

## Further Evidence on the Prehistory of Sesame

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### Abstract

*Recent botanical studies indicate that cultivated sesame derives from wild populations native to South Asia, especially the western Indian peninsula, or the Punjab and parts of Pakistan. These wild populations have been alternatively named Sesamum malabaricum or S. mulayanum, which should be regarded as synonymous. Archaeological finds of sesame are reviewed from 22 sites. These data indicate that cultivated sesame was established in northwestern South Asia by the time of the Harappan civilization and had spread west to Mesopotamia before 2000 BC. Sesame had been adopted in other parts of India to the east and south before the end of the 2<sup>nd</sup> millennium BC. Sesame may not have been cultivated in Africa until more recently.*

This article reviews the current state of botanical and archaeological evidence that bears on the origin and early distribution of cultivated sesame (*Sesamum indicum* L., syn. *S. orientale* L.) (Fig. 1). An important article by Mehra (2000), originally published in 1967 has been reprinted in Asian Agri-History. This article provides an important compendium of textual evidence for sesame use in India through the ages. Since the original publication of Mehra's article, there has been a significant increase in the archaeological evidence for sesame in India and beyond. In addition new botanical evidence and arguments about the geographical origins of sesame have been put forward. Here I review these recent contributions and synthesize the current picture of sesame origins and dispersal.

### Botanical evidence for the origin of sesame

It has often been suggested that *S. indicum* was domesticated somewhere in Africa, a hypothesis suggested by Mehra (2000) and Nayar and Mehra (1970), which follows the lead of earlier scholars such as Hiltebrandt (1932). Also, Seegler (1983) and Burkill (1997) mention the significance of sesame in Africa. In a recent review Nayar (1995) equivocates over whether this crop is of African or South Asian origin. Studies of wild populations of *Sesamum* spp. by Ihlenfeldt and Grabow-Seidensticker (1979) and Bedigian and Harlan (1986), including an analysis of seed protein profiles (Bedigian *et al.*, 1985) have supported a South Asian origin. Recently a systematic study of chromosome numbers, meiotic behavior, and

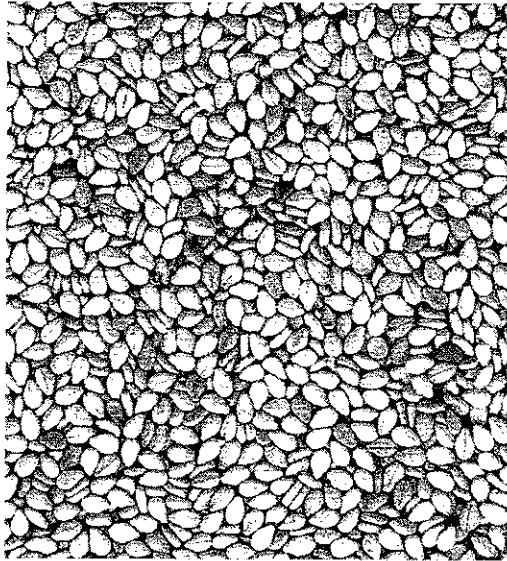


Figure 1. Sesame seeds.

seed lipids was undertaken in 47 accessions representing 11 species of the genus *Sesamum*, and genomic relationships between species were assessed through interspecific crosses (Patil, 1999). This work confirmed that cultivated *S. indicum* belongs to a subgenus with 26 chromosomes, and also with fruit capsules that are neither ribbed nor have protruding locules (see also Ihlenfeldt and Grabow-Seidensticker, 1979). The hybridization experiments indicated high compatibility between *S. mulayanum* Nair, collected from wild populations in South India, and *S. indicum* consistent with identifying *mulayanum* as a wild form of cultivated sesame (Hiremath and Patil, 1999). In addition, recent genetic finger-printing of cultivated sesame populations from India

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and elsewhere indicates much higher genetic diversity in South Asia and has thus been argued to indicate South Asian origins (Venkataramana Bhat *et al.*, 1999). A more detailed indication of the geographical region (in terms of specific regions and ecological zones) of origin of sesame remains problematic, and requires further botanical research, but a general distribution is shown in Figure 2 (area in gray with hatching).

