CHAPTER 3

THE SPANISH DISCOVERS THE NEW WORLD DYE COCHINEAL FOR PRODUCTION AND TRADE

Documentation of Cochineal in Early Colonial Spain

Much of what we know of the people who occupied Mexico before the arrival of the Spanish comes to us from several sources: the ethnographic material written shortly after the arrival of Cortez, for example, the Florentine Codex; the few remaining Indian codices which were not destroyed by the Spanish; results of archaeological investigations of material remains; and deductions made from direct observation of Pre-Columbian traditions which are still in use today. After the arrival of the Spanish, there are many documents, from a multitude of sources, which give insightful information on the activities of the Aztec, Mixtec, Zapotec, and Spanish. This includes the growing, harvesting, and trading of the red dye cochineal.

The information contained in this chapter on the Spanish New World and the production and trade of cochineal has been taken from numerous articles and books. The authors, through translation and scholarly endeavors, have made it possible to learn of this three hundred and fifty-year period. Information on the early days of the Spanish in Mexico was obtained from historical letters, royal documents, ships' manifests, religious documentation, and travel logs.

The modern translation of the 13 Book Florentine Codex by Dibble and Anderson (1954-63) reveals the rich culture of the Aztec and the considerable trade and use of cochineal. Another publication written by R. A. Donkin (1977), titled "Spanish Red: An Ethnogeographical Study of Cochineal and the Opuntia Cactus," is the most exhaustive

writing on the subject of cochineal and how it was produced in Colonial Mexico. Other good sources for information about cochineal come from books and articles which focus on one aspect or another of cochineal. Some of these resources concentrate on the growing and harvesting of cochineal, while others are more focused on Oaxaca, and the political and religious environment under which the cochineal industry flourished. Still, other writings give abundant information about the trade and shipping of cochineal and the Spanish policies under which this was carried out.

Arrival of the Spanish and the Discovery of Cochineal

When the Spanish invaded Mexico in the early sixteenth century, they discovered the Indians using a scarlet pigment for both dyeing and painting. This bright-red dye, which they called "Nochexti," was used and traded in large quantities by the Aztec. One of Cortez's soldiers reported seeing great quantities of cochineal offered for sale beneath the arcade in the marketplace of Tenochititlán, the ancient name for Mexico City (The Saltillo Sarape 1978, p. 11, 15, 16). This New World red dye, which was called "Nochezli" by the Indians, but was given the Spanish name "grana" cochinilla or cochinilla (derived from the Latin word "coccinus," meaning scarlet-colored) by the Spanish. The English word, still in use today, is cochineal, which is the Anglicized form of the word "cochinilla" (Born 1918, p. 214; see Appendix II).

There was an immediate interest in this bright scarlet dye, for it was quickly recognized by the Spanish invaders as resembling the European red dye kermes. Spain was interested in the possibility of kermes being found in the New World, because it was not easily obtainable in the markets and dye shops of Europe. In response to a report on this newly discovered red dye that was sent to Spain, a reply was sent to Ferdinando Cortez in 1523, by Charles V, inquiring about the presence of kermes in the New World. The order stated, "[w]hether what has been reported is true that kermes were to be found in abundance in New Spain and, if so, could they be sent with advantage to Spain." The

order added, "[s]hould this information be true, pay attention to it, and cause as much as possible to be collected with diligence" (Leggett 1944, p. 85).

To comply with the King's order and quickly obtain a quantity of this red dye for shipment to Spain, Cortez initiated, in the many small towns and villages where the dye was grown, the Aztec tribute system. By 1536 this royal tribute was reported to have reached twenty-eight cargas or 6,300 pounds of dye (see Tables 2, 3; Lee 1948, p. 454).

Table 2. Weights, Measures, and Currency.

Weights, Measures, and Currency
1. Cochineal was weighed before shipment to Spain in cargas of 9 arrobas:
1 arroba = 25 Spanish pounds = 25 English pounds
1 carga = 225 pounds
2. A surron was approximately 100 pounds
3. Maize, wheat, and beans were weighed as follows:
4 cuartillow = 1 almud = 7.568 liters
12 almudes = 1 fanega = 22.704 liters
2 fanegas = 1 carga = 181.630 liters
4. A vara was the linear measure for textiles:
1 vara = 0.838 meters = 32.99 inches
5. Currency:
12 granos = 1 real
8 reales = 1 peso
1 peso = 4 shillings sterling (c. 1780)

Source: Hamnett 1971, p. ii.

Table 3. A Note on Currency and Measurement.*

Currency	Measurement
Peso	The silver peso of Mexico in the late eighteenth century was equal to the American dollar.
Real	The peso was divided into eight silver reales or twenty copper reales (reales de vellion).
Fanega	A dry measure for cacao, wheat, and maize. Usually equal to 1.5 English bushels, but there were local variations, for example in Mexico where the famega of maize could be either 1.5 or 2.5 bushels.
Quintal	Usually translated as "hundredweight" and composed of 4 Spanish arrobas or 100 libras.
Arrobas	The Spanish arroba weighed about 11.5 kg (25 lb). The Portuguese arroba weighed 14.5 kg (32 lb).

Source: Bethell, ed. 1984, p. xii.

