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Cotton

CHARLÈNE BOUCHAUD

National Centre of Scientific Research (CNRS), AASPE Laboratory, and National Museum of Natural History, France

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GENERAL CONSIDERATIONS

Cotton constitutes almost half of the present world's textile fiber production and is the most widely used plant fiber. It is also one of the first oil plants to be used (the oil being derived from its seeds), and its cultivation presents major economic and environmental challenges.

Cotton belongs to the Malvaceae family and the genus *Gossypium*, which includes about forty-eight annual and perennial shrubby or tree species of tropical and subtropical regions. Four cotton species have been domesticated. They rely for growth and maturation on hot, humid, and short days and they grow during summer in the Northern Hemisphere. They do not tolerate temperatures below 5°C (Viot 2019). Two kinds of fiber cover the seed coat (Figures 1 and 2). The longest constitutes the lint, which can be easily pulled off at maturity to be spun into threads. The shortest, called “fuzz,” are more difficult to remove and are used today as cotton wool (Reis, Vian, and Bajon 2006: 47). Today, the two most cultivated cotton species are the American cottons, *G. hirsutum*, a very productive species native to Central America and domesticated about 5000–4000 years ago, and *G. barbadense*, characterized by its extra-long fibers and native to Peru, which was used about 7000 years ago (Brubaker, Bourland, and Wendel 1999; Dillehay *et al.* 2007). Two species were domesticated in the Old World, *G. arboreum* on the Indian subcontinent and *G. herbaceum* in Africa. Their domestication processes are not well understood. *G. arboreum* has a primitive perennial form in western India, but its wild ancestor is unknown and probably disappeared. The discovery of textiles and seeds points to a possible center of domestication in present-day Pakistan (see below). The wild ancestor of *G. herbaceum* could be the population “*africanum*” which existed in southern Africa. However, its present distribution is unrelated to the first archaeological evidence located much further north (see below). One of the common hypotheses considers that domestication occurred somewhere in northeastern Africa and the wild subspecies later disappeared in the same way as the wild *G. arboreum* population disappeared after its domestication (Brubaker, Bourland, and Wendel 1999; Viot 2019). The two diploid species are little cultivated today. They have similar growing patterns (i.e., annual or perennial), lint characteristics, and seed morphology. Both are drought and pest resistant (Viot 2019). Archaeological finds mostly correspond to fibers or seeds that cannot be assigned to one of these two cottons using classical morphological observations only.

THE FIRST EVIDENCE AND DIFFUSION

A cotton thread, preserved by mineralization inside a copper bead and discovered at Mehrgarh, Pakistan, sixth millennium BCE, constitutes the earliest known example of cotton in the Old World (Moulh erat *et al.* 2002). The analysis did not reveal whether it corresponds to a wild or an already domesticated species. Nevertheless, the presence of several other cotton finds dated to slightly more recent periods in the same region shows that cotton (*G. arboreum*) was probably domesticated somewhere in the northwestern Indian subcontinent between the sixth and the fourth millennium BCE, before

spreading to the south of the Indian subcontinent from the third millennium BCE onward (Fuller 2008). Then, and more particularly from Roman times when Indian Ocean trade networks intensified, the Indian subcontinent became a major cotton producing and exporting region (Wild and Wild 2014b), and this has remained the case up to the present day. From surrounding regions, potential old archaeological cotton finds dating back to fifth to second millennia BCE have been found in Jordan (Betts *et al.* 1994), the Caucasus (Kvavadze, Narimanishvili, and Bitadze 2010; Shishlina, Orfinskaya, and Golikov 2003), and Nubia (Chowdhury and Buth 1971). They could be the result of early trade (for the first two) or the sign of first use in Africa. However, they all are isolated discoveries, with sometimes insecure contexts, and cannot constitute conclusive evidence of early cotton presence in these regions (see criticisms in Clapham and Rowley-Conwy 2009: 249; Fuller 2015: 14).

