

Wild pejibaye (*Bactris gasipaes* Kunth var. *chichagui*) in Southeastern Amazonia

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RESUMO – (Pupunha brava (*Bactris gasipaes* Kunth var. *chichagui*) no sudeste da Amazônia). As distribuições geográfica e da variação morfo-genética de populações silvestres e cultivadas de espécies agrícolas são informações essenciais para identificar o centro de origem de um cultivo. A pupunha (*Bactris gasipaes* Kunth) é a única palmeira domesticada nos Neotrópicos, cujos frutos amidosos e oleosos são produtos de subsistência e cujo palmito é um agronegócio em expansão. A origem da pupunha é desconhecida, mas provavelmente pode ser encontrada na distribuição de *B. gasipaes* var. *chichagui* do tipo 1, até agora encontrado apenas no sudoeste da Amazônia. Uma nova área de ocorrência deste tipo foi encontrada ao redor de São Félix do Xingu, Pará, Brasil, 52°41' W 6°34' S, cerca de 600 km ao nordeste da próxima população ao oeste, no centro de Mato Grosso, Brasil. As plantas dessa população são um pouco menos robustas que as de outras populações do tipo 1 e possuem cachos de frutos menores (60-70 frutos), frutos menores (0,45 g e 10 por 9 mm) e sementes menores (0,23 g e 6,5 por 7,4 mm) que os relatados anteriormente. Embora essas populações sejam disjuntas das relatadas previamente, é pouco provável que outras populações estejam ausentes entre São Félix e o centro de Mato Grosso, o que expande a distribuição da variedade *chichagui* tipo 1 em cerca de 30% e a redefine como um componente típico das florestas transicionais úmidas / semi-úmidas ao sul da Amazônia, em vez de um elemento dos Andes que está expandindo sua presença na região.

Palavras-chave: expansão de distribuição, morfometria de frutos e sementes, origem do cultivo, pupunha silvestre, botânica econômica

ABSTRACT – (Wild pejibaye (*Bactris gasipaes* Kunth var. *chichagui*) in Southeastern Amazonia). The geographical distribution and morpho-genetic variation of wild and domesticated populations of a crop species are essential information for identifying a center of origin. The pejibaye (*Bactris gasipaes* Kunth) is the only domesticated neotropical palm, whose starchy-oily fruits are subsistence products and whose heart-of-palm is an expanding agribusiness. The origin of pejibaye is unresolved, but probably will be found in the distribution of type 1 *B. gasipaes* var. *chichagui* in southwestern Amazonia. A new area of occurrence of this type is reported around São Felix do Xingu, Pará, Brazil, 52°41' W 6°34' S, about 600 km northeast of the eastern-most known population, in central Mato Grosso, Brazil. The plants of this population are slightly less robust than other type 1 plants and have small fruit bunches (60-70 fruit), small fruit (0.45 g and 10 by 9 mm) and seed (0.23 g and 6.5 by 7.4 mm), all smaller than previous descriptions. Although this find is disjunct from earlier reports, it is unlikely that other populations are absent between it and central Mato Grosso, expanding type 1 var. *chichagui*'s distribution by 30% and redefining it as a typical element of the transition between humid and semi-humid forests across southern Amazonia, rather than an Andean element expanding into the region.

Key words: range expansion, fruit and seed morphometrics, crop origin, economic botany

Introduction

The pejibaye (*Bactris gasipaes* Kunth) is the only domesticated neotropical palm. The location of its center of origin as a crop has been debated for more than a century (Clement 1995; Mora Urpí *et al.* 1997), but not enough solid evidence is available to reach agreement yet. As with other crops, multiple lines of evidence must be woven together to identify the center of origin. Among these, the geographical distribution and morpho-genetic variation of wild and domesticated

populations of the species are essential, as is a clear phylogenetic hypothesis that relates these. This paper provides one more piece of evidence.

Henderson (2000) offered a revised systematic treatment of *Bactris* and a new phylogenetic hypothesis about pejibaye. This hypothesis united all wild populations of pejibaye into var. *chichagui* (H. Karsten) Henderson and all cultivated populations into var. *gasipaes*, and proposed that the cultivated populations originated from the wild variety. Individual wild populations had previously held species status within

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Guilielma (as either a genus or sub-genus; reviewed in Clement 1995; Mora Urpí *et al.* 1997), creating a situation of one species giving rise to a cultigen (a species known only in cultivation), which is unacceptable phylogenetically.