* Various units of value and measurement are referred to in the text. It is not possible to give exact equivalents in modern terms, particularly as there were many local variations. The above explanations are helpful.

Cochineal: A Superior Dye to Kermes

It was quickly learned that the New World red dye was not kermes, but was a dye of superior quality (Leggett 1944, p. 85). Directives came from the mother country to continue shipping a goodly supply of the dyestuff (Basle 1938, p. 217). In Europe, cochineal rapidly replaced the scarlet dye kermes, which was obtained from the oak tree shield louse. In the seventeenth century, when a tin mordant was added to cochineal to produce a vivid scarlet color, kermes was no longer used in the dyeing industry.

There were many reasons why cochineal was preferred over kermes as a dye. Cochineal was a more profitable dye than kermes because it could be cheaply grown in large quantities year round in the warm tropical climates of Mexico and Central America,

while the European dye shops frequently had difficulty in obtaining kermes (Leggett 1944, p. 85; Weigle 1974). This tiny insect dye made an ideal export item because of its low weight and compact size. While cochineal was initially more expensive than kermes, its dyeing capacity was ten times stronger. In addition, there was a booming textile industry in Europe, which this red dye could supply. Another advantage of cochineal was its medicinal properties. When mixed with vinegar and formed into tablets, cochineal could be used to clean teeth, cure wounds, and as an aid to heartburn, headache, and stomach distress (Lee 1948, p. 472).

Due to the many advantages in the use of cochineal, there was a growing demand for this dye by the European markets. To meet this demand, the production of cochineal rapidly increased until it became the second most lucrative export item, second only to the metals, especially silver, of the Spanish colonial empire in the New World.

The Cochineal Insect and Its Production

Cochineal was being produced by the Indians before the arrival of the Spanish. The production remained in the hands of the Indians who had developed successful methods for producing the red dye.

The Nopaleros

Cochineal was derived from the scale insect Dactylopius coccus which is parasitic to the prickly pear cactus. The work of propagating, collecting, and processing this insect required time, skill, and knowledge for the task to be successful. The Indians who knew how to raise the cochineal insect were called "nopaleros." The export of cochineal by the Spanish placed demands on the nopaleros to increase the supply of cochineal. Their response supplied cochineal dye to the local and European markets for the next three hundred years.

Dactylopius Coccus

Cochineal was derived from the dried bodies of the insect Dactylopius coccus. It was raised on the joints and pads of the Mexican cactus Opuntia (opuntia Ficus-indica) and Nopal. The Spanish called the cactus "tunal" and the fruit "tuna" (Donkin 1977, p. 12). The dyeing properties were contained in the wingless females of the species who outnumbered the males two hundred to one. The insect was grown from eggs deposited on a cactus plant. They attached themselves to the pads by their hollow, cylindrical proboscises. In this way they extracted juices from the host cacti and were nourished during their three-month life span. Eggs were laid beneath the female's body, which in turn produced larvae which passed through a chrysalis stage before they were ready to be collected for dye production (see Figure 1; Lee 1948, p. 450-451).

Wild and Domestic Cochineal

Cochineal collected from nopalerias (the nopal cactus farms on which the cochineal insect was grown) was called by the Spanish "grana fina" (meaning fine, delicate, excellent, pure), while the inferior but hardier wild variety, which could be collected six times a year, was called "grana silvestre" (meaning wild, uncultured, rustic). "Grana fina" was distinguishable by its coating of fine, waxy powder giving the name "mealy bug" or "mealy cochineal," while the wild species had a prominent cotton-like tomentum, giving it the name "cotton cochineal" (Donkin 1977, p. 14). The wild cochineal was only half as large as the cultivated variety and resembled minute, concave, shield-like grains, with a surface that was furrowed and frequently striped (Lee 1948, p. 450-451). The domestic cochineal insect, Dactylopius coccus, is very delicate and vulnerable to insects, and must be protected from interbreeding with the wild variety. When cultivation and protection cease, Dactylopius coccus tends to quickly disappear (Donkin 1977, p. 15).

