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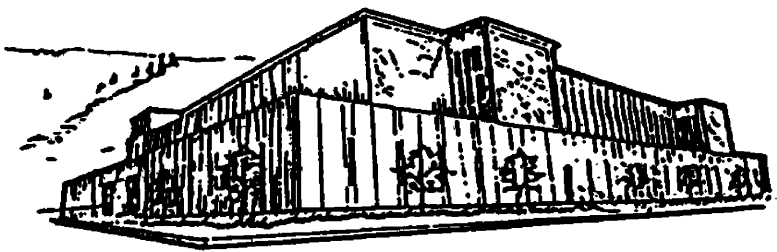
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Maureen Hass

Date:

10 June 1994

THE ETHNOBOTANY OF CAPSICUM IN SOME NEW-WORLD SOCIETIES

by

Marcia J. Hass

B. A., University of Colorado--Boulder, 1967

Presented in partial fulfillment of the requirements

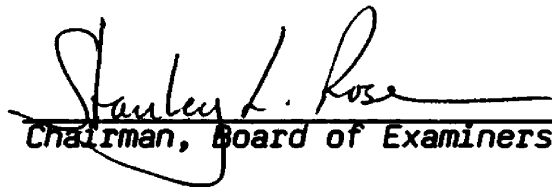
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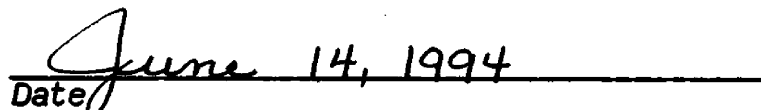
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Spanish

The Ethnobotany of Capsicum in Some New-World Societies (105 pp.)

Director: Dr. Stanley Rose *SRose*

Capsicum (chili pepper) enjoys a long cultural tradition in the New World, where it originated. In my thesis I have researched the ethnobotany of this plant in some New-World societies from pre-Hispanic times to the present-day in order to establish a coherent view of its role in these cultures and to provide a pedagogical resource.

While the emphasis remains on the role of Capsicum in pre- and post-Hispanic cultures, the United States is developing its own ethnobotanical relationship with Capsicum. In light of the increasing consumption of chili peppers in this country, as well as the interest in healthful foods and traditional medicine, research data on the implications of eating Capsicum and using it in medicine are included.

Data on the relationship of the early societies with Capsicum were obtained from European observers writing between the fifteenth and the nineteenth centuries. Twentieth-century sources include two books devoted to chili peppers, a Ph.D. dissertation on the ethnobotany of chili peppers in Mexico and anthropological studies which treat the customs, diets and beliefs of the modern descendants of the early peoples in Middle and South America. Medical journals provided data on the research of Capsicum in diet and medicine.

Capsicum permeated the fabric of the pre-Hispanic cultures and continues to do so. Its culinary, ritual, and medicinal roles have survived throughout the centuries. Modern research has confirmed its valuable role in contributing flavor and important vitamins to diets. It has also validated many of the medicinal uses of Capsicum, which the ancients had discovered empirically.

Since Capsicum figured importantly in a variety of roles, tracing those roles involved researching the cultures' diet and medicine, warfare, religion and world views, ritual and magic, as well as tribute systems and social organization. The data gathered serves as a pedagogical tool for instructor and student alike to enrich socio-cultural input in the classroom.

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CHAPTER 1
INTRODUCTION

The science of ethnobotany, established in the early part of this century, studies plants in relation to the customs and needs of a specific ethnic group. Among the peoples in South and Mesoamerica chili peppers enjoy a long cultural tradition. Members of the genus Capsicum and native to this hemisphere, they permeated the fabric of the lives of pre-Hispanic groups. Today their culinary, religious and medicinal roles live on among the descendants of the early cultures.

Then, as now, peppers were used to enhance the taste of diets high in bland cereals and legumes. Long-Solis reports that chili peppers form part of the Mexican diet in all social levels. Since national identity is formed through cultural characteristics common among all social groups, she proposes that peppers constitute one of the common cultural denominators that identify a person as Mexican (Long-Solis 1986, 9).

All societies have ways and means to deal with those who sin and are in need of purification through penitence. In some pre-Hispanic cultures abstinence from eating chili peppers was imposed on sinners, for whom it represented a great sacrifice. "Without chili peppers they did not think they were eating," said Fray Bartolomé de Las Casas in the sixteenth century (Las Casas 1967, 2:195)).

In the absence of a monetary system, the Aztecs, Mayas and Incas exacted tribute, often in the form of labor or products. In all three cultures chili peppers were an important item of tribute.

Chili peppers also went to war. Soldiers carried them when on campaign as part of both food supply and arsenal. When burned, pungent chilies constituted a powerful weapon against the enemy.

The role of peppers in folk medicine and magic continues to the present day. Appearing as they do in creation myths, legends, religion and rituals, peppers were, and in some cultures still are, associated with the gods and the supernatural.

The Aztec emperor Moctezuma, on hearing that fair-haired, light-skinned men had landed on the coast of the Gulf of Mexico, sent forth officials to determine whether or not they were returning gods. Aztec cosmology had predicted that light-complexioned *Queztalcoatl* and other gods would return in the year ce acatl, equivalent to 1519, the year that Hernán Cortes landed with his men at present-day Veracruz, Mexico. Among the gifts sent by Moctezuma to the newcomers were many kinds of food dishes, some prepared with chili peppers. The emperor charged his officials to note carefully if the Spaniards ate and enjoyed the Mexican food. If so, the Aztecs could be assured that *Queztalcoatl* had indeed returned. When the messengers reported that the Spaniards had eaten well and had found the viands delicious, Moctezuma uttered this poignant lament:

What is to become of us? Who is truly in command? Oh, in other times it was I! My heart is in danger of dying! As if it were immersed in chilies - how it anguishes, how it burns! Where to, then, our Lord? (León-Portilla 1961)

Moctezuma was right to anguish. Within two years these chili-eating "gods" stood in command, having dismantled the Aztec society.

Yesteryear's shamans and curers, who communicated with the gods and the supernatural to predict, advise and heal, find their present-day counterparts throughout the Americas. In Brazil the pimentólogos are folk healers who prescribe medicine made from chili peppers (Naj 1992, 105). The pepper chanters among the Cuna Indians of Panama effect cures and communicate with the spirits (Stout 1947, 46).

While the emphasis of this paper remains the ethnobotany of the pre-Hispanic societies and their present-day descendants, the United States, too, is expanding its own relation to this plant. Chili peppers have a large and growing following as a food additive in this country, which has resulted in a doubling of cultivated acreage in the United States between 1980 and 1990.

Concern in the United States for bodily health and health foods and an increased interest in folk medicine has prompted the inclusion of modern research into the nutritional value and medicinal applications of chili peppers.

Scientific research has taken an interest in peppers for their high vitamin A and C content and for the potent chemical substances which give them their pungency, the capsaicinoids. The vitamins provided by eating peppers form a valuable nutritional component in areas of the world where the food supply is either scant, imbalanced or not highly varied.

As for the capsaicinoids, there is evidence that they reduce the metabolism of lipids, increase the resting metabolic rate and lower the incidence of thromboembolism, to mention a few virtues. In topical applications they act as analgesics in the treatment of a variety of painful ailments.

As the role of peppers in diet and medicine unfolds in the following pages, it will become evident that the pre-Hispanic Indian cultures had discovered empirically uses for peppers which modern scientific investigation has since validated.

CHAPTER 2

ORIGIN, EVOLUTION AND CLASSIFICATION

Chili peppers belong to the Solanaceae, commonly known as the nightshade family. The scientific name is derived from the genus name Solanum, which presumably comes from the Latin word solamen, meaning quieting. It may allude to the effect many of the species produce (Heiser 1969, 1-2). Estimates of the number of species range from 2300 to 3500 in some 90 genera of flowering herbs, shrubs and a few trees (Hawkes et al, 1991, 27). The family comprises other food plants, among them, the potato, tomato and eggplant. Tobacco and the ornamental petunia count among its members as do many poisonous and medicinal plants - Atropa belladonna, or deadly nightshade; mandrake; henbane and several species of Datura, some of whose common names are Jimson weed, stinkweed, stramonium and devil's apple (Heiser 1969).

The family is considered one of the most important to man due to the food plants it provides. Its most important may be the potato, whose world production is exceeded only by wheat, maize and rice (Hawkes et al 1991, 1). While peppers are not considered a staple crop, they are the most widely used condiment in the world.

The Solanaceae family has been termed paradoxical because of its many member plants which produce drugs and poisons that provoke hallucinogenic effects - or death, if used to excess. The Amerindians were well aware of these properties and employed more than 100 species in

religion, magic and medicine (Schultes 1979, 138). Although the genus Capsicum, to which chili peppers belong, is not known to produce hallucinogenic effects, it may have been used in combination with other substances to enhance or achieve a state of trance. In pre-Columbian Panama the sacred elite may have smoked a concoction of cocoa and chili pepper in order to enter into a hallucinatory state which enabled them to journey to the underworld or to the heavens to mediate with the good and evil spirits (Helms 1979, 118-119). Among some present-day tribes in Ecuador, pepper is occasionally added to tobacco snuff to make it more effective (Schultes and Raffauf 1991, 42).

Today these plants continue to represent an important source of drugs in medicine, pharmacy and drug therapy. While the chili pepper has been classified as a food plant, its potent chemical substances, the capsaicinoids, have received increasing attention in pharmacological research in the past twenty years. The studies and applications in medicine, pharmacy and research are detailed in chapter 7.

As previously mentioned, chili peppers are members of the genus Capsicum, which originated in the western hemisphere. Before Columbus and his Spanish-speaking crew members arrived in 1492, the American Indians had, of course, their own names for them. The Mexicans called them chilli in Nahuatl; chil refers to the plant and also means "red" (Andrews 1984, 8). In the Caribbean the Arawak Indians termed them ají and in the Andes, uchu in Quechua and huayca in Aymará, two languages of the Incan empire. On their arrival, the Spaniards labeled the plant and its pungent berries pimiento, after pimienta, the black pepper. Today in Mexico chilli has persevered in the modern word chile. Ají is the term used in the West Indies and South America, although some Indian groups

use uchu (Heiser 1969, 20). In the United States chilli has survived in several different spellings, as has the term "pepper." To distinguish it from the black sort, pepper often appears modified by hot, spicy, mild or sweet.

In Europe Linnaeus adopted the designation Capsicum from the original description of the genus published in 1719 in Joseph Tournefort's Institutiones rei herbariae (Andrews 1984, 31). Tournefort left no explanation for his choice of the term. Some suggest it derives from the Latin word capsa, "box," referring to the shape of some of the fruits which encapsulate their contents. Others propose a Greek etymology - kapto, meaning "to bite," alluding to peppers' pungency (Heiser 1969, 21).

When speaking of the fruit of the genus Capsicum in general in this paper, the terms chili, chili pepper or pepper will be used. These terms refer to both the sweet and hot varieties.

While the genus name has remained stable, reseachers continue to propose different theories on peppers' place of origin, evolution, domestication and taxonomy.

A highly speculative paper on the origins of Capsicum, published in 1982, proposes that an area in central Bolivia gave rise to the genus. It suggests that the part of the genus which ultimately evolved into the domesticated species first occurred in a nuclear area around Comarapa, Bolivia, a subtropical zone (Figure 1). After migrating and radiating along river systems, the ancestral segment, through evolution and selection, became the five domesticated species still cultivated today: C. pubescens in highland Bolivia, C. baccatum var. pendulum in lowland Bolivia, C. frutescens and C. chinense in the Amazon basin

much further north and C. annum in Central America and Mexico (Eshbaugh, Guttman and McLeod 1983, 49). Figure 2 shows the distribution of chili peppers at the time of the arrival of the first Europeans in the New World (Heiser 1976; McLeod et al 1982).

Since archeological evidence of the genus is meager, a more detailed model for the origin of domesticated peppers cannot be presented. However, these scant findings confirm that Amerindians were eating peppers at an early date. In the Tehuacán Valley 150 miles south of Mexico City, seeds found in cave dwellings and human coprolites were discovered at levels dating back to 7000 B.C. Although the small seed size indicates that they are wild samples rather than domesticated, they do serve to establish early consumption of peppers. Other remains found at Huaca Prieta, Peru, show that Capsicum baccatum was being cultivated around 2000 B.C. (Pickersgill 1969).

Researchers also speculate about whether domestication occurred at one center or at several. Pickersgill, who proposes multiple centers, believes that selection and domestication occurred independently at parallel moments in time. She suggests that multiple domestication is more likely for non-staple crops such as chili peppers. In the case of peppers, yield was probably not a primary consideration for early planters. Wild peppers produce many small fruits of good quality, confirmed by today's continued exploitation of wild species (Pickersgill 1979, 698).

While theories proliferate, so does the number of species as researchers continue to comb corners of the Americas. At this writing

the genus comprises 20 wild and five domesticated species. The domesticated species, listed above in the model of origin, do not differ greatly from those cultivated by pre-Hispanic groups (Hawkes et al 1991, 81; Andrews 1984, 11).

CHAPTER 3

EUROPEAN OBSERVERS FROM THE FIFTEENTH TO THE NINETEENTH CENTURIES

Although he did not call them peppers, Columbus, in his first letter to Ferdinand and Isabella, may have been the first person to refer to them. He wrote, "In these islands there are mountains where the cold this winter was very severe, but the people endure it from habit, and with the aid of the meat they eat with very hot spices" (Columbus cited in Andrews 1984, 2-3). Later, in an entry in his journal in 1493, Columbus had learned the native word for those "hot spices" when he wrote, "Also there is much aji, which is their pepper and the people won't eat without it, for they find it very wholesome. One could load fifty caravels a year with it in Hispaniola" (DeWitt 1990, 83).

Credit for the first written account of peppers of the West Indies goes to Dr. Diego Alvarez Chanca, who accompanied Columbus on his second voyage as physician to the fleet. In a letter sent to his hometown of Seville in 1494, Dr. Chanca, having arrived only three months earlier, included observations on peppers. In the first one he did not yet have a name for them, for his first encounter with them came on his first setting foot on land in the Caribbean.

There were wild fruits of various kinds, some of which our men, not very prudently, tasted; and upon only touching them with their tongues, their countenances became inflamed, and such great heat and pain followed, that they seemed to be mad, and were obliged to resort to refrigerants to cure themselves. (Chanca 1868, 23)

Some weeks later, having acquired more knowledge of the Caribees and their language and diet, he mentioned the hot, wild fruit by its name in the language of the native people:

Their food consists of a sort of bread, made of the roots of a vegetable which is between a tree and vegetable, and the agé (Ipomea batata or yam), which I have already described as being like the turnip, and very good food; they use to season it, a spice called aji, which they also eat with fish, and such birds as they can catch of the many kinds which abound in the island. (Chanca 1868, 66)

While Chanca receives credit for the first written record of peppers, Pietro Martire de Anghiera (Martyr), 1455-1526, had already written about them in September, 1493. An Italian cleric and historian who tutored the royal princes at the Spanish court in Barcelona, he was present when Columbus arrived there in April 1493. Based on interviews with the men who had made the first voyage, he wrote the first book on America, entitled Decade of the New World, or West India and published in 1511. In it he reported the following observation on peppers:

Something may be said about the pepper gathered in the islands and on the continent - but it is not pepper, though it has the same strength and the flavor, and is just as much esteemed. The natives call it axi, it grows taller than a poppy. When it is used there is no need of Caucasian pepper. The sweet pepper is called Boniatum, and the hot pepper is called Caribe, meaning sharp and strong; for the same reasons the cannibals are called Caribs because they are strong. (Anghiera 1904)

The first official chronicler of the New World and the first to document peppers in Tierra Firme, the southern coast of the Caribbean Sea, was Gonzalo Fernández de Oviedo y Valdés (1478-1537). Arriving at Darién, Panama, in 1513, this Spanish caballero spent the next thirty-four years in different parts of the Spanish Main and, in 1526, published his General and Natural History of the Indies. He observed that the Indians consumed pepper or aji both in the islands and on the

mainland. "The Indians everywhere grow it in gardens and farms with much diligence and attention because they eat it continuously with almost all of their food" (Oviedo y Valdés 1950, 235). When planted in fertile ground and watered, the pepper plant grew as tall as a very tall man, he stated. He described several kinds of pods. One was finger-shaped of a very fine red, another red and round like a cherry. A third fruit was small and green, while yet another with blueish-black areas was eaten raw and did not burn (Oviedo y Valdés 1851). This last pepper may have been the precursor of the mild, sweet pepper.

Oviedo y Valdés reported that the Indians used leaves of the pepper plant to prepare meat stew, as well as in sauces. He proclaimed the resulting flavor of these leaves to be as good as or better than the flavor of parsley. Merchants and other people ordered it brought back to Europe because it was "a very good spice." "In truth," he stated, "aji is better with meat and fish than is even very good pepper" (Oviedo y Valdés 1851). Pepper in the latter quotation refers to piper nigrum, black pepper, of the East Indies.

Another early observer, who knew or corresponded with both Oviedo y Valdés and Díaz del Castillo, was Fray Bartolomé de las Casas (1474-1566). He arrived in Hispaniola in 1502 where he actively participated in campaigns against the Taíno Indians. By 1514 he declared his decision to dedicate his life to the defense of the Indians. In 1523 Las Casas became a Dominican friar, and in 1544 he was appointed bishop of Chiapas, Mexico. As an advocate for and defender of the Indians' rights he has become known as "Father of the Indians" and the "Apostle of the Indies." He produced two works, History of the Indies,

1520-1561 and Apologética historia de las Indias, published in 1875-76 and 1909, respectively.

Las Casas documented many plants, among them peppers. On Hispaniola he observed three kinds, two domesticated and one wild variety. One cultivated pepper was long, finger-shaped and red and the other was round like a cherry and more pungent. The third he described as growing voluntarily and bearing very small fruits, much like the black pepper familiar to the Spaniards (Las Casas 1967, 1:58). This pepper was probably Capsicum annum var. aviculare, or bird-pepper.

Meticulous and discerning, Las Casas even took pains to pinpoint the part of the pepper which "burned." He wrote that the pungency emanated from the seeds and the "strips" (placenta) that formed the dividing walls inside the pod. The flesh in between was "sweet and soft." He further noted that peppers figured to such an extent in the local diet that the islanders ate it with everything, whether boiled, roasted or raw (Las Casas 1967, 1:58).

Travels took Las Casas to Central and South America, as well. In Guatemala he observed the abundance of chili peppers for barter in the markets clustered around the temples (Las Casas 1967, 2:514). In Peru he described the great warehouses of the Incas, full of salt, dried or salted meat and fish, and dried peppers. The latter, he commented, constituted a very important part of the Peruvians' diet (Las Casas 1967, 2:586).

Chili peppers were well-known all over Spain by then, and Spanish doctors considered them a healthful food. The best proof was the fact

that the Indians, who "eran temperamentisimos para comer cosa que sea dañosa," ate such large quantities of it (Las Casas 1967, 1:58).

Loosely translated it means that the Indians were extremely finicky about eating anything that might be harmful to their health.

Bernal Díaz del Castillo (1492-1581) was a soldier who marched with Hernán Cortés from Vera Cruz to the Aztec capital in 1519. His work, The True History of the Conquest of New Spain, completed in 1568, chronicles events between 1514 and 1568. In crossing through the lands of the Tlaxcalans and Cholulans he stated that "they wished to kill us and eat our flesh, and had already prepared the pots with salt and chiles and tomatoes" (Díaz del Castillo 1908, 2:14). He also wrote that the Aztecs ate their sacrificial victims' legs and arms with chilmole, a sauce composed of chile, tomato and onion" (Díaz del Castillo 1980).

On a more peaceful note, Díaz described the city of Cholula, stating that the surrounding land was "fruitful in maize and other vegetables, and much chili pepper" (Díaz del Castillo 1908, 2:18). He also had the opportunity to observe Moctezuma's habits and daily routine, especially for the time the Aztec emperor was held under a sort of house arrest by the Spaniards. Díaz wrote that "after saying his prayers and making sacrifices to his idols, he took his breakfast, which was a small matter, for he ate no meat, only chili peppers" (Díaz del Castillo 1908, 2:108).

Pedro de Cieza de León (1520-1554) arrived in the Americas in 1532 as a boy-soldier of thirteen. On his return to Spain seventeen years later, the journals he had managed to write and protect throughout 3,000 miles of soldiering became his Chronicles of Peru. One book, marked as

his Chronicles of the Incas, was published in 1553, during his lifetime. The second was discovered and published in 1880. Most scholars consider his pioneer work the cornerstone when writing of the Incas.

His chronicles record the cultivation of both New and Old World crops in the different regions he travelled. For example, in his description of Puerto Viejo, a coastal area south of Guayaquil in modern-day Ecuador, he noted that the land was extremely fertile, "yielding abundance of maize, yucas, aji, potatoes, and many other roots which are useful for the support of man" (de Cieza y León 1864, 174).

Francisco Cervantes de Salazar (1518?-1575) arrived in Mexico between 1549 and 1551, where he became the first professor of rhetoric at the Universidad Real y Pontífica of Mexico and later the official chronicler of the Imperial City of Mexico. In his Chronicle of New Spain, compiled between 1557 and 1564, he wrote that chili served as the main spice in New Spain; it was hot, aided digestion and bowel movement; it was tasty to such an extent that most dishes and sauces contained it. He noted that there were red and yellow peppers, these being the mature fruit, while the unripe were a green color. Furthermore, some burned more than others. His comment that the Spaniards made no less use of chili peppers than the Indians indicates that this New-World food had already found its way into the hearts and stomachs of the Europeans (Cervantes de Salazar 1971, 244:119).

