

**MEXICAN MARKET PLANTS OF 16th CENTURY.  
I. PLANTS RECORDED IN  
HISTORIA NATURAL DE NUEVA ESPAÑA.**

ROBERT A. BYE, JR.

and

EDELMIRA LINARES

*Jardín Botánico, Instituto de Biología  
Universidad Nacional Autónoma de México  
04510 México, DF, MEXICO*

**ABSTRACT.**—Four vegetal products and one ecological associate are registered by Francisco Hernández from the central Mexican markets during the period 1571 and 1576. The commercially important plants were "cacahoaquáhuil" ("cacao," *Theobroma cacao*), "texócotl" ("tejocote," *Crataegus pubescens*), "xochinacaztli" ("flor de oreja," *Cymbopetalum penduliflorum*), and "nantzinxócotl" ("nanche," *Byrsonima crassifolia*) while the market floor was carpeted by "tianquizpepetla" (*Guilleminea densa* and *Alternanthera repens*). Although names and certain uses for each plant are comparable in both the 16th and the 20th centuries, the continuity between these periods is limited to the edible seeds of "cacao" and edible fruits of "tejocote." Two tropical products (aromatic flowers of "flor de oreja" and medicinal bark of "nanche") derived from the former Aztec Empire periphery disappeared entirely from the Mexico City markets between the 17th and 19th centuries. The increase in the number of named fruit forms of "nanche" and "tejocote" may be due to an intensification of their domestication since the colonial period.

**RESUMEN.**—Productos de cuatro plantas y una planta ecológicamente asociada son registrados por Francisco Hernández para los mercados del México central, entre el período 1571 y 1576. Las plantas comercialmente importantes fueron "cacahoaquáhuil" ("cacao," *Theobroma cacao*), "texócotl" ("tejocote," *Crataegus pubescens*), "xochinacaztli" ("flor de oreja," *Cymbopetalum penduliflorum*), y "nantzinxócotl" ("nanche," *Byrsonima crassifolia*), mientras que los suelos del mercado estaban tapizados por "tianquizpepetla" (*Guilleminea densa* y *Alternanthera repens*). Aunque los nombres y ciertos usos para cada planta son comparables en ambos siglos el XVI y el XX, la continuidad entre esos períodos está limitada a las semillas comestibles de "cacao" y a los frutos de "tejocote." Dos productos tropicales (las flores aromáticas de "flor de oreja" y la corteza medicinal de "nanche") procedentes de la periferia del imperio azteca desaparecieron por completo de los mercados de la Ciudad de México entre los siglos XVII y XIX. Se incrementaron las clases nombradas de frutos de "nanche" y "tejocote," lo cual se pudo deber a la intensificación de su domesticación desde el período colonial.

**RESUME.**—Quatre produits végétaux et une plante écologiquement associée sont compris dans le registre des marchés mexicains pendant la période 1571-1576. Les plantes d'importance commerciale étaient "cacahoaquahuitl" ("cacao," *Theobroma cacao*), "texocotl" ("tejocote," *Crataegus pubescens*), "xochinacaztle" ("fleur d'oreille," *Cymbopetalum pendulifloru*), et "nantzinxocotl" ("nanche," *Byrsonima crassifolia*), pendant que le plancher du marché s'est couvri pour "tianquizpepetla" (*Guilleminea densa* et *Alternanthera repens*). Bien que les noms et

certains des usages de chaque plante sont comparables dans le 16-ième et le 20-ième siècle la continuité entre ces deux époques s'est limité aux semences comestibles du "cacao" et aux fruits comestibles du "tejocote." Deux produits tropicaux (les fleurs aromatiques de la "fleur d'oreille" et l'écorce medicinale du "nanche"), qui sont dérivés de la région périphérique de l'empire aztèque, sont disparus des marchés de Mexico entre le 17-ième et le 19-ième siècles. On peut expliquer l'augmentation chez le numéro des formes nommés des fruits du "nanche" et du "tejocote" pour l'intensification dans sa domestication après l'époque coloniale.

## INTRODUCTION

Since the economic institutions of a society are deeply embedded within the social fabric of their respective cultures, archaeologists and historians have found source analysis and resource movement to be useful. The study of the flow and direction of materials allows the spatial modeling of economic activity and the reconstruction of social interactions. Ethnobiology promises to benefit from using a similar analysis of biological remains and their associated artifacts and historical references.

The market system ("tianquiztli" in Nahuatl) of the Aztec Empire was a highly developed social, political and economic system with an intergrated exchange mechanism among diverse ethnic groups and across different ecological zones. According to Hernán Cortés (1981), Bernal Díaz del Castillo (1977), Diego Durán (1971) and Bernardino de Sahagún (1979), the first Spaniards arriving in Mexico marvelled at the richness, size, complexity, and smooth operation of the Triple Alliance's markets such as that at Tlatelolco, near Tenochtitlan.

These markets were one of the chief traits of Mesoamerican societies (Kirchhoff 1943) and dated back more than 20 centuries (Hirth 1984). During the Formative Period (1500 BC-AD 150), the market as well as other methods such as reciprocity, redistribution, and patron-client lineages developed for exchanging goods (e.g., ceramic, obsidian and shell material and products) (Sanders 1984). Later, when marketplace trade enjoyed considerable growth, the socioeconomic and political structures became more complex. In response to this expansion, two classes of merchants evolved—the "tlamacani" who were dedicated to local resale and the "pochteca" who practiced long distance trade (Acosta 1945). The integration of the regional markets gave a certain degree of coherence to the conquest-state. During the early Postclassic Period (AD 950-1150), the long-distance trade by the peoples of the Basin of Mexico exploded as the Classic Period Mayan, Teotihuacan and Monte Alban states collapsed and the network of the elite societies intensified (Smith 1986).

With the disintegration of other Mesoamerican cultural centers, that of the Basin of Mexico dominated because it had a larger and denser population than surrounding areas and also had more intense processes of political interaction and competition (Smith 1986). In 1429, the Triple Alliance was formed by the Mexica, Acolhua and Tepanec polities and ruled most of Mesoamerica from Tenochtitlan. After 1438, however, their integration mechanisms, similar to those used by earlier conquest-states, were not as effective in binding the provinces

outside of the Basin of Mexico to the Triple Alliance. This deterioration was caused by increased distances and physiographic obstacles to communication between the conquered peoples and the imperial capital, by tenacious ethnic affiliation, and by persistence of strong regional marketing (Smith 1986).