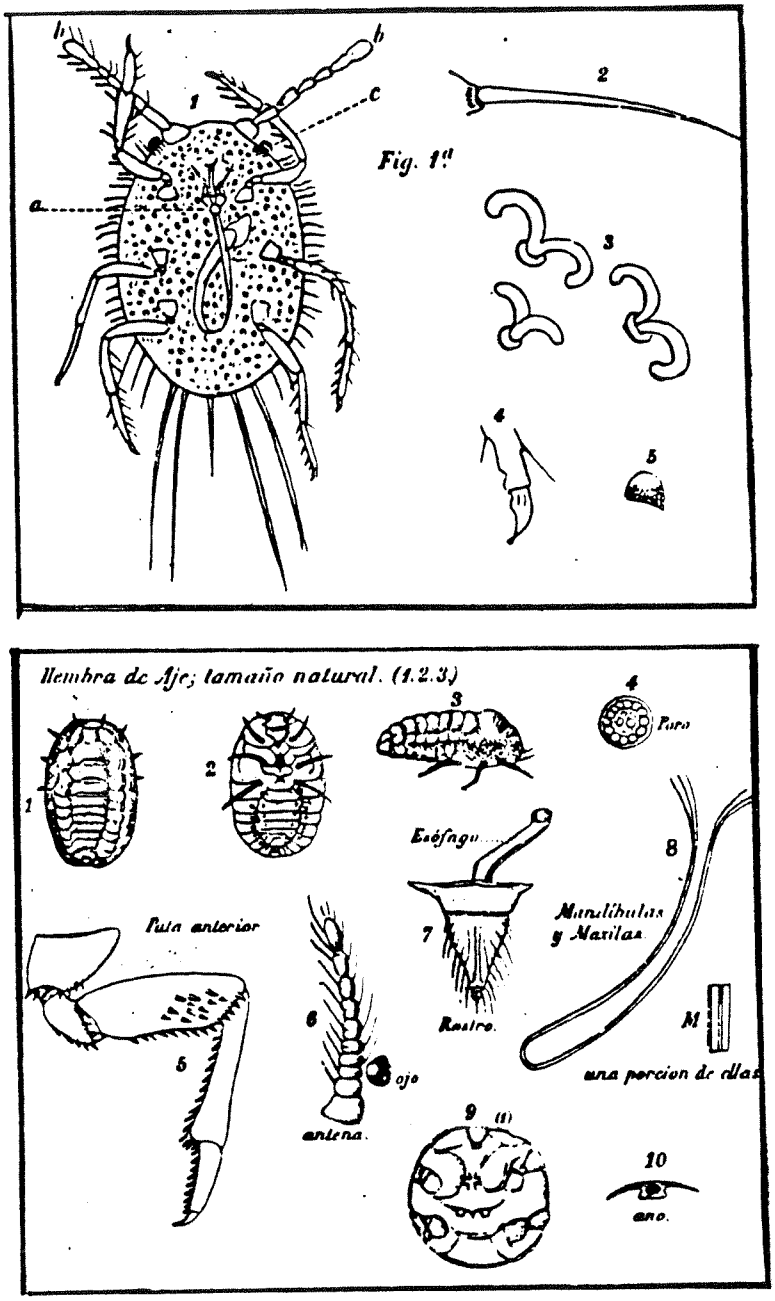

Figure 1. Eighteenth-century diagrams of the cochineal insect and body parts. Source: Secretaría de Fomento 1884, p. 67, 81.

The wild variety of cochineal "grana silvestre" continued to grow throughout the winter months and could be harvested six times a year. While this wild variety produced much smaller insects, and thus less dye for the same amount of collecting effort, it was still collected and sold as an inferior form of cochineal (Lee 1948, p. 467).

Great care was taken to harvest the female insects at the right time because there are two types of cochineal: the most highly prized silver grana which was produced from the impregnated females before they lay their eggs; and dark or negra, produced from the females after the eggs are laid. The silver crop was the more desired crop because it was believed to produce a better color, and obtained a greater price.

Nopalerias

The domestic variety of cochineal was grown on nopal cacti on nopal farms call "nopalerias." Nopals were usually propagated from cactus joints, cut from old plants. The "pencas" or cuttings were planted a half-meter deep, in rows two to three meters apart. The nopal can grow in deficient soils, but responds well to improved conditions, such as the addition of wood ash, or the application of house yard refuse. Good drainage is desirable, because under humid conditions, the insects were subject to wasting diseases known as "Choreo" and "Chamusco."(Donkin 1977, p. 13).

Although the largest quantity of cochineal came from small Indian holdings, there were also large nopal plantations of as many as 50,000 nopal (Donkin 1977, p. 13). Growing, collecting, and killing the insect was a labor-intensive endeavor, and a tedious process which required patience, skill, and dexterity. Two hundred pounds of cochineal can be produced from one acre of nopals, and it takes 70,000 of the dried insects to produce one pound (approximately 14,000,000 insects per acre) (Leggett 1944, p. 83). The mature female insects were collected three times a year, during May, July, and October, before the rainy season (see Figures 2, 3; Leggett 1944, p. 3).