In his description of the variety of items for sale in the markets of Mexico City, he observed that "the things that they sell to eat are innumerable because very few living things are not considered edible" (Cervantes de Salazar 1971, 244:329). He then described what must have

been a type of algae or eggs which grew on the surface of the shallow lakes around the city. It was gathered by means of very fine nets, spread out to dry and made into brick-like cakes which were sold not only in the city markets but 100 leagues inland, as well. The Indians ate it as the Spaniards ate cheese, he noted. It had a slightly salty taste and was quite delicious when eaten with chilmoli" (Cervantes de Salazar 1971, 244:329).

Hans Stade, a Hessian, spent from 1547 to 1555 in eastern Brazil as captive of the Tupinambá Indians. The account of his seven and a half years among the Indians, published in 1557, included this observation on peppers:

The pepper of the country is of two kinds: the one yellow, the other red; both, however, grow in like manner. When green it is as large as the haws that grow on hawthorns. It is a small shrub, about half a fathom high, and has small leaves; it is full of peppers, which burn the mouth. They pluck it when it becomes ripe, and they dry it in the sun. (Stade 1874, 166)

In describing food preparation among the Indians, Stade wrote, "When they boil anything, be it fish or flesh, they generally add green pepper thereto, and when it is pretty well done they lift it out of the broth, and make with it a thin pap, which they call Mingau" (Stade 1864, 133). Apparently, the Tupinambá favored the unripe green fruit when preparing this particular broth (Stade 1874, 133). Modern Brazilians still preserve the term Mangao.

Furthermore, Stade's account established peppers as a desirable trade item. On several occasions during his captivity French ships arrived to barter with the natives for feathers, parrots, monkeys, Brazil wood, cotton, and, always, red pepper (Stade 1874: 67, 81, 94, 109).

Chili peppers also played a role in Stade's escape. Until 1555 the opportunities to be rescued by fellow Europeans had come to nought. Either the French, not wanting to antagonize their trading partners, refused to allow him on board, or the Indians, believing him to be Portuguese and an enemy, refused to release him to his French "brothers." Finally, in the fall of 1555, a more generous and humanitarian Frenchman by the name of Perot came to the aid of Stade, who described their plan:

He was to be my brother, and he had brought me several cases full of merchandise, that they might take me with them to the ship to fetch the cases. And he was to make believe, that I would remain among them, and collect pepper and other produce, until the ships returned next year. (Stade 1874, 110)

Once on board ship with his Indian master, the captain, Stade and ten sailors who, they said, were Stade's brothers, convinced the chief to allow Stade to return to his homeland, for "father wished to see me once more before he died" (Stade 1874, 111).

José de Acosta (1539-1600) was a Jesuit priest, poet, historian and cosmographer who spent several years as a missionary in Peru, followed by one year in New Spain at the end of the sixteenth century. In his The Natural and Moral History of the Indies he wrote about Mexican and Peruvian chili peppers:

They had not found at the West Indies any kinde of Spices, proper or peculiar to them, as pepper, cloves, cinnamon, nutmegges or ginger ... but the natural spice that God hath given to the West Indies, is what we call in Castille, Indian pepper, and in India Axi, as a general word taken from the first land of the Isands, which they conquered. In the language of Cusco, it is called Uchu, and in that of Mexico Chilli. When this Axi is taken moderately, it helps and comforts the stomach for digestion: but if they take too much, it hath bad effects, for of itself it is very hot, fuming and pierceth greatly, so as the use thereof is prejudicial to the health of young folk, chiefly to the soul, for that it provokes . . . to lust. (Acosta 1880, 2:239)

He also affirmed that it burned "on entering and on leaving, too." In his opinion it was only the seeds and the "venillas" or veins that produced a burning sensation (Acosta 1940).

About 1566 another clergyman and, later, Bishop of Yucatán, Diego de Landa (1524-1579), wrote his Relación de la Cosas de Yucatán, which included a thorough account of the social anthropology of the ancient Maya. Especially complete in recounting Maya religion and ritual, only Sahagún's manuscript covers a similar range of subjects. Landa wrote about chili peppers in Mayan agriculture, diet, in fasting, as a tabu and in punishment.

Landa established the importance of peppers as a crop among the Mayas when he listed the different seeds they gathered and stored for eating and planting: "very good maize of many varieties and colors," beans, squash, gourds and pepper (Landa 1941, 18:195). He also described the layout of native towns, designed to provide protection from being taken captive by their enemies. He wrote that towns spiraled out from their central plaza with its temples, around which stood the homes of the lords and priests. Next to to these were located the homes of the rich, and on the outskirts, the houses of the lower classes. Close by stood what he termed "their improved lands," planted with cotton, peppers and maize (Landa 1941, 18:64).

As elsewhere in the New World, chili peppers accompanied the preparation of corn as food and beverage. When they had no meat for the evening meal, the Mayas ate stews of peppers and vegetables. Their fare during the day consisted of beverages prepared with corn. One such beverage they made out of corn which was parched, then ground and mixed with water and a little pepper or chocolate (Landa 1941, 18:90-91). The

parched corn is kah in Maya and pinole in Spanish. It was and is still used in place of atole or chocolate. The present-day Maya toast corn, add cinnamon, aniseed and often pepper and grind them all together. This forms the basis of a drink they boil like coffee (Landa 1941, 18:90). Landa declared these preparations to be savory and "of great sustaining power" (Landa 1941, 18:90).

Bernardino de Sahagún (?-1590), a Franciscan brother, arrived in Mexico in 1529. While at the Imperial School of Santa Cruz of Tlatelolco, established to educate the sons of noble Aztecs, he became extremely interested in the Mexica culture. About 1557, with the aid of Aztec elders and a questionnaire, he began to collect data on their customs. His General History of the Things of New Spain, also known as the Florentine Codex, was published in 1569. Written in both Nahuatl and Spanish, with drawings depicting answers to the questionnaire, this work documented the daily life of the Mexica as it was before the arrival of the Spaniards. One of three important sources on plants in New Spain, it refers to peppers more than to any other condiment.

Sahagún compiled data on food and meals among both the poor and noble classes. The dietary fare of the latter included chicken empanadas (turnovers) prepared with yellow pepper. Red pepper, tomato and ground squash seeds went into a chicken dish, called pipián; yet another stew called for the yellow pepper. The nobles also prepared many kinds of vegetable soups with peppers: one contained yellow pepper; another, chilmolli, made with either chiltecpitl and tomatoes or yellow pepper and tomatoes; yet another, green pepper. There also seemed to be an appropriate pepper for each kind of fish stew: yellow pepper for

white fish; red for brown fish; chiltecpitl for small red fish.

Sahagún found the fish stews prepared with chile, tomatoes and ground squash seeds to be very good indeed. Frogs the lords ate prepared with green chile, newt (axolotl) with yellow pepper, tadpoles and shrimp stew with chiltecpitl. Winged ants were eaten with chiltecpitl and maguay grubs with chiltecpitl molli. Of these dishes, the most esteemed were the white fish, iztimichi, prepared with pepper and tomato, and the axolotl with yellow pepper (Sahagún 1969, 2:306-307).

Beverages also contained ground chili pepper. Atolli, ground corn boiled in water to form a thick broth, was called nequatolli when prepared with honey, chilnequatolli when powdered chili was added (Sahagún 1969, 2:307).

Aztecs who lived nearer to either coast of Mexico drank chilote, a liquor made with pulque (fermented agave pulp), ancho chili peppers and herbs (DeWitt 1990, 83). Cacaoatl, "chocolate water," when it contained chili pepper was called chicacahuatl (Long-Solis 1986, 37). Today in Mexico atoles, the Spanish term derived from Nahuatl, can be found everywhere from the markets and streets to formal gatherings. A bowl of chocolate seasoned with cinnamon and almonds is standard fare from morning to night in the markets of Oaxaca City in Oaxaca, Mexico.

In reference to street vendors, Long-Solis is quick to point out that the street stands so prevalent and popular in Mexico today are not a result of a lack of time and the pressures of modern-day life.

Sahagún, writing in the sixteenth century, described similar stands whose merchants offered all manner of antojitos or snacks and small servings of dishes seasoned with chili pepper and tomato. Never lacking were tender ears of corn, boiled or roasted and sprinkled with chili

pepper (Long-Solis, 1986, 37). Vendors continue to sell them today throughout Mexico and Central America.

Sahagún also recorded the organization of markets among the Aztecs. Given the frequent marriage of chili peppers with the food dishes described above, the placement of the stands seems well-planned and practical. Chili-pepper merchants shared an area in the market with those who sold corn, beans, amaranth, hens, roosters, partridges, hares and rabbits, venison, birds, maguey and bee honey and tomatoes (Sahagún 1969, 2:326). Some pepper vendors sold their own produce, others were retailers. They sold mild red peppers, broad peppers, pungent green peppers, yellow peppers, cuitlachilli, tenpilchilli and chichioachilli, water peppers (possibly comparable to the Bell peppers), conchilli, smoked peppers, small peppers, tree peppers, thin peppers, those like beetles. They sold peppers planted in March, sharp-pointed red peppers, a late variety, peppers from Atzitziuacan, Tochmilco, Huaxtepec, Michoacan, Anahuac, la Huasteca, la Chichimeca. Separately they sold strings of peppers, pot peppers (de olla), fish peppers and white-fish peppers (Sahagún 1963).

He also described the qualities of a bad chili merchant. These were merchants who sold peppers which were rotten, bitter, smelly, immature, soft, grown in humid earth, impossible to burn, or had no flavor and were very green and small, like buds (Sahagún 1969, 3:137).

His description of those who sold prepared dishes further emphasizes cooked peppers in combination with the same products neighboring them in the market scene previously described. He wrote:

The person who sells stews made with chili peppers and tomato usually combines the following: ajf, squash seeds, tomatoes, green

chili and big tomatoes, and other things that make the dishes very tasty; it is also their job to sell roasted meats and meats prepared underground, and chilmolli of all kinds and many other kinds of dishes. (Sahagún 1969, 3:138)

Peppers also figured in Sahagún's description of those who sold tortillas and atoles. The tortilla vendor offered tortillas that had meat and chili pepper inside, while others were dipped in peppers or chilmolli. Atoles were sold either hot or cold and might contain pepper or honey to give them flavor (Sahagún 1969, 3:156):

The Mexicans offered not only a wide variety of peppers both fresh and dried, but also linguistic terms to indicate levels of pungency. Sahagún reported them as follows (Sahagún 1953):

<u>Nahuatl</u>	<u>Spanish</u>	<u>English</u>
cococ	picante	sharp
cocopatic	muy picante	very sharp
cocopetzpatic	muy, muy picante	very, very sharp
cocopetztic	brillantemente picante	brilliantly sharp
cocopetzquauitl	extremadamente picante	extremely sharp
cocopalalatic	picantísimo	sharpest

Sahagún's description of the various tribes included observations on their agriculture and diet. The presence or absence of peppers was often explicitly mentioned. For example, of the Ocuiltecas, Mazaoques and Totonagues he said they prepared good stews and chicken empanadas and that their principal condiment was chili peppers which they ground and rubbed into their tortillas as these came hot off the griddle (Sahagún 1969, 3:202). The Tlaluhaica grew a lot of cotton and chili peppers while the Quaquata grew only corn and beans and hauhtli, a grain. They lacked both salt and chili peppers (Sahagún 1969, 3:200, 204).

Dr. Francisco Hernández (1514-1587), physician to King Felipe II of Spain, compiled another of the three important sources on plants in

New Spain. The King gave him the title of physician to the Indies and commissioned him to write the ancient, political and natural history of New Spain in five years. In 1570 Dr. Hernández, accompanied by his son, left for Mexico, and by 1575 had produced sixteen volumes. He spent another two years in Mexico City, where he worked with doctors, administering the Indian medicines and recording trial results.

Hernández' work was never published during his lifetime. When the King finally commissioned a Dr. Recchi to translate it from the Latin, he instructed him to extract only what he, Dr. Recchi, considered the most useful and important parts of the manuscript for publication. Chosen were the parts treating medicines and their uses. As a result, today there exists Quatro libros de la naturaleza y virtutes de las plantas y animales que estan recevidos en el uso de medicina in la Nueva España, published in Europe only in 1651. Except for a few pages, the entire original manuscript and colored drawings were destroyed in a fire in the Escorial in 1671.

In Mexico Recchi's compendium fell into the hands of a Dominican lay brother, Fray Francisco Ximénez, who translated it into Spanish from the Latin. Published in Mexico in 1615 and reprinted there in 1888, it remained unknown in Europe for many years.

In a chapter entitled "Chilli or Indian Pepper," Hernández noted that this "herb" had found its way to Spain long before. It was grown in gardens and planters and served as both decoration and condiment. However, he had observed many more varieties in New Spain, where it enjoyed such popularity in stimulating the appetite and enhancing the flavor of food that "no table in the Indies was without chillies" (Hernández 1888, 106).

Hernández named in Nahuatl and described seven different chilies used by the Indians. The chilies named are quauhchilli, chiltecpin, tonalchilli, tzinquauhyo, tzonchilli (or texochilli or tePOCHilli), chilcoztli, and milchilli (Hernández 1888, 106-108). Table 1 shows a table relisting these seven chiles with their descriptions and comparisons with modern cultivars (Andrews 1984, 28).

The Royal Commentaries of the Incas, the first part published in 1609 and the second in 1617, is the first account authored about America by an American. It was written by Garcilaso de la Vega, El Inca, (1539-1616), born Gómez Suárez de Figueroa, the son of a Spanish nobleman and a royal Incan woman.

Garcilaso reported that the Indians cultivated and harvested crops from the lands assigned to the Inca ruler and to their principal deity, the sun, as well as those assigned to maintain their own individual families. "One of the chief crops was uchu, which the Spaniards call axí, and for another name pepper" (Garcilaso 1869, 2:15).

Peppers enjoyed such importance that their absence was worthy of note. In his description of the highland province of Collao, Garcilaso commented that "owing to the extreme cold neither maize nor uchu (which the Spaniards call pepper) will ripen..." (Garcilaso 1869, 2:213).

In chapters devoted to describing the fruits of the Peruvians The Inca wrote:

With these fruits, and even as the most important of them according to the taste of the Indians, we may place the condiment which they use in all their dishes, whether stew, roast, or boiled. They cook no dish without that which they call uchu, known to the Spaniards as pepper of the Indians. It is also known as axí, a name in the language of the Windward Islands. My countrymen are so fond of this uchu that they will not eat without it, even if their meal should be raw herbs. Owing to the flavor it gives to their food,

its use was forbidden in the fasts of the Indians, to make them more rigorous, as I have mentioned elsewhere. This pepper is of three or four kinds. The most common is thick, somewhat long, and without a point. This is called rocot uchu, or "thick pepper," to distinguish it from the next kind. They eat it green, and before it assumes its ripe color, which is red. There are others yellow, and others brown, though in Spain only the red kind has been seen. There is another kind the length of a gema (the space between the end of the thumb and the end of the forefinger, both extended), a little more or less, and the thickness of the little finger. These were considered a nobler kind, and were reserved for the use of the royal family. Their special name has escaped my memory, but they are also called uchu. It is the adjective to be added that I cannot recollect. Another kind of pepper is small and round, exactly like a cherry with its stalk. They call it chinchí uchu; and it burns far more than the others. It is grown in small quantities, and for that reason is the more highly esteemed. The poisonous reptiles fly from the pepper and from its plant. I heard a Spaniard say, who had arrived from Mexico, that the pepper was very nice to look at, and that he, therefore, had two roasted capsicums at every meal. Generally the Spaniards, who return to Spain from the Indies, eat them regularly, and like them better than the kind from the East Indies. The Indians are so fond of them that they value them more than all the other fruits we have mentioned. (Garcilaso 1869, 2:365-366)

Thomas Gage (1597-1656), a Dominican priest from Ireland, spent twelve years in Guatemala, from 1625 to 1637. His book, The English-American, his Travail by Sea and Land; or, A New Survey of the West Indies, 1648, was the first authentic account of New Spain and Central America written by a well-educated Englishman. In it can be found confirmation of the Spanish Creoles' having adopted a diet which included New-World foods, in particular, beans prepared with peppers. Gage wrote, albeit disparagingly, that it was common for the Creoles to dine only on a dish of frijoles (beans) in black broth, boiled with biting chilli and garlic and to proclaim it "the most nourishing meat in all the Indies" (Gage 1928, 158). Gage himself was never without the ingredients for preparing the New-World beverage, chocolate, as he made his way through Mexico to his post in Guatemala. While he seems only to

have drunk his chocolate with achiote (annatto), he mentioned the production of "other drugs for chocolate," one being the chilpaelagua (Gage 1928, 205). This "chile for water," for the Indians prepared their beverage in water, was of medium pungency. Today in Guatemala a chile chocolate is sold in the markets. In Mexico the costeño is used in chocolate beverages (Andrews 1984, 30). Gage also identified three other kinds of pepper - the very pungent chilchote and chiltipiquin and the tonalchile, less pungent and eaten with tortillas (Gage 1969).

In describing the small daily markets called tianquis in Antigua, Guatemala, he observed that at four in the afternoon the market filled for an hour when the country women arrived to sell what the Creoles considered dainties, among them "puddings made of Indian maize, with a bit of fowl or fresh pork in them seasoned with much red biting chilli, which they call anacatamales" (Gage 1928, 198).

Not surprising, then, is his observation regarding Indian men who were required to absent themselves from their homes for a week at a time to provide labor where needed for the Spanish landowners in the area. They arrived in Antigua for their assignments, carrying tools and food for a week, the latter being "commonly some dry cakes of maize, puddings of frijoles, or French beans, and a little chilli or biting long pepper" (Gage 1928, 231).

In a chapter devoted to the customs, feast days and diet of the Guatemalan Indians, he described how a community joined in to build a house or thatch a roof for one of its members. The participants charged only chocolate, which was served to them in pint-sized cups and flavored

with aniseed and chili pepper. He found that the Indians held themselves "well-satisfied" with a diet of black or white beans, always in great abundance, boiled with peppers. He noted that, in fact, they ate everything with biting peppers or dipped their food in water and salt in which there were bruised peppers. A family too poor to obtain beans ate tortillas with peppers and salt, dipping them in the water, salt and the chili-pepper brine already mentioned (Gage 1928, 238).

While Gage never expressed liking beans boiled with peppers, he did praise iguana meat stewed in a broth and flavored with them (Gage 1928, 241). He also ate wild deer which the Indians let lie covered with leaves for a week, parboiled with an herb similar to tansy and then smoked. Just before eating it, the meat was boiled and "commonly dressed with Indian red pepper." He avowed that he did not find "any evil taste in it," but he "never durst be too bold with it" because "the worms and maggots which formerly had been in it troubled much my stomach" (Gage 1928, 240).

The Jesuit priest Bernabé Cobo (1580-1657) travelled and lived in Latin America for over fifty years, arriving in the West Indies about 1597. Except for an extended trip to Mexico from 1629 to 1642, this naturalist and historian spent his time in Peru. In 1609 he followed the Inca roads from Lima to Cuzco and, in the years following, walked across most of central and southern Peru. In 1653 he finished the History of the New World. Finally published between 1890 and 1893, at the beginning of modern scientific research, his book has become one of the most important and extensive resources on the Incas.

Referring mainly to Peruvian customs, Cobo stated that, next to maize, aji was the plant held in highest esteem by the Indians. He

described a stew called motepatasca, made of "whole kernels of maize with some herbe and aji peppers." Another stew was prepared with either fresh meat or dried, the dried being charqui in Quechua, jerky in English. This stew, called locro, contained a lot of chili peppers, freeze-dried tubers, called chuño, and other vegetables (Cobo 1990, 198). Tamales he described as rolls (bollos) of corn with a lot of pepper (Cobo 1953).

Spanish sailors took both dry and pickled (en escabeche) peppers with them on their transatlantic voyages, Cobo wrote (Cobo 1956). Perhaps the men had discovered that they escaped the mariners' malady, scurvy, by supplementing the poor diet on ship. Scurvy can be warded off by consuming just ten milligrams daily of vitamin C; one hundred grams of chile poblano contain 24.64 milligrams (Long-Solis 1986, 42).

Cobo also recorded the role of chili peppers in Incan origin myths, in religious rites, penitence, fasts and tribute. His observations appear in chapter 6.

Lionel Wafer (1660?-1705?), an English buccaneer with some notions of surgery and medicine, made the first report on peppers in Panama. In the spring of 1681 he was injured in a gunpowder explosion and subsequently abandoned by his pirate mates on the isthmus of Panama. The Indians of Darién took him in, and for a period of six months he lived among them. In 1699 Wafer published a book about his adventures in which he included comments on the lives and customs of his Indian hosts. Salt the Indians used sparingly since the process of extracting it from seawater was tedious. However, they did not restrain themselves in their consumption of peppers. In reporting on their cultivated

plots, he never observed herbs or vegetables growing. "But they never forgot to have in their Plantations some of their beloved Pepper" (Wafer 1699, 149-150). He wrote:

They have two sorts of pepper, the one called Bell-Pepper, the other Bird-Pepper, and great quantities of each, much used by the Indians. Each sort grows on a Weed, or Shrubby Bush about a Yard high. the Bird-Pepper has the smaller Leaf, and is by the Indians better esteemed than the other, for they eat a great deal of it. (Wafer 1699, 107)

Wafer further described food preparation in the Darién. All meat, whether dried or fresh, was simmered, never boiled, with roots, plantains and always generous amounts of pepper. For formal feasts, each person had at his right hand a gourd bowl with water in it. Since the Indians ate their meat "excessive hot, as well as violently pepper'd," Wafer never knew whether their frequent dipping of fingers into the water was for "cleanliness or cooling" (Wafer 1699, 164).

