Tipití: Journal of the Society for the Anthropology of Lowland South America

Volume 11
Issue 2 *Special Topics: Plant Domestication in Amazonia*

Article 6

2013

A Chronology of the Introduction of Domesticated Plants in Central Brazil

Myrtle P. Shock
Universidade Federal do Amazonas, Manaus, Amazonas, myrtleshock@gmail.com

Renato Kipnis
Scientia, São Paulo

Lucas Bueno
Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina

Francini M. Silva
Laboratório de Arqueologia dos Trópicos, Universidade de São Paulo, São Paulo

ARTICLE

A Chronology of the Introduction of Domesticated Plants in Central Brazil

Myrtle P. Shock
Universidade Federal do Amazonas, Manaus, Amazonas
myrtleshock@gmail.com

Renato Kipnis
Scientia, São Paulo

Lucas Bueno
Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina

Francini M. Silva
Laboratório de Arqueologia dos Trópicos, Universidade de São Paulo, São Paulo

Abstract

The paleoethnobotanical analysis of archaeological remains from two sites in central Brazil provides chronological data for the introduction of domesticated plants to the region. The sites of Lapa dos Bichos and Lapa Pintada, located in the northern portion of the state of Minas Gerais, are within rock shelters in limestone rock outcroppings. The dry conditions at the sites preserved both burnt and unburnt organic materials, including the seeds and fruits that were analyzed in this study. The chronological documentation for the introduction of domesticated plants is based on relative chronology from excavation stratigraphy and radiocarbon dating. The domesticated plants found include maize (*Zea mays*), manioc (cf. *Manihot esculenta*), cotton (cf. *Gossypium barbadense*), peanut (*Arachis hypogaea*), common bean (*Phaseolus vulgaris*), bottle gourd (*Lagenaria siceraria*), and squash (*Cucurbita* spp.). Central Brazil is not documented as the region of origin for these species and as such is a periphery where they were introduced. Maize and manioc are found in the strata dated between 750 and 2000 BP at Lapa dos Bichos and c. 1200 BP at Lapa Pintada; bottle gourd occurs in earlier strata (2000 to 4250 BP at Lapa dos Bichos). In addition to domesticated plants, numerous native plant foods were identified in the archaeological assemblage, such as palm nuts (*Syagrus oleracea*), passion fruit (*Passiflora* spp.), jatobá (*Hymenaea* spp.), umbu (*Spondias tuberosa*), and pequi (*Caryocar brasiliensis*). At the site of Lapa dos Bichos human habitation is known to span the entirety of the Holocene. Based on the archaeological macroscopic plant remains, the introduction of domesticated plants to central Brazil was a gradual process.

Introduction

One aspect of the study of domesticated plants is determining the timing of their introduction to subsistence systems (Zeder et al. 2006). This chronology can be utilized in interpreting the geographic spread of domesticated plants and the integration of domesticated plants into subsistence practices (Pearsall 2000). This article considers a local chronology from central Brazil and its potential implications for the spread of domesticated plants in and through Amazonia. Central Brazil is geographically distant from the locations where domesticated plants originated. The Amazon is the major environment separating central Brazil from these locations. The integration of domestic plants into subsistence practices of populations living

in the scrub forest and savanna environment of central Brazil is not discussed here.

Methods and data analysis

Two archaeological sites from northern Minas Gerais state, Brazil, provide paleoethnobotanical evidence for the chronology of the introduction of domesticated plants to central Brazil: Lapa dos Bichos in the Peruaçu River Valley and Lapa Pintada in the Montes Claros region (Figure 1). Both sites are located in rock shelters in limestone formations where botanical material was preserved due to charring and desiccation. Botanical material was collected from the archaeological deposits using dry screening and flotation techniques. Analysis of preserved botanical material focused on plant seeds and fruits from the size fraction greater than 2 mm. Seeds and fruits were sorted into types by physical morphology and known species.