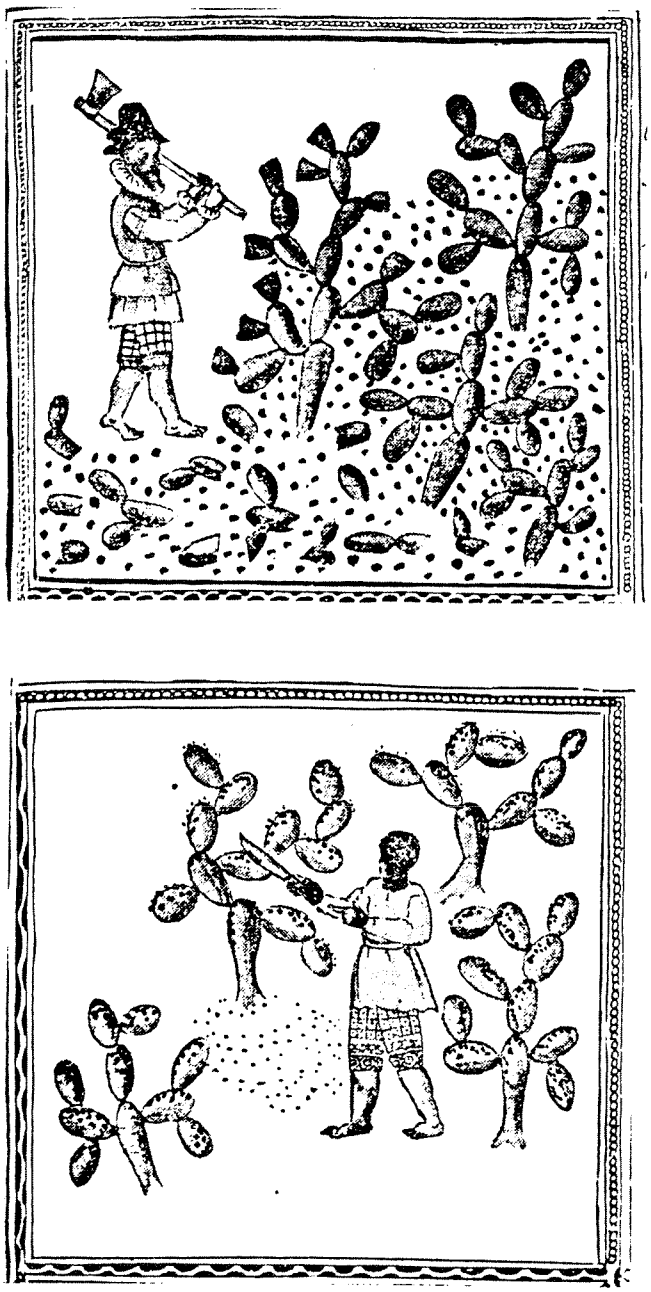

Figure 2. Eighteenth-century woodcarving showing the tasks of cochineal production. Source: Hijos 1963.

Figure 3. Eighteenth-century woodcarving showing the labor intensive nature of cochineal production. Source: Hijos 1963.

Protection from Rain, Wind, and Sun

To protect the mother-cochineal from the rain, branches of cactus plants loaded with insects were cut off and placed in baskets prepared with palm-leaf beds. The insect-filled baskets were then carried to the drier mountains of Ixtepeje, above the village of Santa Catalina. There the insects were placed on nopals until the end of the rainy season in October. Then once again they were re-introduced to the nopal in the nopalerias (Donkin 1977, p. 17). If the insects were not taken to the mountains, the baskets of insects with their palm-leaf beds, were taken into the house or placed under the overhangs of the roof for protection from the rain (Leggett 1944, p. 83).

After the end of the rainy season, the pregnant insects were carefully re-introduced to the nopal. This was carried out on a fair day in March or April. In the next three months, until collection, the tiny mother cochineal insect needed protection from the wind and the sun. It was desirable to plant the nopals on slopes where the cochineal would be protected from cold winds. The nopals were also planted near maize fields or next to mud walls for this purpose, and very large white cloth would be spread out on vertical sticks to provide further wind protection and shade (Donkin 1977, p. 13).

Predators of the Cochineal Insect and Host Cacti

There were many pests and diseases which invaded the nopals. Among them was a worm called "noxtequili" which bored into the heart of the nopal's base and killed it. There was also an insect called "tenchicol" which ate the young cactus pads, and a worm called "nopaloquili" which attacked the roots of the cacti. A serious disease called "nopal caquatl" could only be stopped by severe pruning of infected parts or removal of the entire plant (Lee 1948, p. 466).

Other predators were chickens, turkeys, and cattle which might come into the area, as well as lizards which ate the insect and its eggs. An insect called "zacapochin" devoured the cochineal insect, and a worm called "nopalaque cueaychin" ate the immature grana.

Another insect called "hahayote" ate both eggs and immature cochineal. Of real danger were the worms call "chichan," "tzotzon," and "cuymilin" which preyed on the immature insect. Another pest was the false cochineal called "ixquimiluiaqui," which often attacked the cochineal and withered the cactus leaves (see Figure 4; Lee 1948, p. 467).

Damage caused by cattle to the unfenced nopalerias was extensive. The cattle ate the nopal, and it was difficult for the Indians to keep them away. In one incident, the entire town of Hueyotlipan was temporarily abandoned in 1594 after the destruction of its nopal and fruit crops by roving cattle (Gibson 1954, p. 152-153).

Cochineal Insect Harvest

Escaping all these dangers, the adult insect was ready to harvest in May. This was carried out with a pointed wooden stick or a squirrels' tail, taking care not to touch either the insect or the plant. It was believed that touching would kill both. The adult insect was scraped from the nopal into a wide-mouthed jar, wooden bowl, or bag held beneath the leaf. This process was repeated again in July and October. After the third harvest, which was usually the smallest, the cacti were allowed to regain their strength until the cycle began again the following March.

Killing and Drying the Harvest

The last step of the cochineal production process was the killing and drying of the collected insects. There are a number of procedures to carry this out, some of which were considered to produce a better grade of dye. The oldest method was to spread the insects on mats and place then in the sun. This method worked best if the insects were taken out of the sun periodically, or if partial shade was provided. This method usually required four or more days and was thought to produce the best dye (Donkin 1977, p. 17). Other methods employed were drying the insects in an oven, holding a bag of insects over steam, submerging the insects in boiling water, or any number of combinations of these methods.

