

A Nutritional Study of *Aiphanes caryotifolia* (Kunth) Wendl. (Palmae) Fruit: An Exceptional Source of Vitamin A and High Quality Protein from Tropical America

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Abstract

BALICK, M. J. (Institute of Economic Botany, New York Botanical Garden, Bronx, New York 10458-5126, U.S.A.) and S. N. GERSHOFF (School of Nutrition, Tufts University, Medford, Massachusetts 02155, U.S.A.). A nutritional study of *Aiphanes caryotifolia* (Kunth) Wendl. (Palmae) fruit: An exceptional source of vitamin A and high quality protein from tropical America. *Advances in Economic Botany* 8: 35-40. 1990. *Aiphanes caryotifolia* (Kunth) Wendl. is a palm native to northern areas of South America, primarily occurring in the lowlands, but found at elevations to 1800 m. Its fruits are a common food in the areas where it grows. The mesocarp of the fruit contains a pulp rich in vitamin A, with 16,000 IU/100 g (wet weight basis). Fatty acid analysis shows that the endosperm is rich in lauric acid. While the palm is apparently not a major component of the local diet, it is still a rich source of nutrition.

Key words: *Aiphanes*; palm; nutrition; vitamin A; beta carotene; protein; oil.

Resumen

Aiphanes caryotifolia (Kunth.) Wendl. es una palmera oriunda a las áreas del norte de Sur América, encontrándose principalmente en las tierras bajas a elevaciones menores de 1800 m. Sus frutos son frecuentemente usados como alimento en las áreas donde crece. El mesocarpio contiene una pulpa de alto contenido de vitamina A, con 16,000 IU/100 g (en base

de peso húmedo). El endospermo contiene 4.3% de una proteína de alto valor nutricional (en base de peso húmedo). El análisis de los ácidos grasos del endospermo revela que éste es rico en ácido láurico. Aunque la palmera no es un componente principal de la dieta en éstas áreas, si es una fuente de buena nutrición.

Introduction

Aiphanes Wendl., a neotropical genus, is primarily known for its horticultural value. The most recent taxonomic revision of the genus was by Burret (1932), who reported 28 species. Moore (1973) recognized 38 species, of which seven were included in the checklist of cultivated palms he published in 1963. Dransfield and Uhl (1986) placed *Aiphanes* in the subfamily Arecoideae, Coccoae: Bactridinae. The genus *Martinezia* is considered a synonym of *Aiphanes*, although the name is still occasionally found in the literature.

Aiphanes caryotifolia (Kunth) Wendl., is distributed primarily in the lowlands of northern South America, but also occurs at elevations up to 1800 m (Pérez-Arbeláez, 1978). In Venezuela it is found in the partially open dense forests of the upper Orinoco region (Braun, 1968). Galeano and Bernal (1987) noted that it was originally a plant of the Inter-Andean valleys of Colombia, but is now frequently cultivated in Tropical America. Patiño (1963) considered it to probably have been a species domesticated since pre-Colombian times, although no conclusive proof was cited.

Aiphanes caryotifolia grows to 8 m or more, and is solitary in habit. Its stem is covered with black spines, and the sheath, petiole and leaf rachis are also covered with prickles. The leaves are pinnate with wedge-shaped pinnae in groups of four to six along the rachis. The fruits are borne in interfoliar panicles ca. 0.6–0.75 m long. Mature fruits are globose, ca. 1.5–2.0 cm in diameter, and bright red in color. The endocarp is bony, often pitted, with three pores at or above the middle. The endosperm is white, oily, and homogeneous.

Aiphanes caryotifolia is known by various local names throughout its distribution (Table I). Aside from its value as an ornamental plant, several other uses have been reported. The Island Caribs of Dominica eat the mesocarp and endosperm

(Hodge & Taylor, 1957). Pérez-Arbeláez (1978) noted that the tasty endosperm is used in confections as a substitute for almonds and filberts. The leaves of *Martinezia* sp. (= *Aiphanes* sp.) are apparently edible (Martin & Ruberté, 1979) although we have never observed this practice. In general, the consumption of this palm appears limited to the fruits.

In July of 1984, one of us (MJB) travelled to Colombia to participate in a palm germplasm collecting expedition in the Chocó region of that country. Due to a limitation on internal air travel, the team was forced to take an overland route from Medellín to Calí, where our trip was to begin. At various points on the Medellín–Calí road, people were selling panicles of *Aiphanes caryotifolia* fruit (Figs. 1, 3). We stopped to speak to the vendors, and they reported that both the mesocarp and endocarp were edible, and commonly eaten in the area. A few kilograms of fruits were purchased and stored for later analysis. Upon our arrival in Calí, economic botanist Dr. Victor Manuel Patiño confirmed the identification and use of this local food.