As "one of the most impressive survivals of ancient Mexico" (Peterson 1959:217), the markets provide fertile ground for ethnobotanical investigation. Contemporary ethnobotanical studies of market plants reveal spatial and temporal partitioning, patterns of flow, ecological variables and evolutionary changes (Bye and Linares 1983). An examination of historical documents should reveal similar phenomena if we assume that contemporary markets of central Mexico have persisted since prehispanic times. However, until the elements of ancient and modern markets can be shown to represent either continuity or disjunction, we advise caution in the interpretation of past and present patterns which appear to be the same. Studies in Mesoamerican art (Kubler 1961) and religion (van der Loo 1987) using thematic units have demonstrated certain continuities in which these units have survived over time in the same cultural contexts as well as certain disjunctions in which particular elements of different time periods are similar but are found in different frameworks.

In an attempt to construct an information base from which to project future ethnobotanical inquiries grounded in source analysis and resource flow and to determine the continuity or disjunction of the biological products of plant-human interactions over time, we analyze the information about market plants of 16th century found in early post-Conquest documents in comparison with that of the 20th century. Because we assume that the descriptions of the markets by the Spanish chroniclers of the 1500s are applicable to the pre-Conquest "tianguis," no distinction is made between the Aztec and the early colonial markets of central Mexico. This report is the first in a series that will focus on plants mentioned by the early colonial authors as being specifically associated with the markets. This approach contrasts with an earlier method in which we examined contemporary market plants that were cited in historical publications (Bye and Linares 1987). The work of Francisco Hernández, *Historia Natural de Nueva España*, initiates our series.

#### THE WORK OF FRANCISCO HERNANDEZ

Francisco Hernández wrote the *Historia Natural de Nueva España* based upon his field observations in Mexico starting in 1571, 50 years after the Conquest. For five years, he served as Spanish King Phillip the Second's medical doctor in the New World and was charged with documenting the indigenous remedies. Although his original documents are lost, two early editions are known (Flores and Valdés 1979). The "Thesaurus" or Roman edition was published in 1651 with Latin text and illustrations. In 1790, the Madrid edition known as the "Matritense" appeared with Latin text and few illustrations. During the 20th century, two more editions appeared but with Spanish texts. Between 1942 and 1946, the Institute of Biology of the National Autonomous University of Mexico (UNAM) printed an incomplete version with only seven of the existing 24 botanical books. Later, all the natural history books plus other works of Hernández as well as contem-

porary analyses of his contribution were published by the Hernández Commission of UNAM starting in 1959. Volumes II and III of the *Obras Completas* (Hernández 1959) include the *Historia Natural de las Plantas de Nueva España* and are based upon translations from both the Roman and Madrid editions.

Valdés and Flores (1985) have summarized the botanical analyses of the plants described in Hernández (1959). Of the 3076 plants discussed in his work, 1544 have been studied by various authors. Of these, 98 have been identified to family, 249 to genus and 667 to species. It was not possible to identify the remaining 530 plants. The geographic distributions are given for 1858 plants and reflect his travels in the Valley of Mexico as well as in the modern states of Guanajuato, Hidalgo, Mexico, Michoacan, Morelos, Oaxaca, Puebla, Queretaro, and Tlaxcala. Nahuatl names are given for 3000 plants while fewer than 300 plants have Purepechan, Huastecan, Antillian, Peruvian and Philipian names. Other data include morphological descriptions, habitat information, uses and hot-cold qualities of the plants.

## METHODS

We used the analytical index of the UNAM edition (Hernández 1959: III: 419–524) to select the plants that Hernández associated with markets or “tianguis.” This search yielded five plants. In order to compensate for possibly incomplete indexing, we generated a list of associated plants that were reportedly used in combination with each of the five main plants. The plants in this list were subsequently located in other chapters so that we could determine if other market references occurred. No additional market plants were found.

In order to determine the botanical identity of each market plant, we then: (1) consulted previous suggested identifications (Valdés and Flores 1985); (2) analyzed the morphological and ecological characteristics mentioned in Hernández’ text; (3) examined the diagnostic features of the accompanying illustrations (Figs. 1–4); and (4) compared the characteristics of Hernández’ plants with those of contemporary plants sharing similar common names (Martínez 1979a). The Nahuatl names were analyzed using Santamaría (1978) and Siméon (1984).

Once the scientific names were determined, we compared the uses and qualities of each historic plant with those of plants in modern Mexican markets (principally the Mercado Sonora in Mexico City; Bye and Linares 1983; Linares *et al.* 1988), in the field and in ethnobotanical literature. Voucher specimens are deposited in the Ethnobotanical Collection of the Herbario Nacional (MEXU). Published data and specimens deposited in UNAM’s Herbario Nacional (MEXU) were used to map the geographic distributions.

## RESULTS

Hernández (1959) reported five plants from the 16th century Mexican markets. Four taxa were commercial elements and included “cacahoaquáhuatl,” “nanzinócotl,” “texócotl,” and “xochinacatzli.” The fifth plant, “tianquizpepetla,” was ecologically associated with the markets based upon the derivation of its common name.