One potential source of confusion regards nomenclature as applied to probable wild progenitors of sesame. Bedigian and Harlan (1986) and Bedigian *et al.* (1985) trace the origin of the crop to the domestication of *S. orientale* L. var. *malabaricum* John, Narayana & Seshadri (= *S. malabaricum* Burm.), a name used by other researchers (e.g., Prabakaran, 1996). This was suggested to be a wild variety of sesame by John *et al.* (1950) based on their collection in western South India, although the nomenclature of these authors lacked typification and standard Latin description. This work has not been widely cited by subsequent workers, perhaps due to its publication in a relatively obscure journal. Work on collections from the Punjab by Nair (1963) led to his identification of a distinct wild type that he typified and published as *S. mulayanum*. A comparison of the descriptions of Nair (1963) and John *et al.* (1950) suggests that they are describing the same species, as does the concurrence of the range of *S. mulayanum* outlined by Ihlenfeldt and Grabow-Seidensticker (1979) and that of Bedigian and Harlan (1986) for *malabaricum*. This *mulayanum/malabaricum* type resembles the cultivar generally but differs by having smaller, highly

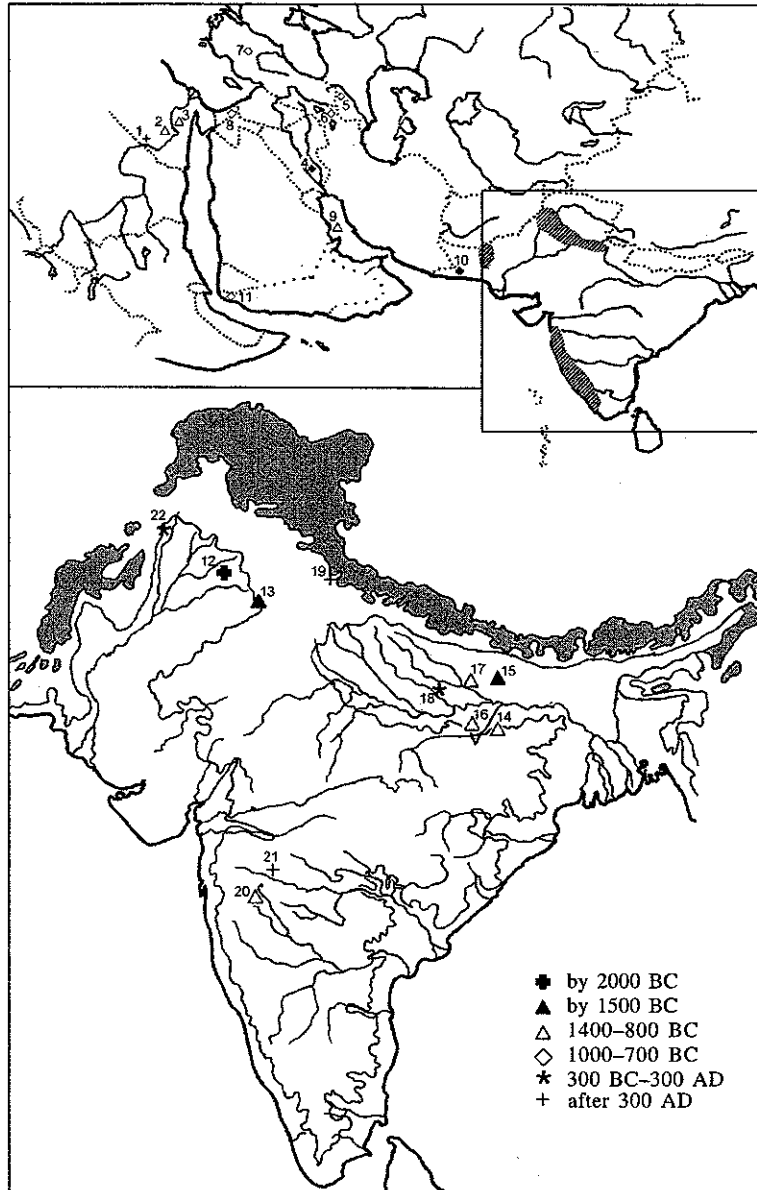


Figure 2. Sites with archaeobotanical evidence for sesame (for sources see text): 1. Qasr Ibrim; 2. Luxor (Tutankhamun's tomb and Deir el Medineh); 3. Amarna; 4. Abu Salabikh; 5. Karmir Blur; 6. Bastam; 7. Gordion; 8. Deir 'Alla; 9. Bahrain; 10. Miri Qalat; 11. Sabir; 12. Harappa; 13. Sanghol; 14. Malhar; 15. Imlidh-Kurd; 16. Senuwar; 17. Narhan; 18. Hulaskhera; 19. Ufalda; 20. Inamgaon; 21. Paithan; 22. Hund. [Note: The hatched gray area in the small map indicates the approximate distribution of possible wild progenitor populations of *Sesamum mulayanum*/*S. malabaricum* type. Shaded area in the large map is land over 1500 m. The 500-m topographic interval is indicated by a line. (Source: Ihlenfeldt and Grabow-Seidensticker, 1979)]

