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ETHNOBOTANY AND CONSERVATION OF TIUSINTE (*Dioon mejiae* Standl. & L.O. Williams, ZAMIACEAE) IN NORTHEASTERN HONDURAS

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ABSTRACT.—This paper describes the significance of the arborescent cycad “tiusinte” to Honduran culture. *Dioon mejiae* is a wild food that supplements maize-bean diets for an estimated 33,000 indigenous and mestizo Hondurans. Female cones are harvested for their seeds, which are processed and made into tamales, tortillas, and other products. Leaves are used for a variety of Catholic celebrations; minor uses of the leaves and female cone parts also persist. Tiusintes, a common-property resource, are being destroyed by the adverse effects of timber extraction, pastoralism, and swidden agriculture. However, traditional tiusinte protection schemes are still practiced, and these may provide the germ of a more comprehensive conservation policy for the species.

Key words: conservation of cycads, *Dioon mejiae*, ethnobotany of cycads, Honduras, Zamiaceae.

RESUMEN.—En este trabajo se describe el significado de la cícada arborescente “tiusinte” en la cultura hondureña. *Dioon mejiae* es un alimento silvestre que sirve de complemento a la dieta basada en maíz y frijoles de unos 33.000 hondureños aproximadamente, entre indígenas y mestizos. Se cosechan los conos femeninos para extraer sus semillas, las cuales se procesan para elaborar tamales, tortillas, y otros productos. Las hojas se utilizan en diversas festividades católicas y además persisten algunos usos menores de las hojas y de partes del cono femenino. Los “tiusintes” son un recurso comunitario que está siendo destruido como consecuencia de los efectos negativos de la extracción de madera, la ganadería, y la agricultura de roza y quema. Sin embargo, aún persisten algunas prácticas tradicionales de carácter sostenible, y éstas tal vez puedan servir para elaborar una más completa estrategia para la conservación de esta especie.

RÉSUMÉ.—Cet article souligne l'importance que revêt la cycadacée arborescente «tiusinte» dans la culture du Honduras. Pour environ 33 000 Honduriens

indigènes ou métis, le *Dioon mejiae* demeure un aliment sauvage qui complète leur diète basée sur le maïs et les haricots. Les cônes femelles sont récoltés afin d'utiliser les graines dans la fabrication des tamales, des tortillas et autres produits. Quant aux feuilles, elles sont utilisées lors de diverses célébrations catholiques. Les feuilles ainsi que certaines parties des cônes femelles entrent aussi dans d'autres utilisations de moindre importance. L'agriculture par écobuage, le pâturage et la coupe de bois ont des répercussions néfastes sur le «tiusinte» et détruisent cette ressource collective. Cependant, des stratégies traditionnelles de protection du «tiusinte» sont toujours maintenues. Elles pourraient faire en sorte qu'une politique plus globale de conservation de cette espèce soit mise en place.

INTRODUCTION

Published works on the ethnobotany of New World cycads (Zamiaceae: *Ceratozamia*, *Chigua*, *Dioon*, *Microcycas*, *Zamia*) describe human uses of the plants across Mexico (Alcorn 1984; Chamberlain 1919; Gómez-Pompa et al. 1997; Vázquez Torres 1990), Central America (Bonta 2003; Duke 1975), the Caribbean and Florida (Broome 1999; Roig y Mesa 1963; Small 1921), and South America (Pérez Arbelaez 1956; Schultes and Raffauf 1990). Much of the literature is fragmentary, incidental to broader botanical studies, and anecdotal; other than the current study, very little in-depth ethnobotanical research on Zamiaceae has been carried out that approaches the scope and depth of work conducted on Old World cycads (e.g., as summarized in Donaldson 2003; Jones 1993; Thieret 1958). The current study is important for New World cycad research and conservation in general in that it not only provides a detailed ethnobotanical examination but also informs a revision of the *Dioon mejiae* species concept (Haynes and Bonta *in press*).

In this article, we describe the ethnobotany of *Dioon mejiae* Standl. & L.O. Williams (Standley and Williams 1950; see also DeLuca and Sabato 1978),¹ an abundant, arborescent cycad utilized intensively as a source of food by an estimated 33,000 Hondurans and as ornamentation in Catholic ceremonies in hundreds of communities across its 5,000 km² native range and beyond (see Figure 1). This is one of the few New World cycads that plays a major role in diets across a cultural region. The alimentary importance of *D. mejiae*, though unusual in contemporary Latin America, is comparable to Old World cycad dietary regimes (Beck 1992; Jones 1993; Thieret 1958), particularly in aboriginal Australia. Although other Zamiaceae form small components of local diets (Vázquez Torres 1990), they are not (or are no longer) seasonal staples. Historical accounts underscore the importance of Zamiaceae seeds in local diets, but with the exception of some indigenous groups in Oaxaca, Mexico (e.g., the Chinanteca), present-day uses generally exclude the dietary and are restricted primarily to the ornamental, religious, and medicinal (Chamberlain 1919; Gómez-Pompa et al. 1997; Small 1921; Vázquez Torres 1990).

The continued importance of *D. mejiae* to local Honduran society is a function of its abundance and the high return on labor needed to harvest it. No other New World species is estimated to have in excess of 20,000 plants (see Stevenson et al.

“teocinte” derived toponyms on topographical maps (Bonta 2003). From 2000 to 2003, the authors of this article visited 21 *tiusinte* populations and demarcated the species’ wild range, discovering that 5,000 to 6,000 households in seven municipalities across three departments harvested an annual average of 30,000 female cones (six per household), chiefly to tide them over during the lean months of April to August when maize stores are depleted.

STUDY AREA

Research Sites.—The bulk of this study was carried out in three Honduran departments: Colón, Olancho, and Yoro (see Figure 1). Within those departments, 44 ethnographic interviews were conducted in cities, towns, villages, and hamlets within the following municipalities (*municipios*) that contain wild *Dioon mejiae* populations: Tocoa (Colón dept.); Esquipulas del Norte, Gualaco, Guata, Jano, and Manto (Olancho dept.); Olanchito (Yoro dept.). Additional ethnographic data on wild populations were collected in the municipalities of Savá (Colón); La Unión and Juticalpa (Olancho); Arenal (Yoro).

Flores Pinot’s parallel survey of cultivated *D. mejiae* was based in Juticalpa and garnered responses from 68 informants native to 14 of the 23 municipalities of Olancho, as well as the cities of Comayagua, Danlí, and Tegucigalpa in other departments.

Additional research sites included the Paul C. Standley Herbarium (EAP) at the Pan-American Agricultural School in El Zamorano, Francisco Morazán; the National Herbarium (TEFH) at the Universidad Nacional Autónoma de Honduras, Tegucigalpa; Lancetilla Botanical Garden, Tela; Danlí, El Paraíso. Searching for unpublished ethnobotanical data, we examined vouchers at Zamorano, Lancetilla, and the UNAH, and interviewed botanists Antonio Molina and Cyril Nelson. In the city of Danlí, we located living isotypes of the species and gathered ethnobotanical data, with the help of Dario Hernández.

At present, we consider the rumored existence of additional, disjunct wild *D. mejiae* populations (in central and western Honduras, and in northern Nicaragua) highly unlikely. The possibility of wild populations in western Honduras (departments of Copán, Lempira, and Santa Bárbara) was investigated by Cyril Nelson, German Sandoval, Carlos Monroy, and Carlos O’Reilly during a collecting trip in October 2003. They discovered that the toponym “Teocintal” (which signifies a population of *D. mejiae* in eastern Honduras) indicates Poaceae species (as it does elsewhere in Mesoamerica) (Haynes and Bonta 2003).

Physical Geography.—On the Caribbean slope of northeastern Honduras, 22 small, isolated populations, one large population (approximately 168,000 adult plants at Saguay) and two “superpopulations” (clusters of spatially proximate groves that formed large populations until recent habitat destruction) of *Dioon mejiae* are known, stretching from 14°48’ to 15°32’ N lat., and from 86°0’ to 86°58’ W long. Smaller, isolated populations occupy from two to 400 ha and contain from two to 12,000 adult plants. The two superpopulations of Olanchito and Mame contain an estimated 200,000 and 250,000 adult plants and cover 2,700 and 6,000 ha, respectively. *Tiusinte* populations flourish in a wide variety of environmental

situations between 120 and 1,000 m above sea level (masl). An extinct population in La Unión, Olancho, reached 1,200 masl, while cultivated individuals flourish from sea level to 1,500 masl across Honduras (and elsewhere in Central America, as well as overseas).