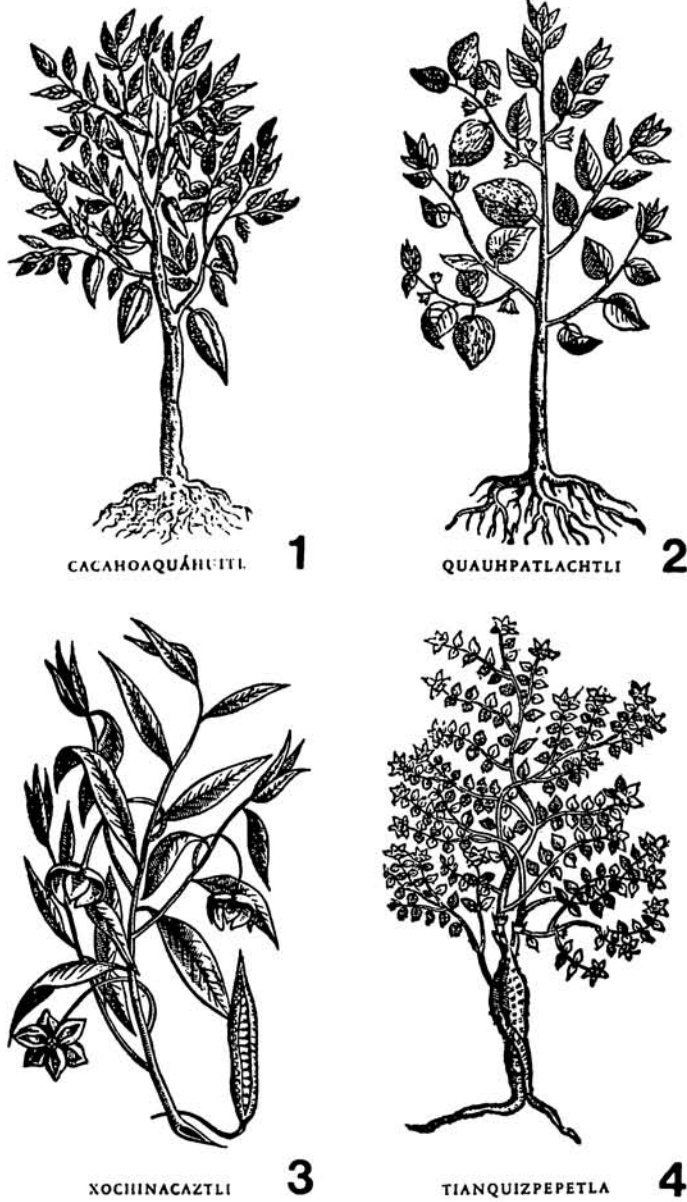


FIG. 1.—“Cacahoaquáhuítl” or *Theobroma cacao* from Hernández (1959: II:303).

FIG. 2.—“Quauhpatlachtlí” or *Theobroma bicolor* from Hernández (1959: II:304).

FIG. 3.—“Xochinacaztlí” or *Cymbopetalum penduliflorum* from Hernández (1959: III:68).

FIG. 4.—“Tianquizpeptla” or *Guilleminea densa* and/or *Alternanthera repens* from Hernández (1959: III:144).



"*Cacahoacquáhuatl*"—This name is derived from 'cacahuatl' = cacao and 'quauitl' = tree and was called "árbol del cacao." It is *Theobroma cacao* L. (Valdés and Flores 1985) although two native species, *T. angustifolium* DC. and *T. bicolor* Humb. & Bonpl., are also known as "cacao" (Standley 1920-1926). Hernández (1959: II:303-305) commented that this tree (Fig. 1) was cultivated in the shade of "atlinan" (probably *Licania arborea* Seem.) in the hot regions of New Spain and had four recognized forms, listed in order by decreasing size of the fruits: "quauhca-cáhoatl," "mecacacáhoatl," "xochicacáhoatl," and "tlalcacáhoatl." All produced seeds, "cacáhoatl," which were used as money and to produce a beverage, although the seeds of the last variety were not used much as coins because of the small size. "Quauhpatlachtli" (Fig. 2) is probably *T. bicolor*. It was considered a close relative of "cacahoacquáhuatl" and produced sweeter seeds which were eaten toasted like almonds or less frequently prepared in a beverage.

The drink based upon only the seeds of "cacahoacquáhuatl" was given to the ill in order to alleviate fever and pain and for liver ailments. To treat dysentery, four "cacao" seeds toasted with an ounce of the gum "holli" (unidentified, probably a natural rubber which is known as "hule" in Spanish) were eaten.

The "cacao" beverages, originally reserved for the Aztec nobility, were diverse and were adopted by the Spanish. Hernández (1959: III:305) warned that excessive drinking of "cacao" would cause intestinal obstruction, changes in one's color as well as "caquexia" (possibly "cachexia," a wasting disease; M. Kay, pers. comm.)<sup>1</sup> and other incurable illnesses. In addition to the simple drink in which the "cacao" seeds were the sole ingredients, four compound beverages were reported. "Atextli" ('watery paste') was a mixture of the finely ground, raw or toasted "cacao" seed with an equal amount of "grano indio" (unidentified). "Mecaxóchitl" (*Piper* sp.), "xochinacatzli" (*Cympotetalum penduliflorum* (Dunal) Baill.) and "tlilxóchitl" (*Vanilla planifolia* Andr.) were pulverized and added to this paste. Then the mixture was blended with water by pouring it back and forth in vessels until a foam was formed on top. The refreshing and nutritious drink was said to stimulate the appetite. Another preparation combined the seeds of "cacahopatlachtli" (*T. bicolor*) with those of *T. cacao* and "grano indio." A third drink called "chocóllatl" consisted of equal amounts of crushed seeds of "cacao" and "póchotl" (*Ceiba aesculifolia* (HBK.) Britt. & Bak. and *C. pentandra* (L.) Gaertn.) which were churned in water until foamy. In addition to being refreshing, it was said to be fattening. The fourth drink, "tzone," was made from cooked seeds of "cacao" and "grano indio." Hernández reported "cacao" as intermediate ("templado") on the hot-cold scale. According to Acosta (1945, in Florescano 1983), annual tributes of "cacao" seeds came from both the Pacific coast (present-day states of Michoacan and Guerrero) and the Gulf coast (present-day state of Veracruz) (Fig. 5).

Today, "cacao" is grown in the warm, humid tropical zones on the Pacific coast in Guerrero and Chiapas and on the Gulf coast in southern Veracruz, adjacent Oaxaca, Tabasco, and adjacent Chiapas (Fig. 5) (García and Falcón 1986; Niembro 1986). Three cultivars of *T. cacao* are grown in Mexico today (Braudeau 1970): "criollo," "forastero amazónico" ("cacao ceilán" or "cacao Costa Rica"), and "trinitario." Of these, the "criollo" was probably domesticated in Mexico during pre-Columbian times from plants originating from the lower eastern