Fray Francisco Ximénez (1666-1728 or 1729) was a Dominican priest who arrived in Guatemala in 1688. Sent in 1694 to minister among the Indians living in the interior, Ximénez became interested in the native languages and in the flora and fauna so different from those of Europe. Between 1701 and 1703 he compiled his Tesoro de las tres lenguas, Cakchiquel, Quiché y Tzutuhil. This publication includes the translation of the major work of the Quiché Maya, the Popol Vuh, which Ximénez discovered. In 1722 he began work on the Historia Natural del Reino de Guatemala, in which he reported on a number of peppers. He counted more than 32 different kinds, of which he had seen only two or three in Spain. Peppers were consumed by the entire population, he noted. The pepper called chamborote served well for preparation in vinegar, much better than the pepper used in Spain, since the chamborote was more

tender and not as pungent. The native population consumed primarily a pepper, which he did not name, of medium sharpness. The Indians harvested great quantities of it, and he proclaimed it to be very good. In a place called Tactic he identified two kinds of peppers: one short and wide and very wicked (bravo) and another called chocolate chili. The meanest of all was a pepper called tempenchile, "as small as grains of black pepper" and "so biting it seems like fire." He had heard that in Havana, Cuba, there was yet a stronger pepper, so biting that one pod was enough to render a bull unable to eat (Ximenez 1967, 290). The tempenchile is the chiltecpin in Mexico. The Cuban pepper was probably the one known today as the habanero, the most pungent chili pepper of all.

Francisco de Ajofrín, of the Capucine order, left a record of pepper crops in the eighteenth century in the states of Michoacán, Guanajuato and Querétaro, Mexico. In 1764 he travelled through these states collecting donations for the Church. So impressed by the quantity of peppers in Mexican food and fields, he wrote that dishes were "loaded with chili pepper" and listed the most common preparations which contained it: mole, chilmole, enchiladas, tamales, pipián and beans (Ajofrín 1936).

He had the following to say about crops around Celaya, Guanajuato:

It has many haciendas in its jurisdiction, in which there are abundant harvests of wheat, corn, barley and other grains; but the biggest business and utility of these haciendas consists in the large harvest of pimiento (which they call chiles here) of all kinds, but the pasilla pepper is the most esteemed. It will seem unbelievable to the Europeans if they are told that for many leagues there is nothing but peppers in the fields, the consumption of which is so great that this vegetable is one of the most important items of commerce. (Ajofrín 1936)

These fields were very beautiful because, among the pepper plants, the Indians seeded all kinds of flowers to decorate their altars

and crosses placed alongside the roads (Ajofrín 1936). Long-Solis notes that this region has retained its importance in the production of chili peppers (Long-Solis 1986, 43).

An English planter and historian, Edward Long, made a general survey of Jamaica in 1774. He reported finding fifteen varieties of peppers growing in most corners of the island. The most common were the bell pepper, goat, bonnet, bird, olive, hen, Barbary, finger, cherry, ram's horn and coral (Long 1972, 3:857). Except for the bird pepper, which was gathered when ripe, the other varieties were usually gathered from the plant before they were ripe. He wrote that peppers were "used liberally in the West Indies" and speculated that, given the climate of the region, were necessary in assisting digestion, promoting bowel movements, invigorating the blood and correcting the "flatulency of vegetable aliments" (Long 1972, 3:723).

Combatting flatulence may very well be part of the contribution of peppers as an ingredient in the pepper pots in the Caribbean. Long reported that the kidney bean was cultivated everywhere on the island and used chiefly in these pepper pots (Long 1972, 3:786). The Carib Indians prepared this stew in ancient times, and today it is reported that pepper pots are always cooking in the islands. Fresh meats and vegetables are added daily, and, reportedly, some of these pots have been going for generations (DeWitt 1990, 122). Long considered these stews to be very wholesome, stating that they constituted the main fare of the Negroes and were relished by both the early Spaniards and later the Creoles. He believed that the constant mixture of animal and vegetable food, with emphasis on the vegetable, was more healthful than the

European diet of much meat, cheese and butter - often rancid - with very few, if any, vegetables. He considered the abundance of vegetables and varieties of peppers "a most benevolent provision" of nature in the West Indies and stated that "the natives, white and black, covet them with singular avidity" (Long 1972, 2:528).

As elsewhere in the New World, the islanders were very fond of drinking chocolate and also prepared it with pepper at times. Long mentioned a costlier chocolate which contained cinnamon and hot spices. While he recommended that newly-arrived Europeans drink chocolate "to keep the body always open," he cautioned them against indulging too freely in the spiced version, considering it too rich (Long 1972, 2:532).)

Long described in detail the pickling process of the bell pepper, noting that they were considered the "wholesomest pickle in the world." The bird pepper was used in making cayan-butter. Gathered when ripe, then dried in the sun, pounded and mixed with salt, it was then preserved in capped bottles. This mixture was also held in high esteem "for the excellent relish it gives to soups, turtle and other dishes" (Long 1972, 3:722-723). He believed that the pickled bell peppers and the cayan-butter might be considered articles of export to aid commerce with North America.

The Abbé San Juan Ignatius Molina (?-1829) published his Geographical, Natural, and Civil History of Chile as two separate works, in 1782 and 1787. He recorded that many species of pimento (Capsicum), called thapi by the Araucanians, were cultivated in Chile. Among others, there grew the annual pimento, a perennial, the berry pimento and the

pimento with a subligenous stalk. He noted that "the inhabitants make use equally of all the three to season their food" (Molina 1808, 1:95-96).

From 1779 to 1804 Alexander von Humboldt (1769-1859), a German scientist and explorer, and Aimé Bonpland journeyed throughout Central and South America. Their scientific expedition produced the following observation on peppers:

The different species of pimento (C. annum, C. frutescens, C. baccatum), called by the Mexicans chilli, and the Peruvians uchu, . . . is as indispensably necessary to the natives as salt to the whites. The Spaniards call pimento chile or axi (ahí). The first word is derived from quauh-chilli, the second is a Haitian word that we must not confound with axé . . . (Humboldt 1814, 457)

In nineteenth-century Mexico Jose Antonio Alzate y Ramirez produced Gazetas de Literatura de México in 1831. This publication contained information on several contemporary topics, one of them being the description and technique of cultivating chili peppers in the chinampas of Xochimilco, the area of Mexico City which provided produce to the city in ancient times and, to a certain extent, today. He explained in detail box measurements, the number of seeds to plant in each hole and even how to build the roof required to protect the seedlings from frost (Alzate y Ramirez 1831).

A macabre and possible apocryphal tale of hot chili peppers was recounted by H. H. Bancroft in his Native Races of the Pacific States of North America, published in 1882:

This pungent condiment is at present day as omnipresent in Spanish American dishes as it was at the time of the conquest; and I am seriously informed by a Spanish gentleman who resided for many years in Mexico and was an officer in Maximillian's army, that while the wolves would feed upon the dead bodies of the French that lay all night upon the battlefield, they never touched the bodies of the

Mexicans, because the flesh was completely impregnated with chile. Which, if true, may be thought to show that wolves do not object to a diet seasoned with garlic. (Bancroft 1882)

Once the wars of independence from Spain had been fought and won by the Latin American nations in the nineteenth century, there came an influx, not of conquistadors and clergymen, but of adventurers, diplomats and entrepreneurs. Following are some observations of this new group of foreigners who arrived in Mexico.

Generally, these people complained on first coming into contact with Mexican cuisine. The Marquise Calderón de la Barca stated that only hunger could make palatable chili peppers and garlic and that it required a throat lined with tin to withstand the quantity of peppers the Mexicans consumed (Calderón de la Barca 1974).

Brantz Mayer, an American diplomat, said he had never before tasted anything approaching the concoction of chili peppers, onions, bacon and garlic with which Mexicans ruined meat (Mayer, 1953)

An English diplomat, Henry G. Ward, travelled extensively throughout the provinces. His observations, including some on peppers, appeared in his publication Mexico in 1827. He noted that entire haciendas in the central plateau were devoted to growing "this powerful stimulant" which constituted one of the necessities of life of the native and mestizo population. It also appeared "in great quantities" on the tables of the creoles of every social level, of which there were seventeen in eighteenth-century Mexico. The uninitiated suffered absolute excoriation at first, noted Ward, but one's palate became accustomed and the habit of eating peppers became indispensable. He

also remarked on the great attachment the lower classes felt for peppers, which flavored their "insipid tortillas" and which they would not exchange for either meat or wheat bread (Ward 1981).

Ward expressed amazement at the prodigious quantities of peppers sold in the plaza of Zacatecas, recounting that carts loaded with peppers and pulled by six oxen arrived hourly from Aguascalientes. Enough chili peppers to "excoriate the palates of half of London" disappeared in only a few minutes (Ward 1981).

Yet another diplomat, Joel R. Poinsett from the United States, wrote that "the quantity of red pepper raised in all parts of the country is almost incredible" (Poinsett 1969, 146).

Other reports on peppers in the nineteenth century were recorded by Clements R. Markham in the notes to his edition of Pedro de Cieza de León's chronicles about Peru, published in 1864. He wrote:

Aji or uchu, a Chile pepper with a very peculiar flavour (Capsicum frutescens), is the favourite condiment of the Peruvian Indians, sometimes eaten green, and sometimes dried and pounded. The consumption of aji is greater than that of salt; for with two-thirds of the dishes, more of the former than the latter is used. (Cieza de León 1964, 232)

In another note Markham reported his observations in 1853 of the irrigation system in the coastal valley of Nazca. Cieza de León had marvelled at these coastal irrigation systems in the sixteenth century. Fallen into ruin after the arrival of the Spaniards, this one remaining system provided water for a variety of crops, among them, chili peppers (Cieza de León 1864, 236).

Markham also observed that in another coastal valley, the Camana, a yellow pepper was famous and that guano had been used to fertilize the crop "from time immemorial" (Cieza de León 1864, 265).

Markham's observations complete this brief survey of significant references to chili peppers from their discovery to the late nineteenth century. Their continuing roles in twentieth-century societies appear in the following chapters. Although most of the information will refer to descendants of the pre-Hispanic cultures, some data from countries around the world have been included.

CHAPTER 4

PEPPERS AS WEAPON AND IN PUNISHMENT

Chili peppers were used in warfare and as a means of punishment in pre-Columbian times. In modern times they enjoy uses which parallel those of the earlier era.

In his Mexican Chronicle written in the sixteenth century, Alvarado Tezozómoc related that Moctezuma Xocoyotzin sent a group of high-ranking officials with orders to collect tribute in the towns of Ahuilizapan and Cuetlaxtlan on the Gulf of Mexico. Upon arriving they were attacked and suffocated with smoke from burning peppers. They were then disemboweled, stuffed with straw, placed on elegant benches and insulted by their attackers (Chapman 1971).

Fray Diego Durán recounted a similar event in his History of the Indies of New Spain, also produced in the sixteenth century. He wrote that the lords of Cuetlaxtlan, spurred on by the conniving Tlaxcalans, had refused to send their usual tribute to Moctezuma. In this instance, as well, Moctezuma dispatched lords to inquire into the matter. When the lords arrived at the governor's house in Cuetlaxtlan, they were ushered into a room, made welcome and advised to rest until the governor was notified of their arrival. The lords of the town then ordered the door blocked and a quantity of peppers to be set afire. Once dead of suffocation, the envoys were disemboweled and their entrails wrapped around their necks (Durán 1967, 1:198).

Hans Stade wrote that the Tupinambá in eastern Brazil employed chili peppers to drive their enemies from their forts. When the wind was blowing, they would make huge fires, and onto them they would throw peppers. If the wind direction cooperated, the fumes struck the huts of their enemies, who were forced to evacuate them. Although he never witnessed this practice between two warring Indian factions, on another occasion he almost fell victim to it. His Portuguese shipmates and he were

lying dry, with a ship in a river, for the flood had left us; and many savages came, thinking to take us, but they could not. Upon this they threw heaps of dry underwood between the ship and the shore, also intending to drive us away with pepper fumes, but they could not light the wood. (Stade 1874, 154)

The warfaring and cannibalistic Carib Indians of the Lesser Antilles took home the captives they did not eat immediately following a successful attack. Before being cooked, the hapless fellows suffered several days of torture, which included being burned and cut and having chili pepper rubbed in the wounds (Heiser 1969, 9).

Peppers played a more indirect role on one occasion during the reign of the Inca Guayna Capac, when his uncle Gualpaya schemed to usurp the crown for one of his own sons. Gualpaya instructed his allies to introduce arms into Cuzco by hiding them in baskets normally used for coca and chilies. More than a thousand of these baskets had found their way into the city when the conspiracy was uncovered by thieves, who had stolen some baskets in a provincial city. Rather than coca and chilies, they found themselves in possession of arms and military supplies. Word reached townspeople not involved in the plot, and, finally, a governor and uncle friendly to the Inca. The baskets were confiscated and the hapless owners of the baskets tortured (Cobo 1979, 152).

Chilies also functioned as a means of discipline in the New World. Figure 3 from the Mendocino Codex contains an illustration of a father punishing his eleven-year old son by forcing him to inhale the smoke from dried, roasting chilies (Solis 1984, 32). There is also a pictograph showing a mother threatening her six-year old daughter with the same punishment (Dewitt and Gerlach 1990, 86). This practice continues today among the Popoloca south of Puebla, Mexico (Wauchope 1969, 7:496-497).

Among the Maya of the Yucatán, women were expected to be chaste, follow rules of appropriate behavior and to be good workers. Mothers punished most lapses of behavior by giving their daughters pinches on their ears and arms. However, if the young women were caught raising their eyes, their mothers rubbed them with chili pepper, a very painful punishment, wrote Landa. If they were unchaste, they were whipped and another part of their body" was rubbed with pepper (Landa 1941, 18:127).

The British also discovered pepper as punishment. In the West Indies they would rub the pungent Bahamian pepper into the eyes of mutinous slaves (Naj 1992, 3).

Departing from the Americas briefly, in Zaire a mother was observed lightly passing a fresh goat pepper across the armpit of her recalcitrant child (Ruth Gilman personal communication, March 1994). Africans also spray water containing chili-pepper juice into the eyes of disobedient children (Naj 1992, 3).

When Iraq invaded Kuwait, they were reported to have beaten the Kuwaitis and made them sit naked in hot chili-pepper sauce (Naj 1992, 3).

The United States have also adopted chili peppers to wage chemical warfare. Hikers now have recourse to canisters of chili-pepper spray to

protect themselves from bears. Mace has been replaced by a less potent version of the bear spray and is being used by the general population and police forces. When it was discovered that tokens were being sucked out of their slots in New York's subway, the problem was solved by placing ground chili inside the token slots.

Centuries-old practices have been passed down or, in some instances, have been rediscovered and dressed in new clothing. Peppers, an "all-natural" substance, have provided not only an efficacious means to an end but an ecologically sound one, as well.

CHAPTER 5

CHILI PEPPERS IN TRIBUTE AND BARTER

One of the objectives of the territorial expansion of both the Aztecs and the Incas was to be able to exact tribute from the groups they conquered. Generally, these groups were expected to contribute local products, which were often food items. Chili peppers constituted one of the most common.

While the written records in the form of codices establish peppers as a tribute product in Mesoamerica, there exists a legend recounted by the Aztecs about the time prior to their rise to power in the Valley of Mexico. At this time the Aztecs, or Mexica, themselves were obliged to pay tribute to tribes already established in the valley. The legend confirms that peppers were an item of tribute sufficiently important to merit divine intervention.

In order to appreciate the legend it is necessary to understand the system of agriculture based on chinampas, which the Mexica began to practice to an extent in the thirteenth century, upon their arrival in the southern end of the Valley of Mexico. Chinampas are planting areas constructed by hand along the edges of the shallow lakes which abound in the Valley of Mexico. Layers of aquatic plants and reeds, tule, are alternated with layers of mud and earth to create a long, rectangular parcel of land. The uppermost layer, which lies above water level, is

formed by scooping up the rich sediment from the lake bed. Finally, ahuejote trees, whose roots prevent erosion, are planted along the edges of the parcels.

As was mentioned previously, the Mexica were obliged to pay tribute to groups already established there in the thirteenth century. Among other products, they paid in green chilies (chilchotl) from their chinampas. One day the king raised the amount of tribute to an impossible level. He demanded that the Mexica build on the water a "raft" on which they could plant all the vegetables of the region, including corn, beans, squash, amaranth and chili peppers. With the help of the god Huitzilopochtli the Aztecs managed to present the king with the raft bearing the above-mentioned plants already fully-matured (Durán 1967, 2:58-59).

If the word "raft" is substituted by "chinampa" the legend becomes more comprehensible (Long-Solis 1986, 82). In any event, it establishes chili peppers as an item of tribute among the groups in Mexico.

Once the Aztecs became the dominant group in the valley, the Aztec ruler began to exact tribute. The greatest burden of tribute fell on the shoulders of the macehuales, or common people. Tribute of chili peppers was made in the form of fresh or dried pods or as seeds. The macehuales offered peppers by the load (the amount that a person could carry using a tumpline), in baskets or bundles of varying sizes or by seed plot (Long-Solis 1986, 18). To give an idea of the quantities exacted, the area of Texcoco paid the court in Tenochtitlán a total of 18,150 cestones (large baskets) annually in the form of chile ancho (the dried poblano chili), chile menudo and small chilies (Alva Ixliilxochitl 1975).

In addition to a fixed tribute, the macehuales were obliged to contribute an additional quota for special celebrations. When Moctezuma Xocoyotzín became emperor of Tenochtitlán, present-day Mexico City, there arrived daily from 150 leagues around 1,000 Indians bearing cacao, fish, fruit, birds and chili peppers (Long-Solis 1986, 18).

Like the Incas, the Aztecs built depositories to store products of tribute. Dried chili peppers were one of the products deposited in community warehouses in the chief towns. Pictographic records were kept of the contents of these warehouses, called calpixcacalli or texancalli. The community kept part of the contents for their ill, aged and poor people. The remainder was divided among the local lords and the capital, Tenochtitlán (Long-Solis 1986, 19).

In times of need, the products stored in the royal depositories, the petlacalli, were distributed to the populace in the interests of reducing tension in the empire. During the famine which occurred in the mid-fifteenth century, the Emperor Moctezuma Ilhuicamina, called for an accounting of the quantity of food items, among them peppers, in the royal storehouses. He then ordered them distributed among the ill, the aged and the disabled (Durán 1951).

Peppers continued to be an item of tribute after the arrival of the Spaniards and throughout the sixteenth century. The Spaniards introduced the following European measures: the fanega, 55.5 liters, the almud, 4.5 liters, and the arroba, 11.506 kilos (Long-Solis 1986, 51). Following is a sampling of amounts of chili pepper exacted as tribute from various regions by the Europeans. Ixtapa, Michoacán, paid eight loads (111 liters) every twenty days at one point, and at another,

one seed plot and 240 petates (straw mats in which chilies were bundled) of two arrobas each annually (Miranda 1980). In Chalco the Indians brought 200 peppers daily; in Coyoacán they contributed 700 weekly (Gibson 1964).

As previously mentioned, the Aztecs kept pictographic records or codices. While the majority was destroyed in the first years after the arrival of the Spaniards, the 500 remaining provide information about daily life and tribute in Mexico prior to and after 1519. The following figures, which show chili peppers as tribute, have been taken from these surviving codices, whose names appear in parentheses.

Figure 4 shows tribute paid by Oxitipán, present-day San Luis Potosi, which contributed 100 white blankets, 800 colored blankets, 400 loads of dried chilies bundled in petates (straw mats) and one live eagle "or as many as they found and caught" (Long-Solis 1986, 21).

From the Yanhuitlán Codex, painted between 1545 and 1550 by the Mixtec Indians of Oaxaca, comes figure 5. It illustrates three cribs of the calpixcacalli or community warehouse. The upper portion contains 16 baskets full of wheat, while the lower part holds chili peppers and beans. At the bottom of the drawing appears a sentence in Mixtec, "Ytu yahasi yya tonine," which in Spanish means "chili-pepper plot of the Great Lord" (Long-Solis 1986, 22, 24).

Figure 6 shows tribute paid to the chieftains of Tecomaxtlahuaca, Oaxaca. Dated 1578, it contains drawings of beans, squash, corn, textiles and chili peppers (Long-Solis 1986, 24).

The Sierra Codex presents the expenditures of the community of Santa Catarina Texupa, Oaxaca, between 1550 and 1564. Reading from the

top down, figure 7 illustrates not only the cost but also the food purchased for a banquet the town offered to its vicar, for the Easter celebration of Corpus Christi and for the feast of St. Peter and St. Paul.

For the banquet the town spent 45 pesos and 6 tomines on wine, chickens, eggs, honey, fish, shrimp, a banana and a quince, and a branch of chili peppers with fruit and flowers still on it. For Corpus Christi, which cost 40 pesos, a large jug of wine, a turkey, cacao beans and another branch of a chili plant with fruit and flower were purchased. The last frame on the lower left depicts the key of St. Peter, the sword of St. Paul, two coins, and once again, a large jug of wine, cacao beans, a turkey and the chili-pepper branch with flower and fruit. (Long-Solis 1986, 24-26).

Figure 8 comes from a codex dated from 1542 to 1552 and depicts tribute from the mining regions of Tlapujava, Mexico, and Tzintzuntzan, Michoacán. It shows drawings of heads of Indians, blankets, clothing and several food glyphs, among them ten measures of chili peppers (Long-Solis 1986, 26).

The list of tribute in figure 9, possibly from central Mexico, depicts erect chili peppers in the lower left frame and in the third frame down on the right side (Long-Solis 1986, 27).

Figure 10 shows part of Codex 31, belonging to a collection of codices entitled Códices de algunos pueblos del Marquesado del Valle de Oaxaca (Indigenous Codices of Some Towns of the Marquisate of the Valley of Oaxaca, dated 1552. In it, lords of Xoloc, Cuatalpan and Tepujaco in the jurisdiction of Tepozotlán, Mexico, are denouncing the governor and officials of Tepozotlán and an Indian judge. Instead of

doing his duty, the Indian judge spent some 30 days in Tepozotlán, showing toward the governor and his men much love and good will. What is more, he ordered the lords from the three towns to bring, daily, large quantities of chili peppers, turkeys, beans, tortillas, stews, pigs, salt and other products (Long-Solis 1986, 28-29). The chili peppers are depicted to the right; they are represented in groups of five in each of the seven rows of tribute items.