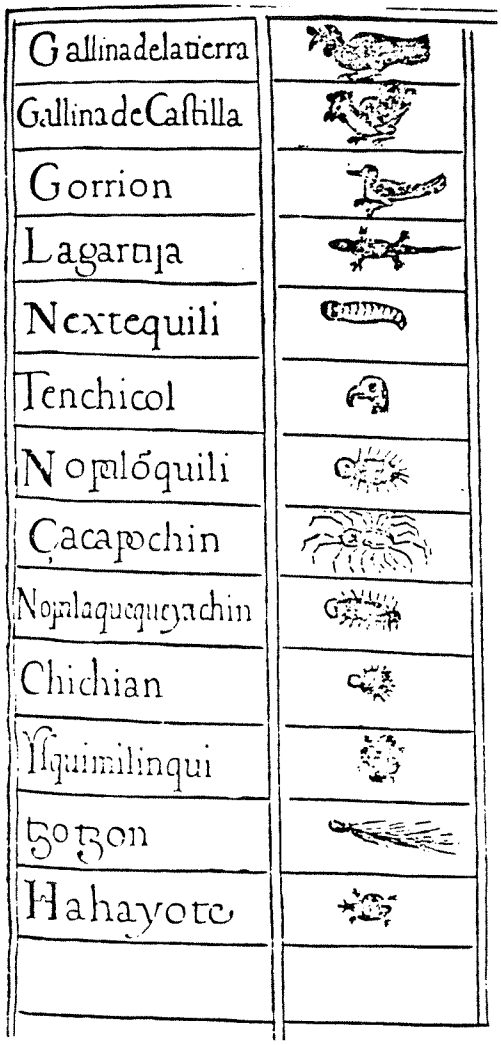

Figure 4. Sixteenth-century figure of predators of the cochineal insect and the nopal cactus. Source: Hijos 1963, p. 202.

One method describes placing the insects in a container and shaking them violently, then drying them in the sun. Another method mixed the insects with hot, powdered ashes. Still another method dried the cochineal insects on hot tortillas plates, which produced a black cochineal called "cochineal negra" (Donkin 1977, p. 17).

New Methods of Cochineal Production

By 1600, Spanish administrators and Indian producers had developed superior methods for growing grana. Old cacti were replaced with new shoots which were allowed to grow for a year before the cochineal insect was introduced, and sturdy, healthy plants were encouraged by semiannual pruning. Also, the fruit of the nopal was not allowed to develop. Nopal groves maintained in this manner remained productive for at least ten years (Lee 1948, p. 466).

Spanish Cochineal Exports

Regulations for Export of Cochineal

Regulations regarding the drying, grading, collection, inspection, and marketing of cochineal were carried out by the office of the "jueces de grana." In September of 1573, a regulation issued by the juecces de grana stated that killing cochineal by any method other than drying in the sun was forbidden (Lee 1948, p. 470).

Exporting Cochineal

Evidence of the growing importance of cochineal can be found in a mid-sixteenth-century manuscript by a Franciscan friar, Motolinia. He noted:

> - - - in these tunas, that are red, the grana is born, that in this language is called mocheztli - -It is a thing of high value because it is bright red. Among the Spaniards it is called carmese. (Lee 1948, p. 456)

Cochineal was not exported in great quantities in the first half of the sixteenth century, yet much activity took place which laid the ground work for the large export of cochineal in the second half of the century. During this period, a market for cochineal was

created in Europe, the production of cochineal was increased in Mexico, and trade was established between the Spanish and the Indian growers. In the second half of the sixteenth century, cochineal took a position in Mexico's economy as the second most lucrative export item, a position which lasted until its decline in the first half of the nineteenth century (Lee 1948, p. 457).

In the early colonial days, the Spanish took over the production of products which required high outlays of capital, but they entrusted to the Indians all low capital products, retaining for themselves the handsome profits of their distribution. Among the low-cost production items were cochineal, cotton, silk, and cacao. The Spanish entrepreneurs mediated the trade with Spain while the Indians remained the primary producers under strong local, religious, and Spanish encouragement (Wolf 1959, p. 180-181).

By the 1540s cochineal was being sold in large quantity in the market of Tlaxcala (a state in central Mexico), and the development of the commercial cochineal industry was bringing economic prosperity to the Tlaxcala Indians (Gibson 1954, p. 156; Hamnett 1971, p. 9). The local town council, in response to the lucrative market, encouraged the local Indians to increase their production of cochineal (Hamnett 1971, p. 9).

There was a period of discord between the Indians and the Spanish in the mid-sixteenth century, which resulted in the Spanish confining their economic interest mainly to market activities. This allowed the Indians a great deal of freedom in the production of cochineal (Gibson 1954, p. 192). In the following generations, the Tlaxcalans underwent stages of prosperity and decline intimately related to Spanish influence and Indian compliance (Gibson 1954, p. 193).

Production of cochineal was primarily in the Tlaxcala and Puebla regions of Mexico, and to a lesser extent in the northeast valley between the towns of Otumba and Cempoala, where the Spanish first became interested in this dye. The industry declined steadily after the sixteenth century, and the main production shifted to Oaxaca. Towards

the end of the colonial period there was only a small amount still being produced in Chalco province (southeast of Mexico City) (Gibson 1964, p. 354). While production of cochineal declined in the Tlaxcala area, the Tlaxcala market thrived and became the location where both the Indians and Spaniards met to buy and sell goods, including cochineal (Gibson 1952, p. 148).

