Genetic Resources and Crop Evolution **43**: 505–515, 1996.
© 1996 *Kluwer Academic Publishers. Printed in the Netherlands.*

History of coconut (*Cocos nucifera* L.) in Mexico: 1539–1810

Daniel Zizumbo-Villarreal
Centro de Investigación Científica de Yucatán, A.P. 87, Cordemex, Mérida, Yucatán, CP 97310 México

Received 22 August 1995; accepted in revised form 19 December 1995

Key words: coconut, diversity, genetic resources, history, Mexico

Abstract

The genetic diversity of coconut palm in Mexico has arisen from introductions carried out during the Spanish colonial period (1539–1810). The interest of estimating the extent and origin of the genetic diversity motivated the investigation of sites, dates and origins of the introductions, the initial areas of production, the economic importance of the cultivation and its diffusion during the colonial era. Historical records indicate that the first introductions to the Atlantic coast were through the ports of Veracruz and Campeche around 1549 and originated from Cape Verde (West Africa) and the Caribbean islands. Introductions to the west coast were carried out through the ports of Colima and Acapulco and originated from Panama around 1539, from the Solomon Islands around 1569 and from the Philippines from 1571 onwards. Coconut was present in the west coast of Panama in pre-Columbian times, but its origin and introduction date is unknown. Commercial plantations of economic importance were established on the west coast stimulating further introductions and a wider diffusion of the plant during the 16th and 17th centuries. This diffusion may have brought about genetic flow between ecotypes from different origins. No commercial plantations were established on the east coast during the 16th and 17th centuries. Prohibitions of the cultivation of this plant brought about a halt in development on the west coast during the 18th century. This historical knowledge has enabled us to select key sites in which to gather samples to establish germplasm collections.

Introduction

Mexico is the main producer of copra in America, large areas of production exist on the coastal plains of the Gulf of Mexico and the Pacific, covering an area of almost 200,000 hectares (Zizumbo et al., 1993). The coconut palm is not native to Mexico, the present genetic diversity is a product of introductions carried out during the Spanish colonial period. Earlier reports exist of its introduction to Puerto Rico in the Caribbean Islands from Cape Verde around 1549, to the west coast of Mexico from Panama in 1539 (Bruman, 1947) and from the Philipines between 1571 and 1816, to the Pacific (Smith, 1970; Zizumbo et al., 1993). There are no earlier reports of its introduction to the coasts of the Gulf of Mexico. To estimate the present genetic diversity in the country, and how it was generated, research as carried out on: 1) the exact locations of introductions to Mexico, their dates and origins, 2) the first areas of production in the country, their magnitude and economic importance, and 3) the continuity and historical development of the crop. Other aims were to discover the ecotypes introduced that comprised the productive areas on both coasts, their diffusion, the incentives for new plantations, the sites where different ecotypes came into contact with each other, and for what period. This knowledge is essential to interpret the direction of the evolutionary process of the species in Mexico, and to select critical sites for the collection of samples to form germplasm repositories for the evaluation of productivity and resistance to lethal yellowing disease (LY).

Method

The most important historical works concerning coconut introduction and cultivation were analysed, such as: Cortés (1526–1535); Francisco Hernández (1565–1571); Diego de Landa (1565); The 1580

Historical-Geographical Reports of the Dioceses of Antequera, Mexico, Michoacan, Nueva Galicia, Tlaxcala, (Acuña 1984–87), Yucatan (De la Garza et al., 1983); Documents of the History of Colima 16th-18th centuries (Calderón, 1979) and Documents of the Municipality of Colima (1612–1624) (Sevilla del Río, 1977).

An estimate of the production of coconut for the Diocese of Michoacan during the period from 1612 to 1760, was based on the Documents of the Municipality of Colima (1612–1624) (Sevilla del Rio, 1977), the Report on the Diocese of Michoacan of 1631 (López, 1973) and the series of tithes of the Diocese of Michoacan of 1636–1810 (Florescano and Espinosa, 1987) which refer to the production tithed or levied by the church. The tithe (or tax) has been found to be an effective means of studying the dynamics and tendencies of the agricultural production during the colonial era (Florescano and Espinosa, 1987).

The absolute values of the production were difficult to estimate due to a lack of knowledge of the units of measurement used, such as the 'botija perulera' and the 'arroba'. The first is a measurement of volume in which an earthenware vessel was used, the vessel had a narrow base, wide centre and a narrow neck, and had its origins in prehispanic Peru (Arreola, 1980). The second, a measurement of weight equivalent to 11.6 Kg, is equated to the 'botija' in the documents, therefore, if can be assumed that the 'botija' is equivalent to approximately 11.6 litres if it carried water or wine. In the series of tithes, the 'botija', the 'botijuela' and the barrel are used as units in relation to wine, oil and vineger. All the vessels had variable capacities and equivalents (Florescano and Espinosa, 1987), i. e. 1 botija = 5 to 8 litres; 1 botija = 5.04 to 6.04 litres of wine; 1 botija = 3.52 to 4.53 litres of oil; 1 barrel = 50.24 to 81.64 litres. Therefore, only relative comparisons between the different crops within a region were performed, and the production tendencies for the period under study observed. The series of tithes were used to estimate the annual average value per decade of the tithe in pesos for the decades with yearly reports. This information was used to compare the relative importance of the coconut to other crops in the region.

Introductions of the coconut to west coast of Mexico

The first record of the presence of the coconut on the American Pacific coast is 1514–25, when Gonzalo Fernández de Oviedo y Valdéz (1851–55) observed this plant in the region of Chiman on the west coast of Panama in Punta Burica (on the border between Costa Rica and Panama) and reported its presence on Isla de Cocos (Costa Rica) and diffusion to Nicaragua around 1525 (Peninsula de Nicoya in Costa Rica). The coconut was not present on the Mexican coast in 1539, the year in which Alvaro de Guijo notified Cortés of the shipment of two dozen coconut seeds from the west coast of Panama to be planted on the Mexican coast (Bruman, 1947). The exact site of introduction and the location of the first plantation are not known, however, it could have been the port of Zacatula (Guerrero), Salagua or Santiago (Colima) where an important agricultural area was under development based on the commercial cultivation of cocoa (*Theobroma cacao* L.), around 1540 (Lebrón de Quiñones, 1554; Sauer, 1988) (Fig. 1). Cortés was greatly interested in this region for the strategic location of ports to be used in the exploration and conquest of the Philippines, China, California, and to guard the coasts of New Spain from pirate raids. Therefore, it was vital to provide the Spanish population with a solid economic base. By 1527, he had ordered the navigator Alvaro de Saavedra y Cerón, in his exploratory voyage to the Moluccas Islands, to bring plants in his ships to the port of Aguatlán, now Colima (Cortés, 1925).