Another codex, from a town in the state of Hidalgo, depicts tribute in the form of seed plots. In the upper right-hand corner of figure 11 there appears a seed plot and in it a chili pepper, a bean, a squash and the measurements of the plot, expressed in native glyphs (Long-Solis 1986, 29, 31).

The Inca Empire exacted tribute from its farflung corners, as well. All communities contributed produce and goods, which were stored in granaries and warehouses throughout the land. While this natural treasury was earmarked for the upkeep of the court, the nobility and the priests, it also had other uses. From this inventory the army was fed, clothed and armed, rewards were allotted to the meritorious, and, in the event of natural catastrophes - floods, earthquakes, drought - the decimated regions received aid.

Given its importance in the diet of the Empire, peppers were perforce one of the products the populace contributed. In 1573 the Indians of San Luis de Paute, the region in present-day Ecuador where the ancient Cañaris once lived, remembered that "they would give in tribute to Guaynacaba and Atagualpa all that they harvested from their land, such as corn, potatoes and chili peppers" (Estrella 1986, 225). During the

first years after the arrival of the Spaniards, the Indians demonstrated their submission to the new rulers by offering them, among other items, firewood, coca and chili peppers (Estrella 1986, 115).

Besides serving as an article of tribute, peppers also figured in trueque, or barter, among the Indians of Mesoamerica and in the empire of the Incas.

In the sixteenth century Sahagún reported that in the markets in Mexico atole and pozole were paid for with a fresh fish, bird feathers or a handful of chili peppers (Sahagún 1953-1975).

Cobo described women in seventeenth-century Peru bringing to market fruit, corn, salt, coca, fish, meat both cooked and raw and chili peppers. He observed some buying salt in exchange for peppers, noting that there was no standard of valuation. Barter took place to the satisfaction of the parties involved in the transaction (Cobo 1979, 35). Valcárcel, writing in 1925 about social structure in pre-Columbian Peru, proposed that chili peppers, a product of tropical climates, were sought eagerly by groups living in regions where they could not be grown. Thus, peppers may have acquired such a high value as to become the article of barter par excellence. In the market of Quito in 1577 Indians brought products to barter, among them, chili peppers (Estrella 1986, 225). Until the mid-twentieth century shoppers in the main plaza in Cuzco could purchase items with a handful of chili peppers (about 6), called a rantii (Andrews 1984, 80; Valcárcel 1925, 178-179).

CHAPTER 6

PEPPERS IN MYTH, RITUAL AND FOLKLORE

Both the Andean and Mesoamerican Indians had evolved into agriculturalists. As planting societies they identified their own life sequences with the plant world in which something or someone must die in order for life to emerge (Campbell 1988, 102, 104). As a result, both groups had developed a religious life rich in ritual and ceremony in which offerings and sacrifice accompanied almost every rite. Chili peppers played a role both as offering and as tabu in these ancient societies, whose primary areas of anxiety revolved around the agricultural cycle, that is, food production and health. In some instances peppers have retained present-day roles analagous to their ancient ones. This chapter recounts some of the myths and rituals in which chili peppers figured and continue to figure among the Aztecs, Mayas, Incas and Cuna Indians.

Different versions of the myth of the origin of the Incas mentioned uchu or chili peppers. These versions were recorded by Garcilaso de la Vega in the sixteenth century and by Father Cobo in the seventeenth. While both men expressed frustration about the variety, it bears mentioning that most cultures recount two or three creation stories (Campbell 1988, 54). In addition, many of the variations told by the Incas present a common denominator characteristic of planting

cultures - that man is thought of as having come from the womb of Mother Earth (Pachamama) (Campbell 1988, 53).

Garcilaso, who interviewed a number of people in an attempt to record the one true myth, received varied and confusing responses. However, he proposed an allegorical interpretation of one of them, based on what he believed his interviewees were attempting to express. The myth recounted that the Incas originated when four men and four women, all siblings, emerged from the earth and made their way to Cuzco, which they either settled or conquered. The first brother, Manco Capac, became the first Inca, or ruler. His three brothers were named Ayar Cachi, cachi = salt; Ayar Sauca, sauca = rejoicing; and Ayar Uchu = chili pepper. Salt represented the teaching the first Inca gave them about natural life. Chili peppers represented the pleasure or relish the people took in that life, and sauca, or rejoicing, corresponded to the joy and contentment in which they lived afterwards (Garcilaso 1869, 1:74).

Father Cobo encountered a wide variety of myths, as well, finally choosing to report on the six most widely-accepted versions. Two of the six included mention of the eight siblings, one of whom was the brother Ayar Uchu (Cobo 1979, 103-107). Unlike Garcilaso, Cobo did not attempt an interpretation.

In his book Del Ayllu al Imperio, Valcárcel also wrote about the presence and significance of Ayar Uchu as the Peruvians progressed from kinship groups (ayllu) to empire. He proposed that peppers constituted an important part of life in that it was one of the names given to primitive social groups prior to the formation of the Incan empire.

In pre-Incan Peru, the ayllu-clans, wishing to strengthen kinship ties within, adopted totems that corresponded to vegetables or animals present or cultivated in their region. Valcárcel postulated that the founders of Cuzco originated in the ancient province of Chillques y Mascas which lies 18 miles southeast of Cuzco and which today is the province of Paruro. In a book listing the partitioning of land of this province in 1572, there appeared uchu-pampa, or the plain of chili peppers, thus proving the presence and prevalence of this plant in the proposed region of origin (Valcárcel 1925, 72-73). Cobo's observations support Valcárcel. According to him, place names and names for inanimate things were given according to the attributes, features and qualities of the place or thing. Thus, the Incas had a River of Aji, or River of Chili Peppers (Cobo 1990, 183).

In the myth of the brothers and sisters of the Ayar fraternity, their clan adopted wild quinoa (Ayar) as the communal totem, while salt, parched corn and chili peppers became some of the individual totems (Valcárcel 1925, 15-16). It is postulated that the Ayar siblings broke away from their clan to seek more and better land, eventually migrating to the Valley of Cuzco. Once they had conquered the tribes and ayllus already living there, Manco Capac, the eldest brother, founded Cuzco and became the first ruler (Inca) of the Empire.

According to one version, the brothers decided at some point that each should undertake a specific function. Ayar Uchu remained at Huanacauri, a hill on the edge of Cuzco, and became the cult object of the shrine (huaca) there. Before turning himself to stone, he gave his brother Manco Capac instructions on performing young men's maturity rites (Steward 1946, 2:317).

Ayar Uchu became not only a shrine but one of the founding groups (ayllus) of Cuzco as well. Once in the Valley of Cuzco the Ayar siblings became recognized by an equivalent "Cuzco" name - Allcahuiza, in the case of Ayar Uchu (Valcárcel 1925, 72-73). The Ayllu Allcahuiza (Chili-pepper Clan) lived in Hurin Cuzco, or Lower Cuzco, a neighborhood situated in the southwest part of the city (Valcárcel 1925, 60).

People claim the land where they live by creating sacred sites and by mythologizing the plants and animals there. The land is thus invested with spiritual powers (Campbell 1988, 92). In assigning the totem uchu to one of the mythological brothers and, subsequently, turning Huancari into a sacred site, the Incas sanctified their landscape, in part, by anointing it with the chili-pepper plant.

Other Southamerican societies, whose existence predates the rise to power of the Incas, also accorded peppers a special place. Figures 12 and 13 show archeological evidence in the form of embroideries from the early Nazca culture (400-600 A. D.) and a carved obelisk from the early Chavín culture (800-1000 A. D.), respectively.

The embroidery, called the Nazca shirt, contains two rows of figures on the front and back depicting 23 agriculturalists with some of the principal crop plants of the time. The farmer, identified as figure 12 of the garment, is not only holding peppers, but also has two chili pods hanging from his neck.

The obelisk, named the Tello Obelisk, was rediscovered in 1919 by Julio C. Tello in the town of Chavín de Huantar, situated in the Peruvian Andes at an altitude of 10,200 feet at the headwaters of the Amazon River. A local farmer had found this carved, rectangular granite shaft in a temple among ancient ruins outside the town. It eventually made

its way into the local church, where Tello first saw it. Now located in the Museo Nacional de Antropología y Arqueología in Pueblo Libre, Lima, the stela (8 ft. 3 in. tall, 12½ in. narrowing to 10½ in. wide) depicts two mythical creatures in the shape of the black caiman. One caiman holds in his claws blooms, leaves and four pods of a chili-pepper plant (Lathrap 1973; Tello 1960; Pickersgill 1969).

Another myth, in which chili peppers figure, is still recounted today by the Cuna Indians of Panama. The myth tells the tale of the universal hero's journey in which the hero leaves on an adventure and returns to his people, having recovered or discovered something of value for his society (Campbell 1988, 123-124).

In the Cuna myth the hero found and returned with tobacco, but not before undergoing a test involving pungent chili peppers. The myth recounts the events of the journey the hero made to the home of the chief of evil spirits, who gave him calabashes of biting chili-pepper juice to drink. To the surprise of the evil spirit, the hero had no trouble drinking it. However, when the hero squeezed juice from newly-grown tobacco leaves he had brought, the evil chief and his wife, upon drinking it, suffered terrible nausea and were unable to drink it all. The devastating effect of the tobacco led the people to believe that yet another medicine to fight evil had been discovered (Helms 1979, 117).

Among the Cora Indians of west coast of Mexico there has been preserved a fragment of their creation myth which indicates that chilies were gifts of the gods.

The Maker created a man and a woman. The man was called Narama, the woman, Uxuu. He put them in a place with many fruits and minerals, but afterwards cast them out. Then, Narama began to sweat, and his sweat was changed into salt. The Maker chose him the patron of salt, mescal and chili. As for Uxuu, He made her matron

of all the seeds and fruits of the summer, and of watering the earth with rain. Other creatures peopling the earth were assigned to be the nurturers of additional foods, vegetable or animal.

A few days after having made these arrangements, the Maker invited all these people to a fantastic fiesta. He set a table in the middle of the earth, and each creature brought the foods entrusted to them to share. Narama was among the last, and he came naked, covered with salt. After everyone was already seated, he presented himself at the table, took salt from his face and sprinkled it upon the foods. Then he reached down, and his testes turned into chili pods. He began to sprinkle their spice onto all of the foods.

This crude action annoyed all the other patrons, who angrily scolded Narama. To this, he replied that if the others could provide the fruits, fish, fowl, seeds and vegetables that were the basic staples of the fiesta, why could not he provide something that these foods needed to be truly tasteful? He declared that there was nothing so necessary as salt and chili. If they would just try the food both with and without these ingredients, they would know that in their hearts. They ate, and not only became satisfied, but enthusiastic. (Nabhan 1985, 123-124)

The Cora's neighbors to the north, the Papago of the Sonoran Desert, also revere chili peppers, in particular, the wild progenitor Capsicum annum var. aviculare, commonly known as the bird pepper or the chiltecpin. They sometimes refer to it as I'toi ko'okol, which suggests that its place is "at the beginning" (I'toi) (Nabhan 1985, 124).

As was previously mentioned, the Inca ceremonies and rituals revolved around the planting cycle. The calendric festivals were celebrated according to the month of the year, while other noncalendric religious rituals were organized in the face of stressful or worrisome situations. Once again, chili pepper makes its appearance.

In December, the first month of their year, the Incas held the festival of Capac Raymi, meaning sumptuous or principal festival (Cobo 1990, 126). The festival emphasized the intent of the gods, especially the Sun, in the Inca Empire (Steward 1946, 2:308-309). During this month one hundred choice llamas were sacrificed. Each day of the month

three or four llamas were quartered and burned in a fire built with quinoa wood (stalks). At the same time, "white maize, ground aji, and coca were thrown on the fire" (Cobo 1990, 128). Furthermore, from the first day of the festival of Capac Raymi until the new moon of the second month, Camay, the Incas fasted "without eating salt or aji, and there were people designated to find out if anyone broke this fast" (Cobo 1990, 136).

During Camay, that is, in January, the ashes left over and saved of the bones of sacrifices of the entire previous year were ground with "two cestos (bundles) of coca, many flowers of diverse colors, aji, salt, and burnt maní (peanuts)." Subsequently, the Incas threw this offering, among others, into the small Capimayo stream which flows through Cuzco, in hopes that the water would carry it to the sea and to their seagod, Viracocha, creator of all things (Cobo 1990, 137).

The festival of the fifth month was held in honor of the royal insignia. An elaborate pompom on a staff and a perfect white llama, sumptuously attired, appeared in the main plaza of Cuzco. Fifteen llamas were sacrificed in the name of this white llama, which symbolized the first llama to appear on earth after the Flood that occurred in one of the Inca creation myths. The month concluded with the burning of a "large number of cuis (guinea pigs), aji, and other things" (Cobo 1990, 139).

The feast of Hatun Raimi (Very Solemn Feast) was the principal festival of the year, held at the end of August to celebrate the harvest of "corn, potatoes, quinoa, oca (a tuber), and the other seeds they plant." In order to demonstrate greater devotion and solemnity, "it is

said they fasted for ten or twelve days, refraining from eating much and sleeping with their women, and drinking chicha only in the morning, which is when they eat, and then during the day taking only water, and no hot pepper..." (Cieza de León 1959, 181-182).

Chili peppers have retained their ritual role in the planting cycle of present-day Aymará Indians, who practice a ceremony called tincat. It is associated with the earth (Pachamama), a female deity worshipped particularly by women in ancient Peru. Either the women themselves or sorcerers would offer chicha and mashed corn to the earth at sowing time. Today, the tincat is offered to promote fertility. The Aymará burn coca, llama fetuses and tallow, the Koati plant and chili pepper. The ashes are then buried in the fields and red wine is sprinkled on the ground. Thus the earth, who is also achachila (earth spirits) receives remuneration for her favors and renewed energy to produce new crops (Karsten 1926, 390-391).

The Itu festival, which Cobo termed famous and magnificent, was a noncalendric festival. As such, it was performed "in times of great need, such as when a severe earthquake occurred, when there was severe pestilence, when the rains were late in coming . . . and, especially, when the Inca decided to go to war in person" (Cobo 1990, 153). Fasting was imposed on men during the days preceding the festivities. They "stayed away from their women, ate nothing with salt or aji, nor did they drink chicha (alcohol), which was the important part of their fast" (Cobo 1990, 151). This festival must have impressed Acosta, as well, for his work, which did not include much information on religious ceremonies, did make mention of the "feast of Ytu which was great" and of the fast imposed (Acosta 1880, 339).

Peppers also figured in the purification and confession of sinners. The Incas believed that sin angered the gods, thus making a person unfit to participate in a religious ceremony or enter a religious sanctuary while on a pilgrimage (Steward 1946, 2:304). Cobo recounted the penitence imposed on pilgrims who desired to visit the third most important sanctuary in the Inca Empire.

Located on two islands on Lake Titicaca near Copacabana and dedicated to the sun and the moon, travelers arriving on a pilgrimage first passed guards, who then turned them over to confessors. The penitence imposed on sinners was in accordance with the gravity of the offenses. "It started with some blows on the back with a stone, after which the rest consisted of abstaining from salt, meat and aji" (Cobo 1990, 96).

Cobo stated that the most rigorous penance imposed on sinners in general was fasting. However, their fasts did not consist in abstaining from all foods nor in eating less quantity. Rather, "the Indians only abstained from using salt or aji, which were their spices and tastiest seasonings" (Cobo 1990, 124).

As in Peru, in Mesoamerica some type of offering or death sacrifice usually accompanied important rituals, the most important being the eighteen veintenas (20-day periods) geared to the 260-day divinatory cycle and linked, in the majority, to the annual agricultural cycle. Among the Aztecs, seven of them were involved in propitiating Tlaloc, the rain god. The fertility goddesses who presided over maize and the earth were also especially revered. Other ceremonies were dedicated to the most important deities, who expressed other themes (Wauchope 1969, 10:434).

To propitiate or show devotion to the gods, Indians in Mesoamerica also abstained from eating peppers or took care to include them in offerings made in the observance of some religious rituals. Among the Aztecs, fasting customarily took place preceding the ceremony during a preparatory period of four days or a multiple thereof. Individuals often undertook longer votive fasts (Wauchope 1969, 10:431).

Fray Bartolomé de las Casas and Clavijero described the festival to the main deity of the Tlaxcalans, during which especially stringent penitence was imposed on the entire population for a period of eighty days. The penitents were forbidden to let hearth fires die, to bathe, or to converse with their spouses. Their diet consisted solely of tortillas - absolutely no chili peppers. It is in this context that Las Casas emphasized the severity of the fast when he wrote that "this is a thing without which they do not think they are eating" (Las Casas 1967, 2:195; Clavijero 1958, 2:126).

For the festival in honor of the god of fire, Macuilxochitl, the Aztecs could choose to abstain from chili pepper during four days prior to the celebration. Those who chose not to eat chili pepper "and other delicious things" would take only the midday meal. On the fifth day individuals who so chose could offer the god five small tamales placed on a wooden platter and accompanied by chilmolli in its own recipient (Sahagún 1938, 1:33-34). Note the abstinence from, followed by the presence of chili pepper in the offering.

The Mayas in the Yucatán celebrated a festival held on the first day of Pop, the first month of their new year. A solemn affair, fasting could begin three months but no fewer than thirteen days in advance for

priests, lords and principal individuals. The rest of the populace could choose to do so to show its devotion. The fast became more stringent during the thirteen days immediately prior to the celebration. Besides abstaining from their wives, they did not eat salt or pepper in their food (Landa 1941, 18:152).

As was briefly noted above, some religious festivals required the presence and some the absence of chili pepper. Both Sahagún and Landa took care to note this in describing the following ceremonies.

For the festival in the month of Xul to Kukulcan, the Mayan name for the plumed-serpent god, the Mayas presented "five magnificent banners of feathers" to the host province. The banners were placed atop the god's temple while, in the courtyard below, the participants spread out their own personal idols on tree leaves. Offerings to Kukulcán included burning incense and presenting food cooked without salt or pepper (Landa 1941, 18:158). On the other hand, the Mayas showed reverence to the god Kinich Ahau by offering his statue different breads, one of which was made "of dissolved pepper" (Landa 1941, 18:144).

Among the Aztecs, the feast of the fire god, Izcalli, involved preparing a special kind of tamale which was eaten with shrimp prepared in chalmolmulli, a red-chili broth (Sahagún 1969, 1:221). For the feast honoring the god of rain, Tlaloc, four green chilies figured among the offerings that the satraps attending the temple could choose to present. A ritual meal of porridge accompanied by chilmolli followed four days of fasting. Should any satrap spill a single drop of either the porridge

or the chilmolli into which he dipped it, he suffered punishment unless he redeemed himself by making a payment of some sort (Sahagún 1938, 1:148).

When Tlaloc failed to cooperate and drought reigned despite the above-described feast, the Aztecs would pray to him and to the gods associated with him. In piteous and formal language they would complain to this god of all things green and flowering that, not only had his gods gathered and hidden water, but that they had also spirited away the goddess of chili peppers (Sahagún 1938, 2:72).

In addition to ceremonial fasting, abstinence was also imposed on sinners in Maya society. As did the Peruvians, the Mayas had the custom of confessing their sins. However, they only confessed once they were actually suffering due to the deaths of loved ones or some other affliction. The most common sins to which they confessed were theft, homicide, weaknesses of the flesh and false witness. Penitence generally required omitting salt and chili pepper in their stews, "which was a very hard thing for them" (Landa 1941, 187:106-107). Landa's statement echoes that of Las Casas quoted previously regarding the Aztecs.

Another rich world of ritualism revolved around noncalendric events such as special moments in the life cycle, among them, birth and baptism, puberty rites, marriage and death. Departure and homecoming ceremonies and the dedication of new structures, secular or religious, were also important moments. These noncalendric ceremonies contained many of the ritual elements characteristic of the calendric rites, some of them being fasting, food and other offerings and post-ceremony feasting (Wauchope 1971, 10:435). Present-day groups continue some of the ancient practices, although oftentimes the symbolic significance of

the ritual may have been forgotten. The locals, when they cannot give a reason for a certain practice, resort to saying it is costumbre, or custom. The following rituals described, both ancient and present-day, require the presence of or abstinence from peppers.

Peppers played and continue to play a role in the rich tradition of folklore having to do with pregnant women and newborn babies. Among the Aztecs, giving birth was considered a heroic deed. Women who died in childbirth were deemed heroines and went to the same heaven as warriors killed in battle (Campbell 1988, 125). Children were a great economic asset among the ancient peoples of the Americas. Today they continue to constitute a source of labor and social security for their parents, not to mention proof of fecundity and reproductive prowess.

At the same time that they were valued, pregnant or newly-delivered mothers, babies and small children were believed to be in an extremely vulnerable state, veritable walking repositories for evil airs and spirits. Following are described the rituals, folklore and cures which were or are performed for them and which involve chili peppers.

In the case of a feared miscarriage in ancient Peru, a sorcerer was summoned to perform a ceremony which involved chicha, an alcoholic beverage made of corn. Preparation of chicha required mastication of the corn only by women who, during the preparation, had abstained from sexual intercourse and had eaten neither salt nor peppers (Baudin 1968, 201).

San Francisco Tecospa is an Aztec village which once belonged to a pre-Columbian kingdom. Today it is one of the oldest and smallest villages in the district of Milpa Alta. Its folklore includes the following traditions involving pregnant women and newborn babies.