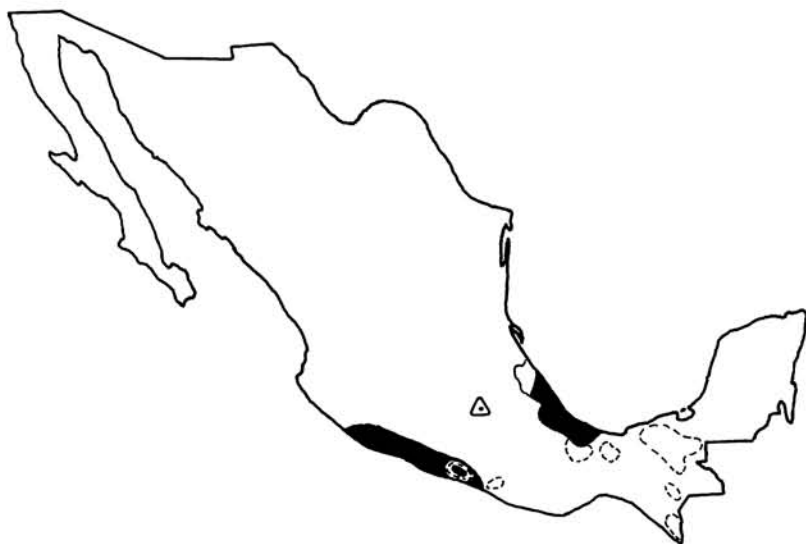


FIG. 5.—Distribution of source areas (solid) of "cacao" tribute (after Acosta 1945) and of current commercial production (line) of "cacao" seed (after García and Falcón 1986) in Mexico.

equatorial slopes of the South American Andes (Purseglove 1977; Simmonds 1976) and is represented by two forms: "criollo de México" and "cacao lagarto" or "cacao pentágonas."

Dried seeds of *T. cacao* are readily available in the markets throughout Mexico and are said to come from Tabasco. They are used in the manufacture of chocolate beverages, usually with milk, sugar and spices. "Chilate," "pataste," "chocolate" and other "cacao" seed-based beverages are consumed in various parts of Mexico.<sup>2</sup> Except for a chocolate drink administered to the mother during childbirth,<sup>3</sup> no medicinal uses have been reported in contemporary times. Commercial candies and flavorings are made from cocoa and chocolate derived from the "cacao" seed as is the cacao fat which is used in the production of emollients and creams (Niembro 1986). Contemporary vendors consider "chocolate" to be hot ("caliente") with reference to the hot-cold quality spectrum.

On the other hand, fresh fruits of *T. bicolor*, "pataste," are found only in the local markets near the areas of cultivation on the Pacific slope from Guerrero to Chiapas. The seeds and the surrounding pulp are added to the toasted cacao seeds and water to make a refreshing drink.<sup>4</sup> The inhabitants of Tabasco add the seeds and pulp to "chorote," a cold drink of cooked maize and toasted "cacao" seeds, and sweets (Rodríguez 1965). Sweetmeats are prepared from the seed (Standley 1920–1926).

*Theobroma cacao* is known in Mexico by the following names (Martínez 1979a): "biziáa" (Zapotec), "bizoya" (Zapotec), "cacahuatl" (Nahuatl), "cacao," "cacao-cuáhuil" (Nahuatl), "cacaotero" (Nahuatl), "cacauatzaua" (Zoque), "caco"

(Mixe), "cagua" (Popoloc), "cahequa" (Purepecha), "cajecua" (Purepecha), "caocauatzaua" (Zoque), "chudechú" (Otomi), "chudechu" (Otomi), "dehy" (Otomi), "haa" (Maya), "kakau" (Maya), "kako" (Mixe), "mamichamoya" (Chinantec), "mamuguía" (Chinantec), "mochá" (Chinantec), "pizoya" (Zapotec), "yagabisoya" (Zapotec), "yagabizoya" (Zapotec), "yagapizija" (Zapotec), and "yau."

"Nantzinxócotl"—This Nahuatl name for *Byrsonima crassifolia* (L.) HBK. is derived from 'nantli' = mother or womb and 'xocotl' = fruit and was called "xócotl de las madres o de las viejas." Valdés and Flores (1985 list only *Malpighia* sp. as the scientific name for this plant while "segundo ahoaxócotl" is attributed to *B. crassifolia*. This shrub was reported from warm regions of New Spain (Hernández 1959: II:30). The edible fruits were bland but agreeable. The powdered bark was used to cure ulcers (sores), to reduce swollen legs, and in childbirth. In the market, the bark of "nantzinxócotl" was sold in a medicinal concoction to aid digestion, clean the stomach, increase appetite, purge the uterus, induce the production of milk, and give new mothers energy. This mixture also included the following unidentified plants: "tlatlacótic," "cuicuitlapilli," "tlapalezquáhuil," "chichicpatli," "tatzayanalquiltic," "iztacpatli," "tlacapolin," "coapatli," "cicimátic," "hueipatli," "poztequizpatli," and "atepocapatli." Hernández reported "nantzinxócotl" bark as being cold ("fría").

"Nanche" is a native shrub of the deciduous tropical forest of both Mexican coasts from southern Tamaulipas and central Sinaloa through Chiapas and the Yucatan peninsula where it may also be protected<sup>5</sup> or cultivated (Pennington and Sarukhán 1968; Standley 1920–1926) (Fig. 6). From April through October, youths collect the fruits from wild plants and sell them in local markets (Pennington and Sarukhán 1968; Rose 1899). These fruits are transported to the major markets of the principal cities of Campeche,<sup>6</sup> Guerrero, Morelos and the Federal District<sup>6</sup> where the prices increase four times (Sánchez 1988). Different forms varying in color (yellow, green, pink and purple) and taste (sweet, acid and astringent) are known (Pennington and Sarukhán 1968; Sánchez 1988). Recently the shrubs have been planted for commercial,<sup>5</sup> ornamental<sup>7</sup> and reforestation purposes (Niembro 1986; Sánchez 1988). People who appreciate the mildly bittersweet fruits eat them raw, prepared in fresh and fermented drinks, candies and ice creams, or preserved in liquors and vinegars<sup>8</sup> (Martínez 1979b; Pennington and Sarukhán 1968; Sánchez 1988; Standley 1920–1926). The cooked fruits are added to chicken stews, soups and tamales (Rose 1899). Mexicans have used the tannin rich bark for tanning and dyeing and as a source of a strong fiber (Standley 1920–1926). Rural residents employ medicinally various parts of the plant for colds, diarrhea, fevers, and snakebites (Niembro 1986; Standley 1920–1926). Martínez (1969) reports that the concoction of the bark with rhubarb (*Rheum* sp.) and lemon peel (*Citrus* sp.) is used to treat infected gums and diarrhea and to tone intestinal muscle. To date, we have not documented the bark of "nanche" being sold in the market for curative purposes. The hard, flexible wood is used for firewood, charcoal, furniture, tool handles, and building construction (Niembro 1986). Market vendors say that the fruits are cool ("fresca") on the hot-cold scale.