Dioon mejiae is naturally an understory or subcanopy inhabitant of broadleaf forests receiving 800–2,000 mm of precipitation per year. These forests range from evergreen “rain forest” at the northeastern edge of the tiusinte’s range (a disjunct population in Tocoa), to deciduous mixed forest throughout seasonally dry northwestern Olancho, to arid thorn forest at Saguay and in Olanchito (upper Valle de Aguán). Trees in highly arid locations (less than 1,000 mm average annual precipitation) are often found growing in “gallery forests” near streams. Though much of the tiusinte’s home range is characterized by *Pinus* forests growing on rugged hills, the cycads usually grow within streamside deciduous broadleaf woods rather than among immediately adjacent, upslope pines.

While most small tiusinte populations are restricted to steep and rocky terrain, the large Saguay population and the two superpopulations contain many plants on the first, second, and third Quaternary terraces above watercourses. Tiusintes thrive in sandy or clayey alluvion as well as on soils weathered from the limestones, granites, gneisses, and schists that predominate in the region. Soil samples from eight populations were analyzed at El Zamorano, providing the following results: pH ranged from 6.32 to 8.05; percentage of organic matter ranged from 2.26 to 18.94; in parts per million, potassium ranged from 2.74 to 123.77, phosphorus from 144 to 610, calcium from 1,330 to 14,500, and magnesium from 250 to 450 (Haynes and Bonta 2003).

Dioon mejiae is often encountered in agricultural, pastoral, and forested landscapes that are burned annually or semi-annually by humans. No populations are unaffected by recent human landscape transformations. At present, whole populations are being degraded rapidly by a combination of multiple annual fires and removal of plants (see Figures 2, 3, and 4).

METHODOLOGY

Bonta, in collaboration with Flores Pinot, began to investigate Gualaco tiusinte populations in 1999; in 2000, Bonta visited the sole Colón population. Graham conducted two days of video interviews in Esquipulas del Norte in 2001 and three days in Los Encuentros, Gualaco, in 2002. Flores Pinot’s survey of cultivated populations began in 2002 and continued through early 2004. From June to August 2002, Bonta conducted six days of extensive ethnographic interviews in Guata and Gualaco with the assistance of José Mendoza. From July 10 to July 28, 2003, a Montgomery Botanical Center/TEFH expedition visited numerous populations. Bonta was joined by Flores Pinot (an agronomist) and Haynes and Sandoval (botanists). Also active in the 2003 expedition were Honduran conservationists Marta Moreno, José Mendoza, Manuel Rey, Ricardo Steiner, Rafael Ulloa, and Isidro Zúniga; ethnographic data were gathered principally by Bonta and Zúniga.

All research prior to 2003 was explicitly for the purpose of gathering ethnobotanical data on *Dioon mejiae* as well as pinpointing locations of plant



FIGURE 2.—Seven- to nine-meter tiusintes survive in a recently-cleared pasture on the ecotone between gallery forest along the Quebrada de los Hornos (Saguay, Gualaco), and deciduous tropical broadleaf forest upslope. This figure illustrates an early stage in conversion from *finca* to pasture; Figure 3 shows a later stage. Photo by M. Bonta.

populations and users. The intent of the 2003 expedition was to visit as many wild populations as possible within the time frame allotted and to gather plant materials for a variety of scientific purposes (see Haynes and Bonta 2003; vouchers were deposited at TEFH). Ethnobotanical data were gathered using the methods described in the following sections.

Semi-structured Interviews.—From 1999 to 2004, Bonta, Flores Pinot, Graham, and Zúniga interviewed 122 persons using open-ended questions in a semi-structured format. Our intent was to document local knowledge of the cultural, economic, and political significance of *Dioon mejiae* in the greatest detail possible. We focused on food preparation, the harvest, and sacred uses, and also gathered data on environmental perceptions, land use conflicts, autochthonous conservation practices, economic importance, trade, and minor uses (e.g., as toys and medicine). Interviews were conducted only after gaining verbal consent from the subjects and ranged from ten minutes to more than an hour. For those informants identified locally as expert *tiusinteros* (male cycad harvesters) and *tiusinteras* (female cycad food preparers), Graham (in 2001 and 2002) and Bonta and Zúniga (in 2003) solicited permission to videotape detailed interviews as well as demonstrations of harvest and food preparation techniques. Graham obtained



FIGURE 3.—Pasture with tiusintes in Saguay, Gualaco, along the Quebrada de los Hornos. Clearance of the tropical deciduous forest *finca* has taken place since 1990; tiusintes, respected as common-property resources, were not intentionally removed, and as hardy woody species, managed to survive repeated fires. Over time, however, serious degradation of the remaining tiusintes has occurred. Photo by M. Bonta.

permission from interviewees to include video clips in a 2003 Spanish-language educational video that he produced (“El otro teocinte”); Bonta and Zúniga’s footage was used solely for research analysis.

Researchers used digital photography to supplement written and video documentation.

Student Interviewers and Informants.—Flores Pinot personally interviewed owners of cultivated *Dioon mejiae* plants in dooryard gardens in the city of Juticalpa and coordinated the compilation of data gathered by his agronomy students at the Escuela Normal Mixta de Olancho who interviewed *D. mejiae* owners across Olancho.

Participant Observation.—At different times and sites we were able to observe most of the processes currently used in the harvest and preparation of food items; we participated in the harvest but were onlookers in most of the food preparation processes.

Data incorporated herein were cross-checked for accuracy against accounts of other informants as well as against our own field observations, where possible. The use of leaves was only observed directly in one case (see Figure 10) because



FIGURE 4.—Remnant of the Saguay, Gualaco *tiusintal*, referred to locally as the *finca*. Tall tree in left foreground is seven meters in height; lighter-colored leaves are the present year's flush (*vestimento*). Middleground habitat is dense gallery forest along the Quebrada de los Hornos; slopes in the background are cloaked in pasture and tropical deciduous broadleaf forest and scrub. Altitude 600 m above sea level. Photo by M. Bonta.

we did not conduct research during the days when tiusinte use is most prevalent (e.g., Semana Santa [Easter Week], Día de los Muertos [All Souls' Day], Noche Buena [Christmas Eve], and bishops' visits).

RESULTS

Demography, Ethnicity, and Class Background of Users.—Currently, only a few hundred of the approximately 11,000 remaining self-identifying "indios" in the wild tiusinte region think of themselves as members of the "Tribu Nahoá." However, the municipality of Guata is still at least 80% indigenous, while Jano and Esquipulas del Norte contain significant indigenous population nuclei. Tiny pockets of indios also exist in Chindona, Gualaco. In Yoro, the village of Agalteca identifies itself as indigenous. The Tolupan, a well-defined ethnic group studied extensively by Chapman (1992), have one tribal unit, the Tribu Zapotal, in the tiusinte region. Their traditions and uses for the plant are quite similar, though not identical, to those of their mestizo neighbors. Their name for tiusinte is *tiñ-uk*, which appears to be a variant of "teoc," the root of "teocintle," a Nahuatl word from which "tiusinte" is derived (Bonta *in press* discusses the complex and confusing etymology of "teocintle" in Mesoamerican Poaceae and Zamiaceae).

Across the wild tiusinte region (2003 estimated population 115,000, based on figures published by the Instituto Nacional de Estadística 2001), “Ladino” (mestizo) Hondurans also consume tiusinte, and in three municipalities—Gualaco, Olanchito, and Tocoa—they comprise the majority of consumers. Overall, indigenous tiusinte consumers constitute only 15% (~5,000) of total users (~33,000). However, 45% of indios in the tiusinte region consume tiusinte, compared to only 27% of Ladinos.

In Guata, indios occupy the most impoverished stratum of society and are seen as more traditional. Hence, they are more likely to depend on tiusinte during times of maize scarcity. Tiusinte use in this municipality is closely associated with social class, and dependence on it as a “famine food” is stigmatized. A similar situation appears to exist in Jano. In the remaining municipalities, the opposite is true. In Esquipulas del Norte, for example, all social classes seek out tiusinte to supplement their diets, whether or not other food supplies are running low; there is pride, rather than a stigma, attached to its use.