Pregnant women may not carry food seasoned with chili peppers either to a fiesta or to the fields where her husband is working. If she does not heed this advice, the rain dwarves may hit her, grab the food and put large quantities of water in her womb. Likewise, an expectant mother who approaches the caves of the rain dwarves while bearing molli or spicy-hot food runs the risk of catching air sickness and passing a lot of water on giving birth (Madsen 1969, 75).

If women of questionable virtue or licentious men should enter a house during a newborn's first bath, they may pass on to it a disease which blinds the child. Protection can be provided by placing a piece of chili pepper and a pepper-tree twig in the form of a cross underneath the petate (straw mat) where the baby and its mother lie (Madsen 1969, 81). This cross will also protect the baby from evil eye (Madsen 1969, 84).

The parents of a child suffering evil-eye sickness must beg a chili pepper from each of four grocery stores located in position that forms a cross. The peppers are given to a curandera who cleans the child's body with an egg, then with herbs and, lastly, with the four chilies. She then burns the chilies, egg and herbs, thus symbolically burning the evil eye of the person causing the sickness. According to one curandera, this person feels a burning sensation when the symbolic burning takes place. A baby vomiting worms due to evil-eye sickness was cleaned in the morning, at noon, in the afternoon, at midnight and again the next morning with the same combination. The baby subsequently recovered (Madsen 1969, 205).

Some of the Tzotzil communities of the Chiapan highlands in Mexico place salt in the mouths of newborns and rub ground pepper on their lips

(Wauchope 1969, 7:187). This may well be a baptismal rite similar to the one practiced in Tecospa in central Mexico, where the midwife baptizes the infant by placing a pinch of salt in its mouth (Madsen, 1960,

Rites of passage constitute another key station in the life cycle. The ancient Incas and Caribs of the Lesser Antilles incorporated pepper as a ritual element in initiation ceremonies, as do the present-day Cuna in Panama.

Among the Incas one of the most severe fasts, generally authorized for no more than three consecutive days, allowed consumption of only a small amount of water and fresh herbs, "with no condiments, and neither salt nor pepper." However, the young men of royal blood who aspired to become knights (hauracu) underwent this stringent fast for six consecutive days. Any sign of weakening, complaint or request for food meant immediate expulsion from the novitiate. The fathers, brothers and close relatives also fasted, although less strictly (Garcilaso 1961, 185). Preparations for the ceremony as well as the ceremony proper included pilgrimages to Huanacauri, the hill near Cuzco where Ayar Uchu, turned to stone, had become a shrine. The candidates made the first pilgrimage to ask permission of the shrine to perform the rite, and each sacrificed a llama. On the second pilgrimage they made more llama sacrifices followed by a return to town during which relatives struck their legs with slings and urged them to be strong and brave (Steward 1946, 2:283).

While the young Inca nobility was expected to abstain from pepper, the Carib Indians required its presence to accomplish their purpose. They rubbed ground chili into the wounds of boys during the rites which prepared them to become warriors (Heiser 1969, 9).

At Cuna girls' puberty rites cacao beans and pungent chili peppers may be burned in braziers. The smoke purportedly protects and is beneficial to those participating in the ceremony. It is believed that the smoke aids in neutralizing evil spirits at a moment when a young woman is particularly vulnerable. The cacao smoke soothes them while the chili-pepper fumes irritate them and drive them away. This is also the procedure used during the administration of medicines and during death chants, when the bodies of the sick and the souls of the dead require special protection from malevolent spirits (Helms 1979, 114).

Among the ancient Aztecs, the couple being wed received advice which included mention of chili peppers. In the case of the woman, one of the husband's elder female relatives would impress upon her the womanly duties expected of her. Dealing astutely in the market place for salt, firewood and peppers with which to prepare meals figured among those duties. In his turn, the bridegroom was counselled by his mother-in-law to leave behind the habits of bachelorhood and to be prepared to work and earn his living by the sweat of his brow. Among other tasks, this meant being willing to go from town to town laden with salt, fish and chili peppers to trade (Sahagún 1938, 2:156-157).

Today among the Tzeltal in Chiapas, Mexico, the bridegroom must still deal with quantities of peppers. The articles he brings to the wedding to "warm up" the wedding festivities include ten kilograms of pozole stew prepared with chilies and one kilogram of chili peppers (Wauchope 1969, 7:217).

Among some groups, ground pepper is necessary to complete the last rite of the life cycle. The Tzotzil communities who received their

newborns into the world by rubbing ground chili on the babys' lips also take leave of their dead in a ritual involving chili pepper. When burying their dead, salt water is sprinkled in and around the house or hearth after the coffin has been removed, and pepper is burned. Thus the soul is called to the cemetery (Wauchope 1969, 7:193).

In Aztec society, the pochteca (travelling merchants) followed certain rules in the use of chili pepper while away. Before leaving on his journey, which presented risks to life, limb and merchandise, a pochteca about to depart offered a meal to fellow merchants and family. At one point, one of the guests would formally advise the merchant that if he wanted their merchant deity, Yiacatecutli, to allow him to complete his trip and return alive, he should consider it an honor to abstain from salt and chili pepper while enroute (Sahagún 1969, 3:24-25).

The successful pochteca, wishing to share their good fortune, offered banquets, the more costly of which lasted three days and at which human flesh was served. To prepare for this feast, the host merchant purchased slaves, whose flesh was to be served. He also bought great quantities of corn, beans, all kinds of sage, cups for atolli, salt, tomatoes, 80-100 hens, 20-40 dogs and great quantities of chili peppers (Sahagún 1969, 3:44-45). When it came time, on the third day, to prepare the slaves' flesh, they first cooked the corn that was to accompany it. However, no peppers were added to either the corn or the flesh, only salt (Sahagún 1969, 3:56).

The dedication of new structures was another important noncalendric ritual in pre-Hispanic America. In ancient Peru, for example, it was

customary to place metal hearts in the walls of palaces or other important houses (Karsten 1926, 390).

An analagous rite takes place among the present-day Aymará in Bolivia. The night before the architect is to officiate after the construction of a new house, the Indians prepare as many tiny bundles as there are corners in the house and an extra one for the center. In the bundles they place a pig and llama fetus, a piece of llama tallow, leaves of the Koati plant and coca leaves. The next day, part of the ceremony, called tincat, includes burying the bundles in each of the four corners and in the center, adding to them chili pepper, sugar and salt (Karsten 1926, 387). The items used in this ritual apparently possess a magical character, thus warding off invisible supernatural inhabitants of the structure. They may also directly impart strength to the new structure (Karsten 1926, 389).

Throughout time and across cultures chili peppers have also figured in divination and shamanistic rituals, in superstitions and in curing rituals for individuals other than the mothers and infants previously mentioned.

The Incan rulers depended entirely on divination, never acting until favorable auguries had been forthcoming (Steward 1946, 2:281). As a result, the Inca, wherever he went, took with him diviners called yacara (consultant of the dead). Capable of summoning evil spirits, these men were greatly feared by the people and by the Inca himself. They were called upon only in regard to serious matters involving rebellions or plots against the Inca and when "it was impossible find out what was happening through witnesses, torture, or

any other method." Summoning the evil spirits involved great sacrifices, which the Inca sometimes elected to witness. If he chose to be present, the Inca first "fasted for two or three days without tasting aji, salt or meat" (Cobo 1990, 170).

In another setting, however, chili peppers must be included in predicting future events. Among the Rama in twentieth-century Nicaragua the sukya (shaman) drinks an infusion of cacao beans and chili peppers (cayenne with annatto) to induce sweating and then a trance. The shaman is thus enabled to communicate with his jaguar counterpart to learn of future events. The pepper and cacao combination represents fire and water, symbolizing the shaman's power to cure (Helms 1979, 195).

Among the present-day Cuna, the largest group to work with the supernatural are innatuledis, the doctors of the community. While their cures and contacts with the spirits are effected primarily through chanting, they also utilize a large variety of powdered medicines prepared from plants, among them, several varieties of chili peppers (Stout 1947, 44).

Magic, black or white, has also required the presence or absence of chili peppers throughout the centuries.

Chanting is a powerful medium among the Cuna, and, in addition to specialists in the supernatural, they have around a dozen men on each island who know one or two particular chants. The chants may be imparted to anyone who would like to learn them and can pay for the instruction. There are cacao chanters, headache chanters, fever chanters, death chanters and pepper chanters (Stout 1947, 46).

In northwestern Mexico the Mayo dancers and musicians are said to have dealings with the devil. However, even they may fall victim to witches or sorcerers, indicated if they should suffer leg pains. To protect themselves, they wear a charm of the wild chiltecpin and also eat it during fiestas (Toor 1947, 337).

The Tarahumara, another group in northwestern Mexico, also believe in the powers of the chiltecpin. One Tarahumaran confided that "this plant, used ceremonially and privately, is thought to drive away the approaching sickness. The man who does not eat chili is immediately suspected of being a sorcerer" (Nabhan 1985, 123).

In a curing ceremony which incorporates chili peppers, therefore, the Tarahumara are attempting to prevent illness caused by future witchcraft rather than cure a current affliction. This malevolent witchcraft is practiced by a sukurame sorcerer who uses a bird called a disagiki as the agent who transmits the malady. The bird lives on tortillas and meat, is no bigger than a fingertip and can only be seen by the sorcerer. It flies into the house sounding "Sht! Sht!," then eats one's food or leaves its droppings on the inhabitants. "The only way to prevent its coming is to throw chiltecpines into the air and eat some yourself. This bird is like no other birds. More like evil people than like its feathered kin. It cannot stand chiles" (Nabhan 1985, 133).

In and around Tepoztlán, Morelos, Mexico, stubborn agaujqe, spirits of the air, must be bribed to leave a body of which they have taken possession. To entice them to leave, good things to eat are offered them, among them red chili peppers. Everthing is placed in baskets brightly decorated with crepe-paper and left at the spot where

the patient was hit by the spirits. The cynics say that the shaman or curandero takes the food home for himself (Toor 1947, 147).

In Spanish it is common to express experiencing bad luck as being "salado," or "salted." In the folklore bad luck comes to those whose person or home has been salted, literally, by another. In the ritual performed to counteract the salting of one's home, a sahumerio (a smoking-out) is performed at prescribed intervals. A mixture of chiltecpin, rosemary, rue and valerian may be burned on coals (Latorre 1977, 137).

To counteract the salting of one's person, there is a prayer to recite followed by the ritual of holding twelve chiles anchos (dried chile poblano similar to, but spicier than the Bell) in the left hand, three pinches of coarse salt in the right, and rubbing them over the body in the form of a cross (Latorre 1977, 139).

A woman suffering acute pain on the soles of her feet believed she had been hexed. The curandera rubbed the painful area with whole egg, a lime and a chile ancho to cleanse and drive away the evil (Latorre 1977, 139)

Instances in which chili peppers have functioned as good-luck charms or as appeasements have also been recorded.

In a book on omens, superstitions and good-luck charms, Sahagún described a practice among blanket merchants in the Aztec society. On returning home at night with their unsold wares, they would place two pepper pods in the pile of blankets. Giving them chili peppers to eat increased the chance of selling the blankets the following day (Sahagún 1938, 2:33).

Chili peppers are part of an offering in several villages of high-land Chiapas, Mexico. In almost every house is hung an offering to Chin-Uch, a tiny fly, so that it will not come and spoil the pozole, a corn stew. To appease this pest, various small objects are proffered - a ball of pozole wrapped in a banana leaf, a tortilla, an ear of corn and a red chili pepper (Toor 1947, 9).

While this chapter has divided the role of peppers between religious and what seem to be secular rituals and ceremonies, it must be emphasized that in the highly ritualized ancient societies of the Americas, religion permeated every facet of their cultures. The roles of priest, diviner, curer and sorcerer were not rigidly departmentalized. Thus, most priests practiced various shamanistic and curing techniques in addition to performing their regular ritual functions. Furthermore, since disease was believed to have strictly supernatural causes, cures could only be effected through religious and magical means. While both the Andean and Mesoamerican cultures used efficaciously a wide variety of medicinal plants and therapeutic techniques, magic entered perforce into most of their curing procedures (Steward 1946, 7:299; Wauchope 1964-1976, 3:676; 10:444). Given the all-pervasive role of magic and the supernatural, the plants and plant products, among them chili peppers, can be assumed to enjoy a magical character, to possess supernatural virtues in themselves (Karsten 1926, 385).

Among present-day communities, health remains a constant preoccupation, and disease continues to be attributed to supernatural causes. While the organized priesthood was destroyed in the sixteenth century, practitioners of magic and curers survived and preserved the traditional

practices despite the efforts of missionaries. As a result, the old traditions live on in the twentieth-century practices described previously.

Despite the magical character of most procedures, both the ancients' and the moderns' knowledge and efficacious application of plant therapy deserves recognition. The following chapter discusses that knowledge in regard to chili peppers.

CHAPTER 7

PEPPERS IN MEDICINE

While illness and curing were associated to a great extent with the supernatural, the Amerindians had remarkable practical knowledge of plants and their curative powers. This chapter will report on the use of chili peppers in remedies among pre-Hispanic people, as recorded by Acosta, Sahagún and Hernández, followed by data gathered in nineteenth-century Jamaica and twentieth-century Guatemala and Amazonian areas. It will also discuss some of the findings of modern medical research on peppers. These findings often explain scientifically what the ancients had discovered empirically to be the medicinal and nutritional value of chilies. Many present-day medicinal uses of peppers parallel those of the ancients, who used them to combat respiratory and stomach disorders, pain and inflammation. Indeed, the effects of capsaicinoids, the chemicals responsible for peppers' pungency, dominated pharmacological literature in the fifteen years prior to 1991 (Govindarajan and Sathyanarayana 1991, 436).

Writing at the end of the sixteenth century, Father Acosta described the physiological effects of chili peppers, reporting that, ingested in moderation, they aided the digestive processes. Too much aji, however, was prejudicial to one's health. In particular, it could result noxious to the soul in that it provoked lust (Acosta 1880, 2:239)

He was supported in his opinion by another sixteenth-century researcher, Dr. Francisco Hernández, who studied medicinal plants and practices in Mexico. Dr. Hernández also believed that the use of chili peppers stimulated both the corporal and the venereal appetites (Hernández 1888, 106).

On the theme of sexual appetite, today in Arab countries and in Samoa, among others, chili peppers are considered an aphrodisiac. In Samoa they are one of the ingredients of kava, a love potion that enhances virility. African women bathe in chili water to augment their sexual appeal (Halasz 1963). While, to date, there is no medical verification of an aphrodisiacal effect, capsaicin administered to a water flea did cause "pronounced and continual excitatory movements of the male genital organ" (Viehoever and Cohen 1938). Similar stimulation has been provoked in human males when the same body part has come into direct contact with chili peppers (Dr. Stanley Rose, personal communication, March 1994).

In addition to inciting the appetite for food, Hernández listed other qualities of chili peppers which he considered to be virtues. He recorded that they aroused intestinal gases and provoked bowel movements. When cooked, they eased and softened the bowel.

In 1878 Endre Högyes confirmed that capsaicinoids stimulated the mucous membrane of the mouth and stomach, resulting in strong peristalsis; that is, they promoted motility of the bowel. Other studies carried out in the mid-twentieth century found that eating chili peppers intensified acid secretion, thus stimulating the saliva and gastric juices which enhance the appetite and promote digestion (Andrews 1984, 72).

Hernández wrote that peppers were also thought to provoke urination and the menstrual period and to comfort the stomach in times of feeble digestion. He also recommended peppers in evacuating the "phlegmatic humors," especially those which occupied the hip joints, the latter being, he said the cause of sciatica (Hernández 1888, 106).

Today medical research has found that relief from sciatic pain, lumbago, rheumatism and arthritis may be obtained via the topical application of capsaicinoids (Long-Solis 1986, 13). The results of a 1991 study on the treatment of arthritic pain appear later in the chapter.

The ancients also employed peppers in the treatment of respiratory ailments. To treat tuberculosis, the Mexicans practiced a kind of acupuncture - with the addition of chili peppers - proclaiming it an extremely efficacious remedy. They pierced the stomach and shoulders of the patient with thorns which had been coated with ground chili. The resulting heat provided a beneficial effect (Hernández 1888, 106). The Mayas, too, used peppers to treat respiratory disorders such as asthma, coughs, sore throats and tuberculosis (Roys 1931). Present-day natives of the northwest Amazon dry and powder Capsicum frutescens to take "in very small doses when breathing is difficult" (Schultes and Raffauf 1991, 35).

Today Dr. Irwin Ziment at the University of California's Los Angeles School of Medicine prescribes hot spices, among them pungent peppers, to patients who suffer from chronic ailments of the respiratory tract, including bronchitis and asthma. Capsaicinoids help to relieve the mucous congestion associated with these ailments (Andrews 1984, 74).

In fact, the chemical in over-the-counter cold and cough remedies such as Robitussin, Vicks Formula 44D and Sudafed, among many others, is derived from guaiacol which has the same chemical structure as capsaicin, one of the potent chemicals in chili peppers (Naj 1992, 107)

However, Hernández also issued a warning. According to his Indian informants, when ingested to excess, chili peppers caused internal malaise and abscesses. In particular, he recorded chili-induced pain in the liver, kidneys and lungs. In the case of the latter organ, he wrote of "dolores de costado," another term for pleurisy, as well as of "hepleumonias," which indicates that respiratory distress could be triggered by peppers (Hernández 1888, 106). Today, as well, the message is, frequently, to exercise caution and eat peppers in moderation.

A third scholar from the sixteenth century, Bernardino de Sahagún, is the author of one of the three important sources on plants in New Spain. In his General History of the Things of New Spain he mentioned several medical problems in which chili peppers played a curative role.

To cure the pain and halt supurating of the inner ear, the remedy consisted of applying three times a day drops of a warm liquid made from a certain herb (coyoxochitl) mixed with chili (Sahagún 1969, 3:170). The Mayas also used chili peppers in treating earaches (Roys 1931).

The leaf of the same herb was ground and mixed with chili powder and applied directly to lesion on the outside of the ears (Sahagún 1969, 3:170). The pepper may have served as an antiseptic and antiinflammatory substance.

For another type of lesion, tongue bites, the cure consisted of rinsing with a solution of water boiled with chili and salt and then

applying bee honey or the juice of the maguey plant (Sahagún 1969, 3:174). Once again, chili may have acted as an antiinflammatory and antiseptic substance (Long-Solis 1986, 125).

Peppers' antiseptic properties were confirmed by Brian Massman, who is vulnerable to infection of the septum. Rather than purchase the prescription medication, whose active ingredient is capsaicin, he simply takes care to douse his food now and then with Tabasco Sauce, thus staving off the infection (personal communication, October 1991).

Toothaches and painful gums were also treated with chili peppers. To alleviate the pain of a toothache, a hot chili pod and salt were pressed against the offending tooth (Sahagún 1961). Figure 14 depicts a person in the act of doing so. Today the Mayna Jívaros in Peru continue to place the fruits of Capsicum annum directly to the teeth to treat toothaches (Schultes and Raffauf 1991, 35).

A scientific justification for this remedy was first made public in 1983 at an International Symposium on Substance P. Capsaicinoids, the pungent chemical substances in chilies, act on certain neurons to deplete the production of Substance P, a pain transmitter. Topical application of capsaicin, one of the pungent chemical compounds, on the alveolar dental nerve reduced the presence of Substance P in the dental pulp (Long-Solis 1986, 135). The resulting analgesic effect diminished or eliminated the toothache.

The Mayas held pepper pods in their mouths to cure infected gums. In 1983, findings reported that increasing the consumption of vitamin C might help fight periodontal disease, thus giving credence to the Mayan remedy (Roys 1931; Goldschmidt 1983).

Those suffering from a cough were advised to rub their throat with a finger and drink a mixture of water, lime and chili or to drink water boiled with chili pepper, called chilpozonalli (Sahagún 1969, 3:175).

Among present-day Mayan groups in highland Guatemala chili peppers are also used to purge the stomach and intestines (Orellana 1987, 80). When taken mixed in a drink, chili is said to clear the chest (Orellana 1987, 113). The latter two remedies reflect the heritage of the pre-Hispanic Maya.

Today in the United States, gargling with warm water containing ten drops of Tabasco Pepper Sauce (more drops as tolerance develops) is recommended to promote expectoration and to dislodge mucous congestion that can be associated with coughs. An alternative aid is to suck on the throat discs manufactured by Parke, Davis & Co., which contain a small amount of capsaicin (Andrews 1984, 74).

The remedy for looseness of the bowels in adults included chili peppers to make the potion more palatable. The sufferer was advised to sprinkle ground chili pepper on an atole made with chiantzotzol (chian refers to the sage plant) and sage seeds (chia) in order to "drink it with a measure of pleasure" (Sahagún 1969, 3:180). Today the Kamsá Indian medicine men of the northwest Amazon put the potent Capsicum pubescens in their many "medicinal" potions, possibly to disguise the unpleasant taste of other substances in the drinks (Schultes and Raffauf 1991, 35).

Not only were peppers employed to alleviate loose bowels, they were also a remedy for constipation. The Aztecs combined them with saltpeter in water (López Austin 1969). The Mayas also resorted to chili peppers to provoke diarrhea and as a stomach remedy (Roys 1931).

Modern researchers believe that the capsaicinoids affect the activity of the colon. Ingesting large amounts of chili peppers inhibits the contraction of the colon - a reduction in the frequency of the electrical slow waves was detected - resulting in abnormal colon motility (Govindarajan and Sathyanarayana 1991, 439).

Among the Aztecs, for those who were spitting blood, grains of wheat and cocopi, the latter similar to corn, were toasted until black, then ground, shaped into balls and sprinkled with a little chillmulli. Drunk in the morning, at midday and again in the afternoon, it provided relief (Sahagún 1969, 3:323). The Mayas also employed chili peppers as a remedy for this same problem (Roys 1931). The secret for successful treatment may lie in the fact that the peppers were ingested in combination with food.

