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Sri Lanka's Earliest Wild Musa Bananas?

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Abstract

In spite of their importance as a crop today, records of the use of wild banana and the antecedents of the modern domesticated bananas are relatively obscure. Banana dispersal pattern from their native range (e.g. Island South East Asia and New Guinea) is also poorly known. Excavation at Fahien Rockshelter in South Western Sri Lanka yielded phytolith sequence dating from 48,354 to 3900 cal BP. Phytolith evidence suggests that Rockshelter occupants used wild banana (Musa. acuminata and M. balbisiana) through the late Pleistocene to early Holocene, i.e. 8000 cal BP. After this age, occupants significantly decreased the use of wild bananas.

Keywords: Banana; Phytolith; Dispersal; Archaeology; Sri Lanka

Introduction

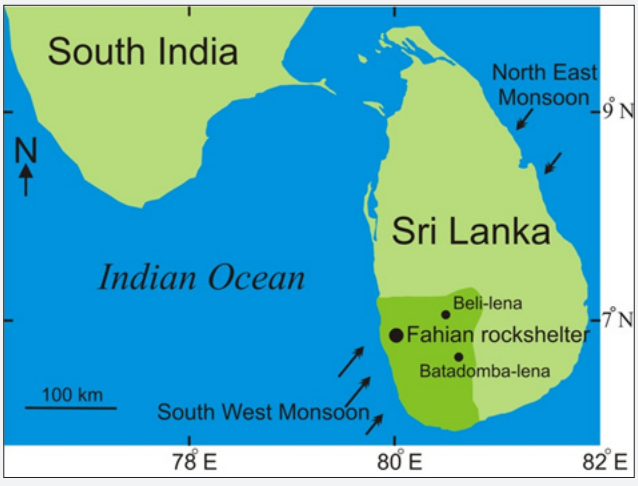

Figure 1: Location of the Fahien rockshelter in Sri Lanka. Area marked by dark green color receives relatively high rainfall (>2,500mm/yr) from the South West Monsoon while area marked by light green color receives relatively low (< 2,500mm/yr) rainfall from the North East Monson.

The earliest known banana cultivation is at 6,950-6,440cal BP at Kuk Swamp in the highlands of Papua New Guinea [1]. The dispersal of bananas from Papua New Guinea, the role of human agents and the arrival of the first cultivated bananas in many other geographical areas in the world have so far been poorly documented, but has recently been discussed using data from phytoliths, archaeology, genetics and linguistics [2-7]. Bananas are known from Munsa, Uganda by 5,492-5,100cal. BP [3,8] and Kot Diji, Pakistan by 4,500-3,900cal. BP [5] although their domestication status is unclear. By 2,760-2,300cal. BP, banana had reached Nkang, Cameroon, West Africa [2,9-12]. But the route and chronology are still disputed on chronological [4,13], archaeological [14,15,16,17] historical and linguistic [18-20] and archaeobotanical [13,21] grounds. There is also discussion about the proposed mode of dispersal on terrestrial [6,7,22] and maritime routes [6,7,20,23] from South East Asia to South Asia and Africa. The island of Sri Lanka in the Indian Ocean has evidence of the prehistoric settlements from several Rock shelter sites dating from 36,000cal BP onwards, and one terminal Pleistocene sits yielded a few evidence of wild Musa banana used as one of the starchy food in prehistoric life [24,25], but no conclusive evidence has been presented for understanding the prehistory of wild Musa banana in their native region. This publication reports the very early occurrence of the phytoliths of wild bananas from the late Quaternary archaeological sequence (48,354 -3900cal BP) at Fahien Rock shelter (Figure 1).

Fahien Rockshelter

Fahien Rockshelter is situated at 80° 12' 55" E 6° 38' 55" N and 130m above mean sea level in Yatagampitiya village near Bulathsinhala in the Kalutara District, in the humid southwest of Sri Lanka (Figure 1). FaHien Rockshelter is one of the oldest prehistoric sites in Sri Lanka [26,27]. Investigations at FaHien Rockshelter included work on the stratigraphy, sediments, lithics, bone tools, beads, bones, terrestrial and marine shells, charcoal, macrofloral remains (Canarium sp. nuts, Artocarpus sp. epicarps), coprolites, and several interred anatomically

modern humans, some coated with red ochre. The rockshelter deposits also contain several of preserved hearths, palaeofloors and postholes. The sequence dates from ca. 48,000 to 3900cal BP [24-30], and these works identified 6 major layers with approximately 250 archaeological contexts. These were grouped into 8 archaeological phases (Figure 2).

