In the excavations of Oriyo Timbo in the Shavnager district of Gujarat state dating to 2000- 1500 BC, 77% of seeds were found to be of millets comprising little millet, among others. This site was believed to be a seasonal encampment occupied every year during the months of March to July. The evidence is suggestive of a primary preHarappan agricultural tradition based on native monsoon-adapted crops.

6.2.3 Brown Top:

millet This was a major millet in the Mature Harappan period. The Hallur site in Karnataka yielded the evidence for its cultivation in neolithic period of 2000-1500 BC.

6.3 Millets and Mughals:

During Mughals period, in 16-17th Century AD, Pearl millet was grown in dried areas of the northwest and western zones. Further, millets were also cultivated in wheat dominant areas and other drier districts. Sorghum and pearl millet were the two main millets.

The Ain-i-Akbari (16th century AD) written by Abul Fazl, records that millets which included sorghum, pearl millet, kod millet, barnyard millet and finger millet formed the kharif crops and were cultivated in Malwa, Gujarat, Ajmer, Khandesh, Lahore, Agra, Allahabad, Awadh and Multan.

Abul Fazl has given statistics on yields of crops on Bigha basis in different cultivation conditions, including that of sorghum and pearl millet.

Francisco Pelsaert of Dutch East Indian Company at Agra (1621-1627 AD) writes that sorghum, pearl millet and foxtail millet were the food grains eaten by the poor in the 17th century.

Mughal emperor Jahangir (1569-1627 AD), in his autobiography Tusk-e-Jahangir, talks about laziza (tasty), a kind of khichdi he encountered in Gujarat. Laziza was a mixture of bajra (pearl millet) and peas cooked together. He writes: 'It was not devoid of good flavour and it suited me well. I ordered that on the days of abstinence, when I partake of dishes not made with flesh, they should frequently bring me this khichdi.'

Mahabat Khan, the Mughal noble who served under Jahangir and Shah Jahan, used to eat only once in 24 hours, and during this meal, his table was laden with two trays each of pulao, ash-ha (broths), and trays of rice and millet khichdi.

6.3.1 Kingdom of Hyder Ali:

Hyder Ali Khan (1720 – 1782 AD), the Sultan of the Kingdom of Mysore was, at times, known to consume dry roti of finger millet or sorghum with just water. However, the finger millet, the staple food of his subjects, was always a part of his menu.

James Scurry (1766–1822 AD), a British soldier who was held captive by Hyder Ali and Tipu Sultan for 10 years (1780–1790) at Srirangapatam, wrote that during his march from Bengaluru prison to another place, he was fed with food made from finger millet flour.

6.4 The Colonial India:

During the colonial period when European nations controlled India, there was no emphasis on millets as the colonizers manipulated agricultural production to suit their needs of imports which included spices, cotton, indigo and other commercial crops. Evidences indicate that from 17th century to 20th century, the productivity of food grains including millets did not rise. Scottish physician Francis Buchanan, who toured across South India in 1807, writes "The crop of Ragy [finger millet] is by far the most important of any raised on dry field, and supplies all the lower ranks of society with their common food. Among them, it is reckoned the most wholesome and invigorating food for labouring people; and in every country, most fortunately, a similar prejudice appears to prevail, the most common grain always reckoned the nourishment most fit for the labourer... My Bengal and Madras servants, who havebeen accustomed to live upon rice, look upon the Ragy as execrable food, and, in fact, would experience great inconvenience were they compelled to live upon it."

It is recorded that when the Tungabhadra dam was built in the 1940s near Hosapete, Karnataka, "surveyors recall that rice was difficult to obtain; they found eating millets distasteful, an enduring memory of a hardship posting".

It was the interest of Leslie Coleman, a Canadian scientist, who worked for British as the second director of agriculture in Mysore State, when posted in Bengaluru, to initiate research on finger millet. He was farmer-friendly and also ate finger millet 'mudde' with them. He contributed the first finger millet variety too.