We found indigenous tiusinte users in Olanchito to be quite reserved about the knowledge they revealed to us. By contrast, Ladino users were extremely open about their knowledge, thus leading to the perhaps paradoxical situation wherein the least valuable data were provided to us by the supposedly most traditional users, while the most valuable, detailed, and nuanced data were obtained from more “modernized” Ladino users (Table 1). However, we spent little time in the most indigenous settings, and three-way cultural barriers among indios, Ladinos, and foreigners could not be breached in scant days of research.

Oral Historical Accounts of the Harvest.—Though we are aware of no written documentation of the pre-20th century cycad harvest, informants have assured us that the practice has existed from time immemorial. Our oldest informants described practices in northwestern Olanchito in the 1920s, more than 50 years before any automobile road reached the region. A main pack trail (*camino real*), dating from early colonial and presumably pre-Columbian times, bisected the tiusinte’s range, passing directly through large cycad populations in Jano, Guata, and Esquipulas del Norte on its way north to Yoro from Olanchito. According to various informants, rainy-season travelers heading to the Olanchito banana plantations to find work, and mule trains carrying trade goods, would often be delayed by the Mame River, impassable at flood stage, in northern Guata at the village of Pueblo Viejo. There, the only plant foods available for sale were tortillas and tamales made from tiusinte seeds. (Some of these travelers, including Dr. Isidoro Mejía, carried seeds back to their homes in other parts of the country, helping to spread the species in cultivation). This sales opportunity for tiusinte products dried up when the modern highway between Olanchito and Yoro was built in the 1980s.

After at least a decade of growth, male tiusintes begin to produce pollen cones (*churutes* or *churutones*) that harbor an endemic *Rhopalotria* (sp. nov.) pollinator weevil (*gorgojo de tiusinte*). During the dry season (February to June or later), the *gorgojos* fly to nearby developing female cones (*cabezas*) and pollinate them. The *cabeza* develops over a period of 18 months, dehiscing in September or

October of its second year. However, most *cabezas* are harvested well before then. The cycad harvest (*cosecha de tiusinte*) commences in February and continues into June. Cone production varies from year to year, increasing and decreasing over a three-year period. Generally, the height of a good *cosecha* is April and often coincides with Semana Santa. Previously, in Gualaco, *tamales de tiusinte* were prepared together with maize tamales on Holy Friday.

Wild tiusinte has always been, and remains, a common property resource (*patrimonio*) that by custom cannot be owned by individuals, even when it occurs within a few meters of a private dwelling. The harvest of female cones (each weighing 7 to 22 kg, and containing 100 to 300 seeds) has always been on a first-come, first-serve basis; *tiusinteros* cannot customarily reserve them or protect them for their own future use. Some non-traditional private landowners, however, try to keep cones on their land for themselves and refer to trespassing *tiusinteros* as “thieves.”

Historically, the hungriest sector of society descended on the *tiusintales* as soon as reasonably mature seeds might be procured. In years of extreme hunger, unripe cones were often harvested but later discarded when discovered to contain immature seeds. The most accessible trees were harvested first—women as well as men participated—and by late in the season only cones on trees growing in inaccessible places were left; these were often considered too risky to procure.

Entire families walked or rode more than a day to get to the main populations. Some villages, however, were fortunate enough to have large *tiusintales* within a few minutes' walk. It was (and remains) rare for harvesters to leave the confines of their municipalities. In the case of Guata and Jano, the municipal seats (*pueblos*) of the same name had a few small, highland populations nearby, but these were in no way sufficient to feed the hundreds of families that resided in the sterile pine forest landscape of the interior Olancho highlands. As soon as the need arose—when maize stores ran out in the early months of the year—families would saddle up several pack animals and trek north down the precipitous trails to the Mame River superpopulation which even today still contains 250,000 adult plants in patches along 40 km of the main river and up the side streams. Jano *tiusinteros* stayed on their side of the Mame (the west), while Guata *tiusinteros* stayed on theirs (the east). Families harvested from six to 50 cones, procuring from 70 to over 450 kg of seeds.

The mechanics of the harvest have remained unchanged: female trees (*tiusintas*)—notched with *escaleras* (“ladders”) that endure “forever”—are scaled; the *tiusintero* twists off the cone after chopping away the sharp leaves of the crowns (Figure 5). Trunks commonly grow 6–9 m in length and often extend over the edges of precipices. The *tiusintero* tosses the cone to the ground or places it in a sack, carries it back to where the pack mules are tethered, breaks it apart by striking it repeatedly with a stick, and extracts the seeds (*cumbitos*), still inside their white sarcotestas (*conchas*). Mesh bags (*matates*) are loaded up with seeds and are taken home for further processing. One mule can carry 70 kg of seeds.

In contrast to the uncontrolled harvests of other municipalities, Gualaco, up until the 1980s, strictly managed its harvest through the imposition of an *embargo*—a closed season. All seven Gualaco tiusinte populations fell under this

TABLE 1.—Lexicon for tiusinte (*Dioon mejiae*).

Term	Definition
<i>Alma</i>	“Soul”: Embryo of the seed (Gualaco)
<i>Almidón</i>	“Starch”; see <i>harina</i>
<i>Apaguaste</i>	Toxic, residual water from raw, steeped tiusinte
<i>Atol de tiusinte</i> or <i>atolito de tiusinte</i>	Beverage made from <i>harina de tiusinte</i>
<i>Bebidita de tiusinte</i>	See <i>atol</i>
<i>Brea</i>	“Tar”: Mucilage on the female cone
<i>Cabeza</i>	“Head”: female cone
<i>Cal</i>	Lime (substituted for ash in the <i>nixtamal</i>)
<i>Cáscara</i> or <i>concha</i>	“Shell”: Sclerotesta, sarcotesta, endotesta
<i>Ceniza</i>	Wood ash, preferred for the <i>nixtamal</i>
<i>Comida</i> or <i>producto</i>	“Food” or “product”: Megagametophyte
<i>Corona de tiusinte</i>	Tiusinte leaf wreath
<i>Coronar</i>	To go to the cemetery on Nov 2 and place a tiusinte wreath on a deceased relative’s gravesite
<i>Cosecha de tiusinte</i>	Tiusinte harvest
<i>Cumbo</i> or <i>cumbito</i>	Seed
<i>Churute</i> or <i>churutón</i>	Male cone
<i>Embargo</i>	“Embargo”: season when tiusinte harvesting was formerly illegal in Gualaco
<i>Enchute</i>	Pin-and-target toy made from the seed
<i>Espíritu</i>	“Spirit”: Embryo of the seed (Gualaco)
<i>Escalón</i>	“Ladder” of horizontal cuts made to scale female trees
<i>Finca</i> (<i>fincón</i>)	“Farm”: Gualaco’s Saguay tiusinte population
<i>Gorgojo</i>	Weevil
<i>Grano vano</i>	“Useless grain”: Seed that does not develop (Guata)
<i>Harina de tiusinte</i>	Tiusinte flour
<i>Hembra</i>	Female plant
<i>Horchata</i>	A term for <i>atol de tiusinte</i>
<i>Jucuyul</i> or <i>uva</i>	Unidentified <i>Myrsinaceae</i> tree, the leaves of which are used to wrap tamales
<i>Macho</i>	Male plant
<i>Masa</i>	See <i>nixtamal</i>
<i>Mascaduras</i>	Oven-baked tiusinte foods
<i>Mata</i>	The tiusinte tree
<i>Matilla, matita</i>	Seedling
<i>Nixtamal</i>	The ash-washed, cooked, ground tiusinte seed preparation
<i>Pan de tiusinte</i>	Tiusinte bread
<i>Penca</i>	Flush of new leaves; a leaf
<i>Pinol</i>	A term for <i>atol de tiusinte</i>
<i>Plantación</i>	“Plantation”: Gualaco’s Río de Oro tiusinte population
<i>Rosquete</i>	Leavened doughnut-shaped cookie
<i>Rosquilla</i>	Unleavened doughnut-shaped cookie
<i>Sazón</i>	Describes a mature cone
<i>Seleque</i>	Describes an immature cone; “tierna” is also used
<i>Silbador</i> (also <i>chiflador</i> , <i>chiflón</i> , or <i>cachinflín</i>)	Whistle made from the seed
<i>Tamal de tiusinte</i>	Tiusinte tamale
<i>Temporada, La</i>	Harvest (n.)
<i>Teocinte, Teosinte</i>	Alternative spelling for <i>D. mejiae</i> , found in written accounts but not reflecting local pronunciation
<i>Tiusinta</i>	Female plant
<i>Tiusintal</i>	Place where tiusinte grows: a population

TABLE 1.—Continued.