Among the Mayas, those who passed blood in either the feces or urine or suffered from hemorrhoids were treated with chili peppers. From twentieth-century West Africa comes a report by a French Army officer who, in 1956, wrote about a similar medicinal use in the Bulletin of the Society of Exotic Pathology. He noted the absence of varicose veins and hemorrhoids in the West Africans and attributed it to the daily use of red chili pepper. "Native workers on the railroad always carry a supply with them and consider them as a panacea necessary for good health," he reported. He claimed to have cured his and his fellow officers' hemorrhoid problems by incorporating red chilies into their diet, as well. The cure took effect in a matter of days, but only with the ripe red chilies, not the unripe green ones (Stevenel 1956). The reason may be that red chili peppers contain a higher concentration

of vitamin A, important in the protection of the skin. Studies published in 1953 and 1981 reported on the prescription of peppers to treat hemorrhoidal pain, validating the West African folk remedy (Morton 1981; Petelot 1953).

Chili peppers are a rich source of vitamins A and C, important in preventing nightblindness and scurvy, respectively. Soon after their arrival in the New World, the Spaniards seem to have come to an empirical understanding of peppers.

The Inca Garcilaso de la Vega overheard a Spaniard comment that chili peppers were good for his eyesight, and, therefore, he never failed to eat two roasted chili pods for dessert after every meal (Carcer and Disdier 1953).

Bernabé Cobo, writing in the early seventeenth century, noted that Spanish sailors took pickled chiles (en escabeche) to sea with them. Although he made no mention of the medicinal value of this practice, it is possible that the sailors had discovered that by eating chilies they not only enjoyed a food-seasoning but also warded off scurvy. Adequate amounts of vitamin C, or ascorbic acid, prevent the disease.

The discovery of this vitamin won a Nobel Prize in 1937 in physiology and medicine for Albert Szent-Gyorgyi, a Hungarian professor. Experimenting in 1928 with a chemical he called "God-knows," since no one knew its uses, he succeeded in extracting only very small amounts from the adrenal glands of cows, insufficient to conduct extensive experiments. One day, instead of eating a dinner dish of peppers that his wife had prepared and which he did not care for, he took it to his laboratory to analyze the peppers' compounds. He subsequently made

history when he was able to extract from them large quantities of ascorbic acid, so named because it cured scorbutic disease (Dewitt and Gerlach 1990, 236; Naj 1992, 116-117).

Long's report from Jamaica confirms that eighteenth-century groups living in the Caribbean had similar knowledge of and uses for peppers. In his survey, written in 1774, Long wrote that a mixture called man-dram seldom failed to stimulate the appetite. He listed its ingredients: sliced cucumbers, finely-chopped shallots or onions, a bit of lime juice and Madeira wine, a few pods of well-ground bird or bonnet pepper "and mixed with the liquor." Infusing chilies in wine reduced their strength, he added (Long 1972, 3:723). Long speculated that the addition of chilies to a diet high in legumes counteracted flatulence (Long 1972, 3:723). He may have been correct; present-day Indians in Amazonian Colombia eat the raw pod of Capsicum frutescens to combat this condition (Schultes and Raffauf 1991, 35).

Even horses and mules could profit from the ingestion of chilies. If the animals, having eaten rank grass, suffered from dry gripes, they were fed bird and Guinea peppers. Chilies were also applied externally in cataplasms, whether to man or mule was not clear (Long 1972, 3:723). In any case, today, products such as Heet contain capsaicinoids to aid in relieving muscle aches.

In a discussion of cassava and its poisonous nature to humans if not properly prepared, Long mentioned a variety of remedies. The Indians of Guiana gave the patient "red pepper bruised in rum" (Long 1972, 3:780).

Menstruating women and expectant and new mothers also undergo various treatments employing peppers. The medicine men among the

Andokes of the northwest Amazon mix dried or fresh pods of Capsicum baccatum with the flowers of Urtica to hasten prolonged labor. If other complications arise, the woman's whole body is rubbed with the mixture (Schultes and Raffauf 1991, 35). In highland Guatemala it is used as a cathartic to purge recently-delivered mothers (Orellana 1987, 135). Among the Tzeltal, a Mayan group who live in the central part of the state of Chiapas, Mexico, new mothers are also given a hot chili beverage, cloves and corncake to keep her "warm and fertile" (Wauchope 1969, 7:223). Among the Zapotec in Oaxaca, Mexico, newly-delivered mothers remain in bed for 20 days and eat a diet of chicken, atole, chilies and salt (Wauchope 1969, 7:356).

The novelist Rosario Castellanos describes a related remedy in Oficio de Tinieblas, which takes place in the highlands of Chiapas, Mexico. In the novel an exhausted young Mayan woman of the Tzotzil branch has just given birth to her first child. On the hearth bubbles something that will restore her strength and spirits: chili water (Castellanos 1962, 49).

For women suffering from menstrual problems in highland Guatemala, a remedy considered efficacious is an atole, tlamiztatole, made from boiling corn and water with chili and American wormseed (epazote) (Orellana 1987, 169).

Chili peppers have long been popular in treating alcoholic dyspepsia. Referring once more to Castellanos' novel, a young lothario described the cure for a hangover after a romantic but very chilly night of serenading in the Oaxacan highlands. Suffering the effects of having drunk to keep warm the night before, chicken broth taken with plenty of toasted chili pods was the remedy (Castellanos 1962, 172).

Peruvians resort to chilies for this purpose as well. In Aunt Julia and the Script Writer, Vargas Llosa's narrator arrived at noon at his Uncle Lucho's house to find Aunt Olga and Lucho "eating mussels in chile sauce and drinking ice-cold beer recover to get over a hangover" (Vargas Llosa, 7).

The real life of shamans often involves ritual intoxication. In Amazonian Ecuador shamans' wives administer Capsicum chinense to their men when they are suffering from the effects of ayahuasca, a hallucinogenic potion (Schultes and Raffauf 1991, 35).

The use of chili peppers in nineteenth and twentieth-century folk medicine is limited, in this paper, to data gathered mostly in Jamaica, Guatemala and the Amazon. However, parallels with ancient practices are evident in their continued role in the treatment of respiratory and digestive ailments, as an appetite stimulant and as a pain reliever.

Before launching further into peppers' use in modern medicine and diet, a discussion of their pungent principle merits discussion. The chemicals, colorless and virtually flavorless and odorless, which impart the bite to pungent chili peppers, are capsaicinoids. First thought to be a single substance, capsaicin, it was soon shown that pungency was produced by a mixture of ten chemical compounds in addition to related trace components found more recently. This mixture, now called capsaicinoids, is predominantly capsaicin and dihydrocapsaicin, which make up 80 to 90 percent of the capsaicinoids. The different species, varieties and members of the same cultivar of chili peppers contain varying amounts and composition of capsaicinoids; for example,

in the widely-cultivated species C. annuum var. annuum (the chile poblano) the total capsaicinoid content can vary from 0.1 to 1.0 per cent (Govindarajan and Sathyanarayana 1991).

Furthermore, each capsaicinoid varies in pungency and affects different parts of the mouth and throat, according to a study done at the University of Georgia in Athens. When 16 trained tasters were asked to characterize very dilute solutions of the four most prevalent capsaicinoids, they found capsaicin and dihydrocapsaicin to be twice as pungent as nordihydrocapsaicin, which was the mildest and "least irritating." The fourth, homodihydrocapsaicin, they found about two thirds as hot as the two most pungent. As to locus of pungency in the oral cavity, the two hottest produced their bite from the mid-tongue and palate and down into the throat. Their sting developed rapidly and lasted longer than that of nordihydrocapsaicin. The latter, found to be the mildest, was characterized as producing a "mellow warming" which developed immediately upon swallowing and receded quickly. Pungency centered in the front of the mouth and palate. Homodihydrocapsaicin caused a sting which did not develop immediately; however, once burning did occur, it was described as a "very irritating" and "numbing burn" in the throat and back of the tongue and palate. Its pungency was the most prolonged and difficult to rinse out (Anon. 1988, 41). To give an idea of the power of the pungency principle, a single drop of capsaicin, the most potent compound, diluted in 100,000 drops of water produces persistent burning of the tongue. When diluted in one million drops of water, the drop still produces a perceptible warmth.

As was previously mentioned, the species, varieties and pods harvested from the same chili-pepper plot, or even plant, vary in their

capsaicinoid content. In 1912 a pharmacologist, Wilbur Scoville, devised the first method to standardize measurement of capsaicinoids in chili peppers. Called the Scoville Organoleptic Test, its original purpose was to measure the temperature of chilies used in the muscle salve Heet. A panel of five tasters sampled and analyzed a solution of exact amounts of peppers which had been dissolved in alcohol and diluted with sugar water. A majority of three had to agree before the peppers could be assigned a pungency value. The pungency level was then recorded in multiples of one hundred "Scoville Units." This subjective and not-very-reliable test has since been replaced by the technique called high-pressure liquid chromatography, developed in 1980. In this process, ground pepper is placed in a solvent and then analyzed by means of a spectrofluorometer. Once the meter has measured the capsaicin level in parts per million, a computer converts the reading into Scoville Units, which have remained the standard industry measurement. The test is sensitive to two parts per million, equivalent to about thirty Scoville Units. Pure capsaicin measures sixteen million Scoville Units (DeWitt and Gerlach 1990, 241; Robbins 1992, 46).

Following is the scale of pungency ratings based on tests made using high-pressure liquid chromatography at the Texas Agricultural Experiment Station at New Mexico State University and by a number of chili-processing companies. It is necessary to keep in mind that the capsaicinoid content is quantitatively measured only for a particular pod on a particular plant in a particular location in a particular season. Local conditions will cause the varieties to vary from the scale (DeWitt and Gerlach 1990, 241-242).

Table 2.--Official Chili Heat Scale

Rating	Approximate Scoville Units	Chili Varieties
10	100,000-300,000	Habanero, Bahamian
9	50,000-100,000	Santaka, Chiltecpin, Thai
8	30,000-50,000	Aji, Rocoto, Piquin, Cayenne, Tabasco
7	15,000-30,000	Chili de Arbol
6	5,000-15,000	Yellow Wax Hot, Serrano
5	2,500-5,000	Jalapeno, Mirasol
4	1,500-2,500	Sandia, Cascabel
3	1,000-1,500	Ancho, Pasilla, Española
2	500-1,000	NuMex Big Jim, NM6-4
1	100-500	R-Naky, Mexi-Bell, Cherry
0	0	Mild Bells, Pimiento, Sweet Banana

When playing with fire one should be aware of the best way to extinguish the burn. In an experiment conducted in 1989 a taster chewed a slice of Serrano chili for one minute after which various remedies were applied to ease the burning sensation. The amount of time lapsed until the bite eased was measured for each; the winner was ordinary milk.

Having established that capsaicinoids are, indeed, potent chemical substances, here follows a discussion of their physiological and pharmacological effects and further instances of their use in medicine today. Peppers' role in research and possible future medical applications will also receive brief mention.

When orally ingested, capsaicinoids affect the human body physiologically. Specifically, they act on the oronasopharyngeal region and stomach by stimulating their mucous membrane. This results in tearing of the eyes, nasal discharge, increased salivation in the mouth and blood flow in the stomach. Their action on salivation and the stomach

causes strong peristalsis and ultimately aids digestion (Halasz 1963; Govindarajan and Sathyanarayana 1991, 438).

The physiological reactions of burning in the mouth, flushing of face and neck and sweating of the forehead are uncomfortable. Rozin and Schiller have attempted to analyze the reasons why people develop a positive preference for a food which initially causes such aversive responses. They believe that an affective shift occurs. The avid pepper consumer develops a liking for the burning sensation, much as others develop a preference for other bitter or irritating substances, such as alcohol, tobacco, coffee or strong cheese. They describe this affective shift as being benignly masochistic. In addition, they propose that chili-lovers experience a "constrained risk" - negative stimuli and defensive responses are present but not life-threatening. As the body secretes endorphins to counteract the pain, a pleasant thrill results (Rozin and Schiller 1980). Contrary to reports from some researchers that the affective or hedonic shift is uniquely human, animals may experience the same shift. In the Yucatán in Mexico goats, dogs and chickens have developed a taste for the habanero pepper, the most pungent of all peppers. To thwart the scavenging beasts, pepper plants are often hung from the ceiling in pots. In the Philippines rats perpetrated extensive damage to crops of pungent peppers, and in India cats, dogs and cows do not hesitate to eat biting food scraps (Naj 1992, 224-225).

The capsaicinoids also effect a unique physiological action on a particular population of sensory neurons which contain Substance P.

On coming into contact with the skin, capsaicinoids first stimulate then deplete the production of this pain-transmitter and powerful vasodilator. Initial topical application of the capsaicinoids causes burning pain. However, after repeated applications, desensitization of the skin follows, producing long-lasting sensory loss or decrease in sensitivity to some chemical irritants and innocuous heat. In addition, a reduction in vasodilation occurs, resulting in an antiinflammatory effect. There is no impairment in the responses to light touch, pin prick or innocuous cold (Hori 1984, 404).

The antiinflammatory and pain-killing actions of capsaicinoids were known to the ancients, as has been previously illustrated. Modern medicine, which better understands the mechanism of action due to pharmacological studies, continues to use capsaicinoids in linaments, plasters and salves. Today, topical capsaicin cream is used to treat the pain of herpes zoster, or shingles (Anon. 1988, 10-11), epidermal and oral post-herpetic neuralgia (Bernstein 1987; Hawk and Millikan 1988), arthritis (Chad et al 1991), diabetic peripheral neuropathy (Basha and Whitehouse 1991), and trigeminal neuralgia, an intensely painful disease caused by damage to the nerve that supplies feeling to the face (Roblin 1990). It has also proved to relieve the intense itching of the skin of those suffering from notalgia paresthetica (Wallengren, 1991).

In a clinical study involving psoriatic patients, the application of topical capsaicin reduced scaling and erythema, or abnormal redness of the skin, in 68 percent of the patients overall as compared with 44

percent in the control group. The researchers believe that capsaicin's antiinflammatory effect acts to inhibit the cutaneous vasodilation characteristic of this disorder (Bernstein et al 1986).

In another study, a woman suffering from apocrine chromhidrosis, the secretion of colored sweat by apocrine glands, was successfully treated with the application of topical capsaicin once or twice daily. The condition returned in two days after treatment was discontinued. The findings suggest that Substance P may act in sweat production and that capsaicin's action to deplete it suppressed the chromhidrosis. No other therapy has proved successful to date (Marks 1989).

Sufferers of cluster headaches have also obtained relief through treatment with capsaicin. In clinical studies a capsaicin solution was applied to both nostrils once a day for five consecutive days. The resulting capsaicin desensitization was accompanied by a rapid decrease in the number and intensity of attacks as well as in nasal secretion and painful burning sensation (Sicuteri et al 1990).

Capsaicinoids also affect the cardiovascular system. A study conducted in Thailand in 1982 reported that Thais, who consume great quantities of pungent chilies, have a lower risk of blood clots, compared to Americans. It was found that capsaicinoids cause an increase in fibrinolytic activity, thus protecting against thromboembolism, which is the blockage of a blood vessel by a clot transported by the bloodstream from another part of the body (Anon. 1983, 80).

Other studies have been prompted by the observation that people living in countries where chili peppers are commonly consumed show a

lower incidence of cardiovascular problems. The addition of capsaicinoids at normal-use levels to the diet of rats produced lowering of very low- and low-density lipoprotein triglycerides while enhancing high-density lipoprotein cholesterol. These results have implications in the treatment and prevention of high cholesterol levels and arteriosclerosis (Govindarajan and Sathyanarayana 1991, 451).

Lipid metabolism was the subject of yet another study using rats as subjects. It is significant that capsaicin ingested in the range of human intake lowered lipids in the animals, which were fed high-fat diets. The rats exhibited a lower rate of body-weight gain and a decreased uptake of lipids by adipose tissue. The action of capsaicinoids on lipid metabolism indicates that chili consumption may be of value in combatting obesity (Srinivasan and Satyanarayana 1987).

Reactions in the gastrointestinal tract to the consumption of chilies or capsaicinoids have also been investigated. Descriptions of some of the studies and their conflicting results follow.

In one trial high concentrations of ground fresh Capsicum minimum, a highly pungent variety, instilled via intragastric tube into the empty stomachs of humans caused pathological changes from edema to overt bleeding (Govindarajan and Sathyanarayana 1991).

Jalapeño peppers injected nasogastrically in another experiment revealed no mucosal damage (Anon. 1989, 338).

When the watery extract of Capsicum minimum was taken orally into a fasting stomach, it stimulated acid secretion and a feeling of warmth but provoked no damage (Govindarajan and Sathyanarayana 1991, 439).

In contrast, another study has suggested that even mild solutions can cause severe damage in subjects with a history of vomiting blood or passing it through the stools. In this study a group of researchers observed through a gastroscope the effects of a chili-pepper solution on twenty subjects. While the concentration of the solution, milder than that of Indian and Thai chutneys and condiments, remained constant, the subjects varied in age and in their consumption of chili peppers, from nonconsumer to high consumer. The experiment found no relationship between chili consumption and gastric damage. However, the solution did produce a severe reaction in one subject with the above-described history of undetermined cause. This led the investigators to recommend excluding chilies from the diets of those suffering from ulcers or gastritis (Viranuvatti et al 1972).

The above findings conflict with more recent ones regarding the healing rate of duodenal ulcers. Patients fed one gram of ground chili with each of three daily meals showed no erosion of gastric mucosa nor a slower healing rate (Govindarajan and Sathyanarayana 1991, 439).

Another study recorded only a low incidence of gastric erosion when chili peppers were ingested in foods. Twelve volunteers were served four different meals: a bland meal, a bland meal with aspirin, a spicy Mexican meal and a pepperoni pizza. None of the subjects showed duodenal damage. Eleven suffered gastric erosions after the bland meal with aspirin, while only two developed the symptoms after the Mexican meal and one after the pizza (Anon. 1989, 338).

Certain levels of capsaicin consumption may even prevent ulcers. Gastric ulceration occurred in rats given high concentrations of capsaicin intragastrically. On the other hand, low concentrations stimulated mechanisms which provided resistance to ulcer formation (Szolcsanyi and Bartho 1981).

While this small sampling of studies illustrates conflicting findings, at the same time it illustrates the diversity in the procedures. The variation in effects may be due to variation in material, vehicle, mode of administration and dose of capsaicinoids, as well as in the species used as subjects. It is suggested that deleterious effects were due to high levels or unnatural modes of ingestion of peppers. In addition, these effects were transitory, attenuated or stopped after ingestion of capsaicin ended (Govindarajan and Sathyanarayana 1991, 454).

The carcinogenicity of capsaicinoids has also been a subject of study. In one experiment mice were fed a crystalline mixture of mostly capsaicin and dihydrocapsacin in five levels ranging from 0.0625 to one percent mixed with powdered diets. The lowest level corresponds to fifty times the highest amount consumed by avid chili-eaters in South Korea - 80 milligrams of capsaicinoids per day contained in chili peppers with a capsaicinoid level of one percent. None of the doses affected the survival rate. Duodenal tumors occurred once in each dose level except the highest, where there was none. This corresponded to a combined tumor incidence of ten percent. No tumors were seen in the control group. Researchers term carcinogenetic testing at high levels "equivocal." They point out that ingested capsaicinoids are not very stable. Even at high levels they leave the system within 48 hours (Govindarajan and Sathyanarayana 1991, 448, 457).

No epidemiological reports have been found on the effects of long-term daily ingestion of peppers in countries of high consumption (Govindarajan and Sathyanarayana 1991, 448, 457).

Other reports on carcinogenicity come from Peter Gannett and Patrick Iversen at the Eppley Institute for Research in Cancer at the University of Nebraska in Omaha. In the mid-eighties experiments at the Institute showed that capsaicin can cause genetic mutation. Later work suggested that it might cause colon cancer in animals. Now, the newest studies indicate that the chemical may be an antioxidant, capable of neutralizing certain potentially harmful enzymes. First, oxidization of the capsaicin occurs, apparently aided by the very enzymes which, when they subsequently bind to the capsaicin, are inactivated. In other research, capsaicin, instead of causing mutagenicity, destroyed it in a known animal carcinogen. It is suggested that capsaicin may present a low-level cancer risk to the gut and at the same time neutralize enzymes that "might otherwise turn on classes of other carcinogens" (Anon. 1988, 41).

To conclude the discussion of capsaicinoids, their role as research tool merits brief mention. Of all natural compounds, capsaicin and dihydrocapsaicin are the most potent in evoking pungency, pain and specific desensitization. As such, researchers are finding them useful in their studies of the mechanisms of sensory neurons and the role of substance P in pain and desensitization (Govindarajan and Sathyanarayana 1991, 470; Maggi 1991, 7).

Given the ever increasing consumption of peppers around the world, and particularly in the United States, a discussion of the risks versus

the benefits of using chilies as a food additive seems a fitting conclusion to the chapter. The results of some of the studies outlined previously reveal the deleterious effects of the capsaicinoids. It bears repeating that those studies employed very high doses of the chemicals and, in some instances, injected them in pure form directly into a fasting stomach. Nevertheless, the negative results inevitably give rise to health concerns among eaters of pungent varieties. To allay those concerns, numerous positive factors can be listed. The most important one weighing in favor of hot peppers may be their long history of use as vegetable and condiment in cultures throughout the world. Except for one report from Mexico, no adverse effects of chili consumption have come to light from countries such as Thailand and Korea, where high per-capita consumption has been traditional since early times (Govindarajan and Sathyanarayana 1991, 449).

In fact, there is evidence that bodies are capable of adapting to consumption of peppers. Rats fed chili extracts at high human-use levels showed diminished erosive action to gastric mucosa over time and developed protective mechanisms (Govindarajan and Sathyanarayana 1991, 454).