6.5 Domestication of Millets:

6.5.1 Introduction:

The origins of agriculture in North China were underpinned by millet cereal grasses, including foxtail millet (Setaria italicssp. Italic) and broomcorn millet (Panicum miliaceum; Crawford, 2006; Hunt et al., 2011; Zhao, 2011). Other wild grasses were likely also eaten and are frequent components of Neolithic Chinese sites (Crawford et al., 2005; Lee et al., 2007). At the western end of Eurasia, late Upper Paleolithic seed remains in the Near East indicate that early farming and agriculture was based around.

wheat and barley (Wilcox et al., 2012) domesticated after millennia of use (Weiss et al., 2004). However, no charred seed evidence exists for millets in East Asia before 10,000–8000 BP (Bettingeret al., 2007; Crawford, 2006; Crawford et al., 2013). Micro fossil research has been used to inform the origins of agriculture in China (Liu et al., 2010; Lu et al., 2009; Yang et al., 2012a, 2012b) but is problematic.

Domestication evidence from starch grainsand phytoliths is either not species specific (Liu et al., 2013) or iscontroversial like the phytolith and starch evidence of early milletat Cishan (Lu et al., 2009; Yang et al., 2012b) and debated (Zhao,2011). In addition, multiple starch grain studies on the same site (Donghulin) have yielded contradictory results from differentresearchers (Liu et al., 2010; Yang et al., 2012a).

Grass identification based on charred seeds is less controversial and more specific. Here, we present Late-Paleolithic seeds recovered from theShizitan Locality 9 site in North China and discuss these in relation to worldwide debate on the origins of agriculture. These arethe only late Upper Paleolithic seeds ever recovered from NorthChina. We suggest that food patterns which show a preference formillet grasses and which are evident in China during the latePaleolithic (Liu et al., 2011, 2013) continued into the Neolithic.

6.5.2 Shizitan Locality:

Shizitan Locality 9 is a late Upper Paleolithic occupation and one of more than 25 localities which form the Shizitan site cluster in Jixian county, Shanxi Province. These localities extend along a15 km stretch of the Qingshui River, a tributary of the Huanghe. Chinese archaeologists have suggested that micro liths in the upper 17,000 to 11,900 cal. BP layers of the site complex indicate that the site is transitional between the Paleolithic and Neolithic (Shizitan kaogudui, 2010; Xia et al., 2002). Seeds are too small to be directly dated at this time, however, charcoal from the same flotation samples as theseeds was accelerator mass spectrometry (AMS) dated.

The uppersection of layer IV returned AMS dates between 12,700 and11,600 cal. BP, while the lower strata of layer IV dates between13,800 and 12,700 cal. BP (Liu et al., 2011; see also Table 1). Overall, charcoal andburnt bone fragments from the site are AMSdated between 13,800 and 8500 cal. BP (Liu et al., 2011). Seedswere collected through flotation of 225 L of sediment taken fromlayer IV and processed using a 0.212-mm sieve and bucketflotation.