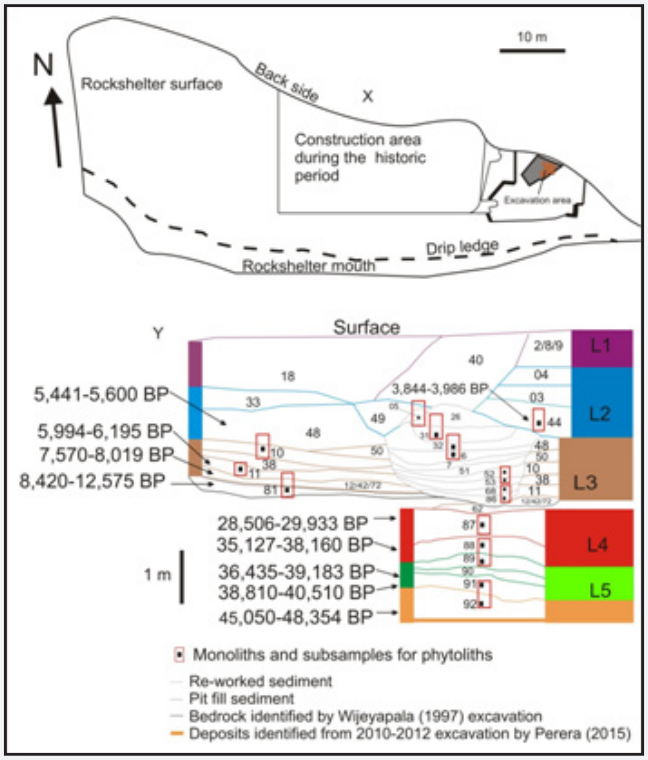

Figure 2 : X: Plan of the rock shelter with excavated areas. Y: Stratigraphy with the archaeological layers (L5-L1). Locations of the monoliths and subsamples taken for phytolith analysis are indicated.

Sample Selection, Material and Methods

Eleven 30x10x8cm monoliths were taken from the southern profile of Fahien Rockshelter excavation Area. From these monoliths, seventeen subsamples were selected for phytolith analysis. The composition of the subsamples is generally pebbly loam. Ten of the subsamples were from L2, of middle/late Holocene age. Figure 2 shows the subsample location and the contexts identified within the major layers.

The methods used in this study follow [31]. Sediment samples of 10-15g were used. They were dried at 40 °C for a few hours and passed through 2 mm sieves. The fraction passing the sieve was used. $CaCO_3$ was removed using 10% HCl at 40 °C in a hot water bath and the material was centrifuged at 2000rpm for 5 minutes. The supernatant was decanted and the materials were checked with 1% AgNO3 solution to ensure freedom from $CaCO_3$. The material was oxidized in 40 ml of 30% H_2O_2 at 80-90 °C in an oven for 2-3 hours. After cooling a few drops of NH_4OH solution was added to check for excess H_2O_2. The resulting suspension was passed through a150µm sieve to remove coarse sand. The fraction less than 150µm was mixed with 20ml 0.5% $Na_2P_2O_7.10H_2O$. Clay particles were removed using density gradient techniques based on Stoke's Law. The silty fraction was removed and dried. 0.5g of dry materials were mixed with 10ml ZnBr2 solution (density exactly adjusted to 2.35gcm3) in a centrifuge tube. It was allowed to settle for 30 minutes and centrifuged at 2000rpm for 30 minutes. This process allowed separation of phytoliths from silt and other heavy minerals. The phytolith fraction was removed and mixed with 1N HCl and centrifuged at 2000rpm for 5 minutes. The final phytolith fraction was mounted in Canada Balsam and observed under the Olympus BX51 microscope. Micrographs were taken using F-View Soft Imaging System. In each sample, a minimum number of 250 phytoliths were counted at X400. Phytolith morphotype classifications and taxonomic identification were made according to the reference collection from number of modern and wild banana species collected from the flora of Sri Lanka and Royal Botanic Garden, Kew. Comparative studies (shape, size and measurement of volcaniforms) on phytolith morphotypes produced from leaf, seed and fruits were carried out using standard preparation methods [32].