Analysis of Fruit

Because the bright pigmentation of the mesocarp and oil-rich endosperm suggested high levels of carotenes and Vitamin A, we decided to analyse the composition of this fruit. Analyses were carried out by Hazleton Laboratories America, Inc., in Madison, Wisconsin. A single collection was submitted for analysis; the results are presented in Tables II–V.

Most striking is the content of Vitamin A from carotene, 16,000 IU/100 g (wet weight basis; dry weight basis is 73,392 IU/100 g). This fruit has a remarkable content of Vitamin A, superior to the best sources known in the plant kingdom such as carrots, which have a maximum of 12,000 IU/100 g (range 2000–12,000 IU/100 g). Sweet potatoes, another excellent source of Vitamin A,

Table I
Common names for *Aiphanes caryotifolia*

Name	Country (region, group or language)	Reference
charascal	Colombia (Antioquia)	Peréz-Arbeláez, 1978
chontaruro	Ecuador	Peréz-Arbeláez, 1978
corozo	Colombia (Antioquia)	Galeano & Bernal, 1978
corozo anchame	Venezuela (Bolívar)	Peréz-Arbeláez, 1978
corozo chiquito	Colombia (Antioquia)	Galeano & Bernal, 1987
corozo colorado	Colombia (Antioquia)	Peréz-Arbeláez, 1978
corozo de chascará	Colombia (Valle de Cauca)	Patiño, 1963
corozo del Orinoco	Venezuela (Bolívar)	Peréz-Arbeláez, 1978
fish tail palm	Zanzibar	Williams, 1949
gri-gri	Trinidad and Tobago; Dominica (French)	Williams & Williams, 1951; Hodge & Taylor, 1957
majerona	Brazil	Patiño, 1963
mararabe	Colombia (Llanos)	Peréz-Arbeláez, 1978
mararai	Colombia (Magdalena; Llanos)	Patiño, 1963
palma de corozo	Venezuela	Patiño, 1963
paxiuba mangerona	Brazil	Patiño, 1963
pujamo	Colombia (Pujamo)	Peréz-Arbeláez, 1978
qualte	Colombia (Nariño)	Peréz-Arbeláez, 1978
quindío	Colombia; Ecuador; Peru	Patiño, 1963
rókri	Dominica (Carib)	Hodge & Taylor, 1957
ruffle palm	U.S.	Staff, L. H. Bailey Hortorium 1976
spine palm	U.S.	Staff, L. H. Bailey Hortorium 1976

contain 8800 IU/100 g of raw portion (Bogert et al., 1973).

Vitamin A in the Diet

Vitamin A is an essential component of the diet. Unfortunately, Vitamin A deficiency remains one of the major public health problems in many developing countries, particularly in Asia and the Middle East and some parts of Africa. Even in countries such as the United States and Canada there has been recent concern about the Vitamin A nutriture of many of their citizens. It has been estimated that at least half a million Asian children develop potentially blinding corneal involvement every year as a result of Vitamin A deficiency (Sommer, 1982). Except for the northeastern part of Brazil and Haiti, most Latin American countries do not report a major xerophthalmia problem despite low intakes and blood levels of Vitamin A (WHO, 1976). Severe Vitamin A deficiency often results in death from infection. A recent report (Committee on Diet, Nutrition and Cancer, 1982) states: "A growing accumulation of epidemiological evidence indicates that there is an inverse relationship between

the risk of cancer and the consumption of foods that contain Vitamin A or its precursors."

The precursors are carotenoids, particularly beta carotene which are found in plant foods. Because they must be converted to Vitamin A, the carotenoids show less Vitamin A activity when fed than Vitamin A (retinol) itself. The Vitamin A of a food is expressed in retinol equivalents or international units (IU). One retinol equivalent equals 1 μg retinol, 6 μg beta carotene or 12 μg of other provitamin carotenoids. A retinol equivalent equals 3.33 IU from retinol or 10 IU from beta carotene.

