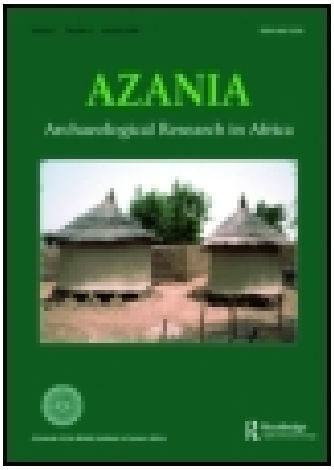

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The initial history of bananas in Africa. A reply to Jan Vansina, *Azania*, 2003

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Ru Swennen, H. Beeckman, E. De Langhe and P. de Maret

The arrival of the first cultivated bananas in Africa has been a matter of speculation for over a century. While they necessarily would have come 'from the East', the centre of *Musa* diversity stretches from New Guinea to India (Denham *et al.* 2004), the timing of their introduction and the human agents responsible have never been determined with certainty.

Three competing theories have been put forward to explain the introduction of bananas to Africa. First, bananas were introduced by the Portuguese during the 16th century, second, by Arab or Persian traders around the 8th century or earlier, or third, by the Austronesian-speaking people who settled in Madagascar early in the first millennium AD, making possible a subsequent introduction to the continent. The third theory, advanced by the late Norman Simmonds (1962), an authority on bananas, has steadily been gaining ground. Common to all theories is the belief that bananas did not reach the African continent before the Christian Era (CE), i.e. before 2000 years ago.

Recently, phytoliths from refuse pits excavated in central Cameroon were identified as coming from a cultivated banana after a comparative study of the genera *Musa* and *Ensete* (Mbida *et al.* 2000, 2001). They were dated c. 2500 Before Present (bp). If confirmed, this would shed a different light on the early evolution of agriculture in humid tropical Africa. For example, agriculture in the rainforest would not have relied on yam, which is generally not very productive in the absence of a dry season, but could have developed around plantains, which prefer such an environment.

Such an early date for banana cultivation in Africa calls for critical examination of data and the broader argument. In a note published in the 2003 issue of *Azania*, Jan Vansina expresses serious reservations about this finding (Vansina 2003).

He writes, for example, "one can only accept that the earliest evidence in Africa for the cultivation of edible seedless bananas in Africa dates from the later sixth century CE and perhaps even as late as the ninth century CE", and goes on to argue why bananas could not have reached West Africa by 2500 bp. His argument is based on the assumption that India is the area of origin of the AAB bananas, with the consequence that they must have been cultivated in the dry areas of North and East Africa before their diffusion to the humid parts of West Africa. To support his position, he refers partly to historical sources such as Pliny's *Natural History*, and partly to archaeobotanical evidence recovered during the excavations at the Roman port of Berenike, and notes that no trace of banana was found there, or is reported in any of the ancient historical sources. It will be shown below why the route proposed by Vansina is out of the question, making these sources irrelevant.

Vansina's other arguments are based on a critical review of the reference material used to identify the Cameroonian phytoliths. We respond to these critricisms in the second part of this note.

Bananas and Bananas

Any study on the antiquity of banana in Africa needs to account for a quite specific geographical distribution of the traditional banana-groups[1] if its conclusions are not to result in additional confusion. Three such categories can be distinguished for Africa: the

[1] Traditional: not including the recent intrusion of 'alien' varieties since the 19th century due to European influence.

AAB plantains, with their unique diversity in the rainforest (more than 100 varieties); the AAA East-African cooking/beer bananas (AAA-EA), largely dominating the Great Lakes area (more than 50 varieties); and the 'Indian Ocean Complex' found along coastal areas but also partly diffusing during recent decades into the eastern continent-side (at least the more drought-resistant varieties). The term 'Indian Ocean Complex' has been coined for a heterogeneous set of popular banana varieties grown in all suitable countries around the entire Indian Ocean across to Western Indonesia (De Langhe *et al.* 1994/95). The category displays an almost complete spectrum of genome combinations (edible-AA, AAA, AB, AAB, ABB) and its distribution clearly is a product of trans-Indian Ocean cultural contact, followed by the mainly Portuguese impact on the Atlantic coasts of Africa. It is important to note that these varieties are totally absent in traditional rainforest agriculture, despite their proven capacity to be even more productive in such environments than elsewhere.[2]