Term	Definition
<i>Tiusintalito</i>	A small <i>tiusintal</i>
<i>Tiusintera</i>	A woman known to be talented in preparation of tiusinte foods
<i>Tiusintero</i>	A male tiusinte harvester
<i>Tiusintillal</i>	A place where (a) small tiusinte(s) grow(s)
<i>Tiusintillo</i>	A small tiusinte tree
<i>Tortilla de tiusinte</i>	Tiusinte tortilla
<i>Vello</i>	The tomentum ("down") on the female cone
<i>Vestimento</i>	Flush of new leaves (Gualaco)

embargo, though the focus was the Saguay *tiusintal*, which contained at one time in excess of 300,000 adult plants (it has subsequently been reduced by almost half), and produced at least 15,000 harvestable *cabezas* annually. The other major *tiusintal* was that of Río de Oro, which contained around 20,000 plants and produced up to 1,000 *cabezas*. To prevent wastage of *cabezas* and to give everyone a fair chance, the mayor of Gualaco, based on updates he or she received from the auxiliary mayors in the villages, kept the season closed until early March. The opening date of the season varied from year to year, depending on the hunger felt by the human population, a factor closely related to the quantity of maize harvested in the previous year. As soon as the mayor declared the season open, hundreds of families from across the municipality descended on the *tiusintales* to fill up their *matates* in time to prepare for Semana Santa. Informants describe the pre-1980s period as the heyday of the harvest, when the plants still grew in what Gualaqueños call *fincas* or *plantaciones* (farms or plantations shaded by forest), and every family harvested as much as it desired. One informant mentions, however, that some mayors only opened the harvest (*soltaron el embargo*) after they and their aldermen had gathered their fill.

The Gualaco *embargo* was unique. The use of *finca* and *plantación* to describe the tiusinte populations of Saguay (*fincón*) and Río de Oro (*finquita*), combined with a strict management regime, indicate historical processes quite distinct from the laissez-faire attitude that prevailed in the other municipalities. Nevertheless, we have encountered no oral tradition in Gualaco of the cycads being, in fact, at one time a managed plantation or farm. The *embargo* was abandoned as ranchers in the 1980s enclosed the state land (*tierra nacional*) on which the *fincas* were located and introduced barbed wire, grazing stock, and pastures.

Our estimates and interviews indicate that, as a minimum, the average household of six consumers (children over two and adults) needed six average-sized *cabezas* (70 kg of seeds) to feed each member for a month on tiusinte, to the exclusion of maize and beans (Figure 6). Twelve or more *cabezas* can therefore be considered the minimum harvest per family to stretch them through the leanest two months of the year, while families gathering up to 50 cones were either treating tiusinte as a year-round staple, selling it, or both. In villages where an early *Phaseolus vulgaris* L. bean harvest was obtainable and where other resources could also be procured in the dry season (white-tailed deer as principal protein, and mangos, also common property, as the standard "starvation" fruit),



FIGURE 5.—*Tiusintero* in Río de Oro, Gualaco, preparing to harvest a large cone from a tiusinte overhanging a precipice. Photo by M. Bonta.

tiusinte could be “stretched,” combined with other foods to tide the family through until the first maize harvest, which in some cases could be as late as September.

Informants told us that tiusinte was “magnificent” because it could always be counted on to produce sufficient cones, thus helping avert famine. In this, the tiusinte region differed starkly from nearby mountainous regions of Honduras: in central Olancho, for example, many families subsisted during lean years solely on mangos for weeks at a time. (There is convincing evidence offered by one informant, however, that in the 1800s tiusinte seeds were brought from the north and used in central Olancho during times of scarcity.)

Present-day Tiusinte Harvests.—Tiusinte consumers constitute a shrinking percentage of municipal populations that have swollen primarily because of immigration to forest frontier and (in Olanchito) banana-growing zones. Immigrants from other parts of Honduras have little knowledge of or interest in tiusinte. Nevertheless, harvests remain an important autochthonous tradition among long-time indigenous and mestizo residents. In Gualaco and Esquipulas del Norte, there is little obvious correlation between wider availability of imported foods and purposeful exclusion of tiusinte from diets. However, in Guata and Jano, where a stigma is attached to tiusinte consumption, many families claim to have stopped using it altogether.

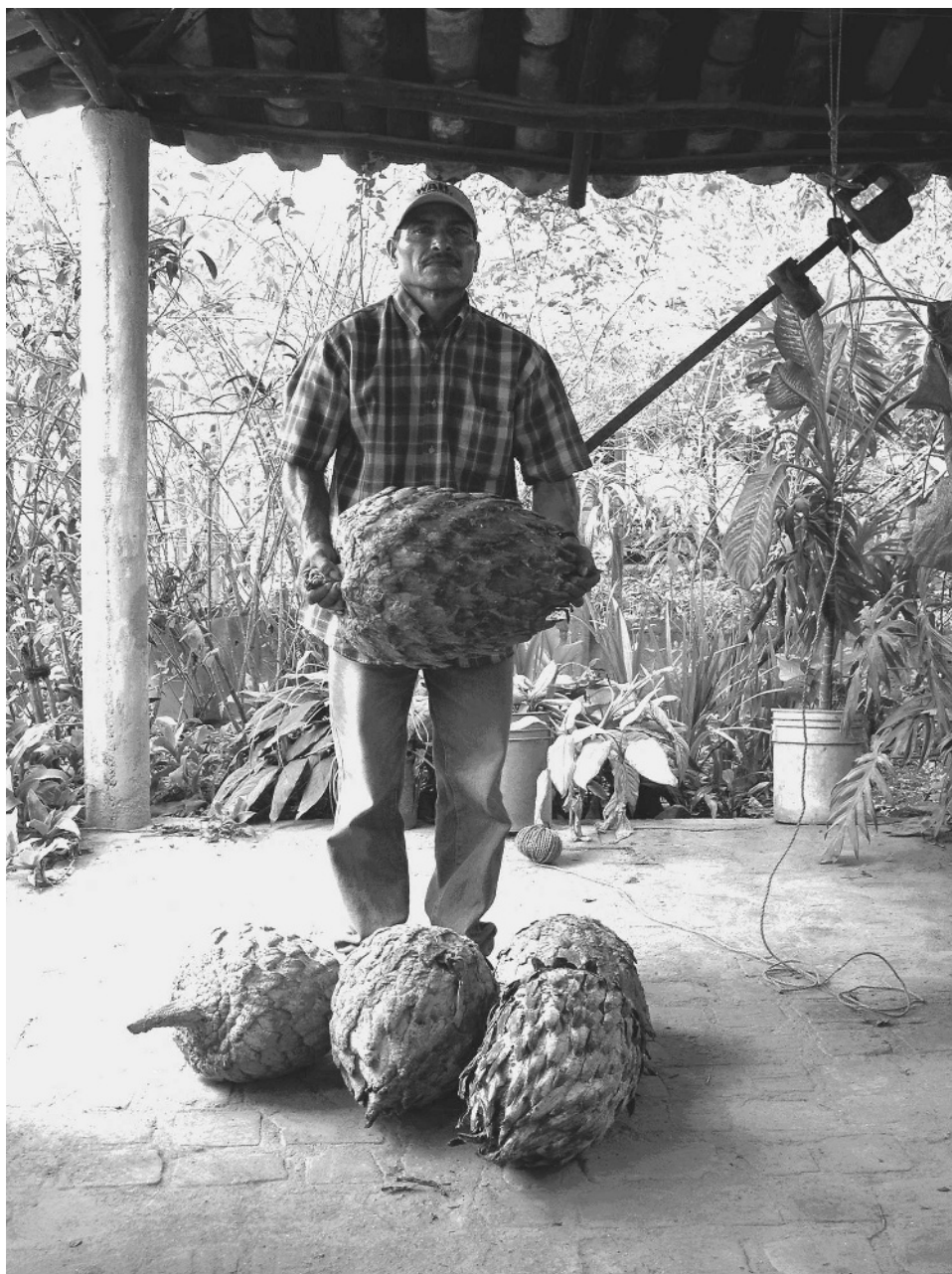


FIGURE 6.—Don Manuel Antúnez, *tiusintero* from Suncuya village, Esquipulas del Norte, with five tiusinte cones. He is holding a very large cone weighing 22 kg and containing over 250 seeds. Photo by M. Bonta.