("ponche"). Rose (1899) encountered strands of fruits on *Yucca* fiber as a form of selling "tejocotes" in the Guadalajara market. The Mexican prepared food industry uses the fruits as a source of pectin for manufacturing jellies and jams (Niembro 1986).



FIG. 7.—Distribution of *Crataegus pubescens* by states based upon herbarium specimens in MEXU.

The leafy branches, fruits and wood from stems and roots are used medicinally and are sold frequently in the markets.<sup>11</sup> In the Mercado Sonora and La Merced of Mexico City, the herb vendors offer fruits either fresh or dried in disks. A decoction of the dried fruit is drunk to suppress coughing (Martínez 1969). Certain merchants combine the fruits in a dry mixture<sup>12</sup> called "flores cordiales" (which also includes "gordolobo" *Gnaphalium* spp.; "bugambilia" *Bougainvillea* sp.; "eucalipto" *Eucalyptus* spp.; and "tabachín" *Caesalpinia pulcherrima* (L.) Swartz) which is prepared as a tea and ingested to alleviate coughs. Some "curanderos" recommend drinking the infusion made from the Mexican crabapple wood and other plants ("cola de caballo" unidentified Poaceae, *Equisetum* spp.; "cabeza de chivo" unidentified Cyatheaceae; "cancerina" *Hemiangium excelsum* (HBK.) A.C. Smith; "guásima" *Guazuma ulmifolia* Lam.; "matarique" *Psacalium* spp.; "palo azul" *Eysenhardtia polystachya* (Ort.) Sarg.; "pingüica" *Arctostaphylos pungens* HBK.; "tlanchichinole" *Kohleria deppeana* (Schl. & Cham.) Fritch.) to alleviate kidney ailments and female illnesses (Linares *et al.* n.d.). The infusion made from roots is said to be diuretic, antidiarrhetic and antidysenteric (Martínez 1969; Niembro 1986). The market sellers consider the fruit and sprouts to be hot ("caliente") while the wood and root to be cool ("fresca") on the hot-cold scale.

In addition, the local farmers value the hard, compact wood for fuel and tool handles (Niembro 1986).

*Crataegus pubescens* is known in Mexico by the following names (Martínez 1979a; Standley 1920–1926; specimens in MEXU): “bilohui” (Zapotec), “caiasa” (Purepecha), “carasu” (Purepecha), “chisté” (Tzotzil) “cohuaxochitl” (Nahuatl), “dopini” (Otomi), “dopiri” (Otomi), “elpateshimalo” (Chontal), “karash” (Purepecha), “kerbusi” (Purepecha), “manzanilla,” “manzanillo,” “manzanita,” “manzanita tejocotera,” “pedyi” (Mazahua), “pelohuij” (Zapotec), “tejocote,” “tejocote cimarrón,” “tejocotl” (Nahuatl), “texócotl” (Nahuatl), “vipeni” (Otomi) and “yagabelohui” (Zapotec).

“Xochinacaztli”—Valdés and Flores (1985) register “flor de oreja” (‘xochitl’ = flower; ‘nacaztli’ = ear) as *Cymbopetalum penduliflorum* (Dunal) Baill. Hernández (1959: III:67–68) described it as a tree (Fig. 3) from the hot country of New Spain. He specifically stated that nothing was more common in the markets than the flowers of “xochinacaztli.” They were highly esteemed as an additive to the chocolate beverage “cacáuatl.” This drink essence not only provided a delicious flavor and pleasant aroma but also was curative in that it reduced flatulence, thinned phlegm, and warmed and strengthened cold, weak stomachs and hearts.

The “flor de oreja” tree grows in the humid, perennial tropical forest of southern Mexico in the states of Campeche, Chiapas, Oaxaca, Tabasco, and Veracruz (Fig. 8) although northern extensions may exist in Jalisco and Guerrero. As a household remedy in Chiapas, the infusion of the flowers is drunk to aid digestion and to treat asthma (Martínez 1969). Even though there are no contemporary reports of this plant in the Mexican markets, Standley (1920–1926) notes the sale of dried flowers in Guatemalan markets.



FIG. 8.—Natural distribution of *Cymbopetalum penduliflorum* in Mexico (after Pennington and Sarukhán 1968).

The common names used for *C. penduliflorum* are (Martínez 1979a; Pennington and Sarukhán 1968; specimens in MEXU); "flor de oreja," "guineillo," "guineillo prieto," "guineo de montaña," "hueynacastli" (Nahuatl), "hueynacastli" (Nahuatl), "orejuela," "orejuelo," "orifela," "platanillo" "sochinacastle" (Nahuatl), "xochinacastle" (Nahuatl), and "xochinacastli" (Nahuatl).



FIG. 9.—Distribution of *Guilleminea densa* by states based upon herbarium specimens in MEXU.

"Tianquizpepetla"—Although not mentioned as a plant of commerce, this name as recorded by Hernández (1959: III:144–145) suggests that it was associated with the markets. Also known as "alfombra del los mercados" ('tianquiztli' = market; 'pepetla' = fiber mat), it has no recorded scientific name (Valdés and Flores 1985). A synonym was "tececequi" ('tetl' = rock; 'cecec' = cold; 'c' or 'qui' = over) because of the habitat where it grew. *Guilleminea densa* (Willd.) Moq. (synonyms, *G. illecebroides* HBK., *Brayulinea densa* (Willd.) Small) and *Alternanthera repens* (L.) Kuntze (synonym, *A. achyrantha* (L.) R. Br.) are the best candidates for this plant. Hernández reported that this herb (Fig. 4) grew flat and covered the soil anywhere regardless of the climate. Although not analyzed, there were two other classes of "tianquizpepetla": "chalcuítlal" ('cuitlati' = excrement) also known as "estiércol crepitante" or "tianquizpepetla menor" (Hernández 1959: II:235) identified as *Alternanthera repens* (Valdés and Flores 1985) and "segundo tlalocoxóchitl" ('tlalli' = earth, field; 'ocoxóchtil' derived from 'ocotl' = pine and 'xochtil' = flower) (Hernández 1959: II:108–109). The latter plant, "ocoxóchitl," may refer to *Galium* sp. (Valdés and Flores 1985).