Henderson (2000) observed that there are three fruit types within var. *chichagui*: the first type has subglobose fruits (1.0-1.5 cm diam.) and ellipsoid endocarps (a smaller version of var. *gasipaes*) and is found in southwestern lowland Amazonia; the second type is similarly small, has subglobose fruit and endocarps, and is found in the northwestern low to mid-elevation Andes in Colombia and Venezuela, on both sides of the mountains; the third type is larger (1.5-2.3 by 1.5-1.8 cm), with almost ovoid fruits and ellipsoid endocarps (also a smaller version of var. *gasipaes*), and occurs in populations scattered along the Andes and adjacent lowlands from Costa Rica to Bolivia. Mora Urpí (1999) listed several type 3 populations in Ecuador, Colombia, Panama and Costa Rica that were not included in Henderson's analysis. Ferreira (1999) proposed that southern populations of var. *chichagui* (as *B. macana* (Mart.) Pittier) are ancestral to var. *gasipaes* because of endocarp shape and germinal pore position, but did not discriminate between Henderson's (2000) types 1 and 3. This suggests that var. *chichagui* needs further study, although this will not be attempted here.

Henderson (2000) also suggested the possibility that *Martinezia ciliata* Ruiz & Pavon, the first wild pejibaye described (1798) and found in the lower Andes on the west side of the Ucayali River, was based on a mixture of fruit types (1 and 3), but he himself had not seen the holotype. Henderson (2000) also concluded that Barbosa Rodrigues' *Guilielma mattogrossensis* (1898) is a type 1 var. *chichagui*; the type locality is in central Mato Grosso (Brasil). Huber (1904) described a type 1 population in southern Amazonas (Brazil) and a type 3 population near the mouth of the Ucayali River (Peru), when naming *Guilielma microcarpa*. Clement *et al.* (1989) described several allopatric populations (as *B. dahlgreniana* Glassman) of type 1 in Acre and Rondonia (Brazil) and a population of type 3 in Ucayali (Peru). Saldías Paz (1991) described a type 1 population near Santa Cruz, Bolivian Amazonia (as *B. dahlgreniana*). Clement *et al.* (1999) described sympatric populations (as *B. dahlgreniana*) of type 1 (denominated type Acre) and 3 (type Ucayali) in far western Amazonas (Brasil). All of these populations are now var. *chichagui* and occur in

lowland southwestern Amazonia. We here report a new find of type 1 var. *chichagui* in southeastern Amazonia, significantly extending the geographical range and modifying the morphological extremes of this variety.

Wild pejibaye in São Felix do Xingu – São Felix do Xingu, Pará, Brazil, 52°41' W 6°34' S, is located at a bend of the Xingu River, where the Fresco River joins the Xingu. Rainfall is close to 1,750 mm per year, with a strongly pronounced dry season never less than 6 months in duration. Altitude varies from 150 m above sea level near the river to 220 m a.s.l. on nearby plateaus. This region originally had an open forest, with a low canopy punctured by emergents. Lianas and palms were relatively abundant. This vegetation type was defined by Pires & Prance (1984) and is common across the transition between humid and semi-humid areas in southern Amazonia. One of the palms is called *pupunharana* locally, which means the false pupunha (the Brazilian name for pejibaye). This name also shows that traditional taxonomies are well related to modern taxonomies.

One of us (JBFS) has collected orchids and other plants in the region of São Felix do Xingu since 1979. During this period the forest has been eliminated over large sections of the municipality, which is located in the so-called arch of fire, where the Amazon forest is being substituted by pasture. As the forest is eliminated, it is easier to see the palms, since they are generally not cut during the initial felling of the forest.

In March 2002, JBFS mapped a dozen populations of wild pupunha along major and minor roads in a 280×200 km area in the São Felix do Xingu region, with one population in each adjacent municipality (Altamira to the northwest and Tucumã to the southeast). A voucher specimen was deposited at **BRAZIL. Pará:** Belém, J.B.F. Silva (1.179), n. RG 178.287 (IAN, Embrapa Amazônia Oriental). Fruit from three bunches were collected for germination and DNA analysis (not reported here).

In this region, wild pejibaye occurs in small populations, with one to three plants, with the populations widely separated from each other, similar to the situation described by Clement *et al.* (1989) in central Rondonia. The plants are generally located in the lower sections of the landscape near small water courses. In these areas the plants are mixed with other elements of the stream-edge vegetation. Occasional populations are found on higher ground, but tend not to withstand the periodic burning (used to control weeds in the pastures) for more than a couple burns.

The plants observed in São Felix do Xingu are less robust than typical var. *gasipaes* and even a little less robust than the var. *chichagui* described by Clement *et al.* (1989) in Rondonia, perhaps partially because of the extended dry season and the poor soils (Fig. 1). The clumps rarely contain more than three stems and single-stemmed plants are common, perhaps because of the frequent use of fire in pastures.

The fruit bunches (Fig. 2) are small (35 to 45 rachillae), with 60-70 red to orangish-red fruit, smaller than those reported by Clement *et al.* (1989), perhaps due to the extended dry season and poor soils. The fruit averaged 0.45 g and 10 by 9 mm, quite a bit smaller than the 1.4 g and 15 by 13 mm fruit reported in Acre and Rondonia (Clement *et al.* 1989). The seed averaged 0.23 g and 6.5 by 7.4 mm, also smaller than previously reported (0.5 g and 12 by 10 mm; Clement *et al.* 1989).