The first report on the presence of coconut in New Spain was made by Francisco Hernández in 1573–74: *'... hay dos generos principales de estas palmas, uno bueno para dar fruto y otro para extraer licor de él...'*. The report also specifies the wide use of this plant in making wine, spirits, vineger, honey, sugar, oil, milk or butter. The use of the fruit and seeds in the manufacture of cups decorated with gold and silver, fibre for making threads, wicks or fuses for gunpowder, cables and filling material used for sealing between planks in the construction of ships. Wood, planks and masts for the ships were obtained from the trunks. He also makes the first report of the existence of dwarf coconuts: *'...hay tambien en las islas Filipinas según testigos fidedignos, palmas enanas que apenas brotan de la tierra y ya dan fruto...'*. He does not specify the site of the observations or the sources of information, although it is likely that this refers to the west coast as his voyages of study were carried out towards the Pacific (Miranda, 1960) and he does mention the Philippines.

Around 1580, the Geographic Reports indicate the presence of coconuts in the area of Motines in Colima. It also specifies the use of this plant in making wine, but does not mention its origin (Alcalde, 1580; Xeres,

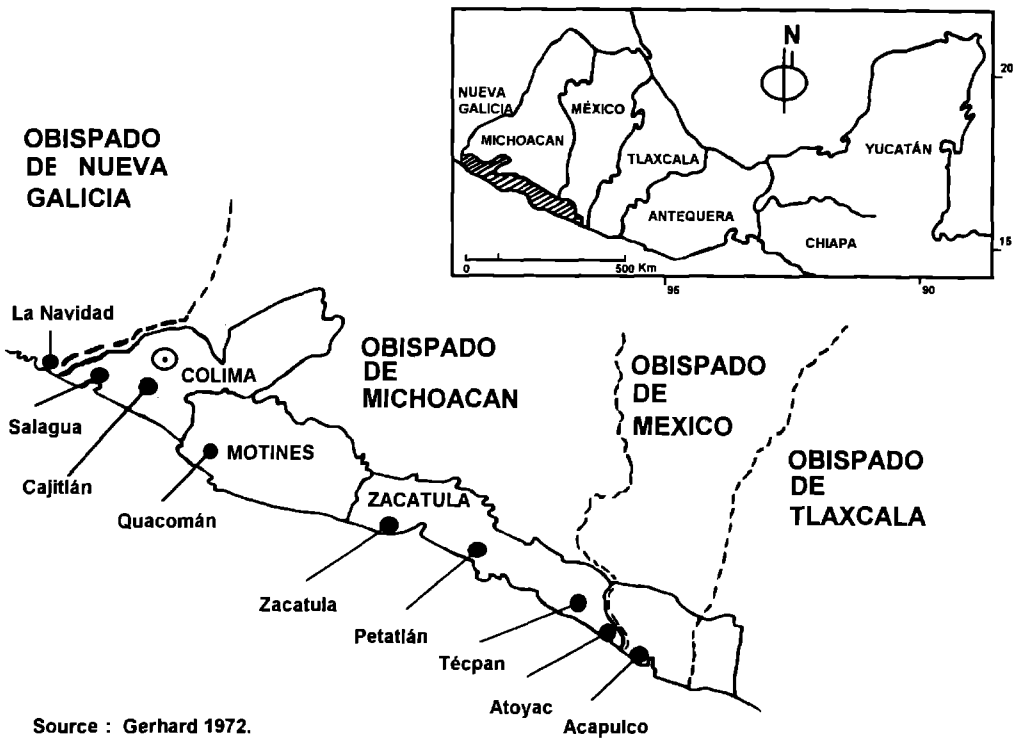


Figure 1. Limits of the Diocese of Michoacan in the 16th century.

1580; Arreola, 1980). In 1580, the presence of adult plants producing tuba (sap) for making wine, in sites relatively distant from the site of introduction, could indicate that the first introduction was, in fact, carried out from Panama to Colima around 1539. There are records of a second introduction to Colima, originating from the Solomon Islands around 1569. The first successful voyages across the Pacific were made during 1565. The first arrived at the port of Navidad on the 9th August, captained by Alonso de Arellano. The second arrived at the port of Acapulco with Andrés de Urdaneta and Felipe Salcedo. It is known that neither transported coconuts (Burman, 1944; 1947). Between 1565 and 1570, only three other voyages were made, that of Juan de la Isla who arrived on the 16th November 1567; Alvaro de Mendaña from the Solomon Islands, arriving at Santiago (Colima) on the 23rd January 1569 and Felipe Salcedo who arrived in June 1569 (Bruman, 1945). There are direct testimonies of the introduction of the coconut to Colima around 1570 (Gorjón, 1612; Herrera, 1612).

Subsequent introductions to the west coast were associated with the commercial route between Acapulco and Manila. Although Cortés opened the port of Acapulco to navigation in 1535, it was not populated until 1550 (Toro, 1859). It was not until López de Legaspi imposed his authority in the Philippines and Urdaneta established the 'tornavuelta' in 1571, that a commercial route was established with Manila (Nao de China), creating two complementary routes, one which connected Manila with China (galleon of Manila) and the other connecting Peru with New Spain (Goleta de Lima). This route favoured active trading between Spain and China, functioning every year between 1571 and 1815. Through this route, Philippine and Chinese immigrants were introduced to New Spain to work in the mines and in agriculture. Plants, such as rice, citrus and other fruits, were also introduced along with the technology for the distillation of liquors, the machete, etc. (West and Augelli, 1966). New introductions of coconut were carried out *via* this route. At the beginning of each trip, coconuts were taken aboard to provide coconut meat and water during the voyage. The coconuts which either germinated or were not consumed, were then planted on arrival (Eleazer, 1981; Gruezo and Harries, 1984). The volcanoes of Colima

were a point of reference for the navigators arriving from the Philippines. The port of Santiago (Colima) was often the first landing point for the ships in America, to obtain provisions and send messages to Mexico City. It was also an alternative port to Acapulco during the war of independence. The absence of customs officials or guards in this port encouraged the smuggling of goods and people. A large number of Philippines entered New Spain through the port of Santiago, forming an important social stratum in the population of Colima by the end of the 16th century (Terriquez, 1984). In this way, Philippine coconuts could have been planted in Colima and Acapulco.