Development of the Cochineal Industry in Oaxaca

Cochineal growing had been flourishing in a number of locations in Mexico before the arrival of the Spanish. Perhaps the earliest center lay in the heart of the Mixtecta in the state of Oaxaca. The Mixtec Indians called this place "Nunduco," or land of the cochineal (nuhu, land, and n'duco, cochineal) (Donkin 1977, p. 12). Less than ten years after the Spanish arrived in Mexico, they moved into the valley of Oaxaca (around 1519) accompanying the shift in production of cochineal from Tlaxcala and Puebla to this area. Oaxaca soon became the dominant center of the cochineal industry, remained the predominant producers throughout the colonial period, until the decline of the industry in the mid-nineteenth century.

Oaxaca was an ideal area to concentrate cochineal production and assure economic success. There was a large, willing, and stable population of capable Indians who could increase production of cochineal with existing technology. Also, grana could be grown in sufficient quantities to meet the demands of the Spanish export market, because the lands and climate of the region were well suited to the growing of cochineal. In addition, a dependable supply of goods, services, and tribute could be provided by the Indian producers, and be made available to the crown and church. The Spanish could also derive profit by selling externally produced goods to the local Indian population (Spores 1984, p. 122-123).

Cochineal was already growing in towns in the valley of Zimatlán, Tehuantepec, and the Sierra de Juárez region at Ixtepeji in the Mixteca Alta, and in the Southern Zapotec

region around Miahuatlán (here it was reported to have been of superior quality). In these locations and other parts of the Oaxaca Valley there existed a subsistence economy consisting of a simple domestic agriculture, with few crops and the barest of equipment. Secondary sources of supply for the Indians came through the local markets (Whitecotton 1977, p. 198).

Due to Spanish influence, the end of the sixteenth century brought a dramatic increase in cochineal production around Nochixtlan, the Tamazulapan and Teposcolula valleys, Tlaxiaco, Coixtlahuaca, and Mitlatongo. While these areas were responsible for the huge increase in the cochineal supply, some cochineal was being produced in every community of the region (Spored 1984, p. 128). There was some financial gain for Indians who grew the cochineal, but the Spanish prospered the most by its production.

Early development of cochineal production in Oaxaca was stimulated naturally by an expanding market, and the direction of the Dominican friars (in areas outside of Oaxaca the Franciscans exercised similar authority), who offered encouragement and guidance to Indian producers under the name of the Catholic Church and the Bishopric of Oaxaca (Born 1938, p. 217; Gibson 1952, p. 149; Hamnett 1971, p. 10; Lee 1948, p. 463). Financing for growing cochineal came from the merchants working for the Consulado of Mexico. In this manner, credit was extended to local officials who in turn issued credit to Indian laborers (Lang 1975, p. 24-40).

At the same time that stimulation to increase cochineal production was coming from the local domain, the Spanish were jealously controlling the cochineal supply for the benefit of the crown, the church, and the private merchants. So while the traditional forms of production, marketing, and interregnal trade continued on the local level, they did so within the framework of the colonial system. In this manner the business of raising and selling cochineal grew and became more efficient and profitable (Spores 1984, p. 122-124).

One advantage the Oaxaca Indians had over the Spanish was trade and marketing secrets which excluded non-Indians. As a result, the Oaxaca area population remained more Indian and suffered less intrusion by the Spanish than most areas of Mexico (Bethell, ed. 1984, p. 252). In spite of this advantage, there came a time when the viceregal government compelled the Indians to raise cochineal in suitable areas, plant nopals, care for the maturing cochineal, and "work with diligence" at all phases of production (Lee 1948, p. 463).

Throughout the colonial period, the actual "rearing" of the insect remained in the hands of the natives of Oaxaca, and there is no evidence of forced Indian labor or Spanish-operated nopalerias. The Indians were not subjected to unusually harsh labor demands by the Spaniards, and when abuses were committed, the viceregal authority was usually quick to remind local magistrates that the Indians were not to be forced to perform labor services for the Spaniards against their will (Lee 1948, p. 463).

It is true that the Oaxaca Indians remained in charge of the means of producing cochineal and were not unduly forced or mistreated to any extent, but they did not remain the Indians of the Pre-Conquest days. The Zapotecs and Mixtecs who were the primary growers of cochineal in Oaxaca were ultimately stripped of their native elite, and their religious and political traditions. In this way they were reduced to subject peasantry concentrated in rural communities, where they served as a repository of labor, goods, and souls for the crown, the nobility, and the clergy (Whitecotton 1977, p. 4).

Unlike land in other parts of Mexico, which was converted into classic haciendas based on nobility and exploitation of the peasant, Oaxaca remained oriented toward intensive peasant agriculture. Thus the Oaxaca Valley, where the most intense raising of cochineal took place, remained composed of a large Indian peasantry concentrated in medium-sized towns and villages (Whitecotton 1977, p. 4).