The first solid clues of cotton use and cultivation outside the Indian subcontinent date to the first half of the first millennium BCE, in Mesopotamia. Akkadian texts and textile discoveries show that cotton was introduced, probably *G. arboreum* from the Indian subcontinent, and cultivated at that time, complementing the textile sources hitherto offered by linen and wool (Alvarez-Mon 2010: 30–72; Muthukumar 2016; Quillien 2019). The Greek author Theophrastus indicates that, during the fourth century BCE, Indian cotton was known and traded in the Mediterranean, suggesting its introduction at Bahrain (Persian Gulf) (Theophrastus, *Historia Plantarum* 4.4.8; Amigues 2010). The earliest archaeological traces of cotton in northeastern Africa date back to the latter part of the first millennium BCE to the beginning of the first millennium CE and come from Qasr Ibrim, lower Nubia (Clapham and Rowley-Conwy 2009). From the first to the second century CE onward, an increasing number of finds and documents (seeds, textiles, and papyrological texts) point to several centers of agricultural production, in Sudan and Nubia, western Egypt, and north-western Arabia (Bouchaud *et al.* 2018), as well as the importation of cotton from India to the Mediterranean world via harbors on the Egyptian Red Sea coast (Wild and Wild 2014a). Whereas cotton remains a minor fiber compared to linen and wool in Arabia and Africa, Sudan and Nubia played an important role in the development of cotton production, part of which is dyed indigo blue, and exchange during Antiquity and the medieval period (Yvanez and Wozniak 2019). The unique ancient DNA analysis carried out on cotton finds from Qasr Ibrim identified *G. herbaceum* (Palmer *et al.* 2012). The process of diffusion of cotton in north-eastern Africa and Arabia likely involved this species, although Indian cotton (*G. arboreum*) might have been introduced as well, especially in the western Egyptian oases (Tallet, Gradel, and Letellier-Willemin 2012), in northwestern Arabia (Bouchaud *et al.* 2018), and in the Levant (Shamir 2019), which are regions connected to both Indian and African/Nubian spheres during Antiquity and medieval times. From the tenth century onward, Arab medieval literature and technical treatises indicate a slow but continuous spread of cotton in the Iranian regions and toward the greater Mediterranean (Bulliet 2009; Mazzaoui 1981), and in western Africa (Champion and Fuller 2019) where it acted as a key product for trans-Saharan trade (Nixon, Murray, and Fuller 2011).

Regarding agronomic conditions, several written references from Akkadian, Greek, Latin, Chinese, and Arabic corpuses refer to “trees” or “shrubs” in different places and times, showing that ancient cotton had to be widely cultivated as a perennial rather than as an annual plant as it is today (Bouchaud, Yvanez, and Wild 2019). The presence of cotton in Central Asia during the fourth century CE, that is, in regions suffering from frost during winter, is perceived as a sign of the emergence of new annual forms of the plant (Brite and Marston 2013), although we cannot rule out the introduction of resistant perennial varieties of *G. herbaceum*. Until recently, cotton trees were still sporadically cultivated in parts of western Africa, such as in Cameroon (Seignobos 2019). Finally, although the evolution of water management structures, such as the emergence of the waterwheel (*saqiya*) in northeastern Africa at the beginning of the first millennium CE, may have favored the development of such summer crops, which require water during the dry season (Fuller 2015), some data show that ancient cotton could endure drought conditions and was undoubtedly a less water-demanding crop than the current varieties (Bouchaud, Yvanez, and Wild 2019; Palmer *et al.* 2012).

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Figure 1 Cotton boll, *Gossypium arboreum*, Las Chapatales (Sevilla), Spain. Source: photograph by the author.

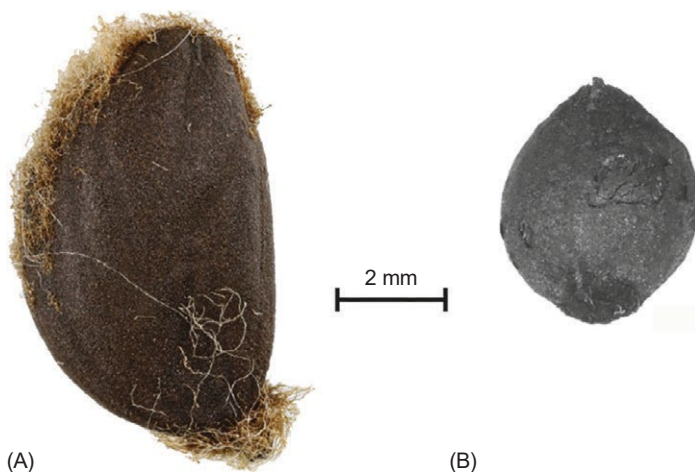


Figure 2 Cotton seeds. (A) Modern, Las Chapatales (Sevilla), Spain. (B) Archaeological (Hegra, Saudi Arabia, first–third century ce). Source: photograph by the author.