Introductions of the coconut to east coast of Mexico

Oviedo and previous authors do not report the presence of the coconut in the Caribbean Islands (Oviedo, 1535). Neither do they report its cultivation by the Yucatecan Maya or its presence in the Mayan area (Colunga and May, 1992; Landa 1978). The first record of introduction is through the port of Campeche, around 1550 (Piña-Chan, 1977). Around 1550, an introduction of coconuts was made through the port of Veracruz originating from Cape Verde region in West Africa (Patiño, 1580). The narration of Mama and Kantemo, Yucatán in 1580, indicates its introduction from Santo Domíngo (Aguilar et al., 1580). No mention was made of the dates of introduction, however, they were probably carried out around 1549 when the coconut was also introduced to Puerto Rico, as it is known that the plant was taken to the Caribbean Islands and the American mainland from Cape Verde around this year (Harries, 1977).

First cultivation and expansion on the west coast

The main area of cultivation at the end of the 16th century was in Colima. This included the valleys of Cihuatlan, Tecoman, Cajitlan, Colima and Alima. In this area, the coconut plants were cultivated within the already existing fields of cocoa, in which also could be found fruit trees such as white zapote (*Manilkara zapota* (L.) van Roy.); black zapote (*Diospyros digyna* Jacq.), mamey (*Pouteria sapota* (Jacq.) Moore et Stearn), avocados (*Persea americana* Mill.), citrus (*Citrus* spp.) and bananas (*Musa* spp). Coconuts were also established in newly cultivated land. Therefore, the plant was present in both mixed orchards and as monocultures (Gorjón, 1612; Gómez 1612; Alonso, 1612; Muñoz, 1612).

It was common to rent orchards and plantations through the system of 'mediania' between Spaniards, also concessions were given to Philippines for the cultivation, the extraction of tuba, and the manufacture of wine, vinegar and coconut spirits. The Philippines were hired to work and administer the plantations and coconut orchards, their earnings being covered on a share-cropping basis (Terriquez, 1984). The cultural influence of the Philippines in Colima was very important. Even today, a marked influence in relation to the use and management of the coconut in the area can still be observed (Williams, 1988).

By 1602–1603, the commercial coconut groves were located in the Spanish settlements on the coast in the old Diocese of Michoacan (Fig. 1). In the southernmost part of the Diocese, coconuts were recorded on the beaches close to the plantation of Apasagualcos, and on the banks of the River Atoyac in the present day state of Guerrero. In the central area, they were recorded on the delta of the River Balsas, in the alluvial valleys of Zacatula. In the north, they were recorded on the banks of the rivers Coahuayana, Rio Grande and Maravasco, in the valleys of Alima, Colima and Cihuatlan (Figueroa, 1603). At the end of the 16th century and the beginning of the 17th, there is still no mention of the presence of the coconut around the port of Acapulco (Carlatti, 1594–1606; Vizcaino, 1602).

Cultivation on the east coast during the 17th and 18th centuries

In 1580, coconut was recorded near the port of Veracruz (Patiño, 1580), Mérida (Palomar 1580), Mama, Kantemo (Aguilar et al., 1580) and Oxcutzcab, Yucatan (Muñoz-Zapata, 1580). During the same period, no reports are made of coconut cultivation in Nabalam, Tahcabo and Cozumel, Quintana Roo (Contreras, 1580) or in the province of Tabasco (Rodriguez and Alfaro, 1580; Villegas 1580). Similarly, there are no reports of its presence in the towns of Espiritu Santo (Cuatzacualco) (Suero de Canagas, 1580), Chinantla (Esquivel, 1580), Ucila (Quijada, 1580) or in Tlacotalpa, Tuxtla and Cotaxtla (Patiño,1580), Xalapa (Bravo, 1580), Misantla (Péres-Acuña, 1580) and Papantla, Veracruz (Velázquez, 1580) (Fig. 2).

No commercial plantations were developed on this coast because the Spanish population was evacuated

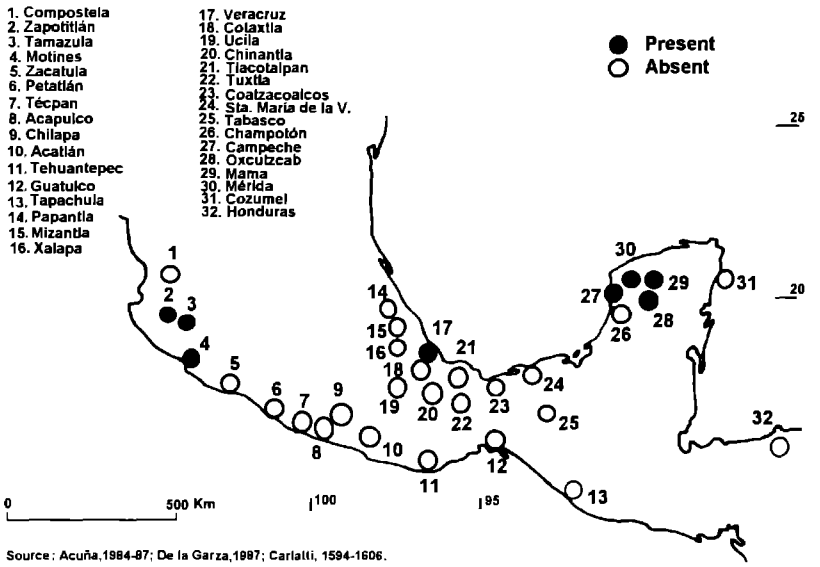


Figure 2. Presence and adsence of the cultivation of coconut in 1580 in Mexico.

due to piracy, which was the scourge of the ports and towns close to the coast. Therefore, in this area, coconut palms were found only in the orchards within the towns. Coconut cultivation probably spread to the coastal settlements of Tlacotalpa, Coazacoalcos, Villahermosa and Champoton after the second half of the 18th century.