Because of their thick roots and prostrate branches with the leaves pressed flat to the ground, these perennial herbs could thrive in heavily travelled areas such as the market plazas where other plants would fail to survive. Today, both species are distributed widely throughout Mexico (Figs. 9-10) and are associated with disturbed habitats, especially sites with heavy trampling where most plants would be crushed to death. Other plants with similar habits, habitats and names include (Martínez 1979a): *Euphorbia heterophylla* L. and *Plumbago pulchella* Boiss. Detailed comparative analyses of the uses and characteristics of *G. densa* and *A. repens* are not made because Hernández did not consider "tianquizpepetla" a plant of commerce.



FIG. 10.—Distribution of *Alternanthera repens* by states based upon herbarium specimens in MEXU.

## DISCUSSION

The five plants that Hernández reported from the early colonial Mexican markets reflect different patterns. Using Tenochtitlan (present-day downtown Mexico City) as the center of the Aztec Empire, three of the four commercial plants originated from the distant periphery while one was found on the surrounding mountains. The fifth plant was an ecological associate of the disturbed market sites. Using the species as the thematic unit and the cultural, ecological and evolutionary characteristics to define the context, limited evidence for the continuity of market plants is found even though names and uses are comparable in the 16th and 20th centuries.

"Cacahoquáhuil" of the 16th century is known as "cacao" today. Although the seeds are important in international trade as a source of vegetable extracts, they are no longer used as currency. Mexicans still consume cold and hot



beverages prepared from the seeds but the recipes are different from those described by Hernández except for that of "chilate" and for the addition of vanilla. The hot-cold classification of chocolate changed from being intermediate to being hot. The trees are still cultivated in the tropical regions of Mexico and the seeds are sold in the Mexico City markets and in local markets. However, the knowledge of its applications and properties in contemporary medicine has not persisted in the center. The number of domesticated forms of the past is equal to that found today but it is not possible to determine if they are the same cultivars. As in the 16th century, the center depends upon the cultivation of this plant in the tropical periphery.

"Nantzinxócotl" of the past is the "nanche" of contemporary dry tropical Mexico. The 16th century commercial remedy prepared from the bark is not known in the modern markets. However, one of the early colonial medicinal uses, that to aid digestion, is still appreciated in rural Mexico. Although the edible fruits were not listed by Hernández as items of commerce, Mexicans today purchase them in both central and local markets. Hernández did not record the management practices and the diversity of fruit forms that are known today. Either he was not aware of them or they did not exist in the 16th century. The medicinal bark product of "nanche" from the dry tropical periphery has disappeared from the center while the diversified edible fruits have entered contemporary central Mexican commerce.

The last tropical periphery element reported in the central markets of the 16th century is "xochinacatzli" which is still known as "xochinacatzle" and "flor de oreja." The dried flowers, once considered to be the most common element of the central market, have disappeared from trade in central Mexico. Today the only use which is comparable to that of the past is the medicinal infusion drunk to aid digestion. The flowers of this humid tropical tree, restricted to the extreme southern limit of the Aztec Empire, disappeared commercially from the central markets where it had been valued as a major flavor additive to chocolate beverages. Further inquiry is needed to understand why this chocolate complement was abandoned and why vanilla was not.

An example in our study that comes closest to demonstrating continuity is that of "texócotl" which is known today as "tejocote." Also, it is the only near-center plant recorded historically from the central market. In addition to retaining its name, though modified, the marketed fruits continue to be eaten and prepared in the same form as in the past. As a medicinal plant, the same parts are used even though they were not registered from the central market in the past nor are their uses and combinations similar. This tree still grows in the temperate climate of the mountains surrounding Mexico City. As in the case of "nanche," Hernández did not record the various management practices and evolutionary forms that are known today, thus leaving open to discussion historical inaccuracy versus intensification of ethnobotanical processes during the last 400 years.

"Tianquizpepetla" due to its ecological tolerance of intensively perturbed habitats was a common element of indirect importance to the market. Many open urban areas today provide habitats similar to those of the 16th century and are covered with both species of these prostrate perennial herbs. However, they are

not found growing on the asphalt and concrete floors of contemporary Mexico City's markets.

With the partial exception of *Theobroma cacao*, the three market plants of peripheral origin lack continuity of use today. This situation may have resulted from a failure in the market system of the Aztec Empire, prior to or after the Spanish Conquest. If we assume that the trade of market items is one of the provisioning mechanism associated with the reinforcement of relationships within the society (Hirth 1984), the weakening of the Triple Alliance exchange system, which included one cultivated and two wild tropical lowland plants, suggests correlated cultural changes due to difficulty of maintaining the center-periphery trade interactions (e.g., disintegration of socioeconomic ties, restriction of suppliers, decline of transport systems) and/or to altered cultural appreciation of the products (e.g., lack of demand, product substitution, change of preference). The cause-and-effect relationships between center-periphery market exchange and sociocultural development merits detailed examination in the future.

One response to eliminate trade dependence upon distant plants is to bring them into a local agricultural system. The lack of cultivation of these peripheral plants in the center may reflect the limitations dictated by biological factors that were stronger than the Aztec technological capability to deal with them. The royal gardens contained a great diversity of plants from all parts of the Triple Alliance Empire and illustrated its advanced horticultural ability (Paso y Troncoso 1883-1884). For example, a peripheral tropical tree ("flor de manita" or *Chiranthodendron pentadactylon* Larreat.) was cultivated in pre-Hispanic Aztec royal gardens of the center (e.g., Tenochtitlan) and persists in the Valley of Mexico (Bye and Linares 1987). Apparently the highly desirable *Cymbopetalum penduliflorum*, the money-bearing *Theobroma cacao* and the medicinal *Byrsonima crassifolia*, all of the tropics, defied cultivation by the royal horticulturists in the temperate climate of the Empire's center. Consequently, the Triple Alliance merchants were forced to import these products from the tropical periphery.

The apparent lack of early colonial documentation of fruit diversification for *Byrsonima crassifolia* and *Crataegus pubescens* indicates the need for more detailed analysis of the historical documents. Were the Spaniards unable to detect products of the various stages of Mesoamerican domestication processes or was there rapid evolution of these plants directed by human selection following the Spanish Conquest? The recognition by Hernández of different cultivars of *Theobroma* suggests that the early Spanish chroniclers in Mexico were able to distinguish genetically different forms; hence, the latter explanation of intensified domestication of these plants after the Conquest may be more plausible.