Families in the poorest villages still trek at least a day to encamp at some of the *tiusinte* populations; however, the times are long gone when main towns such as Guata would empty out during the cycad harvest. Meanwhile, most *tiusintales* (*tiusinte* populations) are under heavy threat from migratory agriculture and ranching, and fire and removal of plants are widely recognized as dire threats to their continued existence.

Harvesting techniques have changed only slightly. However, older informants stressed the ignorance of the current generation, citing neophytes who chop down a tree to get a cone—a practice frowned upon because of the common knowledge that the tree takes untold centuries to grow. In some places (e.g., Saguay), harvests may take place by pick-up truck, because most populations are now more accessible.

Some of the *tiusinteros* with whom we interacted had intricate knowledge of the natural history of the plant, including the pollination process, the exact environmental requirements for its growth, the presence of seed dispersers (e.g., the Central American agouti, *Dasyprocta punctata*), and the various pests that affect it. In the latter case, *Eumaeus childrenae* (*mariposa de tiusinte*, “*tiusinte* butterfly”) caterpillars are the most noxious, though due to the extreme hardness of the plant, they were not believed to cause mortality in wild plants. One *tiusintero* identified the *papelillo* (endotesta) between the seed kernel and the sclerotesta as the seed’s defense against a Curculionidae snout weevil that attacks the kernel.

For plants similar to *tiusinte* in importance, traditional prescriptions that govern the plant gatherer’s actions are the rule, not the exception, in Honduras. But one noticeable feature of the cycad harvest—and of *tiusinte* in general—is the absolute lack of beliefs connecting it to anything “supernatural.” This stands in stark contrast to local beliefs about plants and the Honduran landscape in general, to which “enchanted” characteristics are normally attributed (Aguilar Paz 1989; Bonta 2001). Locally, numerous other plants as well as animals are attributed magical and miraculous qualities. With one exception, not even the oldest informants could recall anything even slightly “inexplicable,” mysterious, or miraculous about the plant. In the town of Esquipulas del Norte and surrounding hamlets, an old saying has it that “one who eats *tiusinte* will never leave Esquipulas” or, alternately, “one who eats *tiusinte* will always (or quickly) return to Esquipulas.” The belief is laughed at by some but afforded credence by others.

Economic Geography.—In addition to its significance in the subsistence diets of harvesters, *tiusinte* has long been a minor item of trade and barter. In Gualaco, *tiusinte* from Saguay was once bartered for coffee from distant villages. Today, in Gualaco, Guata, Esquipulas del Norte, and Olanchito, some *tiusinteros* harvest seeds for the local market, a practice that appears to be thriving in the latter two municipalities. In Gualaco and Olanchito, *tiusinteros* also harvest and sell small *tiusinte* plants, mostly to local households but also, when the demand arises, to nurseries elsewhere in Honduras for the internal and external ornamental plant market.

Currently, the standard measurement used for the sale of seeds—with or without the sarcotesta—is a plastic container that can hold 7.5 liters. Price varies from year to year depending on the size of the harvest, but at least for a couple months of the year, *tiusinteros* can earn 30 to 35 lempiras per container, or a few hundred lempiras a week (in 2003 prices) as a supplementary income. (In 2003, the local daily compensation for a full-time agricultural wage laborer was as low as 30 lempiras in some areas.) Seedlings from the wild sold for six to ten lempiras each.

Trade in *cumbitos* is more significant in Olanchito than in Olancho, primarily because there are still many hundreds of families who consume *tiusinte* in the city proper as well as in the nearby indigenous village of Agalteca, which retains usufruct rights over nearby *tiusintales*. *Tiusinteros* from Agalteca not only sell seeds to other villagers (a process replicated throughout the many *tiusinte*-consuming villages of Olanchito municipality) but also sell them in Olanchito, either directly to consumers or to market vendors for resale. In addition, *tiusinteras* in villages such as Agalteca prepare large quantities of tamales for resale in Olanchito (Figure 7). At least formerly, prepared *tiusinte* meal—*harina* or *almidón*—was also sold in the Olanchito market (Monografía de Yoro 1926). Additionally, nurseries currently buy seeds for export to the U.S. at 1,000 seeds for 300 lempiras. No comparable multi-tiered market system exists anywhere in Olancho.

Toxicity.—*Tiusinte*, like all cycads, is poisonous (Brenner et al. 2003), and though this was known to some informants, there was no overt concern. Traditional methods of food preparation were believed to remove the toxins effectively. Indeed, most informants were either unaware or unconcerned about *tiusinte*'s toxicity.

Only the occasional domestic animal or person suffers ill effects from *tiusinte* consumption. The *almidón* prepared as a base for *atol* and *rosquetes*, for example (see below), leaves a residual, uncooked “cycad water” that is discarded, and cases of poisoning in humans (causing nausea and vomiting) have occurred. This same *apaguaste*, when fed to piglets, can kill them. In Gualaco, we observed a pig become sick after chewing on leaves that we left in a courtyard.

It is likely that *tiusinte*'s various toxins are effectively destroyed or neutralized by the processes described below, for we neither witnessed nor were told of any cases of neurodegeneration. However, further study is needed to eliminate the possibility of long-term effects such as those Whiting identified among the Chamorro of Guam (Whiting 1963).

Food Preparation.—When sacks of *cumbitos* are unloaded from the mules at the house, they become the provenance of the women and girls of the household. If long-term storage is desired (some families keep reserves of seeds throughout the year), *cumbitos* may be dried for several days in the sun, inside their sarcotestas, which turn black, or in their sclerotestas alone, or just as kernel pieces. In all cases, families take the risk of the seeds' being attacked by *gorgojos* (Curculionidae snout weevils, in this case); informants did not identify any storage techniques that would prevent this spoilage.



FIGURE 7.—Doña Sonia Posas, *tiusintera* in Esquipulas del Norte. Photo by D. Graham.



FIGURE 8.—*Tamales de tiusinte*: (a) chopped-up and cooked seeds; (b) shaped *masa*; (c) wrapped in *jucuyul* leaves and cooked; (d) eaten with *mantequilla*. Photos by D. Graham and M. Bonta.

Seeds for immediate consumption are split open (usually by girls) with rocks. The white, starchy kernels (*comida* or *producto*) are broken into small pieces as the second step in the preparation of all tiusinte food products. From that point on, however, techniques of preparation and types of products prepared vary from family to family, village to village, and municipality to municipality.

The *tamal de tiusinte* (Figure 8) is the most appreciated and most frequently prepared of tiusinte foods. The second most common food is the *tortilla de tiusinte* (Figure 9); though rarely praised, it is easy to make and is derived from the same prepared *nixtamal* as the tamale. Third in importance is the drink known variously as *atol*, *pinol*, *horchata*, or simply *bebida de tiusinte*. The only other food prepared throughout the tiusinte's wild range is the *rosquilla*, a doughnut-shaped, unleavened, salty cookie. In Gualaco, two other products are still prepared, though few people retain the knowledge of their preparation: the doughnut-shaped *rosquete*, and leavened cycad bread (*pan de tiusinte*). Collectively, *rosquillas*, *rosquetes*, and *pan* are referred to as *mascaduras*.

To obtain the *nixtamal*, kernel chunks are boiled in water with ash, ideally from broadleaf *Quercus* (*roble*) or narrow-leaved *Quercus* (*encino*) (see Table 2). *Masica* (*Brosimum* spp.) is used among the Tolupan of Tribu Zapotal, Olanchito.

The possibility of substituting lime for ash was mentioned widely across the study area, but except among the Tolupan, it was said to produce a poorer



FIGURE 9.—G. Sandoval sampling *tortillas de tiusinte* prepared by Doña Elizabet Montoya, La Laguna village, Esquipulas del Norte. Photo by M. Bonta.

TABLE 2.—Plants culturally associated with tiusinte (*Dioon mejiae*).