Areas of cultivation in the west in the 17th century

The main area of cultivation in the west, during the 17th century, was located in Colima, where approximately 50 large orchards or plantations existed by 1612 (Sevilla del Rio, 1977). A similar number is reported for the Diocese of Michoacan, in 1631. Only one coconut plantation is recorded in Zacatula area, none in Petatlan, three in Tecpan and one in Atoyac (López, 1973). The presence of the coconut is not reported in the coastal settlements of the Diocese of Antequera: Tehuantepec (Arias de Lujan, 1580), Guatulco (Vargas, 1580), Xalapa and Cintla (Maldonado, 1580). Neither is it reported in the Diocese of Tlaxcala: Chilapa (Cabañas, 1580) and Acatlán (Vera 1580).

The expansion of coconut cultivation along the west coast and its intensification in the region of Colima was brought about by the high price commanded by coconut wine in the mining zones of the centre and north of the country, such as Pachuca, Guachinango, Guanajuato and San Luis Potosi (Sevilla del Rio, 1977). The commerce of coconut wine affected Spanish Crown's economic interests as it caused a drop in the sales of wine from Castille and therefore orders were dictated which prohibited its production and sale in the province of Colima in 1603 (Figueroa, 1603). However, the order was not sufficient to contain production and commerce of the coconut wine. In 1610, the Viceroy Luis de Velasco signed an order prohibiting the elaboration and sale of coconut wine (Velasco, 1610).

In 1612, the Royal Audience of Mexico ordered that coconut palms be cut down in their totality in the province of Colima in an attempt to eliminate, once and for all, the production and commerce of coconut wine. The manufacture of the wine was carried out in stills, seemingly with techniques introduced by the Philippines (Alarcón 1612; Tello, 1632–36).

In 1612, coconut cultivation was the main agricultural activity in Colima, displacing the cultivation and commerce of the cocoa. The cultivation of the coconut and the elaboration and commerce of the wine sustained, to a great degree, the social development of the area (Vera 1612; Alonso, 1612).

The felling of the palm groves was not carried out, due to their great economic and social importance to Spanish population in the region of Colima. Coconut cultivation, along with the elaboration and commerce of coconut wine, received the support of the colonial government until the second decade of the 18th century. This was not the case in the area of Zacatula, where the

prohibitions brought about the change to fruit production. There are records of several permits for planted coconut and production wine, granted to the town of Colima. In 1627, the Viceroy Pacheco issued a license (Pacheco, 1627). Later, in 1637, another license for the Viceroy Diez de Armandariz was granted (Diez de Armendariz, 1637). In 1644, 1653, 1664, 1668 and 1671 other permits were granted to the people of Colima (Bruman, 1945). These allowed the production and trade of the wine to continue in the mining zones and continued to favour the development of coconut cultivation.

Dynamics of production in the west: 17th and 18th centuries

In 1612, in the town of Colima, as well as in the valleys of Aguacatitlan, Cajitlan, Tecoman and Alima, a production of more than 20,000 'arrobas' or 'botijas peruleras' of wine per year was reported from 50 existing plantations (230,000 litres, given that the 'arroba' or 'botija' is equivalent to 11.16 litres). The cultivation represented 100 to 200 thousand Castille ducats. With an average yearly rent per plantation of between 1,500 and 2,000 pesos (Monroy 1612, Polonte, 1612).

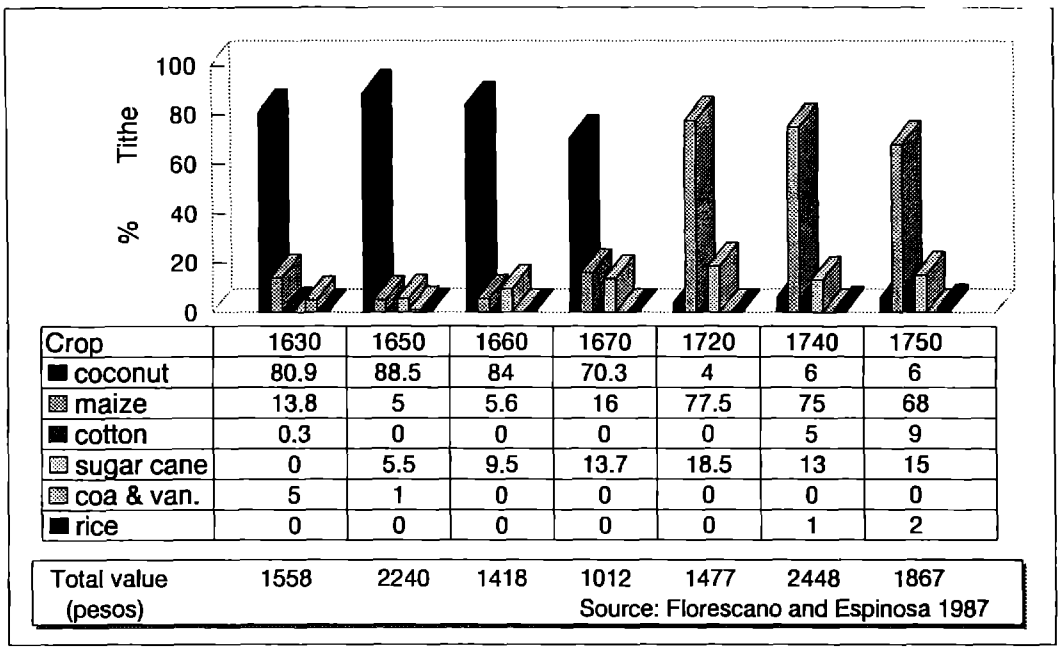
For Colima, the Diocese of Michoacan, in 1631, reported the production of about 21,500 'botijas peruleras' of wine per year from approximately 50 plantations. For Motines, the Diocese reported five plantations in Maquilí with a production close to 1,000 botijas per year. In the Zacatula area, there was only one plantation, belonging to the church, with only a small annual production. No plantation was reported as producing coconuts in the Petatlan area. In the Tecpan area, three plantations were reported with a production of 210 botijas per year and in Atoyac, a large plantation (Apasagualcos) produced 300 botijas yearly (López, 1973).