6.5.3 Charred Seeds:

In all, 6 of the 16 Shizitan Locality 9 flotation samples preserved a total of 28 charred seeds, half of which are unidentifiable due to the loss of diagnostic features (Table S2). The other 14 seeds are from two families: Chenopodiaceae (goosefoot) and Poaceae (grasses; Table S2). Most are grass seeds (caryopses missing their palea and lemma or husks) among which all but two are from the millet tribe (Panicoideae subfamily, Paniceae tribe). These two are broken seeds that are not further identifiable. Four goose foot seeds were recovered. The Paniceae includes 27 genera and 145 species in China, mostly tropical and subtropical. Only six genera are common today in north temperate Shanxi province: *Digitaria, Echino-chloa, Oplismenus, Panicum, Pennisetum,* and *Setaria* (Chen etal., 2013). Wild Paniceae or millet tribe grass seeds are identified by their small grain size (<3 mm long), dorsal compression, dorsal ridge absence, lateral groove absence, and embryo shape and size (Nesbitt, 2006). Two important crops in ancient North China belong to the Paniceae: foxtail millet (*S. italicssp. italica*) and broomcorn/common millet (*P. miliaceum*). Late Neolithic foxtail and broomcorn millet grains are larger and more spheroidal (expanded along the dorsal–ventral axis) compared with the dorsally compressed seeds of the weedy/wild members of the two genera. The husks, particularly the lemmas of Paniceae grasses, also aid in distinguishing genera (Nasu et al., 2013); however, no husks are in the Shizitan flotation samples. Imprints of the husk pattern may sometimes be visible on the grain under high magnification; however, this is not the case for the Shizitan specimens. The Paniceae specimens are dorsally compressed and shorter than 3.0 mm with no ridges or grooves. None of the charred specimens areDigitaria, Oplismenus, Panicum, or *Pennisetumcaryopses*. Three of the grass specimens compare best with green foxtail grass (*S. italicsubsp. viridis*), while three others are broken seeds that are only identifiable to Paniceae tribe. The specimen with a well-preserved embryo compares well with those of the green foxtail grass reference sample and not with domesticated foxtail millet. The embryos of the potentialSetariaseeds are about half the length of the seed or slightly longer. Two specimens are comparable to barnyard grass (*Echino-chloasp*.) except that they are significantly smaller. Several species of Echinochloa grow in the Shizitan area today (Chen and Phillips, 2006). The caryopsis-to-embryo length ratio is significantly higher than inSetaria, and the caryopsis width-to-length ratio is also higher than that ofSetaria. Wild-type barnyard grass seeds are reported from several sites, including the Peiligang Period Jiahu site (Zhao and Zhang, 2009), the Houli culture Yuezhuang site (Crawford et al., 2006, 2013), and Liangchengzhen (Crawford et al., 2005). Barnyard grass (*Echinochloa crus- galli*) is the wild progenitor of *Echinochloa esculenta* (*syn. Echinochloa utilis*; Japanese millet; Crawford, 2008), and evidence for its domestication is based on a population with significantly larger seeds than in wild populations present at the Middle Jomon Usujiri B site in Japanc. 4000–3800 BP (Crawford, 1983). No evidence for barnyard grass domestication exists from China in the Neolithic period, but in the historic Jin Dynasty,11 seeds of large-sized, possibly domesticated barnyard grass were recovered from the Lichunjiang site near Dehui City in north-eastern Jilin province (Yang et al., 2004). Chenopod or goosefoot seeds are present in both upper and lower strata of layer IV at Shizitan. They may have been cultivated for a long period in China (Lee et al., 2007: 1090), although direct evidence of chenopod domestication in the form of a thinner testa has not yet been demonstrated. This does not invalidate the hypothesis that chenopods were purposefully managed or grown. Research on Chenopodium in the Chinese archaeological record is on-going.

6.6 Discussion:

This research demonstrates that late Upper Paleolithic plant macrofossils are recoverable using flotation and complements the growing record of starch grains and phytoliths from the same period. Grass seeds recovered by flotation from locality 9 of the Shizitan site (13,800–11,600 BP) are mainly green foxtail grass, the ancestor of foxtail millet (Harlan and De Wet, 1971; Prasada Rao et al., 1987). The oldest clearly identified foxtail millet grains exhibiting signs of increase in seed size and shape so far reported are from the 8000–7700 cal. BP Yuezhuang site (Craw-ford et al., 2013) and the*c.* 7600 cal. BP Xinglonggou site in north and north-east China, respectively (Zhao, 2011). Wild-type Paniceae caryopses are found in high densities in Neolithic sites in dry farming contexts in North China post-dating 8000 cal. BP.

The most common genera are Digitaria, Panicum, Setaria, and rarely Echinochloa (Crawford et al., 2005; Lee et al., 2007). These are all associated with disturbed habitats, including humanly disturbed sites and millet fields. The narrow range of grasses recovered from Shizitan indicates that people were tar-getting the wild ancestor of foxtail millet and possibly the wild ancestor of Japanese millet as opposed to other grasses. Future research should explore whether this selectivity also involves management. Pollen analysis (Xia et al., 2002) indicates that grasses were predominant from 30,000 cal. BP onward at the Shizitan site in a mild and semi-arid steppe type environment with some broad-leaved species also present. This indicates the type of environment preferred by late Upper Paleolithic humans. The wildSetaria from Shizitan Locality 9 represent the earliest association of panicoid grasses and people in North China.