Common Name	Latin name	Family	Part used	Use	Municipality
Bijao or Platanillo	<i>Heliconia bihai</i> L.	Heliconiaceae	Leaf	Tamale wrap	Suncuya village, Esq. del Norte
Caña de azucar	<i>Saccharum officinarum</i> L.	Poaceae	Leaf	Tamale wrap	Agalteca village, Olanchito
Chata (variety of edible banana)	<i>Musa sapientum</i>	Musaceae	Leaf	Tamale wrap	Throughout
Encino (narrow-leaved oak)	<i>Quercus</i> spp.	Fagaceae	Wood	Ash for <i>nixtamal</i>	Throughout; Gualaco
Guineo (common cultivated banana)	<i>Musa sapientum</i>	Musaceae	Leaf	Tamale wrap	Las Labranzas village, Jano; Esq. del Norte; Agalteca village, Olanchito
Jamacuao	<i>Acacia</i> sp.	Mimosaceae	Wood	Ash for <i>nixtamal</i>	Arenal
Jucuyul, Uva, or Uva de montaña (a tree)	n/a	Myrsinaceae	Leaf	Tamale wrap	Throughout
Masica	<i>Brosimum alicastrum</i> Sw.	Moraceae	Wood	Ash for <i>nixtamal</i>	San Lorenzo village, Olanchito
Maulote	<i>Renalmia alpinia</i> (Rottb.) Maas 1982	Zingiberaceae	Leaf	Tamale wrap	Las Cruces village, Gualaco
Ocote	<i>Pinus oocarpa</i> Schiede ex Schltdl	Pinaceae	Wood	Pin for <i>enchute</i>	Throughout
Pita, Cabuya, or Maguey	<i>Furcraea</i> spp.	Agavaceae	Leaf fiber	<i>Enchute</i> string	Gualaco
Roble (broad-leaved oak)	<i>Quercus</i> spp.	Fagaceae	Wood; leaves and twigs	Ash for <i>nixtamal</i> ; in tamale cooking water	Throughout; Gualaco
Tapatamal	<i>Neomillspaughia paniculata</i> (Donn. Sm.) S. F. Blake	Polygonaceae	Leaf	Tamale wrap	Arenal
Tapiquil or Caña brava	<i>Gynierium sagittatum</i> (Aubl.) Beauv.	Poaceae	Leaf	Tamale wrap	Las Labranzas village, Jano; La Laguna village, Esq. del Norte

quality *nixtamal*, and few would admit to using it (lime is the key ingredient in maize *nixtamal*, hence the association). The Tolupan do, however, substitute lime for ash.

In a few homes, clay cooking pots are still used, but otherwise, aluminum suffices. After about half an hour at a rolling boil, with constant stirring, the kernel chunks are strained through a cucurbit-rind or plastic colander, washed off, and cooked again in new ash water. This process may be repeated up to six times. In most cases, at some early point in the process of *nixtamalización* the *tiusinte* is left to soak in the water-ash mixture overnight. The following morning, it is ready to grind. In one case in Gualaco, Graham observed a further cooking in water with *Quercus* leaves and twigs, purportedly to reduce the stickiness of the resulting *nixtamal*.

The thoroughly-cooked *tiusinte*, now a grayish hue, is ground one or more times—formerly by hand on a stone *mano y metate*, now usually in a metal hand grinder—to produce the *nixtamal*. Dollops of *nixtamal* are then placed on leaf wraps and shaped into cylinders varying from 15 to 20 cm in length and up to 2 cm thick. They are wrapped, rarely tied, the leaf ends are folded over, and they are stacked in a pot for cooking, between 20 minutes and an hour. Banana leaves are also sometimes used to cover the stacked tamales. In Gualaco, spherical tamales are occasionally prepared.

One of the most important components of tamale preparation is the type of leaf wrap (see Table 2). The only leaf that is universally used—and almost always mentioned as the “ideal” leaf—is from a plant called *uva* or *jucuyul*, an unidentified deciduous forest tree of the Myrsinaceae family. *Jucuyul* leaves are superficially similar to grape leaves and are said to produce the best-tasting *tamal de tiusinte*. Otherwise, the leaves of various musaceous plants and others are utilized as “second-best.”

Tamales de tiusinte are among the most highly-regarded dietary items in Gualaco and Esquipulas del Norte. Their quality is assessed not in their taste but in their rubberiness—an ideal tamale is so rubbery (*huloso*) that it can be bent back upon itself without breaking. Poor quality tamales, such as those made with lime, break easily. Tamales are quite filling, and it is said that three make a complete meal. They are eaten with red beans, plantains, and other traditional foods; when available, *mantequilla* (sour butter) or *cuajada* (cream cheese) accompany them.

For tortillas, the *nixtamal* is shaped into 13- to 20-cm-diameter cakes that are cooked briefly on the griddle. The tortillas have a ruddy color, and are said to be comparable in taste to *tortillas de yuca* (manioc tortillas).

Formerly, both tortillas and tamales were important to long-distance travelers, who used them as durable and long-lasting food for treks by mule train (*tiusinte* products last three or more days without spoiling, while maize tortillas and tamales may spoil overnight).

The other *tiusinte* foods are prepared without ash. Two main techniques exist for the preparation of the *almidón* (“starch,” otherwise known as *harina*, “flour”). The simpler process is the repeated grinding of raw, sun-dried (or, occasionally, stovetop-dried) seeds, followed by boiling of the resulting fine, white flour in water. From this, *atol* can be prepared quickly. The boiled slurry is filtered

through a sieve, with a slight bit of salt and some cane sugar added, with or without cows' milk. The resulting drink is widely considered to be delicious.

The more complex process of *almidón* production seems to be the more traditional of the two. Sun-dried seeds are ground, then placed in a cloth that is suspended in a container of water. After up to three days, the *apaguaste* water—containing the toxins—is discarded, and the paste is left to dry in the sun, where it takes on a spongy consistency. (The process is quite similar to modes of preparation used by Australian aborigines and others, as described in Thieret 1958.) For *atol*, this *harina* is boiled, and the strained water drunk. For *rosquillas*, the *harina* is mixed with salty cows' milk cheese and shaped into rings, which are baked in adobe-brick, firewood ovens.

The (Gualaco-only) *rosquete de tiusinte* is a sweet pastry. The spongy *almidón*—sometimes mixed with maize flour—is beaten with unrefined cane sugar (*dulce*), lard, and eggs, then cooked. When it begins to bubble, the mixture is left to cool and is then shaped into rings that are baked in the oven. According to one informant, the *rosquetes* are ready when they “melt on the tip of the tongue.”

Bread—*pan de tiusinte*—is prepared (only in Gualaco) with one part *almidón de tiusinte* and one part wheat flour. Baker's yeast is used, in addition to all the ingredients mentioned for *rosquetes*. The dough rises, is shaped, and is baked in the oven.

The only case of *tiusinte* used to feed animals was one informant's mention in Gualaco that cooked, it could be consumed by chickens. However, she was adamant that *tiusinte* is a supremely human food, because it is superior in taste and quality to other foods—to maize, for example—which were more apt for animals. The belief that *tamales de tiusinte* are better than *tamales de maíz* is widely held across the region.

Uses for the Tiusinte Leaf.—The two-meter-long *tiusinte* leaf is used in Catholic festivities not only throughout its wild range but also sparsely across the rest of Honduras and in Nicaragua as well. However, palm fronds as well as plastic and paper leaves have widely supplanted *pencas de tiusinte*. Cycad leaves are used worldwide in rites of Catholicism and other religions (Jones 1993), and, at least in Honduras, one of the reasons for their popularity has been their durability—they can last several weeks before turning brown—as well as their aesthetic appeal. In no case do *tiusinte* leaves have any innate sacred significance in Honduras, and we found no evidence of non-Catholic (e.g., indigenous or syncretic) religious overtones. However, there is a marked geographic differentiation in the nature of the events for which the leaf is used. In the southerly city of Danlí, El Paraíso dept., *tiusinte* leaves (from cultivated plants) are used solely for the funerals of children. In central Olancho (Juticalpa, for example), leaves are used for household funeral altars (Figure 10) and for wreaths placed at cemetery gravesites on Día de los Muertos. The cemeteries of outlying villages such as Punuare sometimes contain *tiusinte* trees (though paper wreaths are primarily used now). To the north, in Gualaco, *tiusinte* leaves are associated with individual death and also with Semana Santa events. In northwestern Olancho (Guata, Jano, and Esquipulas del Norte), leaves are associated partly with death



FIGURE 10.—*Pencas de tiusinte* (*Dioon mejiae*) in a household altar in Juticalpa, Olancho. Photo by D. Graham.

and partly with the Christmas season. Nativity scenes in Esquipulas del Norte contain tiusinte leaves. In Olanchito, the tiusinte leaf is associated primarily with the 24th of December and minimally with death (e.g., tiusintes once grew next to gravestones in the public cemetery).