In Oaxaca as many as thirty thousand Indians were employed in the industry of growing cochineal (Meyer and Sherman 1983, p. 255). Some areas had as many as fifty to sixty thousand cactus plants under cultivation, but most cochineal was raised on thousands of small individual or community plots (Diffie 1945, p. 348; Lee 1948, p. 463). The wealthier Indians, the "principales," could maintain greater areas under cultivation than the Indians of the lower class for they could afford oxen, iron plows, and other farm implements as well as hired laborers (Gibson 1952, p. 150). Pay for laborers was the customary rate, which for two centuries was 6 reales (3/4 peso) for a six-day work week (see Tables 2, 3; Spores 1984, p. 129).

In some of Oaxaca's towns, cochineal production was so great that 7,000 arrobas would be gathered in an average year at the rate of 12 reales of silver per pound. (Hamnett 1971, p. 10). Because of this prosperity, the Indians became so preoccupied with the profitable cultivation of the nopalerias that they neglected growing maize and other subsistence crops. There was fear by the Dominican friars that such neglect would lead to a shortage of food, for at times half of the laboring population of Oaxaca became occupied in the cultivation of cochineal (Hamnett 1971, p. 14-15).

Throughout the colonial period the dye trade prospered under a system of deliberate, widespread corruption. The Consulado of Mexico had merchants who covered the "fianza" (guarantee) and contributed to the financial support of the local official in exchange for a contract, whereby they were guaranteed delivery of a specified quantity of cochineal by way of Indians through the local government. In this manner, the Indian cochineal growers were provided with cash, commodities, or equipment on the merchant's account (Dominquez 1980, p. 94).

The paternalistic Catholic church was against such practices because it exploited the Indians. In 1786 the Ordinance of Intendants abolished the old local government post, and put a ban on trade through a government middleman. Without the coercive pressures of

local officials with vested financial interest in production, the Indians turned to indolence and vice. In 1804 the Crown yielded, and the cochineal trade returned to its old structure (Dominquez 1980, p. 95; Hammett 1971, p. 148).

The Spanish tribute system functioned throughout the colonial years as one of the crown's most effective forms of revenue production. In the first half of the colonial period, the tribute was standardized at one and a half pesos per year (less than one week's work). In the late eighteenth and early nineteenth centuries the tribute was increased (Spores 1984, p. 130).

Inspection and Export

Unpopular petty traders collected cochineal from the local markets of the Oaxaca Valley, and were often the main link between the peasant producer and the more cosmopolitan markets where the dye was purchased by Spanish merchants and sent to Puebla. From Puebla it was transported by mule packs to a port town, then shipped to Europe (Gibson 1952, p. 149).

Problems associated with the cochineal industry prompted the establishment in 1572 of this Spanish Ordinance authorizing the office of "jueces de granas" (cochineal magistrates) in the city of Puebla, and demonstrated the Royal right to control the industry. The office was to function as the overseer of the quality and production of cochineal and to restrain the frequent frauds in trade (Hamnett 1971, p. 10). When the harvest was brought to a weigh-station, it was examined by a judge from the office of the jueces de grana to make certain that it conformed with all regulations concerning cleanliness and quality and that the cochineal had not been adulterated (Lee 1948, p. 470).

Cochineal was adulterated by adding a variety of foreign substances of similar size and color. If these substances were mixed with damp cochineal it was hard to detect. Impurities, such as small twigs and leaves, were found in grana that had been carelessly harvested. The "jueces de grana" had the authority to seize and clean all adulterated

cochineal, and were instructed to visit cochineal markets regularly. Through strict controls, the "jueces de granas" were to use their authority to assure the quality of the dye exported to the European markets. Frequently, however, the officials of the "jueces de grana" were part of the abuses that existed throughout the history of the cochineal industry (Hamnett 1971, p. 11; Lee 1948, p. 470).

After a sack of grana passed inspection, the sack was sealed and placed in a shipping box, nailed shut, and branded with a special branding iron and held until shipment. Undersized grana was exported in separate containers and was known as "granilla" or "garblings." By the 1890s, in response to the many problems created by the increased production and shipping of cochineal, additional grana legislation for the prevention of fraud was enacted (Lee 1948, p. 468-471).

All cochineal was sent to Spain or used locally. Interregionally, grana was traded from Peru, Nicaragua, Mexico City, and other towns of New Spain. Silver and other trade items were taken to Guatemala City, where they were exchanged for cochineal. Often the Indians got the short end of the trade and were exploited by fly-by-night traders, whose principle was merely to "buy cheap and sell dear" (Lee 1948, p. 461).

Cochineal Production Levels

It was during the sixteenth century that the cochineal dye trade obtained a position second only to silver in exports leaving New Spain for Europe (Hamnett 1971, p. 9). This role was to exist, with little competition, until the combined effects of the 1810 war of Independence increased competition from Guatemala around 1820, and the invention of aniline dyes in 1856. These factors combined to damage the cochineal economy to such an extent that in Oaxaca dye production was practically eliminated (Hamnett 1971, p. 9).

Towards the end of the sixteenth century, the Spanish population increased rapidly while there was a great decline in the Indian population. This factor led to a markedly diminished production of cochineal, but was not accompanied by a corresponding

reduction in the demand (Gibson 1954, p. 156). By the early seventeenth century, the Indian population and cochineal production had recovered, and from that time forward cochineal, with yearly fluctuations, remained an important trade item for the Spanish until its decline in the last half of the nineteenth century (Spores 1984, p. 128).