Some suggestive ethno-botanical considerations

Plantains in the African rainforest, together with the above mentioned AAA East-African cooking bananas and the AAB 'Maia maoli-Popoulu-Iholena' (MMPI) bananas in Polynesia[3], are the only three groups which are cultivated far from the original wild *Musa* germplasm area in south Asia and New Guinea but still display an extraordinary diversity. Each group displays exceptional variation in a specific region and nowhere else. Such diversity can only be explained by a long and cumulative series of somatic mutations and, what is more significant, within the regions of their current presence. A somatic mutation is a rare event in natural circumstances. The fact that mutation rates when banana tissue is proliferated *in vitro* are much higher than those in the field (Vuylsteke *et al.* 1991), points to a cultivation history spanning many centuries for a comparable degree in diversity to be reached.

A hint about the necessary time-depth for such *ad hoc* diversification is offered by the case of the MMPI-group. The group finds its largest diversity in the Pacific, east of the Solomon Islands, the domain of Polynesian people, who were the architects of the diversity. It is commonly accepted that the key islands from New Caledonia to the Marquesas were colonised by the ancestors of these Austronesian speaking people between 3200 bp and 2000 bp (Denham 2004). A safe estimation of the time taken to generate the MMPI variety would thus be 'at least 2000 years'.[4] Since many more varieties have been recorded in the African-plantain group (Swennen 1990; Lebot *et al.* 1994), it is probable that this larger plantain diversity may have required an even longer time to develop.

Furthermore, if according to the arguments to which Vansina apparently adheres, bananas were introduced to the African continent by the end of the first millennium AD only, i.e. in a period of intense trans-Indian Ocean activity, they would include not only the plantains but the two other above mentioned 'African' categories as well, the AAA East-African cooking bananas and the 'Indian Ocean Complex'. More specifically, as many varieties of the 'Indian Ocean Complex' are more vigorous than the plantains at lower altitude, why were these banana groups not more widely diffused over the entire rainforest as it was the case with the plantains?

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[2] Some three to four varieties of this complex underwent a very limited diffusion along the main streams in West Africa, probably due to initial Portuguese or Spanish influence (Rossel 1998).

[3] Sometimes called 'Pacific plantains' because of their broad similarity to the African plantains.

[4] A very small number of MMPI cultivars was found in New Guinea and may have formed the basic stock (Lebot *et al.* 1993)

The above considerations invite the hypothesis that a basic stock of plantain varieties reached Africa far more than 2000 years ago, and that these varieties diffused in the rainforest and produced more than 100 mutants over the centuries of cultivation by local farmers. Placed in such context, the discovery of banana phytoliths at Nkang would appear to provide supporting evidence entirely compatible with this hypothesis.

Not from India

The Indian sub-continent hosts the two constitutive species of edible bananas (*Musa accuminata* = A and *M. balbisiana* = B) and has long been considered as the main centre of origin of edible bananas (Champion 1967, pp 195-99). It is currently accepted as only a part of that centre, especially for AxB hybrids (Simmonds 1962) — the typical South Indian AB diploids and AAB dessert varieties, and the dominant ABB triploids used for cooking. The most popular of these varieties form the essential part of the above-mentioned 'Indian Ocean Complex'.

The AAB plantains are scarce to absent over India with the exception of Kerala State and the southern part of Tamil Nadu where a few varieties are grown on farms. This raises the following question: If these varieties correspond with the original stock that would have been introduced from India into Africa, where it generated more than 100 varieties, why did the same degree of diversification not happen in India over the same time period? The human and physical environment in South India was as favourable for such development as the African rainforest and many Indian tribal groups have preserved their original plants (including the wild *Musae*) and crops. An alternative explanation, that plantains were once popular in India (for example, before c. 2000 BP) and were later supplanted by the currently wide spectrum of other AxB hybrids, is not tenable either. Plantain fruits are still very popular in Kerala and Tamil Nadu and consequently the many cultivars would have survived there, perhaps not on farmers' fields where selection would have taken place, but at least among neighbouring hunter-gatherers and in the general vicinity. Yet, an intensive collecting expedition conducted in these areas did not find more than 16 varieties, all but one restricted to the French plantain subgroup (Menon and Aravindakshan 1998).