Cultivated plants outside of the tiusinte's wild range are often grown for the express purpose of having a leaf supply or simply as decorative plants, while in villages within its wild range there are, perhaps surprisingly, less uses for and appreciation of the leaves than in towns and cities.

As integral parts of household altars—erected not only during the funeral event itself but also at prayer events (*rezos*) at forty days, six months, a year, and every year thereafter—tiusintes are decorated with glitter and paint and form a prominent part of the shrine; they are sometimes molded into a heart shape.

For Day of the Dead, tiusinte leaves are decorated with silver paint—an arduous process often assigned to children—and shaped into circular *coronas* (wreaths). These are taken by families to *coronar*, the act of placing the wreaths on graves of the deceased.

Formerly, in Guata and Gualaco, tiusinte leaves were used as awning on the arcades constructed along the approaches to churches on the event of a wedding or the arrival of a bishop (a rare and important occurrence). In Olanchito, leaves are still used to decorate the façade of the cathedral during the Christmas season.

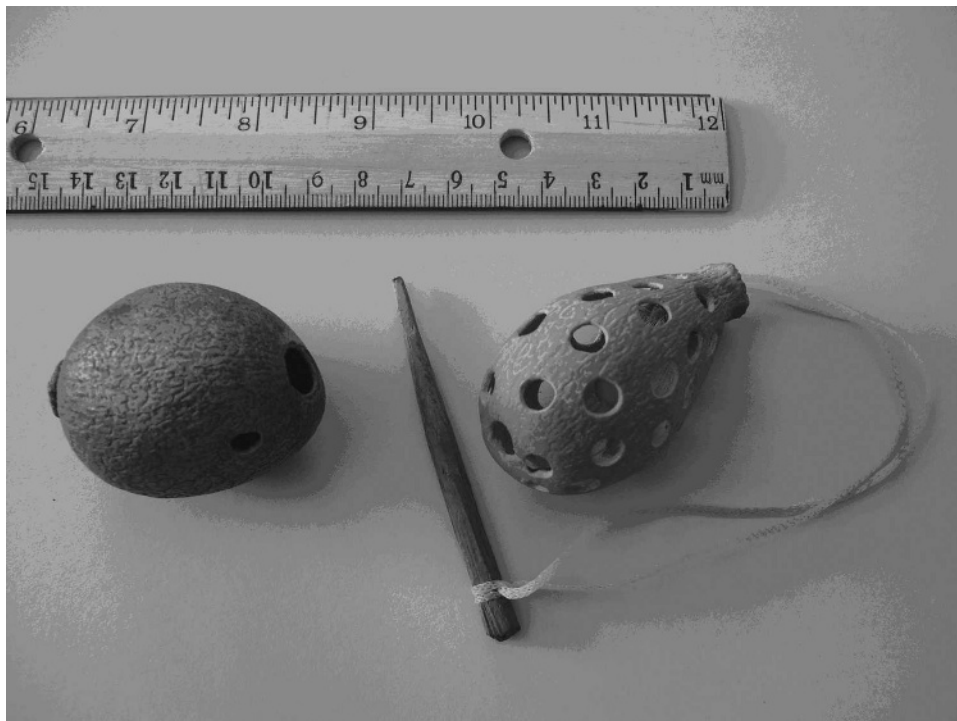


FIGURE 11.—Tiusinte toys. At left, *silbador*; at right, *enchute* (pin is carved from *ocote* [pine], string is synthetic). Photo by M. Bonta.

Tiusinte leaves also have diverse but seldom-seen secular uses: in floral arrangements, Independence Day (September 15) parade floats, and, among the Tolupan, as the roofs of temporary shelters.

In Juticalpa, there are few cases of leaves actually being sold; in general, it appears that these are regarded as gifts. Overall, the use of leaves has lessened considerably throughout Honduras during the last 25 years.

Further Uses for the Female Cone.—The most widespread secondary product of the *cabeza* is the whistle, fashioned by children from the dry *cumbito* (Figure 11). Two small holes are made—one on the end opposite the chalazal appendix, and the other on the side—and the endosperm is extracted with a sharp object. The resulting instrument, called a *chiflador*, *chiflon*, *silbador*, or *cachinflín*, is little-used today, but was once employed as a type of informal announcement that the cycad harvest had begun. According to one informant, its ocarina-like tones were heard in every house in Gualaco as soon as the first seeds were brought back. A series of four mournful whistles, the third on a higher key and the other three at a lower register, were said to bring “gladness to the hearts” of local families. Flores Pinot sees this as an analogue to the importance accorded locally to the calls of certain doves, though this connection was not explicitly drawn by our informants.

Another children's toy was the *enchute* (pin-and-target), now rarely seen (Figure 11). The empty sclerotestas were perforated with holes and attached via an agave *cabuya* (string, nowadays made of durable plastic twine) to a small *ocote* (pine) pin sharpened at one end. The object of the game was to make the *cumbito* hop onto the pin. When this happened, the player would remark "*te puse una panza*" ("I put a belly on you"—i.e., I impregnated you). For this reason, the game was normally not played between a girl and a boy.

The sticky *brea* (mucilage) of the *cabeza* has several minor uses. In Gualaco, it has been used to seal envelopes. In Guata and particularly in Esquipulas del Norte, it is still used to stanch wounds. In the latter municipality, the practice once existed of using the *brea* as a fixative in a mixture with the *peluza* (tomentum) of the *cabeza* and the lard of the *danto* (Baird's tapir, *Tapirus bairdii*); this was affixed to the forehead, and the tapir fat acted as a decongestant. Presumably because the tapir is extremely rare now, the practice has all but disappeared.

Tiusintes and the Rural Landscape.—Across its native range, *tiusinte*'s overall dietary importance is third or fourth among plant foods, following *Zea mays* L. and *Phaseolus vulgaris*, and sometimes *Musa* spp. (In Guata, *maulote* [*Renealmia exaltata* L., Zingiberaceae] starch approaches *tiusinte* in importance.) *Musa*, *Zea*, and *Phaseolus* are either grown separately or intercropped in a variety of environmental situations. Generally, maize and beans are planted with dibble sticks in recently burned fields. Local soil types and moisture regimes, along with socioeconomic factors, determine how many crops can be obtained by a given family in a given year. In most cases where *tiusintes* are found in maize fields, bean fields, and mixed maize-bean fields, they are not intentionally destroyed, and are indeed considered part of the cropping system. *Tiusinte* leaf crowns are often thinned by machete because they shade out crops, while the cumulative damage from ground fires appears to retard growth and eventually kill mature *tiusintes*, as well as discourage regeneration of *tiusintes* from the few seeds that escape the *tiusinteros*.

In the village of Suncuya (Esquipulas del Norte), maize-bean subsistence farmers are also *tiusinteros* for profit (supplying the nearby town). According to Manuel Antunez (Figure 6), they discussed the problems of *tiusinte* loss (well prior to our 2003 expedition) and have begun to practice more careful management. They continue to utilize fire to "clean" the fields, but no longer remove the *tiusinte* leaf crowns. They believe that while fire aids the flushing of new leaves, the wanton destruction of adult leaves hurts the plant. Their aim is to achieve sustainable harvests of *tiusinte* within flourishing grain fields.

In Gualaco, *tiusinte* is seen as a forest product, and any removal of surrounding vegetation for swidden agriculture or pastoral use is criticized. In all municipalities, as mentioned above, *tiusinte* is always common property, regardless of the tenure of the land on which it grows. It is part of what municipalities consider to be *patrimonio*—the natural and cultural heritage of a particular region, its "commonwealth" (see Bonta 2001).

In pine forest regions, *tiusintes* are subject to intensive burning regimes, particularly where both pine and cycad grow in active pastures. Pine woods,

even where cattle are absent, are also burned to create palatable growth for white-tailed deer, the primary prey of hunters in the region. In addition, many of the roads through and near *tiusintales* are a result of the pine logging industry, one of the mainstays of the regional economy (Olancho is one of the most productive pine forest regions in Central America, though the economic benefits accrue mostly to large, outside logging companies rather than to local economies). In Saguay, Gualaco, for example, a road that cuts directly through the *finca* has affected hundreds of *tiusintes* and allowed easier access for speculators who have financed rapid conversion of *tiusintales* to pasture.