One hundred palms produced one botija perulera per day (López, 1973), which indicates that, in the Colima area, there existed approximately 6,000 palms in production (as 21,500 botijas ware produced yearly o 60 diarly). As the orchards of Colima, at the present time, have a density of 79 palms per ha in mixed cropping (Pelayo, 1984), it may be assumed that there were approximately 76 ha in production with on average of 1.5 ha per plantation (given that the plantations densities were similar to present day ones). The area under coconut palms was probably larger than this since the cultivation was expanding and there would also have been immature, non-productive palms. Using similar estimates, it can be calculated that there were approximately 275 palms around Maquilí, occupying an area of 3.5 hectares. In the Tecpan area, there would have been 60 palms. In Atoyac there were about 82 palms. In Zacatula there were probably only a few palms in the church orchard.

The dynamics of coconut production in the 17th and 18th centuries can be see in Figs 3 and 4. In Colima, cocoa was the most important crop during the 16th century (Sauer 1988). The displacement of cocoa cultivation in preference for coconut was evident from the beginning of the 17th century (Fig. 3). Cotton cultivation also lost importance during the first decades. By the middle of century, sugar cane cultivation was introduced and became increasingly economically important towards the end of the century. Maize cultivation remained low throughout the century. Vanilla and beans had little economic importance. During that century, between 70 and 80% of the tithe was derived from coconut cultivation, which reflected its importance in the region's economy.

During the 17th century in Zacatula, cocoa cultivation was not displaced by the coconut, as was the case in Colima, and vanilla production grew in importance. The contibution of these two proucts to the total value of the tithe remained between 75 and 100% (Fig. 4). The contibution of the coconut remained at very low levels, indicating the secondary importance of this crop in the area during the period. During the 18th century, in Zacatula area, cotton became the most important crop representing 61.1% of levied production in the 90's (Fig. 4). The cultivation of cocoa decreased in importance during this century. Maize was important and cocoa and coconut became of marginal importance.

In the 18th century, new prohibitions on the production and trade of coconut wine drastically affected the development of the crop. In Colima, the structure of agricultural production changed markedly. The area began producing basic grain crops (maize and beans), and sugar for export to the mining zones, all at the expense of coconut wine. The objetive of coconut production therefore changed, focusing mainly on the production of fruit, in the form of peeled or stripped coconut. In the valleys of Zacatula, Petatlan, Tecpan and Atoyac, coconut cultivation failed to expand and its economic importance was marginal. In the second decade of the 18th century, the Viceroy of New Spain, Juan de Acuña, tried to prohibit the production and trade of coconut wine (Acuña, 1724). Towards the

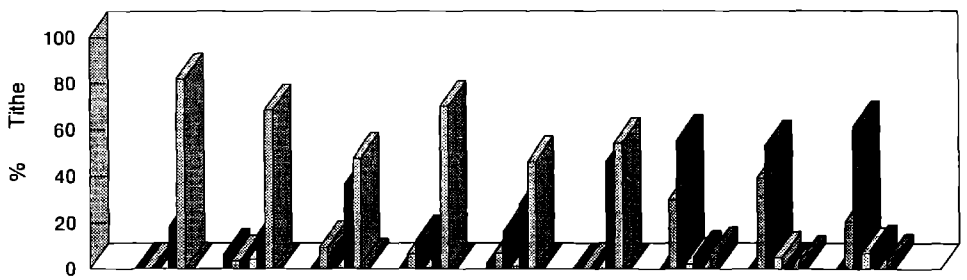


Crop	1630	1650	1660	1670	1720	1740	1750
coconut	80.9	88.5	84	70.3	4	6	6
maize	13.8	5	5.6	16	77.5	75	68
cotton	0.3	0	0	0	0	5	9
sugar cane	0	5.5	9.5	13.7	18.5	13	15
coa & van.	5	1	0	0	0	0	0
rice	0	0	0	0	0	1	2
Total value (pesos)	1558	2240	1418	1012	1477	2448	1867

Source: Florescano and Espinosa 1987

Figure 3. Average annual tithe per decade in Colima between 1630 and 1750.

Fig. 4. Average annual tithe per decade in Zacatula, Petatlán and Técpan during XVII and XVIII Century



Crop	1630	1660	1670	1680	1690	1710	1720	1730	1760
coconut	0	6.3	0.5	0	2.4	0	0.2	0	0
maize	0	3.4	9.3	6.4	6.7	0	29.8	39.1	20.3
cotton	0	2.9	4.5	12	16	0	55	52.7	61.1
rice & s.c.	0	4.3	0	0.2	1.2	0	2.2	5	6.7
vanilla	18.2	14.7	36.4	11.3	28	46	5.3	0	8
cocoa	81.8	68.3	47.4	70	46	54	0.2	0	0
tobac. & chili	0	0	2	0	0	0	6.9	3.1	4
Total value (pesos)	587	866	754	1221	1583	1008	1395	2406	2354

Source: Florescano and Espinosa 1987

Figure 4. Average annual tithe per decade in Zacatula, Petatlan and Tecpan between 1630 and 1760.

middle of the century the Viceroy, Duque de Alburquerque prohibited, once and for all, the production and sale of coconut wine. Mid-century descriptions mention the abandoment of coconut wine production (Villaseñor y Sánchez, 1748; Pérez-Ponce, 1776–77).

Discussion and conclusions

The historical colonial records reveal that the first introductions of coconut took place on the Pacific coast through the ports of Salagua or Santiago in Colima and Acapulco in Guerrero. On the Gulf of Mexico coast, it took place through the ports of Veracruz and Campeche.

The first introduction could have been to the Pacific coast in 1539 from Panama. Later from the Solomon Islands in 1569 and from the Philippines between 1671 and 1815. Introductions to the coast of the Gulf of Mexico were carried out in 1549 from Cape Verde Islands and Santo Domingo. The introductions to the Pacific coast were direct, whereas those of the Gulf of Mexico were indirect, first the Portuguese were thought to have collected seeds from Mozambique and planted them in Cape Verde Islands, from were the Spaniards took them to the Caribbean Islands and Mexico. Colonial records indicate that the coconut germplasm on the west coast of Mexico originated from at least three geographically distintc regions. These regions were the Pacific coast of Panama, the Solomon Islands and the Philippines.