rugose or reticulate seeds with distinct sharp margins. It also differs by having generally purple rather than white flowers, lobed and cordate leaves, and longer acuminate beaks on the ends of its capsules. Some landraces of the crop from South Asia, however, show some of these features including black seeds that have somewhat rugose seed coats (Ram, 1930), and the distribution of these has been added to that of *S. mulayanum* to suggest the possible range of the wild progenitor (Fig. 2).

Another potential difficulty confounding research into the origins of sesame is that this species is not clearly domesticated. If we take a strict definition of domestication in seed crops to be those species that have become heavily dependent upon human dispersal through the loss of natural seed dispersal mechanisms (see Harlan, 1995; Zohary and Hopf, 2000), then sesame cannot be regarded as a domesticate. The capsules in sesame split as the seeds mature, leading to varying degrees of seed loss or unripe harvesting. This remains a major problem confronted by sesame producers and breeders (Day, 2000). In terms of identifying wild progenitors, however, this makes it highly likely that spontaneous populations will establish themselves around cultivated fields, and thus it is unclear to what extent the reported distribution of *S. mulayanum* is made up of feral reversions to uncultivated morphotypes. Nevertheless, these wild morphotypes appear to be constrained in

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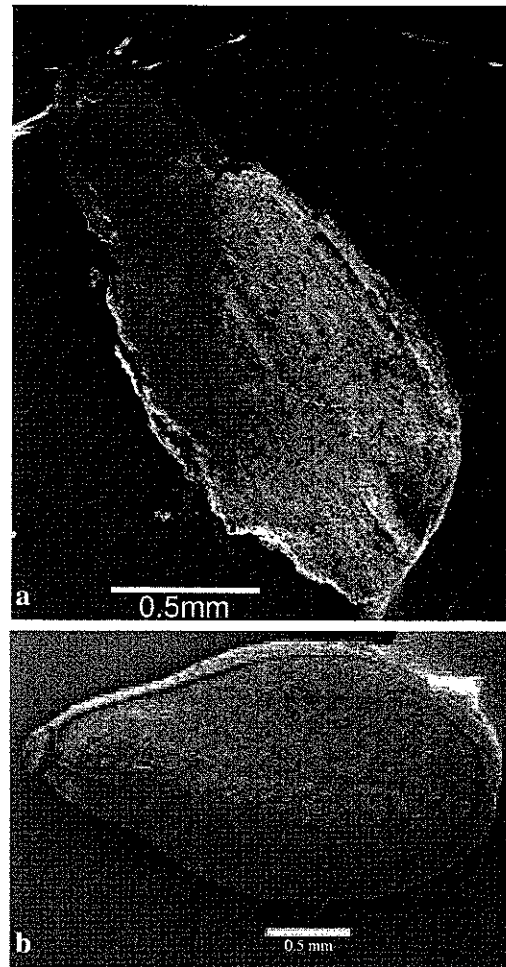
their distribution suggesting that some ecological factors play a role. Further research into these ecological constraints promises insight into the potential environments in which sesame was first cultivated. The available distributional information, however, does suggest some variation here as reported populations include those of the wet tropical regions of the western Indian peninsula, although often noted in "wasteland" secondary habitats as well as semi-arid zones in northwestern South Asia.

## Archaeobotanical finds from South Asia

Although the report of charred sesame seeds from Harappa (Vats, 1940) is often cited as the earliest or only find, there is now a growing body of additional evidence for protohistoric cultivation of sesame in South Asia [for more complete reviews of the archaeobotanical record in South Asia, see Fuller (2002); Fuller and Madella (2001)]. While the Harappan find is often quoted as dated to the late 4<sup>th</sup> millennium BC, following Vats, it must be recognized that such a dating was mere guesswork in an era before radiocarbon dating. The Harappan civilization is now very well dated, and the area from which the sesame came (Trench V, Stratum III of Mound F, north of the central citadel) can be more securely dated to the mature phase of Harappan urbanism. More recent work on this site places the Mature Harappan period between 2500 and 2000 BC (Allchin and Allchin, 1982; Lal, 1997; Kenoyer, 1998), which seems the most likely period for Vats' sesame find. Additional contemporary evidence comes

from the recent archaeobotanical study on the Harappan site of Miri Qalat in the Makran of Baluchistan, dating to the same period (Tengberg, 1999). This latter find is well-documented with scanning electron microscope (SEM) images and comparison with modern material (Fig. 3).