## CONCLUSIONS

Francisco Hernández recorded four vegetal products (three from the tropical periphery of the Aztec Empire and one from the temperate mountains near its political and economic center) and one ecological associate from the central Mexican markets during the period 1571 and 1576. The commercial plants include: "cacahoaquáhuil" (*Theobroma cacao*), "nantzinxócotl" (*Byrsonima crassifolia*),

"texócotl" (*Crataegus pubescens*), and "xochinacaztli" (*Cymbopetalum penduliflorum*) while the market floor was carpeted by "tianquizpepetla" (*Guilleminea densa* and *Alternanthera repens*). The botanical identifications of "nantzinócotl" and "tianquizpepetla" described by Hernández represent new reports.

Although some of the uses for these plants are comparable and the current common names are derived from earlier Nahuatl terms, we suggest that there is limited continuity of the market plant products and uses from the 16th century to the present. The current sale of the plant parts not documented earlier in the market or the disappearance of the plant from the central market while its use is maintained at the local level may indicate comparable cultural value but these situations probably represent disjunctions due to different socioeconomic contexts. Only the tropical "cacao" seeds for beverages and the edible temperate "tejocote" fruits provide limited evidence for continuity of the Aztec market plants. The disappearance of other uses of "cacao" and of the aromatic flowers of "flor de oreja" and the medicinal bark of "nanche" may have been due to the weakening of the market relationships between the center and the periphery.

#### ACKNOWLEDGEMENTS

We acknowledge the valuable help and hospitality of our collaborators and vendors in various Mexican markets that we have visited, especially those in the Valley of Mexico. We thank the curators and staff of the Herbario Nacional (MEXU) for maintenance of and access to the herbarium specimens. Felipe Villegas M., illustrator of the Instituto de Biología, drew the final version of the maps. The importance of center-periphery and of continuity-disjunction to ethnobotanical problems was brought to our attention by colleagues of the Mesoamerican Archive and Reserach Project of the University of Colorado, Boulder, especially David Carrasco (Director), Doris Heyden, Anthony Aveni, Eduardo Matos Moctezuma, Johanna Broda, and Peter van der Loo. Margarita Kay and Willard Van Asdall provided useful comments on the manuscript.

#### LITERATURE CITED

- ACOSTA SAIGNES, MIGUEL. 1945. Los pochteca: ubicación de los mercaderes en la estructura social tenocha. *Acta Antropológica (México)* 1(1).
- BRAUDEAU, JEAN. 1970. El Cacao—técnicas agrícolas y producciones tropicales. Editorial Blume, Barcelona, Spain.
- BYE, ROBERT A. and EDELMIRA LINARES. 1983. The role of plants found in the Mexican markets and their importance in ethnobotanical studies. *Journal of Ethnobiology* 3(1):1-13.
- \_\_\_\_\_. 1987. Usos pasados y presentes de algunas plantas medicinales encontradas en los mercados mexicanos. *América Indígena* 47(2):199-230.
- CORTÉS, HERNÁN. 1981. Carta de Relación, enviada a Su Sacra Magestad del Emperador nuestro señor por el Capitan General de la N. España. Tomo II in *Historia de Nueva España* (Hernán Cortés). Miguel Angel Porrúa, S.A., and Secretaría de Hacienda y Crédito Público, México, DF.
- DÍAZ DEL CASTILLO, BERNAL. 1977. *Historia Verdadera de la Conquista de la Nueva España*. Manuel Porrúa, México, DF.
- DURÁN, DIEGO. 1971. *Book of the Gods and Rites and the Ancient Calendar*. University of Oklahoma Press, Norman.
- FLORES OLVERA, MARÍA and JAVIER VALDÉS GUTIÉRREZ. 1979. La obra botánica del Dr. Francisco Hernández a más de cuatrocientos años de su realización. *Medicina Tradicional (México)* 2(6):84-88.
- FLORESCANO, ENRIQUE. 1983. *Atlas*

## LITERATURE CITED (continued)

- Histórico de México. Siglo Veintiuno Editores, México, DF.
- GARCÍA DE MIRANDA, ENRIQUETA and ZAIDA FALCÓN DE GYVES. 1986. Nuevo Atlas Porrúa de la República Mexicana. Editorial Porrúa, México, DF.
- HERNANDEZ, FRANCISCO. 1959. Historia Natural de las Plantas de Nueva España. Vol. I & II in *Obras Completas* (Francisco Hernández), Tomos II & III. Universidad Nacional Autónoma de México, México, DF.
- HIRTH, KENNETH G. 1984. Early exchange in Mesoamerica: an introduction. Pp. 1-15 in *Trade and Exchange in Early Mesoamerica* (Kenneth G. Hirth, ed.). University of New Mexico Press, Albuquerque.
- KIRCHHOFF, PAUL. 1943. Mesoamérica, sus límites geográficos, composición étnica y caracteres culturales. *Acta Americana* (México) 1:92-107.
- KUBLER, G. 1961. On the colonial extinction of the motifs of pre-Columbian art. Pp. 14-34 in *Essays in Precolumbian Art and Archaeology* (S.K. Lothrop, ed.). Harvard University Press, Cambridge, Massachusetts.
- LINARES MAZARI, EDELMIRA, BEATRIZ FLORES PEÑAFIEL and ROBERT BYE. 1988. Selección de Plantas Medicinales de México. Editorial Limusa, México, DF.
- LINARES MAZARI, EDELMIRA, ROBERT BYE, TEODOLINDA BALCAZAR, VICTOR TORRES and LETICIA MARTÍNEZ. n.d. Contribución al conocimiento de las plantas medicinales del Mercado Sonora del Distrito Federal, México. In *Memoria de Primer Simposio de Herbolaria*. Academia de la Industria Farmacéutica, México, DF.
- NIEMBRO ROCA, ANIBAL. 1986. Árboles y Arbustos Útiles de México. Editorial Limusa, México, DF.
- MARTÍNEZ, MAXIMINO. 1969. Las Plantas Medicinales de México. Ediciones Botas, México, DF.
- \_\_\_\_\_. 1979a. Catálogo de Nombres Vulgares y Científicos de Plantas Mexicanas. Fondo de Cultura Económica, México, DF.
- \_\_\_\_\_. 1979b. Las Malpigiaceas. Pp. 233-236 in *Flora del Estado de México*, Vol. I (Maximino Martínez and Eizi Matuda, eds.). Editorial Libros de México, México, DF.
- PASO Y TRONCOSO, FRANCISCO DEL. 1883-1884. La botánica entre los nahuas. *Anales de Museo Nacional de México* 3:137-235.
- PENNINGTON, T.D. and JOSE SARUKHAN. 1968. *Arboles Tropicales de México*. Instituto Nacional de Investigaciones Forestales, México, DF.
- PETERSON, FEDERICK A. 1959. *Ancient Mexico—An introduction to the pre-Hispanic cultures*. G.P. Putman's Sons, New York.
- PURSEGLOVE, J.W. 1977. *Tropical Crops. Dicotyledons*. Longman, New York.
- ROSE, J.N. 1899. Notes on useful plants of Mexico. *Contributions from the United States National Herbarium* 5(4):209-259.
- RODRÍGUEZ RIVERA, VIRGINIA. 1965. *La Comida en el México Antiguo y Moderno*. Editorial Pormaca, México, DF.
- SAHAGÚN, BERNARDINO DE. 1979. *Códice Florentino; El manuscrito 218-20 de la Colección Palatina de la Biblioteca Medicea Laurenziana*. Archivo General de la Nación, México, DF.
- SÁNCHEZ VÉLEZ, A. 1988. El nanche (*Byrsonima crassifolia* L.) y otros elementos reforestadores no convencionales para los trópicos secos. *Revista Chapingo* (México) 50/51:33-41.
- SANDERS, WILLIAM T. 1984. Formative exchange systems: comments. Pp. 275-279 in *Trade and Exchange in Early Mesoamerica* (Kenneth G. Hirth, ed.). University of New Mexico Press, Albuquerque.
- SANTAMARÍA, FRANCISCO J. 1978. *Diccionario de Mejianismos*. Editorial Porrúa, México, DF.
- SIMEÓN, REMI. 1984. *Diccionario de la Lengua Nahuatl o Mexicana. Siglo Veintiuno Editores*, México, DF.
- SIMMONDS, N.W. (ed.). 1976. *Evolution of Crop Plants*. Longman, New York.
- SMITH, MICHAEL E. 1986. The role of social stratification in the Aztec Empire: a view from the Provinces. *American Anthropologist* 88:70-91.
- STANDLEY, PAUL C. 1920-1926. *Trees and*