The populations present in Panama on the arrival of the Spaniards could have arrived either naturally, transported by the marine currents from Palmyra atoll (Harries, 1978) or carried by Polynesians from the Pacific Islands or by both means. Oviedo, in 1514–25, noted the presence of two contrasting types of coconut that have been described for the Pacific Islands, *Niu Kafa* or wild type and *Niu vai* or domesticated type (Harries, 1978; Ashburner, 1994). The domestic type would have required the intervention of Man in order to reach America. Man could have transported both types, and in this way, carried out introductions not long before the arrival of the Spaniards in America.

Both wild and domestic coconut types have been registered on the west coast of Central America (Romney, 1969, Richardson et al., 1978), as well as on the coast of Colima (Zizumbo et al., 1993). However, their origins are not clear, as these types could also have originated from coconuts introduced at a later date. In the case of wild type, it could also have originated from the Solomon Islands, as this type is present on the route followed by Alvaro de Mendaña (Kelly, 1965; Whitehead, 1966; Ashburner, 1994). The domestic type could have been introduced from the Philippines where it is also found (Baliñgasa et al., 1974). Phylogenetic studies involving the populations of these sites may eventually enable us to discover their origen. The introductions from the Philippines may have involved dwarf coconuts, as they already were present there in 1574. A germplasm survey of the Mexican Pacific coast (Zizumbo & Harries, 1990) found specimens of dwarf coconuts in some plantations in Costa Grande in Guerrero and in Matanchen, Nayarit, which originated from plantations dating from the beginning of the century, and therefore do not correspond to the germplasm of the dwarf coconut which was introduced to the country in 1940. Therefore, the possibility of older introductions of the dwarf coconut, or their generation *in situ*, can not be ruled out.

The most important productive area during the period studied was Colima, where the production and trade of coconut wine were the most important economic activities during the 17th century. This favoured the immigration of Philippine people and the futher introduction of coconuts. After prohibition of these activities, Colima became a producer of basic grains during the 18th century and the cultivation of the coconut became of secondary importance. In the areas of Zacatula, Petatlan and Tecpan, the production of cocoa and vanilla was of great economic importance during the 16th and 17th centuries but was displaced by the cotton and tobacco production during the 18th century. The economic importance of the coconut was secondary and marginal. On the other hand, on the Gulf coast, the coconut was found only in populated areas and the production was focused on fruit throughout the duration of the period studied.

The economic importance of the coconut in Colima, during the 16th and 17th centuries, its presence during the 18th century and its continuity to present times, allowed this area to become a source of germplasm for the western region. In the same way, the areas of Zacatula, Tecpan and Atoyac, Guerrero became the source of germplasm for the copra-producing regions of the twentieth century, mainly on the coast of Oaxaca and Chiapas. The coconuts present in Veracruz, Campeche and Yucatán were the 'seed base' for the establishment of present day production areas on the Gulf coast. In this way, the initial introductions of the colonial era constitute the genetic base of coconut production in Mexico. A great expansion in the cultivation of the coconut took place at the end of the 19th century

and the beginning of the 20th, when the plant became important on a world level due to increased vegetable oil demand. Mexico became one of the closest and safest suppliers for the United States of America (Harries, 1978; Zizumbo et al., 1993). The main objectives of the production of the coconut have changed; from the elaboration of wine in the 16th and 17th centuries to the fruit production during the 18th century and finally to the production of copra and oil from the end of the 19th century to the present day.

The out-crossing nature of tall coconut palms has permitted the hybridisation of ecotypes of different origins and characteristics. Therefore, the planting of different ecotypes within the same plantations, over many generations, would have favoured their recombnation and quite likely increased the initial diversity.

Historical sources indicate the existence of relationships between the genotypes of Mexico and those of Panama and Peru, due to the introductions from Panama to Mexico and introductions to Peru of the Philippine genotypes via Mexico. This is of great importance to this country as the genotypes of Panama and Peru showed high levels of resistance to lethal yellowing disease in Jamaica (Been, 1981). These genotypes have been useful in the selection and genetic improvement programmes of the plant, and have allowed us to combat the disease (Harries and Romney, 1974). In this way the genetic diversity of the coconut palms in the west of Mexico is a product of the contact of genotypes of different origin, over a long period of time. This increases the possibility of finding a differential behaviour of the populations to LY and the possibility of finding resistant genotypes. It also means that this area takes precedence in the collection of germplasm and its testing for response to LY. Populations and individuals may then be selected for resistence to LY and be used to generate hybrids for replacement of susceptible coconut palms.

Acknowlegments

Thanks to Ismael Aguayo F., Gregorio Macedo L., Juan Oseguera V., Ernesto Terriquez S., Patricia Colunga G-M. and Roger Ashburner for their valuable assistance in preparing this paper. The investigation was supported by Consejo Nacional de Ciencia y Tecnología, Mexico (CONACyT), grand N9109-0598.

References

Acuña, J., 1724. Mandamiento. in: F. Sevilla del Rio (ed). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977, Ed. Jus. México. pp. 173–178.

Acuña, R. (ed.), 1984–87. Relaciones geográficas del siglo XVI: Antequera, México, Michoacán, Nueva Galicia, Tlaxcala. UNAM, México.

Aguilar, J. de, A. González and A. Pech, 1580. Relación de Mama y Kantemo. in: Mercedes de la Garza et al. (eds) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. I. UNAM, México. 1983. pp. 109–116.

Alarcón, B.H. de, 1612. Testimonio. in: Sevilla del Rio (ed). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Río. 1977. Ed. Jus. México. pp. 79-84.

Alcalde, de la, R., 1580. Relación de la provincia de Motín. in: R. Acuña (ed). Relaciones geográficas del siglo XVI: Michoacán. UNAM. México. 1987. pp. 156–180.

Alonso, M., 1612. Testimonio. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de Sevilla del Rio. 1977. Ed. Jus. México. pp. 38–41.

Arias, de L.P., 1580. Relación de Teguantepec. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo II). UNAM. México. 1984. pp. 107–125.

Arreola, C.R., 1980. Coalcoman. Gob. del Edo., Morelia, Michoacán.

Ashburner, C.R., 1994. Characterisation, collection and conservation of *Cocos nucifera* L. in the south Pacific. PhD. School of agriculture and forestry. Univ. Melbourne.