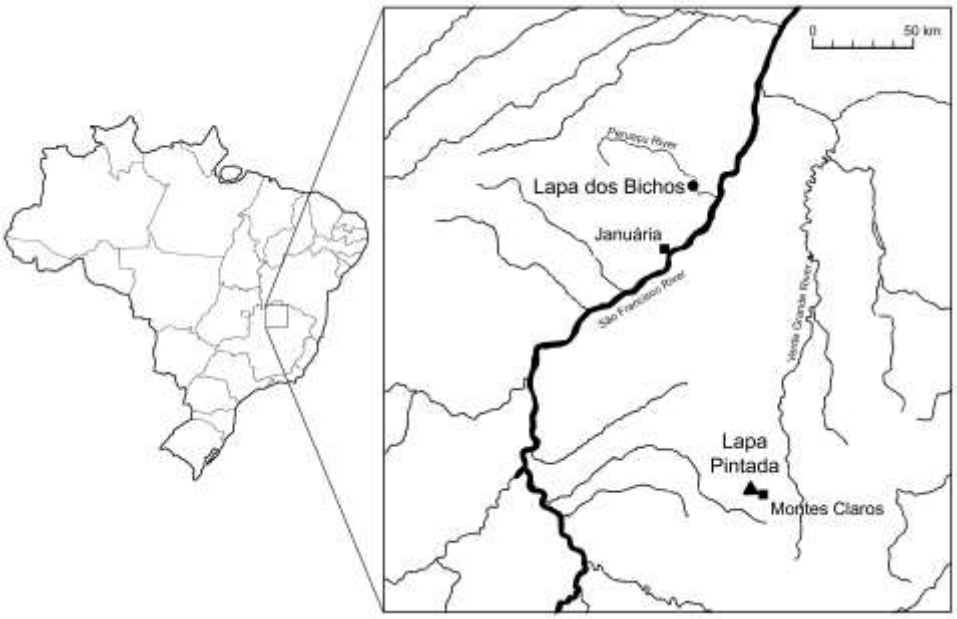

Figure 1: Location of the archaeological sites Lapa dos Bichos and Lapa Pintada in relation to the cities of Januária and Montes Claros, Minas Gerais, Brazil.

Excavations at the archaeological sites were conducted by natural stratigraphic changes or intervals of 5 cm. Charcoal and other organic materials were collected to date the excavation levels. At Lapa dos Bichos, 22 radiocarbon dates distinguished eight archaeological strata that, combined, document human occupation spanning the Holocene (Kipnis 2002). Lapa Pintada is under ongoing investigation, but five radiocarbon dates from the site document at least three divisions in subsistence practices and stratigraphy (Bueno, in press).

Results

The identified botanical types include native foods, domesticated foods, technological plants, and weeds. Native plant foods identified in the archaeological assemblages included palm nuts (*Syagrus oleracea*), passion fruit (*Passiflora* spp.), jatobá (*Hymenaea* spp.), umbu (*Spondias tuberosa*), and pequi (*Caryocar brasiliensis*). The domesticated plant species identified in the archaeological remains are of specific interest to this discussion (Figure 2). A greater range of domesticated plant species was found at Lapa dos Bichos than at Lapa Pintada (Table 1).

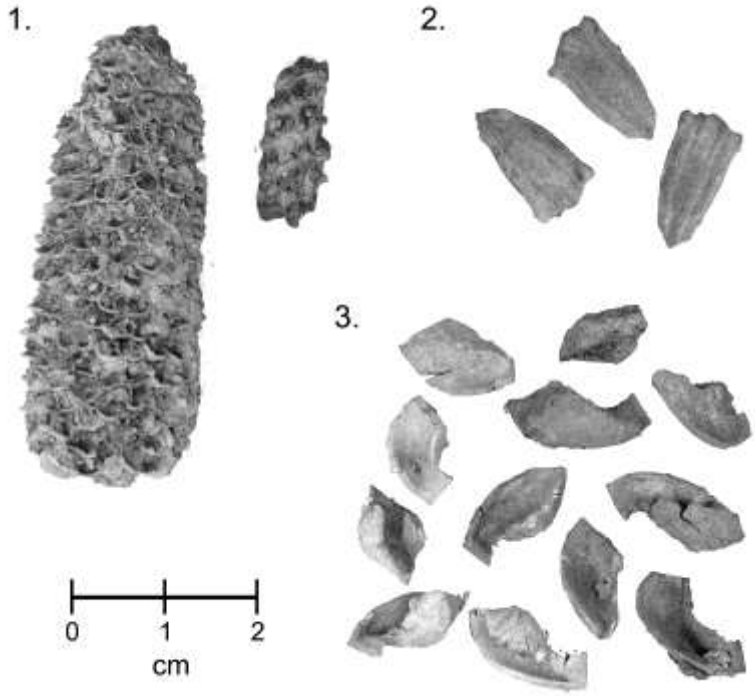

Figure 2: Domesticated plant species include maize (1; *Zea mays* cobs), bottle gourd (2; *Lagenaria siceraria* seeds) and manioc (3; cf. *Manihot esculenta* fruit).