It has been frustrating to nutritionists that even in countries where edible plant sources of beta carotene exist in quantity, it has been frequently difficult to get people to eat them. For example, in many parts of the world red palm oil, an excellent source for the carotenoids which give it its color, is consumed as a dietary component. However, in Indonesia it has been impossible to get people to consume this readily available oil because it has been traditionally used for non-food purposes. Programs which enrich foods with Vitamin A or provide vitamins to individuals in capsules or by injection are expensive and have had limited success. Clearly, the availability of

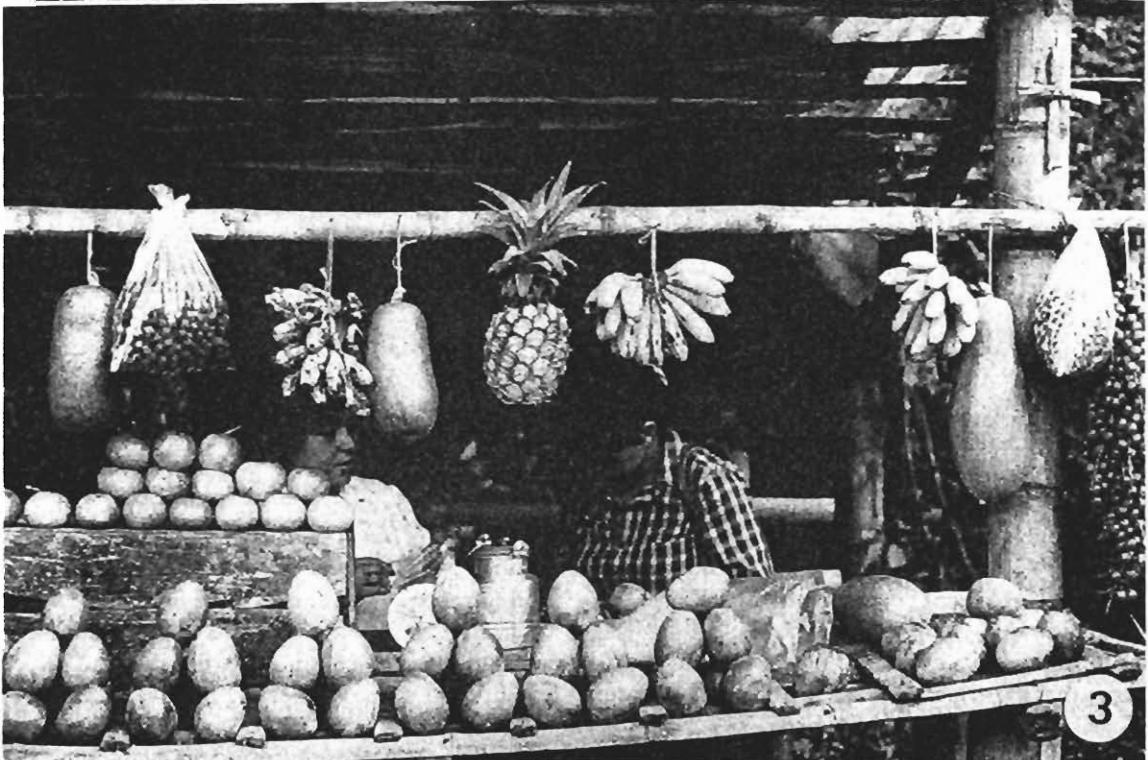
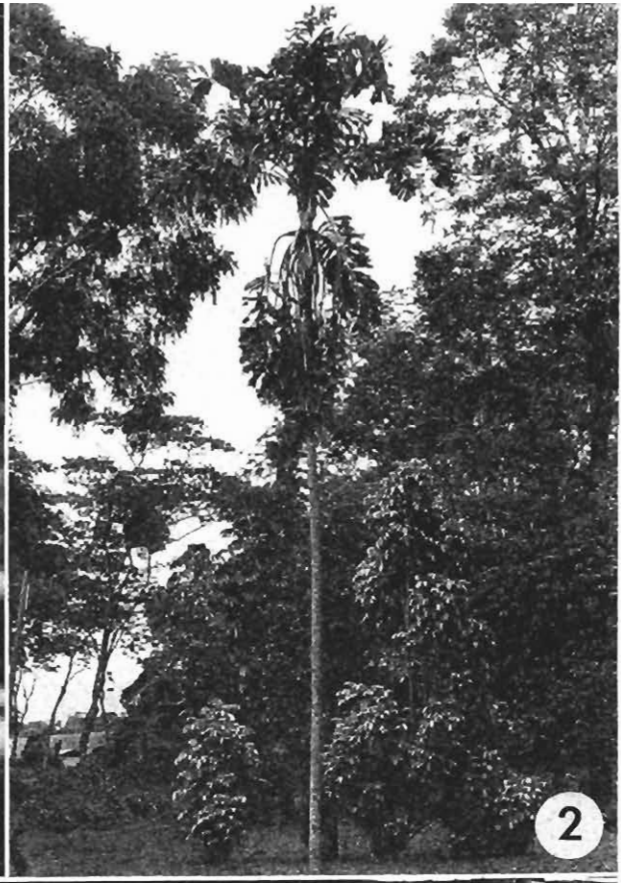