Baliñgasa E.N., C.B. Carpio and G.A. Santos, 1974. Coconut varieties in the Philippines. in: 5th Annual Meeting of crop Science Society of the Philippines. (May 2–4) Nega City, Philippines.

Been B.O., 1981. Observations on field resistence to lethal yellowing in coconut varieties and hybrids in Jamaica. Oléagineux 36: 9–12.

Bravo L.C., 1580. Relación de Xalapa. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Tlaxcala (tomo II). UNAM. México. 1985. pp. 243–271.

Bruman, H.J., 1944. Some observations on the early history of the coconut in the New World. Acta Americana 2 (3): 200–243.

Bruman, H.J., 1945. Early coconut culture in Western Mexico. Hispanic American Historical Review. 25: 301–314.

Bruman, H.J., 1947. Notes and comment a further note on coconuts in Colima. Hispanic American Historical Review. 27: 212–223.

Cabañas, J. de, 1580. Relación de Chilapa y Minas de Zumpango. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo II). UNAM. México. 1984. pp. 109–119.

Calderón, A.Q. (ed.). 1979. Documentos para la historia del Estado de Colima, siglos XVI–XIX. Col. Peña Colorada. Ed. Novaro. México.

Carlatti, F., 1594–1606. Razonamientos de mi viaje alrededor del mundo (1594–1606). UNAM, Mexico, 1983.

Colunga, G-M.P. and F.P. May, 1992. El sistema milpero y sus recursos genéticos. in: D. Zizumbo et al., (eds). La modernización de la milpa en Yucatán. CICY/DANIDA. Mérida, México. pp. 97–134.

Contreras, D. de, 1580. Relación de Nabalam, Tahcabo y Cozumel. in: Mercedes de la Garza et al. (ed.) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. II. UNAM, México. 1983. pp. 185–190.

Cortés H., 1526. Cartas de Relación. Ed. Porrua. México 1970.

Cortés H., 1535. Cartas y otros documentos. Sevilla 1925.

Diez de Armendáriz, 1637. Ordenanza. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 164–165.

Eleazar, 1981. Coconut production and marketing with small farmers. Quart. Suppl. (marzo 1981): 1–10.

Esquivel D. de, 1580. Relación de Chinantla. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo I). UNAM. México. 1984. pp. 100–109.

Florescano E. y L. Espinosa, 1987. Fuentes para el estudio de la agricultura colonial en la diócesis de Michoacán: series de diezmos 1636–1810. Col. Fuentes. INAH, México. 2 vols.

Figueroa E. de, 1603. Mandamiento. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de Sevilla del Rio. 1977. Ed. Jus. México. p. 13.

Garza M. de la, A.L. Izquierdo, M. C. León and T. Figueroa. 1983. Relaciones histórico-geográficas de la gobernación de Yucatán. 2 Vols. UNAM, México.

Gerhard P., 1972. A guide to the historical geography of New Spain. Cambridge Univ. Press. Cambridge. 476p.

Gómez M.H., 1612. Testimonio. in: Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de sevilla del Rio. 1977. Ed. Jus. México. pp. 45–48.

Gorjón T. de, 1612. Testimonio. in: Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 67–74.

Gruezo, W.Sn. and H.C. Harries, 1984. Self-sown, wild type coconuts in Philippines. Biotropica 16(2): 140–147.

Harries, H.C., 1977. The Cape Verde region: (1499–1549): the key to coconut in the western hemisphere? Turrialba 27: 227–231.

Harries, H.C., 1978. The evolution, disemination and classification of *Cocos nucifera* L. The Botanical Review 44: 265–319.

Harries, H.C. and D.H. Romney, 1974. Maypan: an F1 hybrid coconut variety for commercial production in Jamaica. World Crops 26: 265–319.

Hernández F., 1571–1573. Historia Natural de Nueva España. 5 Vols. UNAM, México. 1960.

Herrera C. de, 1612. Testimonio. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 75–78.

Kelly Celsus, O.F.M., 1965. Australia Franciscana, Madrid.

Landa Fray Diego de, 1565. Relación de las cosas de Yucatán. Ed. Porrua, México. 1978.

Lebrón de Quiñones, 1554. Relación sumaria de la visita que hizo en Nueva España a docientos pueblos. in: J. Antonio Calderón Q. (ed.). Documentos para la historia del Estado de Colima, siglos XVI–XIX. Texto paleográfico de Ramón Ma. Serrera. 1979. Col. Peña Colorada. Ed. Novaro, México. pp. 27–106.

López L.R., 1973. El obispado de Michoacán en el siglo XVII: Informe inedito de beneficios, pueblos y lenguas. Fimax publicistas. Morelia, Michoacán. 1631.

Maldonado J.L., 1580. Relación de Xalapa, Cintla y Acatlán. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo II). UNAM. México. 1984. pp. 277–293.

Medina J. de, 1580. Tlacotalpa, Tuztla y Cotaxtla. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Tlaxcala (tomo II). UNAM. México. 1985. pp. 283–297.

Miranda, J., 1960. El viaje y la exploración de la Nueva España, in G.D. Somolinos (ed.). Vida y obra de Francisco Hernández. Obras completas Vol. I. UNAM, México. pp. 194–224.

Monroy, Juan D. 1612. Peticiones y autos. in: F. Sevilla del Rio (ed). Provança de la villa de Colima. Texto paleográfico de Sevilla del Rio. 1977. Ed. Jus. México. pp. 9–31.

Muñoz, G., 1612. Testimonio. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 62–66.

Muñoz-Zapata, H., 1580. Relación de Oxcutzcab. in: Mercedes de la Garza et al. (ed.) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. I. UNAM, México. 1983. pp. 355–357.

Oviedo y Valdés, Gonzalo Fernández de, 1535. Historia General y Natural de las Indias, islas y tierra firme del mar oceano. Parte 1. Sevilla. Edición y Estudio preliminar de José Amador de los Ríos. 1851–55. Real Academia de la Historia, Madrid.

Pacheco O.R., 1627. Ordenanza. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Edición y Texto paleográfico de Felipe Sevilla del Rio. 1977. Jus. México. pp. 164–165.