Pastoral land-use regimes are extremely damaging to *tiusintales*, and though in most cases *tiusintes* are the only trees not chopped down during the initial conversion from woods to pasture, they die off after at least three consecutive years of fires (pastures are burned annually, sometimes on multiple occasions, for a variety of reasons).

The result of the last 25 years of rapid land transformation across the *tiusinte* region was the destruction of around one-half of the total population of *Dioon mejiae*, including the fragmentation of the two superpopulations. Though the species remains the most common cycad in the Americas (Haynes and Bonta *in press*) and continues to be an important dietary item for around 5,000 families, many of its individual populations are in dire threat of extinction.

Uses for Cultivated Tiusintes.—*Tiusintes* grow in villages across Olancho outside the *tiusinte*'s native range (they are infrequently cultivated within the *tiusinte* region). There are rarely more than ten per village. In each of the larger towns and in the cities of Juticalpa and Catacamas, several dozen are still found, always in private indoor patios and dooryard gardens. Conversely, in Olanchito, Yoro, *tiusintes* traditionally grew in the public cemetery and are also found in the modern, landscaped central park. In Tegucigalpa, *tiusintes* grow prominently in a few public parks and in interior courtyards of older government ministry buildings.

In Juticalpa (population approximately 30,000 in 2003), at least 50 mature *tiusintes* exist, and though others were destroyed in recent years, some of those that remain are still cherished for their leaves or ornamental qualities. The *tiusintes* of Juticalpa originate chiefly from travelers who passed through the *tiusinte*'s native range; the rest come from seeds and offshoots of cultivated plants elsewhere. Two-meter-tall *tiusintes* often date from the 1800s (trunks appear to grow about a meter per century, at most, yielding an age of close to a millennium for the tallest wild *tiusintes*).

Many of the Danlí plants are derived from suckers and offshoots of the *tiusintes* Isidoro Mejía brought from his ranch at El Boquerón near Juticalpa. Suckers, offshoots, and seeds from the Danlí plants were planted around 1950 at the Pan-American Agricultural School at El Zamorano near Danlí; those produced abundant suckers and offshoots of their own, though never fertile cones. The small plants were sold over the years to visitors to the school from around the country. This illustrates a case of the mechanism whereby *tiusintes* were dispersed as cultivated plants across Honduras (and to nearby Nicaragua).

CONCLUSIONS

Three findings in the present study are particularly instructive for future work on the ethnobotany of New World cycads, and particularly *Dioon*. First and foremost is the dietary importance of tiusinte. Its presence appears to guarantee that subsistence consumers do not suffer from hunger during the period of scarcity between the time staple food stores run out and the beginning of the next maize-bean harvest season. This guaranteed alleviation of hunger draws a stark socioeconomic distinction between the tiusinte's native range and adjacent non-tiusinte areas. There is no other wild plant that plays such a role in Honduran society.

Despite varying modern attitudes on the shame associated with being partially reliant on what some think of solely as a *comida de hambruna* (famine food), there is little to indicate to us that the plant is summarily abandoned by a local family or population when hunger is no longer the threat that it once was. The continual and predictable importance of tiusinte in local diets combines with its common-property status to favor any and all projects and plans to preserve it. (We lack, of course, a study of tiusinte's exact nutritive properties, and, not least, some idea of the effects that long-term consumption of tiusinte has on the human brain and liver.)

The second main discovery, something that is well-nigh universal in ethnobotanical research (Shanley and Rosa 2004), is the ever-increasing erosion of the traditional knowledge base of tiusinte. Though the number of consumers is increasing, the nuances of harvest and food preparation are being lost (and the number of available female cones is decreasing). Constraints such as the Gualaco *embargo* have been jettisoned. Few among the younger generation have learned the best ways to prepare foods such as *rosquetes* and *pan de tiusinte*. Situations such as these, at least among the Olancho consumer base, can be blamed on the post-1980 economic modernization that has accompanied the penetration of the export timber industry into the tiusinte region.

The third discovery is the importance of the municipality as a distinct cultural and economic (and in Gualaco, political) entity vis-à-vis the tiusinte's harvest, food preparation, and leaf use. Ethnobotanical differentiation between municipalities is to be expected, given that *municipios* containing *tiusintales* have been distinct from each other at least since early colonial times, and have as a result developed divergent and distinct geographic "personalities" (Bonta 2001). Municipalities such as Gualaco and Guata were, until recently, largely self-contained in terms of necessary natural and human resources, while their rugged terrain helped to isolate them from neighboring municipalities, from regional political and market centers, and from the national capital.

Complementing this municipal differentiation rooted largely in social isolation and divergence are traits found throughout the tiusinte's native range: the tamale, tortilla, and *atol*; the *jucuyul* as leaf wrap; the tiusinte as common property (*patrimonio*); and the sole common name, "tiusinte." Whether these are relicts of an "original" widespread tiusinte culture that has since become fragmented or are concepts and practices that have diffused from a central location in colonial or pre-colonial time, we are unable to say at present. Overall,

we can conclude that tiusinte retains a central role in the cultural self-identification and, hence, autochthony of entire municipalities, even though prior to 2003 it was ignored completely by environmentalists as well as development professionals working in the region.

Conservation of tiusinte, as of all cycads, is of course paramount (see Donaldson 2003). Tiusinte is unique in that its numbers are so high—it can still provide researchers insights on biological and cultural aspects of cycads that are not possible for most New World (and particularly *Dioon*) species. However, *Dioon mejiae* numbers are declining rapidly, so without a coherent attempt on the part of the Honduran government and society to preserve the species (beyond what is practiced at present), populations will continue to be eroded drastically in the coming decades. The current article, accompanied by detailed unpublished reports already completed by these authors (e.g., Haynes and Bonta 2003), provides a basis for conservation strategies that build upon the ethnobotanical knowledge still present—which is fully adequate for the task of protecting the plants. There is strong local interest in establishing or reestablishing tiusinte protection systems, particularly in Gualaco. Tiusinte is hardy and fire-tolerant, and thus, its protection does not necessarily have to function at cross-purposes to timber extraction, pastoralism, or swidden agriculture. Conservation of tiusinte does not violate most existing cultural mores, and it can be protected without initiating radical changes in traditional treatment of the landscape.

Because tiusintes are not yet endangered, are already perceived as important, and are a common property resource, we do not find a strong case for peasant nurseries such as those established for *Dioon edule* and other species in Mexico (Vovides et al. 2002).

Our central conclusion respecting sustainable conservation is that municipalities should delineate their *tiusintales* (cycad populations) and establish clear protocols for public usage as well as limits on private exploitation of the land on which tiusintes grow. Though impetus for this should come from the national government as well, it is the (politically autonomous) municipality that most clearly benefits from formal protection.

Municipal governments can also act in concert with private landowners. Indeed, the best current example of overt tiusinte protection is a cattle ranch in Río Grande, Gualaco, that includes around 100 ha of protected tiusinte groves for reasons of aesthetics and pride. While neighboring ranches have been responsible for much of the devastation of the giant *tiusintal de Saguay* (Figures 2 and 3), the ranch owner's widow continues the legacy of her husband, who achieved complete protection of several thousand plants. Thousand-year-old tiusintes thrive together with cattle in the front yard, through the pastures (which are weeded with machete but only rarely burned), and into the patches of gallery forest that are left intact (foreground of Figure 4). The owner was generous in offering her land as a research site for further in-depth, short-term or long-term studies of *Dioon mejiae*.

Therefore, conservation of tiusintes has already been achieved on a limited basis—on the Río Grande ranch, among the *tiusintero* farmers of Suncuya, through the Gualaco *embargo*, and even at the national level, through a presidential decree protecting the superpopulation of the Mame valley (as

referred to in Standley and Williams 1950). Though the latter two cases are long defunct, there are numerous other cases of “unconscious” *de facto* tiusinte protection at the local level, based essentially on the propositions that tiusintes are worth more uncut, that their presence does not harm anyone, and that they are *patrimonio*—common property. The challenge facing conservationists and legislators is to appreciate traditional conservation and learn how to rescue it and extend it to the species as a whole.

NOTE

¹ Type specimen voucher *Standley 16756*, Chicago Natural History Museum Herbarium; duplicate at Pan-American Agricultural School Herbarium, El Zamorano, Honduras.

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