As for the AAA East-African cooking bananas, the picture is simple: they are totally absent on traditional farms across the whole of Asia, and an Indian origin is thus out of the question.

Chemico-taxonomic research and cytoplasmic DNA-RFLP analysis demonstrate that the AAB plantains, as well as the AAA East-African cooking bananas originated in New Guinea and the surrounding islands (Horry 1989; Lebot *et al.* 1993; Carreel 1994; Carreel *et al.* 2002). Moreover, recent archaeological investigations point to the possibility that an initial form of banana cultivation may have started in the Kuk area of Papua New Guinea[5] as early as 10,000 BP (Denham *et al.* 2003, 2004). Vansina does not seem to have been aware of these data, which suggest another pathway for the introduction of bananas into Africa via the equatorial zone, such as present-day Tanzania (De Langhe and de Maret 1999). From there, the bananas would have diffused across the continent from east to west, eventually reaching present-day Cameroon, along a route nowhere exposed to harsh growing conditions (De Langhe, in press).

[5] Hereafter PNG.

About phytolith analysis

Vansina believes that the phytoliths found in Cameroon belong to the genus *Ensete* — the so-called African false banana — rather than *Musa*. In his note he states that phytolith analysis is a "rather recent technique" and, that "no direct laboratory comparison at all was made with phytoliths used in earlier studies especially in Southeast Asia" (Vansina 2003, p. 174-6).

In the case of archaeological research in Africa, phytolith analysis might indeed appear as a "recent technique". Phytolith analyses (even archaeobotany in general) are not frequently requested by archaeologists working on the African continent, and relevant publications regarding the sub-Saharan part are even less frequent (Lejju *et al.* in press; Alexandre *et al.* 1997; Polcyn *et al.* 1997; Mercader *et al.* 2000; Runge 1995, 1999; Vrydaghs and Doutrelepont 2000). On the American, Asian and Australian continents, however, phytolith analyses have been recurrent applications for nearly 40 years (e.g. Twiss *et al.* 1969; Rovner 1971; Piperno 1988; Pinilla *et al.* 1997; Meunier and Colin 2001; Hart and Wallis 2003). These efforts have resulted in the publication of several reference collections (e.g. Geis 1975; Palmer 1976; Palmer and Tucker 1981; Piperno 1989; Rapp and Mulholland 1992; Runge 1996; Ball 2002), some of which are now available online (http://www.missouri.edu/~phyto/index.shtml and http://webpub.byu.net/tbb/).[6] A review of these data allowed one of us (Vrydaghs 2003) to establish a phytolith atlas relying on more than 800 genera and 1500 species. This Atlas substantiates the distinctiveness of the Musa phytoliths.

These developments also provide additional evidence of early banana cultivation. First, it should be mentioned that the Nkang finds are not the first recorded evidence for banana from Africa. In 2001, Runge reported on the occurence of some banana phytoliths from a steep slope near Bunyakiri (Kivu, DR Congo). They date from our era. As to the other published finds of *Musa*, all are from sites in Asia.[7] Of these, the most important breakthrough for archaeologists interested in the cultivation of banana comes from discoveries in PNG, where Wilson reports the occurrence of *Musa* phytoliths at Kuk in the upper valley of the Wahgi River, on Mount Hagen (Wilson 1988). The oldest levels of the site are dated to 10,000 years ago. A detailed analysis suggested that the observed phytoliths correspond to the Eumusa and Ingentimusa sections of the *Musa* genus, but not Australimusa. Even if Wilson found it difficult to discriminate between *M. ingens* and other *Musa* sections, he positively identified Eumusa phytoliths — even if its reference collection includes some *Ensete* material (*E. glaucum* (Roxb.) Cheesman syn. Musa calosperma F. Muell (Simmonds, N.W., 1962)). Hence, Wilson's report does not support Vansina's statement that "it is practically impossible to distinguish between phytoliths of Musa (bananas) and other Musaceae (in this case *Musa ingens*)" (Vansina 2003: 174-76). A programme for the Kundill section at Kuk carried out during the 1990s relying on a multi proxy approach to the analysis of new samples confirmed Wilson's observations (Denham *et al.* 2003; Lentfer 2001). Phytoliths also provide evidence of banana on the island of Watom, eastern PNG (Lentfer and Green 2001). The latter is dated between 400 BC and 650 AD. Elsewhere, phytoliths recovered from sites across Asia provide further evidence of banana in Laos and Malaysia (Bowdery 1999), Pakistan (Madella 1995) and India (Fuller and Madella 2001).