Figure 1. A multi-stemmed clump of pupunharana (*Bactris gasipaes* Kunth var. *chichagui*, type 1) in abandoned pasture near São Felix do Xingu, Pará, Brazil, in 2002.

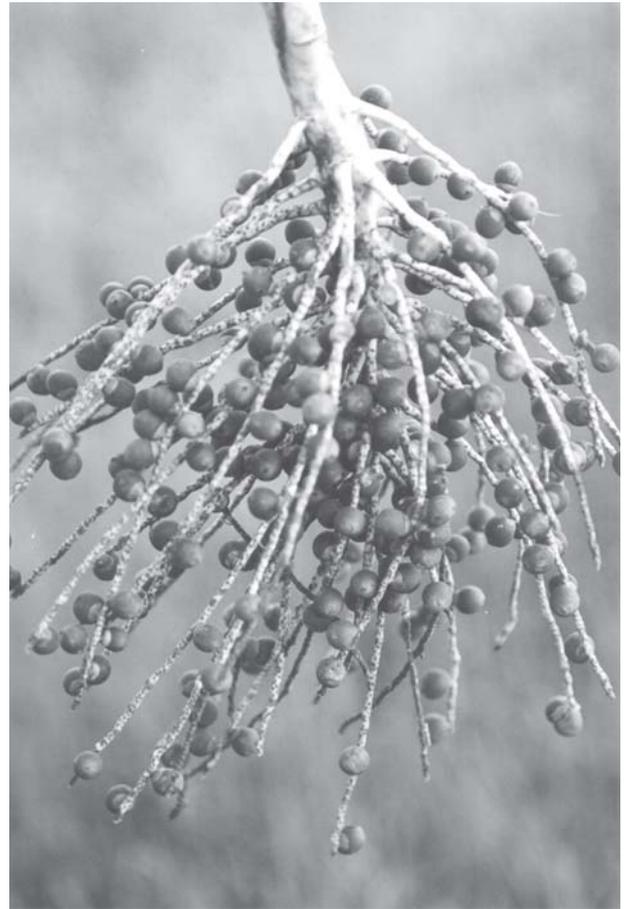


Figure 2. A mature fruit bunch of pupunharana (*Bactris gasipaes* Kunth var. *chichagui*, type 1) near São Felix do Xingu, Pará, Brazil, in 2002.

Implications of the new distribution – Since it is unlikely that wild pejobaye is absent between central Mato Grosso and São Felix do Xingu, Pará, the distribution of wild pejobaye, as type 1 var. *chichagui*, is expanded by about 30% (Fig. 3). Until this report, var. *chichagui* had always been reported in or adjacent to the Andes (e.g., Clement 1995; Henderson 1995; 2000; Henderson *et al.* 1995; Mora Urpí 1992; 1993), except for some type 3 populations listed in southern Central America (Mora Urpí 1999). At least type 1 var. *chichagui* must now be considered an element of the lowland open tropical forest, which is consistent with its modern lowland distribution.

This implies that var. *chichagui* type 1 is an ancient element of this open forest type, rather than an essentially Andean element adapting to the lowlands as its range expanded during the return of the forests at the end of the Pleistocene. At the end of the Pleistocene, the transitional open forests probably occupied a much greater fraction of Amazonia than they do today, putting their populations of var. *chichagui*



Figure 3. Map of the expected distribution of pupunharana (*Bactris gasipaes* Kunth var. *chichagui*, type 1). Most black dots represent collections reported by Henderson (2000); northern-most dot represents Clement *et al.* (1999); eastern-most dot represents approximate location of Barbosa-Rodrigues' *G. mattogrossensis*; SFX surrounded by dotted line represents the area reported here around São Felix do Xingu, Pará, Brazil.

in potential contact with early humans throughout the region. *A priori*, this proposal supports Mora Urpí's (1992; 1993; 1999) argument that pejibaye could have been domesticated various times at various locations, with the possibility of the number of locations enormously expanded after this report. However, Ferreira's (1999) report that all var. *gasipaes* seeds have the shape and germinal pore position of var. *chichagui* type 1 limits the area in which to search for the origin(s?) of pejibaye, i.e., to what Ferreira called the 'Southern populations' of wild pejibaye.

The São Felix do Xingu type 1 var. *chichagui* will shortly be analyzed with modern DNA marker methodology and compared with type 1 populations from Acre, Rondonia and Amazonas, type 2 populations from Colombia and Venezuela, and type 3 populations from Ucayali and Amazonas. This analysis is expected to further limit the area in which we expect to find the origin of cultivated pejibaye (var. *gasipaes*).

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