Palomar, M. de, 1580. Relación de la Ciudad de Mérida. in: Mercedes de la Garza et al. (ed.) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. I. UNAM, México. 1983. pp. 65–82.

Patiño, A., 1580. Relación de la Ciudad de Veracruz. in: Acuña (ed.) Relaciones geográficas del siglo XVI: Tlaxcala. UNAM. México. 1985. pp. 321.

Pedraza C. de, 1544. Relación de la provincia de onduras e igueras in Relaciones y documentos de Yucatán. Documentos ineditos. Univ. Autón de Yucatán. Mérida. 384–409.

Pelayo H.A., 1984. El cultivo del cocotero en Colima y su reabilitación. in: Memoria del primer seminario sobre el cultivo del coco en Colima.CONAFRUT/SARH. México. pp. 14–24.

Pérez de A.A., 1580. Relación de Misantla, in R. Acuña (ed.). Relaciones geográficas del siglo XVI: Tlaxcala (tomo II). UNAM. México. 1985. pp. 181–191.

Pérez Ponce de León, M.J., 1776–1777. Descripción del Distrito de Colima y del corregimiento agregado de San Miguel Xilotlán. in: J. A. Calderón Q. (ed.). Documentos para la historia del Estado de Colima, siglos XVI–XIX. Texto paleográfico de Pablo Emilio Pérez-Mallaia B. 1979. Col. Peña Colorada. Ed. Novaro, México. pp. 176–207.

Piña-Chan, R., 1977. Campeche durante el periodo Colonial: 1550–1790. INAH, México.

Polonte, Juan de, 1612. Testimonio. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1997. Ed. Jus. México. pp. 35–38.

Quijada, H. de la, 1580. Relación de Ucila; Relación de Coatzacoalco & Relación de Villa del Espiritu Santo. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo I). UNAM. México. 1984.

Richardson, D.L., H.C. Harries and E. Balseviscus, 1978. Variedades de cocotero en Costa Rica. Turrialba 28: 87–90.

Rodríguez, V. and M. de Alfaro, 1580. Relación de la Provincia de Tabasco. in: Mercedes de la Garza et al. (ed.) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. II. UNAM, México. 1983. pp. 367–378.

Romney, D.H., 1969. Central America, in FAO: Coconut breeding: Yearly Progress Report of the FAO. Rome, 6–8.

Sauer, C., 1988. Colima of New Spain in the sixteenth century. Berkley.

Sevilla del Rio, F. 1977. Provança de la Villa de Colima: Documentos originales del Archivo Municipal de la Ciudad de Colima 1612–1724. Textos paleográficos de F. Sevilla del Rio. Ed. Jus, Mexico D.F. 189 p.

Smith R.W., 1970. Mexico y Venezuela, in FAO: Coconut breeding: Yearly Progress Report of the FAO. Rome, 20–21.

Suero de Cangas Q., 1580. Relación de Coatzacoalco. Villa del Espiritu Santo. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo I). UNAM. México. 1984. pp. 116–127.

Tello, A., Crónica Miscelanea de la Sancta Provincia de Xalisco. Texto paleográfico de J.L. Razo Z. 2 vols. Gobierno del Estado de Jalisco/Universidad de Guadalajara. Guadalajara. 1973.

Terriquez, S., 1984. La del coco, una cultura transterrada. Segundo Foro Interamericano: Las culturas populares y la educación superior. Univ. de Colima. Colima. pp. 11–17.

Toro, M.M., 1859. Noticia estadistica del Distrito de Acapulco de Tabares. Bol. Soc. Mex. Geogr. y Est. 7: 407–428.

Vargas, G, de, 1580. Relación de la descripción del Puerto de Guatulco. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Antequera (tomo I). UNAM. México. 1984. pp. 187–199.

Velasco L. de, 1610. Mandamiento de 1610. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 163–164.

Velázquez, J., 1580. Relación de Hueytlapa. in: R. Acuña (ed). Relaciones geográficas del siglo XVI: Tlaxcala (tomo II). UNAM. México. 1985. pp. 151–179.

Vera, J. de, 1580. Relación de Acatlán. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Tlaxcala (tomo II). UNAM. México. 1985. pp. 31–61.

Vera, S. de, 1612. Testimonio. in: F. Sevilla del Rio (ed.). Provança de la villa de Colima. Texto paleográfico de F. Sevilla del Rio. 1977. Ed. Jus. México. pp. 56–61.

Villaseñor y Sánchez S.A., 1748. Descripción de Colima. 1748. in: J. Antonio Calderón Q. (ed.). Documentos para la historia del Estado de Colima. Paleografía de José J. Hernández. 1979. Col. Peña Colorada. Ed. Novaro. México. pp. 166–168.

Villegas, H., de, 1580. Relación de la Villa de Santamaría de la Victoria. in: Mercedes de la Garza et al. (ed.) Relaciones histórico-geograficas de la Gobernación de Yucatán. Vol. II. UNAM, México. 1983. pp. 415–431.

Vizcaino, S., de, 1602. Descripción de la Costa de Colima. in: J.Antonio Calderón Q. (ed.). Documentos para la historia del Estado de Colima. Texto paleográfico de José J. Hernández P. 1979. Col. Peña Colorada. Ed. Novaro. México. pp 109-112.

West, R.C. and J.P. Augelli, 1966. Middle America: Its lands and peoples. Prentice-Hall, New Jersey. 482p.

Whitehead, R.A., 1966. Sample survey and collection of coconut germplasm in the Pacific Islands. ODA, Overseas Research Publ. 16. 77 p.

Williams G.R., 1988. Colima: Fuego y palmeras: esbozo de una cultura regional. Univ. de Colima. Col. Ameyalli No. 5. 34 p.

Xerez D., de, 1580. Relación de Tuxpan y su partido. in: R. Acuña (ed.). Relaciones geográficas del siglo XVI: Michoacán. UNAM, México. 1987. pp. 383–403.

Zizumbo-Villarreal, D., and H.C. Harries, 1990. Variadades y disponibilidad de germoplasma en México. in: M. Robert y D. Zizumbo. La problemática del Amarillamiento Letal en México. CICY. Mérida. pp. 103–122.

Zizumbo V.D., F.R. Hernández, and H.C. Harries, 1993. Coconut varieties in Mexico. Economic Botany 47(1): 65–78.