Cochineal trade was characterized by a series of periodic fluctuations between 1758 and 1782. The 1770s saw a peak in cochineal production, followed by a decline brought about when overproduction drove the prices down. After 1782 a substantial decline set in which was never reversed. The bottom was experienced in 1794, which resulted in a drastic cut in production. Between 1805 and 1810 production tripled and prices increased steadily, until the rise culminated with a production and price boom, followed by an all-time low between 1818-1826 (Dominquez 1980, p. 65-66). These fluctuations could be evidenced in the amounts of dye exported on fleets departing from Veracruz to the port of Cadiz, on the southwest coast of Spain (see Table 4; Hamnett 1971, p. 31-32).

Table 4. Mexican cochineal production and value from 1758 to 1826.

Period	Production (pounds)	Value (pesos)
1758-1767	8,413,874	18,157,924
1768-1777	9,807,540	27,122,413
1778-1787	7,911,812	16,452,162
1788-1797	4,513,512	8,136,268
1798-1807	3,869,162	10,428,180
1808-1817	3,383,764	11,661,339
1818-1826	3,025,674	7,857,798

Source: Hamnett 1971, p. 171.

Shipping Cochineal and the European Market

Once in Spain, cochineal was traded in the great Spanish merchant houses like the Casa de Uztáriz and the Cinco Gremios Mayores de Madrid. These great merchant houses supplied the European market (Hamnett 1971, p. 148). Cochineal was in great demand in the thriving textile industries of Europe: France, Holland, Britain, Italy, Spain, and Belgium.

Trade Routes From the New World to Europe

Upon discovery of the New World, trade routes were established to and from the Americas. Trade connections through Veracruz were the primary umbilical cord connecting the Spanish colony to the mother country. Exported from New Spain were silver, gold, sugar, cacao, cochineal, indigo, leather, and tallow. Shipping records reveal that for twenty-four years, from 1796-1820, bullion accounted for 74.9 percent of all exports, cochineal for 12.4 percent, sugar 2.9 percent, and all other products the remaining percent (Dominquez 1980, p. 64). The port city of Veracruz was overseen by the Consulado (a privileged merchant with judicial powers over trade) (Wolf 1959, p. 187).

During the high export years of cochineal between 250,000 and 300,000 pounds, valued at 500,000 to 600,000 pesos, moved annually through the port city of Veracruz to the cloth markets of Europe (Lee 1948, p. 472). Most of the cochineal was transported overland to the port of Veracruz and from there traveled by ship to the Spanish port of Seville. Some of the dye was shipped from the port of Caballos, Honduras, which was more accessible to southwestern Mexico and Guatemala. When this port became unsafe, the dye was transported overland to the Nicaraguan gulf coast, shipped by fast frigates to Cartagena, Bolivia, and re-exported to Spain (Lee 1948, p. 460).

The first shipment of Tlaxcala-Oaxaca cochineal took place in 1526, and the first cargoes arrived in Belgium in 1552 and 1553. By 1569 records showed cochineal being shipped to England, and by 1589 Amsterdam had received its first shipment of cochineal

(Hamnett 1971, p. 9-10). By 1600, the estimated cochineal import to Spain reached around 11,000 arrobas, valued at 600,000 pesos, and as early as the 1620s, a substantial quantity of cochineal was being shipped to the port of Seville (Hamnett 1971, p. 10).

The Spanish cochineal industry thrived for over three hundred years. During that time, vast quantities of the red dye were shipped to Europe. One example of how much dye was being shipped to Europe was recently discovered. The Santa Maria de Yciar, a Spanish ship which had sunk with a full load in 1541, was discovered. Her cargo contained 20,000 pounds of cochineal (40 barrels of 500 pounds each) (Dr. Herman Smith 1991, personal communication).

The Two-Hundred Year Secret

The Spanish, in an effort to protect their lucrative commodity and maintain their monopoly over cochineal, fostered a common belief that cochineal was a seed or grain. The appearance and the name "grana" often led to the confusion regarding the source of the red dye, and helped the Spanish to maintain the secret. The Spanish Government also forbade the export of live cochineal insects (Leggett 1944, p. 85). For over 200 years New Spain remained the only producer of cochineal. Europeans did not know how the red dye was produced and the Spanish allowed no one to visit Mexico and inspect the nopalerias (Leggett 1944, p. 85). Many efforts were made to learn of the source of the dye, but it wasn't until the 18th century that the cochineal secret was found out, and the insect and host cactus were taken from the New World (Wolf 1959, p. 181-182).

It was the invention of the microscope by van Leeuwenhoek that led to the discovery of the source of cochineal dye. When, in 1704, a cochineal particle was placed under the microscope, van Leeuwenhoek exclaimed that it was a bug. With the aid of magnification, he had seen clearly that the cochineal dye came from an insect with six legs, a head, and two wings (Trengrove 1970, p. 337). Despite the detective work of van Leeuwenhoek, the debate continued. Spain's monopoly over cochineal was not lost until,

in 1777, a French naturalist, Nicholas Joseph Thiery de Menonville, managed to enter Oaxaca secretly on foot, where he collected samples of both the cactus pads and the insect (Edelstein 1958, p. 1).