There are numerous reports from the 2<sup>nd</sup> millennium BC. Sesame has been reported from Sanghol, a site of the Late Harappan period (1900–1400 BC) in Indian Punjab (Saraswat and Chanchala, 1997). Additional finds from post-Harappan periods come from the Gangetic basin and the northern Deccan suggesting that sesame cultivation was more widespread in India by the second half of the 2<sup>nd</sup> millennium BC. These finds include, the Early Iron Age levels at Malhar, with radiocarbon dates back to c. 1600 BC (Tewari *et al.*, 2000), Period I at Imlidh-Kurd, which dates to before 1300 BC (Saraswat, 1993), and probably to the earlier 2<sup>nd</sup> millennium on the basis of its cord-impressed pottery, late Ocher-Colored Pottery deposits at Sringaverapura, 1200–800 BC, Senuwar II, 1200–600 BC (Saraswat and Chanchala, 1995), Narhan, phase I, 1200–800 BC (Saraswat *et al.*, 1994, illustrated with a photograph), and Early and Late Jorwe periods at Inamgaon, Maharashtra, i.e., 1500–1200 BC and 1200–900 BC (Kajale, 1988, illustrated with a photograph). Later finds include the earliest Black-Slipped Ware deposits at Hulaskhera, 700–500 BC, and Early Historic (250 BC–250 AD) levels at Hulaskhera and Sanghol. Additional finds from historic periods come from Kushana period Hund (Northwestern Frontier Province, Pakistan), mid-1<sup>st</sup> millennium AD Ufalda (near Srinagar, Garhwal), and early Medieval Paithan (all



**Figure 3.** Scanning electron micrographs of: (a) Carbonized sesame seed from the archaeological site of Ufalda, Garhwal (Photo by Sarah Walshaw); and (b) Modern sesame seed with smooth surface from the market in Khartoum, Sudan.

three sites studied by the author, archaeobotanical reports forthcoming).

While the earliest finds remain those from northwestern South Asia, including Rajasthan and the Harappan region, this region need not be the area of domestication. This evidence must be weighed against the fact that there are very few systematically

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collected archaeobotanical assemblages of equivalent age or earlier from extra-Harappan regions (see Fuller, 2002). In the case of Miri Qalat, sesame is absent from earlier levels, back to 4000 BC (Tengberg, 1999), indicating that it is likely to have been introduced to this site during the Harappan period. For some of the reported finds, accurate taxonomic identification, separating *S. indicum* from possible use of wild *S. malayanum* or var. *malabaricum*, needs to be made, although reports from Narhan and Miri Qalat appear to be the smooth-seeded cultivar.

### Archaeobotanical evidence beyond South Asia

Outside South Asia, there is now evidence to suggest that sesame had been dispersed to Mesopotamia before the end of the 3<sup>rd</sup> millennium BC (during the era of the Harappan civilization), and reached Egypt during the 2<sup>nd</sup> millennium BC. The presence of sesame in early Mesopotamia has long been controversial, with specialists on the ancient Sumerian language arguing over the identity of various words for oil plants and their oils. Until recently the 1<sup>st</sup> accepted evidence for sesame came from the Iron Age (early 1<sup>st</sup> millennium BC), when there is evidence for oil-pressing equipment at Karmir Blur, north of Mesopotamia

(Bedigian and Harlan, 1986; Zohary and Hopf, 2000), and several reports of sesame seeds at Bastam, Gordion, and Deir 'Alla (Miller, 1991). Recently, however, some well-documented charred seeds of sesame have been reported from Abu Salabikh in Iraq (Charles 1989; 1993; 1994), demonstrating the presence of sesame in Mesopotamia back to c. 2300 BC. This would therefore appear to support the identification of sesame with the Assyrian word *shamas-shamme* (Postgate, 1985) and the earlier Sumerian *she-gish-i* perhaps as early as 2400 BC (Bedigian, 1985; Bedigian and Harlan, 1986). By c. 1400 BC sesame was being cultivated in the Persian Gulf, indicated by archaeological evidence from Middle Dilmun (or Kassite) period in Bahrain (Tengberg and Lombard, 2001, including illustrations of the smooth-seeded cultivar). A burnt storage context at site of Sabir in Yemen, dated to c. 900 BC, included large quantities of sesame and other oilseeds like linseed and mustard (de Moulins *et al.*, in press).