[6] Both web sites present some excellent light and SEM views of *Musa* phytoliths.

[7] Although see the recent reports of possible finds near Munsa in Uganda (Lejju *et al.* 2003).

Some banana phytoliths were also reported from Easter Island garden pits (Cummings 1998; Vrydaghs *et al.* 2004).

When we submitted our paper (Mbida *et al.* 2001) we were aware of only two histological studies relevant to Musaceae (Tomlinson 1959, 1969), and one archaeological study (Wilson 1985). We referred to these papers, as well as to reference collections published for the American (Piperno 1988), Asian (Kealhoffer and Piperno 1998) and African continents (Runge 1996, 1997). All these collections present illustrations of the opal phytolith extracted from *Musa*. They illustrate phytoliths similar to the one we extracted from our reference material, supporting the view that *Musa* phytoliths are mineral bodies with consistent morphology. None of these contributions extensively described the *Ensete* phytolith. Yet, the differentiation of *Ensete* phytoliths from those of any *Musa* phytolith was the very point of our study (Mbida *et al.* 2001).

Vansina's critique that "the comparative material used is too limited" seems to reflect a misunderstanding of the methodological requirements for this specific type of study. Since the phytoliths found at Nkang, if not from banana, alternatively could only have belonged to native African *Ensete* species, an extensive comparative study was undertaken to investigate whether the morphology of *Ensete* phytoliths could be distinguished from the one of the genus *Musa* as suggested by Wilson's paper. Several samples of *Ensete gilletii* and *E. ventricosum*, the only *Ensete* African species, were examined. Since *E. gilettii* is typical of the Cameroon landscape, a specimen from a plant growing there was included in the reference collection, in addition to the specimen from the International *Musa* Germplasm collection. No striking variation in phytolith form was noticed among the examined *Ensete* samples.

On the other hand, *Musa* phytoliths, if present in Africa in ancient times, would necessarily point to an introduction of banana plants from outside the continent. Introduced cultivars could have belonged to any of the banana cultivar genomes AA, AAA, AAB and ABB. Representative cultivars of these genomes groups, were thus examined for their phytoliths. Careful examination of phytolith morphology led us to conclude (1) that variation in phytolith form is hardly noticeable within each genus, and (2) that the form widely differs between the two genera (Mbida *et al.* 2001). All but one of the observed characteristics were mutually exclusive. Consequently, the two phytolith populations for *Ensete* and *Musa*, respectively, are so widely distinct that statistical analysis is not even needed.

In conclusion, we stand by our previous conclusion that the phytoliths from the Nkang site, dating from c. 2500 bp, belong to the genus *Musa* and that they point to banana cultivation in Africa at that time. We accept that the Nkang phytolith finds need to be substantiated by more specimens, preferably from other sites. It would, therefore, be desirable to differentiate AAB plantain from the AAA East African bananas, and efforts to that end are currently being conducted in order to develop an identification key of the phytolith deriving from the genus *Musa*, triploids cultivars included. The key involves qualitative and quantitative criteria (Ball *et al.* 2005a&b, and submitted). Hence, we hope that the present debate encourages more archaeologists to track banana phytoliths in humid tropical Africa in order to apply the *Musa* phytolith identification key for further documenting the antiquity of banana in Africa.

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