This association between wild millets and human's dates at least 4000 years prior to the first clear evidence of the domesticated crop in North China. The similarity between the wildSetariafrom Shizitan Locality 9and the wildSetariafrom nearby Peiligang sites, such as Fudian Dong where the only Peiligang domesticates in the Yiluo region were recovered, suggests continuity of use of these taxa from the late Upper Paleolithic into the early agricultural Neolithic. Starch residues from grinding stones at the earlier locality 14of Shizitan dating to approximately 23,000–19,500 cal. BP include Paniceae (millet) tribe and Triticeae (wheat and wild wheat) tribe grasses (Liu et al., 2013). These starch grains are not further identifiable. The starch evidence for use of at least two different grass tribes at Shizitan suggests that people were experimenting with or auditioning a range of different types of grasses during the late Upper Paleolithic. Eventually, only millets were domesticated in North China. Triticeae grasses were never domesticated in China, although domesticated Triticeae were introduced to Chinac. 4500–4000 BP (Zhao, 2009). The evidence for use of several different types of grasses in at least two distinct grass tribes mirrors the evidence from the Ohalo II site, Israel (Weiss etal., 2004) where a range of both large and small-grained grasses were utilized. The use of small-grained grasses gradually decreased at Ohalo II, and only large-grained grasses were eventually domesticated in the Levant. In North China, large-grained grasses were used sparsely, and two millets became the focus of human cropping and management. Combined with starch grain and phytolith evidence, this suggests thatSetariaandEchino-chloaspp. grasses were associated with people and potentially part of their diet from at least 23,000 years ago. Starch residues from grinding slabs located near the sampled sediment at Shizitan indicate that in addition to grasses, a corn sand tubers were utilized (Liu et al., 2011). Other plant remains from S9

include chenopods and unidentified seeds as well as rind type fragments, all attesting to the importance of plants in the diet. The first systematic flotation at a Paleolithic occupation in North China, Shizitan Locality 9, demonstrates the effectiveness of the technique in providing important data complementary to the recovery of starch grains and phytoliths. The data indicate that panicoid grasses were specifically targeted and associated with human habitation at least 4000 years prior to the grasses' cultivation and eventual domestication. The dual trajectory of experimentation with different types of grass at opposite ends of the Eurasian continent resulted in different types of grasses being domesticated in the Near East and in Asia.

6.7 Sorghum, Pearl Millet and Finger Millet Were Domesticated in Africa:

The most prominent and well known millets are the large or great millets of Africa, Sorghum and Pennisetum. These two taxa account for the majority of millet grain produced around the world. While these small seeded grasses account for less than one per cent of food grain produced in the world today, they are essential food crops in some regions today. Ethiopia and Eritrea have been a pivotal region for prehistoric contacts between Africa, Asia, Egypt, and Southwest Asia for the past 4000 years. Evidences indicate an early dispersal (before 2000 BC), of sorghum, finger millet, and tef out of Ethiopia and Eritrea regions of Africa suggesting the existence of earlier local domestication events. Although the African origin of these species has been established by botanical and cytogenetic studies, in several cases the earliest evidence for these crops is outside Africa.

For example, the earliest known archaeological finger millet is found in India dating to the second millennium BC. Tef appears in the form of pottery impressions at Hajar bin Humeid, a site in southern Yemen dating to the first century BC. Although there is a report of sorghum in the Khartoum area dating to the sixth millennium BC, the earliest confirmed archaeological specimens appear in India by at least 2000 BC, probably arriving via trade routes from Yemen or other parts of the Arabian Peninsula. Claims have been made for the presence of sorghum in North and South Korea during the Plain Pottery Period (ca. 2000-500 BC).

6.7.1 Sorghum:

Sorghum domestication started in Ethiopia and sub-saharan Africa some 5,000 to 6,000 years ago. The largest diversity of cultivated and wild sorghum is also found in this part of Africa. Based on the presence of wild sorghums, the possible areas of domestication of sorghum have been predicted to be the eastern Sahara-Nile valley, the lake Chad region and the inland Niger delta.

Another report indicated that the origin and early domestication of sorghum took place in north-eastern Africa, north of the Equator and east of 10°E latitude, approximately in 3000 BC. Archeological evidences in Sudan indicate sorghum cultures around 2100BC. Sorghum adapted to a wide range of environments throughout Africa, spreading from the highlands of Ethiopia to the semi-arid Sahel. Through farmer selection numerous improved sorghum typeswere developed, which then spread via trade routes into other regions of Africa and India and eventually worked its way into Australia.

6.7.2 The Indian Domestication of Sorghum:

The secondary center of origin of sorghum is the Indian Subcontinent, with evidence for early cereal cultivation dating back about 4,500 years. It has been hypothesized that the first truly domestic sorghums came from the Durras of India. According to this theory, the early Bicolors were transported from Africa along the Sind-Punjab trade routes to India around 1000 BC and the Durras later came in from India through the Middle East and down the Nile.