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A NOTE ON THE EARLIEST EVIDENCE ON THE DISTRIBUTION OF CHICKPEA (*CICER ARIETINUM*) IN NEAR EAST AND EUROPE

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Abstract

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Chickpea (*Cicer arietinum* L.) was a part of the everyday diet of the Eurasian Neanderthal population and the modern human Palaeolithic hunter-gatherers at the end of the last Ice Age. The major criteria to determine the domestication in chickpea and other ancient grain legumes are non-dehiscent pods, larger seed size and smooth seed test. Chickpea seeds were found among the earliest findings of cultivated crops at the site of Tell El-Kerkh, Syria, from 10th millennium BP. Along with cereals, pea and lentil, chickpea has become definitely associated with the start of the 'agricultural revolution' in the Old World. Chickpea entered Europe in its southeast regions and progressed into its interior via Danube. Its distribution was rapid, since the available evidence reveals its presence in remote places at similar periods. The linguistic evidence supports the fact that most of Eurasian peoples have their own words denoting chickpea, meaning that its cultivation preceded the diversification of their own proto-languages.

Key words: archaeobotany, archaeology, *Cicer arietinum*, chickpea, crop domestication, crop history, Europe, historical linguistics, paleogenetics

Beginnings

Legumes (*Fabaceae* Endl.) are one of the richest plant families in the world, extending over all continents with hundreds of genera and thousands of species (Lewis et al., 2005). Numerous members of this family have economic importance and have been used for diverse purposes for millennia, including human consumption, animal feeding and green manure (Mikić et al., 2011). One of such species is chickpea (*Cicer arietinum* L.), an annual legume crop with a specific significance in temperate regions and Mediterranean climates (Shahbazi 2011).

Most of the traditional Eurasian grain legumes, such as chickpea (*Cicer arietinum* L.), lentil (*Lens culinaris* Medik.), pea (*Pisum sativum* L.) and common vetch (*Vicia sativa* L.) originate primarily from the Near Eastern centre of diversity, while some of their closest botanical relatives and economically important species, such as bitter vetch, red pea (*Lathyrus cicera* L.) and grass pea (*Lathyrus sativus* L.), evolved primarily in the Mediterranean centre of diversity, with Near East as the secondary one (Zeven and Zhukovsky, 1975).

Humans had known chickpea and other grain legumes before they became cultivated crops. The earliest evidence of their use in human consumption are the fossilized microremains in calculus of the Neanderthal skeletons from Shanidar Cave in Iraq about 46,000 years old (Henry et al., 2011), along with few other cereals. Grain legumes were present in the everyday diet of the hunter-gatherers at the end of the last Ice Age in Europe, as witnessed by the remains from the site of Santa Maira, Spain, from 12 000-9 000 BP (Aura et al., 2005).

Domestication

The remains of domesticated chikpea and other grain legumes often occur at high frequencies during the 10th and 9th millennia (Willcox et al., 2008) may contribute to the possibility that the domestication of grain legumes could predate cereals (Kislev and Bar-Yosef 1988). However, little is known about the early stages of grain legumes domestication. It is hard to determine there is very little evidence of how, when and where they were domesticated, mostly due to a fact that all those changes, being mostly morphological, do not survive to the present day.

In all plant species, the process of domestication led to certain morphological changes that, in many aspects, strongly resemble the methods of selection used in contemporary plant breeding programmes. In grain legumes, the major criteria to determine the domestication are non-dehiscent pods, larger seed size and smooth seed testa. In the case of pea, the best studied close relative of chcikpea, the gene *Dpo*, controlling pod dehiscence (Weeden et al., 2002), underwent modifications during the domestication and thus became responsible for the development of non-dehiscent genotypes. Larger seed size in cultivated forms in comparison to that

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in wild ones is not typical only for grain legumes, but is often very hard to interpret. A smooth testa, due to the domestication, is the most reliable characteristic in telling wild from cultivated forms. Apart from these three major, there are several other indicators of the pea, vetchlings (*Lathyrus* spp.) and other ancient Eurasian grain legumes domestication, such as absent seed dormancy, dwarf growing habit, less prominent basal branching, neutral photoperiodical reaction and improved grain quality (Weeden, 2007).

Distribution

While early pea occurred first in the south Levant, early chickpea and lentil occurred first in the north Levant (Allaby et al., 2010). It is quite certain that chickpea was one of the most ancient crops that entered Europe, after it had become more suitable place for living again, following the end of the last Ice Age. Thus chcikpea, along with pea (Ljuština and Mikić, 2010a), lentil (Ljuština and Mikić, 2010b) and several cereals, has become definitely associated with the start of the 'agricultural revolution' in the Old World (Erskine, 1998). Chickpea entered Europe in its southeast regions and roughly progressed into its interior via Danube. Its distribution was a rapid one, since the available evidence reveals its presence in mutually remote places at similar periods (Figure 1).