- Shrubs of Mexico. Contributions from the United States Herbarium 25(1-5): 1-1721.
- VALDÉS, JAVIER and HILDA FLORES. 1985. Comentarios a la Obra de Francisco Hernández; Historia de las Plantas de Nueva España. Pp. 7-222 in *Obras Completas* (Francisco Hernández), Tomo VII. Universidad Nacional Autónoma de México, México, DF.
- VAN DER LOO, PETER L. 1987. *Códices, Costumbres y Continuidad: Un estudio de la religión mesoamericana*. *Indiaanse Studies* 2, Leiden, Nederland.
- VELÁSQUEZ GALLARDO, PABLO. 1978. *Diccionario de la Lengua Phorhépecha*. Fondo de Cultura Económica, México, DF.

## SPECIAL NOTE

We dedicate this article to Dr. C. Earle Smith, Jr., whose conversations on Mexican plants stimulated our curiosity about the continuity of ethnobotanical processes over evolutionary time and about the poorly known, yet culturally important, tropical food plants such as *Byrsonima crassifolia*:

## NOTES

- <sup>1</sup>Margarita A. Kay, R.N., Ph.D., College of Nursing, University of Arizona, Tucson, AZ 85721.
- <sup>2</sup>*Bye & Linares* 12068: Market, Campeche, Campeche; 31 March 1983. *T. cacao* ("cacao") from Pichucalco, Chiapas, used to make beverage. *Bye & Linares* 16745: Market, Guanajuato, Guanajuato; 11 December 1988. *T. cacao* used to make "chocolate casero" beverage.
- <sup>3</sup>Notes from Mercado Sonora, Mexico City, DF; 6 June 1982. Hot beverage of "chocolate," "yerba dulce" (*Lippia dulcis* Trev.; *Bye & Linares* 11140: "canela" (*Cinnamomum* spp.), and "retama" (*Cassia laevigata* Willd.) drunk to promote child delivery.
- <sup>4</sup>*Bye, Flaster & McCaleb* 16102: Market, Ayutla, Guerrero; 18 March 1988. *Bye & Rendón* 16261 & 16260: Market, Ayutla, Guerrero; 1 July 1988. *T. cacao* ("cacao" from Tabasco) and *T. bicolor* ("quapataite" grown locally), respectively, used to make "chilate."
- <sup>5</sup>*Bye, Flaster & McCaleb* 16095: Protected tree on hill top S of Ayutla, Guerrero; 18 March 1988. *Bye & Rendón* 16258: Market, Ayutla, Guerrero; 1 July 1988. Fresh fruit from cultivated "nanche;" yields all year round with irrigation.
- <sup>6</sup>Observed in Mercado La Merced, Mexico City, DF, various years. *Bye & Linares* 12128: Market, Campeche, Campeche; 3 April 1983. Fresh fruits of "nanche" from local shrubs.
- <sup>7</sup>*Bye & Linares* 15346: Quintana Roo, Cozumel; 21 April 1987. Cultivated "nanche" in main plaza.
- <sup>8</sup>*Bye & Linares* 12053: Market, Campeche, Campeche; 31 March 1983. Fruits of "nanche" prepared in vinegar.
- <sup>9</sup>*Bye & Linares* 16088: Santa Catarina del Monte, Texcoco, Mexico; 14 March 1988. Semi-domesticated "tejocote" along margin of cultivated field.
- <sup>10</sup>*Bye & Linares* 10686: Mercado Sonora, Mexico City, DF; 13 February 1982. Fresh "tejocote" fruits. *Bye & Linares* 11575: Market, Xalapa, Veracruz; 8 October 1982. Fresh "tejocote" fruits.
- <sup>11</sup>*Bye & Linares* 11689: Mercado Sonora, Mexico City, DF; 13 November 1982. Roots of "tejocote" used medicinally. *Bye & Linares* 12039: Mercado Sonora, Mexico City, DF; 6 March 1983. Tender shoots of "tejocote" used medicinally coughs; is "caliente."
- <sup>12</sup>*Bye & Linares* 16055: Mercado Sonora, Mexico City, DF; 6 February 1988. Compuesto de flores cordiales.