Scientific name	Common name	Lapa dos Bichos	Lapa Pintada
Arachis hypogaea	peanut	x	
Cucurbita spp.	squash	x	
cf. *Gossypium barbadense*	cotton	x	
Lagenaria siceraria	bottle gourd	x	x
cf. *Manihot esculenta*	manioc	x	x
Phaseolus vulgaris	common bean	x	
Zea mays	maize	x	x

Table 1: Domesticated plant species found in archaeological remains at the sites of Lapa dos Bichos and Lapa Pintada, Minas Gerais, Brazil.

The dated strata provide the context to examine the chronology of domesticated plant introductions to the region (Table 2). Due to the differential fragility of plant materials, the quantities of a given species are not compared to that of others. Furthermore, it is impossible to prove the absence of a given item from a culture due to its absence in the archaeological assemblage (Drennan 1996).

Therefore, the discussions are based upon the documented presence of a species. At present the domesticated plant remains, themselves, have not been dated, so refining the timing of their occurrence within the strata where they were found is not possible.

.

Lapa dos Bichos		Lapa Pintada	
150 - 750 BP (stratum 2)	manioc maize squash peanut common bean cotton bottle gourd		
750 - 2000 BP (stratum 3)	manioc maize cotton bottle gourd	800 BP, 1200 BP	maize manioc bottle gourd
2000 - 4250 BP (stratum 4)	bottle gourd manioc* lima bean*	4300 BP, 4400 BP	manioc bottle gourd
4250 - 6500 BP (stratum 5)	none	7000 BP	none

* Identification from very fragmentary remains

Table 2. Distribution of domesticated plants within the archaeological deposits of Lapa dos Bichos and Lapa Pintada, Minas Gerais, Brazil. Dates are based on uncalibrated radiocarbon assays.

Discussion

The long-term and continual occupation of northern Minas Gerais is well-documented (Prous and Rodet, eds. 2009). The paleoethnobotanical data supports a continuous occupation. Furthermore the introduction of domesticated plant species was not an abrupt occurrence; some species were utilized before others. This temporal pattern within the paleoethnobotanical remains supports the inference of group-to-group diffusion of domesticated plant types.

Central Brazil is not the known location of origin for any of the domesticated plants found in the archaeological assemblages. The most probable route by which domesticated plants entered central Brazil was by way of the Amazon. For maize, this route has been demonstrated genetically by Freitas (Freitas et al. 2003; 2013-this volume). Archaeological evidence from central Brazil provides information on the timing and movement of domesticated plants in the lowland Neotropics and a reference for constructing hypotheses for neighboring regions.

Plants as technology transfer to central Brazil

Domesticated plants are not generally considered or analyzed as technologies. However, we argue that the plant itself is a form of technology, a specific new item with certain inherently useful or interesting characteristics that could be transferred between people. The general models for the conveyance of technology are horizontal and vertical transmission (Mulder et al. 2006). Applied regionally, horizontal transmission is group to group diffusion, frequently driven by trade between neighboring groups. Vertical transmission of technology is generally related to maintenance of cultural traditions over generations. Over a geographically expansive area, population migration is a vehicle for vertical transmission.

These methods of technology transfer establish cultural and temporal expectations for the spread of domesticated plants. A very rapid spread of

knowledge is feasible in group-to-group diffusion. In this scenario, the acquisition of domesticated plants may occur without the disruption of cultural continuity within other aspects of life. In human migration, the populations often move with their entire set of cultural knowledge and the pace of expansion of technology would be based on population growth or the submission of other populations. While neither model can be taken as purely predictive for the archaeological record, they provide a general context within which to examine the adoption of domesticated plants.

The archaeological records from Lapa dos Bichos and Lapa Pintada present evidence for the sequential introduction of domesticated plants into central Brazil. Bottle gourd and manioc are the earliest domesticated plants to appear in the archaeological assemblages. Subsequently, maize, and cotton at Lapa dos Bichos, were included in the archaeological deposits. The latest introductions were squash, peanut, and bean, occurring in the archaeological deposits dated between 150 and 750 BP at Lapa dos Bichos.

A model of group-to-group diffusion is the best explanation for the timing and nature of the introduction of domesticated plants to northern Minas Gerais. Supporting evidence is the existence of a chronological gap, as shown stratigraphically, between the introduction of maize and the subsequent appearance of squash, beans, and peanuts. Furthermore, the maintenance of material culture and subsistence practices documented at Lapa dos Bichos, and surrounding sites, contradicts a model of population migration being responsible for the adoption of domesticated plants (Shock 2010).