The following selection of archaeological findings offers nice examples that confirm the extreme importance chickpea had in the primeval agriculture in Near East and Europe.

- 11 100–10 610 BP, El-Hemmeh, Jordan. Chickpea was present at this sizeable multi-period Pre-Pottery Neolithic site with a substantial occupation dating to the Pre-Pottery Neolithic A (PPNA) period together with lentil and vetches (White and Makarewicz, 2012).
- 8750–8470, Tell El-Kerkh, Syria. Among the earliest findings of cultivated grain legumes is this site with the seeds of bitter vetch, chickpea (Figure 2), grass pea, faba bean (*Vicia faba* L.), lentil and pea (Tanno and Willcox 2006).

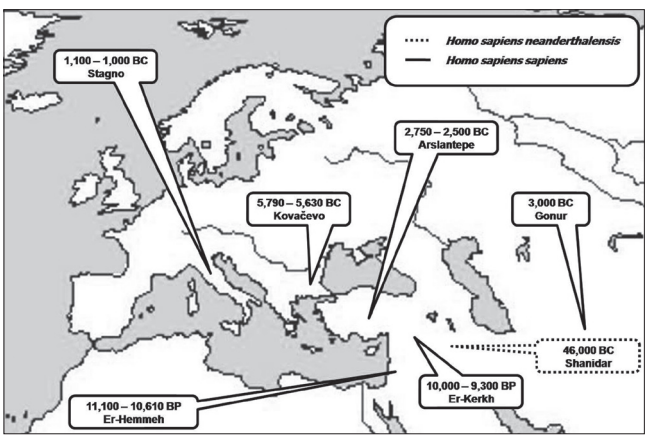

Fig. 1. Some of the archaeobotanical findings of chickpea in Near East and Europe

- 5790-5630 BC, Kovačevo, southeast Bulgaria. The final early Neolithic site in southwest Bulgaria, with grass pea, lentil, grass pea, pea and red pea found along with chickpea and several cereal species (Marinova and Popova, 2008).
- 3000 BC, Gonur, Turkmenistan. At this site, often referred to as the basis of the "oasis civilizations" of the Bronze Age, chickpea was cultivated and used in everyday diets together with lentil and pea (Miller 1999).
- 2750–2500 BC, Arslantepe, Malatya, Turkey. Chickpea (Figure 3) was the second most important crop, following barley (*Hordeum vulgare* L.), being represented with about 17% in the total plant remains and rather dominant over lentil and pea (Sadori et al., 2006).
- 1100-1000 BC, Stagno Tuscany, Italy. Vetches, together with chickpea, lentil, pea and vetchlings, were included in the everyday use at this Final Bronze Age – Iron Age site near Livorno (Bellini et al., 2008).

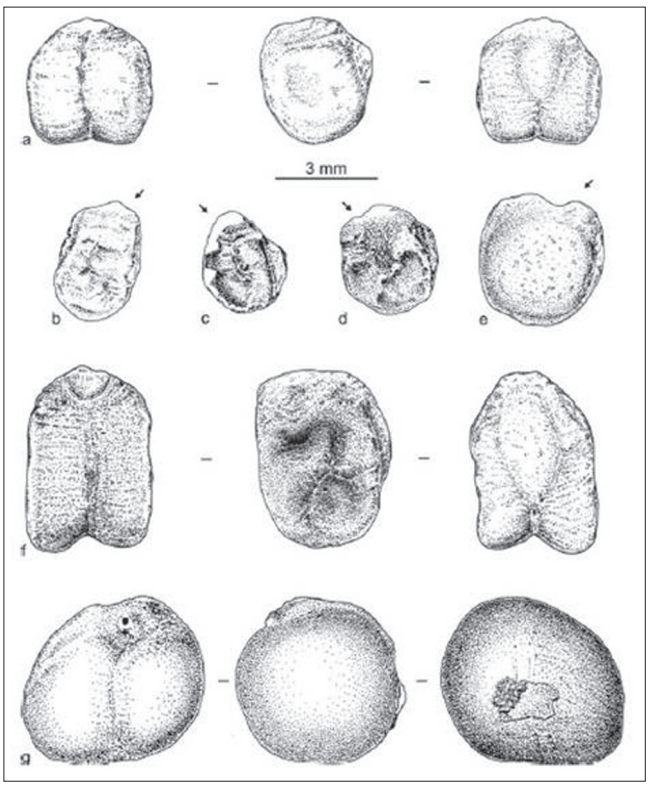

Fig. 2. *Cicer arietinum* from early PPNB levels at Tell Ain el-Kerkh. a shows the most common type, b–e are lateral views to show morphological variation from more wild forms to more domestic forms arranged from left to right. The wrinkling which is often seen in *C. a. reticulatum* can be seen in b, c and f. f shows a large, ssp. *reticulatum*-type seed. g shows a large rounded seed with its beak and a fragment of testa. Arrows indicate presumed position of beaks (Tanno and Willcox, 2006)