Results and Interpretation

There is secure radiocarbon and OSL dated rockshelter stratigraphy (Figure 2) including lithics, beads, animal and human bones, shell, charcoal, and plant macrofossils of breadfruit (Artocarpus nobilis) epicarps, Carnarium nuts, coprolites, postholes, hearths and two interred individuals coated with red ochre. Banana (Musa spp.) phytoliths from seeds and leaves are present throughout the late Pleistocene-Holocene stratigraphy

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at Fahien Rockshelter (Figure 3). High percentages of phytoliths of wild bananas and disturbed lowland forest taxa including Palmae, Artocarpus cf. nobilis, Burseraceae/Canarium sp. are evident in all habitation deposits. Phytoliths from woody (e.g. Burseraceae) and weed flora (e.g. Asteraceae, Cyperaceae and Poaceae) occur throughout the sequence. Herbaceous and woody taxa become more frequent just after 8000 cal BP. The phytolith sum also increases at this time. Substantial quantities of burned phytoliths (including Artocarpus sp, Musa spp. and Poaceae) in the late Pleistocene are indicative of frequent fire. Freshwater diatom and few finds of marine diatoms are reported. All these are clearly suggestive of deliberate human activity – import and burning of woody and other plant materials, gathering of wild banana fruits and leaves for multiple purposes (e.g. food, medicine and rituals). The phytolith data demonstrates that wild banana have existed in Sri Lanka for the last 48,354 years. It is not surprising that wild bananas exist as an element in disturbed lowland rainforest and edge habitats from which they colonize disturbed areas in Sri Lanka [33,34]. The occurrence of wild banana phytoliths significantly decreases after 8000cal BP, but they occur in very low percentages through the middle to late Holocene samples suggesting a change of subsistence patterns of Rockshelter occupants.

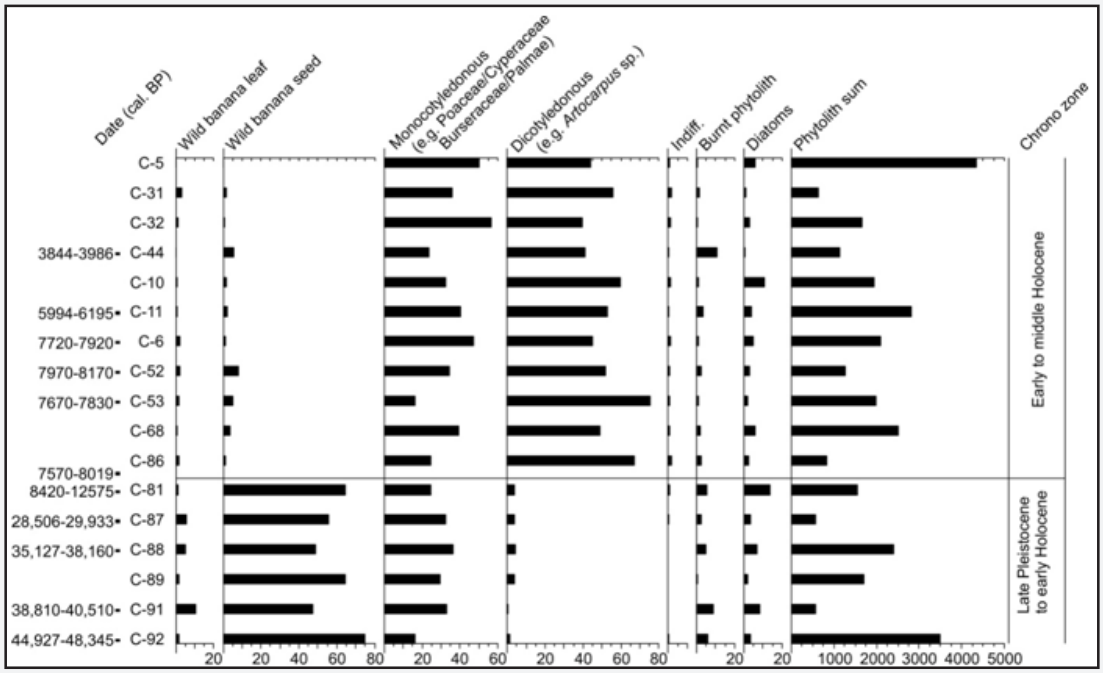

Figure 3 : X: Percentage summary phytoliths diagram from the Fahien Rockshelter sequence studied.