The concurrent transmission of multiple technologies has often been suggested by archaeologists, in particular an unwritten, underlying link between the spread of ceramic technologies and domesticated plants. Few ceramics are found at the archaeological sites in question. At Lapa dos Bichos, ceramics are found in strata 3, 2 and 1. However, the distribution is counterintuitive. The density of ceramics in features from stratum 3 is four times higher (1.28 ceramic fragments/liter) than in stratum 2 or stratum 1 (0.27 and 0.2 ceramic fragments/liter, respectively). At Lapa Pintada, almost no ceramic fragments have been found. Present archaeological research has not determined how the spread of ceramic technologies across northern Minas Gerais related to the introduction of domesticated plant technology. There is no general pattern, as the model linking ceramics and plants appears to be a possibility for Lapa dos Bichos, where maize and ceramics may have been introduced concurrently, but does not apply to Lapa Pintada.

Chronological comparisons

The documented occurrences of domesticated plants in central Brazil are more recent than the earliest documented occurrences of these plants anywhere else in South America. The western coast provides the majority of the earliest observations. By the fifth millenium BC maize, beans, squash, and bottle gourd were utilized (Erickson et al. 2005; Pearsall 1992). The interval when cotton, manioc, and peanut were first observed dates to between 4000 and 2000 BC (Pearsall 1992). The time gap between the introduction of domesticated plants in western South America and central Brazil suggests that across portions of the Amazon a temporal progression for the transfer of these domesticated plants between populations should be expected. Dates specific for the Amazon are increasing but do not yet present a full picture. In the Ecuadorian Amazon maize phytoliths dating to 6000 BP (calibrated) have been reported (Bush et al. 1989). In the Columbian Amazon maize and manioc predate central Brazilian remains, dating to circa 4700 BP (Mora et al. 1991).

When compared with western South America and northwestern Amazonia, the introduction of domesticated plants species at Lapa dos Bichos and Lapa

Pintada is significantly more recent. This temporal difference is characteristic of the introduction of domesticated plants to central Brazil. However, this study is not the only to document domesticated plants in central Brazil and our dates for plant occurrence are not the earliest available documentation for all species. From published literature, earlier occurrences of maize, beans, and peanut in central Brazil can be indicated. Available dates, like those used in this study, pertain to the archaeological strata in which the plant remains were found. Maize occurs at the site of Santana do Riacho, Minas Gerais state, in a stratum dated between 2800 and 4500 BP (Prous et al. 1991, Resende and Prous 1991). In the São Raimundo Nonato region, Piauí state, the remains of beans and peanut have been dated between 1600 and 1200 BP (Martin 2005).

Implications for the spread of domesticated plants in Amazonia

Archaeological interpretations of cultural chronologies and affinities can employ data on both the chronology of and routes by which domesticated plants spread. The timing of introduction can be used in conjunction with cultural chronologies to better understand temporal changes. Furthermore, the routes by which domesticated plants spread can inform us about cultural affinities or the spread of populations. Paleoethnobotanical data from central Brazil may aid in the construction of both types of hypotheses. It is probable that the introduction of domesticated plants to central Brazil was based on their occurrence and extension within neighboring areas in Amazonia. As such, the archaeological remains from central Brazil provide some minimum dates for the occurrence of these domesticated plants within Amazonia. Furthermore, the gradual introduction of domesticated plants into central Brazil may reflect a similar sequential introduction of the plants into Amazonia.

The times when domesticated plants were available to inhabitants in different parts of the lowland Neotropics is still a question of research; however, the data from central Brazil suggests that domesticated plants were not introduced as a single package. While we can never know if species may have been available before their inclusion in the archaeological record, the progressive nature by which domesticated plants were added to the assemblage suggests that the spread of individual species was somewhat distinct. With further studies, it is likely that we will be able to distinguish overlapping temporal and spatial webs of species dispersal. In the eastern United States, the temporally distinct adoption of maize and beans, introduced domesticates, has been well documented (Scarry 2008; Yarnell 1993). In the lowland Neotropics, distinct spreads might be predicted for plants on the basis of the probable locations of their domestication and subsequent directions of dispersal, among them manioc, maize, and peanuts. The lowland Neotropics are a large and culturally diverse region. The diffusion of plant technology into northern Minas Gerais in no way precludes the spread of a suite of domesticated plants into other locations by means of cultural expansion.

Acknowledgments

Thanks to the colleagues whose participation made this research possible. Paleoethnobotanical analysis was funded by grants from the National Science Foundation and University of California, Santa Barbara. Funding for excavations at Lapa dos Bichos came from the National Science Foundation and the National Council for Scientific and Technological Development (CNPq), Brazil (Grant 402709/03-9). The excavations at Lapa Pintada were funded by FAPEMIG, Brazil (SHA 00234/07) and CNPq (Grant 400425/2008-4). Renato Kipnis also thanks CNPq for a research scholarship (Fellowship 300892/2005-5).

References

Bueno, Lucas

in press Tecnologia e território no centro-norte mineiro: um estudo de caso na região de Montes Claros, MG, Brasil. *Arqueología Suramericana*.

Bush, Mark B., Dolores R. Piperno, and Paul A. Colinvaux

1989 A 6,000 year history of Amazonian maize cultivation. *Nature* 340:303-305.

Drennan, Robert D.

1996 *Statistics for archaeologists: a commonsense approach*. Plenum Press, New York.

Erickson, David L., Bruce D. Smith, Andrew C. Clarke, Daniel H. Sandweiss, and Noreen

Tuross. 2005 An Asian origin for a 10,000-year-old domesticated plant in the Americas. *PNAS* 51:18315-18320.

Freitas, Fabio Oliveira, Gerhard Bendel, Robin G. Allaby, and Terence A. Brown

2003 DNA from primitive maize landraces and archaeological remains: implications for the domestication of maize and its expansion in South America. *Journal of Archaeological Science* 30:901-908.

Kipnis, Renato

2002 Foraging societies of eastern central Brazil: an evolutionary ecological study of subsistence strategies during the terminal Pleistocene and early/middle Holocene. Unpublished Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Martin, Gabriela

2005 *Pré-história do nordeste do Brasil*. Editora Universitária, Universidade Federal de Pernambuco, Brazil.

Mora C., Santiago, Luisa Fernanda Herrera, Inés Cavelier F., and Camilo Rodríguez

1991 *Cultivars, anthropic soils and stability: a preliminary report of archaeological research in Araracuara, Columbian Amazonia*. University of Pittsburgh Latin American archaeology reports, no 2. Programa Tropenbos, Bogotá, Colombia

Mulder, Monique Borgerhoff, Charles L. Nunn, and Mary C. Towner

2006 Cultural macroevolution and the transmission of cultural traits. *Evolutionary Anthropology* 15:52-64.

Pearsall, Deborah M.

1992 The origins of plant cultivation in South America. In *The origins of agriculture: an international perspective,* edited by C. Wesley Cowan and Patty J. Watson, pp. 173-205. Smithsonian Institution Press, Washington.

2000 *Paleoethnobotany: a handbook of procedures*, 2nd edition. Academic Press, San Diego.

Prous, André, and Maria Jacqueline Rodet, Eds.

2009 Arqueologia do vale do Rio Peruaçu e adjacências - Minas Gerais. *Arquivos do Museu de História Natural da Universidade Federal de Minas Gerais Vol. XIX*. Belo Horizonte, Brazil.

Prous, André, Paulo A. Junqueria, Ione M. Malta, and Y. Chausson

1991 Métodos de escavação, estratigrafia arqueologica e datações. Santana do Riacho - Tomo I. *Arquivos do Museu de História Natural, Universidade Federal de Minas Gerais* 12:67-83.

Resende, Eunice T., and André Prous

1991 Os vestigios vegetais do grande abrigo de Santana do Riacho. In Santana do Riacho - Tomo I. *Arquivos do Museu de História Natural, Universidade Federal de Minas Gerais Vol. XII:* 87-111.

Scarry, C. Margaret

2008 Crop husbandry practices in North America's eastern woodlands. In *Case studies in environmental archaeology*, edited by Elizabeth J. Reitz, C. Margaret Scarry and Sylvia J. Scudder, pp. 391-404. Springer, New York.

Shock, Myrtle P.

2010 Holocene hunter-gatherer plant use and foraging choice: a test from Minas Gerais, Brazil. Unpublished dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Anthropology. University of California, Santa Barbara.

Yarnell, Richard A.

1993 The importance of native crops during the Late Archaic and Woodland periods. In *Foraging and farming in the eastern woodlands*, edited by C. Margaret Scarry, pp. 13-26. University Press of Florida, Gainesville.

Zeder, Melinda A., Eve Emshwiller, Bruce D. Smith, and Daniel G. Bradley

2006 Documenting domestication: the intersection of genetics and archaeology. *TRENDS in Genetics* 22:139-155.