Similarly evidence for cultivation in Egypt is being identified from earlier contexts. It has often been suggested that sesame was not cultivated in Egypt until the Greek period (4<sup>th</sup> to 1<sup>st</sup> century BC), when there is textual

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evidence normally interpreted as indicating its cultivation (Gallant, 1985; Sandy, 1989; Bagnall, 2000; Serpico and White, 2000). Earlier sesame in Egypt has been controversial. One issue has been whether or not an edible plant oil known from ancient Egyptian texts as 'n' during the New Kingdom (1700–1200 BC) can be regarded as sesame. Keimer (1924), in a study of garden plants in ancient Egypt identified sesame oil as the 'n' oil. This is presumably the ancient Egyptian identification alluded to by Mehra (2000). The interpretation of this word is, however, uncertain and the identification with sesame has been rejected or queried by some Egyptologists especially due to the belief that sesame had not yet reached Egypt by this time (Sandy, 1989; Koura, 1995; Serpico and White, 2000). Archaeobotanical finds of sesame from Egypt have been few and many scholars have called for caution in inferring its presence in Egypt as a crop in the 2<sup>nd</sup> millennium BC (Germer, 1985; Serpico and White, 2000). Some reports that bear credibility are finds from the Egyptian New Kingdom, from at least the later 14<sup>th</sup> century BC, including seeds from Tutankhamun's tomb (Germer, 1989; Hepper, 1990; de Vartavan and Asensi Amorós, 1997), from a storage jar at Deir el Medineh, an important site of the later New Kingdom (Bruyère, 1937, p. 108, but not illustrated), and from Amarna (Chris Stevens, Institute of Archaeology, University College of London, UK, personal communication). The seeds from Tutankhamun's tomb have raised some questions, as they possess a distinctly reticulate seed coat. Although this is not typical of most sesame cultivars, it is of

course characteristic of the wild progenitor of *mulayanum/malabaricum* type. Also some landraces in India retain a somewhat reticulate seed coat (Ram, 1930), so the presence of this feature is not a reason to doubt the identification of this material to sesame. There are a few later finds in Egypt as well as the Greek textual evidence already mentioned.

Although limited, the available archaeobotanical evidence from Africa could suggest a rather late historical spread across or south of the Sahara. The earliest evidence for sesame seeds further south in Africa comes from post-Meroitic Qasr Ibrim in Nubia (southernmost Egypt), 300–500 AD (Rowley-Conwy, 1989). Slightly further south possible sesame capsules have been reported from the Christian settlement (6<sup>th</sup> century AD or later) at Abdallah Nirqi (Skoflek and Arendas, 1981). Further south in the Sudan medieval plant assemblages of subsequent centuries have so far been without sesame (Fuller and Edwards, 2001; Van Der Veen and Lawrence, 1991; Cartwright, 1998). Also Roman and Byzantine sites in northern Libya lack sesame (Van Der Veen *et al.*, 1996). By the 12<sup>th</sup> century it was attested in Arabic sources as a crop in West Africa (Burkill, 1997).

The eastward spread of sesame is largely undocumented. With no archaeobotanical

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finds as yet, the earliest evidence comes from apparent textual references to sesame that date to the Chinese Han Dynasty, c. 200 BC–100 AD (Simoons, 1991).

## Conclusion

Clearly more work is needed, especially more detailed investigation of the ecology and genetics of possible wild populations in South Asia, such as *S. mulayanum* (which I regard as synonymous with *S. malabaricum*) in both South India, Punjab, and adjacent parts of Pakistan. More archaeobotanical evidence is likely to be slow to accumulate due to preservational biases against oilseeds like sesame in favor of charred preservation of more robust-seeded species such as cereals and pulses. Although there is still a very poor archaeobotanical record for sub-Saharan Africa, the current archaeobotanical evidence suggests that cultivation of sesame in northern Africa was quite late. There is a small but coherent body of botanical and archaeobotanical evidence for a dispersal of sesame westwards out of South Asia starting in the later 3<sup>rd</sup> millennium BC. This archaeobotanical pattern is therefore in agreement with the latest botanical studies indicating an origin from the wild populations of *S. mulayanum* in western peninsular or

northwestern India, although further details about the regional and ecological context of initial cultivation requires further investigation. Since the earliest finds available at present come from Harappan contexts, the most plausible working hypothesis is that sesame was domesticated from wild populations in the Indus valley or its hinterland during the pre-Harappan period, with smooth-seeded cultivar type seeds evidence by the Harappan period.

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