Table II
Proximate composition of *Aiphanes caryotifolia* mesocarp

	Dry weight	Wet weight
Protein	6.0 g/100 g	1.3 g/100 g
Moisture (70° vac. oven)	—	78.2 g/100 g
Fat	1.8 g/100 g	0.4 g/100 g
Ash	6.9 g/100 g	1.5 g/100 g
Crude fiber	15.6 g/100 g	3.4 g/100 g
Carbohydrates	69.7 g/100 g	15.2 g/100 g
Beta carotene	44.1 mg/100 g	9.61 mg/100 g
Vitamin A from carotene	73,392 IU/100 g	16,000 IU/100 g
Calories	319 cal/100 g	69.6 cal/100 g

palatable foods high in Vitamin A activity would have major public health value in many parts of the world.

Oil and Protein in *Aiphanes* fruit

Another interesting observation is that the endosperm of this species (Table III) contains 37% fat (dry weight basis). It is, then, a good source of calories and oil in the local diet. The oil is primarily (63%) lauric acid (a saturated fat, and thus relatively similar to coconut oil).

The protein of *Aiphanes caryotifolia* is of a high biological value (Table IV), containing as its most limiting amino acid threonine, at 77% of the ideal protein value (FAO/WHO, 1973). With its total protein composition of 37%, the endosperm of this palm is a good source of nutrition.

Aiphanes sp. fruit is also reported to be consumed in small amounts by the Oilbird, *Stea-*

tornis caripensis (Snow & Snow, 1978), and presumably is a valuable source of nutrition for this and other animals.

Cultivation and Use of *Aiphanes*

During a recent trip to Honduras, one of us (MJB) observed this palm in cultivation in the palm garden of Dr. William Plowden in Peña Blanca, Department of Cortés (Fig. 2). Plowden reported that he had collected seed of this palm in the vicinity of Medellín, Colombia, and transported it to his farm in Honduras. Interestingly, the fruits of this palm are also collected and eaten by the people of the area in the same manner as

Table III
Proximate composition of *Aiphanes caryotifolia* endosperm

	Dry weight	Wet weight
Protein	7.9 g/100 g	4.3 g/100 g
Moisture (70° vac. oven)	—	45.9 g/100 g
Fat	37.0 g/100 g	20.0 g/100 g
Ash	2.0 g/100 g	1.1 g/100 g
Crude fiber	34.68 g/100 g	18.7 g/100 g
Carbohydrates	18.5 g/100 g	10.0 g/100 g
Calories	438 cal/100g	237 cal/100 g

Table IV
Fatty acid composition of *Aiphanes caryotifolia* endosperm

Fatty acid	Percent composition
Saturated	
Arachidic (20:0)	0.07%
Capric (10:0)	2.1
Caprylic (8:0)	1.7
Lauric (12:0)	62.8
Myristic (14:0)	17.9
Palmitic (16:0)	5.4
Pentadecanoic (15:0)	0.08
Stearic (18:0)	3.0
Unsaturated	
Linoleic (18:2)	2.2
Oleic (18:1)	4.7

FIGS. 1-3. 1. Panicle of ripe *Aiphanes caryotifolia* fruit for sale along the Medellín-Calí road. Note bag of loose fruit also for sale. 2. Mature specimen of *Aiphanes caryotifolia*, grown from seed collected in Colombia. 3. View of fruit stand where *Aiphanes caryotifolia* is being sold (far right and bag on left).

Table V
Analysis of essential amino acids in *Aiphanes caryotifolia* endosperm protein

Amino acid component	mg/g	FAO/WHO amino acid scoring pattern	% of scoring pattern
Isoleucine	31.87	40	80
Leucine	58.62	70	84
Lysine	55.82	55	101
Methionine & cystine	28	35	80
Phenylalanine & tyrosine	56.52	60	94
Threonine	30.7	40	77
Tryptophan	10	10	100
Valine	50.47	50	101

the fruits are consumed in Colombia as well as other areas where the palm is native.

While *Aiphanes caryotifolia* is a palm with great nutritional value, it is likely that it will remain a minor food plant throughout its distribution, eaten on an opportunistic basis and occasionally sold by local farmers, as in the instance along the Medellín-Calí road. However limited in importance, this species should be recognized as an important source of both Vitamin A and protein and therefore a valuable supplement to the diet of those who consume it. As long as economic and social dislocations continue to result in a decrease in the quality of the diet of both rural and urban dwellers in many Third World countries, little-known plant species such as this palm will continue to play a useful role in human nutrition.

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