Paleogenetics and historical linguistics

One of the future challenges in the research on the earliest days of chickpea should surely be the extraction of ancient DNA (aDNA) from the collected charred seeds. A good guide towards this goal could be probably the first successful extraction of aDNA from the charred legume seeds, done from the pea and bitter vetch (*Vicia ervilia* (L.) Willd.) samples from the site of Hissar in southeast Serbia (Jovanović et al. 2011). In comparison to more recent sources, the amounts of aDNA extracted from charred seeds are much lower, mostly due to largely anoxic or low-oxygen events occurring with different archaeological remains. In the case of the charred bitter vetch seeds from Hissar, about 2 ng μl^{-1} aDNA using the standard cetyltrimethylammonium bromide (CTAB) method and 7.2 ng μl^{-1} aDNA by the commercial QIAGEN DNAesy kit were obtained respectively. The whole genome amplification (WGA) and the sequencing of this chloroplast aDNA should bring more data on the traits of the ancient bitter vetch population from Hissar, encouraging further attempts in extracting also aDNA from nucleus and mitochondria.

The linguistic evidence supports the fact that chickpea had been present in nearly all regions of Europe before the modern European language families were developed. Peoples like Indo-Europeans, Turkic, Caucasians or Basques, each have their own words denoting chickpea, meaning that it preceded the diversification of their own proto-languages into their contemporary descendants. Among the most ancient words denoting chickpea in Eurasian proto-languages are the Proto-Indo-European roots **kek-*, *k'ik'-* (Figure 4) (Mikić, 2012). Similar is with other most ancient legume crops such as pea (Mikić, 2009), lentil (Mikić, 2010) or faba bean (Mikić, 2011).

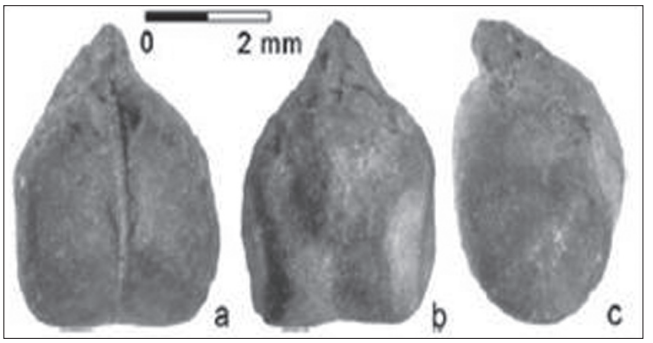

Fig. 3. Arslantepe (Malatya), period VIC. Room A607; *Cicer arietinum* seed. a. ventral, b. dorsal, and c. lateral view (Sadori et al., 2006)

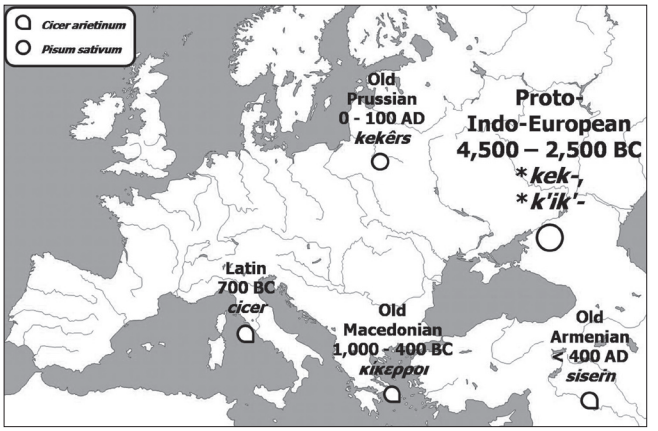

Fig. 4. Initial evolution of the Proto-Indo-European root **kek-, k'ik'- (Mikić, 2012)

Conclusions

As one of the most ancient crops in the world, chickpea played an important role in the introduction of agriculture in post-glacial Europe, often representing the main pulse in the diets of local communities across the continent. The future research on this subject certainly must make a more detailed map of its paths over Europe and, especially, its long-term and essentially important ties with the pea domestication and distribution in Asia Minor, Near East and North Africa.

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