Discussion

The banana (Musa sp.) is one of the most important commercial crops in the world and its centre of origins appears to lie in Papua New Guinea [1,4,6,7,35]. It is usually said that these bananas seem to have been introduced to all tropical and subtropical regions of the world, where they gained great importance and popularity. In Sri Lanka, 29 banana cultivars and two wild species (M. acuminata and M. balbisiana) have been reported [36-40]. Evidence for wild banana exploitation has been found in the form of their seeds from the terminal Pleistocene samples at Kitulgala Belil-lena, a rockshelter in Sri Lanka [26,41,42]. In Sri Lanka, the antiquity of this tradition is pushed back to 48,000cal BP, as shown by the very significant occurrence of wild banana seed and leaf phytoliths from the late Pleistocene cultural sequence at Fahien Rockshelter. Comparative studies indicate that these banana phytoliths are identical to those found in modern M. accuminata and M. balbisiana populations in Sri Lanka and South India (Figure 4). This phytolith evidence suggests that prehistoric people originally used these two wild banana plants, which probably occurred as natural elements in lowland rainforest in Sri Lanka, both for fruit consumption as well as for other uses such as textile making medicines and rituals [5,43]. It is conceivable that, in the remote past, prehistoric people were responsible for maintaining Musa acuminata and Musa balbisiana over Sri Lanka and the Indian Peninsula at very early stage, as suggested by [5,44].

Recent multidisciplinary investigations (genetic, archaeological and linguistic) suggest that Sri Lanka and its wild sub-species (e.g. accuminata subsp. burmannica) are not significant for understanding banana domestication [6,7,22]. Our data, however, suggest that its location in the Indian Ocean is important for understanding the diversity of M. accuminata subspecies and the appearance of semi-domesticated banana, a form of M. accuminata subspecies in Sri Lanka. Because, the great reduction of wild banana phytoliths corresponds to the appearance of phy-

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toliths comparable with domesticated forms (8000-3900cal BP) which are suggested as semi-domesticated bananas herewith, implies deliberate import and planting activities. It is possible to suggest that new form (s) of bananas emerged through early to middle Holocene. This new form (s) may be a part of domesticated bananas; if so, that would be a great platform to discuss several important issues related to the origin of domesticated bananas in their native regions and dispersal models given in the introductory chapter with this paper [44]. Additional investigations are being conducted to understand those complex issues.

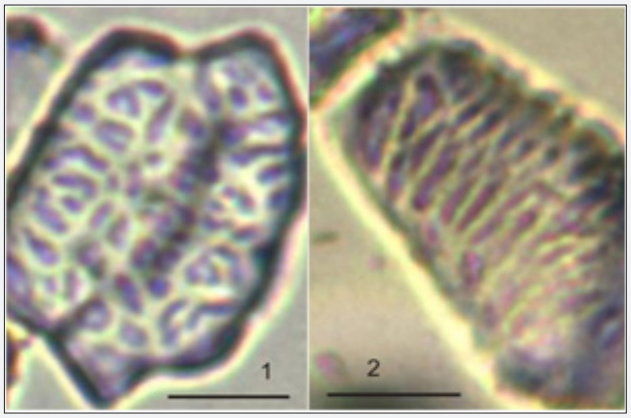

Figure 4: Phytolith of wild bananas, Musa accuminata [1] and M. balbisiana [2].

Conclusion

Phytoliths recovered from the archaeological sequence at the Fahien Rockshelter in South Western Sri Lanka show that rockshelter occupants used wild bananas (Musa acuminata and Musa balbisiana), most probably for various purposes (e.g. fruit consumption, textile making, medicines and rituals) as early as 48,000 cal BP. Use of wild bananas continued through late Pleistocene to early Holocene, i.e. 8000cal BP. After this age, this tradition significantly decreased with the appearance of new form (s) of bananas.

Acknowledgment

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