Another factor in favor of peppers is their self-limiting quality - even a very small increase in use levels results in pain. Other beneficial factors include their high content of vitamins A and C, their lipid-lowering effects and role in increasing fibrinolytic activity and metabolic rates. These effects have implications in the treatment and

prevention of heart disease, thromboembolism and obesity, respectively (Govindarajan and Sathyanarayana 1991, 470; Srinivasan and Satyanarayana 1991, 151).

As the Mexicans say, "Peor es el chile y el agua lejos" (it is worse to have chilies and water far away).

CHAPTER 8

CONCLUSION

The study of cultures can be approached from a variety of perspectives, one of them being ethnobotanical. Tracing the ethnobotany of Capsicum in some New-World societies, both ancient and modern, has constituted the vehicle which enabled exploration of many of their facets. As a cultural constant from prehistoric times to present day, peppers have figured importantly in ritual, tribute, war, diet and medicine. Investigating the role of peppers in these contexts necessarily meant learning about world views, religious beliefs, social organization and structure, and territorial expansion.

Inevitably such investigation results in heightened cultural awareness. At the same time that one may register a feeling of horror at the ritual sacrifice of humans, there comes an understanding of this practice on the part of agricultural societies which believe that death must occur for life to begin in a new season.

The tribute system among the Incas deserves admiration. The storehousing of food and clothing provided social security in times of famine or duress. The Spaniards marvelled at how well they were fed wherever they stopped, sometimes for weeks or months at a time.

In their dietary role, peppers not only have enlivened bland diets of legumes and grains, but have also provided important vitamins which complement those diets; in societies where little red meat is consumed,

vitamin C enhances the absorption by the body of the iron in beans. Nutritionists today admire the balanced diets achieved by the ancients and their descendants.

Capsicum, as has been shown, has figured from early times in the pharmacopoeia of New-World societies. The early Spaniards accorded the pharmacopoeia of Mexico great respect, and Spanish doctors adopted many of its herbs under their Mexican names (Hawkes et al 1991, 203). Today's researchers have established scientifically the medicinal benefits and uses of peppers. In so doing, they have validated many of the ancient remedies which have been passed down to their descendants in Middle and South America.

An anonymous Mexican writer has been quoted as saying that chili is the king and soul of the Mexican - food, medicine, drug and solace (Lomeli 1991, 9). This statement could well have been uttered by other groups throughout the Americas.

In conclusion to this selection of data on Capsicum in culture, the words of Dr. Francisco Hernández seem appropriate. Realizing that peppers could be an inexhaustible subject, the sixteenth-century physician ended his report by saying, ". . . of Mr. Chili and his varieties, enough said" (Hernández 1888, 108).

APPENDIX

TABLE 1

Nahuatl Names for Seven Pre-Columbian Peppers with Descriptions by Hernández

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1. **QUAUMCHILLI**: Quahu = tree. Chilli árbol, or tree chilli; Haitians call it chillimontes. The smallest and hottest of all; leaves smaller than any other chilli species; similar in shape to olives. Bears fruit all year. Used as a condiment, not as a vegetable.
cf. **CHILTECPIN**: has woody, treelike stalks and very small leaves; leaf size, fruit size and pungency are not those of the long, cylindrical pointed chile de árbol we know today.
 2. **CHILTECPINTLI**: Tecpin = flea. Size and bite of a flea. There are three forms, which differ only in location, harvest season or pungency. All bear three times during the harvest season from December to April. Sometimes seems more burning than quauhchilli but loses its heat more readily.
 1. **TOTOCUITLATL**: Toto = bird; cuitla-tl = excrement; Haitians call it huarahua; largest of the three.
 2. **TLILCHILLI**: chilli negro = black. Turns dark; three sizes, smallest in last harvest.
 3. **TZANALCHILLI**: grown irrigated in August; smallest of the three.
cf. **CHILTECPIN** = ovoid; **CHILIPQUIN** = elongate.
 3. **TONALCHILLI**: Tonal = heat of the sun. Chilli del sol because it fruits during the summer months only and is the color of the sun, pale yellow. Haitians call it chili blanco. Green at first, turning pale yellow, finally red.
cf. **CARRICILLO** or **TORNACHILI**.
 4. **TZINQUAUHYO**: Tzin = stump; quauh = wilderness, mountain forest; also tzin = one's rump. Some authors say it means "wild," "from the mountain." In Hispaniola it is called ají coral = like coral. Thin, five fingers long, red when ripe.
cf. Capsicum violaceum DC. Hort. Monsp 87, 1813, according to Herrera (1904, 102); however, it does not match that description. A comparable modern species has not been determined.
 5. **TZONCHILLI**, **TEXOCHILLI**, **TEPOCHILLI**: Tzon = head; texo = ground, like flour; tepotz = rump. Also pochilli. Chile de masa (dough) because it is sweet and bland and can be eaten with tortillas. Long, narrow, some sweetness, red color, of a smooth bitterness. Soft flesh (pericarp) must be preserved by smoking, thus pochilli (pochilli = smoked; invert root word for chi pocli).

- cf. JALAPEÑO: cannot be dried; it may have seemed sweet to early Mexican Indian tastes by comparison; also there has been time for growers to have increased the pungency through selection.
6. CHILCOZTLI: Co = yellow. Foods cooked with it take a saffron color. Six fingers long; bears all year. Called ají azafrán (saffron pepper) by Spaniards in Haiti. Reddish, sometimes turning raisin color. cf. GUAJILLÚ: a strong coloring agent.
7. MILCHILLI: Mil = field (not specifically corn field). Long, narrow, ending in a sharp point. Red when ripe. Smaller than texochilli. Sown and reaped in corn season, thus "field of corn."
cf. CHILE DE ARBOL or perhaps another Cayenne type.

(Andrews 1984, 28)

ILLUSTRATIONS

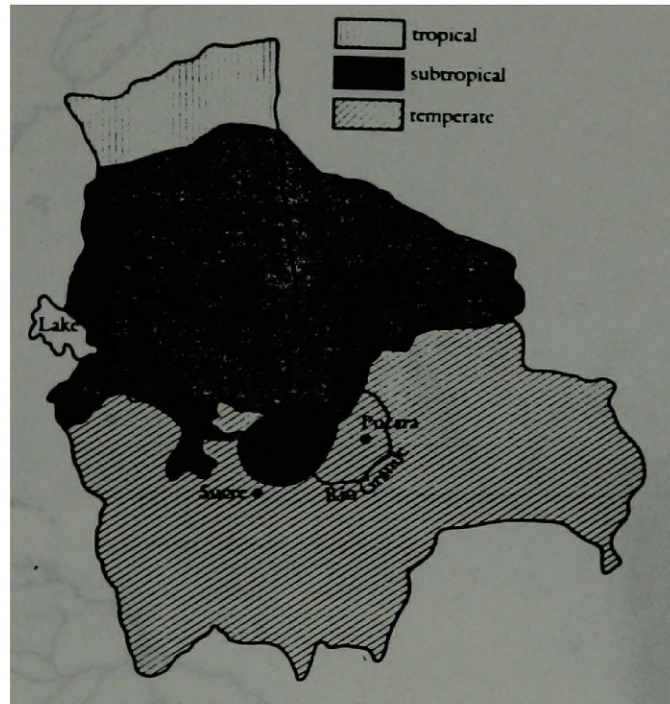


Figure 1. Area of origin of Capsicum around Comarapa, Bolivia.
(Heiser 1976; McLeod 1982)

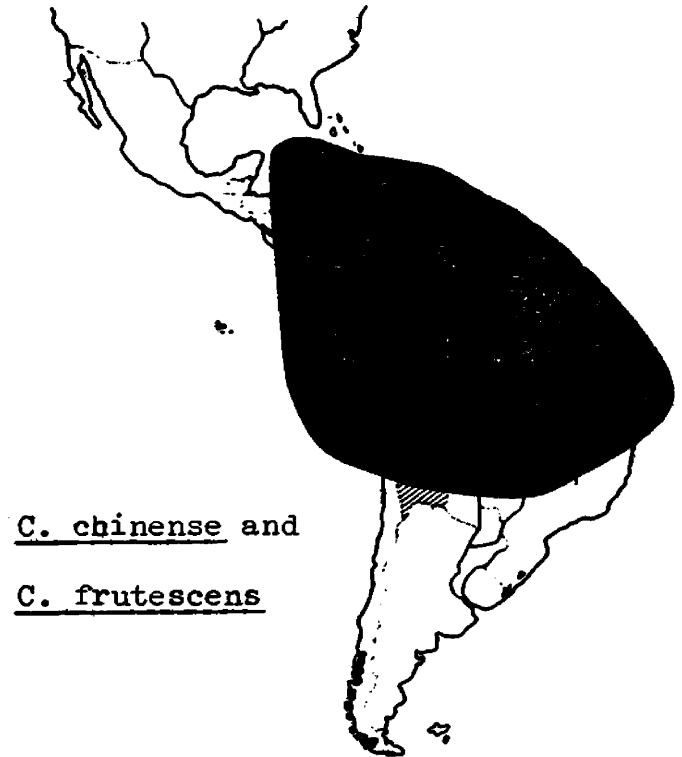
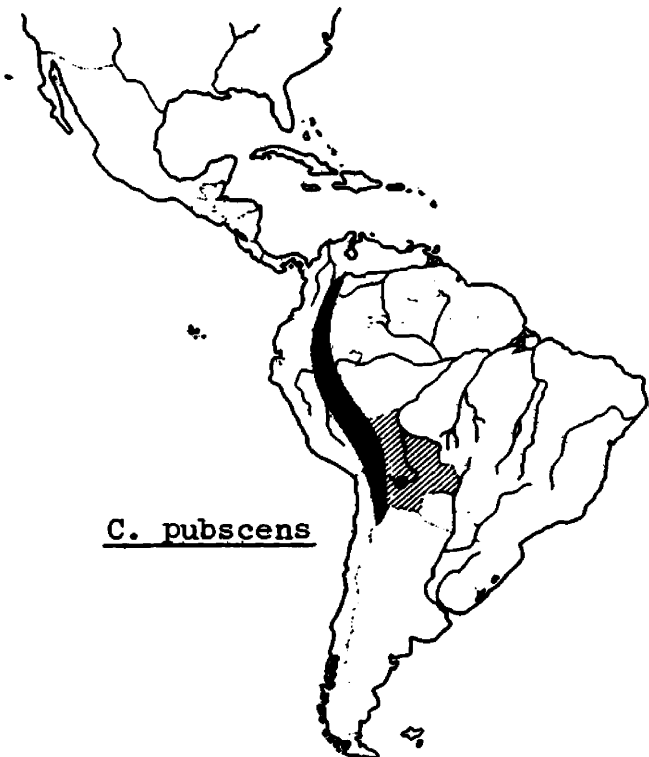
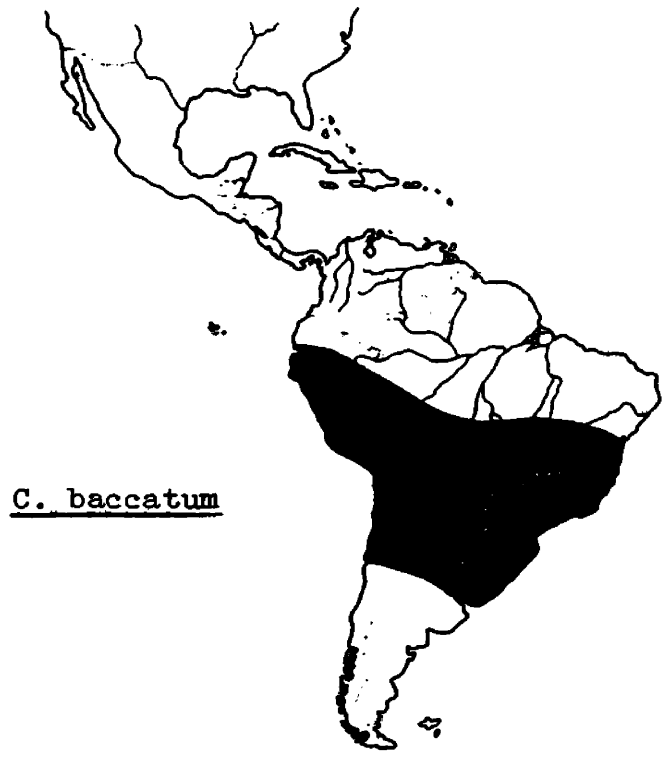


Figure 2. Distribution of the domesticated Capsicum peppers at the time of the arrival of the Europeans. (Heiser 1976; McLeod 1982)



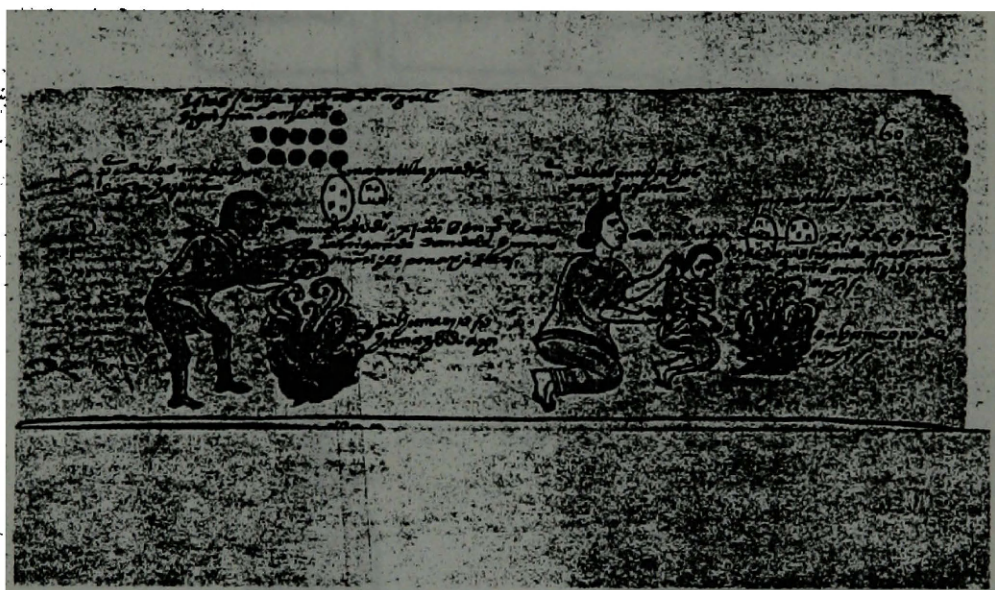


Figure 3. Father and mother punishing their children by forcing them to inhale smoke of burning chili peppers. (Mendocino Codex)

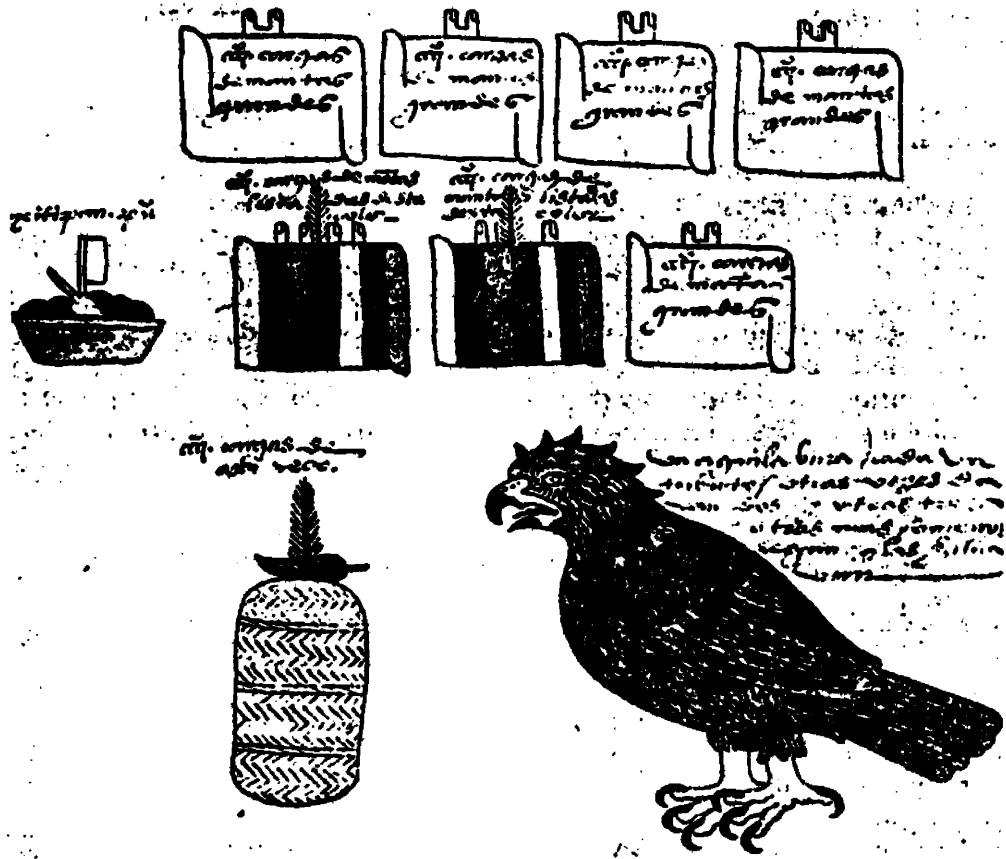


Figure 4. Tribute products. (Mendocino Codex)

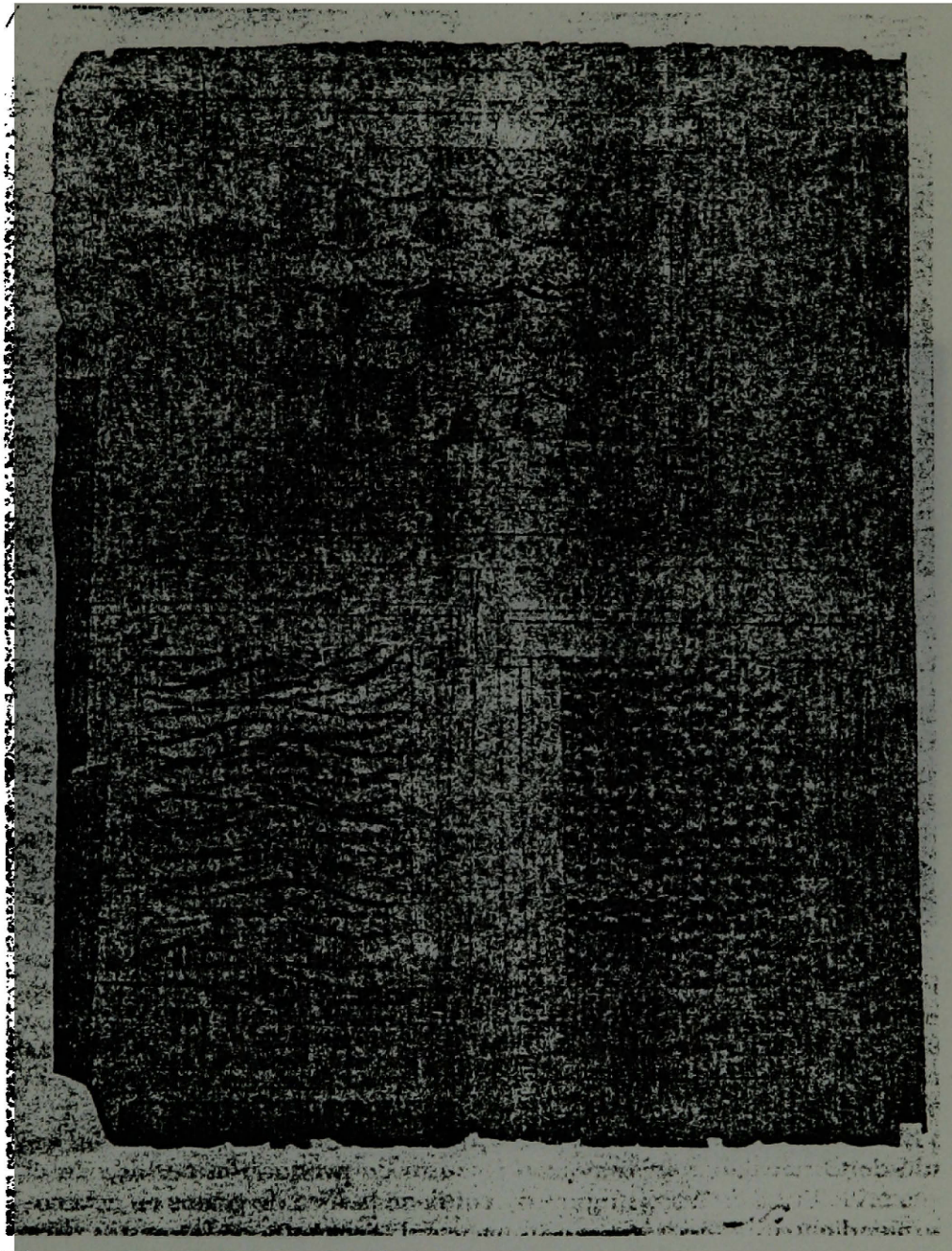


Figure 5. Cribs containing tribute products. (Yanuitlán Codex)

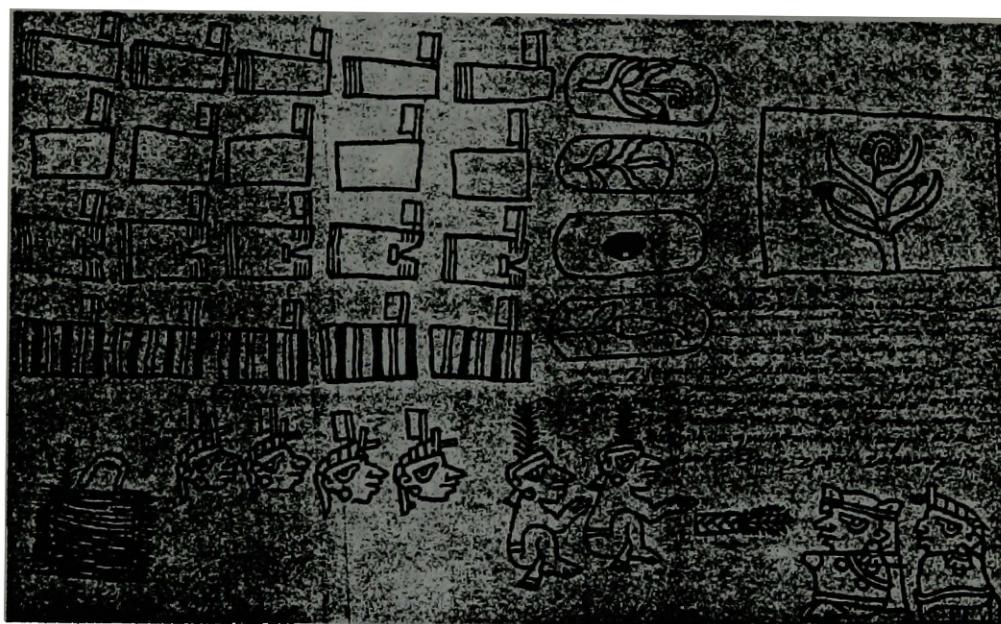


Figure 6. (Codex of list of tributes of Tecomaxtla-huaca, Oaxaca)


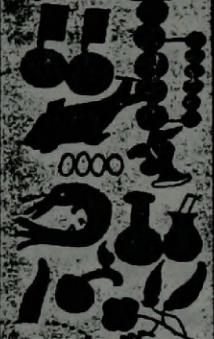


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	<p> II on poqualli ma cuilli ps ypa epi que con tom and omobing tla qualli semer el Canon ga fuan de ga za to vicario amo ca vac vino to tolli to tol te t quaxi na cu tli mepi cha calli epi tli yzta tli xesti qualli ymo epi mo Campobua tao sui tla tla oc Ca nativi tat s'joon on tla mi ynterquius oc epi quaxi ma tli m'cano thalia ad to parti yca oxca xi sui tli 1563. cui ya q. g. g. ya ye xxm. ti ca te matati Junius. y quac on pagua ya te quixm fualad taj fuan de ispinoga vica rio ta ma calampama </p>	<p>0000</p>	<p>xlvi p. v. 18</p>
	<p> III on poqualli ps. omonequi pad qua cox paxi amo cogua c vino to tolli Coca guathi conlli yzta tli mo epi tlaya ti amo nequi tea pan y mo can pagua tao o ca manda m' epi vico Ray </p>		<p>xl p. 18</p>
	<p> IV on poqualli ps. monequi y gualti lanpetro y va san bable yca omoco vac vino to tolli ca ca gna tli epi tli yzta tli tao epi tlaya te gmo na qui te o pan o canna da mian tod. de nos vico Ray </p>		<p>xl p. 18</p>
			

Figure 7. (Sierra Codex)

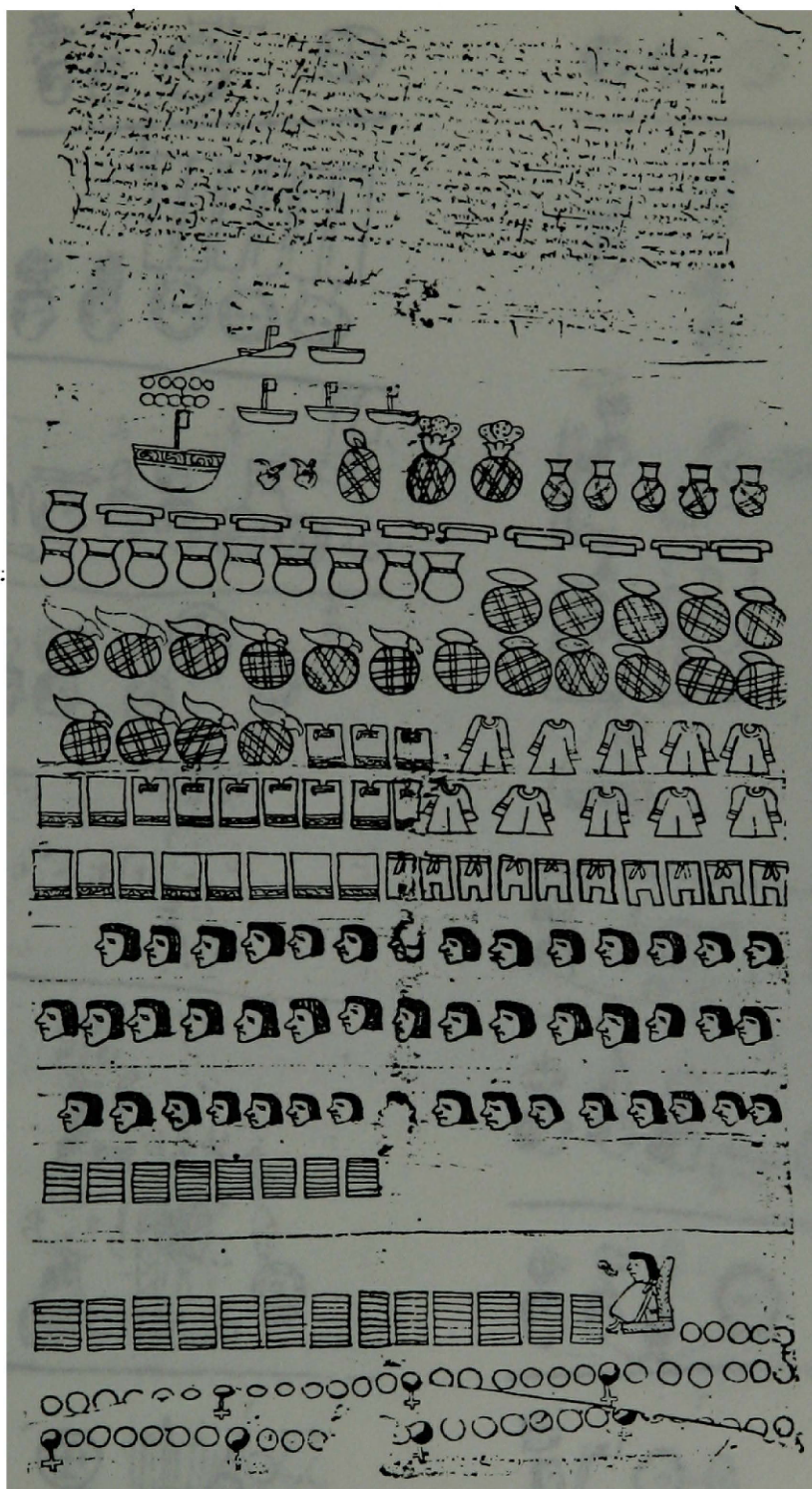


Figure 8. (Tributes of Tzintzuntzan and Tlalpujava)

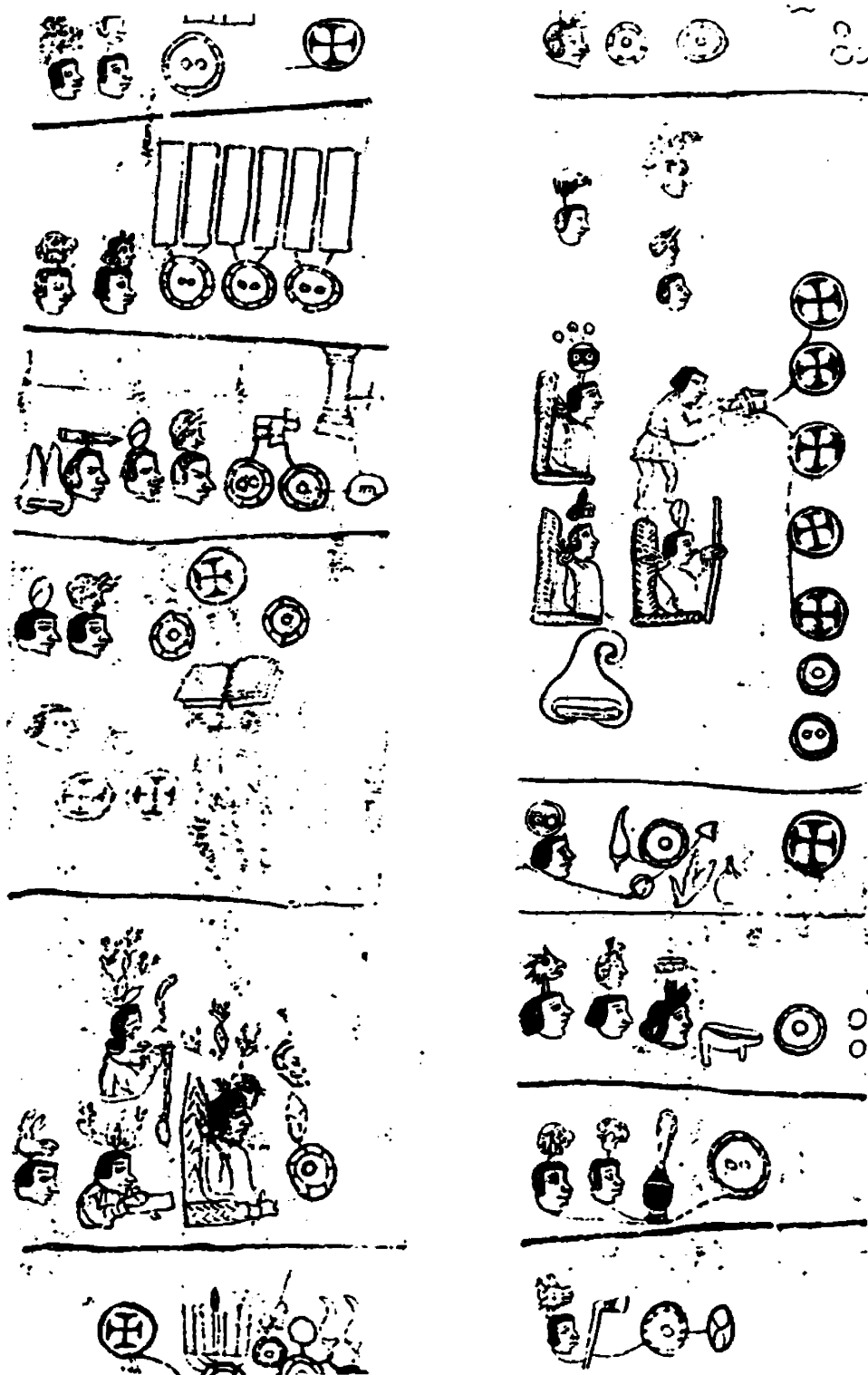


Figure 9. (Gilcrease Fragments)

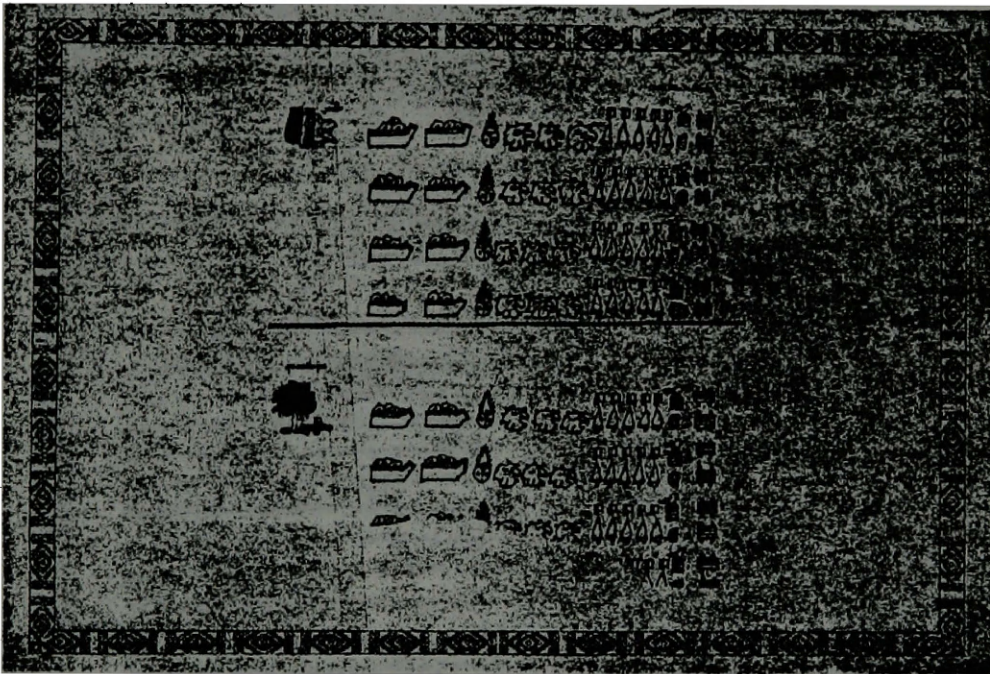


Figure 10. Codex no. 31. (Codices of the Marquisate of the Valley of Oaxaca)

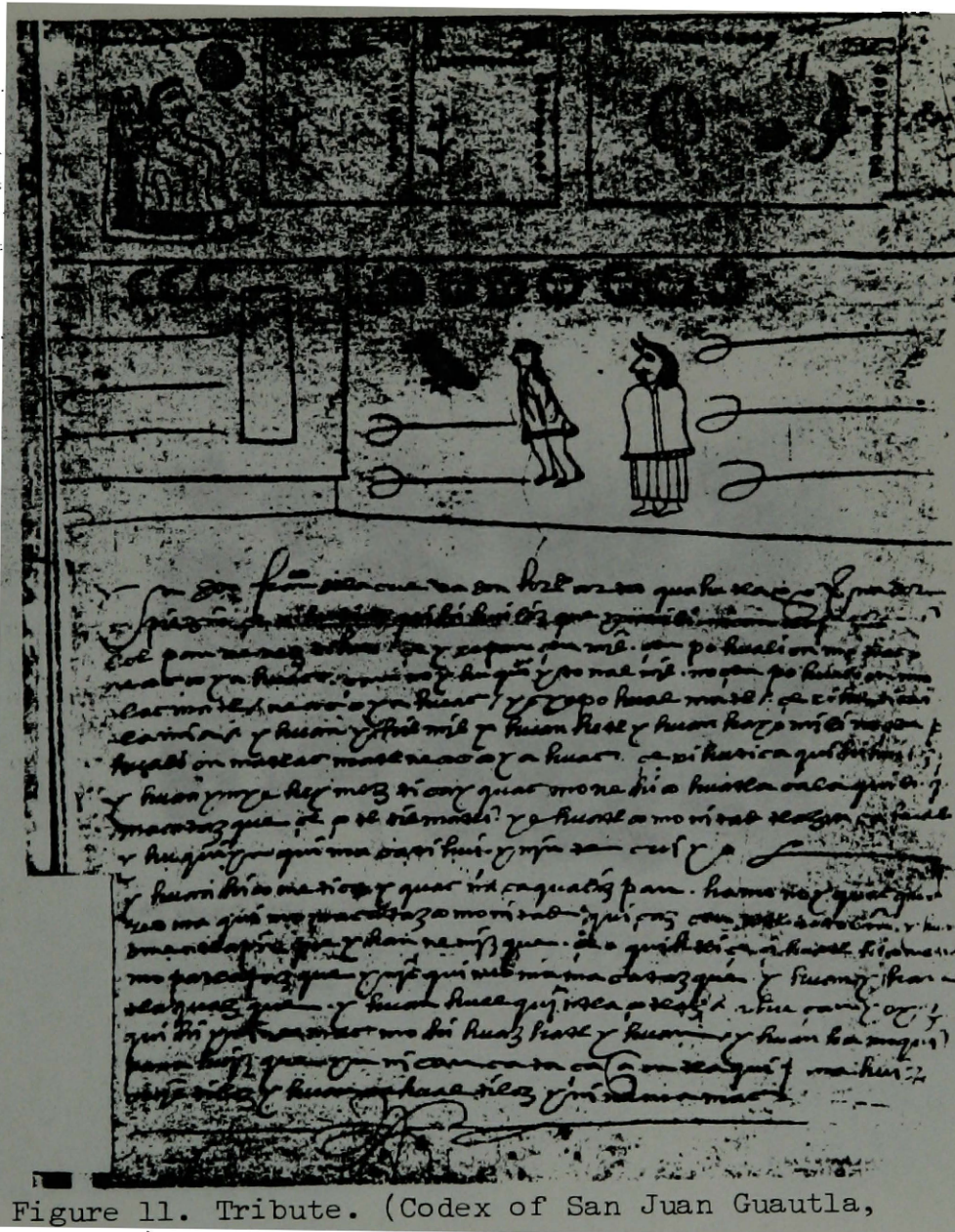


Figure 11. Tribute. (Codex of San Juan Guautla, Hidalgo)

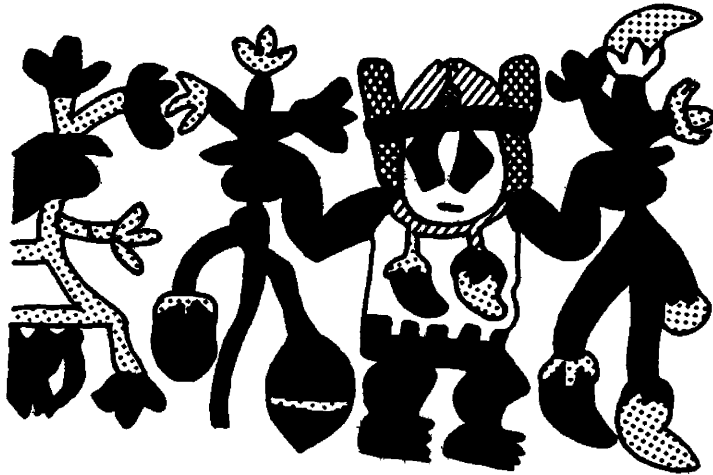


Figure 12. Nazca embroideries. (Lowie Museum of Anthropology, University of California, Berkeley)

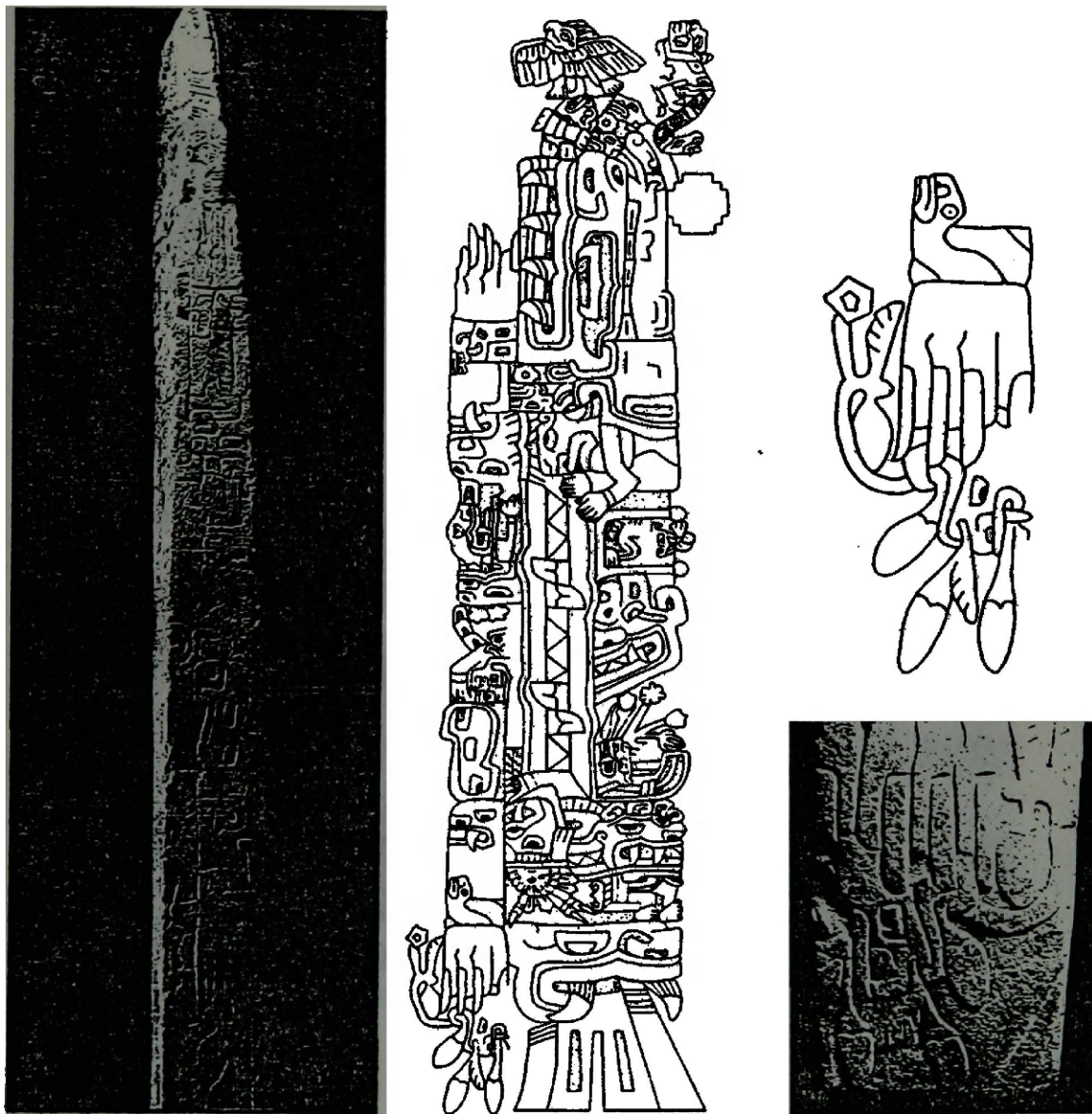


Figure 13. Tello Obelisk. (Museo Nacional de Antropología, Lima, Peru)



Figure 14. Curing a toothache with peppers. (Florentine Codex)

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