



Tradiciones & transformaciones en Etnobotánica

MARÍA LELIA POCHETTINO
ANA H. LADIO
PATRICIA M. ARENAS
(EDITORAS)



Editor responsable:

**CYTED - Programa Iberoamericano Ciencia
y Tecnología para el Desarrollo**

Coordinación de la edición:

**Red Iberoamericana de Saberes y Prácticas Locales
sobre el Entorno Vegetal (RISAPRET)**

Nilda Dora Vignale (Coordinadora)

Facultad de Ciencias Agrarias

Universidad Nacional de Jujuy

Alberdi 47

4600 San Salvador de Jujuy

Argentina

Tel.: + 54 388 422-1548

ndvignale@yahoo.com.ar

www.fca.unju.edu.ar/risapret

© 2010

ISBN: 978-84-96023-95-6



Impreso en Argentina.

Todos los derechos reservados. Esta publicación no puede ser reproducida, en todo ni en parte, ni registrada en o transmitida por un sistema de recuperación de información, en ninguna forma ni por ningún medio, sea mecánico, fotoquímico, electrónico, magnético, electroóptico, por fotocopia, o cualquier otro, sin el permiso previo por escrito de los autores.

PLANT DOMESTICATION AND MAN-PLANT DEGREES OF DEPENDENCE
IN THE PRE-HISPANIC CULTURAL DEVELOPMENT OF ARGENTINEAN NORTHWEST**Verónica S. Lema***Laboratorio de Etnobotánica y Botánica Aplicada,
Departamento Científico de Arqueología, FCNYM - UNLP, CONICET
vslema@hotmail.com***ABSTRACT**

LEMA, V. 2010. Plant domestication and man-plant degrees of dependence in the pre-Hispanic cultural development of Argentinean Northwest. Plant domestication in the Argentinean Northwest was analysed from a palaeoethnobotanical perspective focused on the identification of degrees of dependence in Man-plant relationships. Methodology consisted in anatomical, morphological and biometrical analysis of archaeobotanical macroremains of *Cucurbita* sp. and *Phaseolus vulgaris* L.. The obtained results show the absence of a *continuum* of transformation in a lineal transition from the wild to the domesticated form in both taxa. Instead, archaeological record evidences the existence in the past of wild-weedy-crop complexes, resulting from husbandry practices and selective pressures which enhanced diversity over homogeneity.

Keywords: domestication, Argentinean Northwest, Palaeoethnobotany.

RESUMEN

LEMA, V. 2010. Domesticación vegetal y grados de dependencia ser humano – planta en el desarrollo cultural prehispánico del noroeste argentino. La domesticación vegetal en el Noroeste argentino fue analizada desde una perspectiva paleoetnobotánica centrada en la identificación de grados de dependencia en las relaciones Hombre-planta. La metodología consistió en análisis anatómicos, morfológicos y biométricos de macrorestos arqueobotánicos de *Cucurbita* sp. y *Phaseolus vulgaris* L.. Los resultados obtenidos muestran la ausencia de un *continuum* de transformaciones en una transición lineal entre la forma silvestre y domesticada de ambos taxa. En su lugar, el registro arqueológico evidencia la existencia en el pasado de complejos silvestre-maleza-cultivo, resultantes de prácticas de manejo y presiones selectivas que propiciaron la diversidad por sobre la homogeneidad.

Palabras clave: domesticación, Noroeste argentino, Paleoetnobotánica.

INTRODUCTION

This paper aim is to study plant domestication through the identification of degrees of dependence in Man-plant relationships (Harlan, 1992) during pre-Hispanic cultural developments at the Andean South-central Area in general, and at the Argentinean Northwest in particular. The degrees of dependence are included in a *continuum* of local transformations in which Man-plant interactions change through time (Ford, 1985). Interactions changed as husbandry practices and cultural selection criteria

did in the past. These changes will be analysed from a palaeoethnobotanical perspective. Palaeoethnobotany has the same study object as Ethnobotany, but differs from it in chronology, working with evidence of past societies such as the archaeological record (Giovannetti et al., 2008). When studying archaeobotanical remains in a diachronic perspective, cultivated plants will be considered as cultural artefacts (Ford, 1985; Balée 1998), being their morphological changes footprints of past human practices (Hillman et al., 1993).

MATERIALS AND METHODS

Methodology consisted in the anatomical, morphological and biometrical analysis of archaeological macroremains of *Cucurbita maxima* Duch. ex Lam. and *Phaseolus vulgaris* L. from Andean South-central Area, since is believed that both taxa were domesticated on it (Piperno & Pearsall, 1998). As is the domestication process in general the one studied in this paper, and not only the first stages linked to the so-called "origins of agriculture", archaeological sites considered belong to different periods. The archaeobotanical macroremains analysed were recovered in the following sites: Cerro Lampay (Vega Centeno, 2005), Bandurria (centre and south of Perú), Tulán 85 (northern Chile) (3000-1000 AC); Huachichocana III (ca. 8000 AC- 1600 DC) (Fernandez Distel, 1986), SSaLap20 (ca. 9960 AP-2000 AP) (Lema, 2009), Puente Río La Viña I (1440 AP =510 DC) (Escobar, 2008), Pampa Grande (1720 +/-50 AP = 260-430 DC) (González, 1972), Cueva de los Corrales (2060 AP) (Olizweski et al., in press), Los Viscos (ca. 500 AC- 1536 DC) (Korstanje & Würschmidt, 1999) and El Shincal (1435 – 1536 DC) (Capparelli, 1997) at the Argentinean Northwest.

Cucurbita maxima Duch. ex Lam. subsp. *maxima* and *Phaseolus vulgaris* L. var. *vulgaris* populations are sympatric with their wild counterparts, which causes hybridization and mixture problem, since both taxa are interfertile.

Evolutionary changes under domestication from *C. maxima* Duch. ex Lam. subsp. *andreana* Naudin Filov to *C. maxima* subsp. *maxima* involved: seed, fruit and peduncle increase in size; diversification of fruit characters (shape, lobes, warts, colours), lost of toxic substances (cucurbitacin), among others (Cutler & Whitaker, 1961; Nee, 1990; Piperno & Pearsall, 1998). Changes from *Phaseolus vulgaris* L. var. *aborigineus* (Burk.) Baudet to var. *vulgaris* were mainly two: increase in seeds size with diversification of shape and colours, and fruit (legume) becoming indehiscent, with the concomitant anatomical changes in the orientation of pod tissues related to active-twisting dehiscence (Gepts & Debouck, 1991; Herrera Flores et al., 2005). Weedy forms resulting from introgression events are characterized by pods and/or seeds bigger than wild ones, but with wild colour pattern and dehiscent pods; or cultivated beans with seeds smaller than domesticated ones (Freyre et al., 1996).

Reference collections of both taxa were constituted. The cucurbitaceae reference collection included seeds, fruits and peduncles from different populations of South American taxa: *Lagenaria siceraria* (Mol.) Standl. subsp. *siceraria* (Kobiak.) Heiser, *C. ficifolia* Bouché, *C. moschata* Duch., *C. maxima* subsp. *andreana* and *C. maxima* subsp. *maxima* including seven different landraces. *Phaseolus* reference collection included seeds and fruit of different population of both varieties (*vulgaris* and *aborigineus*).

RESULTS

Cucurbitaceae reference collection

Through micro-morphological seed's testa analysis a dichotomous key for species differentiation was made, including micro-morphological quantitative changes in testa after experimental charring at 300°C during 120' (Lema et al., 2008). Macroscopical and biometrical *C. maxima* seeds analysis showed no overlapping in length and width measurements between *C. maxima* subsp. *maxima* and *C. maxima* subsp. *andreana* before and after experimental charring. By means of the quantitative analysis of rind thickness, a range of measurements which represents *C. maxima* subsp. *andreana* was obtained. The anatomical analysis allowed the recognition of several qualitative and quantitative traits of rind tissues, useful to distinguish the different members of the Cucurbitaceae. Peduncles are the best elements to identify Cucurbita species and the increase in their diameter is a fine indicator of changes occurred under domestication. *C. maxima* subsp. *maxima* peduncles can be distinguished from the ones of subspecies *andreana* considering their basal diameter. Peduncle diameter, fruit size and rind thickness increase are correlated from an evolutionary point of view.

Phaseolus vulgaris reference collection

Macroscopical quantitative and qualitative seed characters (length, width, thickness, shape and colour) are useful to distinguish both varieties. In the pods, superficial cuticle striation (more noticeable in var. *aborigineus*); stoma length (with a small range of measurements overlapping) and pod thickness (no overlapping) are traits that can be used to distinguish between wild and domesticated forms.

In order to study changes in the mechanism of dehiscence, orientation of pod tissues in three different sections (cross section, tangent to surface and longitudinal section) in three pods area (faces and dorsal and ventral sutures) were analyzed, finding diagnostic differences between *aborigineus* and *vulgaris* varieties.

Archaeobotanical remains analysis

Results of morphological, anatomical and biometrical analysis of archaeobotanical macroremains can be seen in table 1 for *Cucurbita* sp. and in table 2 for *Phaseolus vulgaris*.

Table 1. Archaeobotanical *Cucurbita* sp. remains. "Intermediate" are those which has characters registered in modern populations of both subspecies of *C. maxima*. In taxonomic identifications the term *affinis* is used to indicate that the remain belongs to the mentioned taxa or to a one close to it, the inaccuracy is due to the lack of certain traits as a result of preservation problems, or to the presence of a combination of characters not registered in reference material (this is also signed as "novel trait" in the table). In the "Taxonomic identification" columns the quantity of remains which corresponds to the category (novel-intermediate) or taxon mentioned is bracketed.

Archaeological site	Organ	Quantity. Preservation state	Methodology	Taxonomic identification	Methodology	Taxonomic identification
Pampa Grande Los Aparejos cave	Seed	9 entire and dry	Testa anatomy, qualitative and quantitative analysis of tissues which form part of it.	<i>C. maxima</i> aff. subsp. <i>maxima</i> (9) With novel traits (6)	Macroscopic and biometrical characters (length and width only in those remains which are entire and identified as <i>C. maxima</i> or related taxa).	<i>C. maxima</i> subsp. <i>maxima</i> (9)
Pampa Grande El Litro cave		1 entire and dry		<i>C. maxima</i> aff. subsp. <i>maxima</i>		<i>C. maxima</i> subsp. <i>maxima</i>
Pampa Grande Cavern III		1 entire and dry		<i>C. aff. maxima</i> subsp. <i>maxima</i> or <i>moschata</i> With novel traits		
Puente Río La Viña		3 entire and 4 charred fragments		<i>C. maxima</i> aff. subsp. <i>maxima</i> (4), <i>C. aff. maxima</i> with novel traits (2), <i>C. maxima</i> aff. subsp. <i>andreana</i> (1)		<i>C. maxima</i> subsp. <i>maxima</i> (2) Intermediate (1)
SSalLap20		3 entire and dry		---		<i>C. maxima</i> subsp. <i>maxima</i> (2) Intermediate (1)
Los Viscos		2 entire and dry		<i>C. aff. moschata</i> (1), <i>C. maxima</i> aff. subsp. <i>maxima</i> (1)		<i>C. maxima</i> subsp. <i>maxima</i> (1)
El Shincal		1 entire and charred		<i>C. maxima</i> subsp. <i>maxima</i> aff. cv. zapallito		<i>C. maxima</i> subsp. <i>maxima</i>
Cerro Lampay		5 entire and dry		<i>C. aff. maxima</i> subsp. <i>maxima</i> or <i>moschata</i> (2), <i>C. aff. maxima</i> subsp. <i>maxima</i> (2), <i>C. aff. maxima</i> subsp. <i>andreana</i> (1),		<i>C. maxima</i> subsp. <i>maxima</i> (2) Intermediate (1)
Bandurria		3 entire and dry		<i>C. aff. maxima</i> (1), <i>C. maxima</i> aff. subsp. <i>maxima</i> or <i>moschata</i> (2),		<i>C. maxima</i> aff. ssp. <i>andreana</i>

Archaeological site	Organ	Quantity. Preservation state	Methodology	Taxonomic identification	Methodology	Taxonomic identification
Pampa Grande Los Aparejos cave	Rind	43 dry fragments	Anatomy, qualitative and quantitative studies of tissues which form part of the rind.	<i>C. maxima</i> subsp. <i>andreaana</i> (6) <i>C. maxima</i> aff. <i>C. maxima</i> subsp. <i>andreaana</i> (5) <i>C. maxima</i> subsp. <i>maxima</i> (29) <i>Cucurbita</i> sp. (3)	Macroscopic and biometrical characters (thickness, only in those remains which are entire and identified as <i>C. maxima</i> or related taxa)	<i>C. maxima</i> subsp. <i>andreaana</i> (10) Intermedio (3) <i>C. maxima</i> subsp. <i>maxima</i> (27)
Pampa Grande El Litro cave		6 dry fragments		<i>C. maxima</i> subsp. <i>maxima</i> (4) <i>Cucurbita</i> sp. (2)		<i>C. maxima</i> subsp. <i>maxima</i> (4)
Pampa Grande Cavern II		1 dry fragment		<i>C. maxima</i> subsp. <i>maxima</i>		<i>C. maxima</i> subsp. <i>maxima</i>
Cueva de los Corrales		1 dry fragment		---		<i>C. maxima</i> subsp. <i>andreaana</i>
Huachichocana III		2 dry fragments		---		<i>C. maxima</i> subsp. <i>maxima</i> (2)
Cerro Lampay		9 dry fragments		<i>aff. C. moschata</i> lignified (8), <i>C. maxima</i> subsp. <i>maxima</i> aff. cv. <i>zipinka</i> (1)		<i>C. maxima</i> subsp. <i>maxima</i> (1)
Pampa Grande Los Aparejos cave	Peduncle	5 dry remains	Qualitative external morphology	<i>C. maxima</i> subsp. <i>maxima</i> (5)	Macroscopic and biometrical characters (basal diameter)	<i>C. maxima</i> subsp. <i>maxima</i> cv <i>zapallito</i> (1) Intermediate (4)
Pampa Grande El Litro cave		3 dry remains		<i>C. maxima</i> subsp. <i>maxima</i> (2) <i>C. ficifolia</i> (1)		<i>C. maxima</i> subsp. <i>maxima</i> cv <i>zapallito</i> (1) Intermediate (1)
Pampa Grande Cavern II		1 dry remain		<i>C. maxima</i> subsp. <i>maxima</i>		<i>C. maxima</i> subsp. <i>maxima</i> cv <i>zapallito</i>
Pampa Grande Cavern IV		1 dry remain		<i>C. maxima</i> subsp. <i>maxima</i>		Intermediate
Los Viscos		10 dry remains		<i>C. maxima</i> subsp. <i>maxima</i> (6), <i>C. moschata</i> (1), <i>C. aff. moschata</i> (3)		Intermediate (6)
El Shincal		1 charred remain		<i>C. moschata</i>		---

Table 2. Archaeobotanical *Phaseolus vulgaris* remains. “Intermediate” are those which has metric characters registered in modern populations of both varieties. “Novel” traits refer to those not found in the reference collection. In the “Taxonomic identification” columns the quantity of remains which corresponds to the category (novel-intermediate) or taxon mentioned is bracketed. Taxonomic identification of the same remains can vary according to the traits considered and the methodology applied.

Archaeological site	Organ	Quantity. Preservation state.	Methodology	Taxonomic identification.	Methodology	Taxonomic identification.
Huachichocana III	Seed	2 entire dry	Macroscopical characters, qualitative (colour) and biometrical (length, width, height and shape).	<i>P. vulgaris</i> var. <i>vulgaris</i>		
SSalLap20		1 entire dry		Intermediate		
Pampa Grande		2685 entire dry		<i>P. vulgaris</i> var. <i>vulgaris</i> (2683) <i>P. vulgaris</i> var. <i>aborigineus</i> (2)		
Pampa Grande	Pod	4 entire dry valves	Anatomical characters of tissues which are part of the pod pericarp.	Intermediate and with novel traits (4).	Cuticle striation.	<i>P. vulgaris</i> var <i>vulgaris</i> (2) <i>P. vulgaris</i> var <i>aborigineus</i> (2)
					Stoma length.	Intermediate (4)
					Pericarp thickness.	<i>P. vulgaris</i> var <i>vulgaris</i> (4)

DISCUSSION

Results of *Cucurbita* sp. archaeobotanical macroremains analysis

Morphological, biometrical and anatomical analysis of archaeobotanical macroremains corresponding to different useful organs allowed the identification of wild, cultivated but non domesticated and domesticated remains of *C. maxima* in the archaeological record of early sites from South-central Andean Area. The presence of plants with a different degree of association with human societies in the same archaeological contexts points to the absence of a *continuum* of transformations through a lineal evolutionary process in this taxon.

Different use and selection traditions in the genus *Cucurbita* was inferred since in archaeological contexts from Argentinean Northwest's eastern slopes remains of *C. maxima* subsp. *andrea* and *C. ficifolia* were identified; while in sites from Peru, Chile and Argentinean Western-Central area and Northwest's longitudinal valleys those taxa were not identified, but the presence of *C. moschata* was detected.

Results of *Phaseolus vulgaris* archaeobotanical macroremains analysis

In Pampa Grande seed analysis showed the presence of wild and domesticated varieties, but pod analysis evidenced a greater diversity with some remains having a combination of characters founds in *vulgaris* and *aborigineus* legumes, and other having novel traits no detected in the reference collection. The only seed found in SSalLap20 presents a combination of traits present in both modern *P. vulgaris* varieties. Other formative archaeological sites also have archaeobotanical remains of both varieties in the same archaeological contexts.

CONCLUSIONS

Both *C. maxima* and *P. vulgaris* archaeobotanical macroremains from Archaic and Formative archaeological sites have a combination or novel characters respect to modern wild and domesticated subspecies and varieties. We can not consider these “intermediate” characters as “transitional” ones since remains which have them are found in the same archaeological contexts as spontaneous and domes-

ticated forms, being the only exception *P. vulgaris* seed from SSaLap20, but this seed was the only one recovered.

Until present there isn't a stage of sole exploitation of wild *C. maxima* subsp *andreana* or *P. vulgaris* var. *aborigineus* in the archaeological record of South America, so we can't reconstruct a *continuum* of transformations through time in Man-plant interactions from wild to domesticated form. Instead, we have recognized wild-weed-crop complexes due to the probably absence of reproductive isolation in the past, being hybridization allowed or even promoted by husbandry practices. Those ancient practices encouraged diversity through the absence of homogeneous selective pressures, allowing (or promoting) interbreeding and different uses given to the same taxa. These seems much as an horticultural –rather than agricultural- system, suggesting that selection criterions and husbandry practices were under the domestic unit control, which coincide with the level of production organization assumed for the first farmer societies at the Argentinian Northwest.

BIBLIOGRAPHY

- Balée, W., 1998. Historical ecology: premises and postulates, in W. Balée (ed.), *Advances in historical ecology*, pp. 13-29. Nueva York, Columbia University Press.
- Capparelli, A. 1997. *Reconstrucción ambiental de la instalación arqueológica Inka El Shincal*. Doctoral thesis. Facultad de Ciencias Naturales y Museo. Universidad Nacional de La Plata. Unpublished.
- Cutler, H. & T. Whitaker. 1961. History and distribution of the cultivated cucurbits in the Americas. *Amer. Antiquity* 26 (4): 469-485
- Escobar, J. M. 2008. *Periodo formativo inferior del Valle de Salta (Salta, Argentina) Una interpretación*. Buenos Aires, La Terminal Gráfica.
- Fernández Distel, A. 1986. Las cuevas de Huachichocana, su posición dentro del precerámico con agricultura incipiente del Noroeste argentino. *Beitrag zur allgemeinen und vergleichenden Archäologie* 8: 353-430.
- Ford, R. 1985. Patterns of prehistoric food production in North America. *Anthropological Papers* 75: 341- 364.
- Freyre, R., R. Ríos, L. Guzman, G. Debouck & P. Gepts. 1996. Ecogeographic distribution of *Phaseolus* spp. (Fabaceae) in Bolivia. *Econ. Bot.* 50(2): 195-215.
- Gepts, P. & D. Debouck. 1991. Origen, domestication and evolution of the common bean (*Phaseolus vulgaris* L), in: A. van Schoonhoven & O. Voyses (eds.) *Common beans: research for crop improvement*, pp 7-53. Wallingford: CAB International.
- Giovannetti, M., A. Capparelli & M.L. Pochettino. 2008. La arqueobotánica en Sudamérica ¿hacia un equilibrio de enfoques? Discusión en torno a las categorías clasificatorias y la práctica arqueobotánica y paleoetnobotánica, in: S. Archila, M. Giovannetti & V. Lema (comp.) *Arqueobotánica y teoría arqueológica. Discusiones desde Sudamérica*, pp: 17-34. Bogotá, UNIANDES.
- González, A. R. 1972. Descubrimientos arqueológicos en las Serranías de Las Pirguas, Pcia. de Salta. *Revista de la Universidad Nacional de La Plata* 24: 388-392
- Harlan, J. 1992. *Crops and man*. 2da. ed. Madison, American Society of Agronomy, Inc.
- Herrera Flores, T., E. Cárdenas Soriano, J. Ortiz Cereceres, J. Acosta Gallegos & M. Mendoza Castillo. 2005. Anatomía de la vaina de tres especies del género *Phaseolus* *Agrociencia* 39: 595-602
- Hillman, G., S. Wales, F. McLaren, J. Evans & A. Butler. 1993. Identifying problematic remains of ancient plant foods: a comparison of the role of chemical, histological and morphological criteria. *World Archaeology* 25(1): 94-121.
- Korstanje, M. A. & A. Würschmidt. 1999. Producir y recolectar en los valles altos del NOA: Los Viscos como caso de estudio, in: C. Aschero, M. A. Korstanje & P.M. Vuoto Eds. *En los tres reinos: prácticas de recolección en el Cono Sur de América*, pp:151-160. San Miguel de Tucumán, Magna Publicaciones.
- Lema, V. 2009. Domesticación vegetal y grados de dependencia ser humano – planta en el desarrollo cultural prehispánico del Noroeste argentino. Doctoral thesis. Facultad de Ciencias Naturales y Museo. Universidad Nacional de La Plata. Unpublished.
- Lema, V., A. Capparelli & M. L. Pochettino. 2008. Taxonomic identification of *Cucurbita* species through seed coat micromorphology: implications for dry and carbonized archaeological remains *Veg. Hist. & Archaeobot* 17 (Suppl. 1): 277-286.
- Nee, M. 1990. The domestication of *Cucurbita* (Cucurbitaceae). *Econ. Bot.* 44 (3) Supplement: Bretting (ed.) *New perspectives on the origin and evolution of New World domesticated plants*: 56- 68.
- Oliszewski, N., J. Martínez & M. Caria. In press. Ocupaciones prehispánicas en una quebrada de altura: el caso de Cueva de Los Corrales I (El Infiernillo, Tafi del Valle, Tucumán). *Relaciones de la sociedad argentina de antropología*.
- Piperno, D. & D. Pearsall. 1998. *The origins of agriculture in lowland tropics*. San Diego, Academic Press.
- Vega-Centeno Sara-Lafosse, R. 2005. *Ritual and architecture in a context of emergent complexity: A perspective from Cerro Lampay, a late archaic site in the Central Andes*. Doctoral thesis. Universidad